

BASIC STRUCTURE OF THE HUMAN BODY

BODY PLANES, DIRECTIONS, AND CAVITIES

OBJECTIVES/RATIONALE

To pursue a career in health care, proficiency in anatomy and physiology is vital. The student will describe biological and chemical processes that maintain homeostasis; analyze forces and the effects of movement, torque, tension, and elasticity on the human body; associate the disease process with changes in homeostasis; identify changes in structure and function due to trauma and disease; and identify normal and abnormal anatomy and physiology.

TEKS: 121.3 (c)(1)(F)(H),
121.4 (c)(1)(G)(H)(I),
121.5 (c)(1)(E)(F)(G)

TAKS ELA 1, 3, 4
Science 1, 2, 3, 4

KEY POINTS

Tissues PowerPoint

- I. Anatomical Terms
 - A. Anatomy: study of the body structure and form
 - B. Physiology: study of the processes of living organisms, or why and how they work
 - C. Pathology: study of the nature and cause of disease
 - D. Embryology: study of the origin and development of the organism (2nd – 8th week = embryo; 8th week- birth = fetus)
 - E. Histology: study of tissues
 - F. Cytology: study of cells
 - G. Homeostasis: ability to maintain relatively stable internal conditions; dynamic state of equilibrium or balance
 - H. Protoplasm: basic substance of all life; includes carbon, oxygen, hydrogen, sulfur, nitrogen, and phosphorus
 - I. Complementarity of structure and function: function reflects structure; what a structure (cell, tissue, organ, system) can do depends on its specific form (structure)
 - J. Hierarchy of structural organization: atoms → molecules → organelles → cells → tissues → organs → organ system → organism
- II. Cells
 - A. Structural unit, building block (trillions of cells in body)
 - B. Carry on functions of life
 - 1. Take in food and oxygen: ingestion, respiration, digestion
 - 2. Produce heat and energy: metabolism
 - 3. Move and adapt to their environment: motility, transport
 - 4. Eliminate wastes: excretion

5. Perform special functions: secretion
 6. Reproduce to create new identical cells: reproduction
- C. Cell membrane
1. Outer protective covering of cell
 2. Composition: proteins and fats
 3. Semipermeable: allows certain substances to enter and leave cell while preventing the passage of other substances
 4. Phagocytosis: “cell eating”, engulfs solids i.e. proteins, dead bacteria, dead cell debris
 5. Pinocytosis: “cell drinking”, engulfs liquids i.e. nutrient absorption in small intestine
 6. Exocytosis: removes particles from the cell i.e. hormones, neurotransmitters, mucus, waste
- D. Cytoplasm
1. Fluid inside the membrane
 2. Contains water, food, organelles, and other special materials
- E. Organelles
1. Nucleus: “brain” of cell; controls many cell activities, including reproduction
 2. Nucleolus: located in cell nucleus; important in reproduction (RNA)
 3. Chromatin network: located in nucleus; forms chromosomes which contain genes that carry inherited characteristics; DNA (A-T/G-C bases); males XY and females XX
 4. Centrosome: located in cytoplasm near nucleus; contains 2 centrioles important in reproduction
 5. Mitochondria: located throughout the cytoplasm; “powerhouse” of cell; helps produce energy ($\text{ATP} \rightarrow \text{ADP}$)
 6. Ribosomes: protein synthesis
 7. Endoplasmic reticulum: transport system of channels
 - a. Smooth ER: lipids
 - b. Rough ER: proteins
 8. Lysosomes: sacks of digestive enzymes
 9. Golgi apparatus: synthesizes carbohydrates (CHO) and transports enzymes/hormones; “packaging” of materials
 10. Vesicle: fluid filled sack
 11. Vacuole: containers
- F. Cell reproduction
1. Mitosis: replaces dead/injured cells; divide into 2 identical cells; form of asexual reproduction; some cells do not reproduce after birth i.e. nerve cells in brain and spinal cord, muscle cells
 - a. Interphase: cells are not undergoing cell division; replication of DNA occurring
 - b. Prophase: chromosomes visible; chromatids held together by centromere; centrioles move away from each other

