

SYLLABUS

TITLE:	General Biology I
CODE:	BIO 111
PREREQUISITE:	N/A
COREQUISITE:	BIO 111L
CREDITS:	4 credits 45 hours contact 30 hours Lab. 1 term

DESCRIPTION

This course has an approach that allows the formation and integral development of the student of the Natural Sciences program. The fundamental principles of animal and plant life and their relationship with the environment are studied. Emphasis is placed on the level of molecular and cellular organization and on biochemical processes: respiration, photosynthesis, mitosis, and meiosis. Introduction to classical, molecular genetics and biotechnology. This course includes theory and practice.

JUSTIFICATION

The fundamental concepts discovered by researchers in the field of biology and their applications in different areas of knowledge, affect all aspects of contemporary human life. Advances in the field of biology in recent years, especially in the field of Biotechnology, have been dizzying and of great impact. Research in this field has culminated in organ implantation, in vitro fertilization, establishment of clones and the production of a wide variety of products for therapeutic use by genetic engineering. In order to understand and evaluate these discoveries, and other problems of common interest in today's world such as cancer and metastasis, the effect of drug and alcohol use and abuse, among others, knowledge of biology is required. It is essential that in the integral formation and development of the student, this basic knowledge is acquired that allows them to understand the world of living organisms, in which we develop, and we are related to it.

COMPETENCES

The course develops in the student the following competences:

- **Critical Thinking**
- **Research and exploration**

OBJECTIVES

At the end of the course, students will be trained to:

1. Recognize the scientific methodology in the study of natural phenomena made by scientists, pointing out the relationships between biology and other sciences.
2. Use the microscope and other scientific research equipment.
3. Know the structure of the atom and explain the types of bonds of molecules and chemical reactions.
4. Identify cell organelles, know their functions and the relationships between them.
5. Discuss the mechanisms of cell division in mitosis and meiosis and interpret the meaning of these processes.
6. Explain the processes of respiration and photosynthesis and recognize their importance in the transformation of energy.
7. Identify the chemical nature of genetic material and explain how its function at the cellular level determines hereditary characteristics at the organismal level.
8. Know the basic principles of biotechnology, its applications and its impact on nature, including humans.
9. Analyze the ethical implications of biotechnology applications, both in the agricultural and environmental sectors, as well as in medicine.
10. Analyze the principles of Mendelian inheritance and their subsequent modifications and apply this knowledge to the analysis of inheritance problems.

CONTENT

- I. Introduction
 - A. Life vs non-Life
 - B. Properties of life
 - C. Science and technology
- II. Chemical basis of life

- A. Organic and inorganic compounds
 - B. Types of links
 - C. Hydrolysis and condensation reactions
 - D. Properties of water
 - E. Concept of pH and Buffers
 - 1. Importance for organisms
 - F. Biological Molecules
 - 1. Carbohydrates
 - 2. Lipids
 - 3. Proteins
 - 4. Nucleic Acids
- III. Cell: Structure and Function
- A. Prokaryotic Cell
 - 1. Composition and structure
 - B. Eukaryotic Cell
 - 1. Composition and structure
 - C. Properties of membrane permeability
 - 1. Chemical composition
 - D. Transport across the membrane
 - 1. Diffusion
 - 2. Osmosis
 - 3. Active Transportation
 - 4. Endocytosis and exocytosis
 - E. Cytoskeleton
 - F. Cell Cycle and Mitosis
- IV. Cell Metabolism
- A. Energy transfer
 - 1. Laws of thermodynamics
 - 2. Metabolic processes
 - a. Aerobic respiration
 - b. Anaerobic respiration
 - 3. Photosynthesis
 - a. Light reactions
 - b. Dark reactions (carbon fixation)
- V. Genetics
- A. Molecular genetics
 - 1. Structure of DNA and RNA

