RePoSS: Research Publications on Science Studies

RePoSS #29:

Responsible Conduct of Research: Why and How

Hanne Andersen

December 1, 2014

Centre for Science Studies, University of Aarhus, Denmark
Research group: History and philosophy of science

Please cite this work as:

Hanne Andersen (2014). *Responsible Conduct of Research: Why and How*. RePoSS: Research Publications on Science Studies 29. Aarhus: Centre for Science Studies, University of Aarhus. URL: http://www.css.au.dk/reposs.

RESPONSIBLE CONDUCT OF RESEARCH: WHY AND HOW

HANNE ANDERSEN, CENTRE FOR SCIENCE STUDIES, AARHUS UNIVERSITY

1. INTRODUCTION

Publicly funded research has increased enormously in recent decades, and countries around the globe allocate a substantial share of their resources to science. For example, member states of the European Union have agreed to the Barcelona Objective of raising public and private investment in research and development to 3% of the GNP in each member state (see http://ec.europa.eu/invest-in-research/action/history_en.htm, accessed August 29, 2014).

In return for this investment, society expects new scientific knowledge on which goverments, public and privates agencies, and individual citizens can trustingly draw in making informed decisions on many different issues in modern life, from dietary advice and medical treatment to energy saving initiatives and computer safety, and which companies can draw on in developing new and improving existing products and technologies. Hence, the consequences of poor or fraudulent science can be quite serious: patients may die from inefficient treatments, people may suffer harm or loss from acting on the basis of incorrect health information, and resources may be lost in pursuing apparently interesting results that turn out to be mere chimeras. To illustrate, we shall provide an example before turning to a general overview of how scientific misconduct has been and is treated internationally, national and locally at the institutions where research takes place.

1.1. WAKEFIELD AND THE VACCINATION SCARE

In 1998, the British medical doctor Andrew Wakefield published a report in the journal *Lancet* in which he and his co-authors from a study of 12 children hypothesized a causal link between MMR (measles, mumps, rubella) vaccination and autism. The news of this disturbing finding soon spread, not only among scientists, but also in the public media, and caused parents to decline the MMR vaccine for their children. However, it later turned out that Wakefield's study was fraudulent, and in 2010, twelve years after its original publication, the paper was finally retracted by the editors of *Lancet* (Editors of the Lancet, 2010; Godlee, Smith, & Marcovitch, 2011). However, by then references to the paper had already spread widely. As a result, at many anti-vaccination web sites and similar sources that parents may encounter when searching information on the pros and cons of vaccines, reference to Wakefield's work is still prominent as an authoritative source of skepticism towards vaccination (Kata, 2010). As a consequence of the vaccination skepticism, several countries do not have herd immunity against measles, mumps and rubella, and epidemics can therefore still occur, and with them the rare but serious complications such as brain damage, sterility and damage to fetuses.

As this case clearly shows, scientific misconduct can have quite severe consequences, and we shall describe below how misconduct has become a more and more pressing issue as society has come to depend more and more on science and its results.

2. SCIENCE AND ITS IMPORTANCE IN THE 21ST CENTURY

Science has not always played such a prominent role in society as it does today. During the 20th and up into the 21st century, science has gained an immense importance. Especially after WWII, when the invention of radars, the development of mass produced antibiotics, as well as the production of the World's first atomic bomb had made it clear to both politicians and the general public alike that science was a truly transformative power, science came to be seen as an endeavor that "when put to practical use mean[s] more jobs, higher wages, shorter hours, more abundant crops, more leisure for recreation, for study, for learning how to live without the deadening drudgery which has been the burden of the common man for ages past" (Bush, 1945). With these high expectation to what advances in science would bring, governments all over the world allocated substantial amounts of money to scientific research in the hope that the flow of new scientific knowledge would be both continuous and substantial. Public agencies for the funding of scientific research to the benefit of society was created in many countries, such as in the US the National Science Foundation in 1950 (Kevles, 1987), or in Denmark the National Research Council (Staten Almindelige Videnskabsfond) in 1952 (Knudsen, 2006; see also Guzzetti, 1995 for an overview of the later European development).

The Cold War and the 1957 "Sputnik chock" only strengthened the political impression of the importance of science, and the 1950es and 1960es witnessed remarkable increases in funding, activities, and results. Historian of science Solla Price argued in his book *Little Science – Big Science* (1963) that the amount of scientific activities and results grew exponentially with a doubling time of only 10-15 years. But he also warned that this growth could not go on indefinitely: "… it is clear that we cannot go up another two orders of magnitude as we have climbed the last five. If we did, we should have two scientists for every man, woman, child, and dog in the population, and we should spend on them twice as much money as we had" (Price, 1963).

I the 1980es and 1990es, although funding was still growing, the rate of the growth started to decline. Large programs, such as the Superconducting Supercollider, were closed for financial reason (Riordan, 2000). Nobel Laureate and president of the AAAS, Leon M. Lederman (1991), lamented how the individual researcher on average had received less and less funding for their research since the late 1960es. Arguments were advanced that national budgets cold no longer afford continued expansion of science, and therefore science needed to rationalize, and become more tightly organized and clearly managed (see e.g. Ziman, 1994). This did in no way mean that science had lost its importance. Quite the contrary, more and more funding was (and still is) allocated to science, but spending so much money on science it also became increasingly important that the money was spent well. Accountability, evaluation and priorities became key topics for science policy and science management. At the same time, competition on funding, collaboration with industry, and large scale collaborations introduce challenged traditional norms of how science were to be pursued. Whereas the sociologist of science Morton by the mid-20th century had described the norms of science by the so-called CUDOS norms that stressed that new results are the common property of the scientific community (communialism), that scientists can all contribute to science regardless of their race or gender or social background (universalism), that scientists are not driven by personal interests in their pursuit of science (disinterestedness), and scientific claims are critically scrutinized by the scientific community before accepted (organized scepticism) (Merton, 1973), Ziman at the end of the century described the norms of science by the PLACE norms that stressed instead that results are proprietary rather than communal, that researchers focus on local puzzles rather than the general understanding, that there is a hierarchical structure of authority rather than the equality implied by Merton's universalism, that research is often commissioned and therefore not disinterested, and that scientists are valued as experts rather than for their originality (which is occasionally included in the CUDOS norms) (Ziman, 2000).

3. THE NEED FOR RESPONSIBLE CONDUCT IN A COMPETITIVE WORLD

The continuous demand for new research results and the limited resources available to provide them make science a very competitive enterprise. Most funding agencies allocate research funding through free competition between applicants. For example, in 2013 the Danish Council for Independent Research received applications for a total of dkk 7.4 billion while granting support for a total of dkk 1.2 billion, i.e. a success rate of 16%. Similarly, applicants at the European Research Council have in recent years experienced success rates around 10%. With such keen competition, researchers are highly dependent on proving their continued success in the form of publications and citations. Many researchers therefore perceive an increasing pressure to publish as much as possible, as quickly as possible, and in as high ranking journals as possible, and for some it may appear tempting to cut corners.

Moreover, current research politics strongly encourage collaboration and co-funding between universities and industry in the hope of seeing higher economic returns from society's huge investment in research. As a result, researchers increasingly engage in research activities with partners from the private sector where financial and other interests may conflict in ways that can compromise the way research is conducted and reported.

Contemporary research is also characterized by greater internationalisation and interdisciplinarity. Researchers from different cultures and with different areas of expertise therefore have to collaborate. At the same time, these collaborating researchers may not each be fully capable of understanding and assessing all aspects of the research conducted, and it can easily become opaque who is responsible for the results produced and accountable for the individual parts.

With all these dangers lurking in the world of contemporary science, it is important that all researchers

- have a clear understanding of what is responsible conduct of research, and know how to adhere to it
- can identify questionable researcher practices and know how to react when it occurs

4. WHEN IT GOES WRONG

Personal ambition, the aim of earning money or gaining power, the pressure to publish, or the desire to please superiors or collaborators are some of the many various causes that lead some researchers cut corners and engage in questionable research behaviors or scientific misconduct (see e.g. Fang & Casadevall, 2013, p. for a recent overview).

One of the spectacular cases of scientific misconduct concerned the work of the immunologists William T. Summerlin who had been hired as senior researcher at the Sloan-Kettering Institute in 1973 to work with Robert A. Good (see e.g. Culliton, 1974; 1974 for a description of this case). They had worked together for some time on a particular procedure for treating skin and other organs before transplantation, which was supposed to prevent rejection of the graft due to the immune response. Summerlin had reported to succesfully have conducted xenogenic skin grafting with humans, pigs, guinea pigs and rats as donors and mice as recipients, and cornea transplants with humans as donors and rabbits as recipients. However, other laboratories had had difficulties replicating their experiments, and the same was the case when Good and Summerlin hired a young research fellow to repeat their experiments.

To prove his case, Summerlin was asked to meet with Good and display the grafting of skin from a black mouse onto a white. Summerlin went to the meeting, bringing from the stables 18 strain A-albino mice that had received skin from strain C57 black mice. But the grafts looked gray, and, alone in the elevator, Summerlin took a black felt pen and painted the skin of two of the mice before he took them to Good's office to present them. Good did not notice the anything suspicious at the meeting, but after Summerlin had returned the mice to the stables, a care taker noticed that the grafts looked stranged, washed them with alcohol - and observed the black color turn greay and dull! He immediately reported it, and the Sloan-Kettering Institute appointed an investigation committee to look into Summerlin's work. The committee discovered that also the cornea transplants were fraudulent. Summerlin had claimed that the experiment involved both eyes of the rabbits, with a fresh cornea grafted on the one eye and a cornea treated according to his new procedure on the other. Hence, when the rabbits later displayed one clear and one opaque eye it had been interpreted as proving that Summerlin's procedure was successful. It now turned out that, in reality, the rabbits had only received transplant on one eye, and that the transplantations had all been failures.

After his fraud had been revealed, Summerlin was dismissed from the Sloan-Kettering Institute. However, the board issued a release in which it was stated that "the most rational explanation for Dr. Summerlin's recent performance is that he has been suffering from an emotional disturbance of such a nature that he has not been fully responsible for the actions he has taken nor the representations he has made" (Culliton 1944b, p. 1155) and that after discussion with both Summerlin and his personal psychiatrist the center would provide Summerlin with up to a year's medical leave on full pay "to enable him to obtain the rest and professional care which his condition may require" (ibid.).

Among the plagiarism cases, the case related to Vijay Soman from the Yale School of Medicine also attracted wide attention (see Hunt, 1981for a detailed account of the case). Reviewing a manuscript submitted to *New England Journal of Medicine*, Soman had recommended rejection of the manuscript while at the same time lifting text and results to a manuscript that he was himself preparing together with his supervisor, Philip Felig. After Soman had submitted the manuscript to *JAMA*, it was sent in review to Jesse Roth who relayed the review job to his assistant Helena Wachslicht-Rodbart – who happened to be the author of the original manuscript from which material had been lifted. When Wachslicht-Rodbart complained to the involved journals, her superior Roth and Soman's superior Felig, who happened to be old friends, first suggested that Felig and Soman would hold their paper back until Wachslicht-Rodbarts had been published, and expected that by resolving the issue of priority Wachlicht-Rodbart would be satisfied. However, she instead insisted on an investigation whether the study reported by Soman and Felig had actually been carried out. After much delay, during which Wachslicht-Rodbart felt that she received little support and was under some pressure to withdraw the case, an external audit concluded that data had indeed been fabricated, and additional investigations revealed that ten out of Soman's papers were either suspicious or clearly fraudulent and had to be retracted too. Soman was immediately dismissed from his position, while Felig had to resign from a prestigious chair he had just been offered and return to his previous professorship. By then Wachslicht-Rodbart had decided to leave research.

