

# BIOLOGY 1306 Spring 2022

## Principles of Biology I

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### Instructor: Ms. Carla Ebeling

Email: [carla.ebeling@angelo.edu](mailto:carla.ebeling@angelo.edu) or [cebeling@angelo.edu](mailto:cebeling@angelo.edu)

Phone: 325-486-6701

Office: Cavness basement, office 002A

Office Hours: Posted on Blackboard

## Course Information

### Course Description

An introduction to the unifying principles of biology with emphasis on biological chemistry, energetics and homeostasis, cell structure and function, gene expression, and patterns of inheritance. Recommended for students majoring in biological sciences or related disciplines. Not intended for non-majors.

### Prerequisite and Co-requisite Courses

Students must register for Biology 1106 laboratory concurrently.

### Student Learning Outcomes

This course introduces the integration between structure and function of biological organization. You will be asked to use processes of science to apply principles of evolution, genetics, diversity, and ecology to living systems. Observation, experimentation, and investigation are emphasized. Biology 1306 requires a conceptual understanding of the material rather than the simple memorization and regurgitation of facts. This course will challenge you to analyze and apply information, solve problems, and make connections different from the context in which they were learned. These are critical skills in biology.

The complete list of specific learning objectives is provided at the end of this document and on the Blackboard course page.

## Course Delivery

This is a face-to-face course with online components that students are expected to access in Blackboard.<sup>1</sup>

## Required Texts and Materials

Textbook: Brooker, R.J., E.P. Widmaier, L.E. Graham, and P.D. Stiling. 2020. Biology. 5th Edition. McGraw-Hill: NY. with CONNECT™ eBook with CONNECT™— ISBN: 9781264114573

Laboratory Manual : Heimann, CP and D.P. French. Investigating Biology: Laboratory Manual to accompany Principles of Biology. ISBN 978-1-64485-275-0 Information regarding purchase of lab manual will be provided during the first week of classes.

## Technology Requirements

Microsoft Office 365. You have access to this software as an ASU student. You are expected to complete assignments in both Word and Excel. Use of Word and Excel is not optional. This is the software supported by the university and familiarity with it will serve you well in subsequent courses.

## Communication

**Written communication via email:** All private communication will be done exclusively through your ASU email address. Check frequently for announcements and policy changes. In your emails to faculty, include the course name and section number in your subject line.

Faculty will respond to email messages within 24 hours during working hours Monday through Friday. Weekend messages may not be returned until Monday.

**Virtual communication:** Office hours and/or advising will be done with the assistance of the telephone, Collaborate, etc.

# Grading

## Evaluation and Grades

Course grades will be determined based on a combined total of 1000 points from lecture and lab as indicated in the following table.

### Assessment Points

Activities (CONNECT, quizzes, homework, etc.)	200
Exam 1	100
Exam 2	100
Exam 3	100
Final Exam* (comprehensive)	200
Laboratory	300
Course total points	1000

Total course points: 700 lecture points; 300 lab points

\*The Comprehensive Final Exam (percentage grade) will, if higher, replace a lower grade on one of the first three semester lecture exams.

## Grading System

Course grades will depend on completing course requirements and meeting the student learning outcomes.

This course uses the following grading scale:

A = 900.0-1000 points

B = 800.0-899.9 points

C = 700.0-799.9 points

D = 600.0-699.9 points

F = 0-599.9 points (Grades are not rounded up)

## Assignment and Activity Descriptions

Knowledge of Student Learning Outcomes will be assessed as multiple choice, matching, true/false questions on examinations. Activities will be a mix of various assignment formats including questions during lecture, CONNECT assignments, Blackboard quizzes, worksheets, and other assessment formats. There will be no makeup activity if you are absent or late.

### Make-up Exams

Make-up exams will be given only in emergency situations which preclude class attendance or pre-arranged, approved university absence. Opportunity to take a make-up exam is based on University policy and instructor discretion. Arrangements for excused make-up exams should be made prior to the scheduled date of the exam, unless it is a health emergency, in which case you should contact the instructor before the first class following the absence.

### Laboratory Grades

Success in the laboratory involves teamwork in designing and conducting experiments, performing pre-lab and lab activities and report writing. In addition, you will conduct activities designed to develop and improve critical thinking and problem-solving skills related to the topics discussed in lectures.

**You MUST earn a minimum of 60% of the lab points (180 out of 300) to pass the course.**

**You WILL NOT pass the course if you fail the lab!!**

## 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](#)<sup>2</sup>
- [Angelo State University Catalog](#)<sup>3</sup>

### 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.

The College of Science and Engineering adheres to the university's [Statement of Academic Integrity](#).<sup>4</sup>

### Accommodations for Students with Disabilities

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.

