

University of Kentucky
Independent Study Program
Lexington, KY 40506-0031

BIO 150 - Principles of Biology I
(3 Credit Hours)

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Text

Biology by Neil Campbell, 5th edition, Benjamin Cummings Publishing Company.

Course Description

This course is an introductory course designed to develop an understanding and appreciation of the basic biological principles used in exploring life at the molecular and cellular levels. The concepts of molecular structure and function will be applied to the structure and function of the cell. Similarities and differences in structure and function of the prokaryotic and eukaryotic cell will be covered along with the origin and evolution of life.

Disabilities/ Medical Conditions

If you have a disability or medical condition that requires special accommodations, please contact me immediately so that we can discuss these accommodations.

Grading

Assignments 26 x 100 pts	2600 points total
Examination #1	100 points
Examination #2	100 points
Examination #3	100 points

TOTAL POINTS POSSIBLE 2900

NOTE: In order to receive a passing grade in the course you MUST earn a minimum of 180 points out of the possible 300 on the examinations. This represents a mean score of 60% for the three examinations. Failure to earn a mean passing grade (60%) on the examinations will result in an automatic grade of E for the course irrespective of your performance on the assignments.

Final grades will be based on total points earned and will be assigned as follows:

- A = a mean passing grade (180 points / 300) on the examinations **AND** a total of 2610 points for the course.
- B = a mean passing grade (180 points / 300) on the examinations **AND** a total of 2320 -> 2600 points for the course.
- C = a mean passing grade (180 points / 300) on the examinations **AND** a total of 2030 -> 2319 points for the course.
- D = a mean passing grade (180 points / 300) on the examinations **AND** a total of 1740 -> 2029 points for the course.
- E = Failure to earn a mean passing grade (180 points / 300) on the examinations **OR** a mean passing grade (180 points / 300) on the examinations and a total of less than 1740 points for the course

EXAM SCORES ARE NOT CURVED. The examinations will consist of short answer questions, multiple-choice, true/false, short essay questions. The short answer/short essay questions will be of the type found in the assignments. The multiple choice questions will be of the type found in the textbook and in the exam review section on the CD that accompanies the textbook. Each examination will be 2 hours long.

You must take examination #1 after you have completed module #4. Assignments #9 - 26 will not be graded until after you have taken examination #1.

You must take examination #2 after you have completed module #7. Assignments #18 - 26 will not be graded until after you have taken examination #2.

About the Assignments

Each assignment consists of a series of short answer questions. Read each question carefully and answer it fully. Note: that some questions consist of several parts. Make sure you answer all parts of a question. **All submitted assignments must be typed or word-processed. Handwritten assignments will not be graded.** You can, however, hand-draw diagrams and graphs. Each assignment is worth 100 points. You will lose points for bad grammar, spelling and sentence construction.

As you review each chapter, do not just memorize the facts. Instead focus on understanding the underlying concepts. Some of the questions in the assignments are direct recall questions, while others are conceptual and/or application questions. Some questions will require you to refer back to previously acquired knowledge or to conduct research either in the library or in later chapters in the textbook. Several assignments (# 25 and #26 in particular) require you to do some extensive research and writing.

As an instructor, my goals for you go beyond you just learning the facts of biology. I feel it is important, and crucial, that you (a) understand the concepts and theories of the subject matter; (b) develop the ability to apply this knowledge to new problems and situations; and (c) effectively communicate this knowledge to other people.

You have one year to complete all of the course requirements. Ideally, you should plan on submitting a completed assignment every 12 days. Some of these assignments require some library research and planning, so do not leave it till the last minute to work on assignments.

Supplemental Course material on the World Wide Web

The following courses, which I teach, can be found on the World Wide Web-

BIO 102, Human Ecology

BIO 150, Principles of Biology I

BIO 208, Principles of Microbiology

All three of these courses can be accessed through “Beattie’s Biology” Homepage.

The URL is: <http://www.uky.edu/~rebeat1>

This URL will bring you to my home page, which has a table of contents. Click on your selection and you will be connected to the appropriate course. The course lecture schedule, along with other course material is listed. Even though you are probably working through the course material at a schedule different to this one, you can still avail of this supplemental information. The lecture topics in the lecture schedule have been hyperlinked to other pages on the WWW. Just click on any hyperlinked (blue) lecture item and you will be connected to a page listing information on that topic. This list will include review material, additional course material and some information that you will find interesting.

