The changing role of research publishing: a case study from Springer Nature

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Using Springer Nature as a case study this article explores the future of research publishing, with the guiding objective of identifying how such organizations can better serve the needs of researchers and those that support researchers (particularly academic institutions, institutional libraries, research funding bodies and academic societies) as we work together to help advance discovery for the benefit of all. Progress in four key areas is described: improving the publishing process, innovating across science communication, driving the growth and development of open research and adding value beyond publishing. The aim of this article is thus to set out a clear vision of what research publishers can achieve if they especially focus on addressing researchers' needs and apply their considerable resources and expertise accordingly. If delivered with care, this vision should enable research publishers to help advance discovery, publish more robust and insightful research, support the development of new areas of knowledge and understanding, and make these ideas and this information accessible, usable and reusable by humans and machines alike.

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Springer Nature was formed following a merger in 2015. A key focus since then has been exploring the changing role of the research publisher. Publisher services to the research community include helping authors to share their discoveries, enabling researchers to find, access and understand the work of others; supporting librarians and institutions with innovations in technology and data; providing professional publishing support to societies and participating in research and advocacy around issues that matter to researchers, funders and policymakers. Springer Nature's current strategy has four key objectives:

- improving the publishing process
- innovating across science communication
- driving the growth and development of open research
- adding value beyond publishing.

Improving the publishing process

The first, most fundamental objective is to make the publishing process easier for researchers, saving them time and guiding them through the process in the simplest way, improving the value and robustness of the content we publish. We have worked with researchers to find out about their pain points and to trial potential solutions. We have learned that authors often spend too long submitting their own research and working to get their research published, and that sometimes researchers undertaking peer review find the papers they are assessing to be incomplete, insufficient or containing inappropriate content. We also know that there are significant concerns around the integrity of some published research, there is potential bias in the review process and there are widespread and real concerns about the reproducibility of some research results that still make it through to publication.

Integrity, transparency and replication

We need to improve the integrity, efficiency and speed of the publishing process. In the case of integrity, we think creating standardized editorial pre-checks covering areas like plagiarism, fabrication, image manipulation, competing interests and so forth are a good start. By standardizing them and making them externally visible (for example, via badges), we can ensure transparency and greater consistency, increasing everyone's confidence in the outcome. We can apply essentially the same approach to one of the thorniest issues in modern science – reproducibility of published experimental results. To enable other researchers to replicate published results we need research papers to have more detailed method sections than have been traditionally published. Our Nature-branded journals have now added extended methods sections and BioMed Central's (BMC's) open access (OA) journals do not apply any limits to such sections.

'We need to improve the integrity, efficiency and speed of the publishing process'

Open data approaches also facilitate replication by requiring the experimental data resulting from all published research to be stored, made freely accessible and sufficiently well described for others to understand and be able to reuse the data. Open data is discussed further below, but in the context of improving the publishing process, making data accessible and well described greatly helps editors and peer reviewers to be able to assess the experimental data results and the research conclusions that are based on them.

Efficiency in peer review

Given the time required of all involved, more efficient peer review is essential, and more open techniques facilitate this, together with greater recognition for the researchers that devote their time to it. Last year, BMC published over 40,000 open peer-review reports,[1] allowing 24,000 peer reviewers to be recognized for their contribution to research and early career scientists to more easily learn about peer review from the work of others. Alongside this, Springer Nature also ran seven other peer-review trials in 2016, including double-blind peer review, which reduces risk of perceived or actual bias in the system. This is now an author option at all Nature Research journals.

Concerns are often raised regarding the lack of negative results publishing,[2] which may result in duplication of the same failures in multiple labs. To address this, Springer Nature recently relaunched BMC Research Notes,[3] which now has an increased focus on data publication, incremental results and a strong remit for the open publishing of negative results. The publishing of incremental results also has a role to play in addressing the need to speed up research.

'a strong remit for the open publishing of negative results'

More generally, for most research, speeding up the publication process begins with simplifying the author submission process and ensuring editors quickly evaluate the suitability of each submission ahead of peer review to prevent potentially wasted time and effort. By focusing on this goal Springer Nature's new submission system, which is now live for all Nature Research journals, has reduced average author submission times by over 50%. However, the inconvenient truth across science, technical and medical (STM) publishing is that we estimate that over 60% of articles are rejected by the journal their authors initially submit to. This can add weeks or even months to the publication process. One solution is for publishers to offer immediate alternatives that meet authors' goals, such as transfer services which, with the author's agreement, can resubmit their rejected article to an alternative appropriate journal, sometimes together with the original reviews, avoiding the duplicative work by peer reviewers of requiring the review process to start again from scratch. This helps to avoid the time, effort and uncertainty authors otherwise face in having to deal with this themselves. Springer Nature now offers such a transfer service on over 2,000 journals and both author and journal uptake is growing rapidly, especially amongst OA journals.

