Brooklyn College of the City University of New York
Department of Biology
BIOL 1001 - General Biology 1

Systems, Ecological and Evolutionary Biology

Topics Covered

Systems, ecological and evolutionary biology. Integration of plant and animal form and function with biological concepts and theories of evolution, genetics, development, homeostasis, and ecology-biodiversity.

Textbook and Lab Manual

Textbook: *Brooker et al. Biology, Sixth Edition.* McGraw Hill, Publishers

Connect: Online homework Assignments, McGraw-Hill Publishers. Directions are on Blackboard. The class you must register for on Connect is:

Homework: Connect homework comes in 2 parts: Learn Smart and Questions. You must complete and submit both parts for each assignment for credit. There is no partial credit, which means any assignment that is not totally completed by the due date and time gets a 0. It would also be wise to complete the assignment and submit it 2 days before the due date since sometimes there are computer issues. Since you are usually given a week, you have ample time to do the homework and submit. Students who wait until the last minute and are unable to submit homework get a 0. Finally, please note that 12 PM means noon, not midnight.

Laboratory manual: General Biology 1 Laboratory Manual, custom edition; McGraw-Hill, Publishers

Department Goals and Objectives to be covered in this course:

CORE BIOLOGICAL KNOWLEDGE

Cell Biology:

- Compare and contrast prokaryotic cell architecture
- Compare and contrast basic cellular and acellular groups including
    - prokaryotes
    - eukaryotes
    - viruses, viroids and prions

Genetics

- Demonstrate an understanding of Mendelian genetics
- Demonstrate an understanding of the physical basis of Mendelian principles
- Demonstrate an understanding of pedigree analysis.
- Distinguish between autosomal and sex-linked inheritance
- Define DNA recombination.
- Describe the general mechanisms of DNA recombination

Evolution

- Describe the key components of natural selection.
- Explain how natural selection has contributed to evolution and diversity of life forms.
- Describe the consilience between molecular, genetic and organismal-based theories of evolution.

- Describe evidence from microevolution that supports the theory of evolution
- Describe evidence from macroevolution that supports the theory of evolution

Organisms and Ecology

- List defining characteristics of animals and plants
- Describe diversity, body plans and evolutionary relationships among vertebrates and invertebrates
- Demonstrate and understanding of population genetics and demography
- Define the major types of intra- and interspecific interactions including
    - commensalism
    - mutualism
    - parasitism
- Demonstrate an understanding of community structure and dynamics

PRACTICAL COMPETENCIES

- Independently investigate biological phenomena using the scientific method and proven research tools and methods
- Develop familiarity with laboratory and research procedures by
    - formulating hypothesis
    - reading scientific literature
    - designing and carrying out experiments
    - preparing results in tabular and graphical form
- Communicate scientific results in class

PROFESSIONAL ATTITUDES AND ETHICAL RESPONSIBILITIES OF BIOLOGICAL RESEARCH

- Adhere to the highest professional standards of the scientific community

Course lecture outline

Please note that the following lecture outline is subject to change at the lecturer's discretion. You will be informed of any changes in lecture.

Weeks 1 & 2 (Lecture periods 1-3)
Goals: (1) To enumerate and describe the diversity of, and inter-relationships among life forms. (2) To describe how life's fundamental unit of structure and function, the cell, is integral to the organization, behavior and interactions of biological hierarchy.
Topics to be covered:

- *Biological hierarchy and their properties*
- *The scientific method*
    - Chapter 1 (Introduction: Themes in the Study of Life)

Learning Objectives

1. Define and differentiate the scientific basis upon which life forms are categorized.
2. Integrate the concept of cellular units with the diversity of life forms.
3. Describe the relationships from atoms to ecosystems of which Biology is rooted.

Weeks 2 & 3 Genetics (lecture periods 3-5)
Goal: (1) To describe, explain, and analyze the physical basis and principles underlying the transmission of genes and traits from one generation to the next.

