

Publish and Perish?

A seminar on the rapidly changing nature of scientific publishing, peer review, and evaluation.

Text: Ninad Bondre

Introduction

On 29 September, the electronic magazine International Innovation alerted readers to the launch of a new mathematics journal. Entitled Discrete Analysis, the journal will subject to peer review articles that have been hosted on the preprint server arXiv. Free access to the articles will be provided without imposing any fees on the authors. The journal aims to “challenge existing models of academic publishing,” according to Prof. Timothy Gowers, the managing editor.

This new journal and its model exemplify the rapidly changing landscape of scientific publishing, peer review and evaluation – the subject of a seminar entitled “Publish and Perish?” organized by the Young Academy of Sweden. The seminar, which took place at the Royal Swedish Academy of Sciences in Stockholm, featured talks by six individuals with extensive experience in scientific research, publishing, evaluation and management. This was followed by a panel discussion during which the speakers responded to questions from both the moderator and the audience.

The phrase “Publish and Perish” was first used by the late Marshall McLuhan in 1951, according to Young Academy member Johan Åkerman, who introduced the seminar. Åkerman noted several recent developments that underscore the relevance of the seminar’s topic. For example, the publishers of traditional high-impact journals such as Nature are launching more topical journals; open-access publishing is on the rise; and repositories for preprints have become the preferred mode of communicating research in some fields. How, then, do we evaluate science today?

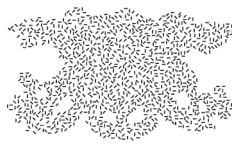
How can a nation support excellence in scientific research and teaching?

Bruce Alberts

Former Editor-in-Chief of Science and former President of the National Academy of Sciences, USA.

“What you measure is what you get. Measuring the performance of science wrong will get the science wrong.” Bruce Alberts’s talk, which touched on the importance of basic research and the flaws in the current system of evaluating research, revolved around this key message. Prof. Alberts, an expert in cell biology, is a former Editor-in-Chief of Science and a former President of the US National Academy of Sciences.

Alberts began by noting that he was a big advocate for young academics, which he felt were more active and effective than traditional academies in reaching out to society. Recalling his early research on the cellular protein machine, he said a lesson he learned early on in his career was to follow the mystery. He emphasised the importance of stimulating innovation. Although the trajectory of basic science is difficult to predict in



advance, significant applications can often be traced back to fundamental scientific advances made decades ago. “Unfortunately, our present system discourages risk-taking and applied research is often prioritised over basic research,” he said.

In the rest of his talk Alberts focused on how science is published and evaluated in today’s world. He strongly criticised using a journal’s impact factor to evaluate the performance of individual scientists.

“The impact factor was originally developed for an entirely different purpose – as a tool that helped librarians decide which journals to subscribe to,” he clarified. “Today, impact factors distort the behaviour of even the best journals: for example, a journal might feel tempted to publish more reviews, which tend to be cited more frequently, to raise its impact factor.”

Thompson Reuters, the company which came up the concept of an impact factor, defines this number as a measure of the frequency with which the ‘average article’ in a journal has been cited in a particular year or period. Alberts said he met with the company last year and made a number of requests with a view to minimising the misuse of impact factors. The requests include: a) provide separate impact factors for reviews and primary research; b) provide the median value of citations per citable article rather than the mean; and c) stop quoting the impact factor to three decimal points.

Preprint servers such as bioRxiv are becoming an increasingly popular avenue to communicate research. “Well functioning preprint servers may lead to fewer irreproducible results being published,” Alberts felt. “But it will take a strong push from young scientists to generate change!”

Publication assessment and university governance

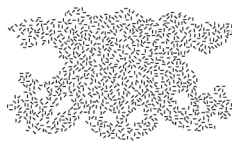
Arne Johansson

Professor in Mechanics and Vice-President of the Royal Institute of Technology (KTH), Stockholm, Sweden

Today, 20,000 or so universities are competing with each other for world-class status. With so many players producing so much knowledge, how do we identify and evaluate excellence in research? This was the focus of the second talk of the seminar, delivered by Arne Johansson, Professor of Mechanics and Vice-President of Sweden’s KTH. “We must be humble enough to accept that there is no perfect way,” he said as he began his reflection.

Elaborating on the growing importance of university rankings, Johansson remarked that this has taken on the character of popularity polls. Big companies often prefer to recruit alumni of the top-ranked universities. Students, particularly in Asia, tend to choose universities based on their ranking. “I even know of a case where Dutch authorities based their decision to grant a residence permit on the ranking of the applicant’s university!”

