

Protein Toxins in Cell Biology

Biology 422/522

Instructor:

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Suggested prerequisites:

Either Cell Biology 322 or Neurobiology 360

Credits: 4

Course Description and Goals:

This course investigates the mechanisms used by protein toxins to kill or debilitate humans and other animals and how they have been used as molecular scalpels to dissect important questions in cell and neurobiology. Bacterial pathogens, predatory animals and prey have devised toxins to kill or defend themselves from being killed. These toxins have been studied in order to treat humans against these medical challenges. The research has led, however, to understanding fundamental questions of cell and neurobiology such as neurosecretion, membrane trafficking, synapse formation and membrane channel properties. Toxins covered include tetanus toxin, botulinum neurotoxin (Botox), anthrax, cholera toxin, various snake toxins and ricin. This course not only aims to inform students of mechanisms involved in these kinds of intoxication, but hopes to show how using toxins as molecular tools can greatly advance cell biology.

Course requirements:

Students are required to attend class, to read the assigned material and to participate in class discussions. There will be the same number of scientific papers to read as there are students in the class. All students are expected to read all papers. Each student will present one aspect of a scientific paper within an informal discussion group. There will be a graded mid-term research essay and a graded take-home final exam. There will be two in-class quizzes.

Reading:

In addition to the assigned primary papers, reviews (on Blackboard) and chapters in **Protein Toxins and their Use in Cell Biology**, Rappuoli and Montecucco (Editors), Oxford University Press, will be assigned. The text book can be obtained from the library.

Class Schedule:

Each week there will be two 1.5 hour classes. Discussion classes will use primary scientific papers to understand the toxin and its involvement in a facet of cell biology.

Exams:

2 Midterms: Take home essay questions

Final Exam: Take-home essay

For their final exam, graduate students must choose a toxin and describe how they would use it in a novel experiment to understand some aspect of cell biology. This will be a written paper and presented to the class.

Student workload expectations:

Inside class:

- Attend class lecture
- Participate in discussions and class activities
- Present a paper from primary literature

Outside class:

- Reading textbook and primary literature (5 hrs per week)
- Preparing class presentation or research paper (1 hr per week)
- Write and present an original research proposal (grad students; 2 hrs per week)

Basis for Grading

Undergraduate

Midterm:	30%
Class Presentation:	20%
Final:	40%
Participation:	10%

Graduate

Midterm:	15%
Research Proposal Presentation:	15%
Class presentation:	15%
Final:	45%
Participation:	10%

The goal of the presentations is to get students used to being able to read, understand, summarize and present research papers. The presentations will be graded based on the following:

Flow	5 pts	clarity of presentation and use of audio-visual media
Intro	5 pts	understanding of the overall question / hypothesis
Results	5 pts	understanding of the techniques used and of the results obtained
Conclusions	5pts	understanding of the impact and scope of the study

Graduate vs Undergraduate Workload

Graduate students write a research proposal paper for their final exam. They also present their research proposal to the class. This presentation is in addition to a paper presentation.