BIO-104L: THE CELL AND DNA LABORATORY

Cuyahoga Community College

Viewing: BIO-104L : The Cell and DNA Laboratory

Board of Trustees:
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Academic Term:
Fall 2022

Subject Code
BIO - Biology

Course Number:
104L

Title:
The Cell and DNA Laboratory

Catalog Description:
Laboratory course examines the scientific method, cell structure and function, cell division, DNA structure and function, and Mendelian and molecular genetics. Includes microscope work, models, and various experiments designed to illustrate concepts covered in the lecture course.

Credit Hour(s):
1

Lecture Hour(s):
0

Lab Hour(s):
3

Other Hour(s):
0

Requisites

Prerequisite and Corequisite
Concurrent enrollment in BIO-1040 The Cell and DNA is strongly recommended.

Outcomes

Course Outcome(s):
Apply the scientific method to laboratory investigations and observations made in everyday life.

Objective(s):
1. List and explain the steps of the scientific method.
2. Distinguish between observations and inferences.
3. Explain the concept of a variable, including how variables influence experiments, and differentiate between independent and dependent variables.
4. Evaluate sample experimental designs using the scientific method and distinguish between scientific and non-scientific evidence.
5. Formulate hypotheses that can be tested by designing and conducting experiments.
6. Analyze the results of scientific experiments and state inferences based upon the outcomes of experiments.

Course Outcome(s):
Use laboratory equipment to make observations and take precise metric measurements of mass, length, volume, and temperature.

Objective(s):

1. Use electronic balances to take measurements of mass.
2. Record temperatures in Celsius using a thermometer.
3. List and describe the functional components of a compound light microscope.
4. Demonstrate the ability to convert between units in the metric system.
5. Use a variety of tools to record linear measurements.
6. Use volumetric instruments to take measurements of volume.
7. Demonstrate safe and proper use of lab equipment and respond appropriately to instructor feedback as it is given.

Course Outcome(s):

Analyze the chemical building blocks that make up a living cell.

Objective(s):

1. Describe the chemical makeup of proteins, carbohydrates, lipids, and nucleic acids.
2. Describe the reactions that occur in cells to build and break down macromolecules.
3. Conduct lab experiments that test for the presence of specific biomolecules in solutions.

Course Outcome(s):

Describe the form and function of eukaryotic and prokaryotic cells.

Objective(s):

1. Prepare wet mount samples of live cells and view them under a compound light microscope.
2. Identify important cellular components in bacterial cells.
3. Compare and contrast bacterial cells with plant and animal cells.
4. Apply proper tissue staining techniques to view animal and plant organelles under a compound light microscope.
5. Explain the processes of diffusion and osmosis as they occur in living cells, and differentiate between passive diffusion and active transport.
6. Conduct an experiment to simulate the process of diffusion using a semipermeable membrane.
7. Observe osmosis in living cells by preparing live tissue slides and viewing them under a compound light microscope.

Course Outcome(s):

Observe specific chemical reactions that occur in cells and explain their role in contributing to the metabolic functioning of cells.

Objective(s):

1. Describe the general structure and function of an enzyme.
2. Investigate factors that can influence enzyme activity by conducting experiments using enzymatically active cells.
3. Explain the differences between aerobic and anaerobic respiration.
4. Summarize the chemical reactions involved in cellular respiration and fermentation.
5. Use experimental procedures to study the processes of cellular respiration and fermentation and draw evidence-based conclusions.
6. Compare and contrast the generalized reactions for cellular respiration and photosynthesis.
7. Summarize the chemical reactions involved in the light reaction of photosynthesis and explain the importance of the products formed in the reaction.
8. Explain the role of plant pigments in photosynthesis by studying the structure of chloroplasts and investigating the process of chromatography.
9. Examine the light-dependent and light-independent reactions of photosynthesis by conducting experiments using live plants.
10. Communicate the results of experimental procedures pertaining to cellular processes with others to demonstrate that scientific data is reproducible but can have limitations.

Course Outcome(s):

Describe the ways in which cells divide by explaining the eukaryotic cell cycle and the processes of mitosis and meiosis.

