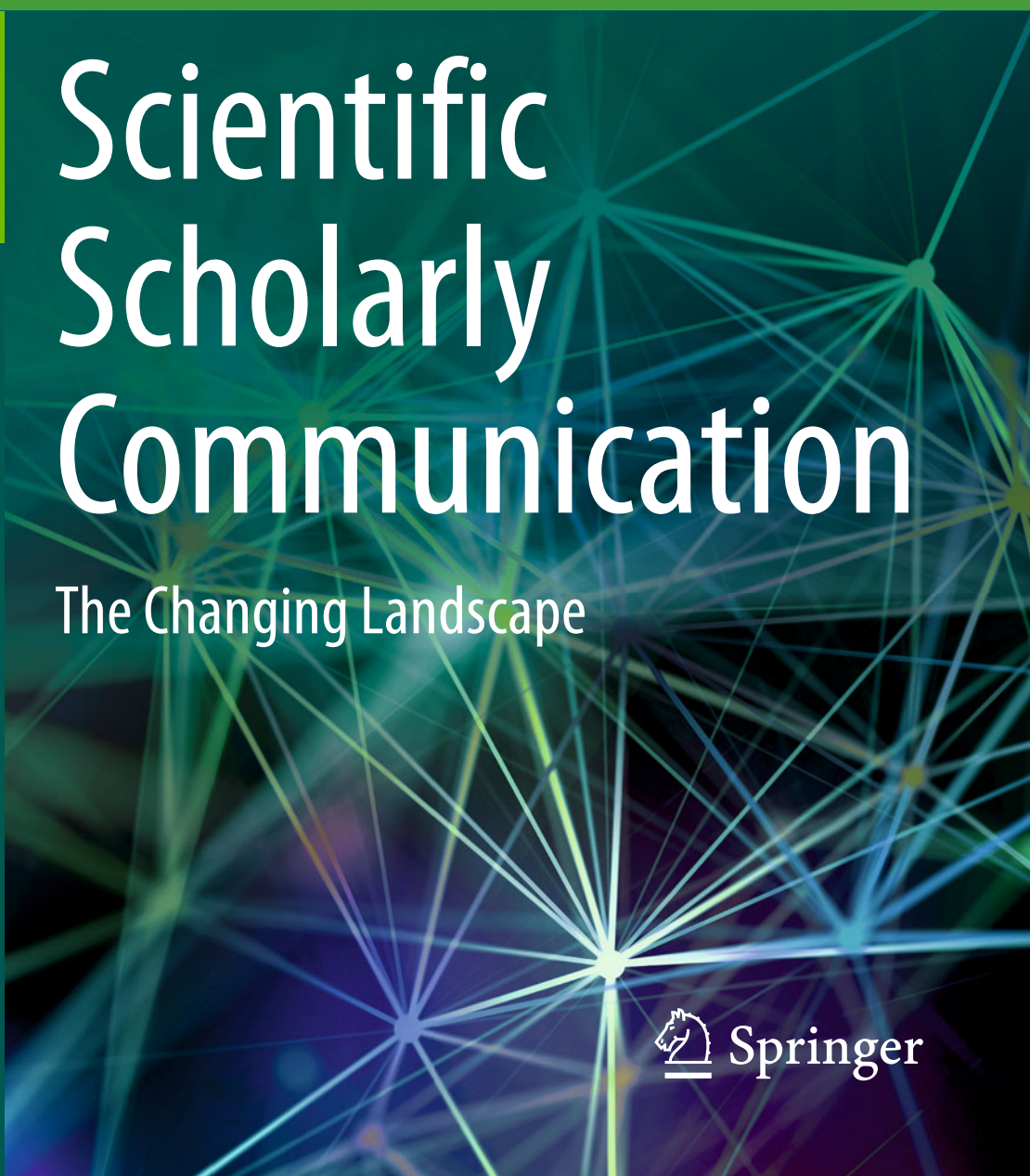
Fascinating Life Sciences

Pali U.K. De Silva
Candace K. Vance

Scientific Scholarly Communication

The Changing Landscape



Springer

Fascinating Life Sciences

This interdisciplinary series brings together the most essential and captivating topics in the life sciences. They range from the plant sciences to zoology, from the microbiome to macrobiome, and from basic biology to biotechnology. The series not only highlights fascinating research; it also discusses major challenges associated with the life sciences and related disciplines and outlines future research directions. Individual volumes provide in-depth information, are richly illustrated with photographs, illustrations, and maps, and feature suggestions for further reading or glossaries where appropriate.
Interested researchers in all areas of the life sciences, as well as biology enthusiasts, will find the series' interdisciplinary focus and highly readable volumes especially appealing.

