Advancing the culture of peer review with preprints

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Summary

Preprints enable new forms of peer review that have the potential to be more thorough, inclusive, and collegial, and thus fundamentally shift the culture of peer review toward constructive collaboration. In December 2022, 80 researchers and representatives of funders, institutions, preprint servers, journals, indexers, and review services were invited to gather online and at the Janelia Research Campus for a workshop on recognizing preprint peer review. Sponsored by HHMI, ASAPbio, and EMBO, this meeting aimed to catalyze community consensus and support for preprint peer review and to create model policies for funders, institutions, and publishers that recognize both preprints with reviews, and reviews of preprints. Here, we make a call to action to stakeholders in the community to accelerate the growing momentum of preprint sharing and to empower researchers to provide open and constructive peer review for preprints.

Introduction

Critical views (“reviews”) from independent researchers (“peers”) can identify conceptual, logical or methodological gaps in scientific work. Peer review has therefore become a key feature of the scientific process. Peer review can help authors improve manuscripts and give readers (including the general public) increased confidence in the findings reported. Although researchers are increasingly comfortable making manuscripts publicly available as preprints before peer review, most say that peer review improves their work and believe that the quality of published evidence would suffer in its absence [1,2].

Nevertheless, journal peer review faces many challenges [3]. It can be slow, inefficient, error-prone, inequitable, and unduly focused on advising on a journal's editorial decision. Despite the huge time investment by the research community [4,5], peer review by two or three individual researchers cannot detect all problems in a study [6]. As a result, serious flaws in many studies only come to light after journal publication, when the paper becomes visible to a broader group of experts. Meanwhile, a lack of transparency can mask errors and bias in the review process [7]. While some journals now publish peer reviews alongside published articles [8], the majority do not, and peer reviews of rejected papers are almost never made public. This is a wasted opportunity to provide both recognition for reviewers and additional contextual information that could help readers of an article assess its merits. In addition, reviewers may be charged with judging whether a paper is sufficiently exciting or "complete" for a particular journal. This may contribute to a tendency for reviewers to suggest additional experiments or analyses rather than provide advice focused solely on the work presented. As a result, articles are now often expected to include significantly more data [9,10], which creates an additional burden for authors and ultimately slows the dissemination of new scientific evidence.

The growing adoption of preprints offers an important opportunity to experiment with new approaches to peer review that could help address these issues. At the recent Recognizing Preprint Peer Review meeting [11], representatives from the research community, funders, institutions, preprint servers, journals, indexers, and review services examined how peer reviewing preprints could improve the process of peer review. New approaches involving open peer review on preprints could provide benefits to authors, reviewers, and readers.

When peer reviews of preprints are made publicly available, readers are able to see the reports alongside the article, evaluate the claims, and join the conversation. Interactions between authors, reviewers, and readers stimulated by public posting of reviews may surface perspectives from a larger and more diverse sample of the community, increasing the robustness of the assessment and providing further context. This can allow a wider audience, including non-specialists, to benefit from these insights and gain an understanding of how experts perceive the strengths and weaknesses of an article. Preprint review can also give readers more rapid access to peer-reviewed information because, unlike journal publication, reviews can be made available immediately rather than after multiple cycles of review and revisions (e.g., preprint comments are posted a median of 23 days after the article [12], in contrast to an observed 199-day delay between preprinting and journal publication [13]).

Preprint review offers benefits to trainees. While early career researchers in certain disciplines may seldom be invited to review by journal editors, they can freely participate in many forms of preprint feedback and review, offering valuable perspectives. Early career reviewers may be more attentive and have hands-on experience with new techniques that may be less familiar to senior reviewers. Preprint review is already being incorporated into undergraduate and graduate courses on scientific publishing [14–16]. By focusing journal clubs on preprints rather than journal publications, participants can move beyond simply discussing a paper that is unlikely to change, and produce reviews that will help authors and readers.

Preprint peer review can also benefit journals. For example, journals can use preprint reviews to identify papers to invite for submission. In some cases, they may choose to reuse the reviews to expedite their own peer review process, reducing the burden on the reviewer pool, and—when reviews are signed—providing useful leads to identify qualified reviewers for other papers.

