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Alabama Department of Postsecondary Education

Representing Alabama's Public Two-Year College System

Jefferson State Community College

BIO 101

Prefix No.

INTRODUCTION TO BIOLOGY I

Course Title

NONE

Pre- or Corequisite

Credit Hours: 4

Contact Hours: Lecture 3 Lab 2

I. COURSE DESCRIPTION

Introduction to Biology I is the first of a two-course sequence designed for non-science majors. It covers historical studies illustrating the scientific method, cellular structure, bioenergetics cell reproduction, Mendelian and molecular genetics, and a survey of human organ systems.

II. GENERAL COURSE COMPETENCIES AND OBJECTIVES

After having completed this course, the student will have learned the following basic concepts. He/she will:

- A. Understand the scientific method, its possibilities and limitations
- B. Understand the characteristics which are unique to life
- C. Understand the basic chemistry of life
- D. Understand the structures and functions of prokaryotic and eukaryotic cells
- E. Understand the basis of cellular transport
- F. Understand the metabolic pathways and how energy relates to these two pathways
- G. Understand cell division with comparisons between mitosis and meiosis
- H. Understand Mendelian genetic inheritance patterns
- I. Understand DNA structure, function and replication and DNA control of protein synthesis
- J. Understand homeostasis and how it works within human tissues, organs and organ-systems
- K. Understand the morphology and physiology of a neuron and the chemical basis behind synaptic impulse transmittance between neurons
- L. Understand the various regions of the human brain and their functions
- M. Understand the sensory structures found within humans and how they work
- N. Understand the effects of endocrine control on the human body; be able to list the major hormones produced within the human body, the organs or cells, where they are produced, the target organs or cells and the effects of each hormone
- O. Understand how the integumentary, skeletal and muscular systems produce support protection and movement within the human body

- P. Understand the anatomy and physiology of the human circulatory system.
- Q. Understand how the body's immune system operates
- R. Understand the respiratory process within humans and the organs responsible for this process
- S. Understand the process of digestion and know the regions within the digestive tract where those various activities which produce the digestive process occur
- T. Understand the excretory process in the human body; be able to relate specific excretory organs involved in the excretory process and give the functions of listed organs
- U. Understand the events of fertilization and development in the human embryo
- V. Understand the reproductive systems of humans; how they function, how the embryo/fetus develops; how effective various types of birth controls are and the effect of STD's on the human body

III. COURSE OBJECTIVES

The student will be required to demonstrate that he has attained each general course competency by performing the objectives listed under each competency.

- A. Understand the scientific method, its possibilities and limitations.
 - 1. List the steps of the scientific method in the correct order of sequence
 - 2. Describe experiments that exemplify the scientific method vs. those that do not
 - 3. Be able to choose questions to which the scientific method is applicable vs. those to which it is not applicable
- B. Understand the characteristics which are unique to life
 - 1. Be able to list the characteristics which make life forms unique and distinct from abiotic matter
- C. Understand the basic chemistry of life
 - 1. Diagram the basic structure of the atom in accordance with the conventions presented in the text showing the position of protons, neutrons, and electrons.
 - 2. Identify the biologically significant elements by their chemical symbols, and summarize the main functions of each in living organisms.
 - 3. Interpret simple chemical formulas, structural formulas, and equations.
 - 4. Define the term electron orbital and relate orbitals to energy levels; relate the number of valence electrons to the chemical properties of the element.
 - 5. Distinguish between the types of chemical bonds that join atoms to form ionic and covalent compounds and give the characteristics of each type.
 - 6. Discuss the properties of water molecules and their importance to living things.
 - 7. Compare acids and bases, use the pH scale in describing the hydrogen ion concentration in living systems, and describe how buffers help minimize changes in pH.
 - 8. Compare the major groups of organic compounds--carbohydrates, fats, proteins, and nucleic acids--with respect to their chemical compositions and function.
 - 9. Define the following terms: atom, dehydration synthesis, element, hydrolysis, molecule, peptide bond, compound, ion, polar molecule, organic, inorganic, hydrocarbon, polar solvent, nonpolar solvent, acid, base.
- D. Understand the structures and functions of prokaryotic and eukaryotic cells
 - 1. Explain why the cell is considered the basic unit of life and state the cell theory
 - 2. Describe the general characteristics of cells; discuss cell sizes and shapes
 - 3. Draw and label a diagram of a prokaryotic cell, a plant-like eukaryotic cell and an animal-like eukaryotic
 - 4. List and describe the functions of the various organelles found within the cells listed in number 3 above

