Scholarship & Scholarly Communication in the Electronic Age

BY STANLEY CHODOROW

Our system of scholarly communication is in trouble. Its economy has changed, and its technology is changing. The economy no longer provides adequate support for the scholarly monograph and has made the market for journals chaotic. Technological change is undermining the traditional functions and business of publishing and is giving individual scholars new choices: to publish in traditional print or in electronic journals. Some scholars are already discussing ways the technology might free them from the traditional system of scholarly communication. Libraries, the largest single node in the system, are caught in the middle. The new technologies affect both acquisitions and staff budgets. What will happen to the system? The foundation of prediction is history.

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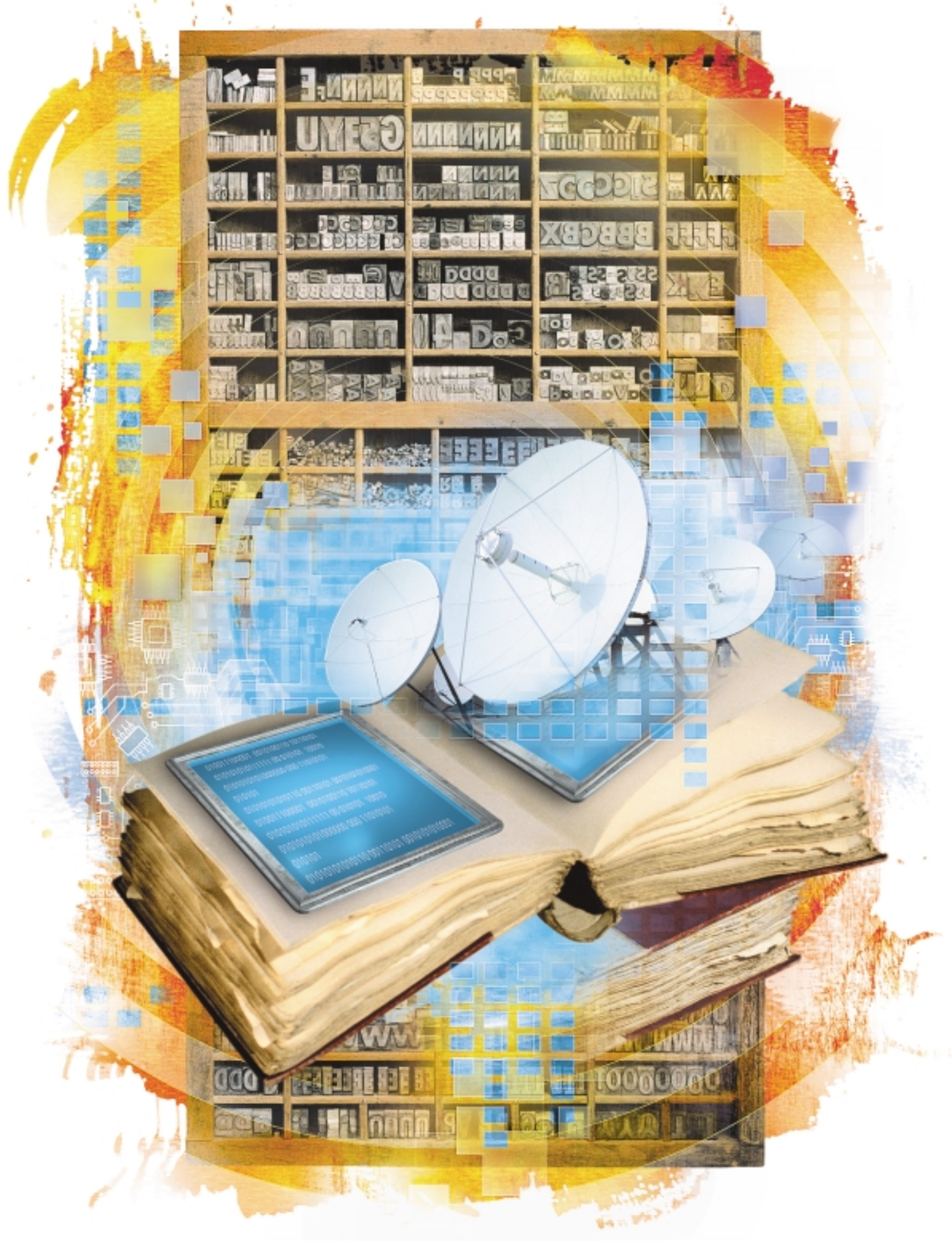

