BIO-2331: ANATOMY AND PHYSIOLOGY I

Cuyahoga Community College

Viewing: BIO-2331 : Anatomy and Physiology I

Board of Trustees:
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Academic Term:
Fall 2023

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.

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):
a. Demonstrate the relationship between anatomy and physiology.
b. List, from simplest to most complex, the major levels of organization in the human body.
c. Use the language of anatomy to describe the human body and directional terms to allow for orientation of structures in anatomical position.
d. Describe the 11 organ systems including their major organs and functions.
e. 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):
a. Relate disruptions in the homeostatic regulation to disease states in the human body.
b. Define homeostasis and provide examples of it in the human body.
c. Compare and contrast positive and negative feedback in terms of the relationship between the stimulus and response.

d. 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.
e. Predict the response of the body to factors that disrupt homeostasis.

Course Outcome(s):

Demonstrate microscope competency.

Objective(s):

a. Identify the parts of the compound microscope and describe how to use, handle and store it.
b. Define magnification, resolution, parfocal, field of view, and working distance in relation to microscopy.
c. Describe how to adjust the magnification and resolution of a specimen under the microscope.
d. Calculate the total magnification of a viewed specimen at each objective lens.

Course Outcome(s):

Apply the fundamental knowledge of cell theory and membrane biology to human physiology.

Objective(s):

a. Describe cell theory.
b. Identify the common parts of a human cell and describe the structure and function of each.
c. Describe the structure of the plasma membrane and explain how this structure relates to its selective permeability.
d. Describe active and passive membrane transport mechanisms.
e. Define tonicity and relate it to osmotic pressure.
f. 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):

a. Describe the major functions of the integumentary system.
b. Identify and describe the two components of the cutaneous membrane.
c. Identify and describe the five layers of the epidermis including the specialized cells in each.
d. Describe the process of epidermal growth and keratinization.
e. Explain the biological basis for the color of the epidermis in humans.
f. Identify and describe the two layers of the dermis.
g. Identify the subcutaneous layer and describe its composition.
h. Identify and describe the accessory structures of the integumentary system.
i. Describe the growth cycle of hair follicles and the growth of hair.

j. Evaluate the physiological significance of the presence or absence of sebaceous or sweat glands in specific regions of the body.
k. Explain how the integumentary system maintains homeostasis of body temperature.
l. 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):

a. Describe the major functions of the skeletal system.
b. Describe the composition of osseous tissue including the specialized cells and organic and inorganic components of the extracellular matrix.
c. Identify the microscopic components of compact and spongy bone.
d. Describe the anatomy and physiology of the cartilage found in the skeletal system and identify the location of each type in the human body.
e. Describe the gross anatomy of bones and classify bones by type.
f. Identify the major structural components of a long bone relative to the function of the bone in the body.
g. Name and identify the bones of the human body.
h. Identify the major bone markings and describe their physiological relevance.
i. Compare and contrast the anatomy and physiology of a fetal and adult skull.
j. Compare and contrast the anatomy and physiology of adult male and female skeletons.
k. List the functional and structural classifications of the articulations.
l. Classify each articulation based on composition or degree of movement.
m. Identify the accessory structures of the synovial joint including bursa, tendon sheaths, and ligaments.
n. Identify examples of the six synovial joints in the human body and demonstrate their movements.
o. Define arthritis and explain the causes, symptoms and prognosis of specific types of this disease.
p. Define the terms ossification and calcification and explain the roles of osteogenic cells in the formation of bone.
q. Compare and contrast intramembranous and endochondral ossification.
r. Explain the roles of calcitonin, parathyroid hormone and calcitriol in the homeostatic regulation of blood calcium levels.
s. Predict the impact of homeostatic disturbances to blood calcium levels on bone remodeling and growth.
t. 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):

a. Describe the major functions of the muscular system.
b. 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.
c. Describe the organization of skeletal muscle tissue beginning with the skeletal muscle fiber and ending with the whole muscle, including the connective tissue components.
d. Describe the cellular structure of the skeletal muscle fiber including the specialized organelles, transverse tubules, and myofilaments.
e. Explain the anatomy of the myofibril and sarcomere.
f. Identify and describe the function of the contractile, regulatory and structural protein components of the sarcomere.
g. Describe the sliding filament theory of muscle contraction.
h. Identify the components and describe the anatomy of the neuromuscular junction.
i. Define a motor neuron and motor unit.
j. Define membrane potential, action potential, depolarization and repolarization as they relate to the voltage across the sarcolemma.
k. 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.
l. Interpret a graph illustrating the change in voltage over time in a skeletal muscle fiber during an action potential.
m. Describe how excitation is coupled to contraction of the skeletal muscle fiber.
n. List the sequence of events that occur during the contraction cycle of a skeletal muscle fiber.

