Some subscribers have defected recently to the Internet. But John Mullaney, SatelLife's executive director, remains certain that this less glamorous system—based on rational technology—will have a vital role for many years. HealthNet works well enough and is affordable. Full and direct connection to the Internet may be more exciting and, in theory, may be much quicker because it delivers information immediately. But it is more expensive to set up and use, is difficult to use well (because it is unregulated and messy), it needs expensive technical support, and its telephone lines are often engaged or prone to disconnection. "Our store and forward low earth satellite technology may appear to some to be a Model T on the information highway," say SatelLife's directors. "Nonetheless it is appropriate, simple, inexpensive, and sustainable."

Publications are distributed in collaboration with other organisations including the World Health Organisation, the Centers for Disease Control, Atlanta, Appropriate Health Resources and Technologies Action Group (AHRTAG), World Bank, and publishers of medical journals.

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Rights, wrongs, and journals in the age of cyberspace

Following their earlier onslaught on print journals,[1 2] Ron LaPorte and Bernard Hibbitts argue—with a little help from the Beatles—that journals have forced scientists to give up their copyrights and lose control of their work. The Internet, and the possibility it offers of electronic self publishing, has changed all that, and they argue that journals must recognise that the world has changed. We asked the editors of the "BMJ," the "Lancet," the "New England Journal of Medicine," "JAMA," the "Annals of Internal Medicine," "Science," and "Nature" for their comments. One didn't reply and two declined, but the other four responded robustly.

"We all want to change the world"

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You say you want a revolution,
Well you know
We all want to change the world.

These famous lyrics come from the Beatles' song "Revolution." In 1986 the world was startled to hear that the rights to this and most of the other Beatles songs had been bought by Michael Jackson. Paul, George, and Ringo now have to ask Jackson's permission to perform the music they wrote. They even have to pay him royalties. Meanwhile, Jackson can authorise others to use Beatle's materials for any commercial purpose he sees fit. As a result, "Revolution" itself is being used to sell Nike sneakers, and there is nothing the Beatles can do about it.

This artistic tragedy may make many scientists thankful they are not musicians. But wait a minute. Who owns scientific papers? Typically not the scientists who write them, but rather the journals and publishing houses to which scientists routinely grant their copyrights. Once scientists sign copyright forms, other scientists and even the original scientific authors have to seek the journal's permission before reproducing the figures and text which they created. The journals, in turn, can do what they like with scientific papers. They can grant permission to reproduce or reprint them, or they can refuse to grant permission. They can use scientific papers to advertise themselves in the media. In all these instances the original authors are helpless. In some respects, scientists are worse off than the Beatles. The contract with Michael Jackson at least granted Paul, George, and Ringo an ongoing income. Scientists, on the other hand, not only receive no income from the journals but often have to pay them page charges under the same contracts by which they surrender their copyrights.

"Let me tell you how it will be, there's one for you, nineteen for me"

Why do scientists tolerate this situation? The traditional answer is that they have no option. In this century journals have monopolised scientific communication. They have provided virtually the only means of effectively and efficiently communicating research findings to the broader scientific community. Scientists, afraid of becoming like Father Mackenzie,

Writing the words of a sermon that no one will hear,

are willing to agree to virtually any terms of publication dictated by the *BMJ*, *Science*, *Nature*, the *Lancet*, the *New England Journal of Medicine*, and the like. They know that if they do not agree to those terms their papers will not be published, their work will not be known, and their careers will be compromised. No wonder scientists say,

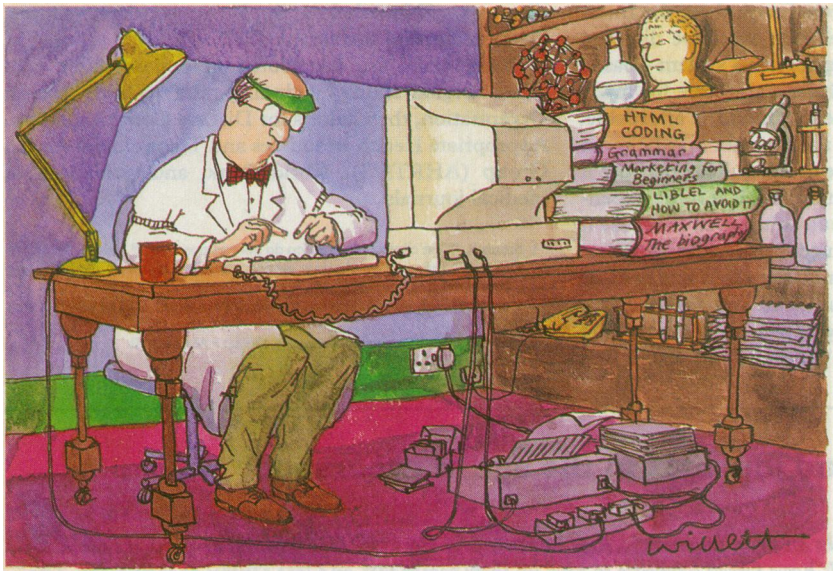
If you really like it, you can have the rights.

