

**Course Outline for:** BIOL 2207 Cell Biology**A. Course Description**

1. Number of credits: 4
2. Lecture hours per week: 3  
Lab hours per week: 3
3. Prerequisites: BIOL 1502 (C or higher)
4. Corequisites: None
5. MnTC Goal: #3 Natural Sciences

This course is designed for students majoring in biology. Students will explore major concepts in cell biology including eukaryotic cell structure and function, the cellular use of biomolecules, membranes, signal transduction, motility, and the extracellular matrix. Students will engage in techniques appropriate to the study of cells and cellular processes and gain experience in experimental design, data analysis and interpretation, and the communication of results. Lecture 3 credits, 3-hour lab 1 credit.

**B. Date last reviewed/updated:** March 2023**C. Outline of Major Content Areas**

**Lecture:** Subtopics listed under each main topic may vary due to recent developments in the field and current events.

1. Introduction to cell biology
2. Microscopy
  - a. Light microscopy techniques
  - b. Electron microscopy techniques
3. Cell fractionation and centrifugation
4. Biological molecules
5. Bioenergetics
6. Cell structure
7. Membrane structure
8. Plasma membrane physiology
  - a. Transport
  - b. Membrane potential and action potentials
  - c. Signal transduction and intracellular signaling
  - d. Cell recognition
9. Cytoplasmic physiology
  - a. Endomembrane system
    - i. Endoplasmic reticulum
    - ii. Golgi
    - iii. Endosomes and lysosomes

- b. Metabolism and energy conversions
  - i. Cytosol
  - ii. Mitochondrion
  - iii. Chloroplast
  - iv. Peroxisome
- c. Biomolecule trafficking
  - i. Synthesis
  - ii. Sorting and delivery
- d. Cytoskeleton
  - i. Motility
  - ii. Skeletal muscle contraction
- 10. Intercellular and extracellular interactions
  - a. Extracellular matrix
  - b. Adhesion
  - c. Tissue formation
- 11. Cell Cycle
- 12. Stem cells
- 13. Cancer
- 14. Current issues in cell biology
  - a. Impact of cell biology on medicine, agriculture, and biotechnology
  - b. Cell biology and society

**Laboratory:** Students will actively participate in lab by applying the scientific process to studies related to:

1. Light microscopy
2. Scanning electron microscopy
3. Differential staining
4. Cell culture
5. Homogenization
6. Differential centrifugation
7. Density gradient centrifugation
8. Spectroscopic determination of protein concentration
9. pH and buffers
10. Enzyme kinetics
11. PAGE and western blotting
12. Investigative project

#### **D. Course Learning Outcomes**

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

1. Explain and apply fundamental concepts found in Principles of Biology I by explaining cellular life in terms of the biomolecules used by cells. (Goal 2a, 2c, 3a)
2. Understand the underlying molecular and cellular mechanisms of cellular structure and function. (Goal 2b, 2c, 3a)
3. Use critical thinking skills to understand, evaluate, and analyze processes of membrane structure and function, trafficking of molecules, the endomembrane

- system, signal transduction pathways, extracellular matrix, and the cell's cytoskeleton/motility. (Goal 2a, 2c, 3a)
4. Formulate a hypothesis and conduct and analyze an experiment. (Goal 2b, 2d, 3b)
  5. Organize, draft, edit, and revise formal scientific writing and communicate that written material in oral presentations. (Goal 2b, 2d, 3c)
  6. Read, interpret, incorporate, and cite information and ideas from primary literature into writing and oral presentations. (Goal 2c, 2d, 3c, 3d)
  7. Utilize and understand the application of selected biotechnologies. (2a, 2d, 3a)
  8. Analyze classic experiments that contributed to our current knowledge of cell biology. (2c, 2d, 3d)
  9. Explain and illustrate the role that cell biology and its applications play in medicine, agriculture, biotechnology, and social issues. (3a, 3d)
  10. Identify, summarize, and critique key debates and arguments about current societal, ethical, and political issues that are relevant to cell biology such as organismal cloning and stem cell research. (2b, 2d, 3d)

**E. Methods for Assessing Student Learning**

A variety of evaluation and assessment methods may be used including, but not limited to, the following:

1. Examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer and critical thinking questions)
2. Writing assignments
3. Quizzes
4. Case studies
5. Laboratory reports
6. Formal scientific writing
7. Oral presentations
8. A final comprehensive exam

**F. Special Information**

Instructors will include the most recent version of the Departmental Expectations document in their course syllabus.

The laboratory portion of the course is delivered in the Biology Learning Center (BLC). Instructors will include the most recent version of the Biology Learning Center (BLC) Expectations document in their course syllabus.

Laboratory procedures may require the handling, treatment, manipulation, and killing of living organisms including but not limited to plants, invertebrates, and microscopic organisms; there are no exceptions or alternate activities.