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On Research Ethics: A Proposal for an Undergraduate Ethics Course using a Graduate Research Ethics Course as a Baseline

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Part One: BIOL526

During my undergraduate coursework, I had little to no interaction with the ideas of ethics. I had learned about some ethics for a high school psychology class, and my lab has a quarter where we discussed ethics, but within Western's biology department itself there were no classes to take. The process of how research works-- the structure of labs, and the experience of being a lab and working under a PI-- was also largely unknown to me, until I joined a lab within the department. I am fortunate to have had the opportunities from my lab to learn about ethics, but if I had not joined the lab I would not have had the knowledge I did at the beginning of this project.

There is a lack of ethics courses within the Biology Department. From 2015 to 2024, there was only one ethics course within the biology department: BIOL526, for graduate students during 2022-2023, and 2023-2024. Outside of the Biology Department, courses that relate to ethics are predominately exclusive to majors within respective departments, and are largely upper-level courses with class prerequisites (WWU). There are also other STEM departments without ethics courses-- while it should be noted that Environmental Sciences has some, departments like Chemistry also did not have ethics courses. It was from this lack of an ethics course that inspired me to want to create one.

I got in contact with Dr. Pollard in fall quarter after I mentioned looking for a mentor to my advisor. Dr. Pollard was beginning working on BIOL526 at the time, and we began working together on co-developing the course in weekly meetings during winter quarter.

How was BIOL526 organized?

BIOL526 was a eight-week course modeled after the Responsible Conduct of Research (RCR) course from CITI Program, a program that provides various courses that Western is partnered with (CITIProgram). Their RCR course, when completed, fulfills the National Science Foundation's ethics training requirements that graduate students need to complete in order to apply for grant funding. BIOL526 used various modules within the RCR course as pre-class assignments– of the nine required modules and the eight optional modules, seven required modules and four optional modules were assigned– where students were asked to read through the modules, and write a reflection. Students were not required to take the quizzes at the end of the modules for the course, but could do so if they needed to complete the module for their NSF requirements. The goal was for students to be given a space to complete the majority of the required RCR course modules if they wanted to.

The class was formatted as a discussion-based class, discussing the assigned RCR modules and looking at case studies pulled from CIMER and OBAS which correlated to the pre-assignment modules. CIMER, or Center for the Improvement of Mentored Experiences in Research, is an organization that provides resources to improve mentoring relationships within research, according to their website (CIMERproject). OBAS, or On Being a Scientist, a Guide on Responsible Conduct in Research, is a publication by the National Academy of Sciences that provides supplementary material for ethics teachings (National Academy of Sciences). Ethics as a course benefits from discussion and collaboration between peers. While a lecture may be able to help with learning base concepts, it would not prepare a person for how to interact with them when they come across them during their day to day lives. Students should be able to interact with the concepts and theoretical scenarios and work with each other to find solutions, with professors acting as guidance.

Schedule for BIOL 526

The eight-week course was organized by the following modules:

Week One: Introduction

Week Two: Mentorship

Week Three: Authorship

Week Four: Collaborative Research and Conflicts of Interest

Week Five: Animal Subjects, Human Subjects, and Environmentalism in Science

Week Six: Research Misconduct

Week Seven: Data Management, Reproducibility in Research

Week Eight: Peer Review and Plagiarism

Week One served as an introduction to the course, talking about how the course would run, classroom norms, and what everyone's initial understanding of ethics was. While the (Module Name) module served as guidance, it was not assigned to be completed before the class met.

Week Two focused on Mentorship. What defines a good mentor? How can someone set themselves up for success in a peer-mentor relationship? What should someone do if they do not feel supported by their mentor?

Week Three covered Authorship. When should authorship be discussed? Who is considered an author by publishers? What problems can arise when talking about authorship?

Week Four was the first week with two modules with Collaborative Research and Conflicts of Interest. What are some things to keep in mind when working collaboratively with

others– within or between labs? What counts as a Conflict of Interest, and what are examples of different types of conflict of interest?

Week Five focused on Animal Subjects, Human Subjects, and Environmental Considerations in Research. Environmental Considerations in Research is not a module for RCR, but is a topic that is applicable for a lot more research than animal and human subject research. What is a Green Lab? What could be done to make research more sustainable? What may prevent research from being more sustainable? What counts as Human Research? What resources does Western have for both Animal and Human research? Who should you contact if there are concerns about abuse towards animal and/or human subjects?

Week Six addressed Research Misconduct. What counts as research misconduct? What should one do if they witness research misconduct? What should one do if they unintentionally make an error in research?

Week Seven focused on Data Management and Reproducibility of Research. What are consequences of poor data management? What does reproducible research look like? This week also included an activity where students looked at lab notebooks and data to see if they could understand the methods without the author of the notebook explaining it to them.

Finally, **Week Eight** was Peer Review and Plagiarism. When do people begin peer reviewing? What counts as Plagiarism? How much needs to be cited/when is something considered common knowledge?

This organization of courses aimed to follow the scientific method, and approximately when certain ethical considerations are most likely to come up during a research project. When

people think of research ethics, a lot of people only think about research misconduct, people changing results and protocol. While this is a part of research ethics, and a part that does need to be discussed, it's also important to recognize the other potential times where problems may arise.

