SEIZING THE MOMENT
SCIENTISTS' AUTHORSHIP RIGHTS IN THE DIGITAL AGE

Report of a Study by the
American Association for the Advancement of Science

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Attribution and Disclaimers

The report underwent several revisions based on comments and suggestions from many of the project participants. The participants represented people with diverse backgrounds and perspectives on the issues associated with scientific publishing (see Appendix A). Such diversity was intended in order to give voice to the range of positions that have fueled the debate on the matters presented in the report.

As the report evolved, a consensus was reached on the central thrust of the study—that scientists should be more assertive in claiming their intellectual property rights and that they leverage those rights to increase access to and use of their works through more creative and expanded use of licensing. The basic terms of such an approach were generally agreed to, with participants expressing varying views on the details.

The American Association for the Advancement of Science (AAAS) has made this report available to contribute to public and professional dialogue on controversial issues affecting science; it is not intended to be legal advice to readers. Any opinions, findings, and recommendations expressed in the report are based on a collaboration between the author and those experts convened to advise on its preparation, and do not necessarily represent the official positions of AAAS or the National Science Foundation.

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Several present and former AAAS staff and interns contributed to the project and preparation of the report. With gratitude, I acknowledge the assistance of Alexander Fowler, Imran Khaliq, Lindsay Kuhn, Erin LaFarge, and Parisa Morris. The contributions of Rachel Gray, who assisted in organizing both project workshops, and Kristina Schaefer, who helped produce this report, were invaluable.

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Introduction

Publication is the chief currency of science. It is the primary measure of a scientist's productivity and affects one's reputation, promotion, intellectual property claims, and future access to both intellectual and financial rewards. It is the means by which research findings are communicated to other scientists, stimulating still further research advances. Equally important for the public is that open publication is the primary means for disseminating "certified" knowledge to a larger audience, so that it can be considered in personal decision making and public policy deliberations. Publication also contributes to a set of credentials respected by parties external to the scientific community, such as when the scientist testifies as an expert witness in legal proceedings, acts as a consultant to industry, or is invited to serve on a government advisory panel. It is not a trivial matter, therefore, when the traditions of scientific publishing must face head on a revolution in publishing technology, as is happening with the advent of the Internet.

While the challenges posed by the Internet for scientific publishing are many, the American Association for the Advancement of Science (AAAS), with support from the National Science Foundation, undertook a study focused on intellectual property and electronic publishing in scientific journals on computer networks (excluding journals only available on CD-ROM or other fixed media). In most scientific fields, journals are the principal source of the primary scientific literature, where original data are presented and findings disseminated. They also serve to document claims of originality and priority among scientists.

One of the features of scientific information is that it increases in value as more people have access to it and add new insights into its interpretation. Data are likely to be enriched and more fully documented the more that scientists are able to review them. "While [scientific information] has commercial value, it is in the main being passed around a loop from an author to a user community, which are largely overlapping. The interest of all is maximum availability, and facilitators such as publishers and librarians are ultimately judged by this criterion. It is therefore essential to see how copyright regimes act as a help rather than a hindrance for information transfer."[1] If science is to remain a "public good" at the service of all humankind, then the legal regime adopted by governments both to protect intellectual property rights and to foster dissemination of scientific information will continue to play a major role in defining the parameters of information creation, dissemination, and sharing. [2]

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[1] Roger Elliott, ICSU Press and UNESCO, Electronic Publishing in Science, Proceedings of the Joint ICSU Press/UNESCO Expert Conference, Paris, France, February 1996, p.15; or see http://associnst.ox.ac.uk/~icsuinfo/ConfProc.htm

[2] Intellectual property law is, of course, only one of several factors that influence the creation and flow of information. We recognize that science is in a period of considerable stress as scientists and their institutions debate their responsibilities regarding the dissemination of and access to scientific data in an environment increasingly characterized by the promise of economic rewards and profoundly affected by the events of September 11, 2001. Eyal Press and Jennifer Washburn, "The Kept University," *The Atlantic Monthly* (March 2000), p. 39 *passim*; and Gina Kolata, "Scientists Debate What to Do When Findings Aid an Enemy," *New York Times*, September 25, 2001.

The Internet is precipitating a reassessment of the national and international system of intellectual property rights laws and treaties.[3] Both public and private sector stakeholders recognize that the full promise of new information technologies may never be realized unless a clear and stable legal framework is in place. In this study, we wanted to identify those aspects of the intellectual property regime that would likely facilitate or constrain scientific publishing in the electronic era. We were motivated by a strong preference for broad access to scientific information.

Rather than attempt to examine these issues globally, we concentrated our modest resources on U.S. law and policy. Nevertheless, we fully recognize that any effort to establish a legal framework to nurture scientific publishing and maximize the dissemination of scientific information must eventually occur at the international level. Science is an international enterprise, increasingly independent of geography and national boundaries, and the difficulties described in this report will require an international solution. Indeed, if proposals for change are to secure international support and cooperation, they should avoid being viewed as driven solely by national interests. AAAS realized this from the outset and, within the constraints of the project's resources, provided for international representation in our study by the International Council for Science (ICSU) Press and the International Council for Scientific and Technical Information (ICSTI), so that our work could be connected to on-going deliberations by international bodies.

The study was a collaborative effort by AAAS staff and a working group of 25 persons, comprised of scientists, journal editors, publishers, librarians, practicing attorneys, and legal scholars. (A list of participants can be found in Appendix A.) They were organized into three working groups, each of which was given a specific task following a meeting of the group as a whole in March 1999. The group assignments were as follows: Working Group I was tasked with identifying the key stakeholders and their interests, and drafting a statement of the values of a system of scientific publishing intended to promote the advancement of science. Working Group II was charged with examining how the existing U.S. intellectual property regime attempts to balance the interests of various stakeholders in scientific publishing, and with assessing how well the current system is positioned to balance those interests in the digital era. Working Group III was to focus on what changes, if any, to the existing legal regime in the U.S. are needed in order to realize the full potential of electronic publishing and to "promote the Progress of Science and useful Arts." The three working groups conducted their work online over several months, and then presented their initial proposals for discussion at a second meeting of the entire group in November 2000. This final report brings together the results of those efforts.

From Paper to Electrons: The Evolution of Scientific Journals

Since the 17th century, with advances in printing technology, print journals have played a pivotal role in the creation and dissemination of new knowledge. Four centuries later, these journals continue to be the primary means for communicating research. But changes are in the air, as the Internet, and the World Wide Web in particular, alter the ways that scientists communicate and interact with each other, as well as with non-

[3] Peter Jaszi, "Summary of International Copyright and IP Activities," Association of Research Libraries, 1996; see http://www.arl.org/info/frn/copy/treaty.html; and "Proposal for a Directive on Copyright and Related Rights in the Information Society: Response from the Library Association," The Library Association, 2001; see http://www.la-hq.org.uk/directory/prof_issues/dcrris_3.html.

scientists, transforming the process by which scientific information is disseminated, collected, used, and archived, and compressing both time and distance in ways previously unimaginable.[4] Even what constitutes "publication" in science will continue to require rethinking in the face of emerging information technologies.[5]

One area where these challenges manifest themselves is in the emergence of electronic scientific journals, as adjunct to or instead of paper journals. As an innovation in publishing, electronic journals present a new and exciting prospect for science and its patrons. The electronic medium creates added value for research, education and publication in a number of ways. It widens the array of potential collaborators. It creates opportunities for virtually instantaneous feedback and commentary. The timeframe for moving from manuscript submission to peer review to press can be greatly accelerated in the electronic environment. It promises more powerful indexing, and the size of the audience it reaches can efficiently be expanded well beyond the readership of paper-based journals.

Electronic publishing also offers more powerful and creative ways for exhibiting and illustrating research findings than is possible in print publications. For example, e-publishing will allow scientists to progressively and dynamically update their articles by, for example, making corrections or modifying findings. It can also add value by including graphs, sound clips, videos or designs, and links to references and databases, which may themselves be in a dynamic state of updating.[6] All of these features can facilitate research and enhance educational offerings. Online publishing is also likely to increase lay access to scientific works, so that the general public can be better informed about science.[7] These advantages have led to an increase in the percentage of major scientific journals creating electronic versions of their publications as well as a boost in the number of journals published only online in science, engineering, and medicine, which according to a recent report, numbered about 7,000.[8]

Skirmishes at the Electronic Frontier

Paralleling the emergence of these transformative technologies has been a social movement among scientists to retain some or all rights to the products of their labor.[9] This movement has its origins in concerns by many scientists that access to information is too concentrated in the hands of a few major commercial publishers.[10] According to critics, this concentration has resulted in prices for paper-based and online journals so

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[4] Tim Berners-Lee and James Hendler, "Publishing on the Semantic Web," *Nature*, 410:1023-24, April 26, 2001.

[5] "Defining and Certifying Electronic Publication in Science," Proposal of an International Working Group to the International Association of STM Publishers, June/July 2000; see http://www.aaas.org/spp/dspp/sfrl/projects/epub/define.htm.

[6] Authors of such articles may also want to alter those additional items in ways that constitute an entirely new work. Of course, it may be necessary for an author to obtain the right to prepare such derivative works.

[7] However, one cannot be sure that what the public reads on the World Wide Web is credible scientific information. This may place an even greater responsibility on the part of journals in the electronic era. See Mark S. Frankel, "Publishing Research on the Internet: New Responsibilities for Electronic Journals," *Electronic Journal of Biotechnology*, 4(1), 2001; see http://www.ejb.org/content/vol4/issue1/editorial.html.

[8] Brian McKenna, "Distribution Dollars Drive Ingenta's Growth," *Information Today*, 18(7): 544 *passim*, July/August 2001

[9] Lisa Guernsey, "A Provost Challenges His Faculty to Keep Copyright on Journal Articles," *The Chronicle of Higher Education*, September 18, 1998; see http://chronicle.com/colloquy/98/copyright/background.htm.

