

BIOLOGY 11

Human Anatomy and Physiology

(4 credits and 7 hours)

SYLLABUS AND COURSE INFORMATION

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**PROFESSORS AND COURSE COORDINATORS
FOR
BIOLOGY 11 & 12**

BIOLOGY 11: HUMAN ANATOMY AND PHYSIOLOGY

PROGRAM GOALS FOR STUDENT OUTCOMES

Allied Health Programs

1. Demonstrate knowledge of basic concepts in anatomy and physiology.
2. Demonstrate proficiency in use of basic laboratory equipment and instruments.
3. Apply knowledge to distinguish normal from homeostatic imbalances.
4. Demonstrate basic computer skills and competence utilizing the Internet for solving problems.
5. Solve a biomedical problem through analysis and interpretation of tabulated and graphical data.
6. Demonstrate understanding of the scientific literature related to allied health fields through presentation of findings in written form and to an audience.

COURSE GOALS

1. Demonstrate understanding of the scientific literature related to allied health fields through presentation of findings in written form and to an audience.
2. Solve a biomedical problem using biomedical knowledge, logic and reasoning skills.
3. Collect data and make sense of it through charts and graphs.
4. Carryout basic quantitative manipulations of biomedical data.
5. Analyze and interpret tabulated and graphical data.
6. Demonstrate knowledge of basic biomedical concepts.
7. Demonstrate proficiency in use of basic laboratory instruments.
8. Demonstrate basic computer skills and competence in use of the Internet.
9. Use knowledge and laboratory skills to recognize normal and disease states.
10. Develop and master the knowledge and biomedical skills to achieve career goals including acquisition of advanced training.

Statement to the Students

Course Prerequisites:

Placement at the English 12 and Math 09 levels on the CUNY assessment tests.

Course Description:

Biology 11 is the first semester of a one-year course in Human Anatomy and Physiology. Both Biology 11 and Biology 12 are designed to provide students with a thorough understanding of the basic principles inherent in the study of human anatomy and physiology, and is intended for students majoring in the allied-health professions, e.g. nursing, pre-physical therapy, pre-physicians assistant, etc. The emphasis of this course will be concerned with understanding the structural and functional relationships of the major organ systems of the human body. A special effort will be made to understand the concept of homeostasis and how the individual organ systems of the body interact with each other in the maintenance of the normal functioning of the entire organism.

Biology 11 combines both lecture and laboratory experiences over a twelve week period. Each week, the class meets for a three-hour lecture session, a one-hour recitation and a three hour laboratory session. Attendance at these sessions is mandatory, and excessive absences beyond the college regulations can result in a "WU" grade.

There will be a five page writing assignment during the semester relating to an aspect of human anatomy and physiology. For this paper you should use three primary sources (other than your textbook or other textbooks) such as a medical journals, the Tuesday edition of the NY Times Science Times, or some other scientific reference approved by your instructor. The topic of your paper should correspond to a topic in any of the course units. **Alternative** writing assignments may be substituted by your instructor.

The assignments are to be submitted type written, double-spaced on 8 1/2 x 11 typing paper, and must include a complete bibliographic reference to the source of the original article from which the abstract was prepared. **A photocopy of the original article must be submitted together with your writing assignment.** The grades for this assignment will be incorporated as 5% of your laboratory grade for the semester. Additional information concerning this assignment will be provided by your instructor.

Plagiarism **as a violation of academic integrity** is the intentional use of another's intellectual creation(s) without attribution. Determination and penalty—ranging from grade reduction to course failure—is at the sole discretion of the faculty member. If a faculty member suspects that a student has committed a violation of CUNY or KCC's Academic Integrity Policy, he/she shall notify the student of the facts and circumstances of the suspected violation whenever possible. It is then at his/her discretion to seek an academic or disciplinary sanction.

Required materials

Required materials include textbook, laboratory manual, lab coat, gloves, goggles and dissecting instruments. Students will not be allowed in the lab without lab coat. Open toed shoes are not permitted in lab.

Textbook for Biology 11 and Biology 12:

Saladin, Ken Human Anatomy and Physiology: The Unity of Form and Function. , Fifth Edition, McGraw-Hill Publishing Company, 2009.

Laboratory Manual for Biology 11 and 12:

Nicpon-Marieb, Elaine, Human Anatomy and Physiology: Laboratory Manual (Fetal Pig Version, Ninth edition), , Benjamin-Cummings Publishing Company, Redwood City, California 2009.

