Science's Efforts to Ensure Research Integrity

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Weekly, interdisciplinary journal, published by AAAS

130,000 print circulation, ~1 million online readers

News, Commentary, original research

Most important **basic** research

12,000 submissions, ~ 800 published papers
~8% acceptance rate

Extensive press coverage of papers

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The Problem:

Science is larger and more complicated than in the past

- More big science. Data sets are larger and analyses are more complex
- Long distance and international collaborations
- Disconnect between PIs and scientists at the bench; close oversight is not occurring.
- High profile cases of misconduct – Hwang stem cells and Schoen physics
- Money is tight, competition and pressure on scientists is growing

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Authorship

Then:

- Corresponding author takes responsibility for all authors having seen and approved the submission

Now:

- Ascertain that each coauthor has seen and agreed to the submission
- Require each author to describe their contribution to the study

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Conflict of Interest

Then (1999):

> Authors were asked to voluntarily disclose any "information about the authors' professional and financial affiliations that may be perceived to have biased the presentation."

Now:

- For acceptance, each author must fill out a detailed, online conflict of interest form that asks for financial or management conflicts.

Image manipulation

Then:

Images were not screened

Now:

Each image for accepted papers is screened by hand for manipulation

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Statistical Review

Then:

Statistical review responsibility of individual peer reviewers

Now:

Assessing Science papers for statistical accuracy and need for separate statistical review for each one

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Unpublished data

Then:

Could be cited if from authors own lab or referenced by personal communication with permission

Now:

Not allowed to support any major conclusions. May be allowed in discussion

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Security Considerations

Then:

No special treatment

Now:

Certain papers evaluated by an ad hoc committee selected by the Editor-in-Chief

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Ethical Considerations

Then:

No special treatment

Now:

Certain papers evaluated by an ad hoc committee selected by the Editor-in-Chief and other managers

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Data and Materials Availability

Then:

Any reasonable request for materials, methods or data necessary to verify the conclusions of the paper must be honored

Now:

Sequence, structure and microarray data must be deposited in public databases. If none is available data must be in the paper or supplementary online material.

Any restrictions on material sharing (MTAs) must be disclosed during review and may preclude publication.

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Will these measures prevent fraud?

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Peer review will not catch all instances of fraud

EDITORIAL

More Questions About Research Misconduct

Talk of research misconduct is, alas, once again in the air, and so we have to deal with it. On p. 34 of this issue, we review the history of the remarkable research program conducted at Bell Labs by Jan Hendrik Schön and a number of colleagues. That program has now come under scrutiny: Physicists from other institutions have been examining their papers in several leading journals, finding problems with the figures that are difficult to explain, and offering cautiously couched speculation that the experiments have been cooked, or the data manipulated.

Were such a charge substantiated, how much of this group's work product would then be at risk? Who if any among 20 or so coauthors on over 15 papers might be a coconspirator? These are among the questions swirling about amid a cloud of rumor and speculation.

In fact, those questions can't be answered, because we just don't have the whole story. Bell Labs management has appointed a review committee chaired by Professor Malcolm Beasley of Stanford to look into the matter. It is a distinguished group and can be counted on to do a careful job. Unfortunately, it does not expect to conclude its work until summer's end—a long interval, allowing for unlimited speculation and guesswork. So the topic will hang in the air, continuing to command media attention—and ours.

The topic of scientific fraud has had a bumpy and disappointing history. Concerns that surfaced in the 1970s and '80s, sometimes by congressional overseers of federal research budgets, at first met with skepticism on the part of science leaders. National Academy of Sciences president Philip Handler, among others, argued that it was so rare that we shouldn't bother ourselves. But a few clear cases, and an opportunity to grab headlines, persuaded some in Congress to demand more vigilance by the granting agencies—which responded, as agencies will. The result was a mixed bag: The Orwellian-named Office of Research Integrity at the National Institutes of Health (NIH) found some miscreants, but also committed the farrago of errors that led, in the case of Imanishi-Kari, to a reversal. This deferred justice ended years of undeserved opprobrium for her and for her senior colleague, David Baltimore.

Trust is a shared value of science.

That painful lesson and others made it clear that suspicions of this kind require cautious and considerate handling. Thus it would be unfairly premature to judge the Schön case: Bell Labs has done the right thing in appointing a strong outside committee to examine the matter, and *Science* will await its findings before saying anything about the work we have published from this group.

But other questions arise that can be answered now. We have been asked, for example, whether if there were a finding of misconduct, it would raise questions about the quality and reliability of the peer review process applied to the Schön papers. It wouldn't, because peer review has never provided immunity against clever fraud. Last year, an author had to retract a paper because of data manipulation by a participant in the experiment. In an accompanying editorial, I wrote: "…many years ago, George Price…pointed out that although science had developed robust ways of controlling chance, it had invented scant protection against fraud. A clever laboratory cook can invent data that are immune to vigilant reviewers and to any diagnostic test save repetition, the only proven scientific remedy."

