Diversification and Decentralization of Peer Review: Part 1—Initiatives at the Forefront

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The traditional peer review system, long regarded as the cornerstone of scholarly publishing, is facing growing scrutiny due to inefficiencies, biases, and barriers to inclusivity. In response, a wave of innovation is reshaping research evaluation through the diversification and decentralization of peer review. This article explores emerging models—including preprint servers, overlay journals, and postpublication forums—that enhance transparency, broaden reviewer participation, and streamline the publication process. By leveraging technology and community-driven initiatives, these new approaches aim to create a more equitable and efficient scholarly ecosystem, ultimately strengthening the integrity and accessibility of research.

Peer review is often regarded as the bedrock of scientific quality control, ensuring that only rigorously vetted research reaches the public sphere. Tracing its origins back to *Philosophical Transactions of the Royal Society* in 1665, it has remained a cornerstone of scholarly publishing. However, the system as it stands today is overburdened, slow, opaque, and susceptible to bias—leading to growing calls for reform.

At its core, peer review is an iterative process where experts assess the work of their peers, ideally improving research quality. Traditionally, it follows a structured model: An author submits a manuscript to a journal, the editor assigns anonymous reviewers, and their feedback informs the decision to publish, revise, or reject. While this system has served its purpose for centuries, its inefficiencies have become more pronounced in recent years.

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One major criticism is the slow pace of the process. It can take months—or even years—for a manuscript to navigate through rounds of review, revision, and eventual publication. This delay is especially problematic in fast-moving fields like biomedicine and climate science, where timely dissemination of research is crucial.

Opacity is another challenge. Traditional peer review occurs behind closed doors, with authors often receiving limited insight into the decision-making process. This lack of transparency can lead to frustration and, in some cases, the perpetuation of errors or flawed research.

Bias also remains a significant concern. Studies show that factors such as an author's gender, nationality, or institutional affiliation can influence review outcomes. Women and scholars from underrepresented regions are disproportionately disadvantaged, while the anonymity of reviewers can sometimes enable harsh or unfair assessments without accountability. Additionally, an overreliance on traditional metrics like Impact Factor and citation counts can reinforce systemic inequities in research evaluation.

Another pressing issue is the increasing burden on a small pool of reviewers. With the volume of submitted research continually growing, finding qualified reviewers has become more difficult. Overworked reviewers may provide rushed or superficial feedback, undermining the integrity of the process.

In response to these challenges, a movement toward decentralized and community-driven peer review is emerging (Figure). Leveraging technology and new platforms, alternative models aim to diversify participation, enhance transparency, and make research evaluation more efficient.

Decentralization allows feedback from a broader pool of reviewers, including early-career researchers and those traditionally excluded from the process. By shifting research evaluation into a more public space—such as preprint servers and open peer review platforms—these models foster greater accountability and collaboration. They also highlight previously overlooked values in research assessment, enabling more nuanced and inclusive evaluation criteria.

