BIO-1040: THE CELL AND DNA

Cuyahoga Community College

Viewing: BIO-1040 : The Cell and DNA

Board of Trustees:
December 2021

Academic Term:
Fall 2022

Subject Code
BIO - Biology

Course Number:
1040

Title:
The Cell and DNA

Catalog Description:
Designed for non-science majors. Considers cell structure, function, and metabolism, cell division, DNA structure and function, and Mendelian and molecular genetics. Scientific method and reasoning are emphasized. To fulfill laboratory science requirements, students should enroll in the related laboratory course.

Credit Hour(s):
3

Lecture Hour(s):
3

Lab Hour(s):
0

Other Hour(s):
0

Requisites

Prerequisite and Corequisite
ENG-0995 Applied College Literacies, or appropriate score on English Placement Test.
Note: ENG-0990 Language Fundamentals II taken prior to Fall 2021 will also meet prerequisite requirements.

Outcomes

Course Outcome(s):
Relate the process of science to the study of living organisms.

Objective(s):
1. List and explain the steps of the scientific method.
2. Define and distinguish among variables, controls, hypotheses, observations, inferences, and scientific theories.
3. Identify the criteria used to characterize life by describing the characteristics common to all living things.
4. Distinguish between scientific thinking and other ways of gaining knowledge.

Course Outcome(s):
Analyze the chemical basis for cell structure and function.

Objective(s):
1. Describe the structure and components of an atom using the Bohr Model.
2. Describe the properties of elements using the Periodic Table of the Elements.

3. Differentiate between types of chemical bonds and explain how specific elements are able to form chemical bonds to create compounds.
4. Evaluate the role of carbon as an integral element in the building blocks of living cells.
5. Explain the properties of water that make it critical to life on Earth.
6. Describe the chemical makeup and functions of the biomolecules that make up all cells.

Course Outcome(s):

Analyze the structure and function of cells and integrate cell structure with signaling and metabolism.

Objective(s):

1. Explain the Unified Cell Theory, including the evidence that led to the formation of the theory and its applications in biology.
2. Compare and contrast the components of eukayrotic and prokaryotic cells.
3. Identify common eukaryotic organelles in plant and animal cells and describe their functions.
4. Describe the structure of cell membranes and how they function in transport and signaling.

Course Outcome(s):

Compare and contrast the mechanisms by which cells generate, expend, and transfer energy based on the Laws of Thermodynamics.

Objective(s):

1. Distinguish between potential, kinetic, and chemical energy and integrate the First and Second Laws of Thermodynamics with energy transfer in cells.
2. Outline the process of glucose catabolism in cells by summarizing the reactions and products involved in glycolysis.
3. Compare and contrast the metabolic differences between aerobic and anaerobic respiration.
4. Explain how the Citric Acid Cycle and electron transport chain function in generating energy-yielding products in eukaryotic cells.
5. Compare and contrast the reactants and products of cell respiration and photosynthesis.
6. Describe how the structure of chloroplasts relates to the function of harvesting energy from the sun.
7. Summarize the metabolic steps of the Light Reaction and explain how the products are used in the Calvin Cycle.
8. Summarize the metabolic steps of the Calvin Cycle, including how sugar molecules are generated.

Course Outcome(s):

Compare and contrast the methods by which different types of cells divide and integrate the process of meiosis in eukaryotic cells with sexual reproduction and inheritance.

Objective(s):

1. Explain the basic principles of cell division that apply to all dividing cells.
2. Evaluate the cell cycle as it occurs in eukaryotic cells and integrate cell cycle regulation with aberrant cell growth.
3. Analyze the process of mitosis by interpreting the important cellular events that occur in each phase, including cytokinesis.
4. Compare and contrast cell division as it occurs in eukaryotic and prokaryotic cells.
5. Analyze the process of mitosis by interpreting the important cellular events that occur in each phase, and compare and contrast the meiosis and mitosis.
6. Apply the mechanisms and products involved in meiosis to the chromosomal basis of genetic inheritance.