[10] Nicole B. Usher, "Scientists Demand Free Journal Access," *Harvard Crimson*, April 23, 2001.

high that neither scientists nor their institutions can afford to maintain current collections, let alone purchase new subscriptions. A report produced under the auspices of the Association of American Universities, the Association of Research Libraries, and the Merrill Advanced Studies Center at the University of Kansas noted that, "The increasing volume and costs of scholarly publications, particularly in science, technology, and medicine (STM), are making it impossible for libraries and their institutions to support the collection needs of their current and future faculty and students."[11] These conditions have prompted worries that less, rather than more, information will be accessible. While these concerns regarding increased costs are not new, when combined with more recent accusations that publishers are not making their journal contents as widely available and in as timely a manner as they should, and a growing capability to disseminate such information cost-effectively outside traditional publication channels, the social movement has gained new potency and currency.

The movement has extended beyond commercial publishers to all journals that, in the view of the movement's organizers and contributors, restrict access to scientific papers. There have been calls for boycotts of journals, and efforts to establish other mechanisms for disseminating scientific information. Perhaps the most visible of these efforts is the *Public Library of Science* (PLS), which posted an Open Letter on the Web (http://www.publiclibraryofscience.org/plosLetter.shtml) urging scientific publishers to deposit all research articles from their journals in a public online archive free within six months following publication. The letter states that "the permanent, archival record of scientific research and ideas should neither be owned nor controlled by publishers, but should belong to the public, and should be freely available through an international online public archive." To add teeth to their mission, the signers of the letter, who numbered over 32,000 from 177 countries as of July 2002, pledged that, "beginning in September 2001, we will publish in, edit or review for, and personally subscribe to, only those scholarly and scientific journals that have agreed to grant unrestricted redistribution rights to any and all original research reports that they have published, through PubMed Central and similar online public resources, within 6 months of their initial publication date." Despite the pledge, very few scientists actually followed through, leading one of the boycott's organizers to admit that "In retrospect, it was not an effective strategy."[12] Recently, PLS announced plans to create its own publishing system to "provide scientists who have supported its campaign with a place to publish that provides free access."[13] Yet another instance of "rebellion" by scientists was the October resignation of 40 members of the editorial board of the computer science *Journal of Machine Learning Research* in order to support a competing journal that is circulated free online.[14]

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[11] Mary M. Case, "Principles for Emerging Systems of Scholarly Publishing," *ARL Bimonthly Report*, June 2000; see http://www.arl.org/newsltr/210/principles.html.

[12] Jeffrey R. Young, "Journal Boycott Over Online Access Is a Bust," *The Chronicle of Higher Education*, May 16, 2002; see http://chronicle.com/free/2002/05/2002051601t.htm

[13] Declan Butler, "Public Library Set to Turn Publisher as Boycott Looms," *Nature*, 412:469, August 2, 2001. In May 2002, boycott leaders announced plans to publish several new journals on biology and medicine as soon as January 2003 and make the content free online. See Jeffrey R. Young, "Journal Boycott Over Online Access Is a Bust," *op. cit.*, note 12. Also see a discussion site on the web created by *Nature* to examine this and other issues related to electronic scientific publishing; http://www.nature.com/nature/debates/e-access.

[14] Michael Jordon, "Letter of Resignation from Machine Learning Journal," October 8, 2001; see http://mail.cs.uiuc.edu/pipermail/colt/2001-October/000553.html

The online public archive specifically referred to, PubMed Central, was established at the National Library of Medicine in 2000 for the storage of life sciences literature (http://www.pubmedcentral.nih.gov/). The archive seeks to store articles in a common format to facilitate focused literature searches and to promote long-term access. It asks journals to contribute all their research articles for posting at the site as soon as possible. While a few journals are participating, others are hesitant to do so. Although many already offer free access to their published articles after a period of time on their own Web sites, because of concerns regarding authenticity and quality control as well as economic considerations, they are reluctant to have them appear elsewhere. For journals that wish to maintain posting on their own Web site, but also have a link from PubMed Central, they must make full text available free and without access restrictions within one year after publication. The reluctance of some journals may change, however, with the recent announcement by PubMed Central that it would permit publishers to link access exclusively back to their own Web sites rather than require that they display full-text articles on the PubMed Central site. PubMed would still receive a copy of the full text for search purposes, but it would not be accessible there by the public.[15]

Other mechanisms established to facilitate the dissemination of scientific information include the Los Alamos e-print archive (http://xxx.lanl.gov/), which has moved to Cornell University (http://arxiv.Cornell.edu/). It was set up to distribute e-prints in physics and mathematics without any initial involvement of publishers.[16] Another initiative is represented by efforts on the part of colleges and universities to establish online "institutional repositories" to assemble the cumulative scholarly works of their scientists (and other faculty).[17] The intent is to increase access to scientific work, with some viewing it as an alternative form of publishing. Yet another endeavor is the *Scholarly Publishing and Academic Resources Coalition (SPARC)*, a "worldwide alliance of research institutions, libraries and organizations that encourages competition in the scholarly communications market" (http://www.arl.org/sparc/). It seeks to reduce the cost of journal acquisition, especially in scientific, technical, and medical fields, and provide scholars with responsive alternatives to current publishing vehicles. SPARC "strives to return science to scientists."[18] Other similar ventures are catalogued in Appendix B. Many of these initiatives, of course, rely on resources – human and financial capital – for their continuance. There is no guarantee that those resources will be available over the long run.[19] But regardless of whether these efforts are long-term solutions, they have already left their mark on scientific publishing.

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[15] Edwin Sequeira, Johanna McEntyre and David Lipman, "PubMed Central Decentralized," *Nature*, 410:740, April 12, 2001.

[16] The archive and its founder, Paul Ginsparg, moved to Cornell University in order to expand the archive's reach to a broader range of disciplines. Mark Sincell, "A Man and His Archive Seek Greener Pastures," *Science*, 293:419 & 421, July 20, 2001.

[17] Jeffrey R. Young, "'Superarchives' Could Hold All Scholarly Output," *The Chronicle of Higher Education, July 5, 2002*; see http://chronicle.com/free/v48/i43/43a02901.htm

[18] SPARC recently posted a manual "to help universities, libraries, societies, and others implement alternatives to commercially-published scholarly and scientific information. See http://www.arl.org/sparc/GI. It also announced plans to partner with BioMed Central (http://www.biomedcentral.com) to support "efforts to develop a sustainable business model that will ensure long-term open access to biomedical research results." See http://www.arl.org/sparc/core/index.asp?page=f59.

[19] One of the reasons given for the transfer of the Los Alamos e-print archive to Cornell was recognition of the need to have a stable source of funding. See Sincell, *op. cit.*, note 16, p. 419.

What drives all of these ventures is a commitment by scientists to the accessibility of scientific information. With differences over how best to increase the flow of such information, the debates continue, as the various parties stake out claims to the fruits of scientific labor. Before examining in more detail the range of stakeholders engaged in these debates, we highlight the values that should underlie a system of scientific publishing designed to maximize information transfer in science.

Values at the Core of Scientific Publishing

One outcome of the AAAS study is identification of the core values that should be embedded in any system of scientific publishing, whether print or electronic. Our intention is to capture the values applicable to publishing in science that, if optimally realized, would maximize the quality of, access to, and use of scientific information. Those values are presented in Table 1.

TABLE 1: Core Values Animating Scientific Scholarly Publishing

GROUP 1: Quality values associated with the individual published work

1.1 Authenticity: stable, unambiguous identity of the work and its authorship, reliably reflecting authorial intentions.
1.2 Originality: freshness of insight, expansion of knowledge; differentiation from prior work.
1.3 Quality: scientific insight, authoritative understanding of subject, clarity of statement, accuracy of reporting and documentation.

GROUP 2: Quality values associated with scientific publication venues. (A venue is a site that publishes science; journals and Web sites are the most familiar venues.)

2.1 Added scientific value: authors and users are able to add value to the publication by linking it to related items (for example, related data sets provided to enrich scientific discourse).
2.2 Editorial activities: editorial practices improve factual accuracy, clarity of language, and effective communication.
2.3 Editorial integrity: fosters free and open inquiry, follows ethical principles to manage conflicts of interest (with advertisers, publishers, etc.), and espouses the values of good science (i.e., Group 1 values).
2.4 Impact: authority and prestige are reflected in the citation frequencies of the publications in the venue.
2.5 Peer review: employs an effective and fair peer review process to ensure quality and originality of individual publications.
2.6 Research ethics: scholarly publishing venues should conform to and support the ethics of science, including research integrity and the protection of human participants in research.
2.7 Timeliness: authors have prompt publication and authoritative evidence of priority of discovery and reporting.

GROUP 3: Values associated with a system of publication

3.1 Access: users have assured, easy, enduring access to information.
3.2 Affordability: costs do not unduly limit access to information.
3.3 Archiving: users are confident that information will remain permanently available to them, with no impairment of authenticity (that is, 1.1).
3.4 Bibliographic services: cataloging, abstracting and indexing services, and other appropriate means of intellectual access are provided to guide users to the information they need.
3.5 Entry: barriers to new publication venues should be low so long as Group 1 quality values are preserved. Similarly, quality work that challenges established thinking should find a publication venue. Sub-disciplines and specialties that meet standards of quality should find systems of publication that allow them to establish their identities.

3.6 Privacy: systems of scholarly publishing should respect the privacy of users by enabling them to determine how much information about their use of scholarly publication they want revealed.

3.7 Reuse: subject to limitations under intellectual property law, authors are able to build on, modify, and extend their own work and that of other authors at no or nominal cost. Examples of such reuse are fair use quotation, application of data to new inquiries, postings on laboratory Web sites, reserve readings and teaching materials, creating hyperlinks, etc.

No stakeholder in the scientific community is indifferent to or uninvolved with the values described above. One of the striking features of the community is the degree to which stakeholders assume multiple roles as, for example, when a person serves as both an author and an editor. Also striking is the variety of roles stakeholders may have, ranging for instance from patients to environmental advocates, from investors to policy makers, and from university tenure committees to bench scientists. Given the diversity of roles and interests, and the degree and variety of overlap among them, there is no simple way to predict how these values will play out as we move into the digital era. Nevertheless, we proffer these values as a basis for defining a common ground for collaborative work among all the stakeholders in building new publishing systems and legal frameworks.

Stakeholders and Their Interests

Publishing systems operate in a legal and commercial framework that enables the various stakeholders involved in the creation, collection, storage, dissemination and use of scientific information and materials to play their roles with a reasonable degree of certainty. This framework offers a balancing of interests that might not be agreeable to all, but has certainly been a foundation upon which either to rest or build.

