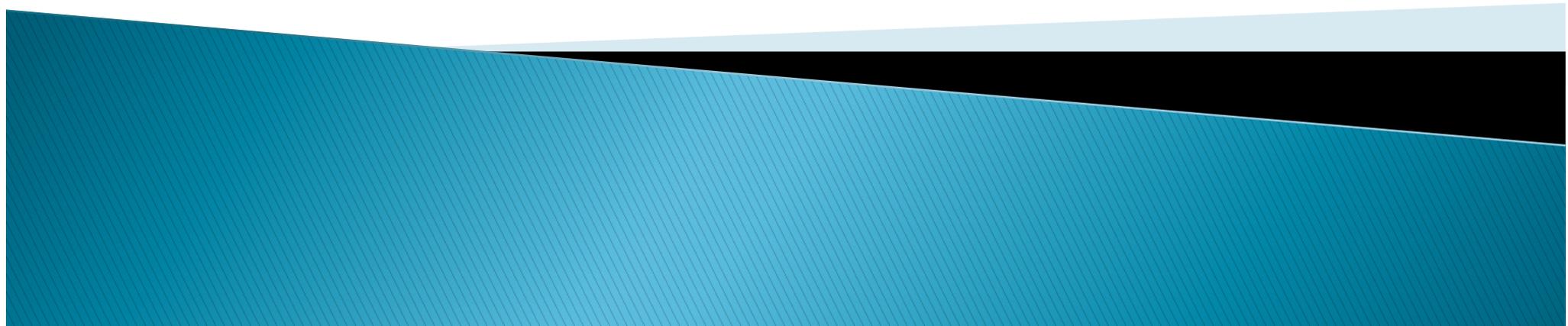


Responsible Conduct of Research

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One High Profile Case of Scientific Misconduct

- ▶ Jan Hendrik Schön (Bell Labs) was a researcher in condensed matter physics – semiconductors.
- ▶ He was found to have reused data sets in several papers and generated some data from mathematical functions (2002).
- ▶ Investigating committee found that raw data was not available, no lab notebook had been kept, and samples were damaged or discarded.
- ▶ 28 papers withdrawn by the journals, more in question
- ▶ Generated discussion about responsibilities of co-authors and peer reviewers

Vaccines and Autism

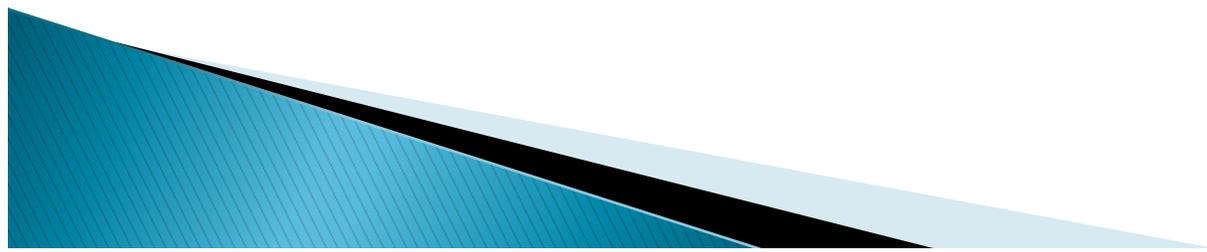
- ▶ In 1998 Dr. Andrew Wakefield published a study (and a video) based on 12 cases that implied a causal relationship between the MMR vaccine and autism.
- ▶ This connection was investigated again and again but no reputable study was able to confirm his findings.
- ▶ Dr. Wakefield had not revealed to the publisher that his studies were funded by lawyers who wanted to file lawsuits against the manufacturers of vaccines on behalf of parents of children with autism.
- ▶ The study also turned out to be fraudulent in terms of the reported findings from the 12 cases.
- ▶ Dr. Wakefield lost his medical license.

The damage has been done.

Increasing Awareness of Need for Ethics Training

- ▶ Several high profile cases of research misconduct
- ▶ Federal regulation have been enacted
- ▶ American Physical Society (APS) published Guidelines for Professional Conduct in 2002
- ▶ National Science Foundation and National Institutes of Health now require Responsible Conduct of Research (RCR) training of undergraduates, graduate students and postdocs who are working on funded research project.

