

## SPECIAL REPORT

# Should journals police scientific fraud?

Editors don't expect peer review to catch deliberate fakers. But recent scandals mean that journals are looking at other ways to detect fabricated papers. **Emma Marris** investigates.

The scientific community is sunk in one of its periodic bouts of angst over research fraud. After the Korean researcher Woo Suk Hwang's cloning work turned out to be spectacularly false, recent weeks have brought revelations that range from spurious Norwegians in a cancer study to doubts over RNA work in Japan (see page 514).

With high-profile cases putting the reputations of journals — and science as a whole — on the line, is there more that editors can or should do to prevent such embarrassments?

Whenever a published paper is exposed as a fake, editors are wont to repeat that peer review is not capable of catching fraudulent science. After a Norwegian study published in *The Lancet* was found to be based on imaginary patients (see *Nature* 439, 248–249; 2006), the journal's editor, Richard Horton, pointed out: "Short of me flying to Oslo and checking out every entry on the computer, there is really no way for me to detect the fraud."

And other groups seem to agree that the primary responsibility for determining whether a paper ought to be shelved in fiction or non-fiction should not rest with journals. This opinion is based partly on the patchy staffing and funding of most journals, which are volunteer-run society publications. "Journals don't have the resources or the expertise," says Mary Scheetz, director of extramural research at the Maryland-based Office of Research Integrity, which investigates ethical violations in work funded by the US National Institutes of Health.

In addition, journals have very little disciplinary power — the worst they can do is refuse to publish work, or publish a retraction. The responsibility for investigating allegations lies mainly with institutions and funding agencies that pay for the work, points out James Kroll, who examines misconduct at the US National Science Foundation.

But in the past few years, journal editors have been taking a more proactive approach to dealing with fraud, and exploring what they can do with the resources they have.

Examining every paper submitted for fabrication would be pretty much impossible. "It

would be an astronomically expensive and difficult thing," says Drummond Rennie, deputy editor of the *Journal of the American Medical Association*. "It would take months; we are talking hundreds of thousands, and sometimes millions of dollars."

Stephen Evans, a statistician at the London School of Hygiene and Tropical Medicine, occasionally analyses papers in which the raw data are suspect. Tricks include looking for 'digit preference', the tendency of humans to round towards 0s and 5s, or the amount of variance in the data. "It is very difficult to invent data that has the right variability," says Evans. But he agrees that the time and expense make checking every study "totally impractical".

Instead, journals are investigating the potential of automated computer searches on submitted data, which could be incorporated into the review process with minimal time and effort. One idea catching hold is the introduction of screens to catch unacceptable image manipulation (see 'Forensic software traces



**Paper trail:** statistical tests may detect fake data, but checking every submission is impractical.

tweaks to images'). Editors are also exploring text-comparison software to help pick up plagiarism (see *Nature* 435, 258–259; 2005).

"As information technology becomes more sophisticated, I think you are going to see more journals adding new tools to their

## Forensic software traces tweaks to images

The editors of scientific journals could catch fraudulent images by using computer tools similar to those being developed for law enforcement and photojournalism, say computer scientists.

Recent fraud at the lab of stem-cell researcher Woo Suk Hwang (*Nature* 439, 122–123; 2006) highlights the ease with which scientists can cook up fake images. In the South Korean team's 2005 *Science* paper, for example, two photographs in the same figure were found to be partial duplications.

The Hwang furore is encouraging journal editors to seek ways of detecting

suspicious images before they are ever published. Such screening could identify outright fraud, as well as a far more pervasive practice in which biologists use programs such as Photoshop to tweak and smarten scientific images before publication (see *Nature* 434, 952–953; 2005).

At least one group of journals, published by the Rockefeller University Press (RUP), already carries out such image forensics by eye. Mike Rossner, managing editor of the *Journal of Cell Biology* in New York City, has trained a production editor to enlarge and scrutinize images for obvious but

illegitimate changes, such as bands erased from a gel or cells slipped into a microscope image. This production editor checks manuscripts accepted for publication at the *Journal of Cell Biology* and two other RUP journals.

But this is time consuming, and computer scientists say that computer algorithms could automatically scan digital images and ferret out signs of manipulation. The development of such systems, prompted by the explosive spread of digital cameras and imaging programs, is also of interest to lawyers and police, who want to check for tampered crime-scene images, as well as to news organizations keen



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screening processes," says Scheetz.