Topics to be covered:

- *Somatic cell division and the production of gametes*
    - Chapter 16 (mitosis and meiosis)
- *Genotypes and phenotypes*
    - Chapter 17 (Mendel and the gene idea)
    - Chapter 18 (complex patterns of inheritance)

Learning Objectives:

1. Define the concepts of genes and alleles.
2. Delineate, on the chromosome and gene level, the process of meiosis.
3. Demonstrate that gamete formation gives rise to haploid cells.
4. Describe and apply the Mendelian principles of segregation of alleles and independent assortment.
5. Demonstrate and apply the principles of inheritance of sex-chromosome linked genes.
6. Define and apply the synthesis of Darwinian evolution and Mendelian genetics.

Weeks 3 & 4: Ecology (Lecture periods 5-7)
Goal: (1) To understand how organisms are organized into populations, communities and ecosystems and how these levels evolve and interact.
Topics to be covered:

- *Population biology*
    - Chapter 56 and 57 (Population Ecology and Species Interactions)
- *Community interactions and their influences on species diversity*
    - Chapter 58 (Community Ecology)

Learning Objectives

1. Define biotic and abiotic systems.
2. Delineate the interactions between biotic and abiotic systems.
3. Define the concept of populations and communities.
4. Describe how different populations interact in ecosystems.
5. Synthesize the principle of population and genetics into the field of population genetics.
6. Define interactions that influence species that comprise a community.
7. Describe features that influence community structures including trophic structure, species diversity, biogeographic features and pathogens.

Weeks 4 & 5: Evolution (Lecture periods 8-10)
Goals: (1) To enumerate and describe the diversity of, and inter-relationships among life forms. (2) Introduction to biological diversity within the framework of evolution.
Topics to be covered:

- *Darwinian revolution*
    - Chapter 22 (Descent with Modification)
- *Genetic variation makes evolution possible*
    - Chapter 23 (The Evolution of Populations)
- *Speciation*
    - Chapter 24 (The Origin of Species)

Learning Objectives

1. Identify the impact Darwinian Theory has had on understanding the species concept and the inter-relationships between diverse life forms.
2. Analyze and apply Darwinian Theory to modern biological experimentation.

3. Identify factors that contribute to speciation.

Weeks 6–8: Taxonomy and Microorganisms (Lecture periods 11-15)
Goal: (1) To list key distinctions between acellular infectious agents and unicellular life forms.
Topics to be covered:

- *Determining phylogeny*
  - Chapter 25 (Phylogeny and the Tree of Life)
- *Viruses, Prions and Viroids*
  - Pages 401-413 of Chapter 19
- *Prokaryotes*
  - Pages 413-421 and Chapter 27 (Archaea and Bacteria)
- *Unicellular Eukaryotes*
  - Chapter 28 (Protists)
- *Microbiomes*
  - Chapter 30 (Microbial Systems on and around us)

Learning Objectives

1. Compare and contrast viruses, bacteria, and protists
2. Describe how phylogenies show evolutionary relationships

Weeks 8 & 9: Fungi and Plant Evolution (Lecture periods 16-18)
Goals: (1) To list the key characteristics of fungi and their role in ecosystems and (2) to trace the evolutionary history of plant diversity listing key features that lead to plant evolution and adaptive radiation.
Topics to be covered:

- *Molds, yeasts and mushrooms*
  - Chapter 29 (Fungi)
- *The origin and diversification of plants*
  - Chapter 31 (How Plants Colonized Land)
- *Plant adaptations to life on land – an overview*
  - Chapter 32 (The Evolution of Seed Plants)

Learning Objectives

1. List key characteristics of molds, yeasts, and mushrooms.
2. Compare and contrast nonvascular plants, seedless vascular plants, and seed-bearing vascular plants.
3. Define the term alternation of generations and give examples.

