

GENERAL BIOLOGY I

Course Outline for Biology 1101

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Textbook: [BIOLOGY](#) by OpenStax, ISBN-13: 978-1-947172-51-7 or <https://openlab.citytech.cuny.edu/openstax-bio/course-outline/>

Laboratory Manual: <https://openlab.citytech.cuny.edu/bio-oer/>

Course Description: The fundamental principles of biology focus on topics including taxonomy, structure, nutrition, reproduction, heredity, development and evolution. The concepts of molecular biology and DNA fingerprinting using representative plants and animals are introduced. The course also includes the use and care of the microscope.

Lecture Schedule

| WEEK | LECTURES | TOPIC |
|------|----------|--|
| I | 1. | BASICS Introduction to the Course Definition, Characteristics and Hierarchy of Life Scope of Ecology: habitat, Population, Community, Ecosystem The Scientific Method Evolution and Classification Systematics, taxonomy, phylogeny |
| | 2. | THE ORIGIN & EVOLUTION OF LIFE Darwin & Evolution The Origin of Life The Geological Time Scale Cellular History Kingdoms and Domains |
| II | 3. | INORGANIC CHEMISTRY I Definition, Classification and Properties of Matter Atomic Structure The periodic Table Isotopes Electrons and Energy Energy Chemical Reactions: Exergonic and endergonic Activation Energy Oxidation and Reduction |

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4. [INORGANIC CHEMISTRY II](#)
Elements, Compounds, Molecules and Mixtures
Bonds: Weak and Strong
- III 5. [WATER & pH](#)
Importance and Properties of H₂O
Acids, Bases, pH, Buffers
6. [ORGANIC CHEMISTRY](#)
Importance of Carbon
Organic vs. Inorganic Compounds
The Hydrocarbons
Functional Groups
Isomers
- IV 7. **Examination I** (Lectures 1-6 inclusive)
8. [MACROMOLECULES I](#)
Monomers and Polymers
Dehydration Synthesis and Hydrolysis
Carbohydrates
Lipids
- V 9. [MACROMOLECULES II](#)
Proteins
Nucleic Acids
ATP
Enzymes and Metabolic Pathways
10. [CELLS](#)
The Cell Theory
Methods of Studying Cells
Cellular Size Limitations
Cell Composition
Prokaryotic and Eukaryotic Cells
Cellular Evolution
Anaerobic and Aerobic Cells; Endosymbiosis; Multicellularity; Viruses, Bacteria and Archaea
- VI 11. [THE EUKARYOTIC CELL](#)
Eukaryotic Cell Structure and Function

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12. [MEMBRANES & TRANSPORT](#)
Membrane Structure and Function
Passive Transport Processes
Active Transport Processes
Cell Surface Modifications
- VII 13. **Examination II** (Lectures 8-12 inclusive)
14. [ENERGY](#)
Cells and the Flow of Energy
Metabolic Reactions and Energy Transformations
Metabolic Pathways
Oxidation and Reduction
- VIII 15. [CELLULAR RESPIRATION I](#)
Cellular Respiration (Anaerobic)
Outside the Mitochondria: Glycolysis
Fermentation
16. [CELLULAR RESPIRATION II](#)
Cellular Respiration (Aerobic)
Inside the Mitochondria:
 The Preparatory Reaction (Hub)
 Citric Acid Cycle (TCA)
 Electron Transport Chain (ETC)
Metabolic Pool
- IX 17. [PHOTOSYNTHESIS I](#)
Photosynthetic Organisms
The Process of Photosynthesis
Plant as Solar Energy Converters: Light Reactions
18. [PHOTOSYNTHESIS II](#)
Dark Reactions: Calvin Cycle Reactions (Carbon Fixation)
Other Types of Photosynthesis
- X 19. [ASEXUAL REPRODUCTION](#)
The Cell Cycle and Its Control
Mitosis and Cytokinesis
The Cell Cycle and Cancer
Prokaryotic Cell Division

