

Methods, preprints and papers

This journal supports preprints as a means to rapidly share research, but discourages their use as stand-alone citations disclosing a new method integral to the key results in a paper.

Earlier this year, the US National Institutes of Health (NIH) published a notice encouraging investigators to use preprints to speed the dissemination of their work and allow their citation in grants. In April, the Chan Zuckerberg Initiative also announced it was putting an unspecified amount of money into developing and expanding the bioRxiv preprint server, stipulating that its grantees should deposit their papers there. Other funders, such as the Howard Hughes Medical Institute, the Wellcome Trust, Cancer Research UK and the French National Alliance for Life Sciences and Health have all recognized preprints as a means to rapidly publish research in a freely accessible form amenable to community feedback. Although some journals still refuse to consider papers previously posted as preprints, *Nature Biotechnology* (like other Nature research journals) has no such restriction and encourages authors to post preprints of their work. This journal also supports the citation of preprints in our papers, with one notable exception: it is unacceptable practice for authors to use a preprint as the sole citation for a new method in one of our papers if that method is required to generate the main claims of that paper.

Preprints have been the preferred means of sharing research for physicists and mathematicians since the preprint server arXiv was established in 1991. Today, arXiv is home to over 1.3 million preprints from a wide range of fields, including physics, math, computer science, electrical engineering and economics.

After a dalliance with preprints at the NIH in the 1960s (*PLoS Biol.* <https://doi.org/10.1371/journal.pbio.2003995>, 2017), it took until 2003 before quantitative biologists started publishing preprints on arXiv. In the following years, at least two attempts were made to launch preprint servers hosting biology—*BMJ's* ClinMed Netprints and Nature Precedings—but these were shuttered in 2005 and 2012, respectively. In 2013, bioRxiv and Peer J Preprints were launched to house preprints across all areas of the life sciences. This time, the biology community was ready. bioRxiv, operated by Cold Spring Harbor Laboratory, has turned out to be by far the most popular and fastest-growing biology preprint server, publishing over 11,000 papers last year and currently holding over 17,000 manuscripts.

Preprints offer several advantages over publishing in a traditional peer-reviewed journal. After a basic screening process, manuscripts are made available almost instantly and are assigned a digital object identifier (doi) to create a permanent, citable record (subsequent revisions are time stamped). This enables researchers to be credited with ideas and discoveries almost as they happen, rather than waiting for the protracted process of peer review. Community feedback is encouraged and can be used to shape and improve manuscripts both before and during journal peer review. As preprints are open access, they reach a much wider audience than articles published behind journal paywalls.

Some vocal proponents of preprints state that they will supersede “obsolescent and slow” peer-reviewed journals. But in the near term, it

seems more likely that they will complement traditional journals; in this respect, there are synergies to be found.

Several journals already participate in the bioRxiv to Journals (B2J) initiative, which enables authors to submit manuscripts and related files directly from bioRxiv to the participating journal. This saves authors the additional and often time-consuming task of uploading files and author information to journal submission systems. Although Nature research journals are not yet signed onto this scheme, *Nature Communications* has recently launched an “Under Consideration” pilot, whereby authors with papers under review at the journal have the option to include a link to a preprint. The pilot has benefitted preprints, with about half the people who opted into Under Consideration reporting they deposited a preprint only after receiving information from the journal.

With preprints having so much going for them, why are some researchers still reticent?

One reason is that many biology journals still refuse to accept manuscripts posted as preprints. According to online resource SHERPA/RoMEO, 53% of journals prohibit consideration of preprinted papers. This should change. Another problem is the fear of being scooped, especially in highly competitive fields—and fields where commercial rights are at stake. Ideas and results posted on a preprint server could be replicated by other groups and published first, particularly when results are generated from publicly available datasets (e.g., UK BioBank or the ENCODE project). Indeed, a legacy of priority races in many areas of biotech may discourage certain groups from rapidly embracing preprints—a phenomenon already observed at ChemRxiv for the fiercely competitive organic chemistry community. As the sheer number of biological preprints increases, ensuring community engagement may also prove tricky; as of today, only 11% of preprints on bioRxiv have comments.

But for this journal, the most important note of caution about preprints relates to the lack of assurance of their quality. Formal peer review goes a long way toward assuring that the methods described within papers are technically sound and robust. In upholding our commitment to publish high-quality, accurate and reproducible science, we therefore will require all methods central to the main findings of a *Nature Biotechnology* manuscript to be accepted in a peer-reviewed journal before proceeding to publication.

There is no doubt that preprints are transforming the landscape of scientific publishing. They are enabling research to be published with unprecedented speed and openness, and shared with a wide audience. From preprint to peer-reviewed publication, it is now possible to see how science changes and this increased transparency can only serve to increase the reproducibility of research. But preprints meet only minimum standards of review. And peer-reviewed journals must ensure that the integration of minimally reviewed preprints into their papers does not compromise the reproducibility of the science they publish. 