Week 10: Animal Diversity (Lectures 19 & 20)
Goal: (1) To define what constitutes an animal and list key shared characteristics of animals in general and distinct characteristics of invertebrates and vertebrates specifically.
Topics to be covered:

- *Characterizing animals by body plans*
  - Chapter 33 (An Overview of Animal Diversity)
- *Key characteristics of invertebrates*
  - Chapter 34 (Invertebrates)
- *Key characteristics of Vertebrates*
  - Chapter 35 (The Origin and Evolution of Vertebrates)

Learning Objectives

1. Define key characteristics of animals
2. Give examples of animal body plans and diversity in function
3. Define characteristics of invertebrates, vertebrates and list the derived characters of mammals.

Week 11: Metabolism and Homeostasis (Lecture 21)
Goal: (1) To define homeostasis within the context of biology and describe the important function enzymes have in maintaining cellular metabolism.
Topics to be covered:

- *Animal form and function*
    - Chapter 41 (Basic Principles of Animal Form and Function)

Learning Objectives

1. Define homeostasis
2. List the different types of animal tissues and how form relates to function of these cells
3. Define osmoregulation and maintenance of body temperature

Week 11–12: Neuroscience (Lectures 22 – 23)
Goal: (1) To understand the evolution of the nervous system and how nervous system structure is related to function
Topics to be covered:

- *Evolution, Structure and Function of the Nervous System*
    - Chapter 43 (Neuroscience II)
- *Cells of the Nervous System*
    - Chapter 42 (Neuroscience I)

Learning Objectives

1. Compare and contrast the functional anatomy of nervous system from diverse organisms
2. Describe the anatomical organization of the vertebrate brain
3. Describe the organization of the peripheral nervous system
4. Describe the structures and functions of the human hindbrain, midbrain and forebrain
5. Compare and contrast the CNS and PNS
6. Describe the function of each cell type of the nervous system
7. Explain the functional relationships among sensory neurons, interneurons and motor neurons
8. Describe the electrical properties of neurons and the resting membrane potential.
9. Compare and contrast graded signals and action potentials
10. Describe the structural features of a synapse
11. Distinguish between EPSPs and IPSPs

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Weeks 13 & 14: Systems Biology
Goal: (1) To understand that homeostasis requires the digestion and absorption of nutrients and their distribution throughout the body, as well as the production of waste products that must be removed from the body. (2) To describe and delineate how diverse organisms perform these functions.
Topics to be covered:

- *Systems to distribute nutrients and gases throughout the body.*
    - Chapter 46 (Animal Nutrition and Digestion)
    - Chapter 48 (Circulation and Gas exchange)

- *Water balance and waste removal in animals.*
    - Chapter 49 (Osmoregulation and Excretion)

Learning Objectives

1. Define the concepts of autotrophic and heterotrophic organisms and be able to discuss the validity of such classifications.
2. Delineate and differentiate how and why diverse heterotrophic organisms digest and absorb nutrients.
3. Delineate what specialized anatomical structures are necessary for the distribution of nutrients, gases and waste in organisms with complex body plans.
4. Describe how the function of different digestive tissues and organs are regulated to produce controlled digestion.
5. Define and apply the concepts of hypotonic, isotonic and hypertonic fluids.
6. Delineate the mechanisms by which homeostatic levels of salt and water are maintained in cells and organisms.
7. Describe how specific organs and organ systems of animals with complex body plans are used to maintain homeostatic levels of salts and water.
8. Differentiate between nutrients and waste products.
9. Describe the relationship of nutrients and waste between diverse organisms.
10. Describe how specific tissues and organ systems are used to remove metabolic waste produces from the body.

Please note: This syllabus serves as a guide for lectures. The lecturer may make changes as the semester progresses. If changes are made, an announcement will be posted on Blackboard.

OUTCOMES ASSESSMENT

Course grading

The final course grade will be based upon students' performance in lecture exams and lab.

