

COURSE OUTLINE

Principles of Biology 1
Course Title

SC109
Dept. & Course No.

I. Course Description:

This is the first semester of a two-semester course that covers cells and molecular biology, genetics, evolution, and the origin and history of life on earth.

II. Semester Credits: 4

III. Contact hours Per Week: 3 3 6
Lecture Lab Total

IV. Prerequisite: None

V. Student Learning Outcomes:

Upon completion of this course, the student will be able, with a minimum of 65% accuracy, to:

1. Demonstrate the proper practices of working safely in the laboratory.
2. List three steps of the scientific method; apply them to investigate a sample scientific problem, and write a lab report following the proper scientific format.
3. List and explain the eight characteristics of living things
4. Describe the basic properties and behavior of matter.
5. Describe the four groups of biological molecules and enzymes.
6. Perform simple laboratory test for a monosaccharide, polysaccharide, a protein, and a fat.
7. Explain what this statement means: cells are

VI. Course Content

A. Scientific Method

1. Observations
2. Hypothesis
3. Experimentation

B. Eight Characteristics of Living Things

1. Highly Ordered
2. Cells
3. Use energy from the environment
4. Respond to stimuli
5. Development
6. Reproduce
7. Contain Genetic Information
8. Evolution

C. Basic Chemistry

1. Structure of Atoms
2. Bonds between atoms
3. Compounds and molecules
4. Movement of molecules
5. Chemical reactions
6. Water

D. Biological Chemistry

1. Biological Molecules
2. Enzymes
3. Metabolism

E. Cells

1. Cell Theory

the structural, functional, and reproductive units of life.

8. Describe the structure and function of the plasma membrane and other biological membranes.
9. Observe and describe the different ways that substances move in and out of cell through a selectively permeable membrane.
10. Describe the main difference between a eukaryotic and a prokaryotic cell.
11. Give at least one function of each of the different structures found in cells and state whether each would be found in prokaryotic, plant, or animal cells.
12. Observe the basic organization of cells and describe how it has adapted to a variety of biological roles through evolution.
13. Explain the rules of energy transactions and show how they apply to chemical reactions carried out by cells.
14. List and describe coenzymes that help capture energy of food molecules during these processes: glycolysis and fermentation.
15. Observe and document the fermentation process
16. Describe the reactions of photosynthesis and adaptations that allow plants in different habitats to flourish under less than ideal conditions.
17. Describe and experiment to measure the rate

2. Unicellular and Multicellular

F. Cell Membranes

1. Biological membranes
2. Membrane structure
3. Roles of plasma membrane

G. Prokaryotes and Eukaryotes

1. Size
2. Compartment
3. Cytoskeleton
4. Cohabitants

H. Cell Structure and Function

1. Nuclear area
2. Nucleus
3. Nuclear envelope
4. Chromosome
5. Nucleolus
6. Ribosome
7. Endoplasmic reticulum
8. Golgi complex
9. Lysosome
10. Peroxisome
11. Mitochondria
12. Plastid
13. Chloroplast
14. Cell wall
15. Vacuole
16. Cytoskeleton
17. Microtubules
18. Cilium or flagellum
19. Centriole
20. Intermediate filaments
21. Microfilament

I. Energy and Living Cells

1. Energy transformations
2. Chemical reactions and energy
3. Photosynthesis and Respiration

J. Cellular respiration and fermentation

1. Coenzymes
2. Glycolysis
3. Fermentation
4. Alternate Food Molecules

K. Photosynthesis

1. Energy Capture
 - a. Light Absorption
 - b. Electron transport
 - c. Chemiosmotic ATP Synthesis

of photosynthesis.

18. Describe the evidence for DNA being the genetic material, how the molecular structure of DNA was worked out, and how DNA is copied, packaged and organized into Chromosomes.

19. Compare and contrast the structures of a eukaryotic chromosome and the prokaryotic DNA.

20. Describe how genetic information is transcribed and translated into protein structures during protein synthesis

21. Describe, compare and contrast the following processes: cell cycle, mitosis, cytokinesis, and meiosis

22. Describe Mendel's breeding experiments and how they revealed the patterns of inheritance.

23. Use genetic crosses to highlight the principles of Mendelian Genetics.

24. Describe the variations from the basic inheritance patterns, how different alleles produce different genotypes and factors that control phenotypic expression of genes.

