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Science and Technology Committee

Peer review in scientific publications

Eighth Report of Session 2010–12

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Contacts

All correspondence should be addressed to the Clerk of the Science and Technology Committee, Committee Office, 7 Millbank, London SW1P 3JA. The telephone number for general inquiries is: 020 7219 2793; the Committee's e-mail address is: scitechcom@parliament.uk

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Summary

Peer review in scholarly publishing, in one form or another, has always been regarded as crucial to the reputation and reliability of scientific research. In recent years there have been an increasing number of reports and articles assessing the current state of peer review. In view of the importance of evidence-based scientific information to government, it seemed appropriate to undertake a detailed examination of the current peer-review system as used in scientific publications. Both to see whether it is operating effectively and to shine light on new and innovative approaches. We also explored some of the broader issues around research impact, publication ethics and research integrity.

We found that despite the many criticisms and the little solid evidence on the efficacy of pre-publication editorial peer review, it is considered by many as important and not something that can be dispensed with. There are, however, many ways in which current pre-publication peer-review practices can and should be improved and optimised, although we recognise that different types of peer review are suitable to different disciplines and research communities. Innovative approaches—such as the use of pre-print servers, open peer review, increased transparency and online repository-style journals—should be explored by publishers, in consultation with their journals and taking into account the requirements of their research communities. Some of these new approaches may help to reduce the necessary burden on researchers, and also help accelerate the pace of publication of research. We encourage greater recognition of the work carried out by reviewers, by both publishers and employers. All publishers need to have in place systems for recording and acknowledging the contribution of those involved in peer review.

Publishers also have a responsibility to ensure that the people involved in the peer-review process are adequately trained for the role that they play. Training for editors, authors and reviewers varies across the publishing sector and across different research institutions. We encourage publishers to work together to develop standards—which could be applied across the industry—to ensure that all editors, whether staff or academic, are fully equipped for the job that they do. Furthermore, we consider that all early-career researchers should be given the option for training in peer review; responsibility for this lies primarily with the funders of research.

Funders of research have an interest in ensuring that the work they fund is both scientifically sound and reproducible. We consider that it should be a fundamental aim of the peer-review process that all publications are scientifically sound. Reproducibility should be the gold standard that all peer reviewers and editors aim for when assessing whether a manuscript has supplied sufficient information to allow others to repeat and build on the experiments. As such, the presumption must be that, unless there is a strong reason otherwise, data should be fully disclosed and made publicly available. In line with this principle, data associated with all publicly funded research should, where possible, be made widely and freely available. The work of researchers who expend time and effort adding value to their data, to make it usable by others, should be acknowledged and encouraged.

While pre-publication peer review (the first records of which date back to the 17th century)

continues to play an important role in ensuring that the scientific record is sound, the growth of post-publication peer review and commentary represents an enormous opportunity for experimentation with new media and social networking tools. Online communications allow the widespread sharing of links to articles, ensuring that interesting research is spread across the world, facilitating rapid commentary and review by the global audience. They also have a valuable role to play in alerting the community to potential deficiencies and problems with published work. We encourage the prudent use of online tools for post-publication review and commentary as a means of supplementing pre-publication review.

On the subject of impact, it was clear to us that the publication of peer-reviewed articles, particularly those that are published in journals with high Impact Factors, has a direct effect on the careers of researchers and the reputations of research institutions. Assessing the impact or perceived importance of research before it is published requires subjective judgement. We therefore have concerns about the use of journal Impact Factor as a proxy measure for the quality of individual articles. While we have been assured by research funders that they do not use this as a proxy measure for the quality of research or of individual articles, representatives of research institutions have suggested that publication in a high-impact journal is still an important consideration when assessing individuals for career progression. We consider that research institutions should be cautious about this approach as there is an element of chance in getting articles accepted in such journals. We have heard in the course of this inquiry that there is no substitute for reading the article itself in assessing the worth of a piece of research.

Finally, we found that the integrity of the peer-review process can only ever be as robust as the integrity of the people involved. Ethical and scientific misconduct—such as in the Wakefield case—damages peer review and science as a whole. Although it is not the role of peer review to police research integrity and identify fraud or misconduct, it does, on occasion, identify suspicious cases. While there is guidance in place for journal editors when ethical misconduct is suspected, we found the general oversight of research integrity in the UK to be unsatisfactory. We note that the UK Research Integrity Futures Working Group report recently made sensible recommendations about the way forward for research integrity in the UK, which have not been adopted. We recommend that the Government revisit the recommendation that the UK should have an oversight body for research integrity that provides "advice and support to research employers and assurance to research funders", across all disciplines. Furthermore, while employers must take responsibility for the integrity of their employees' research, we recommend that there be an external regulator overseeing research integrity. We also recommend that all UK research institutions have a specific member of staff leading on research integrity.

1 Background

What is peer review?

1. Peer review is no more and no less than review by experts.[1] It is pervasive throughout all aspects of academic endeavour.[2] The principles of peer review are commonly applied to "the review of grant applications, and in nationwide resource allocation activities, such as the Research Assessment Exercise (RAE)".[3] Peer review is also used in scholarly publishing, in which it is described by the International Committee of Medical Journal Editors as "the critical assessment of manuscripts submitted to journals by experts who are not part of the editorial staff".[4] Those "experts" are commonly referred to as "reviewers" or "referees".

The importance of peer review in scientific publications

2. Scientific publications are the public face of science; they are the means by which researchers report and explain their findings to the wider world, including other scientists, practitioners, the public, and policy makers. Professor John Pethica of the Royal Society explained that the primary function of peer review in this context is "to improve the process and the coherence of scientific knowledge and its utility".[5] Peer review is used by publishers to help ensure that the scientific record is robust.

The importance of the scientific record to Government

3. The peer-reviewed literature represents an organised body of knowledge, reviewed by experts. Professor Sir John Beddington, Government Chief Scientific Adviser, summarised the importance of peer-reviewed literature to the Government: "scientific evidence is clearly fundamental to Government policy and peer review is a fundamental part of scientific evidence. […] it is absolutely clear that scientific evidence is essential for […] the evidence-based policy of the Government".[6]

Previous work

4. On 20 July 2004, the former Science and Technology Committee published the report, *Scientific publications: free for all?*, which aimed to examine the provision of scientific journals to the academic community and wider public and establish whether the market for scientific publications was working well.[7] On the issue of peer review, the former Committee concluded:

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1 Q 250 [Sir Mark Walport]

2 Q 225 [Professor Ian Walmsley]

3 Ev w20, para 6 [British Medical Association]

4 "Uniform Requirements for Manuscripts Submitted to Biomedical Journals", *International Committee of Medical Journal Editors*, www.ICMJE.org/

5 Q 2

6 Q 287

7 Science and Technology Committee, Tenth Report of Session 2003–04, *Scientific publications: free for all?*, HC 399–I, para 4

> As is the case with any process, peer review is not an infallible system and to a large extent depends on the integrity and competence of the people involved and the degree of editorial oversight and quality assurance of the peer review process itself. Nonetheless we are satisfied that publishers are taking reasonable measures to [maintain] high standards of peer review. Peer review is an issue of considerable importance and complexity and the Committee plans to pursue it in more detail in a future inquiry.[8]

5. Shortly before the former Committee's report was published, the Sense About Science Working Party on peer review published the discussion paper, *Peer review and the acceptance of new scientific ideas*.[9] Since then, peer review has become a more mainstream concept outside of the scholarly community. In April 2005, Sense About Science carried out "a series of workshops with educational bodies, patient groups and information providers to produce a user-friendly short guide to the peer review process".[10] This guide, *I don't know what to believe… Making sense of science stories*, was published in November 2005 and "hundreds of thousands of copies have been downloaded".[11]

6. In recent years there have been an increasing number of reports and articles assessing the current state of peer review, in some cases questioning whether the peer-review system is "broken".[12] These reports have come at a time when there are big changes afoot in scientific publishing: the total number of peer-reviewed publications has grown by a third since the beginning of the 21st century;[13] the share of publications by countries which are not traditional scientific leaders, for example China and India, is rising;[14] Information Technology has transformed the administration of peer review through, for example, online submission tools and reviewer databases;[15] and the web (including tools such as Twitter) is providing new and immediate ways for rating and commenting on scholarly publications.[16] In this rapidly changing environment, and in view of the importance of evidence-based scientific information to Government, it seemed appropriate to undertake a detailed examination of the current peer-review system as used in scientific publications. Both to see whether it is operating effectively and to shine light on new and innovative approaches. As a consequence, this report examines the issues at length and we set out the bulk of our conclusions and recommendations towards the end of the report.

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8 Science and Technology Committee, Tenth Report of Session 2003–04, *Scientific publications: free for all?*, HC 399–I, para 207

9 Sense About Science, *Peer Review and the Acceptance of New Ideas*, May 2004

10 Ev 74, para 3

11 Ev 75, para 3

12 For example: "Nature's peer review debate", Nature Online, www.nature.com/nature/peerreview/debate; Mark Ware Consulting, *Peer Review in Scholarly Journals - perspective of the scholarly community: an international study*, January 2008; and, "Is peer review broken?", The Scientist Online, vol 20, Issue 2, February 2006, www.the-scientist.com

13 Royal Society, *Knowledge, networks and nations: Global scientific collaboration in the 21st century*, March 2011, p 16

14 *As above*

15 Ev w59, para 11 [Academy of Social Sciences]

16 Ev 73, paras 21–22 [BMJ Group]

Our inquiry

7. We announced our inquiry into Peer Review on 27 January 2011 and issued a call for evidence based on the following terms of reference:

1. the strengths and weaknesses of peer review as a quality control mechanism for scientists, publishers and the public;
2. measures to strengthen peer review;
3. the value and use of peer-reviewed science on advancing and testing scientific knowledge;
4. the value and use of peer-reviewed science in informing public debate;
5. the extent to which peer review varies between scientific disciplines and between countries across the world;
6. the processes by which reviewers with the requisite skills and knowledge are identified, in particular as the volume of multi-disciplinary research increases;
7. the impact of IT and greater use of online resources on the peer-review process; and
8. possible alternatives to peer review.

8. We received 96 submissions in response to our call. We would like to thank all those who submitted written memoranda. We would also like to thanks Dr Irene Hames, the specialist adviser we appointed to this inquiry. Her expert advice was valuable and we are grateful for her contribution.[17]

9. In May and June 2011 we held four evidence sessions during which we took oral evidence from seven panels of witnesses, to whom we are grateful:

i. On 4 May 2011 we took evidence from: Dr Nicola Gulley, Editorial Director, Institute of Physics Publishing Ltd; Professor Ron Laskey, Vice President, Academy of Medical Sciences; Dr Robert Parker, Interim Chief Executive, Royal Society of Chemistry; and, Professor John Pethica, Physical Secretary and Vice President, Royal Society.

ii. On 11 May we took evidence from: Tracey Brown, Managing Director, Sense About Science; Dr Liz Wager, Chair, Committee on Publication Ethics and Board Member, UK Research Integrity Office Ltd; Mayur Amin, Senior Vice President, Research & Academic Relations, Elsevier; Dr Philip Campbell, Editor-in-Chief, *Nature* and Nature Publishing Group; Robert Campbell, Senior Publisher, Wiley-

[17] Relevant interests of the specialist adviser were made available to the Committee before the decision to appoint her on 23 March 2011. The Committee formally noted that Dr Hames declared an interest relevant to the Committee's work as a Council member, Director and Trustee, Committee on Publication Ethics (COPE); as a member of the Advisory Board, Sense About Science; as an author of Peer Review and Manuscript Management in Scientific Journals; and as offering advice to the Association of Learned and Professional Society Publishers. During the course of the inquiry as we took evidence Dr Hames declared further interests as an employee (until 31 October 2010) of Wiley-Blackwell; as a member, International Society of Managing and Technical Editors Industry Advisory Board; and as receiving fees for workshops from Roberts' funding for researcher training and career development.

Blackwell; Dr Fiona Godlee, Editor-in-Chief, *BMJ* and BMJ Group; and, Dr Andrew Sugden, Deputy Editor & International Managing Editor, *Science*.

iii. On 23 May we took evidence from: Dr Rebecca Lawrence, Director, New Product Development, Faculty of 1000 Ltd; Dr Michaela Torkar, Editorial Director, BioMed Central; Dr Mark Patterson, Director of Publishing, Public Library of Science; Dr Malcolm Read OBE, Executive Secretary, Joint Information Systems Committee (JISC); Dr Janet Metcalfe, Chair, Vitae; Professor Teresa Rees CBE, Former Pro-Vice-Chancellor (Research), Cardiff University; and, Professor Ian Walmsley, Pro-Vice-Chancellor, University of Oxford.

iv. On 8 June we took evidence from: Professor Rick Rylance, Chair-elect, Research Councils UK; David Sweeney, Director for Research, Innovation and Skills, Higher Education Funding Council for England; Sir Mark Walport, Director, Wellcome Trust; Professor Sir John Beddington, Government Chief Scientific Adviser; and, Professor Sir Adrian Smith, Director General, Knowledge and Innovation, Department for Business, Innovation and Skills.

10. The report begins in chapter two with an overview of the peer-review process in publishing, including common criticisms and new innovations in publishing. Chapter three explores the roles of the editors, authors and reviewers. Chapter four examines the challenges involved in reviewing data associated with submitted work and storing it after publication. Chapter five looks at the growing area of review and commentary after publication. Finally, chapter six explores public debate and trust in science. It also assesses the role of peer review in preventing fraud and misconduct, as well as the broader ways in which research integrity is overseen in the UK.

2 Peer review in publishing

11. Peer review, in the context of publishing, can take place before or after an article is published. The first records of journal pre-publication peer review date back to the 17th century, when the Royal Society's Secretary, Henry Oldenburg, adopted it as editor of the journal, *Philosophical Transactions of the Royal Society*.[18] The concept of peer review, however, may be even older. The Syrian physician, Ishaq bin Ali Al Rahwi (AD 854–931) is thought to have first described the concept in his book, *Ethics of the Physician*.[19] Al Rahwi apparently "encouraged doctors to keep contemporaneous notes on their patients, later to be reviewed by a jury of fellow physicians".[20]

12. The Association of Learned and Professional Society Publishers (ALPSP) explained that "peer review varies considerably between scientific disciplines; it is not a one-size-fits-all process. It has evolved to meet the needs of individual scientific communities".[21] Peer review originally evolved in a piecemeal and haphazard way and did not become standard practice in publishing until the middle of the 20th century.[22] As pointed out by numerous individuals and organisations, peer review is by no means a perfect system.[23] The Publishers Association described peer review as a system "based on human endeavour" which therefore "cannot be perfect or infallible".[24] Professor John Pethica, Physical Secretary and Vice President of the Royal Society, surmised: "Given that there is no perfect system, we have to devise a system which optimises the process".[25]

The traditional peer-review process

13. The key features in the peer-review process in scholarly publishing are summarised in the figure below:

18 Ev w4, para 3 [Richard Horton]; Ev 101, para 2 [Royal Society]

19 "The history of peer review", Elsevier, www.elsevier.com

20 Ev w4, para 3 [Richard Horton]

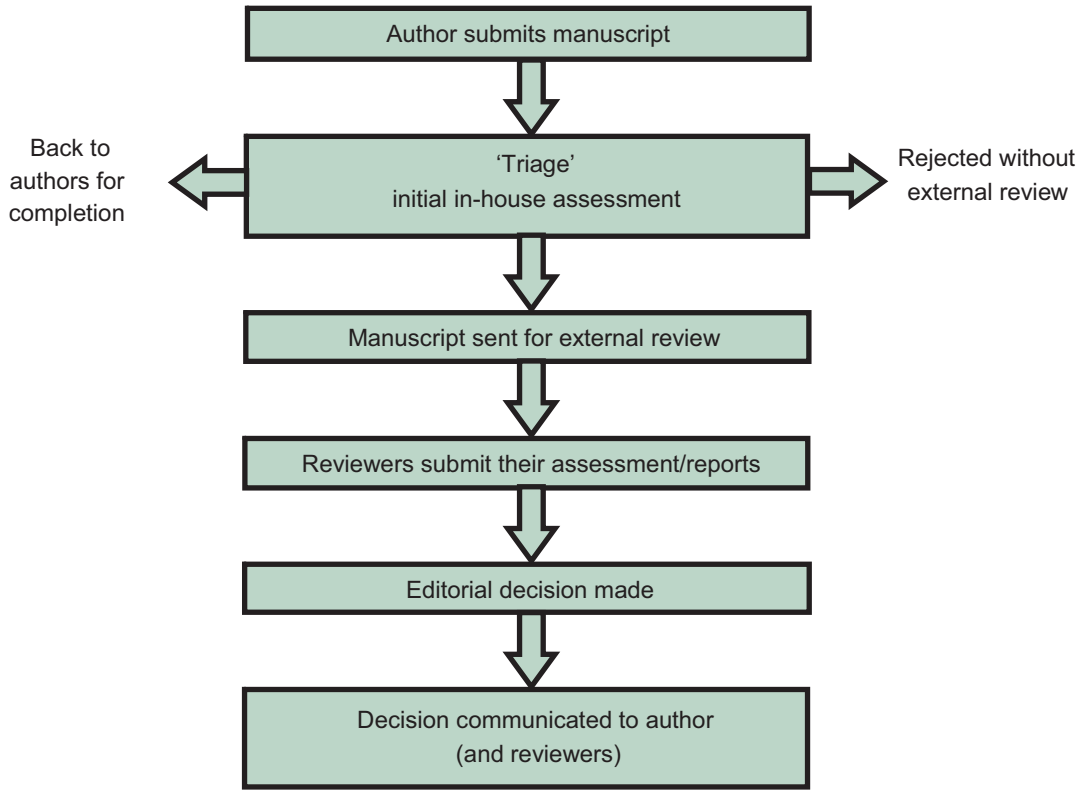
21 Ev w119, para 3

22 "The history of peer review", Elsevier, www.elsevier.com

23 For example: Ev w36, para 1 [Lawrence Souder]; Ev w72 [Political Studies Association]; Ev w77, para 3 [Royal Meteorological Society]; Ev w95, para 19 [British Antarctic Survey]; Ev w105, para 6 [Publishers Association]; Ev 82, para 2 [Wellcome Trust]; Ev 104, para 16 [Royal Society]; and Ev 115, para 7 [Elsevier]

24 Ev w105, para 6

25 Q 5



14. Authors submit a manuscript to their chosen journal, usually via a web-based system. It is not unusual for manuscripts to be sent to a few journals before being accepted for publication, although authors are only allowed—by convention—to send their manuscripts to one journal at a time. Initial in-house checks are carried out by part of the editorial team. These will include basic checks—for completeness and adherence to journal policies, as well as editorial checks—for scope, novelty, quality and interest to journal readership. At this stage, manuscripts may be returned to authors for completion and resubmission if the technical omissions are extensive; in minor cases, authors may just be asked to provide the missing items. Manuscripts can also be rejected at this stage on editorial grounds, without being sent out for external peer review. This decision is made by the journal editors. In some top journals, the rejection rate at this stage can be very high. For example, editors at *Nature* "reject 70–80% of submitted papers (the exact proportion varies with discipline) on purely editorial grounds".[26] Manuscripts that pass the initial checks are sent to external reviewers, usually two or more. The reviewers assess, and report back to the editors on issues such as:

- Study design and methodology;
- Soundness of work and results;
- Presentation and clarity of data;
- Interpretation of results;

[26] Ev 89, para 53 [Philip Campbell, *Nature*]

- Whether research objectives have been met;
- Whether a study is incomplete or too preliminary;
- Novelty and significance;
- Ethical issues; and
- Other journal-specific issues.

The reviewers' role at this stage is to provide a critical appraisal, advise and make recommendations on the manuscript. Editors take the final decision as to whether or not to accept the manuscript for publication. The decision is then communicated to the author. This will generally be one of the following: accept; accept with revision (minor or major); reject but encourage resubmission; or reject.

Types of peer review

15. There are three main types of peer review in use. They are: "single-blind review", "double-blind review" and "open review". The Royal Society explained that:

> By far the commonest system in use is "single blind" peer review in which the author's name and institution is known to the reviewer, but the reviewer's name is not provided to the author.
>
> A number of journals instead choose to operate a "double blind" peer review system which is fully anonymised (i.e. the author(s) are unaware of the identity of the reviewer(s) and vice versa).
>
> Recently, there have been some experiments with a third type, "open" peer review, in which the authors' and reviewers' names are revealed to each other. […] Open peer review can be reasonably described as an experimental system at this stage and is far from common.[27]

16. During the course of this inquiry we heard that the Institute of Physics (IOP), the Royal Society and the Royal Society of Chemistry (RSC) use single-blind review.[28] The publisher, John Wiley & Sons, also primarily uses single-blind review.[29] It is the commonest system in scientific journals. In the social sciences, peer review "is almost invariably a double-blind process".[30] Some journals, such as the *BMJ*, choose to use open peer review.[31]

17. The BMJ Group explained that:

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27 Ev 101, para 5

28 Q 7 [Dr Nicola Gulley, Dr Robert Parker and Professor John Pethica]

29 Ev 66, para 8.1

30 Ev w57, para 3 [Academy of Social Sciences]

31 Ev 72, para 16

> Responses to a 2009 survey of more than 4000 science reviewers suggest, however, that reviewers prefer anonymity: 76% favoured the double blind system where only the editor knows who the reviewers and authors are.[32]
>
> This built on a 2007 survey of around 3000 academics and editors around the world (of whom about 10% worked in UK [Higher Education Institutions] and 18% were working in clinical medicine or nursing) which found relatively little support for open review as an alternative to single- or double-blinded review.[33]

18. It is sometimes suggested that bias in the peer-review process (see paragraphs 42-43) could be reduced by using the double-blind approach.[34] However, Dr Nicola Gulley, Editorial Director at IOP Publishing Ltd, explained that this is not always practical:

> Some of the research communities that I work with particularly are very small, so doing double-blind refereeing where neither the author nor the referee knows who each other is defeats the object because, generally, the referees will know who the author is from the subject area that they are working in or from the references and things like that. It varies very much between different subject areas.[35]

Others also acknowledged the problem of authors guessing the names of reviewers and vice versa in double-blind peer review.[36]

19. Dr Liz Wager, Chair of the Committee on Publication Ethics (COPE), told us that COPE does not recommend one system or another. The reason given was that:

> some editors have said to us, "We work in a very narrow field. Everybody knows everybody else. It just would not work to have this open peer review." There are different options. […] My opinion is that it depends on the discipline. With a discipline as big as medicine, where there are hundreds of thousands of people all around the world you can ask and they probably don't bump into each other the next day, open peer review seems to work. In much narrower and more specialised fields, it perhaps does not, and the traditional system of the blinded review is perhaps better.[37]

20. **We conclude that different types of peer review are suitable to different disciplines and research communities. We consider that publishers should ensure that the communities they serve are satisfied with their choice of peer-review methodology. Publishers should keep them updated on new developments and help them experiment with different systems they feel may be beneficial.**

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32 Ev 72, para 15 and the original 2009 survey: "Peer Review Survey 2009: preliminary findings", Sense About Science, www.senseaboutscience.org.uk/index.php/site/project/395

33 Ev 72, para 15 and the original 2007 survey: Mark Ware Consulting, *Peer Review in Scholarly Journals - perspective of the scholarly community: an international study*, January 2008

34 Ev w95, para 21 [British Antarctic Survey]

35 Q 8

36 For example: Ev w47, para 10 [Professor R I Tricker]; Ev 72, para 14 [BMJ Group]; Ev w99, para 3 [International Bee Research Association]; and Ev w130, para 2.6 [Dr Thomas J Webb]

37 Q 88

Assessing manuscripts

21. The core of the traditional peer-review process is the critical appraisal of the work and its reporting. The Public Library of Science (PLoS) explained that:

> It is helpful to divide [peer review's] functions into two broad areas: technical and impact assessment. Whereas technical assessment tends to be objective and provides greater confidence in (although cannot assure) the reliability of published findings, impact assessment is subjective and its role is less clear-cut.[38]

22. The value of the technical assessment is seldom questioned. Dr Michaela Torkar, Editorial Director at BioMed Central, was of the view that:

> It is fairly straightforward to think about scientific soundness because it should be the fundamental goal of the peer review process that we ensure all the publications are well controlled, that the conclusions are supported and that the study design is appropriate.[39]

We also heard from a number of witnesses that there is evidence that many authors feel that peer review improves the quality of the articles that they publish.[40]

23. Questions are, however, often raised about the impact assessment. The impact assessment can be thought of as the means by which an editorial decision is taken to publish or not publish a manuscript. It is based on various factors, for example, whether the subject of the manuscript will be of interest to the journal readership or whether the research is perceived to represent a ground-breaking discovery. Dr Nicola Gulley of the IOP explained that peer review in this respect acts as a "filter", helping scientists find the information that is of interest to them.[41] Dr Mark Patterson, Director of Publishing at the PLoS, explained the scale of the current situation:

> About 1.5 million [peer-reviewed] articles are published every year. Before any of them are published, they are sorted into 25,000 different journals. So the journals are like a massive filtering and sorting process that goes on before publication. The question we have been thinking about is whether that is the right way to organise research.[42]

24. Professor Teresa Rees CBE, former Pro-Vice-Chancellor at Cardiff University, added that:

> We have an expanding number of journals [...] and there is increasing pressure to publish. I think there is a question of whether academics can keep up with reading all the material in the growing number of journals. One might want to have a debate at

38 Ev 80, para 32

39 Q 162

40 Q 2 [Nicola Gulley]; Q 95 [Mayur Amin]; Ev w5, para 13 [Richard Horton]; and Goodman SN, Berlin J, Fletcher SW Fletcher RH, *Manuscript quality before and after peer review and editing at Annals of Internal Medicine*, Ann Intern Med, 1994, vol 121, pp 11–21

41 Q 2

42 Q 162

> some stage about whether that is the most effective and efficient way of managing all the potential research that can be published.[43]

25. Published research is currently organised and sorted into thousands of journals. The impact or perceived importance of a published article is often judged by the "Impact Factor" of the journal in which it appears. A journal's Impact Factor is calculated annually by Thomson Reuters. It is "a measure of the frequency with which the 'average article' in a journal has been cited in a particular year or period".[44] It is, however, a measure of the journal and not of each individual article. It should also be noted that there are many peer-reviewed journals which are not indexed by Thomson Reuters and therefore do not have an Impact Factor; the Thomson Reuters 2010 *Journal Citation Reports* contains data for 10,196 journals.[45] Impact Factors and high-impact journals are covered in more detail in paragraph 59.

26. The question that arises when assessing the merits of the impact assessment made during the peer-review process is: how do journal editors or reviewers judge whether a particular piece of work is important? Professor Ian Walmsley, Pro-Vice-Chancellor at the University of Oxford, told us that this was "a very difficult thing to do".[46] He added that:

> In many ways [impact] is something best assessed *post facto*; that is, the impact of this work is: how many other people find it a fruitful thing on which to build? How many people find it a productive way to direct their research as a consequence?[47]

Dr Rebecca Lawrence, Director of New Product Development at Faculty of 1000 Ltd, agreed that:

> often it is not known immediately how important something is. In fact, it takes quite a while to understand its impact. Also, what is important to some people may not be to others. A small piece of research may be very important if you are working in that key area. Therefore, the impact side of it is very subjective.[48]

Dr Michaela Torkar of BioMed Central was also of the opinion that "the assessment of what is important can be quite subjective".[49]

27. Dr Mark Patterson, from PLoS, gave his view on the traditional process and how things may begin to change:

> Traditionally, technical assessment and impact assessment are wrapped up in a single process that happens before publication. We think there is an opportunity and, potentially, a lot to be gained from decoupling these two processes into processes best carried out before publication and those better left until after publication. […]

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43 Q 218

44 "The Thomson Reuters Impact Factor", Thomson Reuters, www.thomsonreuters.com

45 "The Thomson Reuters releases journal citation reports for 2010", Thomson Reuters Press Releases, www.thomsonreuters.com, 28 June 2011

46 Q 217

47 *As above*

48 Q 162

49 *As above*

> There are benefits to focusing on just the technical assessment before publication and the impact assessment after publication. That becomes possible because of the medium that we have to use now. The 25,000 journal system is basically one that has evolved and adapted in a print medium. Online we have the opportunity to rethink, completely, how that works. Both [technical and impact assessment] are important, but we think that, potentially, they can be decoupled.[50]

28. Dr Malcolm Read OBE, Executive Secretary of the Joint Information Systems Committee (JISC), agreed that "separating the two is important because of the time scale over which you get your answer".[51]

29. **The importance of a pre-publication technical assessment is clear to us. It should be a fundamental aim of the peer-review process that all publications are scientifically sound. Assessing the impact or perceived importance of research before it is published will always require subjective judgement and mistakes will inevitably be made. We welcome new approaches that focus on carrying out a technical assessment prior to publication and making an assessment of impact after publication.**

Common criticisms

30. As explained in paragraph 12, peer review is by no means a perfect system. Professor Sir John Beddington, Government Chief Scientific Adviser, stated that:

> If you posed the question, "Is the peer review process fundamentally flawed?" I would say absolutely not. If you asked, "Are there flaws in the peer review process which can be appropriately drawn to the attention of the community?" the answer is yes.[52]

However, as pointed out by Dr Fiona Godlee, Editor-in-Chief of BMJ Group, "we have to acknowledge that there is a huge variety in the quality of peer review across the publishing sector".[53] Though there is variation in quality across the publishing sector, it is important to note that "peer review is independent of the business model applied to the journal".[54] In particular, we heard that "it is terribly important to put to bed the misconception that open access [see paragraph 79] somehow does not use peer review. If it is done properly, it uses peer review very well".[55] In this section we explore some of the common criticisms of the peer-review process.

Stifles innovation

31. A common criticism of peer review is that in some cases "there may be a tendency towards conservative judgements".[56] The UK Research Integrity Office Ltd (see paragraph

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50 Q 162

51 *As above*

52 Q 294

53 Q 97

54 Ev w107, para 16 [The Publishers Association]

55 Q 253 [Sir Mark Walport]

56 Ev w44, para 5 [Professor John Scott, University of Plymouth]

254) went so far as to suggest that "there is a danger that the peer-review process can stifle innovation and perpetuate the status quo".[57] In response to this, Dr Malcolm Read, JISC, stated: "that sounds a bit overstated as peer review, in one form or another, has been an underpinning aspect of research—arguably, even before journals as we know them existed".[58]

32. Dr Gulley from IOP Publishing Ltd told us that "there is more conservatism in some research areas than there is in other areas".[59] Professor Ron Laskey, Vice President of the Academy of Medical Sciences, elaborated with an example:

> It can be more difficult to establish a novel and completely unexpected new branch of science if editors of journals are not alert to the fact that it is coming. There are one or two recent examples. One that springs to mind is a study in plant sciences which concerned resistance to viral infection in plants. That has given rise to a completely new area of understanding of a group of molecules that turn out to be important in all cells, not just in viral defence mechanisms against plants but because they change fundamentally in certain types of cancer. That was a small niche of advance that has suddenly become a front-line subject, but it would have been very difficult to publish that in a front-line journal at the time the work was being done.[60]

33. Dr Robert Parker, Interim Chief Executive of the Royal Society of Chemistry (RSC), added that "knowing the right people to ask about research that looks slightly different" was important in the peer review of unexpected or unusual research.[61] He added that the RSC "found, from doing studies on the articles that we reject, that most of them end up being published somewhere else. There are very few articles that we receive that are scientifically completely wrong. Usually, there is some merit in them".[62] Dr Malcolm Read, JISC, agreed, stating that this "cuts against the conservatism".[63]

34. Dr Philip Campbell, Editor-in-Chief of *Nature* and Nature Publishing Group, expressed the view that *Nature* was open to bold new research. He told us that *Nature* "would love to publish something that strongly made a provocative case […] that is not because we want to be sensationalist but because […] it needs to be out there and we would like to be the place to publish it".[64]

35. Robert Campbell, Senior Publisher at Wiley-Blackwell, agreed that it was not in a journal's best interest to be overly conservative. He stated that:

> If you have a very conservative editorial board, the journal will suffer. It is a market; the more proactive entrepreneurial editorial teams will win out and build better,

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57 Ev 124, para 1.4

58 Q 163; and Q 163 [Dr Mark Patterson]

59 Q 3

60 *As above*

61 *As above*

62 Q 6

63 Q 163

64 Q 98

> more successful journals. It is a very dynamic market. A conservative editorial board wouldn't last long.[65]

36. Publishers are becoming increasingly more entrepreneurial and innovative. Authors now have the option of avoiding a conservative editorial judgement on provocative research by submitting their manuscript to one of an increasing number of online repository-type journals, such as *PLoS ONE*. These journals assess only the technical merit of the manuscript and are discussed in more detail in paragraphs 79-89.

37. However, it is not always simply an issue of the research being too "provocative". Dr Philip Campbell, *Nature*, explained that:

> sometimes [bold new claims] are too easily said and not backed up well enough. A journal, which also has a magazine role in *Nature*, has one of the most critical audiences in the world. They love to be stimulated but they also want to make damned sure that the evidence on which we base the stuff we publish is reasonably strong.[66]

As the Royal Society summarised, it seems that "in general, an extraordinary claim requires extraordinary evidence".[67] That is, a piece of research with potentially controversial impact would likely be more rigorously tested than research making a lesser claim.

38. Dr Philip Campbell, *Nature*, expanded on the need to rigorously assess research:

> Another use of the word "conservative" concerns robustness. For us, peer review helps us deliver robust publications. We, at *Nature*, if anything, are more conservative than other journals. We make researchers go the extra mile to demonstrate what they are saying. I also celebrate the fact that we do not want to be conservative with papers that go against the status quo. We want to encourage radical discoveries.[68]

39. Dr Godlee, BMJ Group, agreed that "conservatism is not a bad thing in science or medicine in terms of making sure that what we publish is robust, relevant and properly quality controlled".[69]

Biased

40. In addition to a perceived bias toward conservative judgements, Dr Liz Wager explained that "there are other kinds of biases as well, but a well set-up system and a good editor will minimise those biases".[70]

41. Professor Teresa Rees described the problem of gender bias in peer review:

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65 Q 96

66 Q 99

67 Ev 103, para 9

68 Q 97

69 *As above*

70 Q 64

> Do people operate with a preconceived notion of quality? There is a whole series of studies about this. For example, evidence from the States suggests that if John Mackay or Jean Mackay submits an article it will be peer reviewed more favourably if it is by John Mackay. There is a whole series of papers to that effect. How do we deal with this? I add that this is discriminatory behaviour by both men and women. It seems to me that in the selection of reviewers to serve on research council boards, journals or promotion panels we need transparency so that people can apply and be assessed against merits to gain those positions, and we need turnover so it is not the same people doing that assessment for 20 or 30 years. We might want […] double-blind reviewing so you don't know the sex.[71]

The Committee on Publication Ethics (COPE) also acknowledged the problem of bias but added that "the evidence is not clear-cut and, in some cases, is contradictory".[72]

42. Professor Teresa Rees highlighted another similar problem: that of "unconscious bias against people with foreign-sounding names". She stated that:

> Brazil's science minister is very concerned about this and has encouraged academics there to co-author with people from the US or Europe who may have a surname that is more familiar to reviewers. Double-blind marking would deal with that unconscious bias that affects peer reviewers as it does any other member of the public.[73]

43. The BMJ Group added that studies have shown peer review to also be systematically biased against authors' ideas, reputations and locations.[74] The use of double-blind peer review is one way to minimise bias, but there are practical issues relating to its use, as described in paragraph 18. COPE explained that "it is probably impossible to eliminate all bias from peer review but good editors endeavour to minimize it".[75] The role of the editor is further explored in chapter 3.

Poor assessment of multidisciplinary work

44. It has also been suggested that peer review is biased against multidisciplinary research.[76] The Society for General Microbiology and the John Innes Centre expressed the concern that with the rise in multidisciplinary research it may sometimes be difficult to find reviewers with the right skills and expertise needed to assess multidisciplinary projects.[77]

45. Both PLoS and the UK Research Integrity Office Ltd (UKRIO) recommended that if the work is multidisciplinary, it may be necessary to seek the opinions of a larger number

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71 Q 247

72 Ev 67, para 3.0

73 Q 247

74 Ev 71, para 9; Merton R K. *The Matthew Effect in Science*. Science 1968, vol 159, pp 56–63; and Wenneras C, Wold A. *Nepotism and sexism in peer review*. Nature 1997, vol 387, pp 341–43

75 Ev 67, para 3.0

76 Ev w79 [Professor Grazia Ietto-Gillies]

77 Ev w91 and Ev w133, para 1.2.2

of reviewers.[78] This is the approach taken by the Royal Society, as described by Professor John Pethica:

> The process in the [Royal] Society is, essentially, to increase greatly the number of referees and reviewers. Six or seven would be common, whereas two or three might be the number you would have within a well-defined subject, to try and ensure you get that coverage for a number of broad views. […] In general, one is obliged to do that simply because there may be a few people who have the vast and broad knowledge required, but in truly interdisciplinary areas, which really span gaps, you have to get a broad perspective and that means using more people, including from a variety of countries, environments and so forth.[79]

Expensive

46. Another common criticism of peer review is that it is expensive. In 2008, a Research Information Network report estimated that the unpaid non-cash costs of peer review, undertaken in the main by academics, is £1.9 billion globally each year .[80] In 2010, a report commissioned by JISC Collections brought together evidence from a number of studies.[81] It concluded that it costs UK Higher Education Institutions (HEIs), in terms of staff time, between £110 million and £165 million per year for peer review and up to £30 million per year for the work done by editors and editorial boards.[82] The BMJ Group pointed out that "peer reviewers are rarely paid by publishers, and their work is often done out of hours".[83] The financial and personal burden on reviewers is discussed below.

47. The cost of peer review does not, however, fall solely on reviewers and HEIs. Elsevier explained that "publishers have [also] made significant investments into the peer review system to improve [its] efficiency, speed, and quality".[84] We explored this in further detail with Mayur Amin, Senior Vice President of Research & Academic Relations at Elsevier, who told us that:

> Overall, one of the biggest investments for everyone in the publishing industry in the last decade or so has been migration to some of the electronic platforms. Across the industry, our estimate is that somewhere in the order of £2 billion of investment has been made. That includes the technologies at the back end to publish the materials as well. The technology has included submission systems, electronic editorial systems, peer review support systems, tracking systems and systems that enable editors to find reviewers.[85]

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78 Ev 78, para 13, and Ev 125, para 6

79 Qq 16–17

80 Research Information Network, *Activities, costs and funding flows in the scholarly communications system in the UK*, May 2008

81 JISC Collections, *The value of UK HEI's to the publishing process*, June 2010

82 JISC Collections, *The value of UK HEI's to the publishing process*, June 2010, Summary p 2

83 Ev 70, para 4

84 Ev 114, para 5

85 Q 103

48. Elsevier later explained that the £2 billion estimate was based on a detailed review of Elsevier's own technology investments (£600 million between 2000 and 2010), which were then extrapolated to the entire industry.[86] The areas of investment are summarised in the table below:

Technology investment areas (2000-2010)	Industry estimate
Author submission & editorial systems	>£70m
e-journals and reference works back files	>£150m
Production Tracking Systems	>£50m
Electronic Warehousing	>£60m
Electronic Publishing Platforms, incl. search and discovery platforms	>£1500m
Other related back-office and cross-industry systems. e.g. digital preservation, Crossref for linking, CrossCheck for plagiarism detection, creation of special font sets, development of technical standards	>£300m

Data provided by Elsevier[87]

Burdensome

49. Related to cost issues is criticism of the perceived burden on academics involved in the peer-review process, particularly in the role of reviewer. Vitae, the UK organisation championing the personal, professional and career development of doctoral researchers and research staff, stated that:

> Most researchers will experience both authoring and reviewing papers during their careers and therefore have a vested interest in the system being as robust, ethical and equitable as possible. [...] There is an expectation that researchers will contribute to sustaining the peer review system by participating as reviewers. This is predominantly without financial or formal recognition, except for members of editorial boards (or grant review panels). [Peer review] is rarely acknowledged as part of the formal workload of an academic researcher. [...] Reviewing is often an 'out of normal hours' activity and therefore adds additional burdens on researchers [...] 'Good' reviewers are more likely to be invited to do more reviewing, thereby adding to their workloads.[88]

The "burden" on peer reviewers is discussed in more detail in chapter 3.

Lack of evidence of efficacy

50. Despite these criticisms, the disappearance of pre-publication peer review tomorrow would represent a "danger" to the scientific record.[89] Research Councils UK stated that "the strengths of peer review far outweigh the weaknesses".[90] Professor Ron Laskey of the Academy of Medical Sciences informed us that in the absence of peer review a "particular problem" in the biomedical sciences would be "sorting the wheat from the chaff and

86 Ev 118

87 *As above*

88 Ev 146, paras 6–7

89 Q 2 [Robert Parker, Royal Society of Chemistry]

90 Ev 96, para 5

knowing what information could be depended on".[91] Tracey Brown, Managing Director of Sense About Science, used the analogy of a "sea of material" that needs to be sorted, one way or another.[92] She added that:

> The important thing with a system that produces 1.3 million papers a year is that it is self-reflective. A lot of study goes on […] looking at the fate of papers that aren't published and looking, just generally, at trends across the system. So long as that is going on and patterns of behaviour can be spotted, then the system can be self-correcting.[93]

51. Sir Mark Walport highlighted a recent study by the Wellcome Trust:

> We do conduct studies of peer review. The Wellcome Trust published a paper in *PLoS ONE* a couple of years ago in which we took a cohort of papers that had been published. We post-publication peer-reviewed them and then we watched to see how they behaved against the peer review in bibliometrics. There was a pretty good correlation, although there were differences. Experiments of one sort or another are always going on.[94]

David Sweeney, Director for Research, Innovation and Skills at the Higher Education Funding Council for England (HEFCE), added that:

> Through [HEFCE's] funding of JISC and […] the Research Information Network, much work has been carried out [looking at peer review] and we remain interested in further work being carried out where the objectives are clear.[95]

52. The BMJ Group, however, was of the view that "little empirical evidence is available to support the use of editorial peer review".[96] The little evidence there is on editorial peer review is inconclusive.[97] Richard Horton, Editor-in-Chief of *The Lancet*, explained that Tom Jefferson and colleagues concluded in their review of the evidence that:

> "Editorial peer review, although widely used, is largely untested and its effects are uncertain". [Jefferson and colleagues] went on, "Given the widespread use of peer review and its importance, it is surprising that so little is known of its effects."[98]

53. In a recent article in the journal, *Breast Cancer Research*, Dr Richard Smith, former Editor of the *BMJ*, referred to a quote by Drummond Rennie, deputy editor of the Journal

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91 Q 2

92 Q 63

93 Q 65

94 Q 251

95 *As above*

96 Ev 71, para 8

97 Ev w6, para 18 [Richard Horton] and Ev 66, para 1.0 [Committee on Publication Ethics]

98 Ev w6, para 18 [Richard Horton] and original quotes from: Jefferson T, Alderson P, Wager E, Davidoff F, *The effects of editorial peer review*, JAMA, 2002, vol 287, pp 2784–86

of the American Medical Association, who once said "'If peer review was a drug it would never be allowed onto the market".[99] Dr Smith added:

> not only do scientists know little about the evidence on peer review but most continue to believe in peer review, thinking it essential for the progress of science. Ironically, a faith based rather than an evidence based process lies at the heart of science.[100]

54. COPE, however, noted that:

> lack of evidence of efficacy is not the same as saying there is evidence that it does not work. Peer review is difficult to study, partly because its functions have not always been clearly defined.[101]

55. Dr Godlee, BMJ Group, suggested a way forward:

> The overall level of evaluation of peer review is very poor [...] The UK could lead on [a programme of research]. Funding [for this] should come from [...] a combination of the journal publishing world, the grant-giving world, industry, but also public funding.[102]

56. Professor Rick Rylance told us that Research Councils UK "would be open to trying to think about how that might be researched".[103] However, when we asked Professor Sir Adrian Smith, Director General of Knowledge and Innovation in the Department for Business, Innovation and Skills (BIS), whether there was a need for a programme of research to test the evidence for justifying the use and optimisation of peer review in evaluating science, he responded:

> The short answer is no. [Peer review] is an essential part of the scientific process, the scientific sociology and scientific organisation that scientists judge each other's work. It is the way that science works. You produce ideas and you get them challenged by those who are capable of challenging them. You modify them and you go round in those kinds of circles. I don't see how you could step outside of the community itself and its expertise to do anything other.[104]

57. In summary, the peer-review process, as used by most traditional journals prior to publication, is not perfect. We have heard that there are a number of criticisms of it, including that: it has a tendency towards publishing conservative research (although this should not be confused with robustness); it does not adequately guard against bias; it is expensive; and it represents a huge burden on researchers. Despite these criticisms editorial peer review is viewed by many as important. However, there is little solid evidence on its efficacy.

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99 Richard Smith, *Classical peer review: an empty gun*, Breast Cancer Research, 2010, 12(Suppl 4): S13

100 *As above*

101 Ev 66, para 1.0

102 Q 105

103 Q 251

104 Q 290

58. **We recommend that publishers, research funders and the users of research outputs (such as industry and Government) work together to identify how best to evaluate current peer-review practices so that they can be optimised and innovations introduced, and the impact of the common criticisms of peer review minimised. We consider that this would also help address any differences in the quality of peer review that exist. We encourage increased recognition that peer-review quality is independent of journal business model, for example, there is a "misconception that open access somehow does not use peer review".**

High-impact journals

59. Impact Factor was defined in paragraph 25 as "a measure of the frequency with which the "average article" in a journal has been cited in a particular year or period".[105] As we have noted, a journal's Impact Factor is calculated annually by Thomson Reuters and it often serves as a proxy measure for the impact or perceived importance of an article published in that journal. As such, publishing in a high-impact journal is traditionally perceived to represent a big achievement and is often used as a proxy measure for assessing both the work of researchers and research institutions. This is discussed in further detail in paragraphs 165-177.

60. Elsevier told us that approximately 3 million manuscripts are submitted to journals every year. Of these, around half are rejected. It explained that "rejection rates vary by journal, for example titles such as *Cell* and *The Lancet*, which have extremely high publication impact […] have rejection rates of 95%".[106] We questioned a group of publishers about why rejection rates are so high. Dr Andrew Sugden, Deputy Editor and International Managing Editor at *Science* (where more than 90% of the submissions are rejected),[107] explained that:

> Part of it is simply that they are weekly magazines with a print budget. We are publishing 20 papers […] a week, and a lot of people want to be published in them. We are receiving 10 times as many, roughly. […] We want to showcase the best across the range of fields in which we publish, so we have to be highly selective to do that.[108]

61. Dr Philip Campbell of *Nature* suggested that as journals increase their presence online and the prospect of the decline of print journals happens, the "pressure is lessened".[109] He added, however, that *Nature* would probably still publish the same number of papers.[110] Dr Fiona Godlee, BMJ Group, agreed that printing journals is no longer a constraint, but explained that editorial resource is.[111] She added that journals often find that "if they reduce

105 "The Thomson Reuters Impact Factor", Thomson Reuters, www.thomsonreuters.com

106 Ev 115, para 18

107 Ev 138, para 2

108 Q 116

109 *As above*

110 *As above*

111 Q 118

the number of research papers they publish, their Impact Factor creeps up quicker. That is a commercial reputational issue".[112]

62. While high Impact Factors may be good for journals, the British Antarctic Survey told us that authors are known to complain that "for the very high profile journals with high Impact Factors, competition for space is fierce, and decisions about which papers are accepted can seem rather random".[113] It noted, however that:

> these decisions are often editorial ones based on topicality, and not on peer review; and […] papers rejected from such journals will generally be published elsewhere. If they are of sufficient importance this will usually be recognised by high citation numbers wherever they are published.[114]

The need to publish in high-impact journals and the effect this has on researchers and research careers is discussed in paragraphs 165-177.

63. Authors are faced with a vast range of journals in which to publish if they fail to get into a high-impact journal. We were told that peer review "has led to the development of a pecking order for journals".[115] Manuscripts that are rejected from a high-impact journal will often make their way down the pecking order until they find a home in a journal. This can be a time-consuming process; at each stage the manuscript is first assessed by editors who determine whether it fits the scope of the journal before potentially being sent out for external peer review. Dr Godlee explained that:

> increasingly people are going straight into one of the big open access journals, such as *PLoS ONE*. […] A lot of the publishers are beginning to open up so that people can get speedy publication if they haven't got into the journal of their choice. That is a good thing. That means we will see authors being able to move on to the next thing rather than spending a lot of their time adapting a paper for yet another journal which is going to reject it and then move on.[116]

64. The *PLoS ONE* journal model is discussed in further detail in paragraphs 79-89. Another method for reducing the burden of resubmitting rejected manuscripts to new journals, with fresh rounds of review, is the cascading system of review, which is covered in paragraphs 146-152.

Innovation in peer review

65. Deviations from the traditional peer-review process have been experimented with over recent years, some more successfully than others. In this section we discuss three well-known examples: pre-print servers; experiments in open peer review; and the move towards repository journals.

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112 Q 118

113 Ev w95, para 18

114 *As above*

115 Ev w99, para 7 [International Bee Research Association]

116 Q 118

Pre-print servers

66. An innovative approach to peer review that has worked well for the physics community is the use of a pre-print server. Dr Nicola Gulley of IOP Publishing Ltd explained that the "arXiv" pre-print server was set up to allow authors to submit work that is "at a very preliminary stage".[117] The physics community is then able to access this work and comment on it. Dr Gulley explained that arXiv:

> originated from the high energy physics area where they had a need to be able to discuss the results across the international collaborations. A lot of the work that is posted, particularly from areas such as high energy physics, also goes through internal peer review within the research facilities as well before it is posted.[118]

67. Some of the benefits of the arXiv system were described by the Royal Society: it "allows the scientists to publish research quickly and get informal feedback and identify any weaknesses. This is then followed by formal peer review in a journal".[119] Dr Gulley explained that "a high percentage of articles that are pre-prints are eventually submitted to journals and get published in journals […] so there is still that requirement for the independent peer review".[120] She added that:

> We make it very easy for authors to be able to submit from the arXiv into our journals, for example, and this is common across many physics publishers, where the arXiv number can be used when submitting the article to a journal. Authors are encouraged to update their versions as well. From the publishing side, we encourage them to update the citations so that the link goes back to the final version of record once it has been peer reviewed and published.[121]

68. The IOP provided further details of how it makes this easy for authors:

> Within our online submission form there is an option for authors to enter their arXiv reference number when they submit the article to be considered for publication. This number enables us to locate the article in question and automatically upload the files from arXiv to our peer review system for processing.[122]

69. While physics publishers are clearly well linked into the arXiv server and it appears to be a system that works well for the physics community, it is not necessarily the best model for all disciplines. Dr Robert Parker of the RSC told us that this system was "not popular with chemistry because there is very often the possibility that an author will take out a patent on what they are producing. Putting your results out there in a pre-printed form is risking losing priority on them".[123] Professor Ron Laskey indicated that a pre-print server

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117 Q 11

118 *As above*

119 Ev 103, para 13

120 Q 11

121 *As above*

122 Ev 94, para 1

123 Q 8

would also not be suitable for biomedical sciences.[124] He described two worries from the Academy of Medical Sciences submission to this inquiry:

> One is that biomedical sciences are more prone to inaccurate interpretations […] There is a worry that, if you extended the pre-publication model to the biomedical sciences without any attempt to peer review, a lot of half-truths would creep into the literature.
>
> The second problem is the appetite of the media for some aspects of biomedical science. Without peer review we would get a storm, frankly, of incorrect headlines.[125]

70. Sir Mark Walport, from the Wellcome Trust, reinforced Professor Laskey's point:

> One of the issues in the biological sciences is that the volume of research is extremely high. An important issue in the medical sciences is that an ill-performed study can have harmful consequences for patients. Therefore, there need to be filtering mechanisms to make sure that things are not published that are, frankly, wrong, misconceived, the evidence is bad and conclusions are drawn which means that patients could be harmed. Different communities require slightly different models.[126]

71. Professor John Pethica of the Royal Society suggested that pure mathematics is a "good example of an area" which might benefit from the pre-print server model because "it can take a very long time for the assessment of theorems to become correct".[127] He added that this was in contrast with areas such as engineering, where there is an immediate technological impact.[128]

72. **We conclude that pre-print servers can be an effective way of allowing researchers to share and get early feedback on preliminary research. The system is well established in the physics community, and works particularly well, co-existing with more traditional publication in journals. We encourage exploration in other fields. We note, however, that pre-print servers may not work in fields where commercialisation and patentability are issues, or in the biomedical sciences, where publication of badly performed studies could have harmful consequences and could be open to misinterpretation.**

Open peer review

73. Open peer review has traditionally been defined as review in which the authors' and reviewers' names are revealed to each other. This system has been used successfully by the *BMJ* for more than a decade with no significant problems.[129] BMJ Group told us that:

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124 Q 15

125 *As above*

126 Q 254

127 Q 12

128 *As above*

129 Ev 72, para 16 [BMJ Group]

> PLoS Medicine, however, tried and then discontinued this practice in late 2007 citing reviewers' reluctance to sign their reports—perhaps because at that time it was publishing a lot of laboratory-based research, which is arguably more competitive than clinical research.[130]

74. A more recent and much broader definition can also cover cases where: reviewers' names are publicly disclosed; the reviews are also published; and/or the community can take part or comment. Dr Philip Campbell explained the well-known *Nature* experiment in open peer review:

> In 2006, *Nature* ran an experiment in open peer review, in which over a period of four months, submitting authors were invited to post their papers on an open website for open assessment by peers. Their papers were also peer-reviewed in the usual way.
>
> […] In brief, the take-up by authors was low, as was the amount of open commenting. Furthermore it was judged by the editors that the comments added little to the assessment of the paper.
>
> It is my view, consistent with this outcome, that scientists are much better motivated to comment on an interesting paper when directly requested to do so by an editor.[131]

As a result, *Nature* chose not to adopt the widespread implementation of open peer review.[132]

75. Elsevier described the process operated by another journal, *Atmospheric Chemistry and Physics*, that uses an innovative type of open peer review:

> Following initial review by an editor to assess alignment with the title's coverage the manuscript is published online (usually two to eight weeks after submission). Comments and discussion by members of the public and select reviewers then take place for an eight-week period. The author responds to comments within four weeks, and then prepares a final revised article. The editor then decides whether to accept the paper. The original paper, comments, and final paper are all permanently archived and remain accessible. Other than comments from invited reviewers, spontaneous comments from members of the scientific community have been relatively low.[133]

76. The "transparent" approach, used by the *EMBO Journal*, which is published by the Nature Publishing Group, features "the online display of anonymized referees and

130 Ev 72, para 16

131 Ev 88, paras 42–45

132 "Overview: Nature's peer review trial", Nature Online, www.nature.com/nature/peerreview/debate/nature05535.html

133 Ev 117, para 30(a)

editors/authors' correspondence after publication, alongside the paper",[134] provided as a "Peer Review Process File".[135] However, Dr Philip Campbell informed us that:

> *Nature* and the Nature journals have so far not gone down this route. This reluctance is partly based on a precautionary fear that it might upset the relationship between editors and referees. Moreover, the documents reflect only a part of the process of discussions within the editorial team, between the editors and the referees, and between the editors and the authors. There is also a belief that few people will want to wade through this copious information.
>
> Nevertheless, transparency has its own virtues, and we are keeping this policy under review.[136]

The BioMed Central medical journals also provide this sort of "pre-publication history".[137] Dr Michaela Torkar, from BioMed Central, told us that this was "a very transparent way of seeing how the system works and the sort of records we keep".[138]

77. Others are now also seeing the virtues of transparency, particularly where issues have arisen relating to dissatisfaction with reviews. A recent example of this was the open letter by 14 leading stem cell researchers to senior editors of peer-reviewed journals publishing in their field:

> Peer review is the guardian of scientific legitimacy and should be both rigorous and constructive. Indeed most scientists spend considerable time and thought reviewing manuscripts. As authors we have all benefited from insightful referee reports that have improved our papers. We have also on occasion experienced unreasonable or obstructive reviews.
>
> We suggest a simple step that would greatly improve transparency, fairness and accountability; when a paper is published, the reviews, response to reviews and associated editorial correspondence could be provided as Supplementary Information, while preserving anonymity of the referees.[139]

The letter went on to urge adoption of the *EMBO Journal* model.

78. **The principles of openness and transparency in open peer review are attractive, and it is clear that there is an increasing range of possibilities. There are mixed results in terms of acceptance amongst researchers and publishers, although some researchers are keen to see greater transparency in their fields. We encourage publishers to experiment with the various models of open peer review and transparency and actively engage researchers in taking part.**

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134 Ev 89, para 49 [Philip Campbell, *Nature*]

135 "Editorial Process", The EMBO Journal, www.nature.com/emboj/about/process.html

136 Ev 89, paras 50–51

137 Q 192 [Dr Michaela Torkar]

138 Q 192

139 "Open letter to Senior Editors of peer-review journals publishing in the field of stem cell biology", EuroStemCell, www.eurostemcell.org, 10 July 2009

Online repository journals

79. The constraints of print journals and the challenges associated with authors striving to publish in high-impact journals have been described in paragraphs 59-64. Authors are now able to submit their manuscripts to one of an increasing number of online repository-type journals. One such example is the journal, *PLoS ONE*, published by the "open access" publisher, the Public Library of Science (PLoS). "Open access" is defined as the removal of all barriers (for example, subscription costs) to access and reuse of the literature. To provide open access, PLoS journals use a business model in which expenses are recovered "in part by charging a publication fee to the authors or research sponsors for each article they publish".[140] This model is potentially open to abuse if the peer-review process is not robust and if publishers view it mostly as a revenue-generating venture.[141] However, in the case of *PLoS ONE*, the goal is to publish "all rigorous science",[142] placing an "emphasis on research validity over potential impact".[143] The Wellcome Trust stated that:

> The approach adopted by *PLoS ONE*—where the peer review process focuses solely on whether the findings and conclusions are justified by the results and methodology presented, rather than on assessment of the relative importance of the research or perceived level of interest it will generate—has both reduced the burden on the reviewer and the time it takes to get a paper published.[144]

80. Dr Mark Patterson, Director of Publishing at PLoS, explained that "*PLoS ONE* was launched in December 2006, [it] published about 4,000 articles in 2009 and 6,700 last year, so it became the biggest peer-reviewed journal in existence in four years".[145] The popularity of *PLoS ONE* has spurred the launch of a host of similar journals, as described by Dr Patterson:

> The American Institute of Physics and the American Physical Society have both launched physical science versions; Sage has launched a social science version; the BMJ group, who were actually the first, last year launched a clinical research version of *PLoS ONE*; *Nature* has launched a natural science version of *PLoS ONE*, and on it goes. The model is getting that level of endorsement from major publishers and I think, again, that is probably helping to make researchers very comfortable with the way in which *PLoS ONE* works.[146]

81. He added that:

> if another 10, 20 or 30 of these are launched over the next one to two years, which I think is quite likely […] that could make some fairly substantial changes in the way the pre-publication peer review process works. […] The benefit will be the

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140 "About PLoS ONE", PLoS ONE, www.plosone.org

141 "Open Access Publisher Accepts Nonsense Manuscript for Dollars", *The Scholarly Kitchen*, 10 June 2009, http://scholarlykitchen.sspnet.org/2009/06/10/nonsense-for-dollars/

142 Q 171 [Dr Mark Patterson]

143 Ev 135, para 2 [Academy of Medical Sciences]

144 Ev 83, para 8

145 Q 170

146 Q 171

> acceleration of research communication because you avoid bouncing from one journal to another until you eventually get published. That is a tremendous potential benefit.[147]

82. Professor Ron Laskey, from the Academy of Medical Sciences, explained that:

> initially, people envisaged *PLoS ONE* as a journal they would submit to only if their paper was having severe criticism from other higher impact journals. Now, important research has been submitted to get it on the record quickly before it is scooped by someone else who has a smoother path through the refereeing jungle.[148]

83. Dr Philip Campbell, of *Nature,* added that:

> there are people who are sick to death of editors and who value something like [*PLoS ONE*, or in Nature's case] *Scientific Reports*, which have […] no editorial threshold but do have a peer review process just for the validity aspect.[149]

84. Dr Patterson explained in further detail the way in which *PLoS ONE* achieved quicker publication times than traditional journals:

> the real benefit in *PLoS ONE,* which is relevant to speed, is that authors won't be asked to revise their manuscripts to raise them up a level or two. With a lot of journals, you get asked to do more experiments to raise it up to the standard that particular journal wants. That doesn't and shouldn't happen at *PLoS ONE.* As long as the work is judged to be rigorous, it is fine. The amount of revision can be quite a lot less because authors are asked to do it in that way and that can really reduce the overall time from submission to publication.
>
> There is another way in which I think *PLoS ONE* accelerates research communication generally. Often, articles are submitted to journal *A* and are rejected as not being up to standard. They go to journal *B* and then journal *C* and, eventually, are published. If you have a robust piece of work it will be published in *PLoS ONE* as long as it passes the criteria for publication. You will not have to fight with editors who are trying to argue for a certain standard. I think those two other things really have the potential to accelerate research communication broadly.[150]

85. The speed between submission, acceptance and publication has led to some commentators suggesting that the *PLoS ONE* peer-review process is "light".[151] Dr Patterson was asked whether he would describe it as "light touch" and replied "no, not at all", and then went on to describe the peer-review process at *PLoS ONE*.[152] The Wellcome Trust also defended the peer-review process used by *PLoS ONE*:

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147 Q 173

148 Q 6

149 Q 121

150 Q 166

151 For example: D. Butler, "PLoS stays afloat with bulk publishing", Nature, 2008, vol 454, p11

152 Q 176

> *PLoS ONE* has very good peer review. Sometimes there is a confusion between open access publishing and peer review. Open access publishing uses peer review in exactly the same way as other journals. *PLoS ONE* is reviewed. They have a somewhat different set of criteria, so the *PLoS ONE* criteria are not, "Is this in the top 5% of research discoveries ever made?" but, "Is the work soundly done? Are the conclusions of the paper supported by the experimental evidence? Are the methods robust?" It is a well peer-reviewed journal but it does not limit its publication to those papers that are seen to be stunning advances in new knowledge.[153]

86. *PLoS ONE* publishes 69% of its submissions.[154] However, Dr Patterson explained that this does not necessarily mean that 31% are rejected.[155] He told us:

> Some of them are "lost" in the sense that they may be sent back for revision—maybe 5% to 10% are sent back for revision—and the others are rejected, as they should be, on the grounds that they don't satisfy technical requirements. […] We did some author research in the last couple of years and we have seen that, in both cases, according to the authors' responses, about 40% of rejected manuscripts have been accepted for publication in another journal.[156]

87. There has also been speculation about the level of copyediting that occurs at *PLoS ONE*. Richard Poynder, a journalist with an interest in publishing, wrote:

> *PLoS ONE* does not copyedit [this is the work that an editor does to improve the formatting, language and accuracy of text] the papers it publishes, only the abstracts. But it would appear that even this minimal service is not always provided. [...]When I contacted [Peter] Binfield [*PLoS ONE Publisher*] [...] he said: "Speaking for *PLoS ONE* we do not copyedit content (other than a very light clean up). We do a light (but real) copyedit on the abstract; and at time of submission one of our (many) Quality Control checks is on the quality of the English. However, as a general rule, if the language is intelligible, and passes QC and passes peer review etc., then it will be published as is".[157]

88. We put some of these concerns to Dr Patterson, who explained that:

> In our production process we focus on delivering really well structured files that will be computable, for example. We don't expend effort in changing the narrative. Scientific articles aren't works of literature. That is not to say it wouldn't be nice if, sometimes, a bit more attention was paid to that. It is also true that one of the criteria for *PLoS ONE* is that the work is in intelligible English. If an editor or reviewer thinks that something is just not good enough and they can't really see what is happening, it will be returned to the author.[158]

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153 Q 253

154 "PLoS ONE Editorial and Peer-Review Process", Public Library of Science, www.plosone.org

155 Q 164

156 *As above*

157 Richard Poynder, "PLoS ONE, Open Access, and the Future of Scholarly Publishing", 7 March 2011, http://richardpoynder.co.uk/PLoS_ONE.pdf, p 24

158 Q 167

89. **We are impressed by the success of *PLoS ONE* and welcome the wider growth of quality online repository journals. These will accelerate the pace of research communication and ensure that all work that is scientifically sound is published, regardless of its perceived importance. However, we recognise that this is a relatively new and rapidly evolving model, and potentially open to abuse because publication fees are involved. It is important that a high quality of peer review is maintained across all repository-style journals.**

3 Editors, authors and reviewers

90. At the heart of the peer-review process are the people involved: editors, authors and reviewers. Dr Robert Parker, Interim Chief Executive of the Royal Society of Chemistry (RSC) told us that "having professional people overseeing the peer review process is absolutely paramount".[159] We also heard that:

> Peer review or expert review is as good as the people who do it. That is the key challenge. It has to be used wisely. It is about how the judgment of experts is used. It is about balancing one expert opinion against another. The challenge is not whether peer review is an essential aspect of scholarship because there is no alternative to having experts look at things and make judgments.[160]

91. Peer review is regarded as an integral part of a researcher's professional activity; it helps them become part of the research community. The International Association of Scientific, Technical and Medical Publishers explained that "as every active researcher expects to publish and through peer review receive constructive critical comments on their work, so they too must expect to act as a peer reviewer for others".[161] It is a reciprocal activity; most researchers acknowledge this. Dr Nicola Gulley, Editorial Director at Institute of Physics (IOP) Publishing Ltd, further explained that "in a recent survey that was done by Sense About Science, about 86% of researchers said they enjoyed reviewing and there are benefits to it in that they get to see papers ahead of time and they get to keep up to date".[162] However, others have reported that "for many the review process is perceived as a 'chore and not a pleasure'. Reviewers feel this way because they are not rewarded or recognised for their work".[163]

The role of the editor

92. There are currently approximately 6,000 publishers around the world managing somewhere in the region of 25,000 peer-reviewed journals; publishers have become "stewards of the peer review process on behalf of research communities".[164] Broadly speaking, there are two types of journal editor: internal staff editors and external (academic) editors who are active researchers (see paragraph 101). The role of the editor is "central to the quality of the peer-review process".[165] The RSC explained that:

> It is the editor who will consider the information produced through the process and so ultimately decide what feedback is communicated to the author and which articles

159 Q 3

160 Q 252 [Sir Mark Walport]

161 Ev w126

162 Q 27

163 A Mulligan, *Is peer review in crisis?*, Oral Oncology, 2005, vol 41, pp 135–41

164 Ev 115, para 12 [Elsevier]

165 Ev 97, para 10 [Royal Society of Chemistry]

> are published. The judgement applied by the editor to the information collected in the review process requires knowledge, skill, and care.[166]

93. The British Sociological Association also recognised the importance of the editor in safeguarding against problems in the peer-review process.[167] This could include monitoring and preventing bias, looking out for signs of research fraud or misconduct, and ensuring feedback and requests for further information from reviewers to authors are rational. The latter is becoming an "increasingly troublesome" problem.[168] Professor Ron Laskey of the Academy of Medical Sciences explained that in the biomedical sciences:

> a high proportion of time is spent fending off criticisms from reviewers that may not be on the main theme of the work. The reviews are beginning to dictate the agenda of the science in a way that is not fully productive. That can be frustrating, a waste of time and resource.[169]

94. Reviewer-suggested experiments were the subject of a recent *Nature* article, which suggested that "the problem is made more acute by the unwillingness of editors to express their opinions".[170] Dr Philip Campbell, Editor-in-Chief of *Nature* and Nature Publishing Group, told us that as a result of the remarks made in this article he had questioned his editors to find examples of "recent publications which had had to be revised, but where we had made a judgment that in this particular case this request for extra work was not required".[171] Dr Sugden, Deputy Editor & International Managing Editor at *Science*, explained that:

> Often you will get two or three referees' reports on a paper, but those referees may not agree with each other. It is the editor's job, if they consider the paper worth pursuing, to then make a recommendation as to which of those referees' revisions they should follow and which they should not. [172]

Mayur Amin, Senior Vice President of Research & Academic Relations at Elsevier, added that at Elsevier feedback was collected "from the researchers, authors, reviewers and the editors" so that as publishers they could "take that on board and present it to an editor or a journal and say, 'Look, a whole lot of authors are getting displeased about the way the process is working. We need to modify the process'".[173]

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166 Ev 97, para 10

167 Ev w112, para 7.7

168 Q 6 [Professor Ron Laskey]

169 Q 6

170 H Ploegh, *End the wasteful tyranny of reviewer experiments*, Nature, 2011, vol 472, p 391

171 Q 109

172 *As above*

173 *As above*

Reviewer selection

95. One of the core decisions made by an editor during the peer-review process is who reviews the manuscript. Professor John Pethica, from the Royal Society, described how this decision is taken:

> One can keep a record of how effective various reviewers are, which is done by most journals. Some people are more effective than others and are used correspondingly. Also one uses the community to suggest future names of reviewers. It is very common, for example, if a senior scientist is asked to review something and they can't do for whatever reason, for them to suggest other names of people. This is a productive, rapid and efficient way of connecting the network of scientists. Since you have multiple reviewers in most cases, then of course you can test out the reviewers a little and build up a track record on them.[174]

Dr Parker, from the RSC, added that:

> Building up a knowledge of the community is very important. […] People do get to know a particular area and the interactions between certain authors and referees very well. You do get to know your community and you get a feel for whether there are any issues between particular people.[175]

96. For journals with staff editors, building and maintaining that relationship with the research community is achieved through attending conferences and seminars, as well as visiting universities and industry.[176] Dr Parker told us that RSC editors "regularly attend up to 200 conferences a year overall".[177] Dr Gulley, from IOP Publishing Ltd, indicated that their editors also attended a large number of conferences, in the region of 300–400 a year.[178]

97. Selecting the right reviewers for the job is a particularly important way of combating bias in peer review. Dr Gulley explained that "having a combination of the internal editors as well as the external editors helps with impartiality".[179] She added that there is also the option for authors to appeal if they disagree with the final editorial decision.[180] In addition to this, authors might also choose to take up their concerns in a public arena. A recent example of this is the open letter by 14 leading stem cell researchers to senior editors of peer-reviewed journals publishing in their field (see paragraph 77).

98. Bias in reviewer selection does not always work against authors. In the past, there have been accusations that top journals, such as *Science* and *Nature*, "are locked in such fierce competition for prestige and publicity that they may be cutting corners to get 'hot'

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174 Q 18

175 Q 16

176 Q 18 [Dr Robert Parker]

177 Q 18

178 *As above*

179 Q 21

180 *As above*

papers".[181] The UK Research Integrity Office Ltd (UKRIO) drew our attention to the fact that "the Nobel Laureate, Robert Laughlin, commenting on a series of retractions from these eminent journals said 'in this case the editors are definitely culpable […] they chose reviewers they knew would be positive'".[182]

99. Dr Philip Campbell defended *Nature* against these accusations:

> That is completely wrong. I totally refute that statement [...] It is not in our interests to cut corners. […] we have one of the most critical audiences in the world, and any paper that makes a strong claim is going to be absolutely hammered in the form of testing in the laboratory or scrutinised in terms of discussions at journal clubs, within universities and so on. It is simply not in our interest, for our reputation in the long run, to publish papers that have any degree of cutting of corners in the assessment process.[183]

Dr Campbell added that after a "hot paper" is published, though there is "an immediate stream of interest", there is no "direct effect on sales".[184] He explained that "there is a big barrier of independence, institutionalised within the company, in fact, between the commercial side and the editorial side".[185]

100. **The role of the editor is at the heart of the peer-review process. The judgement applied by the editor to the information collected in the review process requires knowledge, skill, and care; particularly, in respect of identifying the right reviewers for the job and critically assessing the feedback from reviewers to authors.**

Training

Editors

101. Publishers use a variety of arrangements for editorial responsibility during the peer-review process. Broadly speaking, the two main approaches are to appoint staff editors as in-house professionals, or to use editorial boards consisting of active researchers. Regardless of whether journals opt for the use of staff editors, academic editors, or a combination of both, some form of editorial training is necessary—especially in the light of the central role of the editor (paragraph 92).

102. The RSC and the IOP use "a combination of in-house editors and external editors",[186] as does the journal, *Science*.[187] Dr Andrew Sugden told us that the initial filtering to identify "innovative" and "original" submissions at *Science* is carried out through consultation with a Board of Reviewing Editors.[188] This Board is appointed by the staff editors and consists of

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181 For example: "Science Fails When Cheaters Think They Won't Be Caught", Wall Street Journal, 27 September 2002

182 Ev 124, para 1.9

183 Q 134

184 Q 135

185 *As above*

186 Q 16 [Dr Nicola Gulley]

187 "Peer Review at Science Publications", Science, www.sciencemag.org

188 Ev 138, para 4

mid-career active research scientists. "The responsibility for managing the peer review process and for making decisions on rejection/revision/acceptance of submissions for publication rests with the staff editors".[189] In contrast, Dr Philip Campbell, *Nature*, explained that:

> *Nature* and the Nature journals are untypical journals in that they do not have editorial boards of active researchers. All selection decisions are the responsibility of the fully independent and Chief Editors of each journal and their teams.[190]

103. During the course of this inquiry, we questioned a number of publishers about the type of training they provide to their editors, both in-house and external. On the whole, training for staff editors appears to be provided on the job.[191] Dr Philip Campbell explained the situation at *Nature*:

> The training that takes place [happens] by [staff editors] participating fully in the process of selecting papers. Every new editor sits within a small team with a team leader who will initially track their every thought and action in respect of every paper they handle.
>
> As months go by, this scrutiny gradually relaxes. We reckon that it takes about two years of handling papers and visiting many labs and conferences for our editors to gain the full experience of the various ways in which authors, editors and referees can interact and hence optimize the process. Also, over that time, an editor builds up extensive scientific and research-community knowledge and contacts.[192]

104. Training for academic editors and editorial boards—at those journals that use them—varies. The Public Library of Science (PLoS) told us that its:

> [academic editors] and their editorial boards are supported by PLoS staff, who provide initial training and ongoing support in the use of the journal management system. PLoS staff also send occasional communications on best practice to the editorial boards […] The journals have an electronic discussion facility so that all submissions can be discussed with colleagues on the journal or with editors who work on other PLoS journals (on a confidential basis). The PLoS staff editors are occasionally brought in to discussions to provide support on specific content issues or matters pertaining to publishing ethics.[193]

105. A more structured approach is taken by Elsevier, which provides its new external editors with:

> a Welcome Pack which, in some 50 pages, introduces new Editors to Elsevier, its policies, procedures, the editorial and publishing teams which support the journal,

189 Ev 138, para 3 [Dr Andrew Sugden]

190 Ev 86, para 7

191 Ev 81, para (i) [Public Library of Science]; and Ev 90, para 3 [Dr Philip Campbell]

192 Ev 90, paras 3-4 [Dr Philip Campbell]

193 Ev 82, para (ii) [Public Library of Science]

> the peer review process including tools to find reviewers, ethical guidelines, as well as support tools.[194]

The journal, *PLoS ONE*, also provides newly recruited editorial board members with "a pack of information providing guidance about the editorial process and standards associated with *PLoS ONE*", as well as "videos explaining the operation of the journal management system". Additional support and ongoing advice are provided by *PLoS ONE* administrative staff.

106. **Broadly speaking, training for editors and members of editorial boards is provided on the job. We have heard that some publishers opt for a more structured approach, and include, for example, comprehensive welcome packs for new editors that cover peer-review processes, support tools and ethical guidelines. We encourage publishers to work together to develop standards—which could be applied across the industry—to ensure that all editors, whether staff or academic, are fully equipped for the central role that they play in peer review.**

Authors and reviewers

107. In addition to training their editors, some publishers also provide feedback or training for authors and reviewers. Dr Robert Parker, from the RSC, told us:

> We have a feedback loop where referees always get the feedback on the outcome of the articles that they have refereed so that they can learn whether their refereeing activity is generally in line with what is accepted and what is rejected.[195]

108. He acknowledged, however, that the RSC did not run a structured training programme and that the feedback was provided "ad-hoc".[196] Professor Ron Laskey, Vice President of the Academy of Medical Sciences, considered feedback to be very helpful. He told us:

> From a referee's point of view, something that I found extremely educational is to be sent back the referee reports of the other referees. There are several times when I have wanted to kick myself for missing something that the publisher spotted that I had not. Equally, it is not uncommon to find that you are in complete agreement.[197]

However, while feedback is common in some disciplines, it is by no means standard practice across all journals.[198]

109. Publishers are increasingly offering more training opportunities to reviewers, albeit in a sporadic way. Dr Janet Metcalfe, from Vitae, explained that bringing early-career researchers into the peer-review system was particularly important:

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194 Ev 120, para 3.2.2

195 Q 16

196 Qq 22–23

197 Q 23

198 Q 24 [Professor Ron Laskey]; and Q 25 [Professor John Pethica]

> How do you get into that system? How do you become a reviewer? It is very often by recommendation. There are journals that have open calls for reviewers, but becoming a reviewer is usually part of the apprenticeship of being nurtured as a researcher by your principal investigator or senior academic. There are issues in terms of how we support those researchers to become involved and good at peer reviewing on both sides of the fence, but also how we recognise it by acknowledging the broadness of a researcher's activities.[199]

110. We heard examples of how publishers are addressing this challenge. Dr Nicola Gulley, from IOP Publishing Ltd, told us that:

> Recently, as a result of requests from some post-docs and graduates, we have given them some initial training on what peer review means. We are teaching them about what refereeing means and what we are expecting. There is a lot of literature as well that people are not always aware of so we have been trying to raise the visibility of that. Internally, we also try and match the interests of the referees to the papers as much as possible.[200]

111. Elsevier is also working with postdoctoral students on peer review. It has developed a "Reviewer Mentor Programme" whereby:

> experienced editors employed at two universities mentor postdoctoral researchers who have authored papers but not yet served as peer reviewers. Each mentor runs training workshops for the postdocs and then the postdocs review real articles under supervision. Each postdoc is marked, and upon successful completion receives a certificate. We are exploring ways to provide formal certification and a reviewer kite mark to scale up this successful pilot.[201]

112. Professor John Pethica, Physical Secretary and Vice President of the Royal Society, explained that "PhD students […] are trained, as part of their learning process, to understand how to criticise and to find out what is right and wrong with the scientific literature".[202] He added that it was "important that the training of researchers in general includes the understanding that they should participate in [peer review] as an expectation of being a good scientist".[203] Some concerns had, however, been raised about the lack of training in best practice for new reviewers, with suggestions that this should form part of post-graduate training.[204] We, therefore, questioned whether peer-review training should be a formal part of gaining a PhD. Sir Mark Walport, Director of the Wellcome Trust, told us:

> Part of the training of a scientist is peer review. For example, journal clubs, which are an almost ubiquitous part of the training of scientists, bring people together to criticise a piece of published work. That is a training in peer review. Can more be

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199 Q 224

200 Q 16

201 Ev 117, para 29e

202 Q 23

203 Q 26

204 For example, Ev w96, para 25 [British Antarctic Survey]

> done to train peer reviewers? Yes, I think it probably can. PhD courses increasingly have a significant generic element to them. It is reasonable that peer review should be part of that.[205]

113. Professor Rick Rylance, Chair-elect of Research Councils UK (RCUK), was broadly in agreement with Sir Mark's comments. He added that "research is a collective enterprise and that anyone who wishes to enter that field either as an academic or in some other capacity needs to understand that".[206] Dr Janet Metcalfe, Chair of Vitae, provided more details about the current opportunities for new authors and reviewers in universities and research institutions:

> The tradition is very much an apprenticeship model. You learn the system by doing it in terms of writing papers, submitting them and maybe getting feedback from your principal investigator [PI]. Where that works it is absolutely fantastic […] But, because we are a collective in terms of the academic community, there is opportunity for that process not to be as well supported throughout the whole of the academic community as it could be.[207]

When we asked Dr Metcalfe whether she was in favour of more formal training, she responded:

> I think the opportunities to have training should be there. The process by which a researcher learns to become expert is very much up to their individual circumstances. If they are getting good individual nurturing and mentoring by their PI, that is great. But there should also be the opportunity, for those researchers who respond more to formal training, to have that available as well.[208]

114. Professor Ian Walmsley, from the University of Oxford, agreed that "a combination of both mentorship, which I think has a primary role, and some elements of non-mandated training would continue to be very helpful".[209]

115. Others were in favour of formalised training; for example, the British Medical Association (BMA) stated that:

> It is remarkable that there is no formal training process in place for such an important mechanism to ensure scientific quality. Guidance from a publisher alone, who may have parallel but different priorities, is not adequate. The BMA favours a system that provides proper peer review training as an option within postgraduate training.[210]

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205 Q 258

206 *As above*

207 Q 226

208 Q 227

209 Q 229

210 Ev w21, para 12

116. Professor Sir Adrian Smith, Director General of Knowledge and Innovation in the Department for Business, Innovation and Skills (BIS), considered that it was not a "one size fits all" situation, he told us:

> We have to allow a lot of scope for particular research organisations or supervisors to decide on what is appropriate. Peer review training is already part of the Research Councils' postgraduate training. There is a formal expectation that students […] "obtain an understanding of the processes for funding and evaluating research." The terms and conditions of training grants actually put some of this in. If you think about it, if you are doing a PhD, you are having to read and access a lot of literature and synthesise that literature. […] It is an inherent part of the scientific process itself that you are constantly peer reviewing in a way. […] The amount of effort that has gone on in recent years on the part of the research councils to better codify their expectations of what research training should consist of and making that part of the conditions when they give out either doctoral training grants or research grants takes us most of the way. I do not think there is much that we could do in going further.[211]

117. Professor Sir John Beddington, the Government Chief Scientific Adviser, added that:

> a number of universities have exercises where PhD students and some academics examine individual papers. In that case, everybody goes away, reads a paper over the weekend and then they have a meeting and discuss and critically appraise that paper. That is part of the process. Obviously, that practice will differ between universities and subject areas.[212]

118. **A relatively straightforward way of educating reviewers about the quality of their reports and helping them improve their feedback to editors is to send them the reports of other reviewers, done confidentially when necessary. This should be standard practice across all journals. This would be a useful educational tool to improve the quality of future reports from reviewers.**

119. **Training for the next generation of authors and reviewers is also important. Many PhD students and post-doctoral researchers are fortunate to have the opportunity to discuss scientific literature in journal clubs and other informal settings. Some are mentored well by their principal investigator and thereby receive informal training in peer review. Others are not. Given the importance of peer review across the research spectrum, from grant applications to publications, we consider that all early-career researchers should be given the option for training in peer review.**

Funding for training

120. Training in peer review, whether ad-hoc or in a formalised setting is clearly desirable; we therefore examined where funding for this training would come from. Vitae, the UK organisation championing the personal, professional and career development of doctoral researchers and research staff, explained the current situation:

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211 Q 301

212 *As above*

> Until recently there were few opportunities for researchers to undertake formal training. The advent of Vitae and government funding through the UK Research Councils for implementing the recommendations of the Sir Gareth Roberts review[213] have significantly increased the opportunity for early career researchers to participate in professional development opportunities, including academic writing for publication and grant applications. These courses generally include experience of the peer review process. There are also examples of universities and other bodies providing structured development opportunities in being a peer reviewer, including encouraging early career researchers to set up and run journal clubs.[214] However, the numbers participating in these activities are fairly small and with the end of 'Roberts funding' in March 2011 even this level of provision may […] fall.[215]

121. Roberts funding of just under £150 million was provided to the Research Councils in the 2002 Spending Review to "increase stipends, length of doctoral programmes and provide training for their funded researchers".[216] We asked Professor Rick Rylance, from RCUK, how training in peer review would be funded in the absence of Roberts funding, he responded:

> The amount we are giving to universities for training and developing postgraduate research will increase, and it will include components which replace part of the Roberts funding. The issue we have to think about is that, on average, around only 25% of the UK postgraduate population are funded through agencies like the research councils. The rest of it is coming through other sorts of routes. How are universities going to provide a system for three quarters of the population who are not getting money from us? There has to be a joined-up conversation about how we develop that.[217]

122. Some of the other funders that Professor Rylance referred to are also providing the opportunity for training to be incorporated into the PhD programme, for example:

> The Wellcome Trust funds four-year PhD programmes, so we are providing funding for a longer period. […] the four-year model of the PhD is becoming well established and that gives universities the opportunity to provide that transferable skills training.[218]

We queried whether training in peer review was a part of this "transferable skills training", and were told that the Wellcome Trust was "not prescriptive in what universities teach" but that it would be "reasonable" for peer review to be a component of the training.[219]

123. Dr Janet Metcalfe, from Vitae, explained the need to share responsibility for the training of future generations of peer reviewers:

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213 G Roberts, *SET for Success: the supply of people with science, technology, engineering and mathematic skills*, 2001

214 D A Mackey, *Training peer reviewers*, Nature, 2006, vol 443, p 880

215 Ev 146, para 10

216 "Roberts Report", Vitae, www.vitae.ac.uk/policy-practice/1685/Roberts-recommendations.html

217 Q 260

218 Q 259 [Sir Mark Walport]

219 Q 260 [Sir Mark Walport]

> Collectively, we all have a responsibility for [peer review] to work. I think journals have a responsibility to support and provide more information about what is required and to contribute to the training of their reviewers. I think institutions have a responsibility, as signatories to the Concordat for the Career Development of Researchers, to ensure that those opportunities are there. I think research and funding councils and Government have an obligation to provide enough funding within the entire system to make available that kind of training for our early career researchers.[220]

She added that it was also the responsibility of the individual researcher "to take advantage of [training] opportunities and ensure that they are developing their own expertise and understanding of the entire system".[221]

124. **Training for early-career researchers is important. We note that "Roberts Funding" is coming to an end and that the Research Councils will therefore be increasing the amount they give to universities "for training and developing postgraduate research". We invite the Research Councils to set out further details of how and where this money will be allocated and what proportion of it will be dedicated to training in peer review, including academic writing and publication ethics (discussed later in this report). We also ask for further details of how this will be "joined up" across different research funders.**

International challenges and opportunities

125. Earlier we highlighted that significant changes are taking place in scientific publishing, including the fact that the share of publications by countries which are not traditional scientific leaders, such as China and India, is rising (paragraph 6). Mayur Amin, from Elsevier, described the current situation:

> If you take somewhere like the USA, which produces about 20% of the output of papers, it conducts something like 32% of the reviews in the world, whereas China is producing something like 12% to 15% of the output of papers but is probably only conducting about 4% to 5% of the reviews. This is just a transitionary thing. China and India have grown very fast in the last few years; there are a lot of young researchers who will come up and take their place in peer review and start peer reviewing papers.[222]

126. This was widely recognised, for example, the Publishers Association told us that:

> There remain considerable geographical imbalances between those who benefit from peer review and those who contribute, most starkly between the US, the most prolific peer reviewer, and China, whose output of papers in certain disciplines has risen exponentially since 2000 but whose participation in peer review is increasing much less quickly. It is expected however that these imbalances will even out over time and within the UK there is more of a balance between publication output and

220 Q 228

221 Q 232

222 Q 127

> participation in peer review. Publishers active in India and China are appointing editors and establishing editorial offices from where they run workshops on peer review, journal publication practices, and publication ethics.[223]

127. Mayur Amin explained that:

> It is incumbent upon publishers to help out here, both in terms of technical infrastructure to help editors find a broader pool of reviewers, and also in terms of training needs, appointing editorial board members in those developing countries as well as running workshops and providing literature to help train new and young reviewers to come on to the system.[224]

128. We discussed these international activities with a range of publishers. Dr Robert Parker, from the RSC, and Dr Nicola Gulley, from IOP Publishing Ltd, explained that both organisations carry out face-to-face training in peer review, particularly in China and India.[225] Dr Parker told us:

> We do a lot of interaction with the Chinese academic market, as it is. We have two offices in China—one in Beijing and another in Shanghai. We have staff out in China. We do regular visits. We set up conferences in China now. We started off doing roadshows of the top chemistry departments in China. All of our roadshows include presentations on how to publish and how to referee. We have built up quite a significant connection with the Chinese academic market. We also involve them on our editorial boards. We get them involved as associate editors on our journals.[226]

129. Dr Gulley added that IOP Publishing had "been working with researchers in China for the past 11 years. We have a member of staff who visits universities and gives lectures on how to get published. We run workshops and we visit regularly".[227] Robert Campbell, Senior Publisher, Wiley-Blackwell informed us that they had "been carrying out a lot of training since 2005 in China, particularly in chemistry. We are increasing the percentage of peer reviewing from China now. It is still not parity but it is moving towards 20% of our papers".[228] Dr Fiona Godlee added that the BMJ Group was also "involved closely in training in Africa, China and India at the moment".[229]

130. **We welcome the fact that the publishers we have heard from are training authors and reviewers on an international level, particularly those from countries which are not traditional scientific leaders, and we encourage others to do the same. This should help alleviate the current imbalance between publication output and participation in peer review.**

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223 Ev w106, para 13

224 Q 127

225 Q 16

226 Q 51

227 *As above*

228 Q 149

229 *As above*

Finding reviewers

131. In part as a result of the growth of scientific output, both at home and abroad, there have been expressions of concern about the state of the peer-review system, including claims that the peer-review system is in crisis.[230] In particular, claims that there is an increasing burden on reviewers and that "scientists face strong incentives to submit papers, but little incentive to review".[231] Professor Ron Laskey, of the Academy of Medical Sciences, stated that he "wouldn't say [peer review] is in crisis. I would say that the engine is misfiring rather than it has stalled completely".[232]

132. The Society for General Microbiology told us that "with the rise in research that is multidisciplinary and becoming increasingly specialized it is sometimes difficult to find reviewers with sufficient expertise".[233] Robert Campbell, Senior Publisher at Wiley-Blackwell, was of the opinion that there was "no quantitative evidence that [peer review] is in crisis".[234] He explained:

> I think the peer review system, as a whole, is more robust than ever. […] in 2010 we had about 12% more submissions. There was no impact on publishing schedules and no added delays, although we only published 2% more articles, so the rate of rejection was higher. A study has been published in *Nature* by Tim Vines and colleagues where they did try to quantify this issue and tracked all the reviewers. They found that the population of reviewers is increasing with the 3% to 4% increase in the research community, as you would expect. Therefore the load on each reviewer is, if anything, slightly less than 10 years ago.[235]

133. The study by Dr Tim Vines, Managing Editor of the journal, *Molecular Ecology*, and colleagues analysed—at that journal—the number of requests required in 2001-10 to obtain a review; compared the number of submissions in 2001-07 with the number of unique reviewer names in each year; and calculated the mean number of reviews per reviewer in 2001-07.[236] They reported that it was slightly harder to recruit reviewers in 2010 than it was in 2001; editors had to send out more than two requests, on average, for every one acceptance, compared to 1.4 in 2001.[237] This increase, however, coincided with the journal's move from sending personal reviewer e-mail requests to an automated editorial system, leading to suggestions that requests might not be reaching their intended target because they were being tagged as spam.[238] They also found no increase in average reviewer workload over that period, because the reviewer pool had increased in parallel with

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230 Ev w85, para 1 [Professor Jeremy Fox and Professor Owen Petchey]; and A Mulligan, *Is peer review in crisis?*, Oral Oncology 2005, vol 41, pp 135–41

231 Ev w85, para 1 [Professor Jeremy Fox and Professor Owen Petchey]; and Hochberg *et al*, *The tragedy of the reviewer commons*. Ecology Letters, 2009, vol 12, pp 2-4

232 Q 27

233 Ev w91

234 Q 125

235 *As above*

236 T Vines, L Rieseberg and H Smith, *No crisis in supply of peer reviewers*, Nature, vol 468, p 1041

237 T Vines, L Rieseberg and H Smith, *No crisis in supply of peer reviewers*, Nature, vol 468, p 1041; and "Trouble Recruiting Peer-Reviewers? Blame Spam!", The Scholarly Kitchen, http://scholarlykitchen.sspnet.org

238 *As above*

submissions. The study concluded that there was "no crisis" in the supply of peer reviewers.[239]

134. **We are not convinced that there is a "crisis" in the supply of reviewers, especially as so little data are available. It appears that the current imbalance between publication output and participation in peer review may be a transitory phase. However, publishers should not be complacent and should continue actively to monitor the situation by collecting data.**

The burden on reviewers

135. While peer review may not be in crisis, we previously explained that reviewers were feeling the "burden" of peer review (see paragraph 49). The view of the Wellcome Trust was that it "imposes a significant burden on the research community".[240] The Medical Schools Council agreed that "the high volume of peer review requests that members are exposed to in addition to their other demanding roles, is a cause for concern. It is felt that the current system places excessive burden on reviewers".[241]

136. Dr Janet Metcalfe, from Vitae, explained her views on the burden of peer review as part of a wider problem in academia:

> I think many researchers would feel there is a personal cost in terms of the effort they put into peer review. They appreciate that it is a very important part of the system—it is partly about protecting academic discipline and contributing to the academic community—but there is an expectation, not just with peer review but other aspects of being an academic, that you have to put in very long hours and you are expected to work beyond your terms and conditions of employment to be successful. These are systemic issues within the academic community, and peer review falls very much within that. It is also rarely identified as a specific element in workload conversations or models within institutions, so we have no idea how much time is spent by the academic community on peer reviewing.[242]

137. Dr Malcolm Read, from the Joint Information Systems Committee (JISC), did not recognise academic working patterns as a big problem:

> I don't know that many researchers particularly feel they have a nine-to-five existence anyway. So I am not sure to what extent they would particularly resent [peer reviewing manuscripts in their own time]. I don't think there is a nine-to-five mentality in the research community.[243]

138. We were keen to find out whether the burden of reviewing falls disproportionately on one group of researchers over another. Professor Grazia Ietto-Gillies, from Birkbeck, University of London, told us that:

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239 T Vines, L Rieseberg and H Smith, *No crisis in supply of peer reviewers*, Nature, vol 468, p 1041

240 Ev 82, para 2

241 Ev w123, para 3.1

242 Q 219

243 Q 186

> The reviewers' workload is not distributed evenly among academics. Academic stars are unlikely to be available for reviewing; hearsay suggests that sometimes professors ask their assistants or PhD students to do reviews which they sign! Academics low down in the pecking order may not be asked to review. Most reviews are done by academics in the middle range of reputation and specifically by those known to editors and who have a record of punctuality and rigour in their reviews: the willing and conscientious horses are asked over and over again by overworked and—sometimes desperate—editors.[244]

139. The Academy of Social Sciences agreed that "a minority of willing scholars find themselves increasingly burdened by requests and gradually withdraw their goodwill in order to protect their time" for other activities.[245] Once again, this highlights the "importance of employing professional and properly qualified scientific editors", in this instance to make sure "that no one reviewer is overburdened".[246] Electronic databases are making this easier for journal editors to achieve. The International Association of Scientific, Technical and Medical Publishers said that:

> in most cases now, each journal with the help of its publisher has developed an electronic database of experts with links to fields of interest. This usually includes details of all those who have reviewed for the journal before and can also be used as a management tool to ensure the same reviewer is not overburdened with requests. The identification of new reviewers for new fields has been significantly aided by the existence of abstracting and indexing databases that allow all those working in a field to be identified.[247]

140. Professor Ian Walmsley, from the University of Oxford, explained that it was necessary to look at the broader picture of how the burden of peer review falls on the research community:

> peer review is pervasive throughout all aspects of the academic endeavour, not just publishing. For example, one may distinguish that senior people will have more to do with evaluation of others through promotion, tenure, awards or what have you and perhaps at the editorial end in publishing, and that younger people will have more of the burden of evaluating individual articles or specific research grants.[248]

141. There is a sense of give and take about the burden of peer review. Professor Rick Rylance, from RCUK, described it as a "collective enterprise".[249] The IOP told us that "it is felt to be an integrated part of the role of a researcher [and there is] an expectation that by refereeing a peer's work you would in turn expect your work to be reviewed".[250] The IOP considered that there was "a case for revisiting this tradition, as other professions generally

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244 Ev w80, para 2.4

245 Ev w58, para 5(b)

246 Ev w125, para 14 [Geological Society of London]

247 Ev w128, para 6

248 Q 225

249 Q 258

250 Ev 93, para 25

do not proceed on this *pro bono* basis when offering a service" but acknowledged that the "majority of participants" supported the current arrangements.[251] Dr Malcolm Read, from JISC, explained that the situation would only become worrying if scientists had to spend more time on peer review proportionally to their scientific research.[252]

142. Professor Sir Adrian Smith did not:

> regard peer review as a burden which is somehow additional and keeping fabulous researchers away from their day job. Peer review is an integral part of the scientific and research process and is part of the day job.[253]

He added that like peer review, science itself is "time-consuming and labour-intensive" and that peer review of journals was an "incredibly efficient way of divvying up the labour".[254]

Reducing the burden

143. Dr Andrew Sugden, from *Science*, summarised his view of the current situation journal editors find themselves in when trying to find willing reviewers:

> It is usually [difficult to find reviewers] because they are over-committed. It is not usually because of an underlying unwillingness to review or about not having an incentive to review. It is simply because they are doing too many other things at the time. It may take us a week or two to find the three referees that we need for a paper sometimes. It is rare that it takes much longer than that.[255]

144. Journal publishers are working on managing and reducing the burden felt by reviewers, and thereby encouraging researchers to get involved. Two specific examples of this are discussed below.

