Bergen Community College  
Division of Mathematics, Science, and Technology  
Department of Biology and Horticulture  

General Biology I (BIO-101)  
General Course Syllabus  

Course Title: General Biology I (BIO-101)  

Course Description: This is the first course in a two-semester sequence in general biology. The course introduces the fundamental principles of biology and their relationships to society. Lecture topics include: an introduction to science, basic chemistry, cell biology, metabolism, genetics, and a survey of the Prokaryotae, Protists, and Fungi. Laboratory exercises develop a proficiency in the use of laboratory equipment and guide students in investigations of biochemistry, cell biology and metabolism, genetics, microbiology, protists, and fungi.  

Prerequisites: None  

General Education Course: Yes  

Course Credits: 4.0  

Hours per week: 6.0: 3 hours lecture and 3 hours lab  

Course Coordinator: Robert Highley  


Revised 2017 Summer
Student Learning Objectives-

Students will be able to:

1. describe the nature of science as it specifically applies to the discipline of biology. Students will use the scientific method of inquiry. They will be evaluated by lecture and laboratory examinations.

2. explain the process of evolution and the impact that Charles Darwin and other evolutionists had on the explanation of the process. Students will be evaluated by lecture examinations.

3. demonstrate the knowledge of the chemical basis of living organisms and how chemistry defines a large part of the study of biology. Students will be evaluated by lecture examinations.

4. define the characteristics of water, the medium on which all life on earth depends. Students will be evaluated by lecture examinations.

5. be familiar with the nature of organic biocompounds (carbohydrates, proteins etc…) and their importance as building blocks of living systems. Students will be evaluated by lecture examinations.

6. identify the chemical and physical structure and diversity of living organisms and how they interact with the environment. Students will be evaluated by lecture examinations.

7. list the characteristics of living organisms. Students will be evaluated by lecture examinations and student projects.

8. explain the composition and function of biological membranes. Students will be evaluated by lecture and laboratory examinations.

9. define passive transport- diffusion, osmosis, and facilitated diffusion and relate the changing conditions inside and outside of cells to these definitions. Students will be evaluated by lecture and laboratory examinations.

10. define active transport and relate the changing conditions inside and outside of cells to the need for AT. Students will be evaluated by lecture examinations.

11. explain the nature of free energy and the application of free energy to living systems, mainly in the metabolism of cells. Students will be evaluated by lecture examinations.

12. explain and describe the nature of enzymes and their critical importance to living systems. Students will be evaluated by lecture and laboratory examinations.

13. follow the cell’s metabolic pathways and their energetic products in both phototrophic and chemotrophic organisms. Students will be evaluated by lecture examinations.

14. explain the need for cellular reproduction and the different types carried out by selected organisms. Students will be evaluated by lecture and laboratory examinations.

15. explain the nature of informational molecules (DNA and RNA) and the expression of this information through the process of gene expression. Students will be evaluated by lecture and lab examinations.

16. compare Mendelian and non-mendelian inheritance and describe the way living organisms pass characteristics from one generation to the next. Students will be evaluated by lecture examinations and student papers.
17. understand the importance of the light microscope to the practice of biology. Students will be evaluated in the laboratory regarding the proper use of the microscope during a laboratory practical. Students’ laboratory participation may also be evaluated in the form of a student laboratory project.

18. properly use the microscope to examine the difference between selected prokaryotic and eukaryotic organisms. Students will be evaluated by laboratory observation and laboratory exams.

19. make a wet-mount of selected biological material and properly use the microscope to view the material. Students will be evaluated by laboratory observation and laboratory exams.

20. understand the importance of recording laboratory data in the form of a notebook or a laboratory report. Student notebooks or laboratory reports will be evaluated by their instructors as part of their final grade.

21. construct two different types of graphs (histogram and Cartesian), in various lab exercises, using a commercial graphing program. They review each graph for general trends that appear upon the analysis of the biological data. Students will be evaluated by lab examinations and/or lab reports.

