STRANDS AND STANDARDS

MEDICAL ANATOMY AND PHYSIOLOGY, ADVANCED

Course Description

An Advanced Medical Anatomy and Physiology course. This course is a college level Anatomy & Physiology course that teaches in-depth body structures and functions preparatory for further healthcare training programs or careers.

Intended Grade Level	12
Units of Credit	2.0
Core Code	36.01.00.00.115
Concurrent Enrollment Core Code	36.01.00.13.115
Prerequisite	Medical Anatomy & Physiology
Skill Certification Test Number	703
Test Weight	1.0
License Area of Concentration	CTE and/or Secondary Education 6-12
Required Endorsement(s)	
Endorsement 1	Medical Anatomy & Physiology
Endorsement 2	N/A
Endorsement 3	N/A

STRAND 1

Body Plan and Organization-Students will explore and describe the body plan, organization, and homeostasis.

Standard 1

Contrast the sciences of anatomy and physiology.

Standard 2

Describe the six levels of structural organization of the human body and their interrelationship.

- Chemical
- Cellular
- Tissue
- Organ
- System
- Organism

Standard 3

Define anatomical position and identify commonly used planes in gross anatomy and/or imaging.

- Sagittal
  - Midsagittal
  - Parasagittal
- Transverse (horizontal)
- Frontal (coronal)
- Oblique

Standard 4

Apply directional terms used in human anatomy.

- Posterior/Anterior
- Medial/Lateral
- Proximal/Distal
- Superficial/Deep
- Superior/Inferior
- Cranial/Caudal
- Ventral/Dorsal
- Ipsilateral/Contralateral
- Parietal/Visceral

Standard 5

Apply regional terms used in human anatomy.

- Head (cephalic)
  - Skull (cranial)
  - Base of skull (occipital)
- Face (facial)
  - Forehead (frontal)
  - Temple (temporal)
  - Eye (orbital, ocular)
  - Ear (otic)
  - Cheek (buccal)
  - Nose (nasal)

- Mouth (oral)
- Chin (mental)
- Neck (cervical)
- Spinal column (vertebral)
- Trunk
  - Chest (thoracic)
    - Breastbone (sternal)
    - Breast (mammary)
    - Shoulder blade (scapular)
    - Back (dorsal)
  - Abdomen (abdominal)
    - Navel (umbilical)
    - Hip (coxal)
    - Loin (lumbar)
    - Between hips (sacral)
  - Pelvis (pelvic)
    - Groin (inguinal)
    - Pubis (pubic)
    - Buttock (gluteal)
    - Perineal
- Upper Extremity
  - Armpit (axillary)
  - Arm (brachial)
  - Front of elbow (antecubital)
  - Back of elbow (olecranal, cubital)
  - Forearm (antebrachial)
  - Wrist (carpal)
  - Hand (manual)
    - Thumb (pollux)
    - Palm (palmar, volar)
    - Back of hand (dorsum)
    - Fingers (digital, phalangeal)
- Lower Extremity
  - Thigh (femoral
  - Knee
    - Anterior surface (patellar)
    - Posterior surface (popliteal)
  - Leg (crural)
    - Calf (sural)
  - Foot (pedal)
    - Ankle (tarsal)
    - Sole (plantar)
    - Top of foot (dorsum)
    - Heel (calcaneal)
    - Toes (digital, phalangeal)
    - Great toe (hallux)

Standard 6

Identify the body cavities and locate the following organs within each cavity.

- Dorsal Cavity
  - Vertebral (spinal) -spinal cord
  - Cranial-brain
- Ventral Cavity
  - Thoracic
    - Mediastinum-heart, bronchi, esophagus, thymus.
    - Pericardial-heart
    - Pleural-lungs
- Abdominopelvic Cavity
  - Abdominal-liver, spleen, intestines, kidneys, stomach
  - Pelvic-intestines, urinary bladder, sex organs

Standard 7

Identify the four abdominopelvic quadrants and the nine abdominopelvic regions and locate the major organ(s) in each.

- Quadrants
  - RUQ-right upper quadrant-liver, gallbladder, right kidney
  - RLQ-right lower quadrant-cecum, appendix, right ovary
  - LUQ-left upper quadrant-spleen, stomach, left kidney.
  - LLQ-lower left quadrant-left ovary
- Regions
  - Right/Left hypochondriac
  - Right/Left lumbar
  - Right/Left inguinal (iliac)
  - Epigastric
  - Umbilical
  - Hypogastric (pubic)

Standard 8

Define and describe the mechanism of homeostasis.

- Receptors
- Control
- Effectors

Standard 9

Compare and contrast negative and positive feedback mechanisms to maintain homeostasis. Give examples of each.

- Positive feedback (induce or stimulates)
  - childbirth
  - breast feeding
  - blood clotting
  - severe bleeding
- Negative feedback (inhibits or reverses)
  - blood pressure
  - blood glucose
  - thermoregulation
  - water balance (thirst)

STRAND 2

Basic Principles of Body Chemistry-Students will explain basic principles of inorganic chemistry.

Standard 1

Review the following terms and concepts.

- States of Matter
- Elements
- Basic components of the atom
  - Nucleus
  - Electrons
  - Protons
  - Neutrons
- Metabolism
  - Anabolic
  - Catabolic

Standard 2

Identify the major, lesser, and trace elements in the body and their chemical symbols.

- Major
  - Carbon (C)
  - Hydrogen (H)
  - Oxygen (O)
  - Nitrogen (N)
- Lesser
  - Sodium (Na)
  - Chlorine (Cl)
  - Potassium (K)
  - Calcium (Ca)
- Trace
  - Helium (He)
  - Lithium (Li)
  - Beryllium (Be)
  - Boron (B)
  - Fluorine (Fl)
  - Neon (Ne)
  - Magnesium (Mg)
  - Aluminum (Al)
  - Silicon (Si)
  - Phosphorus (P)
  - Sulfur (S)
  - Argon (Ar)
  - Iron (Fe)
  - Selenium (Se)
  - Bromine (Br)
  - Krypton (Kr)
  - Iodine (I)
  - Xenon (Xe)

Standard 3
Differentiate between atomic number, mass number, and atomic mass using the periodic table.

Standard 4
Define isotope and distinguish between stable isotopes and radioisotopes.

Standard 5
Define valence and electronegativity, and describe how they relate to the position of an element on the periodic table.

Standard 6
Describe the characteristics and strength of different chemical bonds.

- Ionic (cation, anion)
- Covalent
  - Non-polar
    - Single
    - Double
    - Triple
  - Polar
- Hydrogen

Standard 7
Describe the properties of water and how it is utilized in the human body.

- Universal solvent
- Transport
- Lubricant
- Heat capacity
- Chemical reactions

Standard 8
Define acid, and base, and describe the pH scale.