There is nothing "wrong" with the peer review process, and there is little journals can do about detecting research misconduct. Other nations (Germany, China) are developing standards for recognizing and punishing scientific fraud—but these plans do little by way of prevention. In the United States, the NIH requires that universities training fellows have courses dealing with research ethics. Having taught in one, I like the idea; and although we still lack outcome data, this approach at least attempts to deal with the problem prospectively.

So we should teach young scientists about the importance of bringing honesty as well as care to our craft. But when research finally reaches the journal in the form of a paper, we can't count on the review process to detect manipulated data. Science is a community venture dependent upon shared values, and trust is one of them. In the end, that's where we have to put our faith.

Donald Kennedy

EDITORIAL

Next Steps in the Schön Affair

There has now been time to examine the findings of the Beasley Committee, the group assigned by Bell Laboratories to investigate charges of falsification in the work of a research group in which Jan Hendrik Schön was a leading participant. The report analyzes the work presented in 25 papers by Schön and various combinations of 20 colleagues. The task was a monumental challenge, and the committee met it admirably. Its conclusion, that Schön is guilty of multiple instances of scientific misconduct, is convincing. The committee also cleared all coauthors of scientific misconduct.

That does not settle the matter. Public interest in the case is intense: The research was an international effort, involving coauthors from several countries, and Bell Labs has earned a record for excellence. The work was published in a number of journals—including, prominently, this one. Strong interest of this kind yields hard questions. In response to one that is frequently asked: *Science* has a standing policy that all authors of a paper must agree to its retraction. Bell Laboratories is working with all coauthors to get such agreements for each challenged paper. If neither they nor we can secure them, we will move promptly to give notice, linked to the published papers, that the work has come under such serious question that it cannot be relied on.

The hard question is this: If the benefits of authorship are enjoyed jointly and severally by all the authors, shouldn't the liability be shared in the same way?

We have been asked whether this sad incident has given us doubts about how well the peer review process at *Science* works. Unhappy experiences should generate efforts to learn from them, and we will use the report to evaluate what we might have done differently in these cases. That said, we would reiterate that it is asking too much of peer review to expect it to immunize us against clever fraud. In other respects, our faith in our quality-control process remains solid. Reporters have also told us that individual scientists have charged us with being too interested in "flashy" papers, and thus overeager to publish these. That is nonsense. We do want important papers of high quality, and our peer reviewers told us in no uncertain terms that these were both.

There's another critical question, and it's one the Beasley committee raised but left hanging, after questioning whether the coauthors exercised "appropriate professional responsibility" in ensuring the validity of the papers' claims. In dealing with authorship issues in other institutional roles, I have encountered vigorous arguments on both sides of this question. One claims that given the interdisciplinary nature of science and the coparticipation of people with various specialties in a project, each author cannot be expected to take responsibility for the validity of the results. Another asserts that because all coauthors receive professional credit for the entire product, all should share the consequences if it is invalid.

It's plain that the Beasley Committee struggled honorably with this problem. But its difficulty is well attested by some of its own language with respect to coauthor conduct: "There is no implication here of scientific misconduct; the issue is one of professional responsibility." That sounds like a distinction without a difference: This is, after all, about science. How could a clear failure of "professional responsibility" in a scientific matter not raise the issue of scientific misconduct?

The difficulty the committee encounters in this domain reflects, as their report recognized, the absence of a community consensus about the nagging issue of coauthor responsibility. It's hard to find a silver lining in the cloud cast by the Schön affair, but it would be good if it were to trigger a thoughtful examination of the issue. The committee said it did "not endorse the view that each co-author is responsible for the entirety of a collaborative endeavor . . ." Well, isn't each one getting part of the credit? And if the benefits are enjoyed jointly and severally by all authors, then shouldn't the liability be joint and several too? The answer has to come in the form of a decision by the scientific community, which now needs to attend to the task. The Ethics Committee of the Panel on Public Affairs of the American Physical Society is well suited to the challenge, and the Beasley report has supplied it with good starting material.

Donald Kennedy

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Science and the peer review process is based on:

Trust

Community norms

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Final Recommendations – for community

Training and mechanisms to protect the integrity of data must evolve with the changes in the practice of science.

Support of public databases is essential.

(Of 89 databases operating in 2000, 7 have folded and >50% are struggling financially (*Nature* **435**, 1010, 23 June, 2005).

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Final Recommendations – for journals

Journals can accelerate the acceptance of new community-driven standards by reacting to problems raised by authors, reviewers, editors and advisors.

Journals must work in concert with leaders in the global scientific community, funding bodies, professional societies, and educators to promote the highest standards of conduct for science