Safeguarding good scientific practice in Europe

The increasingly global reach of science requires the harmonization of standards

Xavier Bosch

National governments invest in research and development with the intention of creating new jobs and commodities and of stimulating economic growth. At the same time, science is becoming a truly global enterprise owing to the increased ease of international collaboration and communication between research groups and the global mobility of scientists themselves. The globalization of science and its growing economic importance underlines the need to establish and harmonize codes of good scientific practice and to regulate procedures for handling allegations of research misconduct. At the moment, however, it is the case that countries—and even different institutions in the same country—apply different standards and procedures to securing research integrity.

The globalization of science and its growing economic importance underlines the need to establish and harmonize codes of good scientific practice...

This fragmented landscape of quality control is dissatisfying for all parties: the public, academic institutions and scientists themselves. In this regard, the USA has had a 20-year head start: responding to widely publicized cases of research misconduct—namely fraud, falsification and plagiarism—US Congress created the Office of Scientific Integrity in 1989—now the Office of Research Integrity (ORI; Rockville, MD, USA)—to handle allegations of scientific misconduct in research that is funded by the

Department of Health and Human Services, which includes the National Institutes of Health. The US procedures stipulate that the ORI must assess investigative reports submitted by institutions and, through an oversight role, decide whether or not misconduct has occurred (www.ori.hhs.gov). In addition, scientific fraud and falsification in publicly funded research are taken more seriously in the USA; they are considered as misappropriation of federal funds, with fitting legal sanctions. Indeed, several US scientists who committed fraud and falsification were eventually sentenced to stiff fines and even jail terms (www.ori.hhs.gov/misconduct/cases).

There is, of course, also a long history of allegations of scientific misconduct in Europe (Sidebar A), but recent cases have given a sense of urgency to the problem and have highlighted the limitations of the current research oversight system in the EU. For example, in 2003 a commission set up by the University of Constance in Germany found that Jan Hendrick Schön—a physicist dismissed from Bell Labs for fraud and falsification of data—had already manipulated data in his 1997 doctoral thesis (Durrani, 2003). The university stripped him of the degree under a rule that allows it to punish graduates who behave in an ‘undignified’ fashion (Anonymous, 2004). One might wonder what would have happened had the university had a mechanism to address allegations about Schön’s dissertation before the notoriety generated by his fraud at Bell Labs.

Early in 2006, the oral cancer research community was stunned when the Norwegian oncologist Jon Sudbø was reported

to have fabricated data in an article that was subsequently retracted by *The Lancet* (Horton, 2006). After questions about this paper were raised, *The New England Journal of Medicine* expressed concerns about, and ultimately retracted, two studies by the same author. An independent investigation of Sudbø’s entire scientific output, starting with his 1993 PhD thesis, concluded that the bulk of his publications were invalid owing to fabrication and manipulation of raw data.

The fact remains that the real extent of misconduct in Europe is still unknown, inadequately investigated and possibly concealed

The examples above illustrate one of the main problems of undetected misconduct: when cases are finally uncovered, the repercussions can touch both past knowledge and future avenues of research as well as damage the careers of those only loosely associated with the fraudulent scientist.

The European Commission (EC) has yet to draw up any regulations or make recommendations to address potential problems of misconduct within its framework research programme (Riis, 1999; Hagmann, 1999). However, other organizations have begun to pay attention. In 2000, the European Science Foundation (ESF; Strasbourg, France) published a policy paper to support a move towards a transcontinental approach to monitoring research (ESF, 2000). The ESF—an association of 78 scientific research organizations