Illustration by Derek Lea

The scholarly community and its system of communication were created in the seventeenth century by followers of Francis Bacon, who had proposed a vast project of research into the observable universe. Bacon saw the practice of what he called "philosophy," and what we call "science," as a single project that could be carried out only by a community of observers and experimenters who were conscious of their common goals. A group at Oxford began this work on a small scale in 1648, founding the Royal Society in London twelve years later. The Society sought to create the community of scholars that Bacon had envisaged and to begin the project he had set for it.[1]

The Fellows of the Royal Society thus set the original foundation stone of the new community of scholars, and the base soon expanded as similar societies were created across Europe.[2] The American Philosophical Society, founded by Benjamin Franklin in 1743, was America's contribution to this structure. These societies recognized their role in scholarly communication. As the editor of the Royal Society's journal, *Philosophical Transactions*, stated in the introduction to the first issue:

> *While there is nothing more necessary for promoting the improvement of Philosophical Matters, than the communicating to such, as apply their Studies and Endeavors that way, such things as are discovered or put in practice by others; It is therefore thought fit to employ the Press, as the most proper way to gratifie those, whose engagement in such Studies and delight in the advancement of Learning and profitable Discoveries, doth entitle them to the knowledge of what this Kingdom, or other parts of the World, do, from time to time, afford.*[3]

The archetype of "the *Press*" was the journal, a serial publication issued under a society's authority and according to its scholarly judgment.[4] Within a short time, the scientific article became the principal form of scholarly communication within the journal. Later, in the nineteenth century, scholarly institutes, whose members carried out large-scale projects, added the monograph to the armamentarium of scholarship. In addition, the founders of the scholarly community sought to organize these products of the communication system, beginning with the members of the Oxford club who undertook to catalog the libraries of Oxford in the 1650s.

This scholarly community and its system of communication have evolved into a complex organism with dozens of disciplinary societies, tens of thousands of journals, and a fragmented peer-review system, but scholars and librarians will recognize its simple form. Most would also say that the system of communication is breaking down because of economic dislocations. For more than a decade, librarians and others have been preoccupied with the economic threat to the scholarly journal and, even more, to the monograph. In current discussions about the use of information technology in scholarly communication, the principal question is always: How will technology solve the economic problems?

Before dealing with the proposed answers to this question, we must understand the economy of scholarly communication. The original system of communication operated as a gift-exchange economy.[5] Until the twentieth century, the world of learning was mostly the province of gentlemen, who had independent financial resources as well as a particular deportment and a code of behavior. The economy of communication in this community covered the costs of production while leaving only modest profits for the publishers. It was a closed, small-scale economy in which the producers and the buyers of scholarship were the same people, who, moreover, contributed a great deal of volunteer labor. Even for most of the twentieth century, when scholarship became a job, the economy of the system remained small and cost-based; scholars gave away their scholarship to build a reputation that paid off in the salaries they received from their universities.

Toward the end of the twentieth century, the economy of the system began to break down. By the early 1980s, price increases for even short monographs forced most scholars to buy selectively. A few years later, libraries began reducing their acquisitions of monographs and then began cutting back on journal subscriptions.[6] The ancient economy of scholarly communication had become dysfunctional. What had happened?

Two developments had led to the breakdown. The first, which took place in the mid-nineteenth century but did not affect the system of scholarly communication until one hundred years later, was the fundamental change in the relationship between universities and their faculty members. In 1862, the passage of the Morrill Act created the land-grant university and introduced a new idea of the university.[7] In the antebellum college, many faculty members would have regarded themselves as being engaged in the great intellectual project embodied in the learned societies, but their scholarly activities were largely independent of their institutions.

In creating the land-grant system of higher education, however, Congress established the principle that colleges and universities should be socially useful. Institutions of higher education had an obligation not only to educate students but also to produce knowledge for the benefit of society. Although the Morrill Act aimed to create agricultural and mechanical colleges, the disciplinary focus was much less important than the idea that the institution, *as an institution*, had an obligation to produce useful new knowledge. The land-grant universities were a new type with a new ideology.

