



## MASTER COURSE OUTLINE

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## COURSE TITLE

Majors Cell/Molecular

## GENERAL COURSE INFORMATION

Dept.: BIOL&

Course Num: 222

(Formerly: BIO 122)

CIP Code: 26.0101

Intent Code: 11

Program Code: N/A

Credits: 5

Total Contact Hrs Per Qtr.: 71.5

Lecture Hrs: 38.5

Lab Hrs: 33

Other Hrs: 0

Distribution Designation: Lab Science LS

## COURSE DESCRIPTION (as it will appear in the catalog)

The second quarter in a three-quarter general biology series, this series is designed for life-science majors, for pre-professional students, and for students intending to take advanced courses in the biological sciences. Topics of study include: cell chemistry and biological molecules, prokaryotic and eukaryotic cells, membrane transport, energetics and cell metabolism, cell communication, DNA replication, gene expression, and gene regulation, cell division, genetics, and developmental genetics. Related investigations take place in a three-hour lab period each week. NOTE: This majors' biology sequence may be taken in the following order: BIOL& 222, 223, and 221, with instructor's permission.

## PREREQUISITES

Successful completion of BIOL& 221 with a 2.0 or better and successful completion of either CHEM& 121 or CHEM& 161 with a 2.0 or better, or instructor permission.

## TEXTBOOK GUIDELINES

A recent edition of a majors' biology text such as *Biology* by Brooker, Widmaier, Graham, and Stilling, McGraw-Hill Higher Education. The text used must have departmental approval.

## COURSE LEARNING OUTCOMES

*Upon successful completion of the course, students should be able to demonstrate the following knowledge or skills:*

1. Apply the scientific method to hypothetical biological problems; design valid experiments.
2. Explain and evaluate how atoms combine into molecules; analyze the chemical nature of water and determine how water enables life; apply pH and buffer systems to life.
3. Describe and explain the structure, functions, and characteristics of molecules found in living organisms.
4. Compare and contrast the structures of prokaryotic and eukaryotic cells; state the structure and function of all eukaryotic cell structures and organelles.
5. Evaluate the structure of cell membranes, analyzing the placement and role of each component; predict and explain the mechanisms that move substances across membranes.
6. Explain energy use, transport, and production within cells, including free energy, the ATP/ADP cycle, and enzyme function.

7. Demonstrate knowledge of metabolism by explaining the step-by-step events of all parts of cellular respiration and identifying redox reactions, phosphorylations, and regulatory parameters; describe and evaluate anaerobic respiration, and fermentation.
8. Classify and explain the types of cellular receptors and their activation, signal transduction, and cellular response, applying these concepts within given examples.
9. Describe and evaluate external cell structures and cell junctions; identify and describe the different types of animal and plant tissues.
10. Demonstrate knowledge of the functioning of genetic material by explaining the detailed processes of DNA replication, protein synthesis, and gene regulation.
11. State the distinguishing events within the eukaryotic cell cycle and its regulation; categorize all events within both mitosis and meiosis and compare and contrast them.
12. Explain the principles of Mendelian genetics and complex patterns of inheritance; predict outcomes of genetic crosses.
13. Describe the genetic properties of viruses and bacteria; explain viral reproductive cycles and methods of bacterial gene transfer.
14. Discuss and explain developmental genetics including pattern formation, positional information, and morphogens, as well as the genes that affect development in animals and in plants (as time permits)
15. Apply content knowledge in lab exercises of microscopes, pH/buffers/macromolecules, cells/diffusion/osmosis, enzymes, cellular respiration, animal tissues, DNA /gel electrophoresis, mitosis/meiosis, crossing over/independent assortment/segregation.

### **INSTITUTIONAL OUTCOMES**

IO3 Human Relations/Workplace Skills: Students will be able to demonstrate teamwork, ethics, appropriate safety awareness and/or workplace specific skills.

### **COURSE CONTENT OUTLINE**

1. Chemistry  
Chemical Bonding, Water, pH, and Buffers  
Formation, Structure, and Function of Carbohydrates, Lipids, Proteins, and Nucleic Acids
2. Cells  
General Features of Prokaryotic and Eukaryotic Cells  
Membrane Structure, Synthesis and Transport  
Energy, Enzymes, and Metabolism  
Cellular Respiration and Fermentation  
Cell Communication  
Multicellularity
3. Genetics  
Nucleic Acid Structure, DNA Replication, and Chromosome Structure  
Gene Expression at the Molecular Level  
Gene Regulation  
Mutation, DNA Repair, and Cancer  
The Eukaryotic Cell Cycle, Mitosis, and Meiosis  
Simple Patterns of Inheritance  
Complex Patterns of Inheritance  
Genetics of Viruses and Bacteria  
Developmental Genetics

### **DEPARTMENTAL GUIDELINES** *(optional)*

- The overall course percentage will be based on the following weighted categories:

- Lecture exams (including 2-4 tests plus a comprehensive final exam) collectively worth 60%,
- Laboratory work collectively worth 25-30%, and
- Class assignments/quizzes collectively worth 10-15% of the overall score.
- A standard grade scale will be used for this course with a 2.0 grade point corresponding to 70-72%.
- All exams are proctored. When possible, exams are held on campus. Online and hybrid courses may have exams online, but they must be proctored to ensure academic honesty.
- Lab is an essential part of this class and is required for credit. Students missing more than two labs will not be given credit for this course.
- PO5 should be assessed: Students will be able to solve problems by gathering, interpreting, combining and/or applying information from multiple sources.

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**DIVISION CHAIR APPROVAL**

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**DATE**