

PUBLIC ACCESS TO PUBLIC SCIENCE: RECOMMENDATIONS FOR THE CALIFORNIA STEM CELL INSTITUTE’S POLICIES REGARDING GRANTEE-PRODUCED JOURNAL ARTICLES

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TABLE OF CONTENTS

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|---|------|
| I. INTRODUCTION | 1177 |
| II. SCIENTIFIC PUBLISHING: BACKGROUND AND OVERVIEW | 1179 |
| III. SCIENTIFIC PUBLISHING: ALTERNATIVE TRENDS AND RECENT DEVELOPMENTS | 1182 |
| IV. CONCLUSION | 1185 |
| A. POLICY RECOMMENDATIONS | 1185 |
| B. FINAL COMMENTS | 1185 |

I. INTRODUCTION

While the public’s attention has been focused on a number of high-profile controversies presented by the prospect of a taxpayer-funded institute for stem cell research, several more arcane—but nevertheless noteworthy—matters have largely escaped the notice of the community activist groups, the town-hall meeting attendees, and the reporters covering the California Institute for Regenerative Medicine (CIRM). One such question is who will own the rights to the peer reviewed journal articles written by CIRM-funded researchers—an open issue the resolution of which will

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substantially determine how accessible those articles will be online for other scientists, the media, students, and the justifiably curious public.

In this brief Article, we argue that in the context of stem cell research, a policy arena rife with seemingly intractable disputes that implicate deeply held and conflicting moral intuitions, one of the few questions that has a relatively straightforward answer is whether policymakers should require that publications arising from CIRM-funded research be freely accessible online. They undoubtedly should. The benefits of a well-crafted plan in this area would be tremendous, and the downside would be trivial. The primary argument against such a policy—that scientists would decline to apply for CIRM funding if it came with an “open access” requirement—is simply implausible.

Why should CIRM require that articles produced by its funded investigators be free online? Within three or four years, researchers will complete the first round of projects funded by the institute. While we all hope that this early work will itself produce powerful new treatments for diseases from diabetes to Parkinson’s, such rapid progress is unlikely to occur. Rather than generating cures initially, CIRM-funded projects will be generating *knowledge* about the basic biology of stem cells—how they behave in the lab and in the clinic—and about prospective applications that do and do not show promise.

The voters who passed Proposition 71 to launch and fund the stem cell institute, eager to see the highly touted potential of stem cell research fulfilled and interested to know if their first billion dollars was well spent, will probably scrutinize these projects more closely than is typical for experimental results on the cutting edge of biomedicine. Certainly, science journalists in the popular media will report on the gist of the discoveries in the broad brushstrokes that they must necessarily use. But if taxpayers want more detail—if teachers want to assign papers for their students to read; if family members of people with potentially curable diseases want to keep themselves abreast of the latest progress in the lab; if entrepreneurs want to learn about the particular methods state-funded scientists used; or if researchers at California institutions of higher education with less-than-generous library budgets simply want to read the articles—they will be out of luck. Insofar as the prevailing practices of the scientific community are allowed to persist, the sole tangible product of this scientific research *specifically mandated by the public itself* will be too expensive for most of the public to access—and for no particularly good reason.

II. SCIENTIFIC PUBLISHING: BACKGROUND AND OVERVIEW

Scientific projects are not finished when the last experiment is done. They are complete only when the results are available for others to scrutinize and build upon in their own research. Scientists conduct this communication and correspondence with their colleagues by publishing papers—replete with details of the methods used, the results obtained, and the conclusions reached—in peer reviewed journals. Journals have been the lifeblood of the scientific community since the 17th century when the Royal Society in London began publishing accounts of experiments and lectures for far-flung members and interested laymen who could not attend the regular meetings.

There are now thousands of scientific journals. It is not hyperbole to suggest that their collective contents are one of humanity's greatest creations—the accumulated ideas and discoveries of tens of thousands of scientists, living and dead, who have dedicated themselves to figuring out how the world works. Today, virtually all of these publications are online by subscription. Consequently, anyone who logs onto the computer network at a major American university has instant access to the latest discoveries in fields ranging from quantum mechanics to astrophysics to, indeed, stem cell biology.

