

# Time to wise up?

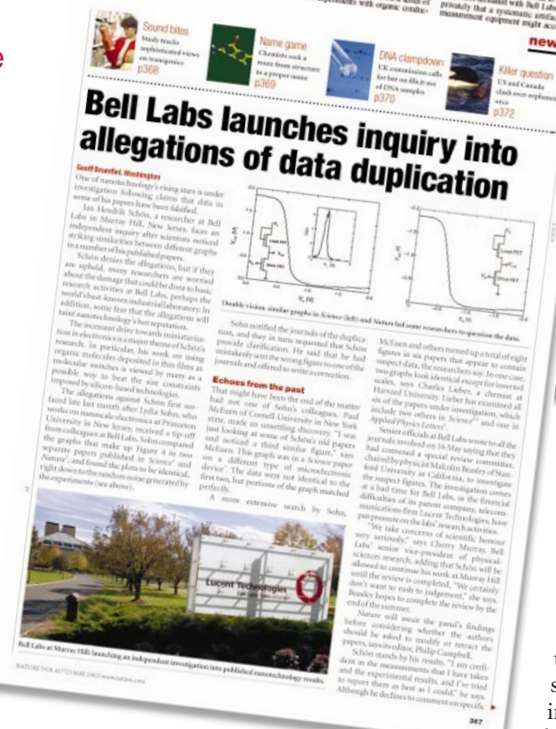
With one of their brightest young stars facing allegations of data falsification, Geoff Brumfiel asks whether researchers in the physical sciences are ready to tackle the issue of misconduct.

The corridors were buzzing with talk about Jan Hendrik Schön's work on nanoelectronics in March at the American Physical Society's meeting in Indianapolis, Indiana. The young researcher was a wizard in the field: he had produced some 80 papers in the previous two years. But other researchers had little luck reproducing his results, and were growing suspicious. Some suspected that Schön was withholding information to hinder competitors. Others were murmuring the unthinkable: could this be scientific fraud?

Then in May, sources inside Schön's workplace — Bell Laboratories in Murray Hill, New Jersey — revealed to an academic colleague that two graphs in separate papers seemed identical down to what should have been random noise (see *Nature* 417, 367–368; 2002). Since then, the list of suspect papers has steadily grown. Bell Labs convened an external panel to investigate; its ruling, on what is already the biggest case of alleged misconduct in the physical sciences, is expected by the end of the summer.

Regardless of the outcome, experts say the case has exposed a community poorly equipped to deal with misconduct. While biologists have been forced to address the issue following a series of high-profile investigations, misconduct seems to fall below the radar for researchers in the physical sciences. *Nature's* inquiries suggest that most are unaware of how to detect suspicious activity in their labs — or how to respond if allegations arise. If this deficit isn't addressed, say experts, the reputations of individuals, labs and even entire fields will remain at risk.

Scroll back two decades, and the same situation prevailed in US biomedicine. But that changed in the 1980s, when a Congressional committee headed by Representative John Dingell, a Michigan Democrat, started investigating allegations of misconduct relating to projects funded by the National Institutes of Health (NIH). Although many biologists regarded the exercise as a witch-hunt, it did eventually result in a system for dealing with alleged misconduct.



Double trouble: *Nature* (left) and Science report the Bell Labs story.

Today, all US universities receiving federal funding are supposed to have policies detailing how misconduct investigations should be conducted. At the federal level, the Office of Research Integrity (ORI), which operates from the NIH's parent body, the Department of Health and Human Services, reviews cases involving NIH grants after the researcher's institution has completed its investigation — and can debar miscreants from federal funding for a defined period.

The National Science Foundation (NSF) has the Office of the Inspector General, the agency's independent watchdog, performing a similar function. In December 2000, after much debate over the definition of misconduct — eventually narrowed to falsification, fabrication and plagiarism — the White House Office of Science and Technology Policy issued guidelines that formalized procedures for the whole of the US government.

### In the dark

Few would claim that the system is perfect. Investigators often struggle to pursue important cases to fruition, and are sometimes hampered by legal action from the accused. But at least biologists know that the system is there. Many of their colleagues

in the physical sciences, however, remain blissfully ignorant. Some researchers interviewed for this article, for instance, were unaware of their own institution's misconduct policy. And some physics research centres — including Bell Labs — don't even have formal policies.

The prevailing view in the physical sciences seems to be that misconduct is someone else's problem. The American Physical Society's 'statement of integrity in physics' begins: "The physics community has traditionally enjoyed a well-deserved reputation for the maintenance of high ethical standards ... Indeed, the American Physical Society is one of the few professional societies which has not felt the need for a formal code of ethics."

One reason why researchers in the physical sciences feel cocooned from dishonesty is that their work often involves precise measurements that are relatively quick and easy to replicate once an experiment has been set up. This means that anyone who fabricates data is fairly likely to be found out. "If my graduate student or postdoc does something remarkable, I want to see the data, and usually, I would need to see the data two or three times done different ways," says Paul Canfield, a materials scientist at the University of Iowa. "That's a luxury I have because we're doing simple measurements."

