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Research Integrity; Protecting Science, Society and Individuals

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The following is a slightly revised version of a lecture presented at the RIA/IUA/HRB workshop 'Research Integrity: Promoting and Building Trust' at the Royal Irish Academy of Sciences, Dublin, on 24 September 2009. Various thoughts and arguments presented in this paper are also discussed in the advisory report of Working Group 2 (Code of Conduct) to the ESF Member Forum on Research Integrity.

1. Introduction

An important mission of higher education is to train students to become critical independent researchers. Textbooks and courses on research design and methodology, as well as learning experiments and supervised practicals are employed to train the student for this purpose. Some students achieve an excellent level, others remain modest researchers. Some of their work will result in papers that pass a journal's peer review with flying colours, others will remain of low quality and will never be published. But this distinction always bears on the quality and relevance of the research work. Once in a while, however, the scientific community is startled by a report about fraud or deceit in research. Recent examples of the physicist Schön at the Bell Laboratory and the medical researchers the Korean Hwang Woo-suk and the Norwegian Sudbø, are cases in point. Particularly if the popular media take care of this news and lay it on thick, it creates shock waves in the scientific community, wondering whether these people are special or even disturbed or 'normal' researchers. Scientists ask themselves: are these cases rare incidents that should be ignored or does it occur more often without being noticed? What brings researchers to swindle? What can or should be done to prevent this? In other words: is this kind of misconduct a harmless phenomenon, seeing as it is rare, or a source of great concern, since it occurs not infrequently and causes serious damage.

Before the 1980s, the world of scientists – including the Academies of Sciences – had been rather closed and sometimes even defensive with respect to research misbehaviour. An earlier presentation that I gave on the subject in my own Academy some 20 years ago evoked reactions such as 'why so much attention to rare incidents?' or 'maybe in other countries, but not in ours', or 'in natural sciences serious misconduct will almost always be detected'. Suggestions that cases of misconduct that came to the surface may only be a tip of a larger iceberg were countered with the assertion that self-regulation and the system of peer review would keep matters under control. Anecdotal evidence of research misbehaviour was believed to be restricted to isolated cases and grossly blown up by a rapacious press.

Now we know better. A survey among the members of the AAAS, conducted at the beginning of the 1990s revealed that approximately a quarter of all respondents had been confronted with one or more incidents of fraud or plagiarism during the past ten years.[1] Over the last 20 years, further systematic evidence has become available, leading to the conclusion[2] that the frequency of misconduct in research ranges from 0.1% to 1.0%, which means that in Europe there are between 100 and 1000 cases per year. Moreover, there is some empirical evidence[3] that there is an increasing incidence of research misconduct nowadays. Pressure to publish, commercialisation, harder competition for funds, more opportunities, for instance through the internet, evaluation practices and the current career system for scientists, may all contribute to this unfortunate development. Unfortunately, misconduct is anything but a rare phenomenon.

It also cannot be denied that the effects of such misconduct are harmful indeed. Research misconduct is damaging to science, because it may create false leads for other scientists or the results may not be replicable, resulting in a continuation of the deception. It is also harmful to individuals and society: fraudulent research may result in the release and use of unsafe drugs, in the production of deficient products, inadequate instruments or erroneous procedures. Furthermore, if policy or legislation is based on the results of fraudulent research, harmful consequences are not inconceivable. Above all, however, damage is done through the subversion of the public's trust in science. The credibility of science would decline and trust in science as a dependable source of information and advice in respect of numerous decisions, so important for the welfare of mankind and society (environment, health, security, energy), would be subverted.

What's more, while international scientific collaboration increases sharply, another difficulty presents itself. Proper dealing with integrity and its obverse, misconduct, in an international project is particularly difficult as definitions, procedures and rules differ between the collaborating countries. Still, it is self-evident that common agreement on such standards, rules and procedures is a necessary precondition for a proper and responsible management of international projects.

The conclusion thrusts itself on us that scientific misconduct is anything but a harmless phenomenon. Given its occurrence and its injurious effects it is a rather serious threat for science, society and individuals. In my view, therefore, a proper definition and orientation, valid means of identification and effective corrective actions with respect to misconduct in science deserve a high priority within national institutions of learning and research as well as international associations of such institutions.