More information about this series at http://www.springer.com/series/15408

Pali U.K. De Silva · Candace K. Vance

Scientific Scholarly Communication

The Changing Landscape

Springer

Pali U.K. De Silva
Murray State University
Murray, KY
USA

Candace K. Vance
Murray State University
Murray, KY
USA

ISSN 2509-6745 ISSN 2509-6753 (electronic)
Fascinating Life Sciences
ISBN 978-3-319-50626-5 ISBN 978-3-319-50627-2 (eBook)
DOI 10.1007/978-3-319-50627-2

Library of Congress Control Number: 2016962031

This book was advertised with a copyright holder in the name of the authors in error, whereas the publisher holds the copyright.

© Springer International Publishing AG 2017
This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.
The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.
The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

The formal scientific scholarly communication system that emerged 350 years ago changed at a slow pace until the last few decades, during which we have witnessed a tremendous state of transformation over a relatively short period. During this time period, many opposing viewpoints have been heard about the direction of the scientific scholarly communication system. The call for information to be freely and openly available is heard alongside the equally strong desire to profit from it. The well-established subscription-based journal publishing model for sharing scholarly information steadily evolved, but increasing subscription rates made many stake holders of scientific information unhappy. Voices of resistance were heard and the open access movement was born, promoting the norms of free and unrestricted access to scientific knowledge. Although the open dissemination and access to scientific information would ensure greater expansion of the knowledge base and enhance scientific progress, there are critical questions pertaining to the economics of open access publishing as well as other issues unique to unrestricted access to scientific information.

Data is considered the foundation of science, and there is growing interest in making scientific data readily accessible. The quest for "open data" is taking shape in parallel to the open access publishing movement, which will revolutionize the way science is documented. Advances in technology have made data collecting, archiving, sharing, and accessing more feasible. Although the advantages of scientific data sharing are increasingly acknowledged, it has not been adopted equally across scientific disciplines due to a variety of reasons such as the cost involved, culture, lack of data management skills, or technological difficulties. Then, there are issues unique to some types of scientific data that require an understanding of ethical and social factors, privacy, and safety and security concerns when openly sharing it.

The idea of democratization of scientific knowledge, one of the facets of the "open science" movement, is gaining attention within many scientific communities, and the benefits of sharing scientific knowledge are almost universally accepted. At the same time, the importance of transforming scientific discoveries into technologies benefiting the society at large has been similarly acknowledged. Two

contradicting ethos—the free flow of scientific information and the commercialization of scientific discoveries—have become a topic of spirited debate, which demands the attention of the scientific communities as well as the society at large.

The astounding rate of technological advancement not only shapes the way we disseminate, share, and access, but also assesses the quality of scholarly information. Quantitative tools facilitated by computer and communication technologies are combined with the traditional pre-publication peer-reviewing in measuring the impact of scientific research. While discussions and conscientious debates to improve existing time-tested measures persist, the pursuit of developing better and more efficient means also continues. There are questions not only about the effectiveness and reliability of assessment methods but also about the efficiency and the time it may take. Is faster better when assessing the quality of scientific research, and if so, at what cost? In addition to measuring scientific quality, should we also be determining the impact of science on society? And if so, how?

The changes in the scientific scholarly communication system are varied and complex, and the numerous participants involved in the debate about its future direction have different opinions. Scientists, probably the most important participants in this discussion, spend a great deal of time and effort to stay current in their respective scientific fields but may fail to stay current regarding the changes in the scholarly communication system. An understanding of the complex nature of these changes will enable them to more easily navigate this evolving landscape when seeking research funding, publishing their work, and managing issues related to their career enhancement. Beyond mere understanding, they must become advocates for the future of scientific scholarly communication—one that is inclusive and sustainable. This requires a sense of responsibility for shaping its future direction, not simply watching it unfold at the hands of publishers and commercial entities whose agendas may be at odds with the public good and the expansion of scientific knowledge.