Johansson then turned to the topic of bibliometrics. “Because simpler papers may attract more citations than complex papers, the reliance on bibliometrics may promote



conservatism in the choice of research topics,” he said. In this context he alerted the audience to a recent report entitled “The Metric Tide”, which was published in July 2015 by the Independent Review of the Role of Metrics in Research Assessment and Management.

The report made several recommendations regarding the evaluation of research excellence in the UK. Underpinning these recommendations was the notion of “responsible metrics”. Expanding on this notion, Johansson highlighted the report’s emphasis on such aspects as humility regarding the role of quantitative metrics and the need for diverse assessment criteria given the diversity of disciplines and career pathways. “In this world of easy publication, we also need good journals that subject papers to stringent quality tests,” he added.

Finally, Johansson reflected on his experience at KTH, which international rankings place at around 100. The institute has a number of strengths including a large number of publications per faculty, many of which involve collaboration with industry. However, it has had only modest success in terms of impact and excellence. “We generate fewer highly cited papers in high-impact journals; moreover, papers with Swedish authors are poorly cited,” he noted.

Johansson has recommended that KTH recruits more young “stars” and stimulates publication in high-impact journals as well as greater international collaboration and co-publication. Above all, “publish smarter and prosper!”

Encouraging innovation through peer review and evaluation

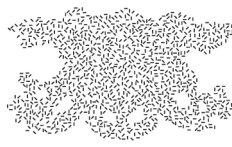
Tony Hyman

Research Group Leader and Director, The Max Planck Institute of Molecular Cell Biology and Genetics (MPI-CBG)

We understand well why societies fund basic research. From ancient Athens to modern-day Silicon Valley, there are many examples of investments in fundamental science stimulating innovation. “Yet the modern system of metrics and impact factors is in fact stifling the very innovation that society desires,” argued Tony Hyman as he set the stage for his talk on encouraging innovation. Prof. Hyman was drawing on his experience as Research Group Leader and Director of The Max Planck Institute of Molecular Cell Biology and Genetics (MPI-CBG) in Germany.

From a potential pool of millions of school students, only a select few go on to acquiring graduate degrees in science and technology. Even fewer among these become researchers or professors. We would like their research to be evaluated on the basis of discoveries and inventions, Hyman noted, but how do we quantify these? “This is where the journals come in: we seem to have given over the process of evaluation to journals.”

“Where you have published has absolutely nothing to do with whether you have made a discovery,” Hyman asserted. “Yet, career and discovery are too often conflated; the former begins to be seen as more important than the latter.” Young researchers feel increasingly that publishing in high-profile journals such as Nature is the only way to secure their careers, Hyman said.



Referring to “the dreaded impact factor”, Hyman said he agreed with Bruce Alberts’s criticisms. “The emphasis on impact factors as an evaluation tool prevents the young from innovating,” he said. “Traditionally, young people have been the motor of innovation, but the undue focus on metrics means that short-term imperatives counter longer term discovery-based imperatives.” Impact factors also allow a potential way to game the system, he said while providing an example of how just one highly cited paper in a journal can bump up its impact factor.

To counter this, Hyman said, his own institution is no longer allowed to consider where a paper was published in hiring or promotion discussions. “We should be proud that Europe has begun to push a new model for stable funding for younger researchers. Blue-skies research is an explicit mandate from the European Research Council.” Hyman discussed a new funding model whereby young researchers would be given stable funding for several years based on their capacity to innovate. “The job of a young person is to identify a new area and go into it,” Hyman said.

So why is it that the impact factor has become such a key tool in research evaluation? It boils down to the sheer number of people involved in research, according to Hyman. For example, while the number of tenured faculty has remained fairly constant over time in the biomedical sciences, the number of postdocs has gone up exponentially. “There is just too much to review.”

“Nevertheless, peer review as a tool to evaluate research as well as researchers must be treasured: we must make it an even more important part of our jobs.” Hyman felt that peer review needed to be recognised and, more importantly, rewarded. “Every granting body or journal should have a pool of paid reviewers,” Hyman noted that at the journal *eLife*, for example, senior editors as well as reviewing editors are paid.

In conclusion, Hyman emphasised that innovation requires the freedom to fail. “Science is about failure and waste, which is why quantifying it is such a problem.”