o. Evaluate the impact of changes in cellular ion permeability or extracellular ion concentration on muscle contraction.
p. Describe how a muscle obtains energy for muscle contraction and explain factors that lead to muscle fatigue.
q. Summarize the events that must occur for a muscle fiber to relax.
r. 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.
s. Define the term tension as it relates to the contraction of a whole muscle.
t. Explain the physiological phenomenon of wave summation and tetanus as it relates to action potential frequency and whole muscle tension development.
u. Define a contraction as isotonic or isometric.
v. Explain how skeletal muscle names can help identify their action, appearance or location in the body.
w. Define origin, insertion and action as they relate to skeletal muscles.
x. Define the terms agonist (prime mover), antagonist, synergist and fixator as they relate to muscle actions during movement.
y. 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):

a. Describe the factors that contribute to the resting membrane potential of a neuron.
b. Define excitation, depolarization, repolarization, inhibition and hyperpolarization as they relate to changes in cellular membrane potential.
c. Compare and contrast the graded potential and action potential.
d. Describe the role of ligand-gated and voltage-gated ion channels in neuronal signaling.
e. Describe the general events that occur during neuronal signaling.
f. Describe the changes in ion permeability during an action potential with a focus on the opening and closing of the gated ion channels.
g. Define the physiological threshold for an action potential and identify the anatomical trigger zone on a neuron.
h. Explain why the action potential is known as an “all-or-none” phenomenon.
i. Interpret a graph illustrating the change in voltage over time during an action potential.
j. Identify the absolute and relative refractory periods on the action potential graph and explain their physiological relevance.
k. Predict how the shape of a graphed action potential will change in response to neurotoxins that impact the voltage-gated channels.
l. Describe the refractory periods of the action potential and state their physiological relevance.
m. Compare and contrast propagation of an action potential in an axon that is myelinated versus an axon that has no myelin.
n. Explain how axon diameter and myelination affects the speed of conduction of an action potential.
o. Describe the events that occur at the axon terminal that cause the release of neurotransmitters into the synaptic cleft.
p. Define the two types of graded potentials and interpret graphs illustrating each.
q. Describe the basic categories of neurotransmitters and explain how a transmitter may cause excitation or inhibition in the post-synaptic neuron.
r. Describe how a neuromodulator acts differently than the neurotransmitter.
s. Compare and contrast temporal and spatial summation of graded inputs in the post-synaptic neuron.
t. Define synaptic fatigue and synaptic delay.
u. Describe how presynaptic inputs can facilitate or inhibit neuronal signaling.
v. Discuss the meaning of the term neuroplasticity and relate this term in a broad sense to learning and memory.
w. Describe the major functions of the nervous system.
x. 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.
y. Describe the hierarchical organization of the nervous system including the central, peripheral, sensory, motor, somatic, and autonomic nervous systems.
z. Map the flow of different types of sensory information through the nervous system, and predict the type of response output.
aa. List the parts of the nervous system that constitute the central nervous system and those that constitute the peripheral nervous system.
bb. Define afferent and efferent as these terms relate to information flow in the nervous system.

cc. Describe the two types of cells found in nervous tissue and state their function.
dd. 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.
ee. Classify neurons based on structure and function.
ff. Describe the location of the soma for a motor, sensory, and interneuron within the nervous system.
gg. List the six types of glial cells, state their location in the nervous system and describe their function.
hh. Compare and contrast myelin formation and structure in the central and peripheral nervous systems and predict the result of its loss in either system.
ii. Define membrane potential and explain its significance in nervous system function.
jj. Describe how the diffusion of ions across the plasma membrane is regulated by gated ion channels.
kk. 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):

a. Define the major structures and functions of the central nervous system.
b. Describe how the development of the human brain explains its structural features including the major regions and ventricles.
c. Compare and contrast white matter and gray matter in the central nervous system based on their anatomy and physiology.
d. Identify the major regions of the brain and describe the function of each.
e. Predict the physiological consequences of damaging a specific region of the brain based on its function.
f. Describe how the skull, meninges, cerebrospinal fluid and blood brain barrier protect the brain.
g. Trace the path of cerebrospinal fluid circulation from production in the choroid plexus to reabsorption into the circulatory system.
h. Describe the gross anatomy of the spinal cord in a longitudinal view.
i. 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.
j. 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):