In addition to these benefits, we believe that preprint review can promote a cultural shift in peer review. Reviewers can focus on the research as it stands, without having to comment on its fit for a particular journal. Open dialog may encourage reviewers to be more collegial and constructive. Authors could use this

opportunity to publicly respond to questions and concerns, thereby ensuring that their responses can be read by all. Finally, by making the comments of reviewers an integral element of scholarly discourse, peer review will increasingly be seen as a scholarly contribution in its own right.

The state of preprint review

Feedback on preprints is not bound by the expectations of journal peer review. As a result, a variety of forms of preprint feedback have emerged, ranging from minimal and informal approaches to in-depth formal peer reviews. This diversity creates a need to formalize the definition of preprint review. Based on input from two Working Groups [17,18], the participants at the Recognizing Preprint Peer Review meeting have defined preprint review as a subset of public preprint feedback that meets certain criteria. Box 1 distills the following discussions about definitions of preprint review from the meeting.

Box 1. Defining preprint feedback and review

Preprint feedback is publicly available commentary on a preprint that is written by a human.

A **preprint review** is a type of preprint feedback that has:

- Discussion of the rigor and validity of the research
- Reviewer competing interests declared and/or checked
- Reviewer identity disclosed and/or verified, for example by an editor or service coordinator, or ORCID login

It was also clear in the discussions that this description of preprint review encompassed a minimal set of requirements. Additional points discussed included whether a minimum number of independent reviews should be required and whether the review process should result in an explicit recommendation or endorsement of the work (akin to an accept/reject recommendation for a journal). Whether the term “peer” should be part of the definition was also debated. Several participants indicated that an understanding of the reviewer’s expertise is necessary in order to establish whether they constitute a ‘peer’, and that this determination requires knowledge of the reviewer’s identity or a public description of their areas of expertise. Others noted that the term ‘peer’ may be interpreted differently by different communities, and that peer review can involve individuals who bring a valuable external perspective (e.g., patient reviews). With this in mind, we opted for a broader description that leaves the determination of whether the individual contributing the preprint review constitutes a ‘peer’ to the user of that review.

Multiple preprint review services whose outputs meet the above definition (including Review Commons, Peer Community In, PeerRef, PREreview, Qeios, and Rapid Reviews: Infectious Diseases) were represented at the meeting. They illustrate the diversity of approaches—from spontaneous posting of reviews by individuals to community-driven review platforms—that can be used to satisfy the above criteria.

