Biology 112: Evolution, Form and Function of Organisms

Tues/Thur 8:30am – 9:45am Harborwalk West Room 217

Course Syllabus – Spring 2016

Instructor Dr. Farah Jafri

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In person office hours 10:00am-11:00am on Tues./Thurs.

Email is the best way to get in touch with me for making appointments. My cell number is 843-810-9599, please use in emergencies only.

Course Description:

A foundation course for science majors providing an introduction to evolution with an emphasis on the structure, form and function of plants and animals. Students will be exposed to lectures, activities, readings, discussions and written assignments to ensure a thorough, lasting understanding of the material. Completion of this class and the associated laboratory meets a General Education requirement.

Pre-requisites:

Biology 111 is a pre-requisite for this course and Biology 112 laboratory is normally a co-requisite, unless students already have credit for the laboratory portion of the course.

Course Learning 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.

About Biol 112:

The primary goal of this class is to prepare you for 200 level biology classes for majors and non-majors alike. Our specific goals include:

- Introduce basic concepts of evolution;

- Introduce evolutionary mechanisms, including natural selection;
- Build on your understanding of cellular physiology (BIOL 111), to understand how processes at the cellular level contribute to organismal physiology;

- Develop an understanding of the relationship between structure (anatomy) and function (physiology) in plants and animals.

-In addition:

- Learn to use appropriate critical thinking skills and problem-solving techniques: not just memorizing what I say, but learning to test hypothesis, interpret data, and apply information to new situations; also to develop observation skills necessary for problem solving.

- Improve both in class and out of class study skills: because expectations in college are higher than in high school.

Always take help from me, or your TA or your SI.

- Begin to develop skills in reading primary literature—see about Journal Assignments, below.

- Learn about Department of Biology; plan your future in biology.

**Required Course Materials:**


**Attendance:**

In lecture I take attendance but you have to write your name on the paper. Please do not miss lecture; it is your responsibility to obtain and learn the missed material.

Also please note: the large lecture setting sometimes makes folk feel like their individual behavior doesn’t matter, you are not alone, however your behavior such as talking to your neighbors or surfing the web can be very distracting to your fellow students and is therefore rude. Don’t do it.

**Accommodation:**

SNAP students, athletes, international, ESL and all students with life circumstances that may warrant accommodations are encouraged to discuss any concerns with instructor in a timely manner. I understand that we all have way more important things going on in our lives than this biology class. I aim to be friendly, approachable and understanding.

**Honor Code and Academic integrity:**
- Lying, cheating, attempted cheating, unauthorized collaboration are violations of our Honor Code. For complete details regarding our updated honor code, please see the following link:

http://studentaffairs.cofc.edu/honor-system/studenthandbook/index.php

**Lecture Content**: Learning to listen and process information while taking notes is a necessary skill for all students and professionals. To be successful in upper-level courses and beyond, you need to learn how to take notes without the crutch of printing out lecture notes but as this is an introductory biology course I will post study notes for each chapter on OAKS this will help you to prepare for quizzes and exams.

I will not post PowerPoint slides as most of the figures and tables I show in lecture will be taken from your text book.

**Assessment**

- **Quizzes**: There will be in class or take home assignments.

- **Exams**: will be in class short answer and multiple choice.

**About Journal Assignments, Case studies and Exams**: The most important literature in science is the primary literature: the first report (hence "primary") of new data. These primary literature articles can be quite a challenge to read and understand! But all 200+ courses in Biology will expect you to be able to use primary literature in your assignments, so it is critical that you begin to develop some familiarity with this specialized form of written communication. The Journal Assignments are assignments designed to help you learn to read and interpret papers published in the primary literature. In addition you will learn about research going in the Biology Department; all of the assignments will be based on articles written by CofC Biology faculty.

For each Journal Assignment, you will read a primary literature article and then complete a short multiple choice quiz. This will be take home assignment. There will be 4 Journal assignments over the semester, see deadlines in the course schedule. Late journal assignments will not be accepted.

