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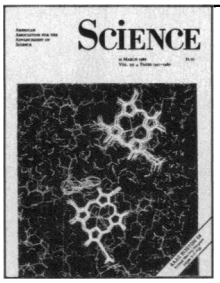
■ The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to foster scientific freedom and responsibility, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.




COVER A molecular dynamics simulation of electron transfer complex formed between cytochrome c and cytochrome $b_5$. Dynamic motions of the cytochrome heme prosthetic groups and cytochrome c phenylalanine 82 are superimposed on a static snapshot of the polypeptide backbones and solvent water molecules hydrating the complex. See page 794. [Graphic output from MOLEDITOR by Richard Hilmer, Central Research and Development Department, E. I. du Pont de Nemours & Company, Wilmington, DE 19898]

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# Retroactive Prophets

Periodically society is confronted with a crisis in which new phenomena appear puzzling or incomprehensible when viewed through existing concepts. Each such crisis generates its own crop of self-appointed experts with fresh hypotheses and pathways to salvation. Whether it be Bhopal or Chernobyl or the crash of the stock market, one can expect sober-looking individuals to announce solemnly that the crisis could have been avoided if the world had listened to their analysis. The pronouncements each sound so reasonable and the solutions so simple that the listener wonders how responsible authorities could have failed to heed such sage advice. Yet, the different experts, with equally passionate conviction, advocate highly divergent solutions. The stock market crisis is a case in point. One group of financial experts says confidently, "The deficit caused it"; others point the finger at trade imbalance, computers, arbitrageurs, the strong (or weak) dollar, or high (or low) interest rates. How should society distinguish between the true expert with a vision of the future and the false prophets who are reciting hindsight?

When new dichotomies confront existing concepts in science, experts in the area attempt to explain them from existing theory and, if unsuccessful, postulate new hypotheses. Since there are frequently competing hypotheses, ability to predict the outcome of experiments is usually the criterion by which the true prophet is selected and the correct theory verified. From atomic structure to genetic inheritance to the germ theory of disease, science has advanced by the sequence of confrontation, hypothesis, prediction, verification.

In applying the scientific method to the stock market crisis, the first question should certainly be the ability to predict. And the criterion for expertise should depend on the answer to, "What did you do with your stocks before black Monday?" Retroactive predictions of the "I told you so" variety coupled with simplistic solutions would be acceptable only if they had been acted upon before the trend became obvious. Otherwise, the listener could correctly conclude that the situation is more complex or less comprehensible than the "expert" is claiming. A less dramatic version of this criterion is even easier to apply: after a particularly passionate exhortation for a specific course of action, the questioner could ask, "What do you predict will happen to the market tomorrow?" In fact, many interviewees in the current crisis answered, "I can't tell" or "No one knows," essentially nullifying the oversimplified solutions they were advocating.

The predictive criterion could be applied to many other social enterprises. Diagnosis of infectious disease is an area in which experts are almost invariably successful and nonexperts do not know where to begin. Parole boards could be tested with case histories of known criminals and asked to predict courses of conduct of these known parolees. Their predictions could then be compared with the actual outcomes to generate a "predictive quotient," like batting averages in baseball are computed to evaluate competence. Cost estimators for public projects, psychiatric experts who commit mental patients, legal experts who predict trial outcomes, and transportation experts who predict usage of public transportation systems are a few of the categories that instantly spring to mind for similar treatment. The day might come when one could look on the wall of a physician's office and see the predictive quotient of the ability to diagnose illness. Judges seeking office might have to produce their predictive quotients on cases in which they gave "good risks" suspended sentences or drunken drivers one more chance. (Asking editors to post track records on the great papers that they rejected is, however, going too far.)

This, at first, may seem utopian, but it is not only feasible but also appropriate for society to evaluate those who claim to be experts.

De Toqueville noted that the public will choose to believe a simple lie in preference to a complicated truth. Sometimes we must face the fact that a situation is so complex that we cannot extract the causes immediately and devise simple solution. In other cases the cause will be sufficiently understood by experts so that certain courses of action are more likely to have good outcomes than others. Issues such as the dangers of microorganisms in the environment, immigration policy, nuclear arms control, surrogate motherhood, and the use of animals in research are some of the complex dilemmas in which some people are better at predicting the future than others. A track record in real prophecies that proved to be correct may help us select those who have a true vision of the future from those who are merely describing the past.—DANIEL E. KOSHLAND, JR.