

Balancing Interests of Science, Scientists, and the Publishing Business

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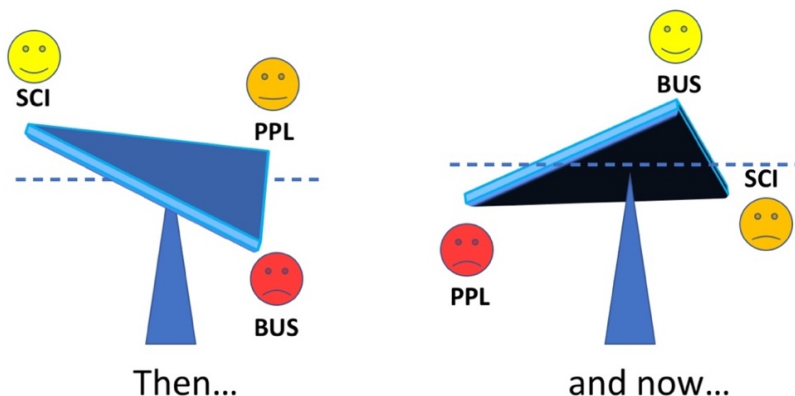
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Keywords

Balance, interests, scholarly publishing, systemic approach

Abbreviations

DORA: The San Francisco Declaration on Research Assessment

OA: Open Access

ISI: Institute of Scientific Information

JIF: Journal Impact Factor

Abstract

In the closely coupled system of diverse interests of science, those of scientists (authors, reviewers, and readers), their organizations (universities, research institutions) and those of publishers, every component is undergoing major changes in the digital era. In reality, these interests are deeply interconnected and long-term dominance of any one of them could hinder progress in many different ways. For science, originality and novelty do not have merit without reproducibility; for scientists, quantity is not a substitute for quality, and if businesses focus only on profit, it will suppress the value of their publications. Science, scientists, and organizations not only coexist, but cannot exist without each other, therefore all participants must adjust their actions to avoid devaluation of the whole. Many efforts are underway to regain this balance, and one possible approach – ours at Precision Nanomedicine – is described here.¹

Rationale and Purpose

Many examples can be found in the literature and in newspapers questioning or outright denying the value and validity of science, as well as blaming individuals or publishing companies for problems in scientific publications. While it is true that individuals are

the face of organizations and easier to hold responsible, these organizations, their structure, and the way they operate round up the playing field of individuals. Thus, a systemic approach is needed to understand these interests. In this editorial we describe our view, and how we at Precision Nanomedicine intend to balance these interests

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Introduction and Discussion

The “good old days”

In order to comprehend the real reasons why are where we are in science communication today, we need to understand how got here. [1] There were two revolutions and major technology breakthroughs that fundamentally changed the way of scientific communication and preservation of scientific knowledge: the industrial revolution (invention of printing press) and the computer revolution/world wide web. The first one created commercial publishing and the second created a global information network that connects billions of people.

As early as the 17th century, societies and scientific clubs of gentleman scholars discussed the origin and validity of different theories and findings, and helped by validating, announcing, and accrediting scientific discovery to the appropriate person. The very first scholarly journal [2] was edited by and published at the personal expense of the society's first secretary. This journal's emphasis was on basic science and was published in the interest society members but was not at all a business success [3].

Printing journals was a much more efficient way of communication than writing letters, especially as it made both distribution and archiving much easier. The new technology (printing press) also generated a new business opportunity. Large-scale printing required the use of specific heavy machinery and professional business organizations that could print, market, and sell books and journals. Thus, commercial publishing companies were formed. To prevent mass copying of books, copyright law was soon introduced [4], and requirements of originality and novelty were also born to assure value of content.

There was plenty of content to discover, competition was low, information exchange was slow, scientists were proud of their work, and they closely guarded its quality. Professors were respected for their work and library funds were never enough, but mostly close to sufficient. Small print shops could not compete with big publishing houses because the machinery was expensive. Quality of content was stringently guarded not only by the editors, but by fellow scientists as well: asking someone to review a manuscript was regarded as a compliment and signaled recognition. In

addition to *originality and novelty, reproducibility* was also a prerequisite.

