

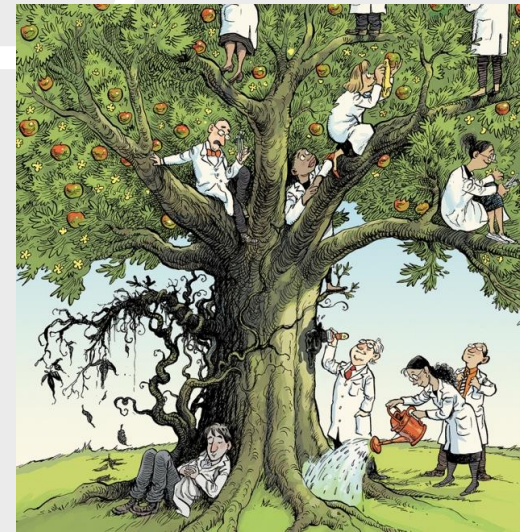
Ethics in Engineering and Research

Lecture #14 Ethics in Research

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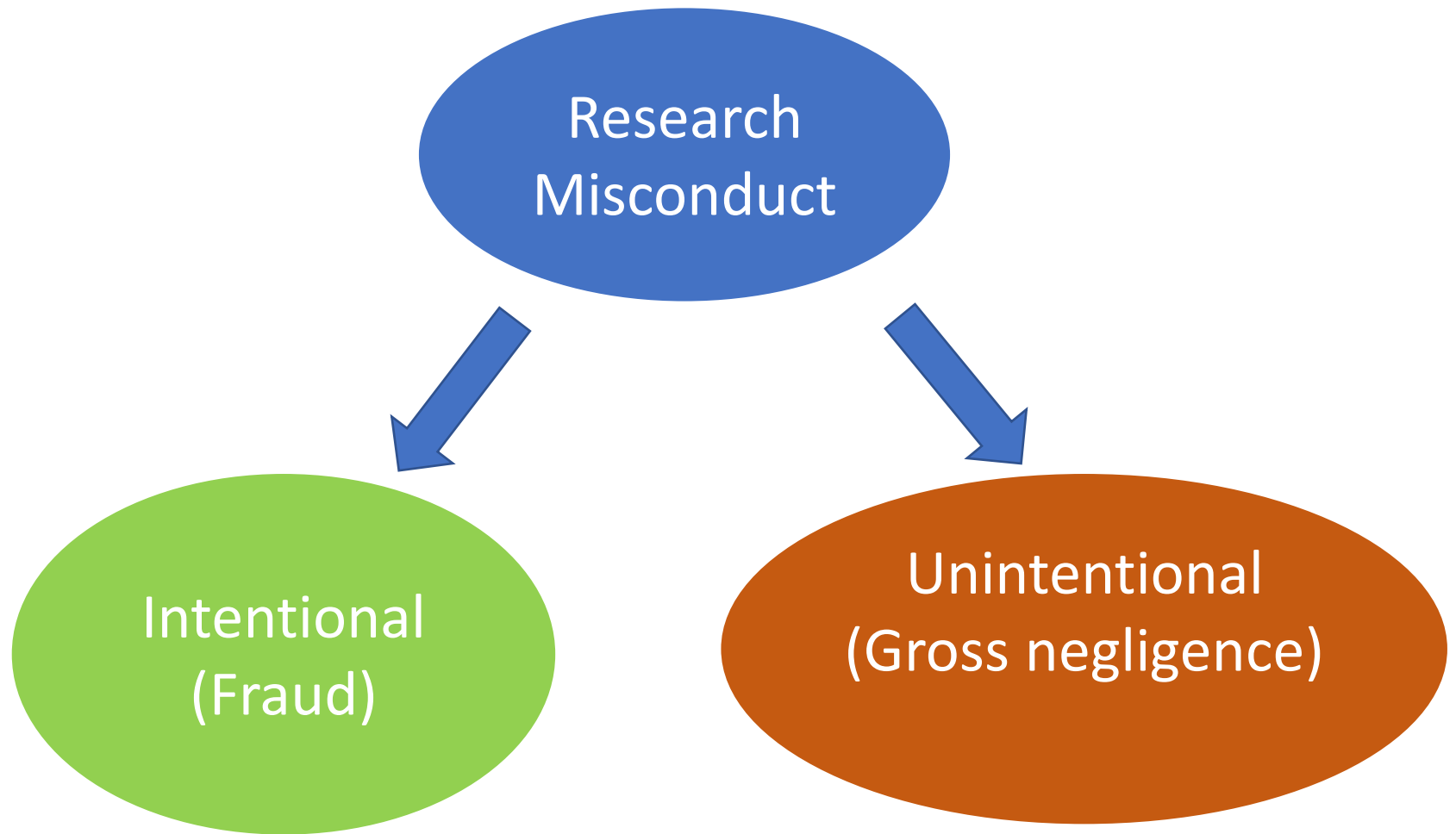
- Integrity in research = promoting excellence in pursuing truth
- **Thinking about honesty** in research should be kept **paramount**
- Ethics should be applied on all stages of research; planning, conducting and reporting



