

On toxic effects of scientific journals

The advent of online publishing greatly facilitates the dissemination of scientific results. This revolution might have led to the untimely death of many traditional publishing companies, since today's scientists are perfectly capable of writing, formatting and uploading files to appropriate websites that can be consulted by colleagues and the general public alike. They also have the intellectual resources to criticize each other and organize an anonymous peer review system. The Open Access approach appears promising in this respect, but we cannot ignore that it is fraught with editorial and economic problems. A few powerful publishing companies not only managed to survive, but also rake up considerable profits. Moreover, they succeeded in becoming influential 'trendsetters' since they decide which papers deserve to be published. To make money, one must set novel trends, like Christian Dior or Levi's in fashion, and open new markets, for example in Asia. In doing so, the publishers tend to supplant both national and transnational funding agencies in defining science policy. In many cases, these agencies tend simply to adopt the commercial criteria defined by the journals, forever eager to improve their impact factors. It is not obvious that the publishers of scientific journals, the editorial boards that they appoint, or the people who sift through the vast numbers of papers submitted to a handful of 'top' journals are endowed with sufficient insight to set the trends of future science. It seems even less obvious that funding agencies should blindly follow the fashion trends set by the publishers. The perverse relationships between private publishers and public funding agencies may have a toxic effect on science policy.

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1. Introduction

The concentration of power in the hands of a decreasing number of ever-larger publishers is a much-debated strength and weakness inherent to our 'free market' economy. There used to be some checks and balances to counter such centripetal trends, but financial interests have weakened many regulations. Admittedly, our market economy has a unique ability to spur innovation and risk-taking. Think of Gutenberg's invention that opened the way to large-scale printing. Remember courageous publishers such as Elzevir who dared to print Galileo's work despite his troubles with the Inquisition in 1638. Think of the marvelous diversity of some 20,000 journals that have sprouted to cater for the needs of scientists. Think of

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Abbreviations used: AAA, American Association of Anthropologists; ACS, American Chemical Society; AERES, *Agence pour l'Evaluation de la Recherche Scientifique* [France]; AIP, American Institute of Physics; AMS, American Mathematical Society; ANR, *Agence Nationale pour la Recherche* [France]; APS, American Physical Society; BBSRC, Biotechnology and Biological Sciences Research Council [UK]; CNRS, *Centre National pour la Recherche Scientifique* [France]; CTI, Committee for Technology and Innovation [Switzerland]; DFG, *Deutsche Forschungsgemeinschaft*; DOE, Department of Energy [USA]; ENS, Ecole Normale Supérieure; EPFL, Ecole Polytechnique Fédérale de Lausanne; EPSRC, Engineering and Physical Sciences Research Council [UK]; ERC, European Research Council [EU]; FP, Framework Programme [EU]; JACS, Journal of the American Chemical Society; JMR, Journal of Magnetic Resonance; MPI, Max Planck Institute; MRC, Medical Research Council [UK]; NERC, Natural Environment Research Council [UK]; NIH, National Institutes of Health [USA]; NSF, National Science Foundation [USA]; PNAS, Proceedings of the National Academy of Sciences [USA]; SNSF, Swiss National Science Foundation; UPMC, Université Pierre-et-Marie Curie

Google, Thomson Reuters and their Web of Knowledge. Think of our ability to search through millions of papers without ever going to a library.

Research has become an economic activity in its own right. Research and development burn up 2% and 2.8%, respectively, of the GDP of the European Union and of the USA¹. Since money is being spent on such a large scale, national and supranational funding agencies have been set up to decide how to spend it². One can no longer rely on serendipity! Hence the frantic attempts of funding agencies³ to define roadmaps for the future of science. Hence the flourishing of *national priority programs* that tend to promote ‘top down’ objectives, usually defined without consulting more than a handful of scientists. Hence the ‘calls’ issued by NSF, NIH, and DOE in the USA; FP in Europe; CNRS and ANR in France; BBSRC, MRC, EPSRC, and NERC in Britain; MPI and DFG in Germany; SNSF and CTI in Switzerland, not to mention numerous granting agencies in major countries such as India, China, Japan, South Korea, etc. Hence the multiplication of journals, editorial boards and referees⁴. Hence the obsession with rankings of individual scientists, departments, universities, countries, and even entire continents, as if science could be organized in the manner of Olympic games.

2. Who defines science policy today?

Are the national and supranational funding agencies fulfilling their mission? Who really decides where science should be going? Where investments should be made? What type of research is promising? Which subjects deserve increased support? What kind of new faculty should be appointed? And conversely: which laboratories ought to be closed down? On first sight, it would appear that science policy is shaped by various funding and evaluation agencies. In practice, however, their panel members and experts often base their judgment on bibliometrics (Ernst 2010; Molinié *et al.* 2010)⁵. They mostly look up *lists of publications* (actually reading the publications themselves would evidently be too time-consuming, and is regarded as hopelessly old-fashioned), check if the investigator is the first or last author (although many labs use the alphabetic order, while others list their team members in order of increasing seniority), and look up the authors’ *h*-factors (often getting trapped by confusions with namesakes) (Molinié and Bodenhausen 2011). Above all, many funding and evaluation agencies focus on the *impact factors*⁶ of the journals. The latter are tacitly assumed to be significant, not merely to judge the quality of the papers that these journals deem worthy of publication, but, more surprisingly, to ascertain the quality of their authors. Clearly, basing scientific evaluation on bibliometrics gives an exorbitant power to journals.