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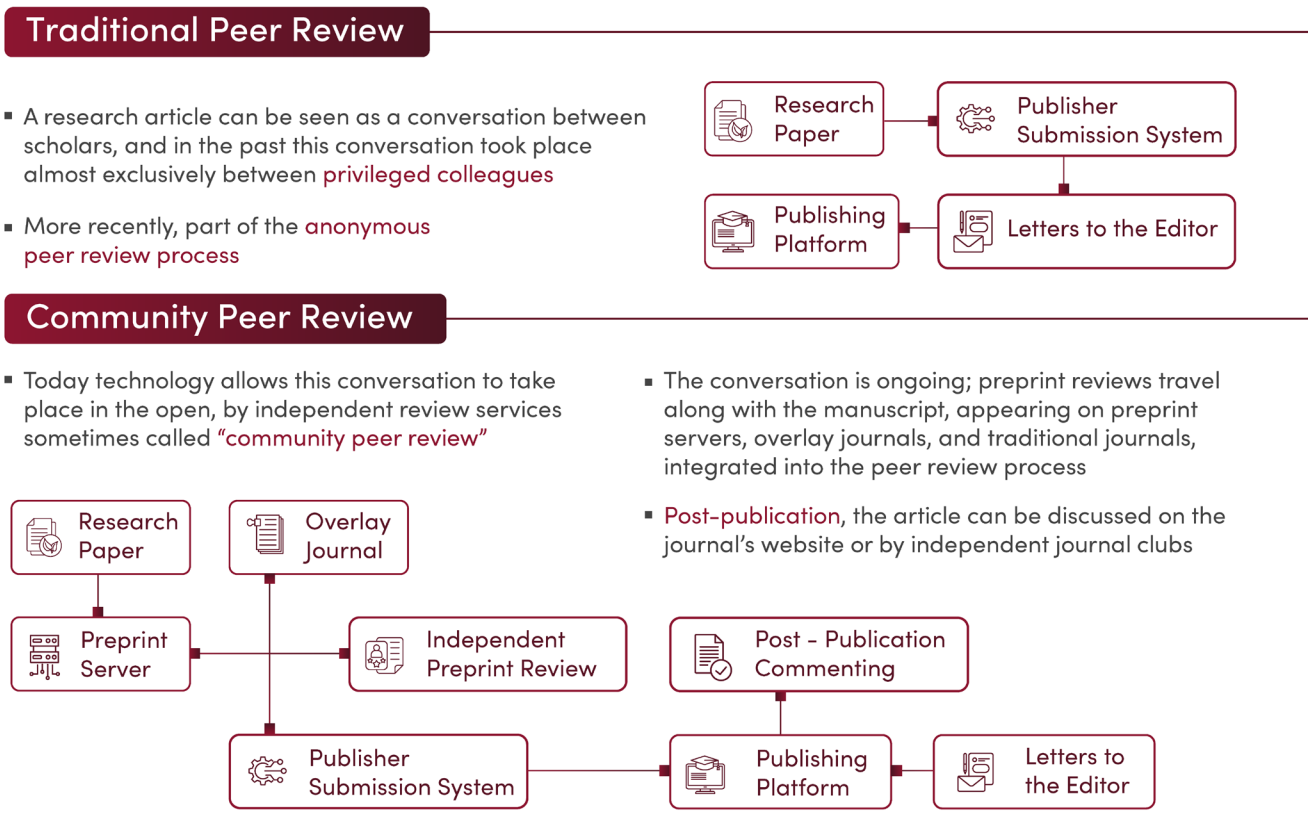

Figure. Traditional peer review is often a closed system, taking place among privileged colleagues. Community peer review expands the opportunities for gathering feedback throughout the publishing lifecycle.

Ultimately, reimagining peer review offers the potential to address long-standing inefficiencies while preserving its essential role in scientific validation. As scholarly publishing evolves, embracing more open, transparent, and diverse review systems may lead to a more equitable and effective research ecosystem.

Preprint Servers: Disrupting Scholarly Publishing

Preprint servers are transforming the landscape of scholarly publishing by offering a more open and immediate form of research dissemination. A preprint, sometimes referred to as a "working paper," is a version of a research article that is shared publicly before it has undergone formal peer review. The primary purpose of preprints is to allow researchers to share their findings with the world as early as possible, gaining feedback from a much wider audience than the traditional journal-based system permits, as has been illustrated in the previous section on independent peer review providers. This form of early dissemination has been especially useful in fast-moving fields like biomedicine, physics, and climate science, where the timely exchange of information can significantly impact ongoing research and decision-making.

Unlike traditionally published articles, preprints are posted, not published. This distinction is important because preprints are not yet formally endorsed by a journal; they are works in progress. However, preprints still hold significant value. By posting to a preprint server, researchers can disseminate their findings to the global community, inviting comments and feedback from anyone who comes across the paper. This process is more formalized than the traditional practice of sending manuscripts to a few colleagues for informal feedback, but it still lacks the finality of a journal version of record.

Preprints are also changing the way journals interact with researchers. Most major journals now allow authors to submit articles that have already been posted on a preprint server, a shift from the earlier practice where preprint sharing could disqualify a paper from submission. In fact, some journals now actively encourage authors to upload their work to preprint servers, while others offer to post submitted articles on a preprint server for authors. This approach allows research to be shared more widely and evaluated in parallel with journal submission, a model illustrated in one of the use cases below.

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Preprint servers often house hundreds or even thousands of research papers in various stages of revision. While some preprint servers are general and accept submissions from a wide range of disciplines, many are domain-specific, focusing on specific fields of research. The first and most well-known preprint server is arXiv.org, which has been used by physicists, mathematicians, and astronomers for decades. In recent years, however, nearly every academic discipline has developed its own preprint server to facilitate the open dissemination of research.

Domain-Specific Preprint Servers and General Repositories

There are numerous preprint servers, each serving specific academic communities. Some of the most prominent include:

- arXiv.org[1]: One of the earliest and most well-known preprint servers, primarily used by physicists, mathematicians, and computer scientists. arXiv has become the go-to platform for researchers in these fields to share early versions of their work.
- bioRxiv[2]: Focused on the life sciences, bioRxiv has become an indispensable platform for biologists and biomedical researchers to share their findings quickly.
- medRxiv[3]: Aimed at the medical sciences, medRxiv was created to facilitate the sharing of clinical research before it undergoes peer review, making it a crucial resource for medical professionals and policymakers. The server gained prominence during the COVID-19 pandemic, as it provided a way for researchers to rapidly share new information about the disease.
- chemRxiv[4]: A preprint server for chemistry, chemRxiv allows chemists to share their latest research, facilitating collaboration and feedback from the community.
- EarthArXiv[5]: A preprint server dedicated to earth sciences, providing a platform for geoscientists to share their research.

