BIO-2331: ANATOMY AND PHYSIOLOGY I

Cuyahoga Community College

Viewing: BIO-2331: Anatomy and Physiology I

Board of Trustees:
2018-01-25

Academic Term:
Fall 2018

Subject Code
BIO - Biology

Course Number:
2331

Title:
Anatomy and Physiology I

Catalog Description:
Study of structure and function of human body. Focus on fundamental concepts of cellular structure, tissues, organs, and systems. Considers structure, function, and terminology of skeletal, muscular, integumentary, nervous and endocrine systems. Laboratory experiences include demonstrations, microscopic observations, anatomic models, and videos related to topics.

Credit Hour(s):
4

Lecture Hour(s):
3

Lab Hour(s):
3

Requisites

Prerequisite and Corequisite
Sufficient score on Biology Placement Test or BIO-1100 Introduction to Biological Chemistry; or CHEM-1010 Introduction to Inorganic Chemistry and CHEM-1020 Introduction to Organic Chemistry and Biochemistry; or BIO-1500 Principles of Biology.

I. ACADEMIC CREDIT

Academic Credit According to the Ohio Department of Higher Education, one (1) semester hour of college credit will be awarded for each lecture hour. Students will be expected to work on out-of-class assignments on a regular basis which, over the length of the course, would normally average two hours of out-of-class study for each hour of formal class activity. For laboratory hours, one (1) credit shall be awarded for a minimum of three laboratory hours in a standard week for which little or no out-of-class study is required since three hours will be in the lab (i.e. Laboratory 03 hours). Whereas, one (1) credit shall be awarded for a minimum of two laboratory hours in a standard week, if supplemented by out-of-class assignments which would normally average one hour of out-of-class study preparing for or following up the laboratory experience (i.e. Laboratory 02 hours). Credit is also awarded for other hours such as directed practice, practicum, cooperative work experience, and field experience. The number of hours required to receive credit is listed under Other Hours on the syllabus. The number of credit hours for lecture, lab and other hours are listed at the beginning of the syllabus. Make sure you can prioritize your time accordingly. Proper planning, prioritization and dedication will enhance your success in this course.

The standard expectation for an online course is that you will spend 3 hours per week for each credit hour.

II. ACCESSIBILITY STATEMENT

If you need any special course adaptations or accommodations because of a documented disability, please notify your instructor within a reasonable length of time, preferably the first week of the term with formal notice of that need (i.e. an official letter from the Student Accessibility Services (SAS) office). Accommodations will not be made retroactively.

For specific information pertaining to ADA accommodation, please contact your campus SAS office or visit online at: http://www.tri-c.edu/accessprograms. Blackboard accessibility information is available at: http://access.blackboard.com.
Eastern (216) 987-2052 - Voice  
Metropolitan (216) 987-4344 – Voice. (216) 987-4048 – TTY.  
Western (216) 987-5079 – Voice. (216) 987-5117 – TTY.  
Westshore (216) 987-3900 – Voice. (216) 987-4048 – TTY.  
Brunswick (216) 987-5079 – Voice. (216) 987-5117 – TTY.  
Off-Site (216) 987-5079 - Voice

III. ATTENDANCE TRACKING

Regular class attendance is expected. Tri-C is required by law to verify the enrollment of students who participate in federal Title IV student aid programs and/or who receive educational benefits through other funding sources. Eligibility for federal student financial aid is based in part on enrollment status. Students who do not attend classes for the entire term are required to withdraw from the course(s). Additionally, students who withdraw from a course or stop attending class without officially withdrawing may be required to return all or a portion of their financial aid based on the date of last attendance. Students who do not attend the full session are responsible for withdrawing from the course(s).

Tri-C is responsible for identifying students who have not attended a course before financial aid funds can be applied to students’ accounts. Therefore, attendance is recorded in the following ways:

- For in-person and blended-learning courses, students are required to attend the course by the 15th day of the semester (or equivalent for terms shorter than five weeks) to be considered attending. Students who have not met all attendance requirements for in-person and blended courses, as described herein, within the first two weeks or equivalent, will be considered not attending.
- For online courses, students are required to log in at least two times per week and submit one assignment per week for the first two weeks of the semester, or equivalent to the 15th day of the term. Students who have not met all attendance requirements for online courses, as described herein, within the first two weeks or equivalent, will be considered not attending.

At the conclusion of the first two weeks of a semester or equivalent, instructors report any registered students who have “Never Attended” a course. Those students will be administratively withdrawn from that course. However, after the time period in the previous paragraphs, if a student stops attending a class or wants or needs to withdraw, for any reason, it is the student’s responsibility to take action to withdraw from the course. Students must complete and submit the appropriate Tri-C form by the established withdrawal deadline.