E. Understand the basis of cellular transport

1. List and discuss the various types of passive transport
2. List and discuss the various types of active transport
3. Be able to determine if transport in a given example would be active or passive transport
4. Be able to use the words hypertonic hypotonic and isotonic in the proper context and predict the movement of water through a selectively permeable membrane

F. Understand the metabolic pathways and how energy relates to these two pathways

1. Be able to state the 1st and 2nd laws of thermodynamics and pick examples which illustrate each
2. Be able to define entropy and exergonic vs. endergonic reactions
3. Be able to discuss the role of ATP in life forms and list its subparts
4. Know what an electron transport system is and how it works
5. Be able to compare the overall equations for photosynthesis and aerobic cellular respiration
6. Be able to define heterotrophs vs. autotrophs (and chemotrophs vs phototrophs)
7. Be able to relate photosynthesis subpathways to the areas of a chloroplast where they occur
8. Be able to discuss the reactants necessary for photosynthesis, tell how the plant obtains them and where within the pathway they are used
9. Be able to divide cellular respiration into its various subpathways and relate where these pathways occur within the cells
10. Discuss the importance of the mitochondrion to cellular respiration and list those activities of cellular respiration which occur there
11. Discuss the fermentation pathways and list the products of each

G. Understand cell division with comparisons between mitosis and meiosis

1. List the various reasons which make cell division a necessity in life forms
2. Be able to identify the various parts of a monad and a dyad chromosome
3. Be able to list the events of the mitotic cell cycle and recognize a cell in each phase
4. Be able to list the events of the meiotic cell cycle, tell how these events produce differences from cells produced mitotically
5. List the various variation-producing processes which occur during meiosis and give the phase during which each occurs

H. Understand Mendelian genetic inheritance patterns

1. Be able to state and understand the 3 Mendelian principles
2. Be able to relate the inheritance of genetic traits to the behavior of chromosomes in meiosis
3. Distinguish between phenotype and genotype, homozygous and heterozygous
4. Be able to solve monohybrid and dihybrid crosses involving dominant/recessive, codominant, incompletely dominant, multiple-alleled, multiple-gened, x-linked and y-linked characteristics

I. Understand DNA structure, function and replication and DNA control of protein synthesis

1. Be able to identify Watson and Crick and define the phrase "double helix"
2. Be able to produce a complimentary sequence of DNA from a given complete DNA
3. Know the base pair to sequence and the parts of a nucleotide
4. Know which nitrogenous bases pair and how one sequence is complimentary to another; know the parts of a nucleotide
5. Be able to define transcription, translation, codons, anticodons, primary structure, mRNA, tRNA and rRNA
6. Be able to correctly sequence the events of protein synthesis and relate each event to the area within the cell where they occur

J. Understand homeostasis and how it works within human tissues, organs and organ-systems

1. Define homeostasis and give examples of both positive and negative feedback

2. List the various types of epithelial, connective, muscular and nervous tissues; give their functions and a location within the human body where they are found
 3. List the various organ-systems of which the human body is composed and give their principle functions
- K. Understand the morphology and physiology of a neuron and the chemical basis behind synaptic impulse transmission between neurons
1. Be able to list the different types of neurons as well as the different regions within a neuron
 2. Be able to trace the directional flow of an impulse and describe the events of an impulse
 3. Know the significance of the sodium potassium pump to impulse transmission
 4. Be able to identify acetylcholine and cholinesterase and give their roles in synaptic transmission
 5. Be able to trace a reflex arch from stimulation site to motor effector site
- L. Understand the various regions of the human brain and their functions
1. Be able to discuss the subparts of the human nervous system including the central, peripheral and autonomic parts
 2. Be able to identify the various subparts of the forebrain, the midbrain and the hindbrain and discuss the activities each controls
 3. Be able to identify white matter, grey matter and neuroglial cells and tell how each functions within the nervous system
 4. Identify the meninges and cerebrospinal fluid and give their role within the nervous system
 5. Be able to state the opposing activities of the sympathetic vs. parasympathetic divisions of the autonomic nervous systems
- M. Understand the sensory structures found within humans and how they work
1. Be able to list the various types of sensory receptors found within the human body and give their functions
 2. Be able to trace a sensory pathway
 3. Be able to discuss olfaction and the sense of taste, identify chemicals referred to as pheromones
 4. Know the anatomy of the inner-ear and its functions for both sound detection and balance
 5. Be able to label the parts of the human eye and give each part's role in the perception of vision
 6. Know the functions of rods and cones
 7. Discuss the common disorders associated with the human eye
- N. Understand the effects of endocrine control on the human body; be able to list the major hormones produced within the human body, the organs or cells, where they are produced, the target organs or cells and the effects of each hormone
1. Be able to define hormone, endocrine gland, neurotransmitter, local signaling molecule and pheromone
 2. Be able to list the endocrine glands found within the human body, their secretions and the target organs for each hormone. Be able to list the effects of each hormone listed above
 3. Be able to differentiate between steroid hormones vs. peptide hormones
 4. Be able to give an example of a positive feedback mechanism vs. a negative feedback example
- O. Understand how the integumentary, skeletal and muscular systems produce support protection and movement within the human body
1. Be able to list the various structures produced from the epidermis and dermis layers of the skin and give their functions
 2. Be able to list the functions of the human skin and relate how ultraviolet light's effect on the skin can be negative
 3. Be able to list the various functions of bones of the skeletal system
 4. Be able to name the cells found within bone and those found within cartilage
 5. Be able to list the bones of both the axial and appendicular subdivisions of the skeletal system

6. Be able to identify the major skeletal muscle within the human body and give the effects of their contractions
7. Be able to list the 2 proteins which are involved in muscle contraction and tell how Ca and ATP are involved in their activity
8. List 3 pathways by which ATP can be supplied for muscle contraction and the positives and negatives associated with each pathway
9. Be able to define isometric vs. isotonic contractions
10. Be able to distinguish between a muscle twitch vs. muscle tetanus
11. Be able to relate the effects of anabolic steroids on the human body

P. Understand the anatomy and physiology of the human circulatory system.

1. Be able to discuss the link between blood and lymph and interstitial fluid
2. Be able to separate whole blood into its component parts; give the volume and function of each component listed
3. Discuss the various blood types found within man; include problems encountered in transfusions (Rh females/Rh fetus included)
4. Be able to trace the flow of blood through a complete circuit through the human heart (include the valves of the heart)
5. Be able to differentiate between pulmonary and systemic circulation
6. Be able to name the major arteries and veins of the body; list the organs or regions which they either supply with blood or from which blood drains
7. Be able to list the steps involved in contraction of the heart; give the various parts of the heart and their function during the cardiac cycle
8. Be able to define systolic and diastolic blood pressure points; know blood pressure readings considered acceptable vs those that may have a negative health impact
9. List the various factors which tend to produce high blood pressure readings and suggest means of control
10. Discuss exchange between the body and the circulatory system as it occurs within capillary beds
11. Discuss the major cardiovascular disorders of man and means which might be used to reduce the risk of each
12. List the organs and tissues of the lymphatic system and their functions

Q. Understand how the body's immune system operates

1. Be able to list the factors responsible for resistance to pathogen invasion at various body surfaces
2. Be able to explain the role of neutrophils, eosinophils, basophils, macrophages, complement proteins, pathogen-killing organs and cells in nonspecific target responses
3. Identify histamines, interleukins and prostaglandins and cite their role in inflammatory responses
4. Be able to define the roles of B and T lymphocytes in immunologically specific responses
5. Define antigens, antibodies, and MHC markers
6. Identify the roles of the 5 classes of Igs (immunoglobulins)
7. Be able to state the functions of virgin T cells, helper T cells, cytotoxic T cells and memory T cells
8. Be able to state the functions of virgin B cells, antigen-presenting B cells, effector B cells and memory B cells
9. Have a general understanding of how antibodies specific for an antigen are produced
10. Be able to discuss HIV infections; list means of infection, effects on the body, possible treatments and prevention behaviors

R. Understand the respiratory process within humans and the organs responsible for this process

1. Be able to label all the parts found within the human respiratory cycle
2. Be able to trace the flow of air through the system during one respiratory cycle
3. Be able to identify the muscles used during respiration
4. Be able to define vital capacity, tidal volume and residual volume