Scientific communication on trial

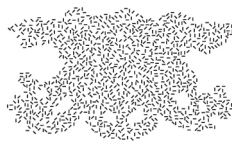
Catriona MacCallum

Senior Advocacy Manager PLOS, and Consulting Editor at PLOS ONE

In the fourth talk of the seminar Catriona MacCallum, Senior Advocacy Manager for the PLOS, drew on her extensive experience to raise some issues with modern scientific publishing and offer recommendations to change the landscape. MacCallum began by noting that we are facing systemic problems with the way research is communicated, but not necessarily with the research itself: there is much excellent research being done.

“PLOS ONE was launched to demonstrate that open access was compatible with high quality science,” she said. “Articles published in the journal are freely accessible, involve no embargoes and can be liberally reused under a Creative Commons license while ensuring authors are given appropriate attribution for the work.”

“This multidisciplinary journal has a large, independent editorial board and has been a success by any measure. The key innovation was to remove subjectivity regarding an



article's interest from decisions regarding its scientific rigour. As long as the work is scientifically sound, it should be published." Unlike traditional journals, she noted, this speeds up publication and enables negative results, which are generally rejected by journals, to be published.

Publication is a core part of the research cycle. "But today I want to question the role of the traditional journal as an effective means of communicating and evaluating science," MacCallum said. She pointed out that journal publishing is an enormously successful business model: English-language journals alone bring in about 10 billion dollars in revenue. "Yet dissemination in a subscription-based journal is a dissemination failure if you can't actually access the material," she remarked.

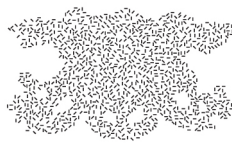
Continuing on the theme of journals, MacCallum informed the audience that open-access publishing has taken off and is growing all the time. A recent review suggests that between 25 and 50 % of published articles are openly accessible. Nevertheless, large publishers following the subscription model are doing extremely well, she pointed out. She noted that paying to make an article in a subscription journal freely available is extremely expensive. Moreover, it is not clear that any journal is communicating research effectively and reliably. There are unnecessary rounds of rejection and re-review; and methodological details are relegated to supplementary information. In this context, "are journals fit for the purpose in a digital age?"

MacCallum then moved on to pre-publication peer review, a topic that was also addressed by previous speakers. Although this is considered as a "gold standard", she noted that the thousands of papers that PLOS ONE publishes each year provide a large-scale window on the numerous problems – from plagiarism to fake review – encountered at all journals. Moreover, she added, science has become much more cross-disciplinary and complicated, and we must ask whether a few editors and reviewers are sufficient to evaluate a paper. "Reviewers are actually reviewing papers to fit the interests and requirements of journals and journal editors, not necessarily those of their peers or the wider society."

Finally, MacCallum questioned the reliability of some of the science being published today. Among the problems she brought up were citation bias, publication bias, poor documentation and the tendency of critical papers to become invisible, often because they are not deemed interesting enough to publish. She mentioned that there are increasing accounts of papers being retracted and that those published in higher ranked journals are even more likely to be retracted.

"Dissemination, peer review, reporting/reliability and evaluation are all failing today," MacCallum asserted. "The culprit is the current incentive system that only rewards researchers for publishing in high impact journals, and it is this culture that also maintains traditional publishing." Although such publishing creates competition, she felt that it had simply too many downsides to merit support. Quoting Stephen Curry, she said we now needed to "focus on the content, not the wrapper".

MacCallum then spoke about potential solutions to rectify the problems she identified in her talk. "Peer review is much younger than we think, so we don't need to be stuck with



the status quo but have an opportunity to improve it.” We need a more open collaborative type of review, she noted, that is appropriate for a digital age and that rewards reviewers as well as authors. “We also need to reward researchers for outputs other than articles – for example, sharing data and software.” MacCallum called for a variety of open metrics, more open access and separating the process of publication from evaluation. “We need to make more information available sooner; preprints may be game changers in this respect.”

Finally, MacCallum urged concerned parties to open up the “black box of peer review” and called for creating an infrastructure to support open science.

Open access publishing with arXiv

Tommy Ohlsson

Professor of Theoretical Physics at the KTH Royal Institute of Technology

The pre-print server arXiv, which was launched in 1991, is owned and operated by Cornell University. It is described on arXiv.org as “a highly-automated electronic archive and distribution server for research articles.” Tommy Ohlsson, Professor of Theoretical Physics at KTH, is also on the Member Advisory Board of arXiv. He provided an overview of how this service facilitates open-access publishing.