There is more to RCR than “don’t make up data”



Common Principles

- ▶ Honesty – conveying information truthfully and honoring commitments.
- ▶ Accuracy– reporting findings precisely and taking care to avoid errors.
- ▶ Efficiency –using resources wisely and avoiding waste.
- ▶ Objectivity – letting the facts speak for themselves and avoiding improper bias.

Procedures and practices vary by discipline and lab

From CITI training modules



Research Misconduct

- ▶ **Fabrication** is making up data or results and recording or reporting them.
- ▶ **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.
- ▶ **Plagiarism** is the appropriation of another person's ideas, processes, results, or words without giving appropriate credit. **Information on the internet must be treated just like information in printed materials.**

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

From CITI training modules



What about Mistakes?

It should be recognized that honest error is an integral part of the scientific enterprise.

It is not unethical to be wrong, provided that errors are promptly acknowledged and corrected when they are detected.

Case Study

You are a graduate student working in a lab where data is accumulated for the purposes of measuring the optical absorption of a variety of samples. For each sample there is a large data file stored on a computer in the lab. In reviewing a lab notebook from one of your predecessors in the lab and comparing that to data published by the lab, you find a gap. That is, some of the data that was published is not accounted for in the lab notebook. Furthermore, you are unable to locate the computer files for this missing data. You talk to a fellow graduate student about this situation, and he tells you that you should be very concerned about the situation and that it should be reported.

Record Keeping

The APS Guidelines for Professional Conduct (see Appendix A) state:

The results of research should be recorded and maintained in a form that allows analysis and review. Research data should be immediately available to scientific collaborators. Following publication, the data should be retained for a reasonable period in order to be available promptly and completely to responsible scientists. Exceptions may be appropriate in certain circumstances in order to preserve privacy, to assure patent protection, or for similar reasons.

Keeping good notes (including dates) can help to establish intellectual property in case of a dispute.



Publications & Authorship

Authorship should be limited to those who have made a **significant contribution** to the concept, design, execution or interpretation of the research study.

All those who have made significant contributions should be offered the opportunity to be listed as authors.

Other individuals who have contributed to the study should be acknowledged, but not identified as authors.

The sources of financial support for the project should be disclosed.

Additional Authorship Guidelines

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.



Case Study

As a graduate student, you have worked closely with a professor and her postdoc on a project studying experimental techniques in microfluidics. The project is going very well and you've even published some of your initial results. You will be graduating this spring with your master's degree. Your advisor is now writing a subsequent paper with a colleague who is developing a theory that accounts for your results. You see a draft of the paper and notice that you are not listed as one of the four authors of the paper, who are the professors and their senior postdocs. However, the paper is directly based on the work that you did and includes a new experimental **plot** that you created in addition to the theoretical calculations.

Conflict of Interest

A conflict of interest may exist when the result of your professional conduct has the potential to benefit you or those you care about. If a reasonable person with knowledge of the situation might consider you to be biased or otherwise unable to be objective, then there is a potential conflict of interest.

There are many professional activities of physicists that have the potential for a conflict of interest.

Any professional relationship or action that may result in a conflict of interest must be fully disclosed.

When objectivity and effectiveness cannot be maintained, the activity should be avoided or discontinued.

Peer Review

Peer review is advice from one researcher about the merit of another's work (for publication, grants, etc.)

Researchers must provide thorough, fair and objective evaluations based on requisite expertise.

Scientists have an obligation to participate in the process.

Privileged information or ideas that are obtained through peer review must be kept confidential and not used for competitive gain.

Reviewers should disclose conflicts of interest resulting from direct competitive, collaborative, or other relationships with any of the authors, and avoid cases in which such conflicts preclude an objective evaluation.

Mentoring

- ▶ A true mentor is typically someone who possesses:
 - Experience with the research and challenges that trainees face.
 - The ability to communicate that experience.
 - The willingness to do so.
 - A special interest in helping another person develop into a successful professional.
- ▶ You can have several mentors
- ▶ Your research advisor is not necessarily a good mentor

From CITI training modules



Mentoring

- ▶ Mentoring can involve individual relationships ranging from a casual offer of advice up to an apprentice relationship.
- ▶ Clear expectations for the relationship are key
- ▶ Good communication is extremely important