Tri-C is required to ensure that students receive financial aid only for courses that they attend and complete. Students reported for not attending at least one of their registered courses will have all financial aid funds held until confirmation of attendance in registered courses has been verified. Students who fail to complete at least one course may be required to repay all or a portion of their federal financial aid funds and may be ineligible to receive future federal financial aid awards. Students who withdraw from classes prior to completing more than 60 percent of their enrolled class time may be subject to the required federal refund policy.

If illness or emergency should necessitate a brief absence from class, students should confer with instructors upon their return. Students having problems with coursework due to a prolonged absence should confer with the instructor or a counselor.

IV. LEARNING OUTCOMES ASSESSMENT

Occasionally, in addition to submitting assignments to their instructors for evaluation and a grade, students will also be asked to submit completed assignments, called ‘artifacts,’ for assessment of course and program outcomes and the College’s Essential Learning Outcomes (ELOs). The artifacts will be submitted in Blackboard or a similar technology. The level of mastery of the outcome demonstrated by the artifact DOES NOT affect the student’s grade or academic record in any way. However, some instructors require that students submit their artifact before receiving their final grade. Some artifacts will be randomly selected for assessment, which will help determine improvements and support needed to further student success. If you have any questions, please feel free to speak with your instructor or contact the Learning Outcomes Assessment office.

V. CONCEALED CARRY STATEMENT

College policy prohibits the possession of weapons on college property by students, faculty and staff, unless specifically approved in advance as a job-related requirement (i.e., Tri-C campus police officers) or, in accordance with Ohio law, secured in a parked vehicle in a designated parking area only by an individual in possession of a valid conceal carry permit.

As a Tri-C student, your behavior on campus must comply with the student code of conduct which is available on page 29 within the Tri-C student handbook, available athttp://www.tri-c.edu/student-resources/documents/studenthandbook.pdfYou must also comply with the College’s Zero Tolerance for Violence on College Property available athttp://www.tri-c.edu/policies-and-procedures/documents/3354-1-20-10-zero-tolerance-for-violence-policy.pdf

Outcomes  
Course Outcome(s):
Compare and contrast anatomy and physiology using the language of anatomy to describe the human body and its organization.

Objective(s):
1. Demonstrate the relationship between anatomy and physiology.  
2. List, from simplest to most complex, the major levels of organization in the human body.
3. Use the language of anatomy to describe the human body.
4. Describe the 11 organ systems including their major organs and functions.
5. Identify and describe the major body cavities, membranes, and associated organs.

Course Outcome(s):
Describe homeostatic regulation and apply the concepts of homeostasis to the integration of life functions in the human body.

Objective(s):
1. Relate disruptions in the homeostatic regulation to disease states in the human body.
2. Define homeostasis and provide examples of it in the human body.
3. Compare and contrast positive and negative feedback in terms of the relationship between the stimulus and response.
4. Define the components of a negative feedback loop in a specific example of homeostasis including the receptor, afferent directional information flow, control center, efferent directional information flow, and effector.
5. Predict the response of the body to factors that disrupt homeostasis.

Course Outcome(s):
Demonstrate microscope competency and apply the fundamental knowledge of cell theory and membrane biology to human physiology.

Objective(s):
1. Identify the parts of the compound microscope and describe how to use, handle and store it.
2. Define magnification, resolution, parfocal, field of view, and working distance in relation to microscopy.
3. Describe how to adjust the magnification and resolution of a specimen under the microscope.
4. Calculate the total magnification of a viewed specimen at each objective lens.
5. Describe cell theory.
6. Identify the common parts of a human cell and describe the structure and function of each.
7. Describe the structure of the plasma membrane and explain how this structure relates to its selective permeability.
8. Describe active and passive membrane transport mechanisms.
9. Define tonicity and relate it to osmotic pressure.
10. Predict the net direction of movement of a substance across a cell membrane given its permeability and concentration gradient.

Course Outcome(s):
Describe and differentiate between the four basic tissues that make up the human body and apply this fundamental knowledge to tissue repair and regeneration.

Objective(s):
1. Define tissue and list the four main types of tissue that make up the human body.
2. Compare and contrast the fundamental characteristics of the tissue types.
3. Identify the sub-types of a tissue by describing its function and location in the body.
4. Identify the specialized cells and extracellular structures within each type of tissue and state their significance in terms of the function of the tissue.
5. Describe the structure, function, and body location of mucous, serous, cutaneous and synovial membranes.
6. Distinguish between exocrine and endocrine glands structurally and functionally.
7. Classify a gland as exocrine or endocrine based on its characteristics.
8. Describe how injuries affect tissues and list the stages of tissue repair.
9. Predict the rate of tissue repair based on the knowledge of the tissue type and its regenerative capacity.