Nature, 537, 29–30

Discussion topics

- Defining research misconduct
- Conducting and reporting experiments
- Protecting research subjects
- Giving and claiming credit
- Reporting misconduct



Research misconduct

- Intentional violations/misrepresentation (Fraud)
- Three kinds of scientific frauds, originally from Charles Babbage's book (Reflections on the Decline of Science in England).
 - **Trimming**: the smoothing of irregularities to make the data look extremely accurate and precise.
Example: removing outliers
 - **Cooking**: retaining only those results that fit the theory and discarding others.
 - **Forging**: fabricating some or all of the research data what are reported, and even reporting experiments to obtain those data that were never performed.
- A common way to define misconduct; sometimes difficult to prove

Scientific Fraud News

<https://retractionwatch.com/>

<https://www.the-scientist.com/news-opinion/the-top-retractions-of-2019-66852>

<https://www.the-scientist.com/tag/scientific-fraud>



Notorious Scandals

Jan Hendrik Schön (Bell Laboratories) and organic semiconductor

<https://debunkingdenial.com/fraud-in-physics-ii-jan-hendrik-schoen-and-organic-semiconductors/>

LK-99 superconductor

<https://www.chemistryworld.com/features/superconductivity-the-search-and-the-scandal/4019292.article>

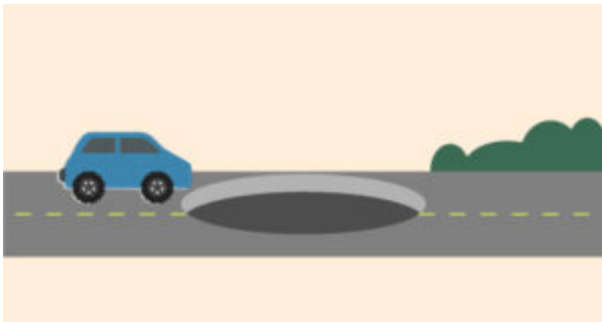
Woo-Suk Hwang's scandal on stem cell research

<https://www.nature.com/articles/nm0106-4a>

Research misconduct

Gross negligence: a researcher **unintentionally, but culpably**, fails to meet the minimum standards for conducting and reporting research, and other forms of extreme incompetence

- lack of due care in setting up an experiment, examples
 - ☐ failing to establish a reliable control group
 - ☐ failing to properly monitor an experiment
- biases and self-deception



Biases and self-deception

- Example: claim about “cold fusion” by Pons and Fleischmann
- What cause biases self-deception?
- **Motivated irrationality**
biased by wishes, hopes, self-esteem and fears
- **An unpleasant reality**
A researcher perhaps senses that the data are going against what he/she want to believe. Then, instead of confronting the data honestly, he/she purposefully disregard the evidence or downplay its implications.

- Research ethics include much more than avoiding fraud!
- Example: if you are doing an experiment, you should report everything that you think might make it invalid, not only what you think is right about it.

How to minimize self-deception and bias

Scientists have developed a vast array of methods that are designed to minimize the problem.

- ❑ Double-blind trials
- ❑ Randomization of experimental subjects
- ❑ Proper use of controls
- ❑ Hypothesis testing

(http://www.stats.gla.ac.uk/steps/glossary/hypothesis_testing.html)

(<https://www.verywellmind.com/what-is-a-double-blind-study-2795103>)



Self Correction

- What to do when you realize your publication is fatally flawed?
 - Correction
 - Retraction
- The stigma of a retraction is immense, even in cases of honest error.
- Ignoring or covering up a mistake is even worse.
- other researchers may be misled and the scientific record muddled.