It is reassuring to know that during the last 20 years or so a variety of initiatives have been taken by academies, research councils, research and educational institutions and international organisations, trying to define proper research standards, to develop codes of conduct and to recommend procedures in dealing with alleged misconduct. A well known and good example has been set by the American National Academy of Sciences with their publication *On Being a Scientist* (first edition 1989, second edition 1995). Many academies have followed suit. As far as the international organisations are concerned we can refer to work of the European Science Foundation (ESF), All European Academies (ALLEA), the International Council for Science (ICSU), the United Nations Educational, Scientific and Cultural Organisation (UNESCO), the Global Science Forum of the Organisation for Economic Co-operation and Development (OECD), the Committee on Publication Ethics (COPE), and the European Commission.[4] At the same time, it has to be admitted that many countries still lack a coherent and generally accepted policy and approach. Moreover, the present patchwork of codes and procedures is most inconvenient in international research projects. This is the reason why the ESF has taken the initiative to create a Member Forum on Research Integrity with the four working groups aiming at 'common approaches'.

2. Principles of Integrity

Both the definition of scientific misconduct and the specification for proper scientific practice are based upon principles of scientific integrity. These are principles that all scientific researchers and practitioners should observe individually, among each other and toward the outside world. In a working paper for the Workgroup 2 of the ESF Member Forum on Research Integrity[5] I suggested including the following.

- *Honesty* in presenting research goals and intentions, in precise and nuanced reporting on research methods and procedures, and in conveying valid interpretations and justifiable claims with respect to possible applications of one's own or other's research results.
- *Reliability* in performing research (meticulous, no carelessness, no inattention), and in communication of the results (fair and full and unbiased reporting).

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- *Objectivity*: founding interpretations and conclusions on facts and data capable of proof, transparency in the collection, analysis and interpretation of data, and general verifiability of the scientific reasoning.
- *Impartiality* and *independence* from commissioning or interested parties, from ideological or political pressure groups, and from economic or financial interests.
- *Open communication*, in discussing the work with other scientists, in contributing to public knowledge through publication of the findings, in honest communication to the general public. This openness presupposes a proper storage and availability of data, and accessibility for interested colleagues.
- *Duty of care* for the object of research, be it a human being, animal, the environment or a product of culture. Research on human subjects should always rest on the principle of respect.
- *Fairness,* in providing proper references and giving due credits to the work of others, in treating colleagues with integrity and honesty,
- *Responsibility for future science generations.* The education of young scientists and scholars requires binding standards for mentorship and supervision.

3. Scientific Integrity: Misconduct

Violating these basic norms leads to research misconduct, which is the crux of inappropriate behaviour in science. Which types of misbehaviour can be distinguished? The two most serious violations of the ethos of science are fabrication and falsification. *Fabrication* is making up results and recording or reporting them. *Falsification* is manipulating research processes or changing or omitting data. Fabrication and falsification can also arise in the reporting of other researcher's results, in the reporting of expert opinion and in the public dissemination of science. A third category of misdemeanour is plagiarism in proposing, performing, or reviewing research, or in reporting research results. *Plagiarism* is the appropriation of another person's ideas, research results or words without giving appropriate credit. Plagiarism is of a different order since it is supposed to be more injurious to fellow scientists than to science as such. However, since openness is one of the basic integrity principles, and since progress in science depends on communication and discussion among fellow scientists and on a well-functioning peer-review system, scientists' hesitation, even refusal, to practice this openness and communication for fear of not being recognised as devisor or author the quality of science would suffer as well. In addition, improper dealing with such infringement of principles of integrity (attempts to cover up, reprisals to whistle-blowers and violations of due process) can be classified as misconduct.

In the literature, another class of misconduct is discussed, the 'questionable research practices' (QRP). Three groups of misbehaviour fall within QRP: firstly personal misconduct: intimidation of students, harassment, discrimination, insensitivity to social or cultural norms in doing research, misuse of funds, and so on. Although we deal with undesirable and, at times, unacceptable conduct here, it is not 'scientific misconduct', since it does not affect the integrity of the research record. Much of this misbehaviour is subject to generally applicable legal and social penalties, as they apply to everyone. Secondly a varied group of bad research practices, such as bad data management, bad research procedures, or publication-related misconduct. Bad practices are objectionable and often harmful to the public's trust in science. They need correction indeed, but are not basic infringements of scientific integrity. In third place are 'petty' misdemeanours that may not lead to formal allegations and investigations, but are just as alarming and damaging given their probable frequency: tampering with data, cutting a corner here, omitting an unwelcome observation there, etc. It should be clear that here we deal with unacceptable violations of the principles of scientific integrity: it is falsification *in statu nascendi*. Particularly if it occurs with students or junior scientists, it should be corrected through proper supervision and mentorship.

It should be recognised that the demarcation line between unacceptable and still acceptable behaviour is not always clear and undebatable. Where does one draw the line between verification on a too small sample and the illustration of an argument with 'case' data? Where lies the boundary between plagiarism and careless citation? Was an incorrect, but 'favourable' statistical technique truly chosen deliberately? Was a biased selection of data meant to start a scientific discussion or intended to present a full review of the evidence?