a. Describe the gross anatomy of a nerve and identify the anatomical features in a cross section.
b. Identify the cranial nerves by name and number, classify each as sensory, motor, or mixed, and describe the function of each.
c. Identify the dorsal root ganglia, dorsal and ventral roots, and spinal nerve on a spinal cord model.
d. Explain how spinal nerves are formed by sensory and motor neuron axons.
e. Trace the path of a sensory neuron axon from the dendrite to the spinal cord including the root, nerve, ramus, and plexus and a motor neuron axon from the spinal cord to the muscle.
f. List the four spinal nerve plexuses, give examples of nerves that emerge from each and describe what structures they innervate.
g. List and describe the five components of a reflex arc.
h. Describe the components, characteristics and purpose of the stretch reflex, tendon reflex, withdrawal reflex, and crossed extensor reflex.
i. Categorize the spinal cord reflexes as innate or acquired, spinal or cranial, somatic or visceral, monosynaptic or polysynaptic, and ipsilateral or contralateral.
j. Define reciprocal inhibition and list the reflexes that utilize it.

k. Explain how a spinal reflex can be facilitated or inhibited by higher regions of the central nervous system.
l. 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):

a. Describe the major functions of the sensory nervous system.
b. Compare and contrast sensation and perception.
c. Define transduction and describe how it occurs in the general and special senses.
d. Compare and contrast general sensation and special sensation.
e. Describe how a stimulus is interpreted according to modality, location, duration and intensity.
f. List the six types of tactile/pressure receptors in the skin, and for each state the anatomy, location, adaptability, and stimuli detected.
g. Define proprioception and describe the types and locations of proprioceptors in the body and what they detect.
h. Describe thermoreceptors, nociceptors, baroreceptors, and chemoreceptors, explaining their anatomy, location, and stimuli detected.
i. Trace sensory input through the afferent pathways beginning at the sensory receptor and ending at the cerebral or cerebellar cortex.
j. Associate a specific sensory receptor with a specific afferent pathway.
k. Trace motor output through the corticospinal pathway beginning in the primary motor cortex and ending at the skeletal muscle.
l. Describe the indirect motor pathways of the nervous system.
m. Explain the role of the basal nuclei and cerebellum in movement.
n. 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 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):

a. Define the autonomic nervous system and explain its function.
b. Compare and contrast the autonomic and somatic nervous systems in regards to neurons, neurotransmitters, and effectors.
c. Discuss the two divisions of the autonomic nervous system and state the general physiological role of each.
d. 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.
e. 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.
f. Predict the side effects of a pharmacological agent binding to autonomic nervous system target receptors.
g. Define the concepts of dual innervation and autonomic tone in regards to autonomic nervous system function.
h. Discuss the implications in homeostatic regulation of effectors that are not dually innervated by both the sympathetic and parasympathetic systems.
i. Describe a visceral reflex arc and list the higher brain regions that can influence these reflexes.
j. Predict the consequences of disruption of the autonomic nervous system to the body.

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):

a. List the five special senses in the human body, the category of sensory receptor each contains, and the type of stimulus that triggers sensation of each.
b. Describe the location of the specialized sensory organ housing the sensory receptors for each.
c. Trace the pathway of light to the retina and explain how light is focused for distant and close vision.
d. Compare the anatomy and physiology of rods and cones in phototransduction.
e. Trace the pathway of visual input from the retina to the occipital lobe.
f. Describe how the anatomical features of the visual pathway and placement of the eyes allow humans to have depth perception.
g. Describe the part of the inner ear that detects sound waves and equilibrium.
h. Describe the structure and function of a hair cell, and state its location in the inner ear.
i. Trace the pathway of a sound wave from the outer ear to the cochlea.
j. Describe how a sound wave inside the cochlea activates a hair cell.
k. Describe how the amplitude and frequency of a sound wave traveling in the cochlea will determine the volume and pitch of a sound.
l. Trace the pathway of the auditory signal from the hair cells in the cochlea to the auditory cortex in the brain.
m. Compare and contrast sensorineural and conductive deafness.
n. Compare and contrast how the vestibular apparatus detects static and dynamic equilibrium.
o. Describe the pathway for equilibrium from the hair cells to the brain.
p. Discuss the processing of equilibrium in the brain and relate that to motion sickness.
q. Explain how odorants activate olfactory receptors.
r. Describe the path of nerve impulses from the olfactory receptors to the various regions of the brain.
s. Explain how dissolved chemicals activate gustatory and olfactory receptors.
t. Describe the path of nerve impulses from the gustatory receptors to the various parts of the brain.
u. List the five primary taste sensations and describe how each is transduced at the molecular level by the receptor.
v. Predict how loss of any of the special senses would disrupt homeostasis.