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20. [SEXUAL REPRODUCTION](#)
Halving the Chromosome Number
Genetic Variation
The Phases of Meiosis
Comparison of Meiosis and Mitosis
The Human Life Cycle (Spermatogenesis & Oogenesis)
- XI 21. [CHROMOSOMES](#)
Changes in Chromosome Number and Structure
22. **Examination III** (Lectures 14-21 inclusive)
- XII 23. [GENETICS I](#)
Gregor Mendel
Mendel's Law
Human Genetics Disorders
24. [GENETICS II](#)
Extending the Range of Mendelian Genetics
Multiple Allelic Traits
Incomplete Dominance
Pleiotropy
Polygenic Inheritance
X-Linked Inheritance
Environmental Influences
- XIII 25. [DNA](#)
The Genetic Material
DNA Structure
DNA Replication
Prokaryotic versus Eukaryotic Replication
26. [GENE FUNCTION](#)
The Genetic Code
Transcription
Translation
Structure of the Eukaryotic Chromosome

- XIV 27. [GENETIC REGULATION](#)
Prokaryotic
Eukaryotic
Regulation Through Mutations
28. [BIOTECHNOLOGY & GENOMICS](#)
DNA Cloning
Biotechnology Products
Gene Therapy
Genomics
- XV 29. [ANIMAL DEVELOPMENT](#)
Early Developmental Stages
Developmental Processes
Human Embryonic and Fetal Development
30. **Examination IV** (Lectures 23-29 inclusive)

LABORATORY SCHEDULE

| WEEK | EXERCISE |
|-------------|--|
| I | The Microscope : Basic skills <ul style="list-style-type: none">• Scientific Method• Reporting in Science |
| II | Chromatography <ul style="list-style-type: none">• Measurements in Science: Metric System• Quantitative Skills |
| III | Chemistry of Water <ul style="list-style-type: none">• Atoms• Water• pH: Acids, Bases and Buffers (activity) |
| IV | Biologically Important Molecules I: Carbohydrates & Lipids <ul style="list-style-type: none">• Basic Organic Chemistry• Carbohydrates Activity |
| V | Biologically Important Molecules II: Proteins & Nucleic Acids <ul style="list-style-type: none">• Protein Activity• Purification of DNA, Dische's Test• Review (concept map) |
| VI | Quantitative Determination of Proteins <ul style="list-style-type: none">• Beer's Law (virtual)• Protein Assay (SpectroVis) |
| VII | Membranes and Biological Transport: Diffusion and Osmosis <ul style="list-style-type: none">• Size• Gummy• Cell Models• Dialysis |
| VIII | Enzymes and Energy <ul style="list-style-type: none">• Enzyme Kinetics activity |
| IX | Cellular Energy <ul style="list-style-type: none">• Anaerobic and Aerobic• Review (concept) |
| X | Photosynthesis <ul style="list-style-type: none">• Pigments• Absorbance Spectra• Light in Carbohydrate Synthesis• Review (concept) |
| XI | Cell Division <ul style="list-style-type: none">• Mitosis: Estimating time of phases<ul style="list-style-type: none">◦ Chromosome Modeling• Meiosis: Reduction Division and Gametogenesis• Comparing Cell Division• Chromosomes and Karyotypes |

- XII [Genetics](#)
- [Single Factor Crosses](#)
 - [Genetics of Taste Activity](#)
 - [Two Factor Crosses](#)
 - [Co-dominance and Multiple Alleles](#)
- XIII Principles of Gel Electrophoresis
- [Analyzing DNA](#)
 - [Restriction Enzymes](#)
- XIV DNA Fingerprinting
- [RFLP Analysis](#)
 - [PCR Technology](#)
 - [Forensics](#)
- XV **Genetics II**
More Genetics Problems
- [Sex-Linked Genes](#)
 - [Chi-Square analysis and Corn Genetics](#)
- Quiz