The principles discussed in the previous section and the infringements defined in this section refer to fundamental and universal norms for proper research behaviour. There is no need for cultural or regional adaptations or compromises in a Code of Conduct that encompasses these principles and infringements.

4. Dealing with Allegations of Misconduct

It is broadly accepted that the primary responsibility for handling cases of misconduct lies within the institute or university where the accused researcher works. These institutions should have a standing committee that deals with misconduct, or should establish an ad hoc committee in case a serious allegation is brought forward. In a few countries in Europe the case is handled by a central national advisory body (e.g. of the Academy of Sciences or the National Science Foundation), or a national governmental committee. Only rare cases are brought to the legal court, and then only if clear civil or criminal misdemeanour is involved.

In many European countries there exists a national body, either within the Academy, or within the National Research Council (or in some cases both), often composed of members of the Academy and/or the Research Council and with outside experts, that has an advisory role, or functions as a court of appeal. In some countries the Association of Universities or Rectors Conference also participates in this national body.

There is the opportunity for associations or bodies like Academies of Sciences to adopt a Code of Conduct, including rules for handling alleged cases of misconduct, on the basis of self-regulation. Their members are expected to abide with this Code of Conduct. Of course, these rules and possible sanctions are restricted to the formal remits of the association or body, and have no statutory character if this association or body is not expressly empowered by law to handle misconducts.

As far as the procedure is concerned, there is a general consensus on the need for a due and fair process that is uniform and sufficiently rapid, and leads to proper penalties. Of course, actions will depend on the seriousness of the research misconduct. In this respect, the level of intent of the misconduct, the consequences of the behaviour, and other aggravating and mitigating factors should be considered. It has to be shown that the misconduct was committed intentionally, or knowingly, or recklessly. As standard proof for the culpability of a suspected researcher 'preponderance of evidence' should be applied. It should be stipulated that research misconduct does not include honest errors or differences in opinion.

In international collaboration, partners should agree to conduct their research according to the standards of research integrity, as developed in this document, and to bring any suspected deviation from these standards, in particular alleged research misconduct, to the immediate attention of the project leader(s). Such a case should be investigated according to the policies and procedures of the partner with the primary responsibility for the project, while respecting the laws and sovereignty of the States of all participating parties.

5. Good Practices

In addition to fabrication, falsification and plagiarism, many other forms of objectionable practices in scientific research deserve attention. Some of them have serious moral or legal consequences, others may create nuisance, discontent or procedural dissension. Many of them may undermine public trust in science just as with the basic infringements of scientific integrity, and should therefore be taken seriously by the scientific community. The following categories may be distinguished.

(1) *Data practices*, including data management and storage, placing data at the disposal of colleagues who want to replicate the findings, and adequate preservation of original data.

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(2) R*esearch procedures*. Deviations from desired practices include insufficient care for research subjects,[6] insufficient respect for human subjects, animals, the environment, or cultural heritage, violating protocols, ignoring the requirement of informed consent, insufficient privacy protection, and improper use of laboratory animals, or breach of trust (e.g. confidentiality). The choice of an improper research design, carelessness in experimentation and calculations, which lead to gross errors, may also be classified under this heading, although the walls between dishonesty and incompetence are rather thin here.

(3) *Publication-related* conduct, including authorship practices. Unacceptable is claiming or granting undeserved authorship and denying deserved authorship, inadequate allocation of credit. Breaching publishing rules, such as repeated publications, salami-slicing of publications, insufficient acknowledgement of contributors or sponsors, or no or a too long delay of publication falls within this category as well.

(4) *Reviewing* and *editorial* issues, including independence and conflict of interests, personal bias and rivalry, appropriation of ideas.[7]

Unlike the fundamental principles of scientific integrity and the violating of these principles through fabrication, falsification or plagiarism, which have, as said, a universal character, good practices as outlined above may be subject to cultural differences: definitions, traditions, legislative regulations and institutional provisions may vary over nations or regions, sometimes also over disciplines. A required system of regulations of good practices in research should, therefore, not be part of a universal Code of Conduct. It should rather be developed in the form of national or institutional *Rules of Procedure*, recognising the legitimate differences between national, disciplinary or institutional systems. In the above-mentioned paper for WG2, I submitted a list of issues to be addressed in such Rules of Procedure, including recommendations on how to deal with them. In general, such recommendations are based on general assent, but, as said, rules of procedure must allow for national differences and cannot claim catholicity.