- Acidic
  - Hydrogen (proton) donor
- Basic (alkaline)
  - Hydrogen (proton) acceptor
- Neutral
- Blood ph = 7.35 to 7.45

Standard 9
Define a pH buffer and describe the carbonic acid/bicarbonate buffer system.

STRAND 3
Basic Principles of Body Chemistry-Students will explain basic principles of organic chemistry.

Standard 1
Distinguish between:

- Inorganic compounds-do not contain carbon, small molecules, usually form ionic bonds
- Organic compounds-usually contain carbon, large molecules, form covalent bonds, flammable

Standard 2

Compare and contrast how anabolic and catabolic processes play a role in monomers, dimers, and polymers.

- Dehydration synthesis
- Hydrolysis

Standard 3

Describe the naming, structure, and functions of carbohydrates and give an example of each:

- Monosaccharides
  - Hexose
    - Glucose
    - Fructose
    - Galactose
  - Pentose
    - Deoxyribose
    - Ribose
- Disaccharides
  - Sucrose (glucose + fructose)
  - Lactose (glucose + galactose)
  - Maltose (glucose + glucose)
- Polysaccharides
  - Glycogen
  - Starch
  - Cellulose

Standard 4

Describe the naming, structures, and functions of proteins and give an example of each:

- Amino Acids
  - Carboxyl
  - R-Group (20 unique groups)
  - Amino Group
- Bonds
  - Peptide
  - Dipeptide
  - Polypeptide
- Levels of protein structure
  - Primary
  - Secondary
  - Tertiary
  - Quarternary
- Enzymes

Standard 5

Describe the structures and functions of lipids and give an example of each:

- Fatty acids (monomer)
  - Saturated
  - Unsaturated
  - Monounsaturated
  - Polyunsaturated
- Trigycerides

- Steroids

Standard 6
Describe the structures and functions of nucleic acids and give an example of each:
- Nitrogenous Bases
  - Adenine
  - Guanine
  - Thymine
  - Cytosine
  - Uracil
- Nucleotide = base + sugar + phosphate (monomer)
- RNA and DNA (polymer)

Standard 7
Describe the structure and function of phospholipids.

Standard 8
Describe the structure and function glycolipids and glycoproteins as cell surface markers.

STRAND 4
Cells-Students will describe basic structures and functions of cells.

Standard 1
Identify the principle parts of a generalized animal cell and their functions.
- Nucleus
  - Nucleoulus
  - Chromosome
    - Chromatin
    - Gene (DNA, RNA)
- Cytoplasm
  - Cytosol
  - Organelles
    - Ribosome
    - Endoplasmic Reticulum (smooth, rough)
    - Golgi complex (body)
    - Lysosome
    - Mitochondria
    - Centrosome (centrioles)
    - Cytoskeleton
    - Cilia
    - Flagella
    - Peroxisome
- Cell membrane
  - Phospholipids
  - Cholesterol
  - Glycoproteins
  - Glycolipids
  - Protein channels

Standard 2
Describe a selectively permeable membrane and factors which influence permeability.

Standard 3
Contrast intracellular and extracellular fluid in terms of location and composition.

Standard 4
Describe each of the following cellular transport processes and classify them as active or passive.

- Passive processes
  - Simple diffusion
  - Facilitated diffusion
  - Filtration (dialysis)
  - Osmosis
- Active processes
  - Endocytosis
    - Phagocytosis
    - Pinocytosis
    - Receptor mediated
- Exocytosis
- Secondary Active Transport
  - Antiport
  - Symport
- Sodium/Potassium pump

Standard 5
Compare and contrast the osmotic effects that occur when a cell is placed in the following solutions:

- Isotonic
- Hypotonic
- Hypertonic

Standard 6
Describe how and where the body produces energy during cellular respiration.

$ATP \leftrightarrow ADP + P + ENERGY$

- Glycolysis (anaerobic)
- Formation of acetyl coenzyme A/lactic acid (aerobic vs anaerobic pathways)
- Citric Acid Cycle (Krebs)
- Electron Transport Chain

Standard 7
Sequence the steps of the cell cycle. Compare and contrast mitosis and meiosis.

- Interphase
  - G0
  - G1
  - S
  - G2
- Mitosis
  - Prophase
  - Metaphase
  - Anaphase

    - Telophase
    - Cyokinesis
- Meiosis
    - Prophase I & II
    - Metaphase I & II
    - Anaphase I & II
    - Telophase I & II
    - Cyokinesis

Standard 8
Describe the process of transcription and translation in relationship to protein synthesis.

Standard 9
Describe the process of DNA replication.

STRAND 5
Tissues-Students will describe basic structures and functions of Tissues.

Standard 1
Identify and describe the general characteristics and functions of each of the four principle types of tissues.
- Epithelial
- Connective
- Muscular
- Nervous

Standard 2
Describe the naming, structural features, and locations of epithelial tissue.
- Structural features
    - Apical surface
    - Basal surface
    - Basement membrane
    - Avascular
- Naming conventions
    - Arrangement of cells
        - Simple
        - Stratified
        - Psuedostratified
- Cell Shape
    - Squamous
    - Cuboidal
    - Columnar
    - Transitional
- Glandular epithelium
    - Exocrine glands
    - Endocrine glands

Standard 3
Describe the structural features, types, and locations of connective tissue.
- Cells

- Extracellular matrix
  - Fibers
  - Ground substance
- Types of connective tissue
  - Loose
    - Areolar
    - Adipose
    - Reticular
  - Dense
    - Regular
    - Irregular
    - Elastic
  - Cartilage
    - Hyaline
    - Fibrocartilage
    - Elastic
  - Blood
  - Bone
  - Lymph

Standard 4

Describe the five main types of cellular junctions.

- Tight
- Gap
- Adherens
- Desmosomes
- Hemidesmosomes

Standard 5

Compare and contrast epithelial and connective tissue membranes.

- Cutaneous
- Serous
- Mucous
- Synovial

Standard 6

Compare and contrast skeletal, cardiac, and smooth muscle tissue.

- Voluntary vs. involuntary
- Striated vs. non-striated
- Location and number of nuclei

Standard 7

Describe the identify the key features of nervous tissue.

- Neuron
- Glial cells

STRAND 6

Integumentary System

Standard 1

Describe the general structures and functions of the integumentary system.

Standard 2

Identify and describe the tissue type making up the epidermis. Identify and describe layers of the epidermis. Differentiate between thick and thin skin. Describe renewal of the epidermis.

Standard 3

Explain how each cell type (stem cells, keratinocytes, melanocytes, Langerhans cells, Merkel cells and discs) and substances (keratin, extracellular lipids) contribute to the function of the epidermis.

Standard 4

Identify and describe the dermis and its layers. Know the tissue types that make up each layer.

Standard 5

Identify and describe the hypodermis/subcutaneous layer. Know the tissue types that make up the hypodermis.

Standard 6

Identify exocrine glands of the integumentary system and describe their function.

