

**University of Jeddah**

**Faculty of Science (Department of Biology)**

**2019**

**General Biology for preparatory Year students**

**Course Guide**

**Dr. Khloud Ghazi Fakiha & Dr. Fatmah Jaber**

بسم الله الرحمن الرحيم

# General Biology SCBI 101

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| Course Name | General Biology |
| Reference | Simon, Dickey, Hogan, Reece. Campbell Essential Biology with Physiology, Fifth Edition. ‎‎2016 |
| Text book | General Biology for preparatory year students, complied by Faculty of Science , University of Jeddah, Pearson, 2018 |

# Course Objectives:

* Getting student acquainted with Life Sciences and their vital applications in many life ‎aspects
* Understanding the basic principles of biology.
* Highlighting the role of Life Sciences in solving out more global issues and man-current ‎issues (e.g. global warming)‎
* Developing student’s general initiative and problem solving skills, which would ‎improve his intellectual ability to choose the career that meet with his skills.‎
* Teaching students the scientific methods for experimentation and analysis by English ‎language, which would improve her reading, written, interpreting and presentational ‎communication skills.‎

# Lecture topics:

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| Week | Topic |
| First | Introduction to biology: major themes in biology and life properties.  |
| Second | Chemical basics of life |
| Second | Biological molecules |
| Third | A tour of the cell  |
| Fourth | The unifying concepts of animal and plant: structure and function |
| Fifth | The working cell (energy and cell) |
| sixth | Cellular respiration and photosynthesis |
| Seventh | Biodiversity |
| eight | Nutrition and digestion |
| ninth | Circulation and respiration |
| tenth | Excretion |
| Eleventh | Reproduction, fertilization and development |
| Twelfth  | Basic genetics |

**Chapters Objectives:**

# Chapter one: Introduction: Biology today

1. Define Biology and the scientific methods.
2. Compare discovery science and hypothesis-driven science.
3. Distinguish the differences between hypothesis, facts and theory.
4. List seven properties that are common to all life.
5. Compare the three domains of life.
6. Distinguish between the three multicelullar kingdoms within Eukarya.
7. Define the common properties of Protists.
8. List the major themes in Biology.
9. Define evolution and compare natural selection and artificial selection.
10. Explain the correlation of structure and function at organ and cellular levels.
11. Describe how DNA encodes a cell’s information through defining genes and genome.
12. Compare the flow of matter and flow of energy in an ecosystem
13. Describe the levels of biological organization from molecular to biosphere.
14. Define the principle of emergent properties between levels in biological organization.
15. Distinguish the smallest level of biological organization that can display all characteristics of life.

# Chapter two: Essential chemistry for Biology

1. Define matter, element, essential and trace elements, and compound with some examples.
2. Describe why iodine and fluorine are added to human diet.
3. List organic and inorganic molecules in living organisms.
4. Describe the polarity of water molecule.
5. List the three properties of life.
6. Define and distinguish between cohesion and surface tension and its importance in water transport in plants.
7. Describe why ice floats and how this property support life on earth
8. Define a solute, a solvent, and a solution.
9. Define acids and basis
10. Explain the basis of the pH scale
11. Explain how buffers function.

# Chapter Three: The molecules of life

1. Explain what is lactose intolerance.
2. Define organic compounds and the chemical properties of carbon atom.
3. Define the functional groups and carbon skeleton
4. List four classes of macromolecules, explain the relationship between monomers and polymers.
5. Compare the process of dehydration synthesis and hydrolysis.
6. Describe carbohydrate structure, function
7. Define isomers with examples
8. List and define the three types of carbohydrates (monosaccharide, disaccharide, and polysaccharide) with examples.
9. Define high –fructose corn syrup (HFCS)
10. Describe the structure, function, properties of lipids and their types.
11. Compare saturated, un-saturated fat and trans-fat and which one is healthier.
12. Define hydrogenation.
13. Compare structure and function of fat and steroids
14. Describe the structure, function and types of proteins.
15. Describe the structure of amino acids
16. Describe how the protein shape’s forms and how it affects proteins’ function, example hemoglobin.
17. List factors that can cause misfolded proteins.
18. Describe nucleic acid macromolecules and monomers (nucleotides).
19. Compare the structure and function of DNA and RNA.
20. Define the gene and how it directs protein synthesis.

