

Prepared by the Department of Natural Sciences and Applied Technology

Date of Departmental Approval: February 3, 2014

Date Approved by Curriculum and Programs: May 14, 2014

Effective: Fall 2014

1. **Course Number:** BIO241
Course Title: Cell Biology
2. **Course Description:** This course provides an introduction to cell structure, function, and physiology. Topics include the function of cellular organelles, enzymes and their role in metabolism and regulation, synthesis of macromolecules, and gene expression and regulation.
3. **Student Learning Outcomes:** Upon successful completion of this course, students are able to do the following:
 - Illustrate the significance of essential macromolecular structures such as nucleic acids, proteins, polysaccharides, and lipids
 - Relate structure and function of various cellular components in prokaryotes and eukaryotes, and describe the differences between prokaryotic and eukaryotic cells, and viruses
 - Explain the functions of various cellular compartments and organelles
 - Illustrate the macromolecular structures of DNA, RNA, and proteins, and associated modifications
 - Associate function and regulation of molecular transport, metabolic pathways, transcription, and translation
 - Explain stepwise, the basis of genetic regulation at multiple levels
 - Illustrate the functional features of biologically active nucleic acids and proteins
 - Explain the basis of mutations, and their effects in cancer
 - Examine and evaluate published genetic and protein data in the form of spreadsheets, graphs, and charts
 - Manipulate, summarize, interpret and present data in the form of graphs and charts
 - Describe the basis of genetic testing methods, and the ethical constraints on privacy of test results
 - Describe the genetic basis of mutations and cancer, its dependence on genetic background, and genetic/epigenetic effects resulting from environmental pollution
 - Describe commonly used technologies for comparative and functional analysis of cells, nucleic acids, and proteins
 - Explain stepwise: cloning technology, DNA amplification, microarrays, and how profiling is carried out
 - Use informatics software for comparative analysis of nucleic acids and proteins
 - Evaluate (consensus) sources of information from authoritative web sites and articles
 - Synthesize and present a point of view
 - Examine and manipulate published molecular data in the form of spreadsheets, graphs, and charts
 - Write at least one formal research paper on a pertinent cell biology topic
 - Demonstrate the ability to use cell biology-related laboratory equipment
4. **Credits:** 4 credits
5. **Satisfies General Education Requirement:** Natural or Physical Science
6. **Prerequisites:** ENL101 and a grade of C or better in CHM151 and BIO151 or BIO251
7. **Semester Offered:** Spring
8. **Suggested General Guidelines for Evaluation:** Weekly quizzes, exams based on lecture material, a research paper, online discussions, lecture and lab final.
9. **General Topical Outline:** see attached

BIO241. Cell Biology
Topical Outline

1	Essential chemistry review	Atomic structure, isotopes, radioactivity Chemical bonds Chemical reactions and catalysis pH
2	Macromolecular structure	Sugars and polysaccharides Amino acids and proteins Lipids, including steroids Nucleic acids
3	Structure and function in eukaryotic cells, prokaryotic cells, and viruses	Eukaryotes: Membranes, nucleus, cytoskeleton, organelles Cell communication and differentiation Cell division, apoptosis, cancer Prokaryotes: Membranes, nucleoid, cytoskeleton Cell communication and differentiation Cell division, biofilm formation Viruses: Structure and replication
4	Cellular processes	Transport Metabolism Transcription and translation Post-translational modification of proteins
5	Structural and comparative analysis of nucleic acids	Structure of various DNA forms DNA modifications and regulation Structure of RNA, secondary structure Post-transcriptional modifications of RNA Web-based tools for comparative sequence analysis
6	Structural and comparative analysis of proteins	Protein function and homology domains Post-translational modification of proteins Web-based tools for comparative sequence analysis
7	Genetics and genomics	Chromosomal organization in eukaryotes and prokaryotes Genetic regulation and epigenetics Mutations and DNA repair Genes and disease, cancer
8	Recombinant DNA and informatics	Cloning technology Polymerase chain reaction Microarray profiling Transcriptomes, proteomes, metabolomes

Laboratory Experiments

Optical microscopy: Bright field, phase contrast, fluorescence observation of cells and cellular structures

Centrifugation: Separation of cellular organelles – nucleus, mitochondria from animal tissue

DNA: Extraction of DNA from microbial cells
Restriction digests, electrophoresis
PCR

Recombinant DNA: Transformation of bacterial cells with GFP plasmid

Protein: Extraction and purification of GFP
SDS-PAGE and ELISA
Effect of pH on proteins