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My essay for the previous edition reflected my interests, needs, and activities during my tenure as president of the Rockefeller University. Now, I have somewhat more focussed informational needs as the head of a laboratory (in molecular genetics). I am also busier than ever as a consultant (on infectious disease-related matters) to government, to NGO's like the National Academy of Sciences, and to the biotechnology industry. These all entail a need for currency in mechanisms of pathogenesis, innovative approaches to diagnosis and treatment, drug discovery, and innumerable interfaces of scientific advance with public policy. But more important by far than these modulations of demand has been the acceleration of change in communications technology itself. As it happens, I have not been innocent of involvement with that technology (1,2) for the last 35 years. But in the last decade this has leapt out of the box of academic arcana (like arpanet) to the now all pervasive internet.

We are still at the early stages of that transformation, and can but dimly guess at its ultimate form. Moore's law, that computer capability will grow at compound interest at about 60 (sic) percent per annum, shows no signs of slackening. The net result has been, several years since, that everyman's desktop PC far exceeds the power of the mainframe "supercomputer" that, for example, powered the entire Stanford University campus 35 years ago; and there is every reason to expect a nearly comparable expansion the next life cycle ahead. The entire literary content of the world's libraries can now be stored in an affordable electronic database, and can be transported and searched by globally accessible means in times comparable to the attention span and patience of human users. It will be some while before very much of that backlog of our technical and cultural heritage is actually scanned and committed to electronic bytes: that is about as cumbersome as scanning documents through a photocopier. And much of that heritage is on crumbling acidified paper that will demand special attention before it

disintegrates. But most of the current literary production is mediated by electronic devices, making it almost trivial to capture new bytes even as they are emailed to the printer.

There are nevertheless hazards about electronic preservation: a byproduct of rapid technological change. The bytes are not so volatile, though there are perils at that level, the more so with malicious assists from hackers planting computer viruses. More parlous: the rapidly changing hardware for electronic storage rapidly obsoletes last year's systems. If you worried about Y2K crises last year , you may have overlooked how you were going to read the soft 5-inch floppy disks that were the standard a decade ago. Not to mention the stacks of IBM magtapes that used to be the status symbols of electronic sophistication.

These concerns, and who will pay for assurance of sustainability, are in the background, affecting most medical users only at second hand. They will become urgent if you are collecting statistics from patient records of a certain vintage; and you may be luck to have had an information technology infrastructure alert to protecting the past as well as ushering in the future.

Of even broader immediate import are the changes in how knowledge is being metabolized. Starting in the laboratory, bioinformatics of course plays an indispensable role in the initial generation and processing of laboratory data, most dramatically obvious in the burgeoning of genomics. Every day, new evidence emerges of the association of disease susceptibility with inherited DNA sequences; and likewise of the recognition of biodiversification of pathogens like HIV and E. coli O:157. Authors and readers will then be quite impatient if they must wait months for new findings to appear in print journals, and further delays in actual access to new scientific claims in traditional print form. This is partly mitigated by the enhancement of

bibliographic services like MEDLINE and Science-Citation-Index appearing on the web, with no more than a few weeks delay from the time of the print. We start to see further acceleration with many journals offering near simultaneous access to the web- and the print-versions. There is a natural conservatism on the part of print publishers as they see their opportunities for cost recovery, and sometimes substantial profit, under scrutiny in the face of these alternatives. The very recent announcement by the NIH that "PubMed-Central" will be made available as a canonical site to receive web-based primary papers opens a new chapter in this challenge. While peer-review will remain a voluntary option, and an insignia demanded by many readers before they expend time and energy on reading, the open question is how far the time-saving and convenience of author-driven display will be prejudiced by a deterioration of quality and reliability. We will inevitably see many races for priority in which authors will rush into web-print at the first hint of positive data -- and hope the false starts will be forgotten if they don't pan out. Readers will adapt: they can only scan a tiny fraction of the overall literature anyhow, and they will rely ever more on their agents: reviewers, interpreters, critical experts -- who themselves will need watching. All in all, however, the most important aspect of peer review is critical discourse post-publication, and this should be enhanced in the web culture.

If primary professional publication is just beginning to make its way on the web, it is preceded by a tide of didactic material, course outlines, bibliographies, news items, some review material -- much of it from reputable academic sources, and often a valuable yield for primary search. One of the best of these is the Encyclopedia Britannica, which does not blink at providing pointers to innumerable web sites that expand its utility as a first stopping place. Similar resources are being developed in support of medical professionals -- one thinks of

medscape.com as an exemplar, along with pdr.com -- both of which provide ancillary connections. Professional societies, both in general medicine -- like ama-assn.org and specialties like geron.org provide invaluable services with links to many other sites. Users: evaluate these by your own lights, and by the reputation of the sponsors. They are easily located with the search button on the standard browsers. The journals from time to time will publish lists of evaluated sites.

Overtaking this tide is a torrent of commercial peddling, from which more and more patients are acquiring a taste for alternative medicine -- bereft of any verifiable evidence of efficacy. It is easy to find thousands of pages on Gingko, Hypericum, DHEA -- you name it. (I was amused that "Gingko" did surface an anecdote of the use of the leaf in book preservation, as noted by palimpsest.stanford.edu.) An urgent task for the profession is to provide reliable interfaces for quality control on behalf of that substantial part of the public that will welcome such guidance. The rest can buy their nutriceuticals, and the books advocating them, right off the net. To deal with their patients' information and misinformation, primary caregivers and specialists will have to familiarize themselves with this cyber-literature. And they will have to organize themselves to cultivate the trusted intermediaries to help organize critical discourse and reliable judgment about the cyberlit, just as the societies have done for the flow of print. The volume grows inexorably, but we also have tools of inestimable power if we commit ourselves to a rational division of labor, towards a well-tuned social intelligence.

(1) Lederberg, J.

Digital communications and the conduct of science: The new literacy.

Proc. of the IEEE (1978), 66(11):1314-1319.