University of Southern Denmark

# Good and Bad Scientific Practice*

Peter Sigmund
Department of Physics and Chemistry
University of Southern Denmark, Odense

June 5, 2011

## 1 Introduction

Good scientific practice is more of an attitude than a set of rules. It is an attitude which you should acquire by monitoring your scientific environment, your international peers, your fellow students and your advisor(s), and by applying your own judgement of what you find good or bad. Nevertheless, there are written and unwritten rules which it is advisable to follow if you want to avoid trouble. And if you decide not to follow one of those rules it is advisable to know some possible consequences.

To strengthen the integrity of Danish research the Committees on Scientific Dishonesty (Udvalgene vedrørende Videnskabelig Uredelighed, in short UVVU) were established to investigate and consider allegations on research misconduct in Denmark. There are similar organizations in other countries such as the Office of Research Integrity in the USA. Most important is the very existence of such organizations. The less they have to do, the better. But experience tells that there is work for them, and sometimes, students and junior researchers are involved. This is why I am addressing you here.

We do not have courses in scientific misconduct, and hopefully we shall never need them. And if, after the talk, you let me know that you were familiar with everything I told you, I apologize for having vasted your time.

### 1.1 Terminology

We distinguish between research misconduct and good research practice. Research misconduct (scientific dishonesty) is defined by law, and a violation is a serious offence which may have consequences for your job. Good research practice is less rigorously defined, it is more like a goal to aim at, and minor violations occur all the time. Such violations may, however, affect your reputation as a scientist amongst your peers, amongst your colleagues and, not the least, amongst your students.

### 1.2 Formal Rules

The legal basis for the activities of UVVU is the Act on the Research Advisory System [1], approved by Parliament, according to which the definition of Scientific Dishonesty is: 'Falsification, fabrication, plagiarism and other serious violations of good scientific practice committed wilfully or grossly negligent on planning, performance or reporting of research results.' Included hereunder are:

- Undisclosed fabrication and construction of data or substitution with fictitious data.
- Undisclosed selective or surreptitious discarding of a person's own undesired results.
- Undisclosed unusual and misleading use of statistical methods.
- Undisclosed biased or distorted interpretation of a person's own results and conclusions.
- Plagiarisation of other persons' results or publications.
- A false credit given to the author or authors, misrepresentation of title or workplace.
- Submission of incorrect information about scientific qualifications.

*Based on a lecture presented to Philos, the association of PhD students at the Faculty of Science of the University of Southern Denmark, 3 May 2011.

Note the repeated occurrence of the term 'undisclosed'. In its absence, several of the above actions would rather sort under the heading of bad scientific practice. You probably have encountered minor violations, e.g. somebody interpreting results as supporting a theory even though they don't. Doing so may not be clever, it may even be stupid, but for it to become dishonest there must be the undisclosed intention to conceal pertinent information to the reader.

Our university has formulated its own set of rules on good scientific practice. You may find them (in Danish) in ref. [2]. Good scientific practice is here defined primarily as lacking conflict with the rules on scientific dishonesty, but also ethical requirements are mentioned. Similar documents have been issued by other universities.

### 1.3 Useful documents

- Firstly I like to mention a document issued by UVVU [3, 4] which is quite explicit with regard to a number issues pertaining to the biomedical area.
- Figure 1 shows a useful compendium, which you may download freely from the internet.


**On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition**

Committee on Science, Engineering, and Public Policy, National Academy of Sciences, National Academy of Engineering, and Institute of Medicine

ISBN: 0-309-11971-5, 82 pages, 6 x 9, (2009)



Figure 1:

- A recent document which may be expected to become influential is the Singapore Statement on Research Integrity shown in figure 2 which has been formulated and accepted at a 2010 conference in Singapore. The Singapore Statement is an NGO document, i.e. it is not a legally binding instrument. Nonetheless, the principles of the statement are expected to serve as a basis for legislators and research institutions worldwide.

## 2 How to survive

What I shall discuss from now on is more some inofficial code of conduct than a set of formal rules. The focus is to some degree influenced by my personal experience, but I hope that I am not too far from mainstream.