- c. Metaphase: nuclear membrane dissolves; chromosomes line up along equator
- d. Anaphase: centromeres split; 2 chromatids of each chromosome are completely separated; chromosomes pulled to opposite poles
- e. Telophase: chromosomes uncoil to form chromatin; nuclear membrane forms; nucleoli reappear; cytokinesis (division of cytoplasm) occurs
- 2. Meiosis: reduction division; 23 chromosomes = ovum; 23 chromosomes = sperm

III. Tissues - Cells of the same type joined together for a common purpose

A. Characteristics of Tissues

- 1. 60-99% water with various substances dissolved in it (tissue fluid)
- 2. Dehydration: insufficient amount of tissue fluid
- 3. Edema: excess amount of tissue fluid → swelling
- 4. Osmosis: unassisted diffusion of water
- 5. Isotonic: solutions with concentrations of non-penetrating solutes equal to those in the cell i.e. 0.9% saline or 5% glucose
- 6. Hypertonic: solutions with high concentrations of non-penetrating solutes → crenation of cells due to loss of water from the cell (sometimes given in an IV to pull excess fluid from edematous patients)
- 7. Hypotonic: solutions with lower concentrations of non-penetrating solutes → lysis due to continued rush of water into cell i.e. distilled water (used carefully to rehydrate extremely dehydrated patients; also in drinks such as colas, tea, and sports drinks)

B. Types of Tissues

- 1. Epithelial: covers surface of body and lining of intestinal, respiratory, urinary tracts, and other body cavities; forms glands
 - a. Has supporting “basement membrane” for protection
 - b. Forms thin sheets, not very strong
 - c. Has no blood vessels but depends on capillaries in underlying connective tissue
 - d. Functions
 - (1) Protection i.e. skin
 - (2) Absorption i.e. digestive tract lining and kidneys
 - (3) Filtration i.e. kidneys
 - (4) Excretion i.e. kidneys
 - (5) Secretion i.e. glands, kidneys
 - (6) sensory reception i.e. skin
 - e. Cell types
 - (1) Squamous: “scale-like”, single layer, flat; diffusion
 - (2) Cuboidal: square, fat; secretion

- (3) Columnar: tall, narrow; absorption, secretion; goblet → mucus; cilia
- (4) Pseudostratified: single layer of differing heights; secretion; goblet cells; cilia
- (5) Stratified: multiple cell layers; protection
- (6) Glandular: make and secrete a particular product
 - i. Endocrine: no ducts; hormones
 - ii. Exocrine: ducts; mucous, sweat, oil, salivary, liver, pancreas

2. Connective tissue

- a. Supporting framework of organs and other body parts
- b. Widely separated cells and abundant intercellular matrix
- c. Fibers in matrix: collagen, elastic, reticular
- d. Soft connective tissue (CT proper)
 - (1) Areolar: support; collagen and elastin fibers, thin and glistening, wraps and cushions organs, nerves
 - (2) Adipose (fat): signet ring shaped cells; stores fat as reserve food or energy source, insulates body, acts as padding
 - (3) Reticular: soft internal skeleton i.e. lymph nodes, spleen
 - (4) Fibrous (dense regular CT): tensile strength when force is in one direction i.e. tendons, ligaments, fasciae, aponeuroses
 - (5) Fibrous (dense irregular CT): tensile strength when force is in many directions i.e. dermis of skin
- e. Hard connective tissue
 - (1) Cartilage: tough, elastic material found between bones of spine and at end of long bones where it acts as a shock absorber; also found in nose, ears, larynx; no nerves poor blood supply → heals poorly
 - i. Hyaline: embryonic skeleton, ends of long bones, costal cartilage of ribs, nose, trachea, larynx
 - ii. Elastic: external ear (pinna), epiglottis
 - iii. Fibrocartilage: intervertebral discs, pubic symphysis, discs of knee joints
 - (2) Osseous (Bone): similar to cartilage but has calcium salts, nerves, blood vessels; body structure, calcium storage