These cases illustrate some of the difficulties related to questionable research behavior and scientific misconduct. First, on the one hand, very often fraudulent research will sooner or later be scrutinized by people with the necessary expertise to detect the fraud. On the other hand, scientists are so used to trusting each other that they can have difficulties realizing when their trust has been misused and should be withdrawn. Second, questionable research practices and scientific misconduct concern not only the individual researchers involved, but also the institutions at which they work, and the journals in which they publish.

5. PUBLIC REGULATION

The kind of behavior now described as scientific misconduct and questionable research practices have always existed in science. Already Charles Babbage (1830) warned almost two centuries ago about the 'forging', 'trimming' and 'cooking' of data. But the consequences of scientific misconduct and questionable research behavior in the form of people harmed and resources lost have gained importance as society has come and to allocate more and more money to scientific activities, and to rely more and more on the research results produced.

Further, scientific misconduct and questionable research practices are unfortunately not rare occurrences. Based on a survey distributed among several thousand US researchers, (Martinson, Anderson, & De Vries, 2005) found that 0,3 % of the scientists who replied to the survey had engaged in the falsification of data, 1.4 % had used the ideas of others without obtaining permission or giving due credit, 6% had failed to present data that contradicted their own research, and 12.5% had overlooked other's use of flawed data or questionable interpretation of data. Similarly, based on a meta-analysis of available studies of the prevalence of scientific misconduct, (Fanelli, 2009) has found that almost 2% admitted to have "fabricated, falsified or modified data or results at least once" (p. e5738), while 33,7% admitted other questionable research practices. When asked about the behavior of colleagues, numbers rose, and 14% reported that they had experienced colleagues engage in falsification while 72% reported to have experienced colleagues engage in questionable research practices.

5.1. The introduction of public regulations

Given this prevalence of misconduct and questionable behavior and the potential harm that it can cause, society has gradually realized a need for regulation. During the 1970es and 1980es, news reports and popular books, especially from the US, described a number of spectacular cases of misconduct, including the Summerlin case and the Soman case described above (Broad & Wade, 1983; Hixson, 1976). To the US public and their politicians, the reported cases indicated an inability within the scientific community to deal with fraudulent behavior in their midst. To the public it looked as if scientists were either gullible or deliberately chose to close their eyes at even glaringly fraudulent acts. In some cases, investigations seemed to be dragged out for ages. In others, perpetrators were not punished, but allowed to move unrevealed to the next institution to continue their questionable or fraudulent behavior. In others again, old-boys networks appeared to work to silence whistle-blowers rather than to support them. Hence, despite initial protest from scientists who maintained that misconduct was best handled internally by the scientific community itself, US politicians concluded that political intervention was needed, and by the late 1980es the US was the first country to implement regulations that required universities receiving public funding to establish clear policies and procedures for handling misconduct (see Steneck, 2007; 1999; 1994 for accounts of the US history on scientific misconduct).

5.2. International differences and harmonization efforts

Gradually, many countries have implemented regulations that define scientific misconduct and specify how cases of misconduct should be handled. However, it is important to be aware that national regulations differ, as do the various definitions of misconduct itself (see e.g. Stainthorpe, 2007 for a brief review of regulations in the EU; or Apel, 2009 for a detailed comparison of national regulations). Hence, when participating in the international world of science it remains important when travelling from country to country, or even from institution to institution, to inquire about local regulations!

Within the last decade, agencies around the globe have worked towards international dialogue on how to understand and promote research integrity and to eventually harmonize standards and regulations.

This work has led to the 2010 Singapore Statement on Research Integrity which outlines "the principles and professional responsibilities that are fundamental to the integrity of research wherever it is undertaken" and the 2013 Montreal Statement on Research Integrity in Cross-Boundary Research Collaborations which outlines the responsibilities of individual and institutional partners in cross boundary research collaborations, including general collaborative responsibilities, responsibilities in managing the collaboration, responsibilities in collaborative relationships, and responsibilities for the outcomes of research.

These statements emphasize that the fundamental principles on which scientific research must necessarily build are:

- 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

While describing the basic principles and professional responsibilities that are fundamental to the integrity of science in general terms, the statements also acknowledge that there are many national and disciplinary differences in the way research is organized and conducted. The detailed interpretation of the general principles and responsibilities are therefore often spelled out in national and local regulations.