Outside of research institutions, though, access to the scientific literature is extremely limited. Universities are prohibited, by contract with publishers, from allowing unaffiliated users to have online access to journals paid for through academic library budgets. And while individuals may subscribe to a publication or two in a given field, such limited access is rarely enough to carry out even the most basic research project, which invariably requires reading papers from multiple sources. Personal subscriptions to scientific journals are substantially cheaper than institutional subscriptions, but they remain relatively pricey. To select an example more or less at random of a journal that might publish the results of research in cell biology, it costs a single reader \$335 for a year's worth of *Leukemia Research*.¹ And while articles are frequently available on a pay-per-download basis, those fees quickly add up as well. It costs \$30 to buy a single article from *Leukemia Research*;² the fees for papers in similar journals typically range up to fifty dollars.³

1. Elsevier.com, Leukemia Research Order Page, http://www.elsevier.com/wps/find/journalorderform.cws_home/583/journalorderform2 (last visited July 24, 2006).

2. Sciencedirect.com, Access Online Article, <http://www.sciencedirect.com/science/journal/01452126> (last visited Aug. 25, 2006) (follow "Volume 30, Issue 9" hy-

How can, and why do, publishers of scientific journals erect barriers to prevent the public from accessing their contents? The answer lies in the curious fact that the only permanent record of the scientific process is owned and controlled not by the scientific community or the public that largely funds its work, but rather by the publishers of scientific periodicals. These publishers first require as a condition of publication that authors transfer the copyrights in their works and then wield those rights to charge scientists and their institutions steep fees to access their journals.⁴

While this state of affairs may seem sensible from the publishers' perspective, the relatively singular system by which scientific research papers come into being renders the prevailing model of disseminating scientific knowledge decidedly disadvantageous for the institutions that produce the work and then buy it back. Consider the relative contributions of different groups to the production of a finished scientific paper. There are the scientists, who do the experiments and submit their work for publication with no expectation of remuneration. Then there are the volunteer peer reviewers—other scientists—who carefully pore over the details of the paper to make sure the methods are sound, the data valid, and the conclusions warranted by the results. Finally there are the sponsors, usually the government or other public institutions, who pay for the research and the salaries of the experimenters. The publisher does something too: it manages the editing and peer review process, oversees production, and posts the completed articles on the web. But to reward this modest contribution to the process with permanent control of the finished product is at best sub-optimal from the perspective of most of the other stakeholders and at worst simply absurd.⁵

perlink; then follow "Full-Text + Links" hyperlink under the article *Facing mortality: A qualitative in-depth interview study on illness perception, lay theories and coping strategies of adult patients with acute leukemia 1 week after diagnosis*).

3. Rick Weiss, *A Fight for Free Access to Medical Research*, WASH. POST, Aug. 5, 2003, at A1.

4. In 2002-03, for example, the University of California ("UC") paid \$8 million for online access *just to scientific journals published by Reed-Elsevier*—a figure that represented fully one-sixth of UC's materials budget that year. See UC BERKELEY LIBRARY – COLLECTIONS MANAGEMENT, ELSEVIER CASE STUDY (2005), http://www.lib.berkeley.edu/Collections/elsevier_case_study.html. For more on the shockingly high costs of scientific journals, see generally Daniel Greenstein, *Not So Quiet on a Western Front*, NATURE WEB FOCUS (2004), <http://www.nature.com/nature/focus/accessdebate/23.html>; Rick Weiss, *A Fight for Free Access to Medical Research*, *supra* note 3.

5. One might, for example, compare the publisher to a midwife. Midwives play an important role in the birth of a child—just as publishers play an important role in the final step of the scientific process. But no midwife would claim that his or her contribution should be rewarded with ownership of the baby. Yet, in a sense, this is precisely what

Why have scientists and their institutions allowed such a system to develop and persist? Until recently, the cheapest and most efficient way to distribute scientific knowledge was to deliver printed journals through the mail, and the costs of publishing a scientific journal arose mostly in producing and distributing printed pages. Since these costs naturally scaled with the number of readers, a subscription-based business model, in which publishers charged for each copy they distributed, made good economic sense. The system was reasonably efficient and fair to readers, to boot. To capitalize on their front-end investments in paper, printing, and postage, journals requested that scientists grant them the exclusive right to publish their work. Scientists, who were unable to publish and distribute works on their own, were happy to comply.