Innovating across science communication

Our second key objective is to innovate across science communications so that researchers can find what they need, understand it, use it and reuse it. We know that researchers struggle to keep up to date with relevant content in a tide of ever-increasing research publications[4] and that they work internationally, necessitating sharing of research to enhance collaboration and innovative thinking. A growing area of focus for our sector is the drive to widen understanding of research-driven advances,[5] both within research communities and beyond. This includes finding new ways to curate content, bringing science to broader audiences in more engaging and accessible ways,[6] greater use of open access and enabling sharing of subscription content.[7]

Open access and open sharing

One of our more established efforts to open up the research we publish was the launch three years ago of Springer Compact.[8] This enables institutions or research funding agencies to pay a fixed price for, firstly, access to all our subscription articles in most of our journals and, secondly, unlimited OA publication in these journals. It also reduces their risk of escalating future costs whilst still facilitating author choice and, so far, the UK, Netherlands, Austria, Sweden and the Max Planck Society have taken up this option.

More recently we have launched SharedIt,[9] to further extend access to research. The digital age makes it easy for researchers to share copies of articles, but frequently these shares are of frozen PDFs that age, disconnected from the rest of the scientific record. As an alternative, we developed SharedIt with ReadCube,[10] to enable our authors and subscribers to share a link to a dynamic PDF[11] that is continuously updated and remains connected to the rest of the scientific record. Researchers can annotate these dynamic PDFs, share their embedded comments with collaborators and store them in shared digital libraries for future use. Additionally, over 200 media and social media organizations can use these links in their articles to make the underlying research accessible to the wider public. Current participants in that programme include the BBC, *New York Times*, *The Guardian*, *The Economist* and our own *Scientific American*. Springer Nature has now enabled SharedIt links for the more than 2,300 journals that we own, and other publishers, such as Wiley, have started to trial very similar approaches for their publications.

'a link to a dynamic PDF that is continuously updated and remains connected to the rest of the scientific record'

Making research more visible and accessible

Researchers also need help in being kept up to date with the most relevant and important research in their fields, as soon as it is published, irrespective of who publishes it. Springer Nature has recently launched a free service, Recommended,[12] which has already been accessed by over one million researchers.

We are also trying to improve the wider understanding of research-driven advances. Our science reporting outlets, *Nature* and *Scientific American*, provide editorial content on research and research-related issues. We are also now testing Nature Briefing, a new free daily e-mail round-up, featuring news gathered from and about the science community. Additionally, we publish free editorial 'highlights' on many articles[13] and are creating free videos for select papers[14] to explain their significance and findings.

'a free service, Recommended … has already been accessed by over one million researchers'

Some research areas need a more interdisciplinary research approach to help find solutions or change behaviours. Journals traditionally followed the structural lines of faculty and research communities; interdisciplinary research needs to bring them together and this requires suitable venues and convening mechanisms. New journals can facilitate this, using online content and physical events to draw them together. We are supporting this by launching new OA journals in areas like climate change, energy, clean water and pollution control.

Driving the growth and development of open research

Our third commitment is to the growth and development of open research,[15] which benefits everyone involved in research and ultimately advances the pace and quality of new discoveries and understanding. The growth of researchers', institutions' and funders' appetites for OA publishing has led them to seek to harness the benefits of open for other areas of research, such as increased data availability and open machine-readable content.[16] Having been actively involved in developing OA journals since the early days of the open access movement, Springer Nature is also working to embrace open data: in 2016, we announced a simplified open data policy,[17] to apply to all our journals, reducing the complexity of data availability requirements to four simple types. These policies have been rolled out to over 600 journals so far, and the policy text has been released under a CC BY licence.[18] We are working with the Research Data Alliance[19] to convene a working group[20] to further support community standards around open data.