Objective(s):

1. List and describe the stages of the eukaryotic cell cycle.
2. List and describe the phases of mitosis.

3. Use preserved tissue samples of plant and animal cells to identify and visualize cells as they appear in different stages of the cell cycle and mitosis.
4. Compare and contrast cell division as it occurs in plant and animal cells.
5. Explain the important phases of meiosis and describe how the process differs from mitosis.

Course Outcome(s):

Apply Mendel's theory of particulate inheritance to genetic crosses.

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. Define and distinguish among the following terms in the context of Mendelian patterns of inheritance: gene, genetic locus, allele, genotype, phenotype, homozygous, heterozygous, dominant, and recessive.
2. Use a Punnett square to predict the outcome of a monohybrid cross.
3. Use one or more examples from model organisms to test the predictions for monohybrid crosses, and apply the concept of inheritance patterns to the transmission and expression of genetic traits in organisms.
4. List and briefly describe alternatives or exceptions to Mendelian inheritance.

Course Outcome(s):

Describe the structure of DNA and use models and experimentation to explain its function in cells.

Objective(s):

1. Examine the structure of DNA using current models, and identify the components of DNA nucleotides, including purine and pyrimidine bases.
2. Describe the important steps involved in DNA replication based on an understanding of DNA structure.
3. Explain how complementary base pairing occurs in a DNA strand.
4. Use experimental procedures to isolate and/or sequence live or synthetic DNA.
5. Describe examples of modern DNA technology and how they are used to address issues or solve problems in the contemporary world.

Methods of Evaluation:

1. Quizzes
2. Laboratory practical examinations
3. Written reports
4. Participation in laboratory activities

Course Content Outline:

1. The Process of Science
   a. Steps of the scientific method
   b. Observations
   c. Hypotheses
   d. Inferences
   e. Experimental variables
   f. Controls
2. Metric Measurement
   a. Metric units and conversions
   b. Measuring mass
   c. Measuring length
   d. Measuring volume
   e. Measuring temperature
3. Microscopy
   a. Parts of a compound light microscope
   b. Using a compound light microscope
   c. Preparing slide samples

   d. Measuring field of view
   e. Measuring depth of field
4. Biological Molecules
   a. Monomers and poylmers
   b. Proteins
   c. Carbohydrates
   d. Lipids
   e. Nucleic acids
   f. Dehydration and hydrolysis reactions
5. Cell Structure and Function
   a. Structure of prokaryotic cells
   b. Microscopic identification of cells
   c. Comparing eukaryotic and prokaryotic cells
   d. Organelles of animal cells
   e. Organelles of plant cells
   f. Cell membrane structure and function
   g. Diffusion and osmosis
   h. Analyzing diffusion experimentally
   i. Tonicity in cells
6. Enzymes
   a. Enzyme structure and function
   b. Measuring enzyme activity
   c. Examining factors that influence enzyme activity
7. Cellular Respiration
   a. Glycolysis
   b. Fermentation
   c. Aerobic respiration
8. Photosynthesis
   a. Chloroplast structure
   b. The light reaction
   c. The Calvin Cycle
   d. Pigments and chromatography
9. Cell Division
   a. The eukaryotic cell cycle
   b. Phases of mitosis
   c. Phases of meiosis
10. Mendelian Genetics
   a. Dominant and recessive alleles
   b. Genotypes and phenotypes
   c. Genetic crosses and Punnett squares
   d. Autosomal dominant and recessive traits
   e. Sex-linked traits
11. DNA Structure and Function
   a. Nucleotides
   b. Base pairing
   c. DNA replication
   d. DNA technology

Resources

Mader, Sylvia. *Laboratory Manual for Biology*. 13. McGraw-Hill, 2019.

Roman Boldyreff. *Biology Works*. 16th ed. Van-Griner, 2018.

Vodopich, Darrell and Moore, Randy. *Biology Laboratory Manual*. 12th ed. McGraw Hill Higher Education, 2019.

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

OpenStax. *Concepts of Biology*. 17. XANEDU C, 2017.

Instructional Services

OAN Number:
Ohio Transfer 36 TMNS

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