3. Nervous tissue

- a. Made up of special cells called neurons and neuroglia (supporting cells)
- b. Transmits impulses throughout the body
- c. Reacts to stimuli
- d. Makes up brain, spinal cord, and nerves

4. Muscle tissue
 - a. Highly cellular, well vascularized
 - b. Produces movement by contraction of muscle fibers (cells)
 - c. 3 types
 - (1) Skeletal: attaches to bones to provide movement; striated, voluntary
 - (2) Cardiac: causes heart to beat; striated, involuntary
 - (3) Smooth: in walls of hollow organs i.e digestive tract, blood vessels; No striations, involuntary
- IV. Membranes: combinations of epithelial and connective tissues
 - A. Mucous: lines body cavities, “wet” membrane; absorption and secretion
 - B. Serous: lines closed body cavities and secretes serous fluid to protect from friction i.e. pleura, peritoneum, pericardium
 - C. Synovial: tough, fibrous tissue that lines the cavities of freely movable joints
 - D. Dense fibrous: tough, opaque for protection i.e. dura mater, periosteum, sclera
 - E. Cutaneous: “dry” membrane; skin
- V. Organ: groups of different tissues that work together for a special function i.e. heart, stomach, lungs, skin
- VI. Organ System: organs and other parts which join together for a particular function
 - A. Integumentary: external body covering
 - B. Skeletal: framework of body
 - C. Muscular: movement
 - D. Nervous: control system
 - E. Endocrine: hormone secretion
 - F. Cardiovascular: transport of O₂, nutrients, hormones, CO₂, wastes, etc.
 - G. Lymphatic/Immune: fluid recycling, guards against foreign substances
 - H. Respiratory: gas exchange
 - I. Digestive: processes foods for nutrients
 - J. Urinary: maintains water and electrolyte balance
 - K. Reproductive: production of offspring
- VII. Anatomic Position: body standing erect with arms to the side and palms facing forward, head and feet forward
- VIII. Directional Terms
 - A. Anterior/Ventral: in front
 - B. Posterior/Dorsal: in back
 - C. Medial: toward the midline
 - D. Lateral: toward the side
 - E. Internal: within body
 - F. External: outside the body
 - G. Proximal: closest to the point of origin
 - H. Distal: farther from the point of origin
 - I. Superior: upper or above
 - J. Inferior: lower

- K. Cranial: towards the head
- L. Caudal: towards the tailbone
- M. Flexion: decreasing the angle between two bones
- N. Extension: increasing the angle between two bones
- O. Afferent: carrying toward a center
- P. Efferent: carrying away or away from a center
- Q. Adduction: moving toward the midline
- R. Abduction: moving away from the midline
- S. Eversion: turning a body part outward
- T. Inversion: turning a body part inward
- U. Pronation: turning a body part downward
- V. Supination: turning a body part upward (as in shrug shoulders, palms up, "what's up?")
- W. Deep: away from the body surface, more internal
- X. Superficial: toward or at the body surface
- Y. Plantar: toward the sole of the foot
- Z. Palmar: toward the palm of the hand

IX.

Planes

- A. Sagittal: divides the body or organ vertically into right and left unequal parts
- B. Medial/Mid-sagittal: divides the body or organ vertically into equal right and left parts
- C. Coronal/Frontal: divides the body or organ vertically into anterior and posterior parts
- D. Transverse: divides the body or organ horizontally or into cranial/caudal parts

X.

