

JAMESTOWN COMMUNITY COLLEGE
State University of New York

INSTITUTIONAL COURSE SYLLABUS

Course Title: Biology: A Molecular Approach

Course Abbreviation and Number: BIO 1575

Credit Hours: 4

Course Type: Lecture/Lab

Course Description: Students will understand how science is actually performed, with a special emphasis on the interdisciplinary nature of science. Basic principles of biology will be taught in context of fundamental principles of chemistry and physics to broaden understanding of the natural world. Students will perform research projects that focus on gene expressions/cell biology and ecosystems to reinforce these basic principles. Additionally, through their authentic applications of scientific method, students will learn basic skills like laboratory relevant math, reagent preparation, lab notebook keeping skills, pipetting and micropipeting skills, etc. This course is intended for biotechnology majors or those with interest in pursuing a career in fields related to genetics, molecular biology or cellular biology (including medicine).

Prerequisite/Corequisite: ENG 1510 and CHE 1500 (or higher) - unless high school chemistry was passed; Eligibility: college level math.

Student Learning Outcomes:

Students who demonstrate understanding can:

1. Identify and apply principles of population, community, and ecosystem ecology and biodiversity, and integrate these principles into general understanding of the unity and diversity of life
 2. Use controls properly within the context of the scientific method.
 3. Name the 4 complex biomolecules: their subunits, the bonds forming them, and the components of their subunits.
 4. Explain and use the structure of DNA, including the antiparallel nature, and the role of the nucleosome.
 5. Describe the role of enzymes in biological systems using the following terms: products, reactants, optimal temperature, optimal pH, active site, and induced fit.
 6. Explain that sister chromatids are identical if replication happens without mutations, and that each are highly compressed theoretically identical helices.
 7. Explain and use the Central Paradigm.
 8. Explain the differences between prokaryotic and eukaryotic organisms.
 9. Explain how cells generate energy in aerobic and anaerobic conditions.
 10. Explain the role of signal transduction
 11. Explain the differences between passive vs. active transport.
 12. Solve Mendelian Genetics problems, including monohybrid crosses, dihybrid crosses, and sex-linked traits.
 13. Explain how photosynthesis captures free energy from the ecosystem and stores this energy in bonds.
 14. Solve problems and use basic laboratory math skills and chemistry to make reagents in a laboratory setting including the concept of moles and molar solutions, percent solutions and dilutions.
 15. Exhibit professional lab skills, including good professional behavior and teamwork, proper lab safety skills, keeping a proper lab book, forming a testable hypothesis, designing and conducting a properly controlled experiment without wasting time and reagents, interpreting data from sound scientific principles, using a computer in a scientific setting, generating meaningful representations of data generated, effective use of online databases like Pubmed and presenting scientific data in a meaningful way, etc. [SUNY Gen Ed – Natural Sciences.]
 16. Demonstrate critical reasoning.
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Topics Covered:

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| • Scientific Method | • Atoms, molecules, bonds and moles |
| • Positive and negative Controls | • Structure Function Relationships of Biomolecules |
| • Basic Ideas central to biology | • Hemoglobin |
| • Basic ideas of Ecosystems | • Sickle Cell Anemia |
| • Basic taxonomy | • Atoms, molecules, bonds and moles |
| • Mosquitoes, <i>Dirofilaria immitis</i> , <i>Wolbachia pipientis</i> and WO phage | • How do atoms store energy |

- Structure Function Relationships of Biomolecules
- What's an enzyme and how do they work?
- How do cells replicate DNA?
- What is Taq DNA polymerase?
- The Polymerase Chain Reaction (PCR)
- What is the difference between eukaryotic and prokaryotic cells?
- Cells are protein synthesis machines
- Eukaryotic cell structures and organelles
- How are denatured proteins and other depleted structures destroyed in cells?
- Cellular Transport Mechanisms
- What are membrane and cytoplasmic receptors?
- What is signal transduction?
- How does cellular communication relate to changes in gene expression?
- How do cells form tissues?
- What is the Extracellular Matrix?
- Cellular Respiration and Glucose Metabolism
- Anaerobic and Aerobic Respiration to make ATP
- Photosynthesis
- Asexual and sexual reproduction
- Mitosis
- What is Cancer?
- Mechanisms of Reproduction and Meiosis
- Genetics
- Transmission of dominant and recessive traits
- Monohybrid and Dihybrid Crosses
- Transmission of sex-linked traits
- Pedigree Analysis

Information for Students

- Expectations of Students
 - [Civility Statement](#)
 - [Student Responsibility Statement](#)
 - [Academic Integrity Statement](#)
- [Accessibility Services](#)
Students who require accommodations to complete the requirements and expectations of this course because of a disability must make their accommodation requests to the Accessibility Services Coordinator.
- [Get Help: JCC & Community Resources](#)
- [Emergency Closing Procedures](#)
- Course grade is determined by the instructor based on a combination of factors, including but not limited to, homework, quizzes, exams, projects, and participation. Final course grade can be translated into a grade point value according to the following:

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|-------|--------|-----|--------|-----|--------|-----|-----|
| A=4.0 | B+=3.5 | B=3 | C+=2.5 | C=2 | D+=1.5 | D=1 | F=0 |
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- Veterans and active duty military personnel with special circumstances (e.g., upcoming deployments, drill requirements, VA appointments) are welcome and encouraged to communicate these to the instructor.

Effective Date: Fall 2023