

Introduction to Biology (CH: 2+1)

BIO-107

Background

Biology – study of living organisms. It is concerned with the characteristics, classification, and behaviors of organisms, how species come into existence, and the interactions they have with each other and with the environment. Biology encompasses a broad spectrum of academic fields that are often viewed as independent disciplines. However, together they address phenomena related to living organisms (biological phenomena) over a wide range of scales, from biophysics to ecology. All concepts in biology are subject to the same laws that other branches of science obey, such as the laws of thermodynamics and conservation of energy.

Rationale

The objectives of the course of Biology are to introduce students to the method of acquiring science knowledge in a scientific manner using scientific investigation and the importance of cultivating scientific attitudes and noble values. Moreover to familiarize students with the building block of living organisms processes which take place in living things, relationship between structure and function, inheritance and understanding of an ecosystem and the relationship between biotic and abiotic components in a dynamic ecosystem.

Educational Objectives

- Acquire knowledge in biology and technology in the context of natural phenomena and everyday life experiences.
- Apply knowledge of biology to improve one's health and well-being. Face challenges in the scientific and technological world and be willing to contribute towards the development of science and technology.
- Realize that scientific discoveries are the result of human endeavor to the best of his or her intellectual and mental capabilities to understand natural phenomena for the betterment of mankind.
- Be aware of the need to love and care for the environment and play an active role in its preservation and conservation.

International Practice

Harvard University

Oxford University

Massachusetts Institute of Technology

University of California—Berkeley

Johns Hopkins University

Course Contents

- Week 1: Cellular and Molecular Biology – Cell structure and function, Mitosis and meiosis,
- Week 2: DNA & RNA, replication, Transcription, Translation & Genetic Code & gene expression
- Week 3: Genetics - Solve problems in Mendelian genetics, including multiple alleles and X-linkage along with the Laws of Segregation and Independent Assortment
- Week 4: Environmental Microbiology and Biotechnology - Understand the advances in environmental applications of microorganisms including GMOs and biosensors.
- Week 5- 6: Human viral & bacterial diseases (diseases pathogenesis and diagnostics and treatments)
- Week 7-8: Genomics and computational Biology / Bioinformatics - Exercises will include algorithmic, statistical, database, and simulation approaches and practical applications to medicine, biotechnology, drug discovery, and genetic engineering.
- Week 9- 10: Bioenergetics (carbohydrates, Glycolysis, TCA, gluconeogenesis, Glycogen & oxidative phosphorylation)
- Week 11: Blood and homeostasis.
- Week 12 -13: Human biological systems (Nervous system, Digestive system, Endocrine glands, Excretory system)
- Week 14: Diagnostics and human diseases
- Week 15: Antibiotics – types, mode of action/mechanism and its application.
- Week 16: Renewable energies - Biofuels/Biodiesel and its applications

Practicals

A: List of Experiments

- 1: Study and description of three locally available common flowering plants, one from each of the families Solanaceae, Fabaceae & Liliaceae including dissection and display of floral whorls, anther and ovary to show number of chambers.
- 2: Study of distribution of stomata in the upper and lower surface of leaves.
- 3: Separation of plant pigments through paper chromatography.
- 4: Study of the rate of respiration in flower buds/Leaf tissue and germinating seeds.
- 5: Test for presence of urea

6: Test for presence of sugar

7: Test for presence of albumin

B: Study/Observation of the following

1: Parts of a compound microscope.

2: Specimens/slides/models and identification with reasons – Bacteria, Oscillatoria, Spirogyra, Rhizopus, mushroom, yeast, liverwort, moss, fern, pine, one monocotyledonous plant, one dicotyledonous plant and one lichen.

3: Virtual specimens/slides/models and identification with reasons. Amoeba, Hydra, liver fluke, Ascaris, leech, earthworm, prawn, silkworm, honeybee, snail, starfish, shark, rohu, frog, lizard, pigeon and rabbit.

4: Tissues and diversity in shapes and sizes of plant and animal cells (palisade cells, guard cells, parenchyma, collenchyma, sclerenchyma, xylem, phloem, squamous epithelium, muscle fibres and mammalian blood smear) through temporary/permanent slides.

5: Mitosis in onion root tip cells and animal cells

Recommended Books

- The Lives of a Cell: Notes of a Biology Watcher by Lewis Thomas Biology by Neil A. Campbell
- The Diversity of Life by Edward O. Wilson
- Darwin's Dangerous Idea: Evolution and the Meanings of Life by Daniel C. Dennett
- The Origin of Species by Charles Darwin

Proposed Research Areas/Benefit(s) to the Society

- Molecular biology
- Cell biology
- Genetics
- Biochemistry
- Developmental biology
- Immunology
- Evolutionary Biology
- Physiology
- Renewable energies