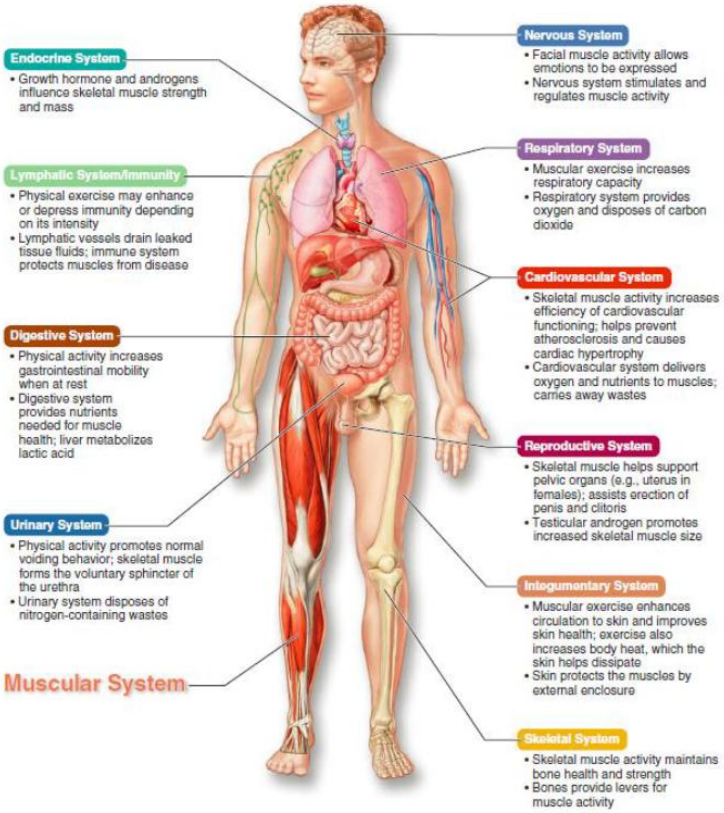


ANATOMY LABORATORY MANUAL

College of Pharmacy-Al-Maarif University

UNIVERSITY OF AL MAARIF

ANATOMY: THE STUDY OF THE STRUCTURE AND RELATIONSHIP BETWEEN BODY PARTS

Anatomy involves analyzing the shape, positioning, and interactions of different body structures.

Prepared by: Dr. Abeer Abdullah Al-Ani

Human Anatomy Practical Manual-Pharmacy

2024/2025

Table of Contents

- Urinary Tract: Ureters, bladder, urethra

10. Nervous System

- Central Nervous System (CNS): Brain, spinal cord
- Peripheral Nervous System (PNS): Nerves, plexuses

1) Introduction

The **College of Pharmacy at Al-Maarif University** integrates foundational anatomical sciences into its pharmacy curriculum to bridge basic medical knowledge with clinical and pharmaceutical applications. Anatomy is taught as theory and practical discipline, emphasizing structures relevant to drug mechanisms, therapeutic targets, and patient care.

Curriculum Context

- Foundational Pre-Pharmacy: Foundational knowledge in human biology and gross anatomy.
- Pharmaceutical Sciences: Applied anatomy modules (e.g., autonomic nervous system for drug actions, hepatic portal system for metabolism).
- Clinical Training: Correlations with pharmacotherapy and patient assessment (e.g., injection sites, lymphatic drug delivery).

Purpose of This Manual

This manual standardizes Structured Anatomy Practical Sessions to:

1. Reinforce pharmacy-specific anatomy (e.g., oral mucosa for sublingual drugs). Promote active learning through station-based rotations (anatomical models, virtual tools).
2. Align with clinical pharmacy competencies, such as understanding drug absorption/distribution pathways.

Lab Session Structure

- Frequency: Weekly 1.5-hour sessions.
- Group Format:
    - Students divided into small groups (4–6) rotating through stations (5-10 minutes each):
        1. Pictures of Cadaver/Prosected Specimens and radiology images.
        2. Anatomical Models (e.g., GI tract for oral drug absorption, respiratory system, human skeleton, disarticulate anatomical model).
        3. Virtual Anatomy Tools (e.g., Anatomage Table).