If a scientist has published some papers in ‘top’ magazines such as *Science* or *Nature*, his work must surely be of the highest standards! If he hasn’t quite made it to the top, perhaps he might be forgiven if he can show a few papers in *Cell*, the *Proceedings of the National Academy of Sciences*, *Physical Review Letters*, the *Journal of the American Chemical Society*, *Angewandte Chemie*, *Chemical Communications*, and similar media. But if the investigator has stooped so low as to condescend to mere ‘technical journals’, he or she may have ruined his chances of success.

¹ <http://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS>.

² To be truthful, some scientists occasionally stumble upon some freaky invention, the discovery of penicillin, a cure for poliomyelitis, the production of fertilizers from atmospheric nitrogen, the invention of transistors and lasers, etc. This was in the happy days of serendipity!

³ Refer to the list of funding agencies in the abbreviations.

⁴ AM is a member of the ‘*comité de rédaction*’ of the *Journal de la Société des Américanistes*. GB is one of the five editors of *Progress in Nuclear Magnetic Resonance Spectroscopy* (Elsevier), member of the editorial boards of the *Journal of Magnetic Resonance* (Elsevier) and *Solid-State Nuclear Magnetic Resonance* (Elsevier), member of the advisory board of *Applied Magnetic Resonance* (Springer), and former member of the editorial board of *Chemistry, a European Journal* (Wiley.)

⁵ SNSF may be an exception that confirms the rule. Martin Quack, who served about ten years on its Research Council, wrote in *Bunsen-Magazin* 5 181–189 (2012): ‘...it may be noted that [the Research Council of the SNSF] is composed of selected scientists who, in the manner of the Swiss army where every citizen is a part-time soldier [‘*Milizsystem*’], is willing to cooperate in the committee for a limited fraction of his time (and for a limited period), *without giving up his active participation in scientific research*. Such a committee is, by its very nature, guided by scientific arguments, and less lured by bureaucratic bean-counting [‘*weniger anfällig für bürokratische Masszahlen*’] (freely translated with our italics).

⁶ For the definition of impact factors, see http://thomsonreuters.com/products_services/science/free/essays/impact_factor/. For a discussion of their perverse consequences, we refer the reader to our earlier paper (Molinié and Bodenhausen 2010). See also Ernst (2010). These can be downloaded from <http://www1.chimie.ens.fr/Resonance/papers.html>.

Professional scientists typically ‘have a good sense of the relative prestige of the journals in their area, and they will usually submit a paper to the highest ranked journal that they judge is likely to accept it’⁷. Some scientists may have a furtive look at impact factors for guidance. The impact factor of a journal gives a measure of the number of times papers that have appeared in that journal have been cited within a narrow window that spans only two years. The value and statistical significance of impact factors is the subject of much acrimonious debate⁶.

Not surprisingly, ‘top’ magazines like *Science* and *Nature*, i.e. those that have the highest impact factors, are buried under an avalanche of thousands of submitted papers, since millions of scientist would like to see their work enshrined in their pages. These magazines are compelled to sort through incoming papers on a semi-industrial scale. *Angewandte Chemie* (largely because its impact factor now exceeds the magic number of 10) expects no less than 10,000 submissions in 2013. Some journals such as *Science* send submitted papers to a small set of scientists who do the initial screening. Many journals appoint specialized staff to run their ‘front offices’, browse through incoming manuscripts, and decide which papers deserve to be sent to referees, and which may be rejected straight away. The staff in charge of this selection process obviously must have clear instructions⁸. The more likely a paper is to be cited abundantly in the next few years, the greater its contribution to the impact factor of the journal will be. Like commercial TV networks, the initial scrutiny seems to be guided mostly by the popularity of the subject. The ‘front offices’ are easily seduced by catchy titles and sexy semantics, like ‘sustainable energy’, ‘neural networks’, or ‘integrative biology’. The staff in charge of the initial selection must be familiar with a few fashionable subjects such as ‘global warming’, ‘exoplanets’, ‘stem cells’, ‘cultural globalization’, ‘subaltern societies’, ‘mixed blood identities’, etc., but cannot possibly appreciate the thousands of papers that they discard. For the happy few that are not rejected straight away, the journals must find qualified referees. In our limited experience⁹ the most prestigious journals do not necessarily consult the most competent referees. It is not surprising that the technical quality of flashy papers that appear in ‘top’ journals often leaves much to be desired. If it were not for our ardent wish to keep a few friends among our colleagues, we could easily cite a dozen papers about NMR that appeared in *Science* but that would undoubtedly have been rejected by the referees of the *Journal of Magnetic Resonance*.