5. DEFINITIONS OF SCIENTIFIC MISCONDUCT

Definitions of scientific misconduct can roughly be divided into the group of narrow definitions focused on fabrication, falsification and plagiarism (aka the "FFP definition") and the group of broader definition that attempt to include a wider zone of questionable and unacceptable behaviours in addition to what is covered by the FFP definition.

The first definition of misconduct was provided by the US misconduct regulations and initially attempted a mixture of the two by defining misconduct as fabrication, falsification, plagiarism, or other practices that seriously deviate from those that are commonly accepted within the scientific community. However, the "other practices that seriously deviate" clause was criticized by many scientists, including the National Academy of Science, because it could be used to punish creative or novel science. The 'other serious deviations' clause was therefore later removed, and the US regulations now include only fabrication, falsification and plagiarism.

Definition of Research Misconduct, Office of Research Integrity

http://ori.hhs.gov/definition-misconduct

Research misconduct means fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results.

(a) Fabrication is making up data or results and recording or reporting them.

(b) Falsification is manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record.

(c) Plagiarism is the appropriation of another person's ideas, processes, results, or words without giving appropriate credit.

Research misconduct does not include honest error or differences of opinion.

In contrast to the US definition of misconduct, the Danish definition of scientific misconduct also includes misrepresentations in the form of e.g. misleading use of statistical methods, distorted interpretations of result, or distorted conclusions. We shall discuss the distinction between misconduct and poor science below, after both national and local rules and regulations have been presented.

Executive Order on the Danish Committees on Scientific Dishonesty

Consolidated Act No. 306 of 20 April 2009, Section 2:

Scientific dishonesty shall mean: Falsification, fabrication, plagiarism and other serious violation of good scientific practice committed wilfully or grossly negligent on planning, performance or reporting of research results. Included hereunder are:

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

In addition to the national regulations, the individual institutions may have local regulations for good scientific practice. For example, at the University of Copenhagen the local guidelines for good scientific practice are based on international codes and recommendations such as the Vancouver Recommendations, the European Code of Conduct from the European Science Foundation (http://www.esf.org/media-centre/ext-single-news/article/the-european-code-of-conduct-for-research-integrity-endorsed-by-european-science-foundations-gove.html), and the Singapore Statement on Research Integrity (http://www.singaporestatement.org/).

Rules on Good Scientific Practice, University of Copenhagen

http://praksisudvalget.ku.dk/english/rules_guide/

Good scientific practice is based on a series of principles that have been formulated and are regularly adjusted by relevant international associations of researchers and research organisations. These principles include:

1. that the research is conducted in a reliable manner

2. that primary data is kept secure and, as far as possible, is made publicly available

3. that the research results are presented openly and honestly

4. that there is openness in relation to possible conflicts of interest

5. that everybody who takes part in the research process is credited in a fair manner.

Similarly, Aarhus University has a local set of rules to safeguard good scientific practice. These rules proscribe against scientific misconduct as it is defined in the national order on scientific dishonesty, and against other questionable behaviors, such as negligence that is not sufficiently gross to count as misconduct but which nevertheless has important consequences, or misrepresentations that are not so serious as to be seen as misconduct.

The University of Aarhus's rules of 29 June 2000 to safeguard good scientific practice

http://www.au.dk/en/about/organisation/index/6/60/au9/

Section 1. Scientific work at the University of Aarhus must be carried out in keeping with **good scientific practice** , cf. Subsections 2 and 3.

Subsection 2. Good scientific practice requires **scientific integrity** . In other words, there must be no display of behaviour which can be characterised as being "scientifically dishonest", as this notion is defined in the Danish Ministry of Research and Information Technology's Order no. 933 of 15 December 1998 concerning the Danish Committees on Scientific Dishonesty (Redelighedsbekendtgørelsen) Section 3. Here, scientific dishonesty concerns actions or omissions which are characterised by:

Falsification or distortion of the scientific message having taken place during research, or grossly misleading information or actions regarding a person's efforts within the research, **and**

The person concerned having acted with intent or gross negligence regarding the activities under consideration.