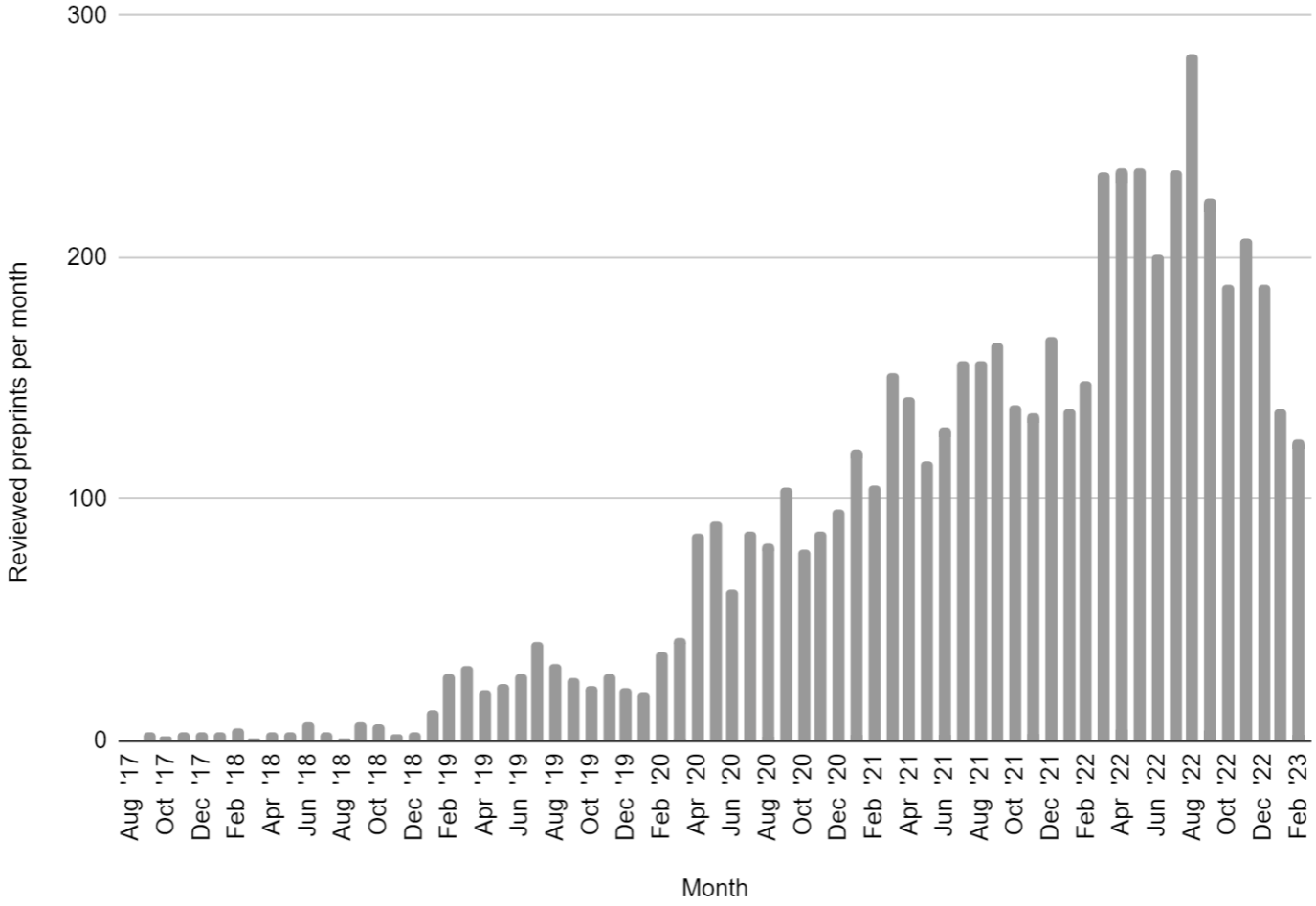

Figure 1. ***Growth of preprint review over time.*** *Preprints reviewed per month on Sciety, excluding reviews conducted by automated tools (ScreenIT) and reviews by journals posted after publication of the journal version. (Source data available [19])*

Prior to widespread adoption of preprinting in biology, some publishers had already implemented workflows that in many respects resemble preprint review. For example, Copernicus's discussion journals encouraged community comments on manuscripts under peer review, and F1000Research developed a model in which manuscripts are published first and then undergo open peer review (reviewers in the F1000 model assign report statuses which contribute to a threshold for passing peer review). As posting of preprints has become more common over the past decade, new preprint review initiatives that decouple peer review from journals have emerged, including platforms such as PREreview and Peer Community In. More recently, *eLife* has introduced a new editorial model in which Reviewed Preprints are the primary output [20]. Review Commons has successfully implemented journal-agnostic preprint peer review in partnership with a growing consortium of journals. In 2022, preprints with reviews were recognized as satisfying the 'peer-reviewed publication' eligibility criterion for EMBO Postdoctoral Fellowships [21], nine funders committed to recognizing reviewed preprints in assessments [22], and cOAlition S stated that for many of its funders, a paper that has "been subject to a journal-independent standard peer review process with an implicit or explicit validation" will be considered equivalent to a journal-reviewed article [23].

Our discussions focused on the peer review itself, rather than any decision or "validation" that follows from it. While some preprint review projects such as Review Commons deliberately avoid making editorial decisions

(leaving this to the journal to which the reviews may be transferred), others provide endorsements or other shorthand signifiers of rigor and impact. Peer Community In, for example, only publishes reviews of articles that have been “endorsed” by their recommender (i.e. by the person coordinating the peer review for the preprint). Other services do not provide an accept/reject decision: Rapid Reviews: Infectious Diseases assigns scores to papers, and eLife’s new model deliberately moves away from accept/reject decisions, instead using a controlled vocabulary to express editorial judgements about the strength of the evidence and the significance of the findings in a summary statement alongside the reviews. These varied approaches may yield different benefits for authors and readers. In cases where an explicit recommendation is not made, reviewers may feel liberated to focus on providing feedback for the author. In contrast, preprint review models that create a recommendation compress reviewers’ opinions into a concise and digestible message that can help readers sift through the scientific literature.