- Sudoriferous
  - Eccrine
  - Apocrine
- Sebaceous
- Ceruminous

Standard 7

Identify nerve endings of the integumentary system and describe their functions.

- Meissners corpuscles
- Merkel disk
- Free nerve endings
- Pacinian corpuscles
- Ruffini ending

Standard 8

Describe the structures and functions of accessory structures of the integumentary system.

- Hair
- Nails

Standard 9

Explain the role of skin in the maintenance of body temperature (thermoregulation).

STRAND 7

Skeletal System

Standard 1

Describe the general functions of the skeletal system.

Standard 2

List the cellular components of bone tissue. List the extracellular components of bone tissue.

- Osteoblasts
- Osteocytes
- Osteoclasts
- Organic
- Inorganic

Standard 3

Compare and contrast compact and spongy bone.

Standard 4

Describe the roles and location of dense regular, dense irregular, and cartilage in the skeletal system.

- Ligaments
- Tendons
- Periosteum
- Articular cartilage

Standard 5

Identify the features of a long bone.

- Periosteum
- Diaphysis
- Metaphysis
- Epiphysis
- Medullary cavity
- Red marrow
- Yellow marrow
- Articular cartilage
- Endosteum
- Compact bone
- Spongy bone

Standard 6

Compare and contrast endochondral and intramembranous ossification.

Standard 7

Explain how hormones are involved in bone growth and maintenance. Explain the roles of calcitonin, parathyroid hormone and calcitriol in bone remodeling and blood calcium regulation.

Standard 8

Define and locate bone markings including:

- Condyle
- Epicondyle
- Facet

- Fissure
- Foramen
- Fossa
- Head
- Meatus
- Process
- Spine
- Sulcus
- Trochanter
- Trochlear
- Tubercule
- Tuberosity

Standard 9

Locate the following bones of the axial and appendicular skeletons.

- Axial Skeleton
  - Mandible
  - Maxilla
  - Zygomatic
  - Frontal
  - Parietal
  - Occipital
  - Sphenoid
  - Ethmoid
  - Hyoid
  - Temporal
  - Vertebrae (lamina, body, pedicle, spinous process, transverse process)
    - Cervical
    - Thoracic
    - Lumbar
    - Sacral
    - Coccygeal
  - Ribs
  - Sternum
- Appendicular Skeleton
  - Clavicle
  - Scapula
  - Pubic bone
  - Ilium
  - Ischium
  - Pubis
- Femur
- Patella
- Tibia
- Fibula
- Tarsals
- Metatarsals
- Phalanges
- Humerus

- Ulna
- Radius
- Carpals
- Metacarpals
- Phalanges

Standard 10
Compare and contrast functional and anatomical (structural) classification of joints.
- Structural:
  - Fibrous
  - Synovial
  - Cartilaginous
- Functional:
  - Amphiarthrotic
  - Diarthrotic
  - Synarthrotic

Standard 11
Describe the different movements of a joint.
- Flexion/extension/hyperextension
- Abduction/adduction/circumduction
- Pronation/supination
- Internal (medial) and external (lateral) rotation
- Plantarflexion/dorsiflexion

STRAND 8
Muscular System

Standard 1
Describe the general functions of the muscular system.

Standard 2
Contrast the general location, microscopic appearance, control, and functions of the three specific types of muscle tissue.
- Skeletal
- Smooth
- Cardiac

Standard 3
Describe muscle organization and structure.
- Sarcomere
- Myofibril
- Muscle cell (muscle fiber)
- Sarcolemma
- Sarcoplasm
- Transverse tubules (T-tubules)
- Sarcoplasmic reticulum
- Triad
- Fascicle

- Endomysium
- Perimysium
- Epimysium

Standard 4
Describe the structures of the sarcomere.
- Myofilaments
  - Actin (thin)
  - Myosin (thick)
- Bands and zones
  - A-band
  - I-band
  - Z-disc
  - H-zone
  - M-line

Standard 5
Label the components of the neuromuscular junction on a diagram and explain the role in triggering a muscle contraction.

Standard 6
Describe the sliding filament model of muscle contraction.

Standard 7
List the sequence of events from muscle cell action potential to the contraction of muscle.

Standard 8
Explain the role of other molecules like creatine and myoglobin in energy metabolism.

Standard 9
Define and describe the terms origin, insertion, action, prime mover, agonist, antagonist, synergist, and fixator.

Standard 10
Define and compare the types of muscle contraction: concentric, eccentric, and isometric.

Standard 11
Relate the different terms used to name muscles:
- Location
- Shape
- Size
- Number of origins
- Direction of fibers
- Origin and insertion
- Action

Standard 12
Identify the following muscles including their location, origin/insertion, and action.
- Upper Extremity
  - Rotator cuff
  - Deltoid

    - Serratus Anterior
    - Pectoralis Major
    - Latissimus Dorsi
    - Triceps Brachii
    - Biceps Brachii
    - Brachialis
    - Brachioradialis
    - Wrist flexors
    - Wrist extensors
- Lower Extremity
    - Iliopsoas
    - Gluteus Maximus
    - Gluteus Medius
    - Sartorius
    - Hip adductors
    - Quadriceps
    - Hamstrings
    - Gastrocnemius
    - Soleus
    - Tibialis Anterior
    - Tibialis Posterior
    - Peroneal (fiblular) group
- Head/neck/Trunk
- Masseter
    - Sternocleidomastoid
    - Trapezius
    - Diaphragm
    - Intercostals
    - Rectus Abdominus
    - Internal/External Oblique
    - Transverse Abdominus
    - Erector Spinae

STRAND 9

Nervous System I-Nervous System

Standard 1

Distinguish between sensory and motor (somatic and autonomic) divisions of the nervous system and the terminology associated

- Ganglion vs nuclei
- Tracts vs nerves
- Gyrus vs sulcus vs fissure

Standard 2

Compare and contrast characteristics of the two cell types of the nervous system: neurons and glial cells.

- Neurons
    - Cell body
    - Axon

    - Dendrite
- Glial Cells
- Astrocytes
- Microglia
- Oligodendrocytes
- Ependymal cells
- Schwann cells
- Satellite cells

Standard 3
Compare and contrast concentration and electrical forces. Apply these principles to the movement of ions across the cell membrane.

Standard 4
List and describe the sequence of events in the action potential. Label a diagram of the action potential including: threshold, depolarization, repolarization, hyperpolarization, and absolute and relative refractory periods.

Standard 5
List and describe in order the sequence of events at the synapse. Begin with the arrival of the action potential and end with the effect of neurotransmission on the postsynaptic cell (postsynaptic potential and/or biochemical change).

Standard 6
List and describe the following neurotransmitters:
- Acetylcholine (AcH)
- Dopamine
- Serotonin
- Epinephrine
- Norepinephrine

Standard 7
Compare and contrast the action potential with graded potentials (EPSPs and IPSPs).