### 2.1 Documentation

Keep your documentation, in particular

- Lab records,
- Computer codes and output,
- Calculations,
- Data treatment and statistics.

This is important in your correspondence with colleagues, not the least those who have arrived at different results. It is also important for yourself and your collaborators in your later work when you may actually have forgotten some essentials. And it is important if it should happen that somebody charges you of misconduct.

How much should you keep? In principle, everything that is necessary to reproduce your results. If you are a mathematician with a good memory, you may not have to keep anything, but if your work involves collecting experimental data, the necessary records may occupy significant space, physical or virtual.

How long should you keep your records? It is a matter of fact that there are scientists that have been charged of misconduct and had their entire scientific production investigated. For an honest scientist it must be a clear advantage to have all necessary documentation accessible. A minimum number of years is needed in investigations of a dishonest

# Singapore Statement on Research Integrity

**Preamble. The value and benefits of research are vitally dependent on the integrity of research. While there can be and are national and disciplinary differences in the way research is organized and conducted, there are also principles and professional responsibilities that are fundamental to the integrity of research wherever it is undertaken.**

## PRINCIPLES

***Honesty*** in all aspects of research

***Accountability*** in the conduct of research

***Professional courtesy and fairness*** in working with others

***Good stewardship*** of research on behalf of others

## RESPONSIBILITIES

***1. Integrity:*** Researchers should take responsibility for the trustworthiness of their research.

***2. Adherence to Regulations:*** Researchers should be aware of and adhere to regulations and policies related to research.

***3. Research Methods:*** Researchers should employ appropriate research methods, base conclusions on critical analysis of the evidence and report findings and interpretations fully and objectively.

***4. Research Records:*** Researchers should keep clear, accurate records of all research in ways that will allow verification and replication of their work by others.

***5. Research Findings:*** Researchers should share data and findings openly and promptly, as soon as they have had an opportunity to establish priority and ownership claims.

***6. Authorship:*** Researchers should take responsibility for their contributions to all publications, funding applications, reports and other representations of their research. Lists of authors should include all those and only those who meet applicable authorship criteria.

***7. Publication Acknowledgement:*** Researchers should acknowledge in publications the names and roles of those who made significant contributions to the research, including writers, funders, sponsors, and others, but do not meet authorship criteria.

***8. Peer Review:*** Researchers should provide fair, prompt and rigorous evaluations and respect confidentiality when reviewing others' work.

***9. Conflict of Interest:*** Researchers should disclose financial and other conflicts of interest that could compromise the trustworthiness of their work in research proposals, publications and public communications as well as in all review activities.

***10. Public Communication:*** Researchers should limit professional comments to their recognized expertise when engaged in public discussions about the application and importance of research findings and clearly distinguish professional comments from opinions based on personal views.

***11. Reporting Irresponsible Research Practices:*** Researchers should report to the appropriate authorities any suspected research misconduct, including fabrication, falsification or plagiarism, and other irresponsible research practices that undermine the trustworthiness of research, such as carelessness, improperly listing authors, failing to report conflicting data, or the use of misleading analytical methods.

***12. Responding to Irresponsible Research Practices:*** Research institutions, as well as journals, professional organizations and agencies that have commitments to research, should have procedures for responding to allegations of misconduct and other irresponsible research practices and for protecting those who report such behavior in good faith. When misconduct or other irresponsible research practice is confirmed, appropriate actions should be taken promptly, including correcting the research record.

***13. Research Environments:*** Research institutions should create and sustain environments that encourage integrity through education, clear policies, and reasonable standards for advancement, while fostering work environments that support research integrity.

***14. Societal Considerations:*** Researchers and research institutions should recognize that they have an ethical obligation to weigh societal benefits against risks inherent in their work.