Avoiding pitfalls

Despite the benefits noted above, preprint review is not without potential challenges. Participants raised a variety of concerns at the workshop, and we discussed how each can be addressed with thoughtful implementation of services and policies.

Preprint review services must address bias and non-collegial input, which can be serious problems in peer review [24]. In the most informal preprint feedback models, anyone may comment on a paper, and anonymous and pseudonymous contributions are permitted; thus, it becomes even more important to address the question of competing interests through transparent declarations or editorial oversight. Likewise, services that have editors or coordinators can promote constructive dialog through moderation of comments. But for more open models that aim to minimize the impact of bad actors through community consensus, we need to nurture a culture in which norms of collegiality are established through training and community regulation [25].

While the practice of posting preprints has been growing, only a minority of biomedical papers are posted as preprints (we estimate less than 10% [26]). Preprint adoption varies across disciplines and geographies [27], so not all communities may be ready to embrace preprint reviewing yet. This should not deter progress among those who are ready, but policies or guidance for preprint review must avoid undermining the value of the preprints themselves. Many funders and institutions recognize preprints cited in CVs and job or grant applications as research outputs alongside journal articles [28]. Recognition for preprint review must build on recognition for preprints. Preprint review can support and enrich evaluation of these articles, but the presence of peer reviews does not itself signal the quality of the work.

Not all preprint authors will feel comfortable actively soliciting reviews of their papers. Those who submit to review services are both willing to risk participation in non-traditional publication models and are comfortable with public critique of their work. Moreover, reviewers and editors may be more willing to perform preprint review for authors within their existing networks, potentially reinforcing Matthew effects [29]. On the other hand, preprints lower barriers to sharing: many preprints are never published in a journal, and this fraction varies from ~20% in high-income countries to ~40% in low-income countries [13] and is correlated with funding disclosures. This suggests that preprints enable the release of scientific outputs that would not otherwise be shared. Free or low-cost reviewing approaches built on top of preprints can make peer review more accessible to authors lacking funding or stable research environments.

If the fraction of biomedical papers posted as preprints is currently small, the fraction of preprints that have reviews is even smaller and it is not equitably distributed. Less than 2% of preprints have accompanying reviews [19]. Preprint review services would need to scale massively to provide reviews for all the preprints that are currently posted. Platforms that organize preprint peer review as a service should be easy to use and able to scale so that any researcher can request or contribute to preprint peer review. Journal editors often report challenges finding reviewers for manuscripts, so it will be important for preprint review services to expand their pools of potential reviewers to enable them to respond to growing demand. Participating in preprint review and thereby developing a portfolio of public reviews may be particularly attractive for early career researchers, who are often underrepresented in journal peer review. This should provide an opportunity for both preprint review services and journals not only to expand their pool of active reviewers but also to include a more diverse group of researchers in peer review. Institutions recognizing preprint review should support preprint review services financially and encourage researchers to participate in organized preprint peer review. It is also essential that preprint peer reviews be visible and citable; we have proposed a citation format elsewhere [30].

While services and frameworks such as Sciety, DocMaps and COAR Notify are emerging, many indexing tools do not adequately connect the distributed network of reviews to preprints [31], which can make it difficult for researchers and other stakeholders to discover preprint reviews. A positive example is Europe PMC, which currently links to various preprint peer reviews from preprints indexed on their platform and is working on infrastructure to ingest DocMaps metadata to facilitate accessibility and visibility of preprint reviews. We urge other databases to implement similar measures. Furthermore, we emphasize that preservation strategies are required to ensure that reviews remain accessible in the future.

We also encourage preprint servers to import or aggregate links to external preprint reviews, as is currently done by bioRxiv. Especially in the absence of such integrations, readers may be inclined to post reviews with the commenting system of the preprint server. Such systems do not currently issue DOIs or any other form of persistent identifier. Ideally commenters posting reviews should also provide an authenticated ORCID, but this may create a barrier to entry, so tension between best practices for long-term discoverability and adoption exists. There is also the question of whether all comments warrant such a formal logging within the scientific record, and if this is not the case, how to distinguish between reviews and informal feedback.