Journals thus end up owning very valuable intellectual property which they barely contributed to making. Taxpayers and charitable donors fund most research; universities house much of it; scientists conceive of it, do the research, and pay to have it published; yet the journals have complete control of the articles coming out of it.

Self publishing for all

There is no need for this any more. The recent development of the Internet, and in particular the world wide web, provides scientists with a publishing alternative that is in many ways superior to traditional journal publication. In brief, scientists with access to web servers at their institutions now have the option of electronically publishing their work themselves. Self publishing on the web enables scientists to:

- Report their findings right away, instead of having to wait months or years for formal review and printing
- Post material virtually for free instead of paying hundreds of dollars per paper in page and reprint charges
- Make their findings available to a worldwide audience far larger than the subscription list of any journal



- Present their work for immediate comment and critique by other scientists, thereby promoting dialogue which is the essence of science itself
- Disseminate their work without forcing them to give up copyright control.

Recently, we have argued in the medical and legal literatures that the development of the Internet and its potential for scholarly self publishing will in the long run cause the collapse of traditional journals.[1,2] Our prognostications have been extremely controversial in both health and legal circles.[3,4] In the short run, however, we think that Internet publishing might supplement journals rather than replace them. Scientists interested in reaching as many of their colleagues as possible—especially those colleagues as yet without Internet access—should distribute their work as self published electronic preprints and simultaneously submit those preprints for formal journal publication.

This significant step in the direction of restoring scientists' control over the distribution and use of their own work will be feasible only if journals agree to publish preprinted material. So far, biomedical journals seem disinclined to do this. The *New England of Medicine* has, for instance, taken the position that a manuscript distributed via email to a couple of dozen colleagues has been previously published and will not be considered for inclusion in one of its issues.[5]

Such a pre-emptive strike against scientific self publishing is inappropriate for various reasons. Firstly, biomedical journals have traditionally allowed a type of prepresentation of scientific data by allowing research findings to be preliminarily communicated to hundreds and even thousands of people at scientific conferences. Far from reducing the value of their articles, such preliminary dissemination generally creates demand for them in more finalised form. Electronic preprinting could well work the same way.

Secondly, biomedical scientists currently operate within a reprint culture which generates income for journals despite readers' access to photocopy machines; even if preprints of papers were available on the Internet, a demand for papers published in journals would persist for some time.

Thirdly, the biomedical journals—and the scientists who edit them—should keep in mind that their ultimate purpose in existing is to serve the scientific community, not to advance or preserve themselves as institutions. What counts is the message, not the messenger.

Fourthly, biomedical journals have a duty to keep their own scientific subscribers thoroughly informed of important developments in biomedical research as rapidly as possible. Whether an important article has previously been preprinted is irrelevant to the fulfilment of this duty.

Fifthly, biomedical journals refusing to publish preprinted material are acting contrary to the established policy of journals in other disciplines, including physics and law, which have tolerated and in some instances even encouraged preprinting.

Finally, biomedical journals refusing to publish preprinted articles are arguably interfering with scientists' rights to do what they wish with their work before any copyright transfer form has been signed; in other words, not content with the prospect of controlling scientific publications after placement, the journals are indirectly attempting to control them beforehand as well.

Try to see it my way,
Only time will tell if I am right or I am wrong,
While you see it your way
There's a chance we may fall apart before too long.

A new way

If biomedical journals persist in refusing to publish preprinted articles, scientific societies such as the British Medical Association, the American Association for the Advancement of Science, and the American Medical Association should consider stepping in to ensure that they conduct themselves in responsible scientific fashion. It may be, however, that these societies will decline to intervene, as many of them derive considerable revenue from the publication of biomedical journals and may fear that preprinting might endanger that.

In these circumstances biomedical scientists may have to take matters into their own hands. Traditional protests might take the form of boycotting particular journals, or stopping subscriptions. A more viable and increasingly plausible alternative might be for as many biomedical scientists as possible to migrate directly to the Internet. There, like physicists, they could create their own online community—complete with central archive and reader rating of papers— where they could publish and speak directly to one another without outside help or intervention. If anti-preprinting policies persisted the biomedical journals might eventually wither from a lack of quality submissions.

To avoid this dramatic development, biomedical journals should take dramatic action to make themselves more rather than less attractive as publishers of scientific research. Instead of threatening scientists with a stick they should consider offering them a carrot. This carrot might take the form of a faster review process, elimination of page and reprint charges, or more Internet editions of print based publications. In the light of concerns expressed earlier in this paper, journals might also consider offering scientific authors the option of non-exclusive licensing. This legal arrangement, already embraced by a number of forward looking print and Internet based periodicals, would give biomedical journals the right to publish scientific articles and derive some profit from them without requiring scientific authors to desist from preprinting or even giving up their basic copyrights as a term of traditional publication.