Standard 8
Describe the gross anatomy of the spinal cord and spinal nerves. Differentiate between gray and white matter. Understand the relationship of the spinal cord and spinal nerves to the bony vertebrae surrounding them. Label on a diagram the structures associated with the spinal cord including lateral corticospinal tract, posterior column, spinothalamic tract, dorsal root ganglia, dorsal and ventral roots, and spinal nerves.

Standard 9
Identify and describe the structures and functions of the brain.
- Cerebrum
    - Frontal
        - Pre-central gyrus (motor homunculus)
    - Parietal
        - Post-central gyrus (sensory homunculus)
    - Temporal
    - Occipital
- Cerebellum

- Brain stem
  - Medulla oblongata
  - Pons
  - Midbrain
- Diencephalon
  - Thalamus
  - Hypothalamus
- Gray/white matter organization
- Brain Landmarks
  - Fissures
    - Medial Longitudinal
    - Lateral
    - Transverse
  - Sulci
    - Central
    - Parieto-occipital
  - Other
    - Corpus Collosum
    - Limbic System

Standard 10
Describe the anatomy and physiology of the sympathetic nervous system. In the description of the anatomy, include the location of preganglionic and postganglionic neurons and synapses. In the description of the physiology, include the activity of various organs innervated by the autonomic nervous system.

Standard 11
Describe the anatomy and physiology of the parasympathetic nervous system. In the description of the anatomy, include the location of preganglionic and postganglionic neurons and synapses. In the description of the physiology, include the activity of various organs innervated by the autonomic nervous system.

Standard 12
Identify the effectors of the autonomic nervous system. Identify the effectors of the somatic nervous system. Compare and contrast these.

Standard 13
Identify the three meninges. For each meninx, be able to describe its anatomical relationship to the skull, to the brain, and to the other meninges.
- Dura Mater
- Arachnoid
- Pia Mater

Standard 14
Describe cerebrospinal fluid. Identify locations where it is made; where it circulates; and where it is resorbed into the bloodstream.
- Lateral Ventricles (2)
- Third Ventricle
- Aqueduct
- Fourth Ventricle
- Subarachnoid space

- Arachnoid villi

Standard 15
Describe the structure and function of the blood-brain barrier.

Standard 16
List the twelve cranial nerves. Be able to correctly associate their names and numbers. State a function for each, and whether it is sensory, motor, or mixed.

Standard 17
Define upper motor neuron. Define lower motor neuron. Compare and contrast these. Describe the motor systems and pathways.
- Pre-central gyrus
- Pyramids
- Lateral corticospinal tract
- Effector

Standard 18
Identify the general features of a sensory system. Define transduction. Describe the sensory pathways for pain and temperature vs touch.
- Pain and temperature
  - Receptor
  - Sensory nerve
  - Dorsal root ganglion
  - Lateral spinothalamic tract (crosses in spinal cord)
  - Thalamus
  - Post-central gyrus
- Touch
  - Receptor
  - Sensory nerve
  - Dorsal root ganglion
  - Posterior column
  - Crosses in the medulla
  - Thalamus
  - Post-central gyrus

Standard 19
Define each of the following three categories of sensory receptors: exteroceptor, interoceptor, proprioceptor.

Standard 20
For the following six sensory receptor types, list the relevant stimulus and state in which sensory system it might be found: mechanoreceptors, thermoreceptors, nociceptors, photoreceptors, chemoreceptors, and osmoreceptors.

Standard 21
State the concept of dermatomes and their importance to human disease. Be able to identify the skin surface features associated with the C6, T4, T10, and L2-L-5 dermatomes.

STRAND 10

Nervous System II-Reflexes; Special Senses

Standard 1

Explain the role of each of the components of a reflex arc.

- Reflex
- Reflex arc
- Receptor
- Sensory neuron
- Association (interneuron) neuron
- Motor neuron
- Effector

Standard 2

Describe examples of common reflexes

- Stretch reflex
- Flexor (withdrawal) reflex
- Cross extensor reflex

Standard 3

Label the components of the eye and describe the neural pathway to the brain.

- Accessory structures
  - Eyelid
  - Conjunctiva
  - Lacrimal apparatus
  - Extrinsic muscles
- Layers of the eyeball
  - Fibrous tunic
    - Sclera
    - Cornea
  - Vascular tunic
    - Choroid
    - Ciliary body
    - Iris
    - Lens
    - Pupil
  - Nervous tunic
    - Retina
    - Rods
    - Cones
  - Neural pathway
    - Photoreceptor
    - Optic nerve
    - Optic chiasm
    - Thalamus
    - Occipital lobe

Standard 4

Explain the location and function of olfactory receptors. Describe the neural pathway to the brain.

- Olfactory receptors
- Olfactory nerve
- Olfactory bulb
- Olfactory tract
- Olfactory cortex of the temporal lobe

Standard 5

Explain the location and function of gustatory receptors. Describe the neural pathway to the brain.

- Gustatory receptors
  - Fungiform papillae
  - Foliate papillae
  - Vallate papillae
- Cranial nerve VII, IX, X
- Medulla
- Thalamus
- Post-central gyrus

Standard 6

Identify the principle anatomical structures of the ear.

- Outer ear
  - Auricle
  - Auditory Canal
- Middle ear
  - Tympanic cavity
  - Tympanic membrane
  - Auditory (Eustachian) tube
  - Auditory ossicles
    - Malleus
    - Incus
    - Stapes
- Inner ear
  - Oval window
  - Round window
  - Bony labyrinth
  - Utricle
  - Saccule
  - Semicircular canals
  - Vestibule
  - Cochlea & Organ of Corti
  - Vestibular duct (scala vestibuli)
  - Tympanic duct (scala tympani)

Standard 7

Follow the sound conduction pathway from the auricle to the fluids of the inner ear. Describe the neural pathway to the brain.

- Neural Pathway Receptors (hair cells)
- Cranial nerve VIII
- Medulla
- Thalamus

- Temporal lobe

Standard 8
Explain the coding of pitch and loudness in the auditory system.

Standard 9
For the vestibular system, compare and contract static vs. dynamic equilibrium. Describe the neural pathway to the brain.
- Receptors (hair cells)
- Cranial nerve VIII
- Medulla
- Thalamus
- Somatosensory cortex

STRAND 11
Endocrine System

Standard 1
Describe the functions of the endocrine system.