With the rise of the internet, though, the trade-offs embodied in this arrangement no longer benefit the producers and users of scientific articles to the same degree. Today, the internet provides the cheapest and most useful way to distribute published scientific work. The intrinsic costs of the online publishing process arise principally from producing the initial peer reviewed, edited, and formatted copy of each work. With printing costs eliminated and distribution infinitesimally cheap, the costs of publication are now largely independent of the number of readers.

Despite this fundamental pragmatic change, most scientific publishers continue to charge individuals and institutions for the right to access the papers they have published. Setting aside for a moment the question of whether this system remains desirable, there is no question that its prevalence is a vestige of a time when the economics of the publishing process were very different than they are today.

It hardly seems radical to suggest that, if the stakeholders in science were to devise *de novo* a system to pay for the peer review and online publication of research papers, they might very well not opt for one in which the final product was accessible only to people or institutions willing to pay annual or per-download fees. Subscription charges and other access fees are now, in some respects, an obstacle to the optimal use of scientific knowledge. They inhibit scientific and medical progress by curtailing the free flow of information upon which research depends; they prevent the development of creative new ways to sort through and use the information contained in the literature; and they deny the public access to the treasury of scientific knowledge it has paid trillions of dollars to create. Insofar, then, as there exists a way to publish scientific research articles of equally

happens in scientific publishing; it's as if midwives claimed ownership of babies and charged parents an annual fee to visit their child.

high quality, sustainability, and *without* fees for access, that alternative system inherently offers numerous advantages over the traditional one.

III. SCIENTIFIC PUBLISHING: ALTERNATIVE TRENDS AND RECENT DEVELOPMENTS

Over sixty percent of internet users have searched for medical information online—more than have downloaded music or than look for salacious images of movie stars.⁶ But while a Google search for any disease or symptom returns a bevy of information, ranging from the useful and informative to the dangerous and quackish, it rarely turns up the careful, peer reviewed studies published in major medical journals that contain the most up-to-date and useful medical knowledge available. Are web users seeking health tips really looking for technical, jargon-heavy articles? Undoubtedly, many are not. But some online searchers surely are, particularly those with a personal interest in solving a serious medical problem. And others conceivably *would be* interested in finding primary literature if they had any reason to believe such reliable information was available—which for or the most part, they currently do not.

The bodies that fund scientific research are gradually becoming aware that this lack of public access is a problem and are slowly—very slowly—devising solutions. The National Institutes of Health (NIH), for example, promulgated a policy in 2005 requesting that scientists who received research grants from the agency's \$28 billion budget submit their resulting journal articles to an online, free-to-access library called PubMed Central.⁷ However, because compliance is not mandatory, and because individual scientists typically have minimal or indirect incentives from self-interest to make their own articles free online, authors' participation in the NIH

6. SUSANNAH FOX & DEBORAH FALLOWS, PEW INTERNET & AMERICAN LIFE PROJECT, INTERNET HEALTH RESOURCES 1 (2003), http://www.pewinternet.org/pdfs/pip_health_report_july_2003.pdf (finding that over sixty percent of internet users have searched for medical information online); MARY MADDEN & LEE RAINE, PEW INTERNET & AMERICAN LIFE PROJECT, TECHNOLOGY & MEDIA USE (2005), http://www.pewinternet.org/PPF/r/153/report_display.asp (finding that about twenty-seven percent of internet users have downloaded music or video files); DEBORAH FALLOWS, PEW INTERNET & AMERICAN LIFE PROJECT, SEARCH ENGINE USERS 5 (2005), http://www.pewinternet.org/pdfs/PIP_Searchengine_users.pdf (finding that "Entertainment or recreation" and "Sex or pornography" both rank below "Health or sciences" among subject matter categories of popular searches).