Student Disability Services is located in the Office of Student Affairs, and is the designated campus department charged with the responsibility of reviewing and authorizing requests for reasonable accommodations based on a disability. It is the student's responsibility to initiate such a request by contacting an employee of the Office of Student Affairs, in the Houston Harte University Center, Room 112, or contacting the department via email at [ADA@angelo.edu](mailto:ADA@angelo.edu). For more information about the application process and requirements, visit the [Student Disability Services website](#).<sup>5</sup> The employee charged with the responsibility of reviewing and authorizing accommodation requests is:

Dr. Dallas Swafford  
Director of Student Disability Services  
Office of Student Affairs  
325-942-2047  
[dallas.swafford@angelo.edu](mailto:dallas.swafford@angelo.edu)  
Houston Harte University Center, Room 112

## **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](#)<sup>6</sup> for more information.

## **Plagiarism**

Plagiarism is a serious topic covered in ASU's [Academic Integrity policy](#)<sup>7</sup> 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. Resources to help you understand this policy better are available at the [ASU Writing Center](#).<sup>8</sup>

## **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<sup>9</sup> for more information.

## **Title IX at Angelo State University**

Angelo State University is committed to providing and strengthening an educational, working, and living environment where students, faculty, staff, and visitors are free from sex discrimination of any kind. In accordance with Title VII, Title IX, the Violence Against Women Act (VAWA), the Campus Sexual Violence Elimination Act (SaVE), and other federal and state laws, the University prohibits discrimination based on sex, which includes pregnancy, and other types of Sexual Misconduct. Sexual Misconduct is a broad term encompassing all forms of gender-based harassment or discrimination and unwelcome behavior of a sexual nature. The term includes sexual harassment, nonconsensual sexual contact, nonconsensual sexual intercourse, sexual assault, sexual exploitation, stalking, public indecency, interpersonal violence (domestic violence or dating violence), sexual violence, and any other misconduct based on sex.

You are encouraged to report any incidents involving sexual misconduct to the Office of Title IX Compliance and the Director of Title IX Compliance/Title IX Coordinator, Michelle Miller, J.D. You may submit reports in the following manner:

Online: Incident Reporting Form<sup>10</sup>

Face to Face: Mayer Administration Building, Room 210

Phone: 325-942-2022

Email: [michelle.miller@angelo.edu](mailto:michelle.miller@angelo.edu)

Note, as a faculty member at Angelo State, I am a mandatory reporter and must report incidents involving sexual misconduct to the Title IX Coordinator. Should you wish to speak to someone in confidence about an issue, you may contact the University Counseling Center (325-942-2371), the 24-Hour Crisis Helpline (325-486-6345), or the University Health Clinic (325-942-2171).

For more information about resources related to sexual misconduct, Title IX, or Angelo State's policy please visit the Title IX website.<sup>11</sup>

## **Information About COVID-19**

Please refer to ASU's COVID-19 (Coronavirus) Updates<sup>12</sup> web page for current information about campus guidelines and safety standards as they relate to the COVID-19 pandemic.

# Modifications to the Syllabus

**This syllabus, including grade evaluation and course schedule, is subject to modification on potentially short notice based on developing circumstances.**

## Course Schedule

Week 1/Jan 18 Science and The Chemistry of Life

Week 2/Jan 25 Cells

Week 3/Jan 31 The Nerve Cell

Week 4/Feb 7 Exam Review and Exam One

**EXAM ONE Friday 11 February**

Week 5/Feb 14 Enzymes and the Energy of Life

Week 6/Feb 21 Metabolism and Cellular Respiration

Week 7/Feb 28 Photosynthesis

Week 8/Mar 7 Exam Review and Exam Two

**EXAM TWO Friday 11 March 2022**

**SPRING BREAK - No Classes March 14-18**

Week 9/Mar 21 DNA Structure, DNA Replication, and Gene Function

Week 10/Mar 28 Cell Cycle, Mitosis, Meiosis, and Sexual Reproduction

Week 11/Apr 4 Review and Exam 3

**EXAM THREE Friday 8 April 2022**

Week 12/Apr 11 Patterns of Inheritance I

Week 13/Apr 18 Patterns of Inheritance II

Week 14/Apr 25 DNA Technology

**April 28 Last Day to Drop/Withdraw Regular Term, Spring 2021**

Week 15/May 2 Review and Exam Review

Week 16/May 9 Final Exam Week

**FINAL EXAM Monday 9 May 2022; 8:00-10:00 AM**

## 1306/1106 LEARNING GOALS Spring 2022

### EXAM 1

#### THE SCIENTIFIC STUDY OF LIFE

1. List and describe the characteristics of science
2. Differentiate between observations, hypotheses, theories and laws
3. Identify and describe elements of the scientific method and how biology is investigated
4. Identify and describe the elements of a controlled experiment including appropriate experimental and control groups.
5. Identify and distinguish between 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 O<sub>2</sub> in respiration.
9. Explain what would happen in each part of cellular respiration if the cell is deprived of O<sub>2</sub>.
10. Explain why fermentation is necessary in O<sub>2</sub> 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.

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<sup>1</sup> <https://blackboard.angelo.edu/>

<sup>2</sup> <https://www.angelo.edu/current-students/student-handbook/>

<sup>3</sup> <https://www.angelo.edu/academics/catalog/>

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- 4 <https://www.angelo.edu/live/files/27603-student-handbook-2020-21#page=97>
  - 5 <https://www.angelo.edu/current-students/disability-services/>
  - 6 <https://angelo.policystat.com/policy/10659448/latest/>
  - 7 <https://www.angelo.edu/live/files/27603-student-handbook-2020-21#page=96>
  - 8 [https://www.angelo.edu/current-students/writing-center/academic\\_honesty.php](https://www.angelo.edu/current-students/writing-center/academic_honesty.php)
  - 9 <https://angelo.policystat.com/policy/10659368/latest/>
  - 10 <https://www.angelo.edu/incident-form>
  - 11 <https://www.angelo.edu/title-ix>
  - 12 <https://www.angelo.edu/covid-19/>