Teaching Methodology

- Faculty-Led Stations: The instructor will guide the students and answer their queries during sessions.
- Self-Directed Learning: the students will use the below to complete their educational experience during anatomy practical.
    - Learning objectives (based on lecture notes).
    - Pre-lab readings (e.g., review lecture notes: Autonomic Nervous System).
    - Application questions/discussions (anatomy relevance for pharmacology and clinical applications e.g., lymphatic nodes and breast cancer).
    - Post-Lab Tasks: Submit station worksheets and reflect on clinical correlations.

Safety Guidelines

General Protocols

- PPE Required: Lab coats, gloves, closed-toe shoes, goggles.
- Prohibited: Food/drinks, bags (use lockers), unsecured jewelry.
- Ethical Conduct: Handle anatomical models with respect; no photography without permission; Document findings in lab notebooks (no writing on models).

Models & Equipment Care

- Models: Reassemble after use; return to original locations.
- Laboratory bench: Do not write/draw on surfaces.

Emergency Procedures

- Fire: Use Fire extinguishers; evacuate via marked exits.
- Injury: First-aid kits at lab exits; report incidents within 1 hour.
- Chemical Exposure: Flush skin/eyes for 15 mins; alert instructor.

Recommended Learning Sources and Materials:

- Grant’s/Netter’s Atlas of Human Anatomy.
- Pharmacy-specific anatomy apps (e.g., Essential Anatomy for Pharmacists).

- Anatomy and physiology textbooks (recommendations shared during first introduction theory lecture).

Evaluation

- Final Examinations: Test lab and lecture content (e.g., identify structures, solve short assay questios).
- Continuous Assessment: Lab participation; stations; lab worksheets and practical manual completion.
- Attendance Policy: Lecture and lab content are integrated in assessments.

Dr. Abeer Abdullah Al-Ani

2) Anatomical Terminology

Standard Anatomical Position

The **reference position** used to describe body structures:

- Standing upright, feet parallel and flat on the floor.
- Arms at sides, palms facing forward (supinated).
- Head and eyes directed forward.

Why It Matters:

- Ensure consistent communication across medical and pharmaceutical fields.
- Critical for interpreting imaging (e.g., MRI, CT scans) and drug administration (e.g., injection sites).

Directional Terms

Terms describing **relative positions** of structures:

Term	Definition	Pharmacy Application
Superior	Toward the head	"The heart is superior to the diaphragm."
Inferior	Toward the feet	"The liver lies inferior to the lungs."
Anterior	Front of the body	"The sternum is anterior to the heart."
Posterior	Back of the body	"The kidneys are posterior to the intestines."
Medial	Toward the midline	"The ulna is medial to the radius."
Lateral	Away from the midline	"The thumb is lateral to the little finger."
Proximal	Closer to the trunk	"The proximal end of the femur connects to the hip."
Distal	Farther from the trunk	"The distal phalanx is the fingertip."
Superficial	Near the body surface	"Subcutaneous injections target superficial layers."
Deep	Internal to the body	"The femoral artery is deep to the sartorius muscle."

Body Planes

Imaginary flat surfaces used to section the body:

Plane	Definition
Sagittal	Vertical, divided into left/right Mid-sagittal: Equal halves; Parasagittal: Unequal.
Coronal (Frontal)	Vertical, divided into anterior/posterior
Transverse	Horizontal, divides into superior/inferior

Regional Terms

Key anatomical regions for drug administration and pathology:

Region	Landmarks
Axillary	Armpit
Brachial	Arm (shoulder to elbow)
Femoral	Thigh
Gluteal	Buttocks
Subcostal	Below ribs

Movement Terms

Term	Definition	Example
Flexion	Decreases joint angle	Bending the elbow.
Extension	Increases joint angle	Straightening the knee.
Supination	Palm facing up	Oral medication administration position.
Pronation	Palm facing down	IV insertion position.

Cavities & Membranes

Body Cavities:

- **Dorsal:** Cranial (brain) and vertebral (spinal cord).
- **Ventral:** Thoracic (heart/lungs) and abdominopelvic (digestive/urinary).

