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Bad Science and Social Penalties

Bad science, especially in the environment and health area, may well impose socioeconomic penalties hardly envisioned. Health effects data, for example, are used as a basis and as a rationale (often emotional) for far-reaching decisions on the control of technology. All too often, published partial findings are taken uncritically at face value, misinterpreted, and misused; their qualifications are disregarded and their uncertainties forgotten. This can lead to technological fixes that do more harm than good.

I use the term bad science whenever hard conclusions from scientific investigation are not warranted by the data or the data are misapplied. The fault can lie with incompetent experimentation, analysis, or interpretation—the scientist's direct responsibility. Or the fault can lie with the misapplication of data. In the past, professional tradition has largely prevented or corrected bad science. Peer review and editorial discretion have promoted the scientific quality of published works; the responsibility and joy of scientists in confirming or denying published conclusions have led to the eventual obscurity of bad science.

But these professional procedures are being bypassed because of the needs of the times. The traditional outlet for scientific reporting is often short-circuited. Scientific work appears in unrefereed reports, news statements, hearing records, symposium transcripts, speeches, and independently published documents. Even editorial reviews are tending to become less critical to avoid any appearance of suppression of controversial findings. Also, much experimental work is becoming extremely difficult to confirm or refute—it may be large-scale, involve sophisticated techniques of experimentation and analysis, and be heavily computerized so that the original data are hard to obtain or the procedures difficult to check. In addition, political and regulatory pressures created by public concern often cannot await the inherently slow pace of scientific tradition.

Many practical problems caused by bad science currently arise from biomedical research, especially from epidemiologic studies. It is easy to understand, for example, why persons of keen analytic mind such as economists, physical scientists, and statisticians feel that if historical records exist on air pollution and in hospitals, it is easy to make correlations and determine the extent to which cleansing the air of the measured pollutants would improve health. But in reality, how difficult! The generally uncertain quality of the original data and the confounding factors are usually overlooked.

What can be done? Bad science, being more newsworthy, will tend to be publicized and seized on by some to support their convictions. Resolution of issues by the "science court" is untested, not having gained broad support, and the National Academy of Sciences is already overburdened. Perhaps the solution lies in greatly increased efforts of individual scientists—to vigorously take initiative and responsibility, to immediately expose bad science whenever it occurs, and thereby to reestablish credibility.

This plea to be more critical in the reporting and acceptance of science as a basis for important decisions is not meant to inhibit innovative work, withhold information from the public, or delay action needed in the public interest. Any reports that suggest a public health problem should be quickly examined to determine if immediate action is needed to prevent existing or imminent harm. (Fortunately, this determination can often be made on the basis of previous experiences.) Then such reports should be used to spur and guide any needed additional research.

The present spate of "doomsday" items, if taken at face value, could cumulatively produce either socioeconomic dislocations with little or no net health benefit, or public derision and counterreaction that would inhibit environmental improvement.—CYRIL COMAR, *Professor Emeritus, Cornell University, and Director, Environmental Assessment Department, Electric Power Research Institute, Palo Alto, California 94303*