Addendum to “Performance Enhancement of Ad Hoc Networks with Localized Route Repair”



AFTER publication of our paper [1], the existence of another earlier paper [2] was brought to our attention on the same topic. The initial theorems involving analytical formulation in our paper are identical to those in [2]. The first author has now admitted that he used material from [2], but did not provide due reference or credit to that paper. This is also an oversight by the other authors. It was never our intention to take credit away from the authors of paper [2]. We regret omission of reference [2] from our paper.

Ramnath Duggirala
Rahul Gupta
Qing-An Zeng
Dharma P. Agrawal

REFERENCES

- [1] R. Duggirala, R. Gupta, Q.-A. Zeng, and D.P. Agrawal, “Performance Enhancement of Ad Hoc Networks with Localized Route Repair,” *IEEE Trans. Computers*, vol. 52, no. 7, pp. 854-861, July 2003.
- [2] I.D. Aron and S.K.S. Gupta, “Analytical Comparison of Local and End-to-End Error Recovery in Reactive Routing Protocols for Mobile Ad Hoc Networks,” *Proc. Third ACM Int’l Workshop Modeling, Analysis, and Simulation of Wireless and Mobile Systems (MSWiM)*, pp. 69-76, Aug. 2000.

In my opinion, there’s no
reason other than one’s ego
to not correct something.
The longer you let it go, the
worse the problem gets.

—Jeffery Kelly,
Scripps Research Institute

REPORT

A Type I–Secreted, Sulfated Peptide Triggers XA21-Mediated Innate Immunity

Sang-Won Lee^{*}, Sang-Wook Han^{*}, Malinee Sriyanum, Chang-Jin Park, Young-Su Seo, Pamela C. Rona...

✦ See all authors and affiliations

Science 06 Nov 2009:
Vol. 326, Issue 5954, pp. 850-853
DOI: 10.1126/science.1173438

Article

Figures & Data

Info & Metrics

eLetters

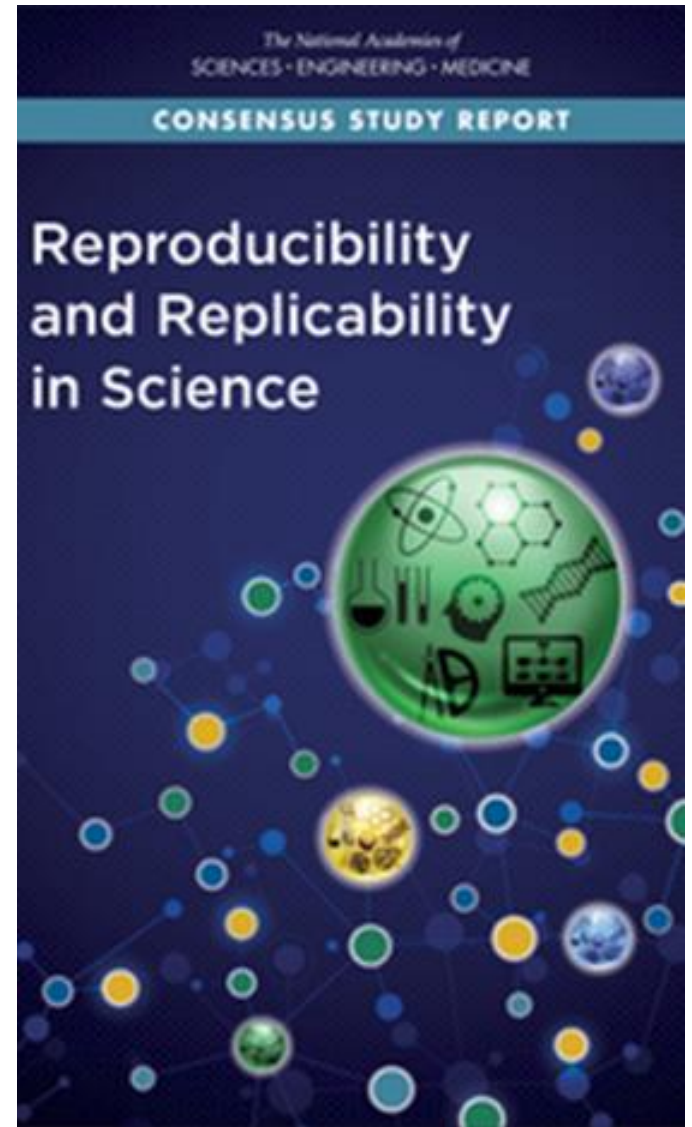
PDF

**This article has been retracted. Please see:
[Is retracted by - October 11, 2013](#)**

Reproducibility

- One of the pathways by which the scientific community confirms the **validity** of a new scientific discovery is by **repeating the research that produced it**.
- **Reproducibility**: Precision in measurements under conditions that may involve different locations, operators, measuring systems, and replicate measurements on the same or similar objects. The different measuring systems may use different measurement procedures.
- **Repeatability**: Precision in measurements under conditions that include the same measurement procedure, same operators, same measuring system, same operating conditions and same location, and replicate measurements on the same or similar objects over a short period of time.

