Open Preprints in Ecology & Evolution

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I. INTRODUCTION

Open preprints servers allow authors to make their manuscripts publicly available before, or in parallel to, submitting them to journals for traditional peer-review. The idea became popular with arXiv, an open preprint server, that started 20 years ago [8]. The idea is fundamentally simple: to make the science available to the entire scientific community as soon as its done instead of having to wait for the peer-review process. The point of arXiv and open preprints servers is not to avoid the peer-review process. Almost all manuscripts on arXiv are submitted to peer-review. The point is to open an important phase of the publication cycle ...

In this article, we will first highlight the advantages of open preprints servers for both scientists and publishers. We will also debunk a few misconceptions, discuss the policies of major publishers in ecology an evolution, and briefly review the most popular open preprint servers.

II. THE CASE FOR OPEN PREPRINTS

The first and most often discussed advantage of arXiv and open preprints is speed 1. The time between submission and the official publication of a manuscript can be measured in months, sometime in years. For all this time, the research is only known to a select few: colleagues, editors, reviewers. Thus, the science cannot be used, discussed, or reviewed by the wider scientific community. ...

The review process as a whole is critically over-loaded, because the number of active scientists increases, because the pressure to publish increases, and because of an effect dubbed "the tragedy of the reviewers commons" REF. At the same time, rejection rates are high in most journals (REF), and when not invited to submit revisions, authors are left with the impression that they must start the whole process all over again. It's thus no surprise that different initiatives emerged over the last few years to decrease the time spent in review. XXX et coll. (REF) called for the recycling and reuse of peer-reviews: by attaching previous reviews, and detailed replies, to a new submission, both the editor and the referees can gauge the work done on the manuscript, and perhaps evaluate it with less prejudice. In a similar way, the *Peerage of Science* initiative allows authors to seek anonymous pre- review by their peers. Some journals (LIST?) now accept papers for publication that received good evaluations, effectively outsourcing the review process. A widespread use of preprint servers can achieve the same goal of reducing the time spent in review. By putting a manuscript out there for open comments and criticisms, the authors will receive valuable feedback, and can improve the version which will be submitted. With a rich enough community of scientists depositing preprints, and commenting on them, the process of an open pre- review can become widespread, and will overall increase the quality of first submissions.

Preprint servers also establish priority in a fair way. Some manuscripts will spend much more time in the review process than others. Public preprint servers offer a much fairer way to establish intellectual priority by making the work available when done, even if the exact organisation of the manuscript may change. Surprisingly, there is a perception in biology that public preprints make it easier to steal ideas, as if scientific ideas only took form in published material. Mathematicians and physicists have embraced arXiv in part to establish priority in a fair way[2].

Some of the responses to public preprints are surprising since they are, essentially, the same as exchanging preprints among colleagues. Prepublication reviews by a small network of colleagues is an important part of the scientific process, which is attested by the fact that nearly all published papers acknowledge comments by people not listed as co-authors. Preprint servers simply offer a way to extend this network of colleagues to the entire scientific community. It ensures that science is not constrained by small networks of scientists exchanging ideas. Paul Ginsparg created arXiv.org in part for democratic reasons: he wanted everyone from students in small universities to Ivy-League professors to have access to the most recent scientific *ideas*. Ginsparg's revolution-

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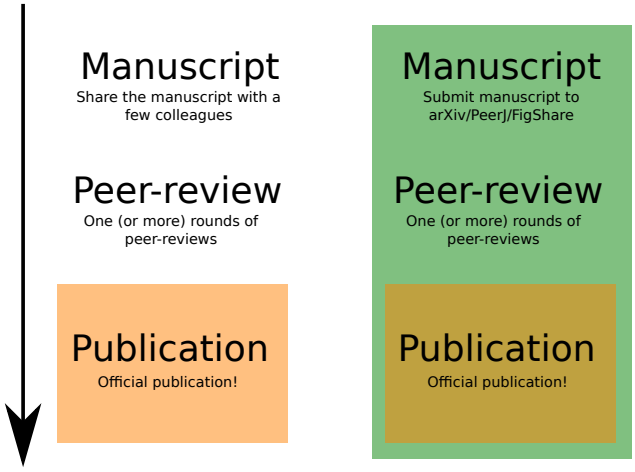

FIG. 1: It can take several months, and even a few years, before a submitted paper is officially published and citable. During this time, few people are aware of the research that has been done (typically, close colleagues are given access to the preprints). With public preprint servers, the science is immediately available and can be openly discussed, analysed, and integrated into current research. It benefits both science and publishers. Both want the papers to be well-known and cited, and public preprints make it possible to integrate research even before publication, greatly improving immediacy.

ary idea was simply to use the power of the internet for preprints, not just for the end product, so the process can be open from A to Z, instead of being just open at the end of the process.

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III. PREPRINTS, ECOLOGY & EVOLUTION

While submitting to public preprints servers is still uncommon in ecology and evolution, preprints are becoming more common in biological sciences. The quantitative biology section in arXiv is experiencing faster growth in submissions than any other fields [2]. Also, most scientific journals are preprint-friendly: Nature, PLOS, BMC, PNAS, Science (mostly) I, and all the journals from Elsevier and Springer. Very recently, the Ecological Society of America recently changed its policy to allow public preprints (REF). In our field, few scientific publications will not consider a manuscript submitted to arXiv. Still, many ecology & evolution journals adopt a "by default" hostile attitude towards preprints, mostly due to the lack of clear policy of the publishers. As an example, Wiley-Blackwell, which publishes some of the leading journal in the field, has no official policy on the subject I.