Sidebar A | Allegations of early scientific misconduct in Europe

Several renowned European scientists have been suspected of misconduct, demonstrating that fraud can occur at even the highest levels. Research into Louis Pasteur's notebooks revealed notable discrepancies between his laboratory records and his publications and public claims concerning the anthrax and rabies vaccines. This is especially relevant because, at one time, Pasteur held one-tenth of the grants provided by the French government (Altman, 1995; Anderson, 1993). Similarly, two years after Gregor Mendel's 1866 landmark paper on plant hybridization was 'rediscovered', it was suggested that the phenotypic ratios of homozygous and heterozygous offspring reported by the Austrian founder of genetics were too good to be true (Montgomerie & Birkhead, 2005). Even Sir Isaac Newton reportedly used what a biographer called a 'fudge factor': apparently, Newton organized his equations in such a way that the results turned out as required (Kreutzberg, 2004). Lastly, Sigmund Freud was so confident of his first theories that he publicly boasted of therapeutic successes that did not materialize, forcing him to revise his theories while failing to admit that he had faked case histories (Israëls, 2003).

in 36 European countries—recommended that national bodies should “initiate discussions on the most appropriate national approach to procedures for investigating allegations of scientific misconduct [...], whether by means of an independent national body [...], formal procedures in each university and research institution, or by other means” (ESF, 2000). It also urged its affiliated funding agencies to consider ways of making an institution's eligibility for research grants conditional on the institution having adequate policies for good scientific practice and procedures for investigating allegations of scientific misconduct.

Another ESF report, published in May 2008 and commissioned for the First World Conference on Research Integrity in Lisbon, Portugal, intended to “provide a systematic review of various approaches to promote research integrity and handle allegations of research misconduct” (ESF, 2008). However, the report missed the opportunity to rigorously follow up the situation seven years later. The methods used—which included, among others, an “extensive internet and literature search [...] to identify relevant institutions”—were

suboptimal and the conclusions too optimistic. Moreover, the study itself seemed somewhat flawed as the process concentrated on gathering information from public funding research agencies and learned societies. Because there is a consensus that research institutions are the main guarantors of integrity, it was surprising that universities, research institutions and private funding agencies, such as the Wellcome Trust in the UK, were excluded. Although the report stated that the countries surveyed used a wide range of approaches to deal with integrity, there was no discussion of the variability of standards and no mention of the number of investigations submitted to existing panels.

Nevertheless, the ESF report sets out guidelines for research integrity and contains useful information about the recent efforts of various countries to promote integrity guidelines. In 2004, the Slovak Research and Development Agency pragmatically adopted the rigorous recommendations of the Deutsche Forschungsgemeinschaft (DFG; Bonn, Germany) for safeguarding good scientific practice. Interestingly, in Croatia, “[it] is mainly due to efforts of the editorial board of the [*Croatian Medical Journal*] that, in 2006, following the reform of the higher education legislation, a National Committee for Ethics in Science and Higher Education (CESHE) was established” to investigate allegations of misconduct brought to its attention (ESF, 2008).

But what is the extent of scientific misconduct in Europe? At first glance, it might seem that it occurs more frequently in northern Europe and is virtually absent in southern countries (Bosch 2007, 2008), although this impression might simply reflect a lack of reporting and monitoring in Mediterranean countries. In Spain, for example, most research institutions have no codes of scientific integrity and no policies to handle misconduct. By contrast, UK universities do have specific procedures, even though they are rarely used (Farthing, 2004). Some have suggested that most European countries tend to conceal individual cases of fraud owing to a lack of precise rules (Coker & McKee, 2001), but the actual situation might well be polarized: in countries with no tradition of monitoring scientific integrity, research misconduct might be far more common than in those with established standards.

...it is clear that in today's scientific climate, yesterday's attitudes are simply not sustainable

The historian Horace F. Judson asserted that fraud is intrinsic in cultures that are “characterized by secrecy, privilege, and lack of accountability” (Judson, 2004). These features are indeed prevalent in some European research organizations that lack transparency (Bosch, 2002; Anonymous, 1998; Gui *et al*, 2002); it has been noted that Russia maintains a “tolerant attitude to violations of ethical principles and falsification in research” (Vlasov, 2002). In Poland, a high-profile case of mass plagiarism led to the proposal of national, independent committees for scientific misconduct, with the power to initiate and conduct investigations (Wronski, 1998; Zawadzki & Abbasi, 1998); yet it has been reported that Polish scientists might be protected from accusation or prosecution (Rivoire, 2003). The fact remains that the real extent of misconduct in Europe is still unknown, inadequately investigated and possibly concealed. In what follows, I present a brief account of how different nations have tried to deal with the problem.

