OPINION ARTICLE

Junior biomedical scientists and preprints [version 1; peer review: 1 approved, 1 approved with reservations]

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Abstract
Researchers, publishers and representatives of funding agencies gathered at ASAPBio (February, 2016) to discuss the use of preprint publications in biology. It became clear through the discussion on Twitter with #ASAPBio that many were unclear as to the purpose of the meeting, how preprints could help or hinder junior scientists, or even what preprints are. As a postdoc attendee of the meeting, I would like to share some information and resources to help junior scientists decide for themselves whether submitting preprints are a worthwhile endeavor, and explain why I, and the lab I am currently part of, have decided to start publishing our papers on preprint servers when also submitting to traditional journals.

Keywords
preprint, publishing, peer review, journals, biomedicine

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Invited Reviewers

1 Needhi Bhalla, University of California Santa Cruz, Santa Cruz, USA
2 Ron Vale, University of California San Francisco, San Francisco, USA

Any reports and responses or comments on the article can be found at the end of the article.

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What’s a preprint?
A preprint is a manuscript in a finished form that has not yet been published in a traditional journal. It is essentially the document that you submit to a traditional journal for peer review, deposited on a server for anyone to access. The practice of publishing preprints is universal in the fields of physics and mathematics since the creation of the arXiv preprint server in 1991, but the biological sciences have been slower to take up the preprint archiving model1-2. A biological sciences preprint server, bioRxiv, is already in existence, and well used. At ASAPBio, Paul Ginsparg, founder of arXiv, gave a keynote talk about the history of arXiv which you can watch on the video stream. iBiology has also released a video with Youreka Science which explains what preprints are. Preprint publication, it has been proposed, could accelerate the dissemination of work and the pace of discovery1 (also in preprint format!).

What is being asked of the community?
There were many discussions on social media surrounding the ASAPBio meeting and aspects of scientific publishing; so many, in fact, that the original intention of the meeting was in danger of being drowned out in the noise. The focus of this meeting, like this paper, was to convince scientists to submit publications to preprint servers such as bioRxiv, before or at the same time as submission to a traditional journal of choice: adding a small step to the normal publication workflow. The goal of the meeting was to make sure that as many barriers as possible to that process could be removed, at journals, funding agencies and within the culture of biomedicine.

Why will I (as a junior scientist) preprint?
From the perspective of a junior scientist, there are several reasons that have convinced me to deposit my publications as preprints in the future (and, incidentally, have also convinced my current lab to do the same).

Disseminating research
Preprints are another opportunity, along with talks, seminars, public lectures and blog posts, to disseminate my work. Because preprints are free and open, I can share it on websites, through social media, to researchers in other countries, to friends and family. Being able to share my work for discussion has always been useful both for improving my science and also for letting people hear about my work. The work can be shared immediately, and can be useful for others to consider in the context of their own work, whilst traditional peer review is taking place. It adds to, and does not detract from, my productivity as a scientist.

Evidence of productivity
Preprints provide evidence of productivity on applications for grants, fellowships, and jobs. Throughout various points of training, there are markers for junior scientists where they need publications to pass to the next phase or receive funding, and the time taken to publish is affecting the time junior scientists spend in training positions. For example, I have heard recommendations that postdocs should apply for a K99/R00 mechanism in the second year of their postdoctoral work, which directly contradicts the expectation that a first-author publication from that work is invariably required to achieve a good score. I have heard similar expectations exist in various funding mechanisms for trainees, through to the NSF Graduate Research Fellowship Program that undergraduates and early graduate students are eligible for. Indeed, with publication requirements for graduating from PhD programs, and, increasingly, an expectation that undergraduates will have publications for graduate fellowships or even applying to graduate school, trainees are taking longer in training positions, or taking time out after undergraduate degrees to work as technicians, simply waiting for publications to be accepted. Preprints give a marker of productivity and moving towards publication that could relieve pressure at this point and subsequently reduce unnecessary time in training. What was most encouraging at ASAPBio (especially as I had the good fortune be in the subgroup on the role of funding agencies with representatives from EMBO, HHMI, NIH, NSF and the Wellcome Trust) was that funding agencies were on board with recognizing a preprint as a product. Representatives from EMBO suggested that they already informally uses these kinds of markers for renewing postdoctoral fellowship applications, because they do not think it is reasonable to expect postdocs to have published by the time of renewal. The NIH Biosketch potentially already allows for these kinds of products to be included as evidence3, although clarification on this is needed and the NIH is due to issue a statement in March. Moving forward the hope is that these products will be more commonly recognized as a marker of productivity and progression, rather than relying on the stop-and-start flow of accepted publications.

