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Title: Microbiology survey shows authors have most to gain from peer review

One-sentence summary: In the week that an international team of publishers, science communicators and other scholarly organisations launch the second international Peer Review Week, the preliminary findings from our new survey reveal that authors gain from peer review than the people who do the actual reviews.

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Peer Review Week is a multi-sector initiative across a number of leading science publishers and science communicators whose aims are to promote the importance of peer review and recognise the efforts of the reviewers, editors and professional editors and publishers who make peer review happen. It was launched by Sense About Science, ORCID, ScienceOpen and Wiley-Blackwell in September 2015 (Meadows 2015a), and following its initial success, the second – with a central theme of recognizing reviewers – takes place from 19-26 September 2016 (Meadows 2016).

The Federation of European Microbiological Societies (FEMS) is a scholarly organisation representing the interests of professional microbiologists across Europe and beyond. Its interest in the issue of peer review is twofold: as both a publisher of scientific journals, and as a representative of the authors, reviewers, editors and readers of scientific content. Established in 1974, the Federation was conceived as part of academia's post-war movement to encourage and facilitate the exchange of (microbiology-related) ideas and expertise across and beyond Europe, and it does this today through publishing journals, organising events and providing a series of grants and awards in support of its 53 Member Societies.

Like other scholarly associations that support scientific journals, FEMS keeps a close eye on developments in publishing, including those emerging in relation to peer review. The issue of scientific quality control has been thrown into the spotlight following developments such as the interest in more open science, the rapid growth of scientific outputs and concerns about so-called "predatory" publishers, who charge for article publication without providing the wide range of services that professional scientific publishing requires (see European Commission 2016; Ware 2012).

This rising interest in peer review has been marked by several large-scale surveys on attitudes to peer review. But bearing in mind the differences between radically different fields of study, FEMS teamed up with its publishing partner, Oxford University Press (OUP), and researchers from the UK's University of East Anglia (UEA), to better understand the perception of the issue within the microbiology community. Having gained ethical approval through the UEA process, FEMS, UEA and OUP developed and circulated

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a questionnaire to the global microbiology community throughout June 2016. By the end of the month the survey had generated 2733 responses across 78 countries.

While the data are currently being analysed, and a full description of the methodology and findings will be reported at a later date, we would like to highlight here the key issues from preliminary analysis that are relevant to this year's Peer Review Week. Specifically, the clear distinction between the value of peer review to authors (which is perceived to be high) and reviewers, where it is less so.

Our results (summarized in Table 1) indicate that the microbiological research community experiences peer review as a fundamental part of scientific endeavor, with 73 % of respondents reporting that their work is "always" peer reviewed, including journal articles (66%) and funding proposals (32%). It is also generally perceived that peer review serves a positive function, with 82% of respondents reporting the positive effect of peer review as an author, and 79% indicating that they are generally happy with reviewers' comments. The vast majority of respondents (92%) recognise that peer review contributes to improving scientific knowledge, as well as to the scientific community in general (91%).

As reviewers, however, the picture is a little different. Only 63% of respondents reported that peer review has any positive effect on their career, while 38% felt it directly supported their career development. Asked specifically for the reasons why invitations to review are accepted or declined, 64% noted that they would accept an invitation to peer review because they felt their expertise was being recognised. In addition, 52% undertake peer review in order to learn how to better present their own work and just over half (51%) were keen to read about new research even before it is published.

However, while the microbiology community seems keen both to have its scientific endeavours reviewed, and to engage in the process as reviewers, there is a problem. For not only are many invitations to review declined, but 76% of our respondents reported an increase in requests to peer review over the last 10 years. Faced with a list of options to choose from, respondents gave the major reasons for declining invitations to review as time constraints (85%), and a lack of expertise (79%) where papers were considered outside the individual reviewer's area of expertise. When offered the opportunity to provide free-text comments on recent changes in peer review, 45% responded, citing trends such as the requirement for faster reviews, and the submissions of more, poorer quality papers. Only a small percentage (less than 10 % each) felt either that their contribution was not recognized, or that there were no incentives for undertaking peer review.

An additional opportunity to provide free-text comments on reasons for declining invitations to review reveals that while peer review is highly regarded by participants, it ranks low compared to other workplace demands, particularly the "core-activities" of publishing research and teaching classes (as opposed to mentoring future authors and editors). Also perceived as a higher priority is the more "prestigious" reviewing of grant applications.

Microbiologists are not unique in this regard. This perception that peer review is not a "core activity" for science has been flagged for years, not least by David Colquhoun, Professor of Pharmacology at the UK's University College London who observed (Colqhuoun 2011) that:

"Imperial College's medicine department were told that their "productivity" target for publications was to publish three papers per annum including one in a prestigious journal "with an impact factor of at least five."

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This, Colquhoun highlighted as an example of the 'publish or perish' culture imposed by "research funders and senior people in universities". His contention is that this has reduced the quality of science, while underpinning an increase in the burden of peer review. This accords with the increase in invitations to review manuscripts that our respondents have reported, a crucial implication from Colquhoun's observations being that the lack of recognition for peer review comes from higher up the food chain; the university administrators and funding bodies. The result is a strong bias in assigning value to generating data compared to other vital processes of the knowledge ecosystem including curation, peer review, synthesis and outreach (see Figure 1).

This is an issue that has been discussed some years ago by the UK Government's House of Commons Science and Technology Committee (STC 2011). During the consultation, Professor Ian Walmsley, from the University of Oxford, observed that:

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.