The Scandinavian countries were the first in Europe to draw up regulations to address scientific misconduct (Riis, 1999; Farthing, 2004; ORI, 1999). These regulations, which were drafted in the early 1990s, include guidelines for good scientific practice and the promotion of scientific integrity, definitions of dishonesty, and procedures and bodies to prevent, detect, investigate and punish misconduct when it occurs (Nylenna *et al*, 1999). Moreover, the education of scientists in good research practice has become mandatory for PhD students and senior scientists (Riis, 1999). In addition, regulations protect whistle-blowers from unfair victimization (Ankier, 2002).

Denmark has a centralized monitoring system; based at the Ministry of Science, its Committee on Scientific Dishonesty—the members of which are qualified in scientific and legal matters—is directly responsible for investigating misconduct allegations that involve both publicly and privately sponsored research. In 1997, the Committee set up three subcommittees to deal specifically with problems in the medical sciences; natural, agricultural and veterinary sciences; and social sciences and humanities.

Cases can be brought to the attention of the committees by whistle-blowers, institutions or the Committee itself, and to ensure harmonization, all three subcommittees have a joint chairperson, who is also a High Court judge. In one of five instances of alleged misconduct that were considered by the medical science subcommittee in 2004, the researcher against whom a complaint had been brought was found to have acted dishonestly.

Lamentably, most ORI recommendations such as ‘adopt zero tolerance’, ‘protect whistle-blowers’ and ‘train the mentors’ are still lacking in many European nations

Norway has adopted the Danish model of independent national bodies, whereas Sweden’s system is a mixture of decentralized and centralized bodies (Riis, 1999; Nylenna *et al.*, 1999). In Finland, the system is fully decentralized: the guidelines produced in 1994 by the country’s National Research Ethics Council state that universities and research institutions are responsible for preventing all forms of scientific misconduct and for investigating allegations (Nylenna *et al.*, 1999). As such, a suspicion of misconduct is first reported to the rector of the university or the director of the research institute.

Estimates from the Scandinavian countries indicate that the prevalence of misconduct is 1–2 cases per million inhabitants, of which only 1 in 5 are serious cases—mainly fabrication, falsification and plagiarism (Riis, 1999).

In the UK, the Medical Research Council was the first institution to publish rules for correct conduct in research, according to which, allegations are to be handled by the individual institutions involved (Ankier, 2002). Significant changes are expected after the recent establishment of the UK Panel for Research Integrity in Health and Biomedical Sciences (Cole, 2006), which aims to offer advice and support to staff and employers in the National Health Service and at universities. The Committee on Publication Ethics—a group of medical journal editors who represent 346 journals—had an important role in applying pressure to the British government to put scientific

misconduct on the national agenda and to create the Panel (COPE, 2005), which now offers a training programme, has a public information agenda and hears complaints from whistle-blowers. However, the Panel is not responsible for investigating allegations. Instead, it passes the matter to the relevant research institution, requesting it to investigate.

It is worth pointing out that the pharmaceutical industry—a major supporter of medical research in the UK—is helping to fund the new panel (Anonymous, 2006). Although the activities of the Panel are intended to be independent of sponsors, it remains to be seen whether pharmaceutical industry funding will undermine public trust in the new body, especially in the light of recent allegations that drug companies have concealed adverse drug effects in clinical trials (Curfman *et al.*, 2006). However, the UK drug industry has conducted its own investigations into misconduct, and the Association of the British Pharmaceutical Industry has identified a significant number of cases (Jones, 2002).

