

BIOLOGY AND SOCIETY

11:300:450:01 and 15:256:550:01
3 Credits

Instructor Name Ravit Golan Duncan	Email address: ravit.duncan@gse.rutgers.edu
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Office Hours: by arrangement	Prerequisites or other limitations: NA
Mode of Instruction: ¹ <input type="checkbox"/> Lecture <input type="checkbox"/> Seminar <input type="checkbox"/> Hybrid <input type="checkbox"/> Online <input checked="" type="checkbox"/> Other	Permission required: <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes Directions about where to get permission numbers:

LEARNING GOALS²

- Students will be able to describe the processes by which scientists develop scientific knowledge, referencing core practices such as modeling and argumentation.
- Students will be able to apply the process described above in the context of an inquiry project of their choice. Students will develop a research question, explanatory model, and experiments to test the model
- Students will write up their inquiry project studies using scientific reporting standards as evident in research journals.
- Students will develop a vision for teaching inquiry in the classroom as well as a set of criteria that they will use to critique lesson plans

COURSE CATALOG DESCRIPTION:

This course is an introduction to the nature of scientific knowledge and practice in the biological sciences and the implications for instruction. Science is about building models and theories to explain natural phenomena. It is about using observations and experimentation to construct evidence-based models that are creative, tentative, and in many ways subjective. These models are then subject to critique and argumentation by the scientific community. In this course we will learn about scientific inquiry and develop a vision of how an inquiry-based classroom operates.

We will therefore begin with an exploration of the nature of scientific inquiry in biology and why we should teach it. We will also examine the goals of biology education and related standards at the national and state level. During the course of the semester we will learn about inquiry-based approaches to science education that emphasize not only the learning of scientific concepts but also learning about the nature of scientific inquiry.

¹ Check 1:

² These can be TEAC claims or objectives from other sources.

GRADING POLICY:

<u>Assignment</u>	<u>Tentative due date</u>	<u>Grade</u>
Participation (individual)	Throughout the course	30%
Scientific article review (individual)	Throughout the course	10%
Inquiry project (group)	Week 14	30%
Lesson critiques (individual & group)	Throughout the course	20%
Individual reflection paper (individual)	Week 15	10%

ASSIGNMENTS³:

Participation: Your participation in class counts heavily towards your grade. It is therefore important that you actively participate in class activities and discussions. Learning is an active process: the more you participate the more you learn. As part of your participation you are expected to read assigned readings, actively engage in class discussion and group work activities.

Readings: There will be assigned readings for each class session; you are expected to read them and be prepared to discuss them in class (part of participation grade). Often I will assign a question or two to guide and focus your thinking as you read the assigned papers. On occasion an additional reading may be assigned or a new reading may be substituted for an existing one.

Scientific article review: As a science educator you are expected to stay well informed of scientific developments in biology. Towards that end you are asked to subscribe (for the duration of one year and in your name) to Scientific American. During the course you will be expected to read and review a major article in this journal (from current or past issues). The review needs to identify the scientific model that is at the heart of the report, the evidence in support of the model and any counter-arguments. You will conduct a brief presentation on the article in class. I also recommend subscribing to Science News a weekly magazine with science updates in short articles that are great for the classroom.

Projects: There are two major activities in this course that will help you develop a better understanding of science on the one hand, and begin to develop your ability to design effective instruction. The first is the inquiry project, which will be conducted throughout the semester. There will be intermediate milestones, such as a project proposal, that you are expected to complete (due dates TBD). Inquiry projects will be done in small groups (2-3 people). The project entails investigating a natural phenomenon, constructing and revising a model of that phenomenon based on tests of conjectural relationships and objects in the model. You will be expected to read scientific articles related to your project. The second project- lesson critiques and revision- will be done partly in groups and partly individually. During several points in the course you will be asked to critique

³ Including exams, papers etc.

and revise an existing lesson. As a class we will develop criteria for judging the merits and shortcomings of inquiry-based lessons.

Individual reflection paper: The last assignment of this course is an individual reflection paper 3-5 pages long in which you (individually) reflect on what you have learned in this course. This reflection should be based on the contribution of the readings, class activities, and final project to your developing understanding of what it means to teach biology effectively.

Academic Integrity Policy: Please make sure to properly cite all academic sources (citations of articles, books, etc) in your assignments

COURSE SCHEDULE

Week 1- Introduction

Subscribe to Scientific American <http://www.sciam.com/>

Write Teaching Philosophy Paper for post bacc students (Due Sep 17)

Week 2- Nature of science I

Donovan, M. J., & Bransford, J. D. (2005). *How Students Learn: Science in the Classroom*. Washington, DC: National Academy Press. Introduction and (1-21) Chapter 9 (397-416)

Week 3- Nature of science II

Duschl, R. (1990) *Restructuring Science Education: The importance of theories and their development*. New York: Teachers College Press. Chapter 1 (1-13)

Lucas, D., Broderick, N., Lehrer, R., & Bohanan, R. (2005). Making the grounds of scientific inquiry visible in the classroom. *Science Scope*, 29 (3), 39-42.

Lederman, N. G., & Lederman, J. S. (2004). Revising instruction to teach nature of science. *The Science Teacher*, 71 (9), 36-39

Week 4- Nature of science III

Windschitl, M. (2008). What is inquiry? A framework for thinking about authentic scientific practice in the classroom. In *Science as inquiry in the secondary setting*. (pp. 1-20). Eds. Luft, J., Bell., Gess-Newsome, J. NSTA press, Arlington, Virginia.

Short inquiry project description due by

Week 5- Lesson critique I

Windschitl, M & Thompson, J. Teaching about science ideas as models. University of Washington (1-11)

Lesson critique due

Week 6- Extended inquiry I

Donovan, M. J., & Bransford, J. D. (2005). *How Students Learn: Science in the Classroom*. Washington, DC: National Academy Press. Chapter 12 (475-515) (read half)

Inquiry proposal due

Week 7- Extended inquiry II

Donovan, M. J., & Bransford, J. D. (2005). *How Students Learn: Science in the Classroom*. Washington, DC: National Academy Press. Chapter 12 (475-515)

Week 8- Extended inquiry III

Scientific American, "Chromosomal Chaos and Cancer," by Peter Duesberg, May 2007, p. 52-59 [access online via library].

Week 9- Lesson critique II

Black, P., & Wiliam, D. (1998). Inside the black box: Raising standards through classroom assessment. *Phi Delta Kappan*, 80(2), 139-148.

Week 10- Inquiry project interlude and the evolution debate

Scott, E. C., and Matzke, N. (2007). "Biological design in science classrooms." *Proceedings of the National Academy of Sciences*. 104(suppl. 1), 8669-8676. May 15, 2007. Part of the v. 104 supplement, "In the Light of Evolution I: Adaptation and Complex Design."

Mirsky, S. (2006 Feb). Teach the Science. *Scientific American*.

<http://www.scientificamerican.com/article.cfm?id=teach-the-science>

Lesson critique due

Week 11- Model-based inquiry in the classroom I

Tang, X., Coffey, J., Elby, A., & Levin, D.M. (2010). Scientific inquiry and scientific method: Tensions in teaching and learning. *Science Education*, 94 (1), 29-47

Revised proposal due

Week 12 – Model-based inquiry in the classroom II

Windschitl, M. (January, 2006). Why we can't talk to one another about science education reform. *Phi Delta Kappan*. 87 (05), 348-355.

Week 13 – Model-based inquiry in the classroom III

No reading

Inquiry paper due

Week 14- Inquiry Poster Fair (Double session)

Poster fair of inquiry projects

No readings

Individual reflection papers due