

Scientific peer-review - a time for renovation?

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Background

To the best of its ability, scientific publishing must establish that what it reports follows rigorous methodology so that it can be independently verified, that the conclusions presented justifiably follow from the data and analysis used. Furthermore, scientific publishing is usually expected to establish that what it reports is important. These stringent criteria place scientific reporting on an elevated platform – society views scientific reports as the closest approximation to "truth" that we have.

Peer-review is the indispensable method for maintaining the dual responsibility of maintaining scientific rigor in scientific reporting. Peer-review necessitates that scientific reports must be evaluated for the soundness, validity and importance of the material by at least two independent reviewers, peers, who are scholars in the particular field of research. In practice, scientific journals have managing editors responsible for organizing peer-reviewing, and editor-in-chief who makes final decisions concerning the publication of the report based on peer-reviews.

However, the ability of current peer review system to deliver what is expected from it is increasingly often challenged. Currently there is a clear dissonance in the academic community: on one hand there's a broad consensus among scientists that peer review is the cornerstone of academic publishing; on the other hand, there's also a widespread perception that peer review does not fulfil what is expected from it, and actually causes problems (Ware 2011, Jubb 2015).

Peerage of Science (PoS) is a web-based service, offering new innovations for scientists, journals and publishers to solve the problems in the current peer-review processes. PoS has three innovations at its core. First, no-one can restrict the freedom of any validated scientist to engage to peer review anything they deem worth their time and expertise – editors can still appoint reviewers but do not hold exclusive right to do so. Second, the reviews themselves are peer reviewed ("*peer-review-of-peer-review*") providing an academic quality control and reward system, and base for new metrics, thus encouraging and quantifying quality in peer review. Third, Peerage of Science positively disrupts the exclusive sequential submission model of scholarly publishing, by empowering authors to submit simultaneously to all participating journals, and empowering editors to make proactive publishing offers to any article under peer review. Here we review the most often encountered problems in current peer review system and the solutions provided by the Peerage of Science.

Challenges and solutions

Author identity is usually known to editors and reviewers, but not vice versa, raising danger of biased judgments based on author's familiarity to the editor, prestige, nationality, gender or political and social views (Lee et al 2013). There is no control except supposed editorial oversight on the validity, accuracy, fairness or competence of peer reviewer's arguments for or against the article under consideration. Importantly, perceived risk of bias harms research and society regardless of whether it is realized: if scientists, especially historically disadvantaged groups, do not trust the publishing system to be objective and fair, they are discouraged from pursuing their most ambitious ideas, voicing their scientific doubts, and asserting sound scientific arguments.

The default approach to anonymity in PoS is triple-blind. This means everyone's arguments - authors, reviewers, editors - must stand on their own scientific merit, affected as little as possible by biases against or for personal factors. Science, innovation and discovery flourish best in egalitarian, collegial and evidence-based systems. Peerage of Science brings this much-needed feature to peer review.

Peer reviewed publishing has also become massively inefficient. A single publishing decision (accept or reject) takes on average more than 100 days, and average rejection rate (=additional round at another journal) is over 50%, correlating with impact factor (Thomson Reuters 2012, Aarsen et al 2008, Pautasso & Schäfer 2010). Scientists-as-authors often face a much longer process with each manuscript. It is common that each manuscript will get peer-reviewed several times, being first rejected by one or more journals, before eventually published. The iterative peer-review is redundantly burdening scientist-as-editor, scientists-as-reviewers, and the sustainability of the academic communications industry. Although multiple

peer review rounds may improve the research output, the society pays for this ineffective system dearly: not only in terms of wasting more of its most expensive labor on the least deserving research, but also by suffering a delay of around one year before research results become available.

PoS solves this by offering concurrent consideration of a single peer review process by multiple journals. Author submits to PoS instead of a journal, PoS arranges peer review, and many journals have access to the same peer review process.

The burden of soliciting reluctant reviewers has become large, and many journals allow authors to suggest peer reviewers. Together with the "publish-or-perish" imperative, and lack of sanity checks, this has predictably led to fraud. The problem has surfaced in force during the past year: the internet watchdog site Retraction Watch now estimates 15% of retractions are due to faked peer reviews, and that is only the cases that get exposed (Retraction Watch 2015).

PoS carefully validates identity and qualifications from external sources for every registered user - but only has to do this once, because later reviewer assignment is through Open Engagement, and restrictions due to conflict of interest due (institutional or co-authorship relationships) are controlled by automated software.

Carelessness, in a sample size of two or three, far overshadows any misconduct problems. Combined with understandable enthusiasm for discovery, it easily results in obvious errors slipping through peer review. Science's "arsenic life" –article had obvious methodological flaws, yet Science's reviewers said that "The results are exceptional", "It's a pleasure to get a well-received and carried-out study to review", and "Reviewing this paper was a rare pleasure, Great job!" (Vergano 2013). Another case was Nature's STAP–stem cell article, where earlier peer reviewer in the rival journal exposed fake images but Nature published the work based on reviewers who said the work was "very interesting", "potentially groundbreaking", "highly provocative" and "truly remarkable" (Retraction Watch 2014). These two cases made headlines because the affected journals are highly prestigious, but in the rank-and-file academic publishing, failure of peer review is most likely a daily, silently ignored phenomenon.

Peer-reviewers receive little or no recognition for excellence. At the same time volume of research outputs requiring peer review is increasing rapidly. This has created a situation where there is growing reluctance to accept reviewing tasks as has been observed by editors of most scientific journals. Furthermore, in the current system there is practically no incentive for scientists to invest time and effort to write careful, high-quality peer review. Consequently, peer reviews are frequently perceived to be incompetent: a survey by Resnik et al (2010) revealed that 62% of scientists have encountered incompetence in peer reviews.

Here the key social innovation of PoS changes everything: peer reviews are themselves judged and scored for scientific validity by other peer reviewers - PoS has peer-review-of-peer-review. As a result, PoS can deliver a meaningful academic recognition system, creating incentives for scientists to invest time and effort into peer reviewing work. Anyone can browse the Peer performance profiles at www.peergeofscience.org/peers. This opens a possibility for reviewers to build their reputation as science critics.

A typical scientific journal rejects at least 30% of submissions without peer review. This is effective when the reason is poor quality, but more often the reason is "lack of fit". Consequently, journal's resources, and the time of submitting authors, are wasted in unproductive activity. If the manuscript enters peer-review, a submission is typically reviewed by only two reviewers, and perversely those research outputs that are rejected more times (=judged poorer) receive more effort from the peer reviewer community than those that are accepted on first attempt (=judged scientifically sound and more important). Moreover, current peer review process has been shown to be poor in identifying those articles that will get cited most (Patterson & Harris 2009).

PoS features Open Engagement - any qualified, vetted scientists with user account can freely engage to review what they want. As a result, only 13% of submissions are left without review - usually for reasons of poor quality. The Open Engagement practice in PoS also means that more peer reviewers engage on more interesting work, thus matching community's efforts with the importance of research positively. This information is available to journal editors to assist decision making.

Conclusions

Although not yet really broken, the current peer-review system is clearly less than optimal. The number of peer reviewed articles increases by steady rate of over 3% annually, and consequently, if the practices are not made more efficient the system may be in risk of collapse. Peerage of Science pursues to keep the traditions of scientific peer-reviewing that are worth retaining and to fix the parts that are broken. The

primary purpose of Peerage of Science, enshrined in the company's Articles of Association, is to "*foster and develop the practice of science, as well as the conditions, societal standing and evaluation thereof*". Science here means the entire ecosystem in science publishing from authors and reviewers to journals and publishers.

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