25. Describe evolution and natural selection, its history, evidence and examples

- d. Carbon Fixation
- 2. Ecological Aspects of photosynthesis

L. DNA and Genetic Information

- 1. Evidence for DNA
 - a. Bacterial Transformation
 - b. Bacteriophages
 - c. Quantity of DNA in cells
 - d. Proportions of bases in DNA
- 2. Structure of DNA
- 3. DNA replication
- 4. DNA repair
- 5. Mutations

M. DNA in prokaryotes and Eukaryotic chromosomes

N. RNA and Protein Synthesis

- 1. Overview of protein synthesis
- 2. RNA
- 3. The Genetic Code
- 4. Transfer RNA
- 5. Protein synthesis

O. Reproduction in Eukaryotic Cells

- 1. Cell cycle
- 2. Mitosis
- 3. Cytokinesis
- 4. Meiosis

P. Mendelian Genetics

- 1. Law of Segregation
- 2. Independent Cross
- 3. Incomplete Dominance and Codominance
- 4. Linkage groups
- 5. Crossing Over

Q. Inheritance Patterns and Gene Expression

- 1. Phenotypic Expression of Mutations
- 2. Lethal Alleles
- 3. Inborn errors of metabolism
- 4. Multiple alleles
- 5. Polygenic characters
- 6. Sex determination
- 7. Sex linkage
- 8. Sex-influenced genes
- 9. Factors that affect gene expression

R. Evolution and Natural Selection

- a. Lamarckism
- b. Darwin and Wallace
- 2. Evidence for Natural Selection
- 3. Evolution by Means of Natural

26. Describe prebiotic earth and outline how nonliving chemicals may have become organized step by step into living cells.

- Selection
4. Genetic Contribution to Future Generations
 5. Adaptations
- S. **Origins of Life**
1. Spontaneous Generation
 2. Condition for the Origin of Life
 3. Prebiotic Earth
 4. Organisms and Environment
 5. History of Life on Earth

VII. Materials and Equipment:

- A. Palau Community College Laboratory and related equipments
- B. Routine classroom materials
- C. Computer Lab and science software
- D. Handouts
- E. Video Tapes on related issues
- F. Slides
- G. TV & VCR
- H. Slide Projector

VIII. Text

- A. Required Student Text:

Freeman, Scott, Kim Quillin, and Lizabeth Allison. Biological Science, 5th ed. San Francisco, CA; Pearson Education, Inc., publishing as Pearson Benjamin Cummings, 2014. (Chapters 1-25)

IX. Method of Evaluation:

- A. Grade Components

<i>Component</i>	<i>Weight</i>
Participation	10%
Quizzes & Homeworks	10%
Lab works	20%
Section Tests	20%
Research Paper	20%
Final Exam	20%
TOTAL	100%

- B. Grade Scale

<i>Percentage</i>	<i>Letter Grade</i>
90% to 100%	A
80% to 89%	B
70% to 79%	C
65% to 69%	D
64% and below	F

**Form NC-2
Task List Sheet**

SC109 Principles of Biology 1

3

1

48

Course No. & Title

Lec

Lab

Total Lab Hrs

Lab Objectives & Accompanying Tasks

Hours

- | | |
|---|---|
| 1. Demonstrate the proper practices of working safely in lab.
a. Demonstrate an understanding of lab safety
b. Identify the safety symbols used in the lab
c. Locate and describe lab equipment
d. Explain proper procedures in case of accident | 3 |
| 2. List three steps in scientific method, apply them to investigate a sample scientific problem and write a lab report following the proper format.
a. Define the problem
b. Formulate Hypothesis
c. Design and Perform Experiment to test the hypothesis
d. Collect data and analyze
e. State the conclusion
f. Write a laboratory report | 6 |
| 3. Perform simple laboratory test for monosaccharide, polysaccharide, and a protein and a fat
a. Perform Benedict's test for reducing sugar
b. Perform Iodine Test for starch
c. Perform Sudan III Test for fat
d. Perform Biuret Test for protein
e. Identify an unknown food by performing different test | 6 |
| 4. Observe and describe the different ways that substances move in and out of cell through a selectively permeable membrane
a. Study diffusion
b. Study the diffusion of silver nitrate, sodium chloride, potassium bromide, and potassium ferricyanide in a solid medium
c. Study osmosis in a model cell
d. Observe osmosis across a living membrane of an Elodea leaf
e. Study active transport in yeast, a unicellular fungus | 6 |
| 5. Observe the basic organization of cells and describe how it has adapted to a variety of biological roles through evolution
a. Make a wet mount of Elodea, observe the different structures under a microscope and make a sketch
b. Prepare a slide of an onion epidermis and observe the nucleus, cytoplasm and vacuole. Make a sketch.
c. Prepare a slide of a human cheek epithelium stained with methylene blue dye, observe the different structure and make a sketch.
d. Make a slide of a prokaryotic cell (bacteria) taken from a yogurt and observe the difference between prokaryotic and eukaryotic cells. Make a sketch.
e. Make a slide of a mushroom (eukaryotic fungal cell) and observe the size of the cell and the structures. Make a sketch.
f. Make a wet mount of Chlamydomonas and observe the similarities with plant cells the unique structure. Make a sketch. | 6 |
| 6. Observe and record the fermentation process
a. Measure CO ₂ production by fermentation yeast | 3 |