Professor Rick Rylance, from Research Councils UK, added 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*.

This was supported by the British Medical Association who suggested some form of "professional recognition, accreditation or development of a reward system to encourage participation" in peer review. In some cases this is already done. For example as the Royal Society of Chemistry's Robert Parker explained (STC 2011):

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.

But this is not the same across all institutions, differs widely from country to country, and for many academics their contributions as a reviewer do not really "count". This is clear from the discussions of the STC and commentators like Colquhoun outlined above, and backed up by the free text responses we received in our survey.

What is equally clear is that the majority of authors feel that they benefit significantly from the activities of peer reviewers, but that this valued contribution to the research and publishing process is coming under threat. For while peer review remains less valued than publishing new data, the former is becoming increasingly sidelined in favour of more "core" activities.

There is a growing view that in order to survive current rates of growth and development in scholarly publishing, peer review must be properly valued along with publishing as an academic activity. This is a

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view that was made explicit by Australian researchers in 2014, in their open letter to the Australian Research Council, demanding that peer review targets be mandated alongside existing publication targets (see Meadows 2015b). It is this kind of thinking that has attracted respected organisations such as ORCID, AAAS, the Royal Society and COPE to join forces in celebrating Peer Review Week. Our hope is that by contributing to this initiative – and highlighting the disparity between authors and reviewers as the beneficiaries of peer review –we can contribute, eventually, to effecting real change.

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Conflict of Interest statement:

Catherine Cotton is the CEO of the Federation of European Microbiological Societies.

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Table 1: Summary of perceptions of peer review from different roles of academics

As academic	As author	As reviewer
• Improve science 92% • Contribution to scientific community 91%	• Work always reviewed 73% • Positive influence as author 82% • Benefit from reviewers' comments 79%	• Expertise recognized 64% • Time constraints 85% • Positive influence as reviewer 63% • Increase in requests 76%

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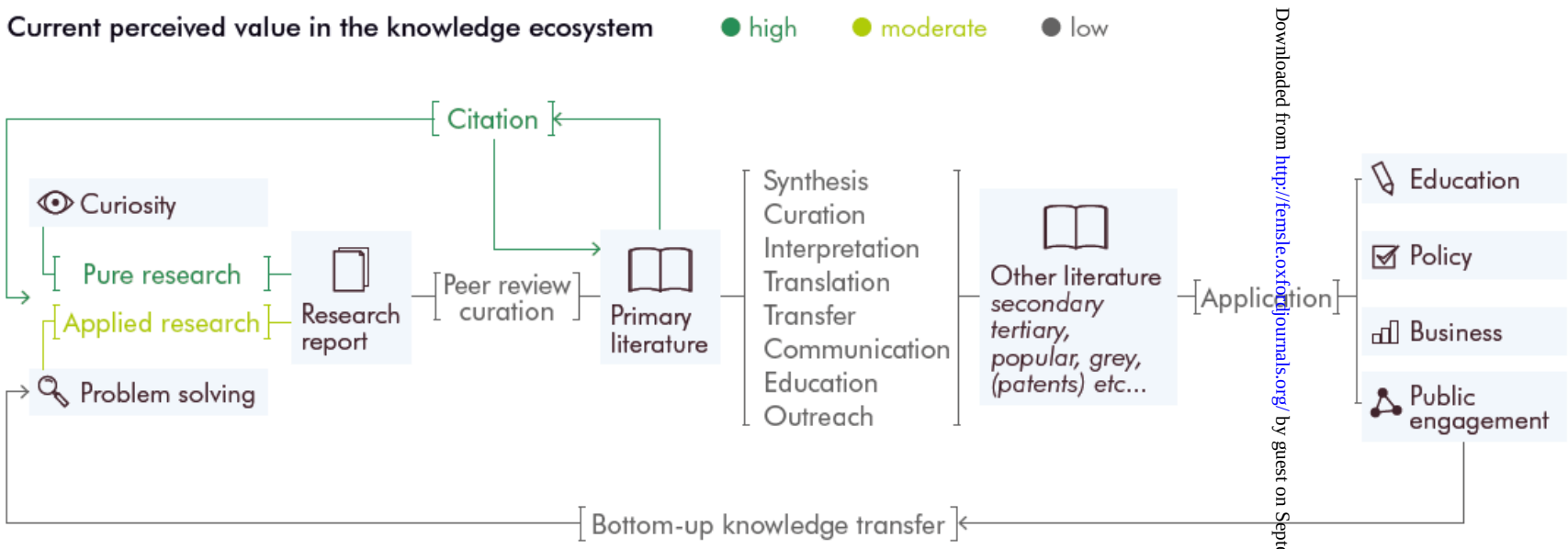

Figure 1: Perceived values in the knowledge ecosystem.

The tradition of associating high academic value with high levels of citation of published research has underpinned the ongoing debate on the real value, perverse incentives and career development implications of the Journal Impact Factor. But even article-level metrics based on academic citation alone, take into account only a fraction of the potential value of published research – particularly in the post-open access age. In an initial effort to address this, the UK has introduced – in its Research Excellence Framework assessment – an element of social and economic impact of published science as it permeates the wider knowledge ecosystem. Given that researchers account for less than 0.4% of the UK population, a better understanding the societal value of the curation, translation and dissemination of the primary research literature might lead to a new appraisal of (among other things) the high value of quality control and content selection provided by the peer review process.

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