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Special Paper

Electronic Biomedical Journals: How They Appear and What They Offer

G. Alloro,¹ C. Casilli,¹ M. Taningher² and D. Ugolini²

¹National Institute for Cancer Research, Genoa; and ²Department of Clinical and Experimental Oncology, University of Genoa, Largo R. Benzi, 10-16132 Genoa, Italy

This study, prompted by a number of articles presaging the imminent demise of biomedical journals due to the rise of their electronic spread, analysed 54 Web sites of the journals included in the Oncology section of the *Science Citation Index*, *Journal Citation Reports* (1994) and the sites of 10 other leading digitised biomedical journals. The aim was to determine quantitative and qualitative differences in terms of information content existing between the two media. The analysis confirmed that there are limits to the information contained in the scientific journals currently on the Internet and upholds the authors' conclusion that, in the oncology field, the printed journal will continue to have an important role for most individual users for some time. © 1998 Elsevier Science Ltd. All rights reserved.

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INTRODUCTION

THE MASSIVE spread of the Internet has prompted heated debate on the future of biomedical journals, on the relationship of these with electronic publications and, in particular, with electronic journals.

Electronic journals should be defined as digital journals, as they are processed, created, edited, stored, reviewed and transmitted electronically, whereas digitised journals are those printed on paper and then scanned, stored and distributed electronically [1].

The aim of this study was to analyse digitised journals by comparing them to printed journals, in order to understand if the traditional paper journal is becoming obsolete, and if, as is believed by some, biomedical journals are subject to a gradual demise and will be replaced by a global information server designed to collect biomedical literature and circulate it more expediently than the printed journal system [2]. Other, more moderately-minded, authors hold that electronic biomedical communication networks can complement and build on paper counterparts and, moreover, increase consumer appetites for them [3–5].

Certainly, the creation of the World Wide Web (WWW, Table 1), which enables users to exchange text, sound and images, constitutes a milestone for biomedical journals [6–8].

WWW hypertext documents offer information, such as links to other documents located in the same server or in the other sites, and represent a much more flexible tool than, for example, Gopher technology (Table 1) which collects and distributes information by easy menu [9].

A number of Web sites containing digitised biomedical journals, particularly in the field of oncology, were analysed in order to describe the contents of these and to point out the quantitative and qualitative differences existing between printed and electronic publications.

METHODOLOGY

Our study took into account the journals included in the Oncology category of the *Science Citation Index*, *Journal Citation Reports* (SCI-JCR) [10] and some other selected main titles in biomedical fields.

In order to locate the existence of Web or Gopher sites of the journals under study, we used different approaches and Internet tools: (a) search engines [11], which identified the specific journal sites directly, sites with journal indices organised by topics, or sites of publishers of biomedical journals; (b) telematic information tools in oncology, such as Oncolink [12,13] and SOS Europe [14–16], which include sections listing sites of electronic journals and newsletters. This investigation was carried out between October and December 1996, and the sites' Uniform Resource Locators (URLs; Table 1) were verified and updated in April 1997. It is

Correspondence to D. Ugolini.

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Table 1. Glossary of commonly used terms

