ENTOMOL 7910: The Nature and Practice of Science
Course Description and Syllabus: Spring 2014

Section: 29727
Credits: 2
Time: Thursdays, 2:20-4:10 pm
Location: 244 Kottman Hall, Columbus video-linked to 121 Fisher Auditorium, Wooster Campus

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Course Description: The course explores the analysis and application of logic underlying scientific reasoning and science as a human endeavor. The application of concepts to the participant’s own graduate research is emphasized.

The first half of the course provides in-depth structural and functional analysis of the scientific method, including contrasting philosophical views, interrelationships of functional components (discovery, empirical observation and pattern detection, theoretical explanation, prediction, and tests), role of inductive and deductive logic in hypothesis testing, and integration of logic with experimental design and statistics.

The second half of the course focuses on science as a human endeavor including creativity, evaluation of scientific productivity including attribution of credit and reward, ethical issues in research and scholarship, and social issues such as women in science. The goal is to engage participants in critical examination of what science is, how science should be done, and the contribution of their research to the larger picture of accumulation of knowledge and ethical obligations of scientists. The course is structured around discussion of carefully chosen readings. Evaluation is based on class participation in these discussions, as well as written assignments that require students to apply subject matter to analyses of primary literature and their own research. The course is targeted towards graduate students conducting independent research, and experience has shown that the course is as beneficial for students beginning their M.S. program as it is for senior Ph.D. students.
Abbreviated Description: Analysis and application of logic underlying scientific reasoning, theory, hypothesis, and their integration with experimental design, discovery, ethics, and science as a human endeavor. Recommended for graduate students conducting independent research.

Evaluation: Course evaluation is based on participation in discussion of the assigned readings, and written exercises that apply readings and discussion topics to the primary literature and participant’s own research. Your contributions to discussions should (1) demonstrate that you have completed assigned readings, (2) share original thoughts about the reading, (3) advance rather than stifle open discussion.

Course objectives:

- Engage participants in critical examination of what science is, how science should be done, the contribution of their research to the larger picture of knowledge accumulation, and ethical obligations of scientists.
- Provide in-depth structural and functional analysis of the scientific method, including contrasting philosophical views, and interrelationships of functional components (discovery, empirical observation and pattern detection, theoretical explanation, prediction, and tests).
- Understand the role of inductive and deductive logic in hypothesis testing, and integration of logic with experimental design and statistics.
- Focus on science as a human endeavor including motivations of scientists, creativity, evaluation of scientific productivity including attribution of credit and reward.
- Examine ethical issues in research, scholarship, and application of scientific knowledge.

Course content:

- Address the question of what is science; philosophical views of accumulation of scientific knowledge; role of inductive and deductive logic in scientific reasoning.
- Integrating scientific logic with experimental design and statistical analysis; role of theory in accumulation of scientific knowledge.
- Issues of scientific discovery, creativity, and innovation and their intersections with evaluation of scientific productivity, including scientific metrics.
- In-depth case study of a contemporary scientific issue as a focal point for an examination of ethical issues in scientists’ motivations and actions in regard to research, scholarship, and extension of knowledge into society.
- Introduction to and applications of tools for inquiry in the “grey area” where science meets society.

Schedule and Reading List

Jan 9: What is science (or, does motorcycle maintenance count)?


Assign Exercise 1: Develop and write a metaphor for science
Jan 16: Philosophical Views of Accumulation of Scientific Knowledge


Jan 23: Role of Inductive and Deductive Logic in Scientific Reasoning


Assign Exercise 2: Compose an essay that integrates vocabulary of philosophy of science

Jan 30: Integrating Scientific Logic with Experimental Design and Statistical Analysis


Feb 6: The Concept and Value of Falsification: class participation exercise


Feb 13: Role of Theory in Accumulation of Scientific Knowledge


Feb 20: Logical analysis of the primary literature: examples

Assign exercise 3: Analyze logical structure of two journal articles of your choosing

Feb 27: Discovery, Innovation, and Social Aspects of Science

Case study: NOVA video "Penicillin: Rise of a Wonder Drug."


**Mar 6: Evaluating Scientific Productivity: Count or Weigh?**


Assign exercise 4: Analyze logical structure of your research program

**Mar 13: Spring Break**

**Mar 20: Women in Science: Panel Discussion**

**Mar 27: Scientific Ethics: Ethics in Research**


**Apr 3: Scientific Ethics: Ethics in Scholarship Including Authorship**

**Apr 10: Scientific Ethics: Case Study**

**Apr 17: Scientific Ethics: Ethics in Application of Scientific Knowledge and the Role of Scientists**

Readings: TBD: topical subject focused on interactions between science and society