In Germany and France, national research organizations and funding agencies manage preventive and corrective measures. The DFG adopted recommendations on misconduct in 1997 and compelled all research institutions to implement rules, or risk being ruled ineligible for DFG grants (DFG, 1998; Bostanci, 2002; Torkar, 2002). Under DFG rules, German research institutions must have independent ombudspersons that are alerted to suspected cases of misconduct. Potential cases are then handed over to special commissions for further investigation. The German system is highly decentralized with an institutional arrangement at each university. The DFG also advises that primary data should be stored for at least ten years. These regulations will hopefully prevent the repetition of cases such as that of Schön.

The regulations adopted by the Max Planck Society (MPG; Munich, Germany) are based on those of the DFG, with an ombudsperson in every institute acting as a confidential advisor when potential violations of good research conduct emerge (MPG, 2000). From 1999 to 2004, the Max Planck Institutes reported 22 cases of misconduct to the central office—16 in biomedical research—and in-depth investigations resulted in severe sanctions in four cases (Kreutzberg, 2004).

In France, the Institut National de la Santé et de la Recherche Médicale (INSERM)—the primary agency for medical and health-related research—established a Committee on Scientific Integrity in 1999 (Ankier, 1999; Breittmayer *et al.*, 2000). Allegations are reported to the Scientific Integrity Officer or regional correspondent who, in turn, reports to the INSERM Director-General. The sequence of events is similar to the USA’s ORI, and measures to combat malicious allegations are contemplated. However, in contrast to the UK, where the law protects an employee from victimization or dismissal by an employer, no specific law exists in France to protect whistle-blowers. Still, legislation dealing with ‘moral harassment’ in the workplace might deal with such victimization (Ankier, 1999).

In Switzerland, the Swiss Academy of Medical Sciences created the Committee for Scientific Integrity in Medical and Biomedical Research in 1999. This Committee has drawn up non-compulsory guidelines on scientific integrity for public and private research institutions (SAMS, 2003). In the Netherlands, at the beginning of the last decade, the Dutch Organization for Scientific Research and the Dutch Association of Universities established a committee for scientific integrity to assess institutional procedures and to operate as a fallback mechanism (Klasen & Overbeke, 2002).

One way to ensure that all co-authors are treated fairly would be to establish a common European policy on scientific dishonesty with uniform procedures for violations

Croatia deserves special mention. Its leading medical journal, the *Croatian Medical Journal*, began cooperation with the ORI in 1999 and its editorial board initiated a dialogue on research integrity with the Croatian Science Ministry (Hren, 2002; Petroveckí & Scheetz, 2001); the journal took the unusual step of creating a Research Integrity Editor. Furthermore, the country has been actively teaching on topics related to responsible research conduct since 1996; for example, since 2001, medical and PhD students have received instruction in the areas of research integrity and scientific misconduct (Petroveckí & Scheetz, 2001).

The common denominator in scientific misconduct is a failure to foster a culture of research integrity. A US Institute of Medicine committee concluded that, “[there] is a lack of evidence to definitely support any one way to approach the problem of promoting and evaluating research integrity” (IoM, 2002). While there is indeed no consensus as to whether the approach should be centralized or decentralized (Breen, 2003), it is clear that in today’s scientific climate, yesterday’s attitudes are simply not sustainable.

Centralized and decentralized approaches both have supporters and detractors. The Danes believe that centralizing the system incorporates an independent element at the outset, potentially overcoming resistance from local institutions to initiate inquiries (Riis, 2001). In a decentralized scenario, they contend, institutions might display a rebound reaction if serious transgressions are identified: to stress the institution’s high ethical standards, a rapid tribunal process is put into motion that results in strong punishments without the necessary fair defence for the accused.

By contrast, supporters of the decentralized system argue that the actions of individual researchers do not exist in a vacuum but are affected by institutional factors, and

that research institutions must be held fully accountable for setting up systems and mentoring processes that foster the integrity of their scientists (Cho *et al*, 2006). A further argument against centralization is that local resistance might be even greater if the move to centralize is perceived as usurping local prerogatives.