*The Singapore Statement on Research Integrity was developed as part of the 2nd World Conference on Research Integrity, 21-24 July 2010, in Singapore, as a global guide to the responsible conduct of research. It is not a regulatory document and does not represent the official policies of the countries and organizations that funded and/or participated in the Conference. For official policies, guidance, and regulations relating to research integrity, appropriate national bodies and organizations should be consulted. Available at:* ***www.singaporestatement.org***

Figure 2:

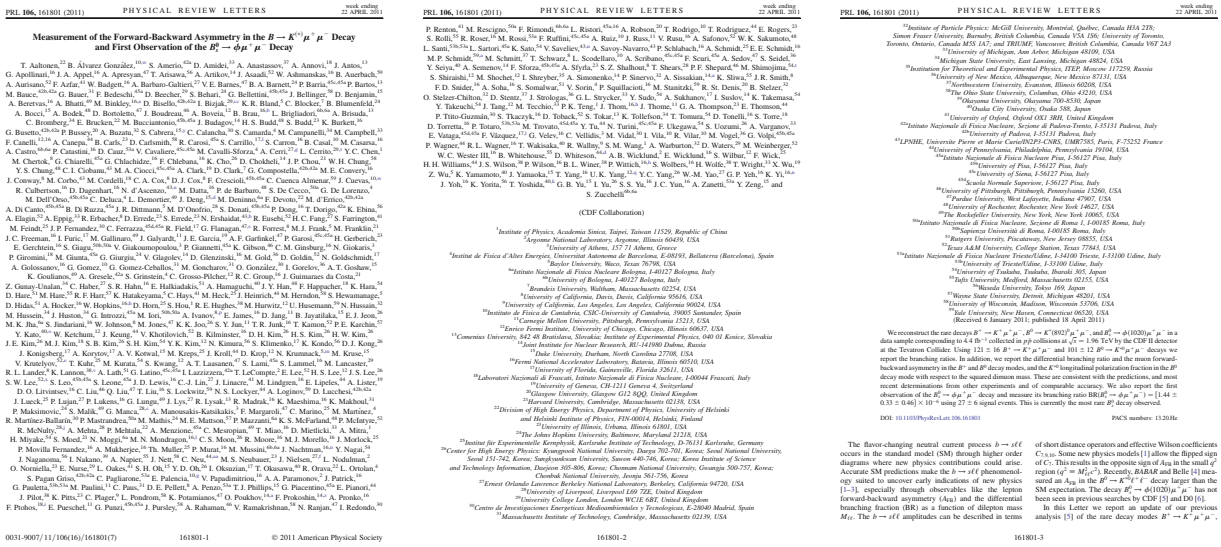

Figure 3: From Physical Review Letters, 22. April 2011

scientist. UVVU quotes five years as a minimum time for data storage, following the Danish Data Protection Agency. This figure may well be increased within the near future.

I have kept my records from almost fifty years of scientific activity until a few weeks ago, when I had to abandon most of it in connection with a relocation of my department. Apart from reprints, the only item that I repeatedly picked out over the years was original figures for reproduction in reviews and books.

## 2.2 Publication

As a scientist you have to publish your findings. Although the opinion seems to be widely spread that it is more important *that*, *where* and *how much* you publish than *what* you publish, don't forget that the primary purpose of a publication is to be read. Admittedly, the quality of published papers is not the only criterion when it comes to allocate funds and jobs, but in our part of the world it is important and often the first criterion.

Characteristics of a good paper are

I) Reporting sound, original and interesting research,

II) Necessary documentation and clear presentation,

III) Fair credit to previous work and

IV) Proper credit to those who have contributed, either in the title page or in an acknowledgement.

While I) depends entirely on your field, there is a lot of literature on II), of which I like to mention ref. [5] from which I have learned a lot, despite almost 50 years of experience.

### 2.2.1 Authorship

Items III) and IV) deserve attention if you want to avoid trouble. Consider IV) first. If all of a paper is your work, both the idea, the method of attack, the very research, the documentation and the writeup, the only problem that may arise is that your supervisor may claim coauthorship. If you have discussed the work with him/her regularly, the claim may be acceptable, and following it may increase your chance for the paper to be read. Otherwise he/she should not be a coauthor. In case of disagreement, try to discuss what is going to happen if the supervisor should report about your work at an international conference and someone in the audience asks a critical question.

Most frequent in the natural sciences are multiple-author papers. Figure 3 shows an example that is representative for high-energy physics. Except for specialists in the field it is hard to impossible to find out who are the key people in this enterprise. Clearly, everybody who had a serious involvement in the project has been listed in the titlepage at the proper alphabetic position. Projects like this have a spokesman who has the right to make the ultimate decisions, but intricate procedures are underlying the publication process to ensure the quality of what comes out of such extremely costly research.

