

INTER AMERICAN UNIVERSITY OF PUERTO RICO
METRO CAMPUS
Faculty of Science and Technology
Department of Natural Sciences

Syllabus

I GENERAL INFORMATION

Course Title:	General Biology I
Code and Number:	Biol 1101
Credits:	3 credits
Academic Term:	
Professor:	
Office Hours:	
Office Phone	
Email	

II. DESCRIPTION

In this course, we study the characteristics and organization of living organisms. The structure of the principal macromolecules, cell, cell cycle and its metabolic processes are learned. We will use the scientific rationale to study biological processes.

III. OBJECTIVES

1. Explain the characteristics of organisms and levels of matter.
 - 1.1 Identify the characteristics of living organisms.
 - 1.2 Describe the hierarchy and levels of organization in nature, from subatomic particles to the biosphere.
 - 1.3 Distinguish between prokaryotic and eukaryotic cells.
 - 1.4 Explain the significance of the relationship between cell structure and function.
 - 1.5 Distinguish the kingdoms into which living organisms are grouped.
2. Apply scientific reasoning in the study of biological processes.
 - 2.1 Recognize the steps of the scientific method.
 - 2.2 Differentiate between inductive and deductive reasoning.
 - 2.3 Recognize the influence of biology in modern society.

3. Relate chemical concepts to biological processes.
 - 3.1 Describe the properties and functions of subatomic particles.
 - 3.2 Identify the main chemical elements present in organisms.
 - 3.3 Distinguish between the different chemical bonds and properties.
 - 3.4 Explain the characteristics of the water molecule.
 - 3.5 Compare the composition and function of the main groups of organic macromolecules.

4. Relate the ultrastructure of the cell to its function.
 - 4.1 Explain the cell theory.
 - 4.2 Compare prokaryotic and eukaryotic cells.
 - 4.3 Compare plant and animal cells.
 - 4.4 Describe the Fluid Mosaic Model of the cell membrane.
 - 4.5 Explain the transport mechanisms through cell membranes.
 - 4.6 Identify the different types of cell junctions.
 - 4.7 Recognize the mechanisms of cellular communication.

5. Discuss the metabolic processes of the cell.
 - 5.1 Define the forms of energy.
 - 5.2 Explain the laws of thermodynamics that apply to biological systems.
 - 5.3 Compare anabolism and catabolism.
 - 5.4 Describe the chemical structure of ATP and explain its role in the cell metabolism.
 - 5.5 Explain the structure and function of enzymes.
 - 5.6 Describe the factors affecting enzyme activity.
 - 5.7 Compare aerobic and anaerobic routes of the catabolic process.
 - 5.8 Compare the processes of respiration and photosynthesis.

6. Explain the events of the cell cycle and mitosis.
 - 6.1 Describe the cell cycle phases.
 - 6.2 Describe the process of cell cycle regulation.
 - 6.3 Compare the stages of mitosis.

IV CONTENTS

- A. Concepts to define in living organisms.
 1. Characteristics
 2. Organization
 3. Classification of organisms
 - a. kingdoms
 - b . domains
 - 4 . Diversity and unity in organisms.

B. Scientific reasoning

1. Scientific Method

- a. hypothesis
- b . prediction
- c . experiment

2 . Deductive vs. inductive reasoning

3 . Science and Society

C. Chemical Basis of organisms.

1. Chemical elements

a. atomic Structure

- 1) Atomic number
- 2) Atomic Weight
- 3) mass number
- 4) Isotopes
- 5) Valence

b . Main elements

- 1) Carbon
- 2) Hydrogen
- 3) Oxygen
- 4) Nitrogen

2. Compounds

a. Bonds

- 1) Covalent bonds
 - a. polar bonds
 - b . nonpolar bonds
- 2) Ionic bonds

b . weak interactions

- 1) Hydrogen bonds
- 2) Van der Waals Forces

3 . Relationship between molecular shape and function

4 . Water molecule

a. Hydrogen bonds formation.

- 1) Capillarity
- 2) Adhesion
- 3) Surface Tension
- 4) Cohesion

b . Specific heat and vaporization of water

c . Expansion of water as it cools

d . Solvent properties

- 1) Aqueous Solutions

- 2) Molarity
- e . Hydrophilic and hydrophobic substances
- f . Dissociation of the molecule
 - 1) Equation dissociation
 - 2) Definition of pH
 - a. Mathematic Equation
 - 3) Definition of acids and bases
 - 4) Implications of changes in pH
 - 5) buffers
 - a) bicarbonate buffer system
- 5 . Organic molecules and macromolecules.
- a. Chemical nature of the carbon atom
 - 1) configuration and number of bonds.
 - 2) Variations in the structure
 - a) linear Forms
 - b) branched forms
 - c) Rings
 - d) Isomers
 - 1) Structural isomers
 - 2) Geometric isomers
 - 3) enantiomers
 - 3) Functional groups and their properties
- b . Hydrolysis and condensation reactions
 - 1) Monomers and biodiversity
- c . Biological functions of macromolecules
- d . macromolecules
 - 1) Carbohydrates
 - a) Monosaccharides
 - b) glycosidic bonds
 - c) Disaccharides
 - d) Polysaccharides
 - 2) Lipids
 - a) Fats
 - 1) ester bonds
 - 2) Saturated bonds
 - 3) Unsaturated
 - b) Phospholipids
 - c) Steroids