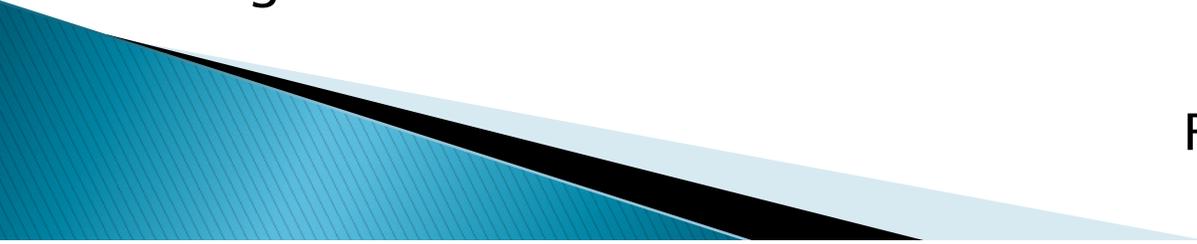
Do not underestimate the value of having one or several mentors at any stage in your career. Cultivate these relationships.



Mentoring Case Studies

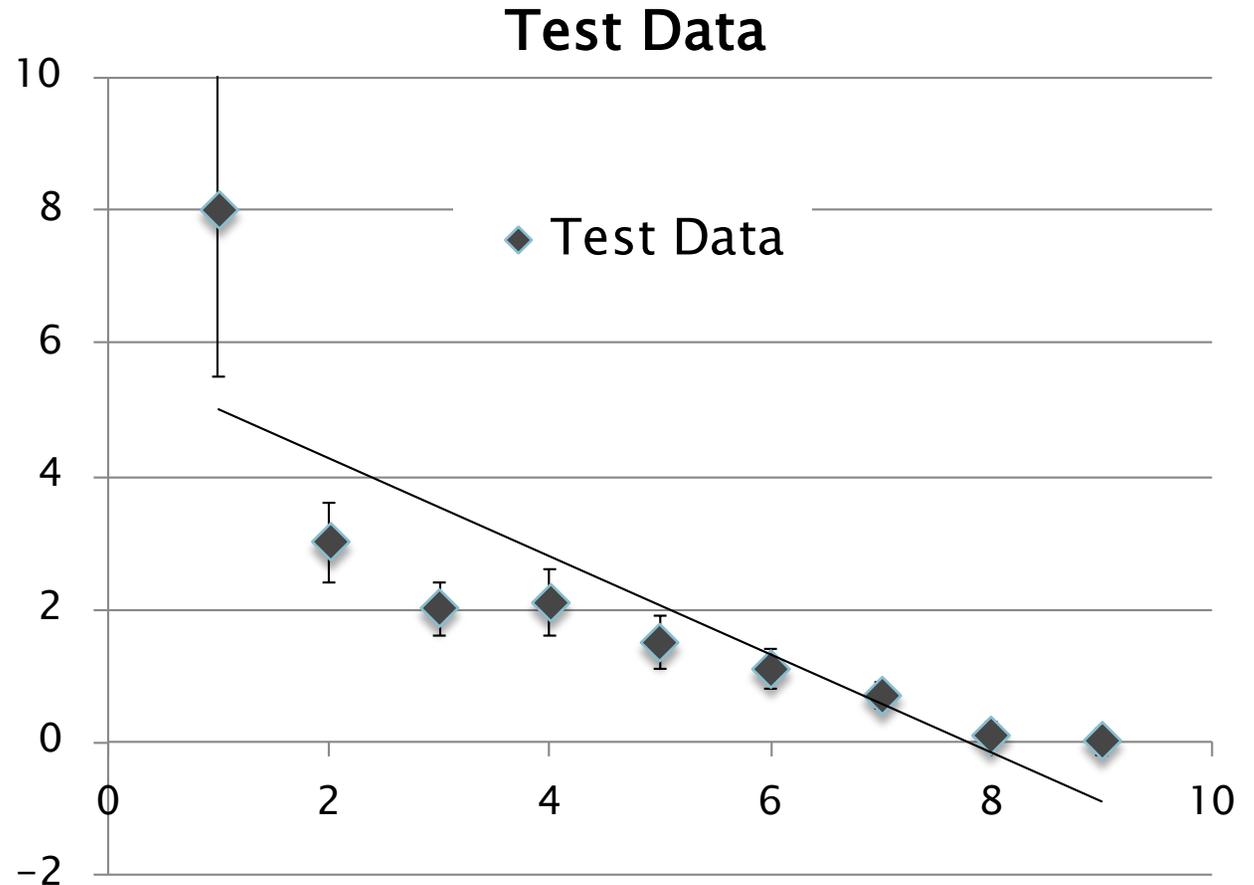
1. You enter graduate school with two full years of support from a fellowship awarded by your undergraduate institution. You easily find a faculty member to work with. At the end of the second year, the faculty member tells you that she will not be your thesis advisor.
2. You are a 3rd year graduate student working in theory. Your research professor has not provided you with a problem and seems uninterested in the work you are doing on your own.
3. You are a student from a very small undergraduate institution, accepted for graduate study in a prestigious university. Your first year is covered by a scholarship. When you arrive, your advisors place you in the standard first year graduate classes. You have doubts about your background.