The objective of this book is to provide scientists, science educators, university administrators, government entities, research funders, and other interested groups with an overview and critical analysis of historical and current developments and ongoing discussions regarding several important aspects of the scientific scholarly communication system based on thorough examination of the published literature on these topics. Therefore, we believe this book will provide an incentive for readers to become informed, join the conversation, and become active participants in helping transform the future of the scientific scholarly communication system that anchors the scientific endeavor, benefiting all of us and the environment in which we live.

Murray, KY, USA Pali U.K. De Silva
Murray, KY, USA Candace K. Vance

Contents

Chapter 1
Scientific Scholarly Communication: Moving Forward Through Open Discussions

Abstract The formal scientific communication system has continued to evolve over the last 350 years, shaped by economic factors, geopolitical events, and technological advances that are taking place at an unprecedented pace. However, throughout this evolutionary process, the discussions, debates, and deliberations that have taken place can be considered the most significant factors in improving the quality of the scientific scholarly communication system. This chapter touches on some of the discussions, debates, and conscientious deliberations that have occurred and currently taking place influencing toward a more efficient scholarly communication system needed to enhance the quality and the speed of scientific progress.

Keywords Scientific communication · Open access · Open data · Genetic data sharing · Scientific scholarly impact · Intellectual property rights

1.1 Introduction

Formation of the first scientific society and the introduction of scientific journals in the 1660s together mark the birth of the formal scientific scholarly communication system. The evolution of this system during the three and a half centuries since then is fascinating; at times it was shaped and directed by geopolitical events, at times it was heavily influenced by economic issues, and at times it has even been in a crisis mode. However, most striking are the technological advances that have caused revolutionary changes in scholarly communication during the past few decades which are continuing and still evolving.

Formal and informal communication among scientists to exchange ideas and discuss research is a significant part of the scientific research process. Therefore, for a robust scientific research system it is essential that all researchers have access to the scientific knowledge base facilitating their active participation; any factor that restricts the dissemination of and access to knowledge impedes the progress of scientific research. Robert K. Morton, the founder of the modern sociology of

© Springer International Publishing AG 2017

P.U.K. De Silva and C.K. Vance, *Scientific Scholarly Communication*,
Fascinating Life Sciences, DOI 10.1007/978-3-319-50627-2_1

science, says scientific knowledge should be considered as "public knowledge" accessible to not just scientists and students, but to the general public as well, a viewpoint that resonates among many others (Merton 1973). This idea of democratization of scientific knowledge is one of the facets of the "open science" movement, a concept which is becoming a buzzword in many scientific communities. Scientific research is becoming increasingly interdisciplinary, demanding the global collaboration of scientists, and unprecedented technological advances make these collaborations possible. More openness in sharing scientific information undoubtedly expands the "pool of researchers" and promotes cross-breeding of ideas which opens up new approaches, broadening and diversifying the scientific research process.

1.2 Open and Unrestricted Access to Scientific Information

After the formal system of sharing scientific research findings began with the publication of the *Philosophical Transactions of the Royal Society* in 1965, scholarly journal publishing developed into a subscription-based model controlled exclusively by commercial publishers and scientific societies. However, the domination of a few players in journal publishing caused access to scientific knowledge to become increasingly unaffordable and restricted, which alarmed scientific and academic communities. In response to these developments, challenging the traditional subscription-based model, the open access (OA) publishing movement was born toward the end of twentieth century, marking a significant milestone in scholarly scientific communication.

Another noteworthy aspect of this development is that it also sparked invigorating and open discussions related to many other aspects of scientific communication among stakeholders of scientific research. Progress in OA publishing facilitated by technological advances, gained attention and support among many groups, including policymakers and research funders. As a result, bold experimentation on different OA publishing models has produced promising options, such as the green (self-archiving) and gold (author-pay) OA publishing models. Although these models show high potential, they are still in the early stages of development. The open discussion among many stakeholders regarding the promises, limitations, and shortcomings of OA publishing is continuing and should continue. Important issues that are being discussed include the economic sustainability of these models, and, most importantly, maintaining high standards of scientific journal quality. The predatory journal publishing practices that exploit the gold OA publishing model have become a sticking point in an otherwise very promising publishing model that has reported many successes.