There are also numerous general preprint servers, including commercial entities and institutional repositories, that allow the posting of research articles and other content like white papers and opinion pieces on a wide-range of disciplines and topics. Some of the most popular include:

- Zenodo[6]: A generalist repository that accepts preprints across all disciplines, Zenodo is popular with researchers looking for an open-access solution for sharing their work.
- OSF Preprints[7]: Hosted by the Open Science Framework (OSF), this server is interdisciplinary and supports the sharing of research across multiple domains.
- SSRN[8]: Initially focused on the social sciences, SSRN has expanded to include papers in a wide range of disciplines, including economics, law, biology and humanities.
- Research Square[9]: This server serves multiple disciplines and is notable for its integration with the journal submission process, offering researchers a seamless path from preprint to formal publication.

The Evolution of Preprint Servers

As preprint servers have grown in both number and credibility, they have started to adopt many of the features traditionally associated with journals. Some preprint servers now offer open peer review, where members of the academic community can comment on and review preprints openly. This feedback is visible to everyone, adding a layer of transparency that is often missing from traditional peer review. Some servers apply editorial oversight in advance, ensuring that preprints meet a basic standard before they are posted. This is particularly important in fields like medicine, where preprints can have immediate real-world impacts.

Moreover, preprint servers are becoming more sophisticated in terms of how they evaluate manuscripts. Artificial intelligence (AI) and machine learning (ML) tools can be used to analyze preprints for quality issues, such as improper statistical methods, data integrity problems, or even image manipulation. These tools offer an additional layer of quality control that supplements the feedback provided by human reviewers.

Preprints are also serving as a way for researchers to stake a claim on new discoveries. In the past, the submission date of a paper to a journal was considered the gold standard for establishing priority. However, as more researchers turn to preprint servers, the posting date of a preprint is increasingly being recognized as the marker for who was first to report a discovery. This is particularly important in competitive fields, where the timing of discoveries can influence careers and funding.

A New Paradigm for Discovery

For journal editors, preprint servers are becoming a resource for identifying novel research. Much like how editors attend conferences and meetings to find new research, some editors now browse preprint servers to discover early versions of articles that could be of interest to their journals. This shift has made it easier for researchers to connect with journals and for editors to stay on top of the latest developments in their fields.

Preprint servers represent a significant shift in the world of scholarly publishing. By offering a faster, more open, and more inclusive way to share research, preprints are democratizing access to scientific knowledge. As the preprint ecosystem continues to evolve, it is likely that these

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platforms will become an even more integral part of the academic publishing process, providing a bridge between informal sharing and formal publication.

Independent Peer Review Providers: Innovators in the Peer Review Ecosystem

Independent peer review providers are pioneering new ways to evaluate research, moving beyond the constraints of traditional journal-based peer review. These platforms operate independently of any specific journal, focusing on providing high-quality, unbiased reviews while promoting open access to research outputs. In this section, I will explore the offerings and impact of several key independent peer review providers: Review Commons, Peer Community In (PCI), PREreview, Sciety, ASAPbio, and preLights.

Review Commons: High-Quality Journal-Independent Peer Review

Review Commons is a platform that aims to provide high-quality, journal-independent peer review specifically tailored to the life sciences. The platform offers researchers a Refereed Preprint, which includes the manuscript, peer reviews from a single round, and the authors' response to those reviews. This review is conducted independently of any journal, allowing authors to focus on the quality of the science rather than fitting a specific journal's criteria. One of Review Commons' major strengths is its ability to facilitate author-directed submission to a wide range of affiliate journals, helping to streamline the publication process and avoid redundant rounds of peer review.

Review Commons collaborates with 28 affiliate journals from publishers such as EMBO Press, eLife, and the Public Library of Science. These journals accept the Refereed Preprint, expediting editorial consideration and significantly reducing the need for serial re-reviews across multiple journals. This system improves the efficiency of the publication process and accelerates the dissemination of research findings.

Key goals of Review Commons include:

- **Focus on science, not journal fit.** Reviewers concentrate on the scientific quality of the manuscript without being influenced by specific journal requirements.
- **Enrichment of preprints.** The platform adds value to preprints by providing in-depth peer reviews before submission to a journal.
- **Reduction of re-reviews.** Journals can benefit from an already-conducted round of peer review that accompanies the submission.
- **Acceleration of the publishing process.** Journals receive high-quality referee reports that speed up the editorial decision-making process.

