

## The Nature of Science Across Time and Culture The Processes and Practices of Science



### Biology 484x/684, Chemistry 490x, Enviro 475x, Geology 475x, and Physics 490x 2 Cr.

This course is an examination of major concepts in the nature of science and how they evolved. This course compares and contrasts of the role and practice of science in various cultures and examination of the interaction between science, technology and culture. CREQ: ILAS 201, 301 or 401; Instructor Permission.

#### Instructor Information - Fall 2016

- **Instructor Name:** Paul Fix
- **Office Location:** Faraday Hall 326
- **Office Hours:** Tues. 9-12, Thurs. 1-3
  - **Send an email if you need to schedule an appointment outside of office hours.**
- **Telephone:** (815) 753-6819
- **Email:** [pfix@niu.edu](mailto:pfix@niu.edu)

#### Meeting Days/Times/Location

Class meetings will be held in **Montgomery Hall 324** on **Wednesdays** from **4:00-6:00 PM**.

#### Materials

Book required for the course:

- *Just a Theory: Exploring the Nature of Science*, by Moti Ben-Ari (ISBN-10: 1591022851/ISBN-13: 978-1591022855)

Suggested Reading (not required):

- Dawkins, R., (2011) *The Magic of Reality: How We Know What's Really True*. Free Press. (ISBN-10: 9781451675047/ISBN-13: 978-1451675047)
- Project 2061 (American Association for the Advancement of Science). (1989). *Science for all Americans: A Project 2061 report on literacy goals in science, mathematics, and technology*. Washington, D.C: American Association for the Advancement of Science. Online version: <http://www.project2061.org/publications/sfaa/online/sfaatoc.htm>

#### Standards Addressed by This Course

- **NSTA Teaching Standards:** 1.c., 1.d., 2.a., 2.b., 3.a., 3.b., 4.a., 4.b., 7.b. and 10.d.
- **Next Generation Science Standards (NGSS):** Appendix H, Nature of Science in the NGSS
  - Scientific Investigations Use a Variety of Methods
  - Scientific Knowledge is Based on Empirical Evidence
  - Scientific Knowledge is Open to Revision in Light of New Evidence
  - Scientific Models, Laws, Mechanisms, and Theories Explain Natural Phenomena
  - Science is A Way of Knowing
  - Science is a Human Endeavor
  - Science Addresses Questions About the Natural and Material World

#### Course Website

**Blackboard.** Note that you will need to use your Z-ID and because this course is cross-listed, each one of you will be put into BIOS 484x Master (undergraduate or graduate). You will need to test whether you have access twenty-four hours after the first class. If you do not, it will be your responsibility to contact the instructor immediately.

## Course Goals

It is well founded that people learn least when simply being told how something is done or what concepts to understand. Profound learning occurs when we are able to scaffold our understanding of material to a prior or shared experience. One can learn or memorize the basic tenants of the nature of science, but without an experience or concept in which to “hang” the information, a true appreciation of the complexity of the nature of science is difficult. This course is intended to teach the nature of science through active learning geared toward the secondary science licensure student.

By the end of this course, I expect that students will:

1. Be able to discuss the nature of science and the process of the scientific method.
2. Be able to analyze the influence of science on society and society on science.
3. Have an appreciation for some of the most notable scientists and their discoveries.
4. Begin to develop a working understanding of the Next Generation Science Standards.
5. Have an understanding of how science impacts their students.
6. Have furthered the development of their own scientific literacy.

## Expectations

We will set a standard of professional comportment, in which professional behavior, including attendance, dress, participation, courtesy, and the submission of assignments by the due date are both expected and required. Professional demeanor, of the type that we expect in the educational workplace, is required at all times in this course. Please silence your cell phone and other electronic devices during class.

## Attendance

Should you need to be late, leave early, or miss a class, please notify me in writing (email is fine) as much in advance as possible. Failure to notify me in writing of an absence will be regarded as an unexcused absence and there will be no make-up assignments, quizzes or tests. Due to the nature of the course and the work involved, attendance is very important. If you must miss class, it is your responsibility to get the notes from a classmate and to find out what went on in class during your absence.