22. work as a member of a laboratory group and learn how to collect data or information as part of this group. Students will be evaluated during the laboratory period and the participation will be recorded as a component of their final grade. The evaluation may be in the form of a laboratory presentation in addition to the class participation.

Student Assessment Tools:

The above student learning objectives will be generally assessed or evaluated by instructors using a variety of assessment instruments including lecture exams, laboratory exams, quizzes, laboratory reports, written reports, presentations, projects, etc. The decisions concerning the type or types and number of instruments that are used in a specific section of the course will be left to the instructor of that section. This information, when given by the instructor should be recorded by the student in the Student Assessment Section of this document.

Course Content

Lecture Topics:

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<td>Part I</td>
<td>The Molecular Basis of Life</td>
<td>(M): p. 1</td>
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<tr>
<td>1</td>
<td>The Science of Biology</td>
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<td>The Diversity of Life is Overwhelming</td>
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<td>Biology is the Science of Life</td>
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<td>Science is Based on Both Observation and Reason</td>
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<td>The Study of Evolution is a Good Example of Scientific Inquiry</td>
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<td>A Few Important Ideas form the Core of Biology</td>
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</table>
The Nature of Molecules and the Properties of water
All Matter is Composed of Atoms
The Elements in Living Systems Have Low Atomic Masses
Molecules are Collections of Atoms held together by Chemical Bonds
The Properties of Water Result from Its Polar Nature
Water Molecules Can Dissociate into Ions

The Chemical Building Blocks of Life
Carbon Provides the Framework of Biological Molecules
Carbohydrates Form both Structural and Energy-Storing Molecules
Proteins are the Tools of the Cell
Nucleic Acids Store and Express Genetic Information
Hydrophobic Lipids Form Fats and Membranes

Cell Structure
All Living Organisms are Composed of Cells
Prokaryotic Cells lack Interior Organization
Eukaryotic Cells are Highly Compartmentalized
Membranes Organize the Cell Interior Functional Compartments
Mitochondria and Chloroplasts are Energy Processing Organelles
An Internal Skeleton Supports the Shape of Cells
Extracellular Structures Protect Cells
Cell to Cell Connections Determine How Adjacent Cells Interact

Membranes
Membranes are Phospholipid Bilayers with Embedded Proteins
Phospholipids Provide a Membrane’s Structural Foundation
Membrane Proteins Enable a Broad Range of Interactions with the Environment
Passive Transport moves Molecules across Membranes by Diffusion
Active Transport Across Membranes Requires Energy
Bulky Materials Cross Membranes within Vesicles

Energy and Metabolism
Energy Flows through Living Systems
The Laws of Thermodynamics Govern All Energy Changes
ATP is the Energy Currency of Cells
Enzymes Speed Chemical Reactions by Lowering Activation Energy
Metabolism is the Sum of a Cell’s Chemical Activities

How Cells Harvest Energy
Cells Harvest Energy from Organic Compounds by Oxidation
Glycolysis Splits Glucose and Yields a Small Amount of ATP
The Krebs Cycle is the Oxidative Core of Cellular Respiration
Electrons Harvested by Oxidation Pass along an Electron Transport Chain
The Total Energy Yield Energy Yield of Aerobic Respiration far Exceeds that of Glycolysis
Aerobic Respiration is Regulated by Feedback Inhibition
Some forms of Energy Metabolism Do Not require O₂
Carbohydrates are not the only Energy Source Used by Heterotrophs

8 Photosynthesis
Photosynthesis Uses Sunlight to Power the Synthesis of Organic Molecules
Experiments Revealed that Photosynthesis is a Chemical Process
Pigments Capture Energy from Sunlight
Photosynthetic Pigments are Organized into Photosystems
Energy from Sunlight is used to Produce a Proton Gradient
Using ATP and NADPH from the Light Reactions, CO₂ is incorporated into
Organic Molecules
Photorespiration Short-Circuits Photosynthesis