According to recent statistics, 97% of manuscripts reviewed through Review Commons are transferred to a journal, and 95% of those papers are published without additional rounds of peer review. This high success rate underscores the platform's effectiveness in facilitating a more efficient and rigorous peer review process. For more information about Review Commons and its affiliate journals, visit ReviewCommons.org.

Peer Community In: Open-Access Peer Review and Recommendation

PCI is a nonprofit organization that offers a free and open-access platform for the peer review, recommendation, and publication of scientific articles. PCI focuses on evaluating preprints in specific scientific fields, ensuring rigorous peer review through its network of thematic PCIs, such as Peer Community in Evolutionary Biology and Peer Community in Ecology. After undergoing evaluation, preprints can be recommended by the PCI, making them citable articles without requiring publication in a traditional journal.

The process is as follows: authors submit their preprints to the relevant PCI, and if a recommender (a scientist active in their field) finds the preprint interesting, they initiate the evaluation process. Based on peer reviews, the recommender decides whether to accept, reject, or request modifications. Once accepted, the preprint is recommended on the PCI website, making it a valid and citable reference. In addition, the recommender writes a recommendation text—that has a DOI—summarizing the significance and solidity of the recommended preprint. The recommendation is generally a summary of the significance and solidity of the research, written by the recommender. Authors also have the option to publish their article in the *Peer Community Journal* or submit it to a PCI-friendly journal that honors PCI's evaluations.

Notable features of PCI include:

- **Open access to articles and evaluations.** All recommended articles, reviews, and editorial decisions are available to the public, promoting transparency and open science.
- **Rigorous peer review.** PCI staff ensure that each article undergoes at least 2 rounds of high-quality peer review.
- **Diversity in peer review.** Mid and early career researchers are encouraged to participate.
- **Free publication options.** Authors can publish their recommended preprint in the *Peer Community Journal* at no cost.

For researchers interested in becoming a recommender, PCI staff encourage early and mid-career scientists to apply, emphasizing the importance of diverse representation in academia. PCI's thematic structure and open access

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model offer a highly innovative approach to peer review. To explore PCI's thematic communities and learn more, visit PeerCommunityIn.org.

PREreview: Fostering Equity and Transparency in Peer Review

PREreview is a community-driven platform that aims to bring equity and transparency to the peer review process. Focused on empowering early-career researchers (ECRs) and individuals from historically excluded groups, PREreview provides the tools and training necessary to participate meaningfully in the peer review of preprints. The platform's mission is to address the flaws in traditional peer review, which is often criticized for its lack of diversity and transparency. PREreview envisions a future where all researchers have the skills to engage in constructive and fair peer review.

PREreview offers a range of services:

- **Finding preprints to review.** Researchers can find preprints from a wide range of servers, including arXiv, bioRxiv, and medRxiv.
- **Requesting reviews.** Authors can request a review of their preprint via PREreview's platform, Slack community, or directly from preprint servers.
- **Training workshops.** PREreview runs equity-focused workshops that train researchers on how to give and receive feedback, helping them recognize and mitigate bias in the peer review process.

By fostering an inclusive and supportive environment, PREreview ensures that marginalized voices are heard in the scientific conversation. The platform's focus on training and empowerment actively promotes more equitable peer review practices. To learn more about PREreview's mission and workshops, visit PREreview.org.

ASAPbio: Accelerating Open Communication in the Life Sciences

ASAPbio (Accelerating Science and Publication in Biology) is a nonprofit organization that champions open and innovative communication in the life sciences. ASAPbio is fostering public participation in preprint review through its Crowd Preprint Review initiative. In this program, groups of researchers are coordinated to provide public reviews of preprints in specific scientific fields, such as cell biology, biochemistry, and infectious diseases. ASAPbio also supports the integration of preprint peer review into more traditional publication pipelines.

Key priorities for ASAPbio include:

- **Focus on researchers.** ASAPbio ensures that researchers have the tools and platforms they need to share their findings openly and responsibly.
- **Openness and inclusion.** The organization promotes accessibility and broad participation by ensuring that researchers from diverse backgrounds can engage in the communication and evaluation of scientific research.
- **Experimentation.** ASAPbio leads experimental initiatives that test new approaches to scholarly communication, helping to drive innovation in the life sciences.