World Wide Web (WWW)	The best known and most user-friendly Internet tool. It is a global hypertext system that uses the Internet as its transport mechanism. It relies on the HyperText Transfer Protocol (HTTP), an Internet standard that specifies how an application can locate and acquire resources stored on another computer on the Internet. The WWW page constitutes the basic unit of information and is built on concepts of hypertext and multimedia: hypertext because each document contains a hidden link to other text, and clicking a mouse on a hypertext word, named hyperlink (usually highlighted or underlined), will lead to another document which also contains hyperlinks; multimedia because the WWW can incorporate graphics, sounds, animations and video.
Gopher	A tool which presents Internet resources in the form of menus, through which it is possible to browse, select and view information easily. Many hosts on the Internet run Gopher servers which provide a menu of documents. A document may be a text, sound, image, submenu or other Gopher object type and can be stored on the same or on another host.
Uniform Resource Locator (URL)	The standard way to give the address of any resource on the Internet that is part of the WWW.
Impact Factor (IF)	An important tool for journal evaluation measuring the frequency with which the average article in a journal has been cited by other authors in a particular year.
HyperText Markup Language (HTML)	The coding language used to create hypertext documents for use on the WWW. HTML looks a lot like old-fashioned typesetting code, where a block of text, or a word, is surrounded with codes that indicate how it should appear; additionally, in HTML it is possible to specify that a block of text, or a word, is linked to another document on the Internet.
Adobe Acrobat	Software for publishing documents online that allows the creation and reading of files in Adobe Portable Document Format (PDF). Access to PDF files on the WWW (i.e. the article of an electronic journal) requires the Adobe Acrobat Reader software, available free on the Internet.
Subject search	A sophisticated technique to search a document for selected, previously assigned terms that identify the topics of a document. The terms can be listed in a subject index.
Free text search	The basic technique to search a document for a word or phrase.

necessary to point out that it is very difficult to give readers a current picture of the situation since the Internet changes from day to day. It is, instead, important to detect in the data analysis a trend in publishers' policies.

JOURNALS ON THE INTERNET

Table 2 summarises the results of our study. Journals included in the Oncology section of the SCI-JCR are listed first, ranked by impact factor (IF; Table 1) in decreasing order; an additional 10 biomedical journals are listed in alphabetical order. In all, 54 titles were reviewed.

Every Web site normally provides the name of the journal, the journal editor and address, its International Standard Serial Number (ISSN) and the names of the editorial board members. Additional information provided by each journal is shown in Table 2.

All journals included in this analysis had their own WWW site. Only the journals *Neoplasma* and *Nature* require a registration with password. Information clarifying journal content (aims and scope) is provided by 46 sites (85%). Instructions for authors are presented in 31 journal sites (57%). A table of contents (TOC) of current and past issues of journals is included in 41 sites (76%), which represents a good percentage of all the analysed sites. This information enables users to be kept up to date on journals which may not be available in the local library. In general, these TOCs refer to the last 2 years (20 sites); only some journals (12 sites) included contents for 3 or more years and others (nine sites) included TOCs for the current year or issue only. In particular, the journal *Protein Science* provides the TOC of the forthcoming issue, as do *Nature* and the *Journal of Biological Chemistry*. Nineteen journal sites (35%) provide abstracts or summaries

showing briefly the content of the most interesting articles. Moreover, the *Journal of Biological Chemistry* allows access to abstracts or summaries only to subscribers of the printed journal. Although full text is the main feature that all users accessing a journal WWW site would hope to find, our analysis showed that it is only available for six journals (11%), and only one of these belongs to the Oncology category. Three of these six journals, namely *Biochemical Journal*, the *Journal of Molecular Biology* and *Protein Science*, offer full-text articles allowing the display or printing of texts, tables, graphics and figures in HTML format (Table 1), so that special printers are not needed for printing tasks, although a laser model is recommended. The *Biochemical Journal* and the *Journal of Molecular Biology* make it possible to download their articles in Adobe Acrobat format (Table 1). In this format, the downloaded article looks just like the printed paper copy. The other three journals allow the full text of only editorials and reviews (*Cancer Journal*), editorials (*British Medical Journal*), or editorials and letters (*Science*). Searchable indices are present in the sites of 22 journals (41%) and are related to the TOCs or abstracts. In general, the search is possible using key words or issue numbers. The journal *Science* provides Author and Subject searchable indices by issue. Some sites provide original information, such as: (a) brief notes on the contents of the most significant papers included in the Research Highlights, e.g. *Science*; (b) a list of interesting articles from journal back issues, as well as most recent debates, e.g. *Nature*; (c) a list of conferences and meetings on topics related to journal contents, e.g. *Nature* and *Science*; (d) jobs and career information, e.g. *Nature* and *Science*.