This is how it used to work for scholarly journals: Publishers received the raw content from scientists (manuscript), sent it to other scientists in the field (quality assurance by peer review), then transferred the copyright of the validated content from the authors, made it into a product (formatted the text, illustrated with figures and tables, compiled articles into issues in a topical journal) printed, then marketed and sold them, predominantly to university libraries who were training future scientists. Libraries subscribed to journals, so publishers knew how many copies to print. Readers (scientists and their students) went to the library periodically to study and update their academic knowledge. *Scientists needed the specialized technology and distribution networks of the publishing industry to have their work nicely presented to academia, and publishers needed the scientists who generated content for their journals which were sold back to scientists as validated and prized knowledge. Interests of science, scientists, and business were in balance.*

The technology of printing on paper was able to keep up with the growth of scientific knowledge by increasing the volume and number of journals, but library budgets gradually fell behind [5] and they had to be more and more stringent in their selections [6]. In 1975, ISI began publishing journal impact factors to estimate the commercial value of journals based on readers' citations. This allowed libraries to make a justified decision which journals to buy, and administrators valued those scientists who published in those (literally) higher-value journals.

Computers and the Internet

Personal computers then appeared on the scene and by the end of 2008 there were more than two billion personal computers in use [7]. Connecting computers worldwide created a world wide web, and the balance of science, scientists, and business dramatically changed within a few years.

Science communication via printed media has been gradually giving way to the much faster electronic and online information exchange [8]. Libraries became quiet archival sites, as neither students nor scientists had to go there to read – they could access information on their computer, tablet, or mobile device at any time and almost anywhere. In addition, small

publishers only needed a few computers and network communication expertise to compete with the bigger companies through online journals. This explosion of speed in information and globalization led to close-to-linear growth in the number of scientists but to an exponential growth in the number of publications. In 2014, a scientific paper was published in every 12.6 seconds (2.5 M papers in 31,536,000 sec) [9].

How about now?

Despite all these changes, research funding remained stagnant, and the competition for funding became fierce. In addition, policymakers and administrators continued to evaluate scientists as before – according to the ‘impact’ of their publications, and used the simple Journal Impact Factor (JIF) to ‘determine’ the ‘impact’ of the research and the ‘value’ of the scientists based on where did they publish - as if people’s value could be judged based upon what restaurant they go to eat²). The truth is that one can only guess the potential impact (impact on what?) of any scientific article and counting total number of citations in

a journal is insufficient to judge a person’s ‘value’.) This deceptive, but cozy, and powerful evaluation method is still alive in many places because it is traditional and easy for administrators to use [10, 11, 12].

As a consequence, most researchers found themselves under tremendous pressure to publish. Scientists had to write more grant proposals to remain competitive, which meant publishing more papers in ‘high-impact’ journals with ‘novel,’ ‘significant,’ and ‘original’ results to demonstrate their own value [a phenomenon known as “Publish or Perish” [13]].

Pools of authors and reviewers began to separate, and reviewing manuscripts was mostly left to junior scientists. The traditional evaluation method of manuscripts by free peer review was becoming less and less effective; there were not enough highly trained reviewers available anymore. Peer review started to be seen as a commodity and peer-review companies began to form.