10 How Cells Divide
Bacterial Cell Division is Clonal
Eukaryotes have Large Linear Chromosomes
The Eukaryotic Cell Cycle is Complex and Highly Organized
During Interphase, Cells Grow and Prepare for Mitosis
In Mitosis, Chromosome Segregate
Events of the Cell Cycle are Carefully Regulated
Cancer is a Failure of Cell-Cycle Control

11 Sexual Reproduction and Meiosis
Sexual Reproduction Requires Meiosis
Meiosis features Two Divisions with One Round of DNA Replication
The Process of Meiosis Involves Intimate Interactions Between Homologues
Meiosis has Four Distinct Features
Genetic Variation is the Evolutionary Consequence of Sex

12 Patterns of Inheritance
Experiments Carried Out by Mendel Explain Heredity
Mendel's Principle of Segregation Accounts for 3:1 Phenotypic Ratios
Mendel's Principle of Independent Assortment Asserts that Genes Segregate
Independently
Probability Allows us to Predict the Results of Crosses
Genotype Dictates Phenotype by Specifying Protein Sequences
Extending Mendel's Model Provides a Clearer View of Genetics in Action

14 DNA: The Genetic Material
DNA is the Genetic Material
The DNA Molecule is a Double Helix
Both Strands are copied during DNA Replication
Prokaryotes Organize the Enzymes used to Duplicate DNA
Eukaryotic Chromosomes are Large and Linear
Cells Repair Damaged DNA
15  Genes and How They Work  
Experiments Have Revealed the Nature of Genes  
The Genetic Code Relates Information in DNA and Protein  
Prokaryotes Exhibit all the Basic Features of Transcription  
Eukaryotes use Three Polymerases, and Extensively Modify Transcripts  
Eukaryotic Genes May Contain Noncoding Sequences  
The Ribosome is the Machine of Protein Synthesis  
The Process of Translation is Complex and Energy Expensive  
Mutations are Alterations in the Sequence, Number, or Position of Genes

16  Control of Gene Expression (Overview)

17  Biotechnology (Optional)  
(M): p. 358

18  Genomics (Optional)  
(M): p. 383

22  Systematics and Phylogeny  
Systematics Reconstructs Evolutionary Relationships  
Cladistics Focuses on Traits Derived from a Common ancestor  
Classification is a Labeling Process, Not an Evolutionary Reconstruction  
Taxonomy attempts to Classify Organisms in an Evolutionary Context  
The Largest Taxa are Domains

23  Prokaryotes and Viruses  
Prokaryotes are the Most Ancient Organisms  
Prokaryotes Have an Organized but Simple Structure  
The Genetics of Prokaryotes Focuses on DNA Transfer  
Prokaryotic Metabolism is Quite Diverse  
Bacteria Cause Important Human Diseases  
Viruses are not Organisms  
Bacterial Viruses Infect by DNA Injection  
Animal Viruses Infect by Endocytosis

24  Protists  
Protists, the First Eukaryotes, Arose by Endosymbiosis  
Overview of Protists  
The General Biology and Ecology of the Protists

25  Fungi  
Fungi Have Unique Reproductive and Nutritional Strategies  
Fungi have an Enormous Ecological Impact  
Fungi are Important Plant and Animal Pathogens  
Fungi are Taxonomically Diverse  
The General Biology and Ecology of the Fungi

(M): p. 548
## Laboratory Schedule:

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<td>Scientific Measurement (2)</td>
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<td>Read: Unit Expression Factors</td>
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<td>Read: Rules for Identifying Significant Figures</td>
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<td>Carbohydrates, Proteins, Lipids, and Nucleic Acids</td>
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<td>Protists, Plant Cells, and Animal Cells</td>
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<td>Diffusion through a Simulated Semi-permeable Membrane (7)</td>
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<td>The Effects of Organic Substances on Cell Membranes (10)</td>
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8. **Energy Generating Pathways** (ELB)
   - Mitochondrion and Chloroplast Structure (11) p. 79
   - Oxygen Uptake during Aerobic Respiration (13) p. 95
   - Fermentation (14) p. 103

