Mathematics/Science Department
Kirkwood Community College

Course Syllabus

**HUMAN ANATOMY & PHYSIOLOGY I**

(BI150T)

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COURSE DESCRIPTION:

Human Anatomy and Physiology I is a 4 semester hour lecture-laboratory course offered through the Mathematics/Science department. Successful completion of high school biology and chemistry or a college level biology course within the last five years is a recommended prerequisite. It is the first in a two semester sequence which is designed to familiarize the student with the structure and function of the human body.

Both Human A&P I and Human A&P II follow the “Course Guidelines for Undergraduate Education” and other recommendations of the Human Anatomy and Physiology Society (HAPS), a group of over 1,000 members in the United States and Canada which promotes communication among teachers of human anatomy and physiology in colleges, universities, and related institutions.

Topics covered in the Human Anatomy and Physiology I include physiological chemistry, cytology, histology, and a systems approach to the human integumentary, nervous, endocrine, skeletal, and muscular systems. Human Anatomy and Physiology II will complete the investigation of human body systems and will also deal with human genetics and development.

GENERAL OBJECTIVES:

1. As part of the Kirkwood Community College Curriculum, Human Anatomy and Physiology I seeks to provide educational experience in a field of science.

2. This course supplies students with a required course in anatomy and physiology for those majors requiring such a course or to students interested in the subject.

3. This course attempts to supply students with a deeper appreciation of themselves as unique homeostatic organisms.

4. This course attempts to motivate students toward creative and informed reasoning in situations encountered outside the classroom.

5. This course presents to the student an undergraduate level course in human structure and function in a two-year college environment that will transfer successfully to four year colleges and universities as equivalent to their offerings in undergraduate level anatomy and physiology as required for various science, paramedical, and premedical profession majors.

6. This course, when followed by Human Anatomy & Physiology II, (B1151T), fulfills the requirements in anatomy and physiology for students in associate degree nursing, health information technology, physical therapy assisting, and dental hygiene.
Physiological Chemistry

Upon completion of a study of physiological chemistry, the student should be able to:

1. Recognize the organization of matter into increasingly complex structural levels.

2. Describe atomic structure using the terms: electron, proton, neutron, nucleus, energy level, isotope.

3. State the name, atomic number, atomic weight, number of subatomic particles, and relative abundance of elements found in biological systems using the periodic table of the elements.

4. Describe the process of chemical bonding, defining and/or distinguishing between:
   - ionic and covalent bonding
   - polar and non-polar bonds
   - ions, cations and anions
   - metabolism, catabolism and anabolism
   - activation energy

5. Differentiate between organic and inorganic compounds, and recognize the types found in the human body and the bonding involved in each category.

6. State the importance of the inorganic molecules water, oxygen, carbon dioxide, and selected minerals using the following terminology:
   - solution
dissociation
   - solute electrolyte
   - solvent acid, base, salt

7. Discuss the structure, function, synthesis, decomposition and examples of the following major classes of biological chemicals: carbohydrates, lipids, proteins, nucleic acids.

8. Describe the role of enzymes in catalyzing chemical reactions in the human body.

9. Understand the process of transcription and translation as related to protein synthesis.

10. State the complementary DNA strand replicated from a parent template and relate this to genetic continuity.

11. Describe the structure and function of adenosine phosphates.
Cytology

Upon completion of a study of cellular structure and function the student should be able to:

1. Discuss the cell as the basic unit exhibiting characteristics of living matter; recognize characteristics of multicellular organisms.

2. Describe the structure and function of the cell membrane using the following terminology:
   - phospholipid bilayer
   - integral & peripheral proteins
   - glycocalyx
   - receptors
   - isotonic
   - hypotonic
   - hypertonic
   - diffusion
   - osmosis
   - passive transport
   - active transport
   - glycocalyx
   - osmosis
   - passive transport
   - active transport

3. Describe, label a diagram and/or state the function of the following components of a "typical" cell:
   - microtubules
   - endoplasmic reticulum
   - centrioles
   - cytoplasm
   - ribosomes
   - vacuoles
   - nucleus
   - golgi complex
   - inclusions
   - nuclear membrane
   - lysosome
   - microfilaments
   - nucleolus
   - mitochondria
   - cilia
   - centrioles
   - glycocalyx
   - cytoplasm
   - ribosomes
   - vacuoles
   - golgi complex
   - inclusions
   - lysosome
   - microfilaments
   - mitochondria
   - cilia
   - centrioles
   - glycocalyx
   - cytoplasm
   - ribosomes
   - vacuoles
   - golgi complex
   - inclusions
   - lysosome
   - microfilaments
   - mitochondria
   - cilia
   - centrioles
   - glycocalyx
   - cytoplasm
   - ribosomes
   - vacuoles
   - golgi complex
   - inclusions
   - lysosome
   - microfilaments
   - mitochondria
   - cilia

4. Differentiate between pinocytosis and phagocytosis and endo- and exocytosis.

5. Discuss cellular metabolism using cellular respiration as an example.
   a. Employ the following terms in discussion:
      - glycolysis
      - NAD-NADH+H
      - citric acid
      - glucose
      - FAD-FADH2
      - carbon dioxide
      - pyruvic acid
      - electron transport
      - oxygen
      - phosphorylation
      - cytochromes
      - water
      - mitochonrdria
      - PGAL
      - Kreb's cycle
      - acetl CoA

   b. Summarize the ATP production occurring during oxidation of glucose.
   c. Differentiate between aerobic and anaerobic respiration.
   d. State the role of molecules other than glucose (glycogen, lipids, proteins) as energy sources.

6. Recognize the significance of mitosis and the intracellular changes occurring during interphase, prophase, metaphase, anaphase, and telophase.
Tissues, Organs & Organ Systems

1. Define tissue and relate this level of organization to other structural levels discussed.

2. Classify human body tissues into 4 types and recognize each type’s structure, function, and location.

3. List the functions and organization of epithelial tissue.
   a. Classify epithelial tissue by cell shape and layer arrangement.
   b. Discuss epithelial junctions: desmosomes, tight junctions, and gap junctions.
   c. Associate the following epithelial types with their location and function:
      - simple and stratified squamous
      - simple and stratified cuboidal
      - simple columnar
      - ciliated pseudostratified columnar
      - transitional
      - glandular epithelium

4. Discuss connective tissue.
   a. List the functions, characteristics and embryological origin of this tissue.
   b. Classify connective tissue into major subtypes according to intercellular matrix.
   c. Use and define the following in a discussion of types of connective tissue:
      - reticular fibers
      - elastic fiber
      - collagenous fibers
      - macrophage
      - adipocytes
      - hyaluronic acid
      - fibroblast
      - mast cells
      - plasma cells

   d. Define and recognize the function and locations of the following connective tissue types:
      - loose or areolar
      - dense or collagenous
      - adipose
      - elastic cartilage
      - bone
      - reticular
      - hyaline cartilage
      - fibrocartilage
      - elastic
      - vascular

   e. Pertaining to the microstructure of cartilage, define or label the following:
      - matrix
      - lacuna
      - chondrocyte
f. Pertaining to the microstructure of bone, define or label the following:

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>osteocyte</td>
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<tr>
<td>lacuna</td>
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<td>canaliculi</td>
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<tr>
<td>lamella</td>
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<tr>
<td>hydroxyapatite</td>
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<tr>
<td>Haversian canal</td>
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</table>

g. Pertaining to the microstructure of blood, define or label the following:

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>plasma</td>
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<tr>
<td>leukocytes</td>
<td></td>
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<tr>
<td>erythrocytes</td>
<td></td>
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<tr>
<td>thrombocytes</td>
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</tbody>
</table>

5. Identify types of muscle tissue by cell structure, location, and control.

6. Define nervous tissue and describe its subtypes.

7. Concerning the anatomy and physiology of the skin:
   a. Define an organ and organ system using the skin and integumentary systems as examples.
   b. List and discuss the functions of the skin.
   c. Describe or label the following and recognize their relationship to total integumentary function:

   epidermis (stratum corneum, stratum granulosum, stratum germinativum)
   dermis (papillary region, reticular region)
   subcutaneous layer or hypodermis (superficial fascia)
   melanocytes
   sweat glands
   nerve receptors

   sebaceous glands
   arrector pili muscle
   hair follicle and hair
The Nervous System

Upon completion of lecture, readings, and associated study, the student should be able to:

1. Discuss the functions of the nervous system and its relationship to homeostasis using the following terms: sensation, integration, responsiveness, irritability, conductivity.

2. Recognize the structure and function of the following neuroglial cells: Schwann cells, oligodendroglia, astrocytes, microglia, ependymal cells.

3. Describe the neuron defining and/or identifying the structure and function of:

   - cell body
   - Nissl bodies
   - axon
   - myelin sheath
   - dendrites
   - Schwann cells
   - telodendria
   - node of Ranvier

4. Discuss conditions necessary for neuron regeneration.

5. Differentiate between the following neuronal types as to structure, function, and/or location:

   - myelinated -- non-myelinated
   - unipolar -- bipolar -- multipolar
   - efferent -- afferent
   - motor -- association -- sensory
   - somatic -- visceral

6. Classify the organs of the nervous system into central and peripheral nervous system divisions.

7. Describe the nervous system at the organ level of organization, and use the following to describe the structure of a nerve:

   - epineurium
   - perineurium
   - endoneurium
   - fascicle

8. Discuss the embryological development of the central nervous system.

9. Identify the structures of the brain stem, and recognize its anatomical relationship to the cerebellum, diencephalon, and cerebrum.
10. Locate and/or describe the function of the following features of the cerebrum:

- left & right hemispheres
- gyrus or convolution
- longitudinal fissure
- lateral sulcus
- corpus callosum
- parietal lobe
- temporal lobe
- precentral gyrus
- primary motor area
- primary sensory area
- Wernicke’s area
- basal nuclei
- left & right hemispheres
- fissures and sulci
- central sulcus
- parieto-occipital sulcus
- frontal lobe
- occipital lobe
- transverse fissure
- post-central gyrus
- premotor area
- Broca's area
- primary visual, auditory, taste, and olfactory areas

11. Locate and describe the function of the medulla oblongata using the following terms:

- pyramids
- nucleus gracilis
- nucleus cuneatus
- medullary reflex centers
- decussation

12. Locate and describe the function of the pons.

13. Locate and describe the functions of the midbrain using the following terms:

- superior and inferior colliculi
- corpora quadrigemina
- substantia nigra
- red nucleus
- cerebral peduncle

14. Locate and describe the functions of the thalamus, recognizing the role of nuclei in the relaying and interpretation of sensory impulses.

