EDITORIAL

On the expanding, then contracting scope of scientific publications

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My great-grandfather was a professor of theology at the University of Bern and a prolific author of scientific papers and books in the late 19th and early 20th century. For his documentation, he used paper slips of 7×15.5 cm, which were specially manufactured according to his specifications. These papers might seem rather tiny, but they were large enough for his hand-written records of theological and historical documents. Obviously, the papers gave him enough space for capturing important biblical messages and divine inspiration. I did not know my great-grandfather personally as he died several years before I was born. But I inherited a large box of his paper slips and, although I have used lots of them over the past 50 years, plenty remain. I find them useful not for archiving purposes, but for momentarily jotting down facts, thoughts and ideas before I forget them.

Scientific documentation was an arduous task until the 1960s. It meant going to a library, finding journals and books, extracting the relevant information from these documents and writing it down on paper – be it on paper slips (like my great-grandfather did), on file cards or in notebooks. Photographic reproduction of documents was expensive and restricted to exceptional cases. Few scholars had direct access to good libraries and even fewer could count on secretarial help with copying and archiving information. As many scientific papers were published in French or in German, scientists needed to know at least the basics of these languages. Abstracts used to be printed at the end of articles and were meant to provide the 'bottom line' to those who had read the text. Yet the scientists who coped with all these difficulties were privileged: they had (or simply took) more time to read and to think about the scientific literature than most of their present day colleagues have now. Chances were that, before 1960, authors had actually read the papers that they cited.

A first major change took place in the 1960s when photocopying became widely available and affordable, at least in capitalist countries. Photocopying greatly helped scientists to retrieve information from older sources and to have access to a much wider range of subjects, representing different fields of research. It was no longer necessary for scientists to go to libraries and to take notes. Instead, photocopied documents could be obtained from the libraries and directly archived. Thus, photocopied materials allowed scholars to deepen and to widen their knowledge of the scientific literature. Initial fears of publishing companies that photocopying might create problems of copyright and damage the market of books and journals proved largely unwarranted (Clarke, 1963). In short, photocopying helped the scientific literature to expand in scope. For instance, *Annual Review of Microbiology* published about 350 pages in the early 1960s and this number rose to about 600 later in the decade. Of course, other factors also contributed to this expansion such as improved funding and a focus on English as a common vehicle of scientific communication. Communist countries feared that photocopying machines would be used as a means of subversion and restricted their use as much as possible. As we know, this policy did not help science in those countries.

A combination of browsing and photocopying became a favourite way of many researchers to keep up with scientific advances. Articles that seemed interesting during browsing were copied. I do not know the statistics but I suspect from own experience that the pile of copied and unread articles was consistently higher than the pile of read articles. A byproduct of this tendency was that a researcher could easily cite an article without having read it in detail. A quick reference to the title and perhaps to the abstract (now printed first after the title) would often do.

A second dramatic change began in the 1990s when electronic access to scientific journals and books gradually became a reality. Again, this was a challenging change for publishing companies and, again, totalitarian states tried (and still try) to restrict the availability of information via the new vehicle. There is no doubt that online access to scientific publications has stimulated the dissemination of science, especially in developing countries, and has resulted in expanding the circle of those who are able to benefit from science (Evans & Reimer, 2009). One might assume that electronic publishing would also widen and deepen the scope of scientific publications.

Paradoxically, the opposite seems to be true. Contemporary scientific publications typically cite only the most recent and the most closely related literature, despite the fact that more and more journals (including issues from 'pre-electronic' times) have become accessible. This narrowing trend probably stems from the literature search practices of

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scientists. While some scientists continue browsing, with a predilection for prime journals, many others preferentially use keywords and hyperlinks to retrieve published information. Such keyword-driven searches are highly efficient, but they tend to limit the number of different articles and journals consulted and may eventually restrict the scope of ideas and findings upon which research is built (Evans, 2008). Many supervisors probably reinforce the same trend: they keep telling their graduate students and postdoctoral associates to stay focused. This task has been greatly simplified thanks to the electronic databases, which rely on keyword indexing and provide links to closely related publications. Another, perhaps even more worrying, tendency concerns the reading practices of scientists. While electronic publishing enables scientists to have access to an increasing number of articles, the average time spent on reading is decreasing, per downloaded article (Tenopir *et al.*, 2009). I do not know how many downloaded articles are never read, but I suspect that they represent a silent majority. Where do these trends lead? Do they cause a narrowing of science and scholarship, as was suggested recently (Evans, 2008)?

FEMS Microbiology Reviews, like other major review journals, try to steer clear of the narrowing trends as much as possible and encourage authors to write reviews on topics of current interest that (quote) provide comprehensive, critical and authoritative coverage. In following these guidelines, capable authors will distill the relevant information, draw important conclusions and suggest perspectives for future research. Authors need to be selective and can never cite all work carried out in a particular area of research. At the same time, selectivity does not mean a narrow focus. On the contrary, only by placing a topic into a reasonably broad context will authors enable the nonspecialist readers to learn about and appreciate recent advances. Probably the hardest part of the art of review writing is to select the most pertinent publications from an ocean of published data. Putting down facts and concepts on pieces of paper, then discarding the less important ones and finally using the remainder to assemble a readable review – all this may be an atavistic way to proceed. However, it works, even without the blessing of divine inspiration.

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