

Las Positas College
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Course Outline for BIO 7B

HUMAN PHYSIOLOGY

Effective: Fall 2015

I. CATALOG DESCRIPTION:

BIO 7B — HUMAN PHYSIOLOGY — 5.00 units

Function and regulation of the human body. This course examines general, cellular, and molecular interactions that integrate the organ systems to maintain homeostasis. Human responses and computer simulations are used to collect and analyze data. Designed for nursing, physical and occupational therapy, and other health sciences majors. Prerequisite: Anatomy 1, Chemistry 30A, or Chemistry 31, or Chemistry 1A. Strongly recommended: Chemistry 30B and English 1A. (Note: Formerly PHSI 1.)

3.00 Units Lecture 2.00 Units Lab

Prerequisite

CHEM 30A - Intro and Applied Chemistry I
with a minimum grade of C
or

CHEM 31 - Intro to College Chemistry
with a minimum grade of C
or

CHEM 1A - General College Chemistry I
with a minimum grade of C
and

BIO 7A - Human Anatomy
with a minimum grade of C

Strongly Recommended

- Eligibility for ENG 1A -
and

CHEM 30B - Intro and Applied Chemistry II

Grading Methods:

Letter Grade

Discipline:

	<u>MIN</u>
Lecture Hours:	54.00
Lab Hours:	108.00
Total Hours:	162.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:

Before entering the course a student should be able to:

- A. CHEM30A
- B. CHEM31
- C. CHEM1A
- D. BIO7A

1. speak and write using anatomical terminology
2. identify organizational levels of the body and explain how they are related
3. use anatomical terminology for regions, positions, planes and cavities
4. identify cellular organelles and relate the cellular organelles to the function of a variety of cell types
5. identify histological tissues and describe the structures, and functions of specific types of epithelial, connective, muscle and nervous tissues

6. give the structure, function, and location of body membranes
7. identify the structures and describe the function of the integumentary system
8. describe the microscopic structure of skeletal muscles
9. list the structural and functional divisions of the nervous system and describe the microscopic structure of a typical neuron
10. describe the anatomy of peripheral nerves including spinal and cranial nerves and the anatomy of the autonomic nervous system
11. identify and describe the anatomy of the brain and spinal cord
12. describe the structure of sensory receptors and selected special senses, and the neural pathways to the central nervous system
13. describe the location and structure of the major endocrine glands
14. identify components of blood and list their functions
15. identify the organs of the cardiovascular system, and describe the anatomy of the heart and blood vessels
16. trace the arterial and venous paths of circulation
17. describe the structure and function of the lymphatic system
18. describe the structures and functions of the respiratory system
19. describe the structures and functions of the organs and accessory organs of the digestive system
20. describe the gross anatomy and functions of urinary organs and the microscopic structure of the nephron
21. describe the structures and functions of the male and female reproductive systems
22. compare normal versus diseased structures, injured or age-related structural changes in any or all of the above organ systems

Before entering this course, it is strongly recommended that the student should be able to:

- A. -Eligibility for ENG 1A
- B. CHEM30B

IV. MEASURABLE OBJECTIVES:

Upon completion of this course, the student should be able to:

- A. explain fundamental laws of physics, chemistry and physiology as they relate to body organization and function;
- B. Review the chemistry of life, with emphasis on nucleic acid and protein function, including anabolic and catabolic metabolism, such as transcription, translation, replication, enzymatic reactions, aerobic and anaerobic respiration;
- C. Discuss water, electrolyte and acid base balance;
- D. review all the organelles and their functions;
- E. define homeostasis and outline how negative and positive feedback loops are used in physiology and medicine;
- F. Review structure and function of the cell membrane and describe the various active and passive transport systems and cell to cell communication modes;
- G. Explain the functions of the integumentary system;
- H. Distinguish between the major body control systems;
- I. Explain the Role of bone tissue in homeostasis;
- J. explain membrane potentials and action potentials, define and explain excitation contraction coupling, and review various mechanisms of synaptic junctions;
- K. Review the nervous system and its subdivisions with emphasis on molecular neuron function and integration;
- L. Review general sensation and explain how mechanical, chemical, and light energy is converted into nerve impulses in the special sensory organs;
- M. Describe how visual accommodation is achieved and describe the defects associated with myopia, hyperopia, presbyopia and astigmatism;
- N. Discuss skeletal muscle structure and function, including regulation of contraction and excitation-contraction coupling, and skeletal muscle metabolism during exercise;
- O. Explain the functioning of the endocrine system, its regulation, and its integration with the nervous system;
- P. Outline thermoregulation;
- Q. Discuss the overall, cellular, and molecular function of the cardiovascular system and its regulation;
- R. Explain the function of the heart and cardiac cycle and obtain and analyze an ECG tracing;
- S. Distinguish between the various functions of the lymphatic system and describe mechanisms of nonspecific and specific immunity;
- T. Explain respiratory system function and regulation and apply a spirometer to conduct pulmonary function tests;
- U. Explain urinary system function and regulation and distinguish between the composition of glomerular filtrate and urine;
- V. Discuss the functions of the different parts of the digestive system and evaluate the role of proper nutrition;
- W. Reproductive functions and regulation;
- X. Review clinical applications by collecting clinical data such as pulse, blood pressure, urinalysis, blood indices and spirometric indices;

V. CONTENT:

- A. Review of fundamentally related chemical and physical principles
 1. Periodic table
 2. Reactivity
 3. Molecules and bonds
 4. Ions and isotopes
 5. Law of mass action
 6. Diffraction and its function as a lab tool
 7. Solutions and solutes
 8. Biomolecules
- B. Cell Biology and Cellular Metabolism
 1. Tissue Remodeling
 2. Apoptosis
 3. Stem cells
 4. Enzymes
 5. Anabolic and Catabolic metabolisms
 6. Cellular respiration
- C. Membrane Dynamics
 1. Diffusion and its variables
 2. Active transport systems
 3. Establishment of a resting membrane potential
- D. Cell Communication and Integration
 1. Gap junctions
 2. Autocrines and paracrines
 3. Hormones and Neurohormones
 4. Cytokines
 5. Signal transduction
 6. Homeostasis
 7. Response and feedback loops
- E. Endocrine Physiology

1. Hormone classes and mechanisms of action
2. Control of hormone release
3. Hormone interactions
4. Endocrine pathologies
- F. Physiology of the Excitable Cell
 1. Depolarization, repolarization
 2. Hyperpolarization
 3. Threshold
 4. Action potential
 5. Graded potential
 6. Temporal and spatial summation
 7. Refractory period, absolute and relative
- G. Synaptic Physiology
 1. Chemical synapse vs. electrical synapse
 2. Role of calcium in neurotransmitter release
 3. Classes of neurotransmitters
 4. Postsynaptic responses: EPSP vs. IPSP
 5. Inactivation of neurotransmitters
 6. Integration of neural information
- H. Central Nervous System Physiology
 1. Neural networks
 2. Blood-brain barrier
 3. Gray vs. white matter
 4. Functional areas of the cerebral cortex
 5. Sensory homunculus
- I. Sensory Reception
 1. Sensory transduction
 2. Receptive fields
 3. Somatic senses
 4. Chemoreception: gustation and olfaction
 5. Vision – Photo transduction
 6. Hearing – Sound transduction
 7. Equilibrium
- J. Muscle Physiology
 1. Sliding filament theory
 2. Excitation-contraction-coupling
 3. ATP supply and phosphocreatine
 4. Muscle contraction studies: muscle twitch, tension development, summation, Treppe, tetanus
 5. isometric and isotonic contractions
- K. Cardiovascular Physiology
 1. Autorhythmic cells and electrical conduction of the heart
 2. Action potentials in myocardial cells
 3. Cardiac excitation-contraction coupling
 4. Cardiac cycle and pumping action of heart
 5. Cardiac output
 6. Autonomic modulation of heart rate
 7. EKG - normal/abnormal
 8. Intracardial and intravascular hemodynamics
 9. Blood pressure and its measurements
 10. Regulation of blood pressure
 11. Peripheral resistance
 12. Exchange at capillaries
 13. Role of lymphatic system
 14. Neural and endocrine considerations
 15. Thrombus and embolus formation
 16. Ischemia and infarction
- L. Blood Physiology
 1. Blood plasma and formed elements
 2. Blood cell production
 3. Blood typing
 4. Coagulation
 5. Blood chemistry and blood pathology
- M. Pulmonary Physiology
 1. Gas laws
 2. Pulmonary ventilation
 3. Gas exchange in lungs and tissue
 4. Gas transport in blood
 5. Hemoglobin vs. myoglobin vs. fetal hemoglobin
 6. Oxygen dissociation curves
 7. Lung compliance and elastance
 8. Surfactant
 9. Indices of spirometry
 10. Respiration and the acid-base balance of the body
 11. Regulation of ventilation
 12. Breathing under special conditions: high altitude climbing and deep sea diving
- N. Kidney Physiology – Fluid and Electrolyte Balance
 1. Sources of loss and gain of water
 2. Filtration, Reabsorption, Secretion
 3. Excretion
 4. Micturition
 5. Water balance and urine concentration
 6. Sodium balance
 7. Potassium balance
 8. Acid-Base balance
 9. Renal failure and its consequences
- O. Digestive System Physiology
 1. Motility
 2. Secretion
 3. Digestion: mechanical and chemical
 4. Roles of salivary glands, pancreas and gall bladder