Some aspects, such as the existence of an ombudsperson, might well be common to both schemes. In a centralized approach, a national or regional ombudsperson might exist not to investigate allegations, but to mitigate the isolation experienced by whistle-blowers. Such an ombudsperson, preferably someone with an MD or PhD degree and expertise in the responsible conduct of research, would have no more than advisory authority but could still provide useful advice. Ombudspeople should also be able to advise those who believe they have been falsely accused of misconduct. In a decentralized scheme, local ombudspeople should also be available to anybody seeking advice on questions of scientific misconduct. As happens at the DFG, they would receive allegations but undertake no investigation, handing over any recommendation to an institution-independent mediator.

Another aspect that might be common to both systems is the publication of an annual

report detailing the main findings of the monitoring body. Decisions on whether or not to disclose the names of scientists proven to have committed misconduct should take into account the prevailing culture and sensitivities. Additionally, to enforce implementation, research funding agencies and private foundations should make grant decisions contingent on the willingness of institutions to adhere to scientific integrity guidelines (ESF, 2000).

Recently, Titus *et al* (2008) recommended six strategies for fostering research integrity, reflecting the efforts of the ORI since its creation. Lamentably, most ORI recommendations such as ‘adopt zero tolerance’, ‘protect whistle-blowers’ and ‘train the mentors’ are still lacking in many European nations (Bosch & Titus, 2009). Countries without a tradition of reporting misconduct or formal systems for investigating allegations have the opportunity to observe existing models and choose the best one to adopt. The scheme they ultimately choose—and its implementation—should be decided by consensus between all participants: the scientists, research institutions, funding agencies and governments.

The existing legislation should also be analysed. European countries have different

judicial traditions that, in most cases, are not adapted to deal with cases of scientific misconduct. However, there are some exceptions. For example, serious scientific misconduct is a reason for dismissal from service under the civil service law of Lower Saxony in Germany, meaning that extraordinary termination of employment with the Max Planck Society might be justified after an instance of misconduct (MPG, 2000). In the absence of appropriate legislation, internal regulations might offer consensual solutions through conciliation or arbitration, as contemplated by the DFG.

The appropriate granting of jurisdiction is also an essential requirement to make the system work by recognizing a research agency's right to enforce its actions

Between 1990 and 2005, the number of international collaborations, measured by co-authorship of refereed papers, grew linearly, but the number of international addresses grew exponentially. This partly reflects collaborations between researchers from countries where procedures for overseeing ethics and investigating misconduct are embryonic or simply lacking. The rise in multiple authorships reflects the multidisciplinary, collaborative character of modern research (Mishkin, 1998). Yet, a lack of homogeneity in monitoring research means that when misconduct allegations appear, authors from different countries are being treated differently. One way to ensure that all co-authors are treated fairly would be to establish a common European policy on scientific dishonesty with uniform procedures for violations (Riis, 2001; Mishkin, 1998). International cooperation in Europe—and between Europe and the USA—might also tackle the problem that arises when scientists relocate—after having committed misconduct—to countries where employers might be unaware of their previous record. Technological advances, especially the burgeoning impact of the internet on scientific discourse and comment, mean that the self-interest of countries demands a common pathway for addressing allegations of scientific misconduct and ensuring transparent research outcomes.

Although heterogeneous in nature, influential national and European academic societies and associations might work out principles of good scientific practice for their area of expertise and make them binding on their members. In addition, Pan-European research funding bodies—notably the EC and the European Research Council (ERC)—might set up regulatory mechanisms and compel institutions to create and enforce research integrity rules and procedures for handling allegations of scientific misconduct. The EC and the ESF are well suited to create a panel of scientists who could act as independent experts in inquiries and investigations of misconduct related to projects financed by the EC framework research programmes and the ERC. These bodies might also take the lead in describing standards and goals.

The appropriate granting of jurisdiction is also an essential requirement to make the system work by recognizing a research agency's right to enforce its actions. The EC might also determine whether any agreed-upon definition of misconduct should be broadly or narrowly based. As a first step, the EC might ask its advisory European Group on Ethics in Science and New Technologies to draw up an opinion paper with recommendations.