In 'big science' areas of physics, where hundreds of individuals may be involved in a single experiment, the scope for fraud is even more limited. "I have to say that mis-

conduct of the kind alleged at Bell Labs is something that I have never heard of in high-energy physics," says David Hitlin, who works on the BaBar experiment at the Stanford Linear Accelerator Center in California, which includes more than 500 physicists. At BaBar, says Hitlin, it would be extremely difficult to falsify results because several groups frequently analyse the same data in parallel.

Given these advantages, some researchers question the need for procedures to address misconduct. "You can sit around and have many meetings about how you can take care of rare cases if they ever occur, but is that the best use of your time?" asks Ronald Moon, who manages materials technology research for the electronics firm Agilent Technologies in Palo Alto, California. George Crabtree, a physicist who oversees materials science research at the Argonne National Laboratory in Illinois, agrees: "If you don't need elaborate procedures, I don't see a great value in putting them in place." Indeed, Argonne has no internal policy on misconduct.

### Eyes wide shut

To Nicholas Steneck, a historian of science at the University of Michigan who studies scientific misconduct, such statements reveal complacency. "Twenty years ago, people in the biomedical sciences said: 'It's not all that common, and it's caught when it happens,'" says Steneck. "Well, 20 years of experience has shown that's not the case." No systematic studies have documented the extent of misconduct in the physical sciences, but Steneck suspects that many cases go unreported because the community lacks awareness.

Just as worrying, he fears that low awareness could also mean that the few researchers who are accused of misconduct might not receive a fair hearing. "People tend to overreact," Steneck suggests. "They fire the person, make sure they don't get a job anywhere, retract all the articles, and then say: 'Whoops, wait a minute, do we need to do an investigation?' Due process is still important."



Readily checked, precise measurements help to safeguard the physical sciences, says Paul Canfield.

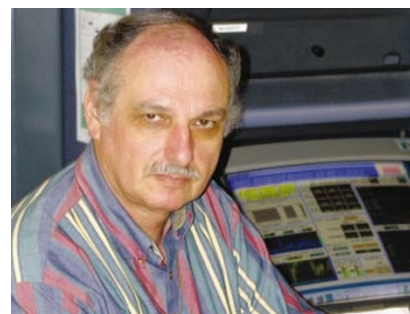
Researchers in the physical sciences could do a number of simple things to improve the situation, experts say. The first is simply to keep in mind that misconduct happens. "If you're not prepared to look for it, you're not likely to see it," says Steneck.

Second, be aware of circumstances under which it is likely to occur. "Junior scientists are somewhat more likely to commit research misconduct," says Helen Kerch, a programme manager in condensed-matter physics at the US Department of Energy (DOE). "Mentoring and guidance can really be beneficial."

But how should you approach the situation if you suspect a protégé of foul play? One physicist who had to investigate a student offers this advice: "If you're really feeling a little nervous about the research — and I think every scientist will have that feeling periodically — you sit down with the worker in your laboratory and say: 'OK, I would like you to show me all the details, because I'll be giving talks on this.'"

Finally, if you do have serious suspicions about a colleague's work, says Kerch, remember to check your institution's policies before doing anything else. "Many universities have a person who is basically in charge of misconduct," she says, and that person should be consulted before any action is taken.

The agencies that fund research in the physical sciences also have some work to do, say experts in misconduct. The DOE,



David Hitlin: so many people work together in 'big science' that the scope for fraud is limited.

for instance, which is the largest provider of US federal funding for physics, is still working to implement the federal misconduct guidelines.

### Forewarned is forearmed

Steneck stresses the importance of training. Since 1989, biomedical researchers have had to receive basic instruction in research integrity to be eligible for NIH training grants. But no such requirement applies to other classes of NIH grant, nor to grants awarded by the NSF and DOE.

Professional organizations could also do more to raise awareness, say experts. The ORI, for instance, sponsors joint conferences on research integrity with groups such as the Association of American Medical Colleges. "But it still hasn't come into the physical sciences," says Steneck.

So will the Schön case provide the jolt to make researchers in the physical sciences, and the organizations that represent them, address the issue? So far, there are no firm signs that this is happening. "The American Physical Society has no specific plans to revise its misconduct policies at this time, but is always alert to making changes in the future," says a spokesperson. The American Chemical Society set up a committee to develop a policy on misconduct in April 2000, but it is still wrestling with whether simply to try to inform members about the issues, or to take sanctions against those who are found guilty of misconduct. "Quite frankly, I don't think we're making a whole lot of headway," one committee member told *Nature*.

A good first step, suggest some experts, would be for agencies, societies or researchers to gather some baseline information on the incidence of misconduct in the physical sciences. "I don't know how serious the problems are, but I do know that when they talk about having fewer problems they're doing it on faith rather than evidence," says Kerch. "I think it's about time they took a look." ■

Geoff Brumfiel is *Nature's* Washington physical sciences correspondent.

US federal guidelines

► [www.ostp.gov/Science/html/sci\\_proj.html#Research%20Misconduct](http://www.ostp.gov/Science/html/sci_proj.html#Research%20Misconduct)



See no evil: Nicholas Steneck believes physicists' attitudes to misconduct betray complacency.