ASAPbio promotes the productive use of preprints for research dissemination and facilitates transparent peer review and feedback on all research outputs. The organization is committed to creating a life sciences communication ecosystem where open discussion and collaboration around all types of research take place at all stages. For more on ASAPbio's initiatives, visit ASAPbio.org.

preLights: Highlighting Preprints in the Biological Sciences

preLights is a preprint highlights service run by the biological community and supported by The Company of Biologists. As the number of preprints continues to grow, preLights provides a curated selection of what they claim are the most interesting and significant preprints in the biological sciences. Early-career researchers from the preLights community review and highlight preprints, offering summaries, comments, and insights into why each preprint is important to the broader scientific community.

preLights offers several key services:

- **Curated preprints.** Scientists highlight preprints they find significant, helping the community stay informed about the latest developments.
- **Expert commentary.** Each preprint is accompanied by a summary of why it was selected, as well as relevant commentary from the preprint's authors and other researchers.
- **Regular digests.** The preLights team compiles regular digests of preprints across the biological sciences, exposing readers to a broad range of research.

By providing a platform for early-career researchers to engage in preprint review, preLights fosters a collaborative and inclusive peer review culture. To learn more about the preLights community, visit preLights.biologists.com.

These independent peer review providers are at the forefront of the movement toward more transparent, inclusive, and efficient research evaluation. By focusing on open access, diversity, and community-driven evaluation, initiatives like Review Commons, PCI, PREreview, ASAPbio Crowd Review, and preLights are trying to reshape the future of peer review. Together, these initiatives are helping to build a more equitable and collaborative scholarly

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publishing ecosystem, with the goal that all voices are heard and that high-quality research is disseminated rapidly and widely.

Hybrid Publications: The Rise of Overlay Journals and the Publish-Review-Curate Model

With the rise of the preprint and the growth of independent peer review, new hybrid publishing models are emerging that blend the accessibility of preprint servers with the formal editorial processes traditionally associated with journals. These hybrid platforms, such as overlay journals and those following the Publish-Review-Curate (PRC) model, offer a more flexible, transparent, and rapid approach to scholarly communication.

Overlay Journals: Increasing Trust in Preprints

Overlay journals are a response to the need for greater transparency and credibility in the preprint ecosystem. Overlay journals provide a mechanism for overlay reviews, which help validate preprint findings and add an additional layer of scrutiny. Unlike traditional journals, overlay journals are typically open access and serve as a curated collection of preprints, public domain articles, or already-published open access papers. They often focus on specific thematic areas and provide editorial review and commentary on the content, making preprints more trustworthy and accessible to the research community.

Discrete Analysis[10] is an arXiv-based overlay journal, meaning its articles are hosted on the arXiv preprint server rather than the journal's own platform. This model combines the flexibility of arXiv with the established practices of traditional mathematics journals. Authors submit their work by providing basic information, including an arXiv URL, which simplifies the submission process, especially for articles already posted on the platform. The journal maintains a conventional peer review system, where submissions undergo anonymous and confidential evaluations to ensure quality. Additionally, it aligns with scholarly standards by assigning DOIs and ISSNs to its articles, listing them on MathSciNet[11] and zbMath Open,[12] and aiming for inclusion in the Web of Science to secure an Impact Factor.

What sets *Discrete Analysis* apart is its integration with arXiv. Articles remain permanently linked to their arXiv versions, allowing authors to update and improve their work on arXiv even after publication in *Discrete Analysis*. While the journal ensures the stability of a permanent version of record, readers can easily access updates via the arXiv page. *Discrete Analysis* enriches its publications with editorial introductions written by the editorial board. These introductions provide context, definitions, and highlights, offering insights that are typically confined to the peer review process.

Another notable example of this model is *JMIRx*, an overlay "superjournal" that focuses on preprints in the health sciences. *JMIRx*[13] offers the same services as a traditional journal—peer review, copyediting, indexing, and archiving—but operates on top of preprint servers such as medRxiv, bioRxiv, and PsyArXiv. *JMIRx* editors proactively identify preprints that show promise, using methods like crowd-sourced reviews, journal club discussions, or traditional peer review. Once reviewed, authors can revise their preprints and decide whether to publish them in one of JMIR's affiliated journals or push them to partner journals

JMIRx has gained recognition in this space, being the first overlay journal indexed by PubMed, with 3 specialized subjournals: *JMIRx*|*MED*, *JMIRx*|*Bio*, and *JMIRx*|*Psy*. The journal's ability to combine the immediacy of preprints with formal peer review offers a novel solution for improving the speed and reliability of research dissemination.

Rapid Reviews: COVID-19 and the MIT Press's Overlay Journal

Another example of an overlay journal is *Rapid Reviews: COVID-19* (RR), launched by MIT Press. RR emerged during the pandemic to provide rapid peer review of COVID-19–related preprints. In this model, preprints posted on COVIDScholar are selected and reviewed by teams of experts using AI-assisted workflows. The goal is to provide high-quality, expedited reviews that are accessible to both the public and academic journals.

