

# Chapter 6

## Open Access and Research Reproducibility in Biomedical Sciences

**Shimelis Getu Assefa**  
*University of Denver, USA*

### ABSTRACT

*Reproducibility-enhancing practices of open access journals in biomedical sciences are investigated. Based on transparency and openness promotion guidelines and relevant reporting requirements by institutions that are in the forefront of advancing reproducibility research, eight standards were used to evaluate 27 biomedical journals to 1) determine the extent to which these journals address reproducibility, 2) identify specific policy themes required, and 3) understand overall infrastructure promoted by the journals to deposit, archive, share, and discover research assets. The results show that almost all the 27 journals required authors to address six of the eight standards when preparing and submitting their research. Two standards that were not frequently addressed are preregistration of the study and preregistration of analysis plans. 'Data availability' policy is the most recurring theme across all journals. The infrastructure promoted to manage the overall scholarly communication workflow range from data, code, software repositories, protocol registration, to funding registry.*

### INTRODUCTION

Open Access (OA) is becoming an established method of scholarly communication. After 20 years of application and experimentation - social, technical, political, and economic factors have converged to make OA a viable form of knowledge production and dissemination. While there were attempts to archive preprints in the early 1980s in ftp servers such as the arXiv project, it's by the turn of the 21st century that open access movement gained momentum after the publishing of manifestos and initiatives such as the Budapest Open Access Initiative (BOAI) (Harnad, et al., 2004), Bethesda Statement on Open Ac-

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cess Publishing (Brown, et al., 2003), and the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (Redalyc, 2003).

Open Access (OA) is defined as “access to literature that is digital, Online, free of charge, and free of most copyright and licensing restrictions,” (Suber, 2010). This definition places emphasis on full open access and hides so much details as to what, when, and how the scholarly literature is to be made available in the open. Open access publishing is achieved, with some slight variations, in two ways: gold open access and green open access (Gargouri, 2012; Harnad, et al., 2004). In Gold OA model (mainly in OA Journals), published works are made freely accessible to readers after the cost of the article processing is borne by the author, or by a sponsoring agency, and in Green OA, while there are different variations, publishers allow authors to self-archive their work (Harnad, et al., 2008).

On the other hand, research reproducibility, or the idea of making one’s research reproducible garners different definitions and accounts across the scientific enterprise. Often different terms such as - reproducibility, replicability, repeatability, reliability, robustness, and generalizability – are used and create confusion (Goodman et al., 2016). While remaining within the umbrella of ‘reproducible research,’ extensive coverage is given in the extant literature to the kinds of reproducibility investigated such as – methods reproducibility, results reproducibility, and inferential reproducibility (Goodman et al., 2016) and computational reproducibility (e.g., Grüning et al, 2018). In this chapter, research reproducibility is broadly looked at that adheres to reporting guidelines on data, methods, statistical analytical steps, computational analysis and software codes, and overall research design.

Most importantly the focus of this chapter is to investigate the degree to which open access scholarly journals promote transparency and reproducibility-enhancing practices. The fact that open access journals are shared freely and in the open on the Internet, it is easy to verify the steps taken by the original study so other independent researchers can achieve similar findings, of course within the confines of the new research parameters. The question, however, is which of the bio-medical sciences open access journals require that authors submit manuscripts alongside data, software codes, and sufficient documentation of the overall research design to promote reproducibility-enhancing practices.

## **BACKGROUND**

Overall, there is an increasing recognition of the fact that sharing published works in the open Internet is vital for scientific progress. In addition to the established scholarly journals that follow either the Green or Gold model, the OA distribution ecosystem is fast expanding that covers - for example personal websites (e.g., <https://terrytao.wordpress.com/>) to OA Institutional Repositories (e.g., <https://deepblue.lib.umich.edu/documents>) to aggregators, discovery and social reference management systems such as Mendeley (Thelwall, 2018), to OA Directory of Journals (DOAJ) (Morrison, 2017), to research work flow management systems (e.g., <https://galaxyproject.org/> & <https://wholetale.org/>) to repositories of preprints and postprints (e.g., arXiv, bioRxiv, medRxiv, PsyArXiv), to fully OA academic & scholarly publishers (e.g, <https://plos.org/>), and to OA software - Essential Open Source Software for Science (EOSS) (e.g., <https://chanzuckerberg.com/eoss/>).

According to ULRICH’S database (Ulrichsweb), the most comprehensive database of periodicals with international coverage (English and non-English), there are about 89,000 active academic and scholarly journals that are referred and/or peer-reviewed - as shown by the search result using the following syntax:

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