<https://www.nationalacademies.org/our-work/reproducibility-and-replicability-in-science>



Giving and Claiming Credit

Some misconducts in giving and claiming credit are:

- Plagiarism
- Misrepresenting credentials
- Misleading listing of authorship

Plagiarism

- Plagiarism is the representation (intentionally or negligently) of another author's language, thoughts, ideas, or expressions as one's own original work.
(*from Wikipedia*)
- Plagiarism is considered academic dishonesty and a breach of journalistic ethics.
- **Self-plagiarism:** any attempt to take any of your own previously published text, papers, or research results and make it appear brand new.
- The publication of identical papers in two places (**duplicate publication**) is also considered as self-plagiarism.

Duplicate Submission

- Unethical behaviour, wasteful of resources and people's time
- IEEE Publication Services and Products Board ((Cl. 8.2.1.B9)

“authors should only submit original work that has neither appeared elsewhere for publication, nor which is under review for another publication. If authors have used their own previously published work(s) as a basis for a new submission, they are required to cite the previous work(s) and very briefly indicate how the new submission offers substantively novel contributions beyond those of the previously published work(s).”

Duplicate Submission

Can I submit a paper, which was published at conference proceeding, to journal?

- A paper submitted to the journal, which is based on a conference paper, should be a substantial extension of the work.
- The conference paper could contain only the details necessary to highlight the main achievement, while the journal paper should describe in details how it was done with analysis, design approach, full measurement details, etc.
- It is necessary that the conference paper is referenced in the journal paper.
- Any use of the same materials (text, figures, etc.) without reference is unacceptable.

Misrepresenting credentials

- NSPE Board of Ethical Review (case 79-5)
- An engineer received a doctoral degree from a “diploma mill” organization that required no attendance or study at its facilities.
- The engineer then listed the degree on his professional correspondence and brochures.
- Listing a doctoral degree, especially without listing where it is from, was indeed using unprofessional deception.

Misleading listing of authorship

- Omitting a co-author who makes a significant contribution to the research.
- Listing a person as co-author who does not contribute to the research
- Sequence of authorship (is it important?)
- In some discipline, No (e.g., philosophy where alphabetical listing is common)
- Engineering, Yes
- It would be unethical to list supervisor name in the first place. (why?)

Misleading listing of authorship

- Allocating credit between a student or junior researcher and senior researcher
- It is quite subjective!
- Decision making is sometimes far from easy and requires **serious thought and collegial discussion**.
- If in doubt, a researcher must **talk frankly** with others in the team, including senior researcher and supervisor.



Credit and Responsibility in Collaborative Research

- Collaboration benefits to researchers.
- Collaboration situations are far more complex now than a generation ago; many papers with large numbers of collaborators and different laboratories.
- But collaboration can also generate tensions between individuals and groups.
- One potential problem: listing of a paper's authors.
- Frank and open discussion of the division of credit as early in the process leading to a published paper as possible.
- Taking credit = Taking responsibility
- Responsibility for error, whether caused by mistakes or fraud.

Ethics in Research with Animals

- Research in engineering sometimes involves experimental subjects and also (nonhuman) animals, especially when it overlaps with biomedical research.
- APA's 2002 Ethic codes
 - Acquire, care for, use and dispose of animals
 - Make reasonable efforts to minimize the discomfort, infection, illness and pain of animal subjects.
 - Use a procedure subjecting animals to pain, stress or privation only when an alternative procedure is unavailable
 - Perform surgical procedures under appropriate anesthesia and follow techniques to avoid infection and minimize pain during and after surgery.
 - Proceed rapidly when it is appropriate that an animal's life be terminated, with an effort to minimize pain and in accordance with accepted procedures.