Cutting out re-review

145. BioMed Central is experimenting with new processes in peer review to help reduce the burden on reviewers, and indeed authors. In a recent experimental policy at its journal, *BMC Biology*, authors are given "more responsibility for ensuring the validity of the paper" by being given the option to opt-out of further peer review once the initial comments come back from the reviewers.[256] Dr Michaela Torkar, Editorial Director at BioMed Central, explained how it works:

> Submissions are usually screened by the editorial team. There is quite a high rejection rate at that point. They will often consult with their editorial board to ask about the question of impact at that point. […] Of those manuscripts that go to peer reviewers about 60% are either rejected or require only minor revisions, so there

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251 Ev 93, para 25

252 Q 185

253 Q 303

254 Q 304

255 Q 126

256 Ev 108 [BioMed Central]

> wouldn't be a requirement for a re-review anyway. Of the remaining 40% of authors who are offered the option of [the experimental] peer review opt-out [policy], more than half will take it up. The editorial team will make a clear decision after the first round of peer review to make sure that they are very clear in their instructions to the authors about what needs to be done. They will then assess the revised manuscript when it comes back and they will usually go ahead with publication without re-review. I think there were only a couple of cases where that really wasn't possible for some reason. If the revisions aren't as extensive as they should be—say, some of the conclusions aren't put sufficiently into context to show there are some limitations to the study—they will commission a commentary which is published alongside the paper. That is written by an expert who will put it in context and point out those limitations just to make sure that non-expert readers understand that there might be some problems.[257]

BioMed Central told us that this policy "has the important effect of lessening the burden on expert reviewers, a scarce resource".[258]

The cascade system

146. The consensus that emerged at a recent workshop convened by the Wellcome Trust in partnership with the Howard Hughes Medical Institute and the Max Planck Society was that "the burden on researchers of reviewing papers is excessive, and we need to move away from the current system where the same paper is often reviewed multiple times by different journals".[259] One way around this is the "cascade" system, whereby if a manuscript is rejected by the author's journal of choice, it can be passed on to another journal, crucially, with the reviews from the first journal. This can occur in one of two ways: either, within one publishing organisation and between its "sister" journals; or, between journals from different publishers.

147. In our discussions with various publishing organisations, we learnt that publishers are, on the whole, happy to share reviews internally within their organisation, that is, between their own sister journals.[260] However, "some journals are a bit squeamish about the idea of acknowledging that the paper went somewhere else before it came on to them".[261] The internal cascading system is used extensively at BioMed Central and PLoS.[262] Dr Michaela Torkar told us that at BioMed Central:

> Sometimes the transfers will happen before the peer review and sometimes with the reviewers' reports. That does save time for authors and reduces the burden on the peer reviewers who don't have to re-review manuscripts for multiple journals.[263]

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257 Q 179

258 Ev 108

259 Ev 83, para 7 [Wellcome Trust]

260 Qq 129 [Dr Andrew Sugden, Dr Fiona Godlee, Mayur Amin] and 181 [Dr Michaela Torkar, Dr Mark Patterson]

261 Q 129 [Dr Fiona Godlee]

262 Q 181 [Dr Michaela Torkar, Dr Mark Patterson]

263 *As above*

148. Dr Mark Patterson, from PLoS, added that "about 10% to 15% of submissions to *PLoS ONE* come from other PLoS journals. It is pretty clear that, internally, that works quite well".[264] He explained, however, that "the much more problematic issue is the sharing of reviews from one publisher to another".[265]

149. A well-known example of publisher to publisher cascading is the Neuroscience Peer Review Consortium, which is "an alliance of neuroscience journals that have agreed to accept manuscript reviews from other members of the Consortium".[266]

150. Dr Philip Campbell, from *Nature* and Nature Publishing Group, explained that the journal, *Nature Neuroscience*, participated in this consortium, he told us:

> We did it with some misgivings because […] we invest a lot in getting editors out into the field and using referees whom we value because of the relationships that we have developed with them. To hand on, as it were, the outcome of that relationship to a competing publisher is something that hurts slightly. At the same time, you do have this competing interest of the research community to save people work. We found that the uptake of this facility, where authors can elect to have the referees' reports of the rejecting journal handed on to the next publisher, is not very great.[267]

151. Dr Patterson, PLoS, agreed that it "was not terribly popular with authors" but questioned "how much publishers were really behind" the experiment. He was "not convinced" that the "sense of ownership", as alluded to by Dr Campbell, was in the best interests of science.[268] Mayur Amin told us that Elsevier also participated in the consortium and also felt that authors were "somewhat reluctant" to engage.[269]

152. **Peer review is a burden on researchers but a necessary one, as it is an integral part of the scientific and research process and is part of the role of a researcher. However, we encourage publishers to work with their reviewers, to identify innovative new practices to minimise the burden.**

Recognition

153. Despite the importance with which it is viewed, peer review is rarely acknowledged as part of the formal workload of an academic researcher.[270] Dr Fiona Godlee, from BMJ Group, told us that:

> scientists are under a lot of pressure on a whole host of things, such as getting funding and the bureaucracy surrounding scientific research, and peer review is just

264 Q 181

265 As above

266 "Home", Neuroscience Peer Review Consortium, http://nprc.incf.org/

267 Q 129

268 Q 181

269 Q 129

270 Ev 146, paras 5–7 [Vitae]

> one other thing. […] the more we can do to make it something that they gain proper recognition for, the better.[271]

154. Tracey Brown, Managing Director at Sense About Science, agreed that there were "very few incentives" to encourage peer review within the university system and that there was "no recognition" of it in a researcher's career.[272] This was particularly the case for reviewing manuscripts according to Dr Janet Metcalfe, from Vitae, who described peer review as an "invisible contribution to the academic community except when you get on to an editorial board or grant panel".[273]

155. Professor Rick Rylance, from RCUK, considered that "peer review should be part of professional development for researchers" and that it was "important that their employers recognise quite how much labour is put into it and how important it is in terms of not just their personal but their general benefit".[274] Indeed, the British Medical Association suggested some form of "professional recognition, accreditation or development of a reward system to encourage participation" in peer review.[275]

Rewards and accreditation

156. In the course of our inquiry we have questioned how carrying out peer review can be better recognised as a professional activity so that reviewers receive credit for their time and effort. Dr Gulley explained that some journals also give rewards "to their top referees".[276] Professor Ian Walmsley, University of Oxford, gave us an example:

> the American Physical Society has an outstanding referee award. Every year it makes a big deal of naming people who have provided consistent, high quality and useful reviews. […] It is not a direct financial compensation for time. However, I think most people would say this is a contribution to the community which reaps values in other ways.[277]

157. Another way in which journals show their appreciation to reviewers was described by Dr Robert Parker, from the RSC:

> Being a referee is often used as one of the criteria for tenure in the US. We deal with a lot of requests from US referees, young academics, wanting a letter of endorsement saying that they have acted as a referee for the RSC and that they have been reasonably good at it. It will help them to gain tenure.[278]

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271 Q 128

272 Q 90

273 Q 220

274 Q 263

275 Ev w20, Executive Summary

276 Q 28

277 Q 220

278 Q 26

Dr Nicola Gulley told us that IOP Publishing also help with requests to "support younger researchers in their applications for green cards".[279]

158. It has also been suggested that payment could be used as an incentive for researchers to undertake the burden of peer review.[280] Dr Parker told us:

> Remuneration would be a difficult thing because, if you gave any realistic payment for the time that is involved, it would be a huge amount of money and it would have to be recovered from somewhere. It is just moving a financial burden around the whole system. The system relies on the benefits that people see from being involved in peer review. There is a quid pro quo as long as you are someone who publishes as well; you are an author as well as a referee, which is not always the case.[281]

There are also concerns that financial remuneration might reduce the impartiality of reviewers.[282] Some have suggested "payment in kind" (such as a free subscription) or a virtual payment system.[283]

159. Another form of recognition for reviewers is through accreditation. Dr Parker considered that this "might be" helpful to reviewers but "it would be quite difficult to do" because the RSC has about 33,000 referees all around the world that it uses routinely.[284] Dr Philip Campbell, from *Nature*, disagreed:

> In principle, I don't think it is [difficult to do]. A manuscript tracking system can be easily programmed. If what is needed is that the referees themselves get a proper statement of credit, that is fine. It is equally easy for a journal to decide to publish a list of everyone who has peer reviewed for them over a particular period.[285]

160. Professor Rick Rylance, from RCUK, considered that "there would have to be quite a complicated cost-benefit analysis" on whether peer review should be formally accredited.[286] His instinct was that it probably wouldn't be worth it.[287]

161. An easier and, currently, more commonly used approach is the annual publication by journals of a list of the reviewers they have used, or provision to reviewers of their reviewing service at the end of each year. Professor John Pethica explained that "at the Royal Society the referee is not paid, but we do publish a list of the referees at the end of the year to formally thank them for their input".[288] Dr Nicola Gulley told us that IOP Publishing also do this for some research communities.[289] The *Nature* journals are working

279 Q 28

280 Ev w46, para 24 [Professor John Scott]

281 Q 28

282 For example, Ev w46, para 24 [Professor John Scott]

283 Ev w21, para 14 [British Medical Association]; and Ev w86, para 8 [Professors Jeremy Fox and Owen Petchey]

284 Q 29

285 Q 130

286 Q 263

287 *As above*

288 Q 28

289 *As above*

on giving more credit privately to referees directly at the end of every year, letting them know what work they have done.[290] Dr Philip Campbell explained that "in a very competitive academic world, when you are going for tenure or for some other promotion, to be able to have something like that stated on the record is helpful".[291] Dr Malcolm Read, from JISC, suggested that "greater transparency in the peer review process" might improve the situation, ensuring that reviewers' work was known to their peers.[292] Dr Andrew Sugden, from *Science*, warned that there can be a "downside" to this approach, as some reviewers prefer to remain anonymous.[293]

162. In the future, Mayur Amin, from Elsevier, told us that it may become easier to set up accreditation systems in peer review:

> the advent of ORCID, which is [a] unique author identifier [system] may give us an opportunity also to be able to track with [a] unique identifier those people who have refereed and acted as referees. That may help to provide a stronger accreditation platform than is currently possible.[294]

163. Dr Mark Patterson, from PLoS, agreed that ORCID would "help to identify who has done what peer review".[295] Accurate identification of researchers and their work is not only useful in terms of tracking reviewer and author contribution, it is also increasingly important because of the problems of name ambiguity. Dr Parker, from the RSC, told us that this was "an issue, particularly in places like Korea, where there are only five or six really common surnames".[296] However, it was not only an international problem, for example, there were "two people with the same name both in the chemistry department at the University of Oxford".[297] The ORCID Initiative aims to establish an open, independent registry that is adopted by the publishing industry. Its goal is to resolve the systemic name ambiguity problem, by means of assigning unique identifiers linkable to an individual's research output.[298]

164. **In order to help research institutions recognise the work carried out by reviewers on peer review, publishers first need to have in place systems for recording and acknowledging it. A variety of approaches are in use, including rewards, awards and letters of endorsement and these should be encouraged. New initiatives for accurate author and reviewer identification may make it easier for publishers to track reviewer contribution to the peer-review process.**

290 Q 101 [Dr Philip Campbell]

291 *As above*

292 Q 187

293 Q 130

294 *As above*

295 Q 190

296 Q 54

297 Q 54 [Dr Robert Parker]

298 "Open Researcher & Contribution ID", www.orcid.org

Assessment

165. Professor John Pethica, from the Royal Society, told us that in addition to assessing manuscripts for the purposes of "generating a coherent scientific record", peer review is often "used for other proxy purposes and assessment" and that this "can, potentially, influence how it is carried out".[299] The proxy use that Professor Pethica refers to is the perceived importance of a piece of published research, as assessed during the peer-review process. When research is published in a high-impact journal—generally taken as one with a high Impact Factor (see paragraph 59)—that traditionally signals to the rest of the academic community that the research is perceived to be important. This has led to the suggestion that scientists have become "increasingly desperate to publish in a few top journals".[300] However, as we have noted, the Impact Factor relates to the journal as a whole rather than the individual published articles. Nonetheless, publication in a high-impact journal is frequently used as a proxy measure for assessing both the work of individual researchers and research institutions.

166. We questioned the logic of using the Impact Factor as a measure of quality. Professor Sir Adrian Smith, from BIS, told us that:

> It is a little circular, is it not, because why would a journal be designated as high impact? It will be related to the quality of the journal, which, in some sense, will be related to the selectivity of the journal, which will be related to the fact that it is sifting out, to some extent, the cream of the things that are submitted to it.[301]

167. Sir Mark Walport, from the Wellcome Trust, disagreed:

> Impact factors are a rather lazy surrogate. We all know that papers are published in the "very best" journals that are never cited by anyone ever again. Equally, papers are published in journals that are viewed as less prestigious, which have a very large impact. We would always argue that there is no substitute for reading the publication and finding out what it says, rather than either reading the title of the paper or the title of the journal.[302]

Professor Rick Rylance, from RCUK, added that "there is no absolute correlation between quality and place of publication in both directions".[303]

168. Below we discuss the use of Impact Factor as a measure of quality in relation to assessing excellence in research institutions as well as assessing researchers and the influence on research careers.

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299 Q 5

300 P. A. Lawrence, *The politics of publication*. Nature, 2003, vol 422, pp 259–61

301 Q 288

302 Q 255

303 *As above*

Assessing research excellence

169. The Higher Education Funding Council for England (HEFCE) distributes public funds to higher education institutions (HEIs) in England for teaching, research, and related activities. There are similar funding councils in Northern Ireland, Scotland and Wales. HEFCE provides quality-related (QR) research funding, on the basis of periodic assessments of the performance of universities and institutions. The last was the Research Assessment Exercise (RAE) in 2008; the next will be the Research Excellence Framework (REF), scheduled for 2014. The criteria for assessment in the REF are currently being developed.

170. The Academy of Medical Sciences told us that "a strong publication record is a key determinant in the allocation of grant funding both to individual researchers and to their universities via processes such as the [REF]".[304] Professor Thomas Ward, Pro-Vice-Chancellor at the University of East Anglia added that:

> The Research Excellence Framework assessing UK Universities is seeking to apply metrics to some aspects of the periodic assessments of research quality. Some of these metrics depend on peer-reviewed publications and citation counting of the articles cited.[305]

171. Dr Parker, from the RSC, told us that:

> When it was the RAE before, [the panel members] always said that they would look at the quality of the papers themselves. They would read the papers themselves and wouldn't rely on the Impact Factors of the journals in which they had been published. […] How they are going to be used in REF, if it changes, I don't know.[306]

172. The proposed use of bibliometrics (that is, citation analysis, which includes counting how many times a particular piece of work has been cited by others), along with the inclusion of an impact measure, were the two major characteristics that were to differentiate the REF from the RAE. The International Association of Scientific, Technical and Medical Publishers told us that:

> Metrics-based assessments have been around since the 1960s […] The literature on these approaches is large but the majority of academics tend to critique these initiatives along the lines of Einstein's quote "not everything that can be counted counts, and not everything that counts can be counted".[307]

173. In April 2010, an article in the Times Higher Education Supplement suggested that HEFCE might not be using citation data in the REF process.[308] HEFCE confirmed to us that it had "ruled out the systematic use of citation data as a key indicator of research

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304 Ev 133

305 Ev w98, para 23

306 Q 32

307 Ev w126

308 "Nervous Hefce 'edging out' of REF citations", Times Higher Education Online, 1 April 2010, www.timeshighereducation.co.uk

quality at present".[309] David Sweeney, from HEFCE, also clarified the situation for the use of Impact Factors:

> With regard to our assessment of research previously through the Research Assessment Exercise and the Research Excellence Framework, we are very clear that we do not use our journal Impact Factors as a proxy measure for assessing quality. Our assessment panels are banned from so doing. That is not a contentious issue at all.[310]

He added that "the [REF] panels are meeting now to develop their detailed criteria, but it is an underpinning element in the exercise that journal Impact Factors will not be used".[311]

Influencing research careers

174. While, in the light of HEFCE's statement, the use of journal Impact Factors to assess research quality may prove not to be a contentious issue so far as the REF is concerned, the fact remains that researchers still feel under pressure to get their work published in the high-impact journals. When we asked Professor Ian Walmsley, from the University of Oxford, why this is the case, he responded that:

> Perhaps a simple answer to that from a parochial view of a university person is that that is the way one's career advances. […] a lot of very good work gets published in journals that do not have such high visibility, and I think that is quite crucial. None the less, having a highly cited paper in a journal that people would regard as high profile is considered important as a way to raise your visibility and develop your career. […]when a CV comes across the desk of a head of department for a faculty post, as a first pass through it makes a difference where those papers are published.[312]

175. However, as we previously noted, decisions about which papers are accepted by high-impact journals "can seem rather random", as a result of decisions that "are often editorial ones based on topicality".[313] We also questioned whether a researcher's contribution to peer review, as a reviewer, should be formally recognised as part of their work and whether this could be taken account of when evaluating them for promotion. Professor Walmsley told us that:

> in evaluating people for promotion one would look not only but primarily at the quality of the research undertaken and published but also at how they have contributed to the working of the community. […] One would normally expect to see, on a CV for evaluation, that somebody had undertaken reviewing for research councils or, in this sense, professional societies or other publishers for journals.
>
> As to the extent one wishes to quantify that to a greater degree, I would be cautious about that. One doesn't want to be prescriptive. One wants to see some threshold of

309 Ev 85, para 9

310 Q 255

311 Q 256

312 Qq 216–17

313 Ev w95, para 18 [British Antarctic Survey]

> evidence that people are playing a role without being quantitative about exactly how much they ought to be doing.[314]

176. Sir Mark Walport, from the Wellcome Trust, added that:

> I think this is one of those things where it is easy to say that you need to give people recognition for peer review. The reality is are you going to promote someone from a lectureship to a senior lectureship or from a senior lectureship to a readership on the basis of review? You are not going to do that. You are going to do it on the core scholarly activities which are education and the research itself. It is something that the community has to recognise. It is beneficial to do peer review. As I said before, it is part of your continuous professional development. It is about keeping up to date with the field.[315]

177. **We have concerns about the use of journal Impact Factor as a proxy measure for the quality of an individual article. We have been reassured by the research funders that they do not consider that publication in a high-impact journal should be used as a proxy measure for assessing either the work of individual researchers or research institutions. We agree that there is no substitute for reading the article itself in assessing the worth of a piece of research. We consider that there is an element of chance involved in whether researchers are able to get their articles published in high-impact journals, depending on topicality and other factors. Research institutions should be cautious not to attach too much weight to publication in high-impact journals when assessing individuals for career progression.**

314 Q 224

315 Q 263

4 Data management

178. In paragraphs 21-22 we discussed the need for reviewers to assess manuscripts to ensure that they are technically sound. One of the questions that arose in the course of this inquiry was, how far should reviewers be expected to go to assess technical soundness? In this chapter we discuss the feasibility of reviewing the underlying data behind research and how those data should be managed.

The need to review data

179. Sense About Science told us that:

> The ultimate test of scientific data [...] comes through its independent replication by others; peer review is the system which allows publication of data so that it can be both criticised and replicated. It is a system which encourages people to ask questions about scientific data.[316]

180. Replication does not usually take place during the peer-review process, although, "in exceptional circumstances, referees will undertake considerable work on their own initiative to replicate an aspect of a paper".[317] Professor Sir Adrian Smith, Director General of Knowledge and Innovation in the Department for Business, Innovation and Skills (BIS), acknowledged that reviewing the underlying data is "rather difficult" where data have come out of laboratories or field studies.[318] He added, however, that replication of "somebody's derivation of a mathematical formula", for example, was possible.[319]

181. Replication of reported results is only possible if the submitted manuscript contains sufficient information to allow others to reproduce the experiments. Dr Mark Patterson, from the Public Library of Science (PLoS), told us that reproducibility is a "gold standard" that publishers should be aiming for.[320] Dr Philip Campbell, from *Nature*, explained that "it is part of the editor's and peer-reviewer's responsibilities to ensure that data and materials required for other researchers to replicate or otherwise verify and build on the work are subsequently available to those who need it".[321] Dr Rebecca Lawrence, from Faculty of 1000 Ltd, added that:

> within the kind of time frames of peer review, [...] you aren't going to be able to repeat the experiment yourself. All you can do is say that it seems okay; it looks like it makes sense; the analysis looks right; the way they have conducted it makes sense and the conclusions make sense. I think the issue of reproducibility must come after publication [...] That is when people say, "I couldn't reproduce it", or, "I could".[322]

316 Ev 75, para 11

317 Ev 87, para 13 [Philip Campbell]

318 Q 297

319 *As above*

320 Q 203 [Dr Mark Patterson]

321 Ev 87, para 16

322 Q 206

Professor Sir John Beddington, the Government Chief Scientific Adviser, explained that this was indeed the way in which science progresses:

> We see all the time in the journals that are published this week that there will be people who have challenged peer-reviewed papers that were published some years ago and pointed out fundamental flaws in them or new evidence that undermines the conclusions of those papers.[323]

182. However, Dr Fiona Godlee, from BMJ Group, explained that there can be problems with inadequate reporting of data:

> We have to acknowledge that peer review is extremely limited in what it can do. We are sent an article, effectively, sometimes with datasheets attached. [...] A vast amount of data do not get through to journals. We know that there is under-reporting, misreporting and a whole host of problems, and journals are not adequate to the task that they are being given to deal with at the moment.[324]

183. Dr Mark Patterson explained what PLoS did when problems of under-reporting arose:

> in general, we have a requirement that, in the interests of reproducibility, you must make the data available. We have had cases where readers have reported to us a problem with getting hold of data from an author published in a PLoS journal. We follow that up. We talk to the author and ask what the issues are. In the majority of cases the author will deposit their data and it is a misunderstanding, almost, that they haven't deposited their data in the appropriate repository, or whatever it is that is done in that particular community.[325]

184. **We conclude that reproducibility should be the gold standard that all peer reviewers and editors aim for when assessing whether a manuscript has supplied sufficient information, about the underlying data and other materials, to allow others to repeat and build on the experiments.**

Depositing data during the peer-review process

185. The body of data reviewed can often be large and/or of a complex nature. An increasing challenge is how to make these large or complex datasets available for reviewers to assess confidentially.[326] Dr Andrew Sugden, from *Science*, told us that "currently no databases allow secure posting for the purposes of peer-review, and some authors are unwilling to release data prior to publication".[327]

186. PLoS explained that:

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323 Q 296

324 Q 106

325 Q 203

326 Ev 93, para 23; and Ev 141, para 27 [Dr Andrew Sugden, *Science*]

327 Ev 141, para 27

> In some fields—for example, genetics and molecular biology—there are well-established curated databases where data can be deposited and linked to particular research articles. Examples of such databases include those available at the European Bioinformatics Institute in Hinxton, UK. The curators who run the databases perform critical quality control checks analogous to the technical assessment of research articles.[328]

These quality control checks are independent of the peer-review process involved in assessing the related research article.

187. The issue of quality control is an important one. Dr Andrew Sugden explained that reviewing data "that is many times the size of the submitted text is a burden to reviewers" and that "standards for reporting and presenting large data sets that allow common analysis tools could help greatly".[329] BioMed Central agreed, adding that:

> Capturing the vast amount of data that is continuously generated and ensuring consistent data deposition according to agreed formats and nomenclatures will be crucial to enabling smooth meta-analyses of datasets from different databases.[330]

188. The area of data deposition is evolving quickly. Dr Mark Patterson, from PLoS, highlighted a new project called Dryad.[331] This is an international repository of data underlying peer-reviewed articles in the basic and applied biosciences, governed by a consortium of journals.[332] Dr Patterson explained how Dryad works:

> The idea is that this is a place where you can deposit your data set [...] and where you can give privileged access to reviewers, for example, during the peer review process and then make the data available once the article is published.[333]

Editors and journals are aiming to "facilitate their authors' data archiving by setting up automatic notifications to Dryad of accepted manuscripts", and thereby streamlining the process for depositing data after publication.[334] Dr Patterson told us that Dryad "is developing a kind of generic database for data sets [...] particularly in the fields of ecology and evolution [...] but they are already talking of expanding into other areas".[335] There is also an ongoing project, DryadUK, funded by the Joint Information Systems Committee (JISC), to develop a mirror site in the UK.[336]

189. **If reviewers and editors are to assess whether authors of manuscripts are providing sufficient accompanying data, it is essential that they are given confidential access to relevant data associated with the work during the peer-review process. This can be**

328 Ev 80, para 29

329 Ev 141, para 27

330 Ev 108

331 Q 206

332 "About Dryad", Dryad, http://datadryad.org/

333 Q 206

334 "About Dryad", Dryad, http://datadryad.org/

335 Q 206

336 "About Dryad", Dryad, http://datadryad.org/

problematical in the case of the large and complex datasets which are becoming increasingly common. The Dryad project is an initiative seeking to address this. If it proves successful, funding should be sought to expand it to other disciplines. Alternatively, we recommend that funders of research and publishers work together to develop similar repositories for other disciplines.

Technical and economic challenges of data storage

190. Dr Malcolm Read, from JISC, cautioned that "there are technical and economic problems" associated with making data available in the long term.[337] He told us that "keeping [data] available, possibly in perpetuity, could end up as a cost that the sector simply could not afford",[338] and explained that different approaches would be required depending on the type of data:

> Keeping available all the outputs of the experiments on the Large Hadron Collider is just infeasible. Other data, such as environmental data, must be kept permanently available. I think that should be made more open. Of course, you can't repeat an earthquake and that data must never be lost. A lot of social data in terms of longitudinal studies make sense only if the entire length of the study is available. In some areas of science the data is produced by computers and programs. In that case, if the data is very large, an option might be simply to re-run the program.[339]

191. Sir Mark Walport, from the Wellcome Trust, agreed that there are "major costs" involved.[340] He added that the "costs of storing the data may in the future exceed the costs of generating it" and that this was an issue for research funders because they fund the research and so have to help with the storage.[341] He added that "our funding is a partnership between the charity sector and the Government and [data storage] is a shared expenditure".[342] Professor Sir Adrian Smith acknowledged that cost was "a real problem".[343] However, given how cheap data storage has become, we consider that this cost is a result of the sheer growth in quantities of data.[344]

192. Dr Philip Campbell, from *Nature*, provided an example of the potential costs involved in making data, software and codes available:

> I was talking to a researcher the other day and he had been asked to make his code accessible. He had had to go to the Department of Energy for a grant to make it so. He was asking for $300,000, which was the cost of making that code completely

337 Q 208

338 *As above*

339 *As above*

340 Q 280

341 *As above*

342 *As above*

343 Q 300

344 For example, "Taking a Hard Look At Storage Costs", enterprisestorageforum.com, 8 August 2008

> accessible and usable by others. In that particular case the grant was not given. It is a big challenge in computer software and we need to do better than we are doing.[345]

He added, however that this should not prevent others from validating the research by attempting to reproduce the work, for example, "you can allow people to come into your laboratory and use the computer system and test it".[346]

193. Dr Malcolm Read explained in more detail why making software code available can be difficult:

> if you are talking about stuff running on so-called super-computers, you have to know quite a lot about the machine and the environment it is running on. It is very difficult to run some of those top-end computer applications, even if, of course, they are prepared to make their code available.[347]

He added that the way to get around this problem was to ensure that authors "make clear the nature of the program they are running and the algorithms".[348] Dr Read explained that:

> A computer will not have any value beyond the way it is programmed. As long as they define the input conditions, as it were, and what the program is designed to do, you should be able to trust the outputs. That would be no different from any statistical test that is run on a data set, so long as you say what the test is. You then start to get down to the accuracy of the data itself, which is perhaps a more fundamental issue than the software or statistical test that is being run on it. I would say that the availability of the research data is a more important issue because then, of course, other researchers could run different types of algorithms on different types of computer on that data. I think access to the data is more fundamental.[349]

A culture of openness

194. Access to data is fundamental if researchers are to reproduce and thereby verify results that are reported in the literature. Professor John P. A. Ioannidis, from the University of Ioannina School of Medicine, stated in a recent *Scientific American* article that:

> The best way to ensure that test results are verified would be for scientists to register their detailed experimental protocols before starting their research and disclose full results and data when the research is done. At the moment, results are often selectively reported, emphasizing the most exciting among them, and outsiders frequently do not have access to what they need to replicate studies. Journals and funding agencies should strongly encourage full public availability of all data and analytical methods for each published paper.[350]

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345 Q 136

346 Q 137

347 Q 202

348 Q 203

349 *As above*

350 J. P. A. Ioannidis, *An epidemic of false claims*, Scientific American, June 2011

195. In response, Professor Rick Rylance, from Research Councils UK (RCUK), stated that:

> I endorse the broad principles of that. The one slight reservation I would have is that, quite often, research is a process of discovery and you don't quite know at the beginning what the protocols and procedures are that you are going to use, particularly in my domain. I would have a slight reservation about that, but the principles are right.[351]

196. Many of the individuals we heard from were broadly in favour of the principle of openness with regard to data availability post-publication.[352] We were told that:

> the principles of openness in science, of making data available and open, are something that the Wellcome Trust and other funders of biomedical research around the world are fully behind and completely supportive of.[353]

197. Professor Sir Adrian Smith, from BIS, explained the current situation and the Government's position on data availability:

> There is a great movement now and a recognition of openness and transparency, which has always been implicit as a fundamental element of the scientific process. But the more we collect large datasets, you have to give other people, as part of the challenge process, the ability to revisit that data and see what they make of it with openness and transparency. There is general support these days for the presumption that the research, the associated data and if you have written a computer code to assess it, should all be available and up for challenge and testing validation. In fact, explicitly the Research Councils encourage that, as Government Departments do. However, there can be complex and legitimate reasons for not necessarily, at least in the short term, being that transparent. An awful lot of policy in recent years has meant that we have been trying to lever more out of public investment by joint working with business and industry and levering additional funding. Once you get into that territory, you do have commercial and intellectual property constraints on a temporary basis at least, for openness and transparency. The presumption is that, unless there is a strong reason otherwise, everything should be out there and available.[354]

198. Sir Adrian added that "there will always be issues of personal data protection, commercial interests and intellectual property and national security, so the situation is quite complex".[355] Indeed, Dr Malcolm Read, from JISC, explained that "a blanket mandate on open data might not be feasible but the predisposition should be to make data openly

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351 Q 277

352 For example: Q 136 [Dr Philip Campbell]; Q 207 [Dr Mark Patterson]; and Q 278 [David Sweeney]

353 Q 277 [Sir Mark Walport]

354 Q 298

355 Q 299

available".[356] David Sweeney, from HEFCE, agreed that consideration needed to be given to "the particular circumstances and the sensitivity".[357]

199. Sir Adrian explained that "different communities, different cultures and different forms of data pose different issues".[358] One example where making data available could be challenging is where confidential patient data are involved in biomedical research. The BMJ Group stated that:

> The Wellcome Trust and other major international funders have called for public health researchers to make studies' raw data available. *Annals of Internal Medicine*, the *BMJ*, *BMJ Open*, the PLoS journals and several BMC journals—among others—actively encourage authors to share data in online repositories with necessary safeguards to protect patient confidentiality.[359]

However, "if you are dealing with clinical material then the confidentiality of participants is paramount. You have to manage data so that they are appropriately anonymised and people cannot be revealed".[360] Dr Fiona Godlee did not see confidentiality as a problem:

> when one is talking about large datasets, confidentiality has already been dealt with, and we should not use that as an excuse for not looking at [data deposition]. There are no doubt practical issues, but […] nationally, we ought to have systems for data depositioning. The practical problems will be resolved, as with trial registration, which seemed impossible five or 10 years ago, and it is now routine.[361]

200. Dr Michaela Torkar explained in more detail the challenge faced by publishers and how these might be overcome:

> It is only if the standards are well established and agreed on by the community that you can really enforce [data deposition] and insist on it as a publisher. It becomes more difficult when, say, databases are not quite ready to accept all of the submissions or formats. That becomes a real barrier for authors. They cannot publish because the publisher insists on it. I think there is a lot of responsibility on the publishers to interact with different communities to establish the right databases and standards and where the limitations are and to make it mandatory in some cases and in others encourage submission and deposition, in particular. I think it depends very much on the communities.[362]

201. If mandatory data deposition is problematic, the question becomes how can we encourage rather than enforce it? Dr Mark Patterson, from PLoS, told us that:

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356 Q 208

357 Q 279

358 Q 300

359 Ev 73, para 19

360 Q 278 [Sir Mark Walport]

361 Q 157

362 Q 207

> First, it would be really helpful for publishers to include some kind of statement about data availability so that it is clear. How do you get hold of this data? Are there any restrictions in terms of accessing it because of the size of the data in some fields or whatever? Secondly, there is an opportunity to incentivise the sharing of data by giving greater credit and finding mechanisms to reward researchers who do that to assess the impact of that sharing as well. Rather than focusing everything on what they have published in whatever journal, to start thinking about different kinds of outputs and their value.[363]

Dr Malcolm Read, from JISC, agreed that researchers "would deserve credit and recognition for that".[364]

202. We note that the Royal Society launched its *Science as a public enterprise* project in May 2011.[365] This will look at how scientific data should best be managed and may explore some of the issues highlighted in this chapter.

203. **Access to data is fundamental if researchers are to reproduce, verify and build on results that are reported in the literature. We welcome the Government's recognition of the importance of openness and transparency. The presumption must be that, unless there is a strong reason otherwise, data should be fully disclosed and made publicly available. In line with this principle, where possible, data associated with all publicly funded research should be made widely and freely available. Funders of research must coordinate with publishers to ensure that researchers disclose their data in a timely manner. The work of researchers who expend time and effort adding value to their data, to make it usable by others, should be acknowledged as a valuable part of their role. Research funders and publishers should explore how researchers could be encouraged to add this value.**

363 Q 208

364 *As above*

365 "Royal Society launches study on openness in science", Royal Society Press Notices, http://royalsociety.org, 13 May 2011

5 Post-publication approaches

Post-publication review and commentary

204. In addition to the checks and balances carried out in pre-publication peer review, the "wider scientific scrutiny post-publication is as important […] indeed, this is a form of secondary peer review".[366] The British Sociological Association considered that:

> Peer review is in fact a layered process in which initial peer review of proposals leads into peer review of publications and thence into post-publication peer review (the latter is sometimes referred to as academic impact). The two are related and equally necessary processes.[367]

205. Review after publication can be carried out in a number of ways. Historically, where fellow researchers either agreed or disagreed with an author's findings, they would publish their own manuscripts or correspondence with the relevant journal in order to progress scientific understanding in their field. Professor John Pethica, Physical Secretary and Vice President of the Royal Society, told us that:

> [Post-publication review] is implicit in the fact that people publish subsequent papers saying, "X was right, Y was wrong, and we did this and produced that." That is implicit in the whole structure of scientific papers and there is a preamble about what has happened so far.[368]

206. In recent years, with the growth of online communication systems, publishers have started to introduce more formal processes for rapid responses to published articles. BMJ Group explained that:

> Many online journals encourage continuing discussion of their content. The BMJ's Rapid Responses or eletters, posted daily, provide a voluminous, lively, and often scholarly discourse and constitute an important source of ongoing peer review.[369]

207. While the BMJ Group reports "voluminous" commenting, others have been less successful with this approach. The Royal Society has an e-Letters system, which allows researchers to comment directly on a published article, the comment is then linked to the article for others to see.[370] This has not proven to be particularly popular as "remarkably few people choose to use it".[371] Other learned society publishers we consulted did not have any formal processes for post-publication review and commentary.[372]

366 Ev w77, para 4 [Royal Meteorological Society]

367 Ev w111, para 4

368 Q 56

369 Ev 73, para 21

370 "eLetters", Philosophical Transactions of the Royal Society B, http://rstb.royalsocietypublishing.org

371 Q 55 [Professor John Pethica]

372 Q 55 [Dr Nicola Gulley and Dr Robert Parker]

208. Other more informal approaches, such as the use of online blogs and social networking tools like Twitter, are becoming more widespread. Sir Mark Walport, Director of the Wellcome Trust, told us that:

> Web-based publishing brings new opportunities, because it brings the opportunity for post-publication peer review and for bloggers to comment. […] This is a fast-evolving space. As the new generation of scientists comes through who are more familiar with social networking tools, it is likely that Twitter may find more valuable uses in terms of, "Gosh, isn't this an interesting article?" All sorts of things are happening. It is quite difficult to predict the future. It can only be an enhancement to have the opportunity for post-publication peer review.[373]

209. The BMJ Group added that with Twitter, even though "their [character limit] allow only the briefest comment, tweets are facilitating rapid and widespread sharing of links to articles and other online content and can, it seems, quickly expose failings in peer review".[374] For example, in December 2010, "many scientists blogged immediate criticisms of [a] widely publicized paper […] heralding bacteria that the authors claimed use arsenic rather than phosphorus in their DNA backbone".[375] Many of the initial criticisms came from "the scientific blogosphere".[376] Since then, "*Science*, the journal that published the original paper, has published eight papers criticising it, as well as a response by the original researchers"; the debate continues.[377]

210. We questioned whether a potential growth in post-publication review and commentary would lead to declining expectation of pre-publication peer review by publishers. Dr Andrew Sugden, Deputy Editor & International Managing Editor at *Science*, did not believe this would happen.[378] Mayur Amin, Senior Vice President of Research & Academic Relations at Elsevier, agreed, adding that post-publication review and commentary would not "act as a substitute" for peer review.[379]

211. **Post-publication review in an era of new media and social networking tools, such as Twitter, is very powerful. The widespread sharing of links to articles ensures that research, both accurate and potentially misleading, is rapidly spread across the world. Failings in peer review can, rightly, be quickly exposed. However, there is no guarantee that false accusations of failings will not also be spread. Pre-publication peer review still has an important role to play, particularly in relation to assessing whether manuscripts are technically sound prior to publication. However, we encourage the prudent use of online tools for post-publication review and commentary as a means of supplementing pre-publication review.**

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373 Q 282

374 Ev 73, para 21

375 A. Mandavilli, *Peer review: Trial by Twitter*, Nature, 2011, vol 469, pp 286–87

376 "Arsenic-based bacteria: Fact or fiction?", New Scientist Online, 27 May 2011

377 *As above*

378 Q 159

379 Q 160

Encouraging participation

212. One of the reasons that post-publication review and commenting is not yet considered to be a viable replacement for pre-publication peer review is that the numbers participating in it are low. The publishers, John Wiley & Sons, told us that:

> Evidence for the efficacy and usefulness of post-publication comment is not yet convincing, both in terms of the quantity and quality of such comments, although we expect to see links to blogs and other post-publication comments as standard practice, and our systems and processes will accommodate this if the academic and professional communities whom we serve want it. Post-publication comment is likely to be a supplement to pre-publication review rather than a substitute for it.[380]

213. Dr Philip Campbell, Editor-in-Chief of *Nature* and Nature Publishing Group, explained that the lack of commenting might be because "there is no prestige or credit attached [to it], there is the risk of alienating colleagues by public criticism, and everyone is busy".[381] Sir Mark agreed that academics do not like to "write critical comments of each other alongside the articles".[382] He added, however, that:

> There are some very interesting community issues here. In the humanities, there is a long tradition of writing book reviews where one academic is scathingly rude about another academic. […] In the case of the scientific world, that tearing apart is done at conferences and at journal clubs. The scientific community does not have a culture of writing nasty things about each other.[383]

214. One of the main challenges is therefore to get post-publication commenting tools more widely used in order to "get the critical views across" and "encourage people to air their criticisms and put their names to them without fear of any repercussions".[384]

215. The issue is not just to get more researchers participating in public commentary; it is also essential that comments be fairly represented online. Dr Fiona Godlee, Editor-in-Chief of *BMJ* and BMJ Group, explained that:

> There are great variations [in journal practices]. Some journals exercise a liberal view, which is the *BMJ*'s view. Others have a much more editorially tight control over what gets written, post-publication. In some cases that I am aware of, critical comment about papers does not get out into the public domain. The other problem is that even when it does, the authors often don't respond. One is left with a situation that is far from perfect. There is a lot of progress with the Internet but it is still not perfect.[385]

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380 Ev 66, para 8.1

381 Ev 89, para 47

382 Q 282

383 Q 284

384 Q 212 [Dr Michaela Torkar]

385 Q 160

216. However, the system could be considered to be "self-correcting" as "a scientist who wrote something that was particularly egregious would be subject to the peer review of their own community".[386]

Filtering content

217. While post-publication review and commentary can be used to further improve the technical assessment of published research, it can also be utilised to fulfil another one of the functions of peer review: to filter research publications and act as a guide for what readers might find interesting.

218. The extreme situation one could envisage would be that in which all research is published and then filtered, an approach advocated by Dr Richard Smith, former Editor of the *BMJ*.[387] However, we have already discussed why publishing research prior to reviewing it could be problematic, in particular for the biomedical sciences (see paragraphs 69-70). Mayur Amin, from Elsevier, explained the consequences of such an approach: "Where everything is published before it gets its first peer review filter, we may end up with a system where it is hard to differentiate between evidence-based conclusions and conclusion-based evidence."[388]

219. However, with the growth of online repository journals (see paragraph 80) and the development of more advanced tools for post-publication review and commentary, the role of the publisher in filtering research prior to publication is diminishing. Professor Ron Laskey, Vice President of the Academy of Medical Sciences, told us that "if there is a move towards publication in journals such as *PLoS ONE* and where impact is less important, then a subsequent impact assessment such as the Faculty of 1000 could become increasingly important".[389]

220. Faculty of 1000 Ltd (F1000) is an online service that collects the comments of selected experts on research articles that have already been published in biology and medical journals. F1000 told us that:

> Our Faculties of 10,000 experts across biology and medicine are asked to highlight those publications that they believe to be particularly important, irrespective of where they are published (the majority of our evaluations—86%—are *not* from what are often thought of as the top-tier journals, e.g. *Nature*, *Science*, *Cell*, *NEJM*, *JAMA*, *Lancet*, *BMJ*). Faculty Members are asked to provide a rating (recommended; must read; or exceptional) and then provide a short commentary ("evaluation") on why they believe the article to be so interesting and how it might impact their own research or specialty, and their names are listed against this. These evaluations are effectively short open referee reports and the service acts as a positive filtering service.

386 Q 286 [Sir Mark Walport]

387 "Richard Smith: Scrap peer review and beware of "top journals"", BMJ Blogs Online, 22 March 2010, http://blogs.bmj.com

388 Q 95

389 Q 57

> Multiple Faculty Members can evaluate the same article, providing a combined higher rating, or can write a dissent if they disagree with an existing evaluation. The authors of the article can write a comment in response to the evaluation, and registered users can also write comments.[390]

221. F1000 has policies to prevent bias in expert commentary; for example, the service is currently adding a specific declaration that Faculty Members will confirm for every evaluation they carry out. This declaration will state:

> This work has been selected for evaluation entirely on its scientific merit. Neither I nor my co-evaluators (where applicable) have collaborated with the authors in the past year or been influenced in the selection of this work directly or indirectly by the author/s or by any third party. This evaluation presents my opinions and those of any listed co-evaluators.[391]

222. Feedback on the usefulness of F1000 was limited. Professor Ron Laskey told us that "its use is patchy but it is recognised as providing a valuable service".[392] Dr Robert Parker, Interim Chief Executive of the Royal Society of Chemistry, added that it was generally a positive thing.[393] At present this service is limited to biology and medicine .

223. **While it is too early to make a judgement on post-publication filtering mechanisms, such as Faculty of 1000 Ltd, we recognise that such a system could offer a valuable service if widely used. It is likely that such services will become more important with the growth of repository-type journals.**

Measuring impact

224. The post-publication filtering of which articles might be of particular interest and subsequent commenting on those articles could be considered to be the foundation of a new model for measuring impact. Indeed, by assessing a specific article in this way, the status quo of using a journal's Impact Factor to assess impact may be threatened. The Public Library of Science (PLoS) told us that:

> a new paradigm is emerging and is being tested in several fields whereby articles are subject only to technical assessment (by peer review) before publication, and impact assessment takes place during the post-publication phase, which can broaden the assessment of the work (by peers) to a much wider constituency than can take place before publication.
>
> […] Rather than relying on the journal in which an article is published, it is now possible to focus on the merits of the article itself. An array of article-level metrics and indicators can be deployed to filter and assess content. Coupled with tools for post-publication commentary and addition of value, there are tremendous prospects for replacing the current impact assessment function of pre-publication peer review

390 Ev 143, paras 3–4

391 Ev 144 [Faculty of 1000 Ltd]

392 Q 58

393 Q 59

> with a post-publication system that has the potential to be more efficient and effective.[394]

225. Dr Mark Patterson, Director of Publishing at PLoS, explained that:

> It is not just about a blog comment […] There is a whole range of metrics and indicators, including resources like Faculty of 1000, which can be brought to bear on the question of research assessment. […] We want to provide an indication when [readers] come to [a] paper of how important [it] is and what impact it has had through usage data, citation information, blogosphere coverage and social bookmarking. There are so many possibilities.
>
> We have moved in that direction by providing those kinds of metrics and indicators on every article that we publish—we are not the only people doing this but we have probably taken it further than most—to try to move people away from thinking about the merits of an article on the basis of the journal it was published in to thinking about the merits of the work in and of itself. Indicators and metrics can help with that. They aren't the answer to the question but they will help. Ultimately, there is really no substitute for reading it and forming your own opinion.[395]

226. David Sweeney, Director for Research, Innovation and Skills at HEFCE, was not convinced that such "article level metrics […] necessarily captured the intrinsic metric" of a published article. He added:

> I remain of the view that there will be no magic number or even a set of numbers that does capture intrinsic merit, but one's judgment about the quality of the work, which may well be, […] in the eye of the beholder, may be informed by a range of metrics.[396]

Sir Mark Walport agreed with Dr Patterson's final point that "if you want to assess the value of an individual article, I am afraid that there is no substitute for holding it in front of your eyes and reading it".[397]

394 Ev 80, paras 33–34

395 Q 209

396 Q 281

397 *As above*

6 Publication ethics and research integrity

227. A US National Academies report explained that, for the individual researcher, integrity embodies a range of good research practice and conduct, including:

- intellectual honesty in proposing, performing, and reporting research;
- accuracy in representing contributions to research proposals and reports;
- fairness in peer review;
- collegiality in scientific interactions, including communications and sharing of resources;
- transparency in conflicts of interest or potential conflicts of interest;
- protection of human subjects in the conduct of research;
- humane care of animals in the conduct of research; and
- adherence to the mutual responsibilities between investigators and their research teams.[398]

The procedures for dealing with many of these areas are covered by publication ethics policies.

228. Peer review does not explicitly assess the integrity of research; nonetheless it has an important role to play. The UK Research Integrity Office Ltd (UKRIO) states in its Code of Practice that:

> Organisations and researchers should be aware that peer review is an important part of good practice in: the publication and dissemination of research and research findings; the assessment of applications for research grants; and in the ethics review of research projects.[399]

The publication and dissemination of research findings is the method by which scientific knowledge progresses. Furthermore, the accurate reporting of scientific results is important in informing public debate on scientific issues.

Public debate and trust in science

229. The London Mathematical Society stated that "public debate should be based on facts. Peer reviewed science is a source of facts".[400] Dr Robert Parker, Interim Chief Executive of the Royal Society of Chemistry (RSC), doubted that the general public have much of a

398 National Research Council of the National Academies, *Integrity in Scientific Research: creating an environment that promotes responsible conduct*, 2002, pp 34–5

399 UK Research Integrity Office, *UKRIO Code of Practice for Research: Promoting good practice and preventing misconduct*, September 2009, para 3.14.1

400 Ev w101, para 4.1

perception of peer review.[401] He explained that "they have a perception of science, that scientists do experiments and that they publish them. They probably don't really care that much about peer review".[402] The Institution of Engineering and Technology added that "the majority of the public does not ever access peer reviewed scientific papers".[403] However, John Wiley & Sons explained that:

> Sense About Science […] has shown the importance of public awareness of peer review, as has the Science Media Centre […] in briefing the media. Publishers like to see their peer reviewed articles quoted by the media and encourage this through press releases and agencies.[404]

These are generally the means by which peer-reviewed research findings are communicated to the general public.

230. Sense About Science told us that:

> people can get very worried and frustrated by conflicting claims and misleading information. It is not possible (nor desirable) to prevent people from encountering a wide range of information about science and health on the Internet and in the news media. […] "Is it peer reviewed?" is the first question anyone can ask to determine the status of the evidence, and one that can help the public weigh-up the claims they are presented with. Understanding the process through which scientific research starts to be scrutinised and evaluated can be a helpful tool for the public to sift information and understand its status.[405]

231. Sense About Science has carried out an enormous amount of work to improve the public understanding of peer review (see paragraph 5), including producing, as we have noted, a short public guide to the peer-review process, *I don't know what to believe… Making sense of science stories*, of which "hundreds of thousands of copies have been downloaded".[406] This encourages people to ask whether or not a piece of published research has been peer reviewed. Tracey Brown, Managing Director of Sense About Science, explained that this is beginning to "take off" as part of a "virtuous circle":

> If, in a Radio 2 programme in the afternoon, the interviewer is equipped to ask the scientist […] "Which of these claims has been published and peer reviewed? Do you have a study that backs this up?", the more that question gets asked, the more the listening audience expects that to be one of the interrogatory questions. The more that the listening audience expects that to be an interrogatory question, the more the radio interviewer feels that they, representing their listening public, must ask that question.[407]

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401 Q 40

402 *As above*

403 Ev w89, para 4.4

404 Ev 65, para 4.1

405 Ev 75, paras 9 and 12

406 Ev 74, para 3 [Sense About Science]

407 Q 86

232. The Institute of Physics (IOP) was also of the view that the public should be encouraged to recognise that a peer-reviewed result was the "gold standard" in research and that it would "produce the most reliable information in the long term".[408] The Royal Society added that "peer review is valuable in informing the public about science as it acts as a 'kite mark' that a piece of research has been properly scrutinised and validated by scientists".[409]

233. In the absence of peer review, the Academy of Medical Sciences warned that:

> Work that is released in to the public domain without some level of quality assurance could potentially lead to situations where imperfect or incorrect science is used by the media and others. Ultimately this could be detrimental to the public's overall trust in research.[410]

234. The Association of Learned and Professional Society Publishers (ALPSP) indicated that this was particularly a problem in biomedical sciences.[411] The Society for General Microbiology considered that "the unreliability of other information published outside of the peer review system should be highlighted".[412]

Balancing the evidence

235. While information published without peer review may not be reliable or be based on opinion rather than facts, it is not necessarily the case that all information published with peer review is completely reliable. Professor John Pethica, Physical Secretary and Vice President of the Royal Society, considered that "it would be useful if the public becomes aware of the fact that mistakes happen".[413] The RSC stated that the "limitations" of peer-reviewed information is not often understood by the public:

> There is still currently a public preoccupation with scientific research providing "answers". A single piece of research rarely provides a definitive answer to a scientific problem. Rather a single piece of research must be viewed in the overall context of the field, as it contributes to the overall debate in a given area. Whilst this distinction is made by other researchers in the field, this is not often the case when a piece of research is examined in the public arena.[414]

ALPSP agreed that it was a "common misconception" that a "single published article provides the definitive answer to a scientific problem".[415] It is possible that within a particular field of research, different articles in the peer-reviewed literature may disagree with one another; there is often room for debate on the results themselves and on their

408 Ev 93, para 20

409 Ev 103, para 11

410 Ev 133

411 Ev w121, para 31

412 Ev w92, para 4

413 Q 42

414 Ev 98, para 18

415 Ev w121, para 32

interpretation.[416] In such cases, one needs to look at the balance of evidence; each published article must be considered in the wider context of the field.[417] In assessing the balance of evidence, it is necessary to be wary of, for example, the competing interests of different authors—the procedures for declaring these are governed by publication ethics.

Detecting ethical misconduct

236. Publication ethics covers a number of areas, including: authorship, plagiarism, fabrication, duplicate publication, competing financial interests and confidentiality.[418] Dr Michaela Torkar and Dr Mark Patterson explained that both BioMed Central and the Public Library of Science (PLoS) take publication ethics "very seriously".[419] It is common for publishers to set out guidelines to authors. Dr Parker, from the RSC, told us that the guidelines produced by the Committee on Publication Ethics (COPE) are "pretty much an industry standard now".[420] COPE is a UK registered charity that promotes integrity in research publication and advises journal editors how to handle cases of research and publication misconduct. It provides a forum for editors and publishers of peer-reviewed journals to discuss specific, anonymised cases. It also publishes a wide range of guidance material.[421]

237. The publication of fraudulent or incorrect papers "damages the public perception of science as a whole".[422] Tracey Brown, Managing Director of Sense About Science, agreed and added that "you cannot build a world that is immune to fraudsters. […] We have to accept that that is the case and hope that we have systems that detect [misconduct] as early as possible".[423] She explained that:

> It would be unreasonable to ask reviewers to spot fraud or plagiarism on a systematic basis, although, of course, there are cases where reviewers are quite well placed to notice such things. Their main consideration is whether the paper is valid, significant and original and whether it provides the basis on which others can understand what has taken place and, therefore, replicate or investigate those results.[424]

238. Critics of peer review claim that it does nothing to detect fraud and misconduct.[425] The RSC stressed that "it is not the role of peer review to scrutinise laboratory practice".[426] However, Dr Philip Campbell, Editor-in-Chief of *Nature* and Nature Publishing Group, considered that on rare occasions misconduct can be detected:

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416 Ev w101, para 4.2 [London Mathematical Society]

417 Ev w121, para 32 [Association of Learned and Professional Society Publishers]; and Ev 103, para 12 [Royal Society]

418 "Publication ethics", Nature, www.nature.com

419 Q 191

420 Q 36

421 Ev 66 [Committee on Publication Ethics]; and "About COPE", Committee on Publication Ethics, www.publicationethics.org

422 Q 40 [Professor Ron Laskey]

423 Q 83

424 Q 74

425 Ev w120, para 17 [Association of Learned and Professional Society Publishers]

426 Ev 97, para 11

> Given that editors and peer-reviewers need to take everything that authors submit on trust, and do not seek to replicate the work, it is almost impossible for referees to detect misconduct. There have been occasions where a sharp-eyed referee has detected an inconsistency or other flaw in reported results that can only have arisen through inappropriate manipulation, but these are few and far between.[427]

239. Dr Parker agreed that the "peer review system relies on people being ethical".[428] He added that if misconduct is not picked up by the reviewer and the article is published, "it should be picked up by a reader and then it is usually dealt with either by the reader coming to the editor of the journal or the reader going directly to the author and dealing with the matter".[429]

240. Professor Ian Walmsley, from University of Oxford, added that co-authors need also take on some of the responsibility for detecting misconduct:

> As more and more papers are published with joint authors there is joint responsibility for doing that. That could lead in two directions: first, increased pressure to get it right because there are more people involved in the discussion; but, secondly, the chance that you will miss a trick or two because there are more people contributing.[430]

Indeed, Dr Philip Campbell told us that "in some of the most severe cases of misconduct, a problem has arisen because of insufficient critical scrutiny between co-authors".[431]

The role of technology

241. In addition to the vigilance of the people involved in the peer-review process, publishers are increasingly relying on technology to help identify certain types of misconduct.

242. Dr Liz Wager, Chair of COPE, told us that publishers are able to use tools such as CrossCheck, which is "very powerful text-matching software" that identifies duplication (with work already published).[432] Whether plagiarism (the use of someone else's writing or ideas without giving them credit for this, i.e. effectively, stealing) has occurred has, however, to be determined by a human being, and this is not always easy. Robert Campbell, Senior Publisher at Wiley-Blackwell, explained that:

> Duplication is also a problem where English is the second or third language. Authors are more inclined to copy text as it gets their message over much more easily than they can by re-writing it. […] publishers have set up a system called CrossCheck for picking up duplication. That is being taken up at a good speed. About 20,000 submissions a month are now being processed through CrossCheck. By the end of

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427 Ev 89, para 60

428 Q 36

429 *As above*

430 Q 236

431 Ev 90, para 61

432 Q 73

> this year, about 10% of all submissions will be scrutinised through CrossCheck for duplication, which can mean plagiarism.[433]

243. Data or image manipulation is another area where technology is proving useful. Dr Wager pointed out that while "the software has […] made it easier to commit the fraud in the first place, it has also made it easier to detect it".[434] Professor Ron Laskey, Vice President of the Academy of Medical Sciences, told us that "in practice many journals now routinely examine the data files to see how the images were prepared".[435] He added that "you rarely hear about those [cases] because the journal simply declines to deal with that author in future".[436] One recent example that had been more widely publicised was the case of the American Society for Microbiology, which "retracted several papers by a Japanese researcher because of image manipulation and [then] issued a 10-year ban on the author from publishing in any of its journals".[437]

244. **The integrity of the peer-review process can only ever be as robust as the integrity of the people involved. Ethical misconduct damages peer review and science as a whole. Although peer review is not designed to identify systematically fraud or misconduct, it does, on occasion, identify suspicious cases. Where ethical misconduct is suspected, guidance for journal editors is in place, for example from the Committee on Publication Ethics, about how best to deal with it. In addition to relying on the vigilance of the people involved in the process, publishers must continue to invest in new technology that helps to identify wrongdoings.**

Frequency of misconduct

245. Richard Horton, Editor-in-Chief of the medical journal, *The Lancet*, told us that:

> editors have had to face an upsurge in the discovery of episodes of research misconduct (fabrication, falsification, and plagiarism). The increasing awareness of research fraud had led not only to greater vigilance […] among editors but also to the birth of institutional mechanisms to set standards and advise on research practice.[438]

246. COPE considered that "misconduct by reviewers and editors is probably rare but can have serious effects on those affected and is recognised as a form of academic misconduct".[439] Dr Wager, from COPE, added:

> I don't think there has been much research on the integrity of reviewers or editors. Much more research has focused on misconduct by authors. There have been some cases of reviewer misconduct. […] I have done a survey of journal editors to find out

433 Q 149

434 Q 73

435 Q 33

436 Q 47

437 Ev 116, para 23 [Elsevier]

438 Ev w5, para 15

439 Ev 67, para 4.0

> how big a problem they thought reviewer misconduct was, and it came pretty low on their list.[440]

247. There is evidence of misconduct by researchers. A large survey of several thousand early and mid career scientists based in the USA and funded by the National Institutes of Health in 2002 revealed a broad range of serious and questionable research misbehaviours, including: falsifying research data, plagiarism, failing to disclose relevant commercial interests, and inappropriately assigning authorship credit. Around a third admitted they had engaged in at least one of the top ten misbehaviours (those seen as likely to be sanctionable at institutional or federal level) during the previous three years.[441] There are not to our knowledge any comprehensive published data on the incidence of research or publication misconduct in the UK.

The need for transparency

248. In cases of misconduct where the behaviour of the people involved in the peer-review process is called into question, it is essential that there is an accurate record of what was said and done at every step of the process. The availability of this "pre-publication history" to journals was considered to be essential by Dr Mark Patterson, from PLoS; he explained that:

> any reputable publisher has to have those kinds of records. These days there are standard systems which support the editorial process and provide the mechanisms you need to archive and keep all that correspondence.[442]

249. He clarified that the records were not publicly available, but were important for "internal record keeping":

> You need them if a dispute occurs two or three years later about some aspect of priority in terms of who discovered what and when or there are some shenanigans in the peer review process that people want to investigate. They are also a fabulous tool to help support the editorial process, in the sense that if you get a new manuscript in a certain area you can then go back, it reminds you of something and you can rediscover what went on. That can help you with the editorial process on a new manuscript.[443]

250. Dr Michaela Torkar added that in a series of BioMed Central's medical journals the pre-publication history was publicly available, allowing people to access "what the peer reviewer said and how the manuscript was revised".[444] Dr Patterson indicated that this was

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440 Q 74

441 B. C. Martinson and others., *Scientists behaving badly*, Nature, 2005, vol 435, pp 737-38

442 Q 192

443 Q 193

444 Q 192

common amongst medical journals.[445] Dr Torkar explained that this was probably an historical decision.[446] She added that:

> we feel in the medical community there is more acceptance of a very transparent model like this. [...] It certainly has no negative impact on the peer review process and it makes it all quite transparent. It is not clear that the biology community would be quite as open to this model, but there are also experiments going on with different journals and different publishers to look at that.[447]

As noted in paragraph 97, other groups are encouraging the more widespread adoption of these transparent processes.

Taking action on mistakes, fraud and misconduct

251. When ethical misconduct takes place or mistakes are made there must be consequences. The IOP told us that:

> if/when incorrect results make it into the literature there are systematic mechanisms in place to correct errors and maintain a record of any corrections. In publishing this is done by the use of corrigenda, retractions or comments and replies, all of which can be linked back to the source article maintaining an updated record of changes.[448]

Robert Campbell, from Wiley-Blackwell, explained how new technology is helping to link retractions or corrections to published articles for a more robust scientific record:

> The [publishing] industry is developing [...] a new project called CrossMark. Every paper that has gone through the peer review process has the ongoing stewardship of the publisher picking up on retractions or corrections. By clicking on to the CrossMark logo, you can go to the metadata and find out if there have been any updates or even retractions. That is a technical solution which is being launched this year.[449]

252. Dr Wager, from COPE, explained that these are other potential consequences when misconduct is discovered:

> If the editor really steps out of line, they can lose their editorial position. Obviously, that would be quite public.
>
> In terms of reviewer misconduct, which is relatively rare but does occur, initially, they might well be sanctioned by their employer. [...] There could be an academic or employment case against them because that would be seen as professional misconduct.[450]

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445 Q 193

446 Q 195

447 *As above*

448 Ev 91, para 4

449 Q 143

450 Q 77

253. Dr Fiona Godlee, from BMJ Group, told us that the consequences "depend on the ethical breach".[451] She stated that:

> If it was a plagiarism, then the paper might be retracted or there might be a statement of the offence. The institution would be informed. The author would be penalised via the institution. If it was a duplicate publication or a conflict of interests that was undeclared, all of these things have very straightforward remedies both through the journal and through the institution. The understanding of how to deal with what are now pretty standard ethical breaches is very well developed. More difficult is [the situation] where institutions or journals fail to pursue something adequately.[452]

Oversight of research integrity

254. Where there is doubt over the appropriate course of action following a breach in ethical conduct, advice is available from a number of sources. As we discussed in paragraph 236, COPE provides guidance and advice to journal editors. It was "established in 1997 by a small group of medical journal editors in the UK but now has over 6,000 members worldwide from all academic fields".[453] In 2006, another body—the UK Research Integrity Office (UKRIO)—was set up to "provide assistance to researchers, research organisations and members of the public" on issues relating to research integrity.[454]

255. Dr Wager, Chair of COPE, explained that though there are some overlaps between COPE and UKRIO, they have "subtly different audiences"; broadly speaking COPE advises journals and is looking at publication ethics, and UKRIO advises institutions and looks at all kinds of research misconduct.[455] While this distinction is clear, the oversight of research integrity appears to have become more complicated; Research Councils UK (RCUK) told us that Universities UK (UUK) are producing "a "Concordat" style document setting out principles on research integrity to which research funders can all sign up".[456] UUK will be "working closely with RCUK, the UK Funding Councils, the Wellcome Trust and the Department of Health" on this.[457]

256. It appeared to us that the oversight of research integrity in the UK is confused. We set out here our understanding of the existing arrangements. UKRIO was set up "primarily with a remit for the biomedical sciences".[458] A number of UK organisations with interests in research came together to set up, fund and support UKRIO, including:

> the four UK Departments of Health, the four UK Higher Education Funding Councils, the Academy of Medical Sciences, the Association of the British Pharmaceutical Industry, the Association of UK University Hospitals, the

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451 Q 141

452 *As above*

453 "About COPE", Committee on Publication Ethics, www.publicationethics.org

454 "About Us", UK Research Integrity Office Ltd, www.ukrio.org

455 Qq 66–68

456 Ev 96, para 2

457 Ev 96, para 4 [Research Councils UK]

458 Q 264 [Professor Rick Rylance]; also Qq 33–34 [Professor Ron Laskey] and Ev 126 [UK Research Integrity Office Ltd]

> Biotechnology and Biological Sciences Research Council, the Committee on Publication Ethics, the Medical Research Council, the Medical Schools Council, the Medicines and Healthcare products Regulatory Agency, Research Councils UK, the Royal College of Physicians, the Royal College of Physicians of Edinburgh, the Royal Society, Universities UK and research charities including the Wellcome Trust.[459]

257. UKRIO had been "set up on a fixed-term basis".[460] In its initial pilot phase, 2006–10, it was hosted by UUK.[461] In late 2010, UKRIO transferred from UUK and became a company limited by guarantee, UK Research Integrity Office Ltd (which continued to be known as UKRIO).[462] Since then, UKRIO has continued to provide "independent and confidential advice to researchers, research organisations and the public".[463] UKRIO's original funding has lapsed but because it was run at a surplus in its first phase, these funds are currently sustaining the organisation as it evolves.[464]

258. In September 2010, RCUK and UUK published *The Report of the UK Research Integrity Futures Working Group*. The working group had been set up to consider the existing arrangements for research integrity in the UK and potential new arrangements from 2010 onwards.[465] The report recommended:

> The UK and its employers of researchers would benefit from a single body to provide guidance and advice across the many universal issues that are common to all research disciplines. This would be more efficient than current disparate approaches, and beneficial to organisations both in terms of management and representation. A clear repository for leadership, but not regulation, would also be more effective across the UK. This would not obviate the need for actions relevant only to certain disciplines, research designs or sectors.
>
> Such a national body would not have powers of regulation or investigation powers into poor practice or misconduct, but should be there to provide advice and support to research employers and assurance to research funders. This would be achieved through assistance with the promotion of training and good management systems, and providing expert advice where appropriate. A national body should, however, do this on behalf of all major research employers and with the active support of all research funders, to ensure consistency of approach and advice available.[466]

This recommendation has not been implemented.

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459 Ev 128, para 2.4 [UK Research Integrity Office Ltd]

460 Q 264 [Professor Rick Rylance]

461 Ev 126 [UK Research Integrity Office Ltd]

462 *As above*

463 Ev 128, para 2.7 [UK Research Integrity Office Ltd]

464 Ev 126 [UK Research Integrity Office Ltd]

465 Research Councils UK and Universities UK, *Report of the UK Research Integrity Futures Working Group*, September 2010, p2, www.rcuk.ac.uk/documents/documents/ReportUKResearchIntegrityFutures2010.pdf

466 Research Councils UK and Universities UK, *Report of the UK Research Integrity Futures Working Group*, September 2010, pp 3–4, www.rcuk.ac.uk/documents/documents/ReportUKResearchIntegrityFutures2010.pdf

259. We asked Professor Rick Rylance, from RCUK, whether he was broadly supportive of this concept. He told us that RCUK wanted:

> a framework that is applicable in its different modes to different sorts of projects and disciplines. The situation in the old [UKRIO] was that it was only affecting a part of the community. Increasingly, there are cross-disciplinary projects which need attention across the piece. That is our anxiety.[467]

Indeed, we had heard reports that not all of UKRIO's original funders were happy with its remit being extended to other sciences.[468] However, UKRIO subsequently contacted us to inform us that in practice, since its inception it has "responded to enquiries on issues of research integrity across all subject areas and [its] published guidance is applicable to all disciplines".[469]

260. In addition to concerns about broadening the oversight of research integrity to all disciplines, Professor Rylance also expressed his concern about the need to "disentangle" various functions which were "caught up" in the original UKRIO.[470] He questioned whether one could be "both an assurer and an adviser" on issues of research integrity.[471] Professor Rylance added "if you are giving advice which then turns out to be wrong, you would then be policing your own mistake at some level".[472] However, UKRIO told us that it had not been created to deliver an "assurance mechanism".[473]

261. The Research Integrity Futures Working Group had not seen the separation of advice and assurance functions as an issue: it had recommended that the new national body "should be there to provide advice and support to research employers and assurance to research funders".[474] One body, covering all disciplines and providing advice to employers and assurance to funders, is an attractive and straightforward system for the oversight of research integrity. The current situation is highly unsatisfactory. Dr Fiona Godlee, from BMJ Group, told us that "the fact that we don't have a proper research integrity oversight body in the UK is a real scandal".[475] In other countries, there is even more stringent oversight of research integrity. For example, the Office of Research Integrity in the USA has a mandate to oversee institutional investigations of alleged misconduct in publicly funded research.[476] Dr Wager acknowledged that "there has certainly been criticism and people saying, 'We do need a body with more teeth, with some statutory powers'".[477] Professor Ron Laskey considered that the need for a body with statutory powers was "a

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467 Q 269

468 Q 33 [Professor Ron Laskey]

469 Ev 132, para 2

470 Q 264

471 *As above*

472 *As above*

473 Ev 132

474 Research Councils UK and Universities UK, *Report of the UK Research Integrity Futures Working Group*, September 2010, p3, www.rcuk.ac.uk/documents/documents/ReportUKResearchIntegrityFutures2010.pdf

475 Q 141

476 "About ORI", Office of Research Integrity, http://ori.dhhs.gov

477 Q 72

difficult matter" but that it was "something that does deserve to be looked at".[478] However, Professor Rylance considered that there was "no appetite" for a regulatory body.[479] Professor Sir Adrian Smith, from the Department of Business, Innovation and Skills (BIS), added that "if we can avoid getting into a heavy-handed regulatory framework, most of us would prefer to see if we could do it in another way."[480]

262. **Oversight of research integrity in the UK is in need of revision. The current situation is unsatisfactory. We are concerned that the UK does not seem to have an oversight body for research integrity that provides "advice and support to research employers and assurance to research funders", across all disciplines. The UK Research Integrity Futures Working Group report made sensible recommendations about the way forward for research integrity in the UK. Research Councils UK, Universities UK and the Government should revisit these recommendations and reassess how they can best be implemented.**

The role of the research institutions

263. Regardless of the system of oversight it is clear that, as employers of researchers, the research institutions have a part to play in dealing with research fraud or misconduct. The UK Research Integrity Futures Working Group concluded in its recent report:

> While there is an urgent need for a clear and joined-up approach at national level, the working group agreed that the primary responsibility in the UK, as in most other countries, must remain with employers of researchers. This does not only mean universities, but also includes industry and health service trusts/employers as well as national research organisations and institutes.[481]

264. Sir Mark Walport, from the Welcome Trust, agreed that "the integrity of the research is absolutely intrinsic to the good functioning of the university or the research institute. This is a responsibility that they must have".[482] He added that:

> Employers are responsible for the integrity of their employees in all sorts of aspects of life. They are responsible in business for making sure that they do not commit fraud and that the accounting is done well. […] as in health and safety, and all sorts of other aspects, such as the good behaviour of employers in respect of how they deal with students, this is an employer's responsibility. Increasingly, universities are taking [research integrity] very seriously. Of course, you can pick examples of where things go wrong.[483]

265. While we agree that it is the employer who must take responsibility for research integrity, we questioned who would oversee the employer and make sure that they were

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478 Q 34

479 Q 270

480 Q 308

481 Research Councils UK and Universities UK, *Report of the UK Research Integrity Futures Working Group*, September 2010, p3, www.rcuk.ac.uk/documents/documents/ReportUKResearchIntegrityFutures2010.pdf

482 Q 267

483 Q 273

doing the right thing. We had already heard that there is "no appetite" for regulation (see paragraph 261). However, expanding on Sir Mark's analogy of employer responsibility for health and safety, we noted that there was an external regulator in this area: the Health and Safety Executive. We put this to Sir Mark and questioned again whether there was a need for regulatory oversight of research integrity. He responded that:

> The question is what those statutory powers should be. Ultimately, it is clear that a scientist who has committed some form of scientific fraud, if I can put it that way, should lose their job. Does that then fall under some other regulator? Is it something that the courts should deal with? Probably not very often. In the case of medical research, Andrew Wakefield eventually met his come-uppance at the General Medical Council.[484]

An article written by Andrew Wakefield and twelve co-authors, linking the MMR (measles, mumps and rubella) vaccine and autism, published in 1998, led to a drop in MMR vaccine uptake.[485] An investigative journalist, Brian Deer, exposed that the research was fraudulent after investigating the case over more than seven years.[486] Dr Wakefield was struck off the medical register for "unethical" research rather than scientific fraud, 12 years after the research was published.[487] In this case, Dr Wager, from COPE, explained that there was: "clear evidence that the institution [the Royal Free Hospital] did not fulfil its duty […] It should have done a proper investigation. […] It has now recognised that, and I believe it is looking into their processes".[488] COPE considered that an "important step would be for all UK institutions to appoint a research integrity officer who would act as a point of contact and coordinate investigations".[489]

266. Dr Wager explained that:

> Institutions don't like to proclaim when things go wrong. I would like to campaign for a change, so that rather than a misconduct finding against a university being a black mark, it is seen as a badge of honour. You should say, "Don't go to a university that hasn't had at least one person fired for misconduct, because it means they are not looking for it properly".[490]

267. While we did not conduct a detailed analysis of university views, of the two university Pro-Vice-Chancellors that appeared before us, neither had come across a case of someone being fired for research misconduct.[491] Despite not having come across a case of misconduct, both Professor Teresa Rees, from the University of Cardiff, and Professor Ian Walmsley, from the University of Oxford, implied that their respective universities had

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484 Q 274

485 "Health Drop in MMR jabs blamed on media scare", BBC News Online, http://news.bbc.co.uk, 26 June 1998; and "Exposed: Andrew Wakefield and the MMR-autism fraud", Brian Deer, www.briandeer.com

486 "Exposed: Andrew Wakefield and the MMR-autism fraud", Brian Deer, www.briandeer.com; and F Godlee, J Smith and H Marcovitch, *Wakefield's article linking MMR vaccine and autism was fraudulent*, BMJ, 5 January 2011

487 "Dr Andrew Wakefield struck off medical register", Times Online, www.timesonline.co.uk, 25 May 2010

488 Q 75

489 Ev 68, para 9.0

490 Q 75

491 Qq 236 [Professor Ian Walmsley] and 238 [Professor Teresa Rees]

robust internal processes for dealing with such matters.[492] We queried how they could possibly know that their policies were robust, to which Professor Walmsley responded:

> I noted that we had not come across cases of fraud in respect of publications. There have certainly been other issues—I will not say it is fraud—associated with ethical conduct of research where we have processes that parallel those we might use for publication, and they have been shown to be effective. In respect of publication I would say that at least within my tenure they are untested, but I think there is good evidence that parallel processes for other issues work.[493]

268. Where fraud or misconduct has occurred and universities instigate some sort of investigation, another problem that journal editors face is the lack of transparency of proceedings. Dr Wager told us that:

> [Journal editors] will go to an institution with an allegation or a suspicion of misconduct and the institution will say, "Oh, we can't tell you. It's confidential." The journal editor may be put in a very difficult position, because if, for example, they have published something, they need to know whether to retract it or whether to publish an expression of concern. That is an area where transparency would be a great advantage. It would also help public confidence. [494]

269. Professor Walmsley explained the process in place at the University of Oxford for reporting proceedings to external organisations:

> The responsibility for investigating [misconduct] lies with the University's most senior officers (in the case of staff members, this is the Registrar; for students, this is the Proctors' Office).
>
> Although the details of such allegations or enquiries are not made publicly available, the University regularly reports externally on allegations and cases of research misconduct, for example to the UK Research Integrity Office, to the US Office of Research Integrity and to Research Councils UK. Where the research in question involves a third party, for example an external funder of research such as the Medical Research Council or the Wellcome Trust, the University is careful to ensure that the third party is kept closely informed of how the case is handled and the outcome of any investigation.[495]

270. Professor Rylance, from RCUK, added that:

> In the 18 months or so that I have been part of the AHRC I have had, perhaps, two or three occasions where relatively minor malpractice has been reported. The institutions involved have acted very readily. There is a working system between the funders and the institutions.[496]

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492 Q 240

493 Q 241

494 Q 76

495 Ev 107, para 2

496 Q 276

271. **Employers must take responsibility for the integrity of their employees' research. However, we question who would oversee the employer and make sure that they are doing the right thing. In the same way that there is an external regulator overseeing health and safety, we consider that there should be an external regulator overseeing research integrity. We recommend that the Government set out proposals on the scope and powers of such a regulator and consult with the research community and other relevant parties to develop them.**

272. **We also recommend that all UK research institutions have a specific member of staff leading on research integrity. Such a person would be a first point of call in case of an ethical breach. Where an investigation subsequently takes place within a research institution, it is essential that the outcome be published.**

The role of the funders

273. In addition to the research institutions themselves taking responsibility, a degree of responsibility also lies with the funders of research. David Sweeney, Director for Research, Innovation and Skills at HEFCE, added that "in England, as the charities' regulator for most universities and as a regulator under the [Charities Act 2006], universities are required to report incidents to [HEFCE] and we monitor the way in which they handle incidents".[497]

274. Sir Mark Walport explained that funders play "a very serious role", adding that:

> We take research integrity very seriously as well. It is a grant condition that the work is done properly. From our perspective, in relation to an institution that failed to manage the research integrity properly, we would have to question whether that was an institution at which we could fund research.[498]

275. We questioned Professor Sir Adrian Smith, from BIS, whether any of the Research Councils had ever withdrawn funding because of fraud or allegations of fraud. We expected the number of incidents to be significant, given the evidence from researchers funded by the National Institutes of Health regarding the frequency of misconduct in the USA (see paragraph 247). However, BIS subsequently wrote to us explaining that there had been "no cases where funding has been withdrawn on the grounds of fraud/misconduct in research".[499] Three proven allegations of scientific misconduct during the last 10 years were highlighted, relating to work funded by the Medical Research Council (MRC):

> None of [these] cases has resulted in withdrawal of funding, but all have had sanctions imposed against the individuals concerned.
>
> 1. In 2001 an MRC-funded Clinical Fellow was reprimanded for serious professional misconduct and suspended for a year by the General Medical Council (GMC) for falsifying published data. The Fellow's supervisor was

497 Q 275

498 *As above*

499 Ev 148

also severely reprimanded by the GMC for not having reacted adequately and promptly.

2. In 2010/11 there was a case related to manipulation of results and falsification of data (images) by a member of MRC staff.

3. In 2010/11 there was a case related to falsification of documentation relating to patient consent in a clinical trial supported by an MRC grant.

In the third case, where the allegation was against the Principal Investigator (PI), MRC temporarily transferred the supervision of the grant to another PI while the investigation was ongoing. This transfer was made permanent once the allegation was proven. This case was also reported to the GMC.

MRC decided to continue the funding the grant in the third case for a number of reasons:

- the recruitment of patients to the trial and collection of biological samples was already complete;
- there was no risk to patients;
- the misconduct did not affect the integrity of the data;
- publication of the results would be possible (having checked patient consent was valid); and
- the data from the trial would be important to inform clinical practice.

It would have been a waste of public money to terminate the grant as this would have prevented the results being analysed and published.[500]

276. Considering the evidence published on the frequency of research and publication misconduct amongst researchers in the USA, we would have expected a similar proportion of researchers to be engaged in these misbehaviours in the UK. We are therefore surprised that there have been no cases where funding has been withdrawn on the grounds of fraud or misconduct in research funded by Research Councils in the UK. **We recommend that the Research Councils, and other funders of research, reassess the robustness of their procedures for dealing with allegations of research fraud or misconduct, to ensure that they are not falling through the cracks.**

[500] Ev 148 [Department for Business, Innovation and Skills]

7 Conclusions

277. **Peer review in scholarly publishing, in one form or another, is crucial to the reputation and reliability of scientific research. Pre-publication peer review has evolved in a piecemeal and haphazard way to meet the needs of individual scientific communities. The process, as used by most traditional journals prior to publication, is not perfect, and it is clear that considerable differences in quality exist. However, despite the many criticisms and the little solid evidence on its efficacy, editorial peer review is considered by many as important and not something that can be dispensed with.**

278. **In order for current peer-review practices to be optimised and innovative approaches introduced, publishers, research funders and the users of research outputs (such as industry and government) must work together. There is much that can be done to improve the quality of pre-publication peer review across the board and to better equip the key players to carry out their roles. We note that new innovations in pre-publication review are being introduced that have the potential to accelerate the pace of research communication and avoid duplication of effort by the research community, with the consequent drain on resources. Publishers can learn much from one another and should share best practice where possible—particularly in relation to the ways in which data are managed and in terms of promoting publication ethics and research integrity. It is clear that breaches in the latter damage both the scientific record and public confidence in science.**

279. **The publication of peer-reviewed articles is not only important in terms of maintaining a robust scientific record, it also has an impact on the careers of researchers and the reputations of research institutions. We have been assured by research funders that they do not use journal Impact Factor as a proxy measure for the quality of research or of individual articles. However, representatives of research institutions have suggested that publication in a high-impact journal is still an important consideration when assessing individuals for career progression. We consider that research institutions should be cautious about this approach, because as we have previously noted, there is no substitute for reading the article itself in assessing the worth of a piece of research.**

280. **While pre-publication peer review continues to play an important role, the growth of post-publication peer review and commentary represents an enormous opportunity for experimentation with new media and social networking tools. Online communications allow the widespread sharing of links to articles, ensuring that interesting research is spread across the world, facilitating rapid commentary and review by the global audience. They also have a valuable role to play in alerting the community to deficiencies and problems with published work. We encourage the prudent use of online tools for post-publication review and commentary as a means of supplementing pre-publication review.**

Conclusions and recommendations

The peer-review process

1. We conclude that different types of peer review are suitable to different disciplines and research communities. We consider that publishers should ensure that the communities they serve are satisfied with their choice of peer-review methodology. Publishers should keep them updated on new developments and help them experiment with different systems they feel may be beneficial. (Paragraph 20)

2. The importance of a pre-publication technical assessment is clear to us. It should be a fundamental aim of the peer-review process that all publications are scientifically sound. Assessing the impact or perceived importance of research before it is published will always require subjective judgement and mistakes will inevitably be made. We welcome new approaches that focus on carrying out a technical assessment prior to publication and making an assessment of impact after publication. (Paragraph 29)

3. We recommend that publishers, research funders and the users of research outputs (such as industry and Government) work together to identify how best to evaluate current peer-review practices so that they can be optimised and innovations introduced, and the impact of the common criticisms of peer review minimised. We consider that this would also help address any differences in the quality of peer review that exist. We encourage increased recognition that peer-review quality is independent of journal business model, for example, there is a "misconception that open access somehow does not use peer review". (Paragraph 58)

Innovative approaches to peer review

4. We conclude that pre-print servers can be an effective way of allowing researchers to share and get early feedback on preliminary research. The system is well established in the physics community, and works particularly well, co-existing with more traditional publication in journals. We encourage exploration in other fields. We note, however, that pre-print servers may not work in fields where commercialisation and patentability are issues, or in the biomedical sciences, where publication of badly performed studies could have harmful consequences and could be open to misinterpretation. (Paragraph 72)

5. The principles of openness and transparency in open peer review are attractive, and it is clear that there is an increasing range of possibilities. There are mixed results in terms of acceptance amongst researchers and publishers, although some researchers are keen to see greater transparency in their fields. We encourage publishers to experiment with the various models of open peer review and transparency and actively engage researchers in taking part. (Paragraph 78)

6. We are impressed by the success of *PLoS ONE* and welcome the wider growth of quality online repository journals. These will accelerate the pace of research communication and ensure that all work that is scientifically sound is published,

regardless of its perceived importance. However, we recognise that this is a relatively new and rapidly evolving model, and potentially open to abuse because publication fees are involved. It is important that a high quality of peer review is maintained across all repository-style journals. (Paragraph 89)

Editors, authors and reviewers

7. The role of the editor is at the heart of the peer-review process. The judgement applied by the editor to the information collected in the review process requires knowledge, skill, and care; particularly, in respect of identifying the right reviewers for the job and critically assessing the feedback from reviewers to authors. (Paragraph 100)

8. Broadly speaking, training for editors and members of editorial boards is provided on the job. We have heard that some publishers opt for a more structured approach, and include, for example, comprehensive welcome packs for new editors that cover peer-review processes, support tools and ethical guidelines. We encourage publishers to work together to develop standards—which could be applied across the industry—to ensure that all editors, whether staff or academic, are fully equipped for the central role that they play in peer review. (Paragraph 106)

9. A relatively straightforward way of educating reviewers about the quality of their reports and helping them improve their feedback to editors is to send them the reports of other reviewers, done confidentially when necessary. This should be standard practice across all journals. This would be a useful educational tool to improve the quality of future reports from reviewers. (Paragraph 118)

10. Training for the next generation of authors and reviewers is also important. Many PhD students and post-doctoral researchers are fortunate to have the opportunity to discuss scientific literature in journal clubs and other informal settings. Some are mentored well by their principal investigator and thereby receive informal training in peer review. Others are not. Given the importance of peer review across the research spectrum, from grant applications to publications, we consider that all early-career researchers should be given the option for training in peer review. (Paragraph 119)

11. Training for early-career researchers is important. We note that "Roberts Funding" is coming to an end and that the Research Councils will therefore be increasing the amount they give to universities "for training and developing postgraduate research". We invite the Research Councils to set out further details of how and where this money will be allocated and what proportion of it will be dedicated to training in peer review, including academic writing and publication ethics (discussed later in this report). We also ask for further details of how this will be "joined up" across different research funders. (Paragraph 124)

12. We welcome the fact that the publishers we have heard from are training authors and reviewers on an international level, particularly those from countries which are not traditional scientific leaders, and we encourage others to do the same. This should help alleviate the current imbalance between publication output and participation in peer review. (Paragraph 130)

The burden of reviewing

13. We are not convinced that there is a "crisis" in the supply of reviewers, especially as so little data are available. It appears that the current imbalance between publication output and participation in peer review may be a transitory phase. However, publishers should not be complacent and should continue actively to monitor the situation by collecting data. (Paragraph 134)

14. Peer review is a burden on researchers but a necessary one, as it is an integral part of the scientific and research process and is part of the role of a researcher. However, we encourage publishers to work with their reviewers, to identify innovative new practices to minimise the burden. (Paragraph 152)

15. In order to help research institutions recognise the work carried out by reviewers on peer review, publishers first need to have in place systems for recording and acknowledging it. A variety of approaches are in use, including rewards, awards and letters of endorsement and these should be encouraged. New initiatives for accurate author and reviewer identification may make it easier for publishers to track reviewer contribution to the peer-review process. (Paragraph 164)

The assessment of researchers and institutions

16. We have concerns about the use of journal Impact Factor as a proxy measure for the quality of an individual article. We have been reassured by the research funders that they do not consider that publication in a high-impact journal should be used as a proxy measure for assessing either the work of individual researchers or research institutions. We agree that there is no substitute for reading the article itself in assessing the worth of a piece of research. We consider that there is an element of chance involved in whether researchers are able to get their articles published in high-impact journals, depending on topicality and other factors. Research institutions should be cautious not to attach too much weight to publication in high-impact journals when assessing individuals for career progression. (Paragraph 177)

Managing data

17. We conclude that reproducibility should be the gold standard that all peer reviewers and editors aim for when assessing whether a manuscript has supplied sufficient information, about the underlying data and other materials, to allow others to repeat and build on the experiments. (Paragraph 184)

18. If reviewers and editors are to assess whether authors of manuscripts are providing sufficient accompanying data, it is essential that they are given confidential access to relevant data associated with the work during the peer-review process. This can be problematical in the case of the large and complex datasets which are becoming increasingly common. The Dryad project is an initiative seeking to address this. If it proves successful, funding should be sought to expand it to other disciplines. Alternatively, we recommend that funders of research and publishers work together to develop similar repositories for other disciplines. (Paragraph 189)

19. Access to data is fundamental if researchers are to reproduce, verify and build on results that are reported in the literature. We welcome the Government's recognition of the importance of openness and transparency. The presumption must be that, unless there is a strong reason otherwise, data should be fully disclosed and made publicly available. In line with this principle, where possible, data associated with all publicly funded research should be made widely and freely available. Funders of research must coordinate with publishers to ensure that researchers disclose their data in a timely manner. The work of researchers who expend time and effort adding value to their data, to make it usable by others, should be acknowledged as a valuable part of their role. Research funders and publishers should explore how researchers could be encouraged to add this value. (Paragraph 203)

Post-publication review and commentary

20. Post-publication review in an era of new media and social networking tools, such as Twitter, is very powerful. The widespread sharing of links to articles ensures that research, both accurate and potentially misleading, is rapidly spread across the world. Failings in peer review can, rightly, be quickly exposed. However, there is no guarantee that false accusations of failings will not also be spread. Pre-publication peer review still has an important role to play, particularly in relation to assessing whether manuscripts are technically sound prior to publication. However, we encourage the prudent use of online tools for post-publication review and commentary as a means of supplementing pre-publication review. (Paragraph 211)

21. While it is too early to make a judgement on post-publication filtering mechanisms, such as Faculty of 1000 Ltd, we recognise that such a system could offer a valuable service if widely used. It is likely that such services will become more important with the growth of repository-type journals. (Paragraph 223)

Publication ethics and research integrity

22. The integrity of the peer-review process can only ever be as robust as the integrity of the people involved. Ethical misconduct damages peer review and science as a whole. Although peer review is not designed to identify systematically fraud or misconduct, it does, on occasion, identify suspicious cases. Where ethical misconduct is suspected, guidance for journal editors is in place, for example from the Committee on Publication Ethics, about how best to deal with it. In addition to relying on the vigilance of the people involved in the process, publishers must continue to invest in new technology that helps to identify wrongdoings. (Paragraph 244)

23. Oversight of research integrity in the UK is in need of revision. The current situation is unsatisfactory. We are concerned that the UK does not seem to have an oversight body for research integrity that provides "advice and support to research employers and assurance to research funders", across all disciplines. The UK Research Integrity Futures Working Group report made sensible recommendations about the way forward for research integrity in the UK. Research Councils UK, Universities UK and the Government should revisit these recommendations and reassess how they can best be implemented. (Paragraph 262)

24. Employers must take responsibility for the integrity of their employees' research. However, we question who would oversee the employer and make sure that they are doing the right thing. In the same way that there is an external regulator overseeing health and safety, we consider that there should be an external regulator overseeing research integrity. We recommend that the Government set out proposals on the scope and powers of such a regulator and consult with the research community and other relevant parties to develop them. (Paragraph 271)

25. We also recommend that all UK research institutions have a specific member of staff leading on research integrity. Such a person would be a first point of call in case of an ethical breach. Where an investigation subsequently takes place within a research institution, it is essential that the outcome be published. (Paragraph 272)

26. We recommend that the Research Councils, and other funders of research, reassess the robustness of their procedures for dealing with allegations of research fraud or misconduct, to ensure that they are not falling through the cracks. (Paragraph 276)

General conclusions

27. Peer review in scholarly publishing, in one form or another, is crucial to the reputation and reliability of scientific research. Pre-publication peer review has evolved in a piecemeal and haphazard way to meet the needs of individual scientific communities. The process, as used by most traditional journals prior to publication, is not perfect, and it is clear that considerable differences in quality exist. However, despite the many criticisms and the little solid evidence on its efficacy, editorial peer review is considered by many as important and not something that can be dispensed with. (Paragraph 277)

28. In order for current peer-review practices to be optimised and innovative approaches introduced, publishers, research funders and the users of research outputs (such as industry and government) must work together. There is much that can be done to improve the quality of pre-publication peer review across the board and to better equip the key players to carry out their roles. We note that new innovations in pre-publication review are being introduced that have the potential to accelerate the pace of research communication and avoid duplication of effort by the research community, with the consequent drain on resources. Publishers can learn much from one another and should share best practice where possible—particularly in relation to the ways in which data are managed and in terms of promoting publication ethics and research integrity. It is clear that breaches in the latter damage both the scientific record and public confidence in science. (Paragraph 278)

29. The publication of peer-reviewed articles is not only important in terms of maintaining a robust scientific record, it also has an impact on the careers of researchers and the reputations of research institutions. We have been assured by research funders that they do not use journal Impact Factor as a proxy measure for the quality of research or of individual articles. However, representatives of research institutions have suggested that publication in a high-impact journal is still an important consideration when assessing individuals for career progression. We consider that research institutions should be cautious about this approach, because

as we have previously noted, there is no substitute for reading the article itself in assessing the worth of a piece of research. (Paragraph 279)

30. While pre-publication peer review continues to play an important role, the growth of post-publication peer review and commentary represents an enormous opportunity for experimentation with new media and social networking tools. Online communications allow the widespread sharing of links to articles, ensuring that interesting research is spread across the world, facilitating rapid commentary and review by the global audience. They also have a valuable role to play in alerting the community to deficiencies and problems with published work. We encourage the prudent use of online tools for post-publication review and commentary as a means of supplementing pre-publication review. (Paragraph 280)

Annex: list of abbreviations

ALPSP	Association of Learned and Professional Society Publishers
BIS	Department for Business, Innovation and Skills
BMA	British Medical Association
COPE	Committee on Publication Ethics
F1000	Faculty of 1000 Ltd
GMC	General Medical Council
HEFCE	Higher Education Funding Council for England
HEIs	Higher Education Institutions
IOP	Institute of Physics
IT	Information Technology
JISC	Joint Information Systems Committee
MMR	Measles, mumps and rubella
MRC	Medical Research Council
PI	Principal Investigator
PLoS	Public Library of Science
QR	Quality-related
RAE	Research Assessment Exercise
RCUK	Research Councils UK
REF	Research Excellence Framework
RSC	Royal Society of Chemistry
UKRIO	UK Research Integrity Office (Ltd)
UUK	Universities UK

Formal Minutes

Monday 18 July 2011

Members present:

Andrew Miller, in the Chair

Gavin Barwell
Stephen McPartland
Stephen Metcalfe
Stephen Mosley
Graham Stringer

1. Peer review in scientific publications

The Committee considered this matter.

Draft Report (*Peer review in scientific publications*), proposed by the Chair, brought up and read.

Ordered, That the draft Report be read a second time, paragraph by paragraph.

Paragraphs 1 to 280 read and agreed to.

Annex and Summary agreed to.

Resolved, That the Report be the Eighth Report of the Committee to the House.

Ordered, That the Chair make the Report to the House.

Ordered, That embargoed copies of the Report be made available, in accordance with the provisions of Standing Order No. 134.

Written evidence was ordered to be reported to the House for placing in the Library and Parliamentary Archives.

[Adjourned till Wednesday 7 September at 9.00 am

Witnesses

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Wednesday 8 June 2011

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List of additional written evidence

(published in Volume II on the Committee's website www.parliament.uk/science)

List of Reports from the Committee during the current Parliament

The reference number of the Government's response to each Report is printed in brackets after the HC printing number.

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First Special Report	The Legacy Report: Government Response to the Committee's Ninth Report of Session 2009–10	HC 370
First Report	The Reviews into the University of East Anglia's Climatic Research Unit's E-mails	HC 444 (HC 496)
Second Report	Technology and Innovation Centres	HC 618 (HC 1041)
Third Report	Scientific advice and evidence in emergencies	HC 498 (HC 1042 and HC 1139)
Second Special Report	The Reviews into the University of East Anglia's Climatic Research Unit's E-mails: Government Response to the Committee's First Report of Session 2010–12	HC 496
Fourth Report	Astronomy and Particle Physics	HC 806 (HC 1425)
Fifth Report	Strategically important metals	HC 726
Third Special Report	Technology and Innovation Centres: Government Response to the Committee's Second Report of Session 2010–12	HC 1041
Fourth Special Report	Scientific advice and evidence in emergencies: Government Response to the Committee's Third Report of Session 2010–12	HC 1042
Sixth Report	UK Centre for Medical Research and Innovation (UKCMRI)	HC 727
Fifth Special Report	Bioengineering: Government Response to the Committee's Seventh Report of 2009–10	HC 1138
Sixth Special Report	Scientific advice and evidence in emergencies: Supplementary Government Response to the Committee's Third Report of Session 2010–12	HC 1139
Seventh Report	The Forensic Science Service	HC 855
Seventh Special Report	Astronomy and Particle Physics: Government and Science and Technology Facilities Council Responses to the Committee's Fourth Report of Session 2010–12	HC 1425

Oral evidence

Taken before the Science and Technology Committee

on Wednesday 4 May 2011

Members present:

Andrew Miller (Chair)

Stephen Metcalfe	Pamela Nash
Stephen Mosley	Graham Stringer

Examination of Witnesses

Witnesses: **Dr Nicola Gulley**, Editorial Director, Institute of Physics Publishing Ltd, **Professor Ronald Laskey CBE FRS FMedSci**, Vice-President, Academy of Medical Sciences, **Dr Robert Parker**, Interim Chief Executive, Royal Society of Chemistry, and **Professor John Pethica FRS**, Physical Secretary and Vice President, Royal Society, gave evidence.

Q1 Chair: Good morning to you all. Some of you may not be aware that Parliament was sitting until the early hours this morning, so some of my colleagues are a tad on the tired side. Please bear with us. May I, first of all, ask the four witnesses to introduce themselves?

Dr Gulley: I am Dr Nicola Gulley. I am the Editorial Director at IoP Publishing.

Professor Laskey: I am Ron Laskey. I am here as Vice-President of the Academy of Medical Sciences.

Dr Parker: I am Robert Parker. I am Interim Chief Executive of the Royal Society of Chemistry.

Professor Pethica: I am John Pethica, Physical Sciences Secretary and Vice-President of the Royal Society.

Q2 Chair: Welcome. You are familiar with the nature of this inquiry. Let me start off with some basic questions. If you feel at the end of the session that you would have liked to have responded in more detail to one of the questions, please feel free to drop us a note with any additional comments. Peer review is perceived to be "fundamental to scholarly communications". If it disappeared tomorrow, what would the consequences be?

Dr Parker: You would have to come up with something else with which to replace it. There isn't anything very obvious to replace peer review with currently. The danger would be to the scientific record, really. The importance of it is laid out in the evidence that has been submitted with great clarity from most people who have submitted evidence in writing to this review. The value and quality of that scientific record is paramount, and peer review helps to keep that in place.

Professor Laskey: In the biomedical sciences there would be a particular problem of sorting the wheat from the chaff and knowing what information could be depended on. This, I think, would corrupt the public understanding of science where a firm basis of trust in scientists is something that we could do with more of.

Dr Gulley: I would add that there is the aspect of the time that it would take for scientists to be able to find the information that they really wished to read, because at the moment peer review also adds value in providing that filter. There is also evidence that many authors feel that the peer review does improve the quality of the articles that they publish as well.

Professor Pethica: To add a historical perspective, of course, this has been going on for a very long time. You asked the question of what would happen if it disappeared. Its primary function is to improve the process and the coherence of scientific knowledge and its utility.

Q3 Chair: Taking Professor Laskey's observation about sorting the wheat from the chaff, in a sense, the opposite of that is something that we have been told in the evidence, that peer review has a tendency towards producing conservative judgments. How big a problem is that for the progression of science and what can be done about it?

Professor Laskey: Some journals have a tendency to believe that things that are already well known to be important have a higher impact. It can be more difficult to establish a novel and completely unexpected new branch of science if editors of journals are not alert to the fact that it is coming. There are one or two recent examples. One that springs to mind is a study in plant sciences which concerned resistance to viral infection in plants. That has given rise to a completely new area of understanding of a group of molecules that turn out to be important in all cells, not just in viral defence mechanisms against plants but because they change fundamentally in certain types of cancer. That was a small niche of advance that has suddenly become a front-line subject, but it would have been very difficult to publish that in a front-line journal at the time the work was being done.

Professor Pethica: To add to that a little, there is always a risk in this process that new ideas may be impeded in the way I have described. That is a risk. It has to be balanced against the fact that the likelihood of radical breakthroughs is, unfortunately, rather smaller than exotic ideas that don't actually work. It is that balance that is difficult to achieve because there is a tension between those two.

Dr Parker: Knowing the right people to ask about research that looks slightly different is one of the most important things. Having professional people

overseeing the peer review process is absolutely paramount, because it ensures that, if something is there that is very different, you could get somebody to look at it who will look at it in an open way. There are different outlets for different sorts of science. Sometimes you can get things published that are a little odd or seem a little odd at the time.

As Professor Laskey said, you don't always know very quickly what is going to be important in areas that are far away from chemistry. You could have some mathematical proof that is not found to be terribly important until 50 years or 100 years later, and suddenly it is important in finding out something else.

Dr Gulley: There is also a cultural difference in certain research areas as well. There is more conservatism in some research areas than there is in other areas. Speaking from the journals' point of view, some journals like to have articles that they feel are cutting edge. That is, partly, how they approach it. Also, different things need to be taken into consideration. There is peer review within, for example, the research conferences where you do get a feel for some of the new areas that are coming up before they go into the journals.

Q4 Graham Stringer: Which areas are conservative and which are bold and radical?

Dr Gulley: It varies considerably. I can only speak from the physics side in which I am involved. There are certain very well-established areas where there would be slightly more conservatism because they are very well established and they want to be sure that before something goes in to be the article of record it is correct. There could be some areas, particularly where you have multidisciplinary areas, where there are more differences of opinion. There is then less conservatism about what gets recorded.

Q5 Chair: You have all acknowledged in different ways that there is a risk or a problem there, but none of you really responded to the second part of the question, which is, what can be done about it?

Professor Pethica: I alluded to that a little bit in my response. Given that there is no perfect system, we have to devise a system which optimises the process, that is to say, one that minimises the risks that have been alluded to but also retains the key advantages of the peer review process in establishing a coherent record. A variety of models have been alluded to in other places. For example, different kinds of publishing models are being evolved all the time. For example, there is the arXiv record in high energy physics which stems from the way that high energy physics actually works. That is another way of establishing the record.

It is also important to recall that peer review, as we are describing it here, is about generating a coherent scientific record efficiently as far as possible, but often it is used for other proxy purposes and assessment. That can, potentially, influence how it is carried out.

Q6 Chair: Following on from that, is something like the *PLoS ONE* model of publishing anything that is scientifically sound, regardless of potential impact or perceived scientific interest, a better way of doing things?

Professor Laskey: It is an alternative that solves some of the problems. At the moment it is an evolving landscape. The attitude of *PLoS ONE* to publish irrespective of impact but based solely on the criterion of the quality of the science can prevent a trap that, in biomedical sciences, is becoming increasingly troublesome, namely, that a high proportion of time is spent fending off criticisms from reviewers that may not be on the main theme of the work. The reviews are beginning to dictate the agenda of the science in a way that is not fully productive. That can be frustrating, a waste of time and resource. *PLoS ONE* provides an alternative to that.

The downside, as Professor Pethica has already said, is that there is now a proxy use of peer review, namely, to judge careers by the calibre of the journals in which people have published and to judge institutions by the Research Excellence Framework, again based on the quality of journals in which people have published. *PLoS ONE*, of course, is not a major front-line high impact journal.

However, that has been compensated for by the ease of electronic searches of the literature. Now you no longer have to depend on readers of a small number of widely read journals seeing your paper, because your paper will be noticed by electronic search routes as an alternative. Against that changing model, there is an increasing value of archival journals, such as *PLoS ONE,* which ignore impact.

There are potential downsides to it because of the proxy use of peer review data, but they do offer an alternative. One trend that has been emerging, and it has been a surprise to many people, is that, initially, people envisaged *PLoS ONE* as a journal they would submit to only if their paper was having severe criticism from other higher impact journals. Now, important research has been submitted to get it on the record quickly before it is scooped by someone else who has a smoother path through the refereeing jungle.

Dr Parker: The *PloS ONE*-type model or the cascading model also has another advantage in that it can reduce the factor of articles being multiply peer reviewed by different journals. It can save time in the peer review process there. Without those cascade journals, you often have the case where papers that are rejected by one journal are then submitted to another and they are reviewed again completely. They could be, and very often are, scientifically acceptable but they just don't reach the impact criterion for that particular journal. So the process goes on until they find a home. The cascading-type journal does away with that. We found, from doing studies on the articles that we reject, that most of them end up being published somewhere else. There are very few articles that we receive that are scientifically completely wrong. Usually, there is some merit in them.

Q7 Stephen Mosley: Dr Gulley, Dr Parker and Professor Pethica, could you summarise for the record the peer review methodology that you use in the journals that you publish?

Dr Gulley: For the IoP Publishing journals, we use single-blind refereeing where the referees know who the author is but the referees' names are kept anonymous.

Dr Parker: We are the same at the RSC. We also use, as I suspect others do, pre-screening as well, so not all papers are sent to referees. Some of them are rejected before they are sent to referees. That is either by internal, qualified editorial staff or by external associate editors.

Professor Pethica: It is the same process for the Royal Society's journals, which is single-blind.

Q8 Stephen Mosley: The three organisations represented here all use the same methodologies, but there are other organisations that use different methodologies. Why are different methodologies used across the journals?

Professor Pethica: I have two background points to make. One is, of course, that the subject areas vary very strongly. We should keep in mind that we are discussing areas from pure mathematics through to biomedical research. As a result, the review process in those cases needs to be quite different simply because of the nature of the subject and what they are trying to establish. As a result, the various experiments in the forms that you have described vary quite strongly across subjects. What you have heard about is physics and chemistry, which are what I might call fairly traditional mainstream subjects. As you move to the more trials-based medical work, you get a different structure. Also, I have mentioned arXiv already and high energy physics. This is a very large-scale collaborative exercise in which that kind of model of communication is quite important. There is some variability across the subjects and I suspect that is the demand of the users. The need to establish fairly rapidly a sensible view of what works in the science affects the methods used. It is fair to say that all of these things are in a state of steady evolution. There are core principles, but the actual method by which it is used varies. You have evidence from a variety of people submitted to you about things like completely open or double-blind processes. You have some responses about that. I don't want to add to those because they are broadly correct.

Dr Parker: I would add that open review pre-printing, particularly, is not popular with chemistry because there is very often the possibility that an author will take out a patent on what they are producing. Putting your results out there in a pre-printed form is risking losing priority on them.

Another aspect that is different across disciplines is the amount of experimental refereeing that is done. In mathematics there might be very few experimental results, but in chemistry and physics there are a vast amount of experimental results that sometimes need specialist refereeing.

Dr Gulley: Some of the research communities that I work with particularly are very small, so doing double-blind refereeing where neither the author nor the referee knows who each other is defeats the object because, generally, the referees will know who the author is from the subject area that they are working in or from the references and things like that. It varies very much between different subject areas.

With regard to pre-print, this is something within physics that we have worked with for many years since the arXiv was set up. That form of open refereeing on the pre-print side is entered into for a lot of the subject areas with which I work. However, when it comes to submitting to journals, we find that people are happier to referee if they are kept anonymous because they feel they have more options to be able to criticise openly. As a result, there is a mixture within the physics area now.

Q9 Chair: Where you have these very small communities, isn't there a tendency for the referee to be somebody who is more advanced in their career than the person whose paper they are refereeing? Doesn't that inhibit the evolution of some of the science because you would feel a little reluctant in criticising previous work?

Dr Gulley: It also works the other way in that you have some of the more junior researchers assessing senior researchers work and the anonymity offered as a referee enables the junior researchers to feel a bit more comfortable when they have to criticise work in particularly well-established research areas, particularly when the research area is small. Then there is less worry about it impacting on grant applications and things like that.

There is also an element of exactly what information the editor or the editorial office of the journal has to take into consideration making sure that there is a balanced opinion. Generally, for IoP Publishing we don't just have one referee on an article, for example. It is generally balanced with at least two referee reports and occasionally more.

Q10 Stephen Mosley: Professor Pethica, I noticed that you were nodding when the Chairman asked his question. Perhaps you have a slightly different view.

Professor Pethica: No, on the contrary. It is quite commonplace for research students to be trained by asking them to review papers. The question of senior people reviewing junior people is very often reversed.

Q11 Stephen Mosley: Dr Gulley, we have heard from Dr Parker that the pre-print server, arXiv, isn't really appropriate for the chemistry community. However, it is widely used within the physics community. Could you give us an explanation as to how it works and how authors interact with the system? Do they maintain their own records, etcetera?

Dr Gulley: The arXiv was set up as a pre-print server so it is the authors' work at a preliminary stage. Large collaborations can use that process to be able to discuss and comment before finalising the paper. It originated from the high energy physics area where they had a need to be able to discuss the results across the international collaborations. A lot of the work that is posted, particularly from areas such as high energy physics, also goes through internal peer review within the research facilities as well before it is posted on the arXiv. There are a number of different stages it has to go through.

As far as linking in with publishing is concerned, a high percentage of articles that are pre-prints are eventually submitted to journals and get published in journals as well, so there is still that requirement for that independent peer review. We link in with that. We make it very easy for authors to be able to submit from the arXiv into our journals, for example, and this is common across many physics publishers, where the arXiv number can be used when submitting the article to a journal. Authors are encouraged to update their versions as well. From the publishing side, we encourage them to update the citations so that the link goes back to the final version of record once it has been peer reviewed and published.

Q12 Stephen Mosley: From what Dr Parker said earlier, it is probably not appropriate across the entire science community, but are there areas other than physics that might benefit from it?

Dr Gulley: I am not sure that I am the best person to comment on that since my area is very much within physics.

Professor Pethica: Pure mathematics is a good example of an area where the numbers are fairly small. It can take a very long time for the assessment of theorems to become correct. Therefore, effectively, the process is hybrid like that. I would like to draw your attention to the contrast with engineering, for example, where you have an immediate technological impact on what you are doing. Then the question of publishing that Dr Parker raised is rather important.

Q13 Chair: Are the extremes the areas where there is a much more collegiate approach to helping solve a global high energy physics problem working in some of the big science projects versus things that are much closer to potential commercialisation? Are those the extremes?

Professor Pethica: There will be a difference. The reason I raised it is that it is not as if there is a lack of collaboration in that area too; it is very extensive in large technological projects. As you know, collaboration is not just in high energy physics. It is the other factors that Dr Parker raised, such as patentability, exploitation and all the issues that concern companies in research that involves collaborative work and pre-exploitation. This boundary is an interesting area that affects what you publish, when and how, and the role of patents as distinct from peer review publication. There is a continuum across the board.

Dr Parker: Also, the speed of reproducibility of results is an issue where you are sharing big resources like synchrotrons or various other things such as in the area of astronomy. It is very good for peer review. There are small numbers of people using big pieces of equipment that are very expensive. It is good for them to share and work together.

Q14 Chair: Even in those areas you get some quite innovative commercial projects emerging. Charge-coupled devices spring to mind and things like that.

Dr Parker: Yes.

Professor Pethica: Silicon technology.

Q15 Stephen Mosley: Professor Laskey, within the Academy of Medical Science evidence you suggest that the dissemination of non-peer reviewed information may be potentially unhelpful, as you describe it. You also go on to say that even things that are kite-marked may not be totally appropriate. Would a kite-mark work or do you still have some concerns?

Professor Laskey: Two worries were voiced in the Academy's submission on this topic. One is that biomedical sciences are more prone to inaccurate interpretations. Measurements in biology tend to be, by the very nature of biological material, more scattered than the more precise measurements that can be made in the physical sciences. Although I don't like the terms from the perspective of a biological scientist, I have to admit that there is some truth in the description of hard sciences, meaning the physical sciences, and the soft sciences, meaning the biomedical sciences, in which it can be more difficult to get precise and incontrovertible evidence. There is a worry that, if you extended the pre-publication model to the biomedical sciences without any attempt to peer review, a lot of half-truths would creep into the literature.

The second problem is the appetite of the media for some aspects of biomedical science. Without peer review we would get a storm, frankly, of incorrect headlines. That is something that would also worry us very much.

Chair: The media don't do badly at doing that, anyway.

Professor Laskey: The scientific community tries to prevent that but not always successfully, I am afraid.

Q16 Stephen Metcalfe: Three of you publish journals. How do you ensure that your editors are selecting the most appropriate reviewers? What process do you go through? Is that process complicated when you are looking at multidisciplinary work which covers a number of different areas?

Dr Parker: The process we go through is that we have internal and external editors. The internal editors are chemists who work within the RSC. The external editors are people who work out in the community, who are largely academics. We ensure that they choose the right referees by having a long period of training for people who do things like that. Building up a knowledge of the community is very important. There are people who work on general journals that cover broad subject areas, but most people will have a specialism within them even if they do work on those broad journals. People do get to know a particular area and the interactions between certain authors and referees very well. You do get to know your community and you get a feel for whether there are any issues between particular people. We also do quite a lot of training of referees. We have a feedback loop where referees always get the feedback on the outcome of the articles that they have refereed so that they can learn whether their refereeing activity is generally in line with what is accepted and what is rejected. We also do straight face-to-face training as well, particularly in China and India, but also elsewhere.

Dr Gulley: It is very similar for IoP Publishing as well in that we have a combination of in-house editors and external editors. We also do some training of our referees, particularly within China. We have different programmes across our international offices as well. Recently, as a result of requests from some post-docs and graduates, we have given them some initial training on what peer review means. We are teaching them about what refereeing means and what we are expecting. There is a lot of literature as well that people are not always aware of so we have been trying to raise the visibility of that. Internally, we also try and match the interests of the referees to the papers as much as possible. Again, that comes from the extensive training that is required for the internal editors, as Dr Parker has mentioned.

Professor Pethica: To add to that, you specifically asked about multidisciplinary situations, which are very broad. The process in the Society is, essentially, to increase greatly the number of referees and reviewers. Six or seven would be common, whereas two or three might be the number you would have within a well-defined subject, to try and ensure you get that coverage for a number of broad views.

Q17 Stephen Metcalfe: Rather than the individuals having a broad knowledge, you expand the number within their speciality and they would look at a part of the particular subject.

Professor Pethica: In general, one is obliged to do that simply because there may be a few people who have the vast and broad knowledge required, but in truly interdisciplinary areas, which really span gaps, you have to get a broad perspective and that means using more people, including from a variety of countries, environments and so forth. What we are describing here is a totally international process.

Q18 Stephen Metcalfe: How do you keep that networking, that knowledge of who is in the community, up to date? How is that managed?

Dr Parker: The editors, whether they are internal or external, are out in the community a lot. They are going to conferences, seminars, doing university visits and industry visits. From the RSC, our editors regularly attend up to 200 conferences a year overall. Our external editors will certainly be attending quite a number of conferences in their own subject areas.

Dr Gulley: Again, it is the same for IoP Publishing in that we attend a number of conferences each year. It is about 300 because of the broad range of subject areas. The editors are encouraged to go along to become part of the community and to update their understanding of the subject area. Equally, we also track the trends internally from various data sources. So we look at what sort of subject areas are coming through and work with the researchers to look at how we can make sure that the journals represent that as well.

Professor Pethica: One is looking at the process of the reviewers as well as the editor. Of course, one can keep a record of how effective various reviewers are, which is done by most journals. Some people are more effective than others and are used correspondingly. Also one uses the community to suggest future names of reviewers. It is very common, for example, if a senior scientist is asked to review something and they can't do for whatever reason, for them to suggest other names of people. This is a productive, rapid and efficient way of connecting the network of scientists. Since you have multiple reviewers in most cases, then of course you can test out the reviewers a little and build up a track record on them.

Q19 Stephen Metcalfe: How do you ensure that the whole system is impartial and that bias does not creep in at any point? The Chairman touched upon this issue. Particularly where you have very small groups, who ensures that that is an impartial process?

Dr Parker: It is synoptic, really. You have editorial boards that oversee the quality of the journals. They review the quality of the decisions that have been made and they oversee the content of the journals in a retrospective sense. There is always the possibility with all journals of appealing any decision. Appeals are dealt with very seriously. They are taken to fresh referees. Usually, you try and pick out particularly senior referees who you really respect. You respect all your referees, hopefully, but there are certain senior referees who you would particularly respect. Sometimes they go to the editorial boards.

Q20 Stephen Metcalfe: Dr Parker, do you allow all appeals through? If people don't like the outcome of the review, can they just keep sending it back?

Dr Parker: All appeals are dealt with, yes. We would always deal with appeals seriously.

Q21 Stephen Metcalfe: For how many times would you allow that process to go on?

Dr Parker: Not for ever.

Professor Pethica: American journals have fixed rules. The *Physical Review*, for example, has fixed rules about that. They have two layers through which you can go. If you fail at the top, with the editorial board having thrashed it out firmly, then the decision would be no, we are not going to take this any further.

Dr Gulley: We have some similar processes. Having a combination of the internal editors as well as the external editors helps with impartiality. There is also the option for appeals, as Dr Parker has said. We also have an external science advisor that we can call on as well if we need somebody to assess that we have actually followed the procedures correctly. There are other options that we can look at as well.

Q22 Stephen Metcalfe: Obviously, training is a key tool in this. Can you describe the training that the editors, the referees and the reviewers receive? Is that a continuous process? Is there a continuous professional development, not only just keeping up to date, but is that a structured training programme?

Dr Parker: We don't have any structured training programme for that. You don't know how often you are going to use a referee. Some referees get used a lot. Some we will use more than 100 times a year, for example. Some you might only use once a year

because of their specific subject area, but you look at their results over a period of time and how accurate their responses have been. If referees need any specific feedback, our editorial staff will give that.

Q23 Stephen Metcalfe: You mentioned that earlier. Again, is that structured? Is it a formal process?
Dr Parker: No. It is ad hoc.
Professor Pethica: We should not lose sight of the fact that we have a large scientific community doing this. I alluded to the fact that PhD students, for example, are trained, as part of their learning process, to understand how to criticise and to find out what is right and wrong with the scientific literature. That process is something they go through and it carries on with post-docs.
I wanted to raise one other issue related to this. It is important to recall that the ultimate test is the data at the end. If a journal repeatedly publishes very unadventurous things, it will soon be left behind by those who are rather keener to publish more exciting things. But those who go too far in that direction, of course, run risks, too. It is a question of how you get that balance right.
Dr Gulley: In regard to training, most journals will offer referees guidelines to which they can refer. IoP Publishing has referee reports where we try and guide the referees through some of the things that they should be looking at, such as the quality, if it is correct, and the methodology. Depending again, on the subject area, it is very much tailored to the research area that we are working with. This is from overall feedback from the editorial boards. Again, at conferences we try and run workshops where we would offer basic training in refereeing. We explain what it is and what is expected. That is internationally as well as within the UK.
Professor Laskey: From a referee's point of view, something that I found extremely educational is to be sent back the referee reports of the other referees. There are several times when I have wanted to kick myself for missing something that the other reviewer spotted that I had not. Equally, it is not uncommon to find that you are in complete agreement. It can be an educational benefit.

Q24 Chair: Is that a standard practice?
Professor Laskey: It varies. Access online to the views of other referees is quite widespread in my own field. The policy, back in the pre-electronic era, was that you were sent the hard copy from some of the better journals, but not all of them did it.

Q25 Chair: What about in other disciplines?
Professor Pethica: It is fairly common in the physics journals, for example, and certainly in the American ones that I have been involved with, that, if there is some dispute or argument, referees will be circulated with the other people's views. That is most instructive and rather helpful.

Q26 Stephen Metcalfe: It does sound like the system around selection is quite ad hoc at the moment. Do you think that any of it should be more formalised—that there should be a standard set of guidelines around which you work rather than allowing it all to grow around what feels right? You have mentioned about PhD students taking some training in peer review. Do you think that that should be a prerequisite of gaining a PhD rather than something that is nice to have done?
Dr Parker: It could be. Being a referee is often used as one of the criteria for tenure in the US. We deal with a lot of requests from US referees, young academics, wanting a letter of endorsement saying that they have acted as a referee for the RSC and that they have been reasonably good at it. It will help them to gain tenure. It is also used within RSC potentially as part of the criteria for becoming a chartered chemist through working in academia. So there is a CPD-type element included.
Professor Pethica: Broadly speaking—you are referring to the training in general—the questions which arise around that are, first of all, the international aspect. This is a process that is, essentially, identical across all countries. Arranging for something like that is an international exercise. The other issue is the question that I raised before, which depends very strongly on the subject area in which you are working and the process that they learn how to do. I have referred to the extremes of, say, pure maths, and the technology of silicon and biomedical. They have their own areas. Of course, there is a continuum between those things. They are all interlocking and are interconnected. One can image a process in a journal, for example, on a specific subject area, where you could set out rules like that, but of course we are constantly raising the question of the boundaries between these things. It is more important that the training of researchers in general includes the understanding that they should participate in this process in an open way as an expectation of being a good scientist.

Q27 Pamela Nash: From the evidence that we have received so far, it has been claimed that "the peer review system is in crisis", that academics and researchers have increasing burdens on their time and there are few incentives to participate in the peer review system. Can I ask each of you what your opinion is on that?
Professor Laskey: It is subject-dependent. I take a slightly different perspective in answering, which, hopefully, addresses the point, which is that the complexities and the duration of peer review can impede the publication of science if it introduces too many distractions from the principal research programme, but I wouldn't say it is in crisis. I would say that the engine is misfiring rather than it has stalled completely.
Dr Gulley: From the surveys that have been conducted over the last few years, most researchers have a very high opinion of peer review. In a recent survey that was done by Sense About Science, about 86% of researchers said they enjoyed reviewing and there are benefits to it in that they get to see papers ahead of time and they get to keep up to date.

From the publishing point of view, we can support that by making the process as easy as possible.

Dr Parker: I do not think it is in crisis particularly. One of the challenges is in building up a core of referees in areas that have a huge growth in the output of the subject area. For us, it is in chemistry. It is also the same for Dr Gulley in physics. There is a massive growth in output from China at the moment. We have been working very hard to build up Chinese referees and the quality of the Chinese referees' reports that we use. Building up the referee base in a linear fashion with respect to their growth is quite difficult at the moment, because the growth in output is quite extraordinary.

Professor Pethica: Our experience is that, as a publishing of scientific literature exercise, it is not a serious problem at the moment. It is possible to find referees in the way we described. It is not a crisis. The point we made in our submission to you in paragraph 15 is, of course, that, inasmuch as peer review is used as a proxy for other kinds of assessment, that can introduce a pressure on it.

Q28 Pamela Nash: Dr Gulley, you mentioned that it would be helpful to make the process of peer reviewing as easy as possible. Do you think that any incentives for reviewers are needed? What would you do to encourage more reviewers? For example, would you advocate payment to reviewers or a formal recognition of any peer review work?

Dr Gulley: We have different ways of encouraging reviewers. Again, it depends on the community. There are different views from the researchers when we talk to them about this. There are different ways of being able to recognise the work that they are doing. For some of the communities, we publish the names of the referees in the journals, for example, and they get recognition that way. Some journals have different rewards that they give to their top referees, for example. There are different ways of recognising what they do. Coming back to what Dr Parker was saying earlier, another way, particularly within the US, is that we get a lot of requests to support younger researchers in their applications for green cards. There is also recognition partly in being involved in the community. Certainly a strong aspect that comes out when we talk to researchers is that they feel it is something they do to become part of the community and stay involved with the community as well.

Professor Pethica: At the Royal Society the referee is not paid, but we do publish a list of the referees at the end of the year to formally thank them for their input.

Dr Parker: We have asked our boards often about the whole recognition of referees and remuneration. Remuneration would be a difficult thing because, if you gave any realistic payment for the time that is involved, it would be a huge amount of money and it would have to be recovered from somewhere. It is just moving a financial burden around the whole system. The system relies on the benefits that people see from being involved in peer review. There is a quid pro quo as long as you are someone who publishes as well; you are an author as well as a referee, which is not always the case. There are some other advantages, some of which have been mentioned, like seeing material in advance and, if you do peer review for high quality journals, then you see some high quality work and some less high quality work, of course. You get a chance to be involved in shaping how a subject develops, which is quite a powerful thing to do.

Professor Pethica: We should not forget that this is not by any means the only method by which scientists communicate. The sort of processes that are being described here happen at conferences all the time. Indeed, as important as it ever was, is going to talk to somebody about what is actually happening.

Q29 Pamela Nash: Dr Parker, you spoke about young academics approaching the RSC wanting experience of reviewing to further their careers. Do you think that any formal accreditation for the peer review system or a more formal definition of that work would be helpful to them?

Dr Parker: It might be. It would be quite difficult to do, though, because we have about 33,000 referees all around the world that we use routinely. Doing something for that number of people could be quite challenging.

Q30 Pamela Nash: We have heard evidence of some publications using the cascade system to pass submissions between journals. Do any of you have experience of this process?

Dr Parker: We do, yes. We find it does save in peer review time. Authors are often happy to go along that route. It reduces the time to publication if the article is not publishable in their journal of first choice. It gives them a quick route for publishing in what might be a journal of second choice.

Dr Gulley: It is exactly the same for IoP Publishing as well.

Professor Laskey: That does work reasonably well in biomedical sciences, too.

Professor Pethica: Likewise.[1] You will see in many laboratories, for example, in the eastern part of the world that they have a long list on the wall of the journals they want to publish in. They just go down the list until they get to one that publishes the article.

Q31 Pamela Nash: There is unanimous support, then.

Professor Pethica: It works.

Q32 Pamela Nash: Finally, I would like to ask a question about the Research Excellence Framework. How is peer review going to be used as a benchmark of quality? Are there any takers?

Dr Parker: The REF panel is a peer review panel itself, isn't it? When it was the RAE before, they always said that they would look at the quality of the papers themselves. They would read the papers themselves and wouldn't rely on the impact factors of the journals in which they had been published. That was stated publicly, at least, in the chemistry area by

[1] Note by witness: Professor Pethica's response of "Likewise" could be interpreted as an indication that the Royal Society operate cascading peer review. We do not.

the chemistry panel. How they are going to be used in REF, if it changes, I don't know.

Professor Pethica: If one just describes peer reviewing as it is termed in the broad sense as described here as something that is acceptable or not within a certain journal, then, of course, to some extent one is only looking at peer reviewed paper submissions as being relevant to REF. I think you are asking a slightly different question, which is that peer review for high impact journals, low impact journals and so forth, as a proxy, as I have alluded to before, for assessment of quality, is a slightly more complicated question. It depends on the individual subject area, the journals, whether certain journals have an assessment of what they consider newsworthy and what others consider is needed to build on to the knowledge base and so forth. That depends, to some extent, on individual journals and how they see themselves and their role within transmitting and building scientific information. It does vary. That is a complication.

Professor Laskey: There is also a problem of matching the expertise of the REF panel to the spread of subjects that they have within that subject area. That often means that there is no one on a particular panel who is expert in the exact area of a particular individual being assessed. So there is a genuine problem. You have to accept a certain amount of breadth and imprecise match of the expertise to the area that they are investigating. It is a difficult issue as to whether or not you can do that by assessing bibliometric criteria or not. They are a very shaky basis for such a fundamental decision. This comes right back to Professor Pethica's earlier point about the proxy use of peer review for other purposes for which it is not perfectly matched.

Q33 Graham Stringer: How can and can't the peer review process be used to guard against fraud or misconduct by scientists?

Professor Laskey: In the current electronic age it has become much easier to detect data manipulation. Initially, there was a problem that data manipulation itself became much easier because of Photoshop-type programs, but in practice many journals now routinely examine the data files to see how the images were prepared. Certainly, in biological sciences that is becoming increasingly common. That makes scientific misconduct more difficult.

Errors of interpretation are still very much things that a good peer reviewer has to sniff out fundamentally. There has been an attempt, with which you are probably familiar, of establishing a research integrity office within the biomedical sciences. That has attempted to look at incidences of misconduct and to draw up a national code of conduct and a national procedure for investigation of misconduct which can run alongside the peer review process. There has been a problem for that organisation in that it was set up to look at biomedical sciences. Research Councils UK has wanted to extend its remit to all sciences. One of the major funding bodies in setting it up was not happy with it being extended to other sciences. That organisation, which could have an important role to play, is caught in the very uncomfortable position between different remits of the bodies that initially funded it. It could make a useful contribution in that subject in addition to the standard peer review process.

Q34 Graham Stringer: Just on that point and we can then come back to the fraud or misconduct issue, do you think the Government should intervene and put it on a statutory basis? The similar office in the States is on a statutory basis.

Professor Laskey: Yes, it is. It is a difficult subject because, if it is done in too draconian a way, it gets into the difficulty that the initial organisation in the States ran into, which led to very substantial criticism in the courts. The current stance of UKRIO is a more balanced one, but whether or not it should be put on a statutory basis across sciences or just retained for the biomedical sciences, which I believe was the wish of the Department of Health representative, I can't judge. That is a difficult matter. It is something that does deserve to be looked at. It could perform an important role for British science.

Q35 Graham Stringer: Can I go back to the fraud issue? Does somebody else want to contribute on that?

Dr Gulley: I want to add that, fundamentally, that responsibility lies with the author but things can be done to help this situation, particularly on the international setting. For example, we have ethical policies. Most journals have an ethical policy that they will promote and ask authors to abide by.

Q36 Graham Stringer: Should it be mandatory to have an ethical policy?

Dr Gulley: In certain subject areas there are parts that are mandatory, such as stating a conflict of interest and certain medical procedures that have to be stated. The ethical policy that we have is much more general. It also takes into account, for example, what is ethical or what is viewed as being ethical in terms of plagiarism, for example, which is one aspect that I wouldn't say has become easier but it is being picked up more frequently now that you have much more electronic access availability.

Dr Parker: There are also the Committee on Publication Ethics Guidelines that are pretty much an industry standard now. The difficulty with fraud is that the whole peer review system relies on people being ethical. That has to be balanced with what happens when you find that someone has not been ethical. In the relatively rare cases when someone has not been ethical, it will usually be picked up by a reader. If it is not picked up by a referee, if it actually gets through to publication, it should be picked up by a reader and then it is usually dealt with either by the reader coming to the editor of the journal or the reader going directly to the author and dealing with the matter.

Q37 Graham Stringer: The most recent fraud-related case is that of Andrew Wakefield, which took 10 years to sort out, even though the journal in which the article had been published had been approached after two or three years showing that there had been

bioselection and that some of the figures had been altered. Why did that take so long? Should the process be altered in view of that experience?

Professor Laskey: I don't know the details of why it took so long. That is not something I am competent to answer. It does illustrate a concern that we expressed in the written submission about it often being more difficult to firmly dismiss incorrect information in the biomedical sciences. That is a further reason why peer review is crucially important. How that can be addressed more rapidly is hard to know. It becomes particularly difficult once the media are involved and everything is scrutinised openly.

I believe there is a tendency, unfortunately, for people to be more reluctant to come forward and speak openly when they think it is something of a major public issue. That, I accept, is not the position that we prefer to see, but there is a tendency of people to be reluctant to enter a public storm.

Professor Pethica: I can give you an example from the physical sciences, which is rather more obvious, which is the case of Schön and the proposals he had for various solid state structures, which, of course, caused a great storm of excitement until people started to do the kind of analysis of the data that had been described, and it all fell apart. That took about a year and a half before people were convinced that it was a fraudulent process which people had tried to repeat.

Here we are faced with a number of diverse paths. One is the question of ethics that institutions, indeed, should have. Many of the research institutions, be it the universities, national laboratories or whatever, do have expected ethical behaviour of their staff. Then there is the question of whether you will catch it by peer review. Of course, the peer review process is designed to try and catch these things, but, by the nature of things being imperfect, something will eventually get through. The numbers are fairly small, as we have seen. Then the question is what happens after that? To some extent, that will depend on the nature of the subject, the complexity and so forth. In a way, it is inevitable that a scientific fraud will eventually be uncovered, as we have seen in other cases. The question is: how do we shorten the time scale and prevent these things getting out before they cause media damage?

Q38 Graham Stringer: Do you think there should be a code? Just using the Andrew Wakefield case—I am sorry if you are not familiar with it in great detail—it was a journalist who was pushing the issue that there had been a fraud. He went to the journal and the journal, effectively, got the co-author to review what was going on and excluded the journalist. Should there be a code of ethics or a process for dealing with external complaints where fraud is suspected with at least some evidence?

Professor Laskey: The UKRIO is attempting to achieve that. It is attempting to provide a first point of call for people who seek advice on how to proceed in examples of suspicion of fraud. It has drawn up a national procedure which has been widely published and distributed to universities and other research institutions. Again, the very nature of fraud is that it is inherently difficult to prove that it has occurred.

Dr Parker: It is something that is also very subject-dependent. The Wakefield fraud relied on clinical trials and statistics. You can understand why that might take a bit longer compared with something in the physical sciences area that could be repeated by someone else relatively quickly and might be right or wrong. It is a different process.

Q39 Graham Stringer: You have given a fairly dry account of what peer review is like. It sounds unexciting. The insight we got into peer review from the leaked e-mails at the university of East Anglia made it look like a pretty tough contact sport where people were taken out on journals and careers were threatened. What is the accurate scenario? Is it the fairly desiccated view that you have been giving us or is peer review a street fighting business where careers are threatened? Where is the better insight?

Dr Gulley: From my experience, it is probably closer to what we have described so far. There are instances where you do get the street fight-type scenario, but that has been very rare in my experience over the last 14 years.

Professor Laskey: I think the rather dry flavour that we have left you with is probably a more accurate description of the majority of cases. There are a minority of exceptions.

Dr Parker: I am sorry to have to agree with that. Yes, it is a rather dry subject, but exactly the number of cases you get that have a big and florid excitement about them are relatively small.

Q40 Stephen Mosley: Does the publication of fraudulent or incorrect papers that have been through the peer review process damage the public perception of peer review as a mark of quality?

Professor Laskey: It damages the public perception of science as a whole and I think that is extremely unfortunate.

Professor Pethica: If a particular journal does that kind of thing, it affects that journal's reputation within the scientific community, which is a significant matter too.

Dr Parker: I doubt that the general public has much of a perception of peer review. They have a perception of science, that scientists do experiments and that they publish them. They probably don't really care that much about peer review, although the Wakefield incident and the UEA climate data issue have brought peer review a bit more to the fore.

Professor Pethica: Not to entirely leave it as unexciting, if a lot is at stake, then the peer review process will tend to be more exciting.

Q41 Stephen Mosley: You can also have a situation where a peer reviewed article may disagree with a previously published paper, and that is perfectly legitimate. If you have a situation where there is some perception of doubt against the peer process, I guess it makes it difficult to judge whether this is a proper result or not. Is that the situation? Are you more wary

of research that contradicts previous research now than you might have been previously?

Professor Pethica: If you divide it by subject areas, the paper that comes along and tells you that they think thermodynamics is wrong is not likely to get much of a listening. There are such papers, I should stress, that still come in. At the other end, there are problems that are sufficiently broad where the information, the types of experiments and so forth are not sufficiently defined where it is rather difficult to be sure. There is a continuum of those things.

Dr Gulley: On the other side, you also have areas where it is still evolving and different models are going forward. For example, modelling of the universe is a good example of that, where you will have contradictory models that will evolve until you start to get some of the data that can back up some of the theoretical models. That is part of science discussion.

Professor Pethica: That is what it is.

Q42 Stephen Mosley: When it comes to public perception and to the perception by policy makers, how do you think the perception of peer review and scientific research can be improved?

Professor Pethica: Perhaps I could venture a comment. Peer review has worked in the sense that the scientific literature we have is coherent and it has effects on the world around us which everybody can see. As to the notion that it is a substitute for getting things absolutely right every time, it would be useful if the public becomes aware of the fact that mistakes happen. It is just that we try and minimise their frequency.

Q43 Pamela Nash: I would like to move on to international issues regarding the peer review system. Are there any perceived differences in the quality of peer review dependent on the country where the publisher of a journal is based?

Professor Pethica: No, basically, to cut a long story short.

Professor Laskey: There are serious attempts to minimise those differences.

Q44 Pamela Nash: Do you see that there are differences to be minimised?

Professor Laskey: No. The harmony outweighs the differences.

Professor Pethica: More than that, it is becoming more coherent. In the past, foreign academies would have certain rules. For example, papers had to be submitted for approval by certain structures. It is unquestionably the case that international competition in this sense, as a consequence of impact of the science and technology, has driven a convergence. It is hard to say that there is any real detectable change. That is, of course, enforced by the fact that journal reviewers themselves are now drawn from across the world, be the journal UK-based, Chinese, Brazilian, in the US or whatever. The process is essentially the same and they all participate internationally in that process.

Q45 Pamela Nash: You mentioned new technology in use in the peer review system. To what extent do different publishing organisations share best practice in terms of using new technology and online systems?

Professor Pethica: There are standard IT packages now.

Dr Parker: A lot of publishers use the same or very similar packages. Publishers collaborate on various things like linking references, but CrossRef as a collaborative publishing group of publishers is also working on anti-plagiarism software and things like that. There are things that are shared across.

Q46 Pamela Nash: How effective are these tools? You have mentioned the anti-plagiarism tools. How is that being developed?

Dr Parker: That is being developed at the moment.

Professor Pethica: It is fair to say, of course, that IT technology advance is a constant battle. People on one side are doing cunning things and on the other side they are advancing the technology. So anti-plagiarism works for certain kinds of things, but it is an arms race, almost, if you like.

Q47 Pamela Nash: Is the technology at a level yet that it is benefiting the peer review system or is it more of a hindrance in that the technology has not caught up yet?

Dr Gulley: My experience on the plagiarism side of things is that we are finding that we are picking things up more before they go out to the referees, for example. It is minimising the burden on the referees. When articles are submitted to us, we can check them against what has already been published. It is definitely helping in that respect.

Professor Laskey: In data manipulation, the software is now picking up cases. You rarely hear about those because the journal simply declines to deal with that author in future. There are cases of data manipulation being detected by software.

Dr Parker: We have done quite a lot of work on, essentially, running macros on the articles that we are going to publish which check the experimental data for consistency. It is the technical detail. You can check that the spectra and the data are consistent with the number of hydrogen atoms that are in the molecule that you have in the reported structure. We do things like that which help to pick things out.

Q48 Pamela Nash: I will go back to my original question to look at review internationally from a different angle. Are you aware of any differences in the quality of peer review carried out through UK-based journals by reviewers from different areas of the world? I realise that this might be a bit of a sensitive question.

Dr Parker: Publishing is so globalised now that there are very few journals that are based within a particular nation or are very isolated. Most of them are globalised. There is very little difference in quality.

Professor Pethica: We referred earlier on to the fact that you look at the review referee's performance. Of course, I can't comment on specific cases but that is a factor.

Q49 Pamela Nash: I am not asking just about the skills of reviewers from another country but perhaps the facilities and funding that is available to them in the UK. Do we take that into consideration or should we take that into consideration in choosing reviewers?
Dr Parker: That is an interesting question, isn't it? There have to be sufficient experimental data in the area that we publish in to justify the conclusions that are being drawn. If there are sufficient experimental data, that is okay. The difficulty comes where, if there is someone working in a developing country somewhere, they don't have access to specific sorts of technology that would give them definitive experimental data. One of the things that we are able to do as a society is to try and work with people in those areas, to try and develop sustainable clinical research, which we do, for example, in sub-Saharan Africa.

Q50 Chair: You might have some views working in a country with incredibly poor facilities, but there is a glimmer of something special in that person's work. If you just judged everything by the standards of access to laboratory facilities that you take for granted, doesn't that squeeze that group of people out of the publishing world?
Dr Parker: Sometimes it is an advantage because you will get referees offering to work with people and it can set up collaborations. If you have a referee who really sees the merit in this bit of research that has come out from someone working under very difficult circumstances, they could offer to set up a collaboration potentially. Those very often are supported through societies as well. They support collaborations.
Professor Pethica: It is fair to say that that is one of the reasons why people in those circumstances are often involved in refereeing for highly theoretical subjects where that disadvantage does not apply, and that is certainly widely used in mathematical and theoretical areas.

Q51 Pamela Nash: Dr Parker, you mentioned earlier about the growth of scientific research in China. How do you support and develop peer review skills in China and other emerging regions of scientific strength?
Dr Parker: We do a lot of interaction with the Chinese academic market, as it is. We have two offices in China—one in Beijing and another in Shanghai. We have staff out in China. We do regular visits. We set up conferences in China now. We started off doing roadshows of the top chemistry departments in China. All of our roadshows include presentations on how to publish and how to referee. We have built up quite a significant connection with the Chinese academic market. We also involve them on our editorial boards. We get them involved as associate editors on our journals.
Dr Gulley: It is the same for us as well. We have been working with researchers in China for the past 11 years. We have a member of staff who visits universities and gives lectures on how to get published. We run workshops and we visit regularly. Again, we build up those links and liaisons. We also work with a number of publishing partners in China who publish their own journals. We certainly work closely with them on looking at peer review and internationalising their journals as well.
Professor Pethica: As you might expect, we work closely with the Chinese Academy of Sciences on this.

Q52 Chair: To what extent do you share best practice amongst publishing organisations, particularly in terms of evolving software and so on?
Dr Parker: There are trade associations for publishing. Publishers get together at those trade associations and at events like the Frankfurt Book Fair. They share non-competitive knowledge as much as possible. Publishers are really quite collaborative these days, much more so than they used to be 20 years ago. They work together a lot more on common issues like anti-plagiarism, reference linking and those sorts of things.

Q53 Chair: It is through the trade fairs and conferences.
Dr Parker: Yes.
Dr Gulley: There are some shared guidelines and recommendations that come out of these discussions.

Q54 Chair: My next question is a slightly amusing example that occurred to me when I was congratulated for getting on the Booker shortlist for publishing *Oxygen*, but it was another Andrew Miller. How big a problem is ambiguity of names? Do you use systems like ORCID to help track authors?
Dr Parker: We are trying to work with ORCID at the moment. That is a developing situation. There will be an author tracking ability in a relatively short time. It is an issue, particularly in places like Korea, where there are only five or six really common surnames. You get an awful lot of people with the same name. For example, we had two people with the same name both in the chemistry department at the university of Oxford. They both had very much UK names. We try very much to keep those people and their records separate. A bigger problem is proliferation of records by the same person. It can be an issue.
Dr Gulley: ORCID is a very good example of the collaboration, where it is required, and it will be a solution to that problem.

Q55 Stephen Metcalfe: Can I ask for your views on post-publication peer review and commenting, whether any of your journals do that and what your experiences are?
Dr Gulley: Currently none of our journals do that. There are experiments within the industry that are trialling this. It will be interesting to see how they progress.
Dr Parker: We don't do it. It is another layer. It is something in addition to pre-publication peer review. Where there is an issue, you should hear pretty quickly from readers or whoever, anyway, so it is a way of opening that up, I suppose, more generally speaking.

Professor Pethica: We do use it. We also have a system that is called eLetters. Is it useful? Not really, because remarkably few people choose to use it. It is important to keep in mind that the implication that once something is published in the peer review literature, that is it, and it is set in stone. As I alluded to before, much of a PhD student's training is the process of assimilating over a long period of time the scientific literature, deciding what is good about it and what is bad about it and then allowing them to progress from there. This process is inherent in the entire scientific enterprise, anyway, in the training of people getting involved therein. Most PhD students, for at least a year or a year and a half, try to figure out which way is up in the scientific literature, which is that process.

Q56 Stephen Metcalfe: So you don't see it growing as a trend?
Professor Pethica: It is already a central part of the enterprise.
Stephen Metcalfe: It is already there.
Professor Pethica: It is nice to have it. It is implicit in the fact that people publish subsequent papers saying, "X was right, Y was wrong, and we did this and produced that." That is implicit in the whole structure of scientific papers; they have a preamble about what has happened so far. To some extent it exists already.

Q57 Stephen Metcalfe: It is not going to change the value of the pre-publication review. It is not going to take away from that because it already exists.
Professor Pethica: In post-publication terms, it is, effectively, the process. That is why at this point scientific literature is supposed to be a coherent structure rather than a series of random samples.
Professor Laskey: In biomedical sciences, the Faculty of 1000 does provide a post-publication assessment of the value of papers, and, if there is a move towards publication in journals such as *PLoS ONE* and where impact is less important, then a subsequent impact assessment such as the Faculty of 1000 could become increasingly important.

Q58 Stephen Metcalfe: Is the Faculty of 1000 welcomed by the academic community? Is it well supported?
Professor Laskey: I think so. Its use is patchy but it is recognised as providing a valuable service.

Q59 Stephen Metcalfe: Has social media, by which I mean blogs, etcetera, had an impact on this process at all? Are they helpful, or is it just a proliferation of unchecked views?
Professor Pethica: There will be a change of view depending upon the age of the person to whom you are asking that question. With the research students it is quite common. As one gets somewhat older, the utilisation is probably less.
Chair: It is the same in this building.
Dr Parker: People are relatively reluctant to blog on things at the moment, but they like to see what other people are reading. If there is some way of seeing what other people find interesting, that is where the Faculty of 1000 comes in. It is a positive thing. Everybody wants to be read by the best people.

Q60 Stephen Metcalfe: So you don't see that as having a significant impact at the moment.
Dr Parker: Not at the moment.
Dr Gulley: It can add to something in the future. It is also an aspect that people are starting to explore around how they explain their science as well to a much broader and more general audience.

Q61 Chair: Aren't blogs used to help promote a piece of work that is being published?
Professor Pethica: Yes.
Chair: We find that modern technology is a very useful way of getting out to the broader scientific community what we are doing.
Professor Pethica: It works.
Dr Parker: We use blogs for trying to promote particular articles that we think would be newsworthy or interesting to a wider audience. Some are more successful than others.
Dr Gulley: It is certainly a way to raise visibility. Again, for some articles, it is more successful than others.
Professor Pethica: The challenge is making it a two-way process, though.
Chair: Graham described peer review as a dry subject. As I said to you at the beginning, some of my colleagues were up into the early hours, but you have kept us awake and interested. Thank you very much for an informative session.

Wednesday 11 May 2011

Members present:

Andrew Miller (Chair)

Gavin Barwell	Pamela Nash
Stephen Metcalfe	Graham Stringer
David Morris	Roger Williams
Stephen Mosley	

Examination of Witnesses

Witnesses: **Tracey Brown**, Managing Director, Sense About Science, and **Dr Elizabeth Wager**, Chair of the Committee on Publication Ethics and Board Member of the UK Research Integrity Office, gave evidence.

Q62 Chair: Good morning. Can I thank you for coming in this morning? Just to start, would the two of you be kind enough to introduce yourselves?

Tracey Brown: I am Tracey Brown, Director of Sense About Science.

Dr Wager: I am Liz Wager.[1] I am the Chair of COPE—the Committee on Publication Ethics. My position is slightly complicated; I am wearing two hats today, because I am also an adviser to UKRIO, the UK Research Integrity Office, where I represent COPE. I am primarily speaking for COPE, but as the representative of UKRIO was not able to be here and as a lot of our policies are rather similar, I will also try to represent their views.

Q63 Chair: Thank you. Peer review is perceived to be "critical to effective scholarly communication". If it disappeared tomorrow, what would be the consequences?

Tracey Brown: Perhaps the best way to understand it is this. We are faced with a sea of material from which something has to determine what is going to grab our attention, what needs our attention and what is important. Something will do that, no matter what, because the reality is that we cannot sift that sea of stuff ourselves, whether we are researchers, members of the public or in policy. There are, fundamentally, three ways that that can happen. You can slice up the sea of stuff. For example, you can say, "We'll just look at clinical reports and not apply particularly strict quality control to that. We just want to look at a very narrow part of it." Or you can try to implement something with aspirations to objectivity, which we have for the peer review system, which is, "Is this valid, significant and original?" and try to apply a fair test to that.

The third alternative is some form of patronage. These days we often hear people talk about alternatives to peer review and they sound really groovy because they talk about online publication and getting people spontaneously to respond, but the reality is that if we had no system for determining what is important and worthy of attention, then something else would determine that, and it would be some form of patronage. It would be the university with the biggest PR department or those researchers who have the best clubby contact books who would get their material recognised. That is the choice that is faced in terms of whatever system is operating.

Dr Wager: I think if it disappeared it would be reinvented with a subtly different name. There is great utility to it. As Tracey said, most researchers are swamped by information. They don't know where to turn, so they use filtering systems—various selective systems—to decide what is reliable and what to read. As I said, it would change. I came up with an analogy for peer review which the journal editors may not like, but it works for me. It is a little bit like the MOT system for cars. It is designed to keep the traffic flowing, reduce accidents and make cars roadworthy. It does not, though, guarantee that every car on the road is going to run tomorrow. We could increase it, and we could say that every car owner must have their car checked once a month, but that would be disproportionate; that would be unreasonable. Similarly, you could have more draconian methods and say, "Journals must review the raw evidence" and so on, but that would be disproportionate. It is a reasonable system.

Another analogy that works is that peer review does not necessarily spot that a car has had its milometer clocked (i.e. put back to show fewer miles than it has actually travelled) and that it is a bit different from what it looks like. It does not pick up major fraud all the time. It also does not necessarily tell you whether you are dealing with a Rolls-Royce or a white van. Different journals are looking for different things. It is a useful system. It is not a panacea, but in the way that the MOT is helpful to the police, to motorists and to various people, peer review is helpful to society as it keeps things rolling. However, other systems are also needed.

Q64 Chair: I will quote from the memorandum that we had from UKRIO: "There is a danger that the peer review process can stifle innovation and perpetuate the status quo. Peer reviewers, for example, are more likely to reject a paper or research grant if it challenges their own belief system." Can you elaborate on how big a problem that is for the progression of science and what can we do about it?

Dr Wager: There is some quite nicely crafted evidence that that is true. In general, peer reviewers prefer positive findings. They prefer findings that confirm their own hypotheses and so on. That is just human nature. One of the very important roles of

[1] Note by witness: My full name is Dr Elizabeth Wager. I should have used this on my written submission so that it was clear when I was citing my own work (which is published as E Wager).

editors, though, is reducing that kind of bias as well as other kinds of bias. One of the things that COPE encourages is to make sure that systems are as objective as possible, to make sure, for example, that journals publish criticism, especially of things that they have published in their own journal, to make sure that they are willing to listen to alternative views and so on. There is a danger of bias towards the status quo. There are other kinds of biases as well, but a well set-up system and a good editor will minimise those biases.

Q65 Chair: Let me just put that in a slightly different way. Is enough being done about it now?

Dr Wager: In the last few years the opportunities to publish have greatly increased, so we do have the less selective journals. In the days when journals were limited by the cost of print and paper and when page space was very limited, it was probably much harder to publish. There are so many more journals now that are less selective. People have done studies at the more selective journals to see what happens to the papers they reject, and they found that about 80% of the studies get published somewhere else. What happened to the other 20%? Maybe they shouldn't have been published at all because they really were misleading or completely whacky. It is difficult to tell. The opportunities to publish have increased. I don't know whether it is too far skewed.

Tracey Brown: May I add something to that? This Committee knows well that research is a dynamic beast. You would expect publishing to reflect that. Sometimes you get fields of research which ossify and stagnate. Therefore you would perhaps expect some of the discussion in those fields to reflect that. Similarly, what happens then is that people go off and form new collaborations in more dynamic fields and set up new journals, or they come into old, stagnating journals and realise that the reviewers are few and increase the field of reviewers. You would expect to see it almost become a mirror image of what happens to research generally. We see departments in universities stagnate and then get taken over by something more dynamic. That is what happens.

The important thing with a system that produces 1.3 million papers a year is that it is self-reflective. A lot of study goes on, as Liz has said, looking at the fate of papers that aren't published and looking, just generally, at trends across the system. So long as that is going on and patterns of behaviour can be spotted, then the system can be self-correcting.

Q66 Pamela Nash: Doctor, can I ask you to put on both your hats this morning and explain to us more about the roles of both COPE and UKRIO, and perhaps touch on why we are in need of both organisations?

Dr Wager: Sure. COPE is the Committee on Publication Ethics. We have quite a narrow focus. We were set up in 1997, originally by quite a small group of about a dozen, mainly UK, medical journal editors. It has grown hugely since then. We now have 6,500 members, all of whom are journal editors or publishers. We are just looking at publication ethics. We are not looking at research misconduct in the broader field. Our members are not research institutions and so on; they are journals and their publishers. We are a registered charity. We are international. We provide advice to the editors, which they are free to ignore. We don't have any particular powers, except that we also provide a code of conduct and we ask all our members to adhere to that code. If they don't adhere to that code, then anybody, be it an author, another editor or a member of the public, can bring a complaint to COPE against a member. We don't get many complaints, but we get a few every year and we hear them, so we feel that there is some accountability as well. That is COPE. We look at the publication ethics issues, like plagiarism, authorship issues, reviewer misconduct.

UKRIO—the Research Integrity Office—is a more recent organisation. It was set up to address the concern that there was no national body in the UK to look at research integrity in the broad sense. It, too, is advisory, so it has no statutory powers, but it is working more with institutions and research bodies. It is providing codes of conduct about how, for example, to conduct an inquiry into alleged misconduct, which is the role of the university or the hospital rather than the journal, whereas at COPE we are guiding the journal editors on how to handle a specific issue. Very often we say to the editors, "You shouldn't be judge and jury. You should hand it on to the institution." So UKRIO is mainly working with the institutions. It is on the broader spectrum, so it would look at all kinds of research misconduct and not just the publication ethics aspects.

Q67 Pamela Nash: Just to be clear, COPE deals more with the actual publication and the journals, but UKRIO is talking about the research that is done before.

Dr Wager: Precisely.

Q68 Pamela Nash: Do you think there is any case for merging the two organisations?

Dr Wager: We work very closely together. The fact is that I am one of the advisers and have been on the board. COPE gave a small amount of money at the outset to help UKRIO get established. There is a sufficient difference that they go along quite nicely. There is some overlap; we do work together. For example, COPE produced some guidelines on how editors should handle retractions when a publication is considered so unreliable that you need to withdraw it from publication. UKRIO produced a complementary set of guidelines heavily referencing the COPE ones, informing researchers and institutions of what their responsibilities were on retraction. We have subtly different audiences.

Q69 Pamela Nash: This Committee has received some evidence from the Academy of Medical Sciences that has alluded to some of the problems that UKRIO has had with funding, which it says stems from broadening the remit of UKRIO from just medical science. Can you clarify what the current situation is regarding funding for UKRIO?

Dr Wager: Yes. James Parry, who is the managing officer for UKRIO[2], would like to give some supplementary written evidence on that point to give you some detail.[3] Yes, it is true that it started looking at biomedical more, with some funding, for example, from the Department of Health and so on. They also had some broader funding from organisations such as Universities UK and Research Councils UK. UKRIO's aim is very much to cover all the disciplines. That would be a great strength if it wasn't sub-divided. One of the problems with the US system is that there are so many different bodies you have to go to, depending on whether it is physics or medical research. One of the strengths of UKRIO is that it was going to be broad. With the current climate and lack of funding in universities and so on, for whatever reasons, RCUK and UUK decided that they did not want to fund UKRIO at the moment. That is the current situation. They are looking at alternative models of funding.

Q70 Pamela Nash: Apart from the organisations that you just mentioned, are there any other potential funders in the pipeline—for instance, from the private sector, perhaps?

Dr Wager: Yes. In the past it did get some funding from the Association of the British Pharmaceutical Industry. That is one area it would look at. As I said, I would suggest that if James Parry can give you some detail on which funders they are planning to approach, that would probably be more appropriate. COPE, on the other hand, gets its money mainly from the publishers, who pay for their journals to be members. So we are getting our funding, effectively, from the private sector.

Q71 Pamela Nash: My next line of questioning was to ask if any of those sources would compromise the independence of UKRIO, but that might be something on which James would want to give us some detail.

Dr Wager: That is an important issue. One of the strengths of UKRIO is being independent. If you are funded by a particular body, you may not feel so comfortable in going to that body and asking questions, whereas if it is seen as an independent organisation, that would be a great strength. The Research Integrity Futures Working Group made some recommendations last year with which UKRIO was very happy, and it was happy to morph into whatever it recommended, and it strongly recommend an independent body—that is, independent of RCUK and independent of all the different funders—but, sadly, it hasn't happened.[4]

Q72 Pamela Nash: Finally, do you think there is any case for UKRIO becoming a regulatory body with full legal powers?

Dr Wager: This is an interesting one. I have spoken to the people at UKRIO to make sure that I am representing their views correctly. They are not against there being a regulatory body, but they don't want to be it; I think that would be the best way of putting it. They still think that an advisory and voluntary group would have its uses. That is their position. There has certainly been criticism and people saying, "We do need a body with more teeth, with some statutory powers", yes.

Q73 Graham Stringer: How can we keep the different people involved in the peer review process honest—the editors, reviewers and authors?

Dr Wager: A lot of trust is involved, and that is necessary. How do we keep them honest? There are various checks and balances. That is why COPE works with editors on, sometimes, seemingly quite small changes to processes that can make a big difference, such as asking reviewers to declare their conflicts of interest and asking the authors to declare their conflicts. Increasingly, though, technology is being used. Publishers are able to use things like CrossCheck, which is this very powerful text-matching software. It can pick up plagiarism and duplication. Publishers are also using software to pick up manipulated images and so on. Whereas the software has also made it easier to commit the fraud in the first place, it has also made it easier to detect it. Coming back to my MOT analogy, it needs to be proportionate. You don't want to put yet more barriers in people's way, but, equally, you don't want to mistrust everybody and assume that you can't trust anything.

Q74 Graham Stringer: You have done some research, have you, about the integrity of reviewers and editors in this area?

Dr Wager: I don't think there has been much research on the integrity of reviewers or editors. Much more research has focused on misconduct by authors. There have been some cases of reviewer misconduct. It is something that COPE picks up now and again. I have done a survey of journal editors to find out how big a problem they thought reviewer misconduct was, and it came pretty low on their list. COPE has produced a flowchart about how to handle allegations and how they should be investigated, because a classic complaint by an author would be, "Someone stole my idea," but that is really pretty uncommon. I don't think it is a huge problem. Signing up to COPE and getting the complaints procedure working will be one mechanism, we hope, to deal with misconduct by editors.

Tracey Brown: Could I answer that? It is important to separate out what can reasonably be achieved through the peer review process, in terms of reviewers looking at a paper and sending comments to an editor, and what journals might try to achieve more broadly. It would be unreasonable to ask reviewers to spot fraud or plagiarism on a systematic basis, although, of course, there are cases where reviewers are quite well placed to notice such things. Their main consideration is whether the paper is valid, significant and original and whether it provides the basis on which others can understand what has taken place and, therefore, replicate or investigate those results.

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[2] Note by witness: James Parry's correct title is Acting Head of UKRIO.

[3] Ev 126

[4] Note by witness: Research Integrity Futures Working Group report is available at http://www.rcuk.ac.uk/documents/documents/ReportUKResearchIntegrityFutures2010.pdf

There are other things that editors and publishers can put in place to which Liz is referring. We perhaps need to make a separation, rather than suggest that the process of other researchers publishing in the field and reviewing the material is falling down just because it doesn't always spot those things. I would also draw attention to the fact that when things do go wrong, particularly on a significant issue that, perhaps, has implications for wider society, there is a blaze of publicity and discussion. That is, perhaps, testament to how unacceptable it is. When we had the controversy around the stem cell work, for example, that was something that was being discussed on radio programmes and across the newspapers and had been caught and addressed. That tells you that there are ways in which these things get noticed and cause quite a lot of self-reflection within the system.

Q75 Graham Stringer: In your submission, you seem to imply that the research institutes themselves should take responsibility if there are allegations of fraud or misconduct on behalf of the authors. Do you think they have the resources to do that? Is there not a conflict of interest? I understand what you say about the stem cell research case, but if you take the Andrew Wakefield case, which got a huge amount of publicity, the institute itself, the co-researcher who seemed to have been involved and the journal wasn't interested. The hero of the hour, or the 10 years it took, was a journalist. What do you learn from that and do you really think that research institutes are going to be the answer?

Tracey Brown: A lot of people along the way have learned a lot, including journalists, publishers and editors. The Wakefield case may be an example of bad cases making bad law, in the sense that that was a pretty exceptional set of circumstances. There is, obviously, a big debate about why that paper was published and also the lack of clarity on allegations that were made in the context of a press conference around that paper rather than within the paper itself. This is something where it would be very hard to set out a one-size-fits-all approach. This is much more Liz's area, but it seems to me that the role of editors in evaluating what is taken up within the journal and what needs to be taken up within the institution is very important to that.

Dr Wager: I would like to add to that by commenting specifically on the Wakefield case. There is clear evidence that the institution did not fulfil its duty in that case. It should have done a proper investigation. Whatever its reasons were for not doing it, it was shoddy. It was not properly done. It has now recognised that, and I believe it is looking into their processes.

You asked if the institutions have a conflict of interest. That is something that concerns me because, yes, they do. Institutions don't like to proclaim when things go wrong. I would like to campaign for a change, so that rather than a misconduct finding against a university being a black mark, it is seen as a badge of honour. You should say, "Don't go to a university that hasn't had at least one person fired for misconduct, because it means they are not looking for it properly." I come back to you and ask: are the institutions well resourced and the right places to do it? They are certainly better resourced and better placed than the journals. It is not appropriate for the journals to be doing that.

There is a great debate about how common misconduct is. The evidence is that it is probably more common than we think—at least the questionable practices. If you are the University of London with however many thousands of researchers, you are going to expect a few bad apples and you need some systems that can sort them out. I would like to see support for that system and, perhaps, yes, a greater level of regulation. In the Wakefield case, the institution clearly didn't do a proper investigation. Some pressure should be brought to bear.

Even in the US, which has a more heavily regulated system—you are probably familiar with the fact that they have their Office of Research Integrity—the ORI doesn't do the investigations. The institutions actually do them, but with the ORI pushing and gently nudging them to do the right thing.

Q76 Graham Stringer: If we moved to either voluntary or statutory regulation in that area, do you think there should be an obligation on the institutes to publish any findings that they make? Sometimes when there are investigations by institutes, they say, "We have investigated it", and that is all you find out.

Dr Wager: Sure. I would welcome greater transparency. That is an issue that journal editors have sometimes. They will go to an institution with an allegation or a suspicion of misconduct and the institution will say, "Oh, we can't tell you. It's confidential." The journal editor may be put in a very difficult position, because if, for example, they have published something, they need to know whether to retract it or whether to publish an expression of concern. That is an area where transparency would be a great advantage. It would also help public confidence. The public are concerned when they feel there is a cover-up. There is concern when they feel that people are getting away with it. They would accept that things go wrong sometimes, but if you don't react to them, or don't react to them properly, that is when the problems occur.

Q77 Graham Stringer: What are the consequences for editors and reviewers if they are found to be behaving unethically? We have an idea of what happens to scientists who produce fraudulent papers. What happens to reviewers and editors?

Dr Wager: Editors tend to get fired if they fall out with the society or the publisher. The publishers and the learned societies have an important role. They employ the editors, albeit usually on a part-time basis, so there is a contract. If the editor really steps out of line, they can lose their editorial position. Obviously, that would be quite public.

In terms of reviewer misconduct, which is relatively rare but does occur, initially, they might well be sanctioned by their employer. If an editor found that a reviewer acting for a journal had acted improperly, they would report that to the institution. There could be an academic or employment case against them because that would be seen as professional

misconduct. In terms of the journal, they would probably not use that reviewer again, or, if they were doing something and it was a matter that they had not realised they were not meant to do, they would perhaps provide some more guidance and so on. It could be taken up.

Dealing more, perhaps, with grant applications rather than journal submissions, if somebody steals somebody's idea from a grant application, then both the funder and the institution would certainly take disciplinary measures against that person.

Tracey Brown: Could I add a postscript to the question of transparency in publication? As this Committee, I am sure, is aware, the Government are developing proposals to reform the libel laws at the moment, in part in response to threats received by scientists and publishers of scientific information. One of the areas on which Sense About Science has received evidence is a fear of publishing information about investigations into research conduct. Even just publishing news items or discussions on those things raises a fear of libel action. That is something that we hope is going to be addressed in new legislation, but it is something on which the Committee may want to comment because it does limit the ability to put these things in the public domain.

Q78 Graham Stringer: I have a final question to follow up on Pamela's question. You recommend there being a research integrity officer within institutes to look at these things. How would that operate? Is there any evidence or experience?

Dr Wager: There is certainly experience. That is how it is done in the US. For any institution that receives federal funding, they must have an appointed research integrity officer. It has various benefits. One is the simple, practical matter of knowing who to contact. It can be very difficult for a whistleblower, a member of the public, or even a journal editor to try and find out who to contact. That person acts as the point of contact.

It also means that somebody has, as part of their job description, the responsibility of taking an active interest in making sure that the institution is doing the right thing, conducting inquiries appropriately and so on. It has benefits. It can also be helpful in this way. Sometimes journal editors say to us, "I've tried to go up the hierarchy of this institution." We had a classic one not long ago. They described this terrible situation. There were very serious concerns about the author. We said, "This is obvious. You need to go to the institution." There was a pause—the man was on the telephone from another country, calling COPE—and he said, "Ah. The author is the president of the institution." That is a very extreme example. If the person to whom you are trying to go is the head of department, they have a stronger conflict of interest for covering it up and keeping it local than a neutral body. Let's say you have a concern in the physics department. If you can go to the research integrity officer, who happens to be from humanities, archaeology or something, they are, perhaps, more likely to deal with the problem in a properly impartial way. If the person was the head of the department involved, there would be a vice-research integrity officer who would deal with it if they had a conflict of interest. There is a clear structure involved.

Q79 David Morris: This question is directed to Tracey Brown. Last week Dr Robert Parker said that the public "probably don't care" about peer review. What is your view on this?

Tracey Brown: The context for that is, when a story takes off in the mainstream media, whether people ask questions about where that story has come from in terms of the integrity or validity of the science. Sense About Science, as I am sure the Committee is aware, published the leaflet that became the public guide to Peer Review.[5] We were rather taken aback; we published 10,000 and then we found ourselves, 500,000 copies later, realising that there was something of an appetite to understand not just the content of the findings of a particular paper but its status. There are many user groups of information. There are policy makers, journalists looking to decide which papers are worthy of discussion, and health service providers, libraries, teachers and information providers right across society, who are looking to understand, when a story says that Alzheimer's is being caused by aluminium foil, whether it is based on peer-reviewed research published in a journal known in the field and what others in the field say about it so that they can begin to interrogate it on that basis.

We found that people, for want of a better word, find this quite an empowering line of questioning. To take the Wakefield example, you are not going to turn yourself into a gastroenterologist overnight in order to assess whether you are going to vaccinate your child or whether there is any credibility to the stories. What you can do is ask questions such as, "How has this information come forward? What do others in the field say about it? What status should I give this?"

One of the reasons why we started doing this was in the field of policy making. We were frustrated that when Government consultations were under way it appeared to us that they were, literally, weighing evidence—you would have five submissions on this side and five submissions on that side; one side suggested one thing about the disposal of nuclear waste, and the other suggested another, for example—rather than going into looking at what status those different studies had. To take an extreme, is a study a review of all the published papers on the subject or is it a set of results that some bloke has got from doing an experiment in his garage around mobile phone safety? Those are the extremes. We are asking people to ask those questions. You can ask questions about where something has come from.

Q80 David Morris: At what stage of general school education do you think the concept and understanding of peer review should be introduced?

Tracey Brown: There has been some success already in introducing it at key stage 4. The new Twenty First Century Science curriculum in schools has had a mixed reception. One of its features that people most seem to like is that it develops discussion around what

[5] Note by witness: The name of the guide is "*I Don't Know What to Believe..."—Making sense of science stories*.

science is, and the nature of scientific ideas and information. We ourselves ended up becoming involved with the people who were developing that curriculum in order to take what is in the public guide and bring it to life by talking about how research reaches the public domain. There is certainly an appetite for that.

It also seems to chime with the point in education where kids are doing experiments in which they might get different results, and they are starting to ask themselves, "Why did Jim and Joe get one set of results, and my experiments come out with a different set of results?" It picks up on the ability to step back from your own experience and evaluate what is going on. They can see that mirrored in a much bigger system.

Q81 David Morris: Is the kitemark of peer review really a gold standard that tells the public and policy makers a particular piece of research is reliable?

Tracey Brown: I don't think it is. For the reasons that Liz and I have already outlined, it is a dynamic system that has all the benefits of human judgment, in that it can recognise good ideas. It can sometimes recognise ideas of which even the authors themselves don't recognise the full implications. It has all the downsides of the system with human judgment, in that it doesn't always recognise good ideas and sometimes it can be a bit shoddy. It has all those benefits to it. I don't think it is something that is a stamp of approval beyond which we ask no further questions. It is seen by the scientific community as the basis on which we select those things that are worthy of further attention, but I would emphasise "further attention".

"Peer reviewed equals true" is not something that would get us very far. We were concerned about that, as were many scientists, when we began popularising an understanding of peer review. Would it be seen as, "Well, it has been peer reviewed so therefore it must be true"? I am rather pleased to report that the public seem a bit more subtle in understanding that. To refer to the example that Liz gave of the MOT, people know that if you give something a standard it doesn't necessarily guarantee that that is going to be good and true for ever. It simply tells you that it has passed an initial assessment.

Q82 David Morris: You feel that a single peer review article may disagree with previously published findings.

Tracey Brown: Yes, absolutely. It may disagree because it develops the science further or because it is not taking into account the work of others. Asking people to ask the question, "Is this peer reviewed?", invites further questions, such as, "What do others in the field say about it, where does it sit in the wider consensus, and where is this research field going?" It opens up that line of questioning rather than close it down.

Q83 David Morris: Does the publication of fraudulent or incorrect papers that have been through the peer review process damage public perception of peer review as a mark of quality?

Tracey Brown: Inevitably, the high-profile discussion about fraudulent activity in particular damages not just the peer review process or publishing but also science as a whole, which is why so many of us are concerned with addressing those issues and there is such vigilance around them. It is inevitably going to happen. The more that people can understand the system through which scientific research results are generated and come into the public domain, the more we can understand why those things happen. You cannot build a world that is immune to fraudsters. Not in any part of life can you build a world that is immune to fraudsters. We have to accept that that is the case and hope that we have systems that detect those as early as possible.

Q84 David Morris: What differences are there in the way in which peer review is perceived by the public outside the UK? Do any countries have organisations or schemes for informing the public about peer review from which the UK would possibly benefit?

Tracey Brown: We are experiencing the opposite at the moment, which is quite challenging for a small charitable organisation like ours. We are experiencing a lot of demand internationally to make use of this to turn it into something which is culturally specific to other societies. There is a lot of interest. We have been working with people in the US and recently with journalists and scientists in China to develop similar things. There is certainly a recognition of the need to build understanding about the context and status of research results. The global discussions about climate change have particularly underlined that. We have found that that has increased rapidly the demand for this.

The answer to your question is that initiatives are being thought of and are under way in a range of places. They are, perhaps, not as under way in the European Commission as much as I would like them to be because recognition of that in the calibre of research that is used in European policy making would be very useful. Elsewhere, people are recognising the need to do this.

Q85 Stephen Metcalfe: Good morning. We all accept that there is a limit to the peer review process. You have said that the public accept that and are able to understand that just because something has a mark of quality, it does not necessarily mean it is true. Do you think that is communicated across the whole of the public? You talked about the public; presumably, that is the part of the public that takes an interest in science as opposed to just having it fed to them. Do you think that is communicated widely enough? When you talk about it being taught at key stage 4, are they also teaching the fact that it is a limited process as well?

Tracey Brown: The simple answer to your second question is yes. I would be very happy to supply further information about that peer review resource that was developed. I believe the University of Reading is going to be working on taking that forward. I will send some more information about that to you.

The way to understand it not to think of society as those people interested in science and those people not interested in science; lots of different organisations have a role in mediating information and ideas to others. That goes right the way through to, for example, midwives on their morning rounds, who, faced, with a story in today's newspapers about the fact that exposure to very hot sun will harm an unborn baby, get questions from new parents asking, "Is this true?" Their professional organisations can have a role in helping them to understand, "Where has this story come from? Does it come from a reputable study? What do others in the field say about it?" They can mediate that information through to midwives, who then mediate that information through. It is a much broader process. I don't think those mothers would identify themselves necessarily as being interested in science by asking that question, but it is significant much more widely.

Q86 Stephen Metcalfe: It is whether or not they understand that just because they have read it in a newspaper, it doesn't necessarily make it true. It is that wider approach. We get fed a lot of science because journalists are interested in it. At times, as in the example that you have quoted, it can distress people. How do we make sure that they understand their limitations?

Tracey Brown: Let me give you a good example. We published a booklet called *I've got nothing to lose by trying it,* which is for people with chronic diseases who go looking for miracle cures and then are trying to work out, "Is this based on any kind of science or not?" We had a really big post bag from that. People were saying how much it really helps them to be able to ward off those friendly neighbours who come round with press cuttings or something off the internet saying, "You must try this diet". They were able to say, "Actually, that has not been through any kind of study. I can't find any published research that suggests that that is good." People can use it in that way.

Going back to the question of whether a person asks if it is peer reviewed, there is the potential—we have seen it take off in a number of places—for a bit of a virtuous circle to take place. If, in a Radio 2 programme in the afternoon, the interviewer is equipped to ask the scientist—this question was not asked in the Wakefield case—"Which of these claims has been published and peer reviewed? Do you have a study that backs this up?", the more that question gets asked, the more the listening audience expects that to be one of the interrogatory questions. The more that the listening audience expects that to be an interrogatory question, the more the radio interviewer feels that they, representing their listening public, must ask that question. We have seen these improvements. For example, in its online material, the BBC always makes reference to where a study has been published. We have worked very closely with science journalists over recent years. That is now the case in many of the newspapers as well, and certainly with online publication that facilitates making links to where research is published.

Q87 Stephen Metcalfe: Where that process goes wrong and fraudulent or incorrect papers have been published, what lessons have been learnt from that? What information is then fed back to the editors, reviewers and the authors about how they can learn from these things? Is there a two-way communication?

Tracey Brown: There is very dynamic discussion around these things. My experience is much narrower than Liz's. Within publishing circles and within the scientific community there is very dynamic discussion of this. For example, most publishers have editorial conferences on an annual basis, if not more regularly, through which they can reflect upon those kinds of experiences. There are also the popular publications within science, which include journals like the *New Scientist* and the science pages in the newspapers, but also the news, views and comments sections of some of the journals that are published that don't just have peer-reviewed content but also have discussion content. Those are also places through which people discuss and debate matters. At a general level, it is widely discussed.

In terms of specific learning, take something like vested interests. I looked at the work that has been done over the last 20 years for a paper that I wrote recently on vested interests; it was very informally determined previously in publications. How do you express whether you have a vested interest in the field that might influence what you said in your paper or the way in which you review a paper? It has now been much more formalised. Post-Wakefield, most journals have much better ways of asking people to express their vested interests or potential conflicts. Over the past few decades there has been a general move towards getting away from the informal, "Yes, they'll mention it if it is a problem", towards a much more formal set of questions and guidance to authors, reviewers and editors.

Dr Wager: Could I add something on that?

Stephen Metcalfe: Yes, of course.

Dr Wager: You were asking about feedback to the authors. Dr Hwang Woo-Suk is no longer the hero that he was in Korea. Jobs get lost. If there is a really major case of fraud and a paper is retracted, there can often be very serious consequences for the authors, which is why editors, sometimes, are a little bit reluctant to set the ball rolling, because they do know it can be serious.

The journals will also usually do some heart-searching and say, "Was there a problem? What went wrong in this case?" If you look at the retractions—this is interesting—the prominent journals with excellent peer review systems like *Science, Nature, The Lancet* and so on publish more retractions or retract more articles than the slightly lower-tier journals. It could be because they are publishing more controversial research. It could also be because they are better at spotting the problems. I don't think there is any question, though, of their systems being at fault. If you look at them, there is not generally a systemic problem. There may have been occasional issues, but I don't think there is a correlation. There has been a big increase in retractions; this is something I have studied. They have gone up about tenfold, in fact.

There has been quite an increase in retractions, if you look at the retractions on the big medical databases. It is because we are better at correcting the mistakes. I don't think there is any evidence that that correlates with a systemic problem in peer review. As I said, peer review is not very good at spotting the major fraud, but some journals and publishers are good at making sure that they clear up the mess when it does get caught.

Q88 Stephen Metcalfe: The UKRIO submission said that the process of peer review needs to be confidential. Can you explain why that is important?
Dr Wager: This is not necessarily something that COPE agrees with. In the traditional system of peer review, the author does not know who the peer reviewers are. The idea is that you protect the reviewers' identity so that they are free to say whatever they want to say. A junior can criticise a senior person and there is no fear of retribution if you bump into that person or you apply for a job, and they say, "You're the person who killed my paper." That is the idea behind the blind peer review.
It sometimes goes one stage further and the author's name may be removed from the paper. The idea of that is more to reduce bias, so that you don't look at it and say, "This is from Professor So-and-So at Oxford. It's bound to be good." That is trying to reduce the reviewer bias. With some journals, the author doesn't know who the reviewers are and the reviewers don't know who the author is.
Some journals have said, "That's not such a great system", because as an author you are being criticised anonymously, and you think, "Isn't transparency a good idea?" Particularly in the medical journals, some of them now operate open peer review. The reviews are signed. The peer reviewer puts their name on to the review. Before they launched these systems, they tested them to make sure that it was feasible because there was a concern that reviewers would say, "No, way. I'm not putting my name on this", and to see if it had an effect. They hoped it would improve the quality of the review. There is some quite nice research. It did not improve the quality but it didn't lessen it either, so they decided it was feasible and practical. Some of the medical journals use this open review, so it is by no means confidential.
Some of them have gone one stage even further and publish the reviewers' comments. BioMed Central has been doing that. You can click on "Publication History" where you can see the submitted version, the reviewers' comments, how the author has responded to it and then the revised version. That is totally open. If you want to criticise somebody, that is good because you will be able to say, "I know who that person works for or who they are funded by" and so on. The conflicts of interest are all out in the open.
The reason why COPE does not necessarily recommend one system or another is because some editors have said to us, "We work in a very narrow field. Everybody knows everybody else. It just would not work to have this open peer review." There are different options. UKRIO is referring to the fact that, if you have a blind system of peer review, then, of course, it is important to keep the names confidential. Obviously, on the other hand, if you have an open peer review system, it is not going to be kept confidential. There is contradictory evidence. My opinion is that it depends on the discipline. With a discipline as big as medicine, where there are hundreds of thousands of people all around the world you can ask and they probably don't bump into each other the next day, open peer review seems to work. In much narrower and more specialised fields, it perhaps does not, and the traditional system of the blinded review is perhaps better.

Q89 Chair: The narrower the discipline gets, the more likely it is that all the parties will know each other anyway.
Dr Wager: You are absolutely right. There are also some nice studies showing that taking the names off doesn't necessarily prevent the people from knowing it both ways.

Q90 Chair: You can work it out from the methodology that has been applied.
Dr Wager: You know who is doing the research. For most authors, the first papers they cite are their previous work, so you look at the references and you can see whose paper it is. Some journals go to the length of removing the author's papers from it. There is evidence that sometimes it is a waste of time.
Tracey Brown: One of the biggest concerns is what reviewers feel comfortable with; there have to be enough reviewers attracted to reviewing. There are very few incentives to review in the university system; there is no time given for it and no recognition of it in your career. These things need to be dealt with, but that is the current position. If you have something that puts people off reviewing, then that is ultimately going to cause the whole system to fall down. Sense About Science ran the biggest ever international survey of authors and reviewers in 2009 because of this perceived crisis in the future of peer review and we wanted to look into it. It found that 76% of the people responding who have reviewed papers said that they feel most comfortable with, or described as best, the double blind system that Liz described, but as she has said, there can also be a lot of openness in doing things in other ways.

Q91 Stephen Metcalfe: You touched on bias; presumably, the double blind eliminates almost all the bias, doesn't it?
Dr Wager: That is the idea, although if you know who the person is anyway, even if they have had their name taken off, it does not. That is the theory behind it. It was brought in for very good motives, but it is not clear that it is a great mechanism.

Q92 Stephen Metcalfe: Finally, if you were to have a more open system, can anything further be done to minimise bias? Once the names are in the public domain, it is too late.
Dr Wager: Quite interestingly, recently concern was expressed by some stem cell scientists who felt that there were cliques and groups and there was bias in the system. One of the journal's responses was to

publish the names of the peer reviewers.[6] They did move towards a more open system, which is interesting. In a lot of disciplines, the open system does work well and transparency can be helpful. Training is also important. If you are recruiting and employing someone, you go through training to make sure that you have proper employment practices and that you are aware of anti-discriminatory laws, diversity and that sort of thing. Sometimes it is a case of making sure that you are doing that. Editors have a fair idea. Sometimes they will pick reviewers because they know they will disagree. That, in a way, balances out the bias.

Chair: Thank you very much. I hope that not too many vice-chancellors take your message too seriously of sacking some academics this afternoon. Thank you very much for your evidence.

[6] Note by witness: I referred to a journal that had responded to stem cell scientists' allegations of bias by publishing the names of the peer reviewers. This was incorrect. The journal in question is the European Molecular Biology Organization (EMBO) Journal. It does not publish the names of its peer reviewers, but it has started to publish the peer reviews. Further detail is available at http://www.eurostemcell.org/commentanalysis/peer-review

Examination of Witnesses

Witnesses: **Mayur Amin**, Senior Vice President, Research and Academic Relations, Elsevier, **Dr Philip Campbell**, Editor-in-Chief, Nature Publishing Group, **Robert Campbell**, Senior Publisher, Wiley-Blackwell, **Dr Fiona Godlee**, Editor-in-Chief, BMJ Group, and **Dr Andrew Sugden**, Deputy Editor and International Managing Editor, Science, gave evidence.

Q93 Chair: I thank the panel for coming in this morning. We have rather a lot to cover in a relatively short time, so please feel free to send us any supplementary notes if we cannot get your particular answer to a question. May I ask the five of you to start off by introducing yourselves?

Mayur Amin: I am Mayur Amin. I work at Elsevier and I head up a research and relations group there.

Dr Campbell: I am Philip Campbell. I am editor-in-chief of *Nature* and of the Nature Publishing Group.

Robert Campbell: I am Bob Campbell. I am senior publisher at John Wiley and Sons.

Dr Godlee: I am Fiona Godlee, editor-in-chief of the *BMJ* and the BMJ Publishing Group.

Dr Sugden: I am Andrew Sugden. I am international managing editor of *Science* magazine at Cambridge.

Q94 Chair: Thank you very much. You will have heard me ask this same question to the first panel. Peer review is regarded as "fundamental to academia and research". What happens if it disappears tomorrow?

Dr Campbell: There would be a sudden decline in trust by academics of what they are reading, and by those in the media and among those members of the public who take the literature seriously, correctly. Increasing numbers of the public do engage with the literature. That, to me, is one of the most important aspects of what you would lose.

Dr Godlee: It is important to distinguish—I am sure others will do this—between pre-publication peer review and peer review generally. Pre-publication peer review is only one aspect of the peer review process, which begins with grant-funding peer review, ethics committees, the pre-publication process, the editing process and then the peer review that goes on after publication. Then there is correction and, in some rare cases, retraction. All of those systems constitute peer review.

If you are talking about the decline or the loss of pre-publication peer review, there are some areas in science and medicine where that would be a problem, as Phil has said, and others where it might be a benefit. The balance between the benefit and harm of peer review is still very poorly experimented with.

Q95 Chair: If we look at the evidence that Richard Smith, the ex-editor of the *BMJ*, sent us, he suggested moving from "filter, then publish" to "publish everything, then filter." Is there any sense in that approach?

Robert Campbell: He is ignoring the other very important part of peer review, which is improving the article. Especially in some disciplines, that is a lot of what peer review is about. It is not just filtering but going back to the author, making revisions and even doing new experiments. It is only taking one part of peer review.

Mayur Amin: In the Sense About Science study that Tracey Brown mentioned, 91% of the authors said that the peer review process helped to improve their paper. Where everything is published before it gets its first peer review filter, we may end up with a system where it is hard to differentiate between evidence-based conclusions and conclusion-based evidence. We end up in a situation where there is a lot of noise and uncertainty as to whether it is credible or not.

Dr Campbell: My other reaction is that all the experience of allowing people to comment online and our experience of open peer review in an experiment that we did at *Nature* suggests that people are much more motivated to comment and assess a paper if asked by an editor before it is published than they are in any other way.

Dr Sugden: I would endorse that, and add the fact that peer review is a system very much for improvement of papers as well as filtering.

Q96 Chair: Mr Campbell said that part of the process is to improve the paper, but some of the evidence we have had suggests that the process has a rather conservative impact on the science. Is there not a problem in that respect?

Robert Campbell: I don't see it as particularly conservative. A good editor will encourage the author to write a better paper, develop those ideas better and

get them over more effectively than in the first draft. It is a positive process. If you have a very conservative editorial board, the journal will suffer. It is a market; the more proactive entrepreneurial editorial teams will win out and build better, more successful journals. It is a very dynamic market. A conservative editorial board wouldn't last long.

Q97 Chair: Do you think that that process mitigates against the creation of a risk-averse culture?

Robert Campbell: Yes. I don't see it as risk averse, no. There are some editorial boards that are, perhaps, more conservative than we would like. On the whole, they are trying to publish better papers each year. There are higher impact factor scores. There is the reverse side, which you picked up: it tends to be the more radical and original article that will win more citations.

Dr Campbell: I completely agree with that use of the word "conservative". Another use of the word "conservative" concerns robustness. For us, peer review helps us deliver robust publications. We, at *Nature*, if anything, are more conservative than other journals. We make researchers go the extra mile to demonstrate what they are saying. I also celebrate the fact that we do not want to be conservative with papers that go against the status quo. We want to encourage radical discoveries.

Dr Godlee: We have to acknowledge that there is a huge variety in the quality of peer review across the publishing sector. Journals like *Nature, BMJ* and *The Lancet*, which have big editorial teams within them, do a very different type of peer review from those with much less resource. At its very worst, peer review has been described—many will have heard this list—as slow, expensive, biased, open to abuse, stifles innovation, bad at detecting errors and hopeless at detecting fraud. At its best, I think we would all agree that it does improve the quality of scientific reporting and that it can improve, through the pressure of the journal, the quality of the science itself and how it is performed, putting pressure back on the funders and the ethics committees, for example.

We have to acknowledge that scientific communication has changed enormously with the increased volume and sub-specialisation. Technology has changed the equation. The economics of scientific publishing has completely changed with the internet. There may be better ways of speeding up innovation, dissemination and quality control. We should not be frightened of those. We need to experiment with them. I would agree that conservatism is not a bad thing in science or medicine in terms of making sure that what we publish is robust, relevant and properly quality controlled. That is absolutely crucial, but I don't think we should be conservative in how we go about achieving that.

Chair: We also have different meanings of the word in this place as well.

Q98 Graham Stringer: Let me follow that up. One of the submissions we have had from a Cambridge professor shows that the criticism of conservatism is stronger than that. He says he tried to get a paper published that showed that a large percentage of work in nanotechnology was never going to result in any practical application. He found it extremely difficult to get it published, and his view was that it was because it was running against the interests both of the other authors as well as the publications. Is that a criticism that you have come across? Do you think it is a fair criticism?

Dr Campbell: We would love to publish something that strongly made a provocative case of that sort. That is not because we want to be sensationalist but because, if there is a good reason to say that, it needs to be out there and we would like to be the place to publish it.

Q99 Graham Stringer: He should have come to *Nature* and not to a nanotechnology publication.

Dr Campbell: Of course. In the same breath as conservatism, sometimes things like that are too easily said and not backed up well enough. A journal, which also has a magazine role in *Nature*, has one of the most critical audiences in the world. They love to be stimulated but they also want to make damned sure that the evidence on which we base the stuff we publish is reasonably strong.

Q100 Gavin Barwell: In 2008, a Research Information Network report estimated that peer review costs about £1.9 billion annually. Would the panel consider that to be a fair estimate?

Mayur Amin: It is an estimate that was made. It is an estimate of the non-cash costs—the cost of the reviewers' time. Yes, on the basis of an estimate, it is a reasonable estimate. The issue is that it is the time spent by reviewers on behalf of others in the academic community. It is a cost that is neither paid for nor charged for in the system. It is a service to the academic community as a whole.

Q101 Gavin Barwell: Does everyone take a similar view to that?

Dr Godlee: I have no doubt that peer review is an enormously expensive process. It is expensive for publishers and it is an investment that is made with a return on the investment expected through a number of revenues and also the reputation of the journals they publish. The unaccounted cost is the peer reviewers' time. One of the questions is how we make that more of a professional activity for which they get academic credit rather than something that gets no credit. We need to make sure that it is understood to be part of an academic's role in contributing to the forwarding of science. That is largely how it is viewed, but it may not get the credit that it deserves.

Dr Campbell: The *Nature* journals are working on giving more credit privately to referees directly at the end of every year, letting them know what they have done for us on the record. In my conversations with senior people in universities, they recognise that they could do more to give their academics credit. Academics themselves don't think about it much. They do take it very much for granted. In a very competitive academic world, when you are going for tenure or for some other promotion, to be able to have something like that stated on the record is helpful.

Q102 Gavin Barwell: That leads me quite neatly into my next question. In 2010, the Joint Information System Committee reported that UK higher education institutions spend, in terms of staff time, between £110 million and £165 million per year on peer review and about £30 million on the work of editors and editorial boards. Does the panel think it is fair that higher education institutions absorb this cost on behalf of publishers? Should reviewers be paid for their time?

Dr Campbell: Yes, I do, but I would change the question. It is on behalf of everybody. Of course, you could get into a situation where publishers would start being the intermediaries that pay, but we don't charge authors to submit papers. At least, there are some systems where that happens, but we don't hand on the cost of peer review, in so far as it costs us anything. Were that to come in as a charging system, there is no way that the publishers could absorb that. I return to my primary point that everybody sees all sorts of peer review, for journals, funding agencies and, informally, between colleagues, as part of the business of doing science.

Dr Sugden: It is, essentially, a reciprocal process. Authors are reviewers as well. It is two sides of the same coin, essentially.

Mayur Amin: It is a service that the higher education system provides to others within the higher education system globally. It is not a countrywide system. In the UK, for example, and certainly within Elsevier, we find that we publish about 6% of the papers that are published out of the UK and 6% of the reviewers are from the UK. So there is a balance. It is a service to the community itself.

Q103 Gavin Barwell: To pick up on the point that Elsevier stated in the memorandum it submitted to the Committee, it says: "Publishers have made significant investments into the peer review system to improve efficiency, speed and quality." Can you give the Committee an idea of the scale of those investments in recent years and the kind of things you were referring to?

Mayur Amin: Overall, one of the biggest investments for everyone in the publishing industry in the last decade or so has been migration to some of the electronic platforms. Across the industry, our estimate is that somewhere in the order of £2 billion of investment has been made. That includes the technologies at the back end to publish the materials as well. The technology has included submission systems, electronic editorial systems, peer review support systems, tracking systems and systems that enable editors to find reviewers. It is not just a question of their friends; they have systems so that they can find newer reviewers that they don't know about. There are also support systems, in terms of guidelines and signing up editors to committees like the Committee on Publication Ethics. There are a number of different ways, such as training sessions and workshops for authors, editors and reviewers. Those are some of the ways.

Q104 Chair: To clarify, did you say £2 billion?

Mayur Amin: Across the industry, in terms of all the technology investments.

Q105 Gavin Barwell: My final question is, particularly, for Dr Godlee. The BMJ Group told us in their submission that "little empirical evidence is available to support the use of editorial peer review". How should a programme of such research be organised, and who would fund it?

Dr Godlee: It has long been felt that a system as important as peer review to most known science is remarkably under-evaluated. There have been studies. There has been an editorially led or research-led approach to this, and some of that funding has come from the NIHR in the UK. We have been very grateful for that. The overall level of evaluation of peer review is very poor—not only journal, editorial peer review, but grant peer review, which is right at the beginning of this process and has an enormous amount of influence on what does and doesn't get funded. I am sure we should have it. The UK could lead on this. As to where the funding should come from, you could say that it is a combination of the journal publishing world, the grant-giving world, industry, but also public funding. It is a very important part of what we do. We can improve it; there are huge flaws. Lots of good things are going on and there are many new experimental ways of going about things. We need to evaluate these so that different specialty areas can take on different approaches as appropriate. A lot could be done with some decent funding.

Q106 Stephen Metcalfe: Good morning. Dr Campbell, you mentioned that you wanted a robust peer review system. What do each of your individual journals do to ensure that the process of peer review is both robust and delivers high quality?

Dr Campbell: We talk to each other a lot about the way we do the process. Senior editors on *Nature*—this would happen equivalently on the other journals—and I will look at individual manuscripts. Whenever there is any sort of complaint, I take personal responsibility for ensuring that it is looked into. In terms of external responses, we always respond as quickly as we can. In terms of due diligence internally, we have the discussion groups and we will look at particular cases where a manuscript may have caused certain types of difficulty. Above all, I rely on the team editors to be looking at every decision that is in any way controversial. Several editors will be involved in discussions about their position. Within the team, there is a quite a degree of transparency and oversight.

Dr Sugden: The system at *Science* is very similar. Editors will always confer with each other about any decision. No decision is made in isolation.

Dr Godlee: The same is true at the *BMJ*. Any of the large journals with a big internal team, as we, *Nature* and *Science* have, will have a similar process. There is a lot of consultation, and a lot of expertise is brought in from outside, through a series of stages, trying to make sure that we reject papers that are not for us very quickly, so as not to delay their moving on elsewhere and to keep the science moving, but also to make sure that those we do pass through to final stages get very heavily scrutinised.

I want to say here—it may come up later—that we are reliant on what the authors send us. We have to acknowledge that peer review is extremely limited in what it can do. We are sent an article, effectively, sometimes with datasheets attached. We have to go with what is sent to us. A vast amount of data do not get through to journals. We know that there is under-reporting, misreporting and a whole host of problems, and journals are not adequate to the task that they are being given to deal with at the moment.

Q107 Stephen Metcalfe: Do you sometimes send those back, and does the reviewer say, "Can you do some more work or experiments on this?"
Dr Godlee: This is not true of different peer review systems, but in the systems you are hearing about here, all papers will be revised before acceptance.

Q108 Stephen Metcalfe: Are the reasons why you are asking for the additional information, experiments to be conducted, et cetera, always made clear to the researchers who are doing the work?
Dr Sugden: Yes. It is made clear to them through the reports that they get from the reviewers and the editors and accompanying recommendations that go with that. They will always know why they are being expected to do something.

Q109 Stephen Metcalfe: Do they get an opportunity to challenge back and say, "I don't think this is worthwhile"?
Dr Sugden: Yes.
Dr Campbell: There was a recent discussion in the pages of *Nature*. Somebody whom we published said that editors on journals such as *Nature* can be rather supine in accepting the demands of a peer reviewer and not protecting an author from excessive demands of that sort. I went back to all of my editors and asked for examples where we have not been supine—recent publications which had had to be revised, but where we had made a judgment that in this particular case this request for extra work was not required. That is an example of the robustness of the discussions that take place.
Dr Sugden: Often you will get two or three referees' reports on a paper, but those referees may not agree with each other. It is the editor's job, if they consider the paper worth pursuing, to then make a recommendation as to which of those referees' revisions they should follow and which they should not, and maybe do some extra ones, too.
Mayur Amin: In addition to the vigilance of the editorial teams, there are in-house editorial teams on large journals or editorial boards within smaller journals. Certainly within Elsevier—and I think other publishers do the same—I do that, because it is my responsibility to get feedback from the researchers, authors, reviewers and the editors on the processes. We have so far collected something like a million items of response from the community. That gives us another measure of whether reviewers, authors and even editors find that certain aspects of the processes are failing. So, as publishers, we can take that on board and present it to an editor or a journal and say, "Look, a whole lot of authors are getting displeased about the way the process is working. We need to modify the process." That is another process-level procedure that we have in place.

Q110 Stephen Metcalfe: Mr Amin, is it correct that, prior to 2005, you had a number of publications that looked like journals and sounded like journals but in fact were a collection of re-published papers that had been sponsored by pharmaceutical companies, and that the data and the articles within the publications came out in support of those particular sponsors? Is that true?
Mayur Amin: Yes. That was a case from early 2000 to 2005 in a division of Elsevier that is not part of the formal peer review process. They are the custom publication division in Australia. I would say that the failure there was of the publishers not to hold the standards that we have. I stress that it was not a peer-reviewed journal. The issue was that there was not sufficient disclosure or sufficient clarity about what the nature of the publication was. When we found out, we acknowledged that. An internal review was done and a completely revised procedure was communicated internally and also externally. It is available on our site.

Q111 Stephen Metcalfe: So you would say that that would have fallen short of publication ethics.
Mayur Amin: It fell short of custom publication ethics. It was not a peer reviewed journal at all.

Q112 Stephen Metcalfe: How do you that happened imagine within a respectable and large organisation? You said "failure", but it must have been a systemic failure.
Mayur Amin: From our investigations, it is a relatively isolated case. I suspect in any human endeavour, in a large organisation, that there will be some failings. The important thing is what we do when we recognise and identify those failings. We have taken action to put procedures in place to minimise those in the future, and also we went public about this as well.

Q113 Stephen Metcalfe: What are those procedures to minimise it in the future?
Mayur Amin: I don't know every single one off the top of my head, but they are in the public domain and I am happy to circulate those procedures to you.

Q114 Stephen Metcalfe: That moves us on to the wider point of where sponsorship comes into this. Presumably, there are people who still want to get sponsored publications out into the public domain. How do you identify those? How do you make sure that there is a clear difference between something that is a peer-reviewed journal and something that is sponsored by someone who wants to get a message across?
Mayur Amin: Our guidelines are all about total transparency and total disclosure about any such sponsorship. That is what it clearly states. There must be total transparency.
Dr Godlee: I think we enter a very tricky area here. We have to acknowledge, and I am sure my colleagues

on this panel will be willing to acknowledge this, that the publishing industry has a number of revenue streams, one of which, certainly in medicine, is the pharmaceutical industry. The pharmaceutical industry, for every good reason and lots of bad reasons, wants to get their results out into the public domain. The journals provide them with a very efficient route to do that. Depending on their rigorous attempts to prevent this, journals are variously used by the pharmaceutical industry, the devices industry and other industries to get their points across. That is not to say that there aren't hugely wonderful things going on in the pharmaceutical industry that need to be disseminated, and perhaps we could do a better job where those are concerned, but there are also extremely dubious practices. The journals are largely naïve on them. We do our best. I don't know the extent to which this happens in biomedicine as opposed to clinical medicine, but it is certainly a major problem in clinical medicine. Sponsored publications can be very blurring at the edges. The reader may not be aware that this has been conjured up within industry and then sold to a publisher to publish to clinicians and others. Even if the publisher tries to make it obvious, it may not be as obvious as they think.

Even on the peer-reviewed side of things, it has been said that the journals are the marketing arm of the pharmaceutical industry. That is not untrue. To a large extent, that is true. Much as I hate to say this and much as it distresses me, we, as a publishing industry, have to acknowledge that and must have many more better systems for making that clear to clinicians and preventing it from happening on the scale that it is happening at the moment.

Q115 Stephen Metcalfe: Can you give an example of how that situation might be addressed? What sort of things should be done?

Dr Godlee: All efforts for transparency are good. Some people think that people pushing for this have gone too far. I personally don't think we have gone far enough. We need centralised systems for conflicts of interest to be declared. In the States, for example, if you are at the Mayo Clinic or the Cleveland Clinic as a clinician or researcher, your conflicts of interest are posted and updated every year. It becomes much easier for people to become accountable for the funding they might get. I don't think we have such good systems in the UK. Obviously, journals and journal editors need to be vigilant about this. Open access to research and data deposition, mandated, eventually, if we could find good systems for doing that, will help. Trial registration has been very important, but we need to push further on that so that the results are made available.

This is a big conversation to be had. It is absolutely not in the pharmaceutical or device industries' best interests in the long term to be involved in the scandals that have been a major part of their lives, certainly in the States; less so here, but is that because the practices aren't happening here or because we don't know about them? It may be a combination of both of those things. It is not in the industries' best interests and it is certainly not in the public interest that data on patients and the public as participants are not made available, are not properly reported and are misreported. Evidence-based practice, which we all want to see in medicine, becomes impossible if guidelines have been created based on distorted evidence. It sounds an extreme point of view. The evidence shows that it is not extreme and we have to begin to acknowledge this situation and take action to avoid it.

Dr Campbell: In the areas in which we publish, we have some clinical review journals, but predominantly, we are in the life sciences and physical sciences. I wouldn't use that language at all. I feel very secure in the internal boundaries and in the transparency that we try to instil. We have internal guidelines that we make available to people. This is not in relation to original research, but where there is sponsored publication there are absolute and rigorous Chinese walls between the interested parties. Editors have the final say on what is published. We have statements that make that absolutely clear. It is essential. I recognise completely that in the clinical world, the pressures and boundaries can be far more difficult to police.

Robert Campbell: We heard from COPE that there has been a huge change in the last 10 years. There is much greater awareness throughout the editorial and peer review community. There has been a very good editorial in learned publishing just last month by Diane Scott-Lichter, using the analogy of the mitigation of cancer with publishing ethics. Better education and better screening can reduce the incidence of cancer, and she made that analogy with publishing. If we do more in terms of education, screening and training, we will reduce the problems later on.

Chair: I am afraid that we are going to have to move on. This is a fascinating area, but we have huge other areas to cover.

Q116 Roger Williams: We are told that some of the top journals may reject 95% of the papers that are submitted to them. Can you tell us why journals like the ones that you edit are so selective in dealing with these applications?

Dr Sugden: Part of it is simply that they are weekly magazines with a print budget. We are publishing 20 papers, say, a week, and a lot of people want to be published in them. We are receiving 10 times as many, roughly. That is the straightforward answer. We need to publish in a timely manner. We want to showcase the best across the range of fields in which we publish, so we have to be highly selective to do that.

Dr Campbell: That is an interesting question. As we move online and as the prospect of the decline of the print journal happens, that pressure is lessened. I still think that we would publish the same number of papers that we publish, pretty much. We are receiving increased numbers of submissions because the output of the scientific community is going up. It might go up for that reason, but the proportion would stay the same. It is to do with our judgment of what is really important.

Q117 Roger Williams: With so many journals publishing peer-reviewed work, does almost all

research get into a peer-reviewed journal at some stage?

Dr Sugden: The evidence is that it does. We heard that said earlier. More than 80% of what passes through our hands will get published somewhere, and mostly somewhere quite good.

Q118 Roger Williams: Does everybody agree with that? Do researchers have multiple submissions? Are they allowed to submit to more than one journal at a time?

Mayur Amin: No.

Dr Sugden: That is absolutely not on.

Dr Campbell: Not at the same time. I have no idea—it would be an interesting statistic; maybe someone else on the panel knows—if you looked across the UK research community, what the average number of submissions per paper is before it gets published.

Dr Godlee: Just to go back, the reasons for publishing so few have changed. As Phil says, print is no longer the constraint. Editorial resource is obviously a constraint, and for a general journal, so is wanting to capture the very top—what we consider to be the top. Impact factor is an issue. Certainly a lot of journals find that if they reduce the number of research papers they publish, their impact factor creeps up quicker. That is a commercial reputational issue.

As to the question about where stuff goes if it doesn't get into one of the high-end journals, increasingly people are going straight into one of the big open access journals, such as *PloS ONE.* BioMed Central has one. BMJ Group has one, as does Nature Communications. A lot of the publishers are beginning to open up so that people can get speedy publication if they haven't got into the journal of their choice. That is a good thing. That means we will see authors being able to move on to the next thing rather than spending a lot of their time adapting a paper for yet another journal which is going to reject it and then move on. That is an improvement, in my view.

Q119 Roger Williams: Do you, as individual journals, have some sort of time target by which you will reject their articles, to be fair to the people who are submitting?

Dr Godlee: Absolutely. Again, it is a market. We will try and be as quick as we can so that authors want to send us their next paper. That is an author service that we want to provide.

Robert Campbell: Editors are screening a higher percentage. Where initially they are saying, "This is out of scope for the journal", they send it straight back, so the author is only losing days.

Mayur Amin: Ultimately, good science will find an outlet. To follow up on Fiona Godlee's point, the important thing is to speed up the process—the waiting time between going from one journal to another.

Q120 Roger Williams: So most of your initial decisions are based on an editorial view—on what will have the biggest impact and interest—rather than on the quality of the science.

Dr Sugden: On both.

Q121 Roger Williams: You have already talked about the model that will publish everything that is scientifically sound, regardless of impact and interest. Is there any evidence that that is expanding, in terms of the opportunities for research?

Dr Godlee: I don't know about the scientific reports that *Nature* is launching, but the model of BioMed Central, *PLoS ONE*, BMJ Open and other people who are doing that is very much to say, "We, the editorial group managing these bigger online repository-type journals, will not make a decision about editorial relevance." If it is relevant to two people in the world and can help them with their work, then that is fine, with no limitation on space. We want to make sure that it is properly reported and is valid science. That is the bar that peer review will help us to achieve. It is not an editorial decision but a science decision.

Dr Campbell: In my conversations with scientists, there are people who are sick to death of editors and who value something like, in our case, scientific reports, which have, as Fiona said, no editorial threshold but do have a peer review process just for the validity aspect of it. There are others who want to be a part of the "badge of honour", if you want to use that phrase, of one of the big journals. They will therefore submit themselves to editors.

Q122 Roger Williams: In this initial sorting out of submitted papers, what are the benefits and disadvantages of editorial boards against staff editors?

Dr Godlee: Cost.

Dr Sugden: We don't pay our editorial boards. Most of our submissions will go to one or more members of the board in the first week they arrive. Then the staff editors will make their decision based partly on that advice.

Q123 Roger Williams: Do you all have editorial boards as well as staff editors?

Dr Campbell: *Nature* and the journals do not have editorial boards. We make extensive use of the peer review advice, of course, that we get. We never have had editorial boards. I guess, therefore, that I haven't lived with an editorial board. All I can say is that our ability to act quickly is helped by the fact that we develop our own standards and depend on them.

Dr Godlee: The *BMJ* has a similar process.

Q124 Roger Williams: As staff editors, you have built up terrific expertise and a broad knowledge, but you are miles away from having done the science. Is that an advantage or a disadvantage? Does it give you more objectivity?

Dr Campbell: We are miles away from having done a very particular piece of science, but we have well over 150 post-doctoral editors that we have working for us. They have all done research. They all go to meetings and to labs for several weeks in a year. I think they have a better overview and a better sensitivity to what is important, but we absolutely depend on the peer review expertise even of distinguished scientists. We are more likely to want to go to the post-doc in the lab of a distinguished scientist, because they are the people right now at the cutting edge of fast-moving techniques.

Q125 Stephen Mosley: In previous evidence we have heard claims that the peer review system is in crisis. Professors Fox and Petchey said: "Scientists face strong incentives to submit papers, but little incentive to review." Would you agree with those sentiments?

Robert Campbell: There is no quantitative evidence that it is in crisis. I think the peer review system, as a whole, is more robust than ever. In our submission, we gave you some data that in 2010 we had about 12% more submissions. There was no impact on publishing schedules and no added delays, although we only published 2% more articles, so the rate of rejection was higher. A study has been published in *Nature* by Tim Vines and colleagues where they did try to quantify this issue and tracked all the reviewers. They found that the population of reviewers is increasing with the 3% to 4% increase in the research community, as you would expect. Therefore the load on each reviewer is, if anything, slightly less than 10 years ago.

Q126 Stephen Mosley: I know that in the written evidence, Dr Sugden, you put forward some evidence which said: "For an editor, the process of finding referees can be time-consuming", et cetera. You implied that it can sometimes be difficult to find reviewers. Is that the case?

Dr Sugden: Yes. It is usually because they are over-committed. It is not usually because of an underlying unwillingness to review or about not having an incentive to review. It is simply because they are doing too many other things at the time. It may take us a week or two to find the three referees that we need for a paper sometimes. It is rare that it takes much longer than that.

Q127 Stephen Mosley: You say they are over-committed. Has that changed in recent years or is it the case that it has always been that way?

Dr Sugden: I don't have quantitative data on that. I haven't noticed a particular change in the situation. Others may have.

Mayur Amin: I would agree with Bob Campbell that the potential pool of reviewers has increased in proportion to the number of researchers, because the reviewers come from that research community. There may be issues, I suspect, with geographical imbalances. If you take somewhere like the USA, which produces about 20% of the output of papers, it conducts something like 32% of the reviews in the world, whereas China is producing something like 12% to 15% of the output of papers but is probably only conducting about 4% to 5% of the reviews. This is just a transitionary thing. China and India have grown very fast in the last few years; there are a lot of young researchers who will come up and take their place in peer review and start peer reviewing papers. It is incumbent upon publishers to help out here, both in terms of technical infrastructure to help editors find a broader pool of reviewers, and also in terms of training needs, appointing editorial board members in those developing countries as well as running workshops and providing literature to help train new and young reviewers to come on to the system.

Dr Campbell: As I said in our submission, we are not experiencing problems in finding reviewers for the most part. Interestingly, Nature and the Royal Society co-hosted a discussion of Royal Society research fellows. They are the young researchers who have been given prestigious positions by the Royal Society. There was definitely a sense that their lives were getting more burdensome. Although the numbers are indeed growing, and although some of us are not having this difficulty, the time that academics have available for refereeing is under pressure. That is, therefore, all the more reason for us to support peer review by giving appropriate credit and so on.

Q128 Stephen Mosley: Does the type of peer review that you do have any impact on the number of reviewers you have? I know that the BMJ uses signed open peer review. Other organisations, like PLoS Medicine, tried it and then discontinued it a few years ago. I know that in the BMJ evidence, you talk about a survey that says that 76% did prefer the double blind system. Does the type of peer review have an impact on the supply and number of people who are willing to review?

Dr Godlee: On that, we found that reviewers are willing to review openly and sign their reviews, that authors very much appreciate that and like it. It has been helpful in revealing some undeclared conflicts of interest amongst reviewers. It is a very important process that works well for us. But we are a general medical journal; the point was made in the last session that specialist journals might find it more difficult. We do have people who decline to review for us openly, which is fine, but we haven't found it a problem in terms of recruiting reviewers. One of the aspects of the open review process is that it is part of the credit system. We are beginning to post those online as well so that the reviewers get a credit for that.

Probably it does add a burden. It means they have to do a better job, which is why we do it; that is a good thing. I take Phil's point entirely: scientists are under a lot of pressure on a whole host of things, such as getting funding and the bureaucracy surrounding scientific research, and peer review is just one other thing. Going back to the previous point, the more we can do to make it something that they gain proper recognition for, the better.

Q129 Stephen Mosley: We are going to be moving on to that point in the next question. I will move slightly away from that. We have had some conflicting evidence on cascading of reviews between publications. Do you have any strong views one way or the other?

Dr Sugden: In the sense of sharing reviews between us?

Stephen Mosley: Yes.

Dr Sugden: We haven't done that so far, but we have had conversations with other journals about possibly doing it. We have not taken that leap so far. Within *Science* and its two sister journals, there is the possibility of sharing.

Dr Godlee: Within the *BMJ* and its sister journals, we do the sharing. Some journals are a bit squeamish about the idea of acknowledging that the paper went

somewhere else before it came on to them and would rather not know, but we are very happy to receive a paper. If it has been elsewhere and it is a good paper, we would like to see the reviewers' comments from the previous journal. We also would probably seek our own comments. There is no doubt that there is duplication of effort. That is the point of the question, I suppose.

Dr Campbell: The sharp edge of this issue is whether competing publishers are willing to share their signed referees' reports internally, even if they don't reveal to the authors who the referee was. We have a journal, *Nature Neuroscience,* that has participated in such an experiment. The neuroscience community has done so. We did it with some misgivings because, as I said in our submission, we invest a lot in getting editors out into the field and using referees whom we value because of the relationships that we have developed with them. To hand on, as it were, the outcome of that relationship to a competing publisher is something that hurts slightly. At the same time, you do have this competing interest of the research community to save people work. We found that the uptake of this facility, where authors can elect to have the referees' reports of the rejecting journal handed on to the next publisher, is not very great.

Dr Godlee: They are hoping that the next reviewer will be more positive. That is the answer.

Dr Campbell: Of course, they may decide that they want to have a different set of reviewers anyway.

Mayur Amin: We participate in that same neuroscience consortium. Yes, the results are mixed. There is generally willingness amongst the publishers and editors to participate, but the authors are somewhat reluctant at the moment. There are also some successes. *PLoS ONE* is a good example of one where they are cascading material from their other *PLoS* journals into it. There are other journals such as *Cell*. I think *Nature* practises it. Internal cascading is working. We are trying out a number of areas, largely to reduce the burden on referees and reduce that time.

Chair: We must move on fairly rapidly because we are going to lose a few Members to Welsh Questions; they have come up in the ballot today.

Q130 Gavin Barwell: I want to pick up on an issue that has just been touched on in response to Stephen's questions and to my earlier question as well. Some of the people who submitted to us said that a lack of formal accreditation for peer review is a problem. Several times, in answer to other questions, it has been touched on that some way of recognising those people who are giving their time to this process would be a good thing. Dr Parker of the Royal Society of Chemistry told us last week that, because of the very large numbers of reviewers that journals use, it would be very "challenging" to have an accreditation system. What do the panel members think about that?

Dr Campbell: In principle, I don't think it is. A manuscript tracking system can be easily programmed. If what is needed is that the referees themselves get a proper statement of credit, that is fine. It is equally easy for a journal to decide to publish a list of everyone who has peer reviewed for them over a particular period. Again, a manuscript tracking system should be able to do that very easily. I don't think in principle it is difficult.

Mayur Amin: I would agree. Individual journals practise this already in terms of listing the referees that they have used over the year, particularly recognising the ones who have done a lot of work. Some I know recognise them at conferences and they acknowledge their efforts. With the advent of ORCID, which is this unique author identifier, publishers are all working together to support this system. That may give us an opportunity also to be able to track with an unique identifier those people who have refereed and acted as referees. That may help to provide a stronger accreditation platform than is currently possible.

Dr Sugden: In a journal for which I used to work, I published a list of referees at the end of the year and received a rather anguished phone call from one of them saying, "Now the author", whoever it was, "will know it is me." There can be a downside to that, too.

Q131 Gavin Barwell: Dr Sugden, can I pick up next on something you said in your submission? You said: "We would recommend that journal editors and academies work together to produce guiding principles for the peer review process that can be adopted and used for instruction at the institutional level." Do you think there is a will among publishing organisations to work together to do that?

Dr Sugden: I don't know. It is something that we think would be a good idea. I don't know whether there is a wider desire for that. It springs from the evidence that we have that the quality of peer reviewing is quite variable. That may well have its roots in the quality of training that scientists get, not just between countries but within countries as well. I know that some institutions and some publishers are working on this kind of thing. There was some evidence from the Institute of Physics last week, wasn't there, on this matter? It is a general recommendation.

Mayur Amin: We are already carrying out workshops and trying experiments of training and support. We would welcome and be supportive of any guidelines that come from the industry.

Robert Campbell: It is happening internationally. The International Council for Science is running a meeting later this month on peer review and how it can be improved. The debate is pretty active.

Q132 Gavin Barwell: Mr Amin, Elsevier mentioned in their submission their Reviewer Mentor Programme. How well received was that by higher education institutes? If it was well received, what plans do you have to scale-up that pilot?

Mayur Amin: There was a small-scale pilot where one or two editors and a single institution took on a few post-docs and encouraged them, in a test environment, to peer review and then they were given guidance. That was a manual hands-on approach. That pilot was received very well at that institution and by the people involved. We are now currently looking at how to scale that up and make it much more of an electronic and online system. We are hoping that by early next year we might well have a system to be able to start scaling that up.

Q133 Gavin Barwell: A final question from me, Chairman. Lots of people who gave evidence referred to the way in which peer review publication is being used as a metric in the Research Excellence Framework. Does that put undue pressure on publishing organisations? Has it affected the number and quality of submissions that you have received? Is it a concern on which any of you would like to comment?

Dr Godlee: We definitely see a spike in the months before the deadline. In that sense, yes. We welcome it. From our point of view, it has not been an overwhelming burden. These are good UK papers. All of us would say that we want to attract the best papers and this is a route to doing that. From our point of view, the answer is that it is not a problem.

Dr Campbell: Without wishing to seem flippant, the biggest pressure point of that sort comes in the summer when everybody sends their paper in, goes off on holiday and is therefore unavailable to peer review.

Q134 Graham Stringer: Dr Campbell, a Nobel Laureate has said in the literature that, in this commercially competitive world, top journals such as *Nature* and *Science* are "cutting corners" in looking for positive reviewers of the articles. Is that fair? What are your comments about that?

Dr Campbell: That is completely wrong. I totally refute that statement, as you would expect me to, I am sure. It is not in our interests to cut corners. As I said before, we have one of the most critical audiences in the world, and any paper that makes a strong claim is going to be absolutely hammered in the form of testing in the laboratory or scrutinised in terms of discussions at journal clubs, within universities and so on. It is simply not in our interest, for our reputation in the long run, to publish papers that have any degree of cutting of corners in the assessment process. I am not sure if it was the same person, but someone else also said that we would select reviewers, because we wanted to publish the paper, who would help us publish the paper by being soft. That, again, I refute in exactly the same terms.

Q135 Graham Stringer: Staying on this line for a moment, if you get a hot paper—maybe something confirming cold fusion—which would have worldwide interest, how does that affect your sales?

Dr Campbell: It doesn't have a direct effect on sales. It is another hot paper. Of course, if there is an immediate stream of interest, the chances that people will subscribe to *Nature* or buy a copy of that paper may go up. In no sense, even implicitly within the company, is that particular sort of relationship seen as a measure of success. There is a big barrier of independence, institutionalised within the company, in fact, between the commercial side and the editorial side. I am absolutely charged with making sure that the reputation of the journal is upheld at whatever cost.

Q136 Graham Stringer: We have had discussions in this Committee about published articles. It is fundamental to science that the science that is done is reproducible, yet we found in other inquiries that computer codes are not always available. What is the attitude of the different journals represented here to the complete reproducibility of the science that is described in articles?

Dr Campbell: This is a hot issue as far as I am concerned and it is one where we do need to do some work with the communities. Journals like *Science* and *Nature* will work with the research communities to enforce deposition in databases, for example, if they are publicly available. When it comes to something like software, if you take a discipline like climate change—

Graham Stringer: That is the debate we were having it about.

Dr Campbell: Right. I was talking to a researcher the other day and he had been asked to make his code accessible. He had had to go to the Department of Energy for a grant to make it so. He was asking for $300,000, which was the cost of making that code completely accessible and usable by others. In that particular case the grant was not given. It is a big challenge in computer software and we need to do better than we are doing.

Q137 Graham Stringer: It rather undermines the science if it can't be reproduced, doesn't it?

Dr Campbell: Yes, but there are other ways of doing that. You can allow people to come into your laboratory and use the computer system and test it.

Q138 Graham Stringer: Do you believe that all journals should publish a publication ethics policy?

Dr Campbell: Yes.

Q139 Graham Stringer: Do you?

Dr Campbell: If you look in our *Guide to Authors*, we certainly do have statements about ethics in terms of declarations of conflicts of interests and such things.

Dr Godlee: The BMJ Publishing Group has a policy of transparency. I know that Wiley-Blackwell has an openly published policy. We all hope for a forward-looking, rigorous and ethical policy on transparency. That is one of the big things that journals and publishers should take on as their responsibility because we have the ability to put pressure on the research community to raise their game in a whole host of ways.

Q140 Graham Stringer: Should there be consequences if the policies are not followed?

Dr Godlee: Yes, and there are consequences.

Q141 Graham Stringer: What are the consequences?

Dr Godlee: It would depend on the ethical breach. If it was a plagiarism, then the paper might be retracted or there might be a statement of the offence. The institution would be informed. The author would be penalised via the institution. If it was a duplicate publication or a conflict of interests that was undeclared, all of these things have very straightforward remedies both through the journal and through the institution. The understanding of how to deal with what are now pretty standard ethical

breaches is very well developed. More difficult is what you were discussing earlier where institutions or journals fail to pursue something adequately. The scientific community is probably not doing enough. There may be a further discussion, but the fact that we don't have a proper research integrity oversight body in the UK is a real scandal.

Robert Campbell: We will see publishers investing more in higher ethical standards because, as we have to set apart what we are publishing from all the social media initiatives and the anarchic approach there, the way we can justify what we are doing and what we are charging for it is to have much higher publishing standards. It is something we will all be investing in.

Dr Sugden: For some years now we ask all authors to declare all conflicts of interest before we can even accept the paper for publication. That is quite tight transparency in our author instructions.

Mayur Amin: I would agree. We have similar policies that are made publicly available. There are, again, consequences where people flout those policies. There are retractions and removals in occasional cases, but we have public retractions so that they are visible and the reasons for the retraction of that article are known publicly.

Dr Campbell: If somebody hasn't declared a conflict of interest and it is subsequently uncovered or if somebody does not fulfil one of the conditions of our publication, which is that you will make as much of your research materials as is reasonable available to others, then we will publish a statement next to that paper that makes that clear. In really egregious cases we will go to the head of an institution that employs the scientist concerned.

Q142 Graham Stringer: Let me be clear. If you have plagiarism, fraudulent claims or people not declaring important conflicts of interest, will you always publish that in subsequent journals?

Mayur Amin: If it comes to our attention, absolutely, yes.

Dr Godlee: We would publish a correction.

Q143 Graham Stringer: Is that standard throughout the industry?

Robert Campbell: I think it will be. The industry is developing—you may have come across it in the submissions—a new project called CrossMark. Every paper that has gone through the peer review process has the ongoing stewardship of the publisher picking up on retractions or corrections. By clicking on to the CrossMark logo, you can go to the metadata and find out if there have been any updates or even retractions. That is a technical solution which is being launched this year.

Dr Campbell: One of the ways in which you can highlight misconduct is to write about it in our magazine pages. We are constrained in that respect. In a recent case, a retraction had to be issued and the author of the paper wanted to highlight the fact that the reason for the retraction was a misconduct case that had been investigated by the university. We published the retraction but we found that we were not able to include the material about why because of the current libel laws. I do want to impress on this Committee, given the draft Defamation Bill that is under consideration, that it is something that really does affect us in many ways.

Dr Godlee: I would like to make a brief point about the hot papers. I agree with Phil that it is in no journal's interest to publish hot papers that turn out to be invalid. Editorial decisions are too often directly influenced by reprint revenue. Medical journals publish articles which then get sold on. I defy any editor who is presented with a large drug trial not to know, as they are accepting that trial, that it will generate revenue for their journal. It is an enormous industry. It is an enormous part of the revenue streams of publishers both in the US and the UK. I would say less so for the BMJ but it is an issue. Something that would be really interesting for this Committee to look at would be what is reprint revenue, how does it influence editorial decisions and is it a good thing? Publishers benefit, but I don't think science benefits.

Chair: That takes us neatly to a question that Stephen is going to ask.

Q144 Stephen Metcalfe: Dr Sugden, in your submission, you referred to the fact that the US Congress has codified the use of peer review in Government regulations. Can you explain how that works and what the consequences are?

Dr Sugden: You have got me more or less at the limits of my knowledge on that, I am afraid. This was something that came in, I think, in the early 1990s, with the case of Daubert *v.* Merrell Dow Pharmaceuticals. The result of that was that the Supreme Court decided on the standards of scientific evidence—I am not sure if I am going to get this right—that should be applied in court. That standard was defined, partly, on the basis of it being peer reviewed. I can find out more.

Q145 Stephen Metcalfe: That may well be useful. Do you think there is a need to do something similar here in the UK?

Dr Sugden: I am not sure that it is for me to say. Perhaps my colleague would know if there is anything of that kind here. I am not aware that there is, but I think it would be useful.

Q146 Stephen Metcalfe: You think it would be useful.

Dr Sugden: I think it would be useful, yes.

Q147 Stephen Metcalfe: Do you think it would have any effect on the quality of the publications if you know that your articles are then being peer reviewed but they can then be used in Government regulations or the courtroom? Do you think that drives standards?

Dr Sugden: I honestly don't know. I am not sure that it would affect it, but I don't know, because you don't know what future cases that evidence might be used in.

Q148 Stephen Metcalfe: As far as you are aware at the moment, are any of the UK scientific advisory groups mandated to use peer-reviewed literature?

Dr Sugden: Not that I am aware of.

Stephen Metcalfe: Perhaps it is an area that we need to look at in some detail elsewhere. Thank you.

Q149 Pamela Nash: I am aware that we have only a few minutes left, so I will try and put all my questions into one and I would ask you to keep your answers quite brief. I want to move on to international issues with peer review. Is there any difference between the standards of peer review, both in terms of the journals and the referees, in different countries and areas of the world? Also, do you have any experience of there being an additional burden placed on peer reviewers, either in the UK or in other established scientific communities with the increase in research that is coming from emerging scientific nations, such as China? Are any of your publications involved in training with reviewers from overseas? I know you touched on that earlier, Mr Campbell.
Dr Godlee: One of the issues that I am most aware of, and this is a brief point, is that American peer reviewers are prone to publish and to push for American work. There is a terrific American bias in PubMed, which is hard to address. There are differences in attitude to research in different countries. In terms of the quality, that is a matter of resourcing. Many countries in the world cannot afford the kind of publication processes that we are talking about. That is a big problem. As was mentioned, there will be a transition where the developing world will rely on the developed world for peer review for a while until systems get developed.
Robert Campbell: We have been carrying out a lot of training since 2005 in China, particularly in chemistry. We are increasing the percentage of peer reviewing from China now. It is still not parity but it is moving towards 20% of our papers. I am sure that the others are doing the same thing.
Dr Godlee: Yes. We are involved closely in training in Africa, China and India at the moment. It is exactly similar.
Mayur Amin: I would not say, necessarily, that the standards themselves vary internationally across regions, but maybe the practices do. Maybe that is partly to do with experience. Interestingly, in the case of one particular journal, I have an anecdotal piece of evidence. There was a sense that, if we appointed members of the board of a journal in China to peer review material in China, they might be softer on that material. In fact the contrary was the case. Reviewers in China are harder on material that comes out from China than, say, people in the UK were. There is a tendency for people in the UK and the US to be seen to be not overly critical of material that is coming out of scientifically developing nations. My sense is that the developing nations and other nations will come up to a level of practice that is seen in the UK and the US. Certainly publishers and all participants have a role to play in training and also supporting that mechanism.
Dr Sugden: The increased mobility of scientists over the past couple of decades has evened out the quality, in terms of the peer review we get. We try very hard to recruit referees from any good scientific centre, wherever it is.
Robert Campbell: Duplication is also a problem where English is the second or third language. Authors are more inclined to copy text as it gets their message over much more easily than they can by re-writing it. We do pick up more duplication from some areas overseas. As you will have read in the submissions, publishers have set up a system called CrossCheck for picking up duplication. That is being taken up at a good speed. About 20,000 submissions a month are now being processed through CrossCheck. By the end of this year, about 10% of all submissions will be scrutinised through CrossCheck for duplication, which can mean plagiarism.
Dr Campbell: I wouldn't deny that the countries in which our referees are working are hugely skewed towards the developed scientific nations. I guess that is because that's where we feel safe. Nationality and the point of origin is never an issue in the choice of a referee. There is no question about that. Also, I am sure we are all aware of the growth of science in China and the way in which that is being spurred by people coming over, having spent time in other countries. We are engaging with the Chinese community in a way that will increase referees from there, especially.

Q150 Chair: I have a final couple of questions. Dr Sugden, you said that there is a challenge in providing confidential access to large and complex datasets during peer review. You touched on this slightly with Graham's questions about large datasets. Why are there currently no databases that allow for secure posting during the peer review process?
Dr Sugden: I am not sure that I can answer that. The challenge is, essentially, because we use a blind peer review system. We don't want the author to know who the referee is. If the author is the person who is hosting the dataset, that can be an issue.

Q151 Chair: There are ways round that, surely.
Dr Sugden: There are, but it can be time-consuming.

Q152 Chair: Even in the cases of very large, voluminous datasets, they may not easily be uploaded online, but a DVD could be sent to the publisher and that could be put on a secure site.
Dr Sugden: Yes. There are a number of ways in which it can be done.

Q153 Chair: So there is an answer to the question that Graham raised about the specific issue that cropped up in the climate change inquiries. There would be a way mechanically of doing that, would there not? One of you mentioned a $300,000 grant.
Dr Campbell: That was for software. I understood that question to be about software and not data.

Q154 Chair: What I couldn't understand about your answer was that that software must exist, otherwise the researcher couldn't have read his own research.
Dr Campbell: Of course you can just send people the software, but you will find that this is not off-the-shelf software. This has been specifically built for the system. You can't just transport it elsewhere without doing extra work to make it transportable.

Q155 Chair: That applies just as much for any piece of laboratory equipment.
Dr Campbell: Yes, it does.

Q156 Chair: Lots of laboratory equipment is custom made. You can describe it in your text.
Dr Campbell: You can describe it, absolutely. The policy that we have with a computer code is that you do have to describe the algorithm. We do have a policy of that sort.
Dr Godlee: For clinical data we have a big challenge, but it is one that we must head up. The journals must move to a mandatory approach.

Q157 Chair: Presumably, part of the challenge in clinical data is because of patient confidentiality.
Dr Godlee: That is a challenge, but when one is talking about large datasets, confidentiality has already been dealt with, and we should not use that as an excuse for not looking at this. There are no doubt practical issues, but it would be great if this Committee were to give a push forward for the kind of approach that, nationally, we ought to have systems for data depositioning. The practical problems will be resolved, as with trial registration, which seemed impossible five or 10 years ago, and it is now routine.

Q158 Chair: Do you all offer post-publication commenting for all of your journals?
Dr Godlee: Yes.
Dr Campbell: Only some of our journals at the moment. We are introducing it.

Q159 Chair: If there were a growth in post-publication reviews, would there be a lower expectation of pre-publication review?
Dr Sugden: No.

Q160 Chair: One doesn't cancel out the other.
Dr Sugden: No, I don't think so.
Mayur Amin: There needs to be a fundamental difference between first publication commentary as a supplement to the peer review process as opposed to post-publication commentary as a substitute for the peer review process. I don't think it will act as a substitute because peer review doesn't just comment on the paper; it helps to improve the paper. But you will end up with less quality or even bad science being made public. People may not comment on it. Therefore, lack of commentary doesn't mean that the paper is good or bad. It will just stay in the public domain.
Dr Godlee: I wouldn't want this Committee to go away with the view that because we all nod dutifully and say that we have post-publication peer review, that is the case across the industry. There are great variations. Some journals exercise a liberal view, which is the *BMJ*'s view. Others have a much more editorially tight control over what gets written, post-publication. In some cases that I am aware of, critical comment about papers does not get out into the public domain. The other problem is that even when it does, the authors often don't respond. One is left with a situation that is far from perfect. There is a lot of progress with the internet but it is still not perfect.
Chair: Thank you very much. We have at least a couple of promises for some additional information from Mr Amin and Dr Sugden. That would be extremely helpful. Any other comments that you would like to add would be extremely helpful. It has been a very interesting morning. Thank you very much for your contributions.

Monday 23 May 2011

Members present:

Andrew Miller (Chair)

Gavin Barwell
Stephen McPartland
Stephen Metcalfe
Graham Stringer
Roger Williams

Examination of Witnesses

Witnesses: **Dr Rebecca Lawrence,** Director, New Product Development, Faculty of 1000 Ltd, **Dr Michaela Torkar,** Editorial Director, BioMed Central, **Dr Mark Patterson,** Director of Publishing, Public Library of Science, and **Dr Malcolm Read OBE,** Executive Secretary, JISC, gave evidence.

Q161 Chair: Welcome, everyone. Thank you for coming in this afternoon. Perhaps it would be helpful if you could introduce yourselves.

Dr Lawrence: I am Rebecca Lawrence. I am from Faculty of 1000.

Dr Patterson: I am Mark Patterson. I am Director of Publishing at the Public Library of Science.

Dr Read: I am Malcolm Read, the Executive Secretary of JISC.

Dr Torkar: I am Michaela Torkar, Editorial Director of BioMed Central.

Q162 Chair: Thank you. We have heard that pre-publication peer review in most journals can be split, broadly, into a technical assessment and an impact assessment. Is it important to have both? Before I ask you, as you are a panel of four, if you want to say anything but feel that you cannot get your two pennyworth in, please feel free to add any further comments in writing after the session. Who is going to start?

Dr Torkar: I guess that you are asking about the importance of impact and scientific soundness. It is fairly straightforward to think about scientific soundness because it should be the fundamental goal of the peer review process that we ensure all the publications are well controlled, that the conclusions are supported and that the study design is appropriate. That is fairly straightforward as a very important aspect which should be addressed as part of the peer review process.

The question of the importance of impact is more difficult. When we think about high impact papers we think about those studies which describe findings that are far reaching and could influence a wide range of scientific communities and inform their next-stage experiments. Therefore, it is quite important to have journals that are selective and reach out to a broad readership, but the assessment of what is important can be quite subjective. That is why it is important, also, to give space to smaller studies that present incremental advances. Collectively, they can actually move fields forward in the long term.

Dr Patterson: If I may add a couple of points, both these tasks add something to the research communication process. Traditionally, technical assessment and impact assessment are wrapped up in a single process that happens before publication. We think there is an opportunity and, potentially, a lot to be gained from decoupling these two processes into processes best carried out before publication and those better left until after publication.

One way to look at this is as follows. About 1.5 million articles are published every year. Before any of them are published, they are sorted into 25,000 different journals. So the journals are like a massive filtering and sorting process that goes on before publication. The question we have been thinking about is whether that is the right way to organise research. There are benefits to focusing on just the technical assessment before publication and the impact assessment after publication. That becomes possible because of the medium that we have to use now. The 25,000 journal system is basically one that has evolved and adapted in a print medium. Online we have the opportunity to rethink, completely, how that works. Both are important, but we think that, potentially, they can be decoupled. That is obviously how the idea of *PLoS ONE* came about, but also certain other things that happen after publication.

Dr Lawrence: I would add that often it is not known immediately how important something is. In fact, it takes quite a while to understand its impact. Also, what is important to some people may not be to others. A small piece of research may be very important if you are working in that key area. Therefore, the impact side of it is very subjective.

Dr Read: That is very much a point I would make. Separating the two is important because of the time scale over which you get your answer. The impact is much longer. I guess the technical peer review is a shorter-term issue.

Q163 Chair: Of course, there are some who take the view that the process of peer review itself stifles innovation and perpetuates the status quo. How big a problem is that, or is that overstating it?

Dr Read: I would have thought that sounds a bit overstated as peer review, in one form or another, has been an underpinning aspect of research—arguably, even before journals as we know them existed.

Dr Patterson: I support that. I am not sure it is a massive problem. When a piece of work is arguing against the received wisdom, perhaps naturally, it can be a bit tougher to get it published. In a way, that is as it should be. If it is a grand claim, there probably needs to be stronger evidence to support it. The peer review process enables that to be examined. It is possible that personal biases and prejudices more associated with the conventional wisdom might come

into play and make it even more difficult. You could argue that there is also a case there for focusing just on technical rigour beforehand which might ease the passage of work like that. Even then, it still has to pass rigorous tests in order to get into the literature.

Dr Read: It gets interesting because I notice one of the other observations you have made is that most articles get published somewhere, even if they have been rejected by peer review. Maybe that cuts against the conservatism, meaning you might not get published by the more conservative journals but you might get published eventually.

Chair: The four of you are basically arguing for the continuation of the process but finessing it. I know that Dr Patterson has some particularly interesting views, and perhaps Roger can pick up there.

Q164 Roger Williams: Thank you very much. These questions are directed very much to Dr Patterson but not solely to him if others want to come in. I think your journal publishes 69% of all submitted articles. Does that mean the other 31% are technically unsound?

Dr Patterson: You are correct that it is about 69%, but that doesn't really mean we reject the other 31%. Some of them are "lost" in the sense that they may be sent back for revision—maybe 5% to 10% are sent back for revision[1]—and the others are rejected, as they should be, on the grounds that they don't satisfy technical requirements. We have done some work to look at the fate of those manuscripts. We did some author research in the last couple of years and we have seen that, in both cases, according to the authors' responses, about 40% of rejected manuscripts have been accepted for publication in another journal. There are probably several reasons for that. One is that some of them will have been rejected by *PLoS ONE* because they are hypotheses or perspectives and are out of scope, or something like that. We publish original research in *PLoS ONE*, so that is fair enough. They end up being published somewhere because there are appropriate venues. Other authors may have gone away and chanced their arm at another journal and got through their peer review process.

Q165 Roger Williams: Is that without being refined?

Dr Patterson: That we don't know. They may have been revised. As the *PLoS ONE* process isn't perfect, another chunk will have been rejected inappropriately. We know there are some such articles. The academic world reviewers tend to get in the mode of peer review but we are doing something different and we have to try to get that message across. So there will be a small batch that is rejected inappropriately.

Q166 Roger Williams: Your *PLoS ONE* website indicates that you have fast publication times. How much faster are you than other journals in that sense?

Dr Patterson: What we are trying to do on *PLoS ONE* is balance speed—lots and lots of surveys have said that speed in publishing is really important to authors—against a process that is sufficiently robust, both editorially and in the production process, to give rise to a high quality product at the end of the day. We are on the fast side, although I don't think we can claim to be super-fast. But the real benefit in *PLoS ONE,* which is relevant to speed, is that authors won't be asked to revise their manuscripts to raise them up a level or two. With a lot of journals, you get asked to do more experiments to raise it up to the standard that particular journal wants. That doesn't and shouldn't happen at *PLoS ONE.* As long as the work is judged to be rigorous, it is fine. The amount of revision can be quite a lot less because authors are asked to do it in that way and that can really reduce the overall time from submission to publication.

There is another way in which I think *PLoS ONE* accelerates research communication generally. Often, articles are submitted to journal *A* and are rejected as not being up to standard. They go to journal *B* and then journal *C* and, eventually, are published. If you have a robust piece of work it will be published in *PLoS ONE* as long as it passes the criteria for publication. You will not have to fight with editors who are trying to argue for a certain standard. I think those two other things really have the potential to accelerate research communication broadly.

Q167 Roger Williams: Is light copy editing a feature of how you can deliver faster times?

Dr Patterson: Again, we are balancing these two competing interests of speed and quality. In our production process we focus on delivering really well structured files that will be computable, for example. We don't expend effort in changing the narrative. Scientific articles aren't works of literature. That is not to say it wouldn't be nice if, sometimes, a bit more attention was paid to that. It is also true that one of the criteria for *PLoS ONE* is that the work is in intelligible English. If an editor or reviewer thinks that something is just not good enough and they can't really see what is happening, it will be returned to the author.

Q168 Roger Williams: Should it be intelligible to your target audience or a broader audience?

Dr Patterson: The research audience, which is the primary audience. Yes, that is what I mean. We are focusing more on technical quality. We also put more onus on the authors to take responsibility for the content, and we will turn a manuscript away if it is really not comprehensible.

Q169 Roger Williams: Are there any other corners that your journal "cuts" in order to deliver faster times?

Dr Patterson: I wouldn't frame it that way. What we are doing is trying to identify and take away any unnecessary barrier to publication. We could probably do a lot more. Our times are okay. As I say, they are not super-fast but they are on the fast side. There is certainly more we could do to streamline the process and make it more efficient.

Q170 Roger Williams: Has your approach and the reputation you have built up resulted in a lot more submissions?

[1] Note by witness: ... and are not resubmitted. This is an important clarification because the vast majority of articles are sent for revision and are ultimately resubmitted.

Dr Patterson: *PLoS ONE* was launched in December 2006 and is still quite a new journal. It is only four and a half years' old. We published about 4,000 articles in 2009 and 6,700 last year, so it became the biggest peer-reviewed journal in existence in four years. It has grown steadily over that time. I am sorry, I have lost the thread.

Q171 Roger Williams: Has your approach and the reputation and impact of the journal itself increased the number of submissions?
Dr Patterson: It has. We see a lot of positive feedback. Going back to my previous comment, the message that if I have a solid piece of work I'm not going to have to grapple with a journal that is basically biased against publication—the goal of *PLoS ONE* is to publish all rigorous science—is a very positive one which authors like. Coupled with ideas about how, then, you might assess the impact after publication, it is definitely gaining ground.
The other very significant thing that has happened in the last nine to 12 months is that eight or more big publishers have announced *PLoS ONE* lookalikes, essentially. That is very striking. The American Institute of Physics and the American Physical Society have both launched physical science versions; Sage has launched a social science version; the BMJ group, who were actually the first, last year launched a clinical research version of *PLoS ONE*; *Nature* has launched a natural science version of *PLoS ONE*, and on it goes. The model is getting that level of endorsement from major publishers and I think, again, that is probably helping to make researchers very comfortable with the way in which *PLoS ONE* works.

Q172 Roger Williams: But will you be a victim of your own success? Will you be overwhelmed by the volume of submissions and then your time to publication suffers as a result?
Dr Patterson: I certainly hope not. The growth has been pretty spectacular and has definitely surpassed our expectations. The people who work on *PLoS ONE* are fantastic. Everyone at PLoS somehow gets involved with *PLoS ONE*. As to the academic community, the 1,600 members of the editorial board have been terrific in stepping up to the plate and helping to make *PLoS ONE* work. Probably one of the things that has helped to make *PLoS* a success is that it was born within the scientific community. Its founders are three fantastic scientists. We have always had that sense of support from the scientific community and there is no question but that that has really helped us.

Q173 Roger Williams: Do you believe that this approach has had an effect on the peer review process perhaps in terms of timing, quality and ease of recruiting or having access to reviewers?
Dr Patterson: It is beginning to. *PLoS ONE* has grown very rapidly in the space of four years to become a very big journal. There are now another eight to 10 on the scene that are being launched, or are about to be launched. If another 10, 20 or 30 of these are launched over the next one to two years, which I think is quite likely—because a lot of publishers will be looking very hard and thinking that if they don't get involved they will potentially lose out—that could make some fairly substantial changes in the way the pre-publication peer review process works. There is a lot to say about post-publication but not yet. So I think the model could change. The benefit will be the acceleration of research communication because you avoid bouncing from one journal to another until you eventually get published. That is a tremendous potential benefit.

Q174 Chair: In your earlier answer you referred to internal research that you have undertaken. Is that in a form we could have sight of?
Dr Patterson: I can send you the links. There are two presentations on SlideShare. They are publicly available.
Chair: That would be very helpful.

Q175 Stephen Metcalfe: There is a move towards greater use of online communication systems. Are there any general guidelines that you think would improve the peer review system and make it more effective and efficient on those kinds of platforms?
Dr Patterson: Are you talking about the tools that you use to administer peer review?
Stephen Metcalfe: Yes.
Dr Patterson: I think the questions are really the same, apart from the fact that we are focusing on technical rigour and defining what those questions are. Those are not new concepts. *PLoS ONE* isn't such a radical departure. It is a very simple idea. We are not really changing the idea that rigorous work should be reviewed properly before publication.

Q176 Stephen Metcalfe: You wouldn't describe your approach as "light touch"?
Dr Patterson: No, not at all. It is important to consider not just the peer review process but everything that goes on before an article is accepted for publication as being critical steps in quality control. There are several components to that, of which peer review is one. At *PLoS ONE* staff are involved in the first step. It goes through a series of quality control steps which are focused. Basically, we want to take stuff away from the academics so that they can focus on the science and we can sort out everything else. We focus on things like whether the competing interest statements are properly indicated; financial disclosures; if the work concerns human participants whether there is an ethics statement and appropriate ethical approval—a whole series of things like that. Hardly any manuscripts get through that without some kind of query going back to the author.
Then there is a step where we involve PhD scientists who scan the work. These are people who have some level of subject expertise. Some—not many—of the submissions are rejected at that point because they are completely out of scope or something. They are also looking for any articles on controversial topics or anything that might require special treatment. They flag work like that. The work then goes to the editors whose responsibility it is to take on the peer review process. It is a pretty involved process.

The peer review part then focuses on seven criteria to do with whether the methodology and analysis are appropriate; whether the conclusions are justified; whether the work is ethically sound and properly reported; and whether data is available as appropriate. There is a set of seven criteria. To decide whether a work is rigorous is not a straightforward task.

Q177 Stephen Metcalfe: Is one of those seven criteria to check that the work has been put into the proper context of existing literature, for example, knowledge about researches and data or something?
Dr Patterson: Yes. One of the criteria is that it is an original piece of work. In that sense, the editor and reviewers will be judging whether, in relation to what has already been published, the work is an original piece of work which deserves to be part of the scientific literature somewhere. Although we don't explicitly state that, it is implicit in that requirement.

Q178 Stephen Metcalfe: The responsibility for that falls on the reviewer, doesn't it?
Dr Patterson: Ultimately, the editor. Their name goes on the paper, so there is a level of accountability. That is something we do across all the PLoS journals. Every article published in a PLoS journal has, associated with it, an academic editor who in some way has been involved in the assessment of the work before publication.

Q179 Stephen Metcalfe: Dr Torkar, what has been the initial outcome of the *BMC Biology* experimental policy which allows authors to decide whether or not the referees see their papers again after revision? Has that worked?
Dr Torkar: Yes, that has been quite successful. A lot of authors take up that option. To explain that process briefly, submissions are usually screened by the editorial team. There is quite a high rejection rate at that point. They will often consult with their editorial board to ask about the question of impact at that point. Is this a sufficiently interesting contribution for a journal like *BMC Biology* which has a higher threshold and is meant to be a broad interest journal? They have a high rejection rate at that point. Of those manuscripts that go to peer reviewers about 60% are either rejected or require only minor revisions, so there wouldn't be a requirement for a re-review anyway. Of the remaining 40% of authors who are offered the option of peer review opt-out, more than half will take it up. The editorial team will make a clear decision after the first round of peer review to make sure that they are very clear in their instructions to the authors about what needs to be done. They will then assess the revised manuscript when it comes back and they will usually go ahead with publication without re-review. I think there were only a couple of cases where that really wasn't possible for some reason. If the revisions aren't as extensive as they should be—say, some of the conclusions aren't put sufficiently into context to show there are some limitations to the study—they will commission a commentary which is published alongside the paper. That is written by an expert who will put it in context and point out those limitations just to make sure that non-expert readers understand that there might be some problems.

Q180 Stephen Metcalfe: Therefore, that puts more responsibility on the author to carry out that work and also moves the burden from the reviewer to the experts who commentate on it afterwards?
Dr Torkar: Yes, to some extent. Often that expert will have been an original reviewer and is quite familiar with the manuscript or study. To complete the story, there is some pressure on those people to put it in context.

Q181 Stephen Metcalfe: How widely used is the system of cascading submissions and reviews from one journal to another?
Dr Torkar: I am sure Mark has something to say about that. We use this quite extensively at BioMed Central and, in particular, with the BMC series which is more or less our equivalent of *PLoS ONE* and was launched in 2001. It is a group of more than 60 community journals which are subject specific: *BMC Immunology*, *BMC Genetics*, etc. As they also have the premise of publishing all scientifically sound studies without putting too much emphasis on the impact and extent of the advance, they will consider manuscripts that were previously peer reviewed or submitted to some of our flagship journals. Sometimes the transfers will happen before the peer review and sometimes with the reviewers' reports. That does save time for authors and reduces the burden on the peer reviewers who don't have to re-review manuscripts for multiple journals.
Dr Patterson: Cascading peer review is a phenomenon that exists at PLoS in its two flagship journals *PLoS Biology* and *PLoS Medicine*. Articles can be transferred from there to other journals. To give you a sense of the size of that, about 10% to 15% of submissions to *PLoS ONE* come from other PLoS journals. It is pretty clear that, internally, that works quite well. A lot of publishers think so and quite a lot of the evidence has shown that.
The much more problematic issue is the sharing of reviews from one publisher to another. I know you heard some talk about the Neuroscience Peer Review Consortium experiment which, interestingly, was not terribly popular with authors, but I am not sure how much publishers were really behind it. For example, it was said that some publishers might feel reluctant to share reviews with another journal or publisher because they have built up relationships with these people and there is some commercial value associated with that. When you hear that you have to ask whether that sense of ownership is in the best interests of science. I am not convinced. That is a question worth asking.
To complete the thought, it is quite natural that journals would feel that way in a world of subscriptions because it is about selling a package of content to a group of readers. That is how the model works. Therefore, anything which allows you to improve that package of content is of value to you commercially. In a way, it is completely understandable that journals in that subscription business model would be reluctant to share their

reviews. When you switch round the model, as BMC, PLoS and many others do now, in terms of supporting and publishing through a publication fee, considering yourselves, as publishers, much more as service providers—you are selling a publishing service to a researcher—your attitude towards sharing peer reviews might be changed. I am not sure.

Q182 Stephen Metcalfe: You are saying that those are two conflicting forces, so the model that is being adopted will affect what system will work.
Dr Patterson: I think it will influence the attitude of the publisher and the journal towards sharing that kind of information.

Q183 Stephen Metcalfe: But which one is in the best interests of science?
Dr Patterson: You probably know what I would say. I would say that sharing is generally better.

Q184 Stephen Metcalfe: Do you all agree with that?
Dr Torkar: Yes, I would agree. We have one journal that is signed up to the Neuroscience Peer Review Consortium: *Neural Development*. We haven't seen that much uptake from authors, but we would welcome it—in both directions: sharing our reports and going backwards. Ultimately, we want to get the publications that are worth publishing out there.
Dr Patterson: The whole issue goes away with the "publish rigorous science first, sort it out later" model in terms of impact, relevance and so on because then you don't have this cascade from one journal to another.

Q185 Stephen McPartland: I would like to turn to value for money. The Joint Information Systems Committee has estimated that the cost to higher education institutions from staff time spent on peer review is between £110 million to £165 million per year. Do you think this is an acceptable cost to higher education institutions which is almost a subsidy to publishers?
Dr Read: I think it is an acceptable part of the scientific process. Of course, the reviewers get a great deal of benefit from doing it. They get early sight of research articles and, particularly if they are an editor, they will also get quite a bit of added standing in their discipline. So I don't think the research community would feel it was an unacceptable activity.
Where we have a worry is if scientists had to spend more time on peer review proportionally to their science. If that starts to escalate, as it is, certainly at the moment, perhaps for the medium term, then there is a concern because less actual research will get done. This is because of the significant increase in research output from Asia where the majority of the peer review is still being done in the western world. One would like to think that sorts itself out over a certain period of time. I don't think researchers would feel this is a particularly burdensome call on their time as long as it doesn't get out of hand.

Q186 Stephen McPartland: Allegedly Vitae, the UK organisation that champions personal and professional standards for research staff, suggests that a lot of peer review is done in their own time because of what you are suggesting, Dr Read. It is starting to get out of hand and many people have to do large amounts at work and then also go home and do large amounts. They feel that if they don't they will lose their standing in the community.
Dr Read: I think that is true. But I don't know that many researchers particularly feel they have a nine-to-five existence anyway. So I am not sure to what extent they would particularly resent this. I don't think there is a nine-to-five mentality in the research community.

Q187 Stephen McPartland: Do you feel they should have some kind of recognition?
Dr Read: That is why, perhaps, greater transparency in the peer review process might work well. They wouldn't get external recognition for peer review work, of course, but the fact that they are peer reviewing would be known to their peers. Being an editor would give you external recognition. I think you raise a good point there, that some form of recognition of the contribution they make in peer review would be welcome.

Q188 Stephen McPartland: Do you feel, outside their peers, their academic institutions take into account the amount of peer review that some of their staff have to take on board outside working hours?
Dr Read: Yes, I would say so.

Q189 Stephen McPartland: Do you feel that higher education institutions and researchers effectively get value for money?
Dr Read: Many people would feel that the whole publishing process doesn't represent value for money, which is perhaps where you were leading but not the particular point you make. A model where library budgets have to pay for journals rather than it being a direct part of the research costs is leading to strains in universities and is getting very serious. Of course, it is a no-win situation. If library budgets get cut and the cost of journals and the amount of publications continue to rise, as they are, researchers will get less access to those journals. There is no obvious way of breaking that particularly difficult chain. I think many people would argue that the publishing industry is not good value for money and there should be cheaper and more modern ways of disseminating the outputs of research.

Q190 Stephen McPartland: Would anybody else like to comment?
Dr Patterson: I would agree with a lot of that. It is a really good question to ask. What is the value that we are getting out of the £120 million to £160 million every year? Moving away from a cascading model for journals sorting content could help to generate greater value for money because the burden on reviewers becomes less if they don't have to review things that are being submitted to multiple journals. That would help, potentially.

I very much agree with the idea that there is a lot of opportunity to recognise the contribution peer reviewers make. I know that project ORCID, which stands for Open Researcher and Contributor ID—it is a unique ID for people contributing to research communication—would really help to identify who has done what peer review. Obviously, it depends on peer review policy as to what you can and cannot make openly available. I think there is also an argument for moving towards more transparent systems of peer review because there are real benefits in providing better and more open recognition of the contribution. There is a lot that could be explored in terms of getting more value for money and more efficiency out of the peer review process.

Q191 Gavin Barwell: I apologise for not being here at the start of the session. I want to ask a question about ethics, essentially. Perhaps I may start with Drs Torkar and Patterson. Do all of your journals have a publicly-declared ethics policy? If they do, what processes do you have to ensure that they are complied with?

Dr Torkar: BioMed Central and, as Mark will confirm, PLoS are members of COPE and have been pretty much from the start. I think you have had a representative of COPE on a previous panel. We put a lot of emphasis on ethical issues. We have clearly defined policies for authors as part of our information, we ensure that authors and referees declare their conflicts of interest and we follow those guidelines very strictly. We work closely with our external editors to ensure that they follow the guidelines. The short answer is that we take that very seriously.

Dr Patterson: It is pretty similar at PLoS. We have policies available on the website. Maybe one thing to add is that we are lucky in that one of our chief editors of *PLoS Medicine* is the secretary of COPE. We take publishing ethics very seriously across the board. You have heard talk of new tools for plagiarism screening. We are planning a pilot in that area in the next few months. We have been doing some work on figure checking, looking for evidence of figure manipulation which occurs sometimes. So we have also done some work on that. It is a very similar story to what you have heard from most of the publishers from whom you have taken evidence.

Q192 Gavin Barwell: How important do you think it is to have an online record of pre-publication history: correspondence between reviewers, authors and editors? What approach do you take to those issues?

Dr Patterson: I think it is an absolutely requirement. Any reputable publisher has to have those kinds of records. These days there are standard systems which support the editorial process and provide the mechanisms you need to archive and keep all that correspondence.

Dr Torkar: The same is true for us. As you might have seen from our contribution, we have a whole series of medical journals that even make the pre-publication history publicly available. You can access, with a published article, what the peer reviewer said and how the manuscript was revised. It is a very transparent way of seeing how the system works and the sort of records we keep.

Q193 Gavin Barwell: We received mixed submissions on this point. Some people suggested they didn't think there was any real demand for people to wade through all of this copious information. Do you monitor how much and to what extent people look at all of that online?

Dr Patterson: It is not available and so is not public, except for the system Michaela described. Medical journals release a lot of the peer review information. We don't do that yet, although we are certainly looking at it. It is for internal record keeping. You need them if a dispute occurs two or three years later about some aspect of priority in terms of who discovered what and when or there are some shenanigans in the peer review process that people want to investigate. They are also a fabulous tool to help support the editorial process, in the sense that if you get a new manuscript in a certain area you can then go back, it reminds you of something and you can rediscover what went on. That can help you with the editorial process on a new manuscript.

Q194 Gavin Barwell: But you make it publicly available?

Dr Torkar: Only on a subset of our journals. We decided at some point that that would make it very transparent, but it is only on the medical BMC series journals. There are about 40 journals.

Q195 Gavin Barwell: What is the reason for doing it on those journals and not others?

Dr Torkar: It is probably historical. Also, we feel in the medical community there is more acceptance of a very transparent model like this. Experience so far shows that rejection rates are very similar. It certainly has no negative impact on the peer review process and it makes it all quite transparent. It is not clear that the biology community would be quite as open to this model, but there are also experiments going on with different journals and different publishers to look at that.

Q196 Gavin Barwell: What are the retraction rates for your journals? Are there any significant differences in the percentages of retractions published by different types of publishers and people using different types of peer review?

Dr Patterson: I don't think so. Retractions happen and they need to happen, occasionally. There was an observation that one tended to see more retractions in the really high profile journals where the potential rewards are higher and so on, but I don't have hard data to back up that assertion. I read it somewhere.

Dr Torkar: I can't expand on this with data.

Q197 Gavin Barwell: My final question is to Dr Lawrence. Faculty of 1000 evaluates published research. If an error is found within the original article, how do you deal with retractions?

Dr Lawrence: I should point out that there are two parts to this. The main part of Faculty of 1000 is the positive post-publication evaluation service. What I mean is that we don't criticise papers we think are poor. Our faculty of 10,000 researchers highlights papers it thinks are particularly important, irrespective of where they are published. About 86% of those evaluated are not in what you would think of as the top journals, which suggests there is a lot of very important research in the other journals. It only highlights, as I say, the interesting stuff.

As to retractions, I am not aware of any that have been picked up that have subsequently been retracted. But we also have a dissent option. In the case of quite a few of our top evaluated articles, where several faculty members have evaluated them and said, "These are really good papers", subsequently a faculty member has come along and said, "I don't agree. I think there are problems with it." We have a system like that.[2]

Q198 Graham Stringer: I have one ethical question following what Gavin has just asked. How much commercial pressure is there from pharmaceutical companies to publish, to take just one example, and how does that commercial pressure interfere with the publication? A journal that publishes a paper which means doctors can prescribe a particular drug stands to make a lot of money, doesn't it? How is that pressure dealt with ethically?

Dr Patterson: This is an issue which has certainly been highlighted in the evidence you have already heard. This is something on which, in particular, the editors of our journal *PLoS Medicine* have taken a very strong position, to reduce what they call the cycle of dependency in some way between the pharmaceutical industry and medical publishing. One of the ways in which that is manifest is with very substantial reprint revenues associated with high profile, hard-hitting clinical trials; for example, sponsored by the pharmaceutical industry.

What *PLoS Medicine* and PLoS as a whole have done, in order to keep the two things apart and separate any commercial interest from the editorial integrity of the content to be published, is refuse to accept any form of drug or device advertising, even though it could be a significant revenue stream for us. We feel that is a very strong leadership position to take in that area. The business of open access is also very important to this. The articles we publish are open in the sense that there are no barriers to reusing that content. A lot of publishers retain rights to contents so that they can reprint the article. They are the only people who can reprint that article at the levels of thousands and thousands of copies for redistribution, which then earns them an awful lot of money. We can't do that.

[2] Note by witness: There are a few instances on F1000 where an article that has been positively evaluated by some of our Faculty Members has subsequently been retracted. In those cases, we do not remove the evaluations but we do make the fact it has been retracted very clear in the evaluations' listing on the site as well as by adding a sentence to the start of the actual evaluation to ensure the reader is clear about the situation.

Q199 Graham Stringer: Are you saying that reproducing your articles is free?

Dr Patterson: Yes.

Q200 Graham Stringer: You are very different from *The Lancet* or other journals?

Dr Patterson: Totally different. We feel that is a very important principle. We have no unique right to take those articles and make that kind of money from them. These are some steps that have been taken. They are not the solution to everything, but I think they are important. I know that other medical publishers from whom you have heard are also taking these issues tremendously seriously and doing whatever they can to ensure the integrity and reliability of the content that is being published.

Q201 Graham Stringer: It struck me, when you spoke earlier, that if a pharmaceutical company wanted to get a drug to market very quickly and within the mindset of GPs and other doctors, your route to publication would be quicker. It might be an incentive, then, for them to go via a route which you said yourself—I can't remember your exact words—was of a different standard; it wouldn't be sent back. That worried me slightly, that, commercially, it might be easier for drug companies to make more money by going via your route. But you don't have a financial interest in that?

Dr Patterson: There is no financial interest, in that sense. To be clear, we consider work that has been sponsored by the pharmaceutical industry but, obviously, it has to conform to the same criteria as everything else. What might make the pharmaceutical industry reluctant, in terms of thinking about the value of that publication commercially, is that to publish in a very high prestige journal would probably be of great value. That is what might put them off coming to, say, *PLoS ONE* which does not, in and of itself equal high prestige. That is not the way *PLoS ONE* works.

Q202 Graham Stringer: I want to ask some questions about the nature of the science that is published in the journals. I still haven't quite got over the shock of listening to scientists from the University of East Anglia talking about Climategate where the science wasn't reproducible by all scientists because the computer codes, programs and data sets weren't available. Do you think all that information should be available, and what do you do to make it available?

Dr Read: That is an area where we have been doing quite a lot of work. Various macro-scale climate models are broadly available across the world, although there is more than one to choose from. The difficulty about making software code available is that, if you are talking about stuff running on so-called super-computers, you have to know quite a lot about the machine and the environment it is running on. It is very difficult to run some of those top-end computer applications, even if, of course, they are prepared to make their code available. Maybe they are not.

Q203 Graham Stringer: In this case, they were not. But how can it be science if it can't be tested and

reproduced by somebody else? If journals are publishing articles which, because of the nature of the super-computer or the secrecy of the data sets or the fact that scientists want to keep their code private, can't be reproduced, what is the point of that?

Dr Read: They should make clear the nature of the program they are running and the algorithms. A computer will not have any value beyond the way it is programmed. As long as they define the input conditions, as it were, and what the program is designed to do, you should be able to trust the outputs. That would be no different from any statistical test that is run on a data set, so long as you say what the test is. You then start to get down to the accuracy of the data itself, which is perhaps a more fundamental issue than the software or statistical test that is being run on it. I would say that the availability of the research data is a more important issue because then, of course, other researchers could run different types of algorithms on different types of computer on that data. I think access to the data is more fundamental.

Dr Patterson: To add a comment, reproducibility is a gold standard that we should be aiming for as publishers. PLoS, and many other publishers for that matter, requires authors to provide the data that underpins their work, or software, though not on a huge scale because then you have practical issues. It is the same with data. When it becomes truly massive you need alternative approaches. But, in general, we have a requirement that, in the interests of reproducibility, you must make the data available. We have had cases where readers have reported to us a problem with getting hold of data from an author published in a PLoS journal. We follow that up. We talk to the author and ask what the issues are. In the majority of cases the author will deposit their data and it is a misunderstanding, almost, that they haven't deposited their data in the appropriate repository, or whatever it is that is done in that particular community.

Q204 Graham Stringer: I don't know whether you have read the transcripts of our last meeting.

Dr Patterson: Yes.

Q205 Graham Stringer: Andrew Sugden from *Science* said that there was real difficulty in getting data sets for peer review. Is there anything that can be done about that? I accept that some of these data sets might be huge in different areas of science, but if it is supposed to be peer reviewed in *Science* it should be available.

Dr Patterson: I agree.

Q206 Graham Stringer: What can be done about it?

Dr Patterson: I think this is probably a very good area for study. In a lot of fields there are well established processes, places, resources and infrastructure to deposit data. I am thinking of fields like the genetics community and the protein structure people. There are established places where you can put data. In other fields the situation isn't quite as advanced but there is some interesting work going on. There is a project called DRYAD that is developing a kind of generic database for data sets. This is work particularly in the fields of ecology and evolution. That is where they are starting, but they are already talking of expanding into other areas. The idea is that this is a place where you can deposit your data set—I'm not sure whether the facility is available yet but it certainly will be—and where you can give privileged access to reviewers, for example, during the peer review process and then make the data available once the article is published. There are facilities being developed to help solve this problem, and I agree it is a problem, but there are ways round it. I don't think it is insoluble.

Dr Lawrence: I think that depositing data is essential. However, within the kind of time frames of peer review, you really can't deal with the issue of reproducibility because you aren't going to be able to repeat the experiment yourself. All you can do is say that it seems okay; it looks like it makes sense; the analysis looks right; the way they have conducted it makes sense and the conclusions make sense. I think the issue of reproducibility must come after publication in the sense that people try to reproduce it. That is when people say, "I couldn't reproduce it", or, "I could."

Q207 Graham Stringer: Do you think that depositing data sets after publication should be mandatory?

Dr Lawrence: Personally, I think that would be a good step.

Dr Torkar: It depends on the community you are talking to. It is only if the standards are well established and agreed on by the community that you can really enforce it and insist on it as a publisher. It becomes more difficult when, say, databases are not quite ready to accept all of the submissions or formats. That becomes a real barrier for authors. They cannot publish because the publisher insists on it. I think there is a lot of responsibility on the publishers to interact with different communities to establish the right databases and standards and where the limitations are and to make it mandatory in some cases and in others encourage submission and deposition, in particular. I think it depends very much on the communities.

Q208 Graham Stringer: To follow that up, are you saying that the depositing of these data sets may be a difficult problem but it is one that could be overcome?

Dr Torkar: Yes. Often it comes down to the communities to establish their needs in order to be able to reproduce each other's work. Then the publishers need to work with them in order to find out the agreements and the right way forward. It is very much to do with communication about what is the best way forward.

Dr Read: I would inject a word of caution here. There are technical and economic problems. Some of these data sets are huge. Keeping them available, possibly in perpetuity, could end up as a cost that the sector simply could not afford. While I would certainly be very much in favour of encouraging a predisposition to make data available, there are technical and economic factors involved in very large data sets that

might simply make it impractical. Keeping available all the outputs of the experiments on the Large Hadron Collider is just infeasible. Other data, such as environmental data, must be kept permanently available. I think that should be made more open. Of course, you can't repeat an earthquake and that data must never be lost. A lot of social data in terms of longitudinal studies make sense only if the entire length of the study is available. In some areas of science the data is produced by computers and programs. In that case, if the data is very large, an option might be simply to re-run the program. I merely say that as a word of caution. A blanket mandate on open data might not be feasible but the predisposition should be to make data openly available.

Dr Patterson: I make two brief points about that. First, it would be really helpful for publishers to include some kind of statement about data availability so that it is clear. How do you get hold of this data? Are there any restrictions in terms of accessing it because of the size of the data in some fields or whatever? Secondly, there is an opportunity to incentivise the sharing of data by giving greater credit and finding mechanisms to reward researchers who do that to assess the impact of that sharing as well. Rather than focusing everything on what they have published in whatever journal, to start thinking about different kinds of outputs and their value.

Dr Read: I strongly agree with that, because the cost of making data available in terms of describing it in ways that people outside your discipline can understand could be very high. They would have to put in a lot of effort and they would deserve credit and recognition for that.

Q209 Chair: You talked about credit for taking on reviewing work. I want to go finally to post-publication commenting. Should publishers introduce some system of prestige or credit for post-publication commentary? Dr Patterson, why is article-based methodology a good one? I don't regard it necessarily as a healthy comment if I make a speech and there is an endless number of blogs. No doubt I will disagree with half of them anyway. Is the F1000 model which uses faculty members to carry out that process a better one, or does it become a biased process? To finish off, let me put to all of you this question: what is a good system of post-publication commenting? Should there be some recognition of the people who participate?

Dr Patterson: Maybe the starting point is to say that at the moment we have a very blunt instrument for research assessment which is basically a number—an impact factor—associated with a journal. We can do much better than that now. The way we are looking at this is to consider all the things you can potentially measure post-publication. It is not just about a blog comment or something like that. There is a whole range of metrics and indicators, including resources like Faculty of 1000, which can be brought to bear on the question of research assessment. Normally, people are looking at the research literature as a whole, they are identifying the papers that are important to them and they are coming to those papers. We want to provide an indication when they come to that paper of how important this is and what impact it has had through usage data, citation information, blogosphere coverage and social bookmarking. There are so many possibilities.

We have moved in that direction by providing those kinds of metrics and indicators on every article that we publish—we are not the only people doing this but we have probably taken it further than most—to try to move people away from thinking about the merits of an article on the basis of the journal it was published in to thinking about the merits of the work in and of itself. Indicators and metrics can help with that. They aren't the answer to the question but they will help. Ultimately, there is really no substitute for reading it and forming your own opinion. Our general approach to the question is to try to capture as much of the activity that happens after publication on to the articles themselves.

Dr Lawrence: We would agree. Faculty of 1000 is a way of using a panel of experts. We have heads of faculty who then suggest the section heads who then suggest the faculty members. It is all very open. All their comments are against their name. On the question of bias, they also have to sign something to say they haven't been unduly influenced and, obviously, provide details of any conflicts of interest.

Q210 Chair: Isn't that a more structured approach to Dr Patterson's X Factor version?

Dr Lawrence: I don't think that any of these different metrics, on their own, are that strong. The point is about bringing together all the various metrics. They all have their own problems. To measure the impact of research you need to use different ones together in a sensible way. In a way, the more metrics you have the better your chance of really understanding the impact.

Q211 Chair: I am getting from this that your methodology is making sure that the judges aren't tone deaf, if I may continue to use my rotten analogy, which is a cruel one to you, Dr Patterson. In Dr Patterson's case, you don't care.

Dr Patterson: No. To be clear, I think both approaches will be required. They are complementary. I would like to see—we probably will shortly—F1000 as one of the indicators on a PLoS article. You go to the article and say, "Ooh! It's been highlighted in F1000 and this is what the person has said", or something like that. There will be a place for expert assessment, evaluation and organisation of content post-publication, as well as grabbing as many metrics and indicators as you can from the world at large.

Q212 Chair: As to the other two, where do you stand?

Dr Read: I think we mustn't underestimate generic social networking tools as a very unstructured way of commenting on publications. Of course, you have to make those publications more widely available before that can happen. More of that will happen in a world of open access than at the moment.

Dr Torkar: I would agree with all of that. It is important to encourage those systems and get them used more widely and, in particular, to get the critical

views across. I think the challenge at the moment is to encourage people to air their criticisms and put their names to them without fear of any repercussions. We need to encourage this as much as we can.

Chair: I thank all four of you very much for your time. I am sorry it has taken a little longer than we anticipated, but it has been a very interesting session.

Examination of Witnesses

Witnesses: **Dr Janet Metcalfe,** Chair, Vitae, **Professor Ian Walmsley,** Pro Vice Chancellor, University of Oxford, and **Professor Teresa Rees CBE,** former Pro Vice Chancellor (Research), Cardiff University, gave evidence.

Q213 Chair: Thank you very much for coming along this afternoon. I apologise that we are running a little later than we were scheduled to. I would be grateful if the three of you would introduce yourselves for the record.

Professor Walmsley: I am Ian Walmsley, Pro Vice Chancellor for Research and University Collections at the University of Oxford.

Professor Rees: I am Teresa Rees. I have just finished being Pro Vice Chancellor for Research at Cardiff University, and I am a member of an expert advisory group to the European Commission on structural change in universities.

Dr Metcalfe: I am Janet Metcalfe. I am Head of Vitae which is an organisation that supports the professional development of researchers in higher education.

Q214 Chair: Thank you very much. We have heard that peer review isn't perfect. What would a perfect system for evaluating scholarly research look like?

Professor Rees: One contribution that I think needs very serious attention is the way in which clinical trials, in particular, and pharmaceutical research address the issue of sex and gender in research. At the moment a considerable amount of research and clinical trials involving rats, mice and people is conducted largely on the male species, if I may put it that way, and yet the consequence is that the research turn into pharmaceutical products that are prescribed for men and women. While men and women have a lot in common—

Q215 Chair: This is about scholarly research. I asked a question about peer review. What is wrong with it? What would a better system look like?

Professor Rees: A better system would be one where the journals into which researchers put their work insist that all those submitting articles specify the sex of the participants in the clinical trials. At the moment pharmaceutical products are being withdrawn from the shelves, although they are based on research that has been peer reviewed and has appeared in journals, because they have not been tested on both sexes.

Professor Walmsley: I would start from the premise that we have two criteria: first of all, we want a system that is accurate and then we would like a system that is precise. I think peer review satisfies the first of those criteria based on the extent of the body of work and its usage over time. I am not sure there is a system that can provide more precision on single instances because one is dealing with new ideas and looking forward into the future. Therefore, essentially, you are trying to evaluate derivatives. The way to make things more precise is simply to have more chances or opportunity, as it were. It is not clear to me that there is a system which will provide both of those criteria in any very simple way.

Dr Metcalfe: I would add to that from the perspective that the peer review is actually a collective in terms of its system. So it is: how do you ensure the expertise and the objectiveness of the collective as a whole? How do you understand the system when you are entering it and ensure that you are being fair and inclusive in terms of the whole process of peer reviewing?

Q216 Chair: If we take Professor Walmsley's observation that there is no perfect methodology, why is it that researchers are put under so much pressure to get work published in the high impact journals?

Professor Walmsley: Perhaps a simple answer to that from a parochial view of a university person is that that is the way one's career advances. As you heard from the previous panel, a lot of very good work gets published in journals that do not have such high visibility, and I think that is quite crucial. None the less, having a highly cited paper in a journal that people would regard as high profile is considered important as a way to raise your visibility and develop your career.

Dr Metcalfe: We have drivers in the system, such as the research assessment exercise, that encourage that, so there is very strong emphasis in terms of the impact of the journal. Coming at it from my perspective as Vitae, it is: how do you support early career researchers to enter into that system and even make decisions about what journals they should be targeting? How do they get a sense of the most appropriate place for them to publish?

Q217 Chair: Doesn't the tie-in between the research excellence framework and high impact journals potentially create a rather subjective judgment?

Professor Walmsley: I would argue that the reason peer review works well is the expertise of the community on an inherently subjective set of criteria; that is, one can with any piece of work assess various objective elements of it. Is it right? Is it novel—that is, is it new and not been published before? But the subjective element, which I think differentiates a number of different journals—because they have different subjective criteria—is the piece that is very difficult to assess in an objective way. Knowing that a piece of work is going to be important is a very difficult thing to do. In many ways that is something best assessed post facto; that is, the impact of this

work is: how many other people find it a fruitful thing on which to build? How many people find it a productive way to direct their research as a consequence? It is difficult to say that one can be completely objective on all elements of assessing research outputs.

To add one more comment, I absolutely take the point about RAE. Having sat on one of the RAE panels last time, I can say the panel was very clear that the forum in which the paper had been published was not determinative. It was reading the individual outputs and assessing the value of the work itself that ended up being more important. None the less, when a CV comes across the desk of a head of department for a faculty post, as a first pass through it makes a difference where those papers are published.

Q218 Roger Williams: Turning once again to value for money, the Joint Information Systems Committee reported recently that it estimated it cost higher education institutions between £110 million and £165 million a year for peer review. Is it fair that these institutions absorb this cost on behalf of publishers?

Professor Rees: In my view, peer review is part of the process of ensuring that research is excellent and improving it. Conducting peer review helps in one's own skill development, particularly early career research about which Dr Metcalfe can speak. So it is part of the academic process. We have an expanding number of journals, as we know, and there is increasing pressure to publish. I think there is a question of whether academics can keep up with reading all the material in the growing number of journals. One might want to have a debate at some stage about whether that is the most effective and efficient way of managing all the potential research that can be published.

Q219 Roger Williams: We were also told that a lot of this work gets done out of hours, so to speak. It seems to me that it is not costing the higher education institutions but individuals.

Dr Metcalfe: I was going to add that comment. I am not sure about the basis of the JISC work and how they did the calculations, but I think many researchers would feel there is a personal cost in terms of the effort they put into peer review. They appreciate that it is a very important part of the system—it is partly about protecting academic discipline and contributing to the academic community—but there is an expectation, not just with peer review but other aspects of being an academic, that you have to put in very long hours and you are expected to work beyond your terms and conditions of employment to be successful. These are systemic issues within the academic community, and peer review falls very much within that. It is also rarely identified as a specific element in workload conversations or models within institutions, so we have no idea how much time is spent by the academic community on peer reviewing.

Q220 Roger Williams: It is probably not part of this inquiry, but it seems to me that if it is the case that a scientist's standing within their subject or community depends on doing peer review then those who perhaps have other responsibilities, such as caring or parenting, are put at a disadvantage in progressing through the profession.

Dr Metcalfe: I do hope it is part of your review. That is a very important aspect of looking at whether or not the peer reviewing system disadvantages different groups within the academic community. I question whether or not there is recognition for being a peer reviewer, although there is certainly recognition that it is an important contribution for academics to make. Some early career researchers put on their CVs when they have peer reviewed to try to make that visible. Otherwise, I think it is an invisible contribution to the academic community except when you get on to an editorial board or grant panel.

Professor Rees: I think it is handy to have time-limited periods serving on editorial boards and research councils, because that is where the bulk of peer reviewing occurs. Perhaps that can be shared more effectively, but journals do vary in the extent to which they impose a time limit.

Professor Walmsley: An important aspect of value for money, from my perspective, is the effective certification that peer reviewed publications have in indicating where the critical mass of research will be. If you are beginning a new project, perhaps as a young researcher, a starting point will be to review the literature. Having a certification that a paper has appeared in *Science*, *Physical Review Letters* or wherever will be a place where you take note and start to think about where you can build on that. That certification does take time. I would like to know the numbers—I am afraid I don't—for the total cost divided by the total numbers of people taking part in science in the UK. It is probably a relatively small number. That might be a useful number to realise.

In terms of overall recognition and internal promotion within universities, you heard Dr Metcalfe talk about that. I would agree. It appears when people are evaluated that they have reviewed for journal X, Y and Z. Certainly it appears and appeared in RAE as an indicator of esteem. That is what you might call passive recognition. I think active recognition is becoming more common; for example, the American Physical Society has an outstanding referee award. Every year it makes a big deal of naming people who have provided consistent, high quality and useful reviews. That is becoming more open. It is not a direct financial compensation for time. However, I think most people would say this is a contribution to the community which reaps values in other ways.

Q221 Roger Williams: You have already mentioned staff from universities taking part as editors and members of editorial boards. That must take them out of their departments for long periods of time. Is there any evidence that universities might discourage their staff from taking up those posts and duties?

Professor Rees: On the whole, I think they like members of their staff to be on editorial boards because there is some recognition of the institution as well as the individual if it is providing people to sit on them. But it is time consuming. Certainly, if you are the editor of a journal that can be reflected in workload management; being a member of a journal

or a reviewer that is just used on an ad hoc basis tends not to be.

Q222 Roger Williams: Overall, would your judgment be that in the best of all possible worlds researchers should be paid for their work as peer reviewers?

Professor Rees: I am not sure of the answer to that question. It is strange that if researchers do the research and publish and then do the peer review and the editing—in some cases now they are asked to pay for their articles to be published—one finds oneself responding to a memo saying, "Which journals do you think we should cut from the library because of budget cuts?" I would say there is a bit of a paradox there.

Professor Walmsley: I would concur with that, having part of the library as my portfolio too. That is an internal and difficult question to address. As to whether reviewers should be paid, I think that may send incentives in the wrong direction. One wants as wide a fraction of the community with appropriate expertise to be involved as possible. The way we might see it internally in departments at Oxford would be that this is a contribution to the community, just as chairing or sitting on committees in the university is considered part of what you need to do in order to make the place and the business function. But the question is about keeping an appropriate lid on that. There are various ways in which one might do that, but in mentoring terms one would often say, "You want to review twice as many papers as you publish and you want to review three times as many grant applications as you submit." That tempers your workload and makes the whole system work.

Chair: We want to pursue that with a few more precise questions on exactly where you left off.

Q223 Stephen Metcalfe: I want to go back to the issue of recognition, if I may. Assuming that we are not going to pay peer reviewers, do you think that peer review should be formally recognised as part of an academic's work and included in the criteria for evaluation, promotion and those kinds of things? If you do agree with that, what barriers are there to putting a system into place that would handle those?

Professor Rees: Funding research councils—because peer review is important for funded research as well as journals—have set up colleges of reviewers. To be a member of such a college does provide some recognition and journals might want to think about referring to their ad hoc reviewers as opposed to their editorial boards—the ones they use on a regular basis—in that way. Some journals will publish, at the end of the year, the names of the ad hoc reviewers they have used during the year but I think that is really neither here nor there. A college system might work.

Dr Metcalfe: Vitae has worked with universities and research funding councils to develop a Researcher Development Framework which recognises the broadness of being a researcher. Very much embedded within that is the importance of publication, both from being an author but also contributing as a researcher in terms of the peer review system, mentoring early career researchers in terms of their development. So, being a researcher in higher education is very much part of the job description. I would say it should be recognised as a workload in the same way as other aspects.

Q224 Stephen Metcalfe: Is that a change?

Dr Metcalfe: It would make explicit things that are now implicit in terms of being an academic specifically in relation to peer review. I think a challenge for early career researchers is: how do you get into that system? How do you become a reviewer? It is very often by recommendation. There are journals that have open calls for reviewers, but becoming a reviewer is usually part of the apprenticeship of being nurtured as a researcher by your principal investigator or senior academic. There are issues in terms of how we support those researchers to become involved and good at peer reviewing on both sides of the fence, but also how we recognise it by acknowledging the broadness of a researcher's activities.

Professor Walmsley: It can perhaps be made more explicit, but I think it is somewhat explicit now; that is, in evaluating people for promotion one would look not only but primarily at the quality of the research undertaken and published but also at how they have contributed to the working of the community. That will come internally, as to how they have worked within the department—and evidence for that would be sought—and as part of the larger community. One would normally expect to see, on a CV for evaluation, that somebody had undertaken reviewing for research councils or, in this sense, professional societies or other publishers for journals.

As to the extent one wishes to quantify that to a greater degree, I would be cautious about that. One doesn't want to be prescriptive. One wants to see some threshold of evidence that people are playing a role without being quantitative about exactly how much they ought to be doing.

Q225 Stephen Metcalfe: Do you think that the peer review burden is growing at the moment and is becoming a greater issue for researchers? If so, who is carrying most of that burden? Is it young and inexperienced researchers or mid-career experienced researchers? Who carries most of the burden at the moment, assuming you agree there is a burden?

Professor Rees: There is certainly a burden. As the sector expands and you have more people applying for promotion and jobs as well there is all the peer review involved in writing either references for people where you have been nominated or assessments where you are required to assess their work. That is another whole area of reviewing. I think that is one that is increasing enormously. Certainly, promotion systems are requiring more external peer review at all levels.

It is hard to say where the burden falls exactly because it would depend on the nature of the reviewing, which kinds of journals and the field, because different journals will call for different numbers of referees. For example, if it is interdisciplinary research you are more likely to ask for a wider number; similarly if it is an interdisciplinary research grant proposal. I would have difficulty in saying that the burden falls definitely in this or that part of the community. It is spread but not in an even way.

Professor Walmsley: I would concur entirely with what Professor Rees said. As she noted, peer review is pervasive throughout all aspects of the academic endeavour, not just publishing. For example, one may distinguish that senior people will have more to do with evaluation of others through promotion, tenure, awards or what have you and perhaps at the editorial end in publishing, and that younger people will have more of the burden of evaluating individual articles or specific research grants.

Q226 Stephen Metcalfe: I want to turn now to the issue of training. Dr Metcalfe, I think that the number of people who take up the opportunity for training either in peer review or other publication training is relatively small. Why do you think that is?

Dr Metcalfe: The tradition is very much an apprenticeship model. You learn the system by doing it in terms of writing papers, submitting them and maybe getting feedback from your principal investigator. Where that works it is absolutely fantastic in terms of somebody taking an early career researcher through the system and giving them feedback before they submit their articles, maybe having several researchers in their group giving feedback, and showing them how the whole process works. But, because we are a collective in terms of the academic community, there is opportunity for that process not to be as well supported throughout the whole of the academic community as it could be.

The challenge is how to help a researcher maximise their opportunities of publication at submission so that they are reducing the amount of rejections and the amount of comments they have to respond to. Formal training in that process is one way in which you can do that. From some of the research Vitae has done, we have evidence of increases in the success rates of grant applications and fellowship applications by having formal training and development in working within the peer review systems for both of those. We could do more in advance of a researcher having to submit their first paper or grant proposal so that they are better informed and therefore more expert about how the whole process works.

Q227 Stephen Metcalfe: You would be in favour of moving towards a more formal requirement for training. You consider that it should be provided across all higher education institutions.

Dr Metcalfe: No, I wouldn't go down that route. I think the opportunities to have training should be there. The process by which a researcher learns to become expert is very much up to their individual circumstances. If they are getting good individual nurturing and mentoring by their PI, that is great. But there should also be the opportunity, for those researchers who respond more to formal training, to have that available as well.

Q228 Stephen Metcalfe: Who do you think should pay for that training?

Dr Metcalfe: Collectively, we all have a responsibility for it to work. I think journals have a responsibility to support and provide more information about what is required and to contribute to the training of their reviewers. I think institutions have a responsibility, as signatories to the Concordat for the Career Development of Researchers, to ensure that those opportunities are there. I think research and funding councils and Government have an obligation to provide enough funding within the entire system to make available that kind of training for our early career researchers.

Q229 Stephen Metcalfe: Does anyone else want to comment on that issue?

Professor Walmsley: I would concur that a combination of both mentorship, which I think has a primary role, and some elements of non-mandated training would continue to be very helpful. Those aspects are in place at Oxford, for example. I think they work well to bring people into a system in a way that helps them to understand and use it.

Professor Rees: We introduced a system in Cardiff where people who had submitted research grants for publication, for example, made them available with the referees' comments so that our young researchers could read that and, by looking at a whole set of these in their field, could understand what a good proposal looked like and the kinds of things that reviewers came up with.

Stephen Metcalfe: But you would not want to establish a training framework.

Q230 Chair: Before you leave that, on the one hand, you argue in favour of maximising fairness across gender, with which the Committee would agree 100%, but, on the other, you are not seeking to create a formal structure. How are you going to get one without the other?

Professor Rees: As to gender, we should be following the lead that has already been shown in the United States among research funding bodies and, in particular, health journals like cardiology, which says that people who are describing research that they have conducted, which involves clinical trials, should specify the participants in those clinical trials. Very often they do not do so and that has led to deaths, particularly of women. But it is also a difficulty for men who experience breast cancer, for example, and who can be prescribed Tamoxifen that has never been tested on men. I think that in order to get more rigorous excellence in research we need to pay proper attention to this.

Dr Metcalfe: One group of stakeholders we have not talked about in terms of responsibility is the early career researchers themselves. I think that is where your comment comes together.

Q231 Chair: Particularly for that group; I think it is fundamental to them.

Dr Metcalfe: There are responsibilities for those early career researchers in terms of thinking about what they need in order to be excellent researchers and more professional in their contribution to the community. Individual researchers need to be able to identify whether or not they need more training in this area and whether they understand the system and processes they have to go through. It may be that an individual researcher will prefer or have the

opportunity to have some mentoring, rather than go on a training course. I think that flexibility in how people develop their expertise—

Q232 Chair: But are you placing that onus on the institution where they are based?
Dr Metcalfe: Not just the institution. The institution has to have the provision and ensure there is enough opportunity for researchers to get that professional development. The responsibility is on the individual researcher to take advantage of those opportunities and ensure that they are developing their own expertise and understanding of the entire system. It is not purely an institutional responsibility.

Q233 Stephen Metcalfe: I can see merit on both sides. There is a growth in the approaches to peer review at the moment but it is changing. Do you believe that researchers will have the wherewithal to adapt to all these changes as they come along? I am also concerned that there might be a time impact. Do you believe that they will have enough time to get involved in things like post-publication commenting, interactive public discussion and all those kinds of areas that may be more time-consuming than getting involved in pre-publication review?
Professor Rees: Innovation and engagement is very much the third arm of research activities. My own institution has introduced it as a main criterion in promotion and researchers have to give evidence of what they have done and how it is of excellent quality. I think researchers are more and more aware, through the impact agenda, of the need to do this, but time is finite. Therefore, one needs to engage in this kind of dissemination and strategic relations with organisations that might benefit from the research in a very effective way. Compared with conducting research and teaching with which we are fairly familiar, in all fairness we are only in the process of developing effective ways of dealing with the agenda of impact and engagement.
Professor Walmsley: I don't think that post-publication itself will play a major role, for two reasons. First, pre-publication is of finite duration; post-publication is ad infinitum. So there will be a half-life associated with that anyway. On post-publication I think the important questions will be: "Is this piece of work relevant to what I do? Has it made me rethink? Has it led to a new fruitful outcome that I will then go on and publish?" That is going to be the important thing rather than a commentary. It is: how is this piece of research now used?
Dr Metcalfe: I would concur with that, but I would also add that critical debate is a very important aspect of the academic community. If it is in an area of specific interest to you then researchers will engage in that debate process because it is fundamental to the way research is done.

Q234 Graham Stringer: Last week the chair of COPE told us that if a university had not fired at least one academic for fraud there was something wrong with the university. Do you agree with that statement? Do you think she was right? If so, have your universities sacked any academics over the last five years for academic fraud?
Professor Walmsley: The answer to the second question is no.
Graham Stringer: So you are not firing.
Professor Walmsley: Yes. I would say that the answer to the first question is probably no, too, but I want to be careful not to suggest that there are no ethical challenges within publication. We have a process within Oxford, which I am certain is the same at other places, to deal with that.[3] Part of the question is: how does it come to your attention?

Q235 Graham Stringer: Before you go on, is that process published?
Professor Walmsley: Yes. It is available on the website through the Research Integrity Portal and there is an access through the SkillsPortal to that as well.

Q236 Graham Stringer: So, that is true for all?
Professor Walmsley: Yes. How do you identify and find that out? I think that internally, at the pre-publication end, there is great onus on researchers. As more and more papers are published with joint authors there is joint responsibility for doing that. That could lead in two directions: first, increased pressure to get it right because there are more people involved in the discussion; but, secondly, the chance that you will miss a trick or two because there are more people contributing. It is a difficult tension. Once the paper is out there, if an external party notes something that looks challenging I guess we will hear about that either from the external people or from editors themselves. If an editor writes, we will be able to investigate that internally.
As to the sanction of firing someone, I said I have not known that to happen, but there are certainly lower levels of discipline that can happen. However, I don't know what the statistics are at Oxford.

Q237 Graham Stringer: If you were to have an investigation, would you publish the results? Would that become a public document?
Professor Walmsley: I don't know the answer to that question.

Q238 Graham Stringer: Would you write and tell us?
Professor Walmsley: Yes, I will do that.
Professor Rees: It is not an issue I have come across, I have to say, in all my years as Pro Vice Chancellor at the university. I think the mechanisms particularly in adhering to ethical guidelines early on in any process of the vetting by ethical committees sometimes involve external agencies as well. Given the different groups of people involved at all the various stages in getting approval to put in a research grant from within the institution and the refereeing that goes on all the way through, I think it is quite difficult to be very successful in conducting fraud.

[3] Note by witness: Both in terms of educating researchers about their ethical responsibilities and providing for disciplinary action in case of a breach of ethics.

Q239 Graham Stringer: In asking the question, the case that has been in my mind through this investigation—and there are other cases—is that of Andrew Wakefield. He had a peer reviewed paper. The institution he was working for was asked to investigate and the journal was asked to investigate. The truth was only arrived at after 10 years because a particular journalist pursued it doggedly. What you seem to be saying is that it isn't a problem. Like the chair of COPE, I just wonder whether you are looking at this hard enough. For instance, as in the Wakefield case—and there are others—do you think there should be an external statutory regulator?

Professor Walmsley: Are we discussing now the issue of the research itself getting underway, or the issue associated with the publication part of it?

Q240 Graham Stringer: I am discussing the situation where an accusation is made that somebody has published academic work that is fraudulent in some way because they have fiddled the results or the sampling in whatever way.

Professor Walmsley: It is not quite clear to me how such a regulator might work except that, before the research was started, as Professor Rees would have said, if it had had certain components it would have gone through an ethical review. That aspect and the method by which data would be taken and the way that would be curated, etcetera, would have been laid out at that stage. On aspects where that was done I think there is good evidence to look back internally at the trail.

In places where that was not done and there were no ethical concerns or issues before the research started, it is hard to see quite how an external regulator would work. One might say, given new research council moves in terms of data curation itself, there will now be a trail that is both internally and publicly accessible to look back at all of that matter, but it could be quite burdensome and onerous. I think the internal processes are reasonably robust. You raised the question of whether it was public, and that is an issue I am willing to look at.

Professor Rees: The processes are more robust now than they have been historically.

Q241 Chair: Hang on a minute. You have not come across cases of fraud. How do you know that the processes in place to deal with them are robust?

Professor Walmsley: It is true. I noted that we had not come across cases of fraud in respect of publications. There have certainly been other issues—I will not say it is fraud—associated with ethical conduct of research where we have processes that parallel those we might use for publication, and they have been shown to be effective. In respect of publication I would say that at least within my tenure they are untested, but I think there is good evidence that parallel processes for other issues work.

Q242 Graham Stringer: Are you talking about plagiarism now?

Professor Walmsley: I am talking about conduct of research on a grant and the terms under which grants were obtained.

Q243 Graham Stringer: I put a final question that you may or may not be able to answer. You listened to the session today. We have been looking at the process, whether peer review can detect fraud and all sorts of things. As I have listened to and read the evidence presented to us I have had a feeling that we should be looking more at the commercial pressure on both editors of journals and researchers. Do you think we should be concentrating more on that? What do you think that we should be concentrating on as a Committee? What would you hope to see emerge from the piece of work that we are doing?

Professor Walmsley: I think the primary consideration is: how does one validate the quality of scientific research? The peer review is certainly one element of that. You have heard from Professor Rees, Dr Metcalfe and myself how pervasive that is in all aspects of the academic side of research. If one is thinking about alternative methods, it would be good to understand how one saw those working across a wide range of different activities where this kind of process works. It is hard for me to understand how one would find a replacement within publications that would also be useful in other spheres. Either confirming the value of peer review or identifying robust alternatives would be a good outcome.

Professor Rees: What I would like to see coming out is some consideration of the new Spanish legislation passed in January which is now binding on all publicly-funded research in Spain. It is an attempt to try to promote excellence. There are some quite innovative ideas in that legislation. Also, as I mentioned earlier, I think we have lessons to learn from the publicly-funded scientific research in the United States on guidelines which again is designed to promote excellence in research.

The European Commission is in the process of drafting two communications, one on modernising universities and one on structural change in research. There are some very interesting discussions going on there about possibly producing a directive for and with Member States which again is designed to increase the quality of research in the EU in the context of increasing global competitiveness. There is much research activity and good practice from those different sources that I hope this Committee might want to take on board because of the amount of work and consideration that has gone into developing it.

Q244 Chair: But don't the Spanish and US examples take us a little beyond the scope of UKRIO and closer to a regulatory framework?

Professor Rees: It is really more about integrating best practice, particularly in Government-funded organisations such as research councils. I think there is a lot to be gained from looking at that.

Q245 Gavin Barwell: I want to ask some questions about gender and other biases. Both Professor Rees in an article and COPE in its submission to us said that the evidence on gender bias in peer reviews was contradictory. What is your assessment of the scale of the problem, even if it can be clearly quantified?

Professor Rees: I think there are two aspects to this problem. The one that I have been talking about is the

way in which clinical trials are often conducted on one sex but the pharmaceutical products or the results that come out of that research are prescribed to both. I am sure you are all familiar with the research that suggests an aspirin a day is very good for heart disease. That was conducted on clinical trials of 27,000 people, so it was fairly robust research but they were all male and heart disease in women is different. There are contraindications for women if they take that kind of medication for heart disease. To me, these are poor methods. It is not doing the research properly.

Q246 Gavin Barwell: Are you saying that is bad science?
Professor Rees: It is bad science, exactly.

Q247 Gavin Barwell: It is not gender bias in peer review. You would expect the peer review to pick up that that is bad science.
Professor Rees: If the peer review is done properly the research will be done properly. Many Government-funded research institutions and journals in the States and other countries insist that that is revealed. Therefore, it is made clear so peer reviewers can do their job properly. You can't really get funding to do medical research in the States from publicly-funded sources unless you explain your research design on those criteria. I have to say it is not just sex. Research for products that would lead to treatment for Parkinson's disease is conducted on very young rats. There is an issue on all kinds of criteria like that. I think this is an extraordinary waste. It is also true in engineering. For example, in developing cars test dummies have been used in crashes. First, they used only male passengers. There are differences in whiplash and so on because of different frames, but as far as concerns the air bag in the passenger seat if you happen to be pregnant the first thing it does is kill the foetus. There is lack of attention to the diversity of human bodies in research. To my mind, that is laziness and poor methodology. Peer reviewers need to be able to assess the quality of research effectively. The other difficult aspect of peer review is whether the gender of the person who is applying for a research grant or has written the article makes a difference. Do people operate with a preconceived notion of quality? There is a whole series of studies about this. For example, evidence from the States suggests that if John Mackay or Jean Mackay submits an article it will be peer reviewed more favourably if it is by John Mackay. There is a whole series of papers to that effect. How do we deal with this? I add that this is discriminatory behaviour by both men and women. It seems to me that in the selection of reviewers to serve on research council boards, journals or promotion panels we need transparency so that people can apply and be assessed against merits to gain those positions, and we need turnover so it is not the same people doing that assessment for 20 or 30 years. We might want what is unfortunately called double-blind reviewing so you don't know the sex. Equally, there is unconscious bias against people with foreign-sounding names. Brazil's science minister is very concerned about this and has encouraged academics there to co-author with people from the US or Europe who may have a surname that is more familiar to reviewers. Double-blind marking would deal with that unconscious bias that affects peer reviewers as it does any other member of the public.

Q248 Gavin Barwell: My final question is to Professor Walmsley. You stated in your evidence: "There is now quite a lot of evidence as to the practical issues which need to be tackled to make the review of funding proposals and of work submitted for publication fairer …" Can you tell us what Oxford is doing to address those issues?
Professor Walmsley: Like Professor Rees, the question of how one populates panels and encourages people to be involved in this process is a key element of that. Therefore, the kinds of things we would be looking at are: internal training, as discussed before, coupled with encouragement that people need to be actively involved in that; and that the chairman or chairwoman of a panel makes sure the terms of reference and what people are being asked to do are clear.
Chair: Thank you very much for staying with us for so long. It has been an intriguing afternoon. Thank you very much for your answers. Professor Walmsley, if you have any references to the documents to which you referred Graham perhaps you would provide the links to them.
Professor Walmsley: Certainly.
Chair: Thank you very much.

Wednesday 8 June 2011

Members present:

Andrew Miller (Chair)

Gavin Barwell	Stephen Mosley
Stephen McPartland	Pamela Nash
Stephen Metcalfe	Graham Stringer
David Morris	Roger Williams

Examination of Witnesses

Witnesses: **Professor Rick Rylance**, Chair-elect, Research Councils UK, **David Sweeney**, Director for Research, Innovation and Skills, HEFCE, and **Sir Mark Walport**, Director, Wellcome Trust, gave evidence.

Q249 Chair: Good morning, gentlemen. I would be grateful if you would just introduce yourselves for the record.
Professor Rylance: I am Rick Rylance. I am the Chief Executive of the Arts and Humanities Research Council, and the Chair-elect of the Executive Group of the RCUK.
David Sweeney: I am David Sweeney. I am the Director for Research, Innovation and Skills for the Higher Education Funding Council for England.
Sir Mark Walport: I am Mark Walport. I am the Director of the Wellcome Trust.

Q250 Chair: Thank you. Evaluation of editorial peer review is poor. Should you, as funders of research, contribute towards a programme of research to, perhaps, justify the use of peer review in publication and find out how it could be optimised? Could that be something that you could usefully do among yourselves?
Sir Mark Walport: It all depends what you mean by "research". It is quite important to have a very straightforward understanding of what peer review is. Peer review is no more and no less than review by experts. I am not sure that we would want to do a comparison of a review by experts with a review by ignoramuses.

Q251 Chair: That's not very nice, is it?
Sir Mark Walport: Having said that, we do conduct studies of peer review. The Wellcome Trust published a paper in *PLoS ONE* a couple of years ago in which we took a cohort of papers that had been published. We post-publication peer-reviewed them and then we watched to see how they behaved against the peer review in bibliometrics. There was a pretty good correlation, although there were differences. Experiments of one sort or another are always going on, but the fundamental question of whether you should compare expert review with just randomly publishing stuff I don't think is something that anyone would be very keen to do. It lacks equipoise.
David Sweeney: Through our funding of JISC and through our funding of the Research Information Network, much work has been carried out in this area and we remain interested in further work being carried out where the objectives are clear.
Professor Rylance: Yes. We, too, would be open to trying to think about how that might be researched. We have to bear in mind that peer review is not a single phenomenon. It is peer review in relation to publication, grant awards, REF and so on. Again, there are differences between the natural sciences, the social sciences and the humanities. You would have to define the task a bit more carefully. We do, from time to time, fund research on, for example, the influence of bibliometrics and its relationship to peer review, so work is going on in that way.

Q252 Chair: The Wellcome Trust highlighted a common criticism of peer review by saying: "It can sometimes slow or limit the emergence of new ideas that challenge established norms in a field." Do the others agree and what can be done about this?
Professor Rylance: Churchill once said that democracy was the worst system in the world apart from all the others. I think the same about peer review. Peer review is absolutely crucial, but, of course, it carries limitations of one kind or another in that it can slow down things. The volume of work load and so on and so forth is increasing but, none the less, we need to remain committed to the principle of doing peer review because, in the end, it is always the first and last resort of quality.
David Sweeney: We think that there is a risk, but we also look at the many experiments that are going on with social networking and modern technological constructs. We hope that the broad view that is taken of those will mitigate the risks which the Trust identified.
Sir Mark Walport: To be clear, the Wellcome Trust, in our submission, said: "Other commonly raised criticisms of peer review are…" We didn't say that we agreed with that criticism. The issue is that peer review or expert review is as good as the people who do it. That is the key challenge. It has to be used wisely. It is about how the judgment of experts is used. It is about balancing one expert opinion against another. The challenge is not whether peer review is an essential aspect of scholarship because there is no alternative to having experts look at things and make judgments.

Q253 Chair: If that common criticism has validity, is the growth of online repository journals like *PLoS ONE* technically sound?
Sir Mark Walport: It is entirely sound. *PLoS ONE* has very good peer review. Sometimes there is a confusion between open access publishing and peer review. Open access publishing uses peer review in exactly

the same way as other journals. *PLoS ONE* is reviewed. They have a somewhat different set of criteria, so the *PLoS ONE* criteria are not, "Is this in the top 5% of research discoveries ever made?" but, "Is the work soundly done? Are the conclusions of the paper supported by the experimental evidence? Are the methods robust?" It is a well peer-reviewed journal but it does not limit its publication to those papers that are seen to be stunning advances in new knowledge. It is terribly important to put to bed the misconception that open access somehow does not use peer review. If it is done properly, it uses peer review very well.

Professor Rylance: It is important to distinguish between peer review that is looking at a threshold standard, i.e. "Is this worthy of publication?" and peer review that is trying to say, "What are the best?" when you are over-subscribed in terms of the things you can publish.

Q254 Chair: Should other journals adopt this methodology?

Sir Mark Walport: Other journals are beginning to. Different communities behave in different ways. For example, the physics community have pre-print circulars. They put papers out online and those are reviewed. When they have been peer-reviewed by the community to some extent, they are eventually published in their final format. One of the issues in the biological sciences is that the volume of research is extremely high. An important issue in the medical sciences is that an ill-performed study can have harmful consequences for patients. Therefore, there need to be filtering mechanisms to make sure that things are not published that are, frankly, wrong, misconceived, the evidence is bad and conclusions are drawn which means that patients could be harmed. Different communities require slightly different models.

Q255 Stephen Mosley: We have heard that the quality of journals, often determined by the impact factor of those journals, is becoming a proxy measure for research quality. Would you tend to agree with that assessment?

David Sweeney: With regard to our assessment of research previously through the Research Assessment Exercise and the Research Excellence Framework, we are very clear that we do not use our journal impact factors as a proxy measure for assessing quality. Our assessment panels are banned from so doing. That is not a contentious issue at all.

Sir Mark Walport: I would agree with that. Impact factors are a rather lazy surrogate. We all know that papers are published in the "very best" journals that are never cited by anyone ever again. Equally, papers are published in journals that are viewed as less prestigious, which have a very large impact. We would always argue that there is no substitute for reading the publication and finding out what it says, rather than either reading the title of the paper or the title of the journal.

Professor Rylance: I would like to endorse both of those comments. I was the chair of an RAE panel in 2008. There is no absolute correlation between quality and place of publication in both directions. That is you cannot infer for a high-prestige journal that it is going to be good but, even worse, you cannot infer from a low-prestige one that it is going to be weak. Capturing that strength in hidden places is absolutely crucial.

Q256 Stephen Mosley: We have had some very good feedback about the RAE process in 2008 and the fact that assessors did read the papers, did understand them and were able to make a subjective decision based on that. But we have had concerns. I know that Dr Robert Parker from the Royal Society of Chemistry has expressed a concern that the Research Excellence Framework panels in the next assessment in 2014 might not operate in the same way. Can you reassure us that they will be looking at and reading each individual paper and will not just be relying on the impact?

David Sweeney: I can assure you that they will not be relying on the impact. The panels are meeting now to develop their detailed criteria, but it is an underpinning element in the exercise that journal impact factors will not be used. I think we were very interested to see that in Australia, where they conceived an exercise that was heavily dependent on journal rankings, after carrying out the first exercise, they decided that alternative ways of assessing quality, other than journal rankings, were desirable in what is a very major change for them, which leaves them far more aligned with the way we do things in this country.

Q257 Stephen Mosley: That is a fairly conclusive response, is it not? Lastly, you were talking about *PLoS ONE* in answering the Chair's questions. From what you were saying, there is a difference in standard between papers in *PLoS ONE* that might not be in that 5% most excellent bracket, but just so long as the work is technically sound and correct, they are in there without being excellent. With the impact factor of those repository journals gradually increasing, does it mean that the proxy use of peer-reviewed publications is even a less valid approach to assessing the quality of research in institutions in the future?

David Sweeney: I think we just don't do that. We are not keen to do that. We want to assess—all the time we do work every few years—on how much we can use bibliometrics in a robust way, particularly as you aggregate the information over a large number of publications. At present we do not feel that the role that that should play is beyond informing the expert judgments that are made by panels. We are very conscious of the fact that our research assessment exercise has to go across all disciplines. There would be little argument that the use of metric information is really quite difficult in many disciplines. We are trying to have a consistent way of doing things. We are very keen to be abreast of the latest research but confident that peer review should remain the underpinning element.

Sir Mark Walport: If you are assessing an individual, there is simply no substitute for looking at their best output. If you are assessing a field, that is when you can start using statistical measures. You can start using

things like the number of citations. If you look at most funders, they are very focused on asking people to tell them what their best publications are, sometimes limiting the numbers. For our Investigator Awards, we limit the number of publications to people's best 20.

Professor Rylance: Following on from David's point, in my field, in the humanities, the majority of publications are not in journals. They are in other forms like books or chapters in books and so on. There simply is not the bibliometric apparatus to derive sound conclusions for that reason.

Q258 Pamela Nash: Given the importance of peer review in both academic research and publishing, do you think that formal training in conducting peer review should become a compulsory part of gaining a PhD?

Sir Mark Walport: Part of the training of a scientist is peer review. For example, journal clubs, which are an almost ubiquitous part of the training of scientists, bring people together to criticise a piece of published work. That is a training in peer review. Can more be done to train peer reviewers? Yes, I think it probably can. PhD courses increasingly have a significant generic element to them. It is reasonable that peer review should be part of that. People sometimes talk about the opportunity cost of peer review. Peer review is a form of continuous professional development. It forces people to read the scientific literature and it gives a privileged insight into work that is not yet published. Most laboratories would involve, if not their PhD students, their early post-docs in peer review work.

Professor Rylance: I would echo and support that. It seems to me that research is a collective enterprise and that anyone who wishes to enter that field either as an academic or in some other capacity needs to understand that. So an engagement with the work of others of a judgmental or other kind is really quite important as part of that process.

Q259 Pamela Nash: I am aware that the "Roberts funding" provided training for PhD students until recently. Would any of you have any ideas on who could be responsible for continuing that funding for that training?

Sir Mark Walport: That funding is available. For example, the Wellcome Trust funds four-year PhD programmes, so we are providing funding for a longer period. The research councils can speak for themselves, but the four-year model of the PhD is becoming well established and that gives universities the opportunity to provide that transferable skills training.

Q260 Pamela Nash: But should specific peer review training be recommended when that funding is given?

Sir Mark Walport: We are not prescriptive in what universities teach. As I said, that would be a reasonable component of it.

Professor Rylance: Shall I say something about the Roberts funding?

Pamela Nash: Yes, please.

Professor Rylance: The amount we are giving to universities for training and developing postgraduate research will increase, and it will include components which replace part of the Roberts funding. The issue we have to think about is that, on average, around only 25% of the UK postgraduate population are funded through agencies like the research councils. The rest of it is coming through other sorts of routes. How are universities going to provide a system for three quarters of the population who are not getting money from us? There has to be a joined-up conversation about how we develop that.

Q261 Pamela Nash: Thank you. Both Research Councils UK and the Wellcome Trust mentioned in their contributions to this inquiry that it would be favourable to reduce the burden—the bulk of the work—on referees of the peer review process. What would each of you propose to help streamline that process and reduce the burden on referees?

Professor Rylance: I would identify three things and I will say a little bit about each one of them. One thing you can do is demand manage. If the burden is increasing, and we recognise that it is just in terms of volume and the complication of frequency, if you start to reduce the number of applications, that work load starts to reduce and the quality of peer review goes up, presumably, how do you demand manage in that situation? You could do it in a draconian way. You could, for example, say, "The quota for this university is whatever it is", based on historic performance. You could do it developmentally working with universities to filter their own application processes, such that ones which are not going to go anywhere in any reasonable scheme are filtered out at an early stage, or you could go for what, in the jargon, is called "triage" processes when you receive them. So you do a relatively light-touch first stage application and then you reduce others.

My personal view—there are differences of opinion about this—is that measures like quotas have quite significant downsides, of which probably the most significant is that they would discourage adventurous, speculative, blue skies applications because, naturally, if you have a quota, people tend to be conservative about what they are putting in in order to try and gain the best advantage. The future of this lies in the direction of dialogue with universities, in trying to develop their processes, share good practice and work with the research councils, other funders and HEIs who are trying to do it. After all, in the end, it is in nobody's best interest to continue in this way. It cannot be the case. We must collectively try and make some headway with this.

David Sweeney: For us it is a volume problem. Obviously, more research is being done and more findings are being produced. We think that the amount that needs to go through the full weight of the peer review system need not continue to increase. Indeed, we are seeing initiatives in that. As part of our assessment exercise, we require four pieces of work over seven years from academics. In most disciplines, they will publish much more than that, but they do not submit it to the exercise because we are interested in selectively looking at only the best work. We would want to encourage academics to disseminate much of their work in as low burden a way as possible, but

submit the very best work for peer review both through journals and then, subsequently, to our system. That is the only way to control the cost of the publication system. We must look for variegated ways of disseminating and quality-assuring the results.

Sir Mark Walport: The first thing is that the academic community is still highly supportive of the fact that peer review is an intrinsic part of the scholarly endeavour. To put some numbers on it, between 2006 and 2010 the Wellcome Trust made about 90,000 requests for peer review. We got about 50% usable responses. The response rate was a bit higher but not every referee's report added value. That is a pretty good response rate, and much of that was international. We used the global scientific community to help review and they do that very willingly. People who are in environments where they know they cannot themselves get a Wellcome Trust grant are, nevertheless, willing to referee for us.

We work hard to reduce the burden. For example, we do some shortlisting of grants by expert committees. So rather than sending out the grants to lots of people to have written comments, we bring an expert committee round a table like *this* and they do the shortlisting. When you get down to the shortlist, there really is no substitute for written peer review. That is where we use that. We use things increasingly like a college of referees. Instead of every grant going to completely different people, you would have one or two people who would look at several grants. We are constantly trying to make the process more efficient. At the end of the day, the system is not broken, it is working and it is an important part of scholarship and research.

Q262 Pamela Nash: As a result of those answers, can I ask two more specific things? Would you say that reducing the burden is just a matter for the entire academic community or is there one group of people who are particularly responsible for that? Also, in the last few weeks, we have heard from publications that are using the cascade system to pass on submissions that they might not publish themselves. Do you think there is any value in that in reducing the burden for academics?

Sir Mark Walport: If I may start on that, peer review, of course, is used for different purposes. The predominant reason why the Wellcome Trust uses peer review is to make decisions about whether to fund a grant or not. Clearly, a cascade system is not appropriate for that. In terms of journal publishing, for a publisher that has a stable of journals, that may work, but then it is up to the authors of the work as to whether they want their paper, if it is rejected by journal A, to go to journal C in that series or whether they would rather try a different publisher. In principle, it is a good idea, but I think its effectiveness is yet to be fully tested.

Professor Rylance: I would like to amplify that. What we are talking about from the research councils' point of view is how you decide to fund *this* grant application rather than *that* one. We are not deciding "Should this be published or should that be published?" Again, if the focus is on journals, it is important to recognise that some disciplines don't primarily publish through journals and do engage with publishers about, for example, books. There are IP issues and the rest of it to do with cascade systems. It seems to me that that is an issue for the publishers rather than ourselves.

David Sweeney: We have a proper concern because of the cost of the system to universities and the way in which that is inflating above most other costs in universities. We are very keen to look at every way there is of reducing the burden. The cascade system is interesting, but we do not think that this is something where our funders should be prescriptive. It is a collaborative exercise between the community, the funders and the universities, and we should work together on that.

Q263 Pamela Nash: You have been very diplomatic. I wanted your opinion, although you are not directly responsible. Finally, do any of you have any ideas about how taking part in peer review can be formally recognised? Would you support a form of accreditation? Do you think there are benefits in that?

Professor Rylance: There are two points. One is whether I think that peer review should be part of professional development for researchers. The answer is, resoundingly, yes, because that is the world they are moving in. It is quite important that their employers recognise quite how much labour is put into it and how important it is in terms of not just their personal but their general benefit. Should it be accredited? There would have to be quite a complicated cost-benefit analysis on that. My instinct is that probably it is not worth whatever cost-plus distraction labour time such an exercise would produce.

David Sweeney: I agree.

Sir Mark Walport: I think this is one of those things where it is easy to say that you need to give people recognition for peer review. The reality is are you going to promote someone from a lectureship to a senior lectureship or from a senior lectureship to a readership on the basis of review? You are not going to do that. You are going to do it on the core scholarly activities which are education and the research itself. It is something that the community has to recognise. It is beneficial to do peer review. As I said before, it is part of your continuous professional development. It is about keeping up to date with the field. It is not broken. I think that system works. You could ask the question, "Should one pay the cost directly of peer review?" That is difficult. Academics do all sorts of things and they are not paid per unit item that they do.

Professor Rylance: Within the academic and research community at large there is a broad consensus that if you did not do certain kinds of activity—peer review would be one and external examining would be another—the whole system would be reduced to jeopardy. That is a general broad recognition and a willingness to support it.

Q264 David Morris: Professor Rylance, have Research Councils UK and Universities UK withdrawn funding from UKRIO, and, if so, why?

Professor Rylance: It is quite a complicated tale, so forgive me. The original RIO was set up primarily

with a remit for the biomedical sciences. It was set up on a fixed-term basis through a multi-agency system, which I am sure you are aware of, that included not just the funding councils, research councils and the Department of Health, but Wellcome were involved and other bodies. When that came to the end of its term, we had to make a decision about whether to continue. In other words, funding had stopped. It was not a question of withdrawing it. Do we continue that funding or do we not? There was a sense of two things. One is that it was really important to establish a body that had a remit and that that body should cover a broader range of disciplines than was the case with the original RIO. Secondly, we needed to disentangle various sorts of functions which were caught up within that original body. Could one be, for example, both a funder and an assurer of it, because you are clearly in quite a complicated relationship? Also, could you be both an assurer and an adviser, because, clearly, if you are giving advice which then turns out to be wrong, you would then be policing your own mistake at some level. We had quite a hard look at this in tandem with all of these bodies. Dame Janet Finch chaired a body that has produced a report on it. The general conclusion was that, in its current format at that stage, RIO was not going to meet the sorts of needs that I have just described. We continued its funding for a little and we are now thinking about different ways in which we can put together a collective agreement on research integrity in the UK, largely through, probably, a concordat style arrangement. The key player in this, just to complete the story, will be Universities UK. The reason why Universities UK are key to this is because they are not funders themselves of research.

Q265 David Morris: Are you saying that it is moving more towards the subscription funding model? Is this a necessary change?
Professor Rylance: It will be a subscription model in the sense that it will involve a series of agencies that will participate in the funding of it. Will that be a subscription based on very specific activities? You can buy in for this bit but not that bit, that kind of thing? We are a long way from agreeing that at the moment. There is a genuine sense among the bodies that I have just described that we need a cross-disciplinary and cross-organisational arrangement to provide assurance and link up the various sorts of assurance mechanisms that each funder has, to look at consistency and so on and so forth. That will be done, as I have described, through a concordat arrangement largely run through UUK, but that is as far as we have got at the moment.
Sir Mark Walport: May I comment on that? The Wellcome Trust was fully supportive of Research Councils UK on this matter. Research integrity is important. There is no argument and no debate about that. The question is where the responsibilities lie for ensuring that it happens. We believe very strongly that the responsibility for the integrity of researchers lies with the employers, so by and large that is the universities for university academics. It is clearly the research institutes for people employed by research institutes. That is why we support moving to a concordat between research funders and the employers whose researchers we fund that it is their responsibility, in the same way that health and safety is a responsibility that is delegated to employers. Frankly, we did not believe that UKRIO in the form that it was constituted was delivering what we needed.
David Sweeney: We are entirely supportive of that. This is something we have got to get right. We can only get it right by being collaborative. I do not think that funding is the core issue. Research Councils UK, working with Wellcome and the UK funding bodies, will support universities through what is needed. Of course, we have a broader assurance role in regard to universities. We are very keen that that should play in full support of the work that we are doing collectively.

Q266 David Morris: What do you think about the recommendation to create a new research integrity body, when one already exists, and should the body in the UK responsible for research integrity be a regulatory body with formal legal powers? Do you think that should be the case?
Sir Mark Walport: No. Let me be clear. UKRIO was not delivering what we needed.

Q267 David Morris: What are the potential future sources of funding for an organisation such as UKRIO? Could any of those sources be compromised in any of its independence?
Sir Mark Walport: But it is not clear, with respect, whether a third party body is needed to do this. This is an intrinsic responsibility of an employer. It is not something they should be delegating to somebody else. The integrity of the research is absolutely intrinsic to the good functioning of the university or the research institute. This is a responsibility that they must have.
Professor Rylance: The issue is not whether assurance should or should not happen. Clearly, it has to. If you give money to a body to do certain things, you must have steps in place to test that that is being used appropriately so there are assurance mechanisms. The issue is how we get consistency and joining-up between the different funders and agencies. That is the problem at the moment. There is no appetite for regulation in this at the moment for the various reasons that people have given.

Q268 Chair: Can I just be clear? In the report of the UK Research Integrity Futures Working Group there was a recommendation to create a single independent body to lead on "research integrity across all disciplines"—I think that was the phrase—and across all research establishments. Are you supportive of that concept?
Sir Mark Walport: No, I am not sure that I am. I believe that this is a responsibility of individual establishments.

Q269 Chair: I thought that is what you were saying. What about research councils?
Professor Rylance: We want a framework that is applicable in its different modes to different sorts of projects and disciplines. The situation in the old RIO—there is a successor body—was that it was only affecting a part of the community. Increasingly, there

are cross- disciplinary projects which need attention across the piece. That is our anxiety.

Q270 Chair: The report, of course, was published by RCUK and UUK in September, but there are differences of opinion about what should happen. Where is there agreement? Is there agreement that it should be dealt with by a single body, or is that controversial?

Sir Mark Walport: Let me try. First, there is agreement that research integrity is extremely important. There is no argument about that. There is also agreement that this is a fundamental institutional responsibility. As to whether an added body is needed, the question is what form that takes. There is certainly a need for a common repository of skills and information as to the processes you might go through. Whether there is any need for some sort of external quasi-judicial body, there may not be agreement on that. As I have said to you, my opinion is that that is not needed.

Professor Rylance: I entirely support that last point. There is no appetite for trying to find a regulatory body. But there is significant progress in two respects. One is towards developing this concordat that could then shape the activities of the various responsible agencies. The second is in terms of data and process-sharing between the various parties. If we, in RCUK, are doing a certain kind of thing that we would like to commend to other people, we will share that with others. Whether they choose to take it up is then their own business.

Q271 Gavin Barwell: Can I just ask a question on the timing? If I heard you correctly, when you were responding to Mr Morris, you said that you are still quite a long way from a final solution to this. You have stopped funding UKRIO at this point. What is the timeline?

Professor Rylance: We have provided some transition funding for UKRIO. I cannot remember exactly when that ran out, but it was about the end of the last calendar year or thereabouts. At the moment, there is the continuing activity by each of the separate funders monitoring their own projects. An early meeting, which included representatives from all three parties here, agreed on these core principles about information-sharing and concordat. The second meeting to try and work out the details of that is currently in the planning stage. That is where we are at the moment.

Q272 Gavin Barwell: Could you give the Committee an idea of when, roughly, you think this might be finalised and the concordat will be in place? I know you cannot predict exactly but could you give a ballpark idea?

Professor Rylance: I would be disappointed if we were getting too far into the late autumn and this thing is not in at least a fit-for-purpose stage.

David Sweeney: That is my understanding.

Professor Rylance: Let me stress that the one body that is charged, for the reasons I have given, with taking this forward organisationally is not here, which is UUK.

Q273 Graham Stringer: Sir Mark, can I follow up your answer to David? At our last evidence session we had the Pro-Vice-Chancellor responsible for research at Oxford here—I could give you the exact quote but I will not read it—who, basically, said that in his experience there had not been an occasion when they had had to investigate somebody for fiddling their results for fraudulent practices in research. On the other hand, we had another witness who told us that, if research institutions had not sacked at least one person, then they were not trying. Taking Oxford as an example, if you take your assertion that it should be the employers, that indicates that the employers are not carrying out that job. Certainly, in the case of Wakefield with the MMR scandal, the employers of Wakefield did nothing. I will now come to my question. Doesn't that mean to say that there has to be a huge change in employers' practices if your view was to be maintained?

Sir Mark Walport: Employers are responsible for the integrity of their employees in all sorts of aspects of life. They are responsible in business for making sure that they do not commit fraud and that the accounting is done well. I can't possibly comment on whether individual universities are immune from the malpractice of their employees. I do not think it alters the fact that, as in health and safety, and all sorts of other aspects, such as the good behaviour of employers in respect of how they deal with students, this is an employer's responsibility. Increasingly, universities are taking this very seriously. Of course, you can pick examples of where things go wrong. You can pick examples of where peer review hasn't worked well. The Wakefield sad story is a very good example of that. That paper should never have been published. But that is not an argument against organisations doing it well. In a sense, the importance of the concordat will be that it sets out in extremely clear terms what the relationship is and what the roles and responsibilities of universities as employers are for the integrity of their employees.

Q274 Chair: It is clear that the universities would have responsibilities, but, taking your two examples of health and safety or fraud in conducting their business, in both of those instances there is an external regulator with statutory powers.

Graham Stringer: Precisely.

Sir Mark Walport: The question is what those statutory powers should be. Ultimately, it is clear that a scientist who has committed some form of scientific fraud, if I can put it that way, should lose their job. Does that then fall under some other regulator? Is it something that the courts should deal with? Probably not very often. In the case of medical research, Andrew Wakefield eventually met his come-uppance at the General Medical Council. There are ways of doing this.

Q275 Graham Stringer: But he did not, did he? He was struck off for bad ethical practice. The General Medical Council did not deal with whether his research was fraudulent or not. In a sense that is a bad example. If I can repeat Andrew's point, yes, it is the

employers' responsibility, but who is going to keep the employers good?

Sir Mark Walport: That is where the funders will play a very serious role. We take research integrity very seriously as well. It is a grant condition that the work is done properly. From our perspective, in relation to an institution that failed to manage the research integrity properly, we would have to question whether that was an institution at which we could fund research. It is not that we don't take it seriously, but we believe that the mechanism for dealing with this has to be through the employer. Frankly, if the employer is unaware of things going wrong in the research, it is difficult to see how others would be aware and the employer would be completely unaware. They are doing it in whistleblowing procedures. As I say, a well-constructed concordat should make it absolutely transparently clear what are the responsibilities of the employer, whoever it is. We need to make sure that the employer takes that seriously, as they take all other aspects of employees' behaviour.

David Sweeney: In England, as the charities' regulator for most universities and as a regulator under the Act, universities are required to report incidents to us and we monitor the way in which they handle incidents. Actually it is routine.

Q276 Pamela Nash: If I could take up that point, without an external regulator—you have just said that funders have a responsibility here on who they fund—surely, that is then an incentive for an academic institution to keep things quiet so that they don't lose funding.

Sir Mark Walport: Not at all. It is the nature particularly of scientific research that errors are found out, and it can't be in the interests of any good university not to have the research done to the highest possible standard. As David has pointed out, there is a regulator. There are major funding sources that have substantial sanctions. There is no incentive to cover up.

Professor Rylance: I would like to make two quick points. One is that the public visibility of data and research is quite important. It is one good argument for open access, in my view. The second issue is that in the 18 months or so that I have been part of the AHRC I have had, perhaps, two or three occasions where relatively minor malpractice has been reported. The institutions involved have acted very readily. There is a working system between the funders and the institutions.

Q277 Graham Stringer: That is precisely the point I was going to move on to, which is access to data. Can I do it by reading a quote from last week's *Scientific American*, which makes the point really well? I would be grateful for your comments. It is by John P.A. Ioannidis: "The best way to ensure that test results are verified would be for scientists to register their detailed experimental protocols before starting their research and disclose full results and data when the research is done. At the moment, results are often selectively reported, emphasising the most exciting among them, and outsiders frequently do not have access to what they need to replicate studies. Journals and funding agencies should strongly encourage full public availability of all data and analytical methods for each published paper." Do you agree with that and do you follow those policies?

Professor Rylance: I do not work in a science area so I will defer to my colleagues here. The answer is yes; I endorse the broad principles of that. The one slight reservation I would have is that, quite often, research is a process of discovery and you don't quite know at the beginning what the protocols and procedures are that you are going to use, particularly in my domain. I would have a slight reservation about that, but the principles are right.

Graham Stringer: Fair point.

Sir Mark Walport: This is one of the arguments in favour of good peer review, because a good peer reviewer when reviewing a scientific paper actually probes and says, "Where are the controls? Where is the missing data?" That is the first thing. Secondly, we do explicitly ask investigators when they are generating datasets how they will handle the data. In general terms, we do encourage openness. In fact, at the moment there is a Royal Society inquiry on openness in science which is looking at the whole issue of openness of data. One has to recognise that there are both real costs and opportunity costs. Data is not an unalloyed good, as it were. It is something that has to be interpretable. It is quite easy to bamboozle by just putting out billions of numbers. It is actually a question of presenting the data in a way that is usable by others. But the principles of openness in science, of making data available and open, are something that the Wellcome Trust and other funders of biomedical research around the world are fully behind and completely supportive of.

Q278 Graham Stringer: Is what lies underneath that answer that you believe that codes, computer programs and all the data that would enable other researchers to replicate the work should be made available publicly?

Sir Mark Walport: Bearing in mind the feasibility and garbage in/garbage out, one has to be careful that the data is usable. Yes, increasingly very large datasets are generated. We want to maximise the value of the research that we fund. Therefore, openness is a very important principle. There are some other issues that need to be dealt with as well, so if you are dealing with clinical material then the confidentiality of participants is paramount. You have to manage data so that they are appropriately anonymised and people cannot be revealed. It has to be in the general interest of the advancement of science and knowledge. As you say, science is validated by its reproducibility. If you cannot see the data, that is a problem. Of course, the revolution of the power of the internet to make data available has meant that it is possible to put out data in ways that were never possible before.

There are no new principles. The way a scientific paper is structured is that it has a materials and methods section which should set out in sufficient detail for anyone else to be able to reproduce the work. There is nothing new here. Broadly, it makes complete sense to make as much data available in as

usable a form as possible. That is something that we strongly support. It is why the funding of institutions like the European Bioinformatics Institute, which is housed at Hinxton, is so important. The UK Government has a good track record in supporting the EBI and funding has recently been announced for an extension there as part of the European ELIXIR project. Making data available is something that is incredibly important.

David Sweeney: We believe in openness and efficiency in publicly funded research. Dr Malcolm Read took you through some of the issues at a previous hearing. We have funded and continue to fund projects that will push this area forward—UKRDS—and now some projects are looking at how cloud computing can help. Of course, we have learnt a lot from the research councils that the ESRC data archive has been a stunning success over many years. As Sir Mark says, the principles are all there. Technology is now allowing us to make advances, and through the work we fund we will learn a lot. Our objective is openness.

Q279 Graham Stringer: Where research is publicly funded, if I can paraphrase what you say, you are saying that the data should be publicly available. If there are good reasons for it being confidential, do you think it should be made available in a confidential depository to the reviewers and, potentially, for other researchers so that it is available in some form?

David Sweeney: That requires consideration of the particular circumstances and the sensitivity. Reviewers should have access to all the information. They need to assure themselves of the quality.

Professor Rylance: You start from that principle and then you think why it is that you shouldn't reveal that rather than thinking you should not make it publically available and then think of execptions.

Q280 Graham Stringer: You have mentioned that you could have a huge dataset. Some of it may be good data and some of it may be rubbish. Are there real problems of costs and, if there are, who should pay for those costs of storage? Are there any other practical problems of storing huge datasets?

Sir Mark Walport: There are very major costs. For example, the Sanger Institute this year alone has generated 1,000 human genome sequences. That is a massive data burden. Indeed, the costs of storing the data may in the future exceed the costs of generating it. Who should be responsible for doing that? It is, ultimately, a research funder issue, because we fund the research and so we have to help with the storage. It is like all of these things. Our funding is a partnership between the charity sector and the Government and it is a shared expenditure.

Professor Rylance: There are issues as well about obsolescence. At what point does this data become simply not relevant any more? The length of time for that will be discipline- specific and so on. There are a whole host of practical issues about how you do this. IP—intellectual property—is one, particularly, in my area, to do with creative works, for instance.

Q281 Stephen Metcalfe: I would like to turn now to the importance of articles versus journals, if I may. As I know you are aware, *PLoS ONE* instituted a programme of article level metrics. Do you believe that that is a good way to judge a piece of published science and, therefore, you are judging it on its intrinsic merit rather than the basis of the publication that it is in?

Professor Rylance: Yes, absolutely. To echo what we were saying earlier on, it is intrinsic merit that we are after. It is not reputational or associational value.

David Sweeney: I am not entirely sure that I would say that article level metrics necessarily captured the intrinsic metric merit. We should look at metrics of all kinds and try and judge where the collection and development of the metric does add value. As you drill down to individual articles, some metrics really are not entirely helpful. We have seen that with certain solid evidence in bibliometrics. Equally, we can see, with some of the networking metrics, that they may provide helpful information. I remain of the view that there will be no magic number or even a set of numbers that does capture intrinsic merit, but one's judgment about the quality of the work, which may well be, in any way, in the eye of the beholder, may be informed by a range of metrics.

Sir Mark Walport: I complete agree with David Sweeney on that. You can alter the number of times that an article is downloaded by merely putting some words in the title. There is good evidence that the content of the title influences the number of times that something is downloaded, so measuring download metrics can be very misleading. Different fields have different types of usage. Methods papers, typically, are extraordinarily heavily cited. There can be a long time before the importance of a paper is picked up. It is like all of these things; at a mass scale the statistics are helpful. If you want to assess the value of an individual article, I am afraid that there is no substitute for holding it in front of your eyes and reading it.

Q282 Stephen Metcalfe: You don't see the article level metrics as a potential threat to the more established high impact journals.

Sir Mark Walport: They are not a threat. Web-based publishing brings new opportunities, because it brings the opportunity for post-publication peer review and for bloggers to comment. There are things like the Faculty of 1000, which provides commentaries on papers. There are more and more ways for finding papers among a long tail of publications. This is a fast-evolving space. As the new generation of scientists comes through who are more familiar with social networking tools, it is likely that Twitter may find more valuable uses in terms of, "Gosh, isn't this an interesting article?" All sorts of things are happening. It is quite difficult to predict the future. It can only be an enhancement to have the opportunity for post-publication peer review. It has turned out to be quite disappointing in that scientists have been surprisingly unwilling to put detailed comments. When the Public Library of Science started, it had plenty of space where you could comment. Academics

are remarkably loath to write critical comments of each other alongside the articles.

Q283 Stephen Metcalfe: Does anyone else want to add to that? Is traditional publishing a threat to the journals themselves?
Professor Rylance: No. I, personally, do not think it is a threat. There are two issues here. One is the recognition of merit. I entirely agree with my colleagues that, in the end, you have got to read the bloomin' thing to see whether that is true. Then there is the issue about how people gain access to the good and the strong. That is a slightly different question.
David Sweeney: I don't care if they are a threat to the base journals because the journal ecology will develop based on competition and alternative ways of doing things. I am sure they will respond. In some ways, I hope they are a threat.

Q284 Stephen Metcalfe: You touched upon scientists being unwilling to get heavily involved in post-publication peer review. Philip Campbell from *Nature* told us that that may well be—I am summarising here—because there is no prestige or credit attached to that particular role and there is the risk of alienating colleagues by public criticism. Do you agree with that? Do you think that there should be a system of crediting people?
Sir Mark Walport: There are two separate issues. There are some very interesting community issues here. In the humanities, there is a long tradition of writing book reviews where one academic is scathingly rude about another academic.
Professor Rylance: That is constructive.
Sir Mark Walport: They feel more or less constructive than insipid. In the case of the scientific world, that tearing apart is done at conferences and at journal clubs. The scientific community does not have a culture of writing nasty things about each other. This is an evolving world.

Q285 Stephen Metcalfe: So introducing a system of credit—
Sir Mark Walport: On credit, I think one has to be realistic. Are you going to promote someone on the basis of the fact that they wrote a series of comments on other scientific articles? The hard reality is that the core activities of an academic in terms of their promotion and pay recognition are going to be around their own scholarship and their own educational activities. It can only be at the margins that you will get brownie points for having done post-publication peer review.

Q286 Stephen Metcalfe: Finally, if post-publication commentary were to grow, are you concerned about how you could ensure that there was no bias in that commentary, either positive or negative, either those wanting to build up someone's reputation or those wanting to tear it down without anyone actually challenging them?
Sir Mark Walport: It is quite clearly a risk. We see that in every other walk of activity on the internet. You have only got to look at the world of bloggs, Twitter or anything else. Openness brings its own risks. If anyone can comment, then they can all say what they want, so of course there are risks like that.
Professor Rylance: You could end up in the rather ludicrous receding world of having to peer-review the post-review and the rest of it to find out whether it has worth. Sir Mark was talking about the way humanities review each other's things in print. Of course, one function for the journals that do that is to act as a quality filter to make sure that nothing defamatory, inaccurate or prejudiced is being said. Clearly, if those filters are removed, there is a danger that people will be relatively unbuttoned about things.
Sir Mark Walport: It is self-correcting in that the scientific community is constantly scrutinising each other. A scientist who wrote something that was particularly egregious would be subject to the peer review of their own community.
David Sweeney: I think those risks exist but there are benefits. We will have to adjust to the use of social networking in this area.
Stephen Metcalfe: Thank you very much.
Chair: I am sure, gentlemen, that a lot of what we say in here will be subject to comment in the social media as well. Thank you very much for a valuable session.

Examination of Witnesses

Witnesses: **Professor Sir John Beddington**, Government Chief Scientific Adviser, and **Professor Sir Adrian Smith**, Director General, Knowledge and Innovation, Department for Business, Innovation and Skills, gave evidence.

Q287 Chair: Good morning, gentlemen. Sir John and Sir Adrian, thank you very much for coming in this morning. You are familiar with the piece of work that we are undertaking. We have heard that researchers perceive peer review to be "fundamental to scholarly communications". Is peer-reviewed literature also fundamental to the formation of Government policy?
Sir John Beddington: Good morning, everyone. The answer to that question is that scientific evidence is clearly fundamental to Government policy and peer review is a fundamental part of scientific evidence. That is not meant to be a cute response, but it is absolutely clear that the process of science involves peer review, and properly so, and that scientific evidence is essential for the evidence-based policy of the Government.

Q288 Chair: Is the proxy use of the impact factor of peer-reviewed publications to assess the quality of researchers and institutions a useful approach? Does it result in pressure on researchers to publish in high impact journals? Is it good for science?
Sir John Beddington: I would turn to Adrian to comment on that.

Sir Adrian Smith: It is a little circular, is it not, because why would a journal be designated as high impact? It will be related to the quality of the journal, which, in some sense, will be related to the selectivity of the journal, which will be related to the fact that it is sifting out, to some extent, the cream of the things that are submitted to it. I do not think any of the processes that we have relating to the RAE and so on actually builds in, in any formal sense, some kind of measure of impact factors. In different disciplines and communities, there will be a very clear peer group sense of the ranking of journals, which ones are more difficult to get published in and so on and so forth. They are all related back, essentially, to quality as perceived by the peer group.

Q289 Chair: Do you see the failure to get published in a high impact journal as a failing on the part of the researcher?

Sir Adrian Smith: It is a rationing process, is it not? If you take conventional journals, each issue will have a certain number of pages and a certain amount of space, so the editorial board will be sifting the best of what it has. It does not mean at all that the one that did not get in might not be a very valuable paper. There is, certainly, a knowledge in most disciplines of which journals are more selective and harder to get into than others.

Q290 Chair: Evaluation of editorial peer review is poor. Do you think that there is a need for a programme of research in this area to test the evidence for justifying the use and optimisation of peer review in evaluating science?

Sir Adrian Smith: The short answer is no. It is an essential part of the scientific process, the scientific sociology and scientific organisation that scientists judge each other's work. It is the way that science works. You produce ideas and you get them challenged by those who are capable of challenging them. You modify them and you go round in those kinds of circles. I don't see how you could step outside of the community itself and its expertise to do anything other. You have probably had it quoted to you already, but there was a paper in *Nature* in October 2010 when six Nobel Prize winners were asked to comment on how they saw the peer review process. Basically, it was the old Churchillian thing that there are all sorts of problems with it but it is absolutely the best thing we have.

Sir John Beddington: Peter Agre makes that point in that same article, saying: "I think that scientific peer review, like democracy, is a very poor system but better than all others."

Q291 Chair: That is twice that that has come up today.

Sir John Beddington: Sorry.

Sir Adrian Smith: That is no reflection on the Committee.

Sir John Beddington: Absolutely not; perish the thought.

Q292 Stephen McPartland: I would like to ask you about Government use of peer review research. The US Congress has codified the use of peer review in Government regulations using the "Daubert Standard". In the US, the Supreme Court codified their use in the courtroom. Have you had any discussions with your American counterparts regarding how this works and what any of the benefits are?

Sir John Beddington: I think I probably could answer this. We would not see particular merit in excluding non-peer-reviewed information, because we have to recognise that there is a whole set of information that comes in as Government makes policy, some of it via the media, for example, evidence that is coming in to deal with emergencies. A basic decision on that I don't think would be helpful. The issue is obviously going to be that, when we provide scientific advice to Government, there will be a weighing of that advice and the fact that certain advice is peer-reviewed and appropriately so, or indeed has been highly cited in a praiseworthy way, will go into the balance of that advice. I think I would advise against a piece of legislation saying that only peer reviewed evidence would be considered. One would also have to question the definition of peer review and so on. I don't think it would be something that I would be recommending to Government to think about adopting.

Q293 Chair: In the case of an emergency—I do not know how you are gathering evidence about, for example, the E.coli outbreak—that is happening in real time and, presumably, cannot be subject to any form of peer review. You have to make judgments on it.

Sir John Beddington: Very much so, Chair. That will always be the case. In other sessions of this Committee we have talked about scientific advice in emergencies. What is important is that the basis of that scientific advice is transparent after the event, but when real times are happening we are not going to be able to get a proper peer review of DNA sequencing of this new E.coli outbreak.

Sir Adrian Smith: There is an implicit peer review, however, because the individuals on whose judgments you draw for that short-term thing when you are not doing a proper peer review in some sense have risen to the surface as the experts through the fact that they have been peer-reviewed to death in their normal working scientific life and have emerged as the people with tremendous track records. There is an implicit peer review filtering of who you get the advice from.

Q294 Stephen McPartland: Do you believe that a test should be developed to identify whether or not peer review is reliable? This Committee recommended in 2005, in a report entitled *Forensic Science On Trial,* that a test for expert evidence should be developed, building on the US Daubert test, and the Law Commission has now built on that and published a draft Criminal Evidence (Experts) Bill.

Sir John Beddington: I would think that this has to be thought about on a case-by- case basis. Peer review is not a homogeneous activity. If one is starting to see that there are, for example, problems of peer review in a particular journal or in a particular area of science, that needs to be addressed by that journal and

by the people who work in that particular area of science. If you posed the question, "Is the peer review process fundamentally flawed?" I would say absolutely not. If you asked, "Are there flaws in the peer review process which can be appropriately drawn to the attention of the community?" the answer is yes. From time to time that will happen and that's the way to do it.

Sir Adrian Smith: And there will, from time to time, be misjudgments in that system. You can distinguish the system from particular cases within the system.

Q295 Stephen McPartland: Are UK scientific advisory groups mandated to use peer review?

Sir John Beddington: No, for the very reasons I gave in my answer to the Chair's earlier questions. We would certainly always take into account peer-reviewed information in providing advice to Government. I don't think we would ever exclude it, but that would not be the sole evidence. In fact, some of the evidence that would come in would depend on the area of science. For example, in a large part of social science the scholarship is developed by the production of books, quite often well after the event. Yet social research is extremely important to Government policy. We would have this but it would not necessarily have been published in a social research journal. By contrast, for example, if we are thinking in the context of some work on genomics, then one would be expecting that to have been peer-reviewed and that would be going into the evidence. Again, I just don't think that one would seek to make regulation. I emphasise again that the evidence we use in scientific, including social research, evidence, will sometimes be peer reviewed. Obviously, we would not seek to exclude peer-reviewed material but we would not wish to exclude material that had not been peer reviewed for these sorts of reasons.

Q296 Roger Williams: This is a fundamental question. In your opinion how well does the peer review process validate the assertions made in articles put forward for publication?

Sir John Beddington: In a sense, both Adrian and I have answered that question earlier. Peer review does not guarantee that the results are correct. Science moves on by its use of scepticism and challenge. We see all the time in the journals that are published this week that there will be people who have challenged peer-reviewed papers that were published some years ago and pointed out fundamental flaws in them or new evidence that undermines the conclusions of those papers. That is the progress of science. We can't say that it is a guarantee, and manifestly not.

We can say that it is an awful lot better than bare assertion without evidence. Particularly when you are looking at scientific issues that are fundamental to policy—I have talked about this to this Committee before—the emergence of scientific consensus is very important. That is not to say you do not have sceptics or appropriate challenges, but peer review does not guarantee that and it never could.

Sir Adrian Smith: It does have a lot of checks and balances in the system. In a past life I spent a lot of time refereeing mathematics papers for journals. In some sense, your own personal reputation does depend, as a reviewer, on not letting through things which are incorrect. The whole system and the direction of travel is to filter and get it as correct as possible, but it can never be a guarantee that you don't miss something.

Q297 Roger Williams: Today, and increasingly, I guess, in the future, submissions in science will be accompanied by very large and complex sets of data. Do you think that the reviewers should be assessing that underlying data as well as the article that is being produced?

Sir Adrian Smith: In an ideal world, but that is rather difficult, is it not, because data will come out of laboratories and field studies. As a reviewer, you can't go off and replicate that. If you are trying to study somebody's derivation of a mathematical formula, you can replicate. The difference between the scientific argument and the data is rather different, but the protocols that are in place for collecting data, for example, in medicine, in conducting proper clinical trials and all the rest of it, are in an environment where all the pressures and checks and balances are to get that right.

Q298 Roger Williams: The problem is getting access to that rather than the burden that is put on the reviewer in doing it.

Sir Adrian Smith: Yes. There is a great movement now and a recognition of openness and transparency, which has always been implicit as a fundamental element of the scientific process. But the more we collect large datasets, you have to give other people, as part of the challenge process, the ability to revisit that data and see what they make of it with openness and transparency. There is general support these days for the presumption that the research, the associated data and if you have written a computer code to assess it, should all be available and up for challenge and testing validation. In fact, explicitly the Research Councils encourage that, as Government Departments do. However there can be complex and legitimate reasons for not necessarily, at least in the short term, being that transparent. An awful lot of policy in recent years has meant that we have been trying to lever more out of public investment by joint working with business and industry and levering additional funding. Once you get into that territory, you do have commercial and intellectual property constraints on a temporary basis at least, for openness and transparency. The presumption is that, unless there is a strong reason otherwise, everything should be out there and available.

Sir John Beddington: Adrian has made a good point that in some of the areas some things are, arguably, not even replicable. For example, field studies are taken at a particular point in time and things may move on. In that case, the first key is to examine the basic methodology for the study and that would be subject to peer review. But in terms of saying, "Did they really do what they said they did in the methodology?" it is impossible to do that in certain areas of science. On the other hand, if something is

coming up in a very odd way, it is highly likely, over a period of time, to be very significantly challenged.

Q299 Roger Williams: Sir John, the Government is, obviously, a very substantial funder of science. Should it, as a matter of principle, require that all this raw data should be made available?
Sir John Beddington: Adrian has made a parallel point. With Government-funded science, the push is to have data out into the open. There are some areas, for example, shared data, which means you have a mix of data where some of the ownership of that data is outside the UK. You cannot make a hard and fast rule. In principle, though, the answer is that the more people who will look at the scientific problems from which we are wanting to get evidence, the better. Therefore, transparency is, obviously, extremely attractive. From time to time, there will be timing issues, IP issues and so on, which will mean that transparency can be problematic. In the area we were looking at—the community of Chief Scientific Advisers deals with this a lot of the time—we would be looking at material, and if it was not out in the open they would ask why not. If there is no good reason, they would urge that it would be put out into the open. Indeed, Research Councils push exactly along these lines.
Sir Adrian Smith: There will always be issues of personal data protection, commercial interests and intellectual property and national security, so the situation is quite complex. I understand that the Royal Society will be doing a study some time over the next 12 months that the Committee may well be interested in.

Q300 Roger Williams: I think there is agreement that this data should be made available, subject to all the concerns that you have expressed about IP and commercial interests. Another matter is the cost of all this. Who should bear that cost if it is going to happen on a greater scale than it has in the past?
Sir Adrian Smith: That is one of the issues that the Royal Society may well look at. Different communities, different cultures and different forms of data pose different issues, but there is a real problem. Yes, you are right.

Q301 David Morris: Gentlemen, should peer review be a requirement of gaining a PhD to take part in formal training, and who do you think should pay for the training in this peer review now that the "Roberts funding" has ended?
Sir Adrian Smith: I don't think that one size fits all in this situation. We have to allow a lot of scope for particular research organisations or supervisors to decide on what is appropriate. Peer review training is already part of the Research Councils' postgraduate training. There is a formal expectation that students—I am going to quote—"obtain an understanding of the processes for funding and evaluating research." The terms and conditions of training grants actually put some of this in. If you think about it, if you are doing a PhD, you are having to read and access a lot of literature and synthesise that literature. In fact, it is part of what I said earlier. It is an inherent part of the scientific process itself that you are constantly peer reviewing in a way. Every time you read something you are re-evaluating and seeing how it fits into what you are doing. I, personally, do not believe that any form of accreditation scheme is necessary. The amount of effort that has gone on in recent years on the part of the research councils to better codify their expectations of what research training should consist of and making that part of the conditions when they give out either doctoral training grants or research grants takes us most of the way. I do not think there is much that we could do in going further.
Sir John Beddington: I would add that a number of universities have exercises where PhD students and some academics examine individual papers. In that case, everybody goes away, reads a paper over the weekend and then they have a meeting and discuss and critically appraise that paper. That is part of the process. Obviously, that practice will differ between universities and subject areas.

Q302 David Morris: What do you think the Government can do to encourage formal recognition of the peer review element of researchers' work loads? Should a formal accreditation scheme be introduced, in your opinion?
Sir Adrian Smith: In my opinion, no.
Sir John Beddington: I agree. I don't think there is much merit in that.

Q303 David Morris: Do you think that steps should be taken to streamline the peer review process and help reduce the burden on researchers? If you do, who is responsible for ensuring that this burden is reduced?
Sir Adrian Smith: I would take issue with the words you are using. I do not regard peer review as a burden which is somehow additional and keeping fabulous researchers away from their day job. Peer review is an integral part of the scientific and research process and is part of the day job.
Sir John Beddington: Yes, I would agree with that.
Sir Adrian Smith: Not only is it a kind of inefficient extra burden but, if you think about it, if every individual researcher had to start from scratch with everything that was produced by somebody else and review it as their own individual reviewer, you would have a mountain of work to do. A system where, in submitting a paper to a journal, one of us takes it upon ourselves to review that and quality assure it for the rest of the community reduces that kind of burden incredibly. It is not only not a burden but—

Q304 Chair: It is a burden in the sense that it is time-consuming and labour-intensive.
Sir Adrian Smith: It is time-consuming and labour-intensive, but that is doing science. Doing science is time-consuming and labour-intensive. This is an essential part of the process. Peer review for journals is an incredibly efficient way of divvying up the labour so that each of us has less of a burden, in your language.

Q305 Gavin Barwell: I want to ask about research integrity and issues around misconduct. The report of the UK Research Integrity Futures Working Group

was published in September of last year. It recommended, and I quote, that "the UK should have a single body to lead on the common issues of research integrity across all disciplines, all types of research, and all research establishments". Do you agree?

Sir Adrian Smith: Yes, that is what it concluded. What happened subsequently was that that analysis and those recommendations were carefully considered by the RCUK executive group. There were a number of people involved in those kinds of discussions. Basically, their conclusion was that they could not go in that direction because they thought that there had not been sufficient attention paid to the appropriate relationship between advisory and assurance functions, the need to keep those apart, the opportunity and operational costs of implementing those and, in fact, that there were some substantial divergences of opinion between partners involved in those studies on what is best for research in terms of assurance. In terms of the current climate of fiscal austerity, it was not thought that that was the optimal way to go. Personally, the direction of travel in RCUK and the way they are trying to take this forward reassures me at this time that we are doing enough. I don't think you should take the fact that that particular recommendation wasn't taken forward in that particular way means that the spirit of what we are trying to do is not being taken forward.

Sir John Beddington: I have nothing to add to that.

Q306 Gavin Barwell: I am not sure if you had the chance to hear the evidence that we took in the previous session but, essentially, the point came out that what they seem to be looking at is some kind of concordat where the primary responsibility would lie with the employer. Reference was made to the parallel with health and safety where the employer has a responsibility. The point that a number of members of this Committee made to the previous witnesses was that in those situations there is a statutory regulator. There is somebody above the employer who has the responsibility for checking assurance. The Government does not believe there is any necessity for that in relation to research integrity.

Sir Adrian Smith: Without going through the full whack of regulation, we do have the UK Research Integrity Office, which is arm's length.

Q307 Gavin Barwell: But its funding has now come to an end, has it not?

Sir Adrian Smith: The funding for the group that Sir Ian Kennedy was involved with.

Q308 Gavin Barwell: UKRIO.

Sir Adrian Smith: I guess the stuff you got was from Rick Rylance, who has been running this. He would have said that the matters that fell under UKRIO—so you are actually trying to mimic some of that—are what the RCUK is trying to take forward in a different form in line with the spirit of the age and the sense of direction. If we can avoid getting into a heavy-handed regulatory framework, most of us would prefer to see if we could do it in another way.

Sir John Beddington: I would add that in terms of the role of the Chief Scientific Advisers, and indeed Government analysts more generally, the key thing is to make certain that the research is of a high quality and has been assessed under peer review, as we have already discussed, and has also been examined to see whether it is good, bad or uncertain. In my time as Chief Scientific Adviser I have not come across papers that have been going into evidence when there is some significant problem of research integrity. I have seen submissions from organisations that are not entirely scientific where I would query the integrity of the research behind them, but that is perhaps another matter.

Q309 Gavin Barwell: Coming on to that issue, Dr Liz Wager, who was speaking to us in her role on the Committee on Publication Ethics, told us—I quote again—"if a university hasn't fired at least one person for misconduct, they aren't looking for it properly". Do you agree with that?

Sir John Beddington: I was not present to hear the exact evidence she gave. Fraudulent activity in a research community is absolutely something that we have to stamp out and stop. For example, let's take a largish research group in which, perhaps, the head of the group is depending on material that has been done by post-docs or PhD students, and one of those post-docs or PhD students does something that is completely fraudulent. It is perfectly reasonable to give a fairly hard time to the head of that research group and say, "Why was this process not picked up?" I think that is a perfectly reasonable line of inquiry. The individual who has committed the fraud is the one that is culpable and the failure to detect the fraud has a degree of culpability. We should be thinking about learning from that. That being said, the detected incidents are pretty low.

Sir Adrian Smith: An awful lot of research is done in big teams. There are hierarchies in teams. There are principal investigators and so on. There could be things lower down in the chain which are hard to spot higher up. The case like that in Korea of fraudulently parading experimentation at principal investigator level is pretty rare. You have the checks and balances in big groups. You have a hierarchy of researchers working together. For any one individual to do something that leads to disaster is pretty unlikely. It happens but you are not going to be able to regulate it out of existence.

Q310 Gavin Barwell: In the past there has been a perception that publication fraud or misconduct has not always been investigated by the institutions in a timely fashion. Wakefield and MMR is an example. Should there be a legal requirement on institutions to conduct a timely inquiry and to publish the full findings of that inquiry and any disciplinary action that is taken?

Sir Adrian Smith: I don't know whether you need to go to what "legal" means, but, if you think of the funding that goes into universities, some of it will come through the Funding Council, for instance, through the QR stream and some through research grants. Both with the research councils and the Higher

Education Funding Council conditions of grant are attached which make it clear what the expectations of behaviour are. I think those are sufficient sanctions in themselves. An institution that would not follow up properly would be putting at risk its funding from HEFCE and the research councils.

Q311 Gavin Barwell: Are there specific conditions relating to what institutions should do if there is a suggestion that misconduct was taking place?
Sir Adrian Smith: Probably not.

Q312 Gavin Barwell: Do you think there ought to be?
Sir Adrian Smith: It is an interesting thing to discuss. My own view, having run a university for 10 years, is that the constraints you are under in terms of conditions from the many funders that one has are quite sufficient to frighten one into doing appropriate things.
Sir John Beddington: The RCUK's code of conduct, too, is a good look guideline in terms of conflicts of interest and appropriate behaviour. In the sense that universities depend on a significant income from the research councils, then they would be extremely unwise not to take forward any issues very quickly where they had detected fraud. The media would be commenting on it and other people in the same scientific area would be commenting on it. There would be a very substantial incentive for the universities to take this forward rather quickly.

Q313 Graham Stringer: If I could follow up Gavin's questions, in terms of fraudulent behaviour, we are in an area where we don't know what we don't know, really. There is a certain amount of evidence that very little fraud is detected in universities and major research institutions in this country. Do you think we should be doing more to try and detect that, because in one sense there is an interest within those bodies not to discover or expose the problems they have, to sweep it under the carpet, isn't there? If you are running a university and you find you have a researcher who just writes down his figures without doing the work, which has happened in one or two cases, the university doesn't want to say that it has been employing a fraudster for 10 years, does it?
Sir Adrian Smith: I would disagree. When I ran a university, I would put it exactly the other way round. The institutional reputation will suffer much more long-term harm if you allowed fraudsters to exist and you don't do anything about it. In fact, I think you would get a lot of brownie points in many communities if you publicly identified such people and threw them out. I think the incentives are all in the opposite direction.

Q314 Graham Stringer: It is surprising, therefore, is it not, to follow Gavin's question, that there are no cases in Oxford, as the Pro Vice Chancellor told us, and that there are very few cases in other universities and research institutes where people have found fraudulent behaviour? In the case of Wakefield, even when fraudulent behaviour was found out, the institution investigated itself and found nothing wrong. The evidence we have is in the other direction, isn't it?
Sir John Beddington: I would not seek to comment on the Wakefield case. The issues here are that there is so much in the checks and balances in the way that science operates that fraudulent behaviour is highly likely to be detected by, initially, I suspect, gossip and then increasing concern that there is something wrong. That will happen. It may happen in the community and the attention will then be drawn to the university, and it would be very unwise for the university to ignore that information. I have not experienced it in 25 years at Imperial College.

Q315 Graham Stringer: Can I ask why you won't comment on Wakefield, because it is one of the great scandals of the last 10 or 12 years? It was not dealt with very well. Are there not things to be learnt from that?
Sir John Beddington: Yes, there are. My reason for not commenting is that I haven't read into it for a while, and I would like to re-familiarise myself before I commented, Mr Stringer, rather than any shyness on my part. I am not on top of the detail.

Q316 Graham Stringer: That's fair enough. That's fraud. Are there problems with peer review in other areas? For instance, there is a huge amount of research sponsored by pharmaceutical companies and companies that produce biomedical products. Do you believe that a lot of researchers in those areas are biased towards the products that those companies are selling?
Sir Adrian Smith: I will make an initial comment. I don't think a lot of the research itself is biased. There are biased reporting effects, because if you are doing clinical trials and you get negative results, there isn't a journal on clinical trials that didn't work. It is the ones that work that get published. There is a selection bias in that sense. Do not forget that at the end of the day these things have to get through the FDA or drug regulatory authorities if they are to come on to the market. Then you have incredibly close scrutiny of the protocols, the trials that were done, the conditions under which they were done and so on and so forth. I think there are tremendous checks and balances in the system against that.

Q317 Graham Stringer: Are there structural problems where there are only three experts in a particular field, so that they are, effectively, all peer reviewing each other and they either agree or disagree? In one sense, that was the major criticism of those people who criticised the researchers at the university of East Anglia for their research, was it not? There is a very small pool of researchers in that area.
Sir John Beddington: Yes, you have that, but people are always moving out of their own fields. There is academic interchange. If things are of sufficient importance, they are likely to get challenged, not necessarily by the top two experts in the field but by others who are around the fringes, particularly if they are of significant interest. That is what one would expect to happen. There are issues, for example,

where journals will have an issue in terms of finding sufficient people on a particular area of expertise to provide assessments. In that case, the usual practice, it seems to me, goes rather outside the field so you get challenged from different directions. That is quite common, in my experience.

Q318 Graham Stringer: To finish on a fairly obvious question, nearly all of our witnesses have used the Churchillian quote, but when you get fraudulent papers that have been through the best process we have of peer review, do you think that peer review is damaged in that process? Getting back to Wakefield, his paper was peer reviewed. Do you think the peer review process has been damaged?
Sir Adrian Smith: How far do you want to take the Churchillian democracy analogy? There are bad things that happen within the peer review system. Not every MP who has been elected has behaved totally honourably.
Graham Stringer: What a shocking thing to say.
Sir Adrian Smith: You would not abandon the democratic process, presumably.
Graham Stringer: No. That would be terrible. Thank you.

Q319 Chair: Finally, are you aware that RCUK has ever cut funding because of fraud or allegations of fraud? If so, could you give us any examples?
Sir Adrian Smith: I would have to go back and look through the archives, as it were, and directly ask that of chief executives. I am not directly aware of a case.
Sir John Beddington: I have no experience of it.
Chair: Thank you very much indeed.

Written evidence

Written evidence submitted by John Wiley & Sons (PR 31)

Introduction

About Wiley

John Wiley & Sons, Inc. was founded in 1807. Wiley's core businesses include scientific, technical, medical and scholarly (STMS) journals, encyclopedias, books and online products and services; professional/trade books, subscription products, training materials, online applications and web sites; and educational materials for undergraduate and graduate students and lifelong learners. Wiley's global headquarters are located in Hoboken, NJ, with operations in the US, Europe, Asia, Canada and Australia. The company's web site can be accessed at www.wiley.com. The company is listed on the New York Stock Exchange under the symbols JWa and JWb.

Wiley-Blackwell is the international STMS publishing business of John Wiley & Sons, with strengths in every major academic and professional field and partnerships with many of the world's leading societies. Wiley-Blackwell publishes 1,500 peer-reviewed journals and nearly 1,500 new books annually in print and online, as well as databases, major reference works and laboratory protocols. For more information, please visit www.wileyblackwell.com or our new online platform, Wiley Online Library (wileyonlinelibrary.com).

1. Wiley welcomes the opportunity to respond to the Science and Technology Committee's inquiry into peer review which it sees as an essential part of the publishing process.

2. The journals published by Wiley (many in partnership with societies) received around 470k submissions in 2010 for peer review. This represents a 12% increase in submissions from 2009, and a 29% increase from 2008. In 2010 we published 2% more articles than in 2009, ie we increased our rejection rate to achieve higher standards.

3. To quote from Peer Review and Manuscript Management in Scientific Journals by Irene Hames (published by Wiley-Blackwell in association with the Association of Learned and Professional Society Publishers): "It is the quality-control mechanism that determines what is and what is not published, and in most scientific disciplines work will not be considered seriously until it has been validated by peer review. It acts as a filter for interest and relevance."

4. Along with the selection function peer review plays an important role in many disciplines in improving the paper before publication.

5. Peer review does not normally deal with fraud and plagiarism although reviewers will sometimes pick these up. There are now tools such as CrossCheck which assist editors in detecting duplication and therefore possibly plagiarism. New tools also enable publishers to detect duplicate submissions to the same journal.

6. Wiley has been instrumental in working with the leading online peer review system, ScholarOne Manuscripts, to introduce features that increase the efficiency of journal editorial staff and the peer review process. Such improvements include: electronic copyright agreements, automatic deposit of NIH-funded papers in PubMed Central, and plagiarism detection.

7. Peer review is a robust and evolving system which has been capable of handling an increase in submissions in recent years of around 10% per annum in our case without slowing publication schedules.

1. *The strengths and weaknesses of peer review as a quality control mechanism for scientists, publishers and the public*

1.1 Ideally peer review filters out poor science, checking that:

(a) Design and methodology is sound.

(b) Work is reported clearly with acknowledgement to previous published work.

(c) Results are interpreted correctly.

It should also help the editor select what will be of interest to the journal's readers, ie within scope of the editorial policy, and help the authors improve the quality of the paper. The Ware survey (Mark Ware & Mike Monkman, "Peer Review in Scholarly Journals—perspective of the scholarly community: an international study", a Publishing Research Consortium Project—see report at http://www.publishingresearch.net/PeerReview) reported that only 8% of papers submitted are accepted without revision; 64% of respondents reported that peer review of their last published paper had identified scientific errors. To quote Ware: "Testing of work through the criticism of peers is in a broad sense at the heart of scientific method".

1.2 As is well understood by all users the quality of journals varies. Authors will submit their best work to high status journals and the reviewer will as instructed by the editor apply standards appropriate to the journal. Users will be aware of this hierarchy when searching the literature.

1.3 The system is remarkably robust. Its demise has been predicted for decades yet it handles an annual increase in submissions of around 5–10% in recent years across the industry.

1.4 The weaknesses of peer review can be minimised by emphasis on publishing ethics. Reviewers, for example, should declare any conflict of interest and not abuse their privileged status.

1.5 Peer review is also criticised for delaying publication but this has to be set against the benefits listed above. In some subjects, such as clinical medicine, releasing a paper without peer review could have serious consequences.

2. *Measures to strengthen peer review*

2.1 It is in the interest of publishers to strengthen peer review whenever possible. We compete for authors who submit largely on the basis of the status of the journal. Most editors are trying to increase the Impact Factor (IF) of their journal. And some customers (libraries) are taking IF into account when deciding on renewals or cancellations.

2.2 There are two elements to improvement:

(a) Technology—electronic editorial office systems have enabled editors to manage the peer review process more quickly and internationally, with feedback on performance.

(b) Conduct and best practice—Wiley, for example, has been a strong supporter of the Committee on Publication Ethics (COPE; http://publicationethics.org/) and issues its own guidelines to editors backed up by surveys.

3. *The value and use of peer reviewed science on advancing and testing scientific knowledge*

3.1 The value is clearly understood by users as was shown in the Tenopir *et al.* study (Research Publication Characteristics and Their Relative Values. A Report for the Publishing Research Consortium, http://www.publishingresearch.net). It is difficult to imagine how research would progress without the foundation of peer-reviewed literature; presumably less efficiently and more slowly.

4. *The value and use of peer reviewed science in informing public debate*

4.1 Sense about Science (http://www.senseaboutscience.org) has shown the importance of public awareness of peer review, as has the Science Media Centre (http://www.sciencemediacentre.org) in briefing the media. Publishers like to see their peer reviewed articles quoted by the media and encourage this through press releases and agencies.

5. *The extent to which peer review varies between scientific disciplines and between countries across the world*

5.1 There is considerable variation between disciplines. We do not attempt to standardize the process but support whatever model has evolved in each community.

5.2 There is also variation between countries but this is perhaps reducing with the widespread adoption of online peer review systems, the efforts of COPE and other organisations such as ICSU with its committee on Freedom and Responsibility in Science (CFRS) and the larger international publishers taking on locally-based journals.

5.3 There is some imbalance between the origin of papers and the location of reviewers. For example North Americans make an above average contribution to the process while the Chinese are below average but this is likely to even out with globalization.

6. *The process by which reviewers with the requisite skills and knowledge are identified, in particular as the volume of multi-disciplinary research increase*

6.1 The greater accessibility of journal content and discoverability enables editorial teams to identify potential reviewers more easily and through online peer review systems their performance can be tracked. As the multi-disciplinary approach develops it will produce more researchers capable of reviewing multi-disciplinary studies.

The challenge to find appropriate reviewers can be more acute in niche subjects where it may be difficult to find two independent reviewers without a conflict of interest.

7. *The impact of IT and greater use of online resources on the peer review process*

7.1 This has enabled us to keep pace with the growth in submission as outlined above. Nearly all of our 1500 journals use online peer review systems.

8. *Possible alternatives to peer review*

8.1 Most of our journals employ single blind review but we monitor closely experience with double-blind review and open peer review. One of our learned society partners (EMBO) is also developing a more transparent approach.

Evidence for the efficacy and usefulness of post-publication comment is not yet convincing, both in terms of the quantity and quality of such comments, although we expect to see links to blogs and other post-publication comments as standard practice, and our systems and processes will accommodate this if the academic and professional communities whom we serve want it. Post-publication comment is likely to be a supplement to pre-publication review rather than a substitute for it.

The real challenge is how to deal with the growth in research data that sits behind the journal article. Policies for data curation and sharing are emerging but there is no related peer review process or quality control.

Conclusion

Peer review depends on the voluntary support of the research community. The Ware survey indicated largely altruistic explanations for their support. The most popular reason was "to play your part as a member of the academic community", followed by "to enjoy being able to improve the paper", and "enjoy seeing new work ahead of publication". The second and third explanations indicate why pre-publication peer review as opposed, say, post-publication comment dominates the publishing process. Researchers like to be involved before publication in producing a better paper. It is our job as publishers to enable reviewers to carry out their task as efficiently as possible. We do this by investing in the appropriate technology, working closely with editors, supporting and implementing the guidelines from COPE and never taking our reviewers for granted.

Robert Campbell and *Cliff Morgan*
John Wiley & Sons

Written evidence submitted by the Committee on Publication Ethics (COPE) (PR 34)

Background: COPE

The Committee on Publication Ethics (COPE) is a UK registered charity that promotes integrity in research publication and advises journal editors how to handle cases of research and publication misconduct. It provides a forum for editors and publishers of peer-reviewed journals to discuss specific, anonymised cases. Summaries of these cases, together with a wide range of guidance material, are freely available (to members and non-members) via its website: http://publicationethics.org.

COPE currently has nearly 6,500 members from around the world and from all academic disciplines. Membership is open to editors of peer-reviewed scholarly journals. COPE's main source of funding is from publishing companies paying for their journals to join. All members of COPE are expected to follow a Code of Conduct for Editors and we have recently developed a complementary Code of Conduct for Publishers. COPE will consider complaints against members alleged to have broken the code. However, COPE does not undertake any other investigations into allegations of research or publication misconduct. COPE publishes guidance documents including a series of flowcharts advising editors how to handle ethical problems such as plagiarism and reviewer misconduct. We are currently developing a distance learning programme for editors.

Scope of This Submission

This submission focuses on the use of peer review before publication by scholarly journals.

1.0 *Does peer review work?*

Peer review is the process by which reports of, or proposals for, research are scrutinised by other researchers. It is widely used by journals to determine what to publish and by funding bodies to determine what to fund. Peer review has been used for at least 300 years, and records of the Royal Society show that it was used in the 17th century to decide which work would be presented before the Society. Although peer review is well-established, evidence of its effectiveness is inconclusive.[1,2] However lack of evidence of efficacy is not the same as saying there is evidence that it does not work. Peer review is difficult to study, partly because its functions have not always been clearly defined.[3] However, the general consensus among editors and publishers is that peer review is useful and is probably the best system currently available for assessing the quality of submissions to journals and ensuring the quality of material published. Most researchers also acknowledge that, while peer review has some shortcomings, it is generally a useful system.

2.0 *Can peer review be abused?*

Peer review relies, to a great extent, on trust between authors, editors and reviewers. All have obligations and responsibilities but journal editors and reviewers occupy a privileged position. Editors have a duty to ensure that peer review for their journal is carried out in a fair and efficient way. Items for publication should

be selected on the basis of the quality, originality and relevance of the work and its suitability for the journal. However, peer review may be affected by bias (for example if editors are biased towards the work of friends and colleagues or against the work of competitors) and misconduct (for example if reviewers steal ideas or data from other researchers).

3.0 *Steps to reduce bias*

It is probably impossible to eliminate all bias from peer review but good editors endeavour to minimize it. Since reviewers are selected for their knowledge and experience in the field being studied, and most will be active in that research area, it is rare to find a completely disinterested reviewer, but editors must seek individuals who are well-informed yet can produce an objective review. Editors need to be aware of financial conflicts of interest, academic rivalries, personal animosities and sometimes political or religious views that might affect objectivity. Studies have suggested that reviewers may be biased towards or against authors from well-known institutions, from other countries, or of a particular gender. However the evidence is not clear-cut and, in some cases, is contradictory.[4]

3.1 Blind (masked) peer review

Some journals use blinded (or masked) peer review in an attempt to reduce reviewer bias. This involves removing the authors' names and institutions, and sometimes other identifying features such as references to their own work, from the manuscript before it is reviewed. However, at least in the medical literature, the evidence of whether blinded review is practicable or reduces bias is contradictory. A summary of published studies concluded that, in the absence of conclusive evidence, editors should judge which system was best suited for their journal.[5]

3.2 Open peer review

An alternative approach to reducing bias is to use open peer review and this has been adopted by some medical journals. In open peer review, not only are the authors' identities revealed to the reviewers, but the reviewers' sign their reviews so their identity is disclosed to the authors. (Note: the term "open review" is sometimes also applied to systems where articles are posted for public comment either before or after publication—this is obviously different from open peer review as described here.) Proponents of open peer review suggest that it may improve the quality of review, reduce personal attacks and help uncover biases and undisclosed competing interests. Opponents fear that individuals may be unwilling to act as reviewers if their identity is revealed, or may be too guarded in their comments. Studies comparing open and conventional review are inconclusive and have failed to demonstrate that one is superior to the other.[5]

4.0 *How common is misconduct by reviewers and editors?*

Misconduct by reviewers and editors is probably rare but can have serious effects on those affected and is recognised as a form of academic misconduct. Although it is hard to tell how often abuse occurs, even low levels of misconduct can reduce trust in the system and are therefore important.

4.1 Cases brought to the COPE Forum

The Committee on Publication Ethics (COPE) considers cases submitted by its members (journal editors) to its Forum for discussion and these provide some information on this question.6 COPE does not adjudicate on the cases, but simply provides informal advice, so it is also important to realise that not all cases labelled as concerning a particular type of misconduct actually involved misconduct. Also, since COPE produces guidance for editors on how to handle the most common types of misconduct, cases brought to the Forum are likely to represent the most complex cases, or those that fall into grey areas rather than clear-cut cases of misconduct. However, in the absence of other data, analysis of the COPE cases indicates journal editors' concerns. Since it was established in 1997, COPE has considered 419 cases (all of which are summarized on the COPE website)6. Of these, 17 (4%) involved possible reviewer misconduct and 29 (7%) involved unethical behaviour by editors. (For comparison, cases involving the most common types of author misconduct, namely multiple submission and plagiarism, were brought to COPE 41 and 43 times respectively.)

4.2 International survey of science journal editors

A survey of 231 science journal editors[7] run by Wiley-Blackwell found that most believed that reviewer misconduct in general, and, more specifically, failure by reviewers to disclose competing interests occurred only rarely in their journals. The average ratings were 0.8 and 0.94 respectively on a scale of 0=never, 1= rarely (less than once a year), 2=sometimes (more than once a year), 3=very often (at least once a month). The editors stated that the frequency of such problems was stable. Out of 16 possible ethical issues identified, these two were rated 8th and 5th respectively in terms of their seriousness.

5.0 *How should editors respond to suspected reviewer misconduct?*

COPE recommends that editors should follow the steps set out in its flowchart if they suspect that a reviewer has appropriated an author's ideas or data .[8] The flowchart recommends that the editor should review the evidence to determine whether the author's allegations are well-founded and, if they are, should discuss them with the reviewer. If the reviewer cannot provide a satisfactory explanation, or does not respond, the editor

should contact the reviewer's institution and ask for an investigation. Another flowchart provides guidance on how editors should handle cases of suspected plagiarism (which may result from reviewer misconduct).[9]

6.0 *What safeguards are in place to prevent and detect misconduct by journal editors?*

COPE requires all its members to follow its Code of Conduct[10] and will consider complaints against those alleged to have broken the code.[11] COPE also provides advice to members through its quarterly Forum meetings and from members of its staff and Council between meetings. COPE also occasionally contacts its members to discuss issues informally. COPE encourages journals and publishers to have systems in place for handling complaints about editorial misconduct (and will only consider complaints itself once such procedures have been exhausted).

7.0 *How can misconduct by reviewers and editors be reduced?*

COPE membership has grown dramatically, starting from about a dozen editors of UK medical journals in 1997 to almost 6500 journals from all academic disciplines today (of which about 750 are journals published in the UK). We have been particularly encouraged that several major academic publishers, including BioMed Central, Emerald, Elsevier, Oxford University Press, Springer, Taylor & Francis, Wiley-Blackwell and Wolters Kluwer, have signed up many or all of their journals (and this has contributed to the rapid increase in COPE membership in recent years). However, by no means all UK publishers or journals are COPE members. COPE is a registered charity and raises funds entirely from membership subscriptions which are set on a sliding scale depending on journal frequency or turnover. However, COPE provides membership at no or reduced cost to journals from developing countries and others that cannot afford the regular subscription. We would welcome public endorsement of COPE's policies and their inclusion into national (and international) standards for publishing.

8.0 *How can editors and publishers prevent bias and misconduct?*

Editors are responsible for the way in which peer review is organized at their journal, although this may also be influenced by systems and resources provided by the publisher. There are many minor variations in the way peer review is conducted across different journals but no clear evidence that one system is better than any other. However, journal systems play an important part in reducing bias and misconduct. COPE therefore advises and educates editors about best practice in this area. COPE produces a Code of Conduct for editors[10]. The Code states that "Editors' decisions to accept or reject a paper for publication should be based on the paper's importance, originality, and clarity, and the study's validity and its relevance to the remit of the journal… A description of peer review processes should be published, and editors should be ready to justify any important deviation from the described processes." The latest version of the Code (in press, at the time of preparing this submission) also states that "Editors should require reviewers to disclose any potential competing interests before agreeing to review a submission".

8.1 The COPE Code of Conduct for Editors states that "editors should strive to ensure that peer review at their journal is fair, unbiased and timely" and that they "should have systems to ensure that material submitted to their journal remains confidential while under review". Journals should also "have systems for managing their own conflicts of interest as well as those of their staff, authors, reviewers and editorial board members". Each journal should also "have a declared process for handling submissions from the editors, employees or members of the editorial board to ensure unbiased review". The Code also states that "Editors should provide guidance to reviewers on everything that is expected of them including the need to handle submitted material in confidence". COPE is working with several major publishers to audit their journals' adherence to the Code and advise them about how they might improve their policies and processes. We are also developing a distance learning package for editors and publishers which we hope to launch in mid-2011.

9.0 Role of Academic Institutions in Preventing and Responding to Allegations of Misconduct

Journals should not be solely responsible for preventing and handling misconduct by reviewers. Academic institutions (and other organizations that employ researchers) should promote good peer review practices, recognize that acting as a reviewer is an essential part of academic work, and provide training in research integrity and publication ethics to all researchers. Institutions should also be responsive to well-founded requests from journal editors to investigate suspected misconduct by reviewers. If an institution finds that a researcher has abused the peer review system (eg by stealing another person's ideas or data during peer review) this information should be shared with the editor of the journal (or the funding body) concerned. However, judging from cases presented to COPE, editors do not always find institutions to be responsive or willing to share results of inquiries into misconduct. Problems have been encountered in communicating with both UK and overseas institutions and COPE therefore plans to work towards improving cooperation and dialogue between editors and institutions. One important step would be for all UK institutions to appoint a research integrity officer who would act as a point of contact and coordinate investigations.

10.0 Recommendations From COPE for Improving Peer Review and Scientific Publications

10.1 Academic institutions should recognize the importance of peer review to the dissemination of scientific research findings and therefore allow researchers time to act as reviewers. All reviewers should be prepared to act as reviewers as part of their academic role on the understanding that others will do the same for their work. Skills of critical appraisal necessary for peer review are also applicable to other activities (for example in the application of evidence-based medicine) and should be properly taught. Institutions should also provide training for junior researchers in research integrity and publication ethics.

10.2 UK research institutions should be required to identify a Research Integrity Officer (as is done in America). This person would act as a point of contact (eg for journal editors to raise concerns about possible research misconduct) and coordinate investigations as required.

10.3 Editors of scientific journals should be encouraged to join COPE and follow its guidance on best practice. UK publishers should be encouraged to support the editors of their journals in joining COPE.

