Ten simple rules for considering preprints

So why make your work available as preprints? There are perceived positives and negatives to disclosing scientific work in the form of a preprint, explored here in the form of 10 Simple Rules. These rules, if they pass review, will appear as part of the PLOS Computational Biology Ten Simple Rules Collection. The rules cover such issues as reward, incentives, speed of dissemination, quality, scooping, and record of priority. You cannot have an article describing preprints, without itself being a preprint!!

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Ten Simple Rules for Considering Preprints

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For the purposes of this discussion, a preprint is a complete written description of a body of scientific work which has yet to be peer reviewed. The term preprint is an anomaly since there may not be a print version at all, but it serves the purpose of placing this research output at the appropriate point in the research process. Typically a preprint is a research article that is ready to be submitted to a journal. It could also be a commentary, report of negative results, a large data set and its description, and more. Starting in August 1991, physics, mathematics and later other fields, have had a tradition of making preprints available through arXiv [1]. arXiv currently contains well over 1 million preprints. While late to the game [2], preprints in biomedicine have gained significant community attention recently [3,4] and led to the formation of a scientist-driven effort, ASAPbio [5], to promote their use. So why make your work available as

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preprints? There are perceived positives and negatives to disclosing scientific work in the form of a preprint, so let us explore them one by one.

Rule 1: Preprints speed up dissemination

A recent analysis highlighted that the median review time — the time between submission and acceptance of an article — is around 100 days, with a further 25 days or so spent preparing the work for publication [6]. However, these figures - although still relatively slow - do not include the time researchers spend “shopping around” for a journal to publish their findings. Stephen Royle, a cell biologist at the University of Warwick, undertook an analysis of the papers his lab had published over the past dozen years and concluded that the average time from first submission to publication was around 9 months [7].

At a time when technology allows research findings to be shared instantly, these publication times appear glacial and of another era and, crucially, slow the overall pace of discovery.

Rule 2: Preprints Enable Open Science and Improved Scholarly Communication

Typically preprints are not encumbered by copyright restrictions or paywalls, and thus they can be mined to better comprehend and utilize the knowledge presented. Software tools that facilitate that comprehension are in their infancy, but are likely to become mainstream in the next 5-10 years. Better still, the traditional content of research articles can be integrated with the underlying data, analytics and commentary to create a new learning experience. To the community, this represents an opportunity to accelerate discovery not offered by traditional publishers; to the contributing authors, this offers new opportunities for your work to be used and cited.

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Rule 3: Preprints provide scholarly content and credit that would otherwise be lost

As scholars, we have scholarly output that we are willing to stand behind, but has no outlet. A graduate student leaves, gets tied up in a new position and the paper never gets that final polish yet contains meaningful results and conclusions. A project yields negative data, or data that simply does not come together into a coherent story yet has value to the community. Replication of a study (or not) represents a useful outcome but is not innovative enough for journal publication. In summary, preprints offer a way of sharing important scholarly output that would otherwise disappear down a black hole after much time and expense. Some might argue if it has not passed peer review it should be disregarded. To those we say, how much useful information do you get from discussions of unpublished data at meetings, blogs and other forms of non peer reviewed content? We would argue that this type of useful information is growing. The same naysayers will then likely say, there is too much misinformation as well as useful information on the internet. We agree that filters are needed. Human filters will not be able to cope with the volume, hence the need for software tools as described as part of rule 2.

Rule 4: Preprints do not imply low quality

Given that preprints have not been peer reviewed, does that imply low quality? Certainly the peer review process can add significant value to the work, pointing out errors or areas for improvement. Nevertheless, authors must stand behind their submitted preprint because it is a public disclosure and hence a citable publication, albeit non-peer reviewed. Even without peer review, their scientific colleagues will be reading and judging the work and their reputations are at stake. Thus, scientists will be careful to disclose their best work that reflects their scientific abilities/expertise, so work of low quality would not be expected. This has been true of arXiv

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over the years and the high quality factor also seems to apply to bioRxiv [8]. To illustrate this, we know a high profile biomedical research laboratory that now conduct their journal clubs exclusively on preprints [9].

Rule 5: Preprints support the rapid evaluation of controversial results

Science is self correcting. Through preprints the time to correct can be much reduced. Experience with arXiv showed that claims concerning, for example, superluminal neutrinos [10] or bicep2 primordial gravitational waves [11] could be discredited before they reached the published literature. In biomedicine a case in point was the publication of information in May 2016 [12] that indicated cell phone radiation boosts cancer rates in animals. Given the controversy around such a statement, the NIH felt an obligation to release all the data as quickly as possible so that others could review the findings. This would not be possible through conventional publishing, but a preprint [13] was posted within 24 hours. In a little over 5 months since the preprint was posted it has been downloaded 148,000 times, providing a more complete picture of the controversial result. It could be argued that the preprint furthered the controversy, but there would seem to be an obligation to provide all available data to describe the research that had been undertaken. You could take this further and argue that the science should have been open as it progressed, but that is still not within the comfort zone of most scientists.