Table 1 Comparison of dominant elements of scholarly journal publishing before and after computers

	Then	Now
Authors/writers	academic professors	Junior scientists, post-docs, and students
Authors/corresponding	academic professors	senior scientists and professors
Reviewers	academic professors	junior scientists, post-docs, a few senior scientists
Readers	academic professors and students	post-docs, students, scientists, engineers, technologists, etc.
Content	Basic science	Basic and applied science, engineering, technology, business
Distribution	Learned societies and commercial (for-profit) publishers	Commercial publishing (for-profits), society, university, and institutional self-publishing in print and online (both for-profit and nonprofit); small publishers online (for-profits and a few nonprofits)
Media	Printed on paper	Electronic and online, some in print
Business model	Subscription	Open access, hybrid and subscription,
Storage/archival	Printed media stored in libraries	Print and electronic storage in libraries, at archival sites, on servers, and on personal computers

Universities value those who can bring in research grant money, so senior scientists either had to focus on writing grant proposals and reports, or warm up to government offices. The quality of publications became less important

than being visible in ‘high value’ journals. Thus, publishing many papers as quickly as possible became the major goal of many scientists. The pressure to publish combined with easy access to the Internet was tempting for fraud and this

² impactful, paradigm-changing papers may come from any journal.

existential pressure on scientists opened up opportunities for predatory journals [14, 15] and publishers [16] to make ‘easy’ money:³

Accelerating pace, increasing competition and uncertain future shifted the focus towards short-term interests for everybody involved, instead of guarding long-term values.

Feeling the need for unrestricted, free access to publicly funded scholarly research, Open Access (OA) Initiatives were signed by scientists, societies, institutions, and foundations [17, 18, 19].

Open Access was intended to provide free access for all readers, but businesses soon realized that not only readers were willing to pay for validated information (subscription model), but authors were also willing to pay for much needed publicity *before* publication, which considerably lowered the financial risk of companies. Thus, the *idea* of OA quickly generated the OA *business model*.

The computer revolution and the OA movement decreased the dominance of the six major academic publishers [20] and gave rise to thousands of smaller publishers and their journals. Existing large commercial publishers also reacted: they increased capacity, split brand name journals into sub-journals and families, created mega-journals and – because of electronic search – often abandoned topics. The numbers of publications multiplied and the number of readers — aided by quick and efficient search algorithms — jumped to new heights, and business profits soared [21].

These developments hit science hard both for objective and subjective reasons. Objectively, scientific knowledge is never completely coherent because we are always partly into the unknown. Moreover, it is not unusual that different experts may interpret the same valid data in different ways. Subjectively, nobody has time anymore to test and confirm; we

simply have to believe, based on individual experience and (real or perceived) prestige of the journal.

Reviewer respond rates plummeted, review timelines increased, and review quality decreased. As a consequence, more but less scrutinized publications appeared, which opened the door to rightful criticism. The quality of publications and even the quality and usefulness of scientific information was publicly debated [22, 23, 24].

This discord has penetrated all three components. One now can find fake authors, fabricated data, falsification, plagiarized articles, fake ‘peer-reviews’ written by ‘entrepreneur’ companies, journals reporting made-up ‘impact factors,’ and publishers who care only about making money. “Authors” began to complain about “reviewers,” indicating that not all authors considered themselves reviewers after all. While editor positions and journal editorial boards are loaded with sincere scientists, the existential burden on researchers and general lack of time has definitely scarred the morality of some who would like to publish but avoid scrutiny

While responsibilities of cheating and unethical individuals are unquestionable, businesses just do what they do the best – provide specific skills and make themselves profitable. As one of the major player’s states its mission: “Our expertise lies in seeking out and fully realizing potential revenue streams for our society partners. We aggressively develop commercial sales opportunities, ... including advertising, supplements, sponsorships, reprints, and translations.” (No mentioning of science or scientists.) These disturbing signs of a systemic imbalance are the consequence of diverging interests, and without addressing this real reason, we will just keep reproducing the same problems in a different format or place [25].

³ In the OA gold model, instead getting paid for generating content - as book writers do - authors pay so called ‘Article Processing Fees’, which usually includes all business costs plus profit.