Declaration of Interests

COPE

The Committee on Publication Ethics is a registered charity (number 1123023). Membership is open to editors and publishers of peer-reviewed scholarly journals and those interested in publication ethics. It obtains funds from subscription fees. Many of COPE's guidance documents are freely available (to non-members) on its website http://publicationethics.org.

COPE is run by an elected Council, members of which are also trustees of the charity and are all unpaid. COPE has one full-time employee and three part-time contractors.

About the author

Dr Elizabeth Wager is the Chair of COPE. This is an unpaid position. She developed the COPE flowcharts and was involved in drafting or revising some of the COPE documents referred to in this submission. She works as a freelance trainer and consultant providing courses on writing, medical publishing and publication ethics to doctors, researchers, writers and other employees working in academic institutions, healthcare institutions, pharmaceutical and medical device companies, communications agencies, and publishers. She is the author of a book on publication strategy ("Getting Research Published" 2nd edition, 2010, Radcliffe Publishing). She has worked as a consultant to Wiley-Blackwell and the BMJ Group coordinating publication ethics audits and a survey.

This submission has been approved by COPE Council (7th March 2010) and represents the views of COPE.

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Committee on Publication Ethics (COPE)

8 March 2011

Written evidence submitted by the BMJ Group (PR 41)

This written evidence on behalf of BMJ Group examines the following aspects of the committee's terms of reference, with particular focus on biomedical publication:

- the strengths and weaknesses of peer review as a quality control mechanism for scientists, publishers and the public;
- measures to strengthen peer review;
- the processes by which reviewers with the requisite skills and knowledge are identified, in particular as the volume of multi-disciplinary research increases;
- the impact of IT and greater use of online resources on the peer review process; and
- possible alternatives to peer review.

1. **Peer review and scientific norms.** Peer review embodies all the so-called Mertonian norms of science.[1] Proposed by US sociologist Robert Merton, these comprise: Communalism (common ownership of scientific discoveries, where scientists give up intellectual property rights in exchange for recognition and esteem [Merton used the term Communism, but did not mean Marxism]), Universalism (claims to truth are evaluated in terms of universal or impersonal criteria and not on the basis of race, class, gender, religion, or nationality), Disinterestedness (scientists are rewarded for acting in apparently selfless ways), and organized Skepticism (all ideas must be tested and subjected to rigorous, structured community scrutiny).

2. **Uses of peer review in science.** Peer review provides scrutiny to support many elements of academic discovery: approval and funding of research studies; regulation and approval of new drugs and medical technologies; selection of research for presentation at conferences and for publication; and rating and funding of academic staff and departments.

3. **Norms for peer review at biomedical journals.** The International Committee of Medical Journal Editors (ICMJE) defines journal peer review as "unbiased, independent, critical assessment…by experts who are not part of the editorial staff" and deems it an intrinsic part of all scholarly work. In biomedical publishing several international organisations offer guidance to editors including the International Committee of Medical Journal Editors (ICMJE http://www.icmje.org), the World Association of Medical Editors (WAME http://www.wame.org/), the Council of Science Editors (CSE http://www.councilscienceeditors.org/), and the Committee on Publication Ethics (COPE http://publicationethics.org/). Each develops and promotes regularly updated policies and guidelines on fair, professional, and efficient editorial and peer review practices. Many biomedical editors are doctors or scientists with little relevant experience or training before taking on the role, so publishers and journal owners should point new editors to such guidance and support them while they learn.

4. **Costs of peer review.** Peer reviewers are rarely paid by publishers, and their work is often done out of hours. Nevertheless, in 2010 a report for JISC Collections, the organisation which supports the procurement of digital content for education and research in the UK, estimated that UK higher education institutions (HEIs) spend—in terms of staff time—between £110 million and £165 million per year on peer review and up to £30 million per year on the work of editors and editorial boards.[2] The authors of this report also cited a study estimating that, worldwide, peer review costs £1.9 billion annually and accounts for about a quarter of the overall costs of scholarly publishing and distribution.[3] Whether such expenditure represents good value for money is unclear, but the conduct and quality of peer review has been evaluated, and it is that evidence that we will focus on.

Biomedical Grant Review

5. **Current status of grant review.** A 2009–10 survey of 28 public and private organisations that give grants for biomedical research in 19 countries, and their reviewers, reported a growing workload of biomedical proposals that is getting harder to peer review.[4] Organisations reported these problems as frequent or very frequent: declined review requests, late reports, administrative burden, difficulty finding new reviewers, and reviewers not following guidelines. The administrative burden of the process had increased over the past five years. About half the responding organisations expressed interest in the development of uniform requirements for conducting grant review and for formatting grant proposals. In a sub-study 258 reviewers from 22 countries reported inadequate support for conducting grant review. Around half said their institutions encouraged grant review, yet only 7% got protected time and 74% received no academic recognition for this work. Reviewers rated these factors as extremely or very important in deciding to review proposals: desire to support external fairness, professional duty, relevance of the proposal's topic, wanting to keep up to date, desire to avoid suppression of innovation. Most had not been trained in grant review and many wanted such training.

Strengths and weaknesses of journal peer review as a quality control mechanism for scientists, publishers and the public

6. **Strengths: journal review has an extensive evidence base.** Appraisal of articles submitted to journals is probably the oldest form of formal peer review. It was used by Europe's first scientific journals—the *Journal des Sçavans* (later renamed *Journal des Savants*) and the *Philosophical Transactions of the Royal Society of London*—when they launched in 1665. Journal peer review is also the most evaluated form; particularly in medical publishing. Many of these evaluations have been presented at the International Congresses on Peer Review and Biomedical Publication (held every four years since 1986) and have then been published in peer reviewed journals, and at the 2009 congress more than 100 studies on peer review were presented (http://www.ama-assn.org/public/peer/peerhome.htm). However, most of this evidence is about identifying the weaknesses of peer review and evaluating its different methods.

7. **Strengths: peer review engenders trust.** The Science and Technology Committee (Commons) concluded in 2004, when considering developments in open access publishing, that there were "at least three strong arguments, however, for keeping the system of peer review intact. Firstly, volume ... academics are producing more research articles than ever before: output increases by approximately 3% per year… Secondly, peer review gives successful articles a mark of distinction that helps to provide a measure of the academic's and their department's level of achievement … Thirdly, peer review gives the lay reader an indication of the extent to which they can trust each article." [5, para 205] Peer review remains the best way to engender such trust in scholarly work.

8. **Strengths: peer review improves manuscripts.** Anecdotally, we know from authors and editors that peer review tends to make articles clearer and more accurate. And now that many journals—including *BMJ Open* (bmjopen.bmj.com) and some BMC journals (BioMed Central. BMC series journals: peer review processes. www.biomedcentral.com/info/authors/bmcseries)—post reviewers' reports and previous manuscript versions on their websites alongside the published articles, readers can see how reviewers' comments lead to revisions. The effects of peer review on manuscript quality have not, however, been much researched. Jefferson and colleagues' 2008 Cochrane systematic review of 28 studies of editorial [journal] peer review, reported that it "appears to make papers more readable and improve the general quality of reporting (two studies), but the evidence for this has very limited generalisability".[6] Moreover, they found only one small study testing the validity of peer review. They concluded that "little empirical evidence is available to support the use of editorial peer review as a mechanism to ensure quality of biomedical research. However, the methodological problems in studying peer review are many and complex… the absence of evidence on efficacy and effectiveness cannot be interpreted as evidence of their absence. A large, well-funded programme of research on the effects of editorial peer review should be urgently launched." Editorial research continues but—as it is mostly conducted by editors interested in their own journals' practices—it is haphazard, unfunded, and focused on processes rather than outcomes.

9. **Weaknesses.** We know from experience and evidence that journal peer review has many potential limitations.[7] Studies have shown peer review to be too slow; overly conservative; unreliable;[8–11] poor at detecting errors and misconduct; open to abuse; skewed towards research with positive results;[12] biased by conflicts of interest; and systematically biased against authors' ideas, reputations, locations, and even gender.[13,14] Much submitted work is uncontentious, but controversial work within polarised debates often poses particular challenges to editors trying to find balanced reviews. However, many journals now have policies and practices aimed at overcoming such problems (see below), and those that conduct peer review research should, arguably, focus now on its impact on the quality of published content rather than the quality of their processes.

Measures to strengthen peer review

10. **Choosing the right reviewers.** For many journals online manuscript handling systems have greatly facilitated the search for and selection of reviewers, making reviewers' and editors' decisions quicker and easier to share. These systems usually have a single database that includes invited reviewers, volunteer reviewers, and everyone who has submitted an article via that journal's online system. Indeed, a survey of more than 3000 academics in 2007 showed that more than 90% of authors were also reviewers.[15] From several blinded studies we know which type of reviewers tend to deliver the best opinions for medical journals: those who work in reputable institutions, understand statistics and epidemiology, and—perhaps counter-intuitively—are aged under 40 and are not yet in the most senior posts.[16] Asking authors to suggest reviewers helps to extend a journal's pool of reviewers and is often invaluable. But editors should note evidence showing that author-selected reviewers—while producing reviews of similar quality—are more likely than editor-selected reviewers to recommend acceptance.[17]

11. **Managing reviewers' behaviour.** The tenth report of the science and technology committee 2003–4 session, *Scientific publications: free for all? (para206),* cited measures used by four high-profile journals—*Cell, The Lancet, Science* and *Nature*—to ensure the integrity of the peer review process.[5] At these and many other journals (including those of the BMJ Group) authors these measures include not using reviewers with potential conflicts of interest (see para 13 below); having clear policies that reviewers should disqualify themselves on the basis of conflicts of interest; using several reviewers per article to allow for the moderation of opinions; editors' tracking of reviews submitted by a particular reviewer to monitor consistency; editors'

evaluations and actions regarding claims of reviewer bias or misconduct; and having formal appeals procedures for authors of rejected articles.

12. **Ensuring scientific transparency in authors' articles and reviewers' reports.** The Committee on Publication Ethics (COPE) expects the editors of its more than 4,000 journal members worldwide to provide detailed advice on conducting high quality peer review (http://publicationethics.org/files/u2/Best_Practice.pdf). For authors the EQUATOR website (Enhancing the QUAlity and Transparency Of health Research www.equator-network.org/) hosts a wide range of freely available guidance on writing research papers, called "reporting guidelines". Reporting guidelines specify the minimum sets of items required to give a clear and transparent account of the design, conduct, and findings for each type of study in biomedical research. At the *BMJ* we do not send research articles for external review until they have been reported in line with the appropriate reporting guideline, thus helping reviewers, editors, and readers to fully evaluate and understand the methods and results and any limitations and biases within the research.

13. **Declaring conflicts of interest.** The International Committee of Medical Journal Editors (ICMJE) Uniform Requirements for Manuscripts Submitted to Biomedical Journals require that all participants in the peer review and publication process must disclose all relationships that could be viewed as potential conflicts of interest, and recommend that journals publish authors' statements of competing interests when these might affect the way the work is judged by readers. ICMJE now provides a single disclosure form that has been adopted by all of its 12 member journals, including the *BMJ* (www.icmje.org/coi_disclosure.pdf). It is important to also ask reviewers to declare conflicts of interest, and in journals such as *BMJ Open*—which post reviewers' reports online next to the accepted articles—these declarations are visible to all. Some conflicts may be unavoidable and acceptable, but when reviewers' declared interests conflict significantly with the content or authorship of particular articles they should either decline to review or should not be chosen by editors for that assignment.

14. **Blinded peer review.** Journals have tried several ways to minimise bias in peer review. Most keep reviewers' identities secret from authors (single blind review), so that reviewers can freely express their views without fear or favour. To reduce the risk of reviewer bias against particular authors or institutions, some journals have also removed authors' names and addresses from manuscripts (double-blind review). Few journals use such double blind review, however: it is hard to do well and, anyway, studies have shown that around a third of the time reviewers correctly guess authors' identities.[18,19] Furthermore, Jefferson and colleagues' Cochrane review found "no clear-cut evidence of effect of the well-researched practice of reviewer and/or author concealment on the outcome of the quality assessment process".[6]

15. **Potential for open (signed) peer review.** Another approach is to ask reviewers to sign their reports and to reveal the identities of reviewers, editors, and authors to each other. Responses to a 2009 survey of more than 4000 science reviewers suggest, however, that reviewers prefer anonymity: 76% favoured the double blind system where only the editor knows who the reviewers and authors are.[20] This built on a 2007 survey of around 3000 academics and editors around the world (of whom about 10% worked in UK HEIs and 18% were working in clinical medicine or nursing) which found relatively little support for open review as an alternative to single- or double-blinded review.[15] Respondents did, however, show considerable enthusiasm for trying different approaches including post-publication review, though mainly as a supplement to formal peer review.

16. **Evidence on open (signed) peer review.** The surveys reported above support the common view that peer reviewers will either refuse to take part in open review or will provide only bland and uncritical comments, because they fear reprisals for criticising other researchers' work openly. But in a randomised controlled trial, where reviewers invited in the usual way to review for the *BMJ* were allocated randomly to single blind review or to open (signed) review, signing did not reduce the extent or quality of reviewers' reports and it improved their tone.[21] Another randomised trial, at the *British Journal of Psychiatry*, showed that such open review was feasible even in a specialist field —where professional rivalries might be stronger than in general medicine.[22] On the basis of its trial the *BMJ* mandated signed open review, and the journal has used this for more than decade with no significant problems. *PLoS Medicine*, however, tried and then discontinued this practice in late 2007 citing reviewers' reluctance to sign their reports—perhaps because at that time it was publishing a lot of laboratory-based research, which is arguably more competitive than clinical research.

17. **Evidence on open review with reviewers' signed reports posted online alongside published articles**. At the *BMJ* we have evaluated an extended kind of open review: making reviewers' reports (with their consent) available to readers as part of an online pre-publication history alongside each research paper.[23] We aim to roll this out in late 2011, and have already done so in our new sister journal *BMJ Open* (bmjopen.bmj.com). Meanwhile the medical journals in the BMC series published by BioMed Central have been using this approach for many years.

Impact of IT and greater use of online resources on the peer review process

18. **Evidence on online community open review.** In other experiments the *Medical Journal of Australia*[24] and *Nature*[25] made articles openly available online during, rather than after, the peer review process and invited free comments from readers. But responses from their communities were limited and both journals concluded that this was no substitute for formal, traditional peer review by experts. In the *Nature* trial, which ran for four months in 2006, papers that survived initial editorial assessment were hosted on an open server for moderated

public comment as well as simultaneous standard peer review. During the study only 5% of authors agreed to take part and, of the 71 displayed papers only half received comments.

19. **Sharing and reviewing raw data.** The Wellcome Trust and other major international funders have called for public health researchers to make studies' raw data available.[26] *Annals of Internal Medicine*, the *BMJ*, *BMJ Open,* the *PloS* journals and several BMC journals—among others—actively encourage authors to share data in online repositories with necessary safeguards to protect patient confidentiality. As yet, there has been no real debate on whether or how such datasets should be peer reviewed.

Possible alternatives to peer review

20. **Invited moderation rather than peer review.** *PLoS Currents: Influenza* (http://knol.google.com/k/plos/plos-currents-influenza) is an open access online journal that uses the application Google knol (http://knol.google.com/k) to post informal articles or knols ("units of knowledge") that readers can rate and comment on. The journal describes itself as "a website for rapid and open sharing of useful new scientific data, analyses, and ideas in all aspects of influenza research [where]… all content is moderated by an expert group of influenza researchers, but in the interest of timeliness, does not undergo in-depth peer review."

21. **Spontaneous post-publication comment.** Many online journals encourage continuing discussion of their content. The *BMJ*'s Rapid Responses or eletters, posted daily, provide a voluminous, lively, and often scholarly discourse and constitute an important source of ongoing peer review (http://www.bmj.com/letters). Twitter has also entered the fray: although their <140 characters allow only the briefest comment, tweets are facilitating rapid and widespread sharing of links to articles and other online content and can, it seems, quickly expose failings in peer review.[27]

22. **Post-publication measures of quality and impact.** The web continues to bring other ways for rating and commenting on research articles and other scholarly publications. These include journal-specific measures of articles' usage and reach eg the article-level metrics provided by PLoS journals (http://article-level-metrics.plos.org/) and the annual audit conducted by the BMJ (http://resources.bmj.com/bmj/authors/bmj-papers-audit-1); the independent rating of articles by services such as Faculty of 1000 (http://f1000.com/) and McMaster/BMJ EvidenceUpdates (http://plus.mcmaster.ca/EvidenceUpdates/); and —yet to come—the Impact Assessment for research within the new UK Research Excellence Framework (http://hefce.ac.uk/research/ref/).

Conclusions

Peer review is an art rather than a science. It can improve the trustworthiness and clarity of scholarly publications, and its known limitations can be minimised. While there are many ways to conduct and improve peer review, evidence shows it can be an open and transparent endeavour without compromising the quality of the process.

Trish Groves
Deputy Editor BMJ, on behalf of BMJ Group

9 March 2011

Competing interests: Trish Groves is the senior research editor at the BMJ and is responsible for running the journal's peer review processes. She is also Editor-in-Chief of BMJ Open.

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BMJ Group

9 March 2011

Written evidence submitted by Sense About Science (PR 51)

Popularising the Role of Peer Review

1. This response is based on observations drawn from the work we have done to popularise the role of peer review for the public, policy-makers, the media and civic groups.

2. In November 2002, Sense About Science established a working party, under the Chairmanship of Professor Sir Brian Heap, to look at how an understanding of peer review might help the public to weigh the relative merits of claims on scientific and medical issues. The report of the working party, "Peer Review and the Acceptance of New Scientific Ideas" was published in June 2004 (Appendix A).

3. Following the recommendations of the working party, in April 2005 Sense About Science undertook a series of workshops with educational bodies, patient groups and information providers to produce a user-friendly short guide to the peer review process. This guide, "I don't know what to believe" was published in November 2005 (Appendix B). It does not present peer review as a guarantee—although it draws comparisons

with kite marking—but rather uses an outline of the scrutiny in the process to explain that not all claims have the same status. Hundreds of thousands of copies have been downloaded and we have noted particularly high demand from medical and health information charities, patient groups and teachers.

4. Our activities, including the publication of "I Don't Know What to Believe", had shown us that while an advanced science education helps a relatively small number of citizens to make sense of specific debates, an understanding of how scientific findings are assessed can help everyone. We also received many requests for the short guide to peer review from teachers and schools and decided it would be helpful to produce an online resource about peer review. The aim of the resource was to make the reasoning of science publishers and scientific researchers available to 13–18 year olds, with particular emphasis on Key Stage 4 (Appendix C). This project built upon our previous work on popularising an understanding of peer review, which has succeeded in influencing the way scientific research is discussed in a range of civic forums; and aimed to introduce the idea of scientific scrutiny to the generation of citizens that has just begun to think about social debates and sources of information.

5. The online resource took advantage of two significant changes in the education system. Firstly, from 2006 all pupils were required to take at least one GCSE in a science subject. Secondly, in September 2006 the role of ideas and evidence in science became an integral part of science teaching at Key Stage 4, and testing at GCSE. Whether pupils take a particular interest in science or not, the resource was intended to equip them to understand how scientific knowledge develops and how to make sense of popular stories about science and medicine.

6. Sense About Science has held a series of ten Peer Review workshops in the UK, elsewhere in Europe, in the US and in South Africa. During the workshops early career researchers hear from leading journal editors, researchers and journalists about how peer review works, the challenges to the process and the role of peer review in helping the public to evaluate research claims. The popularity of these workshops and the positive comments from participants shows that there is a big demand for this information and we have plans to develop discussions about the social and scientific value of peer review in the US and China.

7. In September 2009 the preliminary findings of one of the largest ever international surveys of authors and reviewers, the Peer Review Survey 2009, were released. Sense About Science developed the Peer Review Survey 2009, in consultation with editors and publishers and administered with a grant from Elsevier; the survey included some questions from the Peer Review Survey 2007 (commissioned and funded by the Publishing Research Consortium) for comparison, and new questions about future improvements, public awareness and pressures on the system. The Peer Review Survey was an electronic survey; 40,000 researchers were randomly selected from the ISI author database, which contains published researchers from over 10,000 journals. Altogether 4,037 researchers completed our survey.

8. Broadly, our work has promoted the understanding of peer review as a tool to help people to make sense of science and evidence, and work out whether research claims have been independently scrutinised. Specific outcomes from this work have been:

(a) getting people to ask "is it peer reviewed?" when faced with scientific claims.

(b) getting politicians to move away from weighing up evidence without considering the *status* of the evidence, and encouraging them to ask about the quality of the evidence.

(c) getting the media to be accountable for the source of the material they use by showing where the material came from and citing the journal in articles.

The Importance of Status of Evidence for the Public and the Role of Peer Review

9. We have found, through the work we do in responding to public discussions and questions, that people can get very worried and frustrated by conflicting claims and misleading information. It is not possible (nor desirable) to prevent people from encountering a wide range of information about science and health on the internet and in the news media.

10. It is not feasible to quality-assure such information and would likely be counter-productive to try. There is already something better than a quality assurance scheme in place: the system of critical scrutiny that is the peer review of research results.

11. Peer review is a dividing line within academic research: it indicates that work has been scrutinised for its validity, significance and originality. The ultimate test of scientific data, however, comes through its independent replication by others; peer review is the system which allows publication of data so that it can be both criticised and replicated. It is a system which encourages people to ask questions about scientific data.

12. "Is it peer reviewed?" is the first question anyone can ask to determine the status of the evidence, and one that can help the public weigh-up the claims they are presented with. Understanding the process through which scientific research starts to be scrutinised and evaluated can be a helpful tool for the public to sift information and understand its status. If a piece of research is peer reviewed, individuals can then look for more information on what other scientists say about it, the size and approach of the study, and whether it is part of a body of evidence pointing towards the same conclusions. The central role of peer review in the

selection of the scientific data upon which scientific conclusions are based, makes it extremely significant when accounting for and explaining those conclusions, or policies based on them, to the wider public.

13. Across science, it is widely accepted that there is no better system, although improvements could be made in aspects of its execution and there are limitations to the peer review process that need to be considered:

(a) There is variation in the quality of peer review. Some journals are of a higher calibre than others or draw on expertise more specifically in the field of inquiry. The rigour of reviewers can vary.

(b) Peer review checks for validity, significance and originality. It does not guarantee that the results can be repeated, nor does it provide a guarantee against all mistakes or fraud.

(c) The endurance of findings over time and under wider scrutiny by all scientists in the field is more important.

Criticisms of Peer Review

14. Peer review is a topical subject. Stories in the press about the problems with the peer review process include "Climategate"; the recent reporting in *Science* that NASA scientists had found a bacterium which—unlike any other known organism—lived off arsenic, and the subsequent questioning of these claims; and stem cell scientists speaking out about work being rejected or delayed from publication.

15. Our work in this area and the Peer Review Survey 2009 suggest that in spite of increased pressures on the peer review system, the process remains critical to effective scholarly communication and continues to perform the critical functions: filtering and improving manuscripts.

16. Drawing on from the results of the Peer Review Survey 2009 Mulligan *et al* write in *Serials* (Appendix D): "It is clear that there is no desire to replace [peer review] with the 'wisdom of the crowd' via metrics such as usage statistics, but instead to augment it or to subtly change its approach."

17. The survey draws out comparisons on how peer review varies between disciplines, and how it is viewed by the scientists within these disciplines. It provides views from the research community on the strengths and weaknesses of peer review as a quality control mechanism for scientists. Possible alternatives to peer review are discussed, as well as measures to strengthen peer review, and details such as anonymity and incentives for reviewers.

18. Summarising results on the topical issues of fraud and plagiarism, Mulligan *et al* write:

> "Fraud continues to attract attention in the media, but within the community is not perceived as a critical issue. Nonetheless, there is a desire on behalf of the community for preventive measures to be taken, but exactly what those measures should be is unclear. It is difficult to develop a system that guarantees fraudulent papers are never published—such, it could be argued, is the wider role of science. Repeating the experiment is perhaps the most effective way, but experimental outcomes may genuinely vary, especially in the life sciences. Reviewers can only do what they do best; identify if research is new, interesting, correctly conducted, acknowledges previous work, and is appropriately summarized. Preventing fraud is most likely to be successful when done by the institute at which the research is being conducted. It is the institute that will have access to the laboratory notes and the raw research files."

19. The results of the survey are included in Appendix E. However, the full results have not been published yet and are pending peer review. Some preliminary results have been peer reviewed and were published in an article in *Serials* (Appendix D).

About Sense About Science

20. Sense About Science is a UK registered charity that works to equip people to make sense of science and evidence. We work with over 4,000 scientists, from Nobel prize winners to our Voice of Young Science network of postdoctoral researchers, to help civic groups, community organisations, media and commentators to weigh up claims about evidence.

Declaration of Interests

21. Sense About Science's funding includes donations from a wide range of scientific publishers and learned societies who have publishing arms.

APPENDICES/REFERENCES

Appendix A: *Peer Review and the Acceptance of New Scientific Ideas* (2004). Available online at: http://www.senseaboutscience.org.uk/index.php/site/project/33

Appendix B: *"I Don't Know What to Believe"* (2005) Available online at: http://www.senseaboutscience.org.uk/index.php/site/project/30

Appendix C: Peer Review Education Resource. Online at: http://www.senseaboutscience.net/

Appendix D: Mulligan, A and E Raphael (2009). *Peer review in a changing world—preliminary findings of a global study*, Serials, 23(1), 25–34

Appendix E: Peer Review Survey 2009.[1]

March 2011

Written evidence submitted by the Public Library of Science (PLoS) (PR 54)

PEER REVIEW—OPTIMIZING PRACTICES FOR ONLINE SCHOLARLY COMMUNICATION

About the Public Library of Science (PLoS)

1. PLoS is a nonprofit open-access publishing, membership, and advocacy organization with offices in San Francisco, California, USA, and Cambridge, UK. The mission of the organization is to lead a transformation in scientific and medical research communication, so that the mechanisms for communication are fully adapted to the online medium and so that the literature is a public resource that is open to read and reuse.[2]

2. PLoS publishes seven leading peer-reviewed journals[3] and is developing further innovative online publication venues such as PLoS Currents and PLoS Hubs that, respectively, speed up publication and aggregate content. Most of the work that PLoS publishes is in the health and life sciences, and the evidence that we submit is therefore of most relevance to these fields.

3. PLoS is one of several large publishers (publishing several thousands of research articles each year) that have demonstrated that high quality peer-reviewed open-access journals can be supported sustainably by a publication fee business model. When publishing costs are recovered up front by publication fees (as opposed to downstream recovery, for example, via subscription fees), all restrictions on access and reuse can therefore be removed.

4. PLoS is an innovator. In our view, peer review is one of several aspects of the scholarly communication process that can and should be optimized for online communications systems. We are already exploring a number of ways in which peer review can be reformed so that scholarly communication becomes more efficient and effective. The ultimate goal is to enhance and accelerate the research process itself, while maintaining the quality of the published research literature.

Peer Review and Formal Communication

5. Research articles published in peer-reviewed journals play a central role in communication of research results and ideas. The formal peer-reviewed literature underpins future research, the practical application of research findings, and the development of science and health policy. It is therefore essential that steps are put in place to assess and enhance the reliability of research literature.

6. Research articles are also the primary currency for assessing the contributions of individual researchers and their sponsors or institutions. Journals are currently used to organize such articles, such that publication of an article in a specific journal is an indication that the editors of the journal judge that the work is relevant to a particular audience, and has a certain level of significance for that audience. Thus, in all fields there tends to be a rough hierarchy of journals.[4]

7. Given its critical role, both as a means to communicate new findings and to organize them in terms of relevance and impact, publication in journals is a formal process that is generally regarded to provide the following key functions: registration (date-stamping of the work, so that it can be cited and so that the authors can achieve the appropriate recognition for their achievements); certification (quality control via the editorial and peer-review process); dissemination (ensuring that the work can be read and used); and preservation (for future generations). Peer review therefore sits firmly within the "certification" part of the publication process, but the goals of certification, and the practices by which it is achieved, can and do vary across journals and fields.

8. The differences in terms of the practice of peer review and the variable editorial goals of academic journals mean that there is no accepted definition of peer review. In general, peer review refers to the editorial process that takes place after submission of an article and before it is published (excluding production processes). Operationally, peer review most often involves the assessment of a submission to a journal by a variable number of (frequently two or three) relevant research experts whose identities are not usually revealed

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[1] Not printed

[2] Open access is defined as the removal of all barriers to access and reuse of the literature. The legal tool that is frequently used to indicate that a particular work is open access is the Creative Commons Attribution License (http://creativecommons.org/licenses/by/3.0/)

[3] *PLoS Biology*, *PLoS Medicine*, *PLoS Computational Biology*, *PLoS Genetics*, *PLoS Pathogens*, *PLoS Neglected Tropical Diseases*, and *PLoS ONE*.

[4] Supporting this hierarchy of journals is a proprietary metric—the journal impact factor—produced each year by Thomson Reuters. The impact factor is used in various aspects of research assessment. However, PLoS and many others have pointed out the weaknesses of using the impact factor in research assessment and the detrimental consequences to research itself. (See also http://www.mathunion.org/fileadmin/IMU/Report/CitationStatistics.pdf.)

to the authors. The opinions of these experts are then used to inform the editorial decision regarding the submission, which ultimately determines whether or not the work will be published in the journal.

Peer Review as One Part of Certification

9. Broadly speaking, there are two types of questions that journals attempt to address during the certification process:

9.1 whether the work is a rigorous contribution to the corpus of scientific knowledge (referred to below as technical assessment); and

9.2 whether the work represents the kind of advance (in terms of relevance and importance) that is appropriate for a given journal (referred to below as impact assessment).

10. The specific issues that are encompassed in the two questions that peer review is attempting to address are complex and highly variable. The challenge for any journal is to develop processes that balance the twin needs for thoroughly assessing submissions to the journal and for avoiding unnecessary delays in communicating new research findings.

11. Although the questions being addressed by peer review are usually not demarcated in the way that we have outlined, this is a helpful distinction because it serves to identify some of the strengths and weaknesses of current practices. This perspective on peer review also identifies ways in which the process might be improved.

Technical Assessment

12. There are many aspects to the technical assessment of a new submission. The first assessments are largely administrative and include an assessment of the financial disclosure information, competing interests declaration, whether the appropriate ethical approvals have been obtained and documentation is available, information about related work under consideration, whether the work adheres to appropriate reporting standards (such as the CONSORT standard for clinical trials), and so on. At PLoS, all submissions go through one or more quality control steps at various stages of the editorial process that are conducted by suitably trained and qualified administrative staff.

13. Peer review by external and internal subject experts also plays a critical role in the technical assessment of submissions. Most academic journals have as editors one or more experts in the subject who are responsible for the oversight of peer review. Once administrative checks are done, these editors can provide further assessment of the submission and its suitability for the journal. Then, relevant external research experts can be asked to assess whether the appropriate methods and materials have been used to investigate a given research question, and whether the data analysis and presentation provide adequate justification for the claims and conclusions of the work. For example, in some methodologies, such as clinical trials research, specific experts are consulted to validate the statistical analysis that might underpin the conclusions. The goal is always to find sufficient appropriate experts so that all of the key parts of the work can be assessed for scientific rigour. The number of experts required will often depend on the nature of the submission. If the work is multidisciplinary, for example, it might be necessary to seek the opinions of a larger number of experts to assess all key aspects of the work.

14. The result of technical assessment by peer review is that errors and weaknesses are frequently identified in article submissions, and revision of the work is required before it can be published. If the technical assessment reveals fatal flaws in design or methodology, then the submission will, however, be rejected.

15. Technical assessment of research articles has an important role in enhancing the reliability of the published literature, and in many ways can be considered to be a reasonably objective process. The questions addressed focus on whether the work adheres to the standards accepted within a given field. Subjective judgments clearly need to be made around certain issues, but in general, given a suitably robust process involving internal checks in combination with expert consultation, the decision as to whether a research article satisfies the technical requirements for publication is often clear-cut.

16. An important point to make is that there are always more technical checks that can be done. The reliability or quality of a research article can never be "assured", and there are many examples of peer-reviewed work that has had to be formally corrected or retracted as a result of straightforward error or, on occasion, deliberate misconduct.

Impact Assessment

17. In contrast to technical assessment, judgments about the importance and relevance of a research article tend to be more subjective and are more susceptible to bias and competing interests. Here, the peer-review process is attempting to judge whether the work meets the criteria for impact and relevance set by a particular journal.

18. Editors consider, and reviewers may be asked, for example, to comment on the "strength of the advance" represented by a given piece of research. As discussed above, current systems for research assessment place heavy emphasis on the journal in which a research article has been published. The outcome of the impact assessment aspect of peer review can therefore have profound consequences for the author. Publication in a

high-impact journal, for example, can greatly improve the prospects for obtaining grant funding, promotion, or tenure.

19. Authors will therefore frequently "aim high" when submitting work to a journal, with the result that technically competent work can be rejected from several journals for subjective reasons before it is eventually published. Submissions are often subject to peer review sequentially at multiple journals, and can be revised and resubmitted multiple times, which increases the labour required from authors, reviewers, and editors. The resulting delay between the acquisition of new and important research findings and their eventual communication in a formal journal often extends into years.

20. Although the use of the peer-review process for impact assessment has its weaknesses, all journals strive to ensure that the process is conducted as effectively as possible, free from bias and prejudice. Furthermore, without any form of assessment of impact for specific audiences, the literature would be a disorganized mass of information that would be difficult to navigate and use. Impact assessment is therefore currently an important function of journals, and there are many journals that fulfil this function effectively. However, given the availability of a new medium for the communication of research, it is reasonable to ask whether alternative approaches to impact assessment might be developed that do not rely just on the opinions of the limited number of reviewers and editors that see the work before it is published.

Alternative Approaches to Impact Assessment

21. Having demarcated the peer-review process into two broad sets of issues, it is possible to consider alternatives whereby technical assessment becomes the goal of the pre-publication phase and impact assessment is dealt with after the work is published. It is possible to disaggregate the processes that are currently wrapped up into a single pre-publication phase into components, some of which can usefully be conducted before publication and others which are best left until after publication.

22. At PLoS, we have been pursuing this approach using a journal that was launched in 2006, called *PLoS ONE*.[5] The editorial criteria for *PLoS ONE* are that the work must be rigorously performed with appropriate methodology; properly and intelligibly reported; and ethically conducted. In this way, the peer-review process in *PLoS ONE* is focusing only on technical assessment. Remarkably, in only four years, *PLoS ONE* has become the largest peer-reviewed scholarly journal, and last year published over 6,700 research articles. It is also very striking that, in light of this success, several major publishers have recently launched journals in various fields that are modelled very closely on *PLoS ONE*.[6]

23. Unlike the vast majority of journals, the editors and peer reviewers for *PLoS ONE* make no judgments about the relevance or impact of the work that is submitted. Instead, PLoS is working to provide alternative post-publication tools on individual articles with which these more subjective aspects of research can be examined, based on the actions and opinions of a broader constituency.

24. By focusing attention on the article, as opposed to the journal, it becomes possible to assess impact much more rigorously. For the past two years, we have therefore initiated a program of "article-level metrics" whereby every published article in all PLoS journals is enhanced with metrics about Web usage, citations, social bookmarks, user rating and commentary, and blogosphere coverage.[7] The vision is that a "dashboard" will be available for all research articles that will help users and readers to assess the impact of the work, and also be useful for filtering content and identifying the work that is of most relevance to a particular line of investigation. Given a variety of impact indicators, it will thus be possible to establish more sophisticated and meaningful measures of significance and influence than the journal metrics that dominate research assessment today.[8]

25. As a complement to article-level metrics, many publishers are experimenting with post-publication peer review by providing tools for user-based assessment. At the simplest level, it is possible for users to provide comments and ratings directly on articles. So far, however, the usage of commentary tools is fairly modest, and does not make a major contribution to the assessment of research content. That said, increasing amounts of commentary are taking place away from the journal sites themselves in blogs, tweets, and elsewhere, and one current opportunity is therefore to capture the richness of this commentary on the articles themselves.

26. Another interesting and relevant service is provided by Faculty of 1000, which collects comments of selected experts on research articles published in any journal.[9] The Faculty is invited to post short notes and ratings on articles that they find of interest. Although still limited in its effectiveness, Faculty of 1000 is an example of another way in which impact assessment can be added after formal publication.

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[5] http://www.plosone.org/

[6] *BMJ Open* (http://bmjopen.bmj.com/)from the BMJ Publishing Group, *SAGE Open* (http://www.sageopen.com/) from SAGE; *AIP Advances* (http://aipadvances.aip.org/) from the American Institute of Physics; *Physical Review X* (http://prx.aps.org/) from the American Physical Society; *Scientific Reports* (http://www.nature.com/srep/) from the Nature Publishing Group; and *G3* (http://www.g3journal.org/) from the Genetics Society of America.

[7] http://article-level-metrics.plos.org/. See also the PIRUS2 project, which aims to provide standards around the reporting of article Web usage data: http://www.cranfieldlibrary.cranfield.ac.uk/pirus2/tiki-index.php.

[8] http://altmetrics.org/manifesto/

[9] http://f1000.com/

27. In sum, there are a variety of approaches that are being used to explore how value can be added to content after publication, to help with the continuous assessment of published research. In addition to activities such as Web usage, citation, bookmarking, and so on, users are constructing their own online bibliographies of content and adding subject tags to content at Web sites such as CiteULike[10] and Mendeley.[11] There is thus a wealth of activity that can be aggregated around any given article, and with effective interpretation of such activity, the impact assessment aspect of "peer review" is expanded to a much broader constituency. These new approaches therefore have the potential to make profound improvements to the organization and assessment of research content, and ultimately to facilitate more rapid communication of new findings.

Peer Review of Data

28. We are in a research era where large quantities of data are being generated in a wide variety of disciplines. New research articles frequently report the availability and analysis of new and valuable datasets. In online communication it is frequently possible to append (as supplementary files) large bodies of data that are relevant to a particular piece of work.

29. In some fields—for example, genetics and molecular biology—there are well-established curated databases where data can be deposited and linked to particular research articles. Examples of such databases include those available at the European Bioinformatics Institute in Hinxton, UK.[12] The curators who run the databases perform critical quality control checks analogous to the technical assessment of research articles. Newer resources are also being developed, such as Dryad UK,[13] which provides a more flexible site for data deposition in fields where data sharing is less advanced than in other fields.

30. Peer review of data is another important area where online tools could be used, both for technical and for impact assessment as well. Again, it could be fruitful to consider the separation of technical from impact assessment, with the latter occurring after the data have been made available so that the activity and views of entire communities can be leveraged to enhance the data that are being shared.

Conclusions

31. Scientific communication is undergoing a revolution. Online tools allow universal access to all research findings, and new business models can support publishing in an open-access mode in which access and reuse barriers are both removed. New approaches are also emerging for organization and assessment of research articles after publication.

32. Peer review occupies a central locus within the process of formal scholarly communication, and it is helpful to divide its functions into two broad areas: technical and impact assessment. Whereas technical assessment tends to be objective and provides greater confidence in (although cannot assure) the reliability of published findings, impact assessment is subjective and its role is less clear-cut.

33. Impact assessment, as currently performed by the majority of journals during the pre-publication peer-review process, is the means by which research articles are currently organized in journals. Such organization is essential for the navigation and filtering of content by users, but the current process is not particularly reliable and often results in substantial delays in the communication of new findings. However, a new paradigm is emerging and is being tested in several fields whereby articles are subject only to technical assessment (by peer review) before publication, and impact assessment takes place during the post-publication phase, which can broaden the assessment of the work (by peers) to a much wider constituency than can take place before publication.

34. A substantial opportunity for enhancement of research communication exists in the area of research assessment. Rather than relying on the journal in which an article is published, it is now possible to focus on the merits of the article itself. An array of article-level metrics and indicators can be deployed to filter and assess content. Coupled with tools for post-publication commentary and addition of value, there are tremendous prospects for replacing the current impact assessment function of pre-publication peer review with a post-publication system that has the potential to be more efficient and effective.

35. If greater attention is concentrated on the article rather than the journal, the consequences for research communication are that more results can be communicated more effectively and more rapidly, leading to an acceleration of the research process itself.

Declaration of Interests

PLoS is a tax-exempt, 501(c)3, nonprofit corporation with headquarters in San Francisco, California, USA. PLoS's overall revenues and funding information for 2009 are listed in the 2009 Progress report http://www.plos.org/downloads/progress_update_lo.pdf. PLoS is an open-access scientific and medical publishing organization. We are exploring many ways in which scholarly communication can be reinvented and fully adapted online by altering business models, editorial (including peer review) processes, and publishing

[10] http://www.citeulike.org/
[11] http://www.mendeley.com/
[12] http://www.ebi.ac.uk/Databases/
[13] http://www.jisc.ac.uk/whatwedo/programmes/mrd/clip/dryaduk.aspx

workflows. Broadly, our mission is to lead a transformation in scholarly communication whereby research is open to all to read and use.

Public Library of Science

10 March 2011

Supplementary written evidence submitted by Dr Mark Patterson, Public Library of Science (PLoS) (PR 54a)

Thank you once again for the opportunity to provide written and oral evidence to the Science and Technology Committee inquiry into peer review.

As requested, here are the links to the two public slide presentations (with audio tracks) which provide summaries of the author research that PLoS has carried over the past two years:

http://www.slideshare.net/MarkPatterson/plos-author-research-2009

http://www.slideshare.net/MarkPatterson/p-lo-s-author-research-2010–6638756

In addition, I would just like to highlight a few brief points to emphasize how central open access is to much of the discussion we had in the oral session:

(1) The kind of approach that we (and now other publishers) are taking with PLoS ONE is most suited to an open-access mode of publishing, using a business model that scales with publication volume. Every article that is published is covered by a publication fee, which ensures that PLoS ONE is fully sustainable. Because of their capacity for very rapid growth, PLoS ONE and similar products are therefore helping to drive and accelerate the transition towards comprehensive open access to all research outputs. More broadly, PLoS and other publishers are showing that more conventionally run open-access journals can also be sustainably supported with the publication fee model.

(2) In terms of the question about value for money for the estimated £110–£165 million that is invested in the UK for peer review, we will gain much greater value for money as more of the peer-reviewed articles that arise from these efforts are made open access. In addition, initiatives such as ORCID (http://www.orcid.org/) could, if coupled with greater transparency (ie open) peer review, provide the researchers who do peer review with the academic credit for this endeavour that is currently not given.

(3) In relation to the question about reprint revenue from the pharmaceutical industry in medical publishing, full open access allows the commercial reuse of published articles, and thus ensures that publishers do not have exclusive rights to reprint revenues from the articles that they publish. This important principle helps to mitigate the substantial financial competing interests that come into play when publishing research sponsored by the pharmaceutical or other industries (see also PLoS Medicine's opening editorial—http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.0010022).

(4) Open access is enshrined in the licenses that are used by open-access publishers. The gold standard is to use the Creative Commons Attribution License (http://creativecommons.org/licenses/by/2.5/)—this permits any reuse of the content, commercial as well as non-commercial, subject only to the restriction that the original authors and sources must be cited. Open access thus removes all barriers to the reuse of as well as to the access to research information, and maximizes its impact.

Dr Mark Patterson
Director of Publishing
Public Library of Science

26 May 2011

Further supplementary written evidence submitted by Dr Mark Patterson, Public Library of Science (PLoS) (PR 54b)

What training does PLoS provide for its editors and how often is this refreshed?

We have three types of journals, and the training/support of editors is somewhat different on each of them. In general, our goal is to provide solid ongoing support and advice to all of the academic and staff editors who are involved in the PLoS Journals, supported by materials and documentation that is reviewed and updated as and when needed. PLoS also has its own ethics committee (chaired by the Chief Editor of PLoS Medicine, who is currently the Secretary of the Committee on Publication Ethics, and another member being a Senior Editor from a PLoS community journal) that provides guidance across all PLoS publications.

(i) PLoS Biology and PLoS Medicine are run by professional, staff editors, with PhDs or MD degrees and relevant research experience. Staff editors undergo substantial training on the job, and all editorial decisions are discussed to ensure consistent standards of decision making. Staff editors also have the opportunity to attend relevant external training sessions.

(ii) The PLoS Community Journals—PLoS Computational Biology, PLoS Genetics, PLoS Pathogens and PLoS Neglected Tropical Diseases—are run by internationally renowned academic Editors-in-Chief (EICs), who take overall editorial responsibility for the journal. The EICs and their editorial boards are supported by PLoS staff, who provide initial training and ongoing support in the use of the journal management system. PLoS staff also send occasional communications on best practice to the editorial boards. There is a weekly telephone call with the EICs and other Senior Editors to discuss specific manuscripts or editorial issues, and PLoS hosts a regular (roughly annual) in-person meeting of the EICs so that issues relating to the running of the journals can be aired and discussed. The EICs and Section/Deputy Editors ensure the consistency of the decision-making, and they provide advice and guidance to the wider group of Associate Editors. The journals have an electronic discussion facility so that all submissions can be discussed with colleagues on the journal or with editors who work on other PLoS journals (on a confidential basis). The PLoS staff editors are occasionally brought in to discussions to provide support on specific content issues or matters pertaining to publishing ethics.

(iii) Responsibility for the editorial decisions on PLoS ONE also rests with a community-based editorial board, but PLoS ONE has a less hierarchical editorial structure than the PLoS Community Journals. Newly recruited Editorial Board members receive a pack of information providing guidance about the editorial process and standards associated with PLoS ONE. We also provide Board members with videos explaining the operation of the journal management system, and in the next few months we will be introducing an online training course for all new recruits. Much additional support and ongoing advice are provided by PLoS ONE administrative staff. PLoS ONE also employs professional staff editors (currently five editors who all have post-graduate research experience) who are not involved in the review of individual manuscripts, but are on hand to advise and discuss specific problems or queries with Academic Editors (matters relating to content issues, publishing ethics, reporting standards and so on). As with the other PLoS journals, any submission can be discussed in confidence with other board members or staff using the journal management system. The Editorial Board also has a dedicated private online forum where any matters relating to the running of PLoS ONE can be discussed. Editors frequently post questions on the forum which can be seen by all Board members and are then discussed and answered with the aid of experienced PLoS staff.

Dr Mark Patterson
Director of Publishing
Public Library of Science

7 June 2011

Written evidence submitted by the Wellcome Trust (PR 55)

Summary

1. Peer review ensures that scientific findings and research funding proposals are subjected to independent scrutiny by experts in the field, and as such is a crucial element of the scientific endeavour. The quality of peer review depends entirely on the expertise, rigour, generosity and fairness of the researchers who undertake it. Although this approach is, at times, onerous for the research community, it does provide a form of continuing professional development through their involvement. There is a need to increase levels of understanding of peer review amongst policymakers and the wider public—including its importance, its limitations and the added value provided by the researchers who conduct it.

The Strengths and Limitations of Peer Review

2. We consider that the process of peer review is an integral and irreplaceable part of the scientific enterprise—both at the publication stage and in the context of research funding decisions. At publication, it ensures that research findings have been scrutinised by experts in their field (who may be from academia, industry or other sectors) and are supported by the underlying data. Similarly, at the funding stage, it helps to ensure that the allocation of funds is based on appraisal of the scientific quality of research proposals by independent experts. Although peer review is not a perfect system and imposes a significant burden on the research community, the checks and balances it provides are absolutely core to the scientific endeavour. We do not believe that any viable alternative model exists.

3. A key concern raised in relation to the current peer review system is the associated workload for researchers who provide this review, often on an unpaid basis. Reviewing submitted papers and funding applications forms an integral part of the work of these researchers, and does provide benefits in terms of their ongoing development and breadth of knowledge of their field. But the burden is considerable. A recent study by JISC estimated that UK academics spend a total of two to three million hours per year acting as reviewers, at a cost to the university sector in terms of academic time of between £110 million and £165 million.[1] Meanwhile, the volume of published research is continuing to increase. Senior scientists in a given research field may often be in particularly strong demand to undertake reviews. The pressure on researchers—especially those leading their fields—leads to a significant proportion of requests for review being turned down, and may in turn limit the depth and quality of review in the system.

4. Other commonly raised criticisms of peer review are that it can sometimes slow or limit the emergence of new ideas that challenge established norms in a field; that it has the potential to be abused by scientists in some cases to protect their own interests; and that it can lead to undue delays in the dissemination of scientific knowledge—for example, when reviewers request additional experiments that may have been beyond the scope of the original study.

Measures to Strengthen Peer Review

5. Whilst we believe peer review remains vital, it is important that publishers and funders actively explore ways in which they can help to reduce its burden, whilst not compromising its quality.

Peer review in publication

6. We believe that the continuing transition towards open access publishing approaches over recent years offers some important opportunities. In particular, it can help to ensure that high quality research can find a route to peer-reviewed publication, and that the entire published output of research is free at the point of access for ongoing review and scrutiny by the scientific community after publication—allowing new ideas to emerge no matter where they are published, and ultimately providing more opportunities for the quality of a paper to be judged on its intrinsic merit (rather than the journal in which it appears).

7. The key challenges in the peer review system in the context of the open access movement were discussed at a recent workshop on "Innovation in Scientific Publishing" which was convened by the Wellcome Trust in partnership with the Howard Hughes Medical Institute and the Max Planck Society—the consensus emerging was that:

- the burden on researchers of reviewing papers is excessive, and we need to move away from the current system where the same paper is often reviewed multiple times by different journals;
- whilst delegates agreed on balance that reviewers should not be paid, there was wide consensus that their contribution needed to be recognised; and
- reviewers should not be encouraged to ask for additional obvious experiments over and above those reported—if they do, editors need to use their judgement to curtail this.

8. Several publishers are already adopting innovative approaches to reduce the burden of peer review that are worthy of note. The approach adopted by *PLOS One*—where the peer review process focuses solely on whether the findings and conclusions are justified by the results and methodology presented, rather than on assessment of the relative importance of the research or perceived level of interest it will generate—has both reduced the burden on the reviewer and the time it takes to get a paper published.[2] Another interesting model is that adopted by the Society for Neuroscience—where reviews of rejected papers are passed onto other journals to which the paper is subsequently submitted.[3]

9. Several publishers are also seeking to introduce more transparency into the peer review process—with some journals now using fully open peer review, where the identity of reviewers and their comments are published alongside the article. This could offer some benefits in terms of increasing quality, ensuring accountability and potentially enabling greater recognition for reviewer's contributions. However, it would clearly raise concerns if reviewers did not feel able to comment openly or fully on the work, or were discouraged from providing reviews altogether. We would argue that it would not at this stage be appropriate for all forms of peer review.

Peer review in funding decisions

10. As a research funder, there are a number of approaches we are using to attempt to ease the burden on reviewers, whilst ensuring the quality of review. We actively acknowledge that there are different forms of peer review (for example, peer review by external "remote" written referee reports, and peer review by expert committees, sometimes on the basis of interview) and we apply each judiciously at the appropriate stage of the application process.

11. The approaches we are currently using to obtain the most effective, efficient peer review include making more active use of a preliminary triage process—both through independent expert advisory committees or our scientifically-trained staff (where this is appropriate) so that a smaller subset of grant applications are sent out for review to external referees. We have also worked to shorten and focus our application and review forms. In common with other funders, we have used peer review "colleges" for some schemes to build communities of trusted reviewers, who have agreed to be included. In addition, we actively track the number of approaches to reviewers to reduce over-burdening particular individuals.

Identifying Reviewers

12. The selection of suitable reviewers relies to a large extent on the expertise of editorial staff at journals, and scientifically-qualified staff at funding agencies. As a funder, our staff typically search the published literature for suitable reviewers, maintain an overview of the field, seek advice from members of our expert committees, and develop networks of contacts. Referee selection is also aided by inviting the applicant to

suggest names of suitable reviewers. Whilst it is of course not appropriate to select reviewers exclusively on this basis, it can identify a helpful range of expertise appropriate to the subject area.

13. Selecting the appropriate balance of expertise for reviewers for a particular proposal is key. As the research communities in some areas are fairly small, there is often value in looking beyond specialists in the area covered, and including a number of reviewers bringing different perspectives. This is particularly true where there is benefit in examining a proposal from several angles (focusing variously, for example, on technical issues, the use of animals or study design).

Communicating Research

14. Peer review is at its heart a very simple concept—namely that of independent expert scrutiny. We believe that there is an important need to ensure that peer review is more widely understood amongst both policy makers and the general public. This should include acknowledgement of both the benefits and limitations of peer review, and of the significant role played by academic researchers and the added value they provide. We consider that the development of high quality engagement activities to promote understanding of, and dialogue around, the scientific process and the key importance of peer review within this should represent a continuing priority for funders. Clearly scientists have a key role to play, and we encourage them embrace opportunities to engage in such dialogue.

15. It is also vital that the importance of peer review is respected by those communicating scientific findings. In all cases, it should be made absolutely clear whether a particular finding has been subject to peer review or not, and appropriate caution exercised where this is not the case. It is vital that the scientific community, the media, and other groups involved in science communication act with responsibility and integrity, and recognise the inherent value of peer review in terms of ensuring results and ideas are based on robust research. Failure to do so will risk undermining public trust in science.

The Wellcome Trust

The Wellcome Trust is a global charitable foundation dedicated to achieving extraordinary improvements in human and animal health. We support the brightest minds in biomedical research and the medical humanities. Our breadth of support includes public engagement, education and the application of research to improve health. We are independent of both political and commercial interests.

References

[1] See "The value of UK HEI's to the publishing process" (JISC, Nov 2010) http://www.jisc-collections.ac.uk/Reports/valueofukhe/ (accessed 4 Mar 2011)

[2] See "PLOS One—editorial and peer review process" http://www.plosone.org/static/review.action (accessed 4 March 2011)

[3] See About the Neuroscience Peer Review Consortium (NPRC) http://nprc.incf.org/about (accessed 4 March 2011)

Wellcome Trust

10 March 2011

Written evidence submitted by the Higher Education Funding Council for England (PR 57)

1. The Higher Education Funding Council for England (HEFCE) co-sponsors and manages a major periodic national peer review exercise in the form of the Research Excellence Framework. This note sets out some key points about the structure and operation of the exercise that the Committee may find helpful.

2. HEFCE distributes public funds to higher education institutions (HEIs) in England for teaching, research, and related activities. In 2011–12 the Council's total recurrent grant for research will be £1,558 million.

3. The four UK HE funding bodies jointly conduct periodic exercises to assess the quality of research activity in HEIs across the UK. The last of these was conducted, as the Research Assessment Exercise (RAE), in 2008; a further exercise, to be conducted as the REF in 2014, has recently entered its implementation phase. RAE/REF serves several purpose: its primary purpose is to inform allocations of research grant by the funding bodies, but it also has an important role in assurance—demonstrating what excellent research activity has been supported through the funding; in public information, making available the outcomes of expert review of research in HE; and as a tool for managers within HE. The grant allocation methods of the four funding bodies vary but they share a commitment to allocating the funding selectively by reference to judgements of research quality. RAE/REF is the only case where HEFCE makes systematic use of peer review processes.

4. Both RAE and REF are conducted through the expert review of written submissions from the HEIs, describing their research activity over the previous five years or so and identifying certain published outputs for consideration by the panels—up to four for each active researcher employed by the HEI and named in the

submission. We use the term "expert review" because this is conducted by panels including both leading active researchers ("peers") and people with significant experience in commissioning and using research in the field. The exercises could be described as a form of secondary peer review which is both retrospective (looking back at achievements during the assessment period) and prospective (identifying where the capacity exists to undertake internationally competitive research in the next period).

5. The outcome of the REF will be in a similar form to that of the 2008 RAE: graded quality profiles, showing for each academic discipline how much activity meeting specified quality levels was found in each HEI that made a submission within that discipline. The 2008 exercise looked at all research under 67 subject headings and in 2014 there will be 36 rather larger subject groups.

Selection and Role of Reviewers

6. For 2014 the panel members are selected through a two stage process: the panel chairs are selected by the funding bodies from a pool of applicants, having regard to their endorsement from within a wide group of academic, user and other interests; and they recommend the membership from a field nominated by this wide group, having regard to the need to cover the full range of academic activity as far as possible. Panel members are appointed by the funding bodies in a personal capacity based on their professional experience and standing.

7. At present the funding bodies have appointed a total of some 750 panel members to 36 sub-panels, working under the guidance of four over-arching main panels, and the first round of panel meetings are being held during 2011. These meetings will develop the criteria for assessment to be used in 2014; for the assessment phase of the exercise in that year we envisage appointing additional panel members to broaden and strengthen both the subject coverage and the extent of user engagement in the process.

Multidisciplinary Research

8. Each of the sub-panels covers a specified academic field, with the intention that between them they should cover the entire field of research activity. Multi-disciplinary and interdisciplinary research will need to be submitted to one of these panels; the exercise provides for the assessment of such research by suitably qualified people through the range and depth of experience of the panel members including the additional associate members, through the increased breadth of coverage of the individual sub-panels, and through arrangements for work submitted to one sub-panel to be referred to another where necessary.

Use of Online Resources and Statistical Data

9. During the extensive consultations leading up to the 2014 REF we established that there is not general support within the academic community for making more systematic use of statistical data within the assessment process, beyond informing the judgements of the panels. In particular, we have ruled out the systematic use of citation data as a key indicator of research quality at present. The sub-panel chairs have mostly indicated that they would not wish to use this data at all (especially in humanities and social science disciplines) or that they would wish to be able to refer to it within a primarily judgement-driven assessment process (most science based disciplines). REF will make considerable use of IT systems to collect and circulate the submissions and to give panel members online access to published outputs for review wherever this is possible.

Peer Review Process

10. Expert review and the exercise of academic and other professional judgement are at the core of our approach. The sub-panels will review the research outputs that have been submitted by HEIs. The majority of these outputs have been published in peer reviewed journals, but a range of other types of outputs are also submitted, including monographs, conference proceedings and outputs not in conventional print media. The outputs are graded on a four point scale (with the highest grade being "world leading"), to produce an intermediate sub-profile that shows the proportion of submitted work at each grade. In 2014, the panels' assessment of the quality of the cited research outputs will account for 65% of each of the overall quality profiles, with the assessment of research impact accounting for 20% and research environment for 15%.[14]

11. Details of the assessment process, including the names of the panel members, and panel criteria will be published well in advance and there will be a further consultation on the terms of the criteria before these are finalised. For 2014 we are requiring considerable consistency of criteria and approach between the panels, with consistent quality standards applied throughout—including through the role of the four main panels in signing off the quality profiles—and as a general rule the sub-panels may vary the common process only where they have a strong reason to do so within their field. Thus the assessment process is demonstrably robust and as

[14] Note by submitter: Where we say "In 2014, the panels' assessment of the quality of the cited research [emphasis added] outputs will account for 65% of the overall quality profiles…", we are not referring to citations of journal outputs, but to research outputs, published in any medium, that institutions will list in their REF submissions. To clarify: for each member of research active staff that an institution includes in a REF submission, they may list for assessment by expert review, up to 4 research outputs in any medium, that have been published or otherwise brought into the public domain by that staff member in the period since the 2008RAE. The assessment of these outputs will contribute 65% to the overall score—in the form of a quality profile—awarded to any submission. Further published information about the assessment framework for REF2014 is available at www.ref.ac.uk<http://www.ref.ac.uk>.

transparent as we can reasonably secure compatible with the need for expert judgement to be exercised free from external pressure of any kind.

12. HEFCE regards RAE/ REF as a very strong mechanism both for supporting our funding allocations and for public information and assurance. The framework and processes for the REF have been established following an extensive process of consultation with the academic community and wider public.

Further Information

13. Further information about the REF, including material released so far setting out the detail of its implementation, is available online at www.ref.ac.uk.

Declaration of Interests

14. There are no relevant interests to declare.

9 March 2011

Written evidence submitted by Philip Campbell (PR 60)

1. I welcome the enquiry on peer review set up by the House of Commons S&T Committee. Peer review, after all, is central to the allocation of research grants and to the publication of valid reports of research.

2. I am the Editor-in-Chief of *Nature* and the Editor-in-Chief of the Nature Publishing Group. In the first of the roles, I am responsible for the content of *Nature*, including the 800-odd research papers that we publish every year. In the second role, I am responsible for the long-term support and development of the quality and editorial policies shared by *Nature* and all of the other 33 Nature-branded journals published by the Nature Publishing Group.

3. In this submission I will not attempt a general definition or overview of peer review. My purpose is to highlight a number of issues surrounding peer review, and explain our responses and policies. In some cases these issues relate directly to those highlighted by the Committee. I hope that my discussion of other issues will assist the Committee in its thinking.

4. We keep our policies under review, in order to reflect changing needs within science and changing factors that affect research. In particular, the Chief Editors of the journals meet on a monthly basis in order to keep abreast of relevant developments inside and outside the company, to reflect on researchers' needs, and to develop policies when required.

5. *Nature* is the most highly cited multi-discipline natural science journal. It has a long and distinguished history (first published in 1869) of covering the most important science and of rigorously applying peer-review to the papers it publishes.

6. Nature-branded journals for the most part focus on specific scientific disciplines. Based on their Impact Factors (a measure of the typical level of citations of a journal), they are often the most highly cited in their fields or if not, are one of a handful of top journals in their fields.

7. *Nature* and the Nature journals are untypical journals in that they do not have editorial boards of active researchers. All selection decisions are the responsibility of the fully independent and Chief Editors of each journal and their teams, informed (but not instructed) by the advice from the peer review process. These editorial staff are employees of the Nature Publishing Group, fully dedicated to the task of selecting papers for publication. Through their frequent visits to conferences, laboratories and through constant scrutiny of the literature, they keep abreast of the state of their disciplines and develop contacts with existing and new reviewers.

8. Full details of our approach to peer review and details of our journals are available on the Nature Publishing Group website. This site includes articles that we have written about peer review and also community discussions about the topic: http://www.nature.com/authors/peer_review/index.html and, with particular relevance to this submission: http://www.nature.com/authors/policies/peer_review.html.

How does our peer review add value?

9. We occasionally survey our authors and are encouraged by the fact that the substantial majority believe that peer review has added to the quality of their paper. This reflects the evidence from published surveys: http://www.publishingresearch.net/PeerReview.htm and http://www.senseaboutscience.org.uk/index.php/site/project/395.

10. Referees are expected to read a submitted paper with close attention in order to provide a reasonable assurance of its validity, checking whether its internal logic is consistent and also that its content is consistent with firmly established knowledge of the techniques involved and of the phenomena being discussed.

11. As well as checking for validity, referees are expected to suggest improvements where they feel, for example, that the logic is insufficiently clear, that the previous literature is inadequately represented, or where certain experiments might close loopholes or otherwise strengthen the conclusions of a paper.

12. The task of refereeing a paper takes significant time—anything between several hours and several days.

13. A reviewer is not expected to check the results of a paper by replication. In exceptional circumstances, referees will undertake considerable work on their own initiative to replicate an aspect of a paper.

14. Journal peer review adds value not only to authors and to publishers, but also in a resulting sense of confidence amongst stakeholders and publics that the scientific literature's claims, often based on highly specialized evidence or argument, have credibility.

15. Even after peer review, a scientific paper should be considered provisional, either in its detail or even in its fundamental conclusions. It will ultimately stand or fall on its subsequent replication or corroboration by other scientists in the short term, and on the deepening of scientific understanding in the longer term.

16. It is part of the editor's and peer-reviewer's responsibilities to ensure that data and materials required for other researchers to replicate or otherwise verify and build on the work are subsequently available to those who need it. Such availability may be problematic eg when expensive materials or organisms are involved, but we have policies to ensure such availability where there are facilities such as public databases that enable it, and in general such availability is a condition of publication.

Anonymity in peer review

17. *Nature* commissions confidential reviews of papers on the basis that the identity of the referee will be kept anonymous. This is a firmly held principle in practice—we have on occasion declined requests from university enquiries to reveal referees' identities, for example, though we usually seek referees' agreement to assist in such circumstances.

18. Our key motivation in peer review is always to act on behalf of our readers in ensuring that we publish only the most scientifically significant papers that are submitted to us. The relationship between an editor and his/her referees, and their mutual confidence, can become a key element in optimising the basis for an editor's judgements to that end.

19. Why anonymity? Because otherwise an author rejected on the basis of a review may resent the reviewer and subsequently act against him or her either subconsciously or in deliberate retaliation. This is a particular concern for up-and-coming researchers, who often provide excellent reviews of papers. Also, it is not unknown for authors who have identified a referee to attempt to pressurise them during their assessment of a revised version.

20. Can anonymity be abused? It is an editor's responsibility to apply judgement to protect the interests of authors and readers against such abuse and, if disputes arise, to seek advice from others, and thereby do whatever can be done to ensure both ethical and technical integrity.

21. Surveys suggest that anonymity in peer review is widely accepted and indeed preferred by most researchers (see http://www.senseaboutscience.org.uk/index.php/site/project/395).

22. Where referees ask to be named, we will usually identify them.

Peer review by competitors

23. Our policy is that submitting authors may request that individuals be avoided as peer reviewers on grounds of competing research interests. Provided the number is not excessive (the usual limit is three) we almost always abide by such requests, though reserve the right to choose whoever we need to provide the best advice.

24. In our letter of invitation to referees, we ask them to decline our invitation if they have any interests that they consider to be dangerously conflicting, or at least to notify us of such interests.

25. It is an editor's responsibility to use their knowledge of the field and of individuals to take possible competing interests into account, and to seek additional advice where necessary.

Alleged undue influence by a single referee or a coterie

26. It is sometimes asserted that a single negative referee can force the rejection of a paper. While that can indeed happen on the technical aspects of a paper, our decision-making is structured in a way that helps prevent undue influence by referees, whether negative or positive.

27. Editors are expected to apply their own judgements in selecting what *Nature* should publish. *Nature*'s use of referees is not a process of voting, nor a process where the referees' views are the final arbiter of a decision whether to publish.

28. Editors will involve their in-house colleagues where controversies arise or where several scientific disciplines need to be involved in an assessment of a paper. Except in the most clear-cut cases, no paper is accepted without also being considered by the Chief Biology Editor or Physical Sciences Editor. These senior editors and, in some cases, I will also become involved where a dispute arises between the authors and editors.

29. We value referees' reports both for their technical assessments and for the explanations of their judgements about a paper's significance. Most papers are seen by several referees of diverse specialist expertise in order specifically to assess particular aspects of the paper.

30. Our editors will almost always bow to a referee's expertise on the technical validity of a paper's content. Where a dispute arises about technical matters, we will seek advice from other experts.

31. However, we rely on our editors to make the final decision as to a paper's appropriateness for *Nature*, based on its scientific significance as judged by them. A referee's opinion on this aspect of a paper is often invaluable, but is in no way binding on our editors. Indeed referees' opinions about a paper's importance often differ.

32. Thus, in some cases the editor may choose to accept the paper against a referee's advice about its significance. There have been occasions where a paper has been accepted despite negative judgements of its significance by all of the two, three or (in one case that I am aware of) four reviewers involved. These are inevitably subjective judgements, quite distinct from judgements of the technical merits, where the expert views of the referees take priority.

33. The difference in judgement may operate in the opposite sense also, resulting in rejection despite a positive endorsement by one or more referees.

34. Authors may appeal against negative decisions where they specifically disagree with referees' or editors' comments.

35. Editors frequently try out new reviewers alongside established reviewers. We also encourage senior reviewers to include their younger colleagues (whom they must identify) in the process, in order to grow the reservoir of advice while also ensuring that our reviews are fully informed of the current state of the art in evolving experimental techniques.

Alleged influence of where and who a paper comes from

36. It is a fundamental principle of our processes that papers are judged on their scientific importance, not on their authorship or geographical origins. Any other approach ultimately undermines our perceived value and also may lose us valuable papers.

37. A relevant consideration is that many papers are co-authored by international collaborations, with different components of the work being done in different laboratories. We estimate the average number of authors on *Nature* papers to be between 5 and 6.

38. Our decisions frequently require us to reject authors of high reputation and influence in prestigious institutions, who may also serve us as referees. Such decisions are a part of everyday decision-making.

Double-blind peer review

39. It is sometimes suggested that papers being sent out for peer assessment should be anonymized, in order to prevent bias.

40. Our current policy is not to offer this facility. A full discussion of this and our policy can be found at: http://www.nature.com/nature/journal/v451/n7179/full/451605b.html.

41. I would acknowledge that double-blind peer review is favoured in some surveys (see http://www.publishingresearch.net/PeerReview.htm). We are therefore keeping this policy under review.

Open peer review

42. In 2006, *Nature* ran an experiment in open peer review, in which over a period of four months, submitting authors were invited to post their papers on an open website for open assessment by peers. Their papers were also peer-reviewed in the usual way.

43. The details of the process and the outcome can be found at: http://www.nature.com/nature/peerreview/debate/nature05535.html.

44. In brief, the take-up by authors was low, as was the amount of open commenting. Furthermore it was judged by the editors that the comments added little to the assessment of the paper.

45. It is my view, consistent with this outcome, that scientists are much better motivated to comment on an interesting paper when directly requested to do so by an editor.

Post-publication review and commenting

46. *Nature* provides facilities for open commenting on its research papers. Our experience is that this facility is little used.

47. Our experience of the open peer review experience and the lack of commenting on papers in whichever journal provides it suggests that such unsolicited commenting has yet to take hold as a part of scientific activity. One can readily speculate why: there is no prestige or credit attached, there is the risk of alienating colleagues by public criticism, and everyone is busy.

48. Sometimes public online debate about a paper may arise after its publication, but that usually happens in the blogs of scientists and others.

Publication of referees' and editors' reports and correspondence

49. One journal published by the Nature Publishing Group, the *EMBO Journal*, has pioneered the online display of anonymized referees and editors/authors' correspondence after publication, alongside the paper. For an account of this policy, see the article by the publisher of the European Molecular Biology Organisation (EMBO), Bernd Pulverer at *Nature* v468, p29–31, 4 November 2010, doi:10.1038/468029a, http://www.nature.com/nature/journal/v468/n7320/full/468029a.html.

50. *Nature* and the Nature journals have so far not gone down this route. This reluctance is partly based on a precautionary fear that it might upset the relationship between editors and referees. Moreover, the documents reflect only a part of the process of discussions within the editorial team, between the editors and the referees, and between the editors and the authors. There is also a belief that few people will want to wade through this copious information.

51. Nevertheless, transparency has its own virtues, and we are keeping this policy under review.

Pressure on peer review

52. There is without question a pressure on peer review, in that academics are very busy, the number of papers produced has grown, and so forth. Nature journals are privileged in that the papers submitted and selected for peer review tend to be interesting, thus most have not been affected by this.

53. Our editors reject 70–80% of submitted papers (the exact proportion varies with discipline) on purely editorial grounds, in order not to burden referees unnecessarily.

54. As explained elsewhere, we are always seeking new reviewers, and welcome the advice of younger (but fully qualified) reviewers, who often bring the greatest technical expertise to bear on newer techniques or fast-moving areas of science given their very active involvement in research.

Transfer of reports between publishers

55. Since 2008, *Nature Neuroscience* (NN) has participated in an experiment involving other publishers in which, at the request of authors rejected from NN, and with the explicit agreement of referees, NN's referees' reports and their identities can be passed to another publishers' journal. (Similar transfers are routinely offered as a service to authors rejected by *Nature* or one of our Nature research journals and wishing to submit to another Nature journal.)

56. This experiment was conceived in the belief that it would save referees work—it is quite common for the same referee to be asked to referee a paper several times by a succession of journals as an author seeks its publication. Moreover, an editor might decide to publish or reject a paper immediately, without troubling referees, on the basis of received reports.

57. The take-up by authors of this facility has been small—typically amongst the participating journals, a few percent of rejected authors request it. For those that do, the processing time at subsequent journals has been reduced, though I do not have ready access to the statistics.

58. This facility is controversial within NPG. We invest significant sums of money in our professional editors spending time both in the office and in visits cultivating contacts with referees, and fostering insightful refereeing as best we can. To then hand on the reports and names to another publisher is to some extent undermining our competitive edge. Indeed, the principle competitor of NN, *Neuron*, is not a part of the experiment, and we might well not have joined the experiment if it was.

59. However, if there was stronger evidence that the community wanted this to be happening, and that the burden on referees would indeed be reduced, we would consider developing this approach.

Can peer review detect misconduct?

60. Given that editors and peer-reviewers need to take everything that authors submit on trust, and do not seek to replicate the work, it is almost impossible for referees to detect misconduct. There have been occasions

where a sharp-eyed referee has detected an inconsistency or other flaw in reported results that can only have arisen through inappropriate manipulation, but these are few and far between.

61. In some of the most severe cases of misconduct, a problem has arisen because of insufficient critical scrutiny between co-authors. But that problem lies beyond the scope of this discussion.

Can misconduct arise during peer review?

62. The unfortunate answer is: yes. It is not unheard of, for example, for editors to be visiting a lab and to see lying on a table in an open space a paper that is being refereed, supposedly confidentially, by someone at the lab.

63. The most egregious type of misconduct is for a referee to sit on a paper and to steal its results in order to publish them under his or her own name. Such incidents are very uncommon, in our experience.

64. We are alert to delays by referees' (which will usually be for the reason that they have conflicting commitments), and will cut off a process or seek alternative advice rather than have a referee unduly delay a paper.

65. This brings to a conclusion my description of our practice and some key policies associated with our peer review processes. I hope that the committee find it helpful.

Philip Campbell PhD
Nature

10 March 2011

Supplementary written evidence submitted by Philip Campbell (PR 60a)

1. Nature editors are selected from the ranks of post-doctoral researchers for their unusually broad interests in science and for their abilities, in particular, to take any scientific paper, assimilate its key ingredients and messages reliably and promptly, and apply critical thinking even if the paper is not in their own expert area.

2. Such people will have already experienced the process of peer review as authors and in some cases as peer reviewers. They will also already have a strong sense of how one piece of research might be more significant than another and, within their own disciplines, what would represent an outstanding accomplishment.

3. The training that takes place, therefore, can only happen by participating fully in the process of selecting papers. Every new editor sits within a small team with a team leader who will initially track their every thought and action in respect of every paper they handle.

4. As months go by, this scrutiny gradually relaxes. We reckon that it takes about two years of handling papers and visiting many labs and conferences for our editors to gain the full experience of the various ways in which authors, editors and referees can interact and hence optimize the process. Also, over that time, an editor builds up extensive scientific and research-community knowledge and contacts.

5. After two years, typically, they will be fully autonomous. However, they still act as part of the team, so that decisions are routinely discussed with colleagues, and the team leader ensures that Nature's standards within the team's disciplines have an appropriate degree of consistency.

6. All editors will be given occasional training by the company in relation to ethical and legal issues. Moreover, we set up occasional meetings with external experts to discuss possible changes in standards and criteria, as new research technologies and practices emerge.

Philip Campbell PhD
Nature

20 May 2011

Written evidence submitted by the Institute of Physics (PR 61)

The Institute of Physics is a scientific charity devoted to increasing the practice, understanding and application of physics. It has a worldwide membership of over 40,000, and is a leading communicator of physics-related science to all audiences—from specialists through to government and the general public.

The Institute welcomes the opportunity to respond to the House of Commons Science and Technology Committee's inquiry into peer review, which is particularly relevant to our extensive learned society publishing activities.

The Institute has published academic journals continuously since its foundation in 1874. Today the Institute's publishing is carried out through a wholly owned subsidiary company, Institute of Physics Publishing Ltd (IOP Publishing). The company employs more than 270 people in Bristol and has offices in the USA, Germany, Russia, China and Japan.

The Institute publishes 65 journals, which are international in terms of content and circulation. Around 96% of submitted papers and 95% of subscription income come from outside the UK. This performance has been recognised by the award of the Queen's Award for Export Achievement in 1990, 1995 and 2000. International sales of IOP journals generate a surplus that is transferred annually by Gift Aid to the Institute. Income from publishing forms the largest element of the Institute's total income for its charitable activities in support of its mission to advance physics for the benefit of all.

The attached annex details our response to the questions listed in the call for evidence. If you need any further information on the points raised, please do not hesitate to contact me.

Dr Robert Kirby-Harris CPhys FInstP
Chief Executive

(i) *The strengths and weaknesses of peer review as a quality control mechanism for scientists, publishers and the public*

1. The peer review system provides accountability in science through systematic expert scrutiny of published work. Manuscripts are subjected to critical review by (usually two) scientists in a particular research area who are asked to comment on key issues within the paper including, but not limited to, whether the content appears to be sound, correct procedures appear to have been followed, and there are no obvious mistakes. Peer review in journals can also be guided by quality and scoped criteria set by the editorial board for that journal.

2. In two independent reports[1,2] surveying between 5,000–6,000 researchers, effective peer review mechanisms were felt to be fundamental to scholarly communications with 96% of respondents stating that peer review was very or quite important in regulating the quality of what is published.

3. There are different methods of peer review ranging from double-blind peer review (where authors and referees/reviewers are kept anonymous) through to open peer review where authors and referees are known. The most commonly used method is single-blind peer review, where the authors' names remain on the manuscript but the referees' identities are kept anonymous. There are currently different experiments underway to look at alternative methods of peer review but, whichever method is used, peer review currently remains the only reliable way to ensure quality control of the increasing amount of papers submitted to scientific journals. Research into this and attitudes towards peer review have been conducted and reported in a number of recent independent reports[3, 4, 5] demonstrating varying support for the different methods.

4. Our experience supports what has been reported in other studies: that there is a need for peer review as a check, if not a cast iron guarantee, of quality; and that it is a part of the defence against fraud (eg fabrication of data) or misconduct (eg plagiarism). No system is 100% perfect and if/when incorrect results make it into the literature there are systematic mechanisms in place to correct errors and maintain a record of any corrections. In publishing this is done by the use of corrigenda, retractions or comments and replies, all of which can be linked back to the source article maintaining an updated record of changes. There are specific publishing guidelines for handling cases like this that occur in journals.[6] There are some documented instances of good papers being rejected by the authors' first choice of publication, for varying reasons; the diversity in the publishing landscape, however, offers authors of manuscripts multiple options and it is likely that good papers will get published in a peer reviewed publication. For example, most scientists have a selection of preferred journals that they wish to publish in, with preferences dictated by impact and readership.

5. With the introduction of a publishing industry tool called CrossCheck,[7] many journals have introduced additional layers of checks into the peer review system, looking for duplicated work either by the author, known as self-plagiarism, or the copying of others' work.

6. The strengths of peer review are that it is robust, trusted internationally and the mechanisms are well established, understood and thoroughly tested over many years on a global level. A further strength of the process is that in general it is based on the anonymity of the referees. Peer review forces every author to check his/her work carefully; knowing that it will be critiqued by a peer generally means that more thought goes into constructing a paper so that others can more easily read and interpret the work. At the very least, peer review produces clearer papers and also allows feedback to the authors, which can help improve a paper. Many authors acknowledge the help of the referee in their final paper. In an independent report, 77% of respondents agreed that the referees' comments on their last paper had been helpful and improved the work.[1]

7. Without peer review, flawed and correct research would have the same scientific status. As a result, the pace of scientific progress would be significantly slower.

8. The weaknesses of peer review are that some referees may want to block or delay the publication of a paper because of competing interests, animosity against the authors, or may allow publications of flawed works because the authors are famous and respected. In some research areas there is also an issue with one branch of science dominating to the possible detriment of the other. This can be mitigated to a large extent by careful control of deadlines, the editor's knowledge of the research area and an open system whereby the authors can appeal a decision. Authors can also, and do, highlight any potential clashes when submitting their manuscripts.

9. Another weakness can be the length of time to publication, but this varies between article type, journals and across research areas. A 40 page review article will take much longer to referee than a four page letter. It

is important to note that technology has been used to accelerate this process but there is an inherent delay in any system that requires assessment and checks to allow for careful consideration of the work. A balance must be maintained between speed of publication and time for the referee to assess a manuscript.

10. Peer review is one of the costs of publication but any filtering mechanism will incur costs regardless of the final means of dissemination. For many years physics has had arXiv.org, a pre-print server running in parallel to the peer reviewed journals. There are research areas where pre-prints have become the main conduit for communicating results. However, the majority of papers posted onto arXiv.org also get into peer reviewed journals, as publication in a high impact-factor refereed journal is still seen as the "gold standard".

(ii) *Measures to strengthen peer review*

11. The peer review process can be strengthened by continually broadening the pool of referees, setting enforced deadlines for responses, sending reminders to referees, and monitoring the time an article is left with a referee and sending it to another if that referee is not responding. In addition, a possible improvement to discourage referees holding up publication could be to have more transparency of submission dates as well as published dates on articles. Technology has helped systemise the peer review process by allowing referees to volunteer for journals they write for, continually updating their information online and for reminders to be sent automatically. However, there is a need to understand that referees are volunteers and care needs to be taken not to overburden them and provide reasonable timescales for reports to be received.

12. In addition, editors are responsible for choosing the referees and monitoring their conduct. In many journals there are now preliminary assessments made to enable quick responses to authors whose work is either outside of the scope of the journal or is below the quality criteria set for the journal. This could be one way of relieving the pressure on overburdened referees and adds an additional layer of filter. Careful selection of referees from different research areas is also critical in multi-disciplinary work and the editor has a key role in ensuring that all aspects of the research are considered. For controversial research areas, encouraging additional comments from other specialists provides as fair an assessment as possible.

13. In some research areas it could be an improvement not to reveal the identity of the authors to the referees (ie double-blind refereeing), in order to avoid any form of prejudice. However, in some research areas this would not be practical as there are only a handful of groups engaged in a specific type of research and the authors' identity would be obvious.

14. Good practice in peer review dictates that referees must be technically competent in the relevant research area; referees must be independent, impartial and without vested interest. In some research areas this has to be stated explicitly, in addition to ensuring that referees are not from the same institution as the authors, not in direct competition and not had any significant difficulties with the authors in the past or have any other conflict of interest. The referees should not allow, in so far as it possible, their own work to be directly influenced by the privileged access to the material under review. One important way to strengthen peer review would be to improve the training and information available on best practice, particularly as refereeing is a skill predominantly acquired on the job; there are a number of guides available.[5]

15. It is also important that the organisation requesting the review should make every effort to carefully define the criteria for acceptance or rejection. Report forms guiding referees can be useful in this regard. When selecting referees for multi-disciplinary research it is important to get input from the main contributing research areas to help balance the view.

(iii) *The value and use of peer reviewed science on advancing and testing scientific knowledge*

16. Without the "filter" of peer review, scientists would spend a large part of their time following false leads. Peer review provides added value to the advancement of science and plays a critical role in enforcing the highest standards of evidence. Even in research areas where the pre-print is used as the main route for communication there is still some initial peer review/filtering required either internally (eg in larger collaborations) or by user comments on the article. In these cases the pre-print is also often cross checked for the existence of the peer reviewed version to validate the work.[1]

17. It should also be recognised that referees often make a significant contribution to the quality of the research through the suggestion of different methodologies, interpretations and connections to other previously published work which may be unknown to the original authors.

18. Peer reviewed publications are also used as a comparative measure to assess research output for assessment exercises such as the RAE/REF; they are used as a measure of output and indication of a researcher's career and used in promotion decisions and awards. Whilst this is not a perfect measure it is one that is used internationally, with work published in recognised peer reviewed journals given higher credibility than non-peer reviewed work.

(iv) *The value and use of peer reviewed science in informing public debate*

19. In the discussion paper, *Peer Review and the Acceptance of New Scientific Ideas,*[8] Sense About Science reported that: "…*science has become the subject of many public and political controversies. Exaggeration and*

anxieties about scientific developments often relate to research findings that are regarded by scientific experts as weak or flawed, or that have not been subjected to independent expert scrutiny at all. These developments have resulted in a greater public need for clarity about the status of new research claims. A wider understanding of peer review's role in assessing whether work is competent, significant and original, is central to achieving that clarity about the status of research." The discussion paper made a number of recommendations about how this might be achieved. For example, it suggested that scientific bodies should make systematic attempts to explain peer review and communicate what it is to a wider audience, especially when there is controversy about particular claims. This is a laudable aim as the importance of improving the public's understanding of the role of peer review in the scientific process has not diminished since this discussion paper was published in 2004. Whether any progress has been as a result of the discussion paper and the actions of the numerous bodies involved with communicating science, is hard to judge, but would be very useful to ascertain.

20. The public should be encouraged to recognise that a peer reviewed result is the "gold standard" in research and will produce the most reliable information in the long term, and needs to understand that this process has to be carried out in confidence to protect referees from undue harassment. However, sometimes the peer review process can be too slow to inform debate and encounters difficulties on those rare occasions when results are first presented directly to the media. This is a particular concern in medical research and there are a number of different experiments trialling what is called open peer review on blogs, for example, for situations where time is critical.[9] Peer review is still a critical part of this and needs to retain the confidence of the scientific community and the public at large and is therefore very carefully monitored and mediated.

21. An area for improvement here is to explain clearly to the public the difference between peer reviewed and non-peer reviewed content.

(v) *The extent to which peer review varies between scientific disciplines and between countries across the world*

22. Nearly all journal publications in physics are international and the standards are enforced fairly uniformly. In large experimental collaborations articles have to undergo extensive internal peer review (sometimes for many months) before reaching the submission stage. For example, in particle physics, this contributes to the high use of the pre-prints on arXiv.org as this initial peer review is widely understood and acknowledged, although, as stated previously, the majority of the pre-prints also get published in journals following additional external peer review.

23. There are different expectations across research areas with regards to time to publication, depth of report required, analysis of data, etc. This is also changing as the technology evolves and one challenge for the future is how to make data available for the referees to assess, if required. In medical research there is sometimes greater urgency to discuss issues outside of the traditional peer review structure and, as mentioned, there are a number of different approaches currently being tried.

(vi) *The processes by which referees with the requisite skills and knowledge are identified, in particular as the volume of multi-disciplinary research increases*

24. In multi-disciplinary research there is a need to use multiple referees with expertise in the different aspects within the multi-disciplinary research area; referees with expertise across the whole of the research area are very limited in number, due to the nature of multi-disciplinary research and it is therefore important to have an assessment of all sides of the research where possible. A referee with the broadest appropriate oversight should be sought and the editor and editorial board/assessment panel has a critical role in assessing the overall reports.

25. Currently, the problem is also to identify referees with the requisite willingness or time. The peer review process is rather peculiar in that there is no obvious reward offered to referees; in fact it is felt to be an integrated part of the role of a researcher and the "rewards" are the opportunity to see work in your research area before it is published, and an expectation that by refereeing a peer's work you would in turn expect your work to be reviewed. There is a case for revisiting this tradition, as other professions generally do not proceed on this *pro bono* basis when offering a service, but the majority of participants in the present debate support the current practice of peer review and strongly feel that this is part of their role as a scientist.[3, 4]

(vii) *The impact of IT and greater use of online resources on the peer review process*

26. IT has already had a big effect on the peer review process. In journal publishing the ability to access manuscripts online for review has been common practice for many years and some journals also offer referees access to the literature whilst they are reviewing a paper; tools such as reference linking are available on most published articles making it easier to check the background literature.

27. With the semantic web and changes to PDF technology there is an opportunity to make the process more interactive and easier; for example, using the potential of a PDF for inserting comments into drafts, accessing background data, linking to additional material, etc. However, the use of IT also has to make the process simpler and less time consuming and not add more work to already overloaded referees. In addition to traditional peer

review, there are also experiments utilising technology to enable public, post publication peer review which supplements the initial confidential peer review.

(viii) *Possible alternatives to peer review*

28. There isn't any real alternative, although there can be improvements, as per our response to question 2. Of particular concern is the issue relating to grant proposals as outlined in our response to question 3. There is no obvious alternative to the use of peer reviewed content as a comparative measure of output and quality and it is difficult to see how these processes would work without it.

29. In some areas involving collaborative science, a high level of internal peer review is undertaken before journal submission takes place (see previous comments). The policing role of external peer review is of course still highly important in these cases.

30. The publishing industry and some research communities are trialling different approaches to the traditional models but it is still early days and the experiments to date have had mixed responses.

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[3] Peer review: benefits, perceptions and alternatives. Mark Ware for Publishing Research Consortium; http://www.publishingresearch.net/documents/PRCsummary4Warefinal.pdf

[4] Quality assurance and assessment of scholarly research. A guide for researchers, academic administrators and librarians. Research Information Network, May 2010; http://www.rin.ac.uk

[5] Peer review; a guide for researchers. Research Information Network, March 2010; http://www.rin.ac.uk

[6] Preserving the record of science. STM guidelines, April 2006; http://www.stm-assoc.org

[7] http://crossref.org/crosscheck.html

[8] Peer Review and the Acceptance of New Scientific Ideas, Sense About Science, November 2002-May 2004; http://www.senseaboutscience.org.uk/pdf/PeerReview.pdf

[9] http://www.healthaffairs.org/1500_about_journal.php

Institute of Physics

10 March 2011

Supplementary written evidence submitted by the Institute of Physics (PR 61a)

1. *In relation to Q11 (transcript): How do you "make it very easy for authors to be able to submit from the arXiv into our journals"?*

Within our online submission form there is an option for authors to enter their arXiv reference number when they submit the article to be considered for publication. This number enables us to locate the article in question and automatically upload the files from arXiv to our peer review system for processing.

2. *In relation to Q11 (transcript): You stated "Authors are encouraged to update their versions as well. From the publishing side, we encourage them to update the references so that the link goes back to the final version of record once it has been peer reviewed and published." Why is this not mandatory? Are there any initiatives in the physics community to make it so?*

Updating ArXiv is encouraged as best practice but is currently not mandatory. As a publisher, although we can recommend that authors update the links on ArXiv, it is not within our control to mandate it. ArXiv is independently maintained and operated by Cornell University with guidance from the arXiv Scientific Advisory Board and the arXiv Sustainability Advisory Group. For more information please see http://arxiv.org/help/general. Practically it would also be difficult to enforce.

There are a few initiatives that proactively map different versions of articles to one central reference, including preprints on arXiv and the published version. Examples of these initiatives are:

- www.slac.stanford.edu/spires/about/
- http://inspirebeta.net/
- http://adswww.harvard.edu/

However, it should be noted that they do not update the links in the arXiv record itself as only the author has the rights to do this.

3. *In relation to Q30 (transcript): Do all your journals participate in cascading submissions/reviews? Do you have any data on: How many articles get cascaded? What percentage of those offered take up the invitation? What percentage of those cascaded articles are accepted?*

All journals owned by IOP Publishing will pass on articles to more relevant journals within our portfolio, if appropriate. There are restrictions; if an article has been rejected due to low quality or because referees found major errors then it is rejected from all of our journals. We do not have data on how many articles are cascaded. Generally the articles will be transferred from a general journal to a more specific niche journal. There are rare occasions when an author submits the anonymous referee reports that he/she has received during the review process for a journal published by another publisher; in cases like this it is within the Editor's discretion to take these reports into account in addition to seeking a further independent review.

4. *Additional question: Where inaccurate, misleading or fraudulent articles are published, what processes are in place to ensure that corrections or retractions are implemented in a timely fashion? Are retractions published by all your journals free for everyone to read (or do they sit behind a paywall)?*

This falls into three categories:

(i) If there is an error that is discovered by the author then we will publish a corrigendum.

(ii) If post publication another researcher feels there is an error in the paper, or that there is something misleading, they can either raise the concern directly with the author who can correct the error as outlined above, or the researcher can submit a comment on the paper. Comments on an article are sent to the original article author who has a set time (usually a couple of weeks) to provide a reply to the comment. Both Reply and Comment are then peer reviewed and either published together or the Comment is published on its own if no Reply is received from the original article author.

(iii) In the case of plagiarism we will investigate obtaining any evidence we can, such as any duplicate articles, and will work with other journal editors if appropriate to resolve the issue. We then follow the guidelines provided by Committee on Publications Ethics in issuing a retraction linked to the original article. On the original article there is a notice posted onto the article to say it has been retracted.

Retractions and corrigenda are made open access and are not behind a paywall in any IOP Publishing journal. Comments and Replies are currently behind a paywall in subscription journals.

1 June 2011

Written evidence submitted by the Research Councils UK (PR 67)

1. Research Councils UK is a strategic partnership set up to champion research supported by the seven UK Research Councils. RCUK was established in 2002 to enable the Councils to work together more effectively to enhance the overall impact and effectiveness of their research, training and innovation activities, contributing to the delivery of the Government's objectives for science and innovation. Further details are available at www.rcuk.ac.uk.

2. This evidence is submitted by RCUK and represents its independent views. It does not include, or necessarily reflect the views of the Knowledge and Innovation Group in the Department for Business, Innovation and Skills (BIS). The submission is made on behalf of the following Councils:

Arts and Humanities Research Council (AHRC).

Biotechnology and Biological Sciences Research Council (BBSRC).

Engineering and Physical Sciences Research Council (EPSRC).

Economic and Social Research Council (ESRC).

Medical Research Council (MRC).

Natural Environment Research Council (NERC).

Science and Technology Facilities Council (STFC).

3. RCUK welcomes the opportunity to respond to the Committee's inquiry into "the operation and effectiveness of the peer review process used to examine and validate scientific results and papers prior to publication".

4. Peer review is a highly valued tool in the assessment of the quality of research in both the sciences and the arts. As Research Councils we predominantly use peer review in the assessment and prioritisation of which research to fund—this aspect of peer review is upstream of the processes under discussion by the Select Committee and therefore not addressed in this response.

5. The strengths of peer review far outweigh the weaknesses. Peer review is a key part of the global research landscape, without it the quality of outputs and the quality of research decision making would be much poorer. Peer review provides a detailed technical review of the quality of the research under discussion—essential in order to validate/test assertions made and is accepted as a valid way in which to assure the quality of publications world wide. Researchers take their responsibilities as peer reviewers seriously and the community of peer reviewers represents a significant breadth of expertise; academics, industrialists and other experts both nationally and internationally.

6. Whilst the benefits of peer review are clear it is important to note that it is both time consuming and labour intensive and that demands on reviewers are higher than ever both from Journals and funding bodies nationally and internationally. Where possible steps should be taken to streamline processes without compromising quality.

Research Councils UK

10 March 2011

Supplementary written evidence submitted by the Research Councils UK (PR 67a)

PEER REVIEW ORAL EVIDENCE SESSION HELD ON 8 JUNE 2011

1. This supplementary memorandum is submitted, at the request of the Committee, in support of previously submitted written evidence by RCUK and represents its independent views. It does not include, or necessarily reflect the views of the Knowledge and Innovation Group in the Department for Business, Innovation and Skills (BIS).

2. In July 2010 RCUK wrote to organisations represented on the Research Integrity Futures Working Group to share the final decision of the RCUK Executive Group (RCUKEG) regarding the recommendations made in the Working Group report. One of the strands of activity proposed by RCUK, in discussion with UUK and HEFCE, was the idea of a "Concordat" style document setting out principles on research integrity to which research funders can all sign up.

3. Research funders have a range of priorities and perspectives, but there are a number of core principles upon which most funders would agree. It was considered that a concordat would be useful to set out for the community these shared views, perspectives and expectations. RCUK, together with all funders, recognises the importance of this agenda and the concordat is just one strand of work being taken forward in this area.

4. Since then, Universities UK (UUK) has taken the lead on work in this area, working closely with RCUK, the UK Funding Councils, the Wellcome Trust and the Department of Health. UUK is the representative organisation for the UK's universities and is also not a funder of research itself, which makes it the ideal organisation to lead on the development of this Concordat from a neutral and informed position.