Further added value services are offered to subscribers of the printed journal, such as the link to the Medline database

Table 2. Electronic journals: list of information provided

Journal title (URL)	Aims and scope	Instructions for authors	Table of contents*	Abstracts or summaries	Full text	Searchable index
<i>CA—A Cancer Journal for Clinicians</i> (http://www.lrpublish.com/journals/j1506.htm)	+	—	—	—	—	—
<i>Journal of the National Cancer Institute</i> (http://www.wicic.nci.nih.gov/jnci/jnci_issues.html)	+	+	1994–1996	+	—	—
<i>Cancer and Metastasis Reviews</i> (http://www.wkap.nl/kapis/CGI-BIN/WORLD/journalhome.htm?0167-7659)	+	+	1994–1996	—	—	—
<i>Journal of Clinical Oncology</i> (http://www.jcojournal.org/toc.html)	+	—	Current issue	+	—	+
<i>Oncogene</i> (http://www.stockton-press.co.uk/onc/index.html)	+	—	Current issue	—	—	—
<i>Cancer Research</i> (http://www.aacr.org/cnerrea.htm)	+	+	1996	—	—	—
<i>International Journal of Cancer</i> (http://journals.wiley.com/ijc/)	+	+	1995–1996	—	—	+
<i>Cancer Surveys</i> (http://www.cshl.org/books/cancer_surveys.html)	+	—	1991–1994	—	—	+
<i>Experimental Cell Research</i> (http://www.apnet.com/www/journal/ex.htm)	+	+	1996	+	—	+
<i>Carcinogenesis</i> (http://www.oup.co.uk/jnls/list/carcin/)	+	+	1996	+	—	+
<i>Biochimica et Biophysica Acta. Reviews on Cancer</i> (http://www.elsevier.nl/locate/bba/)	+	+	1995–1996	—	—	—
<i>Breast Cancer Research and Treatment</i> (http://www.wkap.nl/kapis/CGI-BIN/WORLD/journalhome.htm?0167-6806)	+	+	1994–1996	—	—	—
<i>Cancer</i> (http://journals.wiley.com/cancer/)	+	+	1995–1996	—	—	+
<i>Clinical & Experimental Metastasis</i> (http://www.thomson.com/rapid/cemblurb.html)	+	—	—	—	—	—
<i>International Journal of Radiation Oncology, Biology, Physics</i> (http://www.elsevier.nl:80/inca/publications/store/5/2/5/4/7/1/)	+	+	1995–1996	—	—	—
<i>Journal of Immunotherapy</i> (http://www.lrpublish.com/journals/j1046.htm)	+	—	—	—	—	—
<i>Anti-Cancer Drug Design</i> (http://www.oup.co.uk/jnls/list/antcan/)	+	+	1996	+	—	+
<i>Cancer Immunology Immunotherapy</i> (http://www.springer.de/medic/journals/onkolog.html)	—	—	1994–1996	—	—	—
<i>Leukemia</i> (http://www.stockton-press.co.uk/leu/index.html)	+	—	Current issue	—	—	—
<i>Cancer Genetics and Cytogenetics</i> (http://www.elsevier.nl:80/inca/publications/store/5/0/5/7/5/2/)	+	+	1995–1996	—	—	—
<i>Annals of Oncology</i> (http://www.wkap.nl/kapis/CGI-BIN/WORLD/journalhome.htm?0923-7534)	+	+	1994–1996	—	—	—

(continued)