Academic Offenses

Cheating

Cheating is a serious academic offense. The following is an excerpt taken from the “Students Rights and Responsibilities Handbook, University of Kentucky”.

“Cheating is defined by its general usage. It includes, but is not limited to, wrongful giving, taking, or presenting any information or material by a student with the intent of aiding himself/herself or another on any academic work which is considered in any way in the determination of the final grade”

Plagiarism

Plagiarism is a serious academic offense. The following is a excerpt taken from the “Students Rights and Responsibilities Handbook, University of Kentucky”

“All academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research, or self-expression.

When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording or anything else from another source without appropriate acknowledgment of the fact, the students are guilty of plagiarism.

Plagiarism includes reproducing someone else’s work **If the words of someone else are used, the student MUST put quotation marks around the passage in question and add an appropriate indication of its origin.** Making simple changes while leaving the organization content and phraseology intact is plagiaristic.”

Charges of an academic offense will be made against any student that commits plagiarism or cheats. The MINIMUM penalty for such an offense is the assignment of a grade of E for the course in which the offense occurred. More severe penalties include suspension or dismissal from the University. I have a zero-tolerance policy regarding plagiarism or any other academic offense.

BIO 150, PRINCIPLES OF BIOLOGY 1

Course Goals

- The student will develop an appreciation and understanding of the fundamental principles (with emphasis on molecular, cellular, evolutionary principles) which unify all life.
- The student will develop an understanding of the methods and processes of scientific inquiry.
- The student will be prepared for advanced courses in cell biology and genetics.
- The student will recognize the contributions of biology to modern society.
- The student's needs will be met by fostering the development of critical thinking, reasoning, and problem-solving skills, scientific attitudes and values.
- The student will be prepared to make responsible decisions about social issues that relate to science, technology, the environment and health, such as aging, cancer, drugs, energy, genetic engineering, heredity and nutrition.

Instructional Objectives

At the completion of the course, the student should be able to:

Scientific Methods and Tools of Science

1. Demonstrate an understanding of the role of scientific method in scientific investigation.
2. Analyze and interpret data from a given graph or figure.
3. Relate pH scale to hydrogen ion concentration.

Organizing Concepts

4. List the fundamental characteristics of living organisms and discuss the principles that unify living organisms.
5. Discuss the five kingdom system of classification of organisms, and give the criteria used to assign members to each kingdom.
6. Arrange in order the following categories of classification: kingdom, phylum, class, order, family, genus, species.
7. Discuss the various factors involved in natural selection as a mechanism of evolution.

The Chemistry of Life

8. Be able to use the periodic table to determine the electronic configuration, chemical properties and method of bonding of a particular atom.
9. Discuss the role of the following bond types, ionic, covalent, hydrogen and hydrophobic, in the structure of biomolecules.
10. Discuss the likelihood of the formation of hydrogen bonds between two given molecules and the importance of hydrogen bonds as they relate to the properties of water.

11. Identify hydrophobic and hydrophilic functional groups (hydroxyl, amino, methyl, carbonyl, carboxyl, sulfhydryl, phosphate), and polar and nonpolar bonds. Relate their structure to their function.
12. Identify the four groups of biomolecules. Discuss the relationship between the structure and function of the molecules in each group.
13. Demonstrate how macromolecules are formed and how they are broken down.
14. Predict the solubility of compounds in hydrophilic and hydrophobic solvents.
15. Describe the chemical conditions that are believed to have existed on earth at the time of the origin of life. Discuss the steps by which life may have originated from organic monomers.
16. Discuss how the evolution of the first organisms led to changes in those early chemical conditions.

The Cell – Structure and Function

17. Compare and contrast the structure of prokaryotic and eukaryotic cells, and plant and animal cells.
18. Relate the structure of major cell organelles to their function.
19. Describe the role of key organelles in cellular processes such as protein manufacture and secretion.
20. Discuss the evolution of eucaryotes.

Membrane Structure and Function

21. Relate membrane structure to membrane function.
22. Predict the effect of exposing cells to solutions of differing solute concentration and describe the solute concentration in terms of hypertonic, isotonic and hypotonic.
23. Describe diffusion, facilitated diffusion and osmosis and cite examples of each process.
24. Compare and contrast passive transport process with active transport processes.