Reading Assignments

To obtain the maximum advantage from the required readings, you should complete the readings **before** coming to class for the week in which the assignments are given. The lecture syllabus lists the reading assignments that will prepare you for the lectures and laboratory exercises for that particular week and refers to reading assignments in your textbook. The sequence of laboratory exercises lists reading assignments in the laboratory manual. It is very important for you to be familiar with the laboratory exercises before performing the experiments or procedures described in the manual. The benefits that you will derive by completing the readings for lecture and laboratory **prior** to the week for which they are assigned are as follows:

1. You will find that it is easier to understand the lecture and laboratory material because you already have some background regarding the topics that are to be covered.
2. The reading assignments for lecture and laboratory are directly related to the topics that will be covered. If you are already familiar with these topics, you will find that you will be able to take fewer and better notes and pay more attention to what the lecturer is saying.
3. Prior reading of the assignments can help you to pinpoint areas in which may be giving you some difficulty. You then can pay very special attention to what the lecturer is saying when discussing these same topics.
4. Reading the assigned material for the laboratory in both the textbook and laboratory manual **prior** to coming to laboratory will help you to get the maximum benefits from your laboratory experiences. Having relevant background information will help you to better understand the laboratory exercises.

Grade Determination:

1. **Laboratory:** The laboratory portion of Biology 11 represents 50% of the course grade. The grade for laboratory will be based on your quiz grades, the writing assignments, and other factors that will be explained to you by your laboratory instructor.
2. **Lecture:** There will be several unit exams that will be administered during the semester **determined by the individual instructor**. The unit examinations will represent 30% of your grade. The final examination will account for 20% of your grade.
3. **Summary of the grading procedures:**

Laboratory quizzes (35%), papers, lab practicals and reports, ...etc (15%).=50%

Unit examinations = 30%

Final examination = 20%

Total = 100%

Lecture Syllabus (*Textbook*)

Week

- 1. The Human body:** An orientation: an overview of Anatomy and Physiology. Levels of structural organization. Homeostasis. The language of anatomy. **Chapter 1 and Atlas A.**
- 2 Chemistry:** Chemistry comes alive: **Part 1: Basic chemistry.** Composition of matter. How matter is combined. Chemical bonds. Chemical reactions. **Part 2: Biochemistry:** Inorganic and organic compounds. **Chapter 2.**
- 3 Cells:** The living units. Overview of the cellular basis of life. The plasma membrane, structure and functions. The cytoplasm. The nucleus. Cell cycle and organelles. **Chapters 3 and 4.**
- 4 Tissue:** The living fabric. Epithelial, connective, nervous and muscle and tissues. Tissue repair. **Chapter 5.**
- 5 The Integumentary System:** The skin. Appendages of the skin. Functions of the integumentary system. **Chapter 6.**
- 6 Bones and Skeletal Tissues: skeletal cartilages.** Classification of bones. Bone structure. Bone development. Bone homeostasis: bones remodeling and repair. **Chapter 7.**
- 7 Joints:** Classification. Fibrous, cartilaginous and synovial joints. **Chapter 9.**
Muscles and muscle tissue: Overview of muscle tissue. Skeletal muscles gross anatomy.
Chapter 11.
- 8 The Muscular System: Muscle tissue. Muscle physiology:** sliding filament theory; muscle metabolism; treppe, twitch, tetanus; fast and slow muscle fibers. **Chapter 11.**
- 9 Nerve Tissue:** Neurons and glia; resting membrane potential; neuronal pools and circuits; neurotransmitters. **Chapter 12.**
- 10 The Central Nervous system. The brain.** Higher mental functions. Protection of the brain. The spinal cord. **Chapters 13 (pp 482-490) and 14.**
- 11 The Peripheral Nervous System (PNS) and reflex arc.** Peripheral receptors: organization and classification. Gross anatomy of peripheral nerves. **Chapters 13 (490-511).**
The Autonomic Nervous System. Anatomy; comparison to somatic nervous system; neurotransmitters and receptors. **Chapter 15.**
- 12 The Endocrine System: An overview. Hormones. Major endocrine organs.** Other hormonal producing structures. **Chapter 17.**

Laboratory Syllabus (*Laboratory Manual*)