Protecting Research Subjects (Human Subjects)

- Experiments on humans are allowed only after obtaining the voluntary consent of human subjects.
- Risks, possible benefits, alternatives, exact procedures involved should be known.
- There must be no coercion, threats or under pressure.
- The individual must have the capacity to make a reasonable decision about whether to participate.
- How about children and persons with mental health?
- Further information: WHO's ethical standard and procedure for research with human beings (<https://www.who.int/ethics/research/en/>)

Reporting misconduct

- If a reader believes that there could be an ethical problem with a published manuscript, **the first step** would be to **contact the editors of the journal**.
- Editors must take all allegations of misconduct seriously and have the responsibility to look into the case.
- If there is evidence of serious misconduct, they may need to inform the employer(s) of the accused author(s) who will then start another (internal) investigation.
- In some cases, publication of a notice in the journal will be warranted (usually together with the retraction of the paper).

Reporting misconduct (continue)

- The author(s) should always get the chance to respond to any allegations of misconduct.
- Despite the unpleasant situation, all correspondence with editors and/or author(s) should remain objective and kind.
- If there is no response from the journal or the authors—or if their answers are not convincing—the reader can still try to contact the author's employer (or institution) directly to ask for an investigation.

Joint Authorship Of Paper - Case No. 85-1

Engineer A and Engineer B are faculty members at a major university. As part of the requirement for obtaining tenure at the university, both Engineer A and Engineer B are required to author articles for publication in scholarly and technical journals. During Engineer A's years as a graduate student he had developed a paper which was never published and which forms the basis of what he thinks would be an excellent article for publication in a journal. Engineer A discusses his idea with Engineer B and they agree to collaborate in developing the article. Engineer A, the principal author, rewrites the article, bringing it up to date. Engineer B's contributions are minimal. Engineer A agrees to include Engineer B's name as coauthor of the article as a favor in order to enhance Engineer B's chances of obtaining tenure. The article is ultimately accepted and published in a refereed journal.

Questions:

- Was it ethical for Engineer A to use a paper he developed at an earlier time as the basis for an updated article?
- Was it ethical for Engineer B to accept credit for the development of the article?
- Was it ethical for Engineer A to include Engineer B as coauthor of the article?

Credit for Engineering Work Research Data - Case No. 92-7

The XYZ Company headed by Engineer A offered to provide funding to professors in the chemistry department of a major university for research on removing poisonous heavy metals (copper, lead, nickel, zinc, chromium) from waste streams. The university then agreed to contract with XYZ company to give the company exclusive use of the technology developed in the field of water treatment and waste water stream treatment. Under the agreement, XYZ Company will provide a royalty to the university from profits derived from the use of the technology. Also, a group of the university professors organized QRS, a separate company to exploit applications of the technology other than the treatment of water and waste water. At the same time that the university research was being conducted, XYZ continued to conduct research in the same area. Performance figures and conclusions were developed. XYZ freely shared the figures and conclusions with QRS organized by the university professors.

At the university, Engineer B, a professor of civil engineering wanted to conduct research and develop a paper relating to the use of the technology to treat sewage. **Engineer B contacted the professors in the university's chemistry department. The chemistry professors provided XYZ's data to Engineer B for use in the research and paper. The professors did not reveal to Engineer B that the data was generated by Engineer A and XYZ company.** Engineer B's paper was published in a major journal. Engineer A's data was displayed prominently in the paper and the work of XYZ constituted a major portion of the journal. The paper credits two of the chemistry professors as major authors along with Engineer B. No credit was given to Engineer A or XYZ as the source of the data, the funds that supported the research. After publication Engineer B learns about the actual source of the data and its findings.

Question:

Does Engineer B have an obligation under the Code of Ethics to clarify the source of the data contained in the paper?

Engineer's Duty To Report Data Relating to Research - Case No. 85-5

Engineer A is performing graduate research at a major university. As part of the requirement for Engineer A to complete his graduate research and obtain his advanced degree, Engineer A is required to develop a research report. In line with developing the report, Engineer A compiles a vast amount of data pertaining to the subject of his report. The vast majority of the data strongly supports Engineer A's conclusion as well as prior conclusions developed by others. However, a few aspects of the data are at variance and not fully consistent with the conclusions contained in Engineer A's report. Convinced of the soundness of his report and concerned that inclusion of the ambiguous data will detract from and distort the essential thrust of the report, Engineer A decides to **omit references to the ambiguous data in the report.**

Question:

Was it unethical for Engineer A to fail to include reference to the unsubstantiated data in his report?