Recognizing preprint review: a call to action

We believe that all of the above challenges are surmountable, and that we now have the tools and community support needed to embrace preprint review. We recommend the following actions for stakeholders interested in promoting preprint review.

1. Individual researchers
    a. Request reviews and feedback for the next preprint that you post by submitting to a preprint review service (such as Peer Community In, *eLife*, Review Commons, PeerRef, etc.) and/or include on the first page of your preprint an explicit invitation to review it publicly.
    b. Agree to review preprints when invited by platforms such as Peer Community In, Review Commons, Rapid Reviews: Infectious Diseases, and *eLife*.
    c. Review preprints following recommended good practices [25] and post your reviews as citable objects using a service such as PREreview, Qeios, or ScienceOpen. These may be reviews requested by a journal editor (see Publish Your Reviews) or those you decide to write independently. Consider informing authors about your review ahead of posting and leave them time to provide a thoughtful response.

    d. Convert your lab or graduate program journal club to a preprint review club in which discussions are written up, shared with the preprint authors for feedback, and publicly posted [32].
    e. List preprint reviews on your CV, lab website, or via a tool like Sciety to promote their visibility.
2. Funders, departments & institutions
    a. Consider preprints and their reviews in evaluations for funding, hiring, degree requirements, fellowship eligibility, tenure, and promotion. Make this consideration explicit on your website and in application instructions, for example by adopting a CV format that enables listing preprints and their reviews (where candidate is an author of a preprint) and reviews of preprints (where candidate is a preprint reviewer).
    b. Allocate funding and support for preprint review services.
    c. Provide peer review training that incorporates publicly posting reviews on preprints.
3. Journals
    a. Accept preprint reviews as transferred reviews to inform editorial decisions.
    b. Encourage or require preprint posting at submission.
    c. Partner with preprint review initiatives.
    d. Consider posting reviews on preprints prior to acceptance.
    e. Implement a written policy encouraging preprints and preprint reviews. Suggested text has been recommended by the Journals & Preprint Review Projects Working Group [18].
    f. Consider adopting a preprint review model for your journal (*e.g., eLife, Peer Community Journal*).
    g. Implement preprint scoop-protection policies (examples: EMBO Press, PLOS, The Company of Biologists) to allow time for preprint review to proceed.
4. Preprint review services
    a. Facilitate preprint reviews that meet the criteria above (Box 1); invest additional editorial or technical resources into validating identity and addressing competing interests as required.
    b. Create machine-readable metadata for preprint reviews, for example by registering DOIs or providing an API.
5. Preprint servers, indexing & search tools
    a. Create links between preprints and preprint reviews in a human- and machine-readable fashion (e.g., through DOIs and associated metadata or through frameworks such as DocMaps).
    b. Enable authors to solicit reviews at the time of submission of their work to a preprint server.
6. Journalists and other non-specialist readers
    a. Seek preprint reviews to provide additional perspectives on research you cover or use.

Conclusion

Just 10 years ago, preprinting in many disciplines barely existed. Today, preprints are becoming more commonplace, are indexed by major bibliographic databases, and are encouraged (or even required) by many funders. Although preprint review is in its infancy, momentum is building rapidly, and the potential benefits are already evident. Building on the growing enthusiasm within the community, the time is right to promote the growth of this practice so that scholarly publishing may become more constructive, equitable, and transparent.

Authors' Positionality Statement

The authors of this article are a subset of participants invited to the meeting "Recognizing Preprint Peer Review" that took place on December 1–2, 2022 at HHMI's Janelia Research Campus in Virginia, USA. The authors are representatives of funders, institutions, preprint servers, journals, indexers, infrastructure providers, and review services, primarily located in North America and Europe. Outside of gender balance, participant

demographics were not representative of researchers in these regions, skewed toward white and toward senior career stages. The ideas and recommendations offered in this article reflect the authors' identities, backgrounds, values and levels of engagement with the topics discussed.

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