Lecture: 50%

-Lecture exams (4):	40%
-Online homework assignments:	10%

- Lecture exams: Three midterm exams and a final exam will be given on the dates listed on your personal syllabus. The exams will assess your ability to retain and recall the material covered in lecture as well as your ability to integrate and extrapolate the material covered by solving problems. All lecture exams shal be in-person.
- Online homework assignments will be assigned throughout the semester. No late assignments will be accepted.

Make-up exams and quizzes: There are no make-up exams. If you miss one lecture exam you will take a cumulative final which will count for 20% of your lecture grade. Failure to take 2 exams and/or quizzes constitutes an F for the course.

ATTENDANCE POLICY

Lecture Attendance – Lectures provide essential information not covered in the text. It is therefore important that you attend all lectures. If you miss a lecture, **you** are responsible for the material covered. You are also responsible for all announcements made in the lecture. If you miss a class or come late, be sure you obtain missed material from a classmate.

Laboratory Attendance – Attendance at every laboratory session of *your assigned section* is required. Because every lab is full, making up labs is very difficult and most likely impossible.

If you must miss a lab, you must provide documentation to your lab instructor that the absence was unavoidable. It is your responsibility to arrange to make up the missed laboratory with another instructor ***if*** (a) there is room in the laboratory and (b) the laboratory instructor agrees to allow you to attend the lab. Failure to provide documentation and/or failure to make up the lab will result in **one fourteenth (1/14)** of your lab grade being deducted. Thus, if your final lab average is 85 and you missed one lab **your grade will be deducted 3.6 points** to give you a final lab average of 81.4. Failure to attend more than 2 of your assigned labs automatically results in an F for the course.

THERE IS NO SWITCHING OF LABS!
If you cannot officially register for a lab section, you may not attend it.

PLEASE NOTE:
***There are no negotiations for grades*.** Your grade is the sum of the components listed above. There are no extra credit, make-up, or "pity" points. It is expected that you will put 100% effort into all your endeavors including this course. Therefore, there are no extra points for "working hard".

Grade distribution (Please note: There is not curving of grades at the end of the semester)

97.45–100 = A+
92.45–97.44 = A
89.45–92.44 = A-
87.45–89.44 = B+
82.45–87.44 = B
79.45–82.44 = B-
77.45–79.44 = C+
72.45–77.44 = C
64.45–72.44 = C-
<64.45 = F

HOW TO SUCCEED IN BIOLOGY:

- Attend all lectures, labs, and review sessions.
- Read the text and laboratory handouts **BEFORE** class.
- Review your class notes as soon as possible after lecture and immediately before lecture.
- Complete all assignments and turn them in on time. **Late assignments are not accepted.**
- ***Participate in a study group on a weekly basis.***
- ***Know the vocabulary!*** The study of biology is like learning a new language. You need to know the vocabulary in order to understand the concepts. If you come across a word you don't know, look it up!
- Get a good night's sleep before an exam.
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ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

In order to receive disability-related academic accommodations, students must first be registered with the Center for Student Disability Services. Students who have a documented disability or suspect they may have a disability are invited to set up an appointment with the

Director of the Center for Student Disability Services, Valerie Stewart-Lovell, at 718-951-5538. If you have already registered with the Center for Student Disability Services, please provide your professor with the course accommodation form and discuss your specific accommodation with him/her.

Bereavement Policy: If you have a death in the family, please consult the Brooklyn College Student Bereavement Policy which can be found at: www.brooklyn.cuny.edu/web/about/initiatives/policies/bereavement.php

ACADEMIC INTEGRITY POLICY

Academic dishonesty is prohibited in The City University of New York and is punishable by penalties, including failing grades, suspension, and expulsion. Examples of academic dishonesty include cheating, plagiarism, internet plagiarism, obtaining unfair advantage, and falsification of records. A full definition of each form of academic dishonesty, as well as procedures for imposition of sanctions for violations of the CUNY Policy on Academic Integrity, may be accessed at:

https://www.cuny.edu/about/administration/offices/legal-affairs/policies-resources/academic-integrity-policy/