

Las Positas College
3000 Campus Hill Drive
Livermore, CA 94551-7650
(925) 424-1000
(925) 443-0742 (Fax)

Course Outline for PHSI 1

HUMAN PHYSIOLOGY

Effective: Fall 2004

I. CATALOG DESCRIPTION:

PHSI 1 — HUMAN PHYSIOLOGY — 5.00 units

Cellular and systemic body functions. Emphasis placed on physico and electro chemical and clinical methods, collection and analysis of data, extrapolations and conclusions. Working models, including human responses, computer simulations are studied. Prerequisite: Chemistry 30A and Anatomy 1 (both completed with a grade of "C" or higher). Strongly recommended: Chemistry 30B, Eligibility for English 1A or 52A.

3.00 Units Lecture 2.00 Units Lab

Prerequisite

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

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

Strongly Recommended

CHEM 30B - Intro and Applied Chemistry II

ENG 1A - Critical Reading and Composition

Grading Methods:

Letter Grade

Discipline:

	MIN
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. BIO7A

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

- A. CHEM30B
- B. ENG1A

IV. MEASURABLE OBJECTIVES:

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

1. explain fundamental laws of physics, chemistry and physiology as they relate to body organization and function;
2. list some functions of proteins and state how they can provide the specificity required for these functions;
3. distinguish between DNA and the different types of RNA and describe transcription, translation and replication;
4. illustrate the principles of catabolic and anabolic pathways and explain the function of enzymes as catalysts;
5. review all the organelles and their functions;
6. compare and contrast aerobic and anaerobic pathways;
7. define homeostasis and outline how this concept is used in physiology and medicine;
8. compare and contrast negative and positive feedback loops and relate examples to the maintenance of homeostasis;
9. describe the difference between active and passive transport and differentiate the types of diffusion and active transport mechanisms;

10. explain how equilibrium and resting membrane potentials are produced and discuss the role of the sodium-potassium ATPase in the maintenance of the resting membrane potential;
11. discuss the molecular activity during an action potential;
12. review synaptic junctions and their different mechanisms;
13. define and explain excitation-contraction coupling;
14. locate the major brain regions and structures within and describe their primary roles and functions;
15. outline name and functions of the 12 cranial nerves and devise ways of testing these nerves;
16. compare and contrast the sympathetic and parasympathetic nervous systems and recognize their common goal of establishing homeostasis;
17. review functional categories of sensory receptors and distinguish between phasic and tonic receptors;
18. explain how mechanical, chemical, and light energy is converted into nerve impulses in the special sensory organs;
19. describe how visual accommodation is achieved and describe the defects associated with myopia, hyperopia, presbyopia and astigmatism;
20. defend how the endocrine system is an extension/adjunct of the nervous system;
21. correlate the functions of the hypophysis and the hypothalamus to the rest of the endocrine system;
22. discuss the mechanism of skeletal muscle contraction, including regulation of contraction and excitation-contraction coupling;
23. assess skeletal muscle metabolism during exercise;
24. indicate the general functions of the major parts of the circulatory system;
25. compare and contrast the molecular events occurring in the autorhythmic cardiac cells and in the myocardial cells;
26. use an oscilloscope or similar tool to obtain an ECG tracing – measure and analyze some key indices of the cardiac cycle;
27. explain the laws of hemodynamics;
28. discriminate between thrombus and embolus, ischemia and infarction;
29. examine the development of afflictions such as atherosclerosis, hypertension, edema and circulatory shock;
30. distinguish between and describe some of the mechanisms of nonspecific and specific immunity;
31. define the terms compliance and elasticity, and explain how these lung properties affect ventilation;
32. derive dry spirometric indices using a dry spirometer;
33. interpret an oxyhemoglobin dissociation curve and discuss the significance of its shape;
34. outline the composition and production of the glomerular ultrafiltrate and review the events occurring in the nephron leading to the end product urine;
35. describe the role of antidiuretic hormone in regulating the final urine volume;
36. discuss the functions of the different parts of the digestive system;
37. describe the enzymatic reactions leading to the chemical digestion of carbohydrates, lipids and proteins and explain the absorption of monosaccharides and amino acids;
38. evaluate the role of proper nutrition and vitamins;
39. outline some key differences between mitosis and meiosis;
40. review the events occurring after fertilization;
41. interrelate hormonal cycles of the uterus and the ovaries;
42. compile the basic methods of birth control techniques and report on common infertility treatments;
43. utilize a spectrophotometer and compose a standard curve based on experimental data;
44. manage a computer with various interactive software as per laboratory protocol;
45. collect clinical data such as pulse, blood pressure, urinalysis, blood indices and spirometric indices;
46. explain histo-anatomic differences in organs as they relate to system physiology.

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. 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. Multimedia lecture presentations and discussions on major themes and concepts
- B. Readings from the text and the laboratory manual
- C. Utilization of video, CD-ROM and other audio visual aids
- D. Research paper, written assignments and lab reports
- E. Derivation of conclusions and clinical implications
- F. Computer interactive laboratory exercises
- G. Student-led presentations
- H. Laboratory observations, collection and analysis of data

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 to Turnitin.com) 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. Lab Activities

B. **Frequency**

1. Frequency
 - a. At least 2 midterms
 - b. At least 8 laboratory quizzes and/or exams
 - c. 1 written research paper
 - d. 1 oral presentation
 - e. 1 comprehensive final examination

IX. TYPICAL TEXTS:

1. D. U. Silverthorn *Human Physiology, An Integrated Approach*. 5th ed., Pearson/Benjamin-Cummings, 2009.
2. E. N. Marieb *Human Anatomy and Physiology Laboratory Manual – including PhysioEx CD-ROM*, . 9th ed.,

Pearson/Benjamin-Cummings, 2009.

X. OTHER MATERIALS REQUIRED OF STUDENTS: