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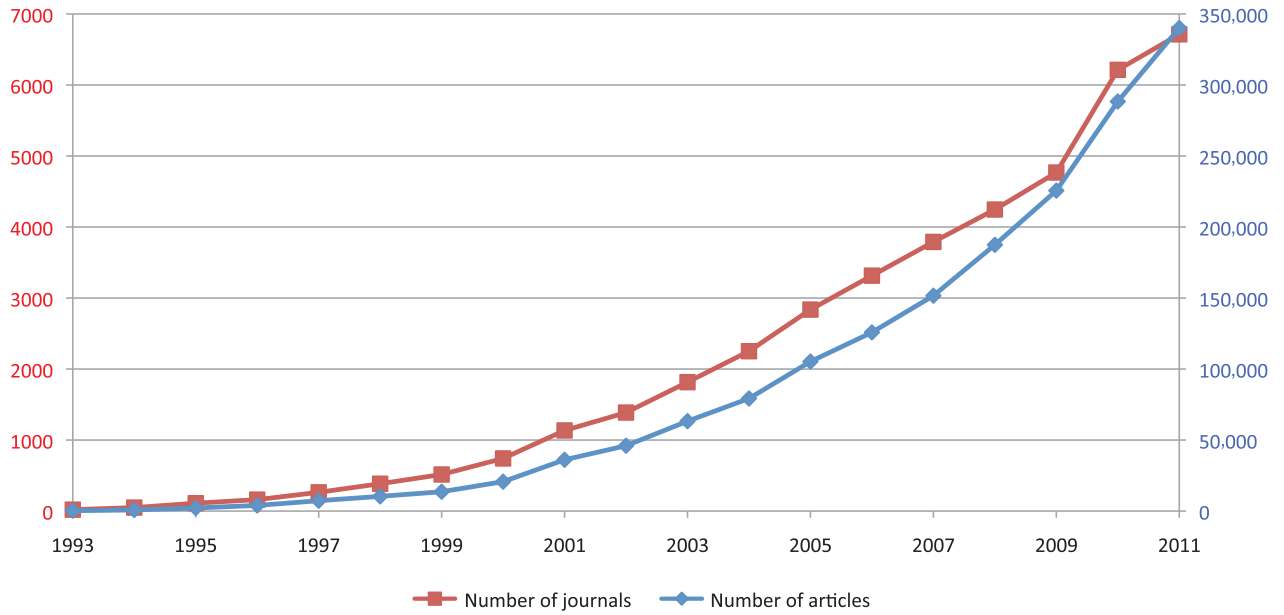
This may be the year for reality to catch up with rhetoric.

Open-access publishing has always been a field in which the words are prone to race ahead of the facts. For more than a decade, advocates and some funding agencies have been proselytizing for open access, frequently pledging that all of their work is going to be rendered open to all.

In 2012, we heard that the Research Councils UK (RCUK) would pursue a new, comprehensive, open-access policy. On 17 July, the European Union said that it would pursue a policy whereby 100 percent of research funded by its Horizon 2020 research program would be open access. In September, the Australian Research Council said that it was going open access. Harvard, Massachusetts Institute of Technology, and other elite institutions have mandates requiring their academics to publish openly on their universities' own repositories. The World Bank put all of its research out for free use on 1 July. At this rate, it is only a matter of time before the United Nations declares an open-access policy for research published from outer space.

And yet, the beast remains untamed. Just try sitting at your home computer, shorn of your university's online journal subscriptions, and attempt to access the literature on a problem of interest, and see how far you get. Last year, a Springer executive told open-access blogger Richard Poynder that



***The number of open-access articles and journals as a function of their year of publication. Sources: The data are from Björk and colleagues (2009, doi:10.1371/journal.pone.0011273) for 1993–1999 and Laakso and Björk (2012, doi:10.1186/1741-7015-10-124) for 2000–2011. The graph was created by* BioScience.**

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open-access journals accounted for just 2.5 percent of the total literature and predicted they would remain "a drop in the ocean." Analysts at Exane BNP Paribas, commenting on how Elsevier, the world's largest scientific publisher and the open-access movement's *bête noir*, would be affected by the European Union's new policy in July, said that it would have "no impact" until 2022—and recommended purchasing the stock.