The Organization for Economic Co-operation and Development (OECD; Paris, France) is currently studying how to encourage good research standards and how to ensure commitment from all parties to investigate misconduct and cooperate in investigations. Inevitably, change will require European countries to adopt OECD guidance or something similar. However, it is doubtful that harmonized standards alone will have much impact. The lessons learned by the US Food and Drug Administration when they brought together Europe, Japan and the USA along with the pharmaceutical industry to set international standards for approving new drug applications might be a useful starting point to study successful efforts to harmonize regulations. Forging universal standards will be a long-term commitment that requires resources and participation from organizations such as the OECD, ESF and ORI to strengthen international collaborations and research integrity.

Some of these issues will be discussed during the Second World Conference on Research Integrity, to be held in Singapore in July 2010. It would also be useful to advance towards an agreed-upon definition

of scientific misconduct, which is urgently needed to unify authority across various countries in order for progress to be made. Punishment makes no sense without prevention, and prevention of research misconduct is necessary because self-regulation is unlikely to be effective (Bosch, 2008). With an overall budget of more than €51 billion, European authorities should not miss the opportunity to protect the Seventh Framework Research Program—to run from 2007 to 2013—and the ERC against this type of scientific crime.

CONFLICT OF INTEREST

The author declares that he has no conflict of interest.

REFERENCES

- Altman LK (1995) The doctor's world; revisionist history sees Pasteur as liar who stole rival's ideas. *New York Times* 16 May
- Anderson C (1993) Pasteur notebooks reveal deception. *Science* **259**: 1117
- Ankier SI (2002) Dishonesty, misconduct and fraud in clinical research: an international problem. *J Int Med Res* **30**: 357–365
- Anonymous (1998) Spanish universities and the obstacles to development. *Nature* **396**: 709
- Anonymous (2004) Physicist Schön stripped of doctorate. *Nature* **429**: 692
- Anonymous (2006) UK unleashes watchdog to enforce research integrity. *Nature* **440**: 980–981
- Bostanci A (2002) Germany gets in step with scientific misconduct rules. *Science* **296**: 1778
- Bosch X (2002) Spanish universities: reforms spark more jobs—and protests. *Science* **295**: 781–782
- Bosch X (2007) Dealing with scientific misconduct. *BMJ* **335**: 524–525
- Bosch X (2008) Integrity: Croatia's standards unusual in much of Europe. *Nature* **454**: 574
- Bosch X, Titus SL (2009) Cultural challenges and international research integrity. *Lancet* **373**: 610–612
- Breen KJ (2003) Misconduct in medical research: whose responsibility? *Intern Med J* **33**: 186–191
- Breittmayer JP et al (2000) Responding to allegations of scientific misconduct: the procedure at the French National Medical and Health Research Institute. *Sci Eng Ethics* **6**: 41–48
- Cho MK, McGee G, Magnus D (2006) Lessons of the stem cell scandal. *Science* **311**: 614–615
- Cole A (2006) UK launches panel to tackle research misconduct. *BMJ* **332**: 871
- Coker R, McKee M (2001) Ethical approval for health research in central and eastern Europe: an international survey. *Clin Med* **1**: 197–199
- COPE (2005) *The COPE Report 2005*. Farnborough, UK: Committee on Publication Ethics
- Curfman GD, Morrissey S, Drazen JM (2006) Expression of concern reaffirmed. *N Engl J Med* **354**: 1193
- DFG (1998) *Recommendations of the Commission on Professional Self Regulation in Science*. Bonn, Germany: Deutsche Forschungsgemeinschaft
- Durrani M (2003) Research conduct: Konstanz clears Schön. *Phys World* **16**: 9
- ESF (2000) *European Science Foundation Policy Briefing. Good Scientific Practice in Research*