From APS Ethics Case Studies



Bias

- ▶ Responsible conduct of research requires scientists to be objective and fair
- ▶ Avoid prejudice in analysis and presentation of data
- ▶ Work hard to minimize or eliminate conscious bias; recognize that there may be unconscious bias as well



Should you throw out the first data point?

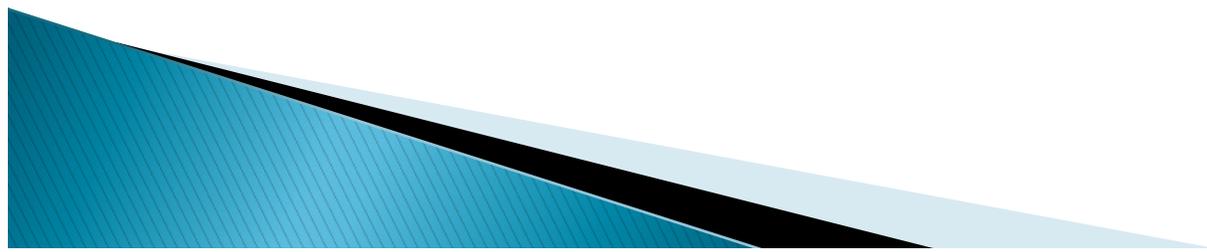
Additional Topics

▶ Health and Safety

- Research must be conducted in a way that does not threaten the safety of the researchers or others
- Training is very important
- Think ahead about possible hazards, emergencies

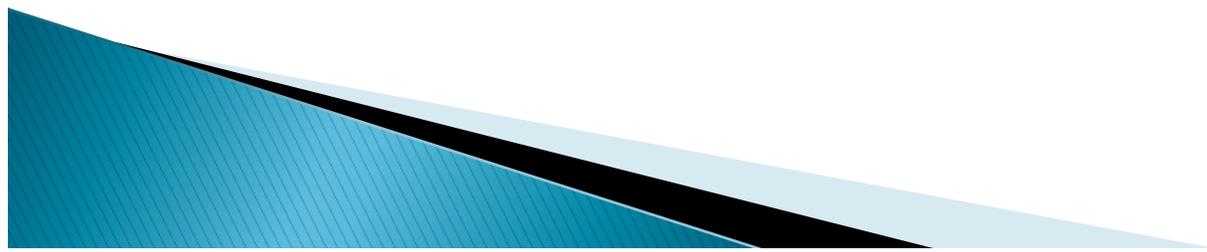
▶ Human Subjects

- Relevant to educational studies, biophysics, surveys
- Health and privacy of human subjects must be protected
- Training is available



Academic Ethics

You are a first year graduate student struggling to get your homework done in addition to your teaching duties. You have a problem set due tomorrow but you have not had a chance to start it yet. Your colleague tells you that he found the answers to most of the problems online. Is it OK to look up the problems online?



Possible Responses

- ▶ Yes. The information on-line is in the public domain.
- ▶ Yes. Many of the other students are doing it so you would just be hurting yourself if you didn't.
- ▶ Yes, as long as you just look quickly at the solutions to get a hint and then you solve it yourself.
- ▶ No, but you have no time and you need to get a good grade to stay in grad school and other students are doing it, so...
- ▶ No. Looking at the solution as you write out your solution is essentially plagiarism.



References

- ▶ American Physical Society – Guidelines for Professional Conduct

- ▶ APS Ethics Case Studies

<http://www.aps.org/programs/education/ethics/index.cfm>

- ▶ Collaborative Institutional Training Initiative (CITI)

Additional Reading

- ▶ *On Being a Scientist*, The National Academies Press

