

Review Article

Copyright and open access in the life sciences: a researcher's guide to sharing and publishing scientific information

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Copyright provides the creator of an original work, such as a journal article or a scientific poster, with exclusive rights to authorize and reproduction and sharing copies of the work. Issues regarding copyright have become more prominent as digital technologies have made copying and distributing information easier. In a research environment, there is ample opportunity to share print and electronic resources among colleagues, which may represent noncompliance with copyright law. The desire to remove the paywall from the published literature has led to several versions of open access (OA), differentiated by the fees charged to the author as article processing charges, where the article is stored, and when the published article becomes freely available as OA. A number of government agencies and major research funders in the U.S.A. and the EU have implemented specific guidelines as to where and how their funded research can be published. Although OA publications can be read for free, they are still subject to various license limitations regarding sharing and reuse.

Introduction

As part of the life sciences ecosystem, you have a variety of responsibilities that range from the ethical pursuit and conduct of research to safeguarding the intellectual property created by you and others. This includes compliance with copyright laws, which exist to encourage the creation of new works by giving special rights to the holder of the copyright. Any original work that is written down, recorded, or captured in some other fashion is protected by copyright, which includes research publications, paintings, musical compositions, blog posts, music, news features, videos, podcasts, scientific posters, and e-books.

Copyright issues are becoming more prominent as digital technologies have made copying and distributing information easier, yet the issue of copyright is one of the most misunderstood concepts among those who work in the life sciences. Simply stated, current copyright laws exist to protect the rights of authors and other copyright holders by giving them exclusive rights to authorize certain uses of their work. The main goals of copyright are to encourage the development of culture, science, and innovation, while providing a benefit to copyright holders and facilitating public access to knowledge.

It is important to note that copyright is a form of intellectual property that protects the expression or presentation of ideas, but does not protect the ideas themselves. Thus, when a researcher writes an article or a book and transfers the copyright to a publisher, copyright protection applies to the words and images in the publication, but others can use the *ideas* presented in that publication with proper attribution [1].

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Sharing licensed content

Research in the life sciences depends on the ability to share information in a timely manner, whether for the purpose of describing new molecular and cellular pathways and processes, explaining gene expression, examining protein function, accelerating drug development, discovering new mechanisms of action, informing health-care providers, submitting regulatory packages, or monitoring drug safety. However, much of this information is either owned by publishers who hold the copyright rights directly or by the author, who holds the copyright right but provides the publisher with the (often exclusive) license to publish the content. The publisher may make an article available under a subscription that limits your use of articles to a single copy that is *not* to be shared with others in the workplace. You or your organization may then need to obtain additional copyright permissions if you intend to create copies to share with colleagues, regulatory agencies, educators, healthcare providers, or specific others.

To address the challenge of reaching out to each copyright holder in order to share content, many academic institutions and life science companies sign agreements with specific publishers. Others seek a broader compliance solution by taking a license from a reproduction rights organization, such as Copyright Clearance Center (US), the Copyright Licensing Association (U.K.) and others, which work with publishers to negotiate the licensing of secondary uses of books, journals, newspapers, and magazines for both local and global use. These licenses authorize users to view and share content such as journal articles, book chapters, and other reference materials within their institutions without fear of copyright infringement or violation. Importantly, however, these licenses typically do not authorize upload of the full text of articles to portals or sites such as ResearchGate.

Note also that while these licenses cover the right to share an entire article, you may require additional copyright permissions to reproduce portions of an article such as a graph or a table onto a slide or an educational presentation. It is prudent to reach out to your institution's library or knowledge center if you have questions as to how you may reproduce data from copyrighted material, even if you have permission to share the article itself.

Why does this matter? Researchers all over the world have access to journal articles, research briefs, and meeting abstracts with the click of a button. It is easy to forget that in today's digital environment, you may not have (and may need to seek) the legal right to share this content. Any time you share works that are copyright protected — by email or instant message or on social media or in a slide deck without checking permission, you risk putting your institution at legal and financial risk. And as importantly, sharing content unlawfully undermines the culture of integrity that is prized by most organizations.

What about open access?

One of the most challenging concepts in copyright over the past few years has been the concept of 'open access' (OA) — literature that is 'digital, online, free of charge, and free of most copyright and licensing restrictions' [2]. While the Internet has made full-length journal articles far more accessible than in the past, much of the data still exist behind a paywall. The belief by researchers and funding agencies that paywalls hinder the scientific enterprise and are a roadblock to the uptake of research results has led to various initiatives and business models among the publishing community to provide 'OA' to journal articles and other related materials.