6. Role of an Academy of Arts and Sciences

Most Academies have an Advisory Committee on Science and Ethics. Of course, these committees deal with a much wider range of problems regarding the ethical aspects of science and scholarship. But issues of scientific integrity certainly fall within their remit. It is suggested that through these committees Academies implement the conclusion of ESF[8] that 'National Academies are well placed to provide leadership in the pursuit of scientific integrity and good practice'.

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Which role could an Academy of Sciences and Humanities (at the national level), and *mutatis mutandis* ALLEA (at the European level), play in this discussion?

First, a formal point: most Academies have a standing committee on science and ethics. These committees report to their respective Boards and President. These advisory committees are the appropriate bodies to handle the issue of scientific integrity, under the auspices of the President or the Board of the Academy.

Which roles could a national Academy then play in this respect?

(1) A general reflective role: reflection on basic values and norms in science and scholarship; reflection on and definition of the nature and orientation of scientific integrity and its obverse misconduct, on causes and possible prevention of the latter, and on the proper balance between a value-based (training, role modelling, self-regulation) and a compliance-based (rules, allegations and sanctions) approach.
(2) A partner in a national Council for Scientific Integrity (preferably with research councils and universities): the promotion and foundation of such a council, the definition of the terms of reference, and the nomination of members, among others from its own membership.
(3) Process monitor: academies could carry out meta-inspection of the processes, verifying the availability of proper provisions and procedures for investigating cases of misconduct, availability of research integrity officers, provisions guarding against malpractice or infringements of a due process, etc.
(4) Consultant in specific cases: e.g. complicated cases or cases in which the Board of the institute or university needs an extra expert judgement, or cases in which one of the parties involved or maybe the general public or the media well-foundedly challenge the fairness of the process or the quality of the judgement.
(5) Investigative body, carrying the responsibility for the investigation of cases of alleged misconduct, including the verdict, and making recommendations for punishment.
(6) Court of Appeal: a kind of higher court, with which one (accused, accuser) can lodge an appeal against the decision reached by the institute or university.
(7) Responsibility for proper research behaviour and dealing with alleged cases of misbehaviour in their own institutes (if such institutes fall under their jurisdiction).

There will be rather general agreement among Academies on the undesirability of roles (5) and (6). Most academies will not be equipped for the handling of all sorts of real and supposed cases of misconduct, neither do they have the legal authority to decide in appeal cases. Maybe to a somewhat lesser degree this

applies to the third role as well. The Academy should avoid any inspector or 'polit-buro' type responsibilities. The real contributive value of Academies, therefore, has to be understood in the light of the roles (1), (2) and (4), and can be characterised as reflective, contemplative, consulting and advisory. In other words, the main thing is their contribution to the debate and good practice by means of reflective analyses and well-considered propositions.

It goes without saying that the Academy will have to make this contribution in dialogue with other relevant actors in the field. In most countries these will include the National Research Council (or research councils),[8] and the Union of Universities/Rectors Conference. Ideally, proposals and recommendations will be a product of tri-partite agreements between these three bodies.[9]

Acknowledgement

Parts of this paper are based on earlier presentations and publications of the author on the subject (see www.pieterdrenth.nl/publications/scienceandethics).

Notes and References

1. Reported in *Science*, 27 March 1991.
2. As for instance drawn by N. Steneck at the first World Conference on Research Integrity in Lisbon, 2007.
3. Reported by N. Steneck at the EFS-ORI first World Conference on Research Integrity, *Fostering Responsible Research*, Lisbon, Portugal, 16–19 September 2007. The same increase of misconduct was generally reported by European Academy Presidents in a survey conducted in 2007, and reported by P. J. D. Drenth (*Strengths and Weaknesses of Current Policies and Practices*) at the same Lisbon conference.
4. In a separate overview, some of their activities have been summarised (P. J. D. Drenth, *International Initiatives Research Integrity*, Amsterdam: KNAW).
5. P. J. D. Drenth (2009) *Scientific Integrity: Code of Conduct* (Amsterdam: KNAW).
6. The treatment of human subjects in research is in many countries regulated by law.
7. With respect to categories (3) and (4) see the excellent publication of the Committee on Publication Ethics (COPE) *Guidelines on Good Publication Practice* (Committee on Publication Ethics).
8. ESF (2000) *Briefing: Good Scientific Practice in Research and Scholarship* (European Science Foundation).
9. Whether or not supported by an independent Office of Research Integrity.

About the Author

Pieter J. D. Drenth studied Psychology at the VU University in Amsterdam and New York University (Fulbright Scholarship). He received his PhD in 1960.

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