



The selfish scientist's guide to preprint posting

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Preprint posting is the right thing to do for science and society. It enables us to share our results earlier, speeding up the pace of science. It also enables us to catch errors earlier, minimising the risk of alerting the world to our findings (through a high-impact publication) before the science is solid. Importantly, preprints ensure long-term open access to our results for scientists and for the public. Preprints can be rapidly posted for free on [arXiv](https://arxiv.org/) and [bioRxiv](https://www.biorxiv.org/), enabling instant open access.

Confusingly for any newcomer to science who is familiar with the internet, scientific journals don't provide open access to papers in general. They restrict access with paywalls and only really publish (in the sense of *to make publicly available*) a subset of papers. The cost of access is so high that even institutions like [Harvard](https://www.harvard.edu/) and the UK's Medical Research Council (MRC) cannot afford paying for general access to all the relevant scientific literature. For example, as MRC employees, members of my lab do not have access to the *Journal of Neuroscience*, because our MRC Unit, the Cognition and Brain Sciences Unit in Cambridge, cannot afford to subscribe to it. The University of Cambridge pays [more than one million pounds](#) in annual subscription fees to Elsevier alone, a single major publishing company, as do several other UK universities. Researchers who are not at well-funded institutions in rich countries are severely restricted in their access to the literature and cannot fully participate in science under the present system.

Journals administer peer review and provide pretty layouts and in some cases editing services. Preprints complement journals, enabling us to read about each other's work as soon as it's written up and without paywall restrictions. With the current revival of interest in preprints (check out [ASAPbio](https://www.asapbio.com/)), more and more scientists choose to post their papers as preprints.

All major journals including *Nature*, *Science*, and most high-impact field-specific journals support the posting of preprints. Preprint posting is in the interest of journals because they, too, would like to avoid publication of papers with errors and false claims. Moreover, the early availability of the results boosts early citations and thus the journal's impact factor. Check out Wikipedia's useful [overview of journal preprint policies](#). For detailed information on each journal's precise preprint policy, refer to the excellent [ROMEO website](#) at the University of Nottingham's [SHERPA](#) project on the future of scholarly communication (thanks to Carsten Allefeld for pointing this out).

All the advantages of using preprints to science and society are good and well. However, we also need to think about ourselves. Does preprint posting mean that we give away our results to competitors, potentially suffering a personal cost for the common good? What is the selfish scientist's best move to advance her personal impact and career? There is a risk of getting scooped. However, this risk can be reduced by not posting too early. It turns out that posting a preprint, in addition to publication in a journal, is advisable from a purely selfish perspective, because it brings the following benefits to the authors:

- **Open access:** Preprints guarantee open access, enhancing the impact and ultimate citation success of our work. This is a win for the authors personally, as well as for science and society.
- **Errors caught:** Preprints help us catch errors before wider reception of the work. Again this is a major benefit not only to science, society, and journals, but also to the authors, who may avoid having to correct or retract their work at a later stage.
- **Earlier citation:** Preprints grant access to our work earlier, leading to earlier citation. This is beneficial to our near-term citation success, thus improving our bibliometrics and helping our careers - as well as boosting the impact factor of the journal, where the paper appears.
- **Preprint precedence:** Finally, preprints can help establish the precedence of findings. A preprint is part of the scientific record and, though the paper still awaits peer review, it can help establish scientific precedence. This boosts the long-term citation count of the paper.

In computer science, math, and physics, reading preprints is already required to stay abreast of the literature. The life sciences will follow this trend. As brain scientists working with models from computer science, we read preprints and, if we judge them to be of high-quality and relevance, we cite them.