Course Outcome(s):
Apply the fundamental knowledge of the integumentary system to explain homeostasis and to predict outcomes of disrupted structure and/or function.

Objective(s):
1. Describe the major functions of the integumentary system.
2. Identify and describe the two components of the cutaneous membrane.
3. Identify and describe the five layers of the epidermis including the specialized cells in each.
4. Describe the process of epidermal growth and keratinization.
5. Explain the biological basis for the color of the epidermis in humans.
6. Identify and describe the two layers of the dermis.
7. Identify the subcutaneous layer describe its composition.
8. Identify and describe the accessory structures of the integumentary system.
9. Describe the growth cycle of hair follicles and the growth of hair.
10. Evaluate the physiological significance of the presence or absence of sebaceous or sweat glands in specific regions of the body.
11. Explain how the integumentary system maintains homeostasis of body temperature.
12. Predict how damage to the skin could disrupt homeostasis in the body.

Course Outcome(s):
Apply the fundamental knowledge of the skeletal system and articulations to explain homeostasis and to predict outcomes of disrupted structure and/or function.

Objective(s):
1. Describe the major functions of the skeletal system.
2. Describe the composition of osseous tissue including the specialized cells and organic and inorganic components of the extracellular matrix.
3. Identify the microscopic components of compact and spongy bone.
4. Describe the anatomy and physiology of the cartilage found in the skeletal system and identify the location of each type in the human body.
5. Describe the gross anatomy of bones and classify bones by type.
6. Identify the major structural components of a long bone relative to the function of the bone in the body.
7. Identify the major bone markings and describe their physiological relevance.
8. Compare and contrast the anatomy and physiology of a fetal and adult skull.
9. Compare and contrast the anatomy and physiology of adult male and female skeletons.
10. List the functional and structural classifications of the articulations.
11. Classify each articulation based on composition or degree of movement.
12. Identify the accessory structures of the synovial joint including bursa, tendon sheaths, and ligaments.
13. Identify examples of the six synovial joints in the human body and demonstrate their movements.
14. Define arthritis and explain the causes, symptoms and prognosis of specific types of this disease.
15. Define the terms ossification and calcification and explain the roles of osteogenic cells in the formation of bone.
16. Compare and contrast intramembranous and endochondral ossification.
17. Explain the roles of calcitonin, parathyroid hormone and calcitriol in the homeostatic regulation of blood calcium levels.
18. Predict the impact of homeostatic disturbances to blood calcium levels on bone remodeling and growth.
19. Evaluate factors or situations affecting the skeletal system or articulations that could disrupt homeostasis.

Course Outcome(s):
Apply the fundamental knowledge of the muscular system to explain homeostasis and to predict outcomes of disrupted structure and/or function.

Objective(s):
1. Describe the major functions of the muscular system.
2. List the three types of muscle found in the human body, and compare and contrast them in regards to location in the body, structure and function.
3. Describe the organization of skeletal muscle tissue beginning with the skeletal muscle fiber and ending with the whole muscle, including the connective tissue components.
4. Describe the cellular structure of the skeletal muscle fiber including the specialized organelles, transverse tubules, and myofilaments.
5. Explain the anatomy of the myofibril and sarcomere.
6. Identify and describe the function of the contractile, regulatory and structural protein components of the sarcomere.
7. Describe the sliding filament theory of muscle contraction.
8. Identify the components and describe the anatomy of the neuromuscular junction.
10. Define membrane potential, action potential, depolarization and repolarization as they relate to the voltage across the sarcolemma.
11. Explain the changes in permeability of the sarcolemma to sodium and potassium during an action potential by describing the opening and closing of voltage-gated ion channels.
12. Interpret a graph illustrating the change in voltage over time in a skeletal muscle fiber during an action potential.
13. Describe how excitation is coupled to contraction of the skeletal muscle fiber.
14. List the sequence of events that occur during the contraction cycle of a skeletal muscle fiber.
15. Evaluate the impact of changes in cellular ion permeability or extracellular ion concentration on muscle contraction.
16. Describe how a muscle obtains energy for muscle contraction and explain factors that lead to muscle fatigue.
17. Summarize the events that must occur for a muscle fiber to relax.
18. Interpret a myogram of a skeletal muscle twitch defining the latent period, contraction and relaxation periods, and describe the physiological events that correspond to each period.
19. Define the term tension as it relates to the contraction of a whole muscle.
20. Explain the physiological phenomenon of wave summation and tetanus as it relates to action potential frequency and whole muscle tension development.
21. Define a contraction as isotonic or isometric.
22. Explain how skeletal muscle names can help identify their action, appearance or location in the body.
23. Define origin, insertion and action as they relate to skeletal muscles.
24. Define the terms agonist (prime mover), antagonist, synergist and fixator as they relate to muscle actions during movement.
25. Identify the major muscles of the human body and state their major actions.

