

# BIOL 0011 - CONCEPTS OF BIOLOGY

## Catalog Description

Advisory: Eligibility for ENGL 1A and MATH 12

Hours: 108 (54 lecture, 54 laboratory)

Description: Designed for non-life science majors desiring an introductory biology course with a lab. Introduces the main concepts of biology, covering molecular and cell biology, heredity and nature of genes, biotechnology, evolution, diversity of life, and principles of ecology. Students enrolling in BIOL 11 after having taken BIOL 10 will lose credit for BIOL 10. Not recommended for students who have completed BIOL 56 and 56L. (CSU, UC-with unit limitation)

## Course Student Learning Outcomes

- CSLO #1: Develop, utilize and evaluate scientific hypotheses through experimentation.
- CSLO #2: Appraise the relationship between cellular respiration and photosynthesis.
- CSLO #3: Formulate the correct structure of the main types of cells and diagnose the hypotheses regarding the evolutionary development of those cells.
- CSLO #4: Assess the role of DNA in living things, construct methods to analyze the patterns of inheritance, and judge the impact of genetic engineering on living things.
- CSLO #5: Justify the role of evolution in the development of living things, the diversity of living things and judge the effects of humans on living things on earth.

## Effective Term

Fall 2022

## Course Type

Credit - Degree-applicable

## Contact Hours

108

## Outside of Class Hours

108

## Total Student Learning Hours

216

## Course Objectives

Via written examinations, quizzes, independent projects, and laboratory exercises, the students will

Lecture Objectives:

1. Apply the main steps of the scientific method to develop a scientific hypothesis. (Lecture Ia)
2. Identify the variables found in scientific experiments and the roles that they play in testing hypotheses. (Lecture outline Ia)
3. Outline the levels of organization of life from molecular to ecosystem level in a diagram (Lecture outline I).

4. Apply knowledge of the parts of an atom to construct molecules with a lower energy state than the atoms that entered into the bond. (Lecture outline Ib)
5. Describe characteristics of the main organic compounds and consider roles of various organic molecules in living organisms (Lecture outline 1c)
6. Outline the functions of the main components of prokaryotic cells and the components and organelles of eukaryotic cells (Lecture outline Id)
7. Defend why a living cell is the basic unit of life (Lecture outline Id)
8. Describe the behavior of molecules during diffusion both within the solution itself and across a membrane. (Lecture outline Id)
9. Hypothesize how the structure of the cellular membrane enables cells to function. (Lecture outline Id)
10. Differentiate between the first two laws of thermodynamics and apply them to living systems (Lecture outline IIa)
11. Diagram how enzymes work and how they can be shut down. (Lecture outline IIb)
12. Identify the role of enzymes in organisms (Lecture outline IIb)
13. Compare and contrast the processes of photosynthesis and cellular respiration, recognize their role in energy flow in ecosystems. (Lecture outline IIc and IId)
14. Compare and contrast the processes of bacterial fission, mitosis and meiosis, recognize their role in the life cycles of organisms (Lecture outline IIIa)
15. Explain the correlation between errors in the cell cycle and cancer (Lecture outline IIIa).
16. Describe the structure of a DNA molecule and the process by which it replicated. (Lecture outline IIIb)
17. Analyze the main steps of protein synthesis. (Lecture outline IIIb)
18. Critique the role that mutations play in protein synthesis and evolution (Lecture outline IIIb)
19. Identify the main implications of DNA technology in the lives of humans. (Lecture outline IIIb)
20. Judge ethical issues associated with the use of biotechnology. (Lecture outline IIIb)
21. Critique the adaptive significance of sexual reproduction and situations in which asexual reproduction would be preferable. (Lecture outline IIIc)
22. Outline the ways by which meiosis and random fertilization contribute to biological adaptation and diversity.(Lecture outline IIIc)
23. Formulate the main Mendelian rules of inheritance and utilize these rules to solve simple genetic problems (involving monohybrid and dihybrid crosses). (Lecture outline IIIc)
24. Analyze the connection between genetics, heredity, epigenetics and the environment. (Lecture outline IIIc)
25. Evaluate natural selection as the main mechanism of biological evolution. (Lecture outline IVa)
26. Defend the importance of variation, overproduction, and heritability in natural populations. (Lecture outline IVa)
27. Describe the history of evolutionary thought (Lecture outline IVa)
28. Compare and contrast microevolution and macroevolution (Lecture outline IVa)
29. Evaluate the Oparin/Miller theory of the origin of life as suggested by geological and biochemical evidence. (Lecture outline IVb)
30. Identify the Domains and Kingdoms recognized by modern taxonomy, list the main characteristics of each domain and kingdom, and give examples of the main representatives of each. (Lecture outline IV)
31. Evaluate the role that microorganisms, plants, fungi and animals play in ecosystems and in the lives of humans (Lecture outline IV)
32. Investigate the main evolutionary adaptations found in microorganisms, plants, fungi and animals. (Lecture outline IV)
33. Examine the main components of an ecosystem and diagnose the ecological roles that organisms play within them. (Lecture outline IVf)

