Editorial Comments JAMIA

Electronic Publishing of Scholarly Communication in the Biomedical Sciences

The main purpose of biomedical publishing is to convey the evolving scientific understanding of living organisms and the use of that understanding as the basis of health care among researchers, practitioners, and (increasingly) consumers. Published papers also serve as an archive of scientific knowledge, documenting both successful and unsuccessful results. Biomedical journals serve other purposes as well, such as providing benchmarks for academic promotion and revenue for professional societies and publishers.

While MEDLINE has become ubiquitous and an increasing number of journals are available electronically, the fundamental model of publishing is unchanged. However, a number of challenges to that model are emerging. Boyd and Herkovic[1] describe four challenges to scholarly publication:

- *Cost*. Publishers are charging increasing amounts of money for universities and academicians to access work that the latter created.
- *Access*. This high cost in turn is leading universities to decrease the size of their library collections, which in turn reduces access.
- *Peer review*. As more new journals, conference proceedings, and other forms of publication are introduced, the standards for peer review are diluted.
- *Archiving*. The growing use of electronic formats raises challenges to the long-term record of scientific publication.

It is not altogether clear in what ways electronic publishing will improve or worsen this situation. On the one hand, the use of Internet-based management of the submission and dissemination process may reduce costs and increase the efficiency of peer review. On the other hand, if copyright laws and electronic protections hinder access, then costs could continue to go up, leading researchers to bypass peer review or reducing the incentive for high-quality scientific publication.

We agree with Roberts[2] that the World Wide Web provides at the same time both the possibilities for unprecedented dissemination of the fruits of scientific research and a brave new world where the price of obtaining such fruits remains high. As academicians who collaborate increasingly over the Internet, publish, read the works of others, and use such works in research, care, and teaching, we are attracted to the potential benefits of digital technologies. We idealize a world of free-flowing information adequately protected by reasonable intellectual property laws. But we fear the downside, whereby information becomes an expensive commodity surrounded by barriers that lock out individuals with lesser resources, such as students and those from developing countries. In summary, we share Roberts' "cautious optimism" about this new medium.

This special issue of *JAMIA* is devoted to the topic of electronic publishing of scholarly information in the biomedical sciences. We sought both original research as well as perspective papers that addressed how electronic publishing affects the use of health and medical information by researchers, clinicians, consumers, and publishers. We have assembled a collection of seven papers that sample some of the important issues confronting the medical informatics community with re-

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gard to electronic publishing. Three papers present viewpoints on the economic and scientific ramifications of this new approach to disseminating scientific information. Two papers provide case studies, highlighting specific experiences with this new medium. Another two papers present formulations for models for specific aspects of electronic publishing that may become prominent in the future.

Coiera's viewpoint paper frames electronic publishing on the Internet in an economic light.[3] He demonstrates the uncertainty we alluded to from Roberts' paper, noting that we cannot yet know how effective this new medium will be. Markovitz[4] and Jacobson[5] provide point and counterpoint views on the value of PubMed Central, the new initiative at the National Institutes of Health to create a freely available archive of scientific research papers built on top of the National Library of Medicine's PubMed system. Their papers highlight what are really two distinct issues in publishing:

- How do we handle preliminary and non-peer-reviewed research reports in this age of rapid information dissemination?
- Can we achieve a model of archive that still allows publishers reasonable revenues from a business standpoint?

Anderson[6] and D'Alessandro et al.[7] provide two case studies of electronic publishing and share their results and perspectives. Anderson draws on the experience of the journal *Pediatrics*, which has been among the innovators in electronic publishing in medicine. He provides insight into the economic challenges facing academic publishers and concludes that while the Internet is a "disruptive technology," there are feasible economic models for sustainable revenues. D'Alessandro et al. provide an examination of issues challenging the development of a well-known medical Web site, the University of Iowa Virtual Hospital. Their paper describes how they handle issues of content ownership, access, and archiving.

Lehmann and Goodman[8] and Tarczy-Hornoch et al.[9] give us a glimpse of the future, showing how the Web has the potential to enhance access to and use of health information beyond being a store and dissemination medium. Lehmann, well known for advocating the use of Bayesian decision making by practicing clinicians, presents a model of how this technique could be made available in a practical way. Tarczy-Hornoch et al. focus on access to information on genetic testing. As we uncover more of the genome and the results of these studies make their way into clinical information, it will be increasingly important for frontline clinicians to have access to that information in synthesized forms. Clearly, these papers are but two examples of a great deal of work in progress that explores the potential of information in a digital world. We unfortunately did not have room for more.

We conclude that an exciting era of publishing of scientific information is at hand. We do recognize that information quality control and dissemination have real costs and truly can never be "free." But we also share the alarm over the growing cost and inaccessibility of information for economic reasons. The new digital technologies are profoundly changing the relationships between producers, middlemen, and consumers of information in all aspects of our lives—including commerce, finance, education, health care, government, and entertainment. Biomedicine is no different, and we are optimistic that models will emerge that allow effective symbiotic relationships among the players and stakeholders. This should, in turn, usher in a new era of unprecedented means of facilitating scientific collaborations and access and interaction with health information that will benefit society overall.—WILLIAM R. HERSH, MD, THOMAS C. RINDFLEISCH, MS

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