7. PubMed Central, which contains the full texts of scientific papers, is distinct from PubMed, which contains the abstracts of scientific papers.

program has been negligible.⁸ The Wellcome Trust, the United Kingdom's largest private funder of biomedical research, has gone a step further. Beginning on October 1, 2006, all journal articles resulting from the £400 million that the charity disperses annually in research grants will be deposited in PubMed Central.⁹ And at the time of this writing, bipartisan legislation is pending in the U.S. Senate that would, if enacted, impose a similar mandate on virtually all scientists funded by the American government.¹⁰

Faced with the prospect of funder-imposed requirements that journal articles be made free online, scientific publishers have divided into two camps. The first group embraces the change and has begun to adopt business models that are consistent with providing unfettered access to journal contents. Those models typically entail an upfront fee, paid from researchers' grants or from centralized pools of money that funders have made available, to cover the publisher's costs of overseeing peer review and preparing accepted articles for publication.¹¹ The Wellcome Trust has estimated that such fees, if paid for all the journal articles its grantees produce, would amount to between one and two percent of the cost of conducting the research reported in the papers.¹²

The second camp of publishers, by contrast, has resisted calls to make the scientific literature free online. The principal grounds for their obstruction have been purely financial. Journals like *Science* have suggested that funding agencies simply would not be willing to pay upfront what it costs

8. NATIONAL INSTITUTES OF HEALTH, REPORT ON THE NIH PUBLIC ACCESS POLICY (2006), http://publicaccess.nih.gov/Final_Report_20060201.pdf. It is worth noting, however, that support is high among prominent scientists for mandatory deposition of NIH-funded articles in PubMed Central. See, e.g., Open Letter from 25 Nobel Laureates to the U.S. Congress (Aug. 26, 2004), <http://www.fas.org/sgp/news/2004/08/nobel082604.pdf> (advocating a requirement that taxpayer-funded research articles be made freely available to the public).

9. See Wellcome.ac.uk, Open and Unrestricted Access to the Outputs of Published Research, <http://www.wellcome.ac.uk/node3302.html> (last visited Aug. 3, 2006).

10. See The Federal Research Public Access Act of 2006, S. 2695, 109th Cong. § 2 (2006); Rick Weiss, *Bill Seeks Access to Tax-Funded Research*, WASH. POST, May 3, 2006, at A21.

11. See, e.g., Nicholas R. Cozzarelli, *An Open Access Option for PNAS*, in 101 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES 8509 (2004), available at <http://www.pnas.org/cgi/content/full/101/23/8509> (describing the policy of *Proceedings of the National Academy of Sciences*). New journals relying on this business model have also sprung up, including the six published by the non-profit organization the Public Library of Science and the dozens published by the for-profit BioMed Central.

12. Andy Gass, *Paying to Free Science: Costs of Publication as Costs of Research*, 31 SERIALS REV. 103, 105 (2005), available at http://www.plos.org/downloads/PLoS_CHE.pdf.

to publish a research article in a selective forum.¹³ Independent estimates, however, indicate that such claims of economic impracticality tend to be wildly exaggerated.¹⁴

An alternative reason for resistance has been a more overtly misguided concern over potential misuses of articles to which publishers hold only some, rather than all, rights. The *New England Journal of Medicine* (“*NEJM*”), for example, has cautioned of the following danger: if a funder of research prohibits its grantees from transferring the full rights to their articles to *NEJM*, then the paltry non-exclusive rights the journal would acquire would effectively “allow third parties to selectively use the materials in scholarly articles for commercial gain.”¹⁵ Not only does *NEJM*’s concern betray a profound misunderstanding of copyright law—which bestows a thin layer of protection on technical works and which allows fair uses of portions of copyrighted research articles—but it fails to support the asserted conclusion (that copyrights must always be transferred in full) even on its own terms. *NEJM*, along with every other publisher of biomedical journals, routinely publishes articles whose exclusive rights it does not hold: articles written by scientists not merely *funded* by NIH, but *employed* there, whose works automatically enter the public domain by virtue of 17 U.S.C. § 105.¹⁶ To date, there has not been a single report of misleading or inappropriate use of any article produced by researchers in the two dozen NIH institutes and centers, despite the fact that all such articles are wholly unprotected by copyright.¹⁷

13. See Lila Guterman, *The Promise and Peril of Open Access*, 50 CHRON. HIGHER EDUC. A10 (2004), available at <http://chronicle.com/weekly/v50/i21/21a01001.htm> (including an estimate by the American Association for the Advancement of Science that it would have to charge \$10,000 per paper to make its articles free online and maintain the revenue it derives from subscriptions).

14. WELLCOME TRUST, COSTS AND BUSINESS MODELS IN SCIENTIFIC RESEARCH PUBLISHING 3 (2004), available at <http://www.wellcome.ac.uk/assets/wtd003184.pdf> (finding that the per-article cost to publish in a high quality, subscription-based scientific journal is around \$2750).