Standard 2
Describe and analyze the following endocrine terminology and concepts.
- Hormone
- Target cells
- Circulating, paracrine, autocrine
- Permissive, synergistic, and antagonistic effects
- Water soluble vs lipid soluble
- Target cell response
  - Up regulation
  - Down regulation
- Primary vs secondary endocrine glands

Standard 3
Describe the location, secretion, and functions of the hypothalamus.
- Growth Hormone Releasing Hormone (GHRH)-targets anterior pituitary
- Thyrotropin Releasing Hormone (TRH)-targets anterior pituitary
- Corticotropic Releasing Hormone (CRH)-targets anterior pituitary
- Gonadotropic Releasing Hormone (GnRH) – targets anterior pituitary
- Prolactin Releasing Hormone (PRL) – targets anterior pituitary
- Antidiuretic Hormone (ADH)
  - Produced in hypothalamus
  - Stored in posterior pituitary
- Oxytocin Hormone (Oxt)
  - Produced in hypothalamus
  - Stored in posterior pituitary

Standard 4
Describe the location, secretion, and functions of the pituitary gland.
- Anterior Pituitary (adenohypohpsis)

- Human Growth Hormone (GH)
  - Targets cells stimulating growth
- Thyroid Stimulating Hormone (TSH)
  - Targets thyroid gland
- Adrenocorticotropic Hormone (ACTH)
  - Targets adrenal cortex
- Follicle Stimulating Hormone (FSH)
  - Targets gonads for gamete production
- Luteinizing Hormone (LH)
  - Targets gonads
- Prolactin (PRL)
  - Targets mammary glands
- Melanocyte Stimulating Hormone (MSH)
  - Targets melanocytes

- Posterior Pituitary (neurohypophysis)
  - Antidiuretic Hormone (ADH)
    - Targets kidneys, sudoriferous glands, smooth muscle of blood vessels.
  - Oxytocin (Oxt)
    - Targets uterus and breasts

Standard 5

Describe the anatomical and physiological relationships between the pituitary (which includes the adenohypophysis and the neurohypophysis) and the hypothalamus.

Standard 6

Describe the location and structures of the thyroid gland. List the hormones produced and target cells. Detail the synthesis, secretion, and transport of thyroid hormones.

- Structures
  - Follicle cells
  - Parafollicular cells
  - Thyroid follicle
  - Isthmus
- Hormones
  - Thyroxine (T4)
    - Follicular cells
    - Targets cells increasing metabolism
  - Triiodothyronine (T3)
    - Follicular cells
    - Targets cells increasing metabolism
  - Calcitonin
    - Parafollicular cells
    - Lowers blood calcium

Standard 7

Describe the location, secretion, and functions of the parathyroid gland.

- Parathyroid hormone
  - Chief cells
  - Increases blood calcium

Standard 8
Describe the antagonistic relationship between calcitonin and parathyroid hormone in regulating blood calcium.

Standard 9
Describe the location and structures of the adrenal gland. List the hormones produced and target cells.

- Adrenal cortex
  - Zona glomerulosa – mineralocorticoids – aldosterone
  - Zona fasciculata – glucocorticoids – cortisol
  - Zona reticularis- gonadocorticoids - androgens
- Adrenal medulla
  - Catacholamines
    - Epinephrine
    - Norepinephrine

Standard 10
Describe the renin-angiotensin-aldosterone system (RAAS) and its role in regulating blood pressure.

Standard 11
Describe the location and structures of the pancreas. List the hormones produced and their functions. Describe the antagonistic relationship between glucagon and insulin in regulating blood glucose.

- Structures
  - Head
  - Body
  - Tail
  - Pancreatic Acini – exocrine – digestive function
- Pancratic Islets
  - Alpha – glucagon – increases glucose levels
  - Beta – insulin – decreases glucose levels

Standard 12
Describe the location, secretion, and functions of the pineal gland.

- Melatonin – regulates sleep/wake cycle

Standard 13
Describe the location, secretion, and functions of the thymus gland.

- Thymosin: T-lymphocyte maturation

Standard 14
Describe the location, secretion, and functions of the gonads.

- Ovaries: estrogen, progesterone
- Testes: testosterone

STRAND 12
Cardiovascular System I -Blood, Lymphatic System, & Immunity

Standard 1
Identify and describe the components of whole blood.

- Erythrocytes

- Leukocytes
- Thrombocytes (platelets)
- Plasma
  - Water
  - Proteins
  - Nutrients
  - Hormones

Standard 2
Describe hematopoiesis including erythropoiesis

Standard 3
Describe the structure and function of the red blood cells (RBCs).
- Physical characteristics
- Hemoglobin
- Hematocrit
- Antigens
  - ABO
  - Rh

Standard 4
Define leukocyte and identify the various types of white blood cells normally present in the blood.
- Leukocytes
  - Granulocytes
    - Neutrophils
    - Basophils
    - Eosinophils
- Agranulocytes
  - Monocytes
  - Lymphocytes
    - B-cells
    - T-cells

Standard 5
Identify the production and functions of thrombocytes.

Standard 6
Define hemostasis and describe the three mechanisms that contribute to hemostasis. Describe fibrinolysis.
- Vascular spasm
- Platelet plug formation
- Coagulation
  - Intrinsic
  - Extrinsic
  - Common final pathway
- Anti-coagulation (fibrinolysis)

Standard 7
Describe the structures and functions of the lymphatic system. Explain how lymphatic is formed and how it circulates.

- Structures
  - Primary lymph organs
    - Thymus
    - Bone marrow
  - Secondary lymph organs
    - Lymph nodes
      - Cervical
      - Submandibular
      - Axillary
      - Inguinal
    - Spleen
    - Appendix
    - Tonsils
  - Lymph capillaries
  - Lymph vessels
  - Lymphatic ducts
- Functions
  - Lipid transport
  - Interstitial fluid drainage
  - Immunity

Standard 8

Define the following terms as they apply to immunity.

- Antigen
- Antibody
- Epitope

Standard 9

Describe innate immunity and give examples of common mechanisms.

- Barriers
  - Physical
  - Chemical
- Fever and Inflammation
- Compliment
- Phagocytosis

Standard 10

Describe adaptive immunity and give examples of common mechanisms. Describe the roles of T-cells and B-cells in the immune response.

- Cell-mediated
  - T- cytotoxic
  - T- helper
  - Memory cells
- Antibody mediated (humoral)
  - B-cells
  - Plasma cells
  - T-helper
  - Memory cells

Standard 11
Distinguish between active and passive immunity and natural vs. artificial acquisition of immunity.

Standard 12
Describe the basic structure and functions of an antibody. Identify and describe the five classes of antibodies. Identify and describe the five classes of antibodies.

- IgG
- IgM
- IgE
- IgD
- IgA

Standard 13
Contrast the primary and secondary immune responses.

STRAND 13
Cardiovascular System II

Standard 1
List the general functions of cardiovascular system.

Standard 2
Describe the general shape and location of the heart.

Standard 3
Describe the major structures of the heart.

- Layers/membranes
  - Endocardium
  - Myocardium
  - Epicardium (visceral pericardium)
  - Parietal Pericardium
  - Pericardial fluid
- Chambers
  - Atria
  - Ventricles
- Great blood vessels
  - Superior vena cava
  - Inferior vena cava
  - Pulmonary trunk
  - Pulmonary arteries
  - Pulmonary veins
  - Aorta
- Valves
  - Right atrioventricular (AV), tricuspid
  - Pulmonary semilunar
  - Left atrioventricular (AV), bicuspid (mitral)
  - Aortic semilunar

Standard 4
Describe the pattern of blood flow in relation to the great vessels, valves, and chambers of the heart. State when each valve is open or closed during blood flow.