Perhaps the analysts are being a little too sanguine, but it has been 19 years since Stevan Harnad, a cognitive scientist at the University of Southampton, first upset the applecart with his online "subversive proposal"—that all researchers should henceforth self-archive their research anonymously, for free (see *http://eprints.soton.ac.uk/253351*). A decade has passed since a landmark meeting in Budapest in February 2002, when academics, librarians, and sympathetic publishers drew up a unified and influential program called the Budapest Open Access Initiative (BOAI). That program backed two complementary approaches to open-access publishing: self-archiving in repositories (later christened *green* open access) and publication in open-access scholarly journals (*gold* open access), but relations between advocates of the two approaches have since deteriorated, and progress toward their goal has been fitful, at best.

"A lot has happened over the last 10 years or so—but not enough," says Mark Patterson, executive editor of *eLife*, an open-access biology journal recently launched with a formidable trio of backers: the Wellcome Trust, the Howard Hughes Medical Institute (HHMI), and the Max Planck Society. "The bottom line is that a majority of content is still not open access, but over a decade, the amount that is has gone from 0 to somewhere between 10 and 20 percent."

Attempts to systemically measure the reach of open-access are fraught with difficulties: For a start, most open-access journals are not counted by the Institute for Scientific Information or by Scopus, the two main databases of the scientific literature. However, in a widely cited 2011 study, Bo-Christer Bjork of the Hanken School of Economics in Helsinki estimated that open-access journals were publishing 7.7 percent of all peer-reviewed articles in 2009 and that this number was growing by 30 percent each year (doi:10.1371/journal.pone.0020961).

***Mark Patterson, executive editor of* eLife*, says that progress in open access has been slow. Photograph:* eLife.**

Advocates of open access believe that the 2006 launch and subsequent explosive growth of PLOS ONE, a journal that publishes peer-reviewed papers—regardless of their importance or originality—has lent great momentum to their efforts. In 2010, PLOS ONE published 6749 papers, making it the largest scientific journal in the world. In 2012, it was set to publish some 20,000 papers, including several that have been often cited and were of very high quality. For example, a study by William Chan of the Fred Hutchinson Cancer Research Center in Seattle, in which male DNA from a fetus was shown to be able to find its way into a mother's brain through a process called *microchimerism*, was published in PLOS ONE in September, drawing widespread international attention. PLOS ONE has also published papers by five Nobel Prize–winning biologists: Francoise Barre-Sinoussi, Elizabeth Blackburn, Jack Szostak, Oliver Smithies, and Barry Marshall.

"The success of PLOS ONE was a real game changer," says Robert Kiley, head of digital services at the Wellcome Trust, the largest research philanthropy in the world, which has relentlessly championed open-access publishing for the work that it funds. That said, the long struggle between the open-access movement and traditional publishers—both commercial and nonprofit—has been characterized more by steady attrition than by game-changing breakthroughs. From Harnad's battle cry to numerous mandates and calls for boycotts of traditional publishers, such as last year's Cost of Knowledge petition, led by University of Cambridge mathematician Tim Gowers and targeted at Elsevier, many scientists have been missing from the barricades.

For those seeking tenured positions or looking out for their students' futures, the top priority remains publication in a reputable traditional journal with a high impact factor. Open access is most popular with "those who are young and don't care and those who have already got tenure," notes Jan Velterop, a UK publisher and original signatory to the Budapest

declaration. "It is the group in the middle that find it most difficult. They want to be in a journal with a high impact factor."

Up until now, the open-access mandates of most funders have allowed grantees to publish where they like, provided that they then deposit the manuscript in an open-access repository within a set period (12 months, in the case of the US National Institutes of Health [NIH]). Such arrangements represent a temporary compromise between funders' desire for immediate open access and publishers' claims on some period of exclusivity.

But this summer's batch of announcements from funders point to a ratcheting up of their expectations. The most significant is probably the new policy introduced by RCUK on 16 July in the wake of an influential report to Britain's conservative-dominated government from a panel chaired by the sociologist Janet Finch.

The Finch report, and the subsequent RCUK policy, called, for the first time, for funds to be allocated to researchers expressly to pay journals to publish their work with immediate open access—the gold open-access model. The decision to pay for publication in this way has been interpreted as a rebuff to the rival green open-access model.

