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Comment 1.

In order to assist the growth of markets related to the access and analysis of the results of federally funded scientific research, agencies should 1) require free, public access to publications and 2) encourage grant recipients to make available that data which their publications are based upon. The productivity of the scientific enterprise is predicated on the ability of scientists and engineers to locate, read and synthesize the hypothesis, data and conclusions of other researchers. It is via this process that we “stand on the shoulders of giants” in order to reach ever greater heights of achievement in physics, in medicine, and in all branches of science and its technological applications. By insisting that federally funded scientific work be made promptly and permanently available, both to specialists and knowledgeable laypeople (e.g. cancer awareness and support groups), the government can ensure that taxpayers continue to receive the benefits of the scientific work their money has commissioned. Policies such as the open-access policy of the National Institutes of Health bear minimal costs, those of archiving electronic documents and permitting them to be accessed via the Internet, but brook disproportionate rewards: the ability of American academia and industry to build on the failures and successes of the past, enriching America's economy by delivering new technologies which improve the lives of people around the globe, and the ability of medical professionals to advise patients on the basis of the most recent and most accurate information. Access to publicly funded research work must therefore be free and open not only to active scientific researchers and engineers, but to the general populace as embodied by doctors, patient groups and knowledgeable citizens.

Comment 2.

In order to protect the intellectual property rights of all stakeholders in the production and dissemination of scientific work, it is necessary to identify the concerned parties and

their roles. Scientists embody the technical wherewithal to perform and review scientific research. Their efforts are the base upon which all other parties in this process depend, and they are supported primarily through monies granted by the federal government, and also in part by salaries and wages from universities and public research institutions, which are typically incorporated non-profits and also heavily funded by government grants themselves. It is therefore the tax paying public that has commissioned these institutions to provide a public good by furthering the scientific and technological progress. Publishers of scientific work are integral to the process of disseminating (as opposed to producing) scientific work, and they provide a valuable service by organizing peer review as well as scientific conferences and meetings. Yet, the act of peer review is also carried out by working scientists who operate either on a volunteer basis, or through the same government funds that have been provided them to perform their research. The open-access model practiced by publishers such as BioMed Central, the Oxford University Press, the Public Library of Science, and others is ideally suited to balancing the needs and rights of the publishers with those of scientists, research-funding agencies and the general public those agencies represent. There could be no policy more destructive to scientific progress and productivity than one that restricts the rights of scientists – that is, the authors of research publications – from freely spreading their work to their colleagues.

Comment 3.

Centralized approaches to managing public access to scholarly publications have the substantial benefit of easing search and analysis of those publications by providing a unified foundation for their organization and access. Federal agencies should maintain custody of all scientific work which benefits from their largesse, both to ensure that that work is available to scientists and the public, and to guard it against loss. Indeed, the concept of the modern patent in which trade secrets are revealed in exchange for a temporary monopoly on production, was developed in order to prevent advances in glassblowing technology from dying with their inventors. Then, as now, it is the government that is best placed to maintain a central repository of the invaluable fruits of research work, especially when it is the American taxpayer who has commissioned federal agencies to fund the research itself. The advantage of decentralized methods for managing publication and public access is that organization, search and analysis of published results may be specialized towards certain fields. A combination of centralized and decentralized approaches towards publication management can be

applied sustainably, as long as access to abstracts and full-text is possible via scientific search engines such as Google Scholar, ISI Web of Knowledge and the National Institutes of Health's own PubMed Central. Again, the profitable open-access publication model of BioMed Central, Public Library of Science, Oxford University Press and others is ideally suited to maintaining public stewardship of, and access to, the fruits of publicly funded science.

Comment 4.

Broad-based scientific search engines such as Google Scholar, ISI Web of Knowledge, SciFinder and others embody public-private partnerships which are lucrative to the private organizations providing these services as well as to the public (including scientists) who use them. By aggregating article metadata and linking to full-text sources from publisher websites to the self-archival pages of individual researchers, while providing rich search and analysis capabilities, these services “take advantage of existing publisher archives and encourage innovation in accessibility and interoperability.” Without services such as these, which range from the free, simple search capability of Google Scholar to the premium, technically advanced “concept” searching of SciFinder, scientific research would still be limited by the slowness of research in the pre-Internet era. Complete, on-demand access to scientific publications has become a key component of modern research, and federal funding agencies' stewardship of the work they have commissioned on behalf of the taxpaying public will be incomplete if they do not pursue opportunities to maintain a high level of access to the most recent and most accurate scientific knowledge.

Comment 5.

Interoperable search, discovery and analysis are most surely delivered by an policy of enforced open access for federally funded research publications. Due to the extremely large corpus of modern scientific publication (the PubMed database alone stands at over 21 million citations), the tasks enumerated above are increasingly dependent on methods for automated text analysis, itself a rapidly developing area of computer science. Automated text analysis and other forms of computer assisted search, organization and analysis, function best when works are available on demand, and in full. They also benefit from the availability of structured metadata which can make these difficult computational tasks more tractable and their results less ambiguous. At

minimum, the metadata to describe a scientific publication includes a unique identifier such as a DOI, a title, a list of authors, a list keywords and disciplines, a list of involved laboratories or research institutions, a publication date, the forum and location of publication (journal name, volume and issue numbers, page numbers), the funding source or sources and the abstract or a condensed abstract. This last should be regarded as essential for the efficient operation of automated text analysis and search capabilities. Federal agencies should mandate that metadata and preferably full text for funded publications be freely available, and should additionally enforce that mandate by making receipt of further funding contingent on compliance.

Comment 6.