3. Politics before science?

Some well-meaning scientists complain that politics have taken precedence over science. In fact, even political considerations are increasingly being set aside to make room for the undivided rule of profit. In many areas of business such as mining, steel production, car-making, supermarkets, television, insurance, banking, etc., the drive is towards an ever-stronger concentration in ever-larger companies. Not surprisingly, the same is happening to publishers. In the fields of medicine, biology, chemistry, and physics, and, to a lesser extent, in human sciences like anthropology, journals are being bought up one after another by a handful of companies, in particular by Elsevier, Springer, and Wiley. A few ‘learned societies’ continue to publish in splendid isolation, including the Deutsche Bunsen-Gesellschaft, the Royal Society of Chemistry (which publishes, *inter alia*, *Chemical Communications*), Nature Publishing Company (which publishes

⁷ See <http://thecostofknowledge.com>. For the impact of this manifesto, see <http://www-fourier.ujf-grenoble.fr/petitions/index.php?petition=3.5>. See ‘Impact Factors, Open Access, and 125 Years of Angewandte Chemie’ by Peter Göllitz 2012 *Angew. Chem. Int. Ed.* **51** 9704–9706.

⁸ The Editor of *Angewandte Chemie* told us that his front office comprises no less than 17 people, all of them in possession of a PhD degree. Could it be that journals of lesser reputation employ people who do not even have a PhD?

⁹ Submitting papers has become a frustrating and time-consuming task. A few years ago, one of our papers was accepted by a ‘top’ magazine (Pelupessy *et al.* 2009 *Science* **324** 1693–1697). Despite its flashy title (‘*High-Resolution NMR in Magnetic Fields with Unknown Spatiotemporal Variations*’), it is technically so challenging that even its most senior author found it hard to understand. To our surprise, *the granting agencies loved it*. A more mature paper on MRI was rejected by several journals and ended up in *Journal of Magnetic Resonance* More recently, we submitted a paper on drug screening to *Nature Methods*, then to *PNAS*, then to a respected member of the National Academy, then to *Nature Physics*, and finally to *JACS*. Only then was the paper actually sent out for review (N Salvi *et al.* 2012 *J. Am. Chem. Soc.* **134** 11076). Another recent paper on high-resolution NMR was initially submitted to *Science*, then to *Nature Physics*, and finally printed in *Physical Review Letters* (S. Chinthalapalli *et al.* 2012 *Phys. Rev. Lett.* **109** 047602-1-4)

Nature and an array of daughter journals), the American Association for the Advancement of Science (which publishes *Science*), the AAA, ACS, APS, AIP³, etc. Other learned societies, like the French *Académie des Sciences*, have handed over their journals to commercial publishers. Only a handful of journals have moved in the opposite direction towards less profit-oriented publishers. Thus, the *Annales Scientifiques de l'Ecole Normale Supérieure*, which until recent years were published by Elsevier, is now published by the *Société Mathématique de France*. Following the resignation of the entire editorial board of Elsevier's *Topology*, some mathematicians proceeded to found the *Journal of Topology*, now published by *Oxford University Press* on behalf of the *London Mathematical Society*¹⁰. To the best of our knowledge, many journals that deal with human sciences, and in particular with anthropology, have not yet been bought up by greedy publishing companies. With surprising success, many seem to live their quiet lives as of old, untouched by the drive to ever-larger profits. However, the American Anthropological Association (AAA), which publishes no less than 22 journals, has struck a deal with Wiley, who provides some revenues to the AAA while keeping the bulk for its own benefit¹¹.

4. Journals fulfill multiple functions

Historically, the *primary function* of scientific journals used to be the dissemination of research papers. Legitimately, publishers used to charge for the cost of typesetting (before the advent of electronic typesetting, this was no trivial matter, in particular in chemistry and physics because of elaborate molecular and mathematical formulae), for the expense of physically printing paper copies of the journals, and for the cost of mailing these copies to libraries and other subscribers.

A *second function* of journals is to evaluate papers through peer review. Peer review plays an essential role in ensuring the correctness and readability of scientific papers. The peer review system depends on the goodwill of suitable referees. Its success is one of the great traditions of science: practically every member of the community willingly takes part in it. It is sometimes felt to be an honor, and sometimes more prosaically perceived as a way to be informed about competitors.

A *third function* that journals in effect fulfill (although perhaps unwittingly) is the promotion of scientists. Publishing papers in research journals is a way of achieving professional recognition. Having a few papers in 'top' journals has become a necessary (and sometimes sufficient) condition for a successful career.

A *fourth function* that journals exert, again in part unintentionally, is that they have a considerable influence on science policy, by setting trends and defining what is perceived as 'modern' and 'promising.' We believe that *this strategic role of journals has been largely underestimated*.

