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Ensuring Integrity in Science

HACKED ELECTRONIC RECORDS OF CLIMATE SCIENTISTS AT THE UNIVERSITY OF EAST ANGLIA'S CLIMATE Research Unit (UEA/CRU) led to worldwide publicity during the December 2009 Copenhagen climate change convention. UEA is conducting a formal investigation to determine whether UEA scientists manipulated or suppressed data or otherwise acted unprofessionally. My reading of the vast scientific literature on climate change is that our understanding is undiminished by this incident; but it has raised concern about the standards of science and has damaged public trust in what scientists do.

In the wake of the UEA controversy, I have been contacted by many U.S. and world leaders in science, business, and government. Their assessments and those from various editorials, added to results from scattered public opinion polls, suggest that public opinion has moved toward the view that scientists often try to suppress alternative hypotheses and ideas and that scientists will withhold data and try to manipulate some aspects of peer review to prevent dissent. This view reflects the fragile nature of trust between science and society, demonstrating that the perceived misbehavior of even a few scientists can diminish the credibility of science as a whole.

What needs to be done? Two aspects need urgent attention: the general practice of science and the personal behaviors of scientists. The good news is that some efforts to address both issues have already begun. But now we must make further advances on both fronts. Clarity and transparency must be reinforced to build and maintain trust—internal and external—in science. Scientists are taught to describe experiments, data, and calculations fully so that other scientists can replicate the research. Last year, the Committee on Science, Engineering, and Public Policy (COSEPUP) of the National Academy of Sciences (NAS), National Academy of Engineering, and Institute of Medicine put forth a framework for dealing with research data,* emphasizing that "Research data, methods and other information integral to publicly reported results should be publicly accessible." Some journals have established policies that require the sharing of materials and data. However, post-publication complaints regarding data sharing persist. Despite many efforts, the scientific community has failed to uniformly integrate these standards into their practices.

It is essential that the scientific community work urgently to make standards for analyzing, reporting, providing access to, and stewardship of research data operational, while also establishing when requests for data amount to harassment or are otherwise unreasonable. A major challenge is that acceptable and optimal standards will vary among scientific disciplines because of proprietary, privacy, national security, and cost limitations. Failure to make research data and related information accessible not only impedes science, it also breeds conflicts. Contention over paleoclimatic data was at the heart of the UEA/CRU e-mail exchanges. Beyond data handling, the relationship between science and society depends on the personal conduct of scientists in all that they do. Fortunately, an up-to-date guide to responsible conduct in research is now available,** and its standards should be energetically pursued throughout the scientific community.

Later this month, at the 2010 annual meeting of the American Association for the Advancement of Science (AAAS) in San Diego, NAS and AAAS will lead a discussion of these important issues, examine points raised by the UEA/CRU situation, review best practices, and encourage scientists to develop standards for data access that work in their fields. The outcome of this special session must be explicit actions, as scientists must do much more now, and with urgency, to demonstrate that science is indeed self-correcting and worthy of the public's trust.

– Ralph J. Cicerone

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*COSEPUP, *Ensuring the Integrity, Accessibility and Stewardship of Research Data in the Digital Age* (National Academies Press, Washington, DC, 2009). **On Being a Scientist* (National Academies Press, ed. 3, Washington, DC, 2009).

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