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9. **Photosynthesis** (ELB)
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   - A Qualitative Absorption Spectrum of Chlorophyll (16) p. 111
   - Carbon Dioxide Incorporation during Photosynthesis (17) p. 115

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**Mitotic Cell Division in Plants and Animals** (18) (ELB): p. 119
   - The Onion Root Tip
   - Plant Cell Division
   - Animal Cell Division

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   - The Flower
   - Meiotic Cell Division

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12. **Viruses and Bacteria** (ELB)
   - Viruses (20) p. 131
   - Oil Immersion Microscopy (22) p. 141
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   - Introduction to the Algae
   - Euglenophyta, Dinophyta, Rhodophyta, Bacillariophyta, Chlorophyta, and Phaeophyta

Questions WE

   - Introduction to the Protozoa
   - Rhizopoda, Granuloreticulosida (Forams)
   - Actinopoda, Kinetoplastida, Apicomplexa, Ciliophora, Myxomycota, Zoomastigota, and Archeoprotista

Questions WE
Student Assessment: Lecture Examinations _______________ _____% 
Laboratory Component _______________ _____% 
Student Project/Report _______________ _____% 
Class Participation _______________ _____% 
Other _______________ _____% 
Total 100%

If you have a medical condition or develop a medical condition during this semester, which prevents you from fulfilling the requirements of this course, you must notify your physician. You and your physician must decide whether or not it is appropriate for you to remain in this course. If the decision is to remain in this course, please obtain a letter from your physician indicating that your continued participation in this course is appropriate and present it to the Department Chair.

Faculty Addenda: As per individual faculty member

Lecture Attendance: As per instructor;

Lab Attendance: As per instructor;

Policy Concerning Late Assignments: As per instructor;

Policy Concerning Make-Up Testing: As per instructor;

Safety Information: As per instructor and assigned exercise.
College Policies:
These policies can be found in the Bergen Community College Smart Catalog.

Student Responsibility
Students will be held responsible for reading all pertinent information in college publications regarding withdrawals, course drops, college deadlines, and tuition refunds. Students are responsible for compliance with the rules and regulations as stated in college publications.

Absence of Instructor
Students are expected to wait twenty minutes for a faculty member to come to class. If at the end of twenty minutes, the faculty member does not come, the students should sign an attendance sheet, which indicates the course, date, and time. A student should deliver the attendance sheet to the divisional office (A304) if between 9:00 a.m. and 5:00 p.m. or to the Evening Office (C107) if before 9:00 a.m. or after 5:00 p.m. Students cannot be penalized by faculty for not waiting longer than twenty minutes.

Academic Dishonesty and Plagiarism
Bergen Community College is committed to academic integrity – the honest, fair and continuing pursuit of knowledge, free from fraud or deception. Students are responsible for their own work. Faculty and academic support services staff will take appropriate measures to discourage academic dishonesty. Plagiarism is a form of academic dishonesty and may be a violation of U.S. Copyright laws. Plagiarism is defined as the act of taking someone else’s words, opinions, or ideas and claiming them as one’s own.

Consequences of Violations Academic Integrity

A. Instructor’s Sanctions for a Violation
The faculty member will determine the course of action to be followed. This may include:
• Assigning a failing grade on the assignment;
• Assigning a lower final course grade;
• Failing the student in the course
• Other penalties appropriate to the violation;
In all cases, the instructor shall notify the Vice President of Student Services of the violation and the penalty imposed. The student has the right to appeal the decision of the instructor to the appropriate department head.