The RR process involves public posting of reviews on the PubPub platform, part of the Knowledge Futures initiative. The preprints are quickly reviewed for novelty, impact, and accuracy, while maintaining a high level of transparency. Authors can engage with reviewers' feedback, and journals can reference these peer reviews when considering preprints for publication. The platform's open commentary and the ability for readers to access preprint reviews in real time make RR a unique contribution to the overlay journal movement. More about RR can be found at rapidreviewscovid19.mitpress.mit.edu.

The PRC Model: A Paradigm Shift

Overlay journals are not the only hybrid innovation in scholarly communication. The PRC model, adopted by journals like *eLife*, offers an alternative to the traditional peer review process by decoupling peer review from publication. In this model, research is first published as a preprint, then reviewed openly, with both the reviews and author responses made publicly available. This open approach to peer review enhances transparency, ensures that all feedback is visible,

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and allows the academic community to engage in the peer review process.

At *eLife*, the process begins with submission of a preprint, either directly or through bioRxiv or medRxiv. The great majority of papers are discussed by a group of 3–4 editors (active scientists in their field) to decide if they would review them or not. Following peer review, there is no accept/reject decision. All papers that are peer reviewed are published as a Reviewed Preprint, which includes the original preprint, the public peer reviews, the author's response (if provided) and a short summary of the paper (called *eLife* assessment) that is written by editors and reviewers together to summarize the strength of the evidence and the significance of the findings in the paper. Authors are free to revise their work based on the feedback, and once revisions are completed, the updated version is posted as a second version of the reviewed preprint. This iterative process continues until the final version, the version of record (VOR), is published, though a great majority turn into VOR after just 1 revision.

The PRC model offers several advantages:

- **Open peer review.** Reviews are published alongside the preprint, making the evaluation process transparent.
- **Quicker peer review.** It is significantly quicker (about 2.5 times) for the community to access the peer reviewed version of a research article, as compared to the traditional publishing model.
- **Iterative improvement.** Authors can revise their work based on expert feedback, leading to higher quality publications.
- **Citable preprints.** Reviewed preprints receive DOIs, ensuring they can be cited in academic literature, even before formal publication. Most reviewed preprints are indexed in Google Scholar and OpenAlex.
- **Focus on the science.** An article's peer reviews and the *eLife* assessment promotes the evaluation of the scientist's contributions based on the content of the article, not journal-specific criteria.

eLife's approach of Reviewed Preprints has been recognized by funding agencies and indexed by major databases like PubMed and Scopus. Full details of the *eLife* submission process and peer review guidelines are available at elifesciences.org.

F1000Research: Continuous Publishing and Open Peer Review

F1000Research offers a continuous publishing platform in which articles are made publicly available within days of submission. Unlike traditional journals, F1000Research provides immediate access to articles without waiting for peer review. Peer review takes place postpublication and is fully open, with reviews and author comments published alongside the article. Authors can revise their work in response to reviews, and once a paper passes peer review, it is indexed in major databases.

This transparent model has significant benefits:

- **Speed.** Articles are made available to the public almost immediately after submission, accelerating the dissemination of research.
- **Open access.** F1000Research adheres to the principles of Open Science, ensuring that all research, reviews, and data are freely available.
- **Flexible review.** The platform supports a range of review types, from traditional peer review to crowd-sourced and community-driven reviews, offering a more diverse evaluation process.

F1000Research has established itself as a versatile platform for researchers across disciplines, including life sciences, medicine, engineering, and the social sciences. To learn more about its innovative approach to scholarly publishing, visit f1000research.com.

The rise of hybrid publishing models, such as overlay journals and the PRC model, represents a major shift in scholarly communication. By integrating the speed and accessibility of preprints with the rigor of peer review, these hybrid models offer researchers more flexibility and control over the dissemination and evaluation of their work, and they promote openness, transparency, and inclusivity in the peer review process.

Post Publication Review: The Evolution of Scholarly Conversations

Traditionally, "letters to the editor" have been a primary method through which scholars engaged in postpublication dialogue within scholarly journals. These letters allowed researchers to critique, comment on, or request clarifications about articles published in the journal. While these discussions were often limited in scope and audience, they played a useful role in maintaining scientific discourse and accountability.

However, as scientific publishing has evolved, so too has the way postpublication conversations are conducted. With the rise of digital platforms and open access, postpublication review has become a more dynamic and widely accessible form of scholarly critique. This new paradigm of engagement allows a broader segment of the academic community to weigh in on research, providing more immediate feedback than traditional letters to the editor. One of the key platforms in this space is PubPeer, which has emerged as a leading forum for postpublication peer review.