Personal perspective
I will lay out my bias here, however. I try to make the conscious decision, when it is mine to make, not to join the impact factor dance in publishing (when I have done so, it has been at points when it has been worth a try for applications, or with collaborators who feel similarly pressured to do so). To me, it makes sense to have a publicly available work that I can solicit feedback on, and then also submit the paper to a journal which I think fits and more importantly, which I think will accept it without much hassle, but which I think will reach the audience for which it is intended. I do this not only because of personal preference (I certainly realize it is an idealistic way of publishing) but because there are many, many postdocs with excellent publications, many in high impact factor journals, competing desperately for jobs and I truly don’t see it being worth the effort, and just want to publish consistently and regularly. The metric of the impact factor has become inflated; and the devolution of decision making on what makes good science to the realm of a few journals and the sheer number of applicants for positions could be resulting in fewer papers actually being read, because reviewers simply can’t read everything from everyone (for commentary and thoughts on this please see relevant discussions on the subject e.g. 5–7). A preprint can give the most recent snapshot of your work and productivity (as your most recent publication could easily be work that’s 2 years old) and could be a useful product in actually evaluating someone’s science directly as part of an application, if reviewers have time to read only a selection of your work. Arguably, a work that has not been through the peer review process and is recent can give a much more realistic snapshot of you as a scientist.

What are the reasons not to preprint?
Philosophical reasons given against preprinting generally revolve around: questions of whether they are recognized products or markers of productivity; the possibility of being scooped; and settling the issue of who has priority over a novel discovery.

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To these, my simple answer was to talk to a physicist. I happened to see a tenured colleague from the physics department at Tufts on my return and explained what ASAPBio was about. When they asked why biologists don’t use preprints, and I gave the answers above, they replied that those were precisely the reasons they use preprints. In grants and tenure review, people recognize that the publication process is not under your control, but producing finished manuscripts and depositing them on a server, where they can be read, and then letting the publication process take its course is taken as an obvious part of the continuing process of science. In terms of being scooped, the manuscript has a DOI and is publicly available, and my physicist colleague told me they use preprints to explicitly avoid being scooped. In terms of priority of discovery, I have to agree with the view that publishing preprints by itself isn’t going to resolve or cause such disputes, unless the field decides to ignore contextual evidence for work in a scientific discovery. I must declare that establishing priority of discovery is not a personal goal, or certainly not one I am particularly concerned about in science, and so am perhaps not the best person to answer to that point, but there is a commentary piece at ASAPBio that directly addresses this topic.

In more practical terms, not all journals will accept preprints, but the vast majority do, with the exception of Cell Press, who publicly stated that preprints were possible to submit only through a vague, non-transparent process of contacting the editor to discuss the matter, with the caveat that the preprint should not have “been noticed” by the field. That they took this opportunity in front of an audience of junior scientists in particular was very surprising, especially as many of the other high impact factor journals, such as Science, Nature, PNAS, PLoS and others as described here in this list on Wikipedia will accept preprints. Indeed a group of publishers have drafted a statement actively encouraging the use of preprints and one of the commentary pieces for ASAPBio came from Genetics and G3 on the synergy that preprints and traditional publications could create. I will state here again for clarification that although there was an active discussion about post-publication peer review and extending that to the end of journals altogether, that was only one of the many areas of discussion and not the goal of the meeting, despite what might have been the impression.