Body Cavities

A. Ventral (Anterior)

- 1. Thoracic: chest, superior to the diaphragm
 - a. Right pleural: right lung
 - b. Left pleural: left lung
 - c. Mediastinum: heart (in pericardial cavity), trachea, right/left bronchus, esophagus, thymus gland, aorta/aortic arch, vena cava
- 2. Abdominopelvic: inferior to diaphragm
 - a. Abdominal: liver, gallbladder, stomach, pancreas, intestines, spleen, kidneys, ureters
 - b. Pelvic: bladder, female reproductive organs (uterus, fallopian tubes, ovaries), male reproductive organs (prostate, seminal vesicles, part of vas deferens), part of large intestine (colon, rectum)

B. Dorsal (Posterior)

- 1. Cranial: houses the brain
- 2. Spinal: houses the spinal cord

XI.

Body Regions

A. Head

1. Parietal: top of head towards the back and sides
2. Frontal: forehead
3. Occipital: base of skull
4. Temporal: sides of head
5. Auricular: ear
6. Buccal: cheek
7. Orbital: eye socket
8. Mastoid: behind the ear
9. Nasal: bridge of nose
10. Mental: chin
11. Submental: beneath the chin
12. Maxillary: upper jaw
13. Mandibular: lower jaw
14. Zygomatic: cheek bone

B. Neck

1. Larynx: front of neck
2. Trachea: front of neck
3. Cervical: back of neck

C. Thorax

1. Axillary: armpit
2. Clavicular: collar bone
3. Sternal: midchest
4. Mammary: breast
5. Costal: rib
6. Scapular: shoulder blade
7. Pectoral: chest
8. Deltoid: shoulder area

D. Abdominal

1. Hypochondriac: under the cartilage of the ribs, right and left
2. Epigastric: over/above the stomach
3. Umbilical: surrounding the navel, belly button
4. Hypogastric: under/below the stomach
5. Inguinal/iliac: groin, right and left

E. Abdominal Quadrants

1. RUQ: liver, gallbladder, large intestine
2. LUQ: stomach, spleen, pancreas, large intestine
3. RLQ: appendix, large intestine, ovary, fallopian tube
4. LLQ: large intestine, ovary, fallopian tube

F. Posterior Trunk

1. Nuchal: back of neck
2. Cervical: neck
3. Thoracic: back of trunk
4. Lumbar: at small of back, lower back, waist area, lateral mid-abdomen, right and left
5. Sacral: pelvis, tailbone area

6. Coccyx: tailbone
7. Gluteal: buttocks
- G. Extremities
 1. Brachial: upper arm
 2. Antecubital: front of elbow
 3. Olecranon: back of elbow
 4. Carpal: wrist
 5. Phalanges: fingers, toes
 6. Manual: hand
 7. Pollex: thumb
 8. Femoral: thigh
 9. Patellar: front of knee
 10. Popliteal: behind the knee
 11. Tarsal: ankle
 12. Pedal: foot
 13. Calcaneal: heel of foot

ACTIVITIES

- I. In pairs, create a stick-like figure, with a head, trunk, arms, and legs using play dough. As the terms are discussed, the student will use a toothpick to designate the area. After all the terms are discussed, cut the figure into the planes.
- II. In pairs, identify the following areas on partner:
 - Area distal to the knee.
 - Area proximal to the elbow.
 - Lateral to the big toe.
 - Anterior side of the body.
 - Posterior side of the body.
 - Area that is medial to the shoulder.
 - Area that is superior to the lungs.
 - Area that is inferior to the heart.
- III. Complete **Five Station Lab**
- IV. Develop a Short Story describing best date or worst nightmare using **anatomical terms**.

MATERIALS NEEDED

Body Orientation Vocabulary

Assorted colors of playdoh
Carrots
Potatoes
Colored toothpicks
Paper plates
Marshmallows

Bananas
Permanent markers

ASSESSMENT

Writing Rubric
Body Orientation Quiz

ACCOMMODATIONS

For reinforcement, the students will make flashcards of all of the terms.

For enrichment, the students will develop questions and design a jeopardy game utilizing the information in this unit.