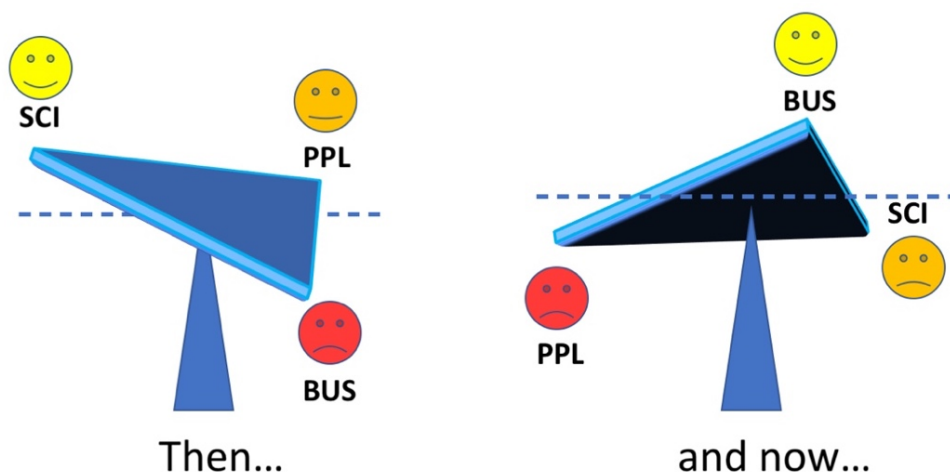


Figure 1: Balancing interests of Science (SCI), Business (BUS), and Scientists (PPL) – Scientists were happy then as opposed to businesses now..

Is there hope?

This system is dynamic, and it balances and regulates itself to a certain extent.

Here are a few examples: In addition to for-profit publishers, nonprofit organizations have also sprung up. New Science Foundations formed to support responsible OA publishing. Plagiarized content is identified early by special software, questionable publications get increasingly retracted, new peer-review methods are being created, dubious meetings [26] cannot be continued forever, journals without support and value quietly dissolve, predatory publishers are called out, and journal-based evaluations are giving way to article-based metrics. Some of the for-profit publishers of the new wave are also fine-tuning their business model [27]. There are battle-cries to increase reproducibility and to allow the publishing of negative results [28, 29, 30, 31, 32, 33, 34]. Universities in several countries are clashing with large publishers [35] [36], and aided by the EU's mandate to make all scientific articles freely available by 2020 [37], are renegotiating deals with major publishing houses [38].

Scientists are also responsible. Authors should not forget that they are also reviewers and readers. *Scientists should create new, easy-to-use tools to make article-based performance evaluations simple and provide these tools to research administrators to simplify their tasks* (the concept of [JIF] was not invented by

agencies, either). Good starting points would be funding agencies and universities, because the primary concern of research administrators is not the quality of science, but how to feed their organization.

Large commercial publishers still have the advantage of powerful and large-scale marketing, sales expertise and established networks, but they should listen to their editorial boards – otherwise scientists revolt [39, 40, 41] and fight back [42, 43, 44].

To rebalance science publishing there are initiatives for academic-led or library-led publishing [45, 46]. Another structural solution is to find and operate nonprofit society supported journals, which are controlled by groups of scientists. Society journals used to dominate scientific publications and some of them are still very strong (ACS, APS). While many societies have hired for-profit publishers to run their media others decided to create their own publishing companies supported by nonprofit foundations.

This is exactly our idea at Precision Nanomedicine, the official journal of the European Foundation for Clinical Nanomedicine (CLINAM), and the goal of Andover House, Inc., the journal's scientists-owned publisher. We are supported and supervised by scientists and report to international and national nanomedicine societies.

Conclusion

Society needs reliable science now more than ever, but progress cannot exist without scientists and sharing reliable information. Science publishing can only move forward if the interests of all stakeholders are in balance. A publisher has to run a sustainable business but needs the oversight of scientists to ensure that the primary interests of all parties are equally served. Scientists provide content, supply quality control, improve scientific merit, and as users they read, share, judge, and utilize content. This structure operates through board members, who guard the prestige and value of the journal. Science publications and in more general science communication is part of the global information ecosystem, which we will have to redesign in the 21st century [47].

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