All that is changing, however, and the historical balance is threatened because technology is modifying, sometimes dramatically, the process by which each of these activities is conducted and the roles of the stakeholders who carry them out. Technology is also creating new forms of information, and in many cases is enabling or facilitating new or different means by which information and the sources of information are validated and authenticated. These changes challenge existing legal frameworks to deal with different business models and operating realities that accompany the digital creation, recording, and transmission of information.

To examine the effect of the growth of electronic publishing, it is useful to understand who the major stakeholders are and what their traditional roles have been. In large measure, these roles are based on intellectual property laws that furnish the legal framework for protecting published works and for defining the relationships between and among the various stakeholders. In the first instance, we have "creators" of published materials (traditionally referred to as "authors"). These include both non-commercial (academic and government) and corporate/commercial research scientists. Indeed, in a seemingly undisciplined, haphazard and lightning-fast networked information environment, even ascribing attribution for intellectual innovation or unequivocal identification of the "creators" of scientific innovation (i.e., those responsible) is increasingly challenging both the scientific and legal communities.[20] For ease of

[20] For example, after the announced discovery of metallic high-temperature superconductivity (Magnesium DiBoride), approximately 80 papers were immediately posted on the Internet, blurring the ability to

reference, when we use the term "scientist," we include academics, independent scholars, industrial scientists, students, and other individuals engaged in doing science.

We next turn to "publishers." The term "publisher" in scientific communities includes learned and professional associations and societies, foundations, think-tanks, government and non-government non-profit and commercial publishers, and has now come to include affiliated and un-affiliated bulletin board, informal or other messaging, distribution and dissemination venues. Essentially, "publishers" render material produced by creators in a format that is capable of being disseminated to users for their perusal or use. In paper-based publishing, editorial, peer review and "gatekeeping" activities are often performed in close association with the publishing community. In the electronic era, however, these functions are increasingly separated from activities performed by traditional publishers. This requires some rethinking about how we define "publishing" in the digital world, when virtually anyone, taking advantage of the efficiencies and capabilities of the digital technology, can be a publisher.[21]

In this report, the concept of "publisher" recognizes that the traditional link between quality control and publishing should no longer be assumed, because technology has made it easy for those functions to be unbundled. In the digital era, it is an open question as to who will perform the editorial and quality control functions traditionally associated with publishers, but these functions are still regarded as very important, even essential.[22]

We next turn to the users of published materials. "Users" consist primarily of research scientists, but also of historians and philosophers, editors, consultants, students and educators, journalists, consumer advocacy groups, government regulators and policy makers, and members of the legal community, as well as any member of that diverse group we refer to as the "general reading public." A user can be a peer, examining the literature for material relevant to scientific investigation, a lawyer preparing for the examination of an expert witness, an individual seeking information in pursuit of a cause, or a government regulator seeking to establish consumer protection standards for a particular activity.

If one assumes that progress in science depends upon and represents the cumulative wisdom available to each succeeding user, then another major category of stakeholder in the electronic publishing arena is the "conservators" of published material. These archivists and repositories of accumulated research and knowledge include network manuscript servers and libraries, publishers committed to archiving their publications, and increasingly, ad-hoc or informal communities maintaining databases of information, including in some cases, unreviewed reports.[23] Today's "conservators" are

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distinguish who did what and when. See MgB2 Preprint List, January-May 2001 at http://www.iitap.iastate.edu/htcu/archive/2001August.html .

[21] See "Defining and Certifying Electronic Publications in Science," o*p.cit*., note 5.

[22] A number of participants in the AAAS project questioned whether it was possible to advance a purely functionally based or activity-based analysis of the various roles of the key players in the scientific publication process in an electronic environment, noting that these roles often remain blurred. There is hardly a consensus on this point, with many of the project participants advancing the proposition that, in order to assess both the risks and the opportunities that the Internet and electronic media afford, we must shed our old ways of evaluating these enterprises and focus on the implications of emerging digital technologies, not historical traditions founded in paper-based publishing.

[23] In both the paper and digital environments, conservators or archivists typically link their preservation and archival activities to the provision of access and dissemination of information. While the maintenance or

often the "publishers," who may assume the archival function for digital publications from libraries, and, not insignificantly, are or have access to the primary sources critical to validation and authentication of scientific information and research. No matter who assumes the mantle of archivist in the digital environment, it is clear that developing effective means for preserving and archiving electronic material will be the most pressing order of business.

Libraries and archives have traditionally seen their mission as the preservation of material to ensure dissemination and access, and have made significant investments in preservation activities. In the world of print-on-paper, this connection can be maintained because libraries own copies of the scientific publications they preserve and their rights to provide access to those materials without further charges are codified in the 1976 Copyright Act. For online publications, however, libraries contract for a right of access, and do not own physical "copies." It is this shift in the form in which publications are disseminated that has broken the traditional link between preservation and access for libraries. Since the need for preservation is generally associated with either historical or access purposes, if libraries cannot re-establish a meaningful link, they are likely to assume only marginal roles in preservation, and publishers' (or others') preservation efforts will necessarily be driven by the need for profitability, or at least to cover costs. Yet another scenario sees an environment in which information resources are part of a "dynamic continually changing distributed archive, managed by those closest to them, [which] may also be the best solution for long-term preservation of archives."[24] Thus, in the digital age, the archival functions of libraries are uncertain.

The categories of stakeholders and the individuals and entities comprising each are not mutually exclusive. For example, scientists may find themselves "creators" of published materials one day, "users" the next, and ultimately "publishers" as well. We have elected to distinguish between the named individual or entity and the function or role being served or played. Because the law examines the conduct or activity, not the label or title of the actor, this approach seemed to fit more consistently with our mission. In preparing this report, it became clear to us that distinctions of title were less important than an understanding of the functions and activities performed, the interplay between those functions, and the legal mechanisms necessary and appropriate to protect and advance them. This is a key to our thinking about legal regimes. The law generally attempts either to categorize legal entities and define rights and restrictions that apply, or to describe a function or activity and categorize it as either permissible, restricted in some way, or prohibited. These categories are then used to create a matrix of rights and responsibilities that can be applied and interpreted by the courts.[25] When roles, functions,

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long-term preservation of materials can be viewed as a separate activity or function, it is important to appreciate that preservation is not an end unto itself, but a means of ensuring continued access to information and materials. Thus, while the activities can be categorized separately, they are inextricably intertwined. Although digital technology has enhanced the capability of archivists also to serve a reproduction, distribution and transmission function, the relatively high cost of keeping up with ever-obsolescing technology can have a chilling effect on such activities, and lead to an increasing separation of these functions in a paperless environment.

[24] "The Future of the Electronic Scientific Literature," *Nature*, 413, 1 and 3, September 6, 2001; see http://nature.com/nature/debates/e-access/Articles/opinion2.html.

[25] The notion of "fair use" under the Copyright Act is a good example, where a certain level of otherwise-prohibited copying of protected works is permitted; (i.e., the law provides a defense to allegations of copyright infringement), so long as the copying meets the limited purposes of fair use.

categories and activities blur or are in flux due to rapid changes in technology, clarity fades and traditional matrices can become obsolete or unusable.

The ease with which information can be published, copied and distributed through digital media promises increased access to all types of information, but it also creates opportunities for the abuse or misuse of material traditionally the subject of intellectual property protection. The technology that facilitates the creation of new work creates a threat that the work will be pirated, depriving various stakeholders of the rewards for their labors. In response, there have been efforts, more fully described later in this report, by copyright holders to use restrictive contracts and/or encrypted technological devices and penalties for their circumvention to make electronic copying much more difficult, and in the process calling into question the effectiveness of the fair use provisions of copyright law.[26] This tension between the interests of copyright holders and of those concerned about excessive restraints on the flow of scientific information is one of the challenges faced by legal regimes that emerged in a technologically different era.

The law is taken advantage of and relied upon, to one extent or another, by creators, publishers, conservators and users, in order to facilitate the distribution of scientific information. Many would argue that it is clearly appropriate to modify our legal systems and our notions of intellectual property protection to keep pace with our dynamically changing world. Others, however, assert that hasty modifications could prematurely threaten laws and regulations that have been enacted, interpreted and applied for the promotion of the public good – even if they are imperfect and may need to evolve or be interpreted further over time. Just how this "balancing act" might be performed in the digital era is the focus of the next section.

Current Status of Intellectual Property Law for Scientific Publishing

The primary purpose of intellectual property law in the United States is to "promote the Progress of Science and useful Arts" (U.S. Constitution, Article 1, Section 8, Clause 8) by encouraging inventors and authors through the granting of limited monopolies in inventions and original works of authorship, with the resulting possibility of commercial reward. The patent and copyright statutes, interpreted by case law, represent attempts by the United States Congress and the courts to craft a balance between the interests of owners and users—between monopoly ownership and control and the interests of the public in free access and use—with the long-term public interest and corresponding benefits to society, the overriding factor. Whether one believes that in practice such a balance is actually achieved is the subject of considerable debate, with one commentator arguing that the public interest is not adequately represented in negotiations that determine copyright legislation.[27] Nevertheless, patent and copyright law, as well as the laws of contract and unfair competition, recognizes certain proprietary rights, with proprietors having greater or lesser ability to restrict access to and use of the information by others. These laws, however, also incorporate limits on the proprietary rights they create, including boundaries on their scope and duration.

The existing framework for protection of intellectual property in the United States has traditionally offered certain safeguards for the various stakeholders in the chain of scientific publication. But this legal framework evolved largely in a world in which there

[26] Mark Cutler, "Libraries Cling to Infringement Exceptions in Face of DMCA, Prevalence of Digital Works," *Electronic Commerce and Law Report*, 7: 46-49, January 16, 2002.
[27] Jessica Litman, Digital Copyright (New York: Prometheus Books, 2001).

were practical limits on the ability to copy, distribute, and archive information. Like it or not, digital technology and ever-growing connectivity and communications capabilities continue to push the legal system to new limits. Lawmakers struggle to create an environment that allows increased access to scientific information while attempting to preserve the rights and commercial expectations of the creators and publishers of such information.

There are four basic legal mechanisms for protection of intellectual property in the United States:[28] patent, trademark (including unfair competition), trade secret law, and copyright. Patent laws protect the rights of inventors who disclose their inventions to the public (through government filing) by preventing others from copying, making, using, or selling the inventions. The interplay between patent and copyright law is likely to become increasingly important in the digital world, as, for example, when a patented process is involved in the performance of a digital work subject to copyright, or when a patent covers the methods used for accessing or structuring data. Trademark law protects "brand names" that identify and distinguish one entity's products and services from those of its competitors. Trademark protection also fosters commercialization of research into marketable products and services.