Subsection 3. Furthermore, good scientific practice requires **good research conduct** . This, in other words, means that scientific work must be carried out with due respect for the generally recognized methods and any scientific codes of ethics that may apply to the area(s) of research in question, as well as in accordance with the protection of the personal and professional integrity of the person or persons concerned. Actions and omissions contrary to good scientific practice might, **for example** , be:

Negligence, which cannot be described as gross, but the consequences of which must, however, be considered as having serious implications for the research.

Deliberate misrepresentation of research results or being misleading about one's own or another person's role in the research, even though the extent and consequences of the unlawfulness cannot in themselves be considered as serious.

Conduct which is not in keeping with the guidelines concerning good scientific practice that apply to the field in question which may be issued by official and/or professionally acknowledged organisations (e.g. applicable experimental protocols, IT, documentation, authorship, private funding, etc.)

Participation in scientific work where personal or financial interests in the course of the work and its results can give reason for reasonable doubt being cast upon the impartiality of the person in question.

Subsection 4. Finally, good scientific practice requires **loyal collegiate conduct**, which respects generally recognized standards for the presentation of and comment on both one's own scientific efforts and those of others.

Subsection 5. The requirement for good scientific practice is **not** a requirement for "political correctness" or a requirement about restraint concerning professional and objective criticism of other people's scientific work or of current professional theories.

The Danish national regulations on scientific misconduct that include misrepresentations in the definition of misconduct require a distinction between misrepresentations that are so grave that it is scientific misconduct, and less grave misrepresentations that are 'just' poor science. The demarcation line between misconduct and poor science can be difficult to draw, and rulings can therefore be controversial. We shall briefly illustrate this with the case of Lomborg and his monograph *The Skeptical Environmentalist*. By the same token, research institutions may not want their employees to engage in poor research, even if it is not misconduct, and they may therefore introduce local rules that supplement the national regulation regarding misconduct, such as it is the case at Aarhus University. Again, demarcating poor science from science as such can be difficult, and also here rulings can be controversial.

5.2. MISCONDUCT VERSUS GREY ZONE BEHAVIOR

Bjørn Lomborg received tenure as Associate Professor at the Department of Political Science at Aarhus University in 1997. By then he had published primarily on game theory and the simulation of multiparty systems. In the beginning of 1998, together with a group of students Lomborg wrote a number of feature articles in the Danish newspaper *Politiken* in which they argued that the widespread and alarming conceptions of the state of the environment were wrong: we are not developing a shortage of raw materials, we are not losing species at an alarming rate, and the importance of the greenhouse effect is questionable. Later the same year Lomborg expanded the material into a Danish monograph, and in August 2001 it was published in English at Cambridge University Press with the title *The Skeptical Environmentalist*. The monograph was controversial, politically as well as scientifically, and a few months after the publication of *The Sceptical Environmentalist* allegations of misconduct were raised with the DCSD.

Since the Danish regulations regarding scientific misconduct regulate only research publications, the DCSD first needed to settle whether *The Sceptical Environmentalist* was a research publication at all. On the one hand, it could be argued that "in its manifest one-sidedness" and "with the vast breadth of topics treated and the lack of qualification of any scientific method - including criteria for the selection of sources" it did not "present the appearance of a scientific work but precisely that of a provocative debate-generating book". But on the other hand, Lomborg presented himself in the book as Associate Professor of statistics and had listed the book as a research publication in the yearbook of Aarhus University, and the many notes and references also gave the book "a scientific form", and the DCSD therefore decided to try the case (cf. UVVU, 2003).