Week

- 1 Scientific method and metric system.** **review pages xii-xviii.**
The language of anatomy: Anatomical position, surface anatomy, body planes and sections, body cavities. **Exercise 1** **The microscope:** Parts; magnification and resolution. Viewing cells under the microscope; examination of pond water. **OMIT ACTIVITY 5. CHEEK CELL HAS BEEN MOVED TO WEEK 5** **Exercise 3.**
- 2 Organ system overview:** Rat dissection. Identification of the major organ using the dissected rat and the torso models. **Exercise 2.** **Matter and Energy.** Elements, atomic structure, chemical bonds, pH, chemical reactions, synthesis of iron sulfate;. **See departmental handouts and study guide sheet; Get Ready for A & P book.**
- 3 Macromolecules:** study and chemical detection. **See departmental handouts.** **The Cell.** Transport mechanisms and cell permeability: **Passive** processes (diffusion-osmosis and filtration), **active processes** **Exercise 5A, act. 1; act. 2; act. 3 (demo); Act 6 exp. 1 and 2.**
- 4 The cell:** Anatomy of the composite cell. Differences and similarities in cell structure. Cell division. **Exercise 4.** **Review of the microscope from the Lab #1. Epithelial Tissue.** Cheek cell smear; Scientific drawings. Classification of covering and lining membranes. **Implement the microscope assessment tool (or next week).** **Exercise 3, activity 5; Exercise 6A (pp.67-73), Exercise 8.**
- 5 Connective Tissue.** scientific drawings **Exercise 6A (pp. 74-80).** **Introduction to the integumentary system and the skin.** Basic structure of the skin and accessory organs of the skin. Cutaneous glands. **Exercise 7.**
- 6 Introduction to the study of the skeletal system.** Study of the appendicular and axial skeleton. Assembly of disarticulated skeleton. The fetal skeleton. **Exercises 9, 10, 11, and 12.**
- 7 Articulations and body movements.** Study of the three major types of articulations, joint disorders and types of body movement. **Exercise 13.**
- 8 Gross and microscopic study of the three muscle types.** Identification of selected muscle groups using the human torso model. **Physiology of skeletal muscle. Muscle Physiology Computerized Simulations.** **Exercises 6A (pp. 82-83), 14, 15, 16A activity 4 Biopac.**
- 9 Histology of nervous tissue. Gross anatomy, histology and physiology of the spinal cord.** Study of the anatomical aspects of the Autonomic Nervous System. **Reflex physiology and Computerized Reflex Simulations.** **Exercises 6A (page 81), 17, Exercise 22 and activity 10 Biopac .**
- 10 Gross neuroanatomy: Sheep brain dissection.** Study of the preserved human brain and models of the human brain. **Exercise 19, 20 (activity 2 Biopac), 21 activity 6 Biopac.**

- 11 **Senses: Vision:** Gross anatomy of the eye Dissection of the cow eye. Visual acuity and color blindness tests. Microscopic examination of the retina. **Implement vision assessment tool here.** **Exercise 24.**
- 12 **Senses: Audition:** Hearing and equilibrium. Gross anatomy of the human ear (using models of the human ear). Auditory acuity and equilibrium tests. Microscopic anatomy of the Organ of Corti. Selected experiments dealing with the gustatory and olfactory senses. ! **Exercises 25 and 26.**

N.B.: Students are required to bring their own dissecting instruments and gloves for dissection during the weeks 2, 10 and 11.

LEARNING OBJECTIVES

Human Body: Orientation and Homeostasis

1. List and briefly describe the following branches of the science of biology and their origins: anatomy, gross anatomy, comparative anatomy, cytology, histology, physiology, and biochemistry.
2. Name and define 10 characteristics (qualities) of life.
3. Describe the levels of organization of matter in the universe with at least 2 specific examples for each level.
4. Define the following anatomical terms: (a) anterior, (b) posterior, (c) superior, (d) inferior, (e) dorsal, (f) ventral, (g) medial, (h) lateral, (i) proximal (j) distal, (k) superficial, (l) deep.
5. Explain how the body or an organ is cut in each of the following planes: longitudinal, sagittal, mid-sagittal, frontal (coronal), transverse (cross-sectional).
6. Describe the quadrants of the human abdomen and the organs underlying each quadrant.
7. List all the cavities within the dorsal cavity of the human body and all the organs in those cavities.
8. List all the cavities within the ventral cavity of the human body and all the organs in those cavities.
9. Define the location of the following serous membranes: parietal and visceral membranes
10. Name all the organ systems of the human body and state their main functions.
11. Complete the exercises on the Foundations of Human Anatomy and Physiology website to review principles of the metric system and medical terminology.
12. Define the following terms: homeostasis, negative feedback and positive feedback.