REFLECTIONS

Medical Prefixes, Suffixes, Body Planes, and Directional Terms

Objective:

Students will have an overall understanding of the terminology presented and how to utilize it in the medical profession

Materials:

Crayons
Potatoes
Knives
Face Masks
Marker
Gloves
Colored toothpicks
Surgical Caps
Bananas
Carrots
Marshmallows
Paper Plates
Straws
Blank Sheets of Paper
Picture of Torso
Body Parts Worksheet

Stations: (See attached specific directions.)

- Station #1 The students make up a story using the medical terminology.
- Station #2 The students color the handout of the torso according to regions
- Station #3 Students perform the requested surgeries on the patient (potato with a picture of a person drawn on it).
- Station #4 Planes and directions are practiced using fruit, vegetables, toothpicks, and marshmallows.
- Station #5 A fun activity matching body parts to other meanings for the words.

Station One

Using the word list provided, write a story showing that you know the correct usage of the terms. Each student must write at least two sentences using the terms. BONUS: USE ALL OF THE FOLLOWING BONUS WORDS!

Arterio-, athero-, arthro-
Ileum, ilium
Infection, inflammation
Laceration, lesion
Mucous, mucus
Myc-, myel- myo-
Palpation, palpitation
Prostate, prostrate
Pyel-, pyo-
Supination, suppration
Viral, virile

The group may help each other. The entire group story must follow the same story line.
The first sentence is started for you.....

You have the Grim Reaper on the autopsy table. As you begin the first incision.....

Station #2

Using a diagram of the torso, color code each section as follows (label specific left and right where applicable):

Umbilical Region - Green

Lumbar Region - Blue

Epigastric Region - Red

Iliac Region - Orange

Hypochondriac Region - Yellow

Hypogastric Region - Brown

Station #3

Prepare for surgery: you will need face mask and gloves.

You do not want to be sued for malpractice. The surgical team requires collaboration and planning. Know what you are going to do before you cut. These surgical incisions are permanent. Scarring is probable. Remember the anesthesiologist has given you only 15 minutes.

Your patient requires multiple procedures. Please perform the following:

1. Abdominocentesis
2. Tracheostomy
3. Left legectomy (what is the proper term?)
4. Rhinoplasty

Station #4 Body Planes and Directions

Be careful with the surgical instruments. Read and follow the instructions very carefully.

Carrot:

Cut the carrot with a midsagittal plane. Stick a blue toothpick in the superior end of one of the pieces. Place a marshmallow on the end of the toothpick.

Banana:

Cut the banana with a transverse plane. Stick a matching (same color) toothpick and marshmallow in the most distal point of the inferior piece. Place matching (same color) bilateral toothpicks on the superior piece.

Station #5 Fun Body Parts

Match the body parts with their non-body parts' meanings. Good Luck!!!!

What Part of the Human Body?

1. Is part of a wagon? _____
2. Is a fraction of a yard? _____
3. Is a measure of the height of horses? _____
4. Is a band instrument? _____
5. Is a church musical instrument? _____
6. Is a sailor's reply? _____
7. Is used to fasten boards? _____
8. Is used by artists? _____
9. Is a church? _____
10. Is a tropical tree? _____
11. Is a baby animal? _____
12. Is a strong box? _____
13. Is a male deer? _____
14. Is a flower? _____
15. Is a slang expression for nerve? _____
16. Is a small, fast animal? _____
17. Is one who goes to school? _____
18. Is part of a tree? _____
19. Is the outside cover part of a car? _____
20. Is part of a comb? _____

Short Story

Incorporate the Following terms into a story describing your describing best date or worst nightmare. Underline the term(s) in the story.

Superior
Visceral Organs
Inferior
Anterior
Abdominal Cavity
Dorsal
Pelvic Cavity
Medial
Oral Cavity
Lateral
Orbital Cavity
Proximal
RUQ
Distal
LLQ
Superficial
LUQ
Deep
RLQ
Cholecystitis
Hepatitis
Craniotomy
Integument
Arteriosclerosis
Blepharorrhaphy
Pneumonomelanososis
Gastrectomy
Carcinoma
Skeletal System
Cardiovascular System