At that time, the Executive Order on the DCSD the definition of misconduct as two separate criteria that both needed to be fulfilled, namely, first, that misrepresentation had taken place, and second, that it had been done intentionally or with gross negligence. As a consequence, the DCSD also divided its ruling in the Lomborg case into two parts. First, with respect to misrepresentation the DCSD argued that "that there has been such perversion of the scientific message in the form of systematically biased representation that the objective criteria for upholding scientific dishonesty ... have been met". Second, with regard to intent, the DCSD argued that "in consideration of the extraordinarily wide-ranging scientific topics dealt with by [Lomborg] without having any special scientific expertise" it could not be proven that Lomborg had acted with intent. Therefore, only one of the two criteria were fulfilled, and the the Committees arrived at the ruling, that "Objectively speaking, the publication of the work under consideration is deemed to fall within the concept of scientific dishonesty. In view of the subjective requirements made in terms of intent or gross negligence, however, Bjørn Lomborg's publication cannot fall within the bounds of this characterization. Conversely, the publication is deemed clearly contrary to the standards of good scientific practice" (UVVU, 2003).

This ruling was controversial. A large group of researchers from primarily the social sciences signed a petition against the DCSD and the ruling. Another large group of researchers from primarily the natural and medical sciences signed another petition in support of the DCSD. After Lomborg had also complained over the ruling to the Ministry of Research, the Ministry changed the executive Order so that the two elements of the definitions, misrepresentation and intent, were no longer treated as two separate criteria. In addition, it was added that the DCSD cannot try cases regarding the quality of the research performed. Finally, it was specified that the DCSD only tries cases in which the researcher accused of misconduct has scientific training in the scientific field that the case relates to. Hence, to day, poor science as well as researchers making claims outside their area of expertise cannot be treated by the DCSD. Such cases therefore have to be handled by other means, either within the scientific community through peer criticism, or through local regulations at the institutions at which the researchers are employed.

Reference List

Apel, L.-M. (2009). *Verfahren und Institutionen zum Umgang mit Fällen wissenschaftlichen Fehlverhaltens*. Baden: Nomos Verlag.

Broad, W. & Wade, N. (1983). *Betrayers of the Truth*. Oxford: Oxford University Press.

Bush, V. (1945). A report to the president by Vannevar Bush, director of the
office of scientific research an development, july 1945. United States Government Printing Office, Washington , 1-30.
Ref Type: Internet Communication

Culliton, B. J. (1974). The Sloan-Kettering Affair (II): An Uneasy Resolution. *Science, 184,* 1154-1157.

Culliton, B. J. (1974). The Sloan-Kettering Affair: A Story without a Hero. *Science, 184,* 644-650.

Editors of the Lancet (2010). Retraction—Ileal-lymphoid-nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children. *Lancet, 375,* 445.

Fanelli, D. (2009). How many scientists fabricate and falsify research? A systematic review and meta-analysis of survey data. *PLoS ONE, 4,* 1-11.
Fang, F. C. & Casadevall, A. (2013). Why we cheat. *Scientific American Mind, 2013,* 32-37.
Godlee, F., Smith, J., & Marcovitch, H. (2011). Wakefield's article linking MMR vaccine and autism was fraudulent. *BMJ, 342,* 64-66.
Guzzetti, L. (1995). *A brief history of European Union Research Policy* European Commission.
Hixson, J. S. (1976). *The Patchwork Mouse*. Anchor Press.
Hunt, M. (1981, January 11). A fraud that shook the world of science. *New York Times*.
Kata, A. (2010). A postmodern Pandora's box: Anti-vaccination misinformation on the Internet. *Vaccine,* 1716.
Kevles, D. J. (1987). The National Science Foundation and the Debate over Postwar Research Policy, 1942-1945: APolitical Interpretation of Science--The Endless Frontier . *Isis, 68,* 4-26.
Knudsen, H. (2006). Politik, penge og forskningsvilkår. In H.Nielsen & K. H. Nielsen (Eds.), *Viden uden grænser. Dansk Videnskabshistorie bd. 4 (1920-1970)* (pp. 259-279).
Lederman, L. M. (1991). *Science: The End of the Frontier?* AAAS.
Martinson, B. C., Anderson, M. S., & De Vries, R. (2005). Scientists behaving badly. *Nature, 435,* 737-738.
Merton, R. (1973). The normative structure of science. In *The Sociology of Science. Theoretical and Empirical Investigations* (pp. 265-278). Chicago: Chicago University Press.
Price, D. J. d. S. (1963). *Little Science, Big Science*. Columbia University Press.
Riordan, M. (2000). The demise of the superconducting super collider. *Physics in Perspective, 2,* 411-425.
Stainthorpe, A. e. al. (2007). *Integrity in Research - A Rationale for Community Action* European Commission.
Steneck, N. H. (1994). Research Universities and Scientific Misconduct: History, Policies, and the Future. *Journal of Higher Education Policy and Management, 65,* 310-330.
Steneck, N. H. (1999). Confronting Misconduct in Science in the 1980s and 1990s: What has and has not been accomplished? *Science and Engineering Ethics, 5,* 161-176.
Steneck, N. H. (2007). The History, Purpose, and Future of Instruction in the Responsible Conduct of Research. *Academic Medicine, 82,* 829-834.
UVVU. (6-1-2003). Afgørelse af klagerne mod Bjørn Lomborg. Forskningsstyrelsen, sagsnr. 612-02-0001 .
Ref Type: Generic
Ziman, J. (1994). *Prometheus Bound*. Cambridge: Cambridge University Press.
Ziman, J. (2000). *Real Science. What it is, and what it means*. Cambridge: Cambridge University Press.