Table 2.—*contd.*

Journal title (URL)	Aims and scope	Instructions for authors	Table of contents*	Abstracts or summaries	Full text	Searchable index
<i>Cancer Causes & Control</i> (http://www.thomson.com/rapid/cccblurb.html)	+	—	—	—	—	—
<i>Radiotherapy and Oncology</i> (http://www.elsevier.nl:80/inca/publications/store/5/0/6/0/4/2/)	+	+	1995–1996	—	—	+
<i>Bone Marrow Transplantation</i> (http://www.stockton-press.co.uk/bmt/index.html)	—	—	Current issue	—	—	—
<i>Japanese Journal of Cancer Research</i> (http://www.elsevier.nl:80/inca/publications/store/5/0/6/0/7/6/)	+	—	1995–1996	—	—	+
<i>Journal of Cancer Research and Clinical Oncology</i> (http://www.springer.de/medic/journals/onkolog.html)	—	—	1992–1996	—	—	—
<i>Cancer Chemotherapy and Pharmacology</i> (http://www.springer.de/medic/journals/onkolog.html)	—	—	1993–1996	—	—	—
<i>Gynecologic Oncology</i> (http://www.apnet.com/www/journal/go.htm)	+	+	1995–1996	+	—	+
<i>Leukemia Research</i> (http://www.elsevier.nl:80/inca/publications/store/5/8/3/)	+	+	1995–1996	—	—	+
<i>Cancer Letters</i> (http://www.cancerletter.com/)	+	+	1995–1996	—	—	+
<i>Anti-Cancer Drugs</i> (http://www.thomson.com:8866/an/default.html)	+	—	—	—	—	—
<i>Journal of Neuro-Oncology</i> (http://www.wkap.nl/kapis/CGI-BIN/WORLD/journalhome.htm?0167-594X)	+	+	1994–1996	—	—	—
<i>Melanoma Research</i> (http://www.thomson.com:8866/mh/default.html)	+	—	—	—	—	—
<i>Cancer Journal</i> (http://www.infobiogen.fr/agora/journals/cancer/homepage.htm)	—	+	1992–1996	+	Editorials and reviews	—
<i>Investigational New Drugs: The Journal of New Anticancer Agents</i> (http://www.wkap.nl/kapis/CGI-BIN/WORLD/journalhome.htm?0167-6997)	+	+	1994–1996	—	—	—
<i>Cancer Detection and Prevention</i> (http://www.cancerprev.org/)	+	+	1993–1996	+	—	—
<i>European Journal of Cancer</i> (http://www.elsevier.nl/locate/ejonline)	+	+	1995–1996	+	—	+
<i>American Journal of Clinical Oncology-Cancer Clinical Trials</i> (http://www.lrpul.com/journals/j1014.htm)	+	—	—	—	—	—
<i>Pediatric Hematology and Oncology</i> (http://www.lrpul.com/journals/j1062.htm)	+	—	—	—	—	—
<i>International Journal of Gynecological Cancer</i> (http://www.blacksci.co.uk/products/journals/xijgc.html)	+	—	—	—	—	—
<i>Supportive Care in Cancer</i> (http://www.springer.de/medic/journals/onkolog.html)	—	—	—	—	—	—
<i>Medical Oncology</i> (http://www.thomson.com:8866/mo/default.html)	+	+	—	—	—	—

Table 2.—*contd.*

Journal title (URL)	Aims and scope	Instructions for authors	Table of contents*	Abstracts or summaries	Full text	Searchable index
<i>Neoplasma</i> (http://savba.savba.sk/logos/journals/ap/neo/home.html)	—	—	1995–1996	+	—	—
<i>Oral Oncology</i> (http://www.elsevier.nl:80/inca/publications/store/1/0/5/)	+	+	1995–1996	—	—	—
<i>Biochemical Journal</i> (http://www.portlandpress.co.uk/bj/)	+	+	1995–1996	+	Articles	+
<i>BMJ—British Medical Journal</i> (http://www.bmj.com/bmj/)	+	+	1995–1996	+	Editorials	+
<i>Cell</i> (http://www.cell.com/cell/index.html)	+	+	1995–1996	+	—	+
<i>FASEB Journal</i> (http://www.faseb.org/)	+	—	Current issue	+	—	+
<i>Journal of Biological Chemistry</i> (http://highwire.stanford.edu/jbc/)	—	+	1995–1996	+	—	+
<i>Journal of Molecular Biology</i> (http://www.hbuk.co.uk/jmb/)	+	+	1995–1996	+	Articles	+
<i>Mortality and Morbidity Weekly Report</i> (http://www.cdc.gov/epo/mmwr/mmwr.html)	+	—	+	+	—	+
<i>Nature</i> (http://www.nature.com/)	+	+	+	+	—	+
<i>Protein Science</i> (http://www.prosci.org/)	+	—	1995–1996	+	Articles	—
<i>Science</i> (http://www.aaas.org/)	+	+	1995–1996	+	Editorials and letters	+

