Responsible Conduct of Research

MDI Biological Laboratory

From Discoveries to Cures

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On Being a Scientist

Research is based on the same ethical values that apply in everyday life

- Honesty
- Fairness
- Objectivity
- Openness
- Trustworthiness
- Respect for others.

http://www.clipartpanda.com/categories/spongebob-squarepants-clip-art-free

Obligations of a Responsible Researcher

1. Student researchers in the SEPA program, like scientists in any program, have an obligation to honor the trust that other student researchers place in them.

- Each year, student results will contribute to an on-going research project on arsenic in wells in Maine and New Hampshire. We must trust that the data are accurate!

2. Student researchers have an obligation to themselves.

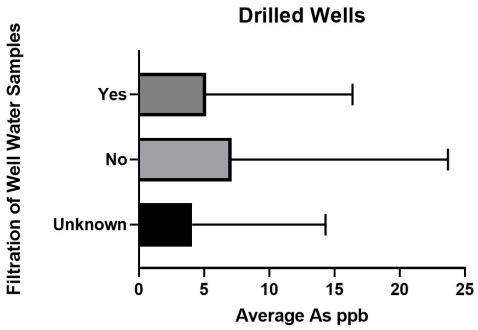
- Adhering to best standards in collecting and reporting data builds personal integrity
- By doing the best job possible, students will achieve their own goals for their education while contributing to the larger goals of the All About Arsenic project

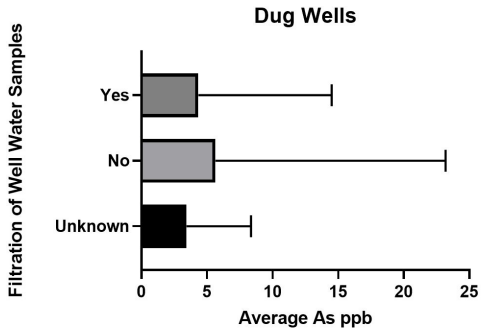
3. Student researchers have an obligation to act in ways that serve the public

- Results of the All About Arsenic project may directly affect health and well-being of family, neighbors, and friends.
- Student data may be used by policy makers to make decisions about arsenic levels in well water or allocating funds to low-income households for arsenic remediation.
- Taxpayer dollars fund the All About Arsenic project. In some ways, students are like public servants!

Treatment of Data

- Data are integral to all research, including student research in the All About Arsenic project.
- How you manage data is important. You should know where and how to record data, where datasheets are kept, how to enter data into Anecdata.
- The integrity of data is of paramount importance. If we cannot connect well water sample data to the household data, a family may not get their results in a timely manner. Or worse yet, they may not get their results at all.





Data Collection

Considerations regarding data collection include:

- Appropriate methods
- Attention to detail
- Authorizations
  - **Human subjects-** when working with humans, you sometimes need approval from an Institutional Review Board or IRB. This helps to protect people's rights and privacy. Even when doing a survey of people, it is good to have IRB approval.
  - **Animal subjects-** when working with vertebrate animals, you need approval from The Institutional Animal Care and Use Committee or IACUC. This helps you to minimize the number of animals you use and be sure that you are treating them humanely.
  - **Biological agents-** when working with biological reagents, like bacteria, you should check with your safety officer so that you handle and dispose of everything safely.
  - **Hazardous Materials** -when working with chemicals, you should check with your safety officer so that you handle and dispose of everything safely.

Data Management

Data must be protected for later use:

- Data Storage
  - Lab notebooks should be kept in a safe place; computer files should be backed up; samples should be kept in a safe place.
- Confidentiality
  - Some data may be subject to privacy restrictions (human subjects or confidential information about home well water)
- Retention
  - In general data must be retained after the completion of the research. Your teacher will make sure that there is a record of every water sample brought into the classroom.

Data Sharing

Although there is general agreement that research data must be shared there are often difficult questions that must be addressed especially when doing public health research like in the All About Arsenic project.

Data on well samples

- it is not necessary or appropriate to tell anyone who you got well water sample from
- it is not necessary or appropriate to tell anyone about your own home (whether you already have high arsenic or use a household filtration system)
- it is not necessary or appropriate to share arsenic results with each other.

Can you think of some reasons why?

Classroom Experiments

It is important to treat classroom experiments as if you are planning to publish the data in a scientific journal. How you conduct these experiments, handle your data, analyze and report your results, will begin to shape your habits as a researcher. Some student data have been published in the scientific literature. You never know!

Lettuce seed bioassays

Classroom Experiments

What are some responsible research practices that have been initiated in this lettuce seed bioassay?

Hint:

- how many replicates are there of each experiment?

- How can you keep track of which dish with seeds is which?

Classroom Experiments: Image Manipulation

Manipulation of images:
It is wrong to manipulate images, for example, making duckweed more green.

In what ways would It be ok to change this image of a Daphnia? In what ways would it not be ok?

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Scientific Publication Practices and Responsible Authorship

- Researchers typically share the results of their activities with colleagues and the public through publication.
- Results of publication in research should meet some minimum standards:
  - A full and fair description of the work,
  - An accurate report of the results,
  - An honest and open assessment of the findings.

Student research may not end up in publication, but any reports of findings that are made should follow these standards.

Responsible Publications

- Elements of a responsible publication
  - Abstract
  - Introduction
  - Methods
  - Results
  - Discussion
  - References
  - Acknowledgements

Responsible Authorship

- The names on a paper or report let others know who conducted the research and should get credit for the work
- The authors listed on papers or reports should fairly and accurately represent the person(s) responsible for the work

Research Misconduct

- Research misconduct is serious and has received considerable public attention.

- Researchers who act dishonestly
  - Harm the research record
  - Waste public funds
  - Distort the research process
  - Undermine public trust
  - May adversely impact public health and safety

Research Misconduct

Research misconduct is defined as fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting results.

