

Cornell Prison Education Program
Essentials of Biology - BioG 1130
Co-instructors: Erin Larson and Michelle Wong
TA: Nathan Barr
Fall 2016
3 Credit Hours

COURSE DESCRIPTION AND PHILOSOPHY

The BioG 1130 course is designed to widely survey topics in the field of biology and to train students in the scientific method. Weekly meetings will be structured as an open forum for discussion, development of scientific skills, and clarification of biological concepts.

COURSE OBJECTIVES

By the end of this course students will...

- 1. Understand the science of biology and remember key concepts and relationships.*
- 2. Have an appreciation of science as a process of inquiry, devoted to approaching problems presented by the natural world in an objective manner.*
- 3. Possess scientific investigative skills through laboratory activities, exercises and experiments.*
- 4. Retain factual knowledge, useful in building a common pool of scientific background for additional courses in science or biology.*
- 5. Be interested in other scientific phenomena and know how to interpret the biological significance of new information and ideas acquired in the future in both their academic and personal life.*

METHODS:

Lecture discussion format with interactive activities. Lecture time will be less than 30% of class time, with small group and one-on-one activities constituting the remaining class time, including discussions about readings, pre-lecture assignments and problem sets, and opportunities to seek assistance from the instructors and teaching assistant. Supplemental tutorial media in the form of handouts and videos will be incorporated into the course.

COURSE TEXTS

Essential Biology, Campbell (10th edition) and additional readings on current topics in biology from popular science magazines, newspapers and other forms of media in the course reader. Texts will be provided at no charge by the Cornell Prison Education Program.

COURSE COMMUNICATION

Two instructors and one undergraduate teaching assistant will be available during the entire class time. Students are also encouraged to attend weekly tutorial sessions led by a teaching assistant to get help with unclear concepts. Finally, at the beginning and end of each weekly 3 hour class period, there will be a 15 minute window for getting help and clarification from the instructors and teaching assistant.

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COURSE OUTLINE (each course section constitutes a weekly 3 hour lecture/discussion, with the course lasting 15 weeks):

1. *Introduction – What is life?*
2. *Organization of Life - Cells*
3. *Organization of Life - Nucleus*
4. *Cellular Reproduction*
5. *Energy Dynamics Part I*
6. *Energy Dynamics Part II (Midterm 1 hr.)*
7. *Plant Form and Function*
8. *Animal Form and Function*
9. *Plant and Animal Reproduction, Development, and Signaling*
10. *Genetics Part I (Midterm 1 hr.)*
11. *Genetics Part II*
12. *Evolution*
13. *Ecology – organisms and interactions*
14. *Ecology – climate and nutrient cycling*
15. *Final Exam*

EVALUATION & ASSIGNMENTS

Lecture quizzes at beginning and end of each lecture, plus two midterms and a final exam and homework assignments. One individual presentation on a scientific paper in biology on topic of interest chosen by student with help from instructors, including description of its hypotheses, methods, major results and broad context of research.

Grade Breakdown

Weekly lecture quizzes (20%)

Two midterms (15% each)

Final exam (10%)

Homework assignments (20%)

In class participation (10%)

Pre-lecture questions (10%)

EXPECTATIONS FOR CLASS PARTICIPATION

The foundation of a learning community is a culture of respect – therefore, evaluation of class participation will emphasize collegial interactions in the classroom environment. There are many ways to participate in a class, including talking in small group discussions, in front of the entire group, and being an active participant in one-on-one activities. Students will not be penalized if they do not speak in front of the entire class, but are expected to interact with students respectfully and actively during small group and one-on-one activities.

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ACADEMIC INTEGRITY

With the exception of explicitly defined group projects, it is expected that the work you submit for this course is your work, and your work alone. Plagiarism, cheating and other forms of academic dishonesty will not be tolerated and are grounds for receiving a failing grade in the course. If you are struggling with concepts, please reach out during class to an instructor or teaching assistant for guidance on strategies for studying, clarification of course material, or any other assistance you may need. Additionally, if you are unsure about what constitutes plagiarism and cheating, please check with an instructor or teaching assistant.

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Week 1 (9/1/2016)

Introduction – What is Life?

- Icebreaker and Introduction
- Course syllabus: objectives and expectations
- Lecture: What is life?
- Small breakout group discussion
- Reconvene to report back from small groups
- Lecture: What is the scientific method?
 - Hypotheses and theories
 - Types of scientific studies
 - Steps of the scientific method
- ***Assign pre-lecture questions and reading for week 2***

Week 2 (9/8/2016)

Organization of Life - Cells

- Checking pre-lecture questions
- Small group discussion; groups report back with answers
- Pre-lecture quiz
- Lecture: A tour of the cell - part 1
- Small group in-class assignment
- Lecture: A tour of the cell - part 2
- ***Assign pre-lecture questions and reading for week 3***
- ***Assign homework 1***

Week 3 (9/15/2016)

Organization of Life – Nucleus

- Checking pre-lecture questions
- Small group discussion; groups report back with answers
- Pre-lecture quiz
- Lecture: What is DNA and how does it work?
 - Structure
 - Chromosomes
 - Bacteria, retroviruses
- Small group activity
- Lecture: What does the nucleus do?
 - Cellular boss
 - Nucleic acids
- ***Assign pre-lecture questions and reading for week 4***
- ***Assign homework 2***

Week 4 (9/22/2016)

