

Format:

- Section I 21 multiple choice questions
Section II 1 essay question and 3 short free response questions

Reading: Hillis chapters 1, 2, and 41

The exam will NOT test memorization of facts or definitions; instead, questions will assess how deeply you understand and can connect the concepts, as well as how they apply to experimental situations. All questions will emphasize one or more of the seven course objectives listed in the syllabus.

- (1) Use representations and models to communicate biological phenomena and solve problems.*
- (2) Apply mathematics and statistics to biological models.*
- (3) Engage in scientific questioning to extend thinking and guide investigation.*
- (4) Plan and implement data collection strategies.*
- (5) Perform data analysis and evaluate evidence.*
- (6) Work with biological explanations and theories.*
- (7) Connect and relate knowledge across scales, concepts, and representations in and across domains.*

Concepts to Review:

- Evolution and Ethology
 - Be able to define the terms *evolution*, *differential survival*, *natural selection*, and *sexual selection*.
 - Be able to describe the key features of an evolutionary model.
 - Be able to distinguish between *proximate causes* and *ultimate causes* of behaviors.
 - Be able to describe the following behaviors: *fixed-action patterns*, *associative learning*, *habituation*, *imprinting*.
- Biochemistry
 - Understand the defining characteristics of *hydrogen bonds* and *hydrophilic/hydrophobic interactions*.
 - Know the difference between *endergonic* and *exergonic* chemical reactions, and be able to give examples.
 - Be able to calculate changes in free energy (ΔG) given data on changes in ΔH and ΔS , and temperature.
 - Be able to interpret a model showing free energy changes over the course of a chemical reaction.
 - Be able to explain how *condensation (dehydration synthesis) reactions* and *hydrolysis reactions* build up or break down molecules.
 - Know the monomers, polymers, and functions of *carbohydrates* and *lipids*.
- Labs
 - Understand the term *model*.
 - Be able to write a hypothesis and identify the *independent variable*, *dependent variable*, *control group*, *experimental group*, and *constants* (see Elements to Consider when Designing a Controlled Experiment handout).
 - Understand why large sample sizes, multiple trials, and statistical analyzes are used to verify results.
 - Be able to graph data appropriately and add 95% confidence intervals to a graph.
 - Be able to write a null hypothesis and use a chi-square test to accept or reject the null hypothesis.
 - Understand the meaning of the *standard deviation* or *standard error of the mean (SEM)* and be able to interpret confidence intervals on a graph.

Overarching Questions to Consider:

****Suggestion: Answer all of these questions in writing, then compare answers with a classmate. I promise that taking the time to do so will be well worth it and much more useful than memorizing facts and definitions.****

1. How are scientific models used to communicate biological concepts? Why are models needed?
2. Why are statistics needed when analyzing biological data? What does the SEM tell us?
3. When is it most appropriate to use a line graph? When is it most appropriate to use a bar graph?
4. Why do observations of altruistic behaviors puzzle evolutionary biologists? How can these seemingly selfless behaviors sometimes increase the fitness of the selfless individual?
5. How do animal behaviors give us clues about the evolutionary history of a species?
6. Why does Mr. Sprague feel that the term *hydrogen bond* is misleading?
7. Why does it matter for a cell whether a vital chemical reaction is endergonic or exergonic?

Practice Exam Questions:

Visit the course website and click on the “Multiple Choice Practice” link. Complete all practice questions for the relevant chapters and check your work against the answer key. Note: these items are password protected.

Exam Question Sneak Peak:

The essay question for the first exam, as well as selected multiple choice questions (with the answer choices removed), are posted the “Exam Review Sheets” page of the course website. Note: this file is password protected.