Standard 5
Identify and describe the condution system of the heart and trace the pathway
- Sinoatrial (SA) node
- Atrioventricular (AV) node
- AV bundle (Bundle of His)
- Bundle branches
- Purkinje fibers

Standard 6
Given a diagram of an electrocardiogram, state the name of each waveform. Explain what is happening at each stage of the electrocardiogram.

Standard 7
Compare and contrast the action potential of an autorhythmic cell and a myocardial cell.

Standard 8
Describe the parasympathetic and sympathetic innervation of the heart.

Standard 9
Sequence the principle events of the cardiac cycle in terms of systole and diastole.

Standard 10
Define the following cardiac function measurements:
- Heart rate
- Stroke volume
- End-diastolic volume
- End-systolic volume
- Ejection Fraction
- Cardiac output

Standard 11
Describe the histology of arteries and veins. Compare and contrast the microscopic structure of arteries and veins.
- Tunica Externa
- Tunica Media
- Tunica Interna

Standard 12
Describe the histology and anatomy of capillaries. Name three types of capillaries, location, and distinguishing characteristics.
- Continuous
- Fenestrated
- Sinusoid

Standard 13
Explain the process of capillary exchange of nutrients, gases, and wastes. Describe Starling's Law of the

Capillary.

Standard 14

Identify the major arteries of the human body. Define: anastomosis.

- Carotids
- Subclavian
- Brachiocephalic
- Brachial
- Radial
- Aorta
  - Ascending
  - Arch
  - Descending
  - Thoracic
  - Abdominal
- Renal
- Iliac (common, internal, external)
- Femoral
- Popliteal

Standard 15

Identify the major veins of the human body.

- Jugular
- Subclavian
- Brachiocephalic
- Brachial
- Radial
- Vena Cava (superior, inferior)
- Renal
- Iliac (common, internal, external)
- Femoral
- Popliteal

Standard 16

Name the parts of the coronary circulation.

- Coronary arteries
  - Right coronary artery
  - Marginal artery
  - Posterior interventricular
  - Left coronary artery
  - Anterior interventricular (LAD)
  - Circumflex
- Coronary veins
  - Great cardiac vein
  - Anterior cardiac vein
  - Middle cardiac vein
  - Small cardiac vein
- Coronary sinus

Standard 17
Contrast pulmonary and systemic circulation.

Standard 18
Compare and contrast fetal circulation to adult blood flow.

STRAND 14
Respiratory System

Standard 1
List the functions of the respiratory system.

Standard 2
List each of the structures through which air passes during inspiration. Differentiate them into upper and lower respiratory tracts and conducting and respiratory zones.

- Nose/mouth
- Pharynx
  - Nasopharynx
  - Oropharynx
  - Laryngopharynx
- Larynx
- Trachea
- Bronchi
- Bronchioles
- Terminal bronchioles
- Respiratory bronchioles
- Alveolar duct
- Alveolar sacs
- Alveoli

Standard 3
Identify the following structures associated with the larynx.

- Epiglottis
- Glottis
- Hyoid bone
- Vocal cords

Standard 4
Identify the trachea and its anatomic features.

- Carina
- Cartilage rings

Standard 5
Identify the coverings of the lungs and the gross anatomical features of the lungs.

- Apex
- Base
- Lobes
- Fissures
- Cardiac notch

- Hilum
- Visceral pleura
- Parietal pleura
- Pleural cavity
- Pleural fluid

Standard 6
Describe the muscles of respiration and their innervation.
- Diaphram
- External and Internal Intercostals

Standard 7
Describe the histology of the respiratory system.
- Pseudostratified columnar ciliated epithelium
  - Goblet cells
- C-shaped hyaline cartilage of the trachea
- Smooth muscle of the bronchi and bronchioles
- Type 1 alveolar cells
- Type 2 alveolar cells
- Alveolar macrophages
- Alveolar-capillary membrane
  - Simple squamous endothelium

Standard 8
Define pulmonary ventilation, inspiration, and expiration.

Standard 9
Define: Boyle's Law. Explain the application of Boyle's Law to inspiration and expiration.

Standard 10
State the four respiratory volumes and four respiratory capacities. Identify each of these on a spirogram.
- Tidal volume
- Inspiratory reserve volume
- Expiratory reserve volume
- Residual volume
- Vital capacity
- Inspiratory capacity
- Functional residual capacity
- Total lung capacity

Standard 11
State Henry's Law and Dalton's Law. Explain how each is relevant to external and internal respiration.

Standard 12
State the ways oxygen and carbon dioxide are carried in the blood.

Standard 13
State the chemical equation which describes the relationship between carbon dioxide, bicarbonate ion, and carbonic acid in blood. Predict how raising and lowering pH or carbon dioxide concentration will affect

respiration rate.

Standard 14
State the location and function of the respiratory control centers.
- Medulla rhythmicity area - medulla
  - Inspiratory center
  - Expiratory center
- Pneumotaxic – pons
- Apneustic - pons

Standard 15
Summarize the embryonic development of the respiratory system. Explain the role of surfactant.

STRAND 15
Digestive System

Standard 1
Describe the functions of the digestive system.

Standard 2
Identify the major and accessory structures of the digestive system.
- Alimentary canal structures
  - Mouth
  - Pharynx
  - Esophagus
  - Stomach
  - Small intestines
  - Large intestines
  - Rectum
  - Anus
- Accessory structures
  - Salivary glands (parotid)
  - Teeth
  - Pancreas
  - Gallbladder
  - Liver

Standard 3
Describe and be able to recognize the histology of the alimentary canal (gastrointestinal system). Identify and describe the function of the following layers: mucosa, submucosa, muscularis, serosa.

Standard 4
Describe the anatomy and functions of oral cavity structures.
- Tongue
- Taste buds
- Teeth
  - Deciduous
  - Permanent

- Salivary Glands
  - Parotid
  - Submandibular
  - Sublingual
- Enzymes
  - Salivary amylase

Standard 5

Describe the anatomy and functions of the pharynx.

- Nasopharynx
- Oropharynx
- Laryngopharynx

Standard 6

Describe the anatomy and functions of the esophagus.

- Sphincters
  - Upper
  - Lower
- Smooth vs voluntary muscle
- Swallowing (deglutition) stages
  - Voluntary
  - Pharyngeal
  - Esophageal

Standard 7

Describe anatomy, histology and function of the stomach. Explain the function, production, and regulation of hydrochloric acid (HCl) secretion.

