Syllabus - Honors Biology 152 - Spring 2016

Instructor: Dr. Brian Scholtens

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Office hours: 10:00-11:15 Tuesday and Thursday or by appointment – I'm pretty flexible

Course description: This is a course for honors biology majors covering life and living systems. It will emphasize the evolution, form and function of organisms. It will introduce you to primary literature and give you practice evaluating this literature. This course should help prepare you for upper level courses in organismic biology.

Learning Objectives:

Understand the basics of evolutionary theory; how populations evolve and what the causes are.
Understand fundamental population genetics and how this relates to evolutionary theory.
Learn the basic structures of plants and animals and how they operate in living organisms.
Understand the interactions among organ systems in plants and animals.
Be able to compare plant and animal adaptations to environments, particular to life on land.
Gain confidence at reading primary literature, even papers outside your 'expertise.'
Learn the basics of evaluating primary literature.

Text: Biological Science, 5th Ed. by Freeman.

Note: Honors 152L is a co-requisite of Honors 152. The laboratory manual for Honors 152L is available at the bookstore.

Tentative Grading Scale:

93-100	A
90 & above	A-
87 & above	B+
83 & above	B
80 & above	B-
77 & above	C+
73 & above	C
70 & above	C-
67 & above	D+
63 & above	D
60 & above	D-
below 60	F

This is the guaranteed scale. If you earn a particular percentage of the total points you are guaranteed the grade indicated by the scale. At the end of the term, I have the option of lowering this scale, if I feel it is justified. Do not count on this. Always assume that the grade you earn based on this scale is the grade you will receive.

Point Distribution:

3 midterm exams (75 pts each)	225
Discussion questions(3 sets - 20 pts. each)	60
Participation	30
Written critique of paper	75
final exam	150
total	540

Attendance: I will not take attendance each day. I leave it up to you as adults to decide how you should best spend your time. I feel the lectures are important. In fact, although I will generally follow the text closely, all exam questions will come from lectures, and several questions on each exam will not be covered by your reading assignments (remember, not all information about biology is in your text; though you may feel like there is more than you ever wanted to know). "It wasn't in the readings" will not be an acceptable justification for a missed exam question. Make-up exams will be scheduled only for students with valid excuses. These must be cleared with me **before** the missed exam. It is easiest to contact me by email.

Final exam: Thursday, 28 April 2016; 8:00-11:00 am

All student discipline will be governed by the contents of the Honor Code.

Introduction to Cell and Molecular Biology/Evolution, Form, and Function of Organisms
BIOL 111 & 111L/BIOL 112 & 112L
Department: Biology

Learning Goals & Objectives

This general education science sequence provides a background for understanding and evaluating contemporary topics in biology. Students develop a foundational understanding of core concepts to use and on which to expand in upper level courses. They also develop the critical competencies that form the bases for the practice of science and use of scientific knowledge.

Core Concepts

This 2-semester course sequence in general biology addresses fundamental principles in biology to prepare students for sophomore and upper level courses in biology:

- EVOLUTION: The diversity of life evolved over time by processes of mutation, selection, and genetic change. The theory of evolution by natural selection allows scientists to understand patterns, processes, and relationships that characterize the diversity of life.
- STRUCTURE AND FUNCTION: Basic units of structure define the function of all living things. Structural complexity, together with the information it provides, is built upon combinations of subunits that drive increasingly diverse and dynamic physiological responses in living organisms. Fundamental structural units and molecular and cellular processes are conserved through evolution and yield the extraordinary diversity of biological systems seen today.
- INFORMATION FLOW, EXCHANGE, AND STORAGE: The growth and behavior of organisms are activated through the expression of genetic information at different levels of biological organization and depend on specific interactions and information transfer.
- PATHWAYS AND TRANSFORMATIONS OF ENERGY AND MATTER: Biological systems grow and change by processes based upon chemical transformation pathways and are governed by the laws of thermodynamic and will be explored to understand how living systems operate, how they maintain orderly structure and function, and how physical and chemical processes underlie processes at the cellular level (i.e. metabolic pathways, membrane dynamics), organismal level (i.e. homeostasis) and ecosystem level (i.e. nutrient cycling).
- SYSTEMS: Living systems are interconnected and interacting and biological phenomena are the result of emergent properties at all levels of organization, from molecules to ecosystems to social systems. The course will explore the dynamic interactions of components at one level of biological organization to the functional properties that emerge at higher organizational levels.