15. Locate and describe the function of the hypothalamus.

16. Recognize the components and functions of the limbic system and reticular formation.

17. Locate and describe the function of the cerebellum using the following terms:

- peduncles
- cerebellar hemispheres
- arbor vitae
- vermis
- cortex

18. List in order, locate, classify as sensory, motor, or mixed, and state the function of the cranial nerves.
19. Diagram or label the parts of the spinal cord and describe its functions using the following terminology:

- anterior gray horn
- lateral gray horn
- posterior white column
- lateral white column
- posterior gray horn
- gray commissure and central canal
- anterior white column

20. a. List the location and function of the following ascending nerve tracts:

- spinothalamic
- posterior column
- spinocerebellar

b. Define first, second and third order neurons.

21. a. Discuss the organization and function of pyramidal (direct) and extra-pyramidal (indirect) pathways in controlling motor function.

b. Define upper and lower motor neuron.

22. Divide the spinal cord into cervical, thoracic, lumbar, and sacral segments and associate spinal nerves and plexuses with these divisions.

23. Describe the structure of spinal nerves using the following terms:

- dorsal root
- dorsal root ganglia
- ventral root

24. Describe a reflex arc and trace the path of impulse conduction from receptor to effector using the spinal cord as the central nervous system component.

25. Describe protection of the structures of the central nervous system.

26. Recognize the anatomy of the meninges; locate the following structures: dura mater, arachnoid mater, pia mater, subdural space, subarachnoid space, dural sinuses.

27. Discuss the formation and circulation, and removal of cerebrospinal fluid (CSF) using the following terms:

- choroid plexus
- interventricular foramen
- cerebral aqueduct
- median and lateral apertures
- arachnoid villi
- dural sinus

- lateral ventricles
- third ventricle
- fourth ventricle
- subarachnoid space
- central canal

28. Define sensation and recognize classes of receptors.
29. Identify the structure and function of the following receptors:

- hair follicle receptor
- Merkel's discs
- Meissner's corpuscles
- Pacinian corpuscles
- nociceptors
- muscle spindles
- Golgi tendon organs
- Ruffini’s corpuscle
- free nerve endings

30. Discuss the following as they relate to sensation: modality, adaptation, receptor potential.

31. Identify the special senses and the organs involved in their reception.

32. Describe olfactory receptors and the neural pathways involved in the perception of smell.

33. Describe the location and structure of taste buds and the neural pathways involved in the perception of taste.

34. Describe the function of the eye and its accessory structures using the following terminology:

   a. Concerning the eye's gross structure, locate and state the function of:
      - sclera
      - cornea
      - choroid
      - pupil
      - ciliary body
      - retina
      - macula lutea and central fovea
      - optic disk
      - aqueous humor
      - vitreous body
      - optic nerve
      - suspensory ligament
      - iris
      - lens

   b. Concerning the generation and pathway of impulses, identify the following:
      - rods and cones
      - rhodopsin
      - ganglion cells
      - optic nerve
      - optic chiasma
      - visual pigments

35. Recognize the location and function of accessory structures of the eye.

36. Describe the following as they relate to vision:

- cataract
- conjunctivitis
- myopia
- glaucoma
- astigmatism
- refraction
- hyperopia
- emmetropia
37. Describe the function of the ear in hearing and equilibrium using the following terminology:

- temporal bone
- auricle
- outer, middle, & inner ear
- tympanic membrane
- malleus, incus, and stapes
- cochlea
- scala vestibuli & tympani
- basilar membrane
- organ of Corti
- utricle
- semicircular canals
- external auditory canal
- ceruminous glands
- Eustachian tube
- oval and round window
- endolymph & perilymph
- otoliths & otolithic membrane
- tectorial membrane
- vestibule
- saccule
- vestibulocochlear nerve

38. Distinguish between conduction and nerve deafness.

39. Discuss the processes involved in impulse generation and conduction using such terms as:

- sodium-potassium pump
- resting membrane potential
- action potential
- threshold potential
- diffusion
- active transport
- cell membrane depolarization
- repolarization
- hyper-hypopolarization
- absolute refractory period
- relative refractory period
- all or none principle
- gated ion channels
- saltatory conduction