Course Outcome(s):
Apply the fundamental knowledge of the organization and electrophysiology of the nervous system to explain homeostasis and to predict outcomes of disrupted structure and/or function.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Describe the factors that contribute to the resting membrane potential of a neuron.
2. Define excitation, depolarization, repolarization, inhibition and hyperpolarization as they relate to changes in cellular membrane potential.
3. Compare and contrast the graded potential and action potential.
4. Describe the role of ligand-gated and voltage-gated ion channels in neuronal signaling.
5. Describe the general events that occur during neuronal signaling.
6. Describe the changes in ion permeability during an action potential with a focus on the opening and closing of the gated ion channels.
7. Define the physiological threshold for an action potential and identify the anatomical trigger zone on a neuron.
8. Explain why the action potential is known as an “all-or-none” phenomenon.
9. Interpret a graph illustrating the change in voltage over time during an action potential.
10. Identify the absolute and relative refractory periods on the action potential graph and explain their physiological relevance.
11. Predict how the shape of a graphed action potential will change in response to neurotoxins that impact the voltage-gated channels.
12. Describe the refractory periods of the action potential and state their physiological relevance.
13. Compare and contrast propagation of an action potential in an axon that is myelinated versus an axon that has no myelin.
14. Explain how axon diameter and myelination affects the speed of conduction of an action potential.
15. Describe the events that occur at the axon terminal that cause the release of neurotransmitters into the synaptic cleft.
16. Define the two types of graded potentials and interpret graphs illustrating each.
17. Describe the basic categories of neurotransmitters and explain how a transmitter may cause excitation or inhibition in the post-synaptic neuron.
18. Describe how a neuromodulator acts differently than the neurotransmitter.
19. Compare and contrast temporal and spatial summation of graded inputs in the post-synaptic neuron.
20. Define synaptic fatigue and synaptic delay.
21. Describe how presynaptic inputs can facilitate or inhibit neuronal signaling.
22. Discuss the meaning of the term neuroplasticity and relate this term in a broad sense to learning and memory.
23. Describe the major functions of the nervous system.
24. Describe the role of the nervous system in homeostatic regulation, identifying nervous system elements that are receptors and control centers, and explaining how the nervous system communicates with effectors.
25. Describe the hierarchical organization of the nervous system including the central, peripheral, sensory, motor, somatic, and autonomic nervous systems.
26. List the parts of the nervous system that constitute the central nervous system and those that constitute the peripheral nervous system.
27. Define afferent and efferent as these terms relate to information flow in the nervous system.
28. Describe the two types of cells found in nervous tissue and state their function.
29. Identify and state the function of the parts of a neuron including the dendrite, soma, axon hillock, axon, axon terminal, and synaptic knob or button.
30. Classify neurons based on structure and function.
31. Describe the location of the soma for a motor, sensory, and interneuron within the nervous system.
32. List the six types of glial cells, state their location in the nervous system and describe their function.
33. Compare and contrast myelin formation and structure in the central and peripheral nervous systems and predict the result of its loss in either system.
34. Define membrane potential and explain its significance in nervous system function.
35. Describe how the diffusion of ions across the plasma membrane is regulated by gated ion channels.
36. Define the electrochemical gradient and use it to predict the direction of net movement of an ion through an open channel.

Course Outcome(s):
Apply the fundamental knowledge of the central nervous system to explain homeostasis and to predict outcomes of disrupted structure and/or function.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.
Objective(s):
1. Define the components and function of the central nervous system.
2. Describe how the development of the human brain explains its structural features including the major regions and ventricles.
3. Compare and contrast white matter and gray matter in the central nervous system anatomically and functionally.
4. Identify the major regions of the brain and describe the function of each.
5. Predict the physiological consequences of damaging a specific region of the brain based on its function.
6. Describe how the skull, meninges, cerebrospinal fluid and blood brain barrier protect the brain.
7. Trace the path of cerebrospinal fluid circulation from production in the choroid plexus to reabsorption into the circulatory system.
8. Describe the gross anatomy of the spinal cord in a longitudinal view.
9. Label a cross section of a spinal cord in a cervical, thoracic and lumbar region and describe the function of the nuclei and columns visible.
10. Predict the motor and sensory symptoms of a spinal cord injury to a specific region of the spinal cord.