The specific topics covered in each course include:

<u>Biology 111 & Biology 111L</u>

- Chemical and physical properties of life
- Cell form & function
- Energetics, metabolism, and photosynthesis
- The cell cycle
    - Mitosis and cell reproduction
    - Meiosis and sexual reproduction
- Mendelian genetics / Patterns of inheritance
- Human Inheritance
- The molecular basis of inheritance
- DNA and protein production
- Regulation of gene expression
- Some aspects of biotechnology

<u>Biology 112 & Biology 112L</u>

- The development of evolutionary thinking
- Basic evolutionary processes

- Comparative plant form & function
- Comparative animal form & function

Core Competencies

- **Nature of Scientific Knowledge**
  - Understand the intellectual standards used by scientists to establish the validity of knowledge, evidence, and decisions about hypothesis & theory acceptance. These standards include: 1) science relies on external and naturalistic observations, and not internal convictions; 2) scientific knowledge is based on the testing of hypotheses and theories, which are under constant scrutiny and subject to revision based on new observations; 3) the validity of scientifically generated knowledge is established by the community of scientists through peer review and open publication of work.
  - Understand that new ideas in science are limited by the context in which they are conceived; are often rejected by the scientific establishment; sometimes spring from unexpected findings; and usually grow slowly, through contributions from many investigators.
  - Understand that science operates in a world defined by the laws of chemistry and physics.
  - Understand the differences and relationships among scientific theories, hypotheses, facts, laws, & opinions.
  - Understand the differences between science and technology, but also their interrelations.
  - Understand the dynamic (tentative) nature of science.

- **Scientific Methods of Discovery**
  - [1]Understand the methods scientists use to learn about the natural world (observing; questioning; formulating testable deductive hypotheses; controlled experimentation when possible; observing a wide range of natural occurrences and discerning (inducing) patterns).
  - Apply physical/natural principles to analyze and solve problems**.**
- **Develop a Scientific Attitude**
  - Develop habits of mind that foster interdisciplinary and integrative thinking (within biology; between biology and other sciences; between science and other disciplines).
  - Develop an appreciation for the scientific attitude - a basic curiosity about nature and how it works.
- **Develop scientific analysis and communication skills**
  - Develop quantitative reasoning skills (quantitatively expressing the results of scientific investigations, or patterns in nature and using knowledge of biological concepts to explain quantitatively-expressed data or patterns).
  - Understand the probabilistic nature of science and the use/application of inferential statistics to test hypotheses.
  - Develop scientific information literacy (library, internet, databases etc…); find and evaluate the validity of science-related information.
  - Communicate scientific knowledge, arguments, and ideas in a variety of different contexts (scientific, social, cultural), utilizing a variety of different media (scientific articles, policy statements, editorials, oral presentations etc.).
  - Develop cooperative problem-solving skills (working effectively in teams), but also habits of mind and skills that foster autonomous learning.
- **Develop an appreciation for the impact of science on society.**
  - Develop an appreciation of humans as a part of the biosphere and the [2]impact of biological science on contemporary societal/environmental concerns.
  - Knowledge of the history of the biological sciences and the influences of politics, culture, religion, race, and gender on the scientific endeavor.

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[1] This learning goal will be measured as part of the general education assessment. The specific learning outcome to be measured is: *Students can apply physical/natural principles to analyze and solve problems.*

[2] This learning goal will be measured as part of the general education assessment. The specific learning outcome to be measured is: *Students can demonstrate an understanding of the impact that science has on society.*

Signature assignments for measuring learning outcomes

Learning Outcome 1: Students apply physical/natural principles to analyze and solve problems.

This learning outcome is assessed using the poster (or scientific article) generated in Biology 112 lab as part of the multi-week student-directed independent research project. In this project students use data they collect (or has been collected in actual research investigations) to test an hypothesis of their choosing. These projects may be themed, with all student groups addressing different aspects of a larger question, emphasizing the interdependence of various research groups needed to address complicated problems. This multi-week project begins the class identifying what questions need to be addresses in the larger problem. Individual student groups then become experts in these areas of the larger problem. The smaller research teams develop a hypothesis, and write a research proposal to test their hypothesis. Students collect (or use already collected data), summarize and statistically analyze the data, and draw conclusions.

Learning Outcome #2 - Students demonstrate an understanding of the impact that science has on society.

Biology 112 lab Students produce a written document based on one of the case-based labs (examples - policy statement, article, stake-holder professional letter or poster) that requires them to research and apply biological knowledge or evidence to defend or critique a proposed solution to a biology-related societal issue. Although the choice of the specific issue or proposed solution is course-section specific, some examples of potential issues include

- exploring environmental/health impacts of genetically modified organisms
- the use of performance enhancing drugs in sports
- the development of antibiotic resistance in disease organisms