5. Be able to relate oxygen and carbon dioxide transport to hemoglobin and bicarbonate molecule
 6. Be able to equate gaseous exchange as a product of partial pressure gradients
 7. Be able to identify the various respiratory disorders of laryngitis, bronchitis, emphysema and lung cancer- and give the effects of smoking on emphysema and lung cancer
- S. Understand the process of digestion and know the regions within the digestive tract where those various activities which produce the digestive process occur
1. Name 5 tasks in which our digestive tract is involved
 2. Be able to trace the path an ingested particle would travel between the mouth and the anus.
 3. Be able to give the function of each digestive organ name in number 2 above
 4. Name the various structures associated with the oral cavity and ingestion
 5. List the secretions of the mouth, stomach and small intestine and give their functions in the digestive process
 6. Who is Helicobacter pylori?
 7. What role does the pancreas and the liver play in the digestive process
 8. What are some of the major digestive tract problems faced by humans (include colon cancer, Crohn's disease, ulcerative colitis, hiatal hernia, etc.
 9. Be able to produce a diet which would be considered "healthy" for your body's size, age, sex, etc.
 10. Be able to relate functions to the major vitamin and minerals required by the human body
- T. Understand the excretory process in the human body; be able to relate specific excretory organs involved in the excretory process and give the functions of listed organs
1. Be able to trace the flow of urine from production site to exit from the body
 2. Be able to diagram the nephron and indicate the activities of urine production within each nephron
 3. Be able to correctly associate various environmental conditions and hormones with their effect on urine production
 4. Be able to equate the effects of thirst, acid-base balance and temperature regulation to actions within the human body which would make corrections for each of these internal conditions
 5. Be able to identify an ectotherm, endotherm and heterotherm
 6. Be able to explain 4 methods animals have of exchanging heat with their environment
- U. Understand the events of fertilization and development in the human embryo
1. Be able to differentiate between sexual and asexual reproduction
 2. Be able to name the 3 germ layers within the embryo and know what each produces
 3. Be able to identify the morula, blastocyst, (blastula) and gastrula stages
 4. Be able to discuss the factors which may play a role in aging
- V. Understand the reproductive systems of humans; how they function, how the embryo/fetus develops; how effective various types of birth controls are and the effect of STD's on the human body
1. Be able to trace the path a spermatozoan takes from production site to outside the male's body
 2. Be able to identify 3 glands associated with the male reproductive system and give the functions of their secretions
 3. Be able to name the hormones which influence development of the male reproductive system and list their effects
 4. Be able to trace the path a secondary oocyte/ovum takes from production site to outside the female reproductive system
 5. Be able to list the various phases of the female menstrual phase
 6. Be able to list the events within the ovary prior to, during and after ovulation
 7. Be able to define the terms coitus, erection, ejaculation and orgasm
 8. Be able to name the 4 membranes associated with the human embryo and give their function
 9. Be able to tell how the placenta develops and give its function

10. Have a general knowledge of the developmental state of various organs/systems within the human embryo/fetus at the different time intervals during pregnancy
11. Be able to list the various stages of human development and relate each to approximate time intervals
12. Be able to list the various types of birth control measures and discuss their effectiveness; be able to list each method's advantages and disadvantages
13. Be able to list the more common types of STD's which affect humans; list the symptoms and impacts on the body of each and be able to indicate means of prevention and cures (if any)

IV. CLASS ACTIVITIES

- A. Lecture.
- B. AV self instruction.
- C. AV classroom instruction.
- D. Weekly laboratory exercises.

V. CRITERIA FOR EVALUATION

The student will have demonstrated attainment of the general course competencies if he accumulates a total of 70 percent of the points possible from the following criteria:

- A. Scheduled lecture examinations.
- B. Laboratory examinations.
- C. The student will pass course with 60% accuracy.

VI. ATTENDANCE

Students are expected to attend all classes for which they are registered. Students who are unable to attend class regularly, regardless of the reason or circumstance, should withdraw from that class before poor attendance interferes with the student's ability to achieve the objectives required in the course. Withdrawal from class can affect eligibility for federal financial aid.

VII. STATEMENT OF DISCRIMINATION/HARASSMENT

The College and the Alabama State Board of Education are committed to providing both employment and educational environments free of harassment or discrimination related to an individual's race, color, gender, religion, national origin, age, or disability. Such harassment is a violation of State Board of Education policy. Any practice or behavior that constitutes harassment or discrimination will not be tolerated.

VIII. AMERICANS WITH DISABILITIES

The Rehabilitation Act of 1973 (Section 504) and the Americans with Disabilities Act of 1990 state that qualified students with disabilities who meet the essential functions and academic requirements are entitled to reasonable accommodations. It is the student's responsibility to provide appropriate disability documentation to the College. The ADA Accommodations office is located in FSC 300 (205-856-7731).