The changing responsibilities of universities required them to build laboratories and other academic facilities, to develop comprehensive and systematic libraries, and eventually to become publishers.[8] Nonetheless, the land-grant university was not an industrial or corporate university, with the faculty functioning as a workforce directed from above. Rather, the new institutions sought to meet their responsibilities by appointing faculty members who would produce what was required. The seventeenth-century idea remained: the progress of learning would be the product of myriad individual efforts coordinated and directed, though not managed, by central institutions. In the land-grant model, individual faculty, not the university as a whole, carried out the task of the institution.[9] The university's *responsibility* for producing knowledge was separated from the faculty's *authority* to produce knowledge.

The second development affecting the economy of the scholarly communication system was the vast expansion of higher education after World War II and particularly after the launching of *Sputnik* in 1957. Beginning in the middle of the twentieth century, the number of research universities mushroomed as states converted teachers' colleges into universities, strove to give regional universities national stature, and founded wholly new institutions. The requirement that all of these institutions support the work of their faculties and students by building vast library collections changed the scale of the scholarly market.

University presses and learned societies took advantage of this enormous market growth, which was fueled by public funding. From the 1950s through the 1970s, they expanded their output in sync with the growth of scholarly production and research libraries. With this expansion of the research enterprise and of the institutions that supported it, any investment in a scholarly press seemed likely to pay off.

Indeed, the growth in the demand to publish the results of research overwhelmed the ability of the societies to invest in journals. Some societies contracted with commercial publishers to publish their journals, while commercial firms independently began publishing new ones. Figures compiled by the Association of Research Libraries (ARL) in 1991 highlighted the growth in the market. The ARL estimated that 118,500 journals were published in that year and that 70,000 of these had been founded since 1971.

The marriage of the gift-exchange economy of the academy and the commercial economy of journal publishing has had very unfortunate results. The commercial publishers have exploited the division between the producers and the purchasers of information. The faculty gives its research to the publishers for free; the publishers sell it back to the university library at high prices.

The anomaly of the new market for scholarship is that both supply and prices have risen sharply because the growth of the scholarly community and the pressure on universities to produce ever-increasing amounts of economically useful knowledge have kept the market pressure high. For more than a decade, librarians have been in the middle, trying to meet the faculty and student demand for information while prices have risen spectacularly and the flood of new works has overflowed their facilities. Now, faculty members have finally noticed that the monograph is on the endangered species list and that the library's collection of journals is eroding.

Leaders of higher education have responded to this crisis by urging two strategies. First, they are asking faculty to retain the copyright to articles. Second, they are looking to information technology to provide a solution to the problem. The copyright strategy aims to create a cost-based scholarship market in universities. However, it is not clear how such a market would work. For obvious reasons, most publishers have a policy of not accepting articles without the transfer of copyright. Meanwhile, individual faculty members cannot afford to challenge the existing system unless everyone does so, because academic careers hinge on the publication of scholarly work in good journals. Consequently, faculty have not given much attention to the copyright strategy.

So, how can the information technology strategy, in which academic institutions have invested millions of dollars, solve the problem? Scholars have been using the World Wide Web to communicate with colleagues and to make data available to collaborators. Why not extend these practices to the formal publication of scholarship? University academic officers have begun thinking about investing in the electronic publication of scholarship, while several scientific societies, led by the American Association for the Advancement of Science (AAAS), are planning to publish electronic journals. In addition, the American Council of Learned Societies has announced a new electronic monograph series.[10]

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tem of scholarly communication except the format. Yet the change of format creates problems. First, the means of preservation of electronic formats have not been established.[11] Scholars will not publish in a format that is not durable, and most define "durable" as lasting for centuries. Second, the electronic format reduces the need to be selective. The standards of the editors and reviewers and the limited space available determine the selectivity of a journal. No one should underestimate the importance that limited space has for selectivity. Reviewers and editors judge many more articles to be acceptable than can be published in their journals; the limit on the number of articles that can be published constitutes the final filter of quality. For monograph series, the production costs of books impose a similar filter. The Web removes these constraints. Whatever their intentions, the editors of electronic publications will base their publication decisions solely on the judgment of peer reviewers. Any article or monograph judged to be good enough will be published. Over time, the judgment of "good enough," unchecked by limits on available space, may drift toward the approval of mediocre work.