There are various models of OA, the most common being gold, green, and hybrid, and each has different elements related to types of copyright, where the article is stored, and when the published article becomes freely available as OA (Table 1). Worldwide, it is estimated that the proportion of hybrid journals increased from 2017 to 9678 between 2009 and 2016, with the total number of articles published in hybrid journals increasing from 8095 to 45 000 over the same time frame [3].

As a researcher today, you face a different decision-making process today than you did in the past regarding dissemination of your work. The decisions you make — which publisher to choose, whether the work will be made available in a subscription journal behind a paywall or as OA, and when your work will first be made available to the public — have a greater impact on the global reach of your work than ever before.

If you select an OA model, you grant the publisher a license to publish the work while you retain the copyright. The publisher will typically publish the article under one of six different Creative Commons (CC) OA licenses, each of which grants a different set of permissions for reuse. While there is a common misperception among content users that by its 'open' nature, OA content can be freely reused in any manner, this is not the

Table 1 Common OA publishing models*

Gold OA journal

- Author, institution, or funder may be asked to pay article processing charges (APCs)
- Many OA journals offer institutional memberships that include a reduction or waiver in APCs
- Peer-reviewed
- Authors usually retain copyright
- Typically associated with a Creative Commons Attribution License
- Access is immediate and permanently free

Green OA (self-archiving)

- Helps authors fulfill funder and institutional mandates
- Author negotiates rights to deposit preprint article (prior to peer review) in subject or discipline-related archive, an institutional archive, or author's website
- Author negotiates rights to deposit post-print article (after peer review, but without copyediting and formatting) for public release, usually following an embargo period
- In some institutions, publication in green OA is not considered a valid form of a peer-reviewed publication

Hybrid OA journal

- Offered as an alternative publication route by a subscription-based journal
- Author or funder pays a fee to designate OA in the regular issue of the journal
- Journal may choose to convert a paid article to OA following an embargo period (delayed OA)

* A comprehensive listing of OA status by journals and publishers is available at www.sherpa.ac.uk/romeo.

case. Some CC licenses allow reuse for commercial purposes; some allow reuse only for noncommercial purposes; and some prohibit the creation of derivative versions of the content (Table 2).

Some STM publishers are now experimenting with other types of solutions that facilitate information sharing among collaborative networks of researchers and scientists. These tools are designed to augment OA publishing and do not apply to sharing between commercial organizations. To learn more about these initiatives, visit *How Can I Share It* (www.howcanishareit.com), which is supported by many organizations that have a unified goal of facilitating content sharing among the scholarly community.

Government funding and OA

One of the more radical OA initiatives, Plan S, has been put forth by 16 funding agencies¹ across the U.S.A., the U.K., and Europe in 2018. Plan S mandates that by 2020, published research funded by these 16 agencies must be made free to read immediately upon publication and be available for anyone to download, translate, or otherwise reuse the work. There are three different ways to comply with the mandate: (1) publish in a pure OA journal or platform, (2) deposit the manuscript in an OA repository without embargo; or (3) publish in a hybrid journal that has committed to various transformative agreements [4].

¹Austrian Science Fund; French National Research Agency; Science Foundation Ireland; National Research Fund (Luxembourg); Italian National Institute for Nuclear Physics; Netherlands Organisation for Scientific Research; Research Council of Norway; National Science Centre (Poland); Slovenian Research Agency; Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning; UK Research and Innovation; Wellcome; Bill & Melinda Gates Foundation; Swedish Research Council for Health, Working Life, and Welfare; Research Council for Environment, Landscaping, and Urban Development (Sweden); Academy of Finland (as of 27/11/2018).

Table 2 Understanding creative commons licenses

License	Author can: Generally retain copyright Enter into other publishing agreements Archive in an institutional repository, subject archive, or personal website	User can: Quote and cite in research	User can: Distribute originals with attribution	User can: Create modified versions for distribution	User can: Redistribute commercially
Attribution CC BY	Yes	Yes	Yes	Yes	Yes
Attribution-ShareAlike CC BY-SA	Yes	Yes	Yes	Yes	Yes
Attribution-No Derivs CC BY-ND	Yes	Yes	Yes	No	Yes
Attribution-NonCommercial CC BY-NC	Yes	Yes	Yes	Yes	No
Attribution-NonCommercial-ShareAlike CC BY-NC-SA	Yes	Yes	Yes	Yes	No
Attribution-NonCommercial-No Derivs CC BY-NC-ND	Yes	Yes	Yes	No	No

Source: Creative Commons. About the Licenses (<https://creativecommons.org>).

