

Time for new models for the communication and dissemination of science

In this article, the authors describe the development and consequences of open, permanent, and free access to the results of scientific research. Thus, the model of scientific communication, based on a publishing system concerned more with the economic returns than the social value of science and its dissemination, is being challenged.

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Open access: what is it and why has it arisen?

Open access refers to an initiative aiming to make scientific and academic literature available online, so as to guarantee the right to unrestricted access to scientific knowledge. With the appearance of arXiv two decades ago, open, permanent and free access to

research results began as an initiative *avant la lettre* backed by researchers seeking to promote a faster, more efficient and more democratic exchange of scientific information.

In 2002 a number of institutions met in Budapest under the auspices of the Open Soci-

ety Institute to prepare the first formal declaration calling for Open Access. This was followed by the Bethesda (June 2003) and Berlin (October 2003) declarations, along the same lines, and with the same underlying principles. Subsequent declarations of this kind are a sign of the open access movement's rapid spread.

What is being challenged is the major publishers' monopoly over the distribution and commercial exploitation of scientific information, the divide between institutions and countries in terms of access to information (digital divide), and the barriers this represents for an efficient and transparent model of scientific



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communication. There are several factors behind the movement's emergence: the so-called "crisis of the journals," driven by exorbitant price rises; the lack of competition; the monopolistic state of the publishing market, and the crisis of permissions caused by publishing constraints (both technical and legal).

On the prevailing model, institutions cannot guarantee access to all the scientific information being generated although, to a large extent, they collectively fund and produce it. Ironically, the technology would allow wider and more immediate access if the publishing scene were not as it is. Hence the current model of scientific communication

based on a publishing system concerned more with the economic returns than the social value of science and its dissemination is being questioned.

Open access has established itself as a channel for scientific communication that challenges the very foundations of the dominant publishing sys-

tem and is catalysing a revolutionary transformation.

The strategies

Nevertheless, the movement does not aim to undermine the market, but to offer an alternative to it along two channels:

1. Open publishing of high quality journals that have a selection committee.
2. A "self-archiving" system for researchers' scientific output in institutional or thematic repositories.

These are complementary rather than competing strategies. Their aims are to facilitate and improve access to scientific information and to promote its dissemination. The movement should not be understood as a "self-publishing" system or as one that eliminates or substitutes for the traditional peer-review model. Nor is it a second-tier system of scientific communication, or a system that seeks to reduce the cost of publishing.

Open access is constructive, not destructive (its goal is not to drive out commercial journals, but increase access to scientific content); it is not synonymous with universal access (institutional, linguistic, accessibility, and connectivity barriers remain, for example). In short, Open Access (OA) aims



Home page of the CSIC institutional repository.

for a new model of access, but is not a business model.

Both forms of open access offer significant benefits for the institutions promoting them, such as:

1. Contributing to returning a common good to society, i.e. the science it finances.

2. Wider circulation of research findings and hence greater impact.

3. Ensuring the long-term preservation of the content produced.

4. Helping managers ensure better control over the scientific publications produced.

5. Building repositories that make it possible to keep researchers' output online and standardise CVs.

6. Increasing readership, which leads to more exploitation of the science they fund, thus increasing citations, which in turn improves the opportunities for obtaining future funding.

7. Enhancing society's perception of the value of research.

8. Raising the political profile of scientific research, driven by society's enhanced perception of the value of science.

9. Using repositories to help funding agencies and researchers locate results in their area of interest.

10. Enabling a faster cycle of scientific communication and for results to be disseminated and read sooner.

11. Allowing researchers to make more conscious use of their copyright.

Institutional repositories

Many scientific and academic institutions have set up institutional repositories. They are also promoted by funding agencies to ensure broad dissemination of the results of the projects they support, with a view to creating sites that host, organise, disseminate and preserve the scientific output they generate or fund. This entails using technology allowing rapid propagation of content online, by *harvesting* it in large-scale collectors of scientific resources and making it available in search engines.

Institutional repositories bring numerous benefits if they

receive explicit support. There are currently around 2,000 repositories worldwide. What were pilot projects a decade ago have become consolidated platforms from which research institutions disseminate their output to the world.