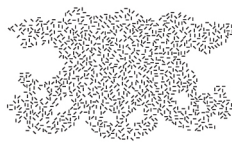
“In certain fields of mathematics and physics, virtually all research papers are submitted and published on arXiv,” Ohlsson said, adding that arXiv was overseen by two boards: a Scientific Advisory Board and a Member Advisory Board. No payment is required either to upload papers or to access papers on arXiv. Today the server contains over a million e-prints.

“Articles on arXiv are not peer reviewed in the traditional sense, but moderators for each subject area do review the submissions and may re-categorise them if needed,” Ohlsson said. He noted that this moderation in addition to the auto-identification of large text overlaps and an endorsement system allowed arXiv to insure the authenticity, originality and relevance of the content. Subscribers are alerted to new content via regular emails.

Ohlsson displayed a graph of submissions to arXiv over time, which confirms the dominance by various branches of physics along with mathematics and computer science. Submissions have grown linearly over the years, and the server now receives about 9,000 per month. More than ten million e-prints are downloaded every month.

Three Swedish universities – KTH, Chalmers and Uppsala – were contributing members of arXiv. 2% of world’s total usage of arXiv comes from Sweden, which contributes to 1.6% of the funding for the server. In a lighter vein, Ohlsson pointed out that Stockholm University, which ranks second in terms of arXiv usage in Sweden, did not yet contribute financially to the service.

Ohlsson then described how the green open-access model for arXiv works in practice. A preprint submitted by authors is uploaded to arXiv and received comments from the community within a week. It is then submitted to a regular international journal for peer



review: if accepted, the proofs are uploaded to arXiv as a post-print version of the manuscript. When it is eventually published by the journal, the reference is made available by arXiv. “The model works due to institutional subscriptions to journals,” Ohlsson said.

Rounding up his talk Ohlsson raised some open questions for the audience to reflect on. For example, is arXiv good for the community? Should scientists from fields that do not use arXiv today begin to do so?

Introducing PubPeer

Brandon Stell

Research Associate, CNRS and Co-Team Leader, Laboratoire de Physiologie Cérébrale, Université Paris Descartes, France

In the final talk of the seminar Brandon Stell, co-creator of the website PubPeer and researcher at CNRS in France, discussed the platform’s rationale, operation and how it is bringing more transparency to research evaluation. “The idea of PubPeer is very simple: it’s a place for scientists to come and discuss publications,” Stell said as he opened his talk.

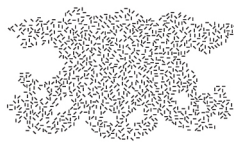
Stell said he viewed PubPeer as a tool that scientists could use to effect change in the publishing landscape. “Instead of complaining about the impact factor we, as scientists could make a difference and free ourselves from our reliance on this factor.”

Elaborating on the rationale for PubPeer, Stell said: “The site is based on the idea of a journal club. As we start going through a paper, issues and criticisms inevitably start popping up. Traditionally, though, there hasn’t been a way for the paper’s authors to respond to the criticism arising from such discussions and no possibility of involving a much broader community in the discussion.” Given their potential human and economic costs, Stell noted, there was thus a need for a mechanism to expose and disseminate flaws in published research.

Stell cited recent commentaries and papers that highlighted problems with the reproducibility of published scientific results. As with some of the other speakers at this seminar, he too identified the pressure to publish as the key underlying cause of such issues. “Publishing in top journals is equated with career success: the journals, however, seem to be more interested in potentially high-impact research than reproducibility.”

Walking the audience through the site, Stell said that any article published anywhere could be the subject of comments. He added: “When someone comments on an article, an email is generated and sent to the corresponding author. The main rules are that comments be based on publicly verifiable stuff and refrain from ad hominem remarks. Browser add-ons alert you to any comments on PubPeer that relate to a paper you are viewing on a particular journal’s website.”

Stell informed the audience that over 35,000 comments in over 2200 journals had been generated since the site’s launch in 2012. He pointed out that a big increase was triggered when the site began allowing completely anonymous comments. “People have



much to say but, for whatever reason, they don't feel comfortable in saying it without being anonymous. We want to include as many people as possible in the conversation, and we think anonymity is essential to that."

Concluding his talk, Stell emphasised that PubPeer sought to overcome the problems associated with the impact factor by focusing on what the community thought about the science rather than where it was published. "If we follow our reflex of commenting on papers we read, we can make a huge change together and don't have to wait for the journals. We can do it together as a community."