Course-Based Learning Outcomes and Alignment with General Education Goals

Upon satisfactory completion of this course, the student will be able to:

| BIO1101 | NYCCT Gen Ed Common Core | CUNY Common Core |
|--|---|---|
| 1. Comprehend the principles of biology | <ul style="list-style-type: none"> Use the arts, <u>sciences</u> and humanities as a forum for the study of values, ethical principles, and the physical world. Engage in an in-depth, focused, and sustained program of study | Identify and apply the fundamental concepts and methods of a life or physical science. |
| 2. Appreciate the relationship of the other sciences to biology | Understand and appreciate the range of academic disciplines and their relationship to the fields of professional and applied study | |
| 3. Understand the scientific method, its history and importance to society | Employ scientific reasoning and logical thinking. | Apply the scientific method to explore natural phenomena, including hypothesis development, observation, experimentation, measurement, data analysis, and data presentation |
| 4. Acquire skills in the use of biological equipment and techniques | Acquire and use the tools needed for communication, inquiry, analysis, and productive work. | Use the tools of a scientific discipline to carry out collaborative laboratory investigations. |
| 5. Develop expertise in the written and oral expression of biological ideas | <ul style="list-style-type: none"> Acquire and use the tools needed for communication, inquiry, analysis, and productive work. Communicate in diverse settings and groups, using written (both reading and writing), oral (both speaking and listening), and visual means, and more than one language. | Gather, analyze, and interpret data and present it in an effective written laboratory or fieldwork report |
| 6. Gain skill in the collection of data and in its mathematical treatment and interpretation | <ul style="list-style-type: none"> Derive meaning from experience, as well as gather information from observation. Understand and employ both quantitative and qualitative analysis to describe and solve problems, both independently and cooperatively. Gather, interpret, evaluate, and apply information discerningly from a variety of sources. | <ul style="list-style-type: none"> Gather, analyze, and interpret data and present it in an effective written laboratory or fieldwork report Identify and apply research ethics and unbiased assessment in gathering and reporting scientific data. |
| 7. Acquire the knowledge needed for a thorough understanding of the major bioethical issues in society | <ul style="list-style-type: none"> Use the arts, <u>sciences</u> and humanities as a forum for the study of values, ethical principles, and the physical world. Understand and apply values, ethics, and diverse perspectives in personal, professional, civic, and cultural/global domains | |

BIOLOGY I (BY 1101) COURSE INFORMATION

MATERIALS

In addition to the lecture text and the lab manual, you will need a separate notebook for lecture and lab. For the lab, you will also need pencils, a pen, and a lab coat. These supplies can all be obtained from the bookstore.

ATTENDANCE AND LATENESS

You must attend both lecture and lab. Absences in excess of 10% of the total lecture or lab hours will result in a 10% drop from your grade due to an inability to meet deliverables of participation. This is in addition to other penalties that will be imposed for failure to complete academic requirements. No more than 3 lecture or 2 lab absences will be tolerated. It is expected that you will be in your seat and ready to work at the start of each period. Any 2 latenesses will be considered to be equal to 1 absence.

GRADING POLICY

Your grade for the course is computed by adding **50%** of your lecture average to **50%** of your lab average. A student must pass **BOTH** lab and lecture in order to pass. **A failure in either component will result in a final grade of F for the course.** There are 4 lecture examinations which each cover one quarter of the lecture work as indicated in the outline; these are announced at least one week in advance by your instructor. 60% of your lab grade is derived from your quiz average (**at least 5 quizzes**). **10%** of the grade will be derived from at least **one full scientific lab report**. The remaining 30% of your lab average is based on the

| <u>Letter Grade</u> | <u>Numerical Ranges</u> |
|---------------------|-------------------------|
| A | 93-100 |
| A- | 90-92.9 |
| B+ | 87-89.9 |
| B | 83-86.9 |
| B- | 80-82.9 |
| C+ | 77-79.9 |
| C | 70-76.9 |
| D | 60-69.9 |
| F | 59.9 and below |

quality and completeness of your lab work as indicated in the Attendance policy. **ALL GRADES ARE COUNTED; NONE ARE DROPPED NOR ARE THEY CURVED. NO MAKE-UPS ARE GIVEN EXCEPT AT THE DISCRETION OF THE INSTRUCTOR PENDING SUBMISSION OF WRITTEN PROOF OF REASON FOR ABSENCE.** All medical documentation must be submitted by the student to Student Accessibility Center (SAC) in L237 (on the second floor where the Library & General Buildings meet). SAC will review the documentation and provide a letter for the student to share with the instructor if accommodations are warranted.