5. Absorption
6. Regulation of GI function
7. Foods, minerals and vitamins
8. Carbohydrate, protein and fat metabolism
9. Energy balance and heat production
10. Metabolic disorders
- P. Immune System
 1. Innate immunity
 2. Physical and chemical barriers, inflammation, NK cells
 3. Acquired immunity
 4. Clonal selection and deletion of B and T cells
 5. Antigen presenting cells and MHC molecules
 6. Antibody classes and functions
 7. Allergies and autoimmune disorders
- Q. Reproductive Physiology
 1. Mitosis vs. meiosis
 2. Gamete production and fertilization
 3. Menstrual cycle
 4. Human cytogenetics and birth defects
 5. Survey of birth control techniques
 6. Survey of infertility treatments
 7. Hormonal changes during pregnancy
 8. Puberty
 9. Menopause and Andropause
- A. Course Content (Laboratory):
 1. Medical Math review
 2. Concentration and dilution review
 3. Cell transport mechanisms and permeability
 4. Biochemical measurements – spectrophotometry and graphing
 5. Enzyme activity and kinetics of salivary amylase
 6. VNTR polymorphism – Polymerase chain reaction and DNA analysis
 7. Neurophysiology of nerve impulses
 8. Human reflex physiology
 9. General sensation – Receptor physiology
 10. Clinical examination of the eye – Conducting visual tests and experiments
 11. Clinical examination of the ear – Conducting laboratory tests of hearing and equilibrium
 12. Clinical examination of olfaction and taste
 13. Skeletal muscle physiology – Electrical stimulation, isometric and isotonic contractions
 14. Human cardiovascular physiology – Conduction system of the heart and EKG studies
 15. Human cardiovascular physiology – Blood pressure and pulse determination
 16. Cardiovascular dynamics – Mechanics of circulation, vessel resistance, and pump mechanics (computer simulations)
 17. Frog cardiovascular physiology – Assessing physical and chemical modifiers of the heart rate (computer simulations)
 18. Blood – Hematologic tests
 19. The immune response – Antibodies and tests for their presence
 20. Respiratory sounds – Clinical assessment of lung function
 21. Spirometry – Respiratory volumes and capacities (wet lab and computer simulations)
 22. Role of respiratory system in acid-base balance of blood
 23. Chemical and physical processes of digestion
 24. Urinalysis – clinical evaluation of urine
 25. Renal Physiology – The function of the nephron (computer simulations)
 26. Acid-base balance – Respiratory vs. metabolic acidosis and alkalosis, renal system compensation (computer simulations)
 27. Experiments on hormonal action – Hormones and metabolism, hormone replacement therapy, insulin and diabetes (computer simulations)
 28. Physiology of reproduction – Gametogenesis and the female cycles
 29. Enzyme-Linked Immunosorbent Assay (ELISA) – Immunological pregnancy testing
 30. Principles of Heredity