5. UUK is planning a discussion to decide details of the Concordat to take place during the next few months. Depending on progress made by UUK, RCUK is hopeful that a working draft will be produced by late autumn. Once a working draft is in place, funders will be invited to sign up to the Concordat and agree to abide by the principles set out within. Following this, UUK will lead on developing a mechanism for implementation.

6. The Concordat is separate from the work of the new UK Research Integrity Office Ltd (UKRIO), which is an independent company limited by guarantee offering an advice and guidance service.[15] The Concordat will, however, be designed to be complementary to the various documents produced by not only UKRIO in its previous incarnation but other bodies which produce guidance and codes of practice for research integrity.

June 2011

Written evidence submitted by the Royal Society of Chemistry (PR 68)

THE ROYAL SOCIETY OF CHEMISTRY (RSC) WELCOMES THE OPPORTUNITY TO RESPOND TO THE SCIENCE AND TECHNOLOGY COMMITTEE'S CONSULTATION ON PEER REVIEW

1. The RSC is the largest organisation in Europe for advancing the chemical sciences. Supported by a network of 47,000 members worldwide and an internationally acclaimed publishing business, its activities span education and training, conferences and science policy, and the promotion of the chemical sciences to the public.

2. RSC Publishing is one of the largest publishers of chemical science information in the world. Over 230 people are employed in the publishing operation. The majority of staff are located in located in Cambridge (UK), although the RSC also has modest offices in Philadelphia (USA), Beijing and Shanghai (China). RSC Publishing is a not-for-profit publisher wholly owned by the Royal Society of Chemistry. Committed to advancing the chemical sciences, any surplus is reinvested in supporting the global scientific community.

[15] http://www.ukrio.org/resources/Relocation%20of%20the%20UK%20Research%20Integrity%20Office%2006–12–10.pdf

3. The RSC Portfolio comprises 32 peer reviewed high impact journals, two highly acclaimed magazines, approximately 90 new books annually and several databases. The RSC is thus an established and experienced scientific publisher serving the chemical science community.

4. This document represents the views of the RSC. The RSC has a duty under its Royal Charter "*to serve the public interest*" by acting in an independent advisory capacity, and it is in this spirit that this submission is made.

5. The RSC believes that the peer review system:

- Is beneficial both for the research communities that it serves, as well as the wider public.
- Successfully balances the demands of enabling researchers to disseminate their work quickly and widely, with ensuring that such work maintains the integrity of the scientific record.
- Whilst it is not flawless, provides a clearly defined code of ethics for those that work in it (authors, editors, publishers and reviewers) together with measures to ensure transparency at all stages.
- Varies between disciplines, which means a "one-size-fits-all" approach is inappropriate. Publishers within each discipline have evolved procedures and guidelines appropriate to each field; an environment where best practice can be shared within the industry allows these organisations to develop continuously. However, to try to adopt uniform guidelines across the industry would be counterproductive and inappropriate.
- Provides a mechanism through which the reliability and authority of disseminated work can be gauged. In an age where information on all topics is so freely accessible, it has become evermore difficult for the public to distinguish between different sources and their respective authority or limitations. However, it is clearly important that an appreciation of the peer-reviewed process is more widely understood.

1. *The strengths and weaknesses of peer review as a quality control mechanism for scientists, publishers and the public*

6. The peer review system is a process that benefits the researchers that it serves, as well as publishers, the wider scientific community and the public. It does not merely constitute a process of accepting or rejecting research papers. Rather, it is a process that examines and refines a piece of research undertaken by a particular author. Criteria such as methodology and correct acknowledgement of other research in the field to avoid repeat publication can be checked. It is a tool that publishers can use to ensure that the research that they distribute maintains the integrity of the scientific record to the highest standards.

7. Reports produced by referees as a result of the peer review process will contain suggestions to strengthen and further the body of research presented. Many authors find that the peer review process helps them to improve their work and so ensure that research in the public domain is of the best quality. A 2009 survey of over 40,000 researchers, conducted by *Sense About Science* revealed that 91% of authors felt that the peer review process had improved their publication.[16] In some cases, recommendations through the peer review process can result in collaborations between academics within a field, leading to new areas of scientific progress.

8. In most fields, peer review is an activity undertaken without payment as part of the scholarly system. The lack of formal accreditation for this activity is seen by some as a flaw. However, acting as a referee is regarded by most researchers as a professional activity making active participation in the peer review process an important part of a scientific researcher's career. 90% of referees interviewed in the aforementioned survey cited "playing an active role in the community" as their primary reason for undertaking peer review. Refereeing falls within the "code of conduct" of the scientific profession and the obligations of its members. Such a code of conduct seeks to maximise the benefits of science to society and the profession. Most referees are also authors, and so have a vested interest in contributing to maintaining and raising journal standards.

9. A potential criticism of the peer review process is that it relies upon the personal judgment of individuals in a given field. Conflicts of interest can occur and the quality and experience of referees is inevitably variable. However, mechanisms to ensure the strength of peer review are extensive (see question 6 also). Publishers employ robust guidelines on ethics and conflict of interest.[17] These include guidelines on the ethical use of live subjects (humans and animals) in research. Publishers, authors and reviewers are obliged to submit research and review research under these guidelines. To ensure the strength of peer review, authors can appeal against the rejection of a paper and there are processes in place for such requests to be dealt with fairly.

10. The role of the editor is central to the quality of the peer review process. It is the editor who will consider the information produced through the process and so ultimately decide what feedback is communicated to the author and which articles are published. The judgement applied by the editor to the information collected in the review process requires knowledge, skill, and care.

11. It should also be noted that peer review is only a single part in the "quality control" procedure for research that is applied prior to the stage of publication. There are other measures in place to assess research

[16] Sense About Science | Peer Review Survey 2009: Preliminary Findings
[17] RSC—Ethical Guidelines and Conflicts of Interest

practices and the authenticity of data collected. Research that is undertaken as a regulatory study must be undertaken with compliance to good laboratory practice.[18] However, a clear distinction must be made between the purpose of the different parts of the "quality control" process; it is not the role of peer review to scrutinise laboratory practice.

2. *Measures to strengthen peer review*

12. Some of the measures employed to strengthen peer review include variation in the operating methods used. Closed peer review involves anonymity of either both the author and reviewer (double-blind) or just the identity of the reviewer (single-blind). In open peer review, both reviewers and authors are aware of each others identity.

13. The RSC uses single-blinding in its peer review process. A number of studies have been carried out regarding the relative merits and effects of double-blinding on the quality of reviewing. However, these have largely proved inconclusive.[19] The success of double-blinding is often hampered by the tendency of authors to reference their previous work within submitted manuscripts. Where referee reports for a single paper vary, the view of a third, usually more senior referee as an adjudicator may also be sought.

14. Open review is a process that has varying acceptance between disciplines. It is a method that has been used by the British Medical Journal for more than 10 years.[19] However, many researchers have expressed reservations over this process. Early-career researchers may be reluctant to use the open review process to critique the work of more senior figures in the field, as this may have implications for their career progression at a later stage. Whilst open review is used in some fields, there is little active demand for such a shift in methodology; 58% of reviewers would be less likely to review if their signed referee's report was available alongside any paper they reviewed.[20]

15. Core measures that are important in strengthening the peer review process should focus on appropriate training. This applies to both reviewers and editors who manage the process. Within the RSC, editorial duties are handled both internally by professional editorial staff and externally by associate editors. Ensuring that consistent procedures are applied in both methodology and ethics are key to maintaining the integrity of the peer review process. RSC Publishing staff actively engage with potential authors and referees in the scientific community. They regularly deliver workshops on the publishing and peer review process both in the UK and across the world.

3. *The value and use of peer reviewed science on advancing and testing scientific knowledge*

16. Peer review is a valuable mechanism for advancing scientific research and knowledge, both as a filtering and refinement tool. Publishing editors must select work that advances scientific knowledge in an area, but take care to ensure that work is reasoned and not overly speculative. As outlined in question 1, a referee's report will usually include improvements to the work presented. These can include further suggestions or modifications to methodology to improve the body of work presented. These aspects of the peer review process ensure the advancement of scientific knowledge in the broadest sense. For a learned society, such as the RSC they enable us to fulfil our charter objective of "*the general advancement of chemical science*".[21] Very few papers are published without amendments and the use of peer review is acknowledged by researchers as an effective method of improving their work and advancing scientific knowledge.

4. *The value and use of peer reviewed science in informing public debate*

17. A sound scientific evidence base is central in the formulation of policy. As such it is important that society as a whole has an appreciation and understanding of science. Peer reviewed research has an important role in advancing the public understanding of science. Currently, it is possible for peer-reviewed research and individual's personal opinion to be presented side-by-side with equal weighting. More critically, the *limitations* of each type of information are not usually distinguished by the public. Often both types of information are interpreted as factual. Peer review is used to check the methodology used, the accuracy of reporting with respect to previously published work in the field and the relevance of the research. The interpretation of the data gathered from such research cannot be certified using this process. However, peer review can give an indication of whether the interpretation of results that is presented is widely accepted within a particular research community.

18. More should also be done to make the public aware of the wider context of scientific research. There is still currently a public preoccupation with scientific research providing "answers". A single piece of research rarely provides a definitive answer to a scientific problem. Rather a single piece of research must be viewed in the overall context of the field, as it contributes to the overall debate in a given area. Whilst this distinction is made by other researchers in the field, this is not often the case when a piece of research is examined in the public arena.

[18] The Good Laboratory Practice Regulations 1999
[19] S van Rooyen, The Evaluation of Peer-Review Quality, *Learned Publishing*, 2001, **14,** 85
[20] Sense About Science | Peer Review Survey 2009: Preliminary Findings
[21] RSC Charter and By-laws

5. *The extent to which peer review varies between scientific disciplines and between countries across the world*

19. Peer review methodology varies between fields, with some fields using blinding methods, whilst others widely use open peer review (see question 2). As in most disciplines, the RSC assigns experts in the field to carry out reviews.

20. The RSC is one of the largest international publishers in the field of the chemical sciences. In order to serve an international research community, referees are sourced from across the world. As businesses, publishers need to be responsive to changes in the international research arena. The recent rise in submissions from institutes in China must be matched in terms of identifying, training and using referees from there and other nations with emerging knowledge-based economies. These measures can help to foster international standards in peer review across a discipline. The RSC's strong presence in Asia, with offices in Beijing and Shanghai, reflects the importance of supporting and developing peer review skills in this region (among other strategic benefits).

6. *The processes by which reviewers with the requisite skills and knowledge are identified, in particular as the volume of multi-disciplinary research increases*

21. For scientific publishing, a scientifically-literate workforce is crucial. As mentioned in question 1, the role of the editor is pivotal in the peer review process. Staff with appropriate training and expertise within the field are essential in identifying reviewers with both suitable knowledge and experience. All internal editors at the RSC have a minimum of a degree in an appropriate science subject, with many also holding postgraduate qualifications. Associate editors are experienced researchers in the field who perform their duties alongside their research, with this commitment and dedication recognised through payment of an honorarium from the Publisher. The management of referees is a continuous, skilled process, with editors building up knowledge and relationships over time to ensure that manuscripts are reviewed fairly and efficiently. The RSC employs approximately 80 internal editors in our Cambridge office, and supports approximately 70 Associate Editors based throughout the world.

22. The chemical sciences are a field that cover a range of disciplines, including health, environment and materials. Increasingly multidisciplinary collaborations across several fields are becoming common, particularly in areas of "challenge-led" research. When reviewing research in emerging areas, it is essential that all aspects of the work are reviewed. This may require the selection of referees with different specialities to address different part of the manuscript. Yet again, the role of the editor in managing the overall process is critical; they must select referees to strike this balance. They are also crucial in building up knowledge of emerging fields as they develop and change.

7. *The impact of IT and greater use of online resources on the peer review process*

23. The RSC received 34,177 manuscript submissions during 2010, sending over 28,000 for peer review. This volume of manuscripts can only be handled effectively through the investment and utilisation of sound IT systems and processes.

24. The use of IT has greatly extended the pool of referees accessible to publishers on an international scale. Of the 32,000 expert referees the RSC consults, the vast majority are based outside the UK. Changes in technology have also allowed the reviewing process to be completed with greater speed and ease. A survey of over 3,500 reviewers showed that more than 70% felt that it was easier to carry out a review due to technological advances.[22] These improvements have not just benefited reviewers, but also authors, with shorter receipt-to-publication times.

25. Technological advances have also led to more sophisticated methods to detect plagiarism. The RSC is planning to introduce the use of word-overlap detection software to guard against plagiarism. This software has been developed through collaboration and in partnership with other science publishers. The use of this technology is an important part of the ongoing process to ensure that peer review serves both its community and the public to the highest standard. Whilst more than 80% of reviewers believe the peer review process *should* detect plagiarism, only 38% believe it is *able* to do so.[22]

26. The greater general availability of research *via* the internet has made it more difficult for us all to distinguish the large amounts of information that we encounter on a daily basis. Whilst researchers in the field and those familiar with the peer review process are able to discern between peer-reviewed research and personal opinion, large sections of the public may not be able to (see question 4 also).

8. *Possible alternatives to peer review*

27. The integrity of the scientific record is important, not just to those in the scientific community, but also for the reliable dissemination of scientific information to the public. Whilst alternatives to peer review may include open forums and post-publication review, the established procedures used in peer review ensure that a consistent process is adopted for all submitted manuscripts. The filtering process to ensure that only an

[22] Sense About Science | Peer Review Survey 2009: Preliminary Findings

appropriate level of research is accepted for publication is an important advantage of peer review. Alternatives to peer-review, such as post-publication forum do not have this filter and so it becomes the responsibility of the reader to determine whether the content they find an authentic and valid contribution in the field.

28. As described above (paragraph 17), peer review cannot guarantee that conclusions drawn by a piece of research are indubitably correct. However, whilst peer review is not infallible, it is the most efficient system for the assessment of new research. Whilst there are variations between fields, publishers are obliged to set and uphold guidelines on the criteria for submission, review and publishing of work.

29. There are procedures in place to raise queries regarding published research that has been subject to peer review. These procedures acknowledge the transparent nature of peer review. It is not inscrutable and these mechanisms strengthen its status as a fair, practical method for the assessment of scientific research.

30. The RSC regularly evaluates the merits and efficacy of the established peer review system for its high impact journals. Alternatives do not appear to provide any significant benefits, and appear to have many shortcomings which could threaten the integrity and accepted authority of published content. The RSC fully supports the existing peer review process and is interested to learn the outcome of this consultation process.

Royal Society of Chemistry

10 March 2011

Supplementary written evidence submitted by the Royal Society of Chemistry (PR 68a)

1. In Relation to Q26 (Transcript)

You stated that you "deal with a lot of requests from US referees, young academics, wanting a letter of endorsement saying that they have acted as a referee for the RSC and that they have been reasonably good at it. It will help them to gain tenure". Can you provide us with further information on this, in particular, how many requests you deal with in an average year and what sort of information is required in the letter?

These requests normally come from young academics working in the US, whose country of birth is elsewhere. For the process of their application for US permanent residence as an "Alien of Extraordinary Ability", they need to gather as much information as possible for their immigration lawyers on their skills and achievements. We receive about five requests for support letters per week across all RSC journals. This currently accounts for approximately 250 per year, although anecdotally the number of such requests seems to have increased somewhat in recent years.

The RSC has a standard letter in response to such requests which purely states facts on the number of times the person in question has provided a referee report or published a paper and for which journal. In the case of a referee, the letter states that, "our journal editors select reviewers based on their research expertise and experience". No comment is made on the person's particular capability.

2. In Relation to Q30 (Transcript)

Do all your journals participate in cascading submissions/reviews? Do you have any data on: How many articles get cascaded? What percentage of those offered take up the invitation? What percentage of those cascaded articles are accepted?

All RSC journals participate in cascading submissions/reviews in some form, whether giving or receiving articles. Such "transfers" may occur before or after peer review, depending on when it becomes apparent a paper would be better suited to an alternative journal. If after peer review, the referee reports are cascaded along with the paper. A paper may or may not be accepted based on these previous reports; it would depend on the nature of them and extent of revisions which may be required. No article is ever transferred to another journal without the consent of the authors. We see it as a way to help authors publish their work in the most appropriate forum.

Accurate data on the number of articles cascaded and published is difficult to track with the workflow system the RSC uses as it may be several months or a different year before a paper is resubmitted to another journal. Currently a small percentage of published papers are the result of cascading; we would estimate this as being in the region of 2%. The uptake rate of authors depends largely on the particular journals in question.

3. Additional Question

Where inaccurate, misleading or fraudulent articles are published, what processes are in place to ensure that corrections or retractions are implemented in a timely fashion? Are retractions published by all your journals free for everyone to read (or do they sit behind a paywall)?

Where errors occur in published manuscripts yet the main body of the paper remains viable, an Addition & Correction statement is published. This appears on the web alongside the article in question and is free to view. The same statement is published in the final print issue of the year to complete the record.

When more serious errors are discovered, a retraction may be considered. These are fairly rare in RSC publications and only occur in the most serious cases which affect the entirety of the article. In these cases, the electronic version can not be taken down from the website, but the title of the article is changed to include the words "Retracted article". The text of the abstract is changed to indicate that the article has been retracted and an additional page is added to the PDF for all who download the article to see. See for example http://xlink.rsc.org/?DOI=10.1039/b815757j. All this information is free to view.

As soon as the RSC editorial office is made aware of any potential problems with a paper we act as quickly as possible to ensure the scientific record is correct. It takes very little time to arrange for these amending statements to appear.

1 June 2011

Written evidence submitted by The Royal Society (PR 69)

INTRODUCTION

1. The Royal Society is a Fellowship of the world's most eminent scientists and is the oldest scientific academy in continuous existence. We aim to expand the frontiers of knowledge by championing the development and use of science, mathematics, engineering and medicine for the benefit of humanity and the world. The Society has three main roles: it is the UK academy of science promoting the natural and applied sciences, a learned society, and a funding agency.

2. The Royal Society has used peer review to make all its publishing decisions since its foundation in 1660 when the Society's Secretary, Henry Oldenburg, first introduced the concept. As a learned society, the Society publishes eight peer reviewed journals, including *Philosophical Transactions of the Royal Society*, the world's oldest scientific journal.

3. It is important to understand that the scientific literature is a very large body of analysis and experimental evidence published in the form of articles over several hundred years. These articles are the individual reports of scientific studies on all aspects of the natural world which, together, form a structured and coherent record of the current state of scientific understanding. They are not based on mere opinion or assertion, but are the result of careful observations and experiments which, over time, have been rigorously tested against each other for consistency in order to develop increasingly robust and reliable theoretical frameworks.

4. We understand that this inquiry is about the operation and effectiveness of the peer review process used to examine and validate scientific results and papers prior to publication. Peer review is the best mechanism currently available for this purpose and has stood the test of time. Its use in the evaluation and validation of scientific research prior to publication is essential.

5. Peer review is the process of subjecting an author's scholarly work or research to the scrutiny of others who are experts in the same field. For most journals, the process generally starts with some form of initial screening of an article ("pre-assessment") to sift out obviously unsuitable material. Items declined at this early stage would include articles clearly out of the subject scope of the journal, or that are obviously non-scientific. The next stage is to select a small number of reviewers expert in the field or fields covered by the article and to send the article to them for review (usually electronically). The reviewers are asked to comment of the scientific validity of the work, the appropriateness and rigour of the experimental methods, the quality of any statistical analysis of the data, and finally to give their opinion of its originality and likely impact on the field. Their recommendations are used by the journal editor to inform the decision as to whether the article should be published or not. In general, there are three categories of decision:

- Accept for publication ("as is", or with only minor revisions).
- Accept pending major revisions and/or further work.
- Reject.

Some journals choose to treat the second of these options as a "re-submission" while others consider it to be a modification of the original submission, but these are technicalities.

There are three types of peer review in use. In order of decreasing frequency of use they are: "single blind," "double blind" and "open".

By far the commonest system in use is "single blind" peer review in which the author's name and institution is known to the reviewer, but the reviewer's name is not provided to the author.

A number of journals instead choose to operate a "double blind" peer review system which is fully anonymised (ie the author(s) are unaware of the identity of the reviewer(s) and *vice versa*.

Recently, there have been some experiments with a third type, "open" peer review, in which the authors' and reviewers' names are revealed to each other. One major study in which articles were made publicly available on the web prior to publication for open peer review concluded "there is a marked reluctance among researchers to offer open comments." (Nature, 2006) Open peer review can be reasonably described as an experimental system at this stage and is far from common.

Specific Terms of Reference of the Inquiry

The strengths and weaknesses of peer review as a quality control mechanism for scientists, publishers and the public

6. Strengths of peer review

The single greatest strength of peer review is the close scrutiny of new scientific findings using evidence and expertise, to provide the reader with a mark of value, reliability and authority. In the absence of peer review some other method of validating scientific research would need to be used in order to prevent the proliferation of untested ideas, invalid conclusions, incompatible theories, pseudoscience and polemics. The progress of science crucially depends on the interpretation of new findings in the context of existing understanding and experimental evidence. Without any means of distinguishing the scientifically valid and coherent from the unfounded assertion, scientific progress would be severely (perhaps fatally) compromised.

Journals go to considerable lengths to select the most appropriate reviewers and to eliminate any potential sources of bias or conflicting interest in order to select the best material to publish. The reputation of the best journals is intimately involved with the rigour of their peer review systems and, in turn, provides a "kite mark" of authority for the research they publish. It also makes the journal more attractive for researchers to both read and to submit papers.

The method in most common use ("single blind") allows reviewers to provide honest and accurate feedback on an article without fear of repercussions. This is particularly important where the author may be "more established," more senior or have a higher reputation than the reviewer.

Some argue that "double blind" peer review is fairer in that it removes any potential bias in the mind of the reviewer resulting from the name, gender and country of origin of the author. The argument here is that a reviewer might be influenced into thinking an article is better than it is, if it comes from a high profile author in a top institution (and *vice versa*). However, it can be argued that complete blinding is impossible as it is often easy to identify the authors or their institution from other elements of the article (such as the reference list which is likely to contain references to the authors' own work, or to unique methodologies.)

It should be noted that the process of peer review can often provide very useful feedback to authors. Peer review does not have to produce a simple accept/reject result, and authors are frequently invited to modify their papers in the light of critical comment. This is an important way in which peer review can substantially improve the quality and value of scientific results.

7. Weaknesses of peer review

Peer review is fundamentally a human operation which relies on individual expertise and judgement. This means that reviewers may occasionally miss methodological errors or invalid conclusions in a research paper. Fortunately, this is relatively rare and its effect tends to be counteracted by the fact that several reviewers are usually invited to review a given article. In the rare event that such errors are not picked up during the process, they are soon picked up by other experts after publication and it is then possible to issue a correction, or in severe cases, a retraction. Where correction is justified there are detailed and robust publishing processes to ensure the scientific record is amended. In the long run, the process is self-correcting; the ultimate test is experimental evidence from the natural world.

Concerns have also been expressed regarding potential reviewer bias. This may be positive or negative and can arise from existing relationships or rivalries between reviewer and author, or from the perceived reputation of the author or their institution appearing to lend (or remove) credibility from the article. Such concerns are often cited as a justification for "double blind" peer review (see above).The risk of an unfair decision is mitigated by the use of several independent reviewers for each article.

Some critics of peer review claim that it can be used maliciously (for example, to suppress the work of rivals or to damage a competitor's career) and it is this concern that has promoted experiments with "open" peer review (under the assumption that reviewers would be less likely to submit malicious reviews in an open system).

Measures to strengthen peer review

8. Publishers, academies and the wider scientific community are constantly looking for ways to make peer review more effective and efficient. It is important to maintain rigorous standards whilst also minimising the demands on the reviewers (who, it must be remembered, are themselves busy researchers giving their time usually without payment). Traditionally peer review has been a paper-based system involving several communications between author, reviewer and editorial office and such a process carries significant financial and time costs.

In the past 10–15 years, however, the process has evolved away from paper to a fully integrated online process and all major journals will now only accept online submissions. The result has been to make peer review quicker and with a far lower administrative burden. Publishers receive articles, data, references, tables and illustrations as electronic files, usually via a dedicated web-based submission system. Manuscripts are then

allocated to reviewers and reviewed online, following which the decision is communicated to the authors in the same system. Many also accept supplementary information such as large datasets, video files etc., which in the case of "paper" journals will only be available on-line. In addition, online peer review systems integrate with the major third-party scientific databases such as *PubMed* which allow bibliographic reference validation and assist in selecting appropriate reviewers. Recently many publishers (including the Royal Society) have introduced integrated plagiarism detection software.

Another key improvement has been the development and widespread adoption of appropriate ethical policies, regulation and best practice. Like many academic publishers, the Royal Society has a publishing ethics policy covering such issues as authorship, dual publication, plagiarism, conflict of interest and openness in data sharing. Authors, reviewers and editors are required to read and adhere to this policy which reflects the high standards we expect in peer review. A number of organisations define codes of practice and support the "policing" of the peer review process. These include COPE and the International Committee of Medical Journal Editors.

The value and use of peer reviewed science on advancing and testing scientific knowledge

9. Science progresses by testing a hypothesis against the available evidence obtained through experiment and observation of the natural world. It is not based on the authority or opinion of individuals or institutions. In fact, the Royal Society motto "*Nullius in verba*" can be roughly translated as "take nobody's word for it". Scientists are trained to be sceptical and during peer review they assess the methods, results and conclusions of a piece of research against existing evidence. Peer review is particularly good at identifying where a claim has no evidence, or if the evidence presented has been arrived at by flawed methods or inappropriate data handling. The greater the apparent claim or discovery, the greater the amount of scrutiny the scientific community tends to give it. In general, an extraordinary claim requires extraordinary evidence.

10. Without peer review, there would be a need for some other form of validation of scientific findings as it is crucially important for scientists to be able to use each others' work with confidence when interpreting the meaning of their last experiment or designing their next one. The age of the web has meant that anyone can now "publish" whatever they like in the form of blogs. The vast proliferation of information (of hugely variable quality) now accessible would be likely to prove to be more of an obstacle than a benefit to scientists if there were there no system of validation helping them to sift the worthwhile from the worthless.

The value and use of peer reviewed science in informing public debate

11. We believe that the use of peer review is valuable in informing the public about science as it acts as a "kite mark" that a piece of research has been properly scrutinised and validated by scientists. Barely a day goes by without a science story being reported in the print and broadcast media and there is a vast amount of scientific material (with extremely variable provenance and validity) freely available to the public via the internet. This often results in apparently conflicting messages about an issue (such as a nutritional or medical question) making it very difficult indeed for those with little or no scientific knowledge to distinguish fact from fiction. It is important for scientists, policy makers, educators and journalists to highlight the value of peer-review in providing evidence-based information.

12. It is also important to put a single piece of published scientific information into the wider context as it may agree or disagree with previously published findings. It is unrealistic to assume that every question will be answered in one go and the public is often unaware of this level of detail, or indeed that doubt is an inherent part of science.

The extent to which peer review varies between scientific disciplines and between countries across the world

13. Science is a truly international enterprise. The process of peer review is about the scrutiny of factual measurements, observations and data. Just as the laws of nature are the same throughout the world, so is the process of peer review. It is therefore independent of any cultural or legal differences between nations. Indeed this is vital if the universality of scientific knowledge and understanding is to be sustained.

The application of peer review is broadly similar in all scientific disciplines, but there are subtle differences. In some areas of the physical sciences such as particle physics articles are usually deposited on the *arXiv* pre-print database prior to formal peer-review. This allows the scientists to publish research quickly and get informal feedback and identify any weaknesses. This is then followed by formal peer review in a journal. In the biological sciences there is an imperative to publish research quickly in a peer reviewed journal. In cross-disciplinary research care must be taken to ensure peer-review balances the consideration of all disciplines involved eg both the physical science and biological science. This often requires the use of many more reviewers for each article which can increase both time and cost. In the field of mathematics, the peer review process is not about looking at experimental evidence and data, but rather the strict and logical development of a mathematical argument.

The processes by which reviewers with the requisite skills and knowledge are identified, in particular as the volume of multi-disciplinary research increases

14. Individuals are selected as reviewers based on a proven track record of scientific achievement in the relevant discipline and a thorough knowledge of the existing literature, and are drawn from across the world. This is vital to effectively validate new work against the existing body of knowledge. Selection is supported by electronic databases both within the Society and from major-third party vendors. Such databases provide great detail on potential reviewers such as their area of expertise, publishing and reviewing record.

Reviewing multi-disciplinary research brings specific challenges. One of our journals is dedicated to science at the interface of the physical and life sciences. Such articles are reviewed by both physical and life scientists and require more referees than for single discipline research. In addition, reviewers are required to state their level of confidence in assessing the physical and biological aspects of an article.

The impact of IT and greater use of online resources on the peer review process

15. IT and other online resources play a vital role in making peer review as rigorous and as efficient as possible. When peer review relied on the postal system it typically took months. With online systems, peer review takes only weeks or sometimes days. The remaining speed limiting factor is the time required to carefully read a paper and produce a considered, evidence based review.

The transition away from paper-based publication has also facilitated bibliometrics, and an increase in its use as a proxy for assessment of research quality and output. This can potentially influence publication behaviour, and further increases pressure on good reviewers.

Possible alternatives to peer review

16. The scientific publishing community has been proactive in exploring adjuncts and alternatives to peer review. Further review and comment after a paper is published ("post publication review") is already important in testing and checking the quality of science. As described earlier, new concepts and results in science are repeatedly tested to validate their reliability and usefulness.

The online environment has provided the opportunity for numerous experiments such as commenting, voting and citation analysis. However, such measures can be crude and are often unproven. We believe they are important in supporting formal peer-review, but are not a substitute.

The posting of non peer reviewed content on the web would have a number of consequences. It would be more difficult to distinguish evidence-based findings from mere opinion or the downright false. Public opinion about science might be determined by opinion and assertion based on what is the most popular blog or television programme at the time. Formulation of policy requires a solid, non-transient evidence base. Scientists have a central role in the better communication of science by highlighting both the strengths of peer review and its limitations.

Peer review is neither perfect nor infallible, but we believe that dispensing with it is not an option.

Declaration of Interests

17. The Royal Society is a publisher of journals, under the imprint *Royal Society Publishing*.

Works Cited

Nature. (2006). Nature's peer review trial. *Nature* , doi:10.1038/nature05535

The Royal Society

10 March 2011

Supplementary written evidence submitted by The Royal Society (PR 69a)

You indicated that it would also be helpful if we could offer a view on:

1. Cascading Peer Review

Cascading peer review certainly has advantages in saving time and resources and avoiding multiple rounds of peer review on the same article. However, authors invariably have firm views on the journal they want to publish in. If they are rejected from their first choice they generally prefer to select the next choices themselves, rather than simply having their article passed automatically to another of that publisher's journals. We would prefer a "soft" cascading approach whereby the publisher offers an alternative journals to the author. Provided the journals are sufficiently similar in terms of scope, peer review systems, standards, etc. it could then be possible to expedite an efficient transfer and acceptance of the article.

2. Corrections/Retractions

Corrections and retractions are published when published articles are later found to be inaccurate, misleading or fraudulent. As the article of record is online, it is easy to publish a correction or retraction alongside the original article in a highly visible and timely manner. Corrections and retractions are not behind any pay wall and are therefore free to access. We are part of a pilot of a new initiative, CrossMark, which will make the existence of corrections, retractions etc. far more transparent and trackable, even in archived PDF versions of documents which are no longer online.

10 May 2011

Written evidence submitted by Professor Ian A Walmsley, Pro-Vice-Chancellor (Research, Academic Services and University Collections), University of Oxford (PR 73)

Major Points

1. Peer review is central to effectively assessing the quality of research.

2. Peer review has been (and is) fundamental to the UK research/science system, and its successes.

3. Peer review of funding proposals makes use of an expert knowledge base to identify the best research. We recognise that it is imprecise, because of the necessarily uncertain capacity of predicting outcomes based on untested ideas. But as part of a research eco-system of sufficient capacity it is effective and indispensible. The alternatives, based on non-expert review or "top-down" delineation of activity are vastly inferior at producing transformational ideas.

4. Peer review is the best, though of course not perfect, system to provide an assurance that what is published can be relied upon.

5. Peer review does place workload pressures on researchers as reviewers. However, the vast majority of researchers are willing to take on this work to ensure the best selection method, viz. peer review, can operate fairly and effectively.

6. There is now quite a lot of evidence as to the practical issues which need to be tackled to make the review of funding proposals and of work submitted for publication fairer, and more effective and efficient. Oxford has supported, and will continue to support, efforts to address these issues.

Further Discussion

Peer review of funding proposals

7. The major funding bodies in the UK, incl. the research councils and biomedical charities, all use peer review for advice on which research projects should be funded in the first place, and often to assess the progress of funded projects/programs.

8. The Association of Medical Research Charities (AMRC) considers that peer review is the best way for charities to select which research to fund. One of its membership criteria is that all AMRC member charities must seek expert advice from external reviewers to help them make decisions about which research grant applications they should fund. AMRC produces guidelines and information on peer review and offers training on this topic.

9. The UK Research Councils state that their policy is to "fund research on a competitive basis employing independent expert peer review. This system is regarded as an international benchmark of excellence in research funding, and this provides a guarantee of the quality of UK research."[23]

10. Proposals for research funding should be assessed for scientific quality by a number of senior academics or "peers", from the UK and overseas, who work within relevant areas of research. This assessment or "review" provides the basis of the funding decision. This approach does not exclude others from participating in decisions, but does emphasise the importance of assessment by experts in the research area.

11. Interestingly, at the National Institutes of Health (NIH), one of the world's foremost agencies conducting and supporting biomedical and behavioural research, *the peer review system is mandated by statute* in accordance with section 492 of the Public Health Service Act and federal regulations.

12. In late 2007 to 2010 the NIH undertook a far-reaching review of its peer review system. A series of reports and enhancements to the system focussed on three "Implementation Goals":

- To Engage the Best Reviewers.
- To Improve the Quality & Transparency of Review.
- To Ensure Balanced and Fair Reviews.

[23] http://www.rcuk.ac.uk/research/peers/Pages/home.aspx

13. NIH's review has been extremely thorough and highly consultative. It found no basis for recommending any dilution of the peer review principle at all, including for multi and inter disciplinary proposals.

14. The changes arising from the review have sought to improve the scoring system, the review criteria, the clustering of proposals, as well as the application forms (esp. to more clearly align the questions to the review and selection criteria). A December 2010 report on the most recent survey of key stakeholder groups—NIH grant applicants, NIH peer reviewers, Scientific Review Officers, Program Officers and Advisory Council members—indicated higher ratings of the system in terms of "satisfaction" and "fairness".[24]

15. What is clear from policy review work such as by the NIH, the Australian Research Council's consultations on "Peer Review Processes" (2009–10),[25] the RCUK Efficiency and Effectiveness of Peer Review Project[26] and the Parliamentary Office of Science and Technology paper on Peer Review, (2002),[27] is that peer review is held to be beneficial to the scientific community and has become central to the process by which science is conducted.

16. Yes there are strains and tensions. For example, from time to time one hears that the peer review system is "close to breaking point" given the demands being placed on researchers to act as reviewers and serve on grant review panels and awarding committees. It is true that workload is an issue. However, the vast majority of researchers accept that there is a price to pay to enable the best selection method, viz. peer review, to operate fairly and effectively, and are willing to pay it.

17. Policy analysis by major research funders and academic research on peer review (incl. from sociological, psychological, economic and other perspectives) has helped to identify some of the difficulties with peer review. Even more importantly, there is increasing experience of ways in which these can be addressed. Many of the issues apply both to reviewing work for publication and assessing grant/funding proposals and include:

- Potential gender bias.
- Conflicts of interest.
- Recruiting and retaining referees.
- Training.
- Clarity of review criteria.
- Opportunities to rebut criticisms.
- Assessing multi- and inter-disciplinary research.

18. The experiences of the NIH community of reviewers[28] echo those of many Oxford colleagues who express frustrations with, eg:

- "Clunky" on-line systems.
- Reviewers being asked questions that, at least to their thinking, bear little or no obvious relationship to the selection criteria.
- Reviewers not being clear why they had been asked to review certain proposals.
- Mismatches in the allocation of referees, where it appears that the information about the potential "pool of referees" has not been sufficiently detailed or accurate to select the right referees.
- Reviewers not receiving any training (on-line or other).
- Reviewers not receiving any feedback on their reviews.

19. Practical issues such as these can be addressed by funding agencies, and improvements can be made.

Peer Review of Work for Publication

20. From their beginnings in the mid-17th century, scientific journals were subjected to criticism about the quality of what they put into print. Thus from the outset they began to develop referee systems for the express purpose of controlling the quality of the papers accepted. The result was an institutionalized mechanism for the application of standards to scientific work, which has changed little in the ensuing centuries.[29]

21. As with peer review and funding decisions, there is now quite a lot of evidence as to the practical issues which need to be tackled to make the publication system fairer, and more effective and efficient.

22. It is important that all reviewers uphold the highest ethical standards.

23. The World Association of Medical Editors (WAME) has proposed a comprehensive policy which addresses all the major areas of publication ethics that contemporary science journals should consider, including:

- Conflict of Interest.

[24] http://enhancing-peer-review.nih.gov/docs/Enhancing_Peer_Review_Report.pdf
[25] See eg http://www.arc.gov.au/general/peer_consultation.htm
[26] http://www.rcuk.ac.uk/research/peers/Pages/vfmpeer.aspx
[27] http://www.parliament.uk/documents/post/pn182.pdf
[28] See http://enhancing-peer-review.nih.gov/continuous_review.html
[29] http://www.the-asci.org/addresses/asci1978.pdf

— Study Design and Ethics.
— Authorship.
— Peer Review.
— Editorial Decisions.
— Originality, Prior Publication, and Media Relations.
— Plagiarism.
— Advertising.

24. As WAME observes, peer reviewers are experts chosen by editors to provide written assessment of the strengths and weaknesses of written research, with the aim of:

— improving the reporting of research, and
— identifying the most appropriate and highest quality material for the journal.

25. Reviewers should be required to meet minimum standards (as determined and promulgated by each journal) regarding their background in original research, publication of articles, formal training, and previous critical appraisal of manuscripts. Reviewers should be selected for their objectivity and scientific knowledge and their reviews professional, honest, courteous, prompt, and constructive.

26. Whilst peer review is commonly accepted as an essential part of scientific publication, practices vary across journals and disciplines. Debates continue as to the best method(s) of peer review, the value-added, the ethics of the review process and how can new technology be used to improve traditional models.[30] And new approaches are emerging. The journal *Atmospheric Chemistry and Physics (ACP)* is an example of "interactive open access peer review" based on a two-stage process of publication and peer review combined with interactive public discussion. One sees the original manuscripts, any background papers, comments by peer reviewers and editors, dialogue with authors and revisions (if any), and there is a distinct section for open, public reaction and comment.

27. What remains essential is that the "users" of research have confidence in the quality and integrity of both the research and the peer review process.

Professor Ian A Walmsley
Pro-Vice-Chancellor
(Research, Academic Services and University Collections), University of Oxford

10 March 2011

Supplementary written evidence submitted by Professor Ian A Walmsley, Pro-Vice-Chancellor (Research, Academic Services and University Collections), University of Oxford (PR 73a)

Please find appended responses to the Committee's questions:

1. The University has published guidelines on its research integrity website (http://www.admin.ox.ac.uk/rso/integrity/) about good practice in publication and authorship (http://www.admin.ox.ac.uk/researchsupport/integrity/publication/) and peer review (http://www.admin.ox.ac.uk/researchsupport/integrity/peerreview/). This website also provides information about related training (both online and "in-person") available through the University's Research Skills tool-kit to all Oxford staff and students (https://weblearn.ox.ac.uk/portal/hierarchy/skills/res_skil_kit) and other related resources (eg from the US Office of Research Integrity at http://ori.dhhs.gov/education/products/). The University runs an annual series of research integrity seminars delivered by a range of high-profile and internationally renowned speakers (details of previous series, including visual presentations and audio podcasts of the lectures is available at http://www.admin.ox.ac.uk/researchsupport/training/integrity/archive/). Extensive online advice for undergraduate and graduate students about good academic practice, is available from http://www.admin.ox.ac.uk/edc/goodpractice/ , which includes detailed information and online training about the seriousness of plagiarism, why this should be avoided, and the University's procedures in cases of suspected plagiarism (http://www.admin.ox.ac.uk/edc/goodpractice/about/).

2. The University's "Academic Integrity in Research: Code of Practice and Procedure" is available at http://www.admin.ox.ac.uk/ps/staff/codes/air.shtml and sets out the "University" standards for research conducted by its staff, students and anyone working on University premises or using University facilities. It also defines misconduct in research for the purpose of the Code and sets out the University's procedures for responding to and investigating allegations of misconduct in research. Such allegations are always taken seriously and there are rigorous procedures for investigating any alleged offence. The responsibility for investigating these matters lies with the University's most senior officers (in the case of staff members, this is the Registrar; for students, this is the Proctors' Office).

Although the details of such allegations or enquiries are not made publicly available, the University regularly reports externally on allegations and cases of research misconduct, for example to the UK Research Integrity Office, to the US Office of Research Integrity and to Research Councils UK. Where the research in question

[30] See *Nature's* Peer Review Debate—http://www.nature.com/nature/peerreview/debate/index.html

involves a third party, for example an external funder of research such as the Medical Research Council or the Wellcome Trust, the University is careful to ensure that the third party is kept closely informed of how the case is handled and the outcome of any investigation.

June 2011

Written evidence submitted by BioMed Central (PR 74)

The advent of the internet radically changed the way many scientific publishers operate. BioMed Central, which was launched in 2000 as the first publisher of peer-reviewed open access biomedical journals, was one of the pioneers to embrace the potential of the internet, by allowing everyone completely free and full access via the web to all scientific research articles as soon as they are published, and by using online technology for manuscript submissions, peer-review and production system right from the start.

Peer-review models

All research articles published in BioMed Central's journals have undergone a thorough peer-review process that relies on expert editorial boards and peer reviewers just as traditional (non-OA) publishers do. The vast majority of the more than 210 journals use the traditional model most commonly used in biomedical publishing: two or more independent experts (scientists or clinicians) are invited to provide an assessment of the scientific soundness of the experiments and the interpretation of the results, and to comment on the extent of the advance or new insights gained. The editor responsible for overseeing the assessment of the manuscript makes a decision on the basis of the referees' and the editorial board's advice.

For most journals, the referees' reports are passed on to the authors in anonymous format, unless the referee elects to sign the report. In contrast, the medical journals within the BMC series (http://www.biomedcentral.com/info/authors/bmcseries#journallist) operate an "open peer review system", thereby making the process more transparent: peer reviewers agree to reveal their identity to the authors and, if the study is published, the pre-publication history, including the referees' reports and previous versions of the manuscript, is published alongside the article (see http://www.biomedcentral.com/1741–7015/9/8/prepub, for example).

BMC Biology, the flagship biology journal of the BMC series, is running an experiment with peer review, allowing authors to opt out of re-review by expert referees in cases where a submitted paper has been revised to meet criticisms of the original version. The experiment is in response to frequent complaints by authors that publication of papers is needlessly delayed by unreasonable demands on the part of referees, especially in the more selective journals. Under the experimental policy, which allows authors to decide whether they wish referees to see their paper again after revision, more responsibility for ensuring the validity of the paper rests on the authors, and on the editors who must decide whether the authors' response to the criticisms is reasonable. The interests of readers are protected by a policy of inviting published commentary from an expert who is given access to the referees' reports and the authors' response if the case of re-review opt-out. This policy also has the important effect of lessening the burden on expert reviewers a scarce resource (see below).

A more extensive and radical experiment was started with *Biology Direct*, which developed its own unique peer-review model: Authors need to convince three Editorial Board members to assume responsibility for reviewing the manuscript. The Editorial Board members skim-read the manuscript in order to form an overall opinion and decide whether they wish to have their name associated with the publication of this article. If they agree, they provide formal comments and criticisms of the study; their comments and names are published along-side the paper, which is published regardless of the severity of the criticisms, unless the authors withdraw following the formal peer review.

Open Access

Peer review is a largely but not perfectly effective system for ensuring that published research is soundly based. Providing full access to the findings and insights reported in the literature is paramount not only to advancing biomedical and translational research, but to ensuring the broadest possible forum for debate, and thereby enhancing the value of the information that informs public debate. By removing subscription barriers, open access publishing allows researchers to reach a much larger group of readers, including those in developing countries, and promote interdisciplinary research and debate. Open access mandates such as those imposed by the UK government's research councils and the European Research Council, that make it compulsory for scientists funded by them to deposit their articles in archives such as PubMed Central and UK PubMed Central, are essential first steps for disseminating scientific information more widely and making it much more visible.

UK PubMed Central is a very important resource by facilitating access to peer-reviewed biomedical and health research in the UK, and it needs to continue to grow and be developed in order to fully represent the research generated here. The continuing support from the UK government funding organizations are vital, so local services, improved and interactive content, and tools can be developed.

The National Center for Biotechnology Information (NCBI), which hosts PubMed Central, has developed a number of tools that are not just valuable for users but also for improving the services publishers can offer to authors. For example, the BioMed Central's online peer-review system makes use of a peer reviewer suggestion tool that is built on technology from the NCBI. This tool helps editors identify potential peer reviewers with expertise in particular research areas on the basis of their previous publications. Making this and other tools more sophisticated and user-friendly will be important for improving peer-review services and ensuring that high standards of peer review are maintained while the research output grows and with it the pressure on the research community to provide expert advice to their colleagues during the peer-review process. It is important for UK research that UK PubMed Central takes a lead in such developments.

The value of peer-reviewed research depends critically on the expertise and sagacity of the peer reviewers, and inevitably draws on limited resources of capable and experienced experts. Online tools for identifying appropriate peer reviewers will become increasingly important. Such tools are already important for enabling journals to focus referees' responses effectively on key issues without making the process more cumbersome for the referee. Another important way of using scarce refereeing resources effectively, and minimizing the delays to publication of research, is sharing of referees' reports between journals with different publication criteria so that manuscripts submitted to one journal can be published without additional review by another, more suitable one (see below).

As with other publishers, rejection rates vary greatly between BioMed Central's journals: Some journals, such as *BMC Biology* and *BMC Medicine*, have a high rejection rate as they are highly selective and aim to publish only articles of sufficient interest or importance to justify drawing them to the attention of a broad readership of biologists or medical researchers, respectively. Other journals, including the BMC series journals, are more inclusive and have a moderate rejection rate, whereas *BMC Research Notes* publishes all sound research that could be of use to researchers within a given field, including negative results and updates on previous studies.

Some manuscripts are rejected because of serious flaws in their results and/or their interpretation, and they can not be published at all unless the authors can correct the flaws. Other manuscripts may be scientifically sound but deemed by the peer reviewers and/or editors to be of insufficient interest to the readership of the journal. In order to avoid lengthy re-refereeing of these manuscripts for other journals, which would delay publication for the authors and generate additional work for the "peer reviewer community", BioMed Central operates a journal cascade whereby authors are offered publication in a journal with a lower interest and "threshold" level. Manuscript files and referees' reports can be readily transferred from one journal to another within the online submission systems.

Online Tools and Additional Data

The availability of large datasets, such as those generated by the Human Genome Project and many other genomic and post-genomic projects since, and the associated development of bioinformatic tools enabling the analysis of such datasets, has made it clear that biomedical science can no longer function efficiently without unrestricted and open access to scientific data. While genomicists and bioinformaticians have long realised the need for, and advantages of, sharing their data in order to exploit their full potential, other communities are following suit, for example, by developing new standards of reporting clinical data and by calling for more transparency and access to more clinical data where possible, while taking into account crucial ethical concerns.

It is increasingly not only the peer-reviewed article itself but the associated data that are important for ensuring that all research efforts have maximum impact and spawn future studies in associated areas. It is for this reason that BioMed Central was set up to exploit the possibilities provided by the online environment and offer authors the opportunity to publish additional data files linked from their articles, including large raw datasets, movies and data formats that can be read directly by other software packages so as to allow readers to manipulate and further analyse the data. Also for this reason, editorial policies at BioMed Central have a strong emphasis on data deposition and encourage or insist on adherence to data formats agreed in the community, where appropriate.

Capturing the vast amount of data that is continuously generated and ensuring consistent data deposition according to agreed formats and nomenclatures will be crucial to enabling smooth meta-analyses of datasets from different databases. The creation of a central dataset archive, possibly associated with UK PubMed Central, would greatly facilitate this process and be extremely beneficial to UK scientific research.

About BioMed Central

BioMed Central (http://www.biomedcentral.com/) is an STM (Science, Technology and Medicine) publisher which has pioneered the open access publishing model. All peer-reviewed research articles published by BioMed Central are made immediately and freely accessible online, and are licensed to allow redistribution

and reuse. BioMed Central is part of Springer Science+Business Media, a leading global publisher in the STM sector

BioMed Central

10 March 2011

Supplementary written evidence submitted by BioMed Central (PR 74a)

"What training does BioMed Central provide for its editors and how often is this refreshed?"

Training of Editors at BioMed Central

In-house professional editorial staff who make decisions on manuscripts, including the Editors responsible for BMC Biology, BMC Medicine, Genome Biology and Genome Medicine, are trained as scientists or clinicians, usually educated to PhD or MD level, and have extensive editorial experience with decision-making on peer-reviewed content. They work closely with editorial boards and leading scientists across various biomedical disciplines in order to stay abreast with key scientific developments and initiatives that might affect editorial policies, including for example data deposition policies. Junior editors on those teams are trained and closely supervised by experienced colleagues on an ongoing basis; decisions on manuscripts on the basis of referees' advice usually involve several members of the team.

BioMed Central's academic Editors-in-Chief usually have had previous editorial experience with other journals before they are recruited to lead a journal within the so-called independent journal portfolio; some might have been editors of their journals for some time before they were transferred to BioMed Central from another publisher. Training for academic editors is provided in the form of extensive written guidelines detailing basic steps and criteria that need to be applied in order to ensure a thorough peer-review process (see www.biomedcentral.com/independent/develop/peerreview for a general overview of basic criteria), as well as various documents illustrating BioMed Central's editorial policies. These documents are continuously updated, and changes in editorial policies or the availability of new guidelines, such as those developed by the Committee of Publication Ethics, of which BioMed Central is an active member, are communicated regularly to external editors via their contacts within the in-house editorial teams. The in-house editorial staff also support and advise external editors on specific issues, such as ethical concerns, arising during the peer review. An annual conference for external editors offers presentations and workshops that provide further training; presentations and training material developed at this conference are made available to all editors after the conference.

Dr Michaela Torkar
Editorial Director
BioMed Central

June 2011

Written evidence submitted by the Joint Information Systems Committee, UCL, and the University of Salford (PR 77)

Increasing the Value from Peer Review and Open Access

Introduction

1. This submission to the House of Commons Committee on Science and Technology is from the Joint Information Systems Committee, UCL, and the University of Salford. These three organisations are members of the UK Open Access Implementation Group, whose members also include Universities-UK, Guild-HE, Research Councils UK, the Wellcome Trust, the University of Edinburgh, the Association of Research Managers and Administrators, Research Libraries UK, the Society of College, National and University Libraries (SCONUL), and the Public Library of Science. The Group has agreed to consider this matter at its next meeting in May 2011, with a view to releasing a public statement thereafter.

Declaration of interests

2. The authors of the submission are: Dr Malcolm Read, Executive Secretary, Joint Information Systems Committee; Professor Martin Hall, Vice Chancellor, University of Salford; Professor David Price, Vice Provost for Research, UCL.

General principles of peer review

3. Growth in a knowledge-based economy depends upon the activities of a knowledge community, one of whose functions is quality control "guaranteed because members can each reproduce, test and criticize new

knowledge".[31] This function is allied to concepts of replicability and objectivity in research (particularly in the sciences), full discovery of prior and relevant work, and open verification. These general principles have been systematized by means of anonymous, double-blind reviews (or variants thereof) and formal compliance requirements ahead of publication.

4. As with all systematization, regulatory approaches run the risk of being reductionist and pro forma, and may defeat their original purpose. For example, closed circles of mutual reviewers may develop, anonymity may be misused to attack work, etc. Perhaps more seriously, narrow and formulaic peer reviews may reinforce currently established views by not allowing for paradigm changes.

5. Peer review is intended to counter closed and restricted systems, to reinforce the accepted scientific norms of communalism, universalism, disinterestedness and organised scepticism. In particular here, that is that scientific results are the common property of the scientific community and that scientific claims are subject to critical scrutiny before being more widely accepted.

6. The report of Sir Muir Russell into University of East Anglia's Climatic Research Unit's E-mails found no evidence that attempts had been made by CRU staff to subvert peer review or the editorial process. It further expressed concern that "much of the challenge to CRU's work has not always followed the conventional scientific method of checking and seeking to falsify conclusions or offering alternative hypotheses for peer review and publication". Whatever its specific mode of operation (closed or open, before or after publication), it is essential that peer review operates, and operates effectively, within scientific discourse.

The cost and value of peer review

7. The value of peer review in maintaining the integrity of scientific discourse is widely accepted, but this value is being lessened by restricted access to the scientific literature. As well as being the principal means by which science implements "organised scepticism", peer review is also a key component in a system of scholarly communication whose economics are questionable, wherein one part of the academy (libraries) pays for products whose principal value—the research report itself and the peer review that assures its quality—has been given away by another part. The result is that access to research papers is restricted, and scientific results are no longer the common property of the scientific community, let alone the wider economy and society that might make use of them to drive innovation.

8. Peer review is an important stamp of quality upon published publicly-funded research outputs. The cost of peer review has been identified in several reports from UK research organisations, notably by the British Academy in 2007,[32] which estimated the cost of peer reviewing publications in the humanities and social sciences to be around £900 per published journal article, but made no attempt to calculate the total cost to UK HE of the peer review system. It is a false perception that publishers pay for peer review; they pay the in-house cost of managing the peer review process but not the cost of the peer review itself, which is usually undertaken by researchers as part of their normal work, for which they are paid by their university or research institute. The Houghton Report from JISC[33] in 2009 did estimate the cost to UK HE of undertaking peer review of publicly-funded research outputs to be around £178 million per annum, while a report from JISC Collections in 2010 estimated the cost to be between £110 million and £165 million.[34] Whatever the exact figures, it is clear that peer review represents a high cost to the UK higher education system in terms of time spent by publicly-funded researchers in peer reviewing research publications. Are there any means by which the UK could gain greater value from this investment, without compromising the principles of peer review or increasing public expenditure?

All stakeholders gain some value from peer review but gains are restricted

9. Every stakeholder in scholarly communication gains some value from the peer review system. Researchers gain the assurance that earlier reports upon which they build their own research have been checked by their peers, although they could gain greater value if those research reports were also openly available in journals or in subject or institutional repositories. Users also know that peer-reviewed publications have been subject to a quality-check. In selling publications advertised as being peer-reviewed, publishers gain from the investment the academic community makes in undertaking peer review. Funding agencies and the taxpayer gain the assurance from peer review that their commitment to fund academic research is yielding research reports of good quality, but the value they receive from the dissemination of research outputs may be lower than it could be because most peer reviewed journal articles and monographs are not openly accessible.

[31] The concept of a knowledge community within a knowledge economy is described by Professor Paul David and Dominique Foray in "Economic fundamentals of the knowledge society" 2002 available at http://ideas.repec.org/p/wpa/wuwpdc/0502008.html

[32] "Peer Review: the Challenges for the Humanities and Social Sciences" British Academy 2007 http://www.britac.ac.uk/policy/peer-review.cfm

[33] "Economic implications of alternative scholarly publishing models" Professor John Houghton and others 2009 http://www.jisc.ac.uk/publications/reports/2009/economicpublishingmodelsfinalreport.aspx#downloads

[34] See the JISC Collections report "The value of UK HEIs contribution to the publishing process" at http://www.jisc-collections.ac.uk/News/Value-of-HEIs-to-publishing/ .

The economic case for openness

10. Two strands of research have made a strong case for the economic value of openness. Firstly the encouragement of innovation is understood to be a key pre-requisite for economic growth. Professor Eric Von Hippel of MIT has described the importance of user innovation, making their products freely available through open source systems.[35] Professor Henry Chesbrough (University of California, Berkeley) has noted that "companies that used to rely primarily upon their own internal resources for R&D today must innovate in a more open manner—integrating their internal ideas with the external ideas of many other companies, universities and startups to create new solutions, new systems and new possibilities that no one company could do on its own." Many UK SMEs are trying to do this, and evidence for the potential role of research papers in fostering innovation is provided by Ware/Publishing Research Consortium,[36] which notes that SMEs give "a very high level of importance to research articles, ranking them ahead of other types of information such as technical information, reference work, technical standards or patents." Restricting access to such articles inhibits innovation and growth, and it is in the UK's economic interest to remove such restrictions.

11. Secondly the economic case for openness has been made by Professor John Houghton and his colleagues, demonstrating the substantial returns to publicly-funded R&D that come through enhanced access to research outputs, estimated at perhaps £172 million per annum for the UK economy.[37] Houghton's work has been used by Dr Alma Swan to illustrate the financial benefits to UK higher education institutions from a switch to open dissemination of research outputs.[38] The conclusion from both the innovation and the economic research into the value of openness is that the entire scholarly communication process—including the peer review element—would benefit from a full switch to open access models. Because it involves shifts in academic practice and consideration of the role of anonymity, open peer review is likely to be a longer term goal. However, some of the value of UK researchers' peer review work can be realised more quickly by ensuring that the products of that work, the reviewed papers themselves, are openly available. The full benefit to the economy comes as the volume of open content grows and is used more widely than content for which access is controlled through financial and technical barriers.

Peer review and open access

12. The 10th report of the House of Commons Science and Technology Committee in 2004, *Scientific Publications: Free for all?*, recommended that "all UK higher education institutions establish institutional repositories on which their published output can be stored and from which it can be read, free of charge, online." Most UK universities now have such a repository. It further recommended that "Research Councils and other Government funders mandate their funded researchers to deposit a copy of all of their articles in this way". The Research Councils and leading charities such as the Wellcome Trust now have such a mandate, and also enable funds to be used for payments to publishers for open access journals.

13. Open access will be a positive step for the UK, but it has not yet been achieved, largely because researchers have not taken the small steps necessary to make their papers openly available. These steps could include:

(i) Putting the final, peer reviewed version of the paper into a repository for immediate reuse by others.

(ii) Opting to publish in an open access journal, utilising funds available via their (or their institution's) grant from research funders where possible.

(iii) Stipulating the conditions under which they provide papers or peer reviews to publishers: in the case of papers, this might be by using a "license to publish" rather than passing full copyright to the publisher (thereby retaining the rights they need to put the paper into a repository); in the case of peer reviews, this might be by making it a condition that the reviewed paper be made open access.

The need for a public position

14. While there is evidence that authors benefit when their papers are open access, for example by a higher citation rate, such arguments have not yet convinced most researchers to take the small steps above. This is partly because researchers do not yet feel fully supported in making those steps, and partly because they have so far been insulated from the effects of the economics of scholarly communication. That is, firstly, the effects of their decisions on the overall cost to HE are borne by the library; and secondly, funders are only now beginning to assess research impact. The steps noted above require small changes in practice, whereas science is rightly conservative and takes time to change. However, the evidence is clear that significant benefits will accrue to the UK from a collective move toward open access, and so a public policy position is appropriate.

[35] Eric Von Hippel "Democratizing Innovation"MIT Press 2005 freely-available at http://web.mit.edu/evhippel/www/democ1.htm

[36] Ware, M / Publishing Research Consortium (2009) Access by UK small and medium-sized enterprises to professional and academic information: http://www.publishingresearch.net/SMEaccess.htm

[37] "Economic implications of alternative scholarly publishing models" Professor John Houghton and others 2009 http://www.jisc.ac.uk/publications/reports/2009/economicpublishingmodelsfinalreport.aspx#downloads

[38] A Swan "Modelling scholarly communication options: costs and benefits for universities: costs and benefits for universities" 2010 available at http://ie-repository.jisc.ac.uk/442/

15. Many research funders already mandate open access, and arrangements are being put in place to monitor compliance. The remaining step for research organisations to take to gain greater value from the peer review work of researchers is to recommend that:

(a) researchers funded from the UK public purse should make it a condition of undertaking peer review of research outputs that, when published, those outputs are then available on open access terms with a minimum of delay; and

(b) there should first be a generic study to confirm that the outputs and necessary workflows, which underpin this recommendation, are realistic and deliverable.

Longer term trends

16. In the longer term, it is likely that further experiments in "open peer review" and open peer commentary and annotation will continue, and that ways will be found to address legitimate concerns over anonymity with respect to peer review. The recent launch of BMJ Open, featuring open peer review, the rise of Mendeley, which features shared annotation via an online platform, and the exploration of new publishing models based on repositories, all indicate continued interest in the potential of new technologies to support novel and more effective research and review practices.

17. These trends, and the strains apparent within the current scholarly communication model, make it likely that significant changes are likely to evolve in the structure of associated businesses, such as journal publishing, and the markets for online search and research management systems. In this context, it is possible that peer review will be increasingly de-coupled from the dissemination of research papers, and become a service in its own right.

18. In this rapidly changing domain, it will be important to have a clear articulation of the principles and role of peer review that is independent of particular economic or technological arrangements, and that allows the UK to benefit from the considerable investment made by its researchers in peer review.

Joint Information Systems Committee, UCL, and the University of Salford

10 March 2011

Supplementary written evidence submitted by the Joint Information Systems Committee (PR 77a)

At the request of the Committee, this supplementary evidence addresses the following question:

"In the 2010 JISC report it was estimated that HEIs spend (in terms of staff time) £110–165 million per year on peer review. How was this estimate calculated? Was the cost of the expert feedback and advice that researchers currently get on their work factored in?"

The answer to the second question is "yes". The estimate of the costs (in terms of staff time) was calculated by a review[39] of the following three studies, each of which in turn draws substantially from the wider literature.

1. *Peer review in scholarly journals* (PRC).[40] This report surveyed the attitudes and behaviour of 3,040 academics around the world in relation to peer review in journals. Around 10% of those worked in UK HEIs. The report does not attempt to calculate the cost of peer review, but gives enough information to make an extrapolation using data from other studies. Using data from this study combined with baseline information from others suggests a possible range from £158,251,968 to £204,906,155. However, the figure of 5.6 hours to review each paper (derived from the survey) covers countries other than the UK (USA, Canada, Australia and New Zealand). A revised UK-only figure of 3.9 hours was derived from the same raw dataset by Cambridge Economic Policy Associates in their study for RIN (see (2) below). Recalculation using this figure would suggest a range of £142,702,501 to £110,211,192.
2. *Activities, costs and funding flows in the scholarly communications system in the UK* (RIN)[41] estimated the costs of peer review at £165 million. The following factors and assumptions were used in the calculations:
   (a) Global peer review costs are £1.9 billion.
   (b) The UK accounts for 8.7% of global peer review costs.
   (c) Each article takes each reviewer four hours on average
   (d) 2.5 reviewers per article average.
   (e) Average global hourly rate £40.40.

[39] The value of UK HEIs contribution to the publishing process: Summary report. Hugh Look, Sue Sparks, Rightscom Ltd for JISC Collections (2010): http://www.jisc-collections.ac.uk/Reports/valueofukhe/

[40] Peer review in scholarly journals: Perspective of the scholarly community: an international study. Mark Ware Consulting & Mark MonkmanMedia for the Publishing Research Consortium (2007): http://www.publishingresearch.net/documents/PeerReviewFullPRCReport-final.pdf

[41] Activities, costs and funding flows in the scholarly communications system in the UK. Cambridge Economic Policy Associates for the Research Information Network (2008): http://www.rin.ac.uk/our-work/communicating-and-disseminating-research/activities-costs-and-funding-flows-scholarly-commu

(f) 7.1% of all published articles are published in the UK.

(g) Peer review accounts for 23% of global publishing and distribution costs.

(h) This figure does not distinguish between reviewers in HEIs and other organisations, so may overstate the position.

3. *Economic implications of alternative scholarly publishing models: Exploring the costs and benefits* (JISC)[42] estimates the cost of peer review for journals carried out in UK universities in 2007 at £140 million; review of other types of content (books, chapters and conference proceedings) cost a further £40 million. The following factors and assumptions were used in the calculations:

(a) The number of papers reviewed in UK HEIs will be proportionate to the number published in UK HEIs, taking into account rejection and resubmission rates.

(b) 50% of submitted papers are rejected (20% of total are rejected without review and 30% after review).

(c) 75% of the rejected are re-submitted and/or re-reviewed (once).

(d) Each paper will be reviewed by an average of 2.5 reviewers.

(e) Each reviewer takes 4.5 hours over each paper.

(f) The total cost of each hour to the HEI was £56.00 in 2007.

(g) This would lead to a figure of around 216,000 papers being reviewed in UK HEIs, taking 2.5 million person-hours.

In addition to the cost of peer review, the cost of editorial work was also assessed, based on figures from the JISC (Houghton) report. The JISC report estimated these costs to be £61.075 million per year, based on the assumption of participation by 24% of UK academic researchers in editorial boards, with 8% performing roles as editors, with editors spending between 10 and 30 days per year (average 20) carrying out these tasks, and editorial board members spending between half and one day (average three-quarters). The JISC Collections review discounted the total cost by 50% to account for payments made to editors. This is seen as a very conservative position; the discount should probably be less, and thus the total cost to HE nearer the £61 million figure.

Dr Malcolm Read OBE
Joint Information Systems Committee

June 2011

Written evidence submitted by Elsevier (PR 81)

1. Elsevier is a world-leading publisher of scientific, technical and medical information and services. Elsevier is part of Reed Elsevier Group PLC, headquartered in London, which employs more than 4,500 people in the UK alone. Elsevier works with a global community of 7,000 journal editors, 70,000 editorial board members, and over 300,000 reviewers. Elsevier's roots are in journal and book publishing where we have fostered the peer review process for more than 125 years. Today we are driving innovation by delivering authoritative content with cutting-edge technology, allowing customers to find the answers they need quickly.

2. The company works in partnership with the global science and health communities to publish more than 2,000 peer-reviewed journals, including *The Lancet* and *Cell,* and close to 20,000 book titles, including major reference works.. Elsevier's online solutions include SciVerse ScienceDirect, SciVerse Scopus, Reaxys, MDConsult and Nursing Consult, which enhance the productivity of science and health professionals, and the SciVal suite and MEDai's Pinpoint Review, which help research and health care institutions deliver better outcomes.

3. We appreciate the opportunity to respond to the Committee's call for evidence regarding its inquiry into the operation and effectiveness of the peer review process. Our response contains an Executive Summary followed by detailed comments. Although peer review is used in many academic contexts, we confine our comments to peer reviewed publications.

Executive Summary

4. Peer review is fundamental to academia and research. Peer review was developed by researchers and exists to assess articles for originality, sound method, and valid conclusions. Peer review is crucial to the learning and progression of scholars, is the essence of the scientific journal, and is essential to the progress of knowledge.

5. Publishers manage the peer review system on behalf of scientific communities. Publishers act as stewards to support its continuous development and facilitate its use for the scientific community. Publishers have made significant investments into the peer review system to improve efficiency, speed, and quality.

[42] Economic implications of alternative scholarly publishing models: Exploring the costs and benefits: John Houghton, et al for JISC (2009): http://www.jisc.ac.uk/publications/reports/2009/economicpublishingmodelsfinalreport.aspx

6. The peer review process is highly valued. Researchers regard it as an integral part of their research and they actively support it to further knowledge, encourage learning, and to ensure the highest quality research is communicated. Peer review has also evolved to underpin other aspects of science, such as allocation of funding and promotion decisions.

7. The peer review process is not perfect in every respect, but it is dynamic and continues to evolve. We strive for continual improvement in three key areas—speed, time commitment for reviewers, and impartiality.

8. Peer review processes continue to benefit from publishers' investments in technological platforms and workflow systems, and from the deployment of guidelines, procedures and frameworks that uphold the high standards of objectivity and ethics in science communication.

Peer Review is Fundamental to Academia and Research

9. As the Committee will be aware, peer review is the system by which experts give informed comments on papers in highly specialised fields of science. The aim is to provide independent, informed, objective assessments to maintain the quality of the scientific record and to ensure that science develops independently of commercial, ideological and political interests.

10. Peer review is used to inform decisions in multiple academic contexts. Peer review panels are deployed to make decisions about career advancement; the award of research grants, funds and prizes; the appointment of members to professional societies; and the acceptance, improvement of, or rejection of articles for publication in peer-reviewed journals.

11. Articles published in peer-reviewed journals mark developments in science over time. Each peer reviewed article is submitted, assessed, disseminated, and preserved and so becomes the definitive "version of record". Peer reviewers assess, amongst other matters, the originality of the research, the validity of the results, the soundness of methods described, whether the interpretation and conclusions are supported by the facts presented, and any major omissions of prior work that should be acknowledged.

Publishers Manage the Peer Review System for Publications on Behalf of Scientific Communities

12. Since the founding of the first peer reviewed journal by the Royal Society in the mid-seventeenth century, publishers have evolved to become stewards of the peer review process on behalf of research communities. There are c. 6,000 publishers around the globe who manage c. 25,000 peer-reviewed journals.[43]

13. Publishers manage publication processes such as peer review on behalf of academic communities, taking on the financial risks of founding and operating journals. Publishers maintain international networks of millions of highly specialised reviewers, and these networks extend beyond those of individual academics, institutions or societies.

14. Publishers identify and appoint editors and editorial board members who in turn appoint expert reviewers that are qualified to provide objective, informed assessments of whether a specific submission is appropriate for publication, and whether it fits with the editorial scope and mission of the journal to which it has been submitted.

15. There are various peer review models. Typically a journal editor will solicit anonymous peer reviews from two to five experts that s/he appoints in the field, or fields, to which the paper would add knowledge. In some cases the peer review process is "double-blind", meaning that the identities of both author and reviewer are hidden to further limit any possibility of bias. However, many employ a single-blind approach where the identity of the reviewer is not revealed to the author, unless the reviewer agrees otherwise.

16. Academics contribute time to provide reviews. The Publishing Research Consortium[44] estimated that researchers spend on average 40 hours per year performing reviews, and an average researcher reviews eight papers each year with an average review time of five hours. Reviewers contribute this time because it is regarded as part of being a scientist—91% of respondents indicated they review to play their part as a member of the academic community. At the same time, researchers also benefit from having their own work peer reviewed, as the publication of their research in peer reviewed publications is valued in decisions for promotion, tenure, association memberships and grants. Researchers also gain prestige if they review for prestigious journals, and researchers often indicate on their Curriculum Vitae those journals for which they have reviewed.

17. Publishers remain largely independent of the decision to publish or reject individual articles, as these decisions are made on a case-by-case basis by the reviewers and the editorial team that are appointed by the publisher.

18. Around three million manuscripts are submitted to journal publishers for peer review each year. Around 50% of manuscripts are rejected, either because they are deemed not to be scientifically sound, or because they do not fit the editorial scope and mission of the journal. The rejection rates vary by journal, for example titles

[43] Sources: Elsevier's Scopus database and Ulrich's Periodicals Directory

[44] Peer Review in Scholarly Journals—perspective of the scholarly community: an international study, Mark Ware/Mike Monkman Media / Publishing Research Consortium—http://www.publishingresearch.net/documents/PeerReviewFullPRCReport-final.pdf

such as *Cell* and *The Lancet,* which have extremely high publication impact (ie are heavily cited), have rejection rates of 95%. The overall level of 50% is not an artificial or arbitrary construct but one that has evolved organically as a result of peer review globally. The resultant filter is one that is neither too high to bar publication of valid research nor too low to lead to too much questionable research getting a publicity.

19. Recent research[45] shows that academics all over the world play a role in the peer review process. In the UK there is a balance between the effort spent reviewing and publishing articles. However this is not true always true: researchers in the US do more reviews in comparison to their output, whereas the opposite is true in China. Elsevier monitors these patterns and actively works in countries showing high article growth to educate researchers on the importance of effective peer review. In addition, Elsevier works with agencies that assist researchers to ensure their articles are linguistically accurate before submission. This helps to reduce burden on reviewers in navigating poor language, enabling them to focus on the research content of the article.

20. Since the late 1990s STM publishers have invested over £2 billion in technology, including systems to support peer review processes and to increase their efficiency. Investments include submission systems that enable authors to upload their manuscripts online, and track the progress of their manuscripts. So while the functions that publishers have performed have remained stable for over 350 years, the ways in which we perform these functions have been dramatically modernised.

21. These systems facilitate the review of around three million submissions by 125,000 editors, 350,000 editorial board members, and hundreds of thousands of peer reviewers. 3.8 million peer review reports and 30 million author/publisher communications are generated each year. Around 1.5 million peer reviewed articles are then published and disseminated to 14 million people globally, resulting in over two billion article downloads and over 40 million article citations per year.

Given the massive scale of publishing—which continues to grow by 3–4% annually driven by equivalent growth in R&D funding—STM publishers have established best practices and standards to protect the scientific record, nurture public trust in science, and to build the reputations of journals. For example COPE (Committee on Publication Ethics) provides case studies to assist editors in resolving cases of ethical infringements (eg plagiarism, fraud, etc), and an online forum to share best practice in protecting the integrity of the scientific record. Publishers also train and support editors and reviewers to have the confidence, integrity and skills to adhere to these high standards. Elsevier provides support in handling ethical issues to editors directly and through an online Publishing Ethics Resource Kit. Publishers have also invested in systems such as CrossCheck to help detect plagiarism.

22. Publishers have robust procedures to take action and to correct the scientific record when errors or fraud are detected. Like other societal systems scientific research and its communication is not immune to abuse including the conscious misrepresentation or misinterpretation of facts. However, such cases are the exception, not the rule. Elsevier publishes over 260,000 articles per year, of which we typically retract 70 articles per year due to information that surfaces post-publication. A further 200 are detected post acceptance but before final publication.

23. The peer review system has formal mechanisms to correct and record abuse, and there are serious consequences for those responsible to discourage such behaviour. For example Chinese computer scientist Chen Jin was fired from Jiaotong University for faking his findings concerning development of microchips[46]. More recently, The American Society for Microbiology retracted several papers by a Japanese researcher because of image manipulation and issued a 10-year ban on the author from publishing in any of its journals.

Furthermore, such transgressions are exposed through formal retractions and corrections to the scientific record.

The Peer Review Process is Highly Valued

24. Academics' perceptions of peer review are important given its central role in scientific communication. Overall, academics value peer review extremely highly. For example,[47]

(a) 90% of researchers think that peer review improves the quality of published research.

(b) 84% of researchers indicate that without peer review there would be no control in scientific communication.

25. As Richard Horton, Editor of *The Lancet*, has commented, "Science journals create the norms and rules that determine the ethics and integrity of science in society, and as such are crucial in building public trust in science. Without journals, there would be a cacophony of claims and voices with no means of judging quality or authenticity. Journals shape an ethics of knowledge, which is critical to the effective use of that knowledge in public affairs".

[45] Sense About Science—Peer Review Survey 2009: Preliminary Findings. http://www.senseaboutscience.org.uk/index.php/site/project/395

[46] http://www.thenewatlantis.com/publications/chinas-phony-science

[47] Sense About Science—Peer Review Survey 2009: Preliminary Findings. Section 2.5, Principles of peer review. http://www.senseaboutscience.org.uk/presentations/PeerReviewSurvey.ppt

26. The significance of peer review is reflected in the HEFCE application criteria for sub chairs for the 2014 Research Excellence Framework. The second criterion for appointment as a review panel sub chair is "experience and understanding of peer review and research quality standards."[48]

The Peer Review Process is Dynamic, and Continues to Evolve and Improve Further

27. Despite the embedded role of peer review and the high levels of satisfaction with it by scientists, we do not claim that peer review is perfect. We strive for continual improvement in three key areas: speed, time commitment for reviewers, and impartiality.

28. While peer review has existed for hundreds of years, it is a dynamic system that continues to evolve to further improve effectiveness, efficiency, and transparency. This is also a by-product of the intensely competitive nature of publishing: thousands of journals compete to publish the articles of millions of authors.

29. Examples of peer review innovations currently in development at Elsevier include:

(a) **PeerChoice** enables reviewers to use advanced analytics software to select articles that match his/her academic competency and current interest. Early results suggest this model can decrease the time to publication decision by nine days.

(b) **Scientific Screening** professional screening helps editors manage the large number of out of scope and substandard papers that would otherwise require peer review.

(c) **Review Sharing** if a paper is rejected from one journal and is considered to be more appropriate for publication in another journal, the article and reviews can be automatically forwarded to the editor of the other journal if the author agrees. We are experimenting with such a system within Elsevier. We are also part of the NeuroScience Peer Review Consortium which cascades submissions and reviews between journals published by different publishers. 129 papers were successfully cascaded through the consortium during 2010.

(d) **ReviewerFinder** a new tool to help editors expand their reviewer network to improve quality and also to decrease the workload of long serving reviewers.

(e) **Reviewer Mentor Programme** experienced editors employed at two universities mentor postdoctoral researchers who have authored papers but not yet served as peer reviewers. Each mentor runs training workshops for the postdocs and then the postdocs review real articles under supervision. Each postdoc is marked, and upon successful completion receives a certificate. We are exploring ways to provide formal certification and a reviewer kite mark to scale up this successful pilot.

(f) **Author Feedback** pilots to improve transparency for authors, so that they understand where their article is in the review process and understand how and when their article will be published or the reason for rejection.

(g) **Open Peer Commentary** published review articles are accompanied by five one-page comments from other scientists along with the author's statement/rebuttal of these comments. While successful in attracting attention to a journal, it is very time intensive. How scalable this is remains to be seen.

30. Some have suggested that the process of review by experts could be replaced and potentially bettered by social networking approaches, leveraging the "wisdom of crowds". Publishers have experimented with open peer review models. So far the outcomes of none suggest that review by selected experts can be replaced to sustain the production and dissemination of high-quality science over the long term:

(a) ***Atmospheric Chemistry & Physics*** journal operates a two-stage open review process. Following initial review by an editor to assess alignment with the title's coverage the manuscript is published online (usually two to eight weeks after submission). Comments and discussion by members of the public and select reviewers then take place for an eight-week period. The author responds to comments within four weeks, and then prepares a final revised article. The editor then decides whether to accept the paper. The original paper, comments, and final paper are all permanently archived and remain accessible. Other than comments from invited reviewers, spontaneous comments from members of the scientific community have been relatively low.

(b) A European-funded project, **Liquid Publications,** envisages an online platform on which scientists can post research outputs including papers, datasets, slides, and other materials. The platform enables other scientists to search, read, comment on, link to and from, and collate materials together into "personalized online journals". The reputation of individuals active on the platform is used to assess quality, assign credit, and measure impact. This project is at an early stage of development and outcomes are unknown.

(c) **PLoS ONE** provides post-publication tools that allow readers to rate the quality and impact of a paper, or to leave comments. All papers are reviewed by invited experts. However, the take up of post-publication commentary or ratings has been very low.

(d) **Nature** tried an open review model in 2006. Willing authors had their submissions posted online for reader comment while in parallel a traditional blind peer review process was conducted. The trial was

[48] Source: Research Excellence Framework, Sub-panel chairs further particulars for applicants—available at http://www.hefce.ac.uk/research/ref/pubs/2010/01_10/01_10fp.doc

cancelled as public comments were rare, and editors found that these were less helpful than the comments of the conventional peer reviewers.[49]

31. Elsevier will continue to innovate in these areas. When developments have potential to improve the peer review process without compromising current high levels of quality, accuracy, objectivity and efficiency then we will actively invest in those innovations.

32. Occasional suggestions are made to replace peer review entirely with post-publication metrics such as citation and/or usage data or to substitute publisher-managed peer review with review by internal university panels. None of these alternatives attract major support from the academic community and most academics continue to see publisher-managed peer review as the best option.[50]

33. Whatever approach is taken it is important that the review system caters for differences between disciplines by continuing to accommodate anonymous and/or identified reviewers, register new science; lead to rapid high-quality publications; be used for static or dynamic publications; facilitate search and retrieval of underpinning data, operate effectively with any business model, and create a permanent, citable, cross-referenced record of science.

Submitted on behalf of Elsevier by:

Mayur Amin
Senior Vice President, Research and Academic Relations, Elsevier

10 March 2011

Supplementary written evidence submitted by Elsevier (PR 81a)

I am writing to you following my appearance before the Science and Technology Committee on 11 May as part of their ongoing inquiry into Peer Review. I am grateful for being given the opportunity to provide oral evidence as part of this important inquiry.

The purpose of this letter is to provide additional information regarding three specific points requested by the Committee subsequent to my appearance on 11 May: (1) clarification of the £2 billion investment made by publishing companies which I cited during my oral evidence; (2) nature of the procedures put in place by Elsevier to prevent the repeat of an isolated case involving the *Australasian Journal of Bone and Joint Medicine* where sponsored article compilation publications had been published by a division of Elsevier on behalf of pharmaceutical clients and were made to look like journals, but without proper disclosure of their sponsorship; and (3) detail of editorial training provided by Elsevier.

1. Investment in the Sector

In the oral evidence provided to the Committee I made reference when responding to a question posed by Mr Barwell (Q103 in the Uncorrected Transcript of Oral Evidence) to the estimated £2 billion of technology investment that has been made by publishing companies.

This industry estimate was based on a detailed review of Elsevier's own technology investments, which were then extrapolated to the entire industry. Elsevier investments in the period 2000–10 were around £600 million. Elsevier has a share of published journal articles of around 20%. Extrapolating this to the industry (600/0.2) gives a total of £3 billion. A lower estimate of "in the order of £2 billion of investment" was communicated in my oral evidence in order to allow for differences in starting points for different publishers. This £2 billion estimate was shared with trade bodies (The Publishers Association, The International Association of STM Publishers and Association of Learned and Professional Society Publishers) who endorsed the estimate after consultation with a selection of their member publishers. This estimate was incorporated into a broader presentation issued by the three trade bodies which I have summarised in the table below for ease of reference.[51]

Technology investment areas (2000–10)	*Industry estimate*
Author submission & editorial systems	>£70m
e-journals and reference works back files	>£150m
Production Tracking Systems	>£50m
Electronic Warehousing	>£60m
Electronic Publishing Platforms, incl. search and discovery platforms	>£1500m
Other related back-office and cross-industry systems. eg digital preservation, Crossref for linking, CrossCheck for plagiarism detection, creation of special font sets, development of technical standards	>£300m

[49] http://www.nature.com/nature/peerreview/debate/nature05535.html

[50] http://www.timeshighereducation.co.uk/story.asp?c=2&sectioncode=26&storycode=414003

[51] "Access to research outputs—a UK success story", presentation produced by The Publishers Association, The International Association of STM Publishers, and Association of Learned and Professional Society Publishers, 2010: http://www.publishersassociation.org.uk/index.php?option=com_content&view=category&layout=blog&id=486&Itemid=1594

This estimate is for technology investments only and does not include the cost of establishing journals, setting up and maintaining Editorial Boards and marketing-related costs.

2. Australasian Journal of Bone and Joint Medicine

During my oral evidence I committed to providing further information regarding procedures which have been put in place by Elsevier to ensure there is no repeat of an isolated case in Australia where a series of sponsored article compilation publications had been published in the *Australasian Journal of Bone and Joint Medicine* by a division of Elsevier on behalf of pharmaceutical clients and were made to look like journals, but without proper disclosure of their sponsorship. This was an issue raised by Mr Metcalfe during the oral evidence session (Q110–Q113 in the Uncorrected Transcript of Oral Evidence).

2.1 *Background*

This episode occurred when an Elsevier publication—the *Australasian Journal of Bone and Joint Medicine*—published reprinted original, peer-reviewed research articles, plus other summarised articles, conference reviews and news clips and was single-sponsored by a global pharmaceutical company. The employees responsible for publishing this publication did not make the sponsorship sufficiently clear to readers. I would like to state again that although isolated, this incident was unacceptable and did not meet the high standards of transparency and disclosure that Elsevier seeks to maintain.

An additional eight "Journal of" titles were published with ads from multiple advertisers and therefore did not call for additional disclosure. None of these titles were primary research journals and should not have been called journals. Single issues were typically distributed to between 2,000 and 10,000 general practitioners (GP) in Australia, and the company is aware of one issue that went to 20,000 (the estimated total number of GPs in Australia). Customised and reprinted compilation publications—including the "Australasian Journal of" series—are not posted on Science Direct, Elsevier's electronic journal platform for its peer reviewed STM journals. Also, they are not required to be archived or retained.

When this practice was brought to the attention of senior Elsevier management in 2009, a public statement was issued by Michael Hansen, CEO of Elsevier's Health Sciences Division on 7 May 2009, making clear that: "This was an unacceptable practice, and we regret that it took place".[52] At the same time Elsevier also announced that an internal review related to this episode had been launched.

2.2 *Action taken by Elsevier*

On 4 June 2009 a further public statement was issued by Elsevier announcing that following the internal review, the company had moved to provide consistent internal guidelines for its pharmaceutical services divisions when producing reprints, article compilations or custom publications on behalf of pharmaceutical companies.[53] While pharmaceutical services divisions often reprint peer reviewed articles from Elsevier, they are managed separately from the division that publishes the company's core collection of primary peer-reviewed research journals.

Elsevier also initiated a review of practices related to all article reprint, compilation or custom publications and set out guidelines on content, permission, use of imprint and repackaging to ensure that such publications were not confused with Elsevier's core peer review journals and that the sponsorship of any publication is clearly disclosed.

On 16 February 2010 Elsevier announced that it was publicly sharing its internal custom publication guidelines for producing custom and sponsored publications.[54] These guidelines are publicly available and cover the necessity for full disclosure of funding and the origin of content and provide guidance on obtaining permission for the use of content.[55] The guidelines also point employees to best practices for medical publications from the International Committee of Medical Journal Editors (ICMJE), the Committee on Publications Ethics (COPE) and the Institute of Medicine. Elsevier publishing units will consider in their approval processes whether a custom publication is consistent with Elsevier's historical standard for world-class content and whether appropriate disclosures are made. They also need to follow the established record retention policy to ensure the company maintains an archive of all custom products produced.

Following the issuing of these new guidelines, affected employees attended presentations on implementation. Elsevier management continue to monitor and assess adherence to the guidelines and standards by its business units globally.

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[52] "Statement From Michael Hansen, CEO Of Elsevier's Health Sciences Division, Regarding Australia Based Sponsored Journal Practices Between 2000 and 2005" on 7 May 2009: http://www.elsevier.com/wps/find/authored_newsitem.cws_home/companynews05_01203

[53] "Elsevier To Create New Guidelines For Pharmaceutical Article Reprint, Compilation and Custom Publications" on 4 June 2009: http://www.elsevier.com/wps/find/authored_newsitem.cws_home/companynews05_01233

[54] "Elsevier's New Custom Publication Guidelines Set New Standards For Publishing Pharma-Sponsored Content" on 16 February 2010: http://www.elsevier.com/wps/find/authored_newsitem.cws_home/companynews05_01429

[55] Elsevier Health Sciences Guidelines for Custom Publications: http://www.elsevier.com/wps/find/intro.cws_home/HS_guidelines

3. Training Provided by Elsevier to Journal Editors

At the request of the Committee, I would also like to detail the training which is provided by Elsevier to the Editors of our journals.

3.1 *Background*

Editors who are appointed are not usually new to journal publishing and peer review. They are invariably experienced researchers who have a track record of publishing in and refereeing for several journals. Some have been Editorial Board members or associates or Section Editors of journals before being appointed as Editors. The support and training of journal Editors is a mixture of training on specific tasks, sharing knowledge and providing guidance on broader issues. The training which is detailed below applies mainly to Editors who are external to Elsevier (the majority) and not full-time employees as in the case for some top-end journals such as *The Lancet* and *Cell*. However, the guiding principles and policies that apply are the same. Editorial matters for some learned society-owned journals, which are published by Elsevier on a contractual basis, are wholly or partially managed by the society. Elsevier advise and provide training and support as required by the society.

3.2 *Support and training provided*

It is probably most useful to outline the support and training provided by Elsevier to the Editors of our journals into three areas: (1) that provided prior to appointment as an Editor; (2) on appointment as a new Editor; and (3) on-going support and training.

3.2.1 Prior to appointment as Editor (or Editor-in-Chief)

Newly appointed Editors will usually have had the benefit of being members of an Editorial Board or served as Associate Editors, Regional Editors or Section Editors prior to their appointment. Elsevier's public website[56] for Editors provides guidance and related reading to all Editors and potential Editors—not just those for Elsevier journals—on a range of issues including impact factors, peer review, ethical issues, support for authors and reviewers, as well as links to matters related to scientific publishing broadly. The site also includes a guide to "Being an Editor-in-Chief on a primary research journal" which Elsevier has produced with the help of long-standing Editors and feedback received from existing Editors.

3.2.2 Appointment of new Editors

On appointment, new Editors are given an outline of responsibilities in their contractual agreement and provided with a Welcome Pack which, in some 50 pages, introduces new Editors to Elsevier, its policies, procedures, the editorial and publishing teams which support the journal, the peer review process including tools to find reviewers, ethical guidelines, as well as support tools (please see Appendix I for full contents list of the Welcome Pack. The pack was last revised in March 2011 and updated twice a year).

In addition, new Editors are introduced to key publishing contact(s) at Elsevier to discuss their needs and requirements, including task areas and core responsibilities in a "how to be a successful Editor" presentation and invited to one of two new editor workshops/conferences held annually where they can discuss broader topics in scientific publishing such as peer review, ethics, citation metrics as well as get practical advice on day-to-day management of journals such as working with electronic submission systems or finding reviewers.

3.2.3 Ongoing support and training

Elsevier view as a priority the ongoing support and training provided to our journal Editors. This is an understandably broad range of activity and I have sought to summarise below the key constituents of ongoing assistance provided to journal Editors:

- Continued liaison with publishing contacts on all matters related to the journal. This is a core task of all publishing staff.
- Editorial board meetings—periodic meetings with the Editorial Board of the journal, typically one such meeting is held each year per journal.
- A dedicated website on Elsevier's public site that guides editors to resources at their disposal, including policies and ethical guidelines.
- A newsletter (Editors' Update) which is a quarterly forum for sharing a broad range of issues of relevance to journals Editors. Now in its 31st issue, topics have included peer review, journal performance, ethical issues related to research publishing, as well as tips from experienced Editors
- A newly-introduced webinar series for Editors which so far has addressed women in science, journal strategies, and peer review. When fully operational we aim to run four to six such webinars ach year

[56] Elsevier "Supporting Editors" website: http://www.elsevier.com/wps/find/editorshome.editors/supported

— Editor conferences where Editors are invited to attend over a day and a half to discuss longer-term and day-to-day issues. Together with the new Editor conferences mentioned previously, we now have five events each year and over 2,500 Editors (from across the world) have attended the 40 conferences so far to discuss, share and learn about new technologies, peer review approaches and processes, ethical issues, strategies to address needs of the research community, as well as practical matters on how to manage their roles and how best to use the electronic systems provided to manage submissions, identifying suitable referees, or deal with ethical problems. The agenda from a recent conference is shown in Appendix II for the reference of the Committee.

— A team dedicated to providing training and support for the Elsevier Editorial System (EES) for managing the submission and peer review process. This team provides training via live online webinars, pre-recorded tutorials, personal one-on-one contact, as well as online FAQs. A team of 10 EES trainers in five countries provide training to over 1200 Editors annually. The training desk site for EES (http://trainingdesk.elsevier.com/ees) currently provides 26 recordings on specific functionality in EES which receive approximately 7,000 unique visits from Editors each month. The on-line support site for EES provides 45 interactive tutorials for Editors covering the full spectrum of features available in EES (http://support.elsevier.com/app/answers/detail/a_id/701). These tutorials receive almost 8,000 unique hits per month. The EES user guide for Editors explains the use of EES in greater detail and is particularly useful for new Editors (http://support.elsevier.com/app/answers/detail/a_id/164).

— Training on dealing with ethical issues is further supported through a dedicated Publishing Ethics Resource Kit (PERK), which is an online set of guidelines and decision trees to help editors navigate specific issues. We work directly with editors in resolving ethical issues. Editors can also refer matters to the Committee on Publication Ethics (COPE) of which all Elsevier journals are paid up members.

— A team of bibliometric (a set of methods used to study or measure texts and information, most notably citation metrics) experts are on hand to provide journal Editors with a range of analyses and advice on the performance of their journals including presenting findings at Editorial Board meetings.

— Customer feedback (from authors and reviewers) obtained and analysed every quarter is shared with journal Editors periodically via publishing contacts and at editorial board meetings.

I hope this letter has served to provide the level of detail required by the Committee. Please do not hesitate to contact me should you require anything further in this regard.

Mayur Amin
Senior Vice President
Research & Academic Relations
Elsevier

1 June 2011

APPENDIX I

CONTENTS OF ELSEVIER'S EDITOR WELCOME PACK

CONTENTS

Version 2.1/2011

APPENDIX II

AGENDA FROM RECENT ELSEVIER EDITORS' CONFERENCE

SATURDAY 14 MAY 2011

08:30 **Conference Open**
08:40 **Helping to Solve the Puzzles of Scholarly research by Making Content Smarter**—YS Chi
09:30 **The Changing Journal Landscape**—Martin Tanke
10:20 Coffee Break
10:40 **A Look at Trends in Journal Publishing**—Mayur Amin
11:30 **Journal Measures and Reporting**—Carl Schwarz
12:15 Lunch & iPad Demo Session
13:15 **Parallel Breakout Sessions—Group A**

— **Ethical Dilemmas Discussed**—Jan Bij de Weg
— **Solving the Challenge of Finding Reviewers**—Graham Brumfield

14:00 **Parallel Breakout Sessions—Group B**

as above
14:45 Coffee Break
15:00 **Parallel Breakout Sessions—Group A**

— **Impact Factor and Other Bibliometrics: What Every Editor Should Know**—Andrew Plume
— **EES: Today and Tomorrow**—John O'Brien/ Adrian Tedford

15:45 **Parallel Breakout Sessions—Group B**

as above
16:30 **Elsevier Managers Respond to your Questions**
17:30 **Your EES Questions Answered**

SUNDAY 15 MAY 2011

09:00 **A Discussion on Open Access**—Michiel Kolman
09:45 **Making Global Editorial Boards**—Lucia Franco
10:00 Coffee break
10:30 **Open Q&A—A Discussion with Publishing Staff**
11.30 Conference close

Written evidence submitted by the UK Research Integrity Office (PR 84)

GENERAL COMMENTS

The peer review process is used globally in science and the majority of other academic disciplines to examine the quality of scientific research findings prior to publication and also to evaluate the quality of research grant applications as part of the selection process before an award are made. Peer review is also used to inform academic promotion.

Peer review is not a perfect process and almost certainly can be improved. One is reminded of the quotation by Sir Winston Churchill in 1947, "Many forms of government have been tried, and will be tried in this world of sin and woe. No-one pretends that democracy is perfect or all-wise. Indeed, it has been said that democracy is the worst form of government except all those other forms that have been tried from time to time".