Another shift is that journal editors are now more likely to challenge papers that they think are suspicious, rather than quietly rejecting them. According to Harvey Marcovitch, head of the London-based Committee on Publication Ethics (COPE), the old way was to "find some excuse not to publish it". But the 200 or so journals that have signed up to COPE's code

of conduct are now committed to going further. "Even if you wouldn't accept a paper if it was completely clean, you have an absolute duty to inquire," says Marcovitch. "If you are not satisfied with the authors' responses, you have an absolute duty to go to the institution and ask them to investigate it."

Most would agree with that sentiment, but there are practical problems. In Britain, for example, editors are particularly loath to accuse anyone of fraud because the country's tough libel laws mean that they risk being taken to court. "Often what you do is ask for more and more clarification in the hope that something will turn up," says Marcovitch. A common step is to request the raw data, although this can be a headache for journals. "What do you do if you are suspicious about a paper, you ask to see the data and you get 25 cardboard boxes, 4 CDs and would have to hire a biostatistician for three months?" asks Marcovitch.

One simple step — which Scheetz says is taken surprisingly seldom — is to include misconduct policies in a journal's instructions to authors. "If something is suspicious, it puts the journal in a stronger position. Editors can request the raw data if it says they can in the instructions to authors," she explains.

Journals are also starting to request that researchers carry out their own checks before even submitting a paper. *Nature* now advises authors to include independent verification for certain cloning papers, for example. And

the *Journal of the American Medical Association* requires that industry-funded trials go through independent data analysis.

Journals are increasingly developing policies together, through programmes such as COPE, or using common policies drafted by groups such as the World Association of Medical Editors, based in Chicago, Illinois. The US Council of Science Editors, in Reston, Virginia, is currently working on a report on publication ethics. And *Nature*, *Science* and *Cell* are thinking about working up policies between them, according to Linda Miller, US executive editor of *Nature*.

Ultimately, if a journal does uncover evidence of fraud, it has to rely on the researchers' institution or funding agency to investigate fully. But this depends on such bodies having the will and authority to do so. When the *British Medical Journal* tried to get someone to investigate the work of cardiologist Ram Singh of Haldberg Hospital and Research Institute in Moradabad, India, for example, no institution or scientific body could be persuaded to make a judgment on the case. Singh went on to publish similar work in *The Lancet*. In the end, both journals published expressions of concern, but did not feel able to retract the papers. And in an ongoing case involving RNA researcher Kazunari Taira, the University of Tokyo seems unlikely to get to the bottom of whether suspicious data were faked, because it does not have the authority to make a full inquiry.

Emma Marris

**"Testing every submission would be astronomically expensive."**

## IMAGE UNAVAILABLE FOR COPYRIGHT REASONS

**Artifice intelligence: programs can now detect manipulation in pictures.**

to detect faked photos.

Partly funded by the FBI, Hany Farid at Dartmouth College in Hanover, New Hampshire, and his colleagues have designed a suite of ten mathematical techniques to

scan images for the hallmarks of manipulation. For example, one algorithm searches for small clusters of identical pixels in an image, and so might reveal where an area of background has been

copied and pasted over a blemish.

A second algorithm can identify whether part of an image has been expanded, perhaps to splice two photos seamlessly together. To do this, a program such as Photoshop generates new pixels by averaging the characteristics of the neighbouring ones — leaving a giveaway signature in the image.

Farid is currently converting his algorithms into a user-friendly form that can be attached to ImageJ, a free image-processing program distributed by the US National Institutes of Health. He is also consulting Adobe, the company that makes Photoshop, about whether the algorithms could be packaged together as a plug-in for the program, for use by different industries. This could help journal editors and reviewers, but also lab heads wanting to

check the work of their team.

Rossner says he plans to trial Farid's system when it is complete. Editors at *Nature* are also consulting researchers about automatic tools for detecting image manipulation.

But there are drawbacks. Such a system could act only as a first line of policing to flag up suspicious images. And editors and technophiles alike agree that anyone determined to fabricate or alter images will be able to fool the forensics software — perhaps by using the very same detection algorithms to learn how. Eric Postma is a computer scientist who devises software to detect fine-art fraud at the University of Maastricht in the Netherlands. "It's always a race between two sides," he says.

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