3) Proteins

a) Amino Acids

1) Classification of amino acids

a) Polar

b) Non- polar

c) electrically Charged

b) peptide bonds

c) Polypeptides

1) Conformation: Primary , secondary, tertiary , and quaternary structures

2) Structural changes

4) Nucleic Acids

a) Nucleotides

b) Phosphodiester bonds

c) polynucleotides : DNA , RNA

1. Watson-Crick model.

2. Functions

D. Cell

1. Contributors to the cell theory

a. Robert Hooke

b . Anthony van Leewenhook

c . Mathias Schleiden and Theodor Schwann

2 . Cell types

a. prokaryotes

b . Eukaryotes

1) animal cell

2) Plant Cell

3 . Intracellular structures

a. function

b . Endosymbiotic theory

4 . Cell membranes

a. structure

1) fluid mosaic model

b. Permeability and transport mechanisms

1) Factors affecting the permeability

a) Polarity

b) Size

c) Electrical Charges

- 2) Passive transport
 - a) Diffusion
 - b) Facilitated diffusion
 - c) Osmosis
 - d) dialysis
- 3) Active transport
 - a) Generation of electrochemical gradients
 - 1. Sodium-potassium pump
 - 2. Proton pump
 - b) Co-transport
- 4) Exocytosis
- 5) Endocytosis
 - a) Phagocytosis
 - b) Pinocytosis
 - c) receptor-mediated transport
- 5. Intercellular junctions
 - a. tight junctions
 - b . desmosomes
 - c . opening joints
 - d . Plasmodesma
- 6. Cellular communication
 - a. Types of communications: local and remote
 - b . receptors
 - c . Signal Transduction
 - d . Response to signals
- E. Metabolic Processes
 - 1. Forms of energy
 - a. potential energy
 - b . kinetics energy
 - 2 . Energy Transformations
 - a. First law of thermodynamics
 - b . Second law of thermodynamics
 - 3 . Free energy (G)
 - a. exergonic reactions
 - b . endergonic reactions
 - c . Energy coupling: role of ATP

- 4 . Enzymes
 - a. structure
 - b . Mechanisms of Action
 - c . Factors affecting the enzymatic reaction
 - 1) pH
 - 2) Temperature
 - 3) Concentrations of enzyme and substrate
 - 4) inhibitors: competitive and non – competitive inhibitors
 - d . Regulation of enzyme activity
 - 1) allosteric regulation
 - 2) feedback inhibition
 - 3) Cooperatively
- 5 . Cellular respiration
 - a. Oxidation-reduction reactions
 - b . Metabolism: anabolic and catabolic
 - c . aerobic respiration
 - 1) Glycolysis
 - 2) Formation of Acetyl - CoA
 - 3) Krebs Cycle
 - 4) electron transport chain
 - 5) Chemiosmosis
 - d . Anaerobic respiration
 - e . Fermentation
 - 1) Alcohol
 - 2) Lactic
6. Photosynthesis
 - a. Light Spectrum
 - b . Photosynthetic pigments and thylakoid membrane
 - c . Light -dependent reactions
 - 1) photosystems I and II
 - 2) Photolysis
 - d . Reactions of carbon fixation
 - 1) Calvin cycle (C3)
 - 2) Routes C4 and CAM
- F. Cell cycle
 1. chromosomes
 - 2 . Interphase : G1 , S , G2
 - 3 . Mitosis: phases
 - 4 . Matching points of the cell cycle
 - 5 . binary fission

V. ACTIVITIES

Conferences , quizzes and exams.

VI. EVALUATION

Midterm Exam I Chapters 1 to 4	100 points
Midterm Exam II Chapters 5 to 7	100 points
Midterm Exam III Chapters 8 to 10	100 points
Final Exam Chapters 1 to 10	100 points
Total	400 points

VII. SPECIAL NOTES

1. Plagiarism, dishonesty, fraud, manipulation and falsification of data or any other inappropriate behavior related to academic work are contrary to the principles and institutional rules and subject to disciplinary action as provided for in Chapter V , Part 1 Section B.2 of the General Student Regulations . Additional information refer to:

http://www.inter.edu/files/ReglamentoGeneralEstudiantesv9junio2005_2.pdf

2 . Students who require special assistance or auxiliary services must request them at the start of the course or as soon as acquire the needed knowledge through the corresponding record in the office of Professional Counselor José A. Rodríguez Franco, Coordinator of Student Services with a disability , located in the University Orientation Program or by email :

jrodriguez@metro.inter.edu

VIII. EDUCATIONAL RESOURCES

Text

Urry L, Cain ML, Wasserman SA, y Minorsky PV, 2005 Campbell Biology in Focus. The 1st edition . Benjamin Cummings. San Francisco , California.

Electronic Resources

Nye-Ruiz, B. 2010. Characteristics of Living things. Available at <http://www.youtube.com/watch?v=OvMBJZLEwFs>

Logos Academy. 2010. Living and non living things. <http://www.youtube.com/watch?v=k3b2VCNzhZo>

Dawkins R. 2013. The making of a Scientist. <http://www.youtube.com/watch?v=EWGAg9iGPLQ>

eHow. 2009. Science Questions : What Are Subatomic Particles? Available at <http://www.youtube.com/watch?v=uXcOqjCQzh8>

PluMGMK 2012. Physics of Subatomic Particles: Proton, Neutron, Pion, Deuteron. Available at <http://www.youtube.com/watch?v=FXRfZLpHnE4>

TEA Biotechnology. 2012. Cell Structure and Function. Available at <http://www.youtube.com/watch?v=o1GQyciJaTA>

IX REFERENCES

Solomon EP, Berg, LR y Martin, DW . 2008 . Biology. The 8th ed. Thomson Brooks / Cole , Belmont , California .

Raven PH , Johnson, GB, Losos, JB, Mason KA y Singer ,SR 2008 . Biology. The 8th ed. McGraw -Hill, New York , New York.

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