Finally, a *fifth function* is that journals are a major source of revenue for their publishers. Prices for 'online content' of two major publishers have increased by about 145% over the past six years, and profit margins on the order of 35% are not exceptional¹².

While peer review and dissemination of knowledge are legitimate functions of journals, they should not be entrusted with the promotion of scientists, the setting of trends, and the relentless drive to make profits at the expense of public institutions must be recognized as perverse.

¹⁰ See [http://en.wikipedia.org/wiki/Topology_\(journal\)](http://en.wikipedia.org/wiki/Topology_(journal)): 'On 10 August 2006, after months of unsuccessful negotiations with Elsevier about the price policy of library subscriptions, the entire editorial board of the journal handed in their resignation, with effect from 31 December 2006. (...) Subsequently, two more issues appeared in 2007 with papers that had been accepted before the resignation of the editors. (...) In early January the former editors instructed Elsevier to remove their names from the website of the journal, (...) but Elsevier refused to comply, justifying their decision by saying that the editorial board should remain on the journal until all of the papers accepted during its tenure had been published.'

¹¹ For a telling example of the struggle between those in favor and against Open Access journals, see <http://blogs.plos.org/neuroanthropology/2012/01/31/american-anthropological-association-takes-public-stand-against-open-access/>

¹² 'The Faculty Advisory Council to the Library [of Harvard University], representing university faculty in all schools and in consultation with the Harvard Library leadership, reached this conclusion: major periodical subscriptions, especially to electronic journals published by historically key providers, *cannot be sustained*: continuing these subscriptions on their current footing is financially untenable. Doing so would seriously erode collection efforts in many other areas, already compromised. (...) Prices for online content from two providers have increased by about 145% over the past six years. (...) Even though scholarly output continues to grow and publishing can be expensive, profit margins of 35% and more suggest that the prices we must pay do not solely result from an increasing supply of new articles' (<http://isites.harvard.edu/icb/icb.do?keyword=k77982&tabgroupid=icb.tabgroup143448>).

5. How do journals work?

To the extent that journals exert an influence on science policy, this is usually through the appointment of their editorial boards. In the case of *Chemistry, a European Journal*, the editorial board comprises no less than 43 members, but merely serves to vouch for quality (one may wonder how!) since the board members are rarely invited to review papers. In other cases, like *Progress in NMR Spectroscopy*, the editorial board has recently been extended from two to five people, all of whom play an active role in inviting and reviewing papers. A journal is known by its *name* (for example, *Helvetica Chimica Acta*), which is a trademark like Coca Cola. This name is owned by a publisher such as *Verlag Helvetica Chimica Acta AG* (VHCA) that in turn may be owned by one or more shareholders⁴. This is reminiscent of the world of banking and high finance, where impenetrable constructions make it virtually impossible to recognize who is responsible for what.

Many scientists believe that editorial boards need not heed the policies of their publishers. In practice, they are 'deemed to act as agents for the Publisher and subject to the Publisher's direction, control and approval' and must sign a contract¹³. Only a few 'top' journals and fashionable magazines employ extensive staff to run their 'front offices'. Many traditional journals are too small to employ an army of people, and are still managed 'as of old' by their editor-in-chief, sometimes with the support of editorial boards. In some cases, members of these boards receive a symbolic payment. Those of *Progress in NMR Spectroscopy* may expect to receive £1250 per year, plus £200 per published article. Since nobody can live on such incomes, the bulk of the salaries must be paid by universities or public funding agencies. Most authors are also employed by the public sector, so they need not be paid for their efforts (*Progress* awards a sum of £200 per paper, to be shared among co-authors). Referees need not be paid either, since refereeing is regarded as part of the normal service of a scientist.

No wonder business is so good! Elsevier boasted an operating profit of \$1.12 billion in 2010¹². This spectacular success results from a massive transfer of wealth from the public sector that supports academics to the private sector that sells their works. Admittedly, it seems pointless to argue against publishing companies merely because they are successful in business. If Apple is so successful, why should Elsevier not be profitable? The difference is that Apple sells products that they design themselves and produce at their expense through subcontracting, while Elsevier 'sells' papers that are produced by scientists who are paid by the public sector. If their greed threatens to cause the whole system to collapse, the scientific community must come forward with alternative models.

6. What makes or breaks the reputation of a serious journal?

In our opinion, there are at least ten factors that contribute to the genuine reputation of a journal. Not everybody agrees on their importance, so we consider them in arbitrary sequence: (i) the impact factor (despite the inherent weakness of this metric), (ii) the prestige of past volumes, (iii) the supposed preferences of the 'front offices' in charge of the initial selection process, (iv) the quality of the referees, (v) the reputation of the editorial board, (vi) the speed of publication, (vii) the convenience of the software that runs exchanges between authors, editors and referees, (viii) the reliability of the servers that allow published papers to be downloaded in a 'searchable' format, (ix) the cost of subscriptions of current and

¹³ Some excerpts of a typical contract between a well-known publisher and one of the authors of this paper: 'Your role as Editor of the Journal includes acquiring Review articles of high scientific standard and sufficient copyflow to meet the publication goals of the Journal. As Editor you will have responsibility for the timely coordination of editing, refereeing, submissions, and communications with authors, as well as ensuring that such activities are done in conformity with the Editorial Policies and good publishing practices (the 'Editorial Services'). Good publishing practices also involve using all reasonable efforts to ensure that published papers and their authors abide by scientific standards for integrity and objectivity, do not infringe the proprietary rights of others, do not defame others, and do not cause damage or harm to persons or property or to the good reputation of the Journal. Such practices also include efficient, timely and confidential administration of the process of receiving papers and submitting the papers for the review, using Elsevier's electronic submission system. All material submitted to you is intended for, and is the property of Elsevier. You hereby assign and transfer to the publisher, to the maximum extent possible, all right, title and interest you may have in and to the Journal, including without limitation the selection, compilation and/or the editing of the material published therein, and authorize use of your name, biography and professional affiliations (at the Publisher's discretion) for purposes of promoting the Journal' (our italics).

past volumes, and (x) the efficiency of their marketing. All of these factors are important if one considers founding a new journal. Aggressive self-advertisement of journals¹⁴ hardly improves their standing!

7. Some wonderful presents

Publishers make laudable efforts to ensure continued support of their referees. Writing referee reports can be rewarding, but it can also be a major commitment of time and effort¹⁵. It was a truly heartwarming experience to receive a magnificent present of €20 (figure 1) that can be spent on anything in Amazon's catalogue – not restricted to Elsevier's products!

In truth, the American Chemical Society has a more classy approach: they sent a colorful 'Certificate' that can be framed to adorn one's office (figure 2)

Never short of imagination, Elsevier recently offered a personalized T-shirt in recognition for publishing a paper in one of their journals (figure 3).

8. Who pays for journals?

The (mostly public) institutions whose libraries pay for journals are, broadly speaking, the same institutions that employ the scientists who are writing, refereeing, and editing these journals⁷. Therefore, the cost of the whole process is predominantly borne by public institutions. Thus the taxpayers are obviously victims of a perverse construction.

Authors are requested to submit their papers in some pre-determined format that, to their grief, varies from one publisher to another. For some journals, authors have to pay substantial page charges. Authors often have to pay exorbitant fees for colour pictures. Some lucky authors are occasionally invited to draft a 'cover page', which is regarded as an honour, but entails more fees. Now that volumes have become virtual, the number of cover pages seems unlimited! Since dissemination occurs through downloading from servers, printing and distribution costs have dwindled. The maintenance of servers and the accessibility of millions of searchable files no doubt carry a price. Unfortunately, *there is no way to ascertain how much publishers invest in such services*. Like banks and insurance companies, publishers like to keep their secrets. Clearly, the cost of publishing and archiving has gone down dramatically. By contrast, the amount of money that is being spent on journals by university and public libraries seems to be growing with no end in sight¹². *Why do scientists contribute all this volunteer labour, and why do their public employers pay all this money, for a service that no longer justifies its cost?*

9. Pricing

Subscribing to the *Annals of Mathematics*, published by Princeton University Press, one of the top journals in mathematics, costs \$0.13/page in 2007. Three other top journals in this field are the *Journal of the American Mathematical Society*, published by the *American Mathematical Society* for \$0.24/page, *Acta*

¹⁴ Unsolicited self-advertisement of journals is a new curse. Although it is easy to track the number of *downloads* from a server, it is obviously impossible to know if an article has actually been *read*. Nor can a publisher monitor the numbers of papers that are passed on between colleagues. We reproduce a few examples of inappropriate self-advertisement (our italics): (a) Dear Dr Bodenhausen, On behalf of the whole Physical Chemistry Chemical Physics (PCCP) Editorial Team, we wish you a very Happy New Year. And *what better way to celebrate than by reading all the exciting content* in Issue 1 of 2012 which is free to access all year! Not only that, but you can now enjoy free access to Issue 1 of every volume of PCCP right back to the year 2000. You can find some of the highlights from this year's first issue below including our latest Perspective articles, a Communication on utilising urine for fuel (which has *already made the headlines!*) (b) Dear Colleague, I am pleased to announce the release of The Journal of Chemical Physics Editors' Choice for 2011. These articles were selected by the Editors as representative of the many high quality and *influential* articles published in JCP in 2011. I invite you to read these articles and explore what JCP has to offer at the forefront of Chemical Physics research today. These *seminal articles* are freely available online until the end of 2012. (c) The Journal of the American Chemical Society introduces JACS *Spotlights* beginning with the first issue of 2012. Spotlights will highlight several recent publications in the Journal, summarizing the key findings but, more importantly, communicating the *impact and significance* of the work in a way that will be relevant to non-experts.

¹⁵ We wrote 29 reviews since 2004 for Elsevier's *Journal of Magnetic Resonance*, 22 reviews since 2004 for Wiley's *Angewandte Chemie*, 33 reviews since 2006 for the *Journal of the American Chemical Society*, 13 reviews since 2006 for the *Journal of Chemical Physics* published by the *American Institute for Physics*, etc. This is by no means exceptional.



Figure 1. A generous present received in recognition for writing referee reports: a voucher for €20.

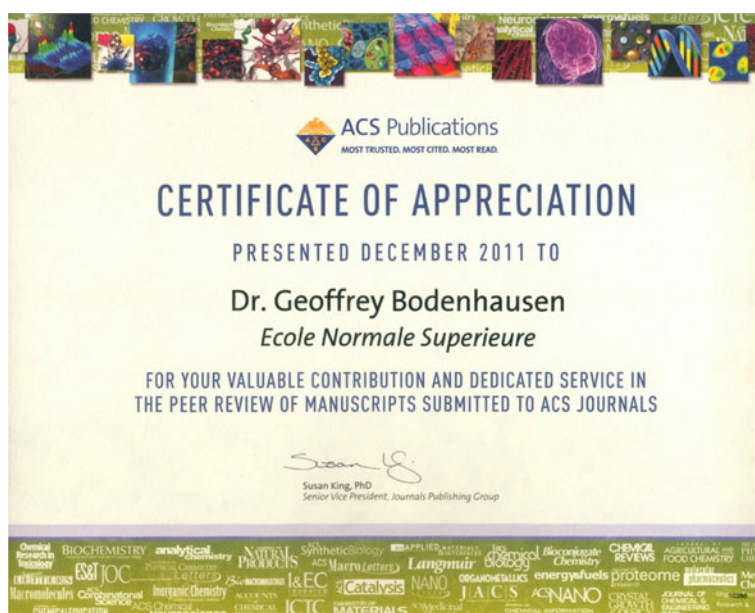


Figure 2. A superb Certificate of Appreciation of the ACS in recognition for writing referee reports.

Dear Professor G. Bodenhausen,

Congratulations! Your research was recently published in the Journal of Molecular Biology. We recognise the importance of making your research have an impact and we are offering you a unique and fun way to increase your article's usage and impact.

As an Elsevier author we have selected you to receive one of a limited number of personalised QR shirts if you are going to be attending the upcoming ESHG (European Society of Human Genetics), in Nurnberg Convention Center Ost, Nurnberg, Germany. Your free personalised T-shirt features a customised QR code linked to your latest article on SciVerse ScienceDirect. Let your colleagues scan the barcode on the back of the shirt, with their smart phones, to see your latest research!

HOW CAN I ORDER?

If you are attending the event, and would like to take advantage of the limited offer, simply click on the link below and follow the steps to order your T-shirt today.

You can collect your QR shirt from the Elsevier stand located in the exhibition hall Booth #522, as well as discover the latest innovations and research from a range of our quality journals in the field. BE QUICK and order before May 14th 2012 to secure your QR shirt.

Figure 3. An ingenious offer for a 'scannable' T-shirt in recognition for publishing a paper in Elsevier's *Journal of Molecular Biology*.

Mathematica, published by the *Institut Mittag Leffler* for \$0.65/page, and *Inventiones Mathematicae*, published by Springer for \$1.21/page. Ten Elsevier journals in mathematics cost \$1.30/page or more¹⁶.

We tried to gather similar data for biology, chemistry, and physics. It turns out that it is virtually impossible to compute the true cost of journals, because of the practice of 'bundling' journals, which compels libraries to subscribe to a *set* of journals, unless they are willing to pay exorbitant prices for the few that they really need. One consequence of these arrangements is that libraries cannot cancel subscriptions to superfluous journals.

Some time ago, the new editor-in-chief of the *Journal of Magnetic Resonance* asked us to write some reminiscences of early work published in 1984. On this occasion, we discovered that the license that our library had negotiated with Elsevier did not include the privilege of browsing issues older than 1995, so that we had no access to our own work. Our excellent librarian informed us that the library was willing to buy such rights for a modest one-time sum: 'This package can be bought for 10,851 EUR + 8% tax.' Since this sounded like a joke, we asked him to negotiate a better price. A few weeks later, the good librarian sent us a message to the effect he had struck a deal: the taxpayer had to pay a lump sum of a mere 3767 USD. A trifle! We were informed that the new deal included 'a small package containing some titles of lesser interest' with 'free' access to the *Journal of Chemical Thermodynamics*, the *Journal of Molecular Spectroscopy*, the *Journal of Supercritical Fluids*, and the *Microchemical Journal*, none of which we have ever wanted to consult. This is a typical example of 'bundling' journals that cover essentially unrelated areas¹⁷. It is not easy to distinguish this new deal from earlier agreements: 'The annual contract agreed in the context of the Swiss Consortium of University Libraries: 676,298.28 EUR HT. Overall expenses including various products that are not included in the above-mentioned contract: slightly over a million Swiss Francs (1 060 000 USD)'¹⁸.