In the U.S.A., PubMed Central (PMC) is a free, full-text archive of biomedical and life sciences journal literature housed within the National Institutes of Health (NIH) National Library of Medicine. Launched in 2000, PMC is also the designated repository for publications generated from government-funded research. Because of concerns related to the free flow of science generated from public funding, the Omnibus Appropriations Act of 2009 (H.R. 1105) included a provision mandating that complete electronic copies of peer-reviewed journal articles funded by the NIH be deposited into PMC [5]. The law includes the caveat that the NIH must implement the public policy access in a manner consistent with copyright law. The mandate applies to all research funded in all or part by NIH funding other than dissertations or book chapters.

As of November 2018, the PMC archive contained 5.2 million articles [6], with contributions coming directly from publishers or authors depositing their own manuscripts into the repository per the NIH Public Access Policy [7], which was developed to meet the requirements of H.R. 1105. It is important to note that the majority of the articles in PMC are subject to traditional copyright restrictions — they are free for individual access, but *cannot* be distributed or reused without permission from the rightsholder. The PMC Open Access Subset contains articles that are protected by copyright but are made available under a CC or similar license that generally allows more liberal redistribution and reuse than traditional copyrighted work.

In a federal expansion of the original NIH mandate, the Office of Science and Technology Policy issued a policy memorandum in 2013 directing all Federal agencies with more than \$100M in R&D expenditures to develop plans to make the results of federally funded research freely available to the public via PMC within 1 year of the original publication date [8].

In 2007, a UK version of the PubMed Central system, UK PubMed Central (UKPMC) was developed by the Wellcome Trust and the British Library with nine UK funders. In November 2012, it became Europe PubMed Central and is now a required repository for journal articles supported by 29 different funders across Europe, including the Wellcome Trust, the World Health Organization, and the NHS National Institute for Health Research. In a slight modification from the PMC model, journal articles must be submitted within 6 months of the publication date [9].

PubMed Central and Europe PubMed Central have established a collaborative effort called the PMC International (PMCI) network. The collaboration helps funding organizations build national or regional repositories of funded research articles and also makes it possible for journal articles to be exchanged between repositories in the PMCI network, subject to copyright and related permissions. A third member of the PMCI

network was Pubmed Central Canada, which was launched in 2009 and ceased operations in early 2018. Data from PMC Canada will continue to be available via both PMC and Europe PMC.

How can I stay in compliance?

First, become familiar with your organization's copyright compliance policy. If you can't locate it, reach out to your library, information center, or compliance officer. Second, learn what tools are available within your organization that allows you to check permissions for materials you wish to share or reuse. If you're part of a growing organization that does not yet have a collective copyright license agreement in place, bring it to the attention of an administrator. Third, learn the difference between what is freely available for sharing, and what is not. For example, you are usually free to share an electronic link to an article or abstract or blog post; however, you should check permissions if you wish to share the content embedded in that link. Even OA articles usually have a level of permissions built in — remember that the 'Open' in OA content refers to your ability to read it for free, not to unequivocally share, distribute, or reuse it. Because each type of OA license has different limits and conditions, it's important to understand the different license terms. Lastly, consider all the various ways content can be shared and make sure that permissions are in hand for those uses. You could be going beyond your rights when you post a commercial podcast from another company or source to your company's Intranet, embed a YouTube video into your slide presentation, or share a journal article with your entire group — unless you have permissions or a license to specifically do so.

Summary

- Per the voluntary principles of sharing STM content, there are new initiatives to allow the sharing of content within research groups; however, recognize that broad/mass sharing of content, such as PDF uploads on public sites, can violate copyright.
- OA content is free to read and can often be freely shared and reused. However, check the content's CC license to see if restrictions apply.
- Choose your journal submissions carefully based on OA versus paywall status, reuse terms, and how quickly your work will be published.
- Your institution most likely has a license that permits reuse and sharing (secondary use) of subscribed licensed content. Speak to your library to learn more and be an advocate for your organization's copyright policy

Author's note

While the present review is based on US copyright law, the issues discussed are considered best practices in the publication and sharing of scientific research.

Abbreviations

APCs, article processing charges; CC, Creative Commons; NIH, National Institutes of Health; OA, open access; PMC, PubMed Central; PMCI, PMC International; UKPMC, UK PubMed Central.

Author Contribution

J.S. is an employee of Copyright Clearance Center, Danvers, MA. J.S. has sole responsibility for the conception, research, and writing of this manuscript.

Competing Interests

The Author declares that there are no competing interests associated with this manuscript.

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