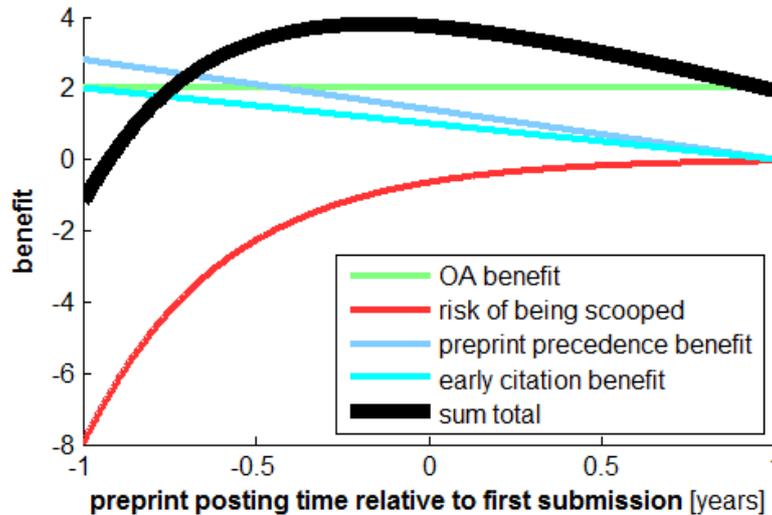
My lab came around to routine preprint posting for entirely selfish reasons. Our decision was triggered by an experience that drove home the power of preprints. A competing lab had posted a paper closely related to one of our projects as a preprint. We did not post preprints at the time, but we cited their preprint in the paper on our project. Our paper appeared before theirs in the same journal. Although we were first, by a few months, with a peer-reviewed journal paper, they were first with their preprint. Moreover, our competitors could not cite us, because we had not posted a preprint and their paper had already been finalised when ours appeared. Appropriately, they took precedence in the citation graph - with us citing them, but not vice versa.

Posting preprints doesn't only have advantages. It is also risky. What if another group reads the preprint, steals the idea, and publishes it first in a high-impact journal? This could be a personal catastrophe for the first author, with the credit for years of original work diminished to a footnote in the scientific record. Dishonorable scooping of this kind is not unheard of. Even if we believe that our colleagues are all trustworthy and outright stealing is rare, there is a risk of being scooped by honorable competitors. Competing labs are likely to be independently working on related issues. Seeing our preprint might help them improve their ongoing work; and they may not feel the need to cite our preprint for the ideas it provided. Even if our competitors do not take any idea from our preprint, just knowing that our project is ready to enter the year-long (or multiple-year) publication fight might motivate them to accelerate progress with their competing project. This might enable them to publish first in a journal.

The risk of being scooped and the various benefits vary as a function of the time of preprint posting. If we post at the time of publication in a journal, the risk of being scooped is 0 and the benefit of OA remains. However, the other benefits grow with earlier posting. How do benefits and costs trade off and what is the optimal time for posting a preprint?

As illustrated in the figure below, this selfish scientist believes that the optimal posting time for his lab is around the time of the first submission of the paper. At this point, the risk of being scooped is small, while the benefits of preprint precedence and early citation are still substantial. I therefore encourage the first authors in my lab to post at the time of first submission. Conveniently, this also minimises the extra workload required for the posting of the preprint. The preprint is the version of the paper to be submitted to a journal, so no additional writing or formatting is required. Posting a preprint takes less than half an hour.

I expect that as preprints become more widely used, incentives will shift. Preprints will more often be cited, enhancing the preprint-precedence and early-citation benefits. This will shift the selfish scientist's optimal time of preprint posting to an earlier point, where an initial round of responses can help improve the paper before a journal vets it for a place in its pages. For now, we post at the time of the first submission.



Benefits and costs to the authors of posting preprints as a function of the time of posting This figure considers the benefits and costs of posting a preprint at a point in time ranging from a year before (-1) to a year after (1, around the time of appearance in a journal) initial submission (0). The OA benefit (green) of posting a preprint is independent of the time of posting. This benefit is also available by posting the preprint after publication of the paper in a journal. The preprint-precedence (blue) and early-citation (cyan) benefits grow by an equal amount with every month prior to journal publication that the paper is out as a preprint. This is based on the assumption that the rest of the scientific community, acting independently, is chipping away at the novelty and citations of the paper at a constant rate. When the paper is published in a journal (assumed at 1 year after initial submission), the preprint no longer accrues these benefits, so the lines reach 0 benefit at the time of the journal publication. Finally, the risk of being scooped (red) is large when the preprint is posted long before initial submission. At the time of submission, it is unlikely that a competitor starting from scratch can publish first in a journal. However, there is still the risk that competitors who were already working on related projects accelerate these and achieve precedence in terms of journal publication as a result. The sum total (black) of the benefits and the cost associated with the risk of being scooped peaks slightly before the time of the first submission to a journal. The figure serves to illustrate my own rationale for posting around the time of the first submission of a paper to a journal. It is not based on objective data, but on subjective estimation of the costs and benefits for a typical paper from my own lab.