



ILLUSTRATION BY MATTHEW HOLLISTER

Open access must enable open use

Those wishing to maximize the benefits of public research must require more than free access, says **Cameron Neylon** — they must facilitate reuse.

At the end of 2012, there is no longer a debate about whether the results of research should be freely accessible. All that remains is to work out when and how access will be enabled. Meanwhile, the political and economic question of 2012 has been: should governments invest to nurture economic recovery, or tighten their belts and risk further economic damage? Publicly funded research has often been at the heart of this debate as governments attempt to ensure that public investment is generating the greatest possible innovation, economic activity and societal gains.

It is in this light that researchers should view the dramatic advance of open access in 2012. This shift, and the reason why governments and funders are increasingly adopting or examining open-access mandates, is about more than just the benefits of access. It is about the potential of open access to improve the efficiency of research itself, and to deliver a greater return on public investment.

In this context, free access is not enough. To maximize the value of the public good

and the return on investment, research outputs must be reusable. That does not just mean making data or papers available on the Internet, but ensuring that innovators can manipulate the material, including mining, translating or expressing it in imaginative ways or for new audiences.

The most significant policy moves in open access in 2012 came from Research Councils UK (RCUK) and the Wellcome Trust, a major UK biomedical funder (see go.nature.com/qqrsq and go.nature.com/u2oqym). From April 2013, papers arising from RCUK funding must be made free to access. Significantly, the core of the policy aims to maximize the reusability of research outputs, not just provide free access. Building on its long-standing leadership in this area, the Wellcome Trust strengthened its open-access policy, harmonizing it with that of the RCUK.

Making research outputs usable has many aspects. The technical side — standardizing the representations of data and knowledge in ways that make them easily transferable — remains challenging and needs further work.

There are also legal challenges, but good tools exist that provide the rights to reuse research in any way that scientists can imagine: the Creative Commons licences. These easily and effectively define precise 'reuse rights'.

The Creative Commons Attribution (CC BY) licence — a key component of the RCUK and Wellcome policies on open access — allows any kind of reuse, provided the copyright holder is properly attributed. PLOS, where I work as advocacy director, has always used the CC BY licence, like other major open-access publishers, and this licence is emerging as a standard for open-access publications. The RCUK and Wellcome policies explicitly encourage researchers to submit their papers to journals that will publish the work under a CC BY licence — making these the first funders to take such a step. The target is to create a critical mass of freely accessible and freely reusable literature. The RCUK and Wellcome have taken the lead, now others must follow if everyone is to reap the full benefits of effective research communication.

There are two established mechanisms

for making research articles accessible. One is for the publisher to make the version of record freely available online. The second is for a version to be made available in an institutional, disciplinary or funder repository. These two routes are often referred to as 'gold' and 'green' (see go.nature.com/ao7k4b). However, because 'gold' has been misused in the past, I will refer to journal-mediated and repository-mediated open access, rather than gold and green, respectively.

ACCESS FOR ALL

Repository-mediated open access has provided the greatest volume of accessible material in the past ten years. Some analyses have estimated that more than 20% of the world's peer-reviewed literature can be read for no charge through this mechanism¹. One of the major contributors to this growth has been the Public Access Policy of the US National Institutes of Health (NIH), which requires that either the published version or the final author copy, after peer review, of NIH-funded papers be deposited into the online archive PubMed Central within 12 months of publication. The policy, along with others, has provided access to an archive that so far contains around 2.5 million articles.

The success of PubMed Central and of other disciplinary and institutional repositories illustrates a weakness. Although millions of articles are accessible to read, the majority of them cannot be used for anything except reading. If, for instance, you wish to index all the gene names in a set of papers, put them on a website, translate them, use text or images in a summary or even just print out several copies of the collected papers, you are limited to a much smaller set of around 500,000 articles that carry a Creative Commons licence (see go.nature.com/heaqoe). For any commercial purpose, which could include simply making copies for a class or company meeting, one is restricted to the smaller subset of papers that have a CC BY licence.