While the RCR course was a good framework for a graduate level course, it does not translate well for an undergraduate course. The RCR course assumes some knowledge in how labs run, and is focused on graduate students, making it less accessible for an undergraduate student who may not have experience being in a lab. Students would likely not interact with concepts like mentorship, authorship, and other modules in the RCR course as an undergraduate, and beginning with modules that do not connect to their experiences and are largely unknown concepts may cause students to be disinterested. In addition, the RCR course and the framework lacked more historical cases. While not necessarily required for the course, they would allow the course to be more grounded in reality.

Part Two: How could A research Ethics Course be altered and implemented for Undergraduate Students?

Goals for Proposed Class Schedule

One of the goals for the undergraduate level research course is accessibility. As mentioned before, not every undergraduate will have experience with research, making the RCR modules confusing if one does not have experience in labs. Due to this, it is necessary to bring in either pre-assignment readings that cover jargon and ideas that would come up in case studies and discussions, or for a professor to give a brief lecture covering the base ideas of the weekly

topics. Despite the lectures, however, ideally the class will be a mostly discussion and collaborative class.

Following with the idea of accessibility, the course would ideally be a lower level course, with little-to-no restrictions on who can take the course. While there may be some topics from upper level biology labs that may help a student understand concepts from the course, the course ideally will give students with no experience with lab work the information needed in order to participate, as well as prepare a student for doing lab work in the future by knowing how labs work structurally.

While there are many potential times this course could be taught, for simplicity, the schedule below will mirror the timeline the original graduate course had-- meeting once a week every Monday during spring quarter, for 80 minute classes.

Schedule

Week One: Introduction

Week Two: Structure/Culture of Labs

Week Three: Research Misconduct (Identification)

Week Four: Research Misconduct (Causes/Prevention)

Week Five: Animal and Human Subjects

Week Six: Sustainability in Science

Week Seven: Reproducibility in Research

Week Eight: Peer Review and Plagiarism

Week One would serve as an introductory week. The class would cover expectations and norms for future discussions, as well as check in on what people's prior experience and knowledge of ethics is.

Week Two begins the discussion on how labs/research groups are structured, and how they have changed over time. This class would focus on ideas from Collaborative Research, Mentorship, and Authorship as well, and bring up potential problems that can arise with those subjects, and how to handle them.

Guiding Questions: How are labs run? What is the structure in a lab, and how has it changed in the past? What is some of the common jargon found within labs? What does it mean to work collaboratively within a lab?

Week Three and Four both focus on Research Misconduct, which is largely what people expect when they hear about ethics. Starting with Research Misconduct earlier in the quarter allows students to build off the ideas they may already know. Week Three would focus on identification. What is Research Misconduct, and what are some examples of Research Misconduct? Case studies would be to help identify what is and what isn't misconduct. Week Four would focus on-- though these weeks can blend into each other-- causes of Research Misconduct. How can a lab's culture impact misconduct? How can (and has) the structure of research impacted misconduct? This week would also focus on conflicts of interest, discussing what they are, the various types of conflicts of interest, and how they impact research. Finally, this class would also discuss resources for students if they see misconduct occur-- who should they talk to, within or outside of the lab?

Guiding Questions: What is Research Misconduct, and what does it look like? Why might Research Misconduct occur? What should people do if they see research misconduct? What are Conflicts of Interest? What types of Conflicts of Interest are there?

Week Five focuses on Animal and Human Subjects. The first part of the class would focus on the historical-- what has research done in the past? Unfortunately, research of the past is built in some ways upon the abuse done to both human and animal subjects. What abuse has been done in the past, and what has been implemented to try and prevent this (talking about the IRB and IACUC) currently would be focused on.

Guiding Questions: What is some of the history of Animal and Human Subject research? What has been implemented to support and protect animal and human subjects? What are the IRB and IACUC?

Week Six focuses on Environmentalism in Science, and the idea of sustainability in labs. What impact do labs have on the environment? How could labs be more sustainable? What are some limitations in sustainability? This week would focus on both wet lab and field research, and how sustainability looks different between labs.

Guiding Questions: How are labs unsustainable, currently or in the past? What does sustainability look like in a wet lab, versus a field lab? What restrictions might exist to prevent sustainability in labs?

Week Seven focuses on Reproducibility in Research. The lack of reproducible studies, and learning about this, is concerning. This week would focus on how to make studies

reproducible. It would also focus a little bit on Data Management, on the idea of storing data, how long to hold onto it for, and why it's important to store data.

Guiding Questions: How much research is reproducible? What does reproducible research look like? What are some steps that can ensure research is reproducible?

Week Eight focuses on Peer Review and Plagiarism. Plagiarism is a familiar concept to many undergraduates, but it would focus on what plagiarism means for research papers, and what needs to be cited and how. Peer Review would, in contrast, take a broader approach; focusing on how peer review works in the context of research, and also focusing on what makes a constructive review for both research and non-research paper.

Guiding Questions: What is Plagiarism? What does it look like for scientific writing? How much needs to be cited? How should things be cited? What is Peer Review? How does the peer review process work? What does constructive peer review look like? How should one give and receive peer review, for a scientific paper, or in general?

Conclusions

It should be noted that this is one of many ways an undergraduate ethics course could be structured, especially using BIOL526 as a guideline. I greatly encourage anyone who reads this, if they are interested in creating an ethics course, to modify it how they wish to accommodate their own teaching style.

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