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PLoS ONE: New Approaches and Initiatives in the Evolution of the Academic Journal

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PLoS ONE, a peer-reviewed Open Access academic journal published by the **Public Library of Science**, was founded in 2006 with the intent of rethinking and reengineering many aspects of the traditional scholarly journal. In pursuit of this goal, *PLoS ONE* has taken elements of the traditional scholarly publishing model and separated them into those functions that are most effectively carried out before publication (for example, peer review in order to evaluate whether an article deserves to join the scientific literature) and those that can most effectively be carried out after publication (for example, the assessment of an article's impact on the field).

In 2007, *PLoS ONE* published 1,231 articles and in 2008 it published 2,722 articles. At current rates of growth, it is on track to publish over 4,300 articles in 2009 and, assuming this growth continues at the same rate, *PLoS ONE* could be publishing as many as 7,000 articles in 2010, or almost 1% of all the articles listed in *PubMed* for that year (*PubMed* lists 803,000 published articles for 2008). Within a remarkably short time, therefore, *PLoS ONE* has grown into a large and widely accepted journal, which is actively contributing to a transformation in the way in which academic journals are published.

Traditionally, filtering and assessment of potential research impact are undertaken during the peer review and editorial process. With the aid of peer reviews, journal editors may make subjective decisions as to whether or not submitted articles meet their title's publishing standards (standards which may be ill defined, and which often relate to things such as "potential impact" or "significant advance"). Even if technically sound, articles that fail to meet that standard are rejected and, as a result, may be re-submitted to successive journals before being eventually accepted and then published many months or even years after their first submission. Authors (and the academic reward system in which they operate) perpetuate this cycle by attempting to get their research published in certain highly regarded journals, with the result that publication is delayed until a suitable journal will accept their work. This in turn increases the "review burden" on the academic community as each re-submission requires another round of reviews with the consequence that articles can be reviewed multiple times, by multiple reviewers, before eventual publication.

In contrast, the *PLoS ONE* peer review process focuses on the objective assessment of scientific rigor and research integrity. It encourages and uses alternate ways to assess research output, and it explicitly avoids the more subjective elements of editorial decision-making. In so doing, *PLoS ONE* seeks to substantially improve the speed and efficiency of the communication of research results,

thus accelerating the research process. The following are the key elements of the *PLoS ONE* peer review process:

1. We provide clear criteria as to what is acceptable for our journal.

We are clear about the criteria we use to judge any submission. There are seven criteria, all listed on our Website,¹ and submissions are rejected only if they fail to meet one or more of these criteria. Briefly, these criteria are:

1. The study presents the results of primary scientific research.
2. Results reported have not been published elsewhere.
3. Experiments, statistics, and other analyses are performed to a high technical standard and are described in sufficient detail.
4. Conclusions are presented in an appropriate fashion and are supported by the data.
5. The article is presented in an intelligible fashion and is written in standard English.
6. The research meets all applicable standards for the ethics of experimentation and research integrity.
7. The article adheres to appropriate reporting guidelines (e.g., CONSORT, MIAME, STROBE, EQUATOR) and community standards for data availability.

2. We do not select content based on perceived impact, interest or uniqueness.

PLoS ONE publishes all submissions that meet the criteria noted above (and rejects any that do not). As a result, we never tell an author that their work "is scientifically and technically sound, but cannot be published in our journal" and feedback from the community indicates that this approach is both refreshing and appreciated.

There are approximately 25,000 journals in the world, and virtually all of them reject some proportion of submissions which, although scientifically sound, are not of interest to that specific journal or journal editor. Journal editors make such decisions for any number of reasons. They may do this because the submission is out of scope; or because they are attempting to publish only the highest impact content; or because they have a limited number of pages they can publish in the year, etc. However, with the combination of our editorial vision, and our business model (which levies an author publication fee, under which each article covers its own costs), *PLoS ONE* has few of these restrictions. It is important to note, however, that in addition to rejecting unpublishable papers, we do reject some papers which are otherwise publishable, e.g., if they are out of scope, as in the case of review articles or opinion pieces.

3. We have a non-hierarchical, academic editorial board who make all decisions on the content.

PLoS ONE makes use of almost 800 Academic Editors (as of May 2009) each of whom is an expert in their field. These Academic Editors make the publication decisions; their names appear on the published article (hence increasing their accountability) and they are required to declare any competing interests.

PLoS ONE currently uses an online peer review system provided by **eJournal Press** (Allen Track). All submissions enter this system and then pass through an initial Quality Check (QC) to ensure that they meet various requirements such as full disclosure of "competing interests," appropriate oversight of human and animal research, full disclosure of funding sources, appropriate deposition in discipline-specific databases, appropriate registration of clinical trials, technical quality of the files, and so forth. In total, our QC checklist includes over 20 different checks, and is one of the most comprehensive in the industry. Some articles will never make it past this stage — we may, for example, uncover problems with adherence to standards; or author disputes; or lack of ethical oversight — and when warranted, we follow up on potential misconducts using the guidelines laid down by the **Committee on Publication Ethics (COPE)** of which **PLoS** is a member.

Once a manuscript passes QC it is assigned to an Academic Editor or to a Section Editor, and the editorial evaluation of the manuscript begins. The primary responsibility of a Section Editor is to identify suitable Academic Editors to handle papers within their Section (and

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then to assign them) — in all other respects they hold the same authority as an Academic Editor and do not, for example, oversee the decisions made on manuscripts in their Section. Academic Editors are responsible for inviting peer reviewers, evaluating and weighing their reports, and rendering a final decision on the manuscript. Throughout this process, they are assisted by in-house administrative staff who respond to queries, lend advice, solve problems, and chase late reviewers for their reports.