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):

a. Define the classes of chemical messengers used by the body based on their mode of secretion.
b. Explain the difference between an endocrine and exocrine gland.
c. Compare and contrast the nervous and endocrine systems as the two major control systems in the body.
d. Describe the characteristics of hormones and how they are classified.
e. Describe the common modes of transport, activation patterns, and secretion patterns of hormones.
f. List the three signals that can trigger hormone secretion.
g. Describe how hormone levels in the blood are regulated via positive or negative feedback.
h. Describe the two basic types of hormone receptors and how they generally alter cell function when a hormone is bound.
i. Define second messenger systems and give examples of common ones activated by hormone receptors.
j. List the major structures of the endocrine system.
k. Describe the anatomical and physiological relationship between the hypothalamus and the pituitary gland.
l. Compare and contrast the structures of the anterior and posterior lobes of the pituitary gland, and the physiological strategies used by each.

m. 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.
n. Analyze symptoms and hormone levels to diagnose common endocrine disorders.

Methods of Evaluation:

a. Quizzes
b. Lecture examinations
c. Laboratory practical exams
d. Reviews of scientific journal articles
e. Case history analysis
f. Concept maps
g. Online activities
h. Class participation

Course Content Outline:

a. Body Plan and Organization
    i. Definitions
        1. Anatomy
        2. Physiology
    ii. Levels of organization
        1. Chemicals
        2. Cells
        3. Tissues
        4. Organs
        5. Systems
        6. Organisms
    iii. Life processes
        1. Metabolism
            a. Catabolism
            b. Anabolism
        2. Excitability
        3. Conductivity
        4. Growth
        5. Contractility
        6. Differentiation
        7. Reproduction
    iv. Anatomic characteristics
    v. Directional terms - anatomic position
    vi. Anatomic names
    vii. Planes
        1. Sagittal (midsagittal)
        2. Coronal (frontal)
        3. Transverse(horizontal)
    viii. Body cavities
        1. Dorsal
            a. Cranial
            b. Spinal
        2. Ventral
            a. Thoracic
            b. Abdominal
            c. Pelvis
b. Homeostasis
    i. Definition
    ii. Methods of maintaining
        1. Positive feedback
        2. Negative feedback
c. Cell Biology

i. General Structure
1. Cell (plasma) membrane
a. Structure
i. Phospholipid bilayer
ii. Integral proteins
iii. Peripheral proteins
b. Functions
c. Membrane transport
i. Passive processes
ii. Active processes
2. Cytoplasm
3. Organelles
a. Nucleus
i. Nuclear membrane
ii. Chromatin
iii. Nucleolus
b. Ribosomes
c. Endoplasmic reticulum
d. Golgi complex
e. Mitochondria
f. Lysosomes
g. Centrosome
h. Cytoskeleton
i. Cilia and flagella
4. Inclusions

d. Tissues
i. Epithelial tissue
1. Characteristics
a. Shape
i. Squamous
ii. Cuboidal
iii. Columnar
iv. Transitional
b. Number of layers
i. Simple
ii. Stratified
2. 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
1. Areolar
2. Adipose
3. Reticular
ii. Dense
1. Regular
2. Elastic
3. Irregular
iii. Cartilage
1. Hyaline
2. Fibrocartilage
3. Elastic
iv. Bone
v. Blood

iii. Muscular Tissue

1. Characteristics
2. Types
    a. Smooth (visceral)
    b. Striated (skeletal)
    c. Cardiac

iv. Nervous Tissue
1. Characteristics
2. Cell types
    a. Neurons
    b. Neuroglia

v. Membranes
1. Mucous membrane
2. Serous membrane
3. Cutaneous membrane (skin)
4. Synovial membrane

e. Integumentary
i. Functions
ii. Skin
1. Epidermis
2. Dermis
3. Hypodermis

iii. Accessory Structures

f. 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

viii. Articulations
1. Classification by movement
a. Synarthrosis
b. Amphiarthrosis
c. Diarthrosis
2. Classification by structure
a. Fibrous
i. Sutures
ii. Synostosis
iii. Syndesmosis
iv. Gomphosis
b. Cartilaginous
i. Synchondrosis
ii. Symphysis
c. Synovial
i. Structure
ii. Types
1. Ball and socket (spheroid)
2. Condyloid (ellipsoidal)
3. Hinge (ginglymus)
4. Pivot (trochoid)
5. Saddle (sellaris)
6. Gliding (arthrodia)
iii. Movements permitted