Course Outcome(s):
Apply the fundamental knowledge of the cranial nerves, spinal nerves, and spinal reflexes to explain homeostasis and to predict outcomes of disrupted structure and/or function.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Describe the gross anatomy of a nerve and identify the anatomical features in a cross section.
2. Identify the cranial nerves by name and number and state the function of each.
3. Classify the cranial nerves as sensory, motor or mixed and describe the function of each.
4. Identify the dorsal root ganglia, dorsal and ventral roots, and spinal nerves.
5. Explain how spinal nerves are formed by sensory and motor neuron axons.
6. Trace the path of a motor axon from the spinal cord to the muscle and a sensory neuron axon from the dendrite to the spinal cord including the root, nerve, ramus, and plexus.
7. List the four spinal nerve plexuses, give examples of nerves that emerge from each and describe what structures they innervate.
8. List the five components of a reflex arc.
9. Describe the components, characteristics and purpose of the stretch reflex, tendon reflex, withdrawal reflex, and crossed extensor reflex.
10. Categorize the spinal cord reflexes as innate or acquired, spinal or cranial, somatic or visceral, monosynaptic or polysynaptic, and ipsilateral or contralateral.
11. Define reciprocal inhibition and list the reflexes that utilize it.
12. Explain how a spinal reflex can be facilitated or inhibited by higher regions of the central nervous system.
13. Discuss how specific reflexes are used clinically to assess the function of the nervous system.

Course Outcome(s):
Apply the fundamental knowledge of the general sensory and somatic nervous systems and their associated pathways to and from the central nervous system to explain homeostasis and to predict outcomes of disrupted structure and/or function.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Describe the major functions of the sensory nervous system.
2. Compare and contrast sensation and perception.
3. Define transduction and describe how it occurs in the general and special senses.
4. Compare and contrast general sensation and special sensation.
5. Describe how a stimulus is interpreted according to modality, location, duration and intensity.
6. List the six types of tactile/pressure receptors in the skin, and for each state the anatomy, location, adaptability, and stimuli detected.
7. Define proprioception and describe the types and locations of proprioceptors in the body and what they detect.
8. Describe the thermoreceptors, nociceptors, baroreceptors, and chemoreceptors, explaining their anatomy, location, and stimuli detected.
9. Trace sensory input through the afferent pathways beginning at the sensory receptor and ending at the cerebral or cerebellar cortex.
10. Associate a specific sensory receptor with a specific afferent pathway.
11. Trace motor output through the corticospinal pathway beginning in the primary motor cortex and ending at the skeletal muscle.
12. Describe the indirect motor pathways of the nervous system.
13. Explain the role of the basal nuclei and cerebellum in movement.
14. Predict the sensory and motor symptoms a patient will experience given a specific lesion to the spinal cord based on the tracts damaged.

Course Outcome(s):
Apply the fundamental knowledge of the special senses to explain homeostasis and to predict outcomes of disrupted structure and/or function.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. List the five special senses in the human body and describe the location of the specialized sensory organ housing the sensory receptors for each.
2. Trace the pathway of light to the retina and explain how light is focused for distant and close vision.
3. Compare the anatomy and physiology of rods and cones in phototransduction.
4. Describe signal transduction in the retinal cells during light and dark.
5. Trace the pathway of visual input from the retina to the occipital lobe.
6. Describe how the anatomical features of the visual pathway and placement of the eyes allow humans to have depth perception.
7. Describe the part of the inner ear that detects sound waves and equilibrium.
8. Describe the structure and function of a hair cell, and state its location in the inner ear.
9. Trace the pathway of a sound wave from the outer ear to the cochlea.
10. Describe how a sound wave inside the cochlea activates a hair cell.
11. Describe how the amplitude and frequency of a sound wave traveling in the cochlea will determine the volume and pitch of a sound.
12. Trace the pathway of the auditory signal from the hair cells in the cochlea to the auditory cortex in the brain.
13. Compare and contrast sensorineural and conductive deafness.
14. Compare and contrast how the vestibular apparatus detects static and dynamic equilibrium.
15. Describe the pathway for equilibrium from the hair cells to the brain.
16. Discuss the processing of equilibrium in the brain and relate that to motion sickness.
17. Explain how odorants activate olfactory receptors.
18. Describe the path of nerve impulses from the olfactory receptors to the various regions of the brain.
19. Explain how dissolved chemicals activate gustatory receptors.
20. Describe the path of nerve impulses from the gustatory receptors to the various parts of the brain.
21. List the five primary taste sensations and describe how each is transduced at the molecular level by the receptor.
22. Predict how loss of any of the special senses would disrupt homeostasis.

