LETTERS

Computer Technology

Philip H. Abelson, in his editorial "Support of scientific journals" (23 Oct., p. 393), addresses a problem that has been developing over a long period of time. The plight of the libraries has developed in step with the growth of science itself. For the various reasons he mentions, institutions are quite unable to provide the resources necessary for libraries to stay abreast of the growth in the volume of the periodical literature. It seems quite impossible at this point for libraries ever to catch up by increasing the volume and variety of their serials holdings, nor is such a solution necessarily a desirable one. It is time to look to the science and technology that have caused the problem to provide ways of solving it.

There have, of course, been a number of very successful attempts to use computer technology in bibliographic work. However, as a rule the more successful of these attempts have involved systems for retrospective search through the contents of the scientific literature.

Possibly the time has come to abandon the idea of publishing papers in the conventional sense. The technology is now available to institute a system for the dissemination of new scientific knowledge by using computers and communications networks connecting individual scientists with "papers" stored on an appropriate computer. The "papers" need be stored only on one computer, or perhaps even on one computer per discipline managed by the appropriate professional organizations that publish today's periodicals. There would be room in such a scheme for the publishing houses also to participate and to obtain their revenue through charges to individual scientists or to their institutions. The papers could be made available in foreign countries by transmitting to the appropriate professional organizations in those countries machine-readable copies of the "journals." Foreign journals could be brought here in the same way.

The individual scientist could browse through the "journals" using software analogous to that developed at the National Institute for Medical Research in London in the mid 1970's (*1*). A scientist needing a hard copy of a paper or parts of a paper could very easily run it off on appropriate equipment associated with his terminal or available at his institution's computing center.

The above is already obvious. Its implementation would encounter a number of obstacles. However, I do believe these obstacles can be overcome, and it is already rather clear that the electronic distribution of information represents the only hope of solving the problems that we all recognize so clearly. Perhaps the AAAS could take the initiative and organize such a solution.

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Creationism and Academic Freedom

In his useful article about the creation science controversy (News and Comment, 6 Nov., p. 635), Roger Lewin remarks that "the fight will be on many fronts." One front largely overlooked thus far in discussions of the issue is the effect of creation science legislation upon the academic freedom of college and university professors. The creation science legislation recently adopted in Arkansas and Louisiana is concerned mainly with public school curricula. Nevertheless, faculty members who educate public school teachers would presumably have to be trained in creation science so that they could educate their students accordingly. But members of college and university faculties in Arkansas, Louisiana, and elsewhere should be able to teach and criticize freely in accord with professional standards. Creation science legislation would impose an unacceptable limitation upon the faculty member's ability to carry out these obligations. For this reason, at its recent annual meeting, the American Association of University Professors declared its opposition to creation science legislation as "utterly inconsistent with the principles of academic freedom" in the higher education community.

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Portfolio Theory

Paul Samuelson's generous article on my career (30 Oct., p. 520) overstates, I think, the weight of portfolio theory in the work for which I was cited. More important, I would like to emphasize more strongly than the article does the prior contribution of Harry Markowitz to this subject. Markowitz invented the mean-variance analysis of portfolio decisions. In his 1952 article "Portfolio selection" (*1*), Markowitz introduced the concept of efficiently diversified portfolios, that is, those that maximize expected return for given risk as measured by variance. In his 1959 monograph *Portfolio Selection* (*2*), he thoroughly elaborated the theory and provided algorithms for calculating efficient portfolios given estimates of the means, variances, and covariances of return on available securities. Markowitz spent the 1955–1956 academic year at the Cowles Foundation at Yale, during which he prepared the monograph; and I would also like to acknowledge his personal help and stimulus to my own work.

Our orientations were different. I was working on portfolio theory because of its implications for macroeconomics and monetary theory. In citing Markowitz's work in my 1958 article "Liquidity preference as behavior toward risk" (*3*) I said, "Markowitz's main interest is prescription of rules of rational behavior for investors: the main concern of this [my] paper is the implications for economic theory . . . that can be derived from assuming that investors do in fact follow such rules." The article applied mean-variance analysis to the choice between safe liquid assets, on the one hand, and risky assets or portfolios, on the other. The paper also introduced the "separation theorem," which together with Markowitz's analysis became the basis for the Lintner-Sharpe capital asset pricing model.

An implication of mean-variance analysis is that assets are generally imperfect substitutes for one another. Many of my papers seek to develop the consequences, for financial markets and for the economy at large, of imperfect substitutability. It is to this work that the Swedish Academy primarily refers in its citation "the analysis of financial markets and their relations to expenditure decisions, employment, production, and prices." I certainly hope that the mention of portfolio selection among other aspects of my work does not obscure the clear precedence of Markowitz's contributions.

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