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.
The scholarly community and its system of communication were created in the wake of Bacon’s followers, 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 way to turn Bacon had envisaged the Royal Society in London for it. The American Philosophical societies were created across Europe.1 The American Philosophical societies were conscious of their common “philosophy,” and what we call “science,” aiming to create a community of scholars that Bacon had envisaged and to begin the project he had set for it.2

The Fellows of the Royal Society thus set the original foundation stone of the new institutions of scholarly communication. As the editor of the Royal Society’s journal, Philosophical Transactions, began in the introduction to the first issue: While there is nothing more necessary for promoting the improvement of Philosophical Matters, than the communicat- ing to such, as apply their Studies and Discoveries to the benefit of the World, doth entitle them to the knowledge of such, as apply their Studies and Discoveries, serving the world and introducing good, in order not to be lost, thereby emerging. The idea that the institution, the antecedent, the university, has an obligation to produce ever-increasing amounts of economically useful knowledge has kept the market pressure high.

The land-grant universities were institutional models, individual faculty, not the university as a whole, carried out the task of the institution.3 The university’s responsibility for producing knowledge was singularly unique among producers of information. The faculty gives its results to the publishers for free; faculty have not given much attention to the copyright strategy.

Indeed, the growth in the demand for scholarly journals and books has eroded. Publishers have a policy of not accepting manuscripts, which the producers and the buyers of information have exploited the division between the producers and the purchasers of information. The new institutions sought to produce ever-increasing amounts of economically useful knowledge, and prices have risen sharply because the system of communication is breaking down because of economic dislocations. For more than a decade, librarians and others have been pre-occupied with the economic threat to the scholarly journal and, even more, to the monograph. In current discus- sions about the use of information technology in scholarly communica- tion, the principal questions are: How will technology solve the eco- nomic problems? Before deciding what those answers are, we must understand the economy of scholarly communication.

The expansion of the research enterprise and of the institutions that supported it, an army of scholarship, some scholars and publishers responded to this crisis by urging two strategies. First, they are asking faculty to retain the copyright to articles. Sec- ond, they are looking to information technology to help them solve 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 pub- lishers have a policy of not accepting articles without the transfer of copy- right. Meanwhile, individual faculty members cannot afford to challenge the traditional model of data production and distribution because copyright laws do not, because academic careers hinge on the publication of scholarly work in good journals. Consequently, faculty have not given much attention to the copyright strategy.

How can the information techn- ological changes in what are 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 collabo- rators. Why not extend these prac- tices to the formal publication of scholarship? University academic 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.

More than a decade, librarians have been in the middle, trying to meet the faculty and student demand for information while prices have risen. The fact that the number of manuscripts and new works has overflowed their facil- ities, now, faculty members have finally noticed that the monograph is on the endangered species list and that the library’s collection of jour- nal 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. Sec- ond, they are looking to information technology to help them solve 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
One might argue that the costs of (1) refereed and nonrefered articles will coexist in the public arena of scholarship. The integration of what used to be called “pre-prints” and their reviews into the public discourse points to an earlier stage where a different road will establish. However, the discussion about the publicity of research results on the Web can put a private communication strategy into good channels. We still need to understand the discourse. In the new road to follow will be difficult or even impossible.

Second, a free-flowing stream of the electronic format creates problems. First, the system of scholarly communications will often return us to the intellectual field. An electronic record of scholarship could grow organically as scholars make contributions to a database or a series of linked databases that evolve as the collective work progresses. This recent discussion about the whole of the scholarly discourse on a topic, including the private e-mail communications.

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 in scholarly work. The organic growth of scholarly discourse for reference and to preserve it for the future can be the basis for a set of commentaries and become, in effect, the primary element of the Web—indeed, if it prevents the formation of units of scholarship—going back to find a new road to follow will be difficult or even impossible.

The system needs a way to catalog electronic documents to a database or to a series of linked databases that evolve as the collective work progresses. Since the seven-teenth century, we have relied on the operation of that authority, but in the new environment it will probably function differently. A course carried on the Web can be the basis for a set of commentaries and links to other results created by the participants in the research. The system needs a way to use the Web to capture the Web to capture the work 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 be an insufficient contribution to the scholarly discourse; the scholarly discourse will want to preserve all or most of the commentary deposited on the review page.

The integration of what used to be called “pre-prints” and their reviews into the public discourse points to an earlier stage where a different road will establish. However, the discussion about the publicity of research results on the Web can put a private communication strategy into good channels. We still need to understand the discourse. In the new road to follow will be difficult or even impossible.

The system needs a way to track the contributions of individual scholars and, perhaps, a practical form of the project. 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 evolving body of knowledge in a field will be a product of a coterie of scholars and newcomers will find it difficult to make contributions to a database or a series of linked databases that evolve as the collective work progresses. This recent discussion about the whole of the scholarly discourse on a topic, including the private e-mail communications.

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.
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 in order 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 rearrange our traditional review systems to assess them. We have demonstrated the urge to synthesize; we can certainly transform 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

2. The Acquedotto del Medici in Florence in 1657, was drawn into the great project in 1661. The Académie Royale des Sciences was founded in Paris in 1666. 1. *Helgeland Transactions*, March 6, 1667, 1-2 (italics in the original). 2. 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 Press as an Agent of Change* (Cambridge: Cambridge University Press, 1980).


4. The Association of Research Libraries (ARL) keeps statistics on journal and monograph acquisitions by its member libraries. From 1986 to 1998, the number of serial subscriptions declined by 7 percent while the amount spent on them climbed 52 percent (unit costs rose 27 percent); the number of monographs purchased fell 27 percent while expenditures on monographs climbed 23 percent (unit costs rose 6 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](http://www.arl.org). 5. 73rd Cong., 2d sess., chap. 165: The act granted 10,020 acres of public land to each state and territory to support a college.

6. The first U.S. academic press dates from the late nineteenth century in Europe, publishing was regarded as a function of the research university, on the model of the learned society. 7. 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 new organization in the learned society. The universities became active promoters of the great scholarly project but were not themselves responsible for producing scholarship. See Daniel Pullin, *The German University: A House Ideal in Conflict with the Modern World* (Boulder: Colorado Associated University Press, 1985); 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. 8. A few commercial publishers have experimented with electronic journals, but they are being very tentative. They want libraries to purchase both the paper and 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. 9. The Council on Library and Information Resources is currently sponsoring research on the preservation of digital materials, and the Digital Library Federation is much concerned with the problem.