Cellular Reproduction

- Checking pre-lecture questions
- Small group discussion; groups report back with answers

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- Pre-lecture quiz
- Lecture: Mitosis
 - Cell cycle
 - Steps of mitosis
 - Cancer and cell cycle control
- Small group assignment
- Lecture: Meiosis and sexual life cycles
 - Gene inheritance
 - Stages of meiosis
- ***Assign pre-lecture questions and reading for week 5***
- ***Assign homework 3***

Week 5 (9/29/2016)

Energy Dynamics - Photosynthesis

- Checking pre-lecture questions
- Small group discussion; groups report back with answers
- Pre-lecture quiz
- Lecture: Steps of photosynthesis
 - Photosynthetic structures
 - Light/dark reactions
- Small group activity
- Lecture: Types of photosynthesis
 - Alternative mechanisms
 - Photorespiration
- ***Assign pre-lecture questions and reading for week 6***
- ***Midterm Review***

Week 6 (10/6/2016)

Energy Dynamics – Metabolism and Respiration

- Checking pre-lecture questions
- Small group discussion; groups report back with answers
- Midterm
- Lecture: Metabolism and respiration in cells
 - Forms of energy
 - Enzyme activity
 - Types of metabolic pathways
- Small group activity
- ***Assign pre-lecture questions and reading for week 7***
- ***Assign homework 4***

Week 7 (10/13/2016)

Plant Form and Function

- Checking pre-lecture questions
- Small group discussion; groups report back with answers

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- Pre-lecture quiz
- Lecture: Where did plants come from?
 - Origins and classification
 - Plant structure
- Small group activity
- Lecture: Plant resource acquisition
 - Transport systems
 - Soils and nutrients
- ***Assign pre-lecture questions and reading for week 8***
- ***Assign homework 5***

Week 8 (10/20/2016)

Animal Form and Function

- Checking pre-lecture questions
- Small group discussion; groups report back with answers
- Pre-lecture quiz
- Lecture: Where did animals come from?
 - Origins and classification
 - Morphology
- Small group activity
- Lecture: Animal resource acquisition
 - Consumption, digestion, and excretion
 - Circulatory systems
- ***Assign pre-lecture questions and reading for week 9***
- ***Assign homework 6***

Week 9 (10/27/2016)

Plant and Animal Reproduction, Development, and Signaling

- Checking pre-lecture questions
- Small group discussion; groups report back with answers
- Pre-lecture quiz
- Lecture: Reproduction and Development
 - Types of reproduction and reproductive structures
 - Growth - from egg/seed to individual
- Small group activity
- Lecture: Signaling
 - Animal behavior
 - Plant chemical cues
 - Neurons and the nervous system
 - Hormones and the endocrine system
- ***Assign pre-lecture questions and reading for week 10***
- ***Midterm Review***

Week 10 (11/3/2016)

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Genetics – Mendelian Inheritance

- Checking pre-lecture questions
- Small group discussion; groups report back with answers
- Midterm
- Lecture: Mendel and Genes
 - Who was Gregor Mendel?
 - Mendelian inheritance
 - Single genes vs. multiple genes
- Small group activity – Punnett squares of blood type
- ***Assign pre-lecture questions and reading for week 11***
- ***Assign homework 7***

Week 11 (11/10/2016)

Genetics – Selective Pressures

- Checking pre-lecture questions
- Small group discussion; groups report back with answers
- Pre-lecture quiz
- Lecture: DNA mutations
 - DNA replication and repair
 - Evolutionary significance of altered DNA
 - Types of small-scale mutations
- Small group activity
- Lecture: Chromosome controls
 - Sex-linked genes
 - Gene linkage
 - Alterations to chromosomes
- ***Assign pre-lecture questions and reading for week 12***
- ***Assign homework 8***

Week 12 (11/17/2016)

Evolution – Darwinian view of natural selection, population level evolution, tree of life

- Checking pre-lecture questions
- Small group discussion; groups report back with answers
- Pre-lecture quiz
- Lecture: Darwin and natural selection
 - Natural selection vs. sexual selection
 - Scientific evidence for evolution
- Small group activity
- Lecture: Consequences of selection
 - Population-level evolution
 - Tree of life and speciation
- ***Assign pre-lecture questions and reading for week 13***
- ***Assign homework 9***

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Week 13 (12/1/2016)**Ecology – organisms and interactions**

- Checking pre-lecture questions
- Small group discussion; groups report back with answers
- Pre-lecture quiz
- Lecture: What is ecology?
 - Populations and communities
 - Food webs
- Small group activity
- Lecture: Interactions in ecology
 - Competition
 - Predation
 - Symbiosis
 - Facilitation
 - Herbivory
- ***Assign pre-lecture questions and reading for week 14***
- ***Assign homework 10***

Week 14 (12/8/2016)**Ecology – climate and nutrient cycling****Review for final exam – bring questions?**

- Checking pre-lecture questions
- Small group discussion; groups report back with answers
- Pre-lecture quiz
- Lecture: What is an ecosystem?
 - Ecosystem energy budgets
 - Primary production
- Small group activity
- Lecture: Global Change
 - Biogeochemical cycles
 - Greenhouse gases and global warming
 - Threats to biodiversity
- Final Exam Group Review – ***no reading or pre-lecture questions assigned!***

Week 15 (12/15/2016)**Final Exam****Wrap-up**