Course Outcome(s):

Analyze the chromosomal and molecular models of genetics as they pertain to inheritance, the flow of genetic information, gene expression, and modern advances in molecular technology.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Evaluate Mendel’s theory of particulate inheritance, including its extensions and exceptions, and apply the concept of inheritance patterns to monohybrid and dihybrid genetic crosses.
2. Apply the concept of inheritance patterns to genetic conditions in humans and draw conclusions pertaining to their transmission and expression.
3. Analyze the structure and function of DNA and RNA and integrate their functions with the Central Dogma of Biology.

4. Evaluate the processes of transcription and translation and apply them to the process of generating polypeptides from DNA sequences.
5. Evaluate the processes by which prokaryotic and eukaryotic cells regulate gene expression.
6. Analyze the applications and limitations of important historical and modern innovations in molecular genetics that have enabled scientists to develop and implement tools to study and manipulate genetic material.
7. Describe examples of the uses and applications of biotechnology in the modern world.

Methods of Evaluation:

1. Examinations and quizzes
2. Participation in group learning activities
3. Written reports
4. Assignments relating to the topics presented

Course Content Outline:

Scientific thinking

1. Science as a process
    a. Observation
    b. Scientific questions
    c. Hypotheses
    d. Predictions
    e. Experiments
    f. Controls
    g. Data
    h. Inferences
    i. Independent and dependent variables
2. Chemistry of biology
    a. Matter
    b. Energy
    c. Atoms and subatomic particles
    d. Bohr model and valence
    e. Chemical bonding and compounds
    f. Organic molecules and functional groups
    g. Carbohydrates, lipids, nucleic acids, proteins
    h. Water
    i. Acids, bases, and pH
3. Cells
    a. Prokaryotic vs. eukaryotic cell structure
    b. Plasma membrane
        i. Fluid mosaic model
        ii. Passive transport
            1. Chemical concentration gradients
            2. Simple diffusion
            3. Osmosis
            4. Facilitated diffusion
        iii. Active transport
            1. ATP-dependent solute pumping
            2. Exocytosis
            3. Phagocytosis
            4. Pinocytosis
            5. Receptor-mediated endocytosis
    c. Organelles
        i. Nucleus
        ii. Endoplasmic reticulum
        iii. Golgi apparatus
        iv. Ribosomes
        v. Mitochondria
        vi. Cytoskeleton

vii. Eukaryotic cilia and flagella
viii. Bacterial falgellum
ix. Conjugation pili
d. Photosynthesis
i. Cellular respiration
ii. photosynthesis
4. Cell division
a. Mitosis
b. Meiosis
c. Spermatogenesis
d. Oogenesis
5. DNA
a. Structure of DNA
b. Structure of RNA
c. DNA replication
d. Transcription
e. Protein synthesis/translation
6. Genetics
a. Classical genetics
i. Mendel's work
ii. terminology
iii. genetics problems
b. Molecular genetics
i. current techniques
ii. applications
iii. ethical considerations

Resources

Biological Sciences Curriculum Studies. *Biological Perspectives*. 3rd ed. Biological Sciences Curriculum Studies, 2006.

Mader, Sylvia and Windelspecht, Michael. *Inquiry into Life*. 16th ed. New York, NY: McGraw-Hill, 2020.

OpenStax. *Concepts of Biology*. 17. INDICO LLC, 2017.

Audesirk. *Biology: Life on Earth*. 12 th ed. Pearson, 2019.

Starr, Cecie, Ralph Taggart, christine Evers, and Lisa Starr. *Biology: The Unity and Diversity of Life*. 15th ed. Boston, MA: Cengage Learning, Inc., 2019.

Koch. *The Cell & DNA Laboratory* . 3. Van-Griner, 2021.

Instructional Services

OAN Number:
Ohio Transfer 36 TMNS

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