

## Biology 190, Introduction to Cellular and Molecular Biology

### Theme-based Objectives and Learner outcomes

The purpose of these theme-based objectives is to provide instructors with a standardized set of learner outcomes that are expected of students upon completion of BIOL 190 while allowing for flexibility and freedom in individualized instruction. These themes will also define categories of pre and post knowledge-based assessment of our students.

#### Themes:

Inorganic Chemistry  
Organic Macromolecules  
Cytology (cell structure)  
Membrane Physiology  
Cell Signaling  
Cellular Energetics (cellular respiration & photosynthesis)  
Cellular Growth & Division  
Heredity  
Gene Expression  
Gene Regulation  
Scientific Inquiry & Investigation

#### Inorganic Chemistry

- Explain fundamental concepts associated with atomic structure, electron energy levels, chemical bonding, water chemistry, and pH, and relate these concepts to the functioning of biological systems.

#### Organic Macromolecules

- Explain the basic structure and describe the functions of the major groups of biological macromolecules: carbohydrates, proteins, lipids, and nucleic acids.

#### Cytology

- Compare and contrast the structures common to prokaryotic and eukaryotic cells and describe the major components of eukaryotic (animal and plant) cells.

#### Membrane Physiology

- Describe the fluid mosaic model of cellular membranes, including factors that contribute to membrane fluidity and how this membrane structure results in selective permeability and interactions with the environment through its non-lipid components.
- Explain the process of osmosis and how cells with and without cell walls respond to iso-, hypo- and hyperosmotic environments.
- Describe the passive, active and bulk mechanisms of molecular transport and explain how each of these mechanisms works to transport molecules or ions across cell membranes.

### Cell Signaling

- Explain how cells communicate through the release of chemical signals in terms of reception, transduction and cellular response, including the mechanisms by which signal specificity and signal amplification is achieved.

### Cellular Energetics

- Explain the principal processes associated with cellular energy transfers with an emphasis on redox and adenosine triphosphate (ATP in the context of eukaryotic cellular respiration and photosynthesis).
- Explain in basic terms how biochemical pathways are organized and function in the context of eukaryotic cellular respiration and photosynthesis.

### Cellular Growth & Division

- Explain how the process of cell division is molecularly controlled and apply this understanding to how the environment and inheritance can contribute to regulatory failure.

### Heredity

- Explain the foundations of Mendelian genetics and chromosomal theory and apply these, with appropriate terminology, to contemporary concepts in genetics.

### Gene Expression

- Understand the Central Dogma of gene expression.
- Understand the redundant and universal qualities of the genetic code and how it is used to determine the amino acid sequence of a polypeptide.
- Describe the processes of transcription and translation in both prokaryotes and eukaryotes at the molecular level.

### Gene Regulation

- Describe how prokaryotes control their gene expression through positive and negative regulatory mechanisms.
- Explain how eukaryotes can control their gene expression through DNA modification and transcriptional, post-transcriptional and post-translational regulatory mechanisms.
- Compare and contrast prokaryotic and eukaryotic genomes in terms of general composition and complexity.

### Scientific Inquiry & Investigation

- Demonstrate the ability to evaluate and reference sources of information, utilize critical thinking and scientific reasoning skills, and correctly utilize scientific terminology.
- Utilize the scientific method to design and carry out a scientific experiment using appropriate laboratory skills and equipment.