You are more likely to be involved in a project involving a small number of people, students, postdocs, technicians and one or more senior researchers. The American Physical Society has formulated the following rights and obligations for coauthors [6],

- All collaborators share some degree of responsibility for any paper they coauthor. Some coauthors have responsibility for the entire paper as an accurate, verifiable, report of the research. These include, for example, coauthors who are accountable for the integrity of the critical data reported in the paper, carry out the analysis, write the manuscript, present major findings at conferences, or provide scientific leadership for junior colleagues.
- Coauthors who make specific, limited, contributions to a paper are responsible for them, but may have only limited responsibility for other results. While not all coauthors may be familiar with all aspects of the research presented in their paper, all collaborations should have in place an appropriate process for reviewing and ensuring the accuracy and validity of the reported results, and all coauthors should be aware of this process.
- Every coauthor should have the opportunity to review the manuscript before its submission. All coauthors have an obligation to provide prompt retractions or correction of errors in published works. Any individual unwilling or unable to accept appropriate responsibility for a paper should not be a coauthor.

Criteria like the above should be helpful to decide who is going to be a coauthor and who should figure in the acknowledgement. Once that has been settled, the next question is the order of appearance in the by-line. It is a widely spread assumption that the first author is the one who has done all the work and the last author is the boss. As you may have noted in the above paper from Physical Review Letters, this is not a universal rule. In fact, there are lots of combinations of hierarchic and alphabetic order in addition to curiosities like a well-known researcher, whose last name starts with a 'Z' and who loves inverse-alphabetic order in the by-line. Or the professor who only accepts students placed behind him in the alphabet.

It may happen that someone publishes a paper about work in which you participated without putting your name into the title. This is legitimate if the matter has been discussed with you and if you agreed. If not, the action may be scientific misconduct.

More frequent is the situation where someone submits a manuscript with your name in the by-line without telling you. Keep away from those people. If the paper contains suspicious results and conclusions that you cannot support, write to the editor and ask for your name to be withdrawn. If you have not been involved in the work, you actually *have to* withdraw your name from the publication, once you have become aware of the matter, otherwise you may be criticized for 'gift authorship'.

### 2.2.2 Quotations

Item III) above concerns quotation. The American Physical Society states the following [6]:

- Authors have an obligation to their colleagues and the physics community to include a set of references that communicates the precedents, sources, and context of the reported work. Proper referencing gives credit to those whose research has informed or led to the work in question, helps to avoid duplication of effort, and increases the value of a paper by guiding the reader to related materials. It is the responsibility of authors to have surveyed prior work in the area and to include relevant references.
- Proper and complete referencing is an essential part of any physics research publication. Deliberate omission of a pertinent author or reference is unethical and unacceptable.

In practice this implies that if you take over from the literature

- An important finding, idea or argument,
- A mathematical derivation,
- A computer program,
- A photo, a diagram and the like, or
- Verbatim text,

you have to clearly identify the source. The way you quote it is a matter of style of the journal.

The above formulation is ambiguous with regard to whether the bibliography of your paper should be complete in some sense. There are many ways to identify research that 'has informed or led to the work in question'. If you are writing a genuine review, you are supposed to aim at completeness. For a typical research paper, you may prefer a rather narrow interpretation, if not for other reasons than space limitations, especially if you work in a field with hundreds or thousands of references.

When having to make a choice I try to identify

- The first paper,
- The best paper, and
- The most recent review.

A complete match is a rare occasion, but this set of criteria is far superior to alternatives that you find much too often in the literature such as a few randomly-picked recent references ('see, e.g., . . . ') or, even more amateurish, a bunch of more or less irrelevant self-citations.

Special attention is indicated in quoting verbatim text (if you want to avoid being charged of plagiarism) and borrowing figures (if you want to avoid a copyright case).

As to verbatim text, be aware that powerful tools are available to detect overlaps, and that anybody can verify the degree of overlap. You can use formulations from the bible or from Newton and Darwin without an explicit quotation, but if you take over a paragraph in your introduction or conclusion from somewhere else, ensure an explicit quote. I myself try to set one line of text as a hard limit, and even less in case of particularly striking formulations.