This matters because a growing body of evidence shows that enabling the reuse of research maximizes its potential for innovation. A natural experiment conducted in the academic community, in which an agreement with the NIH made one set of mouse strains for genetics research more freely accessible, showed that these strains generated more citations, as well as more diverse and more applied research². The publicly funded Human Genome Project and its freely reusable data generated a massive 141-fold return on investment in economic returns alone³. In terms of its wider impact, the reusable data led to 30% more new clinical products than the privately funded, closed genome-sequencing project of the US biotech firm Celera Genomics⁴.

There are fewer and smaller examples that relate to the published research literature, because a critical mass of accessible and

reusable papers has not yet been achieved. This is what the RCUK and Wellcome policies seek to achieve.

Unfortunately, funders cannot solve issues of reusability simply by requiring papers to have a CC BY licence. When funders are not covering publishing fees, it is more difficult for them to require specific licensing terms. The RCUK and Wellcome both allow researchers to use the repository route to open access but, although they request certain terms of reuse, they do not demand it. Traditionally, authors hand control of reuse rights to publishers. For this to change, funders need to gain leverage with publishers.

One mechanism is to buy that leverage. When a funder is paying for publication services, they are in a position to dictate service levels — enabling the RCUK and Wellcome, for example, to require that papers for which they fund publication charges carry a CC BY licence. A consortium approach to creating a journal-mediated open-access environment for particle physics, SCOAP3 (<http://scoap3.org>), achieved the same ends earlier this year by running a competitive tender process for the publication services they required and making licensing terms part of the requirements.

An alternative approach builds on the NIH policy, which stipulates that funded authors retain rights to their research so that it can be placed in a repository. There is no legal reason why this could not be expanded to depositing a copy with a specific licence. This would make it possible to use repository-mediated open access to provide reusable content with the right legal tools.

THE POLITICS OF PROGRESS

The decision in the United Kingdom has been that the benefits of access and reuse will be achieved more quickly and efficiently by supporting the growth of the journal-mediated route. Fundamentally, this is a political judgement. Funders do not feel that they have the political leverage to take a rights-retention approach. The RCUK and Wellcome have decided that the most effective way to support progress towards open access and reuse is to provide the resources to support journal-mediated access.

Not all agree that the focus on licensing is the correct priority. Proponents of repository-mediated open access point to the greater pool of research currently available through repositories, and argue that the cost of delivering that access is lower. In my view, funders who want to maximize the return on their investment in research communication should use the leverage provided by

financing to require immediate access to the final published version, with the right licensing. The RCUK and Wellcome policies are the first to actively do this and represent a significant step forward.

Much of the criticism of the RCUK policy has focused on the transitional costs — while a mix of open access and traditional publishing persists, it will be necessary for institutions to pay both subscriptions and publication charges. However, simple 'back of the envelope' calculations based on current charges by open-access publishers⁵ and an estimate of a few million papers per year suggest that there are significant savings to be made following a move to full open access. Studies of the situation in the United Kingdom show that all institutions would see savings from this approach⁶ — if so, a few years of investment is just smart management.

More broadly, institutions need to take the opportunity to negotiate more imaginative and favourable arrangements with subscription publishers, to constrain transitional costs. Twenty-one years of near 100% open access through the arXiv for particle physics, for example, has not reduced subscriptions to particle-physics journals⁷. But when the community used its combined purchasing power through the SCOAP3 consortium, an entire field was converted to open access with no additional transitional costs (see go.nature.com/aw4jtq).

No change comes without risks. This year's UK policies are among the first to focus on ensuring that research communication is configured to maximize the benefits of the Internet. Other funders equally focused on encouraging innovation from public research must follow this lead. Licensing is only one part of that optimization, but it is an important element that we can tackle today. ■

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