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President's Editorial—Some Thoughts on the Future of Scientific Publishing

As we approach the 50th anniversary of *Journal of Forensic Sciences*, it is fitting, perhaps, to consider the future of scientific journals in general, and by association, of the *JFS* in particular.

Two related issues are affecting scientific journals today—the movement toward Internet-based “electronic journals,” either in addition to, or instead of, traditional paper journals and the “open access” philosophy regarding scientific publications.

Ever since Johannes Gutenberg introduced the printing press in 1436, the major repository for knowledge has been in the form of images committed to paper. This type of information sharing has a number of advantages. The ability to mass-produce printed text makes information available to everyone as opposed to the select few. Printed text also serves as a permanent record of information, eliminating the need to rely upon spoken words passed down from generation to generation, which inevitably results in a corruption of the intent and meaning of the information. Although the technological aspects of printing have improved over the centuries, the processes used today are surprisingly similar to those of past days, and result in a similar product—a bound volume of paper pages onto which words have been printed.

The printed word has served us well for close to 500 years; in fact, we take for granted that any piece of literature, any item of research, or any bit of information regarding the famous or infamous is as close as the inter-library loan desk of our local library. Books, journals, magazines, and the like are convenient—they are, for the most part, portable; they can be read, put away, and picked up and read again; they can be carried with you and accessed anywhere and they can be passed from one individual to another with a minimum amount of trouble. As with all sciences, in forensic science our reliance upon the printed word is absolute.

No silver lining is without its cloud, however, and the printed word is no exception, particularly with regard to those books and journals devoted to scientific research. Because they are of relatively limited appeal, books and journals devoted to the transfer of scientific information tend to be more expensive than those publications directed toward the mass market. According to a recently published study, during the period 1988–2003, the price of a United States nonprofit society journal rose an average of 7.5% per year; the average institutional price of a bimonthly journal (like *Journal of Forensic Sciences*) in 2002 was \$204.00 (1), whereas the average price of all United States academic and other learned journals was just under \$304.00 (2). Because of rising costs, many libraries are cutting back on journal subscriptions or are only adding new jour-



FIG. 1—Ronald L. Singer, President, 2004–05, American Academy of Forensic Sciences.

nals as other journals are removed from the shelves. In addition, as the years go by, space to archive back issues of journals and older texts is becoming an increasing problem. Anyone with ten or more years as a member of the AAFS can surely relate to that problem—where are your back issues of *Journal of Forensic Sciences*?

There is also the issue of lag time between submission of a paper for publication and its actual appearance in print, an issue of utmost importance to both authors, who want their work published before anyone else, as well as to the reader, who wants the information as up to date as possible. Generally, many months are involved in receiving, reviewing, editing, and ultimately publishing an article of scholarly research. This lag is frustrating to both authors and editors and occasionally results in the publication of material that is out of date or no longer of general interest.

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Given today's technology, one solution to many of the problems associated with conventionally printed journals and texts is the use of the Internet as the repository for information. From humble beginnings in 1969, the Internet and the later established World Wide Web have become a major source of entertainment and information. Over 51% of the households surveyed in the 2000 United States census had computers in them (3) and it is estimated that by the end of 2001, almost 55% of the United States population over the age of 18 had access to the Internet (4).

From the researcher's standpoint, information available on the Internet is relatively easy to obtain and it is either free or can be downloaded for a small fee. Searching the Internet is extremely fast when compared to more conventional methods used to search printed text, accesses more sources than a single library or library system, and the searches can be conducted from virtually anywhere. In addition, the material becomes accessible as soon as it is posted, greatly reducing the amount of time required for material to become widely available.

The emergence of online publishing actually coincides with the development of the World Wide Web in the early 1990s. During the first phase of development, journals made their content available on CD-ROM; as that gained in popularity, journal content began to appear on the Internet, both as pre- and post-print editions. By the late 1990s, scientists had, for the most part, accepted the idea of electronic journals either in addition to or in place of printed text journals. In 2002, there were approximately 15,000 active, peer-reviewed journals, of which 12,000 were available electronically, either as exclusively on-line journals or as duplicates of print journals (5). *Journal of Forensic Sciences* is now available to AAFS members on the AAFS web site.

While electronic journals have definite benefits, there are some issues that could be seen as drawbacks. Many of the copyright issues that plague print journals are multiplied when material appears in electronic format. In most instances, it is easier and faster to copy and send articles from the Internet than to accomplish the same with copier and fax machine, and file sharing has become a way of life among many in the computer generation. One suggested remedy for this problem is the "open access" idea, which will be mentioned later.

Another issue, or more specifically, set of issues deals with the question of the worthiness and permanence of the material available. According to Hobbes' Internet Timeline (6), as of January 2004, there were 46,067,743 web servers hosting one or more web sites. As anyone who has used the Internet for research knows, many of these sites are less than accurate in the information that they offer. As the number of web sites increases, it becomes more and more important for the researcher to know the reliability of the site that they are accessing. An additional, and perhaps more important aspect of this problem is the permanence of these sites—what is the guarantee that a site used today and cited (as in this editorial) will actually be there when some future researcher attempts to access it weeks, months, or years from now? Finally, given the speed at which technology changes, what is the likelihood that material stored today in some fashion will be readable 10, 20 or 100 years from now? Printed text that predates Gutenberg's printing press is not only still available, but can still be read and understood. I have data stored on media that is less than 15 years old that is useless because the programming language used to store the data and the manner in which the data were stored are both no longer available.

The final issue that should be considered in any discussion of electronic publishing is cost. While the end user, particularly libraries and other institutional subscribers stand to save money in storage space alone by subscribing to electronic versions of journals, unless the electronic subscription is offered at a lower cost

than a printed version, there is really little other incentive to choose the electronic version. And, although there are certainly cost savings that can be achieved by publishing *only* electronically, the vast majority of scientific journals, driven by the desires of the members of the source organizations, are publishing in both formats, which is actually more costly. It isn't likely that this situation is going to change in the near future.

One suggestion that has been made and is currently the topic of considerable debate is the concept of open access—a free sharing of information on the Internet outside of the bounds of traditional peer-reviewed publications. In one form, the author without prior review of any kind would post information; peer-review would be "open" to anyone accessing the information. In a more structured version of open access, an established journal would post the article after the more traditional peer-review process was completed, but the information would be fully available to anyone wishing to access it. The latter form is generally regarded as more practical because the article is backed by the established journal, and because future retrieval becomes less problematic; however, cost again becomes an issue. If the information is freely available, who will pay the costs associated with the peer-review process, the editing that must be done, and the ultimate storage of data? A recent survey in *The Scientist*, quoted in *Nature*, reported that one of the major reasons individuals join societies is to receive the society's journal either free or at a discount (7); there is some question as to whether members would continue to belong if that benefit were to be taken away. Therefore, support for publication would have to come from the author rather than the end user; current open access models generally involve a process where the author pays a publication fee to ensure that the material is openly available to all. Although this process may work in academic settings where virtually all research is supported by external sources such as grants, it would be impractical for organizations such as the AAFS where very little of the material published has external support.

In spite of the drawbacks associated with electronic journals, the search capabilities of the Internet combined with the ease of retrieval of specific articles or other data makes them a desirable feature of any serious scientific organization's publishing efforts. In addition, the decreased time between submission and publication is an attractive draw for potential authors. However, for most scientific journals, and at least for the present, online publishing should complement the printed word, rather than replace it. Because most of us still send what we retrieve from the Internet to our printers in order to have a hard copy to read, we are still years away from a completely paperless society.

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