40. Diagram and/or discuss direct synaptic conduction using such terms as:

- pre- and postsynaptic membrane
- synaptic vesicles
- synapse
- one way impulse conduction
- acetylcholine
- synaptic cleft
- neurotransmitters
- EPSP
- IPSP
- acetylcholinesterase

41. Recognize the effects of various agents on nerve impulse transmission.

42. Recognize the site of release and the characteristics of the following neurotransmitters:

- norepinephrine
- dopamine
- GABA
- enkephalins and endorphins
- serotonin
- glycine

43. Discuss the role of spatial and temporal summation in synaptic transmission.

44. Define neuronal pool, and recognize divergence and convergence as examples.
Upon completion of a study of the autonomic nervous system, the student should be able to:

a. Compare autonomic and somatic reflexes.

b. Differentiate between the sympathetic and parasympathetic portions of the autonomic nervous system in terms of fiber length, location of ganglia, neurotransmitters released, and general effects on the body.

c. Use the following terminology in discussing the ANS:

<table>
<thead>
<tr>
<th>Term</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>rest-and-repose</td>
<td>fight or flight</td>
</tr>
<tr>
<td>craniosacral</td>
<td>thoracolumbar</td>
</tr>
<tr>
<td>pre-ganglionic fiber</td>
<td>post-ganglionic fiber</td>
</tr>
<tr>
<td>prevertebral (collateral) ganglia</td>
<td>terminal ganglia</td>
</tr>
<tr>
<td>sympathetic trunks and chain ganglia</td>
<td>adrenergic fibers</td>
</tr>
<tr>
<td>cholinergic fibers</td>
<td>nicotinic receptors</td>
</tr>
<tr>
<td>muscarinic receptors</td>
<td>alpha and beta receptors</td>
</tr>
</tbody>
</table>

d. Recognize the effects brought about by dual innervation of the heart, digestive system, and bronchial tubes.

e. Recognize organs innervated only by the sympathetic nervous system.

f. Account for the more widespread effect of the sympathetic nervous system on the body.
**Endocrinology**

Upon completion of study of the endocrine system, the student should be able to correctly answer questions concerning the following subject matter:

A. Discuss the major differences between the nervous and endocrine system as to their control of homeostasis.
   1. method of control - impulse versus hormonal
   2. type of tissues controlled
   3. speed of control
   4. be able to define the following:

<table>
<thead>
<tr>
<th>exocrine gland</th>
<th>target organ</th>
</tr>
</thead>
<tbody>
<tr>
<td>endocrine gland</td>
<td>feedback regulation</td>
</tr>
<tr>
<td>hormone</td>
<td>tropic hormone</td>
</tr>
</tbody>
</table>

5. Describe proposed mechanisms in which hormones function at the target organ cells
6. Discuss endocrine glands and interactions with the nervous system.
7. List the names of the major endocrine glands and briefly describe their location and the hormones they release.

B. Describe the anatomy and physiology of the hypophysis

1. Discuss, diagram, or label structures describing the anatomy of the hypophysis and its relationship to the hypothalamus using the following terms:

<table>
<thead>
<tr>
<th>pituitary gland</th>
<th>infundibulum</th>
</tr>
</thead>
<tbody>
<tr>
<td>adenohypophysis</td>
<td>hypophyseal portal system</td>
</tr>
<tr>
<td>neurohypophysis</td>
<td>releasing and inhibiting factors (hormones)</td>
</tr>
</tbody>
</table>

2. Describe the function and control of the following adenohypophyseal hormones:

   growth hormone (somatotropin)
   gonadotropic hormones
      - follicle stimulating hormone
      - prolactin
      - luteinizing hormone (interstitial cell stimulating hormone)
   thyroid stimulating hormone (thyrotropin)
   adrenocorticotropic hormone (corticotropin)

3. Describe the function and control of the following neurohypophyseal hormones:

   oxytocin
   anti-diuretic hormone (vasopressin)
4. Define the following:

- dwarfism
- gigantism
- acromegaly
- diabetes insipidus

C. Describe the anatomy and physiology of the thyroid gland.

1. Describe the location of the thyroid gland.
2. List the functions of the hormones $T_3$ and $T_4$.
3. Discuss the feedback control of $T_3$ and $T_4$.
4. State the nutritional requirements of $T_3$ and $T_4$ secretion.
5. Be able to define the following:

- hypo-hyperthyroidism
- goiter
- cretinism
- myxedema

6. Discuss the role of the parafollicular-cells (C cells) and calcitonin.

D. Describe the anatomy and physiology of the parathyroid glands.

1. Discuss the function of parathormone.
2. Describe the feedback regulation between parathyroid secretion and blood concentrations of calcium.
3. List the major functions of calcium.
4. Concerning parathyroid disorders, define the following:

- hyperparathyroidism
- hypocalcemia
- hypoparathyroidism
- hypercalcemia

E. Discuss the general location and the functions of the adrenal cortex.

1. Identify the 3 "zones" of the adrenal cortex and the hormones produced by each.
2. List the functions of and the feedback regulation of aldosterone.
3. List the functions of and the feedback regulation of cortisol.
4. State the function of adrenal androgens.
5. Define the following:

- Addison's disease
- glucocorticoids
- Cushing's disease
- gluconeogenesis
- mineralocorticoids
F. Discuss the general location and functions of the adrenal medulla.