The temptation to copy someone else's formulations may be particularly strong if you find your command of English language to be inferior to that of the other author. Try to resist straight copying. After all, your motivation only rarely will be exactly the same as that of the other author. If you are aware of linguistic weaknesses, try to overcome them or consult someone in your surroundings for linguistic help before submitting the manuscript. This will also aid the job of refereeing.

### 2.2.3 Permissions

When borrowing figures you need to ask for permission. You *have to* ask the copyright holder, which is most often the publisher of the book or journal. This process has been automated recently: If your source is an electronic journal, locate the article on the internet and click on 'permissions'. This will most often lead to a printed permission within a minute and free of charge. If that does not work, you (or your publisher) will have to approach the publisher. It may take time to get a response, and it also happens that the publisher sets a charge.

The publisher may also set the condition that you obtain permission from the author. Whether or not that is the case, you should anyhow contact the author. No sensible author will deny permission, but he/she may offer you a better copy than what you can extract from a pdf file on the internet or make you aware of an error in the original work. *Never* quote a figure from someone else's work without specifying the source. And be aware of the possibility that the source from which you copy a figure may not be the original source.

What do you do if you are writing a book and want to borrow 50 figures? Well, the safest solution is to ask for 50 permissions. The only alternative is to produce your own figures. With regard to diagrams this means you construct your own ones from scratch, and with regard to photographs you need to involve your own camera, if that is possible.

This whole complex of permissions used to be mainly a matter of priority within the scientific community, but the copyright issue is getting increased attention. I have not yet heard of a case in court involving an author charged of borrowing a single figure without quoting, but I am not sure about the situation a few years from now.

### 2.2.4 Errata and Corrigenda

Nobody is perfect. Even Nobel laureates make errors. It is part of good scientific practice that you publish a corrigendum if you trace an error in one of your papers. This is not the least a matter of preserving your credibility in the scientific community: If you publicly correct an error, your peers will imply that the rest of your production is error-free as far as you are aware.

Correcting an error is also a matter of your own comfort: After all, an error in your paper may have serious consequences. You may feel guilty if you have not corrected it in due time.

If you write an erratum or corrigendum[1] to a highly-cited paper, you may even increase your citation count and your H-index. This may – whether you like it or not – affect the decision-making on your next application for a job or for research funds.

## 2.3 Refereeing

In our current system, publication in refereed journals is a key ingredient of a scientific career. Therefore, your way of addressing referee reports and your behavior as a referee are part of the scientific code of conduct.

[1] A corrigendum corrects errors in the manuscript, an erratum corrects errors induced by the publisher. In the natural sciences one rarely makes this distinction.

You will not be charged for scientific misconduct, if you try to cheat a referee or if you, as a referee, treat an author unfairly. However, your reputation as a scientist is influenced by your behavior both as an author and as a referee. The formal anonymity of the process does not prevent people from talking about their experiences with you, but of course you will not necessarily get to know what they say.

The problem is that strong emotions may be involved. This is most pronounced when a paper is recommended for rejection by a referee.

### 2.3.1 Author

Consider first the case where you are the author whose paper has been returned with such a verdict. There is one thing that you should *never* do: Sending the manuscript right away to another journal without any further correspondence with the rejecting editor. If not for other reasons, the new editor may send your manuscript to the same referee. If that referee notices that you have totally disregarded his points he has good reasons for putting you on his personal black list.

Here is my recommendation:

1. Send the report to your coauthors.
2. Cool down for at least 24 hours.
3. Itemize the points made by the referee and decide which ones are valid.
4. If there is an acceptable balance between valid and invalid points, make appropriate changes in the manuscript. This may take time.
5. Clarify those points where you do not agree with the referee.
6. If you and your coauthors find the resulting manuscript worthwhile, send it to the editor with a cool and polite rebuttal.

In the rebuttal, address the editor, not the referee. It is the editor who conducts the correspondence. The editor may override a referee report on the basis of the report and your rebuttal. It is the editor who decides whether your manuscript should go to another referee or whether a final decision can be made already.

