

important as ever. Multiparallel high-throughput technologies will provide only new methods for doing so. Another concern for plant scientists in Europe is therefore the need to attract talented young researchers.

Given the current controversy in Europe over the introduction of transgenic food plants, it is essential that European plant scientists help to reorient political and public thinking about this topic. Perhaps the best approach is to make a clearer distinction between basic plant science and the agricultural applications that follow by exploiting the knowledge created. European plant scientists have recognized the urgent need to inform the

public and to lobby policy makers. As one outcome of the current funding crisis, several major European plant research institutions established the European Plant Science Organization (EPSO) in February. Chaired by Marc Zabeau from the University of Gent in Belgium, EPSO will primarily form a multinational platform of plant scientists to increase the visibility and impact of plant science on business and society by advising funding agencies at the European and national levels on long-term strategies to support plant science. To continue the success story of basic plant science in Europe, there has to be a broader understanding and appreciation this research for its own sake.



Chris Bowler

The author is head of the Laboratory of Molecular Plant Biology, Stazione Zoologica 'Anton Dohrn' in Naples, Italy.

E-mail: chris@alpha.szn.it

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World Wide Wisdom

Electronic publishing is moving ahead

The story of publicly funded electronic publishing in the life sciences reads like an old-testament pedigree: E-BioMed begets PubMed Central, which begets PubMed Central Express, both of which are sisters of PubMed and are related to BioMed Central, which is almost family and collectively they inspire the creation of E-Biosci. This saga will eventually affect the work of all practising scientists and has already raised very fundamental questions about the way we have been communicating our results. Issues such as the effectiveness of peer review, the power of editors, the intrusion of commercialism, the altruistic role of scientists in reviewing manuscripts, the physical limitations of printed papers, adaptations of the systems to communicate large data sets, even the limits of the ill-defined area called life sciences are problems that will return in the future but are part of the genesis of this story.

It is a truism that the e-world will have an impact on all areas and activities of society, and the Gutenberg-based method of announcing our scientific results cannot be an exception. But how an internet-based product will look and feel and how we will get there still has to be worked out. By collecting abstracts of a large number of articles and presenting them in

a readily screened manner, Medline and PubMed have already shown the way forward. The popularity of this free, current and increasingly complete compilation of material led to a proposal that there should be a single site where the *full text* of all papers in a certain area of research could be searched at no cost.

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E-BioMed, the first attempt to establish such a system, was brought to the attention of a wide community by David Lipmann from the National Institutes of Health, MD, and Pat Brown from Stanford University, CA, at a Banbury conference at the end of 1998. It was then given the important impetus of Harold Varmus's active support when he was the Director of the NIH. David Lipmann has since been at the core of the development of this electronic service and its delivery by the NIH, and deserves additional credit for pushing forward an ambitious agenda for electronic publishing that will eventu-

ally benefit scientists world-wide. As Lipmann is also the person responsible for the USA component of the international DNA database, the outcome most expected from the Banbury announcement would have been some similar system where the Europeans, Asians and others would have worked out protocols with the NIH to achieve a 'single' electronic publication service.

But the original presentation of E-BioMed attracted a disconcerting amount of criticism, which prevented its rapid implementation. Major concerns were the potential limitation to medical research, the suggestion that peer review could become optional in life science/medical research publications, a lack of realism in terms of distributing, without charge, content owned by others, and the fact that learned societies rely on the income from their journals. The discussions with the European Molecular Biology Organization, which was leading the analysis from a European perspective, were abruptly stopped when PubMed Central, into which E-BioMed had changed in the meantime, decided to launch under its own terms early in 2000, a date that coincided with the end of Harold Varmus's term at the NIH.

This action called for a decision on whether to accept the NIH plans and participate in their system or to establish a similar European-based system. The latter option was chosen, using the name E-Biosci for the project, after a series of meetings organized by the European Molecular Biology Organization with representatives of many European countries, the European Commission, learned societies, representatives of the libraries, other European organizations and the publishers. A main argument for establishing a European site was the concern about a system which, if resoundingly successful, could lead to a monopoly. For instance would access to PubMed Central be denied to scientists in countries regarded as hostile to the USA? Would unfair commercial advantages accrue to the USA if they had possession of all information on the interests of the users? Of course, similar concerns would pertain to any monopoly under the control of a European country.

