Despite attention to research misconduct and other issues of research integrity, efforts to promote responsible behaviour remain ineffective. Misconduct continues, and evidence suggests that increasingly stressful competition for funds and the rush to publish may further erode ethical behaviour. We believe that real change requires a fundamental shift: to be taken seriously, standards of ethical conduct must be linked to funding.

Improvement is badly needed. We know from a meta-analysis of seven major studies that 2% of scientists have reported committing research misconduct at least once. Many draw comfort from this observation because they conclude that there are only a few bad apples. Yet if we extrapolate this finding to the 400,000 US federally supported researchers and team members, 8,000 of them will commit research misconduct during their career and most of the instances will go undetected. In addition, many believe that there is a more serious erosion of science, beyond official misconduct. On the basis of six pooled studies, up to 34% of scientists admitted to one or more questionable research practices such as inappropriate analysis, over-interpretation of findings and changing study design. And a survey demonstrated another dimension of the problem: only 24% of the researchers who had observed possible research misconduct reported it to their institutional official. This strongly suggests that researchers do not feel duty-bound or safe enough to come forward.

Undergraduate cheating is pervasive, with students adopting the behaviour of their peers. The millennial generation (in college since 2000) spends innumerable hours in communication with others; sharing becomes central to their lives and this socialization teaches them how to cut and paste inappropriately or cheat on exams. Their inability to make independent decisions, along with misunderstandings about academic integrity, suggests that this generation may cheat throughout their lives, whether they are scientists, builders or bankers.

Responsible conduct of research (RCR) programmes have developed slowly in the United States over the past 20 years. A lack of comprehensive national regulation has created an inconsistent approach to promoting integrity.

There has been pervasive lobbying by scientists claiming that such efforts are unnecessary and obstructive, stymieing the development of standards to protect data integrity. The National Science Foundation (NSF) and National Institutes of Health (NIH) both issued new directives in 2009, instructing applicants for federal research training funds to provide RCR training to their trainees. The NSF didn’t set requirements for the content of the training, leaving it up to institutions; the NIH established a list of a dozen required focus areas, from laboratory management to responsible authorship. The NIH directed that programmes must include eight hours of face-to-face training, preferably with faculty involvement, specifically prohibiting exclusively web-based training. The NSF did not specify or suggest format issues. As a consequence, universities that struggle to pay for RCR programmes are likely to triage students receiving NIH funding to staff-directed programmes, and those with NSF support to less-intense online training.

Institutions must create RCR plans to receive certification to provide training for the NSF, and attach RCR plans of action to each NIH proposal. The NIH has not set standards for assessing and reviewing the quality of RCR plans in the past 20 years. Currently, the NIH says that future scientific reviewers will

**SUMMARY**

- New oversight process would boost responsible institutional behaviour
- Requirements would go beyond standardized responsible-research courses to values, policies and rules
- Centres of excellence would gain right to compete for additional funds

Tie funding to research integrity

A change in institutional culture is needed to promote responsible scientific behaviour and prevent misconduct. That’s unlikely to happen unless money is involved, say Sandra Titus and Xavier Bosch.
evaluate RCR components, but will not use these evaluations in advising whether to fund scientific proposals. No standards have been announced for these evaluations. Rather, the NIH seems to rely on institutional and researcher self-regulation to ensure research integrity.

We recommend a new oversight process, in which institutions are judged on their plans and performances in what we call ‘responsible institutional behaviour’ (RIB) — a broad term that encompasses much more than RCR courses. Whole institutions, rather than individual researchers, should be rewarded or penalized, to encourage campus-wide reinforcement of good practice. We envisage a system in which centres demonstrating the most commitment and effort would receive ‘centre of excellence’ status. Researchers associated with these centres would have access to additional competitive NIH and NSF funds, in a similar way to the National Cancer Institute’s centres-of-excellence programme.

Only a broad scheme like this can really change the culture at research institutions, giving research integrity the importance and respect it needs and deserves. Scientists in the United States receive a total of more than US$40 billion in research awards each year; the taxpayer expects and deserves accountability. Scientists in many systems — including the financial sector, which led in part to the fiscal crisis. Now, new banking rules are being developed, with enforceable standards, to prevent future economic collapse. RCR has a similar degree of non-regulation; action should be taken to change that, and to prevent a future crisis in research integrity.

We propose that our RIB plan serves as a foundation for these efforts. Fundamentally, we believe that research integrity needs to be strengthened and this requires financial incentives.

Sandra Titus is health science administrator, Office of Research Integrity, 1101 Wootton Parkway, Suite 750, Rockville, Maryland 20852, USA. Xavier Bosch is in the Department of Internal Medicine, Hospital Clinic, IDIBAPS, University of Barcelona, Spain. E-mails: sandra.titus@hhs.gov; xavbosch@clinic.ub.es

“Although money might be tight in coming years, research integrity is too important to neglect.”

Mandatory and frequent

Although we envision RIB as a broad policy effort, good RCR courses remain a vital part of the programme. Such courses should teach accepted standards of scientific conduct and include cutting-edge discussions on issues such as image manipulation. Explicit teaching objectives should be developed, implemented and evaluated, as in any course. One inventory that identifies objectives and topics for seven of the nine core RCR teaching areas was developed through an expert elicitation process in 2009 (ref. 8). This is a good start. Other areas, such as ethical decision-making, social responsibility and cultural sensitivity, need to be identified and evaluated, as in any course. Scientific societies should establish clearer rules about authorship, conflicts of interest and data management. For example, when administrators at Johns Hopkins University in Baltimore, Maryland, determined that their faculty members were unaware of standard medical authorship rules, such as not allowing guest or ghost authorship, they posted a set of rules on the web and circulated it to all faculty members. At the end of a year the university plans to follow up with an assessment to see whether the awareness and behaviour of its faculty members have changed.

Institutions require feedback. Some Scandinavian countries appoint external ombudsmen to evaluate whether social programmes are discriminatory or successful. This is an excellent idea. The US Institute of Medicine also advocates external review to provide an institution with an objective view of their efforts to promote integrity. An editorial in The Lancet similarly urged the use of external reviewers to rank European institutions based on whether and how RCR is taught; it argued that the public’s trust in research integrity is too important to neglect. Further reading online at go.nature.com/H8mgMv.


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