Course Outcome(s):
Apply the fundamental knowledge of the autonomic nervous system to explain homeostasis and to predict outcomes of disrupted structure and/or function.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Define the autonomic nervous system and explain its function.
2. Compare and contrast the autonomic and somatic nervous systems in regards to neurons and neurotransmitters, and effectors.
3. Discuss the two divisions of the autonomic nervous system and state the general physiological role of each.
4. Compare and contrast the anatomy of the sympathetic and parasympathetic divisions, including central nervous system outflow locations, ganglia locations, pre- and post-ganglionic neuron relative lengths, and ganglionic and effector neurotransmitters and receptors.
5. Differentiate between cholinergic and adrenergic nerve fibers and discuss the physiological consequences of acetylcholine and norepinephrine/epinephrine interacting with their receptors at a given effector.
6. Predict the side effects of a pharmacological agent binding to autonomic nervous system target receptors.
7. Define the concepts of dual innervation and autonomic tone in regards to autonomic nervous system function.
8. Discuss the implications in homeostatic regulation of effectors that are not dually innervated by both the sympathetic and parasympathetic systems.
9. Describe a visceral reflex arc and list the higher brain regions that can influence these reflexes.
10. Predict the consequences of disruption of the autonomic nervous system to the body.

Course Outcome(s):
Apply the fundamental knowledge of the endocrine system to explain homeostasis and to predict outcomes of disrupted structure and/or function.
Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Define the classes of chemical messengers used by the body based on their mode of secretion.
2. Explain the difference between an endocrine and exocrine gland.
3. Compare and contrast the nervous and endocrine systems as the two major control systems in the body.
4. Describe the characteristics of hormones and how they are classified.
5. Describe the common modes of transport, activation patterns, and secretion patterns of hormones.
6. List the three signals that can trigger hormone secretion.
7. Describe how hormone levels in the blood are regulated via positive or negative feedback.
8. Describe the two basic types of hormone receptors and how they generally alter cell function when a hormone is bound.
9. Define second messenger systems and give examples of common ones activated by hormone receptors.
10. List the major structures of the endocrine system.
11. Describe the anatomical and physiological relationship between the hypothalamus and the pituitary gland.
12. For the pituitary, thyroid, parathyroid, adrenal, and pancreas glands, describe the hormone(s) they secrete, the stimulus for secretion, the regulation of the hormone levels in the blood, the target tissue(s), and effect(s) of the hormone.
13. Analyze symptoms and hormone levels to diagnose common endocrine disorders.

Methods of Evaluation:
1. Lecture examinations
2. Quizzes
3. Lecture and laboratory quizzes
4. Laboratory practical exams
5. Reviews of scientific journal articles
6. Case history analysis
7. Online activities
8. Class participation

Course Content Outline:
1. Introduction
   a. Definitions
      i. Anatomy
      ii. Physiology
   b. Levels of organization
      i. Chemicals
      ii. Cells
      iii. Tissues
      iv. Organs
      v. Systems
      vi. Organisms
   c. Life processes
      i. Metabolism
         1. Catabolism
         2. Anabolism
      ii. Excitability
      iii. Conductivity
      iv. Growth
      v. Contractility
      vi. Differentiation
      vii. Reproduction
   d. Anatomic characteristics
   e. Directional terms - anatomic position
   f. Anatomic names
   g. Planes
i. Sagittal (midsagittal)
ii. Coronal (frontal)
iii. Transverse (horizontal)
h. Body cavities
i. Dorsal
   1. Cranial
   2. Spinal
ii. Ventral
   1. Thoracic
   2. Abdominal
   3. Pelvis
i. Homeostasis
i. Definition
ii. Methods of maintaining
   1. Positive feedback
   2. Negative feedback
j. Cell structure
i. Cell (plasma) membrane
   1. Structure
      a. Phospholipid bilayer
      b. Integral proteins
      c. Peripheral proteins
   2. Functions
   3. Membrane transport
      a. Passive processes
      b. Active processes
ii. Cytoplasm
iii. Organelles
   1. Nucleus
      a. Nuclear membrane
      b. Chromatin
      c. Nucleolus
   2. Ribosomes
   3. Endoplasmic reticulum
   4. Golgi complex
   5. Mitochondria
   6. Lysosomes
   7. Centrosome
   8. Cytoskeleton
   9. Cilia and flagella
iv. Inclusions
k. Tissues
i. Epithelial tissue
   1. Characteristics
   2. Types
      a. Squamous
      b. Cuboidal
      c. Columnar
      d. Transitional
   3. Glandular epithelium
      a. Endocrine
      b. Exocrine
ii. Connective tissue
   1. Characteristics
   2. Embryonic connective tissue
   3. Adult connective tissue
      a. Connective tissue proper
         i. Loose (areolar)
         ii. Adipose
         iii. Dense (collagenous)
iv. Elastic
v. Reticular
vi. Reticulo-endothelial
vii. Cartilage
viii. Hyaline
ix. Fibrocartilage
x. Elastic

b. Bone
c. Blood

4. Muscular
   a. Characteristics
   b. Types
      i. Smooth (visceral)
      ii. Striated (skeletal)
      iii. Cardiac

