

nature neuroscience

A place for preprint archives?

Free-access online journals are often touted as the next big thing in science publishing, but although they will require new business models, their editorial vision remains conservative. The central function of journals is to filter the scientific literature through expert peer review, and neither PubMed Central nor the Public Library of Science plans to challenge this view. A more radical model is the preprint server, in which authors post unrefereed manuscripts to an online archive, making them freely available to the world. This model has been widely adopted in the physical sciences. Will it ever catch on among biologists?

The largest and most influential server is ArXiv, formerly the Los Alamos preprint server and now hosted by Cornell University. It was founded by Paul Ginsparg in 1991, and it has grown steadily ever since; it now receives around 3000 new submissions each month. It is also heavily used, according to Ginsparg (<http://arxiv.org/blurb/pg02pr.html>), with over 20 million full-text downloads last year.

Apart from removing occasional postings that are deemed inappropriate, ArXiv does not review manuscripts, and it makes no claims for the validity of the information it hosts. It is a no-frills service; manuscripts are not reformatted or copy-edited, and although they are searchable and citeable, they lack much of the linking that is now provided by most commercial publishers. ArXiv may not be elegant, but it is quick and cheap—papers are normally posted within a day of submission, and Ginsparg estimates that the cost is less than \$10 per paper, far cheaper than any journal.

The usage statistics imply that the benefits are widely appreciated, and it is easy to understand why. ArXiv allows researchers to document their claims quickly, without waiting for journal publication, and it makes their findings freely available to anyone who may be interested. Authors can post preliminary versions of manuscripts to be modified in response to community feedback before being submitted for peer review. Although ArXiv has displaced journals in a few fields (notably some branches of theoretical physics), these are the exceptions rather than the rule. For most physicists, publication in peer-reviewed journals remains essential for career progression, and early fears that online preprints would undermine the peer review process have not been borne out. Coexistence is the norm, and many of the preprints that appear on ArXiv are later published in the normal way.

Perhaps the most remarkable thing about the self-archiving model is the contrast between its enthusiastic uptake by physicists and the general indifference of the biology community. Although some physicists may attribute this to biologists' secretive and competitive personalities, it seems implausible that these traits are either unique to or universal among biologists. In fact, ArXiv does contain a few biology preprints, particularly in neuroscience. Most are from a relatively small number of theoretically oriented researchers, particularly those with physics backgrounds. This suggests that cul-

tural habits may be more significant than any deep psychological explanation. Moreover, biologists seem unconcerned about announcing their conclusions online; the Society for Neuroscience website, for example, carries over 13,000 abstracts from last year's meeting alone. Adding data to substantiate the conclusions would seem like a relatively modest step.

One key concern for many researchers is academic credit, and the fear of being plagiarized or scooped is probably the main reason more biologists do not participate. Yet this makes little sense. Whereas it may be difficult to show that a competitor secretly photographed one's poster during a meeting, an archived preprint represents a clear documented claim, and digital searching should make it easy to demonstrate priority and to spot plagiarism when it occurs.

The other major deterrent to self-archiving is the policy of some journals. *Science*, for example, is explicit in its prohibition: "Posting of a paper on the Internet may be considered prior publication that could compromise the originality of the *Science* submission. Thus, if you are planning to submit your paper to *Science*, it should not be posted online." The Nature journals (including this one) have taken a different view: "Nature does not wish to hinder communication between scientists.... Neither conferences nor preprint servers constitute prior publication." Many journals do not state their policies clearly, and one suspects that this ambiguity may sometimes be deliberate, appealing to publishers who are reluctant to offend authors yet nervous about the possible threat to their own revenues.

These concerns seem misplaced. With over a million scientific papers published every year, an unrefereed archive cannot possibly replace the filtering function of the journal system. It is certainly arguable that the "cult of journals" has gone too far (Lawrence, P.A., *Nature* 422, 259–261, 2003), but although the system is far from perfect, most researchers still find it valuable; people who doubt this should consider whether they would be willing to have journal identifiers stripped from Medline searches or candidates' resumes.

New filtering systems could be devised to separate validation from publication. Such systems could overlay an archive of unrefereed manuscripts, highlighting those of greatest significance and conferring visibility and prestige on the authors. It is even conceivable that this might one day be automated, but this does not seem likely to happen soon. The decision to publish a paper in a journal such as *Nature Neuroscience* represents many hours of scrutiny from referees who are typically among the leading experts in the field, and the decision to read a given paper rather than one of the many thousands of others in the field is based in large part on this advice. If someone devises another method that provides the same degree of scrutiny, it might undermine the current system. Until then, however, journals and preprint archives should be seen as complementary rather than as competitors.