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One might argue that the costs of peer review and of the editing process will constrain the ability of individual journals or presses to publish all of the worthy works they receive. Yet the cost of peer review will already have been incurred in making the decision to publish, and the editing cost may not be significant. The editing process has already eroded and may not even survive: pressure on publishers to lower the cost of publication has already reduced the amount of editing, and, in any case, most scholars regard the revisions made on the basis of the readers' reports as sufficient.

However, the discussion about whether information technology can solve the economic problems of the existing system of scholarly communication is a sideshow. The technology will *change* the system, not repair it. Already, experiments in electronic journal publishing point the way to a revolution not in scholarly publishing but in scholarly communication. Several journals are conducting online reviewing, using the Web to distribute submitted articles to reviewers and to receive the reviewers' reports.[12] In one case, a journal put a controversial article on its Web site and invited anyone to send a review.[13] That case may point to the future. If so, many may question the usefulness of the formal publication. Is it simply a record of the editor's choice? Does it represent the guarantee of preservation?

Most likely, formal publication will be used for the latter purpose: to guarantee preservation. On the Web any scholar will be able to compete with journal editors by creating sites linked to favorite articles. However, librarians could rely on the official sites of journals to determine which articles should be preserved. Beyond the problem of competition between private and official sites, the real challenge to the formal Web sites of journals will develop on their own peer-review pages. Some submitted articles will engender a great deal of commentary and become, in effect, sites or occasions for advancing the scholarly discourse on a subject. No revision of the article will be able to capture the commentary, which will go way beyond a review of the work for the benefit of the journal editors. The approval of the article for publication on the journal's Web site will thus be an insufficient contribution to the scholarly discourse; scholars will want to preserve all or most of the commentary deposited on the review page.

Thus the private element of the system—the submission and review of articles or monographs for publication—could become public. Private and public are already mixing in the well-established online archive of papers in theoretical physics, a communication strategy that will be copied in other disciplines. The National Institutes of Health (NIH) has announced that it will establish *PubMed*, an online biomedical research archive in which refereed and nonrefereed articles will coexist in the public arena of scholarship.[14]

The integration of what used to be called "pre-prints" and their reviews into the public discourse points to the coming revolution in scholarly communication. While the traditional system of communication included private and public discourse—private correspondence, the writing process, the prepublication process of review and editing, and finally, the publication of discrete works—the electronic environment unites and mixes these types and stages of communication. The use of the Web can put a private communication into the public domain. The publication of research results on the Web can be the basis for a set of comments and links to other results created by the participants in the research field. An electronic record of scholarship could grow organically as scholars make contributions to a database or to a series of linked databases that evolve as the collective work progresses. This record could contain nearly the whole of the scholarly discourse on a topic, including the private e-mail communications.

Elsewhere I have noted that this organic growth of scholarly discourse will return us to the intellectual world of the European Middle Ages, when notions of authorship were weak and the body of knowledge was formed by accretion.[15] Some of the consequences of this back-to-the-future scenario are clear.

First, the form and substance of scholarly communications will change over time, so that it will be difficult to trace the historical flow of the work. Scholarship often reaches a dead end, and one of the ways out of the cul-de-sac is to retrace the steps to an earlier stage where a different road can be taken. If the electronic record merges the stages into an undifferentiated flow—indeed, if it prevents the formation of discrete units of scholarly publication—going back to find a new road to follow will be difficult or even impossible.

Second, a free-flowing stream of scholarly discourse will reduce the role of scholarly authority in the progress of research. Since the seventeenth century, we have relied on editors and peer review to steer scholarship into good channels. We still need the operation of that authority, but in the new environment it will probably function differently. A discourse carried on through a Web site will likely find its editor, the participant trusted by others to manage the discussion, but the authority exercised will be different from that held now by journal editors. The journal editor makes decisions in private and publishes the article. Colleagues may criticize the editor's judgment, but they cannot challenge it. In contrast, the manager of a public discussion will play a public role, with every decision open to immediate challenge.