5. Nervous
   a. Characteristics
   b. Cell types
      i. Neurons
      ii. Neuroglia

6. Membranes
   a. Mucous membrane
   b. Serous membrane
   c. Cutaneous membrane (skin)
   d. Synovial membrane

l. Integumentary
   i. Functions
   ii. Skin
      1. Epidermis
      2. Dermis
      3. Hypodermis
   iii. Accessory Structures

m. Skeletal system
   i. Functions
   ii. Histology
      1. Composition of osseous tissue
         a. Cell types
         b. Intercellular matrix
      2. Types of bony tissue
         a. Compact bone (haversian system)
         b. Cancellous (spongy) bone
      3. Gross anatomy of bones
         a. Long bones
         b. Short bones
         c. Flat bones
         d. Irregular bones
         e. Wormian (sutural) bones
         f. Sesamoid bones
   iii. Ossification
      1. Sequence of events
      2. Intramembranous
      3. Endochondral (intracartilagenous)

iv. Bone growth
   1. Epiphyseal plate
   2. Epiphyseal line
   3. Growth in diameter
   4. Homeostasis
a. Remodeling  
b. Hormones  
c. Vitamins

v. Fractures  
1. Types  
2. Healing  
3. Remodeling

vi. Axial skeleton  
1. Skull  
2. Hyoid bone  
3. Vertebral column  
   a. Curvatures  
   b. Disorders  
4. Thorax

vii. Appendicular skeleton  
1. Pectoral girdle  
2. Upper extremity  
3. Pelvic girdle  
4. Lower extremity

n. Articulations  
i. Classification by movement  
1. Synarthrosis  
2. Amphiarthrosis  
3. Diarthrosis

ii. Classification by structure  
1. Fibrous  
   a. Sutures  
   b. Synostosis  
   c. Syndesmosis  
   d. Gomphosis  
2. Cartilaginous  
   a. Synchondrosis  
   b. Symphysis  
3. Synovial  
   a. Structure  
   b. Types  
      i. Ball and socket (spheroid)  
      ii. Condyloid (ellipsoidal)  
      iii. Hinge (ginglymus)  
      iv. Pivot (trochoid)  
      v. Saddle (sellaris)  
      vi. Gliding (arthrodia)  
   c. Movements permitted

o. Muscular system  
i. Characteristics  
ii. Functions  
iii. Types

iv. Anatomy of skeletal muscle  
1. Connective tissue  
2. Blood and nerve supply  
3. Histology  
   a. Cell structure  
   b. Myofilaments  
   c. Sarcomere  
      i. A band  
      ii. I band

v. Physiology of muscle contraction  
1. Sliding filament theory  
2. Structure and function of neuromuscular junction (NMJ)
3. Motor unit
4. Steps in muscle contraction
   a. Resting potential
   b. Impulse in motor neuron
   c. Events at NMJ
   d. Action potential
   e. Repolarization
5. Energy for muscle contraction
6. "All or none"
7. Kinds of muscle contraction
   a. Twitch
   b. Tetany
   c. Isotonic
   d. Isometric
8. Tonus
9. Atrophy/hypertrophy
10. Agonist, antagonist, synergist

p. Nervous system
i. Organization
   1. Central nervous system (CNS)
   2. Peripheral nervous system (PNS)

ii. Histology
   1. Neuroglia
      a. Functions
      b. Types
   2. Neurons
      a. Structure
         i. Axons
         ii. Dendrites
         iii. Cell body
      b. Classification
         i. Structure
         ii. Function

iii. Physiology
   1. Nerve impulse
      a. Resting potential
      b. Action potential
      c. Repolarization
      d. Refractory period
      e. Saltatory transmission
      f. Speed of transmission
   2. Conduction across a synapse
      a. Role of the neurotransmitter
      b. Synaptic delay
      c. Excitatory transmissions
      d. Inhibitory transmissions