Recent RePoSS issues

#16 (2011-8) **Kristian Peder Moesgaard**: "Lunar Eclipse Astronomy" (Article)

#17 (2011-12) **Helge Kragh**: "The Periodic Table in a National Context: Denmark, 1880-1923" (Book chapter)

#18 (2012-1) **Henrik Kragh Sørensen**: "Making philosophy of science relevant for science students" (Talk)

#19 (2012-8) **Helge Kragh**: "Newtonianism in the Scandinavian Countries, 1690–1790" (Book chapter)

#20 (2012-9) **Helge Kragh**: "Har Naturvidenskaben en Fremtid?" (Book chapter)

#21 (2013-6) **Helge Kragh**: "Empty space or ethereal plenum? Early ideas from Aristotle to Einstein" (Article)

#22 (2014-7) **Helge Kragh**: "Jørgen From (1605–1651): Et Billede fra Dansk Astronomi- og Lærdomshistorie" (Article)

#23 (2014-8) **Nils Randlev Hundebøl**: "Big ambitions and supercomputing: A case of industry engagement in climate modeling" (Preprint)

#24 (2014-8) **Julie Louise Hørberg Kristensen**: "Jagten på en god oplevelse i zoologisk have" (Masters thesis)

#25 (2014-9) **Allan Lyngs Kjærgaard**: "Offentlig støtte til forskning og udvikling i industrien fra 1940'erne til 1990'erne" (Masters thesis)

#26 (2014-10) **Julie Nørgaard Hostrup**: "Når discipliner mødes: Et casestudie af faglig integration i nanoforskning" (Masters thesis)

#27 (2014-10) **Kristian Danielsen, Morten Misfeldt and Henrik Kragh Sørensen**: "Picks Sætning: Inspiration til undervisning om eksperimenterende udforskning i matematik med et videnskabsteoretisk sigte" (Preprint)

#28 (2014-11) **Mads Goddiksen**: "Philosophical Perspectives on Interdisciplinary Science Education: An Introduction" (Book chapter)

#29 (2014-12) **Hanne Andersen**: "Responsible Conduct of Research: Why and How" (Preprint)

#30 (2014-12) **Hanne Andersen**: "Responsible Conduct of Research: Collaboration" (Preprint)

This list is up-to-date as of December 2, 2014. The full list of RePoSS issues can be found at `www.css.au.dk/reposs`.

RePoSS (Research Publications on Science Studies) is a series of electronic publications originating in research done at the Centre for Science Studies, University of Aarhus.

The publications are available from the Centre homepage (www.css.au.dk/reposs).

ISSN 1903-413X

Centre for Science Studies
University of Aarhus
Ny Munkegade 120, building 1520
DK-8000 Aarhus C
DENMARK
www.css.au.dk

Faculty of Science
Department of Science Studies
AARHUS UNIVERSITET