# Chapter Four: a tour of the cell

1. Define the cell theory.
2. Compare the structures of prokaryotic and eukaryotic cells.
3. Compare the structures of animal and plant cells.
4. Describe the structure of plasma membrane and the differences between hydrophobic and hydrophilic components.
5. Describe the fluid mosaic structure of the membrane.
6. Describe the structure and function of the cell wall, extracellular matrix and cell junctions.
7. Describe the structure and function of the nucleus and define the chromatin.
8. Describe how DNA direct protein synthesis.
9. Define endomembrane system and organs included.
10. Describe the structure, types and function of the ribosome.
11. Compare the structure and function of the rough and smooth endoplasmic reticulum.
12. Describe structure, function of Golgi apparatus, lysosomes, vacuoles types, mitochondria and chloroplasts.
13. Show the similarity between mitochondria and chloroplasts.
14. Describe structure and function of cytoskeleton, cilia and flagella (examples in multicellular organisms).

# Chapter Five: The unifying concepts of animal and plant: structure and function

1. Describe the levels of organization in animal’s body.
2. Relate structure (anatomy) to function (physiology).
3. Define tissue and list the four types of animal tissues.
4. Describe the four types of tissues noting their types, structure and function.
5. Explain how the structure of an organ is based on the cooperative interactions of tissues.
6. Compare monocots and eudicots.
7. List the structure of flowering plant with the function of each part.
8. Describe the structure and function of the three plant’s tissues.
9. Compare types of plant cells.

# Chapter six-1: The working cell

1. Define energy, conservation of energy and entropy
2. Define and compare kinetic, potential, chemical energy and heat.
3. Define cellular respiration and how it generates ATP.
4. Define the energy unit (ATP).
5. Describe how ATP functions as an energy shuttle and how it drives cellular work
6. Describe the structure of enzyme-substrate interaction.
7. Describe how enzymes speed up chemical reactions.
8. Describe the how competitive and noncompetitive inhibitors alter enzyme’s activity.
9. List the diverse functions of membrane proteins.
10. Define diffusion, facilitated diffusion, osmosis and the basic concepts of passive and active transport.
11. Distinguish between hypertonic, hypotonic and isotonic solutions.
12. Describe how animal and plant cells change when placed into hypertonic or hypotonic solutions.
13. Define exocytosis and endocytosis.

# Chapter six-2: cellular respiration and photosynthesis

1. *Cellular respiration:*
2. Compare autotrophs (producers) and heterotrophs (consumers).
3. Compare the process and location of cellular respiration and photosynthesis. Describe the chemical recycling between both processes.
4. Compare the process of breathing (respiration) and cellular respiration.
5. List stages of cellular respiration and the cellular region of each stage.
6. Compare the reactants and products of the three stages of cellular respiration.
7. Define the role of electron carriers (NAD and FAD), ATP synthase.
8. Compare the reactants and products and energy yield of alcohol and lactic acid fermentation.
9. *Photosynthesis:*
10. Define photoautotrophs and the role of different structures in the chloroplast.
11. List stages of photosynthesis.
12. Compare the reactants and products of each stage in photosynthesis.
13. Describe how photosystem capture solar energy and how electron transport chain and chemiosmosis generate ATP in both cellular respiration and photosynthesis.
14. Describe why plant leaves are green

# Chapter seven: How population evolve and diverse.

1. Define Taxonomy and Linnaean system for naming and classifying species.
2. List the major domains and their main characteristics.
3. List the effect of microbiota on human and the environment.
4. List the common shapes of prokaryotes
5. Describe how bacteria causes diseases.
6. Define biofilm
7. List the different habitat of Archaea.
8. Explain why protists is not a taxonomic category.
9. List protists mode of nutrition and habitat.
10. List the informal categories of protists.
11. Distinguish between the different groups of plants
12. Describe the structure of fungi and its ecological and industrial role.
13. Define metamorphosis
14. Describe evolutionary division based on structural complexisity.
15. Distinguish between vertebrate and invertebrate.
16. List major invertebrate groups and the main characteristics of each group.
17. List the major groups of arthropods.
18. List the four features of embryonic chordates.
19. List the three major groups of mammals with their meanings.

# Chapter eight: Nutrition and digestion

1. Define and distinguish between carnivores, herbivores and omnivores.
2. Describe the four stages of food processing
3. Describe the two types of digestion and explain how animals are protected against self-digestion.
4. Compare the structure of gastro-vascular cavity and an alimentary canal.
5. Describe the main components of the human digestive system and the associated digestive glands
6. list the functions of saliva, teeth, tongue, pharynx, esophagus, stomach, appendix, intestine and rectum.
7. Explain how food is directed, in one direction, from the mouth to anus.
8. Relate the structure of the stomach to its function and explain why stomach does not digest itself.
9. List the functions of the pancreatic juices and bile
10. Describe the cause of diarrhea and constipation.
11. Define calories, metabolic rate.
12. Describe the four classes of essential nutrients.
13. Distinguish between malnutrition and obesity.
14. Describe the essential elements for plants ( macronutrients and micronutrients)
15. Define fertilizers with their two types.
16. Describe how water is transported form soil to roots and why most plant depends on bacteria to supply nitrogen.
17. Describe how transpiration-cohesion-tension-adhesion mechanism causes the ascent of xylum sap in a plant.
18. Describe the role of stomata and how guard cells control transpiration.