Third, the roles of individual authors will be obscured in the electronic environment. This will be a problem for deans and provosts who have to assign value to the contributions of faculty members in order to take personnel actions, but more important, it will undermine colleagues' ability to judge the value of contributions. We all apply a rough, preliminary value to work we read, based on what we know of its author's and publisher's standing in the field. The practice calibrates our willingness to accept what an author tells us, and this willingness—this trust—is an inescapable component of scholarly communication.[16] To the extent that the electronic environment reduces the visibility of the author, it will reduce our ability to make those calibrations and to use our time productively.

Fourth, paradoxically, the openness of Web-based scholarly communication will make it both easier and harder for outsiders or newcomers to participate. Electronic scholarly discourse will be vulnerable to uninformed contributions, and outsiders and newcomers will find it difficult to understand the discourse. In the print-based system of scholarly communication, the outsider can gain access to a field through publications on library shelves. In the continuous stream of electronic communication, outsiders will have difficulty finding an entry point. The continuously evolving body of knowledge in a field will be a product of a coterie of scholars carrying on their communications in public. For the serious outsider, the form of the discourse will pose problems; for the contrarian, it will open doors.

Finally, in the print environment, scholarly discourses are fixed in place by the library catalog. In the electronic environment, the site of discourse may change frequently and unpredictably, and there is no map yet available to guide the participant.

In the face of changes in scholarly communication that are both rapid and of uncertain import, we need to define the essential characteristics of a healthy system. In addition, we must shape the use of new technology to preserve these defining traits. The seventeenth-century founders of the system of scholarly communication gave us some guidance. Here is what they and our experience over three centuries have taught us.

First, the system of scholarly com-

Requirements for a Healthy Scholarly Communication System:

1. Web sites through which scholarly discussions are mediated need gatekeepers.
2. The system needs to be cost-based, allowing only a modest profit margin for commercial participants.
3. The system needs a way to catalog electronic scholarly discourse for reference and to preserve it for posterity.
4. The system needs a way to track the contributions of individual scholars and, perhaps, a practice of periodic synthesis.

munication needs a gate. In the traditional print-based system, editors and their army of reviewers man this gate, filtering contributions to public scholarly discourse. In the electronic environment, where anyone with access to the Web can participate in a discussion, we need to manage participation. Web sites through which scholarly discussions are mediated will need gatekeepers. Just as one now applies for an entry card to a great research library, such as the Biblioteca Apostolica Vaticana or the Bibliothèque Nationale de France, one will apply for entry into the scholarly discourse of a Web site. All participants should be allowed to read, but only some to write.

Second, the system needs to be cost-based, allowing only a modest profit margin for commercial participants. In practice, this means that the technological infrastructure of the system must be built and maintained by academic and other research institutions and that, as now, much of the labor in the system must be volunteered. The economy of the system will never again be small-scale, as it was until World War II, but we need to restructure it so that the enormous subsidies provided through universities and research laboratories pay off in the free flow of information. If a major part of the system becomes resident on the Web, the current division between the producers and the purchasers of scholarship, a division so successfully exploited by commercial publishers, may be ended.

Third, we need to develop a way to catalog electronic scholarly discourse for reference and to preserve it for posterity. One of the first tasks of the founders of the community of scholars was to catalog the library. We must soon attack the problem of organizing our new information resources and integrating that organization with the traditional systems for printed works. At the same time, we must decide how we will preserve digital resources. This is both a technical and an organizational problem. As noted earlier, it may be that in the future, the work of scholarly editors will focus on what should be preserved rather than on what should be published.

Fourth, we need to build into the system a way to track the contributions of individual scholars and, perhaps, a practice of periodic synthesis. Scholars need recognition for their work, and our research institutions rely on the assessment of scholarly accomplishment for making personnel decisions. The production of periodic syntheses that stand outside the flow of discourse as markers of progress would help both insiders and outsiders understand the course of scholarship.

All of these essentials are within our grasp. We have enough experience with the exercise of editorial authority to redesign it for Web-based discourse. Universities and other purchasers of information can rearrange their budgets to pay the costs of Web-based scholarship. We have the professional forces needed to solve the problems of cataloging and preservation. We can certainly track the contributions of authors and alter our traditional review systems to assess them. We have demonstrated the urge to synthesize; we can certainly transfer the practice to the Web. What we need are the will and the leadership to change the system's form in order to preserve its function.