- Anatomy
  - Fundus
  - Cardia
  - Body
  - Pyloric antrum
  - Pyloris
  - Pyloric canal
  - Rugae
  - Cardiac sphincter
  - Pyloric sphincter
- Histology
  - Gastric pits
    - Parietal cells – secretes hydrochloric acid (HCl), and intrinsic factor
    - Chief cells – secretes pepsinogen and lipase
    - Mucous neck cells – secretes mucous
    - G cells – secretes gastrin
- Oblique muscle layer

Standard 8

Describe anatomy, histology and function of the small intestine.

- Anatomy:
  - Duodenum

    - Jejunum
    - Ileum
- Histology:
    - Plicae circularis
    - Villi
    - Microvilli
    - Cells
        - Enterocytes – absorb nutrients
            - Carbohydrate
            - Protein
            - Lipids
                - lacteals
        - Goblet cells – secretes mucous
        - Panath cells – enzymes, phagocytes
        - Enteroendocrine – secretes hormones

Standard 9

Describe anatomy, histology and function of the large intestine.

- Anatomy
    - Cecum
    - Appendix
    - Ascending colon
    - Transverse colon
    - Descending colon
    - Sigmoid colon
    - Rectum
    - Anus
        - External sphincter
        - Internal sphincter
        - Defecation reflex
- Histology
    - Taeniae coli
    - Haustra
    - Intestinal glands
        - Absorptive cells – absorb water
        - Goblet cells – secrete mucous

Standard 10

Describe anatomy, histology and function of the liver and gall bladder.

- Anatomy
    - Gall bladder
    - Liver
        - Right and left lobes
        - Caudate and quadrate lobes
        - Ligaments
            - Falciform
            - Coronary
            - Round
        - Lobules

        - Hepatic triads
            - Branch of hepatic artery
            - Branch of hepatic vein
            - Bile duct
        - Acini
- Histology
    - Sinusoids
    - Bile canaliculi
    - Cells
        - Hepatocytes – inactivates toxins, produces bile, metabolizes carbohydrates, lipids, and proteins, protein production
        - Kupffer cells – macrophage

Standard 11
Describe the pathway of bile flow from the liver to the duodenum.

Standard 12
Describe anatomy, histology and function of the pancreas.
- Anatomy
    - Head
    - Tail
    - Body
    - Pancreatic duct
- Histology
    - Islet – endocrine function
    - Acini – exocrine secretions
        - Amylase
        - Lipase
        - Sodium bicarbonate
        - Protein and nucleic acid enzymes

Standard 13
Compare and contrast mechanical and chemical digestion.

Standard 14
Define and understand the following motility functions:
- Peristalsis
- Segmentation
- Migrating myoelectric complex
- Mass movement

STRAND 16
Urinary System

Standard 1
Describe the general functions of the urinary system.

Standard 2
Identify the major structures and locations of the components of the urinary system

- Kidneys
  - Retroperitoneal
  - Area of inferior thoracic vertebrae (T11-T12) and superior lumbar vertebrae (L1-L2)
  - R. kidney slightly lower than left due to space taken up by liver
- Ureters
  - Tubes that connect the kidneys to the bladder
  - Retroperitoneal
- Bladder
  - Hollow, distensible organ in pelvic cavity
- Urethra

Standard 3

Describe the external and internal anatomy of the kidney.

- External kidney
  - Renal capsule, adipose capsule, renal fascia
- Internal kidney
  - Renal cortex
  - Renal medulla
  - Renal pyramids
  - Renal columns
  - Renal pelvis
  - Nephron
  - Renal papillae
  - Calyces
    - Minor
    - Major

Standard 4

Trace the path of blood flow through the kidneys. Explain what makes the vascular system of the kidneys unique compared to other organs.

- Abdominal aorta
- Renal artery
- Segmental arteries
- Interlobar arteries
- Arcuate arteries
- Cortical radiate arteries
- Afferent arterioles
- Glomerular capillaries
- Efferent arterioles
- Peritubular capillaries (including vasa recta in juxtamedullary nephrons)
- Cortical radiate veins
- Arcuate veins
- Interlobar veins
- Renal vein
- Inferior vena cava

Standard 5

Identify the structures that comprise the nephron. Differentiate between cortical and juxtamedullary nephrons. Identify 3 basic functions performed by the nephrons (glomerulus and renal tubules)

- Structures
  - Renal corpuscle
    - Glomerulus
    - Glomerular (Bowman's) capsule
  - Renal tubules
    - Proximal convoluted tubule
    - Descending limb
    - Nephron loop
    - Ascending limb
    - Distal convoluted tubule
    - Collecting duct
- Functions
  - Glomerular filtration
  - Tubular reabsorption
  - Tubular secretion

Standard 6

Describe the structures and pressures which contribute to the filtering of blood through the glomerular membrane. Compare and contrast the composition of blood and glomerular filtrate.

- Structures
  - Three layers of glomerular membrane:
    - Fenestrated capillaries,
    - Basal lamina,
    - Podocytes, pedicels, filtration slits
- Pressures
  - Net filtration pressure
    - Glomerular blood hydrostatic pressure
    - Blood colloid osmotic pressure
    - Capsular hydrostatic pressure

Standard 7

Identify and describe the three regulatory mechanisms to control the glomerular filtration rate (GFR).

- Renal autoregulation
  - Tubuloglomerular feedback
  - Juxtaglomerular apparatus
- Neural regulation
- Hormonal regulation
  - Angiotensin II
  - Atrial natriuretic peptide (ANP)

Standard 8

Compare and contrast tubular reabsorption and secretion.

- Reabsorption
  - Tubules to blood
  - Majority of solutes and water reabsorbed in the proximal convoluted tubule.
  - Reabsorptive cells: cuboidal epithelium with microvilli
  - Transport maximum
  - Water reabsorption
    - Obligatory reabsorption

        - Facultative reabsorption
- Tubular secretion
    - Blood to tubules
        - Secreted substances include H+, K+, NH4+, creatinine, some drugs

Standard 9

Explain the countercurrent multiplier. Describe how the countercurrent multiplier helps regulate blood osmolarity. Describe the countercurrent exchange mechanism and how it assists with water reabsorption.

Standard 10

Describe the anatomy of the ureters. Identify structures and mechanisms that assist with the flow of urine through the ureters. Compare and contrast male and female urethras.

- Anatomy
    - Retroperitoneal
    - 10-12 inches long
    - Attach to posterior base of the bladder
- Urine flow
    - Smooth muscle in ureters assist with peristaltic contractions
    - Gravity
    - Hydrostatic pressure
- Male and female urethras
    - Male
        - 3 regions: prostatic, membranous, spongy
        - Also has reproductive functions
        - 20 cm in length
    - Female
        - External opening between the clitoris and vaginal opening
        - 4 cm
        - Closer proximity to anus

Standard 11

Describe the anatomy of the bladder. Explain the micturition reflex.

- Anatomy
    - Hollow, distensible organ
    - Posterior to pubic symphysis in pelvic cavity
    - Female bladder is slightly smaller than males (uterus takes up space)
    - Rugae (folds)
    - Transitional epithelium
    - Detrusor muscle
    - Trigone (comprised of 2 ureters and urethra at the base of the bladder)
    - Internal and external sphincters
- Micturition

Standard 12

Describe physical and chemical characteristics of urine.