g. 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
h. 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
  iv. Spinal cord
    1. Meninges
    2. Surface anatomy
    3. Cross section
      a. Gray matter
      b. White matter
    4. Spinal tracts
      a. Ascending tracts
      b. Descending tracts
    5. Spinal cord as a reflex center
      a. Anatomic arrangement of spinal nerves
      b. Components of the reflex arc
      c. Types of reflexes
      d. Clinical significance
    6. Spinal nerves
      a. Coverings
      b. Names
      c. Branches
      d. Plexi
  v. Brain
    1. Meninges
    2. Cerebrospinal fluid

a. Composition
b. Absorption
c. Formation
d. Ventricles

3. Blood supply
4. Brain stem
   a. Medulla oblongata
   b. Pons varolii
   c. Midbrain
5. Diencephalon
   a. Thalamus
   b. Hypothalamus
6. Cerebrum (telencephalon)
   a. Cortex
   b. Hemispheres
   c. White matter
   d. Cerebral nuclei (basal ganglia)
   e. Limbic system
      i. Functional areas of the cerebral cortex sensory areas
      ii. Motor areas
      iii. Association areas
   f. Electroencephalogram (EEG)
7. Cerebellum
8. Neurotransmitters
9. Cranial nerves

vi. Motor, sensory, and integrative functions
1. Sensory functions
   a. Receptors
   b. Levels of sensations
   c. Somatosensory area of the brain
   d. Sensory pathways
2. Motor functions
   a. Components of motor pathways
   b. Pyramidal pathways
   c. Extrapyramidal pathways
3. Integrative functions
   a. Association areas
   b. Integrative areas: taste and smell
4. Taste buds and nerve pathways
5. Olfactory receptors and nerve pathways

vii. Vision
1. Anatomy of the eye
   a. Accessory structures
   b. Fibrous tunic
   c. Vascular tunic
   d. Nervous tunic
   e. Lens
   f. Cavities and chambers
   g. Extrinsic and intrinsic muscles
   h. Aqueous and vitreous humor
2. Physiology of vision
   a. Refraction
   b. Accommodation
   c. Constriction and dilation of the pupil
   d. Convergence
   e. Stimulation of the photoreceptors
      i. Rods
      ii. Cones
   f. Visual pathway

- g. Visual field
- h. Disorders of the eye

3. 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

- i. Endocrine system
  - i. General features
    1. Functions
    2. Definitions
    3. Endocrine versus nervous system
    4. Regulation of hormonal secretion
    5. Hormone transport and metabolism
    6. Mechanisms of hormonal action
       - a. Second messenger
       - b. Gene activation
    7. Types of Hormones
  - ii. Hypothalamus

1. Anatomy
2. Regulating hormones
3. Paraventricular and supraoptic nuclei

iii. Anterior pituitary (adenohypophysis)
1. Embryological origin
2. Anatomic and physiologic relation to the hypothalamus
3. Hypophyseal portal system
4. Hormones secreted
   a. Names
   b. Functions
   c. Control of secretion
   d. Effects of hypo- and hypersecretion

iv. Posterior pituitary (neurohypophysis)
1. Embryological origin
2. Anatomic and physiologic relation to the hypothalamus
3. Hypophyseal tract
4. Hormones secreted
   a. Names
   b. Functions
   c. Control of secretion
   d. Effects of hypo- and hypersecretion

v. Thyroid gland
1. Structure and location
2. Histology
3. Hormones secreted
   a. Names
   b. Functions
   c. Control of secretion
   d. Effects of hypo- and hypersecretion

vi. Parathyroid gland
1. Structure and location
2. Parathormone
   a. Function
   b. Control of secretion

vii. Adrenal cortex
1. Histology
2. Hormones secreted
   a. Names
   b. Functions
   c. Control of secretion
   d. Effects of hypo- and hypersecretion

viii. Adrenal medulla
1. Epinephrine, norepinephrine, and dopamine
2. Effects of the hormones

ix. Pancreas
1. Histology
2. Hormones secreted
   a. Names
   b. Functions
   c. Control of secretion
   d. Effects of hypo- and hypersecretion

x. Pineal gland
1. Structure and location
2. Melatonin
   a. Effects
   b. Control

xi. Thymus gland

1. Structure and location
2. Relationship between age and structure
3. Functions of the hormones secreted

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

Resources

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Top of page
Key: 947