In many respects, the peer review process at *PLoS ONE* is the same (though perhaps more transparent) than any other journal. Reviewer reports are detailed and extensive and make constructive suggestions for improvement. Academic Editors judge and assess these reports and advise authors what must be done to meet our criteria. Authors are asked to make revisions where necessary, and revisions are re-reviewed as necessary before a final decision is rendered. The most significant way in which our peer review process diverges from the “norm,” however, is that our publishing decisions are not based on any subjective measure of “impact” (or “relevance” or “interest”). If an article is scientifically sound, reports on appropriately conducted science, and comes to appropriate conclusions based on that science, it should be worthy to join the scientific literature, and so will be accepted by *PLoS ONE*. Having used peer review to vet the submission it is then expected that any judgment regarding its “relevance” or “impact” will be determined by the readers themselves after the article is published (and not by a small group of peer reviewers or editors making those decisions in advance of publication).

Since launch (Dec 2006), *PLoS ONE* has made use of over 11,000 individual peer reviewers.² The average submission receives a first decision in about 30 days (from passing QC), and all submissions go through an average of 1.1 new revisions before being ultimately accepted. In total, 71% of all submissions are eventually published. Up to date summary information on the performance of the *PLoS ONE* peer review process can be found on the journal Website at: <http://www.plosone.org/static/review.action>.

In addition, to the structured peer review process detailed above, we also provide tools for post-publication commenting and notation. Specifically, we allow users to rate, leave comments, and make notes on each article. Users cannot be anonymous, comments must adhere to the norms of scientific discourse, and any conflicts of interest must be declared. As a result, the *PLoS ONE* site is not just the site of publication but potentially the place where all relevant discussion about an article can happen, in the context of the article itself. Several investigators^{3, 4, 5} recently analyzed our commenting activity — in general they found that although the functional-

ity is not as widely used as might be hoped, an encouraging amount of activity is still happening. Note: This functionality should not be confused with post-publication peer review, it is simply post-publication discussion and all *PLoS* titles have this functionality.

Finally, in March 2009, *PLoS* introduced a program that will ultimately provide a variety of “article-level metrics” on every article, allowing readers to make their own decisions regarding the article’s relevance or its impact in their field. Examples of the metrics that we are providing on each article include citation numbers, blog coverage, social bookmarking activity, user ratings and usage data (which will be added in June 2009). This functionality is also in place for all *PLoS* titles, and we expect this program will expand over time to provide an ever increasing amount of relevant information to the reader.⁶

To summarize, because *PLoS ONE* is an Open Access publication, the scientific community is encouraged to re-mix and re-aggregate our articles after publication, with the result that many of the “traditional” functions of a journal can actually occur more effectively post-publication. With this in mind, we are convinced that the combination of *PLoS ONE*’s philosophy towards the peer review process, the inherent abilities of the academic community to assess and re-use the article after

publication, and *PLoS*’s provision of a range of article-level metrics, has the potential to transform academic journal publishing. We also believe that the *PLoS ONE* formula may have the potential to accelerate, and improve, the nature of research itself. 🌱

Endnotes

1. <http://www.plosone.org/static/guidelines.action#criteria>
2. <http://www.plosone.org/static/peerReviewers.action>
3. Adie, E., “Commenting on scientific articles (PLoS edition),” writing in the Nascent blog, February 11th, 2009 (http://blogs.nature.com/wp/nascent/2009/02/commenting_on_scientific_artic.html).
4. Neylon, C., “Can post publication peer review work? The *PLoS ONE* report card,” writing in the Science In The Open blog, August 27th, 2008 (<http://blog.openwetware.org/scienceintheopen/2008/08/27/can-post-publication-peer-review-work-the-plos-one-report-card/>).
5. Singh, D., “Peering into PLoS ONE Comment Stats,” writing in the bgbm blog, August 27th, 2008 (<http://mndoci.com/blog/2008/08/27/peering-into-plos-one-comment-stats/>).
6. <http://everyone.plos.org/2009/05/27/article-level-metrics-at-plos>

Interactive Open Access Peer Review: The Atmospheric Chemistry and Physics Model

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1. Introduction

The traditional ways of scientific publishing and peer review do not live up to the needs of efficient communication and quality assurance in today’s highly diverse and rapidly developing world of science. Besides high profile cases of scientific fraud, science and society are facing a flood of carelessly prepared scientific papers that are locked away behind subscription barriers that dilute rather than enhance scientific knowledge, lead to a waste of resources and impede scientific and societal progress.¹⁻⁶

Among the suggestions for improvement

of scientific communication and quality assurance are open access to publications, public peer review, and interactive commenting and discussion of manuscripts on the Internet.¹⁻⁶ By removing the limitations of subscription barriers, open access gives referees more information to work with; it enables interactive and transparent forms of review and discussion open to all interested members of the scientific community and the public; and it facilitates the development and implementation of new metrics for the impact and quality of scientific publications. The effects and advantages of open access, public review and interactive discussion can be efficiently and flexibly combined with the strengths of traditional scientific publishing and peer review.¹⁻³

2. Interactive Open Access Peer Review

So far, the arguably most successful alternative to the closed peer review of traditional scientific journals is the interactive open access peer review practiced by the journal *Atmos-*

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