1.2.1 *Concerns with Openly Sharing Sensitive Scientific Information*

Unrestricted access to scientific information has many advantages, and certainly it accelerates scientific progress. However, the current trend toward openness in scientific information sharing sometimes collides with economic interests, scientific cultures, and individual professional ambitions. Additionally, there may be instances in which the level of openness in information sharing needs to be carefully assessed. For example, sharing of certain scientific information would harm individuals (e.g., research participants) or the society at large. Research in some scientific fields (e.g., nuclear weapons) has always been considered as sensitive, and restrictions on sharing research findings have been justified on the basis of national security and the risk of proliferation of nuclear weapons. There are other instances that exemplify the need for critical assessment of potential risks versus benefits of sharing scientific information (Resnik 2013). In a notable example, a multinational debate erupted in 2011 when two groups of scientists attempted to publish their research on the H5N1 virus in *Science* and *Nature*. These two studies were conducted in two countries, and one project was funded by the National Institute of Health (NIH) in the US. The concern was that if the details of these genetically engineered H5N1 strains of avian influenza virus, which now had the capability to infect humans, were openly shared, the virus could be used as a bioweapon by terrorist groups. Although the initial recommendation was to publish the papers without the methodological details and share them only with "responsible" scientists, after a year-long conscientious debate, it was ultimately decided to publish the complete articles (Malakoff 2013). This incident persuaded NIH to impose new rules on NIH grant funding requirements, making researchers identify studies that might lead to "dual use" findings (i.e., with the potential for both benefit and harm) and, if so, to create risk mitigation plans. Additionally, NIH examination of abstracts or manuscripts is required prior to conference presentations or submission to journals resulting from such studies. These developments, some argue, not only restrict dissemination and access to knowledge, but even obstruct the freedom of scientific inquiry (Resnik 2013; Malakoff 2013). An open and honest discussion is needed about how to maintain the delicate balance of ethos of openly sharing information and controlling access to scientific information that can be misused to harm human life and the environment.

1.3 Sharing Scientific Data

As science becomes increasingly collaborative, the need for data sharing becomes more apparent, and its advantages have been greatly acknowledged in many scientific disciplines. Therefore, there is a push toward making scientific data readily and broadly available. One of the best examples that highlighted the significance of

this is the human genome sequence project. Rapid release of human genomic data enabled global collaborations of scientists to work on causes of rare human diseases and find new insights into other important health conditions (Birney et al. 2009; Danielsson et al. 2014). Some data-intensive scientific fields, sometimes referred to as "big science," are equipped with data collection and management infrastructures that also support data sharing among dispersed groups of scientists (Kaye et al. 2009; Borgman 2012). However, data sharing is not prevalent in many disciplines, especially in hypothesis-driven, small-scale scientific research fields known as "small science," for reasons such as data heterogeneity, inaccessibility, lack of proper understanding of scientists regarding correct data management practices, and the absence of a data sharing culture.

In many instances, having data unavailable in accessible form is a major concern. This issue is prevalent in some scientific fields such as ecology. For example, environmental and ecological disasters are becoming more frequent and a scientific examination of the ecological impact of such a disaster requires access to a variety of datasets related to multiple disciplines including marine biology (benthic, planktonic, and pelagic organisms), chemistry (for oil and dispersants), toxicology, oceanography, and atmospheric science. Scientists study these incidents and collect enormous amounts of data in diverse forms, and these data sets may be collected to answer specific research questions. However, preserving and making them available in accessible form is important, as these may be useful in another related ecological disaster in a different location or time. Reichman et al. (2011) discussed this issue by highlighting the Deepwater Horizon oil spill in the Gulf of Mexico in 2010. According to them, most current and historical data collected by numerous studies related to oil spills are not available in accessible form or have been completely lost except for data available from a few well-organized research groups. This lack of information (or access to information) limits scientists' ability to examine the short- and long-term ecological effects of oil spills (Reichman et al. 2011). There may be many similar incidents—some that have received attention and many more that have passed unnoticed—that need to be highlighted in order to activate open discussions within scientific communities of different disciplines. Such discussions and debates will lead to increased awareness and promote the culture of data sharing within disciplines where it is lacking.

Sharing data in accessible and reusable forms allows others to recheck the validity of inferences made based on collected data. The ability to scrutinize research findings after formal publication is considered a form of peer reviewing. This post-publication review can be even more important than pre-publication peer reviewing, the traditional quality evaluation measure used in scholarly communication. The openness in data allows confirmation of research findings and self-correction of scientific mistakes. Begley and Ellis (2012) reported disturbing realities revealed through an examination of some preclinical cancer research studies. Out of 53 studies examined, the findings of only 11% could be confirmed.[1]

[1]Scientists at the biotechnology firm Amgen in Thousand Oaks, California.