'a simplified open data policy'

Publishers also need to improve machine readability[21] of content. Much content has been opened up for text and data mining,[22] enabling the creation of new applications by researchers and others, but there is more to do. Springer Nature has recently launched SciGraph,[23] which exposes our 'knowledge graph' – defining and linking the relationships between researchers, institutions, content and their embedded concepts and entities. The hundreds of millions of these relationships are now exposed via a new, linked open data store to support wider understanding of research.

'defining and linking the relationships between researchers, institutions, content and their embedded concepts and entities'

Adding value beyond publishing

Finally, our fourth objective is to add value beyond publishing, and to champion the important role that research plays in our world. Research is a rapidly evolving discipline and the needs of the researchers are myriad, from training to help them advance their careers, to services that help them achieve suitable recognition for their work.

Data, skills and services

Publishers have data, skills and resources that can be applied beyond traditional publishing services to better serve the evolving needs of researchers. This may be by helping researchers do their work, for example through tailored training,[24] editing[25] or careers support;[26] by helping librarians and institutions to more effectively allocate their limited budgets, for example by providing better data to prioritize the most used, shared, cited, and valued journal, books and database content; or by helping to explain and contextualize science and scientific issues, for example by producing policy papers or editorial specials on key areas.

'Publishers have data, skills and resources that can be applied beyond traditional publishing services'

Infrastructure

Open data again plays an important role in research recognition, efficiency (building on the work of others) and advancement. Springer Nature partners with figshare[27] to provide tools and storage space for our authors to deposit data. This means these data sets and descriptors receive a digital object identifier (DOI) and can be cited, leading to greater recognition of this content and the people who create and share it. We also provide free data visualization tools[28] to help other researchers understand the data. We publish specialist OA journals, for example *Scientific Data*, which enable academics to independently and openly publish data descriptors.[29] More generally we are working with figshare to link more seamlessly between research articles and the associated data sets. Last year we launched a helpdesk[30] to support authors in finding the right repository for their data, and to get information on the growing number of funder requirements for open data deposit and citation. We plan to extend our support for authors and funders by applying our data curation and metadata expertise to ensuring discoverability and reuse of data sets.

Training and recognition

Academics must increasingly perform a range of tasks for which specialist training is required but not necessarily given, for example, developmental editing, language editing, creating good papers, data preparation and data management.[31] Springer Nature has provided training in these areas both at institutions and online.

This brings us back to recognition for academics. The scholarly community is progressing towards open and easy-to-understand mechanisms for measuring and evaluating research and academics.[32] Nature Index[33] tracks authors and co-authors (and their university affiliations) of the leading research in the natural sciences irrespective of where it is published. It has been live for four years and currently covers about one million authors and over 30% of citations in the natural sciences. It identifies and explains trends, analyses collaborations and transparently measures and ranks over 8,000 institutions worldwide. Nature Index is published monthly, is freely available, and helps researchers and institutions promote their achievements.

The BookMetrix[34] service, launched in 2015 by Springer Nature, makes the measurement of academic books usage and the success of their authors more accessible and understandable. It covers citations, mentions, readers, downloads, and reviews. During 2016 BookMetrix was used over ten million times. This suggests a high level of interest among academics, and among librarians seeking to evaluate how to prioritize their constrained budgets.

> 'During 2016 BookMetrix was used over ten million times'

Conclusion

Access to, and use of, peer-reviewed articles, books and databases has never been greater, but there is still a long way to go. Major challenges exist around the integrity, efficiency and speed of research communication. Researchers still struggle to identify the content most relevant to them in an ever-increasing torrent of information. Access to much research remains too limited, understanding too narrow and genuine reuse of published content is still too low. Researchers need more help to effectively undertake their work, get published and succeed in their careers, especially given the well-documented challenge of hyper-competition that early career stage researchers face today.

> 'publishers can develop policies, practices and solutions that help scientists and academics succeed in their careers'

While these are major challenges for publishers, they are not intractable. By sharpening our focus on supporting researchers and advancing discovery, publishers can develop policies, practices and solutions that help scientists and academics succeed in their careers – more effectively communicating their advances in understanding, sharing their results more widely, and helping others recognize what they have achieved. Through this we will help to build understanding, publish robust and insightful research, support the development of new areas of knowledge, and make ideas and information accessible to all.

Abbreviations and Acronyms

A list of the abbreviations and acronyms used in this and other *Insights* articles can be accessed here – click on the URL below and then select the 'Abbreviations and Acronyms' link at the top of the page it directs you to: http://www.uksg.org/publications#aa

Competing interests

The author has declared no competing interests.

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