In addition, 10 attendance points will be given for each class period that you fully attend and participate in. If you are late or have to leave early, only 5 points will be awarded for the period. If you are absent, 0 points will be awarded for that period. There will be no make-up for lost attendance points.

## Assignments

You will be expected to complete a number of assignments throughout the semester. I will announce clear deadlines when these assignments must be handed in during class. Late assignments will receive half credit. Assignments that are one week or more late will not be accepted and a zero will be recorded in the grade book.

## Tests and Quizzes

Test and Quizzes (not the final exam) will be given by way of Blackboard. It is your responsibility to make sure your computer works with Blackboard technology. It is important to notify me immediately if you cannot access the material on blackboard. Questions will consist of a blend of T/F, multiple choice, definitions, short answer, and essay questions.

## Project and Presentations

There will be opportunities to conduct laboratory exercises during the semester. You may work with a partner for these projects and both parties will receive the same grade for project produced. In addition, you will be expected to give a presentation on a famous scientist. You will be able to use the technology that is available in the room for your presentation.

### **Graduate Credit for Biology 684**

Graduate students will be required to present research from two different peer-reviewed academic journals in a discipline of their choice and in the field of science education. The presentation details and grading rubric can be downloaded on blackboard in the "Scientific Journal Article Presentation" file. Presentations will be given **Oct. 26<sup>th</sup>, 2016** during class.

#### **Grading:**

Labs/NOS Activities	40%
Discussion boards/Reading Responses	10%
Presentations	15%
Quizzes	15%
Attendance	5%
Final Exam	15%

#### **Accommodations**

If you need an accommodation for this class, please contact the Disability Resource Center as soon as possible. The DRC coordinates accommodations for students with disabilities. It is located on the 4th floor of the Health Services Building, and can be reached at 815-753-1303 (V) or [drc@niu.edu](mailto:drc@niu.edu).

Also, please contact me privately as soon as possible so we can discuss your accommodations. The sooner you let us know your needs, the sooner we can assist you in achieving your learning goals in this course.

**Course Outline and Schedule on Next Page**



Date	Topic	Reading/HW Assign.	Quiz Dates
8/24	<b>Wk 1: Science...is a Process.</b>	- Chapter 1, 5 - Umbrellaology Discussion board	
8/31	<b>Wk 2: Science...Uses a Variety of Methods.</b>	Chapter 2, 8 Amazon Fly activity	
9/7	<b>Wk 3: Science...is Driven by Observations and Hypotheses</b>	Chapter 4 Lesson plan – making observations or generating hypothesis.	Quiz 1
9/14	<b>Wk 4: Science...is Systematic and Logical</b>	Chapter 11  Periodic Table – History of Science Article Qs?  Effectiveness of Study Habits Model Pre-lab	
9/21	<b>Wk 5: Science knowledge...is Based on Empirical Evidence</b>	Chapter 6  Interpolation and Extrapolation – Observation activity	Quiz 2
9/28	<b>Wk 6: Science knowledge...is Open to Revision</b>	Chapter 9, 12 Peer review lesson	
10/5	<b>Wk 7: Science...Constructs Explanations and Designs Solutions</b>	“Dealing with the Ambiguities of Science Inquiry” article”  Inquiry continuum lab analysis	
10/12	<b>Wk8: Science...Addresses Questions about the Natural and Material World</b>	Inquiry-based lab design	Quiz 3
10/19	<b>Wk 9: Science...is a Way of Knowing</b>	Chapter 3  “What’s in a word?” article	
10/26	<b>Wk 10: Science knowledge...is Built by Obtaining, Evaluating, and Communicating Information</b>	Chapter 10  Bio 684 presentations	
11/2	<b>Wk 11: Science knowledge...is a Human Endeavor</b>	Chapter 7	Quiz 4
11/9	<b>Wk 12:</b> Student Presentations		
11/16	<b>Wk 13:</b> Student Presentations		
11/30	<b>Wk 14:</b> Student Presentations		
12/7	<b>FINAL EXAM 4:00 - 5:50pm</b>		