RESPONSE TO SPECIFIC REQUESTS FOR COMMENT

1. *The strengths and weaknesses of peer review as a quality control mechanism for scientists, publishers and the public*

1.1 Peer review is a form of scientific control or self-regulation which aims to check, criticise and improve research. It is a process where scientists open their research to the scrutiny of other experts in the field. It is usually, but not always, a confidential process involving three key partners (i) the investigator/author, (ii) the journal editor or funding agency and (iii) the peer reviewer(s). In most instances, the author/investigator will be unaware of the identity of the peer reviewer, although this is not always the case.

1.2 Science works best in an environment of unrestrained criticism and thus high-quality peer review will aim to detect methodological faults in the design of research studies, identify flaws in the analysis and reviewers should be expected to provide comment on whether the interpretation of the findings is appropriate and make a judgement on the likely impact of the findings on the future development of the particular scientific area. It is the most widely used quality assurance process for selecting papers for publication and for selecting research grants for funding.

1.3 Peer review works well when it is conducted by expert, thorough reviewers who undertake the task in an unbiased and honest way. The process, however, has many weaknesses but, as yet, there is no viable alternative to quality assure the process for the publication of scientific research or to assess the worthiness of grant applications.

1.4 Peer review has many downsides. Peer review has many critics as it is thought to be non-standardised, idiosyncratic and open to bias. This can lead to unreliability, unfairness and a failure to validate or authenticate research. Most disciplines in science are highly competitive. There is a danger that the peer review process can stifle innovation and perpetuate the status quo. Peer reviewers, for example, are more likely to reject a paper or research grant if it challenges their own belief system.

1.5 The most widely used form of peer review is when the author or investigator is unaware of the identity of the peer reviewer, sometimes called "blind" peer review. This secrecy can lead to irresponsibility and failure to produce a fair, balanced review and, on occasions, may invite malice. Many authors will have experienced long delays in the peer review process have suspected that a peer reviewer might be intentionally holding up publication to allow advancement of their own work.

1.6 Blind peer review may allow reviewers to make broad, overarching, destructive statements, such as "this study is fundamentally flawed", without fully substantiating their claims. Such a statement will immediately alert an editor to the potential profound weakness of a study and may trigger a rapid rejection process.

1.7 It is for this reason that many feel that "true experts" may be too close to the work to produce a balanced opinion. While their technical competence cannot be disputed, their proximity to the research area and their competitiveness may be destructive.

1.8 Although in the last decade there have been a number of research studies addressing some aspects of the peer review process, many would still argue that it has been insufficiently tested by objective measures. There is evidence, for example, that the outcomes of peer review are dependent on age, gender, language skills and geographic location, all of which have been shown, to some extent, to influence the outcome of the peer review process.

1.9 By and large these variables are not taken into account when routinely selecting peer reviewers. Most journal editors and funding agencies will be aware that, within the scientific community, there are "hawks" and "doves". In the recent past, editors of some elite science journals have been heavily criticised for their own bias perhaps in selecting reviewers who would produce the answer that they wanted. In a quote from the Wall Street Journal it was said that "Nature and Science are locked in such fierce competition for prestige and publicity that they may be cutting corners to get 'hot' papers". The Nobel Laureate, Robert Laughlin, commenting on a series of retractions from these eminent journals said "in this case the editors are definitely culpable… they chose reviewers they knew would be positive".

1.10 There are still uncertainties as to how many reviewers should be invited to comment on a grant proposal or a research publication. Statisticians might suggest that statistically viable results would require at least six opinions, all agreeing to either reject or accept. It is uncommon for as many as six reviewers being asked to assess a paper for publication. Journal editors will differ in the number of reviewers they engage and at the end of the day, most journals give editors the responsibility for the final decision so he or she is at liberty to accept or reject the advice of reviewers. It is not a democratic process.

1.11 Peer review is an expensive, time-consuming process that is largely unrewarded and unrecognised. Many scientists will review large numbers of papers each year and many will serve on review boards for funding agencies which, again, takes them away from their research and other responsibilities.

1.12 Despite all the shortcomings of the peer review process, there is a real danger in placing research findings in the public domain that have not been quality assured. The possibility for the commercial exploitation of poor science is already evident and there is still a tendency for some questionable findings to be published in the national press before having undergone scrutiny by experts in the field. Peer reviewers do not always get it right but the public deserves scientific findings that can have such a profound effect on society to be quality assured by a gateway process managed by experts.

2. *Measures to strengthen peer review*

2.1 Clear guidance on what is expected of a peer reviewer:

Many journals and funding agencies provide instructions to peer reviewers but there is a lack of consistency and, in some cases, a paucity of detail. Reinforcement of the necessity to understand that this is a confidential process and, in effect, the peer reviewer makes a contract with both the editor/funder and the applicant. A clearer understanding of the variables that influence the outcome of peer review need to be emphasised as is the necessity of disclosing all conflicts of interest.

2.2 Training:

The knowledge and skills required to conduct high quality peer review are usually passed on in an informal way. Peer reviewers in the future perhaps should be required to undertake a period of training which could

be largely online but might involve at least one face-to-face group session (possibly via a "chat room") which could be case based.

2.3 Selection of reviewers:

There is some evidence that younger peer reviewers produce a more thorough review. There is evidence that editors can bias the outcome of the peer review process by selecting particular individuals who they know will produce the answer they require. Most journals have a well-established database of reviewers which can be searched by the area of special expertise. It might be argued that, within disciplines and sub-disciplines, peer reviewers might be selected at random to avoid editorial bias.

2.4 The majority of peer reviewers are not paid and their work is largely unrewarded. Most scientists accept that peer reviewing each other's work is part of the job and many will spend a considerable number of hours every year undertaking the process. As yet there is no satisfactory way of identifying this contribution as a serious part of the research and publication process. One of the advantages of "open" peer review is that the name of the reviewer could be published in the scientific journal along with the authors and it has been suggested that the reviewer's reports might also be available with the online version paper. Contribution to the peer review process might be formally recognise as part of an academic work and the taken into account as a criterion for promotion.

2.5 "Open" peer review:

This approach is used by an increasing number of journals and effectively means that, not only do reviewers know the identity of the authors, but the authors know the identity of their reviewers and reviewers are invited effectively to sign their peer review assessments. Many feel that this leads to greater openness in the peer review process and leads to greater assurance that reviews will be evidence based. There is certainly evidence that reviews conducted under this system are "more constructive and courteous" but no evidence as yet that it improves the quality of the reviews. Further research is clearly required to determine whether this is indeed the way forward. Some younger reviewers, however, are concerned about open peer review as they feel their careers may be at stake if they produce harsh reviews of the work of established giants in the field.

3. *Value of peer reviewed science on advancing and testing scientific knowledge*

The volume of research and research publications has increased almost exponentially over the last 50 years. Most scientists feel that some pre-selection of published work is required as it would be impossible to perform this function on an individual basis. The peer review process also improves the final published work often making it shorter, more focussed and reduces the chance of technical errors, both in the science and in the published article.

4. *Peer review in informing public debate*

The public inevitably relies on experts to pre-select and quality assure scientific data that are placed in the public domain. A Mori survey in 2004 clearly showed that the public have a poor understanding of the peer review process but many want peer scrutiny and want scientific findings to be replicated before findings are widely trailed in the public domain.

5. *Differences in peer review between scientific disciplines and between different countries*

There are differences in the peer review process across the scientific disciplines. The peer review process in life and biomedical sciences generally follows the standard approach described above. However in mathematics and to some extent in physics peer review often takes place in an open and transparent manner often as a collective activity. A good example is the way in which the solution to Fermat's Last Theorem was arrived at. Similarly the peer review process for the 'big experiments' in physics are again often conducted as a collective event in an open and transparent manner. The quality of peer review almost certainly varies globally and from Journal to Journal.

6. *Identification of peer reviewers*

Most journals will construct a large database of potential reviewers whose special interest and expertise has been identified prior to entry onto the database. These databases are searchable by editors and editorial staff and the final selection made of between two and four reviewers being the norm. It is not uncommon for reviewers to decline to review a paper in which case the editor will return to the database and seek alternatives. Reviewer databases are usually refreshed on a regular basis. Tardy or ineffective reviewers may be removed and new and active researchers added.

Multidisciplinary research papers may require a larger number of reviewers to reflect the multidisciplinary approach of the research.

7. *Impact of IT on the peer review process*

Modern information technology has revolutionised the publication process. The majority of major scientific journals have moved entirely to an online submission and review process. This paperless process has reduced the time to publication which has been largely due to the speeding up of the peer review process.

8. *Possible alternatives to peer review*

8.1 The most obvious alternative to peer review is to publish all research studies and allow the scientific community to decide whether a particular study is of high quality and whether it contributes significantly to the body of knowledge. This could work in the same way as the now popular social media sites, including the online versions of daily newspapers and magazines which encourage comments. Some of the weekly medical journals such as the British Medical Journal encourage rapid responses to publish papers and other articles which stimulate an interesting debate.

8.2 With the assent of open access online journals it was anticipated that many of these would dispense with formal peer review prior to publication and allow the scientific community to decide. The majority however have retained a formal peer review process before e publication. It has been suggested however that an open online peer review process could take place during a period of say four—six weeks following which an editorial decision could be made as to whether the paper should be formally published.

8.3 During the past 30 years there has been expansion of the number of scientific journals available to authors and a substantial increase in the number of published papers. If there was a viable alternative to peer review then one might have expected expansion to have driven change. This suggests that as yet there is no viable alternative to the established peer review process and that we have to accept it as a relatively expensive, time-consuming and imperfect process.

Declaration of Interests

This submission draws upon the views of the Board of the UK Research Integrity Office (UKRIO) and its staff. These include persons who have: undertaken research which was then submitted for publication via the peer review process; acted as peer reviewers; acted as editors of academic journals which operate a peer review process; and/or hold senior roles in institutions such as universities which commonly disseminate their research via peer reviewed journals. The Committee on Publication Ethics, a forum for editors and publishers of peer reviewed journals to discuss all aspects of publication ethics, has supported UKRIO and its Chair holds a seat on our Board. UKRIO has received funding from bodies that fund research projects which are commonly disseminated via peer reviewed journals, such as Research Councils UK. None of the bodies which fund or support UKRIO had any input into the content of this submission.

About the UK Research Integrity Office

The UK Research Integrity Office (UKRIO), established in 2006, is an independent body which offers confidential and expert advice and guidance about the conduct of research, covering all subject areas. It helps research organisations, individual researchers and members of the public. UKRIO also publishes guidance on good research practice and the investigation of alleged misconduct, and operates a help-line service where concerns can be reported in complete confidence. UKRIO is not a regulatory body and has no formal legal powers. The advice and guidance it offers is not mandatory but reflects best practice in the conduct of research and addressing misconduct. Further information about UKRIO is available from its website: www.ukrio.org .

UK Research Integrity Office

10 March 2011

Supplementary written evidence submitted by the UK Research Integrity Office (PR 84a)

Further to the oral evidence of our representative, Dr Elizabeth Wager, to the above inquiry, I write to clarify some comments made concerning the funding of the UK Research Integrity Office (UKRIO Ltd), our plans for the future and our desire to remain an advisory body rather than seek regulatory powers. I attach in annex 1 a brief paper giving further information on these issues.

As you may be aware, UKRIO was established to provide independent and expert support to the UK research community and to the public about the conduct of research, including the promotion of good practice and the prevention and investigation of misconduct. Since 2006, we have provided confidential advice on a wide range of issues across all disciplines of research. Use of our services has risen each year—we dealt with more than 60 cases in 2010 alone—and our published guidance has been used by many organisations and endorsed by funding and professional bodies.

The users of UKRIO's services have welcomed our focus on guidance that is appropriate and proportionate, rather than burdensome and bureaucratic. Whilst one might expect researchers, employers and the public to be hesitant about sharing problems with a non-regulatory body, our experience has shown there is no such reluctance. There are significant risks if such support is not available: to the quality and the reputation of UK

research; to public funds; to the safety and wellbeing of members of the public who participate in research, and to the financial and legal well-being of research organisations. The costs of providing UKRIO's services are minimal compared with the personal, institutional, financial, legal and reputational consequences of research misconduct. We are therefore convinced that UKRIO must continue to supply and develop the support it currently provides and are seeking funding for that purpose.

UKRIO Ltd has been established as a company limited by guarantee to continue its vital work. This is in accordance with the original proposal for UKRIO, which indicated that it should move towards a wider pool of funders and supporters after the initial stage of its development. UKRIO was initially funded through a UK broad stakeholder group, including the UK Higher Education Funding Councils, the UK Departments of Health, the Royal Society, several of the Research Councils, research charities and a variety of other bodies. The organisation was run at a surplus in its first phase and these funds currently sustain UKRIO Ltd.

We now plan to implement a subscription model thus ensuring that, crucially, those who employ researchers and are the key users of the service, namely universities, the Department of Health and NHS organisations, other Government Departments and research organisations such as public and private sector research institutes, and industry continue to have the benefit of this vital function. This model has worked extremely well for the Committee on Publication Ethics (COPE) which our Vice-Chair, Michael Farthing, and a number of other editors started in 1997. COPE is now funded directly through a large stakeholder group of the publishers of academic journals; many now regard being a funding signatory of COPE as an indicator of their aspiration to seek excellence in publication ethics and integrity in academic publications.

We are about to write to organisations that employ researchers and undertake research to invite them to become subscribers. We propose to ask individual institutions to contribute a modest annual fee and make a commitment for three years in the first instance. This will give UKRIO Ltd a suitable period to develop its service model to continue to meet the increasing demands made of it. Though these are uncertain times for the funding of many organisations, UKRIO has clearly demonstrated that its services are both required and valued and that it fills a gap in the research community that is not currently provided by any other UK institution.

UKRIO does not seek regulatory powers: to do so would, in our view, conflict with the core values and mission of UKRIO Ltd and with the way in which we have successfully provided support to the research community and the public. We do not seek to trespass on the remits of the various regulatory organisations but instead work with them as appropriate. Indeed, we have worked with existing regulators on matters of mutual interest and, if a statutory regime of regulation was ultimately regarded as desirable, we would be keen to work with the body which was established to fulfil this function.

Virtually all of those involved with UKRIO Ltd are experts who give their time to the project *pro bono*. They represent a positive response to concerns expressed about research integrity, concerns which UKRIO has responded to and met a need which otherwise had gone unmet. Individuals and organisations with experience in addressing research misconduct are welcome to collaborate with UKRIO.

Comprehensive and non-bureaucratic support for research integrity must continue. It is essential that the UK research community continues to have access to expert support from UKRIO to help maintain high standards of research, protect participants, and safeguard public funds.

James Parry
Acting Head
UK Research Integrity Office

May 2011

1. Introduction

1.1 The UK Research Integrity Office Ltd. (UKRIO) is an independent body which provides expert and confidential advice and guidance about the conduct of research, from ensuring good practice in research to help with specific cases of alleged misconduct. Since its creation in 2006, UKRIO has amassed considerable experience in helping employers, researchers and the public with issues of research conduct across all subject areas. No other organisation in the UK has comparable expertise in providing such support and we welcome enquiries from all disciplines of research.

1.2 Further information about UKRIO is available from its website: www.ukrio.org .

1.3 This document provides further information on UKRIO and its work. It describes:

(a) The history of UKRIO, including how UKRIO has been funded in the past and how it is currently supported.

(b) Our plans for the future.

(c) UKRIO's views on the statutory regulation of the conduct of research.

(d) Why we do not seek regulatory powers for our organisation.

2. The History and Funding of UKRIO

2.1 The need for independent support on matters relating to misconduct in research and the promotion of good conduct has been the subject of considerable discussion over many years. UKRIO was set up in 2006 as a result of these discussions, to provide independent and expert support to the UK research community and to the public about the conduct of research, including the promotion of good practice and the prevention and investigation of fraud and misconduct.

2.2 The original proposal for UKRIO set out the intended model of support—an independent advisory body rather than a regulator—and the initial programme of work. The latter included: the creation of an advice and guidance service on issues of research conduct available to all in research; the publication of standards for good research practice and the investigation of alleged misconduct; and the provision of education and training, both direct and via input into institutional training programmes. The proposal also stated that UKRIO should be hosted by an existing organisation in its initial pilot phase. Accordingly, from 2006 to late 2010 UKRIO was an unincorporated association hosted by Universities UK (UUK).

2.3 Although hosted by an existing organisation in its initial phase, UKRIO has remained independent throughout. It has been directed by its own independent Board since its inception rather than by the Board of UUK and has never shared sensitive information regarding its work with UUK or any other third parties. Similarly, UKRIO is not responsible to any external body other than in accounting for the funding it receives in regular reports. Our funders do not determine whom we help or how we help them and any advice given is kept confidential within UKRIO.

2.4 Many UK organisations with interests in research came together to set up, fund and support UKRIO, including: the four UK Departments of Health, the four UK Higher Education Funding Councils, the Academy of Medical Sciences, the Association of the British Pharmaceutical Industry, the Association of UK University Hospitals, the Biotechnology and Biological Sciences Research Council, the Committee on Publication Ethics, the Medical Research Council, the Medical Schools Council, the Medicines and Healthcare products Regulatory Agency, Research Councils UK, the Royal College of Physicians, the Royal College of Physicians of Edinburgh, the Royal Society, Universities UK and research charities including the Wellcome Trust.

2.5 The Board of UKRIO is pleased with the progress that has been made during the past four years. It is evident that researchers, research organisations and the public, all of which might be expected to be hesitant about sharing problems with a non-regulatory body, are willing to come forward and seek guidance on difficult issues. The users of our services and publications have welcomed our focus on advice and guidance that is appropriate and proportionate, rather than burdensome and bureaucratic. Particular achievements include:

(a) The publication of our Code of Practice for Research and Procedure for the Investigation of Misconduct in Research. UKRIO's publications have been adopted and used by many research organisations and endorsed by research funders and professional bodies.

(b) The establishment of a register of expert advisors on issues of research conduct.

(c) The provision of confidential and independent support to researchers, members of the public, higher education institutions, NHS organisations and private sector and charitable bodies on a wide range of issues of research integrity and misconduct. In 2010 alone UKRIO helped with more than 60 cases and use of our services continues to grow exponentially year on year.

2.6 While UKRIO continues to fulfil its remit of supporting the UK life sciences research community, for some time it has assisted with cases which extend across all academic disciplines, including science and engineering, social sciences and the arts and humanities. We have found that the principles of research integrity are common to all disciplines, though we recognise that each discipline has its own technical considerations which cannot be transposed to other disciplines and provide specialist expertise whenever necessary. This approach has been welcomed by the many individuals and organisations who have sought our assistance with cases outside of health and biomedicine since the inception of UKRIO.

2.7 In late 2010, UKRIO transferred from Universities UK and became a company limited by guarantee, UK Research Integrity Office Ltd. There was no break in the continuity of UKRIO's services and we continue to provide independent and confidential advice to researchers, research organisations and the public. UKRIO's transition was in accordance with the original proposal for the organisation, which indicated that we should move towards a wider pool of funders and supporters after the initial stage of our development.

2.8 The majority of UKRIO's staff are experts who give their time to the organisation *pro bono*. Accordingly, we operate very cost-effectively, providing our services to all involved in research at a cost of approximately £90,000 per annum.

2.9 UKRIO was run at a surplus in its first phase and these funds are currently sustain the organisation. Our plans for securing further funding to guarantee the future of our organisation are discussed in section three, below.

3. The Future of UKRIO

3.1 UKRIO has provided comprehensive guidance to research organisations, researchers and the public since 2006, with a focus on support that is appropriate and proportionate, rather than burdensome and bureaucratic. We have regularly responded to requests for assistance in all subject areas and types of research.

3.2 It has become clear since UKRIO was set up that many institutions and individuals value our confidential, independent and expert approach and the services that we offer to all involved in research. Some research organisations may feel that that they have issues of research integrity well in hand; however, it has become clear that many more institutions value being able to seek advice from an external source. Researchers, organisations and the public have all been willing to come forward and seek guidance on difficult issues from UKRIO.

3.3 There are significant risks if such support is not available, risks to the quality and the reputation of UK research, to public funds and to the safety and wellbeing of members of the public who participate in research, as well as to the financial and legal well-being of research organisations.

3.4 UKRIO is therefore convinced that it must continue to continue to supply and develop the support it currently provides to the UK research community and the public and is seeking funding for that purpose. The costs of providing UKRIO's services are minimal compared with the personal, institutional, financial, legal and reputational consequences of research misconduct.

3.5 Comprehensive and non-bureaucratic support for research integrity must continue. It is essential that the UK research community continues to have access to expert support from UKRIO to help maintain high standards of research, protect participants, and safeguard public funds.

3.6 We recognise that the current economic climate means that potential funders will be forced to make hard decisions concerning which expenditures can and cannot be considered. However, it should be noted that the sums involved in continuing the work of UKRIO are modest in comparison with the much more ambitious plans that some stakeholders have envisaged as necessary for a research integrity body and are minimal compared to the consequences of research misconduct. UKRIO operates very cheaply and cost-effectively, with a very small staff backed by a Board and a panel of expert advisers, both of which work *pro bono*.

3.7 UKRIO has always recognised that it will need to further evolve as the needs of the research community change. We also recognise that our previous funding base was designed to support us in the initial phase of our work and will need to change as well in order to support the project in the long-term. Accordingly, we are beginning a process to increase the stability of support for the project by broadening the existing pool of long-term funding bodies. As noted above, this is in accordance with the original proposal for UKRIO, which indicated that it should move towards a wider pool of funders and supporters after the initial stage of its development.

3.8 UKRIO was initially funded through a broad stakeholder group, including the UK Higher Education Funding Councils, the UK Departments of Health, the Research Councils, research charities and a variety of other organisations. UKRIO is now seeking a new model through which to fund its activities. We plan to implement a subscription model thus ensuring that, crucially, those who employ researchers and are the key users of the service, namely universities, the Department of Health and NHS organisations, other Government Departments and research organisations such as public and private sector research institutes, and industry continue to have the benefit of this vital function. This model has worked extremely well for the Committee on Publication Ethics (COPE) which our Vice-Chair, Michael Farthing, and a number of other editors started in 1997. COPE is now funded directly through a large stakeholder group of the publishers of academic journals; many now regard being a funding signatory of COPE is an indicator of their aspiration to seek excellence in publication ethics and integrity in academic publications.

3.9 We plan to write to organisations who employ researchers and undertake research to invite them to become subscribers. We propose to ask individual institutions to contribute a modest annual fee and make a commitment for three years in the first instance. This will allow UKRIO to continue to work actively to develop its service model to continue to meet the increasing demands made of it. Although these are uncertain times for the funding of many organisations, UKRIO has clearly demonstrated that its services are both required and valued and that it fills a gap in the research community that is not currently provided by any other UK institution.

3.10 It should be noted that two aspects of UKRIO's model of support will not change regardless of the move to a subscription model of funding:

(a) Whistle blowers and other individuals will not be charged for our help. Individuals who need guidance and support from UKRIO—whether researchers, research participants, patients or the public—will continue to use all of our services free at the point of delivery.

(b) Our funders and supporters will not determine whom we help or how we help them. Similarly, we will not share confidential information about cases or our other work with our subscribers or any other third parties.

4. Views on the Statutory Regulation of the Conduct of Research

4.1 There is currently no overall statutory regulation of research or of researchers in the UK. While there are regulators for certain types of research, such as human clinical trials or research involving animal subjects, and for certain types of researchers, such as (medical) doctors, these are exceptions rather than the rule. When issues of research conduct arise, if a field of research is not governed by statute, it normally devolves to the employer to investigate and, if necessary, take remedial action.

4.2 There has been considerable discussion by the research community, and also by Government and in the media, over whether there should be more statutory regulation of the research in the UK. Equally, there has been considerable discussion over whether there should be less regulation.

4.3 While some commentators feel that the introduction of statutory regulation of research conduct would be helpful, it appears that this is not the view of the majority and that there is little appetite for more regulation and bureaucracy. Even among those who feel that statutory regulation would be desirable, there is considerable disagreement over what form that regulation should take—its jurisdiction and powers—and also a recognition that its introduction would not be a cure-all. It seems that much of the research community does not want statutory regulation at this time or would not be accepting of it if it was introduced.

4.4 Research in the UK covers a wide variety of organisations and employers (universities, NHS bodies, private sector organisations, charities), subjects (from the arts and humanities to health and biomedicine) and funding sources (government, charities, private sector, etc). It would be extremely challenging to establish a body which could regulate all aspects of the research enterprise. Given that there already exists a variety of bodies with legal responsibilities in this area, primary legislation would be required and Parliament has chosen not to act in this area to date.

4.5 If the introduction of a regulatory regime was felt to be desirable, it would essential that there was considerable discussion and consultation regarding its remit, powers and method of operation. For example, it would be vital that any regulatory body: recognised and accounted for the particular nuances of the wide variety of research methodologies which would fall within its remit, which could range from the arts and humanities to health and biomedicine; ensured that mechanisms for the regulation and governance of research were clear, consistent and transparent; harmonised and streamlined existing regulation for research, retaining what works well out of current arrangements; and be risk-based and proportionate throughout its work.

4.6 Above all, it would be essential to carefully manage any process of introduction and consolidation of regulation to ensure that there was continuous and rigorous safeguarding of public funds and protection of the quality of UK research and, most importantly, the safety and wellbeing of patients and participants.

4.7 The implementation of statutory regulation of research should not be seen as a panacea. For example, regardless of whether all aspects of research conduct were subject to regulation or not, organisations such as professional regulators and representative bodies will produce their own guidance to interpret regulations, many of which will have differences of varying subtlety. Similarly, there will be variation in the interpretation and implementation of the requirements of regulation and governance at the local level regardless of there being one or several regulators. A strength of a research regulator would be that it could take significant steps to alleviate such problems, for example, by simplifying and harmonising existing regulation; however, it should be recognised that statutory regulation of all research would not cure every problem with the system on its own.

4.8 The regulation and governance of research in the health and biomedical sciences was recently the subject of an independent review by the Academy of Medical Sciences (AMS). It is worth noting that the review did not recommend the expansion of regulation beyond its existing boundaries, for example to have jurisdiction over issues of research conduct currently addressed by employers. Rather, it felt that "there is evidence that UK health research activities are being seriously undermined by an overly complex regulatory and governance environment". It concluded that there should be simplification and harmonisation of current regulation and that the application of this regulation should aim to be proportionate and symmetrical.

4.9 In our experience, we have found that employers of researchers, to whom it falls most often to resolve issues of poor practice and misconduct in research, do have the power to take action to determine what has occurred and apply appropriate corrective measures. Indeed, they have a responsibility to do so. In the past there have been questions about how keen employers have been to fulfil their responsibilities and whether they had sufficient expertise to do so in an effective manner. UKRIO was set up to help correct this situation.

4.10 When UKRIO was conceived, there were concerns about how research misconduct was being addressed. Some institutions appeared to lack formal mechanisms to investigate and address misconduct; others had formal mechanisms but it appeared that they were applied inconsistently. Matters have improved since then but institutional mechanisms can still vary a great deal, leading to a lack of parity. However, we have found that guidance from UKRIO, whether on specific cases via our advisory service or through use of our publications, has helped employers fulfil their responsibilities and avoid many common issues and pitfalls. The sharing of good practice in the promotion of good research conduct and the prevention and investigation of poor practice and misconduct is essential. UKRIO makes an important contribution in this area, as do existing regulatory agencies, bodies which fund research and other organisations. This method of support can help further improve the integrity of UK research without requiring the establishment of new regulatory powers.

4.11 We recognise that there are those who might feel frustrated at the state of research integrity in the UK. Virtually all of those involved with UKRIO Ltd are experts who give their time to the project *pro bono*. They represent a positive response to concerns expressed about research integrity, concerns which UKRIO has responded to and met a need which otherwise had gone unmet. Individuals and organisations with experience in addressing research misconduct are welcome to collaborate with UKRIO.

5. Why UKRIO does not Seek Regulatory Powers for Itself

5.1 UKRIO is not a regulatory body and has no formal legal powers. The advice and guidance it offers is not mandatory but reflects best practice in the conduct of research and addressing misconduct.

5.2 Since our inception, we have focused on advice and guidance that is appropriate and proportionate, not burdensome and bureaucratic. We recognise that research and researchers in the UK do not require micro-management or the imposition of more paperwork. Instead, organisations and individuals need guidance and support that is practical and useful, and which encourages research of the highest quality and ethical standards, rather than the creation of burdensome and restrictive systems.

5.3 Accordingly, our advice and standards draw upon existing good practice and our own unique and considerable experiences in promoting good research practice and addressing misconduct. They are designed to avoid creating additional bureaucracy and delays, causing problems for innovative and cross-disciplinary research or, when dealing with allegations of misconduct, being inflexible to the circumstances of individual cases.

5.4 We recognise that there is no "one-size-fits-all" solution but we do believe there is room for common approaches to common situations and that good practice should be shared. Most issues of research integrity are not unique to any particular setting and nor are the solutions proposed. All disciplines have considered these issues, and how to respond to them, to a greater or lesser degree. It is UKRIO's experience that there are many common themes that emerge, though we have always recognised that each discipline will have unique considerations and provide specialist expertise whenever necessary.

5.5 We also feel that our model of support—an independent advisory body offering confidential and expert support to institutions, researchers and the public—is particularly important given the Government's aims to help the sector to save money and further improve its international reputation. Our focus on support that is appropriate and proportionate, rather than burdensome and bureaucratic, is also in accordance with the Government's emphasis on relying on professional responsibility and reducing unnecessary bureaucracy.

5.6 One of UKRIO's strengths is that it is independent and offers enquirers total confidentiality, without having the responsibility or legal requirements of a statutory regulatory body. We do not seek to trespass on the remits of the various regulatory organisations but instead work with them as appropriate. In many ways, UKRIO was set up to fill in the gaps between the various jurisdictions, where no overall regulation might apply, and to direct researchers, organisations and the public to the regulators where their jurisdiction does apply.

5.7 There has been considerable use and uptake of our services since we began our work in 2006. Our status as an advisory body, rather than a regulator, has not been an impediment to this; in fact, it has helped it. We have found that we do not need statutory powers to get results. Our published guidance has been adopted and used by many institutions, while our advisory service dealt with more than 60 cases in 2010 alone. Whilst one might expect researchers, employers and the public to be hesitant about sharing problems with a non-regulatory body, our experience has shown there is no such reluctance. Similarly, employers are more than willing to adopt and use our guidance on issues of research practice and addressing misconduct, despite its use being strictly voluntary.

5.8 Consequently UKRIO does not seek regulatory powers. In fact, we feel that to seek such powers would conflict with the core values and mission of UKRIO and the way in which we have successfully provided support to the research community and the public.

5.9 However, we have worked with existing regulators on matters of mutual interest and, if a statutory regime of regulation was ultimately regarded as desirable, we would be very keen to work with the body which was established to fulfil this function. If Parliament chose to act in this area, we feel very strongly that UKRIO's unique role could help an regulatory organisation minimise the burden of regulation and help maintain the UK's world-class reputation for conducting exceptional and innovative research. Meanwhile, UKRIO will continue to raise the profile of good practice in research and address misconduct.

May 2011

Further supplementary written evidence submitted by the UK Research Integrity Office (PR 84b)

Letter from Professor Sir Ian Kennedy, Chair, UK Research Integrity Office, to the Chair of the Committee, 20 June 2011

1. I write further to the oral evidence to the above inquiry of Professor Rick Rylance of Research Councils UK (RCUK), David Sweeney of the Higher Education Funding Council for England (HEFCE) and Sir Mark Walport of the Wellcome Trust. Regrettably, some of the comments made regarding the UK Research Integrity Office (UKRIO Ltd.), which I chair, were inaccurate.

2. I was surprised at the criticism that UKRIO Ltd. in its first phase did not provide support to all disciplines of research. UKRIO was in fact conceived to support the UK life sciences research community as a pilot for a wider remit. Since our inception, we have responded to enquiries on issues of research integrity across all subject areas and our published guidance is applicable to all disciplines.

3. The research community has been aware of this for some time. In 2009, RCUK's *Policy and Code of Conduct on the Governance of Good Research Conduct* recommended UKRIO's *Procedure for the Investigation of Misconduct in Research*, while the Economics and Social Research Council's *Framework for Research Ethics* (2010) included material from our *Code of Practice for Research* and cites UKRIO as a source of advice on issues of research integrity. These publications are binding on those in receipt of funds from the relevant organisation. Neither suggests that UKRIO or its guidance is applicable only to health and biomedicine. Indeed, demand from employers and researchers led us to support all disciplines of research from early in our first phase, including cross-disciplinary research, and we continue to do so.

4. During discussion of UKRIO Ltd., it was suggested that research integrity is an intrinsic responsibility of employers of researchers and should not be delegated. UKRIO Ltd. agrees entirely with the view that employers have the primary responsibility for the conduct of their researchers and for research carried out under their auspices. However, to suggest that employers delegate such responsibilities to UKRIO Ltd. shows a misunderstanding of our work and the reasons for our creation.

5. UKRIO was established by a consortium of funders to support employers of researchers. That is, to support the institutions which are legally responsible for resolving most issues of research conduct. We have never proposed that employers should delegate their responsibilities to us; instead we provide independent and expert advice on how they might fulfil them. The advice and guidance we offer is not mandatory. It reflects best practice in the conduct of research and addressing misconduct. This method of support has been welcomed: our published guidance has been adopted or otherwise used by many research organisations, including by over fifty universities, while in 2010 alone we helped with more than 60 cases (over one a week). It is evident that employers, well aware of their legal responsibilities for research integrity, are willing to come forward and seek guidance from UKRIO Ltd. when they need it.

6. It is not surprising that research funders say that UKRIO has not delivered an assurance mechanism on their behalf. It was never created to perform such a function, which has remained the responsibility of funding bodies. Rather, UKRIO was created to fill a gap in support to employers, to researchers and to the public. This has been achieved. I would argue that UKRIO Ltd. does indirectly support the work of research funders by promoting and improving research integrity in the organisations in receipt of their funds. It is regrettable that this was not acknowledged.

7. Organisations which provide funds for research must of course satisfy themselves that those funds are used appropriately. They have the power to operate appropriate assurance mechanisms through the terms and conditions of their grants and awards. UKRIO Ltd. welcomes efforts to streamline and harmonise such mechanisms, to ensure clear and proportionate guidance for the research community and avoid duplication of effort. We remain willing to contribute to the development of initiatives such as the proposed Concordat, which could benefit from our considerable expertise and unique practical experience. We agree that assurance and advisory functions must remain separate but that does not weaken the case for drawing on a common repository of skills and information.

8. Regardless of the assurance mechanisms used by research funders, employers, researchers and the public still need wider support on issues of research integrity, support which UKRIO Ltd. will continue to provide. Both the sponsors who created UKRIO and the UK Research Integrity Futures Working Group concluded that only an independent advisory body could win trust and successfully offer confidential and expert support to institutions, researchers and the public. In today's economic climate, it is unlikely that any other organisation will take forward the recommendations of the Working Group and provide an advisory service on issues of research conduct. While we recognise that none of the organisations concerned would have made such a decision lightly or willingly, this will leave the UK research community and the public in danger of having insufficient support on matters of research integrity and risks damaging our national reputation.

9. UKRIO Ltd. is therefore convinced that it must continue. The cost is modest compared with the much more ambitious plans that some stakeholders had envisaged as necessary for a research integrity body and are minimal compared to the damage from research misconduct and poor practice. UKRIO Ltd. operates very cheaply and cost-effectively, with a very small staff backed by a Board and a register of expert advisers, both of which work *pro bono*.

10. We welcome the initiatives being undertaken by research funders to support research integrity. Theirs is a valuable perspective, alongside those of Government, statutory regulators, employers in the higher education, NHS and private sectors, research charities, learned societies, professional organisations, specialist bodies such as UKRIO Ltd. and, not least, researchers, research participants and the public. All have an important contribution to make in support of research integrity. In particular, I feel it would be unfortunate if the unique experience, expertise and data massed by UKRIO since its creation were not drawn upon by others to inform initiatives in this field.

11. How research integrity might best be supported in the UK has been the subject of considerable discussion over many years. As you know, UKRIO was established as a result of such discussions. It is clear that researchers and those personnel who deal with issues of good practice and misconduct on behalf of their organisation value being able to seek our advice. They have welcomed the establishment of UKRIO, as shown by the continuing rise in the use of our services. We would not be approached for assistance if we were not needed. Discussions will undoubtedly continue on how other bodies might support research integrity and we remain ready to inform and participate in this process. Meanwhile, UKRIO Ltd. will continue to raise the profile of good practice in research and address misconduct. Our significant achievements to date in identifying and responding to concerns about research integrity provide the foundation for UKRIO Ltd. to continue to provide a much-needed service.

Professor Sir Ian Kennedy,
Chair, UK Research Integrity Office

June 2011

Written evidence submitted by The Academy of Medical Sciences (PR 89)

Summary

- The Academy of Medical Sciences believes that peer review is required to quality assure scientific publications, to the benefit of all those who use them. It helps to generate trust and consistent standards in science.
- The physical sciences communities have adopted a model of pre-publication community peer review. We believe that some level of peer review before publication is essential in the biomedical sciences because of the more subjective and open ended nature of the research.
- The desire to maintain impact factors, to reduce print production costs and the conservative attitudes of some journals can increase the rejection rates of papers. Researchers may have to approach a number of journals before a paper is accepted.
- High rejection rates and the requirement for unnecessary revisions before publication delay access to the outcomes of publicly and charity funded science and waste the time of researchers. Ultimately they slow the progression of science.
- We welcome models that use peer review simply to assess the validity of the scientific approach taken rather than its potential impact—resulting in a faster rate of publication. To identify the likely high impact papers, post-filtering mechanisms such as the *Faculty of 1000* are helpful to researchers and other users of scientific knowledge.
- Digitisation of scientific publication has facilitated greater use of, and access to, peer reviewed science. It has also created easier and quicker automated systems for both the submitting authors and the reviewers. Online tools for reference checking, plagiarism monitoring and figure enhancement provide new ways to monitor unethical behaviour.

Introduction

The Academy of Medical Sciences welcomes the opportunity to respond to the Select Committee's inquiry. The Academy is the independent body in the UK representing medical science that promotes the advances of medical research and campaigns to ensure these are converted into healthcare benefits for society. Progression of scientific knowledge in all science, including medical science, is dependent on maintaining a firm foundation of information on which future scientists can base their research. Similarly, public trust and comprehension of science are better justified by a system whereby data and scientific ideas have been formally scrutinised and subsequently endorsed. Peer review of primary research is essential to both these goals.

Peer review is used to assess research for quality and potential impact (normally by the journal to which it has been submitted). It is initially viewed by the journal editors who can decide to reject the paper outright or send it on to review, based on the relevance of the manuscript's content to the journal's scope and on its potential impact. If sent to peer review then experts in the field will review the contents of the paper and can either: accept it in its current form; reject it; or send it back to the authors for further revision and/or experimentation. In the latter case, the paper is re-reviewed to decide on final publication or rejection.

Other models of publication use post-publication peer review as part of a traditional journal or a repository. Additional variations include the identification of peer reviewers and the publication of reviews alongside papers.

Peer review is a vital tool in the process of scientific publication and is ultimately beneficial to both the scientific community and the public. However, as we outline in this response, which addresses each of the issues raised by the Committee in turn, the current system can, and should, be improved to increase the speed of the dissemination of scientific knowledge.

1. *The strengths and weaknesses of peer review as a quality control mechanism for scientists, publishers and the public*

The key strength of peer review is that it helps to ensure that weak research is not endorsed through publication in recognised journals. In this digital age where new information can be disseminated very easily, peer review acts as an important filter or "kite mark" to differentiate between research that has reached an acceptable scientific standard and that which has not. This is particularly important in the biomedical field where research is of great interest to many non-scientists. The peer review process can be important in improving a paper before publication but, as we outline below, it can also unnecessarily delay the rate at which new knowledge becomes available.

Scholarly journals use peer review to assess three main features of potential papers:

- The quality of the research carried out.
- The potential impact of the study.
- The relevance of the research to the remit of the journal.

Peer review is the traditional method of regulating scientific publication and requires the knowledge of experienced experts to scrutinise scientific work. Journals vary in nature, for example by the breadth of their remit. The status of any particular journal depends on its impact factor, a measure of the impact its published studies have on science. The various scientific disciplines use slightly different forms of peer review (see section 5). High impact journals are characterised by having a high rejection rate, only publishing what they regard to be the highest impact research.

Publication prestige and quality control for researchers, publishers and the public

There is increasing pressure on researchers to publish in high impact journals such as *Nature* and *Science*. A strong publication record is a key determinant in the allocation of grant funding both to individual researchers and to their universities via processes such as the Research Excellence Framework (formerly the Research Assessment Exercise). This has focused attention on how peer review operates, particularly in high impact journals. Further, the scrutiny offered by the peer review process helps to ensure only scientifically sound work is published, providing a reliable body of information that can be used by other researchers. This also allows publishers to maintain consistent quality and scope of the articles published, justifying subscription costs.

Effective peer review is vital in ensuring that the information subsequently used in the public and policy-making domains, is accountable and trustworthy. Thus peer review can help guarantee that knowledge and ideas derived via appropriate scientific methodology are made available to wider circles of society. Science has also become a stronger part of public culture. Whereas previously peer review would occur in the context of communication between scientists, journals must now consider how new work will be received in a public setting. Concerns have been raised that this could influence the timing of publication of work that may have a public impact (or whether to publish at all) and prevent potentially important findings being scrutinised, and the experiments replicated.

Current publishing models can create a risk-averse publishing environment that can delay progression of scientific knowledge and lead to wasted research time and money

To justify subscription costs and maintain prestige, there is increasing pressure on journals to preserve or improve their impact factor. This in turn places strain on publishers and peer reviewers to raise the rejection rate of papers, effectively leading to greater exclusivity of the work published. In addition, there is an incentive to limit print production costs of hard copies by reducing the numbers of papers published.

We welcome the fact that some journals have a Fast Track review and publication process but ultimately, increased rejection rates and conservative attitudes can delay publication of valid research, which can hamper progress across disciplines. After rejection from one journal, submission to another journal requires not only reformatting of the manuscript, but instigation of an entirely new round of peer review. Even if the research is eventually published, this wastes research time and money and can delay the availability of the findings to the scientists. The behaviour of peer reviewers who may require revisions that are of tangential importance can also contribute to unnecessary time delays associated with publication of research (see below). Many papers will be published eventually and delays attributed to the peer review process can sometimes be beneficial in clarifying a piece of research before publication. However in some of the biomedical disciplines, the delay between submitting a valid scientific paper to the first choice journal and having it published (perhaps in the second or third choice of journal) is causing major concern.

The role of reviewers

Peer review depends on the experts involved having the experience and knowledge to critically appraise scientific research. However, reviewing manuscripts is time-consuming, which can result in delegation of reviewing duties to less senior colleagues, for example post-doctoral researchers. Younger reviewers, perhaps due to positions of less seniority, spend on average more time reviewing a manuscript which can result in a more thorough appraisal of the work.[57] If supervised, this can also be a useful training opportunity for the junior researcher. However, without moderation by the original reviewer it can result in requests for unnecessary additional data or revisions that may be superfluous to the key theme of the study.

Unnecessary changes delay access to new information for scientists and the public and they waste the time and funds of researchers, which is especially detrimental insofar as a significant amount of research is directly (through charitable organisations) or indirectly (through taxation) funded by the public.

Traditionally, the peer review process is a closed system, where the reviewer's identity remains anonymous. This raises the possibility of unfair treatment from competitors and potentially the "theft" of ideas, but does allow reviewers to give their honest opinion about a paper without fear of repercussions. Journals, such as the *British Medical Journal* have adopted an open system, whereby the reviewer's details are made available to authors and the *European Molecular Biology Organisation* (*EMBO)* journal publishes reviewer comments in conjunction with the publication of the paper.[58,59] One randomised study has shown that reviewers that were identified provided reviews that were of higher quality but took longer to complete than unsigned reviews.[60] Reviewers who were identified were more likely to recommend publication.[61]

2. *Measures to strengthen peer review*

We believe that pre-publication peer review is the most appropriate method of quality assuring scientific knowledge in the biomedical sciences, although as outlined earlier, the practices of some journals can create delays to the progress of research. One possible method to improve and strengthen how peer review is utilised is to prioritise the quality of the research as the key determinant for publication rather than its perceived impact. This could facilitate quicker access to new knowledge, while still preventing poor science being published.

Public Library of Science ONE journal approach

An example of a system where peer review places emphasis on research validity over potential impact is that taken by the *Public Library of Science ONE* (*PLoS ONE*) journal (also mentioned in section 8). In principle, any manuscript submitted that presents valid research will be published, with less emphasis on the potential impact of the paper during the peer review process. Initially, many researchers used *PLoS ONE* as a final resort to ensure their work was published somewhere (after previous rejections), but the process undertaken by the journals can result in quicker submission to publication times and more researchers are turning to *PLoS ONE* as a first or second port of call for publication to avoid delays.[62]

The *PLoS* family of journals (along with an increasing number of other journals) also use an open access model where authors pay publication costs, including those incurred from the peer review process and the papers are free to access from the date of publication. This also speeds the rate of access to new knowledge.

3. *The value and use of peer reviewed science on advancing and testing scientific knowledge*

Scientific peer review performs vital roles in both advancing and testing scientific knowledge. If all data were released in a way that did not involve scrutiny, then the onus would fall to the reader to judge the relevance of the work. While some may have the knowledge and capability to do this, many do not, and peer review ensures the services of experts who can carry out these roles. This ultimately results in a solid body of information on which junior scientists can base their own work.

4. *The value and use of peer reviewed science in informing public debate*

As highlighted in section 1, peer review is vital in informing public debate. Journals having access to reviewers who are deemed experts in the field means they can create a "kite mark" of quality associated with the papers they are publishing. This in turn is helpful in informing public trust and reliability of the particular journal and the work contained therein. Work that is released in to the public domain without some level of quality assurance could potentially lead to situations where imperfect or incorrect science is used by the media and others. Ultimately this could be detrimental to the public's overall trust in research. As highlighted above, this is perhaps the most important role of peer review.

[57] Publication Research Consortium (2008). *Peer review in scholarly journals: Perspectives of the scholarly community—an international study.* http://www.publishingresearch.net/documents/PeerReviewFullPRCReport-final.pdf

[58] See: http://resources.bmj.com/bmj/authors/peer-review-process

[59] See: http://blogs.nature.com/peer-to-peer/2009/01/embo_journal_introduces_transp_1.html

[60] Research Information Network (2010). *Peer review: A guide for researchers.* http://www.rin.ac.uk/our-work/communicating-and-disseminating-research/peer-review-guide-researchers

[61] Walsh E *et al*. (2000). *Open peer review: A randomised controlled trial.* The British Journal of Psychiatry **176**, 47–51.

[62] See: http://www.plosone.org/static/information.action

5. *The extent to which peer review varies between scientific disciplines and between countries across the world*

Variation of peer review on the global stage

Science is a global endeavour with an increasing number of multi-national collaborations. At one level, the country from which the research originates should have little bearing on the peer review process. However countries vary in terms of the conditions under which research is conducted (eg the facilities and funding available) and journals need to decide whether to vary their measurements of quality accordingly if they are to take account of local conditions.

Variation of peer review between disciplines

The physical sciences have been quick to adopt newer systems for dissemination that use post-publication, rather than pre-publication, peer review. For example, the database arXiv acts as an online repository for pre-prints of papers in the physical and mathematical fields.[63] Here authors submit original manuscripts to the repository and anyone can view and comment on the work. Authors can subsequently use this information to further improve and modify the paper before submission to the peer review process. Moderators monitor the discussion of each submission to ensure comments do not go "off topic" and all comments and discussions are open and transparent.[64] More formal "Hybrid Peer Review" systems exist whereby the journals themselves provide the open forum for community discussion before sending papers off to traditional anonymous peer review for that specific journal.[65,66] This method is utilised by *The Journal of Atmospheric Chemistry and Physics*.

We feel that approaches that involve the initial publication of papers without peer review in an open forum are less appropriate for biomedical research. In the physical and mathematical sciences studies are more likely to present a finding that will be fundamentally right or wrong. However more subjectivity exists in biomedical research where differing and often competing experimental systems and approaches are used to answer the same questions, creating greater scope for "incorrect" or differing results. The dissemination of non-peer reviewed information, for example about medical research, to the public domain could potentially be unhelpful. Hybrid systems and those that "kite mark" the final, accepted, version of the paper address some of our concerns but the process as a whole may result in a delay in overall publication times.

6. *The processes by which reviewers with requisite skills and knowledge are identified, in particular as the volume of multi-disciplinary research increases*

Identification of reviewers with requisite skills

Peer reviewers are generally experts in their field and thus have the requisite knowledge to review a paper from that subject area. It has been proposed that perhaps, with the author's permission, reviewers can use the manuscript as part of a group discussion with other members of their laboratory or department, in a similar manner to the universal journal club, where papers that have already been published are presented at a laboratory or departmental level.[67] This can be helpful providing (as outlined in section 1) that it does not result in authors being asked to make unnecessary changes to their manuscript. We can see this approach as being particularly beneficial in contributing to some of the post-publication filtering methods (see section 8).

Identification of suitable reviewers for multi-disciplinary research

Multi-disciplinary studies can be potentially problematic to the standard peer review system. Several approaches may be required to ensure fair treatment of these types of study, especially as they become increasingly utilised to address research problems.[68] Each domain of the submitted work must be scrutinised to the same degree, which increases the complexity of the peer review process.

It has been suggested that in the future, official review groups could be set up to act as excellence centres that could review emerging multi-disciplinary studies. Authors would have to submit their work under the knowledge that their research may be reviewed by peer group as opposed to a single reviewer. Or, less formally, a single peer reviewer could be selected with the knowledge that they may select someone they feel could help them review the research.[69] Ultimately peer review needs to adapt to changes in the way that scientific research is conducted.

[63] See: http://arxiv.org/

[64] House of Commons Science and Technology Committee (2004). *Scientific Publications: Free for all?* http://www.publications.parliament.uk/pa/cm200304/cmselect/cmsctech/399/399.pdf

[65] Koop T & Pschl U (2006). *Systems: An open, two-stage peer review journal.* http://www.nature.com/nature/peerreview/debate/nature04988.html

[66] Bloom T (2006). *Systems: Online frontiers of the peer reviewed literature*. http://www.nature.com/nature/peerreview/debate/nature05030.html

[67] Lahiri D (2006). *Perspective: The case for group review.* http://www.nature.com/nature/peerreview/debate/nature05033.html

[68] Lee C (2006). *Perspective: Peer review of interdisciplinary scientific papers.* http://www.nature.com/nature/peerreview/debate/nature05034.html

[69] Lahiri D (2006). *Perspective: The case for group review.* http://www.nature.com/nature/peerreview/debate/nature05033.html

7. *The impact of IT and greater use of online resources on the peer review process*

As with many aspects of science, digitisation has improved how peer review can be conducted—simplifying and quickening the process. With the majority of reputable journals publishing online as well as in hard copy, new models of peer review can emerge due to reduced pressure on number of pages per paper or issue—the main limiting factor in hard copy publication. Indeed, all the aforementioned models and further models discussed in section 8 utilise and are reliant, sometimes entirely, on online resources.[70]

Impact on the peer review process

Digitisation of submission, tracking and reviewing of research papers has in some ways hastened the speed of peer review with many journals using online pro-forma both for authors to submit their work and for reviewers to access and submit their comments and decisions.[70] It is also now easier for reviewers to substantiate the author's claims and detect breaches of ethical behaviour.

Online anti-plagiarism programmes for the ethical misuse of text, or similar programmes for detecting digitally modified figures, are routinely available.[71] Overall therefore, the increased use of online resources aids in raising confidence levels in the reviewers and in the peer review process, which can also contribute to the ability to carry out "light-touch" peer review such as that described for the *PLoS ONE* journal.

8. *Possible alternatives to peer review*

The Academy believes that some form of pre-publication peer review is a key requirement for any trustworthy and valid system for scrutinising scientific publication, particularly as interest in results from those outside the scientific community increases. The example described in section 2, *PLoS ONE* model, represents a variation on the traditional peer review model—with quality and validity of the research carried out taking precedence over expected impact of studies. While one criticism of this approach is the risk of flooding journals with reams of mediocre studies, with no "pre-filtering" on the perceived impact of the study, some modern "post-filtering" approaches can, and are, fulfilling this requirement.[72]

For example, the *Faculty of 1000* (*F1000*) is a dedicated post-publication peer review format by experts, who are elected by peers to determine the paper's impact (as opposed to the journal's impact factor), generating an "F1000 Article Factor" (FFa).[73,74] A post-filter mechanism like this can identify the most significant papers more quickly than more accurate impact measures such as citation indices. While post-publication filters are subjective estimates of the likely impact of papers, they are helpful when the speed of publication and the number of papers being published is increasing.

While we believe that "peer community" discussions of papers prior to publication are not appropriate to biomedical research (see section 5), post publication community review could also be a potential post-filter mechanism to estimate the impact of papers published through organisations such as *PLoS*. A so-called "Amazon-like" process where, like the Amazon website, readers' reviews can generate a collective opinion on the research presented, although we are not aware of a working example of this type of post-filtering.[75]

The Academy of Medical Sciences

The Academy of Medical Sciences promotes advances in medical science and campaigns to ensure these are converted into healthcare benefits for society. Our Fellows are the UK's leading medical scientists from hospitals and general practice, academia, industry and the public service.

The Academy seeks to play a pivotal role in determining the future of medical science in the UK, and the benefits that society will enjoy in years to come. We champion the UK's strengths in medical science, promote careers and capacity building, encourage the implementation of new ideas and solutions—often through novel partnerships—and help to remove barriers to progress.

The Academy's Officers are:

Professor Sir John Bell FRS HonFREng PMedSci (President); Professor Patrick Sissons.

FMedSci (Vice-President); Professor Ronald Laskey CBE FRS FMedSci (Vice-President).

Professor Robert Souhami CBE FMedSci (Foreign Secretary); Professor Susan Iversen CBE.

[70] Bloom T (2006). *Systems: Online frontiers of the peer reviewed literature*. http://www.nature.com/nature/peerreview/debate/nature05030.html

[71] Benos D (2006). *Ethics: Detecting misconduct.* http://www.nature.com/nature/peerreview/debate/nature04996.html

[72] Bloom T (2006). *Systems: Online frontiers of the peer reviewed literature*. http://www.nature.com/nature/peerreview/debate/nature05030.html

[73] See: http://f1000.com/about/whatis

[74] Jennings C (2006). *Quality and Value: The true purpose of peer review.* http://www.nature.com/nature/peerreview/debate/nature05032.html

[75] Arms W (2006). *Ethics: Trust and reputation on the web.* http://www.nature.com/nature/peerreview/debate/nature05035.html

FMedSci (Treasurer); Professor Patrick Maxwell FMedSci (Registrar).

17 March 2011

Written evidence submitted by Dr Andrew Sugden, Deputy Editor & International Managing Editor, Science (PR 91)

1. Peer-reviewed scientific publications represent the primary useful archive of scientific progress. Scientific publications have served other main functions as well: They are a primary means of evaluating scientists and institutions, and they have become a main pathway for informing the general public about science, through coverage in the media and press releases (new results are news). Peer-reviewed publications are also now relied upon in official and legal affairs: In the U.S., the Supreme Court codified the use of peer-reviewed publications in the courtroom, and several acts of Congress have codified their use in government regulations. Many advisory groups rely on, and/or are mandated to use, the peer-reviewed literature. Thus scientific publishers recognize that one of their major responsibilities is ensuring and enhancing the integrity of journal publications for these diverse uses.

2. *Science* magazine's remit is to publish research papers with high conceptual novelty and broad interest, in all disciplines of science, both physical and biological. Science is a weekly publication, and the number of research papers we publish is small—typically about 18 in each issue. We place strict limits on the length of papers, and aim to publish expediently. *Science* is currently the world's widest-circulation general science journal, with a global subscriber base of 130,000 with many more readers accessing the journal online via institutional site licenses. Hence, the number of submissions of research papers from scientists is high, and we can accept few of them for publication: fewer than 10% of submissions are published. Science's editorial workflow and review process are designed to facilitate high-quality choice.

3. The responsibility for managing the peer review process and for making decisions on rejection/revision/acceptance of submissions for publication rests with the staff editors. Staff editors at *Science* are PhD-qualified scientists with postdoctoral research experience (and in some cases subsequent experience as professional editors at other journals). Editors are appointed to Science primarily on the basis of the strength of their research record, and their task is to represent a particular discipline (chemistry, astronomy, immunology, ecology etc) and handle the submissions in that discipline. Editors work in teams of four or five, and *Science's* working practice is that all such decisions are made in consultation with at least one other staff colleague via a common electronic database containing all manuscript records. There is some overlap in expertise between editors, which ensures that no decision need be made in isolation, but also leads to consistency in decision-making. The editorial staff is managed by the Executive Editor, reporting to the Editor-in-Chief who is a senior research scientist appointed by the AAAS Board.

4. *Science* has a 2-stage review process for submitted manuscripts. The first stage is primarily a filter, designed to identify the 25% potentially most innovative and original submissions, which, if correct, would qualify for publication in *Science*. This initial process takes an average of 7 days, which allows authors of solid papers that we deem inappropriate for *Science* to remain competitive at other journals. This stage is carried out through consultation with the Science's Board of 150 Reviewing Editors. Submissions may be sent to one or more Board members, depending on the discipline or disciplines represented. A typical evaluation from a Board member consists of a paragraph of explanation, a score on a rating of 1–10, a rating of the Board member's judgement of his/her own confidence in the score, and (if the submission is being recommended for in-depth peer review) suggestions for appropriate referees. The evaluation is designed to assess the potential scientific importance of each submission rather than to assess its technical qualities in any detail. The staff editor then decides, on the basis of this advice received, whether to proceed to in-depth peer review (see below) or to reject the paper. In keeping with the purpose of this first stage of selection, there is no precisely-defined threshold score required for this editorial decision, which occurs after an average of seven days. When authors are notified of the decision to reject or review at the end of this first stage, the identity and views of the Board member(s) involved remain confidential.

5. Why does *Science* not send more (or all) submissions for in-depth review? The number of manuscripts submitted exceeds the number published by more than a factor of 10. Hence, reviewing a larger proportion would be a hindrance to all parties: authors would suffer delays in finding an alternative journal in which to publish; referees would be spending time reviewing submissions that have a high likelihood of being rejected; the attention of editorial staff would be diverted from those submissions with the highest promise.

6. The Board of Reviewing Editors consists of c. 170 individuals from 20 countries, appointed by the staff editors to represent the spread of subdisciplines across the sciences. They are mostly mid-career active research scientists with a strong record in their respective fields. On appointment, which is usually for three to five years, each Board member agrees to evaluate up to six *Science* submissions per week. The Board's role is purely advisory. Members are not expected to do in depth review or decide the fate of submissions, but may occasionally be consulted by staff editors at later stages of peer review (see below) and on appeals (see below). *Science's* view is that the involvement of the Board at the first stage of review is an important element in the effort to maintain editorial consistency, and it substantially improves the research community's confidence in the fairness of the initial cut.

7. The second stage of review, for the 25% of submissions not rejected at the first stage, is in-depth review by peers. Referees are selected by the staff editor based mainly on the editor's own knowledge of researchers in the field(s) of the submission, plus suggestions from the Board. At the time of submission, authors are asked to submit their own nominations for referees, and staff editors will occasionally follow these nominations where they coincide with the Board's and/or their own suggestions. We also encourage authors to tell us if they believe that certain individuals have conflicts of interest and should not be consulted as reviewers. The number of referees varies depending on the scope of the submission. The minimum is two, but three or more are frequently used, especially where a submission is multidisciplinary and/or combines a number of components/ techniques requiring input from individuals with special expertise. *Science's* editors always seek referees' agreement to review a manuscript before it is sent to them; the referees are asked to return their reviews within two weeks.

8. The role of referees at the in-depth stage of review is typical of that followed at most scientific journals. Referees are asked to assess the technical merits and integrity of the submission, and to recommend improvements and revisions that should be made before the submission can be considered acceptable. In our view, the role of a properly-operating peer review system is to maximise the quality of the published account of any piece of research, within it own limits, regardless of where it is ultimately published. Thus, we expect referees to make detailed recommendations regardless of whether they consider the submission ultimately suitable for our journal. Even if the submission is rejected by *Science* on the basis of in-depth peer review, the referees' comments will generally be helpful to authors in revising the manuscript for submission to a different journal. As a result of the peer review process, many submissions are improved, and improved substantially. Errors are caught (though not always), uncertainties are clarified; standards are met, and even hypotheses can be changed or strengthened. Not all good ideas get delayed through rejection; many become better and stronger.

9. Peer review, as a system for maintaining the integrity of scientific research and improving the quality of published research, inevitably relies on trust in the integrity and reliability of the scientists and editors tasked with carrying it out. It is not a 100% safeguard against clever fraud, but in the great majority of cases it can be relied upon to fulfil its goal of minimizing the propagation of errors. Nonetheless, not every error is caught, and Science and other journals will publish corrections and clarifications when necessary: in the past decade, about 8% of papers have been corrected; in most cases, these corrections affect matters of detail but not the major conclusions of the work. Severe cases that require complete retraction of a paper are much rarer: over the past decade 0.4% of Science papers have been retracted.

10. In addition to their written report on the submission that will be provided to the authors, referees are asked to rate the manuscript as either Excellent & Exciting, Above Average, Too Specialized, or Mediocre/ Poor, as well as to recommend whether the submission should be published without delay, published after minor revision, re-reviewed or rejected. The referees are also given the opportunity to provide confidential comments to the editor.

11. The length of the in-depth review process is generally longer and more variable than that of the initial screening described above. The average time for a round of review for a *Science* submission is currently about three weeks, but may vary depending on the complexity or urgency of the material under review.

12. In-depth review does not always lead to a straightforward decision for the staff editor. Referees may differ as to the technical quality or potential significance of a submission. Experience shows that the editor is often best advised to follow the more critical opinion in such cases, whether in deciding to reject the submission or in asking for revision. However, our editors are urged to use their own judgement in this regard. In some cases, editors will send a revised submission back to referees (or sometimes new referees) for further checking, especially if the revision contains new material (data, experiments) that was not present in the first version of the submission. At this stage, referees will usually be shown the reports of the other referee(s) and will be asked to assess how the author has responded to all the recommendations. A third round of re-review is rare: generally, the final decision on rejection or acceptance will be taken no later than the second round of review.

13. *Science's* policy is to maintain the anonymity of referees in all communication with authors; their reports are unsigned. Although we recognise that the identity of some can be evident from the text of their reports, *Science's* view is that anonymity gives us access to the widest possible pool of referees, for example those who may be at an early stage of their careers relative to the author of a submission. However, referees are not blinded to the identity of the authors, in common with practice at the majority of other journals.

14. We recognise the potential for conflicts of interests in the review process. Hence, we allow authors to request that their manuscript not be sent to particular individuals who might be competitors or where there is other reason to suspect the potential for bias or unfair review. Editors are also expected to be alert to potential abuse of this facility on the part of authors, through their knowledge of the research groups involved. We also ask our referees to return or destroy the manuscript without review if they find a conflict of interest or other reason preventing them from reviewing a manuscript in a timely and fair fashion.

15. In common with other journals, *Science* does not offer any payment for peer review (though the Board of Reviewing Editors receive an honorarium of a subscription to the journal). Payment would be inimical to the process, yet it is also the case that scientists do not routinely receive the recognition that might be expected for the work that they put into reviewing journal submissions. For example, institutions could recognise peer reviewing activities when assessing a scientist's job application or promotional prospects.

16. A small percentage of rejection decisions are appealed by authors. For a submission to be reconsidered after a rejection at the first stage, editors need to be convinced that the author has brought some pertinent new information to the table that the editors were not aware of at the time of the rejection. (Disagreement over the degree of novelty or general interest is not enough). For a submission to be reconsidered after a rejection following in-depth review, the editors need to be convinced that the major mistakes were made in the peer-review process, and that the rejection was based on these mistakes. A small proportion of submissions are reconsidered on appeal, and of these even fewer are eventually accepted for publication following further review.

17. In our experience, the quality of reports from referees is high in most cases, in that they provide pertinent feedback on the key elements of a manuscript and on the importance of the research reported. Nonetheless, we find some reports to be less than ideal in length, detail and focus. Brief reports consisting of a single short paragraph are very rarely adequate for conveying the basis of a decision (whether negative or positive) to an author, yet such reports are sometimes received, and quite often from senior and established scientists. The opposite—reports of excessive length and detail—can also be an occasional problem. And it is not unknown for referees to use inappropriately emotive or forceful language (generally we only edit this out when it is particularly or egregiously offensive).

18. A common complaint is that referees ask for unnecessary extra details and further experiment before a submission is accepted for publication. All research is part of a wider work-in-progress, and progress is facilitated by publishing rather than withholding. Publication is part of the ongoing scientific process, not the end of the road. Hence, while such requests for further work are often legitimate, referees and editors need to be able to recognise when a piece of work is complete within its own goals and frame of reference. We want our editors to consult with each other in making the final decision on this important, quite frequently encountered, issue.

19. Anecdotal evidence suggests that there is wide variation in the training that early-career scientists (graduate students, postdoctoral associates) receive in peer review. Most such training is largely ad hoc and informal, dependent on the input of the supervisor or other senior colleagues. Institution-wide principles for practice and training in peer review are not yet the norm. We would recommend that journal editors and academies work together to produce guiding principles for the peer review process that can be adopted and used for instruction at the institutional level.

20. The chief challenge in the peer review process is the time available for referees. For an editor, the process of finding referees can be time-consuming—not only identifying the appropriate individuals but also sometimes contacting a large number of individuals before finding enough referees willing and able to assess a submission. For referees, assessing a journal submission in the right amount of detail and at the right level involves more than simply reading and commenting on the manuscript and preparing a report. It can involve recalculating results presented in the work, checking citations (including relevant literature not cited), and otherwise checking experiments and analyses reported in the work in order to verify the conclusions. Effective peer review will generally take anywhere from several hours to several days of full-time work. Hence, an editor's first or second choice may well decline to review if other commitments are too pressing.

21. Editors may become understandably biased in favour of using tried-and-tested referees who are known to be reliable and efficient and understanding of the particular requirements of the editor's journal. This is not in itself a threat to the integrity of the peer review process, but it can become a limit to the size of the potential pool of referees as well as placing a disproportionate burden on a relatively small number of individuals.

22. Multiple rounds of review can constitute a further problem for the peer review process. As noted above, Science will generally limit the number of rounds of review to a maximum of two, and this is common practice at many other journals. However, a manuscript may be reviewed several more times at several different journals before it eventually finds a home, sometimes by the same referee more than once. Recognising that this is a further drain on the system, *Science* and other journals have considered sharing referees' reports when a manuscript is submitted to a second or third journal following rejection from the authors' first choice. However, there are several obstacles to such a system, including for example referee anonymity and different editorial policies at different journals.

23. Multidisciplinarity is a potential pitfall for peer review, requiring extra vigilance on the part of editors to ensure that referees are chosen to cover all the main areas of research that are represented in a submission. There is an increasing amount of contemporary research at the interface of biological and physical sciences (for example, in computational biology or climate change biology), and editors need to be able to recognise the appropriate contributory elements in such cases. Sometimes this means that more than three referees will be needed to adequately review a paper. There has also been a perennial difficulty in reviewing the statistical components of research, where editors and referees are not always qualified in the statistical techniques that have been used in a research project.

24. There may be procedural differences in peer review between disciplines (for instance, in physics research is made available to readers through preprint servers) but the principles of peer review as a mechanism for improving and maintaining standards in published research are very similar across all disciplines. Where the peer review process becomes harder is in disciplines that are small, with few experts qualified to comment on submissions, or few without conflicts of interest of some kind.

25. The mobility of scientists, especially younger scientists, coupled with the growth of international collaboration in science and the ease of access to published research via the WWW, means that any national differences in cultural or scientific traditions have become increasingly irrelevant in the context of peer review. National biases in peer review may have been present in the past, because journals have generally been nationally based and hence scientists' work would tend to be reviewed by peers in their own country. The increasing internationalization of research, coupled with the ease of e-communication, will have contributed to the reliability and rigour of peer review in the past two decades. At Science, we have made efforts to ensure that the overall geographical distribution of referees reflects the global nature of the scientific enterprise.

26. Clearly the impact of information technology has been all-pervasive in science. For peer review, the impact of IT and online resources has been mainly on the efficiency of the process, and not on the underlying principle of peer review (though it has also enabled the exploration of new models or variations on the theme of peer review). E-communication has improved the speed of communication (especially international communication) between editors, referees and authors. It has enabled editors to research a broader range of potential referees for individual submissions, and perhaps has enabled referees to better research the background to the submissions they are asked to review. Electronic submission systems have reduced authors' concerns about the cost and time-lost when submitting to journals with the end result of authors submitting to top journals even when the chance of acceptance is very slim.

27. *Science* began featuring supporting online material in the late 1990s (we went online in 1996). Today, most papers (>95%) in *Science* include an online supplement that describes methods and additional data, and some of these supplements are huge in terms of pages and data. This is also the case for many other journals. While there are obvious advantages to supplying the background data to the reader, these supplements are posing growing problems for peer review. Review of a supplement that is many times the size of the submitted text is a burden to reviewers and hinders requests for rapid consideration. It also raises concerns about the quality of peer review. These issues probably can't be avoided, but standards for reporting and presenting large data sets that allow common analysis tools could help greatly. An additional challenge is providing confidential access to large or complex datasets during review. Currently no databases allow secure posting for the purposes of peer-review, and some authors are unwilling to release data prior to publication. We are in some cases sending data, including large data files, separately to reviewers, but this poses an increasing administrative burden. Raw data for some papers in several fields are too large to transmit, and in some cases special software may be required.

28. Notwithstanding the pitfalls of the peer review system outlined above, *Science* maintains (in common with other scientific journals) that it will remain the primary means of validating research for publication. Recognition of the potential pitfalls is the key to ensuring that the system works well, and that errors and poor scientific practices are minimized.

Dr Andrew Sugden
International Managing Editor and Deputy Editor for Life Science
on behalf of and with contribution from Alan Leshner (Executive Publisher); Bruce Alberts (Editor-in-Chief); Monica Bradford (Executive Editor); Brooks Hanson (Deputy Editor, Physical Science), Barbara Jasny (Deputy Editor, Commentary) (Science, 1200 New York Avenue, Washington DC 20005, USA)

25 March 2011

Appendices

1. Peer Review at *Science* Publications (from guidelines for referees at *Science* website): http://www.sciencemag.org/site/feature/contribinfo/review.xhtml

2. Information for reviewers of Research Articles (from guidleines for referees at *Science* website): http://www.sciencemag.org/site/feature/contribinfo/review.xhtml

3. Reviewing Peer Review: Bruce Alberts, Brooks Hanson, and Katrina L Kelner. Science 4 July 2008: 15. [DOI:10.1126/science.1162115]

APPENDIX 1

(FROM GUIDELINES FOR REFEREES AT SCIENCE WEBSITE)
PEER REVIEW AT SCIENCE PUBLICATIONS

— Peer Review at *Science*
— Peer Review at *Science Signaling*

As a peer reviewer for *Science* magazine, you are part of a valued community. Scientific progress depends on the communication of information that can be trusted, and the peer review process is a vital part of that system.

Only some of the submitted papers are reviewed in depth. For in-depth review, at least two outside referees are consulted. Reviewers are contacted before being sent a paper and are asked to return comments within one to two weeks for most papers. Reviewers may be selected to evaluate separate components of a manuscript. We greatly appreciate the time spent in preparing a review, and will consult you on a revision of a manuscript

only if we believe the paper has been significantly improved but still requires input. The final responsibility for decisions of acceptance or rejection of a submitted manuscript lies with the editor.

Ethical Guidelines for Reviewers

1. Reviews should be objective evaluations of the research. If you cannot judge a paper impartially, you should not accept it for review or you should notify the editor as soon as you appreciate the situation. If you have any professional or financial affiliations that may be perceived as a conflict of interest in reviewing the manuscript, or a history of personal differences with the author(s), you should describe them in your confidential comments.

2. If, as a reviewer, you believe that you are not qualified to evaluate a component of the research, you should inform the editor in your review.

3. Reviews should be constructive and courteous and the reviewer should respect the intellectual independence of the author. The reviewer should avoid personal comments; *Science* reserves the right to edit out comments that will hinder constructive discussion of manuscripts.

4. Just as you wish prompt evaluations of your own research, please return your reviews within the time period specified when you were asked to review the paper. If events will prevent a timely review, it is your responsibility to inform the editor at the time of the request.

5. The review process is conducted anonymously; *Science* never reveals the identity of reviewers to authors. The privacy and anonymity provisions of this process extend to the reviewer, who should not reveal his or her identity to outsiders or members of the press. The review itself will be shared only with the author, and possibly with other reviewers and our Board.

6. The submitted manuscript is a privileged communication and must be treated as a confidential document. Please destroy all copies of the manuscript after review. Please do not share the manuscript with any colleagues without the explicit permission of the editor. Reviewers should not make personal or professional use of the data or interpretations before publication without the authors' specific permission (unless you are writing an editorial or commentary to accompany the article).

7. You should be aware of *Science*'s policies for authors regarding conflict of interest, data availability, and materials sharing. See www.sciencemag.org/about/authors/prep/gen_info.dtl.

Supplementary written evidence submitted by Dr Andrew Sugden, Deputy Editor and International Managing Editor, Science (PR 91a)

1. *In relation to Q144 and Q145 (see transcript), could you send further information from your colleagues as referred to?*

The relevant US supreme court case is Daubert v. Merrell Dow Pharmaceuticals—see http://en.wikipedia.org/wiki/Daubert_standard for some general discussion and a link to the full opinion. I'm told that this has been used pretty heavily since then, including in the Dover decision on evolution. Essentially, the Daubert standard sets the scientific standard for evidence given in court by expert witnesses, such that part of the definition of scientific evidence is that it is based on publication(s) in the peer-reviewed literature. On the face of it this seems a sensible direction, though in the US system it has apparently led in some cases to the exclusion of some types of legitimate evidence from court proceedings (see http://papers.ssrn.com/sol3/papers.cfm?abstract_id=963461, or http://www.defendingscience.org/upload/Daubert-The-Most-Influential-Supreme-Court-Decision-You-ve-Never-Heard-Of-2003.pdf). Difficulties could arise from too rigid a definition of peer review (for instance if scientific evidence in the "grey literature"—gov't reports and so forth—was excluded from the definition). So while I stated in verbal evidence that the system could be useful, clearly there are potential pitfalls in its application.

2. *What training does Science provide for its editors and editorial board members and how often is this refreshed?*

Our editors are trained and mentored on the job by their more senior and established colleagues. They are appointed largely on the basis of their scientific experience and credentials, and so their training at Science magazine is focused on the workflow procedures for manuscript handling and peer review, and on Science's criteria for selection (see my written evidence). Because all manuscripts are handled through a common electronic system, the work and decision-making of each editor is transparent to the rest of the group, which reinforces common standards of practice and uniformity in scientific standards. New editors are also sometimes encouraged to attend relevant short courses run by bodies such as the Association of Learned & Professional Society publishers. Training is not formally refreshed, because all our editors are in regular communication with each other, and also meet every week as a group. All editors undergo an annual performance appraisal. Members of our Board of Reviewing Editors, who are professional scientists, do not receive any training from us, beyond instruction on the level and method of input we ask of them. They are appointed on the basis of

their established scientific credentials, and in most cases are rotated from their service on the Board after three to five years (ie the Board itself is refreshed).

26 May 2011

Written evidence submitted by Faculty of 1000 (PR 94)

Background

1. Faculty of 1000 Ltd (http://f1000.com) is a post-publication peer review service, which was launched to cover biology in 2002, and then added medicine in 2006. Since then, it has grown to include a Faculty of 10,000 leading researchers and clinicians who have contributed over 100,000 evaluations of 82,000 articles.

2. This submission does not cover existing methods of pre-publication peer review or the issues relating to them, as this has already been extensively covered by previous submissions from our publishing colleagues. Our submission will therefore focus on our experiences in developing a different method of peer review, post-publication peer review, as well as discuss some of our future plans and how they affect the peer review system.

1 The Existing F1000 Evaluation System

3. We define F1000 as a post-publication peer review (PPPR) service because it evaluates already published research. Our Faculties of 10,000 experts across biology and medicine are asked to highlight those publications that they believe to be particularly important, irrespective of where they are published (the majority of our evaluations—86%—are *not* from what are often thought of as the top-tier journals, e.g. *Nature*, *Science*, *Cell*, *NEJM*, *JAMA*, *Lancet*, *BMJ*). Faculty Members are asked to provide a rating (recommended; must read; or exceptional) and then provide a short commentary ("evaluation") on why they believe the article to be so interesting and how it might impact their own research or specialty, and their names are listed against this. These evaluations are effectively short open referee reports and the service acts as a positive filtering service.

4. Multiple Faculty Members can evaluate the same article, providing a combined higher rating, or can write a dissent if they disagree with an existing evaluation. The authors of the article can write a comment in response to the evaluation, and registered users can also write comments.

5. F1000 has also recently launched an open access repository of posters and slide presentations (F1000 Posters). These posters and presentations have been previously displayed at national and international conferences and have therefore already undergone varying levels of review by the conference organisers at the abstract submission stage. Following deposition of these documents into F1000 Posters, F1000's Faculty Members then review them, and again highlight those they believe to be particularly significant.

2 New Peer Review Initiatives at F1000

6. F1000 is in the process of launching F1000 Research, which will provide a novel way of publishing new research findings and will also use PPPR, but in a different way to that discussed above.

2.1 *Submission*

7. Authors will be invited to submit new research finding reports, short papers and full papers to F1000 Research for publication and refereeing. All submissions will be visible immediately on submission, much like a pre-print service. However, it will be made clear that the submission is awaiting refereeing.

2.2 *Refereeing*

8. The refereeing process will take the form of two separate parts.

9. ***Step 1—Quick refereeing.*** Referees will be suggested by the authors largely from the F1000 Faculty (which will naturally expand significantly as a result). Referees will be asked to check that the research "*seems* reasonable", i.e. that the work is well constructed, clear and not misleading, and that the authors are providing adequate analysis and sensible conclusions. In fact, as many previous submissions to this enquiry have discussed, it is almost impossible to ask a referee to do anything beyond that, i.e. to confirm that the research "*is* reasonable" without asking them to recreate the experiments themselves. This quick refereeing process therefore provides a "best value" solution in terms of speed and effort.

10. Importantly, the process will be completely open, meaning all referee names will be openly listed with their affiliations, and all their comments made on the paper will be published.

11. ***Step 2—Broader commenting***. An ongoing relatively open process can then take place where other Faculty referees and registered F1000 users (active scientists) can attach comments, suggestions and questions. Over time, other researchers may comment on the work and these comments may change as perceptions about the work change, particularly as the true significance (or error) of the work may not be recognised immediately. This also enables the inclusion of a "have repeated this work" review, so that when a researcher successfully

repeats the experiment described (or indeed is unable to repeat it), this information can be provided to others as a very powerful PPPR tool.

12. A combination of these two steps will help authors weed out problems and improve on their original submission.

2.3 *Revising*

13. Authors can submit amended versions of the submission at any time, taking into account the comments made during the ongoing refereeing process, with all previous versions of the submission archived but still accessible.

2.4 *Ongoing "threaded publications"*

14. As researchers move forward with their research topics, they can then submit papers on follow-up research findings, which may be a continuation of the previous submitted work. This results in a threaded set of publications as research develops, rather than separate papers in different publications that we have today.

3 The Major Advantages of Early Deposition of Findings followed by PPPR

15. The major advantages are:

— Immediate access to the latest research findings

— Much less heavy workload in the peer review process—only one set of reviews for any one paper (rather than repeated reviewing by different journals as the paper goes down the journal chain), and shorter and simpler requirements for refereeing that more accurately reflect what is possible to achieve through peer review.

16. By operating a completely open process, referees must take responsibility for how they judge the submission. This may also reduce poor-quality submissions from scientists who hope that the refereeing system will sort the work out for them.

17. Further, the ability to deposit research findings in smaller increments—in effect to "plant the flag" on particular topics and methodologies—will encourage earlier conversation regarding the means of inquiry and unfolding results. In addition, data that are deposited at the prepublication stage can immediately be mined for alternative purposes and therein tested via the most rigorous application of peer review.

By Rebecca Lawrence, Director New Product Development, F1000

On behalf of Faculty of 1000 Ltd

Conflict of Interest Statement

Rebecca Lawrence is an employee of Faculty of 1000 Ltd

May 2011

Supplementary written evidence submitted by Faculty of 1000 (PR 94a)

What measures does F1000 take to ensure that evaluations aren't biased? (for example, how do you ensure that they aren't carried out by people too close either professionally or personally to the author?)

F1000 recognises the potential for bias within our systems and we are always working to add new approaches to try and eliminate this as much as is practically possible. So for example, we would never let a Faculty Member evaluate one of their own papers. We also go much further than this and are currently adding a specific declaration that every Faculty Member must confirm for every evaluation that states: "This work has been selected for evaluation entirely on its scientific merit. Neither I nor my co-evaluators (where applicable) have collaborated with the authors in the past year or been influenced in the selection of this work directly or indirectly by the author/s or by any third party. This evaluation presents my opinions and those of any listed co-evaluators."

Additionally, Faculty Members must declare any competing interests, which includes non-financial competing interests (see below for the specific details). Any declared conflicts are assessed by F1000 as to whether the evaluation might lead a reasonable person to question the impartiality of the writer. These declarations are displayed alongside their evaluation. For example, we recently had an issue where a Faculty Member evaluated a paper and declared a competing interest that stated that the authors of the paper they were evaluating were in the same lab as them, but that they had no input into the paper. Based on this, we rejected the evaluation as we consider this association to be too close for impartiality not to be called into question.

As all the names of the evaluators are always openly displayed against the evaluation, this additionally reduces the likelihood that Faculty Members will select articles where there is some bias in the selection as usually this would be fairly obvious to those in the field. Furthermore, external Section Heads (who are

responsible for suggesting who are appropriate as Faculty Members) are asked to keep an eye on the content within their Sections, and we have our Heads of Faculty and an International Advisory Board to advise us on these issues. Finally, our internal Editors monitor every submission before it goes live, keeping an eye on possible biases.

F1000 Competing Interests Details

What do we mean by Competing interest?

We ask that Faculty Members declare both "Non-Financial" and "Financial" Competing Interests. For every submission (i.e. an evaluation or dissenting opinion) on which they select the "Competing interest to declare" option, they must provide sufficient details (in the textbox provided) to enable the F1000 Editorial team to assess whether their evaluation might lead a reasonable person to question their impartiality. These declarations are displayed alongside their evaluation.

It might be helpful to consider the following examples, but please note that this is not an exhaustive list:

Examples of "Non-Financial Competing Interests"

1) Within the past 4 years, the Faculty Members has held joint grants, published or collaborated with any of the authors of the selected paper.

2) The Faculty Member has a close personal relationship (e.g. parent, spouse, sibling, or domestic partner) with any of the authors.

3) The Faculty Member has a close professional associate of any of the authors (e.g. scientific mentor, recent student).

4) The Faculty Member works at the same institute as any of the authors.

5) The Faculty Members hopes/expects to benefit (e.g. favour or employment) as a result of your submission.

6) *If submitting a Dissenting opinion*: The Faculty Member has a longstanding disagreement with any of the authors.

Examples of "Financial Competing Interests"

1) The Faculty Member expects to receive**,** or in the past 4 years have received**,** any of the following from commercial organizations that may gain financially from their submission: a salary, fees, funding or reimbursements.

2) The Faculty Member holds, or is currently applying for, any patents or significant stocks/shares relating to the subject matter of the paper they are evaluating.

If you believe these criteria have not been met and have noticed specific instances of abuse, please contact our editorial office.

By Rebecca Lawrence, Director New Product Development, F1000

On behalf of Faculty of 1000 Ltd

June 2011

Conflict of Interest Statement

Rebecca Lawrence is an employee of Faculty of 1000 Ltd

Written evidence submitted by Vitae (PR 95)

1. Vitae is supported by Research Councils UK (RCUK), managed by CRAC: The Career Development Organisation and delivered in partnership with eight regional Hub host universities.

2. Vitae works in close collaboration with all UK higher education institutions ((HEIs) to embed professional and career development for researchers into the research environment. Vitae provides HE sector leadership, enabling strategic policy interaction between funders and HEIs, building an evidence base of the impact of researchers and career destinations. We play a major role in providing professional training, developing resources and training materials, sharing practice and enhancing the capability of the higher education sector to provide professional development and training for researchers. Our vision is for the UK to be world-class in supporting the personal, professional and career development of researchers. We work with both postgraduate researchers studying for doctoral degrees and research staff employed in institutions primarily to do research.

3. Within our broader commentary, our response focuses on the implications of the peer review process on the career development of researchers. This includes how early career researchers develop the requisite skills and knowledge to be effective peer reviewers, become involved in the process and the implications for equality

and diversity. We comment on the level of recognition associated with peer reviewing in terms of career progression and workload management. In developing this response we canvassed views from senior academics and staff developers through the Vitae network.

The Strengths and Weaknesses of Peer Review in Publishing

4. Peer review is a critical part of the process of producing research. Overall it has proved to be the most effective system for assuring the quality of research outputs. It provides a mechanism by which the integrity and authority of the research can be assessed by informed reviewers prior to publication, thereby providing a level of confidence to researchers, research users and the public. It is critical for public confidence in research that we are able to demonstrate that the peer review process is fair, inclusive, transparent and robust.

5. As well as assessing the merit for publication, the peer review process contributes to the rigour of the research; referee reports often providing suggestions to strengthen the presentation of the research. Being a peer reviewer improves critical thinking, skills for giving and receiving feedback, and preparing their own work for publication. These are important aspects of the development of research leaders for the future.

6. Most researchers will experience both authoring and reviewing papers during their careers and therefore have a vested interest in the system being as robust, ethical and equitable as possible. Engaging in the peer review process is seen as part of being an academic researcher and contributing to the overall health of the sector. It is not a perfect system however: there are tensions between the need for timely publication and the peer review process. The scale and diversity of the process mean that consistency of quality in reviewing is challenging, if not impossible to achieve. There is evidence that questions the objectivity of the process and whether bias and personal views influence academic judgement.[76]

7. There is an expectation that researchers will contribute to sustaining the peer review system by participating as reviewers. This is predominantly without financial or formal recognition, except for members of editorial boards (or grant review panels). The process of reviewing is time-consuming and seen as an accepted and necessary activity, yet it is rarely acknowledged as part of the formal workload of an academic researcher. Senior researchers may delegate to early career researchers, providing a useful development opportunity, but not always mentoring or acknowledging their contribution. Reviewing is often an "out of normal hours" activity and therefore adds additional burdens on researchers with family and caring commitments. "Good" reviewers are more likely to be invited to do more reviewing, thereby adding to their workloads.

8. Given the lack of recognition, contributing to the peer review process does not significantly contribute to a researcher's career progression opportunities. Research outputs are critical in achieving and sustaining a research career and engaging in peer reviewing may in practice reduce the opportunity for focusing on producing research outputs. However this is tensioned against the fact that engaging in peer review can help researchers improve and attune their own publications. It is important that researches at all stages in their career are given the opportunity and recognition for their peer review efforts.

Measures to Strengthen Peer Review

9. The majority of researchers become experienced in peer review by engaging with the process: "learning on the job". This has its strengths and weaknesses. It is a very effective way of learning, provided it is acknowledged as a learning process and appropriate support is provided, such as mentoring and providing feedback on reviews during the process, to improve their expertise. This could be by editors, fellow reviewers or experienced researchers and provided as part of a managed programme of researcher development rather than in an ad hoc manner.

10. Until recently there were few opportunities for researchers to undertake formal training. The advent of Vitae and government funding through the UK Research Councils for implementing the recommendations of the Sir Gareth Roberts review[77] have significantly increased the opportunity for early career researchers to participate in professional development opportunities, including academic writing for publication and grant applications. These courses generally include experience of the peer review process. There are also examples of universities and other bodies providing structured development opportunities in being a peer reviewer, including encouraging early career researchers to set up and run journal clubs.[78] However, the numbers participating in these activities are fairly small and with the end of "Roberts funding" in March 2011 even this level of provision may be may fall.

11. In recognition that peer review is important to the development of leading researchers and that peer reviewing is integral to academic publishing, all parties have a responsibility to continually improve and assure the quality and robustness of the system. We present a range of possible activities for different stakeholders.

[76] Rees, T (2011) "The Gendered Construction of Scientific Excellence" Interdisciplinary Science Reviews, Special Issue on Gender in Science, Vol. 36, No. 2, pp. 133–45 (in press—June)

[77] Roberts, G (2001) SET for Success: the supply of people with science, technology, engineering and mathematic skills, DUIS (BIS) www.vitae.ac.uk/roberts

[78] Training peer reviewers, Nature 443, 880 (18 October 2006) | 10.1038/nj7113–880b

— Editors of journals using fair and transparent selection procedures for peer reviewers. Providing more opportunities for training peer reviewers, providing feedback to reviewers and mentoring opportunities for new reviewers. Collectively agreeing and promoting the basic principles of peer reviewing for publication. Considering the use of more double-blind reviews to reduce bias.

— Universities providing more development opportunities for building peer reviewing skills prior to researchers becoming peer reviewers for journals, e.g. running journal clubs and training courses that include opportunities to review papers and receive feedback. Peer review and its demands on time should be taken into account in implementing equality and diversity strategies, and its accomplishment recognised in performance management and workload models.

— Senior academics and principal investigators taking active roles in mentoring early career researchers in peer reviewing skill and providing feedback. If delegating reviewing to others, providing critical oversight and acknowledging their contribution. Encouraging and recommending early career researchers to engage in the peer review process.

— Staff developers and trainers ensuring that researchers are given opportunities to develop peer review skills, especially in multi-disciplinary and international settings which now underpin much of collaborative research publication.

— Early career researchers taking responsibility for ensuring they understand the peer review process from both the perspective of writing for publication and being a peer reviewer. Taking opportunities to develop their experience and skills relating to reviewing, including asking peers and senior academics to comment on any papers/reviews before submission. The Vitae Researcher Development Framework highlights the need for resources through which researchers can engage in their own professional development, including skills for publishing and peer reviewing.[79]

The Value of Peer Review in Advancing Knowledge

12. From the prospective of potential authors, particularly early career researchers, the peer review process has a valuable role to play in contributing critical comment and feedback that provides useful quality benchmarks. It is one of the ways in which researchers understand the requirements of publication and improve their chances of being published. However, concerns were expressed that reviewers can be seen as conservative and especially, early career researchers may be better at playing it safe, rather than submitting controversial or cutting edge papers. There was also concern that reviewers may not be objective when reviewing papers that conflict with their own views. This impression, correct or otherwise, could stifle innovation, energy and vitality in publication, especially from early career researchers.

Identifying Reviewers with the Requisite Skills and Knowledge

13. The view of the all the respondents was that the selection of peer reviewers is not set up as a fair or transparent process. Understandably, editors will look for researchers who are experts in their field and from institutions with a strong research profile in the field. Typically, early career researchers will become involved by either recommendation from a senior academic or because they are known to the editor of a journal through their publications. Open calls for journal reviewers exist, but are not the main method, although it is a more common method for setting up grant peer review panels.

14. In terms of equality and diversity, systems that rely on networks and patronage may disadvantage specific groups or individuals. For example, early career researchers working in the less research intensive universities may find it hard to break into the system unless they have a specialist research niche.

15. It is likely that the selection of peer reviewers is predominantly on their research record. However, the ability to give and receive feedback constructively is also important. It is not apparent how this is taken into account when identifying potential reviewers. Furthermore, as an important skill for research leaders, it should be an integral part of the development of researchers.

Further Information

16. Further information about Vitae and its activities is available online at www.vitae.ac.uk.

Declaration of Interests

17. There are no relevant interests to declare.

Vitae

May 2011

[79] The Researcher Development Framework describes the knowledge, behaviours and attributes of successful researchers, including those relating to publication. www.vitae.ac.uk/rdf The associated Researcher Development Statement has been endorsed by the key stakeholders in developing researchers, including RCUK, Universities UK, the funding bodies and the Quality Assurance Agency www.viate.ac.uk/rds

Supplementary written evidence submitted by the Department for Business, Innovation and Skills (PR 98)

SUPPLEMENTARY INFORMATION FOLLOWING ORAL EVIDENCE GIVEN BY PROFESSOR SIR ADRIAN SMITH ON 8TH JUNE 2011

Details of whether any of the Research Councils have cut funding for an individual researcher or institution on the grounds of fraud/misconduct in research.

AHRC—No cases where funding has been withdrawn on the grounds of fraud/misconduct in research.

BBSRC—Under BBSRC's formal complaint procedures BBSRC have withheld payment/processing of grants in four cases while allegations were investigated. However, following the completion of the investigation there have been no cases where BBSRC have cut funding for an individual/institution on the grounds of fraud/misconduct in research.

EPSRC—No cases where funding has been withdrawn on the grounds of fraud/misconduct in research.

ESRC—No cases where funding has been withdrawn on the grounds of fraud/misconduct in research.

MRC—There have been three allegations during the last 10 years of scientific misconduct relating to MRC funded work that were proven.[80] None of cases has resulted in withdrawal of funding, but all have had sanctions imposed against the individuals concerned.

1. In 2001 an MRC-funded Clinical Fellow was reprimanded for serious professional misconduct and suspended for a year by the General Medical Council (GMC) for falsifying published data. The Fellow's supervisor was also severely reprimanded by the GMC for not having reacted adequately and promptly.
2. In 2010–11 there was a case related to manipulation of results and falsification of data (images) by a member of MRC staff.
3. In 2010–11 there was a case related to falsification of documentation relating to patient consent in a clinical trial supported by an MRC grant.

In the third case, where the allegation was against the Principal Investigator (PI), MRC temporarily transferred the supervision of the grant to another PI while the investigation was ongoing. This transfer was made permanent once the allegation was proven. This case was also reported to the GMC.

MRC decided to continue the funding the grant in the third case for a number of reasons:

- the recruitment of patients to the trial and collection of biological samples was already complete;
- there was no risk to patients;
- the misconduct did not affect the integrity of the data;
- publication of the results would be possible (having checked patient consent was valid); and
- the data from the trial would be important to inform clinical practice.

It would have been a waste of public money to terminate the grant as this would have prevented the results being analysed and published.

NERC—No cases where funding has been withdrawn on the grounds of fraud/misconduct in research.

STFC—No cases where funding has been withdrawn on the grounds of fraud/misconduct in research. However, in 2010 STFC pulled a grant application from consideration because of a case under investigation (a case of plagiarism in a proposal which was referred to the university for investigation). STFC has not yet formally been informed of the outcome of this case.

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[80] There have been a number of allegations scientific misconduct but these were either investigated and the allegations disproved, or dismissed at an early stage before a full investigation.

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