VI. METHODS OF INSTRUCTION:

- A. **Directed Study** - Readings from the text and the laboratory manual
- B. **Student Presentations** - Student-led presentations
- C. Derivation of conclusions and clinical implications
- D. **Lab** - Laboratory observations, collection and analysis of data. Lab reports
- E. **Simulations** - Computer interactive laboratory exercises
- F. **Guest Lecturers** - Experts from fields related to human Physiology will share their knowledge during (maximum of) 1 hour talks.
- G. **Projects** - Research project, culminating in paper and/or oral PowerPoint presentation. Other written assignments .
- H. **Audio-visual Activity** - Utilization of video, CD-ROM and other audio visual aids
- I. **Lecture** - Multimedia lecture presentations and discussions on major themes and concepts

VII. TYPICAL ASSIGNMENTS:

- A. Reading and Discussion
 1. Read Chapter 14, "Cardiovascular Physiology," by D. U. Silverthorn, pp. 449-484. Be prepared to list the events of the cardiac cycle in sequence, beginning with atrial and ventricular diastole. Note where valves open and close. Be prepared to list and briefly explain four types of information that the EKG provides about the heart.
 2. Read Chapter 19, "The Kidneys," by D. U. Silverthorn, pp. 599-619. Be prepared to define, compare and contrast filtration, secretion and excretion. What are the advantages of a kidney that filters a large volume of fluid and then reabsorbs 99% of it?
- B. Collaborative learning
 1. With your lab partner work through exercise 31: Electrocardiography. Record ECGs for your lab partner first under baseline (resting) conditions and then under conditions of fairly strenuous exercise. Finally, take a recording while your lab partner holds his or her breath. Then have your lab partner do the same with you. Compare the baseline recordings with the other recordings and determine the reasons for the observed differences in the recordings.
- C. Writing
 1. Complete the review sheets for exercise 31 in your laboratory manual.
 2. Research and write a report on your chosen topic. Turn in the written report to your instructor and be prepared to present your report to the rest of the class in no more than ten minutes. Pretend that you are addressing your report to a group of patients just diagnosed with this disease. Examples of topics: Diagnosis and classification of Diabetes mellitus – A clinical education; Causes and consequences of clinical hypertension – A clinical education.

VIII. EVALUATION:

A. **Methods**

1. Exams/Tests
2. Quizzes
3. Research Projects
4. Papers
5. Oral Presentation
6. Projects
7. Group Projects
8. Class Participation
9. Class Work
10. Home Work
11. Lab Activities
12. Other:
 - a. Examinations on lecture material
 - b. Laboratory practical testing and/or quizzes
 - c. Grading of laboratory reports
 - d. Evaluation of written research paper and/or oral presentation
 - e. Comprehensive final examination inclusive of ALL lecture and laboratory material

B. **Frequency**

1. At least 2 midterms
2. At least 2 laboratory exams or 4 laboratory quizzes
3. 1 research project culminating in written research paper and/or oral presentation
4. 1 comprehensive final examination

IX. TYPICAL TEXTS:

1. Silverthorn, D. U. *Human Physiology, An Integrated Approach*. 6th ed., Pearson , 2012.
2. Sherwood, Lauralee. *Human Physiology From Cells to Systems*. 8th ed., Brooks/Cole, Cengage Learning, 2013.
3. Fox, Stuart . *Human Physiology*. 13th ed., McGraw Hill, 2013.
4. E. N. Marieb, et al. Human Physiology Laboratory Manual, LPC custom version. Pearson Publishing , 2013.
5. Robert Amitrano. Anatomy & Physiology Laboratory Manual. Cengage Learning , 2013.
6. Terry Martin. Laboratory Manual for Human Anatomy & Physiology Main Version. McGraw Hill , 2013.
7. Mastering A&P. Pearson Publishing, (current).
8. PhysioEx. Pearson Publishing, (current).

X. OTHER MATERIALS REQUIRED OF STUDENTS:

- A. One black fine point sharpie.