The key element of the new policy is its provision for funders to pay article-processing charges, which Finch estimated could cost RCUK £38 million annually. "The change in policy will increase the proportion [of open-access literature] very significantly within the next couple of years," predicts Michael Jubb, secretary to the Finch panel and director of the UK Research Information Network, a publicly funded body that promotes resource sharing among UK researchers.

"If you believe that high-quality publishing is an important part of the research process, it has to be paid for in some way," says Jubb. "The UK has a very good record of publishing in high-quality journals. That has a cost; it can't be done for free."

Michael Jubb, director of the UK Research Information Network, says that open access cannot be attained for free. Photograph: Hilary Cole.

The Finch report also argued that gold open access can, more readily than green open access, be implemented such that data will be made available without restrictions on its reuse, including commercial use. "The UK government is very much in support of [the] gold [open-access model], because it will provide instant access without reuse restrictions," explains Jubb, adding that this supports the government's wider agenda of promoting the use of research results for industrial innovation.

However, because the policy offers researchers support to pay for gold open access, it has drawn fierce criticism from advocates of green open access. Many of the latter have worked to build open-access repositories at their own universities, along with mandates to publish in them, and hoped that the open-access movement would revolutionize publishing, rather than propping up its existing structure by paying article-processing charges to publishers.

In a 2012 article in *BMJ*, Peter Suber, director of the Harvard Open Access Project, argued that the UK approach, by failing to require researchers to publish their work on their own university repositories, "puts the interests of publishers ahead of the interests of research."

The European Union's new open-access policy for its next major research program, Horizon 2020, which will cost about €80 billion and will run from 2014 to 2020, is still to be formulated in detail, but its July announcement makes clear that it will back green as well as gold open access. "We think that both of them are very good options," says a European Commission spokesman, "but we will back green [open access] more than the [United Kingdom] has done. We don't want researchers to think they have to go gold."

EU programs account for only about one-tenth of all of Europe's public spending on research, but the European Union, as well as demanding 100-percent open access under its own program, has set a target of 60-percent open access for all of the research in its 27 member states. It is likely, however, that their actions to achieve this will vary from the emphatic mandates already issued in the United Kingdom and Denmark

to no rules at all in some smaller and poorer member states.

In the United States, the federal government's approach to open access has edged steadily along since 2005, when the NIH first asked its grantees to deposit their papers on the PubMed Central repository within 12 months of their publication. The request became a mandate in 2008, and today, according to agency officials, about 75 percent of NIH grantees comply with it. However, the 12-month compliance period is viewed by open-access advocates as being far too long. Furthermore, the US National Science Foundation (NSF) and most other federal agencies have never replicated the NIH mandate. The America COMPETES Act of 2007 asked the NSF to tell all its investigators to complete a short project-outcomes report at the end of each grant, summarizing what had been achieved in everyday language and citing the resultant publications, but in the absence of any other legislative instruction or an executive order from the White House, the NSF does not ask its grantees to do anything else to make their findings available to the public.

Heather Joseph, executive director of the Scholarly Publishing and Academic Resources Coalition (SPARC)—an open-access lobby group set up by university libraries—says that she has grown used to the long, hard grind of pushing for change on the issue. "You have to be pragmatic, working on policy in Washington, DC," she reflects. "We've seen a typically slow, iterative process over the years, and it has slowed down now; the stakes are a lot higher."

In 2012, open-access advocates and publishers again fought themselves to an impasse in the halls of Congress. An Elsevier-backed bill to rescind the current NIH policy was introduced by two members of Congress—Darryl Issa (R–CA) and Carolyn Maloney (D–NY)—in February but then withdrawn. A rival bill to deepen the policy and extend it across the federal government was sponsored by Senator John Cornyn (R–TX), with bipartisan cosponsorship from Senators Ron Wyden (D–OR), Kay Bailey Hutchison (R–TX), and Patty Murray (D–WA), but did not progress. The Obama White House conducted two separate consultations on open access but shied away from issuing an executive order telling agencies what to do about it.

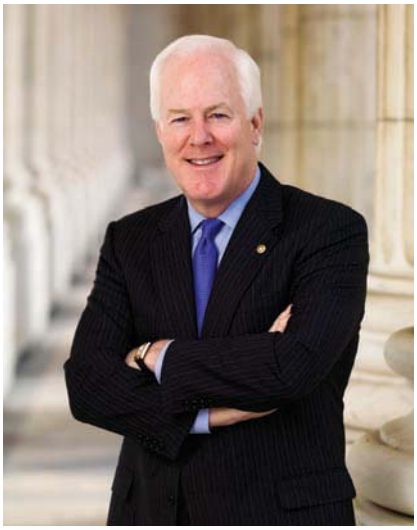
John Tagler, vice president of the Association of American Publishers, says that publishers told the White House that they object to a one-size-fits-all approach to the open-access question. He says that the group would accept something akin to the UK plan. "That's what the Finch report says: Don't throw out the baby with the bathwater," he says. Data can be opened up, but "we don't want to sink the whole system in the process."

It seems, however, that some funders are preparing to turn the screws on the existing system. In June, the London-based Wellcome Trust severely tightened its own open-access policy, telling grantees, for example, that their final grant payment would not be made until their material is up on UK PubMed Central—and that their new grant applications would not go out to peer review until the work done under their old grants is placed there.

Most radically, as of April 2013, Wellcome will expect all of its work to be published under a generous Creative Commons license that allows reuse, even for commercial purposes. "We want our data to be anywhere and everywhere," says Wellcome's Kiley.

The journal *eLife* represents another attempt to spur open access, by launching a top-quality online life-sciences journal that will compete for papers with the likes of *Nature* and *Science*, publishing its papers immediately, with open access, and at no charge to authors. *eLife* will use a novel refereeing process that cuts out nonessential feedback to authors. "We've had a lot of feedback about the length—and painfulness—of journals' reviewing processes," says Patterson. "We think that *eLife* can provide a swift and efficient process."

The journal is just one of a stream of new publishing approaches spawned by the open-access movement. Vitek Tracz, the London-based publisher whose BioMed Central biology journals were the first to prove that open-access models could make money, before he sold them to Springer in 2009, has started an online publishing service called F1000 Research, which will test some of these approaches.



Senator John Cornyn (R–TX) sponsored a bill to expand open access. Bipartisan bills on both sides of the debate have gone nowhere. Photograph: United States Congress.

Papers submitted to F1000 Research will be published almost instantaneously, after staff editors have performed an initial review. Referees nominated by the author from a list of 2000 volunteers will then mark them as "yes" or "no" or "yes, with reservations." The paper will be considered "published" once it attracts two ticks. F1000 Research is a "publishing and refereeing machine," says Tracz. "It will be faster, and it will all be in the open." Authors pay $1000 for papers, and $500 for short items.

David Lipman, director of the National Center for Biotechnology Information at the NIH and one of the prime movers of the open-access movement, says that F1000 Research "is implementing a number of very innovative approaches and could really change biomedical publishing."

Such attempts to monetize open-access publishing have not been universally welcomed, however. If the open-access story started as a battle between open-access advocates and publishers, it seems to have morphed into a feud between gold and green open access, which cuts out the publishers.

"Clearly, there is a split, and I think that's very unfortunate," says Jubb. In an e-mail sent in October to his BOAI cosignatories, Steven Harnad said that "friendly" publishers, including Tracz, had "made profitable and influential use of the ideology of open-access for publishing opportunities, but, when push comes to shove, their loyalty is and always was to the publishing business, not to open access."

Harnad argues that with 150 institutional mandates and more than 3000 institutional repositories now in place worldwide, green open access is capturing far more of the global literature than is gold (with green, he reckons, capturing about 25 percent of the literature, versus gold's 4 percent) and is still pushing the RCUK to create more incentives for researchers to take the green route.

SPARC's Joseph agrees that these institutional mandates are "hugely important" but worries about the green–gold divide. "There have always been some philosophical differences between the approaches, but I think we need both," she says. "The challenge for the movement is to keep its eye on its long-term goal."

F1000 Research offers researchers a quick route to publishing. Their open-access publishing program is currently in beta release. Source: Faculty of 1000, Ltd., © 2011.

Colin Macilwain is a science policy writer based in Edinburgh, Scotland. He currently edits the newsletter Research Europe *and writes regularly on research policy issues for* Cell, Nature, *and* Science.