There was also some discussion about health sciences, and publishing data that may give false hope to patients or be damaging if made publically available prior to peer review. On this point I will simply refer to Stephen Curry’s piece in the Guardian on the Zika virus, and the apparent embrace of open research in that context. We could well ask, why is this not the case for all research, not just for Zika, and recently, Ebola? The consensus at the meeting seemed to be that it was more, not less, important for medical research to be disseminated openly and rapidly. There have however been recent conflicts over the concept of “research parasitism” and data sharing in the medical literature and the battle for open data in the health sciences is a problem in itself. However I would argue that if you have submitted a piece for publication in a journal, then you are confident of those results and there shouldn’t be any serious harm (or any errors may be spotted more quickly, potentially) in a preprint of the article.

This comes down to a lot of what people seem to fear: which is that the literature will be overwhelmed with junk. David Stern wrote a commentary directly addressing this; essentially, it is very unlikely that people who publish junk will be rewarded for doing so. The peer review process is not perfect – no peer review process, to my eyes, is perfect – but added opportunities for review, dissemination, and replication can surely only benefit the scientific process. In addition, as Stern points out, your name is your brand and if you publish junk, your brand will be associated with junk. I would never (consciously) publish junk just to have a piece available and especially not in such an incredibly open and public format. The risks associated with doing so would be too great compared to depositing work I would stand behind publicly.

What next?
I have told you what I am doing and given my opinion and position after attending the meeting; but this is only to encourage more discussion. I and others, such as Samuel L. Diaz-Muñoz who wrote this commentary on a practical guide for young scientists, and James Fraser who wrote a commentary from the perspective of a junior faculty member, are interested in finding out what our community needs or wants, and hopes or fears about preprints. My impression is that firstly most people have not heard about preprints; my second is that there are some misconceptions about what they (and this meeting) were about. I hope this piece has given some clarification on these points but I am aware of my romantic disposition towards doing my science and am also in an environment and field where I don’t feel that some of the pressures people are most concerned about apply.

I am also not a fan of the current push towards “people not projects” as a model that should define biomedical research. Whilst there can be a place for such models, to help those who thrive in that kind of environment, we are pushing ever further into evaluating science on metrics and backgrounds of people, and looking less and less at the science itself. Preprints can provide evidence of the work and mind of the scientist in a more up-to-date fashion and, divorced from the impact factor of a particular journal, the work itself must be considered.

Ultimately I am excited about increasing the transparency and availability of science; increasing access to my work and enabling more discussion about its implications and improvement; and adding to the products that I can point to as evidence of my scientific endeavors in an attempt to reduce the time spent simply waiting around for publications to come out before applying for jobs and grants. Science is a continuous and reformatory process and to me there is a great value in having science openly available for critique as well as having close scrutiny enforced through various models of peer review.

Competing interests
No competing interests were declared.

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The author declared that no grants were involved in supporting this work.
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Open Peer Review

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I think that this article is a useful contribution and would recommend others to read it as well. I should disclose that I am one of the organizers of the ASAPbio meeting, so perhaps that colors my opinion of the article, which describes outcomes of the meeting. However, I do feel that McDowell has done a very good job separating information from his personal opinion. Both are useful to know and his clear wording defines that boundary. McDowell also has done a good job describing the goals of the meeting and the main topics discussed. There was a reasonable amount of confusion on social media, and thus I think that it is valuable to have McDowell clearly spell out the main themes. Furthermore, a complete record of the meeting can be found here, in cases readers want to go directly to the record:

http://asapbio.org/meeting-information

This article is largely written as a meeting report and an opinion piece. But it is particularly timely and important to have the voices of young scientists (like McDowell), especially in essay form. Junior scientists are suffering the most from the current publication system. But they also are the most vulnerable in their careers to managing any changes that might be introduced. They are also the ones who will inherit any new science communication system that will be built. Thus, junior scientists (not just senior scientists like myself) should be given the opportunity to write articles on this matter, such as the thoughtful piece by McDowell. The general message is that preprints are manageable and adaptation to a world of preprints and journals is not hard and indeed very welcome by junior scientists. I need not micromanage the content of this article with my review, especially as the information is accurate and the boundary between opinion and information is well defined. There is a lot of interesting material here in the piece, including McDowell’s discussion of the dilemma of the K99 NIH and publication (and how preprints might help) and the subject of scientific priority. Needhi Bhalla (another referee) also raised points of discussing more about journal submissions in the physics community. Paul Ginsparg discussed this point in his ASAPbio talk and you can download his slides next to his talk on the agenda (or also watch his talk):

http://asapbio.org/meeting-information/schedule-location

But to quote from his slide 13: "'07-'14 data (HEP): > 80% with journal ref; vast majority of rest subject to some form of review (conf proceedings, theses, lecture notes)". Thus the vast majority of work going to
arXiv goes to journals and the remainder also are mostly subject to some form of peer review. The same scenario is likely to happen in biology.

**Competing Interests:** I am one of the organisers of the ASAPbio meeting.

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

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Reviewer Report 18 March 2016

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I appreciated the author explaining the role that preprints could play in biological and biomedical research and support publication. I have several comments that I think could make this a stronger opinion article.

"A preprint is a manuscript in a finished form that has not yet been published in a traditional journal." I would emphasize in this first paragraph that preprints are not peer-reviewed, particularly since the author points out that preprint posting is likely to be simultaneous or soon after submission to a traditional journal.

"The practice of publishing preprints is universal in the fields of physics and mathematics"  
According to Lariviere, et. al, 2014, only 20% of published papers in the general field of physics are posted as preprints on arXiv. While it is nearly universal in some physics subfields, i.e. astronomy, astrophysics and nuclear and particle physics (60-70% of journal articles are posted as preprints), it is less common to post a preprint and subsequently publish in a peer-reviewed journal in fields such as solid state physics. Rather than undermining the value of preprints, this disparity highlights that posting a preprint can be a considered decision rather than a common practice even in the field of physics, something that may also be eventually true in biological and biomedical research.

I appreciated the author’s personal perspective on publishing.

Another point that may argue against the "junk" argument: Several studies have evaluated the impact, in terms of citations, of papers posted on arXiv and subsequently published in journals versus papers only published in journals and found no difference in the level of impact (Davis and Fromerth, 2007; Gentil-Beccot et al., 2009; Lariviere et al., 2014).

**Competing Interests:** No competing interests were disclosed.

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.
I suggest more arguments in favor of preprints:
i) the possibility to get early peer feedback to improve the article and have better chances to be accepted upon submission to a journal
ii) pre-print are like an open access version of the article: through its preprint, the benefits of open access can apply to the article. The first is that open access articles are more cited than the others.
iii)”publishing data that may give false hope to patients or be damaging if made publically available prior to peer review.” The simple solution is just to mention explicitly than the pre-print has not been peer-reviewed, or to which extent. Anyway, this argument is unfair since 90% of cancer research published in so-called peer-reviewed journals has been shown to be irreproducible. That journal’s peer review protects us from wrong claims or bad science is a pure myth.

The question of the governance of preprint servers is important. I suggest you give more options than bioRxiv (which is operated by the private publisher CSHL Press) such as the Self-Journal of Science (SJS), which is operated by an open community of scholar and librarians.

In the "what next" section:
Pre-prints servers equipped with the proper tools (such as SJS) are the basis for a truly global community process that can complement the local and traditional processes of validation and evaluation mediated by journals. In particular, a community-based evaluation of articles can be proposed as an alternative to the impact factor (e.g. www.sjscience.org/article?id=46). This use of preprints may be the most critical one to improve the quality of science in the future.

Michaël Bon

**Competing Interests:** I am the founder of the Self-Journal of Science.
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