34. Evaluate the effect of human activities on the diversity of life on and the geological processes of Earth. (Lecture outline IV)
  35. Diagnose the long-term effect of human population growth on the fate of our planet (Lecture outline IV)
- Laboratory Objectives:
1. Develop, implement and test a scientific hypothesis. (Lab outline I)
  2. Construct biological molecules using modeling kits (Lab outline II)
  3. Describe characteristics of the main organic compounds and consider roles of various organic molecules in living organisms (Lab outline II)
  4. Apply knowledge of the parts of an atom to construct molecules with a lower energy state than the atoms that entered into the bond. (Lab outline II)
  5. Outline the functions of the main components (organelles) of a living cell (Lab outline III)
  6. Observe the behavior of molecules during diffusion both within the solution itself and across a membrane and determine how factors such as tonicity, molecule size and temperature can play a role in that rate of diffusion. (Lab outline IV)
  7. Differentiate between the first two laws of thermodynamics and apply them to living systems (Lab outline IV)
  8. Demonstrate via experimentation the role of the molecules involved in the photosynthetic equation. (Lab outline V)
  9. Demonstrate via experimentation the role of the molecules involved in the process of both aerobic and anaerobic cellular respiration. (Lab outline VI)
  10. Diagram the stages of mitosis outline what occurs during each stage. (Lab outline VII)
  11. Describe the structure of a DNA molecule and the process by which it replicated. (Lab outline)
  12. Analyze the main steps of protein synthesis. (Lab outline VIII)
  13. Critique the role that mutations play in protein synthesis and evolution (Lab outline VIII)
  14. Isolate DNA from the remains of a living organism. (Lab outline VIII)
  15. Formulate the main Mendelian rules of inheritance and utilize these rules to solve simple genetic problems (involving monohybrid and dihybrid crosses). (Lab outline IX)
  16. Utilize the rules of natural selection and Mendelian genetics to demonstrate how natural selection affects the gene frequencies of populations. (Lab outline X)
  17. Critique the roles that sexual selection, gene flow, genetic drift and mutation play in evolution. (Lab outline X)
  18. Investigate the main evolutionary adaptations found in microorganisms, plants, fungi and animals. (Lab outline X, XI, XII, XIII)
  19. Apply the metric system when conducting laboratory experiments; correctly and safely use standard tools and equipment (light compound microscope, digital scale, chemical glassware, etc.) in a biology lab. (All labs)
  20. Collaborate as a team member during biology lab exercises. (All labs)

- IGETC - 5B Biological Science
- IGETC - 5C Laboratory Science

## Articulation Information

- CSU Transferable
- UC Transferable

## Methods of Evaluation

- Essay Examinations
  - Example: Answer in a one page, double-spaced essay which will be evaluated based on accuracy and development of response. Rubric grading. 1. Genetically modified organisms are those which have had their genes altered. This is not the same as selective breeding. In selective breeding agriculturalists select the plants or animals that produce the most food and then breed them together to produce offspring that produce a high amount of food. For example, due to selective breeding cows are able to produce more milk per day today than they were in the past. Genetically modified organisms, however are something different. Genetically modified organisms, or GMOs as they are commonly referred to, have genes from other species of organisms inserted into their own genome. For example, Bt corn is a type of corn that has had a gene from a bacterial species called *Bacillus thuringiensis* inserted into it. This gene makes the corn resistant to a particular corn pest species called the European corn borer. This means that farmers who grow this corn no longer need to spray their corn with pesticides to eliminate this pest. However, there are many who worry about the impact of GMOs on the environment, on humans and on other crop species. What do you think of GMOs? Find some research on-line (from an .org or .edu source) both in support and against the use of these organisms. What do you think of their arguments? Do you agree or disagree? What do you think the global impact of these organisms could be? What percentage of the average American diet is composed of GMOs? Outcomes assessed: 1. Identify the main implications of DNA technology for the medical field and agriculture. (Lecture outline IIIb) 2. Judge ethical issues associated with the use of biotechnology. (Lecture outline IIIb) 2. Answer in a one page, double-spaced essay which will be evaluated based on accuracy and development of response. Rubric grading. In cattle, hornless condition is dominant to horned. If both parents are heterozygous for this condition: a. What is the probability that a calf born to these parents will be horned? b. What is the probability that the calf will be hornless? Outcome Assessed: 1. Formulate the main Mendelian rules of inheritance and utilize these rules to solve simple genetic problems (involving monohybrid and dihybrid crosses). (Lecture outline IIIc)
- Objective Examinations
  - Example: 1. Hypertrichosis, hairiness of the outer ear, is inherited as a Y-linked recessive in humans, If a man with hypertrichosis marries a woman without the trait, what might be the phenotypes of their children? A. All of their children have hypertrichosis B. All of the sons have hypertrichosis, but none of the daughters C. All of the daughters have hypertrichosis, but none of the sons D. None of their children have hypertrichosis 2. Tube feet of sea stars are used primarily for: A. Reproduction B. Circulation C. Movement D. Sensation
- Reports
  - Example: Lab Questions: What wavelengths of light worked best for the production of oxygen? Hypothesize why it was