Repositories offer new functions, providing tools to tend, manage and analyse institutional science, as well as enabling open access. Recently, research organisations and universities have been creating platforms of their own on which they compile, describe and evaluate their scientific output. Linking the repository with these internal systems is essential in order to relate institutional output management, evaluation, dissemination and publication activities with one another. These are activities which until recently were only conceived of independently and in isolation.

Open publishing: the “gold road”

The other open access strategy is based on institutions’ promoting the publication of open scientific journals or their authors’ publishing in open journals. This mode of publishing may in turn be funded by the institutions to which the authors belong.

An example of this can be seen in the new publishing initiatives such as PLoS or BioMed Central journals (gold open access) or traditional subscription-based journals that offer immediate open publishing on payment of a fee by the author/institution (hybrid open access).

The number of institutions and funding agencies with a special fund from which to pay these fees institutionally is growing, as they are coming to consider the cost of open publication to be an

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integral part of their research budgets.

Mandates, policies and directives: open access in research strategies

A greater awareness of the importance of open access to research results financed with public funds has also been observed. On this view, scientific communication takes on more importance and more ambitious goals, expanding the channels by which institutions can relay the knowledge they produce to society.

Studies by the European Commission reveal that small and medium-sized enterprises have only limited access to published public research results and that this has negative impacts on innovation and technology development. Other studies, such as *Implementation of Medical Research in Clinical Practice* (2011) by the European Science Foundation, highlight the need to pass on results of biomedical research by scientific institutions and universities more effectively to hospitals.

According to the World Intellectual Property Organisation (WIPO), knowledge transfer implies the capture, organisation and exchange of explicit and tacit knowledge and includes both commer-



Symbol of the international open access movement.

cial and non-commercial activities. The open-access movement thus demands greater transparency in the transfer of scientific results, an activity which needs to be understood in broader terms than just the patenting of results.

Open access to research results also has direct implications for economic development and innovation. The European Digital Agenda considers access to information, research and pure scientific data as being essential to ensuring the European Union's competitiveness. Neelie Kroes, Vice-President of the European Commission, gave a landmark speech on the topic (<http://europa.eu/rapid/press-ReleasesAction.do?reference=SPEECH/10/716>) in December 2010.

Mandates: open access and copyright

The strong backing for the consolidation of institutional repositories has developed out of an institutional mandate that requires authors' copy of works to be deposited in the repository. A number of studies confirm that voluntary submission of papers does not bring in more than 15% of average annual output, whereas when depositing papers is mandatory the rate rises to 63%.

There are over 130 institutional open access mandates in place worldwide. The universities of Harvard and Princeton stand out for the unanimous support of their scientific communities and their courage in tackling the thorny issue of copyright, advocating the non-exclusive transfer of commercial rights to publishers to avoid the potential negative effects on various future possibilities for the use and reuse of knowledge. This is an ongoing debate with major implications for public institutions that do science and generate knowledge.

Two recent laws in Spain address the question of the transfer of the results of research activity and the ownership of property rights in the knowledge generated. Article 54 of the Sustainable Economy Act, which came into force in March 2011, underlines that *"the results of research, development and innovation activities referred to in the preceding article, and the right to apply for appropriate industrial property rights to ensure their legal protection, shall belong to the institutions to which the researchers who obtained them in the course of their normal duties belong,"* and article 37 of the Science Act provides that

"research personnel whose research activity is funded largely from the National Budget, shall publish a final digital version of the work accepted for publication."

Papers must be deposited in the repositories within twelve months of official publication.

The role of funding agencies

Open access has become a key element in the design of many funding agencies' new strategies. Requiring this type of access to publications and data deriving from the projects they finance is a way of promoting greater transparency for society of the science the public supports. This is particularly relevant in the case of public agencies, as it adds an ethical dimension by guaranteeing free access to resources that otherwise would be hosted only on very costly subscription-based platforms.

The pioneers include the open-access policies of the National Institutes of Health (NIH) in the United States (2007) and the Wellcome Trust in the United Kingdom (2006).

Open access legislation

More and more governments are passing laws on the open dissemination of the research they fund.

Thus, in Spain, since 2008 a number of laws and regulations have been promulgated, such as the Community of Madrid directive (2008). But the most significant is the new Science Act, Article 37 of which, on *Open access dissemination* is an important step forward as it mentions the possibility of linking the evaluation of government bodies' scientific productivity to the open dissemination of the knowledge they produce.