- **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 them appropriate credit

The MMR vaccine and autism: Sensation, refutation, retraction, and fraud

T. S. Sathyanarayana Rao and Chittaranjan Andrade[1]

- In 1998, Andrew Wakefield and 12 of his colleagues[1]
- published a case series in the *Lancet*, which suggested that the measles, mumps, and rubella (MMR) vaccine may predispose to behavioral regression and pervasive developmental disorder in children.
- Despite the small sample size (*n*=12), the uncontrolled design, and the speculative nature of the conclusions, the paper received wide publicity.
- MMR vaccination rates began to drop because parents were concerned about the risk of autism after vaccination.[2]
- Almost immediately afterward, epidemiological studies were conducted and published, refuting the posited link between MMR vaccination and autism.[3,4]
- The next episode in the saga was a short retraction of the interpretation of the original data by 10 of the 12 co-authors of the paper. According to the retraction, “no causal link was established between MMR vaccine and autism as the data were insufficient”.[5]
- This was accompanied by an admission by the *Lancet* that Wakefield *et al*.[1] had failed to disclose financial interests (e.g., Wakefield had been funded by lawyers who had been engaged by parents in lawsuits against vaccine-producing companies). The *Lancet* completely retracted the Wakefield *et al*.[1] paper in February 2010, admitting that several elements in the paper were incorrect, contrary to the findings of the earlier investigation.[7]
- Wakefield *et al*.[1] were held guilty of ethical violations (they had conducted invasive investigations on the children without obtaining the necessary ethical clearances)
- The final episode in the saga is the revelation that Wakefield *et al*.[1] were guilty of deliberate fraud (they picked and chose data that suited their case; they falsified facts).[9]

Research Misconduct

Research misconduct does not include honest errors, differences of opinion, or honest differences in interpretations or judgments of data.

Responsible Conduct of Research

Continuum	Definition
Research integrity	Best practices
Questionable research practices	Sloppy work, lack of expertise, or ignorance of policies and regulations
Unacceptable research practices	Ignorance of best practices, failure to correctly observe applicable policies and regulations
Research misconduct	Deliberate efforts to plagiarize, fabricate, or falsify research data

Case A

Jay, a student from Maine, is putting together a pamphlet on arsenic in well water samples from his class study. There were not any samples greater than 10 ppb. He thought that this would not be convincing data to share with the community. He was afraid no one would test their wells because his class's findings did not reveal a problem. He made up numbers to make the graph show elevated arsenic in two samples.

Questions

1. Is this plagiarism, fabrication, falsification, or serious deviation from best practice?
2. What consequences could Jay be facing?
3. How could this problem be prevented?

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Fabrication. Jay created made up numbers. He doesn't have any actual elevated arsenic data to display in his pamphlet.

Consequences if Jay's fabrication is detected:

- Jay could get in trouble with his teacher. His fellow students may be upset that he made up numbers. As a result, his reputation as a serious student or student researcher could be affected.
- Jay may not be trusted to handle classroom data in the future.
- Jay may get a failing grade.
- The All About Arsenic project leaders may question whether they can trust students to take on this kind of serious public outreach

Consequences if Jay's fabrication is not detected:

- If the pamphlet with the false numbers is distributed in the community, people may be more concerned than necessary about the problem with their well water.
- Jay may conclude that he "got by" with falsification. This may cause Jay to attempt falsification again in the future.

Prevention. Students can check each other's work. Outreach materials can be shared with project leaders for double-checking.

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Case B

Mitchell, a student from New Hampshire, read an article about using water pitcher filters to remove arsenic from well water. He decided to do an experiment to test the same water pitcher filters. He thought that double checking the results in the publication would be very convincing to people in his community. He made similar conclusions to the published paper. In a public meeting, Mitchell said that he had the idea to use pitcher filters and, from his results, recommends using pitcher filters if arsenic in well water is high.

Questions

1. Is this plagiarism, fabrication, falsification, or serious deviation?
2. What consequences could Mitchell be facing?
3. How could this problem be prevented?

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Plagiarism. Mitchell got the idea from someone else and said that the idea was his.

Consequences if Mitchell's plagiarism is detected:

- Someone in the community, listening to Mitchell's presentation, might know about the published article and wonder why Mitchell didn't mention it. This might make them think that other things that Mitchell and his classmates are saying might not be true.
- If Mitchell is knowledgeable about plagiarism and claimed the idea as his own, he could be reprimanded in some way by his teacher or school
- If Mitchell is truly ignorant about this aspect of plagiarism, he may be given an opportunity to correct the situation. This might involve writing a letter to the community, or some other action.

Consequences if Mitchell's plagiarism is not detected:

- Mitchell may remain ignorant, never realizing that he did plagiarize. As a result, he may repeat this behavior. (Given that teachers have a responsibility to educate their students about responsible conduct of research, this outcome should be very improbable.)
- If Mitchell repeats this behavior in college, he could be expelled. If Mitchell repeats this behavior later in his scientific career, he could lose a grant, have a research paper retracted, or lose his job and destroy his career prospects.

Prevention:

- Mitchell should state when he is using other people's research. It will only strengthen his own findings.
- If the other research isn't published, he can ask permission to use the idea, if he gives credit to the person who originated the idea.

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If a student faces a difficult situation

- If students think that there has been some research misconduct
  - Do not rely upon hearsay
  - Do not make the situation worse – avoid rumors
  - Avoid emotional reactions
  - Ask for clarification from teammates
- Talk to the teacher
  - Ask for advice about resolving the problem
  - Seek education about what it means to be a responsible researcher

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Remember

Research misconduct does not include honest errors, differences of opinion, or honest differences in interpretations or judgments of data.

Sources

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