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PubPeer: A Platform for Post-Publication Peer Review

Founded in 2012, PubPeer[14] is an independent platform that enables users to leave comments, signed or anonymous, on scientific papers after they have been published in academic journals. This process of postpublication peer review is a mechanism for scrutinizing published research, encouraging transparency, and maintaining scientific integrity. The platform is managed by the PubPeer Foundation, a nonprofit organization with the goal of improving the quality of scientific research through community-driven dialogue.

One of the primary functions of PubPeer is to accelerate the correction of science by identifying errors or issues that may have been missed during traditional peer review. PubPeer users, often fellow researchers, can leave comments and raise concerns about any published paper, and the platform automatically notifies the authors of the paper, giving them the opportunity to respond. This fosters a continuous conversation around the validity and reliability of published research, ensuring that potential problems are addressed even after the paper has entered the scientific record.

PubPeer contributes to the diversity and decentralization of peer review through its ability to crowdsource critiques from a wide range of experts. Traditional peer review typically involves only a small group of reviewers, who may not catch every flaw in a paper's design, methodology, or analysis. In contrast, PubPeer allows anyone with expertise in the subject matter to offer insights, ask questions, or point out inconsistencies. This broad-based scrutiny can identify issues that were missed during initial peer review, thereby improving the overall quality and reliability of the scientific literature.

For example, one common issue flagged by PubPeer users involves statistical errors in published papers. Peer reviewers, especially in smaller fields, may not always have the statistical expertise required to thoroughly vet the data analysis. By opening the review process to the broader community, platforms like PubPeer provide a space for statisticians and methodologists to evaluate the paper's claims. This can help correct mistakes that might otherwise remain unaddressed, contributing to a higher standard of scientific integrity.

The Impact and Controversy of PubPeer

PubPeer's ability to foster anonymous postpublication commentary has been one of its most distinctive and controversial features. Anonymous commenting allows researchers to raise concerns without fear of professional retaliation, especially in cases involving high-profile authors or institutions. However, this anonymity has also led to criticism. Some users have been accused of making unsubstantiated or defamatory claims, which has resulted in legal challenges. In response, PubPeer has implemented strict guidelines, requiring users to base their comments on verifiable facts to avoid legal issues, such as libel.

Despite the controversies, PubPeer is an effective tool for uncovering scientific misconduct and errors in published research. The platform has played a role in several high-profile retractions and corrections, as documented by Retraction Watch.[15] Researchers on PubPeer have raised concerns about data manipulation, plagiarism, and other ethical violations, forcing journals to reevaluate and, in some cases, retract problematic papers. This aspect of PubPeer's operation has earned it a reputation as a kind of "whistleblowing" platform within the academic community.

The Future of Postpublication Review

As platforms like PubPeer gain prominence, it is clear that the traditional letter-to-the-editor model will continue to evolve. These platforms offer a more democratic and participatory approach to scientific dialogue, allowing for a wider range of voices to contribute to the assessment of research. While there are still challenges to overcome—such as ensuring that comments are factual and constructive—by enabling community-driven critique and holding authors accountable for the accuracy of their work, PubPeer is seen as enhancing the quality and integrity of scientific research, as well as making scholarly communication more diverse, open, collaborative, and rigorous.

Expanding and Diversifying the Peer Reviewer Pool: New Approaches and Training Initiatives

The peer review process has traditionally been dominated by a relatively small and homogeneous group of senior researchers, often from prestigious institutions in Western countries. Historically, underrepresented groups have had fewer opportunities to contribute to the review process. This can limit the breadth of perspectives involved in assessing scientific work, leading to potential blind spots in the evaluation of research. In response, many of the nontraditional peer review providers discussed earlier are working to diversify the peer reviewer pool and create opportunities for ECRs, researchers from non-Western countries, and even citizen scientists. These efforts aim to bring new voices into the peer review process, helping to improve the quality, fairness, and transparency of research evaluation. Initiatives such as preLights, PREreview, and ASAPbio are leading these initiatives by offering training and support to potential reviewers from underrepresented groups.

The Push for Diversity: Expanding Who Participates in Peer Review

Recognizing the importance of inclusivity, platforms like PREreview have made it their mission to open up peer

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review to a wider and more diverse group of contributors. With training workshops focused on equity, diversity, and inclusion, PREreview equips reviewers with the skills they need to evaluate research rigorously and fairly. These workshops address how to recognize and mitigate biases that may arise during the review process, thus creating a more inclusive evaluation culture. PREreview also works with preprint servers and peer review services to provide opportunities for these trained reviewers to engage with manuscripts early in the research process, offering valuable feedback that authors can use to improve their work.