Referees are typical readers, not gurus. If a referee has misunderstood you, it could be his fault, but as a first approximation it is reasonable to assume that it is your fault.

However, there are stupid referees, and there are referees who have a bias. Try to give a chance to the editor to find out, but if he does not, and the referee insists after the second round, it is completely legitimate to ask for another referee or to submit the manuscript to another journal. I have encountered the latter situation on a couple of occasions. Rather than speculating about the identity of the respective reviewers I attached the entire correspondence with the first editor to inform the second editor, and I also informed the first editor briefly about my point of view, asking my message to be transferred to the first reviewer.

### 2.3.2 Referee

With an increased pressure on scientists to publish, the number of submissions and hence the number of referee reports needed increases steadily. At the same time, scientists feel they have less time for refereeing. Therefore, journal editors are constantly in search of new referees. You are likely to receive your first refereeing job as soon as you have published your first paper. When it happens, try to find out whether you are qualified. Do you know a reasonable fraction of the literature quoted in the manuscript?

Once you have decided to accept the job, take it seriously: Pointing just at 2-3 misspellings and nothing else is unsatisfactory for an author. On the other hand, don't be afraid of recommending a manuscript for rejection if it does not present something new.

# 3 Misconduct

The recent literature on misconduct in science, usually denoted as 'fraud' (bedrageri), is extensive. Much of this has been written by journalists. You may find a list of pertinent books etc. in ref. [7]. This author is a prominent scientist himself and he focuses on a small number of cases that have received great publicity. As indicated in the title, he goes beneath the headlines and arrives at much more balanced and sometimes surprising conclusions.

Dramatic cases of fraud are still rare events, although there must be some that have never been discovered. Minor cases are unquestionably more frequent, but in order to become harmful, the respective papers need to be read. Since many papers are never read, the damage must be limited.

Reading through the literature you will soon notice that cases of proven misconduct only rarely start with the intention of fraud. Rather, people get carried away or are under some kind of pressure, including trivial reasons such as lack of time.

In my experience, actual charges of misconduct mostly concern four categories,

1. Fabricated or fictive data,
2. Plagiarism,
3. Manipulating statistics,
4. Questionable scientific basis for drawn conclusions.

Most cases of the last category 4) cannot be treated by UVVU for legal reasons: It is not the job of UVVU to be an arbiter in scientific discussions.

## 3.1 Multiple Publication

If the Danish prime minister has an important message to the people, he may choose to publish it in all leading newspapers of the country. If you have hit an important result in your research, and you decide to publish it in more than one journal, you better be careful about what you are doing.

There have been situations when this was legitimate. Prominent examples are two papers by Niels Bohr that, during wartime, were published both by Nature and Physical Review. Other examples occurred during the time of the iron curtain with papers smuggled across the border. And there are of course numerous cases of entire journals being translated into other languages.

As a general rule, however, in submitting a paper you imply that your manuscript has not been published nor is under consideration somewhere else. Despite that it happens regularly that one and the same paper is published in two or more journals.

Sometimes only the title and the author have changed. Of course you will never consider this primitive type of plagiarism, but you may well become the one whose work is stolen in this way. The proper response is to inform the *chief editors* of the journals involved. If you just address the publisher or the editorial office, you run the risk that the person (or the computer) who reads your message does not realize that this is a serious matter.

More frequent is the case where only the title has changed, while the author's name is the same. This is not currently listed as scientific misconduct, although it is in most cases a violation of copyright. Moreover, it is by no means good scientific practice.

Apart from being dishonest, this sort of action is not very clever. After all, the chance that the second submitted manuscript goes to the referee who recommended the first one for publication is substantial. At any rate, the consequences of such an action are drastic: Apart from a copyright charge they include forced retraction, blacklisting with the journals involved and information of the employer by the journal editors.

Milder forms of multiple publication occur all the time. People want to go to conferences, and in order to receive travel money they have to present a paper. Why not divide up an almost finished paper into two, with different titles, a slightly modified introduction, rearranged list of references and a graph showing wifnium replaced by a graph showing wafnium[2]. This does not violate copyright and is nowhere listed as scientific misconduct. If you do it once it may not even be harmful to your scientific reputation. But don't do it all the time. If not for other reasons: One paper with $Z$ citations gives you more prestige than $n$ papers with $Z/n$ citations.