Standard 13

Describe the fluid compartments of the body and state the relative volumes for the intra- and extracellular compartments. Relate changes in in intracellular and interstitial osmolarity to water movement. Compare the

electrolyte and protein anion concentrations in intra- and extracellular compartments.

- Sodium
- Chloride
- Bicarbonate
- Calcium
- Protein anion
- Potassium
- Magnesium
- Phosphate, Sulfate

Standard 14

Characterize the role of buffers, ventilation, and renal function in maintaining acid-base homeostasis.

STRAND 17

Reproductive system

Standard 1

List the functions of the reproductive system.

Standard 2

Identify male & female reproductive system anatomy.

- Male:
  - Testes
  - Spermatic cord
  - Ductus deferens (vas deferens)
  - Scrotum
  - Dartos muscle
  - Cremaster muscle
  - Epididymis
  - Urethra
  - Prostate gland
  - Seminal vesicles
  - Bulbourethral glands
  - Penis
  - Corpus spongiosum
  - Corpora cavernosa
  - Glans penis
  - Prepuce (foreskin)
  - Seminiferous tubules
  - Rete testis
- Female:
  - Ovaries
  - Uterine (fallopian) tubes
  - Uterus
    - Endometrium
      - Simple columnar epithelium
      - Stratum functionalis
      - Stratum basalis

        - Straight arterioles
        - Spiral arterioles
    - Myometrium
    - Perimetrium
- Clitoris
- Cervix
- Vagina
- Labia minora
- Labia majora
- Perineum
- Mons pubis
- Mammary glands
    - Alveolar glands
    - Myopeithelial cells
    - Areola
    - Suspensory ligaments (Cooper's ligaments)

Standard 3

Characterize the process of spermatogenesis and the pathway from sperm production to release through ejaculation. Describe the role of accessory glands in the production of reproductive fluids (semen, pre-ejaculate).

- Spermatogensis:
    - Spermatogonia -> primary spermatocyte -> secondary spermatocyte -> spermatids -> spermatozoon
- Pathway:
    - Seminiferous tubules -> rete testis -> efferent ducts -> epididymis -> ductus deferens -> ejaculatory duct -> urethra ->ejaculation
- Glands:
    - Bulbourethral glands: secrete alkaline lubricant for urethra and buffer pH (pre-ejaculate)
    - Seminal vesicles: contribute to semen
    - Prostate gland: contribute to semen

Standard 4

Identify and describe the stages of the ovarian cycle including oogenesis and follicular development. Describe female gamete transport and the organs involve.

- Follicular development
    - Primodrial follicles -> primary follicle -> secondary follicle -> mature follicle -> corpus hemorrhagicum -> corpus luteum -> corpus albicans
- Gamete transport
    - Ovary -> fimbriae -> uterine tube ->uterus
- Oocyte development:
    - Primary oocyte
    - Secondary oocyte
    - Ovum

Standard 5

Identify and describe the phases of the uterine cycle including histology and blood supply.

- Endometrium
    - Simple columnar epithelium (shed during menstruation)
    - Stratum functionalis (shed during menstruation)

    - Stratum basalis
- Blood supply
    - Straight arterioles
    - Spiral arterioes
- Uterine phases and key days:
    - Menstural phase - stratum functionalis and spiral arterioles are shed
    - Proliferative phase - spiral arterioles are rebuilt and proliferating straum functionalis
    - Secretory phase
    - Day 1 - first day of menstrual flow
    - Day 14 -ovulation

Standard 6

Compare and contrast the uterine and ovarian cycles and relate the impact of hormone secretions to the timeline of both cycles.

- Hormones to include:
    - Estrogen
    - Progesterone
    - Luteinizing hormone (LH),
    - Follicle stimulating hormone (FSH)

Standard 7

Compare and contrast the process of meiosis and gametogenesis for male and female gametes. Define crossing-over.

Standard 8

Explain the process of conception, including coitus, sperm capacitation, slow block to polyspermy, and fertilization. Describe embryonic events from fertilization to gastrulation and the development of extra-embryonic membranes. Describe fetal events from gastrulation to organogenesis.

- Key items:
    - Zygote (day 0)
    - Blastocyst (~ day 5)
    - Implantation (~ day 7)
    - Gastrulation (~ day 16)
    - Fetal period versus embryonic period
    - Placental development

Standard 9

Describe the role of the following hormones in reproduction:

- hCG – released by chorionic memranea and acts on the gonads (corpus luteum). Maintain corpus luteum activity following implantation if pregnancy occurs.
- Relaxin – released by placenta and relaxes pubic symphysis and cervix to aid dilation for delivery.
- hCS – alters maternal metabolism for increased nutritional requirements of the fetus.
- CRH – role of birth and increased cortisol secretion from adrenal cortex

Standard 10

Describe the stages of labor and the hormones involved. Describe labor as an example of a positive feedback loop. Describe suckling as an example of a positive feedback loop and include the hormones involved.

- Labor stages:
    - 1. Dilation stage – uterine contractions and oxytocin release leading to dilate of the cervix

- 2. Expulsion stage – end of dilation stage to delivery
- 3. Placental stage – after delivery to expelling of the placenta

- Suckling:
  - Oxytocin – milk release
  - Prolactin – milk production

Standard 11

Describe the role of the endocrine system and other factors in male and female puberty. Identify male and female primary and secondary sexual characteristics.

Performance Skills

1. Create a detailed Personal Healthcare Career Plan.
   - What is your healthcare career goal?
   - Reflect on what you have done so far to prepare for that career. Include coursework, HOSA, internships, employment, volunteerism, etc.
   - Define the steps/requirements or additional training that you will need to complete following high school.
   - Determine the workplace skills (soft skills) that your career will need.
   - How do you plan to finance any additional school or training needed?
2. Demonstrate a clinical assessment for each of the twelve cranial nerves. Differentiate whether is testing sensory pathways, motor pathways, or both.
3. Create a research-based poster. Determine a health-related topic and pose a research question. Using scientific methods conduct your research. When complete, create a poster to include a title, abstract, methods, results, conclusions, references, and images. (Use HOSA Research Poster competitive guidelines for reference.)

Workplace Skills

- Communication
- Problem Solving
- Teamwork
- Critical Thinking
- Dependability
- Accountability
- Legal Requirements/expectations

Skill Certification Test Points by Strand

Test Name	Test #	Number of Test Points by Strand	Total Points	Total Questions
Med Anatomy & Phys, Adv	703	1: 3; 2: 4; 3: 2; 4: 2; 5: 2; 6: 3; 7: 8; 8: 3; 9: 17 10: 5; 11: 7; 12: 12; 13: 10; 14: 8; 15: 5; 16: 7; 17: 2	100	100