Trade secret law protects innovative formulae, processes or methods in commerce from misappropriations and industrial espionage, but offers more limited protection than patent or copyright law. Unlike patents and trademarks, which are protected under federal law, trade secrets have traditionally been protected by state common law, although many states have adopted the Uniform Trade Secrets Act. More recently, a federal statute, the Economic Espionage Act of 1996 (http://www.ncix.gov/pubs/online/eea_96.htm), makes it a federal crime to steal another's trade secrets. The law of trade secrecy may be relevant in cases where research data are collected and maintained in proprietary online databases. Trade secret protection of online data can limit access to data, thus restraining the open exchanges normally associated with the scientific community.

Copyright law is by far the most significant intellectual property regime relevant to publishing generally and electronic publishing specifically. As previously noted, copyright law in the United States emanates from Article I of the U.S. Constitution, which authorizes Congress to pass laws to promote the "Progress of Science and useful Arts" by protecting the rights of authors in original works of authorship. Copyright is primarily governed by a federal statute, the Copyright Act of 1976, as amended. The United States is also a party to several international copyright conventions that are implemented by federal statutes.

The Copyright Act protects copyright holders' rights in works of original authorship, fixed in a tangible medium of expression, from which such works may be perceived, reproduced or otherwise communicated, which includes electronic media. Copyright law grants certain exclusive rights to the author or other copyright owner of an original work, including a public performance right, the right to reproduce the work, to create derivative works, and to distribute and display publicly the work. How long one

[28] In the increasingly digital environment, U.S. communications law may also come into play where television programming and electronic publishing are expressed in various digital forms and made accessible via the Internet. There is a growing convergence between the publishing, broadcast, cable, satellite communications and software industries; legal provisions developed for one sector should not be considered in isolation.

may retain those rights has been markedly extended in recent years and is now the subject of litigation to be heard by the U.S. Supreme Court.[29]

Copyright does not protect underlying ideas, systems, or factual information disclosed in a copyrighted work. Moreover, the concept of "fair use" under United States law creates a defense to claims of infringement in certain cases, including those where the purpose of the use is educational (although the application of the fair use doctrine involves evaluating four interrelated factors). Copyright law is relevant to each of the stakeholders in scientific publication.

It will be some time before copyright statutory developments and case law provide consistent and reasonably clear guidance to the electronic publishing scientific community. The rapidity and ease with which electronic publications can be created, distributed, reproduced and altered in the information age also challenges the traditional balance between public and private rights. They may implicate certain copyright exceptions, such as the fair use doctrine, which have played an important role in scientific and scholarly communications. The legal infrastructure emerging from the computing and telecommunications revolution creates uncertainty for scientists and other stakeholders.

Creators

Copyright law in the United States requires three basic elements for protection: originality, creativity and fixation. Copyright protection requires fixation in a tangible medium, which includes traditional paper and digital media. Case law establishes that fixation may occur whenever a computer program is stored in a computer's Random Access Memory (RAM), as well as on a computer's hard drive for a period of more than transitory duration.[30] Originality requires independent development and a minimum level of creativity. Protection is limited to expression, however, and does not extend to the underlying ideas, or to expression necessary to an idea. Since copyright, unlike patent law, does not protect the utilitarian features of a work, the threshold for originality has historically been low.

That does not mean, however, that the legal standards for originality are easily understood as we move into an electronic environment. For example, a list of hyperlinks may constitute an original copyrightable work.[31] Although alphabetical listings of names in a telephone directory has been held not to be original or creative (*Feist Publications, Inc. v. Rural Tel. Serv. Co.*, 499 U.S. 340, 348-51, (1991); see http://laws.findlaw.com/us/499/340.html.), the courts have said that the selection and arrangement of a factual compilation may be original. Thus, even if a list itself is not

[29] Dan Carnevale, "Supreme Court will Hear Copyright Case Affecting Online Resources," *The Chronicle of Higher Education*, February 20, 2002; see http://chronicle.com/free/2002/02/2002022002t.htm. The case is *Eldred v. Ashcroft*.

[30] *MAI Systems Corp. v. Peak Computer Inc*., 991 F.2d 511 (9th Cir. 1993); see http://www.law.cornell.edu/copyright/cases/991_F2d_511.htm. This unauthorized viewing of a copyright document on a computer screen involves making a "copy," and arguably infringing the copyright.

[31] Under United States copyright law, certain hypertext links to a published work may be viewed as citations, and to place such a link in a compilation would generally not require permission. However, at least one case has held that a citation to an infringing site created liability for contributory copyright infringement. See *Intellectual Reserve v. Utah Lighthouse Ministries*, 75 F. Supp. 2d (1999). For a more recent dispute involving links to an alleged infringement of copyrighted material, see David F. Gallagher, "Google Runs Into Copyright Dispute," *New York Times*, April 22, 2002; see http://query.nytimes.com/search/abstract?res=F00814F63B5B0C718EDDAD0894DA404482.

considered creative or original, at some point it is possible that citations and a sequence of linkages may become an integral part of a copyrightable creation. In a constantly evolving world, made possible by electronic publishing technology, it becomes a challenge to determine which is "the work" for copyright purposes.[32]

Most scientists want to communicate their thoughts and results to others, and want to have them recognized, understood, discussed, refined, and then used by their peers to promote the progress of science. It is worth emphasizing that, subject to any contractual agreements with their employers and the work for hire doctrine, scientists, as the originators of the work product, hold copyright of their work unless they assign it to others. Routine assignment by authors of their copyright has been the norm in their relationship with publishers in a world bound by paper. This has led to the contention that publishers are using copyright law more to protect their economic interests than the rights of authors.[33]

It would, however, be unfair to assert that all publishers seek only to exploit the scientific community for economic gain. A significant number of learned and professional society publishers are cooperative ventures designed to promote the dissemination of information to the scientific community and the public they serve. Commercial publishing practices are not, *ipso facto*, exploitative. Often such publishers have been the best means to bring credible and high quality scientific information to the public and to conserve the community's access to archival literature; they are often the only means by which reprints or specialized collections may be made available. Nevertheless, it would certainly be naive to believe that any publisher (whether learned society or commercial for-profit company) would continue in business without the ability to recoup costs (whether through fees, sales or subsidies) or reap a profit. Realistically, both commercial and not-for-profit publishers must act to ensure their own economic viability. In doing so, however, this sometimes means restricting authors' rights and in some cases exercising a monopoly over significant portions of scientific literature. This has troubling implications for the flow of scientific information, although there has been some development of alternative journals by professional communities to soften the impact of these commercial practices.[34]

The work-for-hire doctrine under the Copyright Act provides that works created by employees acting within the scope of their employment belong to their employers.[35] In theory, where professors are considered employees of universities in accordance with any applicable policies and procedures, a work created within the scope of their employment would usually belong to the respective university as work made for hire. Courts, however, have created a "teacher exception" to the work-for-hire doctrine, allowing professors to own copyright in their works (see *Hays v. Sony Corp. of America*,

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[32] Margaret Chon, "New Wine Bursting from Old Bottles: Collaborative Internet Art, Joint Works, and Entrepreneurship," *Oregon Law Review*, 75 (1996), p. 257.

[33] Denise K. Magner, "Seeking a Radical Change in the Role of Publishing," *The Chronicle of Higher Education*, June 16, 2000, pp. A16-17.

[34] See, for example, the Scholarly Publishing and Academic Resources Coalition (SPARC) at http://www.arl.org/sparc/. Also, BioMedCentral has announced plans to launch the *Journal of Biology*, which will offer free access to its contents immediately upon publication online. Authors will retain the copyright for their work. Kendra Mayfield, "A Challenge to *Science* and *Nature*," *Wired News*, May 31, 2002; see http://www.wired.com/news/business/0,1367,52632,00.html.

[35] This statutory principle is discussed in the Supreme Court case, *Community for Creative Non-Violence v. Reid*, 490 U.S. 730 (1989); see http://caselaw.lp.findlaw.com/scripts/getcase.pl?navby=search&court=US&case=/us/490/730.html

847 F.2d 412 (7th Cir. 1988)). Thus, universities typically do not claim rights in traditional literary work, fixed in a form of articles or books, although some universities have policies that specify university ownership of copyright in computer programs and other types of works.

Users

A major issue for users of published scientific research is what the user may do with the information or materials obtained in an e-publishing environment. As noted below, this issue is also a concern to libraries and repositories.

Under the Copyright Act, photocopying or otherwise reproducing copyrighted works without authorization may violate the exclusive rights of the copyright holder. On the one hand, online technology has made it easy and inexpensive to copy copyrighted works, benefiting users while ostensibly depriving authors and publishers of revenue. Yet, on the other hand, the technological capability to control online access permits online publishers to prevent unauthorized use. Absent a legal defense (i.e., fair use or first sale), even an innocent viewer may be held liable for infringement arising from the broad interpretation of what constitutes the making of a "copy."[36, 37]

There have been two cases where preparation by a photocopy shop of a photocopied "course pack" was held to be copyright infringement: *Basic Books, Inc. v. Kinko's Graphics Corp.*, 89 Civ. 2807 (CBM) Southern Dist. of New York (1991); *Princeton University Press v. Michigan Document Services, Inc*. 99 F.3d 1381 (6th Cir. 1996). see http://laws.findlaw.com/6th/960357p.html; cert. denied, 520 U.S. 1156 (1997). The rationale of these decisions would most likely extend to digital copying. There is also a case, *American Geophysical Union v. Texaco, Inc*. 60 F.3d 913 (2nd Cir. 1995). see http://www.arl.org/info/frn/copy/texaco.html), which held that corporate copying of a small number of scientific and medical journals is not fair use under United States copyright law, because the systematic and archival copying of the journal articles had an adverse impact on the publisher's market. In such cases, one might address the issue by having scientists or their sponsoring institutions contract for licenses from institutions such as the Copyright Clearance Center (http://www.copyright.com/). That would allow an institution to reproduce copyrighted works under negotiated or stipulated fee arrangements, with no claim to fair use being made. This is not an impossible arrangement, but is one that would often be time-consuming and inefficient.

In the current environment, institutional site licenses to university, government and corporate journal subscribers provide broad access for researchers and students, usually in the form of printable, down-loadable files. In the context of such site licenses, the doctrine of fair use has little or no meaning to users, having been replaced as a matter of contract by the licenses' terms of use. In practice, these terms may be more or less restrictive than interpretations of fair use. Publishers typically negotiate such license

[36] Ira L. Brandriss, "Writing in Frost on a Window Pane: E-Mail and Chatting on RAM and Copyright Fixation," *Journal of the Copyright Society of the U.S.A.*, 43 (Spring 1996), p. 237.

[37] In a report released in August 2001, the U.S. Register of Copyrights submitted a report to Congress observing that the "ultimate product of one of these digital transmissions is a new copy in the possession of a new person…. The recipient obtains a new copy, not the same one with which the sender began." The Register concluded that "when the owner of a lawful copy of a copyrighted work digitally transmits that work in a way that exercises the reproduction right without authorization, section 109 [of the Copyright Act] does not provide a defense to infringement." See http://www.loc.gov/copyright/reports/studies/dmca/dmca_study.html.

agreements with colleges and universities, state university systems, regional library consortia, and, in some cases, with agencies that represent all of the academic and research institutions in a country. These licenses generally authorize access and copying that would otherwise constitute copyright infringement.

Users' rights are potentially affected more significantly by proposed database protection legislation or by contractual restrictions under the Uniform Computer Information Transactions Act (UCITA), or other state law. These measures could be interpreted to permit greater restrictions on subsequent uses of publications and the data in them than would be permitted under copyright or other law, subject, of course, to federal copyright law preemption, where appropriate. However, the scope of both enacted and proposed legislation of this kind has not been tested in court, nor is it clear to what extent publishers will adopt such restrictions, even if legally authorized.

Nowhere is the tension between scientist's need for open communication and the proprietary interests of information providers more evident than in the on-going debate over scientific databases. Scientists are both users and producers of databases. In the context of global research, much of the knowledge produced by scientists is collected and distributed through databases, and access to the data they hold is critical to the advancement of science.[38] Copyright law, while protecting original selection, sequence and arrangement, has treated data as unoriginal and, thus, unprotectable. However, as technology has led to greater capability to amass, retrieve, transmit, and use data, and the data's corresponding economic and potential commercial value has grown, the demand for legal protection of data has also grown.

The European Union (EU) responded to these issues by passing legislation in 1996 creating a *sui generis* form of intellectual property to protect database rights. In response to the EU Directive on the Legal Protection of Databases (http://www.jus.uio.no/lm/wipo.copyright.treaty.1996/doc.html), a "Draft Treaty on Intellectual Property in Respect of Databases" was proposed for consideration at the December 1996 Diplomatic Conference convened by the World Intellectual Property Organization (WIPO). It was ultimately tabled without formal action taken. The draft was opposed vigorously by the American scientific community, whose concerns were explained in an October 9, 1996 letter (http://www.nas.edu/cpsma/kantor.pdf) from the presidents of the National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine to the then Secretary of Commerce, Mickey Kantor. The letter argued that the regime proposed "would seriously undermine the ability of researchers and educators to access and use scientific data, and would have a deleterious long-term impact on our nation's research capabilities." Subsequently, the Committee on Data for Science and Technology (CODATA) of the International Council for Science issued a statement expressing its concern with efforts to introduce new forms of database protection that could hamper scientific progress.[39]

Proponents argue that database protection laws are needed in this new age of information and digital communication to provide incentives and protect those who invest in the effort to collect and maintain these databases. Even if there is a need for database protection, however, opponents of this legislation argue that the monopolistic

[38] Lila Guterman, "Learning to Swim in the Rising Tide of Scientific Data," *The Chronicle of Higher Education*, June 29, 2001; see http://chronicle.com/weekly/v47/i42/42a01401.htm.

[39] ICS/CODATA Ad hoc Group on Data and Information, "Access to Databases: Principles for Science in the Internet Era," November 30, 2000; http://www.codata.org/data_access/principles.html .

protections in United States and international proposals go far beyond what is necessary, and that restrictions on access and use of factual data from pre-existing works would severely discourage innovation and impede the advancement of science.[40] At this time, the debates continue in the United States, with legislation having been considered by the United States Congress in recent years, but not enacted.

Publishers

Currently, case law is in conflict over the extent to which providers of information in electronic form can restrict copying and other uses of published information through contractual limitations that would otherwise be permissible under existing law. For example, one federal appellate court has upheld the restrictions contained in a "shrink-wrap" license, which prohibited the purchaser of a CD-ROM containing a national telephone directory from copying the list to sell it in competition with the publisher. *ProCD, Inc. v. Zeidenberg*, 86 F. 3d 1447 (7th Cir. 1996). see http://laws.findlaw.com/7th/961139.html). Although the court held that copyright law did not protect the telephone listings, it concluded that the contractual limitation was valid, and that the purchaser of the CD-ROM who made the directory information available on the Internet could be held liable. Over the years, courts increasingly confronted with digital innovation and the ability to download information disembodied from any physical or tangible medium have begun to embrace "click-wrap" licenses as enforceable as well.[41]

At the time this report was prepared, two states, Virginia and Maryland, had adopted versions of the Uniform Computer Information Transactions Act ("UCITA"), which affirms and expands the rights of providers to impose contractual restrictions on the use of information provided in digital form. UCITA is controversial for a number of reasons, including the breadth of rights afforded to information providers who market their services to the public. Under UCITA, providers have broad rights to impose a variety of restrictions and limitations to which the consumer must assent in order to access the information. Some critics have suggested that UCITA may be limited by traditional federal copyright doctrines such as fair use, which generally deny protection to published factual material.[42] However, the validity and reach of UCITA are untested. The drafters' notes of the Act refers to the right of information providers to contract for limitations on the recipient's use of information, even where the information is widely disseminated. These limitations might include restrictions on further dissemination of factual information obtained from electronic media, prohibitions on reverse engineering of software, and even the imposition of royalties or similar financial requirements where the information obtained is applied to commercial or profit-motivated activities.

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[40] Committee for a Study on Promoting Access to Scientific and Technical Data for the Public Interest, National Research Council, *A Question of Balance: Private Rights and the Public Interest in Scientific and Technical Databases* (Washington, D.C.: National Academy Press, 1999).

[41] See, e.g., *i.Lan Systems, Inc. v. NetScout Service Level Corp.* (D.Mass., No. 00-11489-WBY, 1/2/2002). Unlike shrink-wrap licenses, which presume a tangible or physical element to the consummation of a license and sale transaction (i.e., customer purchases a diskette or CD-ROM with programs) with the license terms packaged with, in or on the materials the customer obtains, a "click-wrap" license refers to the situation in which the customer merely signifies assent to license terms with a "mouse-click" transmitting that assent to the licensor, who ostensibly then authorizes the downloading, access and/or use of the programs or materials being licensed.

[42] Mark K. Anderson, "Now, UCITA…Later, You Don't," *The Industry Standard*, March 3, 2000; see http://www.thestandard.com/article/0,1902,12615,00.html .

Another major issue with respect to copyright in individual paper-based articles is whether publishers may republish those articles in electronic media. In *Tasini v. New York Times Co.,*[43] six freelance writers sold articles to major print publications, which then sold the contents of their publications to electronic publishers for inclusion in electronic databases and CD-ROMs. The Copyright Act of 1976 allows a publisher to reproduce and redistribute works as part of "that particular collective work, any revision of that collective work, and any later collective work in the same series." 17 U.S.C. § 201(c). The issue in an electronic context is whether online versions fall within the legal definition of a "revision" or, as the authors claimed, are derivative works, for which separate consent must be obtained. The United States Court of Appeals reversed the trial court's decision. It held that the publisher cannot grant rights to an aggregator to redistribute the articles without the author's permission, and that, by agreeing to have their articles published in the periodicals, the authors had not given up their electronic or database reprint rights.

The case was appealed to the Supreme Court and decided on June 25, 2001, when the Court upheld the Court of Appeals by a 7-2 vote. The Court held that publishers were not sheltered by 17 U.S.C. § 201(c) of the Copyright Act when they reproduced and distributed an electronic version of a print article under an existing licensing agreement with the writers, and that including those articles in electronic databases infringed the copyright held by contributing freelance authors. During oral argument, the publishers contended that the Court of Appeals' decision leaves them with the untenable choice of tracking down decades' worth of free-lance authors in order to obtain retroactive republication rights or, alternatively, destroying vast electronic archives of existing articles, thereby depriving scholars of access to vast amounts of historical information.[44] Lawyers for Tasini and the other freelance authors focused less on the impact to scholarly research and more on the issue of whether the authors' rights had been violated under current copyright law. Since the Supreme Court ruling, publishers must obtain express releases to publish works in electronic databases. Otherwise, they must eliminate earlier print works from electronic databases. Unfortunately, this appears to be occurring, as some publishers have responded to the Court's decision "by purging freelance articles – sometimes entire newspaper archives – from online databases."[45] What impact this case will ultimately have on scientists' access to prior scholarly work remains to be determined. Nevertheless, the case demonstrates how the law shaped in venues outside science could affect the ability of scientists to pursue their research.

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[43] 972 F. Supp. 804 (S.D.N.Y. 1997); http://www.nwu.org/tvt/tvtrule.htm, recon. denied, 981 F. Supp. 841 (S.D.N.Y., 1997), and reversed 206F.3d 161 (2nd Cir. 2000); see http://laws.findlaw.com/2nd/979181.html, affirmed, 121 S.CT. 2381 (2001); see http://supct.law.cornell.edu/supct/pdf/00-201P.ZO.

[44] In an *amicus* brief filed in the case, however, the American Library Association and the Association of Research Libraries argued that the extent to which electronic archives and databases have replaced physical libraries has been greatly exaggerated, and the consequences of removing content from them vastly overstated. They also noted, as did the Supreme Court, that at least retrospectively, publishers did not need to track down every freelance author or remove all freelance materials form their databases. There may be other options, such as those used for blanket licensing of music for broadcasting. See http://www.arl.org/info/frn/copy/tasini.html.