*Available years shown. †At the date of publication EJC had gone online, providing access to abstracts and full text, free for 1998—this was not included in the analysis. URL, Uniform Resource Locator; +, present; —, not present.

and other database resources offered by the *Journal of Biological Chemistry*, or member benefits, such as discounts for meeting attendance, for scientific books and journals and for car rental and travel, offered by the journal *Science*.

DISCUSSION

Our analysis highlights the present limitations of information available in scientific journals on the Internet and, in particular, by the journals included in the oncology field where, at least for clinical research, expedient and extensive dissemination of the results is highly desirable.

Indeed, the Internet seems useful only for publishers seeking to market their products, or for authors needing information for the submission of papers, e.g. journal aims and scope, instructions for authors, names of editorial board members and addresses for manuscript submission. In this regard, electronic submission of manuscripts is sometimes possible. Moreover, some journals make available an order form to request a free sample copy in order to illustrate article content to users and to guide them in the layout and submission of manuscripts.

In order to find complete bibliographic information on specific articles, users can resort more profitably to document delivery services, also available in the Internet, which provide by e-mail and free of charge, periodical tables of contents on specific topics [17]. Moreover, these services allow users to order the original articles, which are then sent via mail or fax (selectively ordered and paid for). The majority of the journals analysed use their Internet sites merely as inexpensive advertising tools for respective products. This use is not innovative: the features of the service are the same as those used in the printed journal and the new applications that the Internet enables are not fully exploited.

Some journals simply provide the tables of contents and abstracts, along with specific pricing and subscription information for printed and/or online journals. In contrast, some electronically distribute entire issues to subscribing members. Essentially, publishers currently utilise the Internet to expedite their services, e.g. to allow online requests for original articles, subscription to the journal or requests for back issues. Difficult payment conditions and the non-confidential nature of the Internet now limit the possibility of providing other useful services via the network.

Only some publishers have recognised that the most promising and practical means to redeem online publishing is to create different services available only for online subscribers: the simple browsing of the current or back issues of a given journal cannot justify the subscription cost of an online journal, even if these are available via hypertext tools. Online costs constitute one of the most important and still unresolved problems. The American Society of Biochemistry and Molecular Biology, after a free-access trial period, eventually opted to offer the electronic version of its journal to subscribers of the paper journal, but at double the cost. Other

scientific publishers are seemingly following suit and adopting this strategy, and the future of their online products will depend on how much users are willing to pay. This is a pressing matter, since it must be borne in mind that users are generally reluctant to pay the charges for these services.

Other obstacles have hampered the widespread uptake of electronic journals. For instance, the inexperience about how to access and to search them: most electronic journals are HTML files which are not easily searchable by subject or free text (Table 1). The WWW interface has tools which can be used for searching these formats, but an unskilled Internet user can still find them difficult. The lack of basic levels of electronic technology in underdeveloped countries presents yet another obstacle. Finally, the electronic medium has yet to resolve all important matters intrinsic to scientific publishing, such as the quality assured by the peer review process and citation analysis, not to mention copyright regulations. For these and other reasons, the replacement of printed journals by their electronic counterparts in the field of biomedicine does not seem possible in the short term.

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