## General Education Information

- Approved College Associate Degree GE Applicability
  - AA/AS - Life Sciences
  - AS - Life Science Lab
- CSU GE Applicability (Recommended-requires CSU approval)
  - CSUGE - B2 Life Science
  - CSUGE - B3 Lab Activity
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)

those particular wavelengths of light that produced the most oxygen. Why did using the full spectrum of light work best for the production of oxygen? Explain why an increase in carbon dioxide in the Habitation Unit would not result in greater production of oxygen. Your explanation should include a discussion on the light dependent reactions and the Calvin cycle.

## Repeatable

No

## Methods of Instruction

- Laboratory
- Lecture/Discussion
- Distance Learning

Lab:

1. Students will be assigned genotypes and the instructor will inform how those genotypes correspond to particular feeding phenotypes. Candy will then be placed on the tables in front of the students. Students will use their phenotypes to forage for food. Those students that do not collect enough food will be removed from the population. Those students who collect enough food will be allowed to parent the next generation. Using the Mendelian ratios based upon the genotypes of the parents, the instructor will allocate new genotypes to the students previously removed from the game. Gene frequencies will be calculated both before and after each round of play.

Lecture:

1. Instructor leads class discussion on the following: "A food manufacturer is advertising a new cake mix as fat-free. Scientists at the US Food and Drug Administration (FDA) are testing the product to see if it truly lacks fat. Hydrolysis of the cake mix yields glucose, fructose, glycerol, a number of amino acids, and several kinds of molecules with long hydrocarbon chains. Further analysis shows that most of these hydrocarbon chains have a carboxyl group (typical to organic acids) at the end. What would you tell the manufacturer if you were the spokesperson for the FDA, and why?"

Distance Learning

1. Following a live-recorded lecture on prokaryotic and eukaryotic cells, the instructor will guide students through the following process: "Perform an internet search for the websites on cell structure. Find sites that: give an overview and illustrate cell organelles and their functions; compare animal cells and plant cells; compare eukaryotic and prokaryotic cells; and, overall, have descriptions and images that are most helpful in illustrating the content of our chapter
2. After you have found such website(s), post a link to them in our Discussion Board, put a comment on why you think this particular site is helpful and what you liked about it. What additional information did you find there that helped you learn the concepts better?"

## Typical Out of Class Assignments Reading Assignments

1. Discover something new in science. In the tradition of a "Today I learned" post, read about a new discovery in science. Evaluate what you read and be prepared to discuss the implications for humans and the environment of that work.
2. Review the data collected and results from a

scientific experiment provided by the instructor (e.g. science surrounding vaccine acceptance). Evaluate the outcome of the experiment. Identify the hypothesis and variables that were part of that experiment.

## Writing, Problem Solving or Performance

1. Complete word problems in genetics that are based in genetic terminology.
2. Evaluate the size of the human population on earth today. Use this information to determine the effects that humans have on the natural world. Detail your findings in a two-page essay that demonstrates critical thought.

## Other (Term projects, research papers, portfolios, etc.)

1. Review the laboratory exercises prior to coming to lab. Answer pre-lab questions prior to arrival in class.
2. Answer review questions posed in lab manual based upon the experiments conducted in lab.
3. Case Studies: Should we clone mammoths? Evaluate what the potential barriers are to cloning mammoths. Discuss the potential effects on the ecosystem of the reintroduction of mammoths into the ecosystem. Use this information to debate issues surrounding the reintroduction of mammoths or other extinct animals back into the ecosystem.

## Required Materials

- Concepts of Biology
  - Author: Fowler, Roush, Wise
  - Publisher: Open Stax
  - Publication Date: 2019
  - Text Edition:
  - Classic Textbook?:
  - OER Link:
  - OER:
- Campbell Essential Biology
  - Author: Reece, Simon, Dickey
  - Publisher: Benjamin Cummings
  - Publication Date: 2018
  - Text Edition: 7th
  - Classic Textbook?:
  - OER Link:
  - OER:
- Laboratory Manual for Biology 11
  - Author: Carroll, Martinez, Pravosudova
  - Publisher: Sierra College
  - Publication Date: 2015
  - Text Edition: 4th
  - Classic Textbook?:
  - OER Link:
  - OER:

## Other materials and-or supplies required of students that contribute to the cost of the course.