1. List the functions of epinephrine and norepinephrine.
2. Discuss the relationship between the adrenal medulla and the sympathetic division of the autonomic nervous system.

G. Discuss the endocrine functions of the Islets of Langerhans of the pancreas.

1. List the functions of insulin.
2. List the functions of glucagon.
3. Describe the feedback control of insulin, glucagon, and blood glucose concentration.
4. Recognize normal blood glucose levels and list additional factors that affect blood glucose concentration.
5. Be able to define the following:

   - alpha and beta cells
   - hypo-hyperglycemia
   - glycosuria
   - gluconeogenesis
   - diabetes mellitus
   - glycogenesis
   - glycogenolysis
   - ketosis - acidosis

H. Identify hormones produced by the ovaries and testes; recognize their general functions.
The Skeletal System

Upon completion of a study of the skeletal system, the student will be able to correctly answer questions concerning the following subject matter:

1. List the major functions of the skeletal system.

2. Describe the microscopic construction of osseous tissue using the following terms:

   compact bone         spongy bone
   Haversian (central) canal  osteoclasts
   lamella              osteoblasts
   lacuna               canaliculi
   osteocytes           osteon
   trabeculae           hydroxyapatite

3. Organize the skeleton into axial and appendicular portions, and recognize the bones of each.

4. Classify bones into long, short, sesamoid, flat, and irregular; recognize examples of each.

5. Diagram and discuss the structure of long bones using the following terms:

   epiphysis             epiphyseal plate
   diaphysis             medullary cavity
   articular cartilage   red and yellow marrow
   periosteum            spongy and compact bone
   endosteum

6. Classify the following bone markings as depressions or openings, joint forming processes, or connective tissue attachments:

   foramen             head
   meatus              tubercle
   fossa               crest
   condyle             facet

7. Describe and differentiate between intramembranous and endochondral ossification; recognize locations of each.

8. Recognize the possible causes and symptoms of the following bone disorders:

   osteoporosis         osteomyelitis
   rickets

9. Define fracture, describe common fracture types, and describe fracture repair.
10. Concerning the axial skeleton:
   a. define fontanel.
   b. describe and state the function of the vertebral column's normal curves.
   c. recognize abnormal vertebral curvatures.

11. Compare the male and female skeleton in terms of bone size, muscle attachment markings, and pelvic structure.

12. Define articulations and classify them into synarthrosic, amphiarthrosic, or diarthrosic according to degree of movement permitted.

13. Classify articulations on a structural basis into these categories: fibrous, cartilaginous, and synovial - recognize examples of each.

14. Diagram and discuss the basic structure of a synovial joints using the following:

   - articular cartilage
   - synovial cavity
   - synovial membrane
   - articular capsule
   - synovial fluid
   - bursa
   - ligament

15. Define the following joint movements:

   - flexion
   - extension
   - abduction
   - adduction
   - rotation
   - circumduction
   - depression
   - supination
   - pronation
   - protraction
   - retraction
   - dorsiflexion
   - plantarflexion
   - elevation
1. List the characteristics and functions of muscle tissue.

2. Compare and contrast skeletal, smooth, and cardiac muscle in terms of their location, microscopic structure, and nervous control.

3. Use the following terminology in a discussion of muscle tissue:

   - muscle fiber
   - sarcolemma
   - T-tubules
   - neuromuscular junction
   - myofilaments
   - H band
   - triad
   - sarcomere
   - actin
   - troponin
   - all-or-none
   - sarcoplasm
   - sarcoplasmic reticulum
   - myofibrils
   - I and A bands
   - Z line
   - cisternae
   - intercalated disks
   - myosin
   - tropomyosin
   - motor unit

4. Describe these types and components of contraction:

   - latent period
   - twitch
   - tonus
   - isometric
   - isotonic

5. Define and/or apply the following to muscle physiology in the three types of muscle cell:

   - refractory period
   - fatigue
   - speed of contraction
   - tetany

6. Describe the sliding filament model of muscle cell contraction.

7. Discuss energy sources for muscle cell contraction; describe the effect of exercise on muscle tissue.

8. Describe selected disorders effecting skeletal muscle functions.

9. Discuss the role of muscles, bones, and leverage in providing body movements.
10. Describe the structure of a skeletal muscle using the following terminology:

epimysium
endomysium
fascia
insertion
perimysium
fascicles
origin
belly

11. Describe the attachments of muscle to bone.

12. Identify fascicular arrangements within muscles.

13. Define the terms prime mover (agonist), antagonist, and synergist and use them in a discussion of movements caused by muscle groups.

14. Recognize approaches to naming skeletal muscles.
LABORATORY

During the semester, students will develop the following skills:

- Care and use of the microscope
- Dissection
- Proper handling of biohazards

In addition, lab exercises from the text are scheduled by the instructor and cover selected objectives described below:

**Getting Started**
1. Perform metric measurements and conversions.
2. Discuss the scientific method and use it in experimental design and performance.
3. Perform basic statistical manipulations.