15. Jeffrey M. Drazen & Gregory D. Curfman, *Public Access to Biomedical Research*, 351 NEW ENG. J. MED. 1343 (2004), available at <http://content.nejm.org/cgi/content/full/351/13/1343>.

16. “Copyright protection under this title is not available for any work of the United States Government” 17 U.S.C. § 105 (2000).

17. It also bears mention that scientific journals whose entire contents are governed by permissive Creative Commons licenses, such as those published by the Public Library of Science, have reported no ill effects of such liberal copyright terms in their concededly brief histories of operation. See Andy Gass, Helen Doyle & Rebecca Kennison, *Whose Copy? Whose Rights?*, 2 PUB. LIBR. SCI. BIOL. 0877 (2004), available at http://biology.plosjournals.org/archive/1545-7885/2/7/pdf/10.1371_journal.pbio.0020228-S.pdf (de-

Discussions of funder-imposed public access requirements often overlook the significance of the copyright-transfer exception that publishers routinely make for NIH intramural researchers. That exception demonstrates, however, that virtually all journals are willing to publish good science, regardless of whether the authors of an article are for some reason prohibited from assigning rights in the work to their publisher.

IV. CONCLUSION

A. Policy Recommendations

The research institute funded by the California stem cell initiative is, if nothing else, a grand experiment in direct public support for biomedical research. Its successes and failures will impact not only stem cell research but also the broader relationship between science and the public. In order to ensure that the public is fully informed about the results of CIRM-funded research, and in order to share as widely as possible the benefits of the knowledge that such research produces, CIRM should adopt the following policies regarding the journal articles that result from its grantees' investigations:

1. Like works produced by NIH intramural researchers, the articles should not be protected by copyright. They should instead be dedicated to the public domain, by rule, in order to allow the public to make creative use of the works in databases, for patient advocacy purposes, in educational settings, and for other projects.
2. As a condition of accepting CIRM funds, grantees should be required to deposit with PubMed Central either the final manuscripts or the published versions of all articles that result from their CIRM-funded work for posting in PubMed Central immediately upon publication in the journals in which they appear.
3. CIRM should make available a standing fund from which grantees can draw money to pay the reasonable costs of publication in open access journals which request such fees.

B. Final Comments

At the "California's Stem Cell Initiative" Conference at Boalt Hall that spawned this Article and the other works in this volume, several knowl-

scribing the Public Library of Science's experience with and reasons for using the Creative Commons Attribution License).

edgeable and influential legal scholars expressed the concern that imposing conditions such as these on grants would cause scientists to turn elsewhere for funds to do stem cell research with fewer strings attached. In other words, some scholars posited that requiring open access to CIRM-funded journal articles would scare off the best scientists. Little empirical data is available regarding the influence of grantor result-sharing requirements on scientists' willingness to accept funds burdened with such conditions.

However, the fear that scientists might be driven away strikes us as baseless. Few scientists are concerned that their funders require them to be too *open* with the results of their work (although undoubtedly some scientists refuse grants that would require them *not* to publicize some findings). Furthermore, even for those researchers who might, all else being equal, object to our proposed conditions, the sad reality is that funds for stem cell research, at least in this country, are relatively hard to come by. In other words, a qualified scientist would not likely turn down a CIRM grant because the articles she produced would enter the public domain and be made free online.

How would scientific journals react to this proposed policy? If their treatment of NIH intramural authors is any indication, then the journals would accept CIRM-funded authors with open arms, despite the scientists' inability to transfer rights in their articles to their publishers. In the event that some journals did object and refused to publish CIRM-funded articles, those journals would be the only stakeholders to suffer. The public would still have access to the identical scientific paper, but published in a CIRM-friendly journal (such as the many peer reviewed open access venues which thrive on the front-end payment model described above). The institutions that evaluate the work of scientist-authors, for the purposes of tenure, promotion, and future grants, would be aware that some journals do not publish CIRM-funded work and would adapt their metrics of evaluation accordingly. Certainly, the publication that refused the article would suffer for excluding an otherwise worthy contribution to the scientific literature for reasons unrelated to its intellectual merit. At the end of the day, as between the bottom line of a subscription-based journal publisher and the public's interest in access to scientific information, the CIRM policy-makers should choose to support the latter.