3. Spinal cord
   a. Meninges
   b. Surface anatomy
   c. Cross section
      i. Gray matter
      ii. White matter
   d. Spinal tracts
      i. Ascending tracts
      ii. Descending tracts
   e. Spinal cord as a reflex center
      i. Anatomic arrangement of spinal nerves
      ii. Components of the reflex arc
iii. Types of reflexes
iv. Clinical significance
f. Spinal nerves
   i. Coverings
   ii. Names
   iii. Branches
   iv. Plexi
4. Brain
   a. Meninges
   b. Cerebrospinal fluid
      i. Ventricles
      ii. Formation
      iii. Absorption
      iv. Composition
c. Blood supply
d. Brain stem
   i. Medulla oblongata
   ii. Pons varolii
   iii. Midbrain
e. Diencephalon
   i. Thalamus
   ii. Hypothalamus
f. Cerebrum (telencephalon)
   i. Cortex
   ii. Hemispheres
   iii. White matter
   iv. Cerebral nuclei (basal ganglia)
   v. Limbic system
      1. Functional areas of the cerebral cortex sensory areas
      2. Motor areas
      3. Association areas
   vi. Electroencephalogram (EEG)
g. Cerebellum
h. Neurotransmitters
   i. Cranial nerves
5. Motor, sensory, and integrative functions
   a. Sensory functions
      i. Receptors
      ii. Levels of sensations
      iii. Somatosensory area of the brain
      iv. Sensory pathways
   b. Motor functions
      i. Components of motor pathways
      ii. Pyramidal pathways
      iii. Extrapyramidal pathways
   c. Integrative functions
      i. Association areas
      ii. Integrative areas: taste and smell
d. Taste buds and nerve pathways
e. Olfactory receptors and nerve pathways
6. Vision
   a. Anatomy of the eye
      i. Accessory structures
      ii. Fibrous tunic
      iii. Vascular tunic
      iv. Nervous tunic
      v. Lens
      vi. Cavities and chambers
vii. Extrinsic and intrinsic muscles
viii. Aqueous and vitreous humor

b. Physiology of vision
i. Refraction
ii. Accommodation
iii. Constriction and dilation of the pupil
iv. Convergence
v. Stimulation of the photoreceptors
   1. Rods
   2. Cones
vi. Visual pathway
vii. Visual field
viii. Disorders of the eye

7. Hearing and equilibrium
a. Anatomy of the ear
i. External ear
ii. Middle ear
iii. Inner ear
   1. Bony labyrinth
   2. Membranous labyrinth
b. Physiology of hearing
i. Stimulation of the receptors
ii. Nerve pathway
iii. Pitch versus frequency
iv. Hearing disorders
c. Physiology of equilibrium
i. Static equilibrium
   1. Definition
   2. Stimulation of the receptors
   3. Nerve pathways
ii. Dynamic equilibrium
   1. Definition
   2. Stimulation of the receptors
   3. Nerve pathways
d. Autonomic nervous system (ANS)
e. General features
i. Visceral motor impulses compared to somatic motor impulses
ii. Two neuron system
   1. Preganglionic neuron
   2. Postganglionic neuron
iii. Divisions
   1. Sympathetic
   2. Parasympathetic
f. Sympathetic division
   i. Preganglionic neurons
   ii. Sympathetic ganglia
   iii. Possible synapses
   iv. Neurotransmitters
   v. Receptors
g. Parasympathetic division
   i. Preganglionic neurons
   ii. Parasympathetic ganglia
   iii. Neurotransmitters
   iv. Receptors
h. Visceral autonomic reflexes
   i. Integration and control of the ANS

8. Endocrine system
a. General features
   i. Functions
   ii. Definitions
   iii. Endocrine versus nervous system
   iv. Regulation of hormonal secretion
   v. Hormone transport and metabolism
   vi. Mechanisms of hormonal action
       1. Second messenger
       2. Gene activation
   vii. Types of Hormones
b. Hypothalamus
   i. Anatomy
   ii. Regulating hormones
   iii. Paraventricular and supraoptic nuclei
c. Anterior pituitary (adenohypophysis)
   i. Embryological origin
   ii. Anatomic and physiologic relation to the hypothalamus
   iii. Hypophyseal portal system
   iv. Hormones secreted
       1. Names
       2. Functions
       3. Control of secretion
       4. Effects of hypo- and hypersecretion
d. Posterior pituitary (neurohypophysis)
   i. Embryological origin
   ii. Anatomic and physiologic relation to the hypothalamus
   iii. Hypophyseal tract
   iv. Hormones secreted
       1. Names
       2. Functions
       3. Control of secretion
       4. Effects of hypo- and hypersecretion
e. Thyroid gland
   i. Structure and location
   ii. Histology
   iii. Hormones secreted
       1. Names
       2. Functions
       3. Control of secretion
       4. Effects of hypo- and hypersecretion
f. Parathyroid gland
   i. Structure and location
   ii. Parathormone
       1. Function
       2. Control of secretion
g. Adrenal cortex
   i. Histology
   ii. Hormones secreted
       1. Names
       2. Functions
       3. Control of secretion
       4. Effects of hypo- and hypersecretion
h. Adrenal medulla
   i. Epinephrine, norepinephrine, and dopamine
   ii. Effects of the hormones
i. Pancreas
   i. Histology
   ii. Hormones secreted
1. Names
2. Functions
3. Control of secretion
4. Effects of hypo- and hypersecretion

j. Pineal gland
   i. Structure and location
   ii. Melatonin
      1. Effects
      2. Control

k. Thymus gland
   i. Structure and location
   ii. Relationship between age and structure
   iii. Functions of the hormones secreted

l. Other endocrine tissue - kidney, gastrointestinal (GI) tract, etc.

Resources


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