

Course Outline for: BIOL 2042 Human Physiology**A. Course Description**

1. Number of credits: 4
2. Lecture hours per week: 3
Lab hours per week: 3
3. Prerequisites: BIOL 2041 (C or higher); CHEM 1050 or 1061 (C or higher)
4. Corequisites: None
5. MnTC Goal: #3 Natural Sciences

This course provides an integrative understanding of how the human body functions with emphasis on homeostatic mechanisms. Body systems studied include nervous, endocrine, muscular, cardiovascular, respiratory, digestive, urinary, immune, and reproductive. Laboratory studies include collecting data from students. Lecture 3 credits, 3-hour lab 1 credit.

B. Date last reviewed/updated: January 2023**C. Outline of Major Content Areas**

Lecture: Subtopics listed under each main topic may vary due to recent developments in the field and current events.

1. Principles of Homeostasis
 - a. Fluid compartments
 - b. Cannon's postulates
 - c. Stimulus-response pathways
 - d. Negative and positive feedback
2. Membrane Transport and the Membrane Potential
 - a. Diffusion and osmosis
 - b. Protein-mediated transport
 - c. Transepithelial transport
 - d. Resting membrane potential
3. Cell Signaling
 - a. Short and long distance
 - b. Signal transduction
 - c. Receptors
4. Neurophysiology
 - a. Graded potentials and action potentials
 - b. Synapse
 - c. Neurotransmitters
 - d. Synaptic integration
 - e. Glial cells
 - f. Major CNS regions

- g. Cranial nerves
- 5. Principles of Sensory Physiology
 - a. Sensory receptors and transduction
 - b. Sensory pathways and integration
- 6. Muscle Physiology
 - a. Neuromuscular junction
 - b. Excitation contraction coupling
 - c. Sliding filament theory of contraction
 - d. Single fiber dynamics
 - e. Energy requirements of skeletal muscle
 - f. Comparison of skeletal, smooth and cardiac muscle
 - g. Motor unit recruitment
 - h. Somatic reflexes
- 7. Autonomic Nervous System
 - a. Sympathetic nervous system
 - b. Parasympathetic nervous system
 - c. Enteric nervous system
- 8. Circulatory systems
 - a. Blood
 - b. Cardiac cycle
 - c. Electrical activity and the electrocardiogram
 - d. Cardiac output
 - e. Blood pressure
 - f. Capillary exchange
 - g. Lymphatics
- 9. Respiratory Physiology
 - a. Ventilation
 - b. Gas exchange
 - c. Oxygen transport
 - d. Carbon dioxide transport
 - e. Acid-base balance
- 10. Renal Physiology
 - a. Filtration, reabsorption and secretion
 - b. Water-solute balance
 - c. Clearance
 - d. Acid-base balance
- 11. Immunology
 - a. Non-specific and specific defenses
 - b. Humoral and cell-mediated immunity
- 12. Digestive Physiology
 - a. Cephalic, gastric and intestinal phases
 - b. Innervation and motility
 - c. Fluid and electrolyte absorption
 - d. Digestion and absorption of carbohydrates, lipids and proteins
- 13. Metabolism and Endocrine Physiology
 - a. Hormones
 - b. Common aspects of neural and endocrine regulation

- c. Energy balance
 - d. Fed and fasted state metabolism
 - e. Diabetes mellitus and hypoglycemia
 - f. Metabolic regulation by glucocorticoids, thyroid hormones and growth hormone
 - g. Calcium and phosphate balance
 - h. Stress responses
14. Reproductive Physiology
- a. Endocrine regulation of male and female reproductive systems
 - b. Pregnancy, parturition and lactation

Laboratory: Students will collaborate to collect, analyze, and interpret data in studies related to at least 8 of the following:

1. Homeostasis
2. Negative feedback
3. Somatic and visceral reflexes
4. Cranial nerve physiology
5. Electromyography
6. Electrocardiography
7. Blood
8. Pulmonary function
9. Exercise physiology
10. Metabolism
11. Water and solute balance
12. Independent investigative project

D. Course Learning Outcomes

Upon successful completion of the course, the student will be able to:

1. Develop critical thinking skills through lecture, discussion and laboratory experiences in physiology (Goal 2a, 3a, 3b)
2. Understand processes whereby science develops, expresses and questions theories and the role of new research techniques and model-building in the elucidation of scientific theories (Goal 3a)
3. Explain the biological basis for normal and abnormal physiology (Goal 3a)
4. Collect, analyze and interpret physiological data (Goal 2b, 2c, 3b)
5. Formulate and test a hypothesis, analyze and interpret data, and present verbally and in writing scientific results and conclusions (Goal 3b, 3c)

E. Methods for Assessing Student Learning

A variety of evaluation and assessment methods will be used:

1. Assignments and quizzes
2. Written examinations
3. Written laboratory examinations and laboratory reports
4. Oral explanations of laboratory findings
5. A comprehensive final exam

F. Special Information

Instructors will include the most recent version of the Departmental Expectations document in their course syllabus

When offered on-campus,

- The laboratory portion of the course is delivered in the Biology Learning Center (BLC).
- Instructors will include the most recent version of the Biology Learning Center (BLC) Expectations document in their course syllabus.
- Experiments include collecting data from students.