Membranes:

- **Pleura:** Lungs → Guides inhaled drug distribution.
- **Peritoneum:** Abdominal organs → Affects dialysis drug clearance.

Quick-Reference Summary Table

Category	Key Terms	Pharmacy Application
Position	Supine, prone, lateral recumbent	Patient positioning for injections/CPR.
Planes	Sagittal, coronal, transverse	Interpreting radiographs for drug dosing.
Directional	Proximal/distal, superficial/deep	Locating veins for IV therapy.

Students' Names and Group:	
College: Pharmacy	Date:
Course Name: Human Anatomy	Topic: **THE SKELETAL SYSTEM**
Semester / Year: Semester 2 / Year 1	Practical Session Instructor: Dr. Abeer Abdullah

STATIONS: SKELETAL SYSTEM

Objective: Identify bone types and anatomical landmarks.

1. Drawing Activity

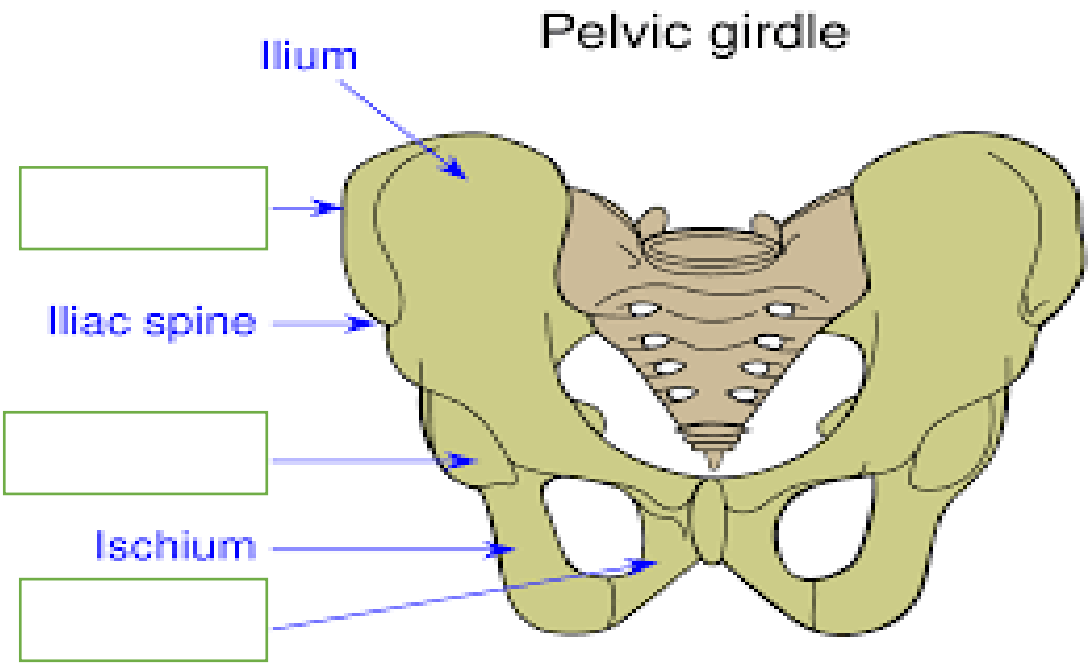
- Sketch and label the following long bones:
    - Humerus
    - Tibia
    - Fibula
- **Label:** Diaphysis, epiphysis, and medullary cavity on each bone.

2. Bone Classification

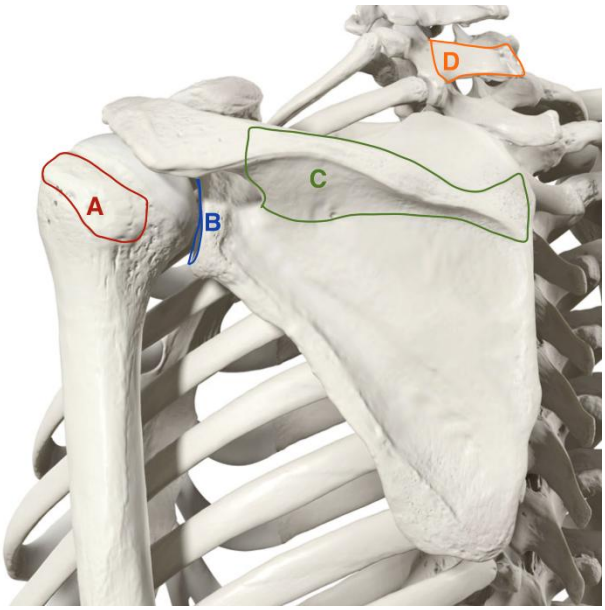
Using anatomical models, classify these bones and provide one example of each:

3. Skeletal Landmarks Identification

A: Label the marked structures on the bone model:



B: Label the marked structures on the bone model:



- Name this skeletal landmark **A**

……

- Name this skeletal landmark **C**

……

Home Activity: Virtual (3D Exploration)

Exercise: Use Complete Anatomy to isolate the rib cage and count true vs. false ribs.

Students' Names and Group:	
College: Pharmacy	Date:
Course Name: Human Anatomy	Topic: **THE CARDIOVASCULAR SYSTEM**
Semester / Year: Semester 2 / Year 1	Practical Session Instructor: Dr. Abeer Abdullah

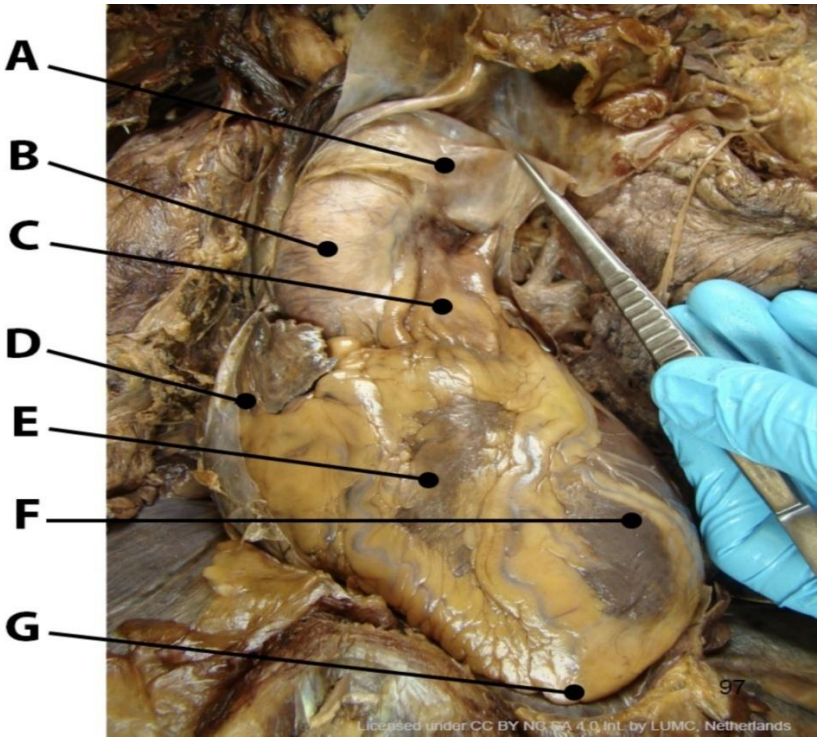
STATIONS: CARDIOVASCULAR SYSTEM

Objective: Understand heart anatomy and blood flow.

1. Structure Matching

Match the letters on the heart model to these structures:

- Left Ventricle ----------
- Apex ----------
- Pericardium ----------
- Right Auricle ----------



2. Blood Flow Pathway

Cardiovascular Station (Models):

1. Use the plastic heart to trace the path of blood flow.
2. Label the aortic valve and pulmonary artery.
3. Time your group: Can you complete the path in <2 minutes?
4. Write the steps of blood flow through the heart (start with vena cavae):

……
……
……
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3. Short Questions

1. Right ---------- receives deoxygenated blood from the body.
2. Papillary muscles are located in the----------
3. Valve between left atrium and ventricle----------
4. Coronary arteries originate from ----------
5. Contractile heart layer ----------