Cellular Respiration – Harvesting Chemical Energy

25. Cite the First and Second Laws of Thermodynamics and explain how they relate to biological systems.
26. Discuss the role of different kinds of energy (potential and kinetic) and different forms of energy (chemical, electrical, heat, mechanical) in biological systems. Discuss caloric content of food.
27. Given equations, energy diagrams, and/or values for ΔG , identify reactions as endergonic or exergonic.
28. Define oxidation and reduction and relate these processes to energy gain or loss.
29. Discuss the role of ATP as the energy currency of the cell.
30. Describe how an enzyme changes the rate of a chemical reaction. Relate enzyme specificity of action to enzyme structure.
31. Describe how environmental changes influence enzyme activity.
32. Discuss the relationship between mitochondrial structure and its function in cellular respiration.
33. Cite the role of key compounds in glycolysis and Krebs cycle.

34. Describe ATP production by chemiosmotic phosphorylation.
35. Compare and contrast ATP production via substrate-level phosphorylation with ATP production via oxidative phosphorylation.
36. Discuss the role of NADH and FADH₂ in ATP production.
37. Compare and contrast aerobic respiration processes with anaerobic processes in terms of energy yield, final electron acceptor, and type of phosphorylation involved and availability of oxygen.

Photosynthesis

38. Discuss the relationship between chloroplast structure and its function in photosynthesis.
39. Relate wavelength of light to energy.
40. Discuss the relationship between the absorption spectrum and the action spectrum for the pigments of any given plant.
41. Compare and contrast cyclic and noncyclic photophosphorylation.
42. Describe the relationship between the light and dark reactions of photosynthesis.
43. Explain the roles of key compounds in photosynthesis.
44. Predict the effects of environmental changes (amount and type of light, carbon dioxide levels) on the rate of photosynthesis.
45. Discuss the roles of photosynthesis and aerobic respiration in the flow of energy through a biological system.

Cell Reproduction – Mitosis and Meiosis

46. Describe the four stages (G₁, S, G₂, M) of the cell cycle.
47. Compare and contrast asexual and sexual reproduction.
48. Identify each of the stages of mitosis and meiosis. Identify the cells at each stage as haploid or diploid.
49. Compare and contrast mitosis with meiosis.
50. Discuss how the process of meiosis contributes to genetic variation.

Mendel and the Gene Idea

51. State Mendel's Law of Segregation and Mendel's Law of Independent Assortment and relate them to events in meiosis.
52. Define the terms commonly associated with basic genetics: phenotype, genotype, homozygous, heterozygous, allele, locus, testcross, segregation, independent assortment, linkage, crossing over, sex linkage, sex determination.

53. Solve problems involving the following genetic principles:
gene assortment (3:1, 1:2:1, F ratios)
independent assortment (9:3:3:1 F ratios)
sex linkage, multiple alleles, dominance v incomplete dominance
54. Cite examples of how an organism's environment may control phenotype.

DNA Structure and Protein Synthesis

55. Describe the structure and chemical composition of DNA and RNA. Discuss the role of hydrogen bonding in DNA replication, transcription and translation.
56. Compare and contrast prokaryotic and eukaryotic chromosome structure.
57. Describe DNA replication.
58. Given a DNA sequence be able to transcribe and translate it into the designated protein.
59. Explain the roles of DNA, mRNA, tRNA, rRNA, DNA polymerase DNA ligase, RNA polymerase, peptidyl transferase, amino acids and ATP in the process of protein synthesis.
60. List the different kinds of mutations and consequences on gene expression and factors that may cause those mutations.
61. Describe how gene expression is controlled in prokaryotic and eukaryotic cells.
62. Describe how genetic engineering is accomplished and cite practical examples in agriculture and medicine.
63. Critically examine moral and ethical issues surrounding genetic engineering, genetic diseases and the Human Genome Project.

Evolution and Natural Selection

64. Define evolution and cite examples that supports it.
65. Explain the origins of genetic variability including mutations, chromosomal aberrations, and crossing over during meiosis and sexual reproduction and relate the importance of recombination to natural selection and evolution.
66. Discuss the various factors involved in natural selection as a mechanism of evolution and the effects of natural selection on populations.
67. Define the term species and discuss reproductive isolating mechanisms.
68. Define and give examples of allopatric and sympatric speciation.
69. Identify emergent macroevolutionary patterns. Cite examples of major events in the evolution of life.

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