Similar rumors have circulated about a recent conflict between Elsevier and the *Consortium Couperin*, while represents, *inter alia*, the *Université Pierre-et-Marie Curie* (UPMC), the largest university of Paris. When the *Consortium* threatened to stop paying the yearly levy of about a million Euros, at the risk of

¹⁶ In a survey by the AMS, it was found that 7 of the 10 most expensive journals in the field of mathematics (based on their 2007 price per volume) were published by Elsevier (<http://www.ams.org/membership/mem-journal-survey>).

¹⁷ <http://www.info.sciverse.com/techsupport/journals/bfphysanachemsup1.htm>

¹⁸ For a public library like EPFL's, Elsevier's license represents nearly 30% of the annual budget for journal subscriptions. It is impossible to reduce costs by keeping only the most useful titles: the rule is take-all or leave. This policy threatens other subscriptions. Mathematicians may be more exposed to this threat since they produce many journals that are published by small societies and institutes. But chemists should also be concerned. By way of example, access to the journals of the Royal Society of Chemistry might be endangered by Elsevier's pricing policy. Elsevier has been buying up many independent journals that were in financial difficulties. The 'backfiles' of these journals are then offered in overpriced packages.

interrupting access to all Elsevier journals, some symbolic reductions were conceded by the publisher. The contract includes a curious clause to the effect that the numbers cannot be divulged¹⁹.

10. Roles that journals no longer fulfill

The editors of 'traditional' journals (who are often seasoned scientists, unlike the people in charge of the initial selection for 'top' magazines) select referees, evaluate their reports, and decide whether to accept or reject the paper. These are then passed on to the publisher, who supplies some administrative assistance in handling the papers. Not so long ago, each manuscript would be carefully corrected by a 'copy editor'. *Academic Press*, the historical publisher of our beloved *Journal of Magnetic Resonance* before it was taken over by Elsevier, used to employ a person (anonymous, as so many heroes of those bygone days, alas!) who would annotate typescripts in pencil, carefully indicating 'Gr' for Greek, 'uc' for upper case, etc., whenever there was some ambiguity. Today, copy-editing has simply been abolished. The authors are requested to fix the numerous errors that are introduced during the editorial process. At their expense of course.

All scientists who are affiliated with public research institutions or with pharmaceutical companies now have access to thousands of journals. But what about scientists who live in developing countries? What about amateur scientists? What about freelance inventors? What about journalists who write essays for the press or prepare TV broadcasts? What about engineers who work in small businesses? Often they have to visit academic libraries to 'log in', since 'off-site access' is usually forbidden by contract, except for regular employees of the host institutions. With the transition from publicly owned libraries to privately owned servers, people who are not in a position to negotiate access to public libraries are in effect locked out.

11. The mathematicians' revolt

Chemists are reasonable people who do not like to stir up dust. They can rarely be found on barricades struggling for some remote ideals. However, mathematicians are cut of a different cloth! A manifesto⁷ signed by over 30 senior mathematicians from Paris, Orléans, Berlin, Munich, Budapest, London, Cambridge, Oxford, MIT, Minnesota, Riverside, Caltech, Durham, Madison, Chicago, Princeton, Berkeley, Seattle, Los Angeles and Tokyo calls for a boycott by refusing to submit papers, to write referee reports, or to serve on editorial boards. This boycott appears to threaten the very existence of some journals owned by Elsevier²⁰.

12. Alternative models exist!

Despite the example of the *Journal of Topology*¹⁰, some of the mathematicians who conducted this courageous revolt fear that switching to a different model may be difficult⁷. It has become quite easy to launch new journals in purely electronic form, in the manner of 'open access journals', to avoid the cost of printing and physical distribution. However, not all attempts to launch open access journals have met with success. The main problem seems to be that *established scientists prefer to submit their work to journals with an established reputation*. But if *Topology* can be successfully replaced by the *Journal of Topology*, we can surely replace, say, the *Journal of Magnetic Resonance* by a *New Journal of Magnetic Resonance*! This is applicable to virtually any existing journal²¹. Admittedly, editing a journal is hard work, and founding a new journal must be even harder. Some kind of compensation of editors beyond their academic salaries seems desirable. Administrative staff must be properly paid. Servers must be maintained. Software

¹⁹ Elsevier sued Washington State University to try to prevent release of similar information. A group of economists collects data on journal prices, citations, numbers of published articles, and estimates of the value of about 7000 journals (<http://www.econ.ucsb.edu/~tedb/Journals/BundleContracts.html>).

²⁰ The mathematician Scott Aaronson (<http://www.scottaaronson.com/blog/>) refers to a report by the investment firm *Exane Paribas* who estimates that the current boycott has caused Reed Elsevier's stock price to fall, but presents this as a great *investment opportunity*, since the price is expected to rebound once this boycott fails!