Since the decision to establish E-Biosci, much has happened away from the public glare: a governing body has been established under the auspices of the European Molecular Biology Conference; a technical committee has worked out various design aspects; the project is looking for a manager; and contacts have been reinforced with the content providers (see <http://www.EMBO.org> for an update).

Although E-Biosci will be based in Europe, it aims to provide a global service by cooperating with PubMed and Pubmed Central. But there are some interesting differences between the European plan and that of the NIH. The European position is that a site with little content will be of little service to scientists, so its supporters hope that the publishers of a very wide range of journals will provide full text to E-Biosci. The publishers will be encouraged to make access to the material available without cost, and there are indications that this will increasingly be the case. In the interim, and on the basis of decisions that will be made by each journal individually, the user may have to pay to access the full text of selected articles.

Another important difference is that E-Biosci will extensively use the skills and content that various groups in Europe have already developed. The European service will therefore be a network of con-

nected sites rather than a centralized server like the one at NIH. The complexity of this system is, of course, obvious but it may ultimately increase the speed of connection, provide backup systems, and allow entry enquiries in different language formats. This would also reflect the manner in which Europe most frequently works. But as the most important goal will be to deliver E-Biosci as soon as possible, some of these steps may have to be taken in a phased manner. The current timetable envisages a launch of a bibliographic and abstract service at the end of 2000, and a move towards full-text searches in 2001.

In contrast to PubMed Central Express, a site related to and run by PubMed Central, E-Biosci does not plan to have non-refereed content although it will monitor developments in this area carefully over time. E-Biosci will also act as a host to those societies or companies that wish to provide serious reviewing and editing services. PubMed Central has announced the same aim, but it appears that PubMed Central and the commercially driven Biomed Central view each other as their favoured partners. This impression comes from the pre-announcement of Biomed Central on the PubMed Central site, and the fusion of the terms PubMed Central and E-Biomed into Biomed Central. If this reading of events is accurate, then it is ironic that a major justification for the establishment of PubMed Central was to combat the excessive profit-making activities of some publishers.

But simply putting papers on the internet certainly does not use the full potential of this medium. E-Biosci will establish a complete information service for its users including databases and other media. An interconnected triangle of online material like journals, databases, and other items such as videos, 3D images or sound will be a major resource used by scientists in the future (Figure 1). Access to the data will come from any point of the triangle but will require links to related information. We will not be limited to, or thinking of, reading an article or a related reference in a journal. For example, our work may yield a new sequence, which will benefit from the DNA and protein databases to define its potential role. The published papers will greatly expand on our understanding of the gene or its product and we

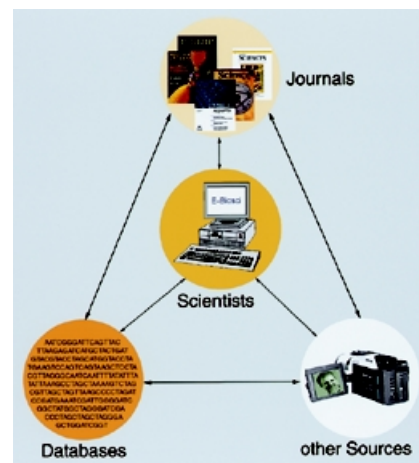


Fig. 1. Schematic of future online resources and their accessibility for scientists.

may be able to obtain a video image of it in action.

In the future, scientists will start their day by logging into one of these sites and asking what is new in their favourite area of research, tapping not only into publications but also numerous databases. This will have consequences beyond simply keeping us better informed. Small specialist journals that are essentially unread today will become more visible. Refereeing mechanisms will have to be re-examined. Archiving of the combinatorial, personalized collection of the material a scientist reads will require new solutions. Basically, it also means that scientists and publishers will have to adapt to this new medium and the presentation of data.

Much will indeed change, but proven systems will of course remain. It has been pointed out that TV did not kill the radio, nor did the pencil die with the arrival of the ball-point pen. Journals in print form will continue to exist. But the option to use the full range of electronic communication will enrich our possibilities to allow a more efficient dissemination of data—the core reason for our daily efforts in the laboratory.

Frank Gannon

The author is the Executive Director of the European Molecular Biology Organization.
E-mail: embo@embl-heidelberg.de

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