Scientists guaranteed ultimate physical and financial control of their work would feel less obliged to choose between preprinting and formal publishing, between the Internet and journals. They would be free to enjoy the best of both worlds for as long as they might wish. In turn, the biomedical journals, far from doing themselves irreparable harm, would be radically improving the chances of their own institutional survival—if not necessarily forever, at least for a long while. At the same time, they would be able to take

pride in their renewed status as good citizens of the scientific community.

Think of what I am saying,
We can work it out and get it straight or say good night.
We can work it out,
We can work it out.

Addendum: The Global Health Network will be doing an experiment to evaluate different forms of research communications on the Internet. A single scientific research communication entitled "Scientists assassinate journals" was written for lay readers, scientists, and editors in a "hypertext comicbook" format. It is available in English, Spanish, Portugese, and Japanese. Viewers will have the opportunity to comment as there are electronic forms to rate the piece on a scale of 1 to 5 and provide a critique on the content and the format. We are encouraging as many people as possible to visit the site: http://www.pitt.edu/Home/GHNet/publications/assassin

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A glass of water and somewhere to whinge

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Almost 10 years ago the United States Office of Technology Assessment predicted that the time would come when authors of scientific papers would communicate directly with readers through electronic networks. Scientific journals would not be needed. Ten years ago few people had heard of the Internet and even fewer people were connected to it. Now many millions of people are connected, and the number increases rapidly everyday. The network is in place for the academy's prediction to come true.

Why would authors want to go directly to readers? Speed. To avoid interference from editors and other busybodies. To maximise control over their product. And—importantly—because they resent making money for publishers. Robert Maxwell and others (not all of them as unworthy and corrupt as Maxwell) have grown fabulously rich from publishing science. And what have those publishers done? I once heard an author in one discipline put it thus to a publisher: "We write the stuff for this journal. We peer review it. We edit the journal. We buy the journal. We read it. What exactly do you do?" The answer, scandalously, in the case of many publishers is "not much."

No future for minimalist publishing

Traditionally, what I call "minimalist" publishers have put up the money to start the journal; paid nothing to the editor, the editorial board, and peer reviewers; neglected design and technical editing; paid somebody to print the journal and the postal service to distribute it; overpriced the journal; not bothered with marketing (because the journal goes to a captive audience); and then gathered in substantial revenues. Because their costs have been minimal their profits have been large.

So are we about to see the end of journals? I think that these minimal journals will cease in paper form. But other journals stand a chance of continuing—and not only because for a short while digital technology will not be able to match the resolution and comfort of print on paper. Journals will survive if they "add value." The best journals add the values of distillation ("drinking from a glass of water rather than from a fire hydrant"), independent legitimisation, first class peer review that improves papers substantially, good design and technical editing, commentaries that set scientific papers in context, an audience, marketing, a voice for a community, a forum for debate, education, an introduction to subjects you never thought important, a means to campaign, up to the minute news, evidence based advice, a place to tell your friends you are dead, somewhere to whinge, a source of after dinner stories, and something to wrap up fish and chips.

What's more the journal can do much of this, and some new things, not only on paper but also on the Internet, using the particular advantages of electronic publishing—speed, links to other material, customisation, and interactivity. I think we add enough value to continue to be paid, but I would, wouldn't I?

A colourless conveyor belt?

Richard Horton

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Richard Horton, *editor*

Paperback Writer? Ah, so perhaps LaPorte and Hibbitts's oracles were in favour of publishing after all. Still, the practice of (Ingel)fingering papers, whether in ink or in HTML, lives on as a curious relic of academic paternalism.* For who can doubt that authors have the right to distribute their research findings how they please? In medicine authors do not need an editor or an invidious "rule" to tell them of the potentially calamitous risks they run by placing their work directly in the public domain without the help of journals. Health and its persistent media scares are not like the minutiae of, say, gene transcription—the impact on public health can be devastating. A discriminating gateway, however imperfect it might seem, provides one means of limiting potentially grievous harm.

LaPorte and Hibbitts accuse editors, and the journals they temporarily preside over, of having a monopoly on scientific communication. But we do not force researchers to send the *Lancet* over 6000 papers and 5000 letters each year. That is no monopoly. It seems to be a genuine need. And when that need vanishes, so will we. Charging for pages? We don't. Begging scientists? Always polite, rarely ingratiating, but never begging I hope.

Should we be ashamed of our links to commercial publishers? Journals are not just vehicles to deliver the perfect prose of others. We peer review; we edit; we commission commentaries, reviews, and series; we write editorials and news. Although we might fail, we try toadd some value to the research we publish. LaPorte and Hibbitts' rather colourless concept of a journal, a