Agencies can maximize the benefit of public access by consistently enacting and enforcing policies which require open access to publications be provided. They can also ease the deposition and retrieval of government funded publications by provided simple and easy means for authors and publishers to upload and annotate their work, and for researchers and laypeople to search and download that work. As a working scientists, the present author submits that there is no greater hindrance to research success, and therefore scientific progress, than the inability to access critical information within publications chained by draconian access provisions, which often cannot be met even by organizations like medical advocacy groups and small or underfunded universities.

Comment 7.

In addition to journal articles, book chapters and conference proceedings form the core of the scientific canon. The latter two forms of publication differ significantly and should be treated as such by the open access provisions of federal agencies. Book chapters typically focus on past work, perhaps giving a synthesis of work in a scientific area, or presenting in detail research work which was the topic of many other successive publications. Conversely, conference proceedings represent the cutting edge of work in a field. Furthermore, papers are often guaranteed publication in an associated journal after acceptance into a conference (e.g. papers accepted to the 2012 Asia-Pacific Bioinformatics Conference will also be published in *BMC Genomics*). Given the disparate roles of book chapters and conference proceedings, and the high similarity of proceedings to standard journal articles, it is meet that open access requirements be wholly extended to conference proceedings, which are often very difficult to obtain

regardless of access policies and despite their high scientific value, but not to book chapters whose information is usually available from other sources. It should also be noted that while authors of peer-reviewed journal articles and conference proceedings do *not* receive royalties or other forms of compensation (on the contrary, authors pay publishers to disseminate their work), authors of books or book chapters *do* receive royalties and/or upfront payment for their work. Thus, journal articles and conference papers are not, in a loose sense, “owned” by the authors, while books and book chapters are. To ensure the long term stewardship of the former, they should be firmly placed in the public hand via its representatives, the federal funding agencies.

Comment 8.

The embargo period for general, peer-reviewed journal articles should be as short as possible, to ensure rapid dissemination of the information contained within. That information is often critical to continuing research, as well as to the making of sound medical decisions on the parts of doctors, patients' groups and patients themselves. American taxpayers have paid for federally funded scientific work to be conducted, and as soon as that work is complete and in print, Americans should be able to access it – whether they be scientists, doctors or laypeople. To be sure, the subscription-free business model of closed-access publishers is likely not sustainable without an embargo period during which they may profit by monopolizing the spread of scientific knowledge. However, this cost must be weighed against the competitiveness of American scientists and engineers who are dependent on the timely availability of that knowledge. Furthermore, universities and libraries across the nation are finding the up-front, per-article fee model of the open-access publishers to be far more palatable in the long term. Once an open-access publication is paid for, it remains paid for, while closed-access publishers are free to increase subscription fees at anytime. Effectively, they may retroactively raise the price for publicly funded work already conducted. This truth was made painfully clear to the research faculty of the University of California in 2010, when the Nature Publishing Group elected to increase fees by a staggering 400% [1]. While the library of the University of California was able to come eventually to an agreement with NPG, the California State Universities were not so lucky, and many CSU campuses – including the present author's – do not have access to new or archived articles from NPG and a long list of other subscription-fee publishers [2], whose prices have risen beyond the capacity of many public universities. This widespread lack of access is devastating to the competitiveness of the American

scientific enterprise.

Making strong, empirical arguments for or against specific embargo lengths for specific publication types is difficult to the a dearth of actuarial data pertaining to the production and publication of scientific articles. Nevertheless, it is indisputable that the open-access model, in which there is no embargo period, has proven profitable, even highly profitable for outfits such as BioMed Central, Oxford University Press, the Public Library of Science and others. PloS in particular has a particularly attractive embargo policy, which balances the public need for information with the need for responsible reporting and publishing. PloS distributes publications to exclusively to media organizations for a period of about one week, before allowing unlimited access. This short embargo period for journal articles is ideal because it "serves scientists, journalists, and the public by ensuring that the article is available to everyone when it is reported in the media. The policy also allows fair and equal access to our content, ensuring that no one reporter or organization receives preferential treatment or advantage over any other. It also gives the media the opportunity to research and accurately report on scientific articles while ensuring that publicity does not appear before the articles are accessible to the public. Furthermore, it gives authors the chance to comment on research before it is reported in the media. It is likewise designed to give public information officers adequate time to coordinate coverage with scientists at their institutions." [3]

[1] University of California Office of the President. "Re: Informational Update on a Possible UC Systemwide Boycott of the Nature Publishing Group." June 2010. (Attached PDF).

[2] California State University Systemwide Electronic Information Resources. FY 11/12 Campus Subscription. (Attached spreadsheet).

[3] Public Library of Science. Embargo Policy. http://www.plos.org/about/media-inquiries/embargo-policy/

Further Considerations.

The massive global impact of open-access policies for American academic publications must be considered. In addition to American researchers at small or underfunded institutions, scientists working in the developing world are often unable to access important scholarly works. Science is a universal human endeavor; when science is retarded anywhere on the Earth, all suffer the consequences in the form of

reduced technological availability and economic output. While the American taxpayer is undoubtedly deserving of free access to the scientific knowledge that his or her money has commissioned, there is a moral impetus to spread the benefits of that knowledge around the world. Modern science is a global phenomenon to which men and women of many countries and cultures have given over their labor and their lives. Its success rests on the trust we place in the process of peer-review, in the focus and conviction of our working scientists and on its ability to satiate, through technology, our desire for longer, more productive and better lives. It is a collaborative effort: though we see far, it is only because we stand on the shoulders of those who have come before. Continued scientific progress is absolutely dependent on the ability of researchers to stand on each others' shoulders, and mandated open-access terms for publicly funded scientific work, along with availability of that work over the global networks, have rapidly become foundational cornerstones of the incredible human capacity for collaborative advancement.

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