Rule 6: Preprints do not typically preclude publication

Wikipedia devotes a page [14] to the preprint policies of publishers and their associated academic journals. As can be seen, very few journals consider preprints as a “prior form of publication” and reject such manuscripts on the grounds that it had been posted to a preprint

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server. In recent months, more life science journals are developing preprint-friendly policies - and a number have mechanisms to accept journal submissions directly from bioRxiv [15]. We expect this trend to continue as publishers grow to appreciate the value of preprints and how community input can help the author to improve their work and manuscript, leading to a better publication of record.

Rule 7: Preprints do not lead to being scooped

As this juncture, you might be thinking, but won't I be scooped if I put my work out there ahead of the formal journal publication? The notion that preprints leads to scooping is covered in some detail [16] by ASAPbio and only a synopsis is given here. Again the presence of arXiv provides a history of what has happened, at least in other disciplines. The short answer - intentional scooping is virtually absent in physics and some other fields, because these communities are aware of the arXiv communication and do not tolerate such behavior. Then the question becomes whether the biomedical community is somehow different in its ethics or behavior? Stepping back, perhaps we should ask, what is the definition of scooping? Here we take it to mean that either inadvertently, or purposely, an author publishes a biomedical finding and does not provide attribution to the original author(s). It is hard for the original authors to prove originality if nothing about the work is registered in the public domain. Posters and oral presentations might prove originality, but they are often not publicly and persistently available or detailed enough to support the originality of a body of work. Preprints can do that, as described in Rule 8, and they can and should be fairly cited.

Rule 8: Preprints provide a record of priority

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There are a number of resources that provide preprint services to the biosciences, for example, bioRxiv and PeerJ Preprints [17]. Both include an uneditable timestamp indicating when the article appeared, which is usually within 24 hours of submission. This date and the preprint itself is open access and thus anyone (using any Internet search engine) can determine the order of priority relative to other published work, or indeed other preprints. One of the original motivations for creating arXiv was to create a transparent public record of a scientist's work. In contrast, while journals provide an important service of validation through peer review, establishment of priority can be significantly delayed because of the work, in most journals, is not public during the process of peer review. The complementary roles of preprints and journals in establishing priority and validation, respectively, are discussed in a commentary by Vale and Hyman [18].

Rule 9: Preprints can further inform grant review and academic advancement

An issue, particularly for young investigators submitting grants, is the lack of a substantive body of work in support of a particular grant application or academic promotion.

First, consider grant applications to funding bodies. Papers submitted, or even accepted, but not yet published, do not help, since the grant reviewer cannot judge the work. In contrast, the availability of preprints can provide a reviewer with the evidence that they need to substantiate recent productivity as well as supporting the work being proposed in the grant application. How individual funders currently treat preprints is variable, and thus their value to investigators in the way described is also variable. NIH currently encourages the inclusion of preprints and other referenceable material in the biosketch, but not in grant applications and reports, although this policy is expected to change. Investigators include them in grants and reports anyway, which

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speaks to a reconsideration of the current practice. Wellcome Trust supports the inclusion of preprints in grant applications and end-of-grant reports. The Simons Foundation encourages PIs to post preprints [19], and the Human Frontiers Science Program will allow them to be listed on applications and reports in 2017 [20]. Currently many funding agencies are re-evaluating their policies (or lack of policies) towards preprints, so we expect many new pro-preprint policies to emerge in the coming year. Progress of funders in this regard can be tracked from the ASAPbio website [21].

Now consider academic advancement. At the time for academic promotion, a significant body of an investigator's work could be tied up in the journal review and publication pipeline. Certainly, submitted papers can usually form part of a promotion file, but this carries less weight and credibility than a preprint, which is an acknowledgment by the author that the work is ready for public viewing and dissemination to the entire scientific community. If a knowledgeable reader has significant thoughts on the preprint, those thoughts could be added, at least on some preprint services. This has wider ramifications, since commentary on preprints may provide the opportunity to improve the final published paper.

Rule 10: Preprints - one shoe does not fit all

bioRxiv, which is the main preprint repository for the life sciences, does not accept preprints that include human subjects data. This makes sense. Since submissions to bioRxiv only undergo a cursory human review before being posted, there is the opportunity for private personal information to be revealed. This has ethical, legal and social issues (ELSI). Such arguments flow into issues of intellectual property where there is the risk of undesirable public release of information. It should be noted this is not an issue restricted to preprints, but can apply to talks,

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posters etc. too. For research articles, professional editors and reviewers provide additional layers to safeguard from sensitive content being inadvertently released. Currently, preprints have only cursory safeguards, though a future system could enable more rigorous review. With open content from preprint services available through APIs, there is the exciting opportunity for any researchers to develop tools to better flag potential ELSI and IP issues which. If those tools were open, they would benefit the publishing industry as well.

What should be apparent from these Ten Simple Rules is that the provision and use of preprints in the biomedical sciences is still evolving, but there are clear benefits to the individual and the community. We invite you to contribute your next paper as a preprint and join the movement.

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