# Chapter nine: Circulation and respiration

1. Relate the the function of the circulatory system to its components.
2. Compare open and closed circulatory systems.
3. List the main components of cardiovascular system in human.
4. Compare the single and double circulation systems
5. Distinguish between pulmonary and systemic circuits.
6. Describe the human heart with the main components.
7. Distinguish between diastole and systole. Explain what causes heartbeats.
8. Explain how heartbeats are controlled.
9. Define blood pressure and explain how blood pressure is measured and what is hypertension.
10. Explain how heartbeats are controlled.
11. Relate the structure of veins, arteries and capillaries to their functions.
12. List the components of the blood and their functions
13. Define anemia and escribe the role of erythropoietin.
14. Describe the process of blood clotting.
15. Define hemophilia and atherosclerosis.

*Respiration and gas exchange*

1. Define the respiratoy system and list the main characteristics of respiratory surface.
2. Descrpe five types of respiratory surfaces and the kind of animals that use them.
3. List the three main phases of gas exchange.
4. Describe the human respiratory system.
5. Compare inhalation and exhalation.
6. Describe how breathing is controlled in humans.
7. Describe how hemoglobin transport gases and how blood transports gases between the lungs and tissues of the body.

# Chapter ten: Unifying concepts of animal structure and function (controlling body temperature and excretion)

1. Describe how animals exchange materials with external environment.
2. Define homeostasis and the principles of positive and negative feedback.
3. Distinguish between endotherms and ectotherms.
4. Describe thermoregulation in animals and what causes fever.
5. Define osmoregulation and describe the associated adaptations of fresheater and saltwater fishes and land animals.
6. Describe the human excretory system and the functions of its component and its role in homeostasis.
7. Describe the four major processes by which the human excretory system produces and dispose of urine.
8. Describe how compounds in urine can detect health status.

# Chapter eleven: Reproduction and development

1. Define reproduction and their types (sexual, asexual and hermaphroditism).
2. Compare external and internal fertilization.
3. Compare and contract the structure and function of male and female reproduction system.
4. Describe and compare the process of oogenesis ad spermatogenesis.
5. Describe the two female reproductive cycles
6. Relate the sperm structure to the function.
7. Describe fertilization.
8. Describe the process and results of cleavage and gastrulation.

*Plants:*

1. List the main parts of the flower. Relate this structure to the overall life cycle of an angiosperm.
2. Describe gametophytes and their role in pollination and fertilization.

# Chapter twelve: Cellular reproduction and pattern of inheritance

1. Define reproduction at organismal and cellular levels and list the roles of cell division.
2. Describe types asexual reproduction in singled- and multi-cellular organisms
3. Describe the structure of eukaryotic chromosome.
4. Describe the stages of cell cycle.
5. List the phases of mitosis and describe the charechtrestic of eachphase. Recognize the phases of mitosis from diagrams.
6. Compare cytokinesis in animal and plant cells.
7. Define the homologues chromosome and distinguish between autosomes and sex chromosomes.
8. Distinguish between somatic cells and gametes and between diploid and haploid cells.
9. List phases of meiosis I and II and describe events charechterstic of each phase. Recognize the phases from the diagrams.
10. Compare and contrast between mitosis and meiosis.
11. Define heredity, genes, character, trait and hybrid.
12. Describe how Mendel cross fertilized pea plants.
13. Distinguish between locus and alleles and between homozygous and heterozygous.
14. Distinguish between phenotype and genotype.
15. List the genotype products of hybrid cross.
16. Define a pedigree.
17. Know examples of human disorder controlled by a single gene (recessive and dominant disorders)
18. Distinguish between Mendel’s law of complete and incomplete dominant.
19. Describe how sex is genetically determined in human.

# Learning outcomes:

1.0 Knowledge

1.1 Recognize the chemical bases and organization of living organisms

1.2 Describe the ways of obtaining and assimilating food in living organisms

1.3 Define ways of obtaining and conservation of energy in living organisms

1.4 Memorize the communication and coordination of distant parts in living organisms

2.0 Cognitive Skills

2.1 Explain mechanisms of physiological activities and the pathways of formation and conservation of energy in living organisms

2.2 Recognize hierarchal divisions of the biosphere and different forms of living organisms

2.3 Differentiate the patterns of inheritance and stages of development of living organisms

3.0 Interpersonal Skills & Responsibility

3.1 Demonstrate regularity in attendance of classes and submission of problem solving.