**Case Study**: Problem based learning/Inquiry based Vs traditional content driven strategies affect the development of biological literacy by examining students post course syllabus, views about various aspects of science –technology-society. This is also being used to assess student views about how the different approaches affected their learning. I will give you two CASE STUDIES to discuss among your class group and with SI and answer few questions related to the case studies. This will be due on 18th April 2016.

**About Exams**: Exams will be mostly "circle all that apply" multiple choice and short answer (we'll discuss exam format in more detail as they approach). Exams will cover ALL material
covered in lecture. Exams will not cover material from the text or reading assignments that wasn’t covered in class, unless specified in lecture. I will drop your lowest in-class exam grade. This DOES NOT include the final exam, the final exam grade cannot be dropped. The final exam will be cumulative.

**Exam re-grade policy:** None of the exams will be “scantron”; with human graders, human error can result in grading mistakes. If you feel a question on your exam has been misgraded, you may submit a re-grade request, including your exam and a brief (not handwritten, please) explanation of what you believe the mistake to be, and why. Re-grade requests are due in class one week after the exams are returned; late re-grade requests will not be accepted.

**Grades Calculated as follows:**

- Quizzes and home assignments – 30%
- Journal Assignment – 10%
- Case study – 10%
- Exams -30%
- Cumulative Final Exam -20%

**Grade Scale:**

- 93-100% A
- 83-86% B
- 73-76% C
- Below 65 F
- 90.0-92% A-
- 80-82% B-
- 70-72% C-
- Failure due to XF
- 87-89% B+
- 77-79% C+
- 65-69% D
- academic dishonesty

**Course Schedule (subject to change):** Please note I plan to cover these topics in this order. If we get behind this schedule, it may change. Updates will be given in class.

**Why are there so many living things?**

- Jan 7 - Introduction to evolution and organismal Biology [1]
- Jan 12 - Charles Darwin: Evolution [25]
- Jan 14 – Charles Darwin: a mechanism (natural selection) [25]
- Jan 19 - Beyond Darwin: other evolutionary mechanisms [26.2-26.6]
- Jan 21 - Population genetics and Evolution [26]
Jan 26 – Species and speciation [27]

How do plants work?

Jan 28- Introduction to plant structure /function [37.1 ,37.3]

Feb 2 **- Plant Nutrition[39] JA 1 due

Feb 4- Plant transport : Xylem & Phloem [38]

Feb 9 - Plant reproduction[41]

Feb 11– Plant reproduction [continued ];

Feb 16-Plant embryonic development to seed germination[41,24.1-2,40.3]

Feb 18- Primary growth[37.2,40.1-2,40.4,40.6]

Feb 23-Secondary growth [37.4]

Feb 25- Plant defensive responses [40.7]

Mar 1- EXAM 1

How do animals work?

Mar 3** – Introduction to animal structure /function [42] JA 2 due

Mar 6- Mar 13 SPRING BREAK

Mar 15- Nervous system and Sensation [46,47]

Mar 17-Muscle & movement

Mar 22-Endocrine systems [48]

Mar 24- EXAM 2

Mar 29-Animal reproduction & development [50,23]

Mar 31- Animal nutrition :basic physiology [44.1-3]

Mar 22- Animal nutrition:regulation & homeostasis [44.4]

April 5 - Animal osmoregulation [43]

Apr 7- Animal “ transport” (circulation) and gas exchange [45]

Apr 12-Animal defensive responses (immunity) [51]
April 14- EXAM 3

April 18- Case studies submission

April 21-Revision of the course for Final Exam

Apr 26, 8:30 am– 11:30am – Cumulative Final Exam

** Journal assignments due.

Information about how this class and lab (along with BIOL 111/111L/ BIOL 112 & 112L) fulfills your Gen Ed requirement:

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:

**Biology 111 & Biology 111L**

- 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

**Biology 112 & Biol 112 L**

- 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**
  - 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.**

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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.
- Develop an appreciation of humans as a part of the biosphere and the 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.

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

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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.