**Exercise 1: The Language of Anatomy**
1. Describe the anatomical position verbally and by demonstration.
2. Use proper anatomic terminology to describe body directions, planes, and surfaces.
3. Name the body cavities and note the important organs in each.

**Exercise 2: Organ Systems Overview**
1. Name the human organ systems and state the major function of each.
2. List two or three organs of each system, and categorize the various organs by organ system.
3. Observe selected human organs and note their position in a dissectible human torso model and cadaver.

**Exercise 3: The Microscope**
1. Identify the parts of the microscope and list the function of each.
2. Describe and demonstrate the proper techniques for care of the microscope.
3. Define total magnification and resolution.
4. Demonstrate the proper focusing technique.
5. Define parfocal, field, and depth of field.
6. Estimate the size of objects in a field.

**Exercise 4: The Cell - Anatomy and Division**
1. Define cell, organelle, and inclusion.
2. Identify on a cell model or diagram the following cellular regions and list the major function of each: nucleus, cytoplasm, and plasma membrane.
3. Identify and list the major functions of the various organelles studied.
4. Compare and contrast specialized cells with the concept of the "generalized cell."
5. Define interphase, mitosis, and cytokinesis.
6. List the stages of mitosis and describe the events of each stage.
7. Identify the mitotic phases on microscope slides.
8. Explain the importance of mitotic cell division and its product.
Exercise 6: Classification of Tissues
1. Name the four major types of tissues in the human body and the major subcategories of each.
2. Identify the tissue subcategories through microscopic inspection.
3. State the location of the various tissue types in the body.
4. State the general functions and structural characteristics of each of the four major tissue types.
5. Successfully identify human body tissues during a practical exam using microscopes and slides.

Exercise 7: The Integumentary System
1. Recount several important functions of the skin, or integumentary system.
2. Recognize and name from observation of a microscopic specimen the following skin structures: epidermis (and note relative positioning of the various strata), dermis (papillary and reticular layers), hair follicles and hair, sebaceous glands, arrector pili, sudoriferous glands, and hypodermis.
3. Name the four major layers of the epidermis and describe the characteristics of each.
4. Compare the properties of the epidermis to those of the dermis.
5. Describe the distribution and function of the skin derivatives -sebaceous glands, sudoriferous glands and hair.

Exercise 19: Gross Anatomy of the Brain and Cranial Nerves
1. Dissect a sheep brain; identify or locate the following brain structures on the dissected specimen, and state their functions:
   a. cerebral hemisphere structures: lobes, important fissures, ventricles, corpus callosum, fornix, septum pellucidum.
   b. diencephalon structures: thalamus, intermediate mass, hypothalamus, optic chiasma, pituitary gland, mammillary bodies, pineal body, choroid plexus of the third ventricle.
   c. brainstem structures: corpora quadrigemina, cerebral aqueduct, cerebral peduncles of the midbrain, pons, medulla, fourth ventricle.
   d. cerebellum structures: cerebellar hemispheres, vermis, arbor vitae.
2. Describe the composition of the gray and white matter.
3. Locate the well-recognized functional areas of the human cerebral hemispheres.
4. Define gyri, and fissures (sulci).
5. Identify at least four pertinent anatomic differences between the human brain and that of the sheep (or other mammal).
6. Identify the cranial nerves by number and name on an appropriate model or diagram, stating the origin and function of each.
7. Observe normal and abnormal human brain specimens.
8. Perform cranial nerve function tests.
9. View the human brain and selected nerves in situ.

Exercise 21: Spinal Cord and Spinal Nerves
1. Identify on a spinal cord model or microscopic preparation gray and white matter, anterior median fissure, posterior median sulcus, central canal, dorsal, ventral, and lateral horns of the gray matter, ventral and dorsal roots, dorsal root ganglia, and posterior, lateral, and anterior white columns, and cite the neuron type found in these areas (where applicable).
2. Name two major areas where the spinal cord is enlarged, and explain the reasons for this anatomic characteristic.
3. Define conus medullaris, cauda equina, and filum terminale.
4. Locate on a diagram the fiber tracts in the spinal cord white matter and state their functional importance.
5. List two major functions of the spinal cord.
6. Name the meningeal coverings of the spinal cord and state their function.
7. Describe the origin, fiber composition, and distribution of the spinal nerves, differentiating between ventral and dorsal roots, the spinal nerve proper, and ventral and dorsal rami, and discuss the result of transecting these structures.
8. Discuss the distribution of the dorsal rami and ventral rami of the spinal nerves.
9. View the human spinal cord and selected nerves in situ.

**Exercise 22: Human Reflex Physiology**
1. Define reflex.
2. Name, identify, and describe the function of each element of a reflex arc.
3. State why reflex testing is an important part of every physical examination.
4. Describe and discuss several types of reflex activities as observed in the laboratory; note the functional or clinical importance of each; and categorize each as a somatic or autonomic reflex action.
5. Explain why cord-mediated reflexes are generally much faster than those involving input from the higher brain centers.
6. Investigate differences in reaction time of reflexes and unlearned responses.