- and Scholarship. Strasbourg, France: European Science Foundation
- ESF (2008) *Stewards of Integrity. Institutional Approaches to Promote and Safeguard Good Research Practice in Europe*. Strasbourg, France: European Science Foundation
- Farthing MJG (2004) 'Publish, and be damned ...' The road to research misconduct. *J R Coll Physicians Edinb* **34**: 301–304
- Gui D, Runfola M, Rossi S, Panunzi S, de Gaetano A (2002) Academic recruitment in Spain and Italy. *Science* **297**: 770–771
- Hagmann M (1999) Europe stresses prevention rather than cure. *Science* **286**: 2258–2259
- Horton R (2006) Retraction—Non-steroidal anti-inflammatory drugs and the risk of oral cancer: a nested case–control study. *Lancet* **367**: 382
- Hren D (2002) In the middle of the beginning. *Croat Med J* **43**: 722–724
- IoM (2002) *Integrity in Scientific Research: Creating an Environment that Promotes Responsible Conduct*. Washington, DC, USA: The National Academies Press
- Israëls H (1993) *Der Fall Freud Die Geburt der Psychoanalyse aus der Lüge*. Hamburg, Germany: Europäische Verlagsanstalt
- Jones R (2002) Research misconduct. *Fam Pract* **19**: 123–124
- Judson HF (2004) *The Great Betrayal: Fraud in Science*. New York, NY, USA: Harcourt
- Klasen EC, Overbeke AJ (2002) Reporting of scientific misconduct in health care research. *Ned Tijdschr Geneesk* **146**: 1622–1624
- Kreutzberg GW (2004) The rules of good science. Preventing scientific misconduct is the responsibility of all scientists. *EMBO Rep* **5**: 330–332
- Mishkin B (1998) *International Guidelines Will Be Needed. Professional Ethics Report*. Washington, DC, USA: AAAS
- MPG (2000) *Rules of Good Scientific Practice*. Munich, Germany: Max Planck Gesellschaft
- Montgomerie B, Birkhead T (2005) A beginner's guide to scientific misconduct. *ISBE Newsl* **17**: 16–24
- Nylenna M, Andersen D, Dahlquist G, Sarvas M, Aakvaag A (1999) Handling of scientific dishonesty in the Nordic countries. *Lancet* **354**: 57–61
- ORI (1999) 4 countries describe scientific misconduct procedures at Warsaw conference. *ORI Newsl* 7 Mar
- Petroveckii M, Scheetz MD (2001) Croatian Medical Journal introduces culture, control, and the study of research integrity. *Croat Med J* **42**: 7–13
- Riis P (1999) Misconduct in clinical research. The Scandinavian experience and actions for prevention. *Acta Oncol* **38**: 89–92
- Riis P (2001) Scientific dishonesty: European reflections. *J Clin Pathol* **54**: 4–6
- Rivoire K (2003) The growing threat to research: scientific misconduct. *MIT Undergrad Res J* **8**: 21–26
- SAMS (2003) Guidelines of the SAMS for scientific integrity in medical and biomedical research and for the procedure to be followed in cases of misconduct. *Swiss Med Wkly* **133**: 52–58
- Titus SL, Wells JA, Rhoades LJ (2008) Repairing research integrity. *Nature* **453**: 980–982
- Torkar M (2002) German institutions introduce ombudsmen to police scientific misconduct. *ELSO Gaz* Oct
- Vlasov VV (2002) Emerging problems of medical ethics in Russia: medical practice and research. *Kardiologija* **42**: 81–84
- Wronski M (1998) Plagiarism in publications by Dr Andrzej Jendryczko. *Przegl Lek* **55**: 629–633
- Zawadzki Z, Abbasi K (1998) Polish plagiarism scandal unearthed. *BMJ* **316**: 645

Xavier Bosch is at the Department of Internal Medicine at the Hospital Clinic and the Institut d'Investigacions Biomèdiques August Pi i Sunyer, University of Barcelona, Spain. E-mail: xavbosch@clinic.ub.es

Received 6 November 2009; accepted 15 February 2010; published online 19 March 2010

EMBO reports (2010) **11**, 252–257.
doi:10.1038/embor.2010.32