B. Institutional Sanctions for Violations
When a violation of academic integrity has been reported regarding a student, the Vice President of Student Services may impose disciplinary penalties beyond those imposed by the course instructor, which may include suspension or dismissal from the College. The student shall have the right to a hearing before the Vice President of Student Services or a designated judicial affairs committee. Judicial procedures governing violations of academic integrity are contained in the student handbook.

Class Attendance
All students are expected to attend punctually every scheduled meeting of each course in which they are registered. Attendance and lateness policies and sanctions are to be determined by the instructor for each section of each course. These will be established in writing on the individual course outline. Attendance will be kept by the instructor for administrative and counseling purposes.

Eating and Drinking
Eating or drinking in classrooms, lecture rooms, laboratories, gymnasium, swimming pool, or passageways is forbidden. Covered beverages only are permitted in the library. Eating and drinking are permitted in cafeteria and vending areas only.
**Learning Assistance**  
**Henry and Edith Cerullo Learning Assistance Center**  
The Tutoring Center, English Language Resource Center, Math Walk-In Center and Writing Center are collectively known as the Henry and Edith Cerullo Learning Assistance Center. The Cerullo Learning Assistance Center is located in the Pitkin Education Building, in Room L-125. The telephone number is (201) 447-7489. The Learning Assistance Center, staffed with peer and professional tutors, offers free individual and group tutoring, supplemental instruction, and online tutoring for subjects offered at the College. The Center provides alternative approaches to problem solving and organizational skills. Tutors help clarify classroom lectures and textbooks and help students prepare for exams. These services build student self-confidence and reduce fear of failure. The Center is equipped with the latest technology and software, including tapes, books, review sheets, exercises and software.

**Services for Students with Disabilities**  
The Office of Specialized Services/Deaf Services, located in L-115 in the Pitkin Education Center provides accommodations and auxiliary services to students with disabilities attending Bergen Community College. Students are encouraged to submit documentation to OSS during the early stages of the admission process. The suggested deadlines for submitting documentation are as follows: August 1st for fall semesters, December 1st for spring semesters. For more information please contact our office at 201-612-5270 or at www.bergen.edu/oss.

**Sidney Silverman Library**  
Main Building, Pitkin Education Center, L-wing, 2nd Floor.  
Paramus Library Hours: (201) 447-7131 or visit http://www.bergen.edu/library/calendar/gcal.htm  
Paramus Service Desk: (201) 447-7970  
Meadowlands Location: 1280 Wall Street, Lyndhurst 2nd Floor  
Meadowlands Library Hours: http://www.bergen.edu/library/calendar/gcal.htm  
Meadowlands Service Desk: (201) 301-9692  
www.bergen.edu/library

**Testing Services**  
The Bergen Community College Office of Testing Services (OTS) is located in Room S-127. OTS serves the college community by identifying, developing, procuring, administering, processing, and/or evaluating examinations, which meet a variety of administrative and instructional needs. To contact the OTS, please call (201) 447-7203. The Office of Testing Services administers makeup tests as a service for students who, for compelling and exceptional reasons, have missed a scheduled classroom examination. Students must receive prior permission from and make arrangements with their course instructors to take these examinations, under specific conditions, in the Office of Testing Services, Room S-127.

**WebAdvisor**  
WebAdvisor is a web interface that allows students to access information contained in Datatel's Colleague, the administrative database used by Bergen Community College. Students may use WebAdvisor to register for classes, to pay tuition and fees, to view their class schedules, to check grades, to check on progress toward degree requirements, etc. WebAdvisor accounts are available for all students enrolled in credit programs. New students are strongly encouraged to attend an in-person registration or advisement session before using a WebAdvisor account. Eligible students without WebAdvisor user names and passwords may access their WebAdvisor account by going to go.bergen.edu and selecting "I'm new to WebAdvisor." Then, follow the on-screen directions. Check the WebAdvisor FAQ for answers to common questions, such as how to reset your password. Students must have a valid e-mail address on file with the College to use WebAdvisor.