## 3.2 Suspicions

Unfortunately, scientific misconduct happens, and if it happens within your scientific environment it is bound to have serious consequences on your day-by-day activity. First there is a period from the day when suspicion arises until the time when a charge has been submitted officially to the appropriate body, which in the first instance typically will be the department head.

There are some indicators that call for attention:

- A large number of publications in high-profile journals can, of course, be a sign of great creativity, but it can also be a sign of wishful thinking or fictitious results,
- Somebody may report measurements with a hitherto unseen precision, using standard apparatus,
- There is missing essential information in publications.

[2]Quote from Samuel Goudsmit, founding editor of Physical Review Letters

Maybe you are able to repeat suspicious measurements with the same apparatus or a similar one. This should give you a clue on whether your suspicion is justified, but it may be not that simple.

Evidently you will not accuse a colleague or superior of scientific misconduct unless you have serious reasons. Once you have convinced yourself that something is wrong, try to discuss the matter with someone whom you trust before going the official way. After all, experience shows that those who receive the message will not necessarily listen to you.

UVVU is a slowly working organization. There may be a long period where the whistle-blower and the one who is charged come to work every day door-to-door. It requires some strength to cope with that kind of tension.

# 4 Concluding Remarks

You cannot guard yourself 100 % against being passively involved in scientific misconduct, but you can do your best to avoid it by carefully choosing your research group. Of course, the scientific topic is an important point of consideration, but the general atmosphere in the group has a long-lasting effect on your career. Talk to alumni and previous members of the group, look at the output in terms of theses and publications, how is the international interface, listen to lectures given by senior group members and try to make a judgement on the personalities involved. You can get much more specific advice from 'On being a Scientist', quoted in figure 1, and a fairly unique book with an amazingly broad scope [8].

**Acknowledgements**

Thanks are due to Peter Højrup, leader of the PhD school at the Faculty of Science, SDU for providing the contact to Philos, to the Philos steering group for efficient organization and to a very attentive audience including the Dean of Science for a stimulating discussion, part of which I have tried to incorporate into this manuscript. Valuable comments on the manuscript have been received from H. H. Andersen and I. Vickridge, editors of Nuclear Instruments and Methods B and from Charlotte Elverdam, general counsel to UVVU.

# References

[1] VTU. Executive Order on the Danish Committees on Scientific Dishonesty. Ministeriet for Videnskab, Teknologi og Udvikling; 2005. Available from: http://en.fi.dk/acts/executive-order-no.-668-of-28-june-2005-on-the-danish-commit/.

[2] SDU. God Videnskabelig Praksis. University of Southern Denmark; 2002. Available from: http://sdunet.dk/Vaerktoejer/Regelsamling/~/media/Intranet/Public/Upload/Vaerktoejer/Love_regler_aftaler/God%20videnskabelig%20praksis.pdf.ashx.

[3] UVVU. Vejledninger i God Videnskabelig Praksis med særlig fokus på sundhedsvidenskab, naturvidenskab og teknisk videnskab. VTU; 2009. Available from: http://www.fi.dk/publikationer/2009/vejledninger-i-god-videnskabelig-udvalgene-vedroerende-videnskabelig/UVVU%20Vejledninger%20GVP%202009.pdf.

[4] UVVU. Guidelines for Good Scientific Practice with special focus on health science, natural science, technical science. VTU; 2009. Available from: http://en.fi.dk/publications/2009/the-danish-committees-on-scientific-guidelines-for-good-scientific-practice/UVVU%20GVP%20ENG%2015052009.pdf.

[5] Lebrun JL. Scientific Writing: A reader and writer's guide. World Scientific; 2007.

[6] APS. APS Guidelines for Professional Conduct. American Physical Society; 2002. Available from: http://www.aps.org/policy/statements/02_2.cfm.

[7] Goodstein D. On Fact and Fraud; Cautionary tales from the front lines of science. Princeton University Press; 2010.

[8] Rosei F, Johnston T. Survival skills for scientists. Imperial College Press; 2006.