

I. CATALOG DESCRIPTION:

- A. Division: Science and Math
Department: Biology
Course ID: BIOL 261
Course Title: Human Physiology
Units: 4
Lecture: 3 hours
Laboratory: 3 hours
Prerequisites: BIOL 260 and CHEM 101

B. Course Description:

Study of the vital processes and functions of the human body [designed for biology and allied health/medical science majors]. Emphasis is on control mechanisms, maintenance of homeostasis, and selected examples of pathophysiology of the major organ systems. Includes laboratory experiences that involve observations, physiological recordings, and analysis of body functions.

Schedule Description:

Study of the vital functions of the human body for biology, allied health, and medical science majors.

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

III. EXPECTED OUTCOMES FOR STUDENTS:

- A. Discuss the dynamic normal functions of all major body systems.
B. Extrapolate from learned basic physiologic principles and apply these principles to new concepts and multiple variables.
C. Explain how homeostasis is achieved, and why the inability to achieve homeostasis leads to body dysfunction.
D. Identify the ways in which normal physiological function is altered by disease.
E. Compare and contrast body system functions and analyze the ways in which body system functions are integrated.

IV. CONTENT:

- A. Functional organization of the body
B. Review chemistry principles (Integrated)
1. Acid/Base
2. Chemical bonds
3. Chemical reactions
4. Organic molecules
5. Metric system
C. Maintenance of homeostasis / compensatory mechanisms (Integrated)
1. Regulation by nervous and endocrine systems
2. Feedback mechanisms
3. Effects of imbalance
D. Cell structures and functions
1. Cell membrane composition structure and function
2. Cytoplasmic organelles
3. Nucleus & DNA
a. Meiosis and mitosis
b. Protein Synthesis
E. Cell membrane transport
1. Diffusion (simple, facilitated, osmosis)
2. 1° & 2° active transport mechanisms

- F. Metabolism highlights
 - 1. Enzymes, isoenzymes
 - 2. ATP production
 - a) Carbohydrate metabolism
 - 1) Glycolysis
 - 2) Decarboxylation and Krebs's cycle
 - 3) Oxidative phosphorylation
 - 4) Aerobic vs anaerobic
 - b) Lipid metabolism
 - c) Protein metabolism
- G. Overview of histology (tissue repair)
- H. Skeletal physiology (bone healing)
- I. Summary of integumentary system (wound healing)
- J. Membrane potential
 - 1. Development of resting membrane potential; ion distribution
 - 2. Action potentials
 - 3. Hyperpolarization vs hypopolarization
 - 4. Refractory periods
- K. Functioning skeletal muscle cell
 - 1. Motor unit
 - 2. Neurotransmitters and receptors
 - 3. Excitation-contraction-relaxation cycle
- L. Nervous system
 - 1. Neuron physiology
 - 2. Neurotransmitters / neuropeptides
 - 3. IPSPs vs EPSPs
 - 4. Spinal cord physiology
 - a.) i.e. pyramidal vs extrapyramidal tracts
 - 5. Functions of principal parts of the brain
 - 6. Cranial nerves function and clinical application
 - 7. Comparison of somatic and autonomic nervous system
 - 8. Physiological effects of the ANS (integrated)
 - 9. Effects of parasympathetic vs sympathetic stimulation
 - 10. Summary of special senses
- M. Cardiovascular System
 - 1. Blood components
 - 2. Cardiac muscle
 - 3. Cardiac cycle
 - 4. Cardiac output (preload, contractility, afterload)
 - 5. Peripheral perfusion
 - 6. Capillary dynamics and fluid shifts
 - 7. Cardiovascular assessments (i.e. blood pressure, pulses, venous pressure)
 - 8. Electrophysiology
 - 9. Hemostasis and blood coagulation
- N. Respiratory System
 - 1. Mechanics of breathing
 - 2. Regulation of respiration
 - 3. Pulmonary pressures
 - 4. Elastic and non-elastic resistances to breathing = work of breathing
 - a) Surface tension and surfactant
 - b) Compliance
 - c) Caliber of the airway
 - d) Frictional resistance
 - e) FEV₁/FVC