[45] Scott Carlson, "Once-Trustworthy Newspaper Databases Have Become Unreliable and Frustrating," *The Chronicle of Higher Education*, January 25, 2002; see http://chronicle.com/free/v48/i20/20a02901.htm

Conservators

Science as a social phenomenon is a process of aggregation, interaction and evolution, dependent on the contributions of many individuals and institutions. A strict intellectual property regime may not offer the flexibility required to maximize the interaction and exchange among scientists necessary to realize the full potential of new electronic technologies. In a digital environment, the role of conservators is changing from maintenance of archival stacks and the provision of traditional paper-based services to that of facilitator for scientific community access. This will require libraries to work with publishers to develop a scheme for managing access. Such management will be highly complex, because institutional networks interconnect desktop resources in the hands of individuals to the information resources contracted by the institution. Indeed, some of the very assessments and discussions in this report are based on technology (the World Wide Web, hypertext links, communications capabilities, even personal computers and wireless portable devices) that did not exist a mere twenty years ago and may well be revolutionized again in the next twenty years or sooner, by innovations not yet imagined.

The recently enacted Digital Millennium Copyright Act ("DMCA"),[46] intended to bring copyright into the digital age, raises numerous legal issues for conservators. For example, there are new rules prohibiting the circumvention of technology designed to control access to protected works with severe penalties to deter hackers or pirates from overriding the protective technology. This prohibition was created to protect electronically distributed works from unauthorized access, reproduction, distribution or modification, and encourage publishers to distribute digital works in encrypted form. Thus, it is likely that more and more works will soon be offered with license terms and royalty or other payments enforced by technical controls, limiting access and use.

Because of a concern that access control measures would diminish the ability of users to make lawful copies, the DMCA gives the Library of Congress, acting through its copyright office, authority to exempt the application of the anti-circumvention rules to users of certain classes of works, if such persons are "adversely affected by virtue of such a prohibition in their ability to make non infringing uses." The Copyright Office issued a rule that took effect on October 28, 2000, and that will remain in effect until October 28, 2003 (http://www.loc.gov/copyright/fedreg/65fr64555.html), designating classes of copyrighted works that are exempt. They are: (1) compilations consisting of lists of web sites blocked by filtering software applications (exemption is based on the notion that measures that control access to lists of blocked sites would hinder criticism, commentary and news reporting, by preventing those who wish to comment from accessing lists of sites blocked by filtering software applications); and (2) literary works, including computer programs and databases, protected by access control mechanisms that fail to permit access because of malfunction, damage or obsolescence (exemption created in response to concerns by the library and educational communities that access controls would limit ability to archive and preserve works unavailable due to malfunctioning or obsolete access controls).

Scientists, educators, librarians, and archivists were hoping for a significantly broader interpretation of the new law, and warned that technological protection measures could prevent legitimate uses of information by using technologies that would control use

[46]Pub. Law No. 105-304, 112 Stat. 2860 (October 28, 1998); see http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=1998_register&docid=98-30563-filed

by controlling access. In an assessment of the Act released in August 2001, the Library of Congress concluded that there was a lack of hard evidence that educators and scholars have been harmed by the ban.[47] Advocates of the narrow rulemaking claim that the ruling reinforces the principle that anyone wishing to make "fair use" of a copyrighted work can subscribe, can buy or rent a copy, or can simply borrow a copy from an archival library – much as they would in a non-digital environment. While this notion of "status quo" may have some appeal, it may make little sense in a world in which libraries and archives are increasingly non-paper based. It can be argued that the ability of scientists, educators and scholars to "borrow" a copy is being eliminated in a paperless world, and that the only way to gain access to works is to pay a royalty or subscription fee, vitiating fair use and potentially causing a long-term chilling affect on access to information for scholarly research and commentary and for educational uses. It cannot be overemphasized that "publishing" has become an integral part of the open scientific dialog, and any infringement on "publication rights" must be carefully assessed for a potentially restrictive effect on scientific exchange. Thus, it is critically important for the legal system (the courts and legislatures) to understand the context and the implications for the scientific community of various technical protection schemes that restrict access to content, whether in databases or other compendia.[48]

Under the Copyright Act of 1976, conservators had certain limited rights to copy and distribute copyrighted works. However, with advances in digital technology, the law has become outdated. The DMCA made changes that certainly make archival functions easier in this age of digital information. Where previously a conservator could only make one copy of a work in facsimile form, the DMCA permits three copies, including copies using digital technology, one for archives, one for use (access), and a third as a master copy. Even where copying is permitted (e.g., Section 107 or 108 of the Copyright Act), conservators still cannot distribute digital copies, nor make a digital copy publicly available outside the physical library facility itself – only a facsimile or printed copy of the work is permitted for these purposes. The DMCA also further expands the prior right of conservators to make a copy in certain cases of damage, loss or deterioration in situations where the format has become obsolete, as when the equipment or software of the original format is no longer made or obtainable at a reasonable price.

Assessing the Current Scene

In assessing how the existing legal regime in the United States affects scientific publishing in the digital age, the AAAS project made the following observations:

- Technological changes, considered without reference to legal constraints, now make it possible to publish scientific works rapidly and relatively inexpensively, whether to select or vast audiences. Costs associated with research can be reduced with increased

[47] See http://www.loc.gov/copyright/reports/studies/dmca/dmca_study.html. The constitutionality of the DMCA was challenged by a lawsuit that argued that a professor's academic freedom was violated by attempts to apply the Act's anti-circumvention provision to scholarly research. The suit has since been dropped. Lisa M. Bowman, "Free-Speech Lawsuit Changes Ahead," *C NET News.com*, July 19, 2001; see http://news.cnet.com/news/0-1005-200-6616457.htm.

[48] The first criminal trial under the DMCA is scheduled to begin August 26, 2002 in California. A company based in Russia is accused of selling a program that permits users to circumvent copyright protections on software produced by Adobe Systems, Inc. The case is *U.S. v. ElcomSoft and Dmitry Sklyarov*; see http://www.siliconvalley.com/mld/siliconvalley/3303774.htm.

efficiency in finding, retrieving and using prior knowledge.[49] The potential social benefits that will be realized by enabling results of scientific inquiry to reach the public, as well as peers, rapidly and cost-effectively, cannot be overemphasized. While protections must be established to ensure that quality is not sacrificed for the sake of speed or cost, more robust communication and information exchange should lead to improved scientific research. Furthermore, the ability to speed research results into useful and productive applications, whether in a laboratory, hospital, a courtroom, or elsewhere, will have enormous consequences for social progress.

- Existing copyright law governing distribution of scientific research is elaborate and well established, but may become increasingly difficult to apply because of technological advances in methods of structuring, managing, processing, and providing access to information in various digital formats. The present copyright framework's emphasis on protecting ownership rights may not always be consistent with the desire to use the new technologies to maximize the broad, inexpensive availability of scientific works for the benefit of the larger society.

- A just system of laws requires that the public perceive them as fair; that sense of fairness in turn generates support for the restrictions imposed by the law. Intellectual property laws, which grant a government-sanctioned monopoly for a period of time, require that a sense of fairness and the need to support a monopoly be both clear and compelling. Indeed, the Constitutional mandate and authority for the enactment of such laws stems from a sense of social purpose and ultimate public good. The existing legal framework is coming under some criticism because it is perceived as potentially impairing the social utility of new technologies in a number of areas, including the area of immediate interest in this project, electronic publishing of scientific research. This view is reinforced by the increasing use of digital technologies by copyright holders to control how their product is used.[50] Over the long term, copyright law will have to be adapted in light of new technological developments to meet society's need for access to information. In the meantime, we expect to see an increase in this social pressure to ease restrictions on the rapid and broad dissemination of scientific information, its accumulation in databases, and the linking of electronic accounts of scientific research. Recent developments involving Internet interests, such as the disputes over the legality of open file sharing (e.g., Napster and MP3, in the music arena), and constitutional questions raised about the Digital Millennium Copyright Act, illustrate this trend. These disputes and those involved in the new initiatives in scientific publishing described earlier in this report reflect efforts to alter the current balance of economic interests expressed in, and protected by, current copyright law. The impact of patent law may also require reevaluation in light of the interplay between copyright and patent in the creation and dissemination of new digital forms of expression.

- The conservation of scientific analyses and findings is vitally important, and both complex and difficult in the digital age. It will not only be conservation in the traditional sense, but also will require ensuring future access to broadly distributed knowledge sources from publishers' and governmental archives to any scientist's desktop computer or wireless computer devices. Whoever takes on the task of managing and migrating

[49] A study underway within the discipline of astronomy indicates a substantial reduction in the time it takes to search the literature for relevant materials. Peter Boyce, personal communication, April 1, 2002.
[50] John Borland, "Lawmaker: Is Copy Protection Wrong?," *ZDNET News*, March 13, 2002; see http://zdnet.com.com/2100-1106-859089.html.

electronic publications, whether it be a library, an independent archive established to serve a specific discipline, or a publisher of scientific works, will need authority (not necessarily on an exclusive basis) to make technical changes, to add appropriate links, and to "republish" the works in new formats to make possible their continuing availability to the scholarly community. Consistent with our recommendation (see below), this authority should be granted through licensing by those holding copyright in order to facilitate long-term access to scientific works. These are expensive activities. Adequate financial resources will need to be found in order to ensure the proper conservation of scientific knowledge.

- The present framework of copyright laws includes a number of international compacts. While these treaties can be changed, an international consensus for change is not now a political reality, and is unlikely to become one until new patterns of electronic publishing are in place.
- Significant changes in domestic copyright usually take many years. Certainly, Internet developments such as the Napster and Digital Millennium Copyright Act disputes are harbingers of political and social battles to come. The combatants are unlikely to view copyright issues of electronic publishing in the sciences as isolated, conceptually or practically, from copyright issues dealing with the distribution of entertainment, the creation and use of non-scientific databases, or the fair-use access claims of librarians, educators and scholars in disciplines other than science.[51] In the arena of scientific publishing, change will also come slowly, as scientific publishers continue to rely on the protection of the present copyright regime to sustain their revenues or to recover their costs. Consequently, any proposals for electronic publishing in the sciences that require changing United States copyright law are unlikely to be successful in the near term (whether or not they have a realistic potential for success eventually).

Recommendation: Create New Patterns of Licensing to Expand Access to Scientific Information

Under the circumstances just described and to reaffirm scientists' control of their work, we recommend changing the patterns of current licensing practices for electronic publishing in order to encourage widespread access to a broad range of scientific works, including traditional research publications and databases. We believe it is essential for scientists, who create and are the principal users of scientific information, to increase their control over its dissemination and access. It is important for scientists to remember that they (or their employer where "work for hire" applies), as creators of a work, initially own the copyright, i.e., the "bundle" of exclusive rights from the time an original work of authorship is created. That being said, scientists, as authors, should strive to use the leverage of their ownership of the bundle of copyright rights, whether or not they transfer copyright, to secure licensing terms that promote as much as possible ready access to and use of their published work. This approach is wholly consistent with existing United

[51] At the moment, it appears that the entertainment industry, more than any other interest, is affecting copyright law in ways that rub up against the values that would maximize access to scientific data. See Litman, *op. cit.*, note 27, and Stephen H. Wildstrom, " Fair Use is Getting Unfair Treatment," *BusinessWeek Online*, May 14, 2002; see http://www.businessweek.com/technology/content/may2002/tc20020514_1528.htm

States and international copyright law, building on the rights accorded to scientists as authors under copyright law. The change we are recommending can be readily done in the context of the broader political and economic forces likely to challenge attempts to alter current copyright law.

The key to success of this scheme will be its widespread adoption by stakeholders in the chain of scientific publishing. Keeping in mind that the scientific publishing community includes a range of stakeholders – creators, publishers, conservators, and users – who not infrequently assume multiple, overlapping roles in the creation, distribution, and preservation of scientific knowledge, it will be in the interests of all the participating parties to consider alternative ways to increase access to such knowledge. In some cases, the publisher would be granted copyright by the work's author and license back certain rights to the author. In other cases, the creator of the information, instead of assigning all the rights associated with copyright to a publisher, may retain most rights to use and distribute the work while granting the publisher a non-exclusive license to reproduce, distribute, and, where dissemination on the Internet is also desired, to perform and/or display the work publicly. In either case, the licenses should support the core values we identify as central to a system of electronic publishing. This in turn will promote broad access to high quality scientific information and help ensure future availability of the work. (See the Guidelines below for further details.)

Scientists and publishers amenable to this recommendation can build on current efforts to develop effective licensing models. We see no need to recommend a particular model, and do not want to tie the acceptability of our approach to any one form of license. Indeed, there may be several approaches to licensing that would advance quality research and publication, broad and timely access, and durable and accessible archives of the scientific literature. Hence, we agree with the recommendation that emerged from the Second ICSU-UNESCO International Conference on "Electronic Publishing in Science," February 20 – 23, 2001, that "At this stage in the evolution of electronic publishing, serious experimentation is needed. Models should be developed that allow for the continued expansion and enhancement of scholarly communication" (see http://associnst.ox.ac.uk/~icsuinfo/recom01.htm). In support of such experimentation, we identify an array of existing licenses in Appendix C that can be used as reference points by individuals, professional societies, and others in drafting appropriate licenses.[52]

There is the traditional license, in which the author transfers the copyright to the publisher, sometimes retaining the ability, either specifically stated or by implication, to retain other rights such as patent rights; the right to use and adapt their own work, or parts of it; to create future derivative works of their own; and to use their work for their classroom teaching needs. There is also the license specifying that authors retains the right to use their work for non-commercial purposes. A quite different approach is for the author to retain the copyright and give the publisher a time-bound exclusive license to use the work for commercial publication in a specifically identified form of expression.

In actual practice, some associations continue to seek transfer of copyright to the publisher, with the author being granted back via license the right to use and distribute the work in defined ways. Some commercial publishers, such as Elsevier Science, are

[52] During the preparation of this report, a new venture in support of expanding the public domain of intellectual works was launched *Creative Commons* will make available on the Web to creators/authors intellectual property licenses and other tools that they can download free of charge and adapt to define the terms of acceptable uses of their works; see http://www.creativecommons.org.

slowly beginning to move in that direction. The Association of Learned and Professional Society Publishers in England has designed a license that leaves copyright with authors but includes terms that preclude authors from selling their work (or even giving it away) "in ways which would conflict directly with the publisher's commercial interests." The right to post articles on the Web site of the author or institution is clearly spelled out (see http://www.alpsp.org.uk). The *Internet Journal of Chemistry* (http://www.ijc.com/), a new electronic-only journal, also leaves the copyright with the author.

Licensing should be viewed as a means for facilitating the publication of high quality research with long-term accessibility achieved through archiving. This is not inevitable, however. Parties to licensing are not obligated to incorporate measures promoting broad public access into their agreements, and agreements that grant access to some, but constrain sharing with others, could be contrary to the goal of increasing the availability and use of information for society's ultimate benefit. For these reasons, it will be important to track the implementation of various licensing agreements over time to determine their impact on access, and to identify those that exemplify good practices in scientific publishing. We are under no illusion that the changes we propose will evolve without growing pains. But we believe this endeavor will be worthwhile if it reinforces similar efforts underway, both inside and outside science, and motivates scientists to consider alternatives to the "old ways" of dealing with publishers.

In advocating creative and expanded use of licensing, we recognize it is not possible to predict how stakeholders will be affected by future change in technology or copyright law. It would not be particularly productive, therefore, to try now to develop "model provisions" that would meet future, unpredictable contingencies. So, while not intended as legal advice to readers of this report, we have included samples of copyright licensing agreements in Appendix C to provide some idea of how others have approached the licensing of their work with a publisher. We urge scientists to consider more generally the following guidelines in developing licensing agreements.

Guidelines for Licensing Agreements Related to Electronic Journal Publishing in the Sciences

Within the rights granted under copyright law and any amending legislation:

- author-publisher license agreements should actively foster the public interest in promoting access to and broad use of scientific information. These terms should embody the core values of scientific publishing identified earlier in the report (see Table 1).
- although it is impossible to know with certainty what added value arrangements will be feasible and desirable in the future, authors should consider carefully the willingness and capabilities of a publisher to furnish future enhancements to their work when deciding whether to transfer all or some of their bundle of copyright rights. They should seek licenses that demonstrate a commitment to adding value and, in the process, to stimulating innovation in publishing that benefits science. We believe that all stakeholders ultimately benefit from a consistent level of high quality information that is accessible in a reasonable, generally accepted framework of rights and obligations.
- licensing agreements should define the rights and obligations of the parties and of third-party users. Particularly important are the following provisions:

- authors should receive proper attribution whenever their work is reproduced or redistributed, in part or in whole. Absent any pre-existing restrictions, authors should also be able to use their work at no or nominal cost in ways that maximize access to it by others for educational and research purposes. Authors' rights to use their own work should persist at least as long as the term of copyright, and their use should not be defined in terms of the technological capabilities of any given time.
- those with the rights to reproduce, distribute, and, where appropriate, perform or display an author's work should be able to sell the fixation of the work in a form acceptable to the author or otherwise make the work available to others, and receive a reasonable return on their investment in adding value to the original work; to have the original publication properly acknowledged by the author and other users; to keep it technologically current; to include the work in any future collections or database that it produces; and to pursue on a non-exclusive basis any other uses of the work in all media as long as the author has agreed to allow any such activities.
- users covered by a license agreement should be permitted to read, display, download and print materials. Users should also be allowed to distribute materials to others at no charge where such distribution constitutes fair use, and otherwise at a nominal charge. Users not covered by the license should have to access to materials on terms compatible with copyright law, including fair use. Encryption and other similar technologies should be managed in ways that do not frustrate the access described here.
- license agreements should allow affordable, long-term access to the work, including provisions for preservation, whether by the publisher, libraries, or some other third party. Conservators should be licensed by copyright holders to obtain and make copies of published electronic works in order to ensure their continuing availability to the research community. Conservator activities must not interfere with the ability of publishers, during a clearly defined period of time, to earn a reasonable return on their investment in adding value to the original work.

Authors and Publishers Working Together

Computer technology is giving authors and publishers many additional, highly efficient means to furnish or gain access to scientific work. The proposed licensing regime can foster increased reliance on these means, as they exist today and as they will evolve, to facilitate the sharing of new knowledge. Ideally, scientific works should be produced to maximize information retrieval, linked, annotated, and included in databases. New information technologies can help establish and manage "knowledge environments" using linking, database, and advanced search technologies, making it easier for scientists to learn about research that is relevant to their particular interests, and to cull that research from the vast quantities of scientific data and analysis that accumulate daily. Information technology can also be used to speed the traditional work of editors and peer reviewers to make version control and the attribution of authorship more consistent and secure.

Many publishers will wish to work with authors to develop licenses consistent with the proposed guidelines. When scientists are unable to find publishers willing or able to do so, they should consider establishing consortia, perhaps managed by distinct or

interrelated intellectual communities of science, to foster publishing practices that strongly advance the public interest in science.

These efforts will undoubtedly involve significant costs for existing publishers and for new organizations. In the latter case, for example, support will be needed to create the peer-review and curatorial infrastructure for sites that will deliver the added value we have described and the pattern of licensing we are proposing. The principle that it is in the public interest for government to support research is well established in the United States and many other countries. Publication is integral to the research process; there can be no advances in science without publication, whatever form it might take. Hence, the federal government, as a major supporter of basic research, should use its competitive grant system to fund experiments intended to bolster alternative models of licensing and publication, and should consider adopting guidelines for grantees that reflect the core values that we identified earlier. The goal is to promote wide access to and preservation of scientific information in cost-effective ways.

Pursuing Changes in Copyright Law

There are compelling arguments to support the view that society will benefit from a realignment of the copyright law to take advantage of technological changes for the good of society. After all, the Constitution explicitly premises Congress's power to grant copyrights and patents for limited periods on the conviction that to do so benefits society as a whole. Copyright and patent decisions of the United States Supreme Court explicitly and consistently reaffirm this rationale, and Congress has normally been guided by it.

Over the long term, there may be great benefit to society in restructuring intellectual property law so that works of authorship are more widely available. But we believe it is premature to recommend such legislation now – both the law and the technology are in considerable flux, and the scientific community is experimenting with a range of models and mechanisms for disseminating digital information. The emergence of new norms of copyright licensing in scientific publishing will gradually create a foundation for change, but this process will take time. Hence, we agree with a recent recommendation by a committee of the National Research Council [53] that "Legislators should not contemplate an overhaul of intellectual property laws and public policy at this time, to permit the evolutionary process" more time to determine what works and what does not. The debate on these issues should be deliberate and well informed; it is likely to be long and contentious. It must benefit from widespread participation and the contributions of a range of interests.

However one views the political possibilities of this kind of legislative initiative – recognizing that it is very much a long-term commitment – there can be an independent push in the scientific community to initiate new models of author-publisher relationships using the licensing approach we propose. In fact, the movement toward more open licensing as a publishing norm can proceed quite well under current intellectual property law and does not preclude either wholesale or piecemeal modification to such laws over time to correct abuses that arise, to refine existing law when agreements are generally accepted, or to allow for differing treatments of electronic and paper-based publication.

[53] Committee on Intellectual Property Rights and the Emerging Information Infrastructure, National Research Council, *The Digital Dilemma: Intellectual Property in the Information Age* (Washington, DC: National Academy Press, 2000), p.16.

This is true both domestically and internationally.[54]

Conclusion

The laws that protect intellectual property underlie most issues that affect each of the stakeholders in the chain of scientific publishing. Copyright laws today evolved in a technological environment spawned by copying that primarily occurred in tangible form. Technology has now made widespread access and dissemination of protected works in digital form, without the need for fixation on paper, a reality. Scientists and scientific publishers have an opportunity now to take a leading role in the creative use of licensing or copyright transfer to build a new publishing system, operating within existing copyright law, that will embody the core values of science that should shape scientific publishing (see Table 1). Our proposal recommends flexible measures adaptable to rapid technological change. Parties can negotiate legally enforceable copyright license terms germane to their particular situations, while not precluding dialogue on avenues for long-term change in copyright law. We believe this transactional licensing approach, bounded by the parameters of existing copyright laws and treaties, holds the most promise for promoting scientific exchange in the rapidly evolving electronic environment for publishing in science.

The developments of licensing recommended here rest on a simple, yet compelling rationale. The control of rights in scientific intellectual property should be guided by a developing consensus (not legislation or editorial coercion) toward new patterns of licensing. This shift in licensing arrangements will reinforce the goal of access that fundamentally motivates scientists, and that benefits society as a whole. Truly, this is promotion of science and useful arts in the best sense.

[54] Although this project took notice of a variety of international and global issues that add additional layers of complexity to any legal analysis of issues involving the Internet, no attempt was made to evaluate or even compile a listing of non-U.S. intellectual property laws in connection with this report. We would be remiss, however, if we did not mention that after significant debate, the European Parliament, on February 14, 2001, approved a new Copyright Directive which, although not ideal, represents a workable compromise that enables most 'fair use' by archivists and archive users to continue. After adoption by the Council of Ministers, the national legislatures of Member countries will be required to enact the Directive into law; see http://www.patent.gov.uk/copy/notices/index.htm

Appendix A

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* The listing of affiliation is for informational purposes only; it does not necessarily mean endorsement by any organization listed.

Appendix B

http://www.ingenta.com
A pay-per-view or subscription site that offers journal articles from over 25,000 publications via arrangement with 170 publishers. The topics run the gamut of sciences and social sciences. The service gleans revenue from the publishers that use the service and its pay-per-view users, not the library subscribers.

http://bestofscience.free.fr/Welcome
A free-access worldwide online scientific publication. Articles are original reports whose conclusions represent a substantial advance in understanding of an important problem, or reviews of broad general interest.

Best of Science has been created to respond to the recommendations of the Second ICSU-UNESCO International Conference " Electronic Publishing in Science" in providing an alternative electronic journal model (free-access reading for rapidity, transparency, peer-reviewing and reduced fees for scientists from developing countries and those in transition).

http://cogprints.soton.ac.uk
An electronic archive for papers in any area of Psychology, Neuroscience, and Linguistics, and many areas of Computer Science, Philosophy, Biology, Medicine and Anthropology as well as any other portions of the physical, social and mathematical sciences that are pertinent to the study of cognition.

http://www.ams.org/preprints/
A directory of mathematics e-print and preprint servers. The directory provides the current URLs of the servers divided into three categories: umbrella servers, special subject servers and servers administered by departments of mathematics and institutions.

http://xxx.arxiv.Cornell.edu
The home page for the Cornell University e-print archive. The site includes the e-print/preprint server EarXiv, a searchable database of articles in physics, mathematics and computer science. Also visit xxx.lanl.gov, a mirror site for the archive

http://www.ssrn.com
Social Science Research Network (SSRN) is devoted to the rapid worldwide dissemination of social science research. The network is composed of a number of specialized research networks in each of the social sciences, receiving working papers

from hundreds of journals, publishers, and institutions for distribution through SSRN's eLibrary and abstracts for publication in SSRN's electronic journals.

http://www.thescientificworld.com
The site offers resources to scientists from article databases to chat rooms to shopping. Searching is free. Downloading is available via pay-per-view and site licenses.

http://www.pubmedcentral.nih.gov
A digital repository of life sciences literature donated by print journal publishers. It is managed by the National Center for Biotechnology Information (NCBI) at the U.S. National Library of Medicine (NLM). Access is free and unrestricted.

http://www.biomedcentral.com
Publishes original, peer-reviewed research in all areas of biology and medicine. Access is free to research articles, but access to reviews, commentaries and other information services is by subscription only.

http://www.crossref.org
Operated by the non-profit, independent organization, Publishers International Linking Association, Inc. (PILA), the site links to over 5000 journals from 88 publishers.
The site itself does not contain full text content, but links directly to the article on the journal's website where it can be accessed via whatever mechanism the journal's online service has in place, e.g. subscription or pay-per view.

http://highwire.stanford.edu/
Run by Stanford University, High Wire hosts almost 300 peer-reviewed journals. Costs depend on the individual journal that contains the article being downloaded. HighWire was founded to ensure that its partners - scientific societies and publishers - would remain strong and able to lead the transition toward use of new technologies for scientific communication

http://www.healthinternetwork.net
Established by the World Health Organization, the *Health InterNetwork (HIN)* is an Internet public health portal providing free or low-cost access to high quality public health information to developing countries, often in their native languages. The first phase, the HIN Access to Research Initiative, was launched in January 2002 and provides free access to almost 1500 scientific publications, with 200 institutions and 70 countries currently participating. The second phase, low-cost access, will be announced in 2002.

http://clinmed.netprints.org/home.dtl
A preprint server backed jointly by the British Medical Journal and Stanford University. The website, implemented in December 1999, is designed as a place for authors to publish their completed studies before, during or after peer review and publication in a print journal. The topic of research is limited to clinical medicine and health.

http://www.e-biosci.org
A project of the European Molecular Biology Organization (EMBO), E-Biosci is platform for providing services relating to access and retrieval of digital information in the life sciences, ranging from bibliographic or factual data to published full text. Objectives of the project are to explore technologies and protocols that will support the creation of a European-based research infrastructure of global impact.

http://www.osti.gov/preprints
The PrePRINT Network, developed by the U.S. Department of Energy (DOE) Office of Scientific and Technical Information (OSTI), provides access to electronic preprints available from diverse sources for information in areas such as physics, materials, chemistry, mathematics, biology, environmental sciences. The PrePRINT Alerts feature allows users to create personal profiles and be notified as new information is added.

www.soros.org/openaccess/read.shtml
Site for the Budapest Open Access Initiative, funded by the Open Society Institute. The goal of the initiative is to create open access, free availability on the internet to the public to download, copy, distribute, print, search, and link to the full texts of scholarly literature by removing the barriers, -- technological, legal, and financial -- that prevent such access today.

www.creativecommons.org
Launched in May 2002, Creative Commons is intended to help those creators who do not want to exercise their copyright to its full extent and, instead, wish to share certain parts of their copyrighted works or enter them entirely into the public domain. The site will offer a Web-based application for creating flexible licenses, allowing copying and creative use of copyrighted works, and for dedicating copyrighted works to the "public domain."

Appendix C

Sample of Copyright Transfer Agreements and Licensing Agreements*

Traditional Full Copyright Transfer Agreements

1. American Geophysical Union, http://www.agu.org/pubs/cprt_top.html
2. Academic Press, http://www.apnet.com/www/journal/copyright.htm
3. Elsevier Science, http://www.elsevier.com/homepage/authors/?main=/homepage/about/ita/copyright.shtml
4. Springer-Verlag, http://www.springer.de/comp/lncs/miscella/copyrigh.pdf
5. Science, http://www.sciencemag.org/misc/con-info.shtml
6. American Meteorological Society: http://www.ametsoc.org/AMS, follow links to FAQs, Publications.
7. American Society of Clinical Laboratory Science, http://www.ia.net/~ischwab/office/forms/copyright.htm
8. Institute of Electronics, Information, and Communication Engineers (Japan), http://www.ieice.org/eng/shiori/appa.html

Transfer with Author Retaining Some Rights to the Work

9. American Physical Society, ftp://aps.org/pub/jrnls/copy_trns fr.pdf
10. American Astronomical Society, www.journals.uchicago.edu/AJ/permission_text.html
11. Society of Photo-Optical Instrumentation Engineers, http://spie.org/app/Publications/pdfs/copyright_form.pdf
12. Society for Computer Simulation International, not available online, but by request.
13. American Society of Civil Engineers, http://www.pubs.asce.org/journalscta.pdf
14. University of Chicago Press, *The Astrophysical Journal*, not available online, but by request.

Author Retains Copyright and Range of Non-Commercial Uses

15. Internet Journal of Chemistry, www.ijc.com/ijc/instr2.html
16. Association of Learned and Professional Society Publishers, http://www.alpsp.org/lplcense.pdf

Author Retains Copyright and Unlimited Rights After First Publication in Journal

17. Journal of Machine Learning, http://www.ai.mit.edu/projects/jmlr/forms/agreement.pdf

* This sample list is intended for informational purposes only. Inclusion in the list does not indicate endorsement by AAAS or any of the contributors to the report in which this list appears.

Author or Publisher Retains Copyright but Licenses Work to the Public Domain

18. Public Library of Science, http://www.publiclibraryofscience.org/ploslicense.htm

Other

19. Ann Okerson, Yale University
    http://www.library.yale.edu/~llicense/standlicagree.html
20. http://www.licensingmodels.com, Four sample licenses:
    a) Single academic institution
    b) Academic consortium
    c) Public libraries
    d) Corporate and other special libraries