- b. Compare fermentation of different carbohydrates in regards to CO₂ production
7. Describe an experiment to measure the rate of photosynthesis 6
- Measure the rate of oxygen production in photosynthesis
 - Demonstrate the effect of changes in light intensity on the rate of photosynthesis
8. Use genetic crosses to highlight the principles of Mendelian Genetics 6
- Use a Punnett square to describe a monohybrid cross and a dihybrid cross in which two genes show independent assortment; give the genotypic and phenotypic ratios expected in each case
 - Define linkage, and describe a dihybrid cross in which two genes are completely linked; give the expected genotypic and phenotypic ratios for offspring
 - Define sex linkage; use a Punnett square to describe a cross of a homozygous female with a mutant male, and give phenotype and genotype of offspring
 - Give the reciprocal cross and explain why the reciprocal cross is necessary when the mutation might occur either dominant or recessive
 - Given the F1 and F2 results from a cross, determine the mode of transmission of the genes
 - Analyze the results using chi-square test to see how closely they fit Mendel's Laws
9. Describe the variations from the basic inheritance patterns, how different alleles produce different genotypes and factors that control phenotypic expression of genes 6
- Determine the most likely mode of inheritance of a genetic trait from the information in a human gene
 - Determine your own possible genotypes for several physical traits
 - Define the terms antigen, antibody, and antiserum
 - Given the possible genotypes of persons with the following blood types: A, B, AB, O, Rh+, Rh-
 - Use diagrams to explain how nondisjunction in the male or female can lead to the following karyotypes: XO, XXX, XXY, XYY
 - Determine the Total Ridge Count (TRC) for your own fingerprints and heritability for TRC in your class

COURSE LEARNING OUTCOMES

SC109 Principles of Biology 1
PALAU COMMUNITY COLLEGE

During the course experience, the **course learning outcomes (CLOs)** will be assessed through the use of signature assignments. A rating scale will be used to determine the students' proficiency level of each CLO using specifically aligned assignments. The numerical ratings of 4, 3, 2, and 1 are not intended to represent the traditional school grading system of A, B, C, D, and F. The descriptions associated with each of the numbers focus on the level of student performance for each of the course learning outcomes listed below.

RATING SCALE:

4- Accomplished

3 - Competent

2 - Developing

1 - Beginning

Course Learning Outcome # 1:

Numerical value	Describes all eight characteristics of living things.
4	Describes all eight characteristics of living things
3	Describes at least five characteristics of living things
2	Describes at least three characteristics of living things
1	Describes less than three characteristics of living things

Course Learning Outcome # 2:

Numerical value	Describes all four groups of biological molecules.
4	Describes all four groups of biological molecules
3	Describes three groups of biological molecules
2	Describes two groups of biological molecules
1	Describes one group of biological molecules

Course Learning Outcome # 3:

Numerical value	Describe the seven major structures and functions of the plasma membrane.
4	Describe all seven major structures and functions of the plasma membrane
3	Describe at least five structures and functions of the plasma membrane
2	Describe at least three structures and functions of the plasma membrane
1	Describe at least two structures and functions of the plasma membrane

Course Learning Outcome # 4:

Numerical value	Identify a function of each of the different structures found in cells and state whether each would be found in prokaryotic, plant, or animal cells.
4	Identify a function from four to five different structures and the diversity of forms found
3	Identify a function from three to four different structures and the diversity of forms found
2	Identify a function from two to three different structures and the diversity of forms found
1	Identify a function from only one different structure and the diversity of forms found

Course Learning Outcome # 5:

Numerical value	Describe five major reactions of photosynthesis.
4	Describe five major reactions of the photosynthesis process
3	Describe four reactions of the photosynthesis process
2	Describe three reactions of the photosynthesis process
1	Describe one to two reactions of the photosynthesis process

Course Learning Outcome # 6:

Numerical value	Describe the evidence for DNA being the genetic material, how the molecular structure of DNA was worked out, and how DNA is copied, packaged and organized into chromosomes.
4	Describe the evidence, molecular structure of DNA and how DNA is copied, packaged and organized into chromosomes
3	Describe the evidence, molecular structure of DNA and how DNA is copied and packaged
2	Describe the evidence, molecular structure of DNA and how DNA is copied
1	Describe the evidence and molecular structure of DNA; describe the evidence for DNA being the genetic material