13. Explain how homeostasis is maintained by negative feedback mechanisms using 3 different examples from the human body.
14. Describe two examples of positive feedback from the human body.
15. Identify the following microscope parts: light source, stage, condenser, iris diaphragm & diaphragm lever, objective & ocular lenses, coarse adjustment, fine adjustment & body tube.
16. Define the following microscopic terms: total magnification & par focal.
17. Demonstrate the ability to focus the letter "e" slide and prepare drawings under 4x, 10, & 40x.

Essential Chemical Concepts

1. Define each of the following terms: matter (substance), element, atom, compound, and molecule, mixture.
2. Distinguish between the following forms of energy: kinetic, potential,
3. Define proton, neutron, electron, electron energy levels, and the rule of eights
4. Explain the difference between atomic number and atomic mass.
5. Define ions, cations, anions, and valence.
6. Define the following types of chemical bonds: (a) ionic, (b) covalent, (c) polar covalent, and (d) hydrogen.
7. Describe how each of the following properties of water makes it important to human life: solvency, cohesion, adhesion, thermal stability, and chemical reactivity.
8. Describe the three major types of mixtures: suspensions, colloidal dispersions, and true solutions.
9. Explain the difference between the four main ways of expressing concentrations of solutions: weight of solute per unit of volume, percent solutions
10. Define acid, base, and pH.
11. (a) Define the term buffer. (b) Explain how a buffer works using bicarbonate buffer as your example.
12. Use simple equations to explain the following types of reactions: a. decomposition, b. synthesis and c. reversible
13. Explain the effect of the following: concentration of reactants, temperature, pH, catalysts

Cytology: Description, cell cycle and transport across the plasma membrane

1. State the Modern Cell Theory and discuss its development.

2. Describe cell shapes from their descriptive terms.
3. Discuss factors that limit cell size.
4. Explain how advances in microscopy have led to a better understanding of cell structure.
5. Draw a typical animal cell, and label its components.
6. Describe the structural components of the plasma membrane, and state their functions.
7. Distinguish between integral and peripheral proteins, and state their functions.
8. Describe the components and functions of the cytoskeleton.
9. Describe the composition and functions of the glycocalyx.
10. Describe the structure and functions of microvilli, cilia, and flagella.
11. Distinguish between membranous and non-membranous organelles, provide examples of each.
12. Describe the structure and functions of the following organelles: nucleus, smooth endoplasmic reticulum, rough endoplasmic reticulum, ribosomes, Golgi complex, mitochondria, centrioles, peroxisomes, lysosomes.
13. Contrast the differences between organelles and inclusions, provide some examples of inclusions.
14. Define the following terms: cytoplasm, cytosol, extra cellular fluid.
15. Describe G1, S and G2 of the typical "cell cycle".
16. Describe the following stages of mitosis: prophase, metaphase, anaphase, telophase, and the process of cytokinesis.
17. Define diffusion
18. Define osmosis. Explain why osmosis is considered a specific type of diffusion.
19. Define the words, isotonic, hypertonic, and hypotonic,
20. Define filtration
21. Define facilitated diffusion. Define active transport. Explain the difference between symport and antiport membrane carriers.
22. Define bulk transport, endocytosis, and exocytosis.
23. Define the following terms: (a) phagocytosis and (b) pinocytosis. Explain the steps involved in (a) phagocytosis and (b) pinocytosis

Tissues

1. List the 4 basic tissue types and state their basic functions in the human body.
2. Name and state the derivatives of the 3 embryonic tissues

3. Define: squamous, cuboidal, columnar, simple, stratified and keratinized with respect to epithelial tissue.
4. Describe the following 3 types of cellular junctions and a tissue that utilizes them: tight junctions, desmosomes, and gap junctions.
5. List common characteristics shared by all types of epithelial tissues,
6. State the 3 fundamental characteristics of connective tissue.
7. Describe and illustrate the structural arrangement of a generalized connective tissue including the terms: ground substance, fibers, matrix, and cells.
8. Explain the difference between collagen, elastin and reticular fibers.
9. Explain the differences in function of the following cells found in connective tissues: fibroblasts, fixed macrophages, other leukocytes, mast cells and adipocytes.
10. Describe the structural arrangement and the functions of the areolar connective tissue underling all epithelial surfaces.
11. Explain the difference between dense irregular and dense regular connective tissue.
12. Explain the functions of the following types of dense irregular connective tissue: investing fascia, deep fascia and organ capsules.
13. Explain the functions of the following types or dense, regular connective tissue: ligaments, tendons, tendon sheaths, bursae and aponeuroses.
14. List the 3 types of cartilage and where they are found
15. Explain why cartilage heals slowly
16. Compare bone matrix to other connective tissue matrices.
17. Describe the structure and function of adipose tissue
18. List and describe the three muscle types of the body.
19. State the major characteristics of nervous tissue.
20. Explain the function of the following types of membranes: mucous, serous and synovial.
21. Explain the difference between endocrine and exocrine glands.