5. Gas exchange (oxygen and carbon dioxide transport)
 - a) Oxygen-hemoglobin dissociation curve
 - b) Lung capacities and volumes
 - c) Arterial blood gases
 - d) Ventilation/Perfusion relationships
- O. Digestive System
 1. Functions of the gastrointestinal tract and accessory organs
 2. Control and regulation of GI secretions and motility
 3. Liver & gallbladder physiology
- P. Renal Physiology
 1. Glomerular filtration
 2. Tubular reabsorption and concentration of urine
 - a) Countercurrent multiplier and exchanger mechanisms
 3. Tubular secretion
 4. Control of osmolality via ADH
 5. Factors influencing fluid volume excretion
 6. Autoregulation of GFR
 7. Measurement of plasma clearance, GFR, RBF, Creatinine, and BUN
 8. Renal regulation of Na⁺ and K⁺
 9. Renal regulation of acid/base balance
- Q. Reproductive physiology
 1. Functions of the testes, ducts accessory sex glands, and penis
 2. Functions of the ovaries, Fallopian tubes uterus, vagina, vulva, and mammary glands
 3. Compare the principal events of the ovarian and uterine cycles
 - a) Hormonal regulation
- R. Endocrine System and Hormonal Regulation (Integrated)
 1. Mechanisms of hormone action
 2. Specific endocrine tissue and associated hormonal functions
 3. Body's response to stress

V. METHODS OF INSTRUCTION:

1. Lecture is the primary method of theory instruction - syllabi
2. Visual illustrations to enhance learning and understanding
 - a) Videos
 - b) Transparencies / slides
3. Interactive methods to actively process concepts and problem solve
 - a) Study group discussions
 - b) Multimedia (CD-ROM)
4. Learning (study guides) which include labeling diagrams and mastery tests, and concept maps which correlate important content.
5. Laboratory exercises

VI. TYPICAL ASSIGNMENTS:

- A. Explain the pathophysiology of Myasthenia gravis. (Evaluated on: (1) an understanding of pathophysiology [it is not a definition or description, not demographics or incidence, not signs/symptoms, diagnosis or treatment], and (2) the use normal physiology to explain the development and consequences of abnormal function.
- B. Complete a laboratory report on a experiment **not** performed (dry-lab). Illustrates the ability to critically read, apply a body of knowledge, and problem solve. Introduces testing hypotheses.
- C. Reading assignments to augment lecture material and add supplementary information not covered in lecture.

VII. EVALUATION:

A. EXAMINATIONS / QUIZZES

1. Explain the development of physiologic polycythemia.
2. A drug results in a decrease in the total peripheral resistance (TPR) and an increase in the systolic pressure due to:
 - a) a and c
 - b) a and d
 - c) b and c
 - d) b and d
 - a) vasoconstriction
 - b) vasodilation
 - c) ↑ in cardiac output
 - d) ↓ in cardiac output
3. **Key:**

Put	"a"	if A is greater than B
	"b"	if B is greater than A
	"c"	if A and B are equal or nearly so

 - A. Heart rate if adrenergic receptors on myocardial cells are blocked
 - B. Heart rate if adrenergic receptors on myocardial cells are not blocked
4. When conditions cause the oxyhemoglobin dissociation curve to shift to the right, there is a greater:
 - a. unloading (release) of oxygen to the tissues
 - b. loading (uptake) of oxygen in the lungs
 - c. unloading of carbon dioxide in the lungs
5. Which of the following pituitary hormones regulates the permeability of collecting duct to water:
 - a. oxytocin
 - b. ADH
 - c. ACTH
 - d. Prolactin
 - e. Aldosterone
6. Which white blood cells have the greatest phagocytic activity?

B. WRITTEN ASSIGNMENTS

1. See VI A & B
2. Laboratory reports

C. FREQUENCY

- 3 sectional theory examinations
1. 1 open book examination
 2. 1 comprehensive final examination
 3. weekly laboratory quizzes
 4. 6-8 laboratory reports
 5. 1-3 written assignments

VIII. TYPICAL TEXTS:

Tortora, Gerald J., and Grabowski, Sandra R. Principles of Anatomy and Physiology. 8th ed. New York. Harper Collins College Publishers. 1996.

Rhoades, Rodney, and Pfanzer, Richard. Human Physiology. 3rd ed. Saunders College Publishing. 1996.

Van de Graaff, Kent M., and Fox, Stuart Ira. Concepts of Human Anatomy and Physiology. 4th ed., Wm. C. Brown Publishers. 1998.

Seeley, Rod R, Stephens, Trent T., and Tate, Philip. Anatomy and Physiology. 4th ed. Mosby Yearbook. 1998.

Marieb, Elaine N. Human Anatomy and Physiology. 3rd ed. The Benjamin/Cummings Publishing Company, Inc. 1995.

Prezbindowski, Kaythleen Schimdt, and Tortora, Gerald J. Learning Guide for Tortora-Grabowski, Principles of Anatomy and Physiology. 8th ed. New York. Harper Collins College Publishers. 1998.

Michaelis, Kenneth A., Wacker, Gtreta B., and McCawley, Donald D. Laboratory Experiences in Human Physiology. 4th ed., Minneapolis. Burgess Publishing/Bellwether Press. 1988.

IX. OTHER SUPPLIES REQUIRED OF STUDENTS

Lab coat optional
Disposable electrodes for electrocardiogram
Disposable mouthpiece for respirometer
Scantron forms