Notes

1. On Bacon's project, the Oxford group, and the commitment of the founders of the Royal Society to Bacon's vision, see Margery Purver, *The Royal Society: Concept and Creation* (Cambridge: MIT Press, 1967). Cf. Barbara Shapiro, *John Wilkins, 1614-1672: An Intellectual Biography* (Berkeley: University of California Press, 1969).
2. The Accademia del Cimento, founded by Prince Leopoldo de' Medici in Florence in 1657, was drawn into the great project in 1661. The Académie Royale des Sciences was founded in Paris in 1666.
3. *Philosophical Transactions*, March 6, 1665, 1–2 (italics in the original).
4. Some early printers had exercised scholarly judgment and had earned a reputation as scholar-printers: Aldus Manutius, Christophe Plantin, and William Caxton. However, the existence of these reputable printers did not constitute an enduring scholarly authority in an organized world of learning. See Elizabeth L. Eisenstein, *The Printing Revolution in Early Modern Europe* (Cambridge: Cambridge University Press, 1983).
5. See Peter Lyman, "What Should We Call the Net?" *Educom Review* 34 (November/December 1999).
6. The Association of Research Libraries (ARL) keeps statistics on journal and monograph acquisitions by its member libraries. From 1986 to 1998, the number of serials subscriptions declined by 7 percent while the amount spent on them climbed 152 percent (unit costs rose 175 percent); the number of monographs purchased fell 25 percent while expenditures on monographs climbed 33 percent (unit costs rose 66 percent). In the same period, the Consumer Price Index rose 49 percent. The studies can be found on the ARL Web page: <http://www.arl.org>.
7. 37th Cong., 2d sess., chap. 130. The act granted 30,000 acres of public land to each state and territory to support a college.
8. The oldest U.S. academic presses date from the late nineteenth century. In Europe, publishing was regarded as a function of the research university, on the model of the learned society.
9. The modern U.S. research university is a hybrid based on the idea of the land-grant and the idea of the German university. In Germany, university reformers had created the research university as a sister organization to the learned society. The universities became active promoters of the great scholarly project but were not themselves seen as responsible for producing scholarship. See Daniel Fallon, *The German University: A Heroic Ideal in Conflict with the Modern World* (Boulder: Colorado Associated University Press, 1980). Whereas the German idea strengthened the notions that scholarship is the province of the faculty and that the university should be a promoter of scholarship, the land-grant idea emphasized that the university should be an engine of economic growth.
10. A few commercial publishers have experimented with electronic journals, but they are being very tentative. They want libraries to purchase both the paper and the electronic versions of the journals, and they want to restrict use of the electronic versions to protect their copyright. The restrictions do not suit scholars or librarians and have not provided the protection that the publishers seek. At this point, the move to publish electronic versions of print journals does not look promising.
11. The Council on Library and Information Resources is currently sponsoring research on the preservation of digital materials, and the Digital Library Federation is also much concerned with the problem.
12. See the report in *Chronicle of Higher Education*, April 2, 1999, A29.
13. The journal was *BMJ: The British Medical Journal*. See *Chronicle of Higher Education*, October 16, 1998, A34.
14. The physics archive is managed by Paul Ginsparg at the Los Alamos National Laboratory: <http://xxx.lanl.gov>. The NIH's *PubMed* proposal, originally called *eBioMed*, has been controversial. See *Chronicle of Higher Education*, June 18, 1999, A30, and July 9, 1999, A25. Floyd Bloom, editor of *Science*, published an editorial questioning the NIH plan: *Science*, July 9, 1999. More recently, Lance Sultzbaugh, a research librarian for Elan Pharmaceuticals, raised questions about the idea in an op-ed piece: *Chronicle of Higher Education*, September 17, 1999, A72.
15. S. Chodorow, "The Medieval Future of Intellectual Culture: Scholars and Librarians in the Age of the Electron," *ARL: A Bimonthly Newsletter of Research Library Issues and Action* 189 (December 1996): 1–3.
16. For an extended study of this issue, see Steven Shapin, *A Social History of Truth: Civility and Science in Seventeenth-Century England* (Chicago: University of Chicago Press, 1994).