There are other "cultural" barriers to adoption of preprint servers by ecologists and evolutionary biologists. The most notable preprint server, arXiv, is designed to work best with TEX, a nearly universal document preparation system among physicists and mathematicians. Jackson [9] further argues that TEX introduced an "open source mindset" to its users, who now freely share their research findings as well as their software. Many biologists instead use proprietary software to prepare their research findings, and many ecology and evolution journals officially prefer Microsoft Word documents as submissions. The recent discipline-wide adoption of free software packages such as R, as well as interest in open access publishing, has coincided with recent use of preprint servers by biologists, supporting Jackson's claims.

Physicists and other quantitative scientists have recently developed a great interest in evolutionary theory, quantitative ecological theory and epidemiological modeling. Unfortunately this has led to a lot of repeated work ("reinventing the wheel"; [3]) that could be avoided by better communication across disciplines. The near-universal adoption of preprint servers in physics provides this vital communication channel. We suggest that biologists reach out to physicists and mathematicians by posting papers to arXiv: a physicist who does not read *Evolution* certainly checks arXiv at least weekly. This benefits both disciplines, as biologists will reach new readers, and physicists will learn the terminology, tools and ideas common in existing evolutionary theory. A recent series of papers on the theory of natural selection was posted to arXiv simultaneously with its publication in the *Journal of Evolutionary Biology* [4–7].

IV. CURRENT OFFERINGS

We briefly discuss the main options to submit preprints to open servers: arXiv.org, Figshare, and the upcoming PeerJ and F1000Research.

A. arXiv

arXiv (http://arxiv.org/) is the most widely-used preprint server today, and its use is almost universal in mathematics and most branches of physics. Physicist Paul Ginsparg originated arXiv in 1991 for theoretical high-energy physicists to communicate preprints via email and ftp, and soon thereafter adopted the newly created world-wide web[9]. arXiv now receives over 7,000 submissions per month (http://arxiv.org/show_monthly_submissions). arXiv divides its submissions into subcategories of physics, mathematics, computer science, quantitative biology, finance and statistics. The

Publisher	Policy
Springer	Accept
BMC	Accept
Elsevier	Accept
Nature Publishing Group	Accept
Public Library of Science	Accept
Royal Society	Accept
National Academy of Science (USA)	Accept
Ecological Society of America	Accept
Science	Accept/Ambiguous
Wiley-Blackwell	No general policy
British Ecological Society	?

TABLE I: Policies for important publishers in ecology and evolution.

quantitative biology category includes subcategories for Populations and Evolution, Quantitative Methods and other categories that may be of interest to ecologists and evolutionary biologists. The creation of new categories is regulated by the same system that categorizes papers.

Submission to arXiv is fully automated via the world-wide web. Authors can submit TEX/LATEX documents or directly in PDF or PostScript (for example, as exported by a word processor). A moderation system was put in place in 2004: papers must be categorized by an "endorser." At least one author of a paper must be an endorser that has previously submitted a paper or has received permission to submit to a particular category. Many authors in mathematics and physics submit papers as soon as they are ready for review by colleagues, although another popular option is submitting simultaneously to a journal and arXiv.

Most papers posted to arXiv are eventually printed in journals. There are notable exceptions, including Perelman's landmark paper leading to the proof of the Poincaré conjecture [11]. arXiv provides a reliable citation system for all eprints (see our citation [11]), lending a form of "intellectual priority" to works posted there. Despite these marks of arXiv functioning as a scientific journal, arXiv has never sought to replace scientific journals and explicitly states that it serves a different function as "an openly accessible, moderated repository for scholarly articles in specific scientific disciplines."

arXiv is now administered by the Cornell University Libraries. Funding comes from voluntary pledges by academic institutions along with matching funds from the Simons Foundation [10]. One-hundred twenty six of the top two-hundred institutions in terms of downloads have provided the operating budget for arXiv over the next five years. This plan reduces the financial burden on Cornell University and transfers governance to a collaborative community in accordance with arXiv's key principles. arXiv takes numerous measures to ensure that the repository will remain permanently available and submissions will be readable.

B. Figshare

Figshare (http://figshare.com/) is an open servers that allow scientists to submit any research output: manuscript, figures, datasets, videos, theses, presentations, and so on. There are no rules to limit what constitutes a research output: anything

All figshare content (article, figures, datasets) have a unique digital object identifier (DOI) like any journal article.

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C. PeerJ

D. F1000Research

F1000Research is not a public preprint server like the previous three servers. Whereas arXiv, Figshare, and PeerJ offer an option to submit a manuscript without having it reviewed, papers submitted to F1000Research will eventually be reviewed. Thus, F1000Research offers a hybrid model with publicly available manuscripts at time of submission and standard peer-reviews. Manuscripts are considered "accepted" and will only be indexed after two positive referee response.

V. CONCLUSION

Responding to the rumour that they refused manuscripts submitted to arXiv, Nature responded that "Nature never wishes to stand in the way of communication between researchers. We seek rather to add value for authors and the community at large in our peer review, selection and editing" [1].

Open preprints server offer a great opportunity for open science, especially if the community embrace the idea of discussing preprints. Initiatives like Haldane's Sieve (http://haldanessieve.org/), a new blog discussing arXiv papers in population genetics, will help make arXiv

attractive for scientists looking to promote their work. These initiatives are important to fully exploit the potential of open preprints servers.

Posting preprints online increases the community of available informal peer reviewers, and uses the internet for its original community-building purposes. Preprint servers also facilitate communication between disciplines, bridging cultural as well as geographic divides. The advantages are clear and the costs are low.

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