Integumentary system

1. Explain the structure of the skin: cell types, layers of the epidermis, and zones of the dermis.
2. Explain each of the functions of the skin.
3. List the organs/derivatives of the integumentary system.
4. Explain the role of the dermis in relation to the epidermis.

5. Differentiate between the structure and function of each of the following types of glands in the skin: sebaceous, apocrine, eccrine and mammary sudoriferous glands.
6. Name the layers of the skin where most of the accessory glands are located in the adult.
7. Explain the role of the hypodermis/superficial fascia/subcutaneous layer.
8. Using specific examples correlate the structure of the skin with its function.
9. List, in order from the bottom, the layers of the epidermis and distinguish each layer according to its structure and function.
10. Explain why the cells in the upper layers of the epidermis die.
11. Explain the anatomical and physiological differences between thick and thin skin.
12. Explain why the skin is a membrane and name the type of membrane that it is.
13. Explain how fingerprints develop.
14. Explain the effect of excessive exposure to the sun on the skin.

Skeletal System

1. List and explain the six primary functions of the skeletal system.
2. List the major components of the axial and appendicular skeleton.
3. State the specific functions each of the axial and appendicular divisions.
4. Classify bones of the human skeletal system based on their shape. Give two examples of each group.
5. Describe the microscopic structure of bone.
6. Discuss the role of hormones and bone cells in bone remodeling.
7. Cite the regions of the vertebral column and list the number vertebrae in each region of the adult vertebral column.
8. List the bones that form the cranium and the sutures that join them.
9. Explain the importance of fontanelles in the fetal skeleton.
10. Distinguish between endochondrial and intramembranous bone development.

Articulations

1. Explain how joints can be classified according to the type of tissue that binds the bones together.
2. Describe the general structure of a synovial joint and the function of synovial fluid.
3. List six types of freely movable (synovial) joints and describe the actions possible

at each of these joints and locate and cite an example of each type that you have mentioned.

4. Describe the location, structure and function of bursae and tendon sheaths.
5. Distinguish between the three types of fibrous joints and cite an example and location for each of the three types you have mentioned.
6. Distinguish between the three types of cartilaginous joints, cite an example of each of the three types and indicate the location of the joint you have mentioned.
7. Clearly indicate the difference between the origin and insertion point of a muscle on a bone.
8. Define the term “articulation” and identify the factors that determine the degree of movement at a joint.
9. Clearly distinguish between the three following terms that are used to classify joints based upon the degree of movement they permit: a. synarthroses, b. amphiarthroses; and c. diarthroses.

Muscle System-

1. Explain the characteristics of muscle tissue.
2. Diagram, label and explain the components of a muscle fiber.
3. Diagram, label and explain the components of a sarcomere and how they relate to muscle contraction, as well as being able to explain the sliding filament theory.
4. Diagram, label and explain all the structures located at the neuromuscular junction and their role as it relates to muscle contraction.
5. Explain the differences and give examples of large motor units vs. small motor units.
6. Explain the events of excitation-contraction coupling and the stages of muscle contraction in detail.
7. Diagram, give examples and explain what is meant by the length tension relationship.
8. Diagram, label and explain all of the components of a muscle twitch.
9. List various ways muscle contraction strength can be increased.
10. Explain and demonstrate the differences between Isometric and Isotonic contractions.
11. Explain and give examples of when and how the various energy systems are used (immediate, short-term and long-term)
12. List the factors responsible for muscles fatigue.
13. Compare and contrast the structure and function of slow twitch and fast twitch muscle fibers.

14. List the main structural and functional differences between cardiac, smooth and skeletal muscle.
15. Identify assigned muscles and be familiar with their origin, insertion and action.
16. Explain criteria used for naming muscles.
17. Give examples and explain the relationship between muscles, antagonists, synergists, and fixators.