WORKLOAD

Considerable effort must be expended in order to satisfactorily complete the course. It is expected that you will spend at least 3 hours per week in preparation for each credit hour of course work; this is a total of 12 hours. If you are not able to devote the requisite amount of time to your studies then you should seriously reconsider your decision to take the course at this time.

ACCESSIBILITY

City Tech is committed to supporting the educational goals of enrolled students with disabilities in the areas of enrollment, academic advisement, tutoring, assistive technologies and testing accommodations. If you have or think you may have a disability, you may be eligible for reasonable accommodations or academic adjustments as provided under applicable federal, state and city laws. You may also request services for temporary conditions or medical issues under certain circumstances. If you have questions about your eligibility or would like to seek accommodations or academic adjustments, please contact the Center for Student Accessibility @ 300 Jay Street L-237. 718-260-5143.

SUGGESTIONS

- Read the chapters **BEFORE** class
 - reading ahead makes you aware of the words so the instructor can clarify
- Take notes **ACTIVELY** in class
 - don't rely on flipping through the slides the night before the exam
 - your notes will not be organized on first pass so re-write them with the aid of the textbook
- Be **AWARE** of announcements
 - ensure you check Blackboard regularly
 - ensure you utilize you **school email** for additional announcements
 - faculty make announcements and can only push to official school email
- **KNOW** your lecture instructor and lab instructor
 - your instructors will provide you with email contact information as well as office hours
 - If you encounter any serious difficulties during the semester, it is suggested that you make an appointment with an instructor to discuss them.
- **KNOW** your classmates
 - form study groups and ensure you can receive missing work from others
- Be **RESPONSIBLE**
 - contact your instructor if you are going to miss class or an exam
- Be **PROFESSIONAL**
 - You are in an institute of higher learning, so address your instructor as Professor and be respectful
 - Learn to communicate by email in a professional manner.
 - Follow the guidelines for [email contact here](#)

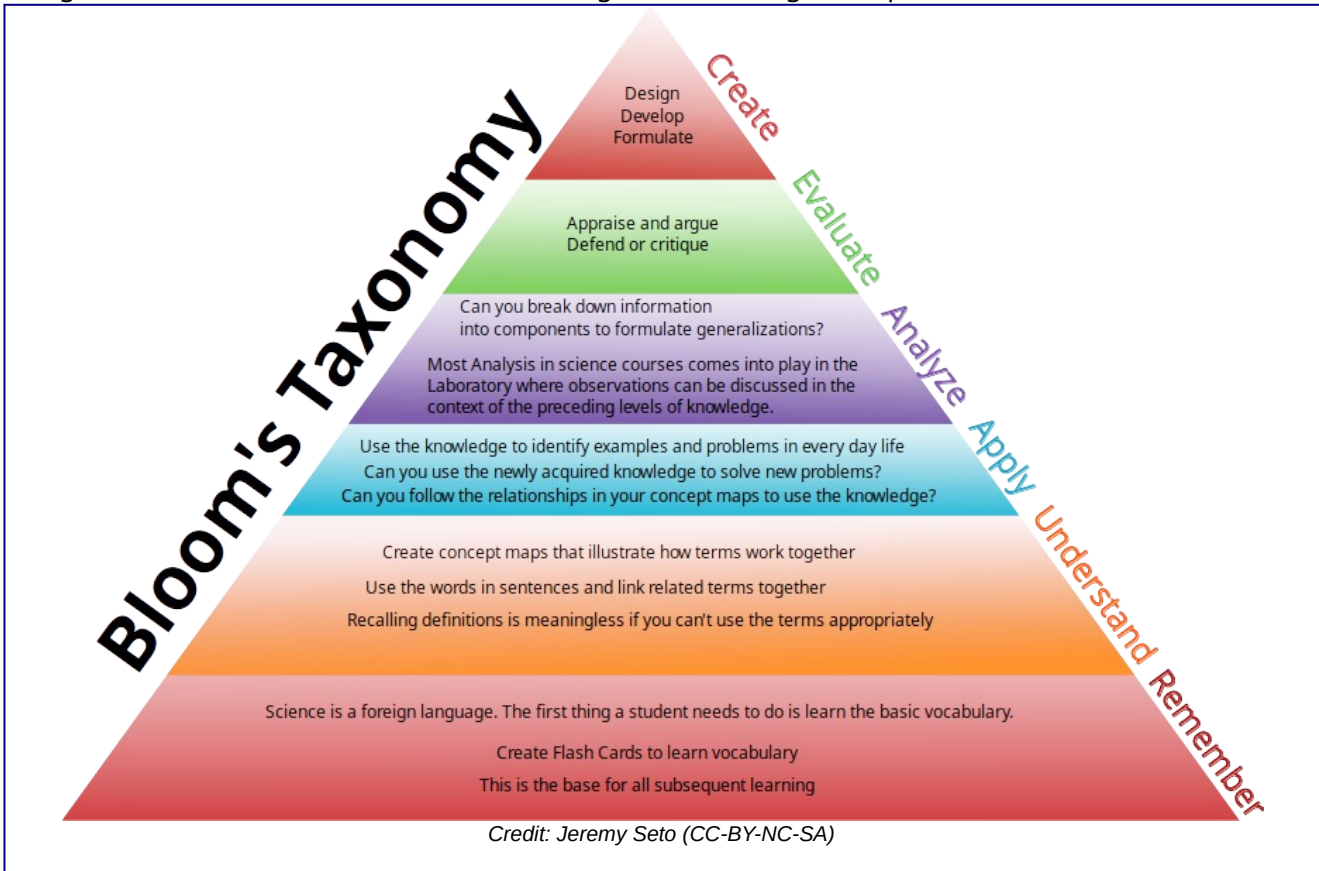
You are responsible for all material, announcements, or assignments mentioned in class whether you are present or not. It is therefore advisable to write down the name of your instructor(s), the office, phone extension and office hours. It is also advised to get the names and phone numbers of several classmates who may be contacted in the event that you are absent. Check Blackboard for announcements, links and schedules from your instructor.