2. DNA replication
3. Transcription and translation (protein synthesis)
- B. Biotechnology
 1. Classical Biotechnology
 - a. Fermentation
 - b. Products (bread, cheese, alcoholic beverages)
 - c. Selective mating
 - d. Antibiotic production
 2. Modern Biotechnology
 - a. Recombinant DNA technique
 - 1) Applications
 - b. Clones
 - c. Core transfers
 - d. Transgenic Organisms
 - e. Stem Cells
- C. Types of biotechnology and their applications
 1. Microbials
 2. Agricultural
 3. Animal
 4. Forensic
 5. Bioremediation
 6. Pisciculture
- D. Genome Project and its importance in science
- E. Ethics and Biotechnology
 1. Ethical problems associated with Biotechnology
 2. Ethical considerations in research with humans
 3. Ethical controversy with genetic testing, stem cells and cloning

VI. Mendelian genetics

- A. Meiosis
- B. Mendelian laws
 1. Segregation Law
 2. Independent Draw Law
 3. Crosses
 - a. Monohybrid
 - b. recessive
 - c. Dihybrid

LABORATORY EXPERIENCES

- A. Scientific thinking

- B. Buffers and pH
- C. Organic molecules
- D. Microscope handling
- E. Cell transport process
- F. Enzyme activity
- G. Cell cycle and mitosis
- H. Aerobic and anaerobic respiration
- I. Photosynthesis
- J. Meiosis
- K. Model construction of the DNA molecule
- L. DNA extraction
- M. Use of yeasts in alcoholic and lactic fermentation
- N. DNA fingerprint

METHODOLOGY

The following strategies of the active learning methodology are recommended:

- Conference
- Question method
- Incorporation of Web tools
- Audiovisual resources: video, presentations, simulations
- Research Based Learning-RBL / Research Based Learning-ABI
 - Discussion
 - Field visits
 - Laboratory exercises
 - Independent use of WEB 2.0 (Blog and My Sacred)
 - Individual or group written reports

EVALUATION

Participation	10%
Partial jobs	40%
Final project or exam	25%
Immersion experience	<u>25%</u>
TOTAL	100%

LEARNING ASSESSMENT

The institutional assessment rubric is applied to the core activity of the course.

BIBLIOGRAPHY

TEXTBOOK

Solomon, Berg, M. (2019). *Biology*, 11 th, Saunders College Publishing.

Laboratory manual: Profesores de Biología, 1999, Manual de Laboratorio BIO 111
Universidad del Sagrado Corazón.

REFERENCES

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Lai, W., & Pugh, B. F. (2017). Understanding nucleosome dynamics and their links to
gene expression and DNA replication. *Nature reviews. Molecular cell
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Diseases. *Results and problems in cell differentiation*, 67, 441–485.
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plants. *Planta*, 249(4), 953–973. <https://doi.org/10.1007/s00425-019-03099-1>

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and response to cellular signaling. *Cellular and molecular life science:
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van Niel, G., D'Angelo, G., & Raposo, G. (2018). Shedding light on the cell biology of extracellular vesicles. *Nature reviews. Molecular cell biology*, 19(4), 213–228.

<https://doi.org/10.1038/nrm.2017.125>

van Oorschot, R., Szkuta, B., Meakin, G. E., Kokshoorn, B., & Goray, M. (2019). DNA transfer in forensic science: A review. *Forensic science international. Genetics*, 38, 140–166. <https://doi.org/10.1016/j.fsigen.2018.10.014>

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ELECTRONIC REFERENCES

<http://www.SoundersCollege.com/lifesci/titles.html>

<https://www.hhmi.org/news/ribosome-studies-turn-new-mechanism-protein-synthesis>

<https://archive.bio.org/articles/what-industrial-biotechnology>

<https://www.accessscience.com/content/cellular-respiration/1181>

Find more information resources related to the course topics on the library page <http://biblioteca.sagrado.edu/>

REASONABLE ACCOMMODATION

To obtain detailed information on the process and the required documentation, you must visit the corresponding office. To guarantee equal conditions, in compliance with the ADA (1990) and the Rehabilitation Act (1973), as amended, all students who need reasonable accommodation services or special assistance must complete the process established by the Vice Presidency for Academic Affairs.

ACADEMIC HONESTY, FRAUD AND PLAGIARISM

Any student who misses the policy of honesty, fraud and plagiarism is exposed to the following sanctions: received a grade of zero in the evaluation and/ or repetition of the work in the course, grade of F (*) in the seminar: suspension or expulsion as established in the Academic Honesty Policy document (DAEE 205-001) effective August 2005.