Nervous System

1. State the general functions of the nervous system
2. State the major anatomical subdivisions of the nervous system.
3. Describe the universal characteristics of nerve cells that enable them to carry out their functions.
4. Draw and label a generalized neuron.
5. Describe anterograde and retrograde axon transport.
6. List the types of neuroglia and state their specific functions.
7. Describe how the myelin sheath is formed and explain its function.
8. Explain how nerve fibers may grow and/or regenerate.
9. Describe the relationship of unmyelinated nerve fibers to their supportive cells.
10. Explain how a cell maintains a transmembrane potential.
11. Explain the difference between depolarizations that result in local potentials and action potentials.
12. Explain how local potentials can generate an action potential.
13. Differentiate between salutatory and continuous conduction, and how action potentials are propagated.
14. Explain synaptic transmissions.
15. Provide examples of neurotransmitters and describe their actions.
16. Explain how a neuron decides whether or not to produce action potentials.
17. Explain the effects of IPSP's and EPSP's.
18. Explain how the nervous system encodes intensity.
19. Explain the operation of convergent and divergent neuronal circuits.
20. Differentiate between spatial and temporal summation.

Central Nervous System (CNS)

1. Distinguish between grey and white matter.

2. Describe the regions and cross-sectional anatomy of the spinal cord.
3. Differentiate between ascending and descending spinal pathways.
4. Define reflex and the general components of a typical reflex arc.
5. Differentiate between flexor and crossed-extensor reflexes.
6. Describe the embryonic development of the CNS and relate this to adult brain anatomy.
7. Describe the meninges of the brain.
8. Describe the ventricular system of the brain.
9. Discuss the production, circulation, and function of the cerebrospinal fluid.
10. Explain the origin significance of the blood-brain barrier system.
11. Describe the major anatomical features and functions of each adult brain region.
12. List the 12 cranial nerves by name and number.
13. State the functions of each cranial nerve.

Peripheral Nervous Systems (PNS)

1. Describe the gross anatomy of a spinal nerve.
2. Describe the formation and structure of the myelin sheath and relate its importance to a peripheral nerve.
3. List the five major nerve plexuses and describe the general anatomy of each.
4. Describe the neural pathways involved in a simple reflex.
5. Define receptor and sense organ.
6. List the four kinds of information obtained from sensory receptors.
7. Outline three ways of classifying receptors.
8. Describe the seven types of somesthetic receptors.
9. Explain how taste and smell receptors are stimulated, and describe their neural pathways.
10. Describe the gross and microscopic anatomy of the ear and the functions of each part.
11. Explain how the ear converts vibrations to nerve signals.
12. Explain how the vestibular apparatus enables the brain to interpret the body's positions and movements.
13. Describe the anatomy of the eye and its accessory structures, and the function of each.
14. Describe the structure of the retina and its receptor cells.

15. Explain how an image is projected on the retina and how this image is converted into nerve impulses.
16. Differentiate between the function of the cells involved in day and night vision.
17. Differentiate between a nucleus, a ganglia, a nerve and a tract.

Autonomic Nervous System (ANS)

1. Explain how the autonomic and somatic nervous systems differ in form and function.
2. Explain how the two divisions of the ANS differ in general function.
3. Distinguish between preganglionic and postganglionic fibers of the autonomic nervous system.
4. Name the neurotransmitters used at different synapses of the ANS.
5. Describe the different classes of receptors in the ANS and how they relate to autonomic responses.
6. Explain how the ANS controls many target organs through dual innervations, and how control is exerted in the absence of dual innervations.
7. Compare and contrast the locations of sympathetic and parasympathetic neuron cell bodies, dendrites and axons.
8. Compare and contrast the specific anatomical and physiological roles of the sympathetic and parasympathetic nervous systems.

Endocrine System

1. Compare and contrast the general functions and mechanisms of action of the endocrine system and the nervous system.
2. Distinguish between exocrine and endocrine glands.
3. List and describe the endocrine glands
4. Explain the relationship between the pituitary gland and the hypothalamus.
5. Describe the chemical classes of hormones, and provide an example for each.
6. Differentiate between direct and indirect mechanisms of hormone action.
7. List and describe the target action of hormones from each of the following endocrine glands: the anterior pituitary, the posterior pituitary, the pineal, the thymus, the thyroid, the parathyroids, the pancreas, the adrenals and the gonads.
8. Describe how hormone secretions are regulated by negative feedback processes. Describe a specific example.