Meanwhile, ASAPbio's Crowd Preprint Review initiative brings diverse researchers together to work collaboratively to provide public reviews of preprints in specific scientific fields. By involving a broad range of reviewers, including those from nontraditional backgrounds, ASAPbio is helping to diversify the reviewer pool and enhance the quality of preprint evaluations. In 2022 and 2023, these activities generated dozens of public reviews, demonstrating the growing interest in open and inclusive peer review. The success of this initiative has led ASAPbio to expand its crowd review activities, with 4 new crowds being organized in 2024, covering fields such as cell biology, immunology, microbiology, and meta-research. More information can be found on the ASAPbio website.[16]

Beyond expanding participation, nontraditional peer review platforms are also playing a critical role in training new generations of reviewers. Traditionally, reviewers received little formal training, learning the ropes through trial and error. This has led to inconsistencies in the quality of reviews, as well as a lack of awareness about the biases that can affect the evaluation process.

PREreview's Open Reviewers program provides comprehensive training for ECRs and other interested participants. This program includes workshops on how to write constructive peer reviews, how to engage in open and transparent peer review, and how to mitigate biases that may affect the review process. Through its partnership with the Howard Hughes Medical Institute (HHMI), PREreview is also running the Transparent and Accountable Peer Review Training Pilot, which trains graduate students and postdocs in HHMI labs to conduct peer review in ways that promote equity and inclusion. This is further discussed in a use case below. These training programs not only improve the quality of peer reviews but also help to build a more diverse and inclusive reviewer community. Learn more about PREreview's training programs here.[17]

preLights, the preprint highlights service supported by The Company of Biologists, is another example of how nontraditional platforms are expanding the reviewer pool. preLights enables ECRs to select, highlight, and comment on preprints they find interesting or relevant to their fields. This process helps expose new research to the broader scientific community while providing ECRs with valuable experience in assessing and communicating scientific findings. By giving these researchers a platform to contribute their insights, preLights is helping to diversify the voices that are heard in the peer review process. The platform also encourages open dialogue between researchers, allowing them to comment on and discuss preprints with their peers. This community-driven approach fosters a more collaborative and inclusive review culture, where contributions from a wide range of researchers are valued. Visit preLights[18] for more information.

The Discovery Stack Pilot: Rethinking Peer Review and Discovery

In addition to these platforms, new projects like the Discovery Stack Pilot are exploring novel ways to improve the peer review process and scientific discovery. The Discovery Stack Pilot, featured on the Solving for Science website, seeks to address some of the key challenges in scientific publishing by creating a more transparent, real-time peer review system. The project is designed to provide quality assessments of research that are independent of journal branding, focusing instead on the scientific value of the discoveries themselves.

The Discovery Stack Pilot operates on the principle of separating quality from impact. Rather than relying on journal prestige to signal the importance of a study, the platform allows discoveries to be evaluated in real-time by the research community. The peer review process is open, with ongoing commentary and refinement, ensuring that discoveries are rigorously assessed for both their scientific quality and long-term impact. This approach aims to reduce the time it takes to review and publish research while promoting greater collaboration and transparency.

Key features of the Discovery Stack Pilot include:

- **Independent reviews.** Research is evaluated based on its own merits, independent of journal branding or impact factor.
- **Transparent reviews.** All peer reviews are publicly available, promoting transparency and trust in the evaluation process.
- **Quality and impact separation.** The platform distinguishes between the scientific quality of a discovery and its impact, allowing both to evolve over time based on community feedback and follow-up studies.
- **Real-time commentary.** The platform fosters ongoing dialogue and refinement of research, encouraging continuous improvement and collaboration.

CONTINUED

To learn more about this innovative project, visit the Solving for Science website.[19]

By expanding opportunities for ECRs, underrepresented groups, and citizen scientists, platforms like PREreview, preLights, PubPeer, and the Discovery Stack Pilot are making peer review more inclusive and representative of the broader scientific community. These initiatives are working to improve the quality and fairness of peer reviews and they are fostering a more collaborative and transparent research culture.

The diversification and decentralization of peer review represent a fundamental shift toward a more transparent, inclusive, and efficient system of research evaluation. By embracing alternative models such as preprint servers, overlay journals, open peer review, and postpublication feedback, the scholarly community is addressing longstanding inefficiencies and biases in traditional peer review. These innovations not only accelerate the dissemination of research but also foster greater collaboration and accountability, ensuring that a wider range of voices contribute to the assessment of scientific work. As these models continue to evolve, they hold the potential to strengthen research integrity, improve accessibility, and create a more dynamic and equitable scholarly publishing ecosystem.

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