In order to optimize your performance, it is strongly advised that you read your lecture and lab assignments prior to coming to class. At the end of each chapter in the text and in the lab manual [review questions](#) are available for you to test yourself. A [Student Study Guide](#) may be purchased along with your text book. Tutorial help in the Resource Center is usually available if additional assistance is needed.

You may use the online reading guide with supplemental material at <https://openlab.citytech.cuny.edu/openstax-bio/>

STRATEGIES FOR LEARNING

Being a successful learner means understanding how knowledge is acquired and utilized.



1. Remember

- Science is a foreign language. The first thing a student needs to do is learn the basic vocabulary.
- Create Flash Cards to learn vocabulary
- This is the base for all subsequent learning

2. Understand

- Recalling definitions is meaningless if you can't use the terms appropriately
- Use the words in sentences and link related terms together
- Create concept maps that illustrate how terms work together
 - Use the [following tutorial](#) to learn how to do this

3. Apply

- Can you use the newly acquired knowledge to solve new problems?
- Can you follow the relationships in your concept maps to use the knowledge?
- Use the knowledge to identify examples and problems in every day life

4. Analyze

- Can you break down information into components to formulate generalizations?
 - Analysis of elements
 - Analysis of relationships
 - Analysis of organization
- Most Analysis in this course comes into play in the Laboratory where observations can be discussed in the context of the preceding levels of knowledge.

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|---|---|
| <p>TEXTBOOK Biology (available in as PDF, online viewing, hardcopy, read-aloud)</p> <ul style="list-style-type: none"> • Publisher: OpenStax College; 1st edition (January 1, 2013) • ISBN-10: 1938168097 • ISBN-13: 978-1938168093 | <p>Lab Manual https://openlab.citytech.cuny.edu/bio-oer</p> |
| <p>Laboratory Instructor_____</p> <p>Office Hours_____</p> <p>Phone_____</p> <p>Email_____</p> | <p>Lecture Instructor_____</p> <p>Office Hours_____</p> <p>Phone_____</p> <p>Email_____</p> |
| <p>Course Coordinator(s)_____</p> <p>Email(s)_____</p> | |
| <p>Classmate Name and Contact Information</p> | |
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