

Biology 1307

Principles of Biology II

Fall 2021



Dual Credit Instructor

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CHS Classroom: A222

Office Hours

Office hours are available MW 8:00-8:30am or by appointment.

Course Information

An introduction to the unifying principles of biology with emphasis on biological diversity, evolution, and ecology. Laboratory is designed to reinforce lecture topics and develop analytical skills essential to the practice of biology. Recommended as a first semester course of a two-course sequence for students majoring in biological sciences or related disciplines. Not intended for non-majors.

As an advanced course, Dual Credit Biology has Biology I and Chemistry I as a prerequisite.

Student Learning Outcomes

EXAM 1

THE SCIENTIFIC STUDY OF LIFE

1. List and describe the characteristics of science
2. Differentiate between observations, hypotheses, theories, and laws
3. List and describe the scientific method and how biology is investigated
4. Recognize a controlled experiment.
5. Understand independent, dependent, and standardized variables

THE CHEMISTRY OF LIFE

1. Explain the chemical nature of biological molecules
2. Identify the primary elements in living organisms
3. Describe the structure of atoms
4. Compare and contrast the different types of bonds

5. Differentiate between atoms and molecules.
6. Explain how the structure of water affects its chemical properties
7. Explain how monomers are used to form polymers
8. Compare and contrast the structures and functions of the four classes of biological molecules.

CELLS (MEMBRANES, ORGANELLE STRUCTURE AND FUNCTION, CELL COMMUNICATION AND TRANSPORT)

1. Describe the properties of a cell.
2. Identify the components common to all cells.
3. Compare and contrast the cells that characterize the three domains of life.
4. Explain how the chemical structure of phospholipids enables them to form a bilayer in water.
5. Explain why a biological membrane has selective permeability.
6. Identify different functions of membrane proteins.
7. Compare and contrast the ways that molecules move across membranes.
8. Explain the relationship between diffusion and concentration gradients.
9. Explain how processes of passive transport work including Osmosis and Diffusion
10. Explain how mechanisms of active transport work including the Sodium-Potassium Pump
11. Explain how larger objects/molecules cross membranes including: Exocytosis and Endocytosis
12. Predict when each of these transport mechanisms might be in use
13. Identify the functions of the organelles in eukaryotic cells.
14. Describe how organelles interact in carrying out a cell's function.
15. Compare and contrast the structure and function of cytoskeletal proteins
16. Compare and contrast different cell junctions in animal cells.
17. Explain the function of plasmodesmata in plant cells.

THE NERVE CELL

1. Describe the structure of a neuron.
2. Describe the forces that maintain the resting potential in a neuron.
3. Understand what is meant by electrochemical gradient
4. Compare and contrast a graded potential, the threshold potential, and an action potential.
5. Diagram and describe the events of an action potential.
6. Diagram and describe how chemical and electrical synapses work.
7. Explain the function of neurotransmitters.
8. Propose hypotheses for the appearance of paralysis or convulsions under various conditions, for example in response to different neuro-active drugs.

EXAM 2

ENZYMES AND ENERGY OF LIFE

1. Describe the energy transfers that are common to life.
2. Describe how cells use energy to do work.
3. Compare and contrast potential and kinetic energy.
4. Explain how physical laws constrain energy use in organisms.

5. Compare and contrast exergonic and endergonic reactions.
6. Explain how oxidation and reduction reactions are linked.
7. Explain how ATP is used in coupled reactions.
8. Explain how enzymes catalyze reactions.
9. Describe how negative and positive feedback regulate reaction rates.
10. Be able to explain homeostasis, feedback loops and their importance to biology.
11. List the factors that influence enzyme activity.
12. Explain how acids and bases affect pH
13. Explain a gradient (thermal, concentration, etc.)
14. Indicate the direction of energy or material flow under different conditions
15. Predict the permeability of membranes under different conditions

METABOLISM AND CELLULAR RESPIRATION

1. Explain how cells use energy in food to produce ATP.
2. Draw and explain the net reaction in aerobic respiration.
3. Compare and contrast the events of glycolysis, the Krebs cycle, and the electron transport chain.
4. Describe where, in a eukaryotic cell, each step in respiration occurs.
5. Draw and explain the net reaction in glycolysis.
6. Draw and explain the net reaction in the Krebs cycle.
7. Diagram and explain the flow of electrons in the electron transport chain.
8. Explain the role of O₂ in respiration.
9. Explain what would happen in each part of cellular respiration if the cell is deprived of O₂.
10. Explain why fermentation is necessary in O₂ deprived cells. Compare and contrast aerobic respiration, anaerobic respiration, and fermentation.
11. Compare and contrast respiration and photosynthesis.
12. Compare and contrast homeothermic, poikilothermic, endothermic, and ectothermic and give examples.

PHOTOSYNTHESIS

1. Predict the effects of various factors on the rate of photosynthesis, e.g.
 1. light intensity
 2. color of light
 3. temperature
 4. pH (concentration of hydrogen ions)
 5. presence of inhibitors
2. Describe the function of photosynthesis
3. Describe the structures in a leaf that are involved in photosynthesis.
4. Describe how plants use the movement of ions, and osmosis, to control the opening and closing of the stomata.
5. Describe the components of the chloroplast and their roles in photosynthesis
6. Describe the components of the light-dependent & light-independent portions of photosynthesis

7. Identify the reactants (chemical inputs) and products (chemical outputs) of the light-dependent & light-independent portions of photosynthesis
8. Describe how to measure photosynthesis in various ways
9. Explain how the light-dependent & light-independent portions of photosynthesis work, how they are linked, and their similarities to cellular respiration

EXAM 3

DNA STRUCTURE AND GENE FUNCTION

1. Understand the structure of DNA and RNA
 1. Explain how information is passed from DNA to proteins
 2. Identify the components of double-stranded DNA
 3. Explain the roles of DNA, RNA, and protein in the central dogma
 4. Describe the events in transcription including the structure and function (role) of each of the following:
 - A. transcription factors
 - B. promoter regions
 - C. RNA polymerase
 - D. mRNA
 5. Describe the events in translation including the structure and function (role) of each of the following:
 - A. mRNA
 - B. rRNA
 - C. tRNA
 - D. Amino acids
 - E. chaperone proteins
 6. Use the genetic code to translate a nucleic acid sequence into protein
 7. Diagram and explain the relationship between codons and amino acids
 8. Understand the ways that mutations can impact protein sequences.

DNA REPLICATION, CELL CYCLE, AND MITOSIS

1. Explain how cells divide to give rise to identical cells
2. Describe the steps of replication and the function of enzymes in each step including:
 - A. helicases
 - B. RNA polymerase
 - C. DNA polymerases
 - D. ligases
3. Explain what features of DNA allow semi-conservative replication to occur
4. Describe the steps that occur as a chromosome folds into chromatin
5. Explain what is happening in a cell at each stage of the cell cycle
6. Diagram and identify the phases in mitosis
7. Explain what is meant by a cell cycle checkpoint and how these relate to cancer
8. Understand how mutations affecting the cell cycle can lead to cancer.
9. Compare and contrast the role of an oncogene and tumor suppressor in cancer

10. Compare and contrast the growth of a normal cell and a stem cell

SEXUAL REPRODUCTION AND MEIOSIS

1. Explain how genetic information is passed from one generation to the next
2. Describe the role of homologous chromosomes in sexual reproduction
3. Explain the purpose of meiosis and gamete formation
4. Differentiate between haploid and diploid cells
5. Diagram and identify the steps in meiosis
6. Diagram and explain how meiosis generates genetic variability in offspring
7. Compare and contrast the impact of crossing over, independent assortment and random pairing during fertilization on variability in offspring
8. Compare and contrast mitosis and meiosis
9. Compare and contrast stem cells and differentiated cells.
10. Compare and contrast pre-implantation genetic diagnosis, genetic testing, and gene therapy.
11. Identify ethical issues associated with the use of DNA technology in medicine

EXAM 4

PATTERNS OF INHERITANCE

1. Explain how genetic traits are passed from one generation to the next.
2. Describe the role of chromosomes in inheritance.
3. Differentiate between the terms gene, allele, locus and chromosome.
4. Explain how meiosis and the production of gametes are associated with inheritance.
5. Explain the relationship between dominant and recessive alleles of a gene.
6. Compare and contrast genotype and phenotype.
7. Differentiate between homozygous and heterozygous.
8. Use a Punnett square to diagram and explain the inheritance of one gene.
9. Explain how meiosis contributes to Mendel's law of segregation.
10. Explain how meiosis contributes to the independent assortment of alleles.
11. Compare and contrast incomplete dominance and co-dominance.
12. Explain how pleiotropy and epistasis can influence phenotype.
13. Diagram and explain why males express X-linked recessive traits more than females.
14. Explain why one X chromosome is typically inactivated in female cells.
15. Analyze a pedigree to determine what pattern of inheritance a trait displays.
16. Explain how the environment and polygenic traits can influence phenotype.
17. Understand how ABO markers contribute to human blood type.
18. Explain how blood type compatibility is determined.

DNA TECHNOLOGY

1. Describe how transgenic organisms are made.
2. Describe the uses of Biotechnology especially, recombinant DNA and transgenic organisms.

Upon completion of this course, students will be able to:

- Identify the cells, tissues, and organs that make up a multicellular plant or fungus body.

- Explain how structures are related to function and how they allow organisms to carry on fundamental life processes in different environments.
- Determine of the major characteristics of the phyla (=divisions) of plant-like and fungi-like protists in the Kingdom Protista and the characteristics of members of the Kingdom Plantae, and Kingdom Fungi (Myxomycota).
- Describe the relatedness of the different plant phyla to one another and fungi phyla to each other as well as their major evolutionary pathways.
- Recognize of the importance of plants and fungi in human ecology.

Course Delivery

Lectures will be delivered in the classroom; lab exercises will be conducted in the lab. Support documents are available in Google Classroom.

Communication

I will respond to email within 24 hours during working hours Monday through Friday.

Evaluation and Grades

Course grades will be based upon completing course requirements and meeting student learning outcomes.

There will be 4 major grades (tests) and 14 minor grades (assignments, quizzes, labs, essays) per semester. The major grades and minor grades will be weighted as 50% of the overall semester grade. Additionally, a semester final will constitute 15% of the overall semester grade.

Course Grade

Grading System

The following grading scale is used for this course:

A = 89.5-100 points

B = 79.5-89.4 points

C = 69.5-79.4 points

D = 59.5-69.4 points

F = 0-59.4 points

Rounding will follow scientific rounding rules; fractions will be rounded to tenths.

Semester Calendar

A calendar is provided on Google Classroom that outlines the due dates of major and minor grades along with a daily agenda.

Modifications to the Syllabus

This syllabus, including grade evaluation and course schedule, is subject to modification.

Student Disability Services

ASU is committed to the principle that no qualified individual with a disability shall, on the basis of disability, be excluded from participation in or be denied the benefits of the services, programs or activities of the university, or be subjected to discrimination by the university, as provided by the Americans with Disabilities Act of 1990 (ADA), the Americans with Disabilities Act Amendments of 2008 (ADAAA), and subsequent legislation.

The Office of Student Affairs is the designated campus department charged with the responsibility of reviewing and authorizing requests for reasonable accommodations based on a disability, and it is the student's responsibility to initiate such a request by contacting:

[Ms. Dallas A. Swafford](#)

Director of Student Disability Services

- 325-942-2047
- dallas.swafford@angelo.edu
- [Houston Harte University Center](#)

Title IX Statement

Angelo State University is committed to the safety and security of all students. If you or someone you know experience sexual harassment, sexual assault, domestic or dating violence, stalking, or discrimination, you may contact ASU's Title IX Coordinator:

[Michelle Nicole Boone, J.D.](#)

Director of Title IX Compliance

- Michelle.boone@angelo.edu
- 325-486-6357
- [Mayer Administration Building](#) 204

Student Absence for Observance of Religious Holy Days

A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. See ASU Operating Policy 10.19 Student Absence for [Observance of Religious Holy Day](#) for more information.

Incomplete Grade Policy

It is policy that incomplete grades be reserved for student illness or personal misfortune. Please contact faculty if you have serious illness or a personal misfortune that would keep you from completing course work. Documentation may be required. See ASU Operating Policy 10.11 [Grading Procedures](#) for more information.

Student Conduct Policies

Academic Integrity

Students are expected to maintain complete honesty and integrity in all work. Any student found guilty of any form of dishonesty in academic work is subject of disciplinary action and possible expulsion from ASU.

[Academic Integrity](#)

Plagiarism

Plagiarism is a serious topic covered in ASU's [Academic Integrity policy](#) in the Student Handbook. Plagiarism is the action or practice of taking someone else's work, idea, etc., and passing it off as one's own. Plagiarism is literary theft.

In your discussions and/or your papers, it is unacceptable to copy word-for-word without quotation marks and the source of the quotation. It is expected that you will summarize or paraphrase ideas giving appropriate credit to the source both in the body of your paper and the reference list.

Papers are subject to be evaluated for originality via Turnitin. Resources to help you understand this policy better are available at the [ASU Writing Center](#).

Copyright Policy

Students officially enrolled in this course should make only one printed copy of the given articles and/or chapters. You are expressly prohibited from distributing or reproducing any portion of course readings in printed or electronic form without written permission from the copyright holders or publishers.

General Policies Related to This Course

All students are required to follow the policies and procedures presented in these documents:

- [Angelo State University Student Handbook](#)
[Angelo State University Catalog](#)