²¹ One cannot use a trademark without permission of its owner, but one can create a new name, as shown in the case of the *Journal of Topology*, which is the new incarnation of *Topology*.

must be purchased. But these costs are ridiculously low compared to the sums that are currently being paid by institution like the *Consortium des Bibliothèques Universitaires Suisses* or the *Consortium Couperin* that represents the UPMC and ENS, not to speak of Harvard University¹². Surely, these institutions could re-direct some of their resources to new journals. Whatever the outcome may be, a continuation of the current business model, with commercial publishers that harvest ever-larger profits from the public sector, *does not appear to be sustainable*.

On first sight, the Open Access policy appears attractive, since the authors (or the institutions that employ them) pay for the cost of publication, while the readers have free access, both to ‘backfiles’ and to recent work. In its most accomplished form (the so-called ‘platinum standard’), the Open Access model could lead to the bankruptcy and collapse of virtually all privately-owned publishers, not to mention that public libraries would see drastic cuts, not only in their expenses, but also in their budgets. Needless to say, some compromise will have to be negotiated to avert such dramatic effects. It remains to be seen if the balance of powers will be advantageous to the public sector or to private interests.

13. Conclusions

It seems urgent to reflect on the power wielded by a handful of commercial publishers, not merely because their profits might be better used elsewhere, but because their selection of submitted papers is not based on sufficient scientific insight to draw a roadmap for the future of science. Currently, those in charge of the preliminary selection decide what is good for publication. Evaluations of research proposals by national and supranational granting authorities give an inordinate weight to these decisions, and thus in effect empower the ‘top’ journals and magazines to set the trends for the future of science. It is time for the granting agencies to wake up and assert their independence.

The perverse mechanisms can be summarized as follows: publishers select papers that enhance their impact factors and sales. Granting agencies accept bibliometric measures like impact factors as criteria to rank proposals and scientists. Thus publishers exert undue influence on the making of science policy. Only papers that boost the publishers’ revenues are deemed worthy of support. In the end, the taxpayers support both authors and reviewers, boost the publishers’ profits through library subscriptions, and allow commercial interests to set priorities in science policy.

Science used to be considered as a form of cultural creativity. It still can be, but one has to make considerable efforts to isolate oneself from all the humdrum, hype, and bling-bling, from the craze of impact factors, *h*-factors, and other toxic by-products of current editorial manias. It may take a while to remedy to the current situation. In 1772, Jean-Jacques Rousseau bitterly complained: ‘*C’est que le corps des auteurs ne tire presque rien de ses travaux, tandis que le corps des librairies en recueille presque tout le bénéfice*’ (Authors draw almost nothing from their work, while publishers draw almost all the benefit.) (Rousseau 1772). Not much has changed in the last 240 years. It is conceivable that the Commission of the European Union²², the US Congress, and private libraries such as Harvard’s, combined with the resounding failure of many financial institutions, may accelerate the pace towards a sustainable model.

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²² ‘Muscle from Brussels as open access gets an 80 billion Euro boost’ (<http://www.timeshighereducation.co.uk/story.asp?sectioncode=26&storycode=419949>): ‘An official at the European Commission, which is drafting proposals for the Horizon 2020 programme, said that for researchers receiving funding from its programme between 2014 and 2020, open-access publishing “will be the norm”. A pilot [programme] under way in seven areas of its current funding programme will be extended to become a mandate across all peer-reviewed research in the new scheme, which will cover fields ranging from particle physics to social science.’

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References

- Chinthalapalli S, Bornet A, Segawa TF, Sarkar R, Jannin S and Bodenhausen G 2012 Ultrahigh-resolution magnetic resonance in inhomogeneous magnetic fields: two-dimensional long-lived-coherence correlation spectroscopy. *Phys. Rev. Lett.* **109** 047602
- Ernst RR 2010 The follies of citation indices and academic ranking lists – A brief commentary to ‘Bibliometrics as Weapons of Mass Citation’. *Bunsen-Magazin* **5** 199
- Görlitz P 2009 Editorial: Impact Factors, Open Access, and 125 Years of *Angewandte Chemie*. *Angew. Chem. Int. Ed.* **51** 9704–9706
- Molinié A and Bodenhausen G 2010 Bibliometrics as weapons of mass citation. *Bunsen-Magazin* **5** 188–198
- Pelupessy P, Renella E and Bodenhausen G 2009 High-resolution NMR in magnetic fields with unknown spatiotemporal variations. *Science* **324** 1693–1697
- Rousseau JJ 1772 Rousseau vu par Bernardin de Saint Pierre, Annex to *Rêveries du promeneur solitaire*, Folio, Gallimard, Paris, 1972, p 246
- Salvi N, Buratto R, Bornet A, Ulzega S, Rentero Rebollo I, Angelini A, Heinis C and Bodenhausen G 2012 Boosting the sensitivity of ligand-protein screening by NMR of long-lived states. *J. Am. Chem. Soc.* **134** 11076–11079

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