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Assessing Ethical Awareness in a Molecular and Cellular Biology Major

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Abstract

Scientists in every field face myriad ethical challenges, from properly handling data and avoiding plagiarism to ethical treatment of human and animal models. Since 2012, I have assessed ethical awareness in my advanced cell biology course, a senior level course which is a core requirement for the molecular and cellular biology major at Cedarville University. I introduce integration of ethics with science to our majors in cell biology, which is a sophomore-level core requirement. Students in cell biology complete a "Bioethics in the News" assignment, which asks them to summarize a recent science news article that has ethical implications. Since many of our majors have interest in health care-related fields, the articles they choose often address topics such as drug development, stem cell research, gene therapy, and modification of the human germline.

Our senior-level students are asked to write a minimum of four paragraphs, providing specific examples illustrating the intersection of ethics and cell biology. Essays are scored on 1. student's understanding of the scientific problems about which they choose to write, 2. student's ability to recognize and integrate ethical principles into the scenarios they choose, and 3. student's writing style and grammatical accuracy. Nearly all of our students meet or exceed expectations, both in terms of their scientific understanding and their integration of ethical principles. We plan to continue both the sophomore-level and senior-level assignments, believing that students should begin thinking about research ethics while they are still in the process of becoming practicing scientists.

Introduction

Scientists practice their disciplines as integrated, whole persons. While ethics is not often considered part of a scientist's training, scientists constantly make ethical decisions about all kinds of questions, including what to study, how to study it, how to report their data, and how the data they obtain should be used. One of the program objectives of Cedarville University's biology majors is to integrate ethics with the students' scientific training so that students are prepared to be well-rounded, ethically-minded practitioners within their disciplines.

Methods

Sophomore and senior-level biology students were given an ethically-related written assignment to complete within the normal purview of their respective courses; BIO 2250-Cell Biology for sophomores, and BIO 4210-Advanced Cell Biology for seniors.

Papers were scored according to the rubric given below. In order to meet our program objectives, >80% of students needed to achieve a score of 16 on the science background and ethics integration portions of the assignment.

Both sophomore and senior-level assignments allowed students to choose the topics being covered. Prompts for each assignment are shown in the next column.

Table 1: Ethics Rubric Used in Scoring Writing Assignments

		Below Expectations	Meets Expectations	Exceeds Expectations
Science Background	Very poor. 0 points	Scientific references are vague or insufficient. 8 points	Scientific references show some knowledge of course content, but lack specificity on some points. 16 points	Scientific references show a clear command of course content. 20 points
Ethics Integration	Very poor. 0 points	Little effort has been made to integrate ethics with scientific content. 8 points	Notable effort to link ethical principles with scientific content, though results may not flow well at times. 16 points	Seamless integration of ethical principles with scientific content. 20 points
Grammar and Style	Very poor. 0 points	Numerous errors in style, grammar, or punctuation. 8 points	Few errors in style, grammar, or punctuation. 16 points	Excellent flow, free of typographical errors. 20 points

Cell Biology in the News Prompt from BIO 2250
Find a recent news article related to something we have talked about in class, and write a two-page paper (double-spaced) citing the article and relating it to what you have learned so far. The issue you are researching should have bioethical ramifications. Be sure to address these ramifications in your paper. Please turn in your assignment as a Word Document.

Bioethics and Cell Biology Prompt from BIO 4210
Some folks say that cell and molecular biologists don't need to worry about ethics, since much of the research mainly deals with biology on a micro level, such as signaling pathways or protein-protein interactions. However, as we have seen, the discoveries made in cellular and molecular biology have ethical ramifications which are influenced by a person's worldview. Chapter 22 is a great example of this, since your book addresses various types of stem cells and their potential uses.

For this assignment, I would like you to write at least 4 paragraphs on how ethics intersects the field of cell biology. Give specific scientific examples of data that demand an ethical response. You may use past mistakes of scientists as well as current ethical battlefields. Your book is certainly one available resource, but you are encouraged to find other resources to supplement it. Please turn in your assignment as a Word Document.

Results

Table 2. Results of Ethics Assessment Data over the past two academic years, 2013-2014 and 2014-2015.

	2013-2014	2014-2015
Sophomore-Level Assessment	100% of students achieved benchmark (N=51). Mean grade for assignment was 95.6%.	100% of students achieved benchmark (N=72). Mean grade for assignment was 97.2%.
Senior-Level Assessment	100% of students achieved benchmark (N = 15). Mean grade for assignment was 97.3%	100% of students achieved benchmark (N = 13). Mean grade for assignment was 98.5%

Conclusions and Action Items

- Data for this academic year (2015-2016) do not yet exist. As this year's advanced cell biology course is the largest in our history (N = 30), it will provide some interesting data.
- We are currently meeting the benchmark for our majors.
- We plan to continue these writing assignments as well as our current assessment in each of these classes.
- We plan to continue to promote and offer the bioethics minor to all of our interested students.
- Principles of Bioethics (BIO 4710) will be offered by the science and mathematics department and will engage students with case studies in biomedical as well as research ethics.
- Ethical integration will continue to be one of the program objectives for the biology majors at Cedarville University.

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