Europe: coordination on open access policy between Europe's research councils

EUROHORCS, the European Research Council (ERC) and the European Commission are supporting initiatives to raise awareness about the duty to make the results of tax-payer-funded research accessible to the public through the design of common policies setting out the procedures research councils should comply with and to develop infrastructure to disseminate this knowledge.

In 2007 the ERC published an open access policy requiring the deposit in repositories of authors' copies of publications and the raw data produced by projects it funds. Since late 2008 the European Commission's 7th Framework Programme (FP7) has run an open access pilot project

affecting the dissemination of 20% of its projects and it will probably extend it to 100% of its projects under FP8 from 2013 on.

EUROHORCS and the European Science Foundation have been working for some years on implementing a road map for coordinated progress towards open access in the European Research Area.

Open Access in Spain

Open access has taken concrete shape through numerous universities and scientific institutions signing up to the Berlin Declaration, with the creation of a large number of institutional repositories. According to the Webometrics Repositories Ranking, some of the most significant repositories are those of the Barcelona Autonomous University, the Catalonia Polytechnic University and the Spanish National Research Council (CSIC). A “collector” of Spanish output available on existing repositories (REC-OLECTA) has also been created. Some universities have institutional mandates and others have begun to consider the option of funding, albeit half-heartedly, the cost of open-access publishing.

However, firm commitment seems to be lacking nationally and at the level of individual institutions when compared to

European Commission portal with its range of initiatives to promote open access to the research projects it funds.

other European scientific bodies (UK Research Councils, Netherlands Organisation for

Scientific Research, CNRS, Max Planck Society). The new Science Act and European

directives, and further legislation, may help shore up the national strategy.

A new scenario; new rules of the game?

Open access is transforming institutions' daily reality, affecting issues as important as the models for negotiating information resources, evaluation systems and the management of rights to commercially exploit results.

New models of negotiation of scientific information

There is a significant number of high quality scientific journals that are open or subject to hybrid open access. But the free publication of scientific content in them always has a cost, which has to be met by the authors publishing their work rather than readers. This implies a change to the traditional model of contracting information resources based on the paradigm of the "library-institution pays" to consult journals, to a new paradigm in which the "author-institution pays" to allow open dissemination. Therefore, negotiating institutional fees for open access has become part of the contract with publishers, as an additional clause, defining how publications that the authors of a particular institution publish in this way are to be paid for. The institutions with the strongest commitment to open access are considering whether research budgets ought to envisage specific budgetary

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provision to cover the cost of the open-access publication of the science they produce.

Changes are also taking place in publishing licence models: in particular, the so-called "green clause" whereby publishers are required to deposit the reviewed drafts of papers by the institutions' authors they publish in their journals with the repository.

New models of scientific evaluation

Open access has entered the debate on the continuing validity of the scientific evaluation model based almost exclusively on the Journal Impact Factor (JIF). Voices have been heard criticising the appropriateness of JIF to evaluate researchers' excellence and productivity, added to the criticism of the proliferation of scientific publications, resulting from the prevailing evaluation model and the validity of the current peer review approach. The Science and Technology Committee in the United Kingdom has addressed both issues, arguing for peer review systems that are better matched to the current situation, and citing *PLOS One* as an example of a possible alternative model, the Committee also advocated making raw scientific data publicly accessible, subject to certain exceptions.

Other evaluation criteria have been gaining ground, such as the Journal Usage Factor, or qualitative criteria, such as the socioeconomic impact of research results and genuine knowledge transfer, in ways that make it possible to access these results in their entirety without having to pay for them a second time.

More and more scientific institutions and universities, particularly in the English-speaking world, are designing new models for the evaluation and funding of scientific projects, enriching the criteria and impact levels under consideration. The new criteria take the form of a requirement that evaluated output be disseminated on an open-access basis or that the institutional repository be made the channel for distribution of the work to be evaluated. The University of Liège offers a successful example of the new approach.

To end, it is worth mentioning the new approaches to stimulate economic performance of scientific production and communication; studies such as *Economic implications of alternative scholarly publishing models* (2009) calculate the cost, benefits and opportunities that a transition to an alternative access model would have. ■