BI 221 : PRINCIPLES OF BIOLOGY: CELLS

Transcript title

Principles of Bio: Cells

Credits

5

Grading mode

Standard letter grades

Total contact hours

70

Lecture hours

40

Lab hours

30

Prerequisites

WR 065 or WR 121Z or minimum placement Wr/Comm Level 7.

Prerequisites with concurrency

CH 104 or CH 221.

Course Description

Introduces fundamental biological concepts and theories about the chemical and molecular basis of life, structure and function, transformation of energy and matter, and information flow at a cellular and molecular level.

Course learning outcomes

1. Describe the building blocks and synthesis of the major classes of biomolecules and the contribution of their three-dimensional structure to their functions.
2. Model cell components, emphasizing them as a system of interacting parts.
3. Predict how a molecule's movement is affected by its thermal energy, size, electrochemical gradient, and biochemical properties.
4. Compare anabolic (photosynthesis) to catabolic (respiration and fermentation) pathways emphasizing the transformation of energy and matter.
5. Predict how cells store, use, and transmit genomic information.
6. Illustrate how conservation of the genetic code and the varying effects of mutations facilitate evolution.
7. Model the processes by which evolution allows for the emergence of cell complexity and diversity.
8. Explain how mutation and genetic recombination contribute to phenotypic variation in a population allowing it to evolve in response to abiotic and biotic selective pressures over space and time.

Content outline

1. The fundamental characteristics of living organisms. Using the scientific process to study living organisms. Experimental variables and how to represent data. Model organisms.
2. Structure and function of atoms, molecules and macromolecules. How size and thermal energy affect movement of molecules. Chemistry of water and how properties of water make life on earth possible. Chemistry of carbon reveals why organic molecules form the structural basis of the biological molecules.
3. Chemical evolution and the biomolecules. Macromolecules. Polymers and chemical processes that lead to polymerization and depolymerization.
4. Nucleic acids as polymers (polynucleotides). Structure and functions of DNA and RNA. History of experiments leading to the discovery of DNA as the genetic material and the structure of DNA. DNA replication and repair. DNA technologies (DNA extraction and purification. Amplifying DNA using the polymerase chain reaction. Visualizing DNA using electrophoresis).
5. Proteins as polymers (polypeptides). Structure and function of proteins. Factors that contribute to protein misfolding and disease.
6. Enzymes as catalysts for cellular reactions. Energetics of enzyme-catalyzed cellular reactions. How structure contributes to functionality of enzymes.
7. Carbohydrates as polymers (polysaccharides). Structure and function of carbohydrates in the cell and extracellular matrix.
8. Gene structure in prokaryotes and eukaryotes. How gene structure contributes to gene expression. The central dogma of gene expression. How gene expression differs in prokaryotes and eukaryotes.
9. Regulation of gene expression. How gene regulation differs in prokaryotes and eukaryotes.
10. The genetic code and mutation. Abiotic and biotic mutagens. How mutation in DNA affects protein structure.
11. The lipids. Structure and function of different classes of lipids. Membrane structure and functions. Osmosis and diffusion across semipermeable membranes. Electrochemical gradients and membrane transport.
12. Prokaryotic cell structure. Examples of prokaryotes. Importance of prokarytoes in biological systems.
13. Eukaryotic cell structure. Evolution of cell complexity and how the first eukaryotic cell evolved.
14. Metabolism. Catabolic cellular processes (cellular respiration and fermentation) and anabolic cellular processes (photosynthesis).
15. The cell cycle of somatic cells and division by mitosis. Regulation of the cell cycle and cancer.
16. The evolution of sex and how sex generates genetic variability. The cell cycle of germline cells and the production of gametes by meiosis. Disorders resulting from nondisjunction.
17. Transmission genetics. Simple Mendelian inheritance. Mendel's first and second laws. Complex inheritance patterns.

Required materials

Textbook (same for all three Principles of Biology courses), access to a computer with internet.

General education/Related instruction lists

- Science Lab