**Exercise 23: General Sensation**
1. Recognize various types of general sensory receptors as studied in the laboratory, and describe the function and location of each type.
2. Define exteroceptor, enteroceptor, proprioceptor, and adaptation.
3. Demonstrate and relate differences in relative density and distribution of tactile and thermoreceptors in the skin.
4. Define tactile localization and describe how this ability varies in different areas of the body.
5. Explain the tactile two-point discrimination test, and state its anatomic basis.

**Exercise 25: Special Senses - Hearing and Equilibrium**
1. Identify the anatomic structures of the external, middle, and internal ear by appropriately labeling a diagram.
2. Describe the anatomy of the organ of hearing (organ of Corti in the cochlea) and explain its function in sound reception.
3. Describe the anatomy of the equilibrium organs of the inner ear and explain their relative function in the maintenance of equilibrium.
4. Define or explain central deafness and conduction deafness.
5. State the purpose of the Rinne and Weber tests.
6. Explain how one is able to localize the source of sounds.
7. Describe the effects of acceleration on the semicircular canals.
Exercise 26: Special Senses - Taste and Olfaction
1. Describe the structure and function of the taste receptors.
2. Describe the location and cellular composition of the olfactory epithelium.
3. Name the four basic types of taste sensation and list the chemical substances that elicit these sensations.
4. Point out on a diagram of the tongue the predominant location of the basic types of taste receptors (salty, sweet, sour, bitter).
5. Explain the interdependence between the senses of smell and taste.
6. Name two factors other than olfaction that influence taste appreciation of foods.
7. Define olfactory adaptation.

Exercise 24: Special Senses - Vision
1. Describe the structure and function of the accessory visual structures.
2. Dissect a cow eye and identify its structural components of the eye; list the function(s) of each.
3. Describe the cellular makeup of the retina.
4. Discuss the mechanism of image formation of the retina.
5. Trace the visual pathway to the optic cortex and note the effects of damage to various parts of this pathway.
6. Define the following terms:
   - refraction
   - myopia
   - accommodation
   - hypermetropia
   - convergence
   - cataract
   - astigmatism
   - glaucoma
   - emmetropia
   - conjunctivitis
7. Discuss the importance of the pupillary and convergence reflexes.
8. Explain the difference between the rods and cones with respect to visual perception and retinal localization.

Exercise 27: Anatomy and Basic Function of the Endocrine Glands
1. Identify and name the major endocrine glands and tissues of the body when provided with an appropriate diagram.
2. List the hormones produced by the endocrine glands and discuss the general function of each.
3. Indicate the means by which hormones contribute to body homeostasis by giving appropriate examples of hormonal actions.
4. Cite the mechanism by which the endocrine glands are stimulated to release their hormonal products.
5. Describe the physiologic relationship between the hypothalamus and the pituitary gland.
6. Describe a major pathologic consequence of hypersecretion and hyposecretion of each hormone considered.
7. Correctly identify the histologic structure of the anterior and posterior pituitary, thyroid, parathyroid, adrenal cortex and medulla, and pancreas by microscopic inspection or when presented with an appropriate photomicrograph or diagram.
8. Name and point out the specialized hormone-secreting cells in the above tissues as studied in the laboratory.

Exercise 10-11: The Axial and Appendicular Skeletons
1. Name the three bone groups composing the axial skeleton (skull, bony thorax, and vertebral column).
2. Identify the bones composing the axial skeleton, either by examining the isolated bones or by pointing them out on an articulated skeleton, or skull, and name the important bone markings on each.
3. Distinguish by examination the different types of vertebrae.
4. Identify (on an articulated skeleton or disarticulated) the bones of the shoulder and pelvic girdles and their attached limbs.
5. Arrange unmarked, disarticulated bones in their proper relative position to form the entire skeleton.
6. Differentiate between a male and a female pelvis.
7. Discuss the common features of the human appendicular girdles (pectoral and pelvic), and to note how their structure relates to their specialized functions.
8. Identify specific bone markings in the appendicular skeleton.
9. Answer questions concerning the above in a practical exam using real bones and skeletons or medical quality plastic replicas.

Exercise 14: Microscopic Anatomy of Skeletal Muscle
1. Describe the structure of skeletal muscle at the microscopic level.
2. Define and explain the role of the following:
   - actin
   - myosin
   - fiber
   - myofibril
   - myofilament
   - perimysium
   - aponeurosis
   - tendon
   - endomysium
   - epimysium
3. Describe the structure of a myoneural junction and to explain its role in muscle function.
4. Describe the more common types of body movements.

Muscle Physiology
1. Define and explain the physiologic basis of the following:
   - action potential
   - threshold or minimal stimulus
   - treppe or staircase phenomenon
   - multiple motor unit summation
   - muscle fatigue
   - depolarization
   - subthreshold or subliminal stimulus
   - maximal stimulus
   - wave summation
   - tetanus
   - absolute refractory period
   - repolarization
2. Name and describe the phases of a muscle twitch.
3. Distinguish between a muscle twitch and a sustained (tetanic) contraction and describe their importance in normal muscle activity.
4. Demonstrate how the computerized physiological data collection equipment or computer simulations can be used to obtain pertinent and representative information concerning various physiologic events of skeletal muscle activity.

The Following Supplemental Lab Activities may be Scheduled by the Instructor.
1. DNA/RNA/Protein Self Study (interactive video and computer simulation)
2. Interactive Physiology [CD-Rom Module - The Nervous System.]
3. Adam Interactive Anatomy (activities from Student Lab Guide)
4. Interactive Physiology [CD-Rom Module – The Muscular System]
RESOURCES

Interactive Physiology: A.D.A.M./Benjamin Cummings. (8 system suite)
Lafferty and Panella, ADAM Interactive Anatomy software and Student Lab Guide to ADAM Interactive Anatomy, Benjamin Cummings, 2002

These texts are also used for Human Anatomy II.

Additional readings concerning current issues in anatomy and physiology may be placed on reserve at the Kirkwood Library.

As a comprehensive community college, Kirkwood has the following resources available:

- The Kirkwood Cedar Rapids Library (Benton Hall) has a large number of books and references, periodicals, and other types of informational resources, etc. The book collection is maintained at approximately 60,000 titles; periodicals number about 500. The Iowa City Campus has a smaller library with 6,000 books and 100 journals. A full-text database is available at both libraries. Away from the two main campuses, library services are provided via computer connection.
- A large videotape collection is available in the Math/Science department and the library.
- The math/science department and its faculty maintain a collection of overhead transparencies, 35mm slides, video disks and player, and models which are routinely utilized.
- The laboratory facility is available to the instructor and to students during scheduled lab sessions and open lab times. Materials housed here include skeletons and bone sets, anatomical and human torso models, light microscopes and extensive slide collection, preserved vertebrate specimens, normal and abnormal human specimens, and other resources which may be employed to explore selected topics.
- A prosected cadaver is available on site at the Cedar Rapids campus and is routinely used by the instructor and students to study human structure.
- The Science Resource Center on the Cedar Rapids campus provides additional instructional opportunities for students in Human Anatomy and Physiology. Twelve multimedia computer stations (2.4 GHz processor, 512 MB memory, 40GB harddrives, CD/RW, floppy and zip drives) are supplied with Internet connections, tutorials, dissection simulations, and interactive physiology modules. The instructor may schedule classes in the center; in addition, students can make use of the facility during unscheduled hours.
- A peer-tutoring service is operated through the personal achievement department. Help is available free of charge to students enrolled in Human Biology.
- In addition to Kirkwood's facilities, the following outside resources are available:
  - The University of Iowa with its general and specialized libraries is located 20 miles south of Kirkwood.
  - Several smaller four-year institutions (Mt. Mercy, Coe, and Cornell College) are located within a 15-mile driving radius.
  - Several area hospitals (St. Luke’s, Mercy Cedar Rapids) maintain medical libraries which are available for student use.
INSTRUCTIONAL FORMAT

Three lecture hours per week are scheduled. Lecture sessions will present material designed to meet course objectives; slides, films, videotapes and disks, computer assisted instruction, student discussion, cooperative learning, classroom assessment techniques, question and answer, recitation, and other classroom activities designed to enhance the student's grasp of material may augment the traditional lecture approach. Two hour weekly lab sessions will be held. Material covered in these sessions will correspond to lecture topics under consideration and will allow the student to explore and apply concepts on an individual and group basis. "Hands-on" activities will be stressed. Lab meets in Room 243 Linn Hall.

STUDENT EVALUATION

At the beginning of each lecture unit covered, the student will be given a set of objectives to be met. It is the student's responsibility to meet these objectives; lecture presentations, reading assignments, and other class activities are designed to aid them in this effort. Quizzes and/or exams will test mastery of stated course objectives. These may include multiple choice, true-false, matching, short answer, and/or essay questions. Policies concerning make-ups for missed quizzes and exams will be determined by each instructor.

Lab evaluation will consist in part of the instructor's review of lab reports. Report sheets for lab activities can be found in the lab manual. Details concerning assignments, due dates, late penalties, etc. will be provided by the instructor in lab. In addition, lab practical exams will be given covering activities undertaken during certain portions of the course. All instructors will administer a histology practical using microscopes and slides and a skeletal system practical using human bones or medical quality plastic bones. In addition to these exams, some instructors may choose to use other topics as sources for practical examination.

At least 75% of a student’s grade will be determined by in-class evaluations such as tests, quizzes, and practical exams. A maximum of 25% of a student’s grade will be determined by out of class evaluations such as homework, lab reports, and open-book quizzes or exams.

There is no extra credit available in this course.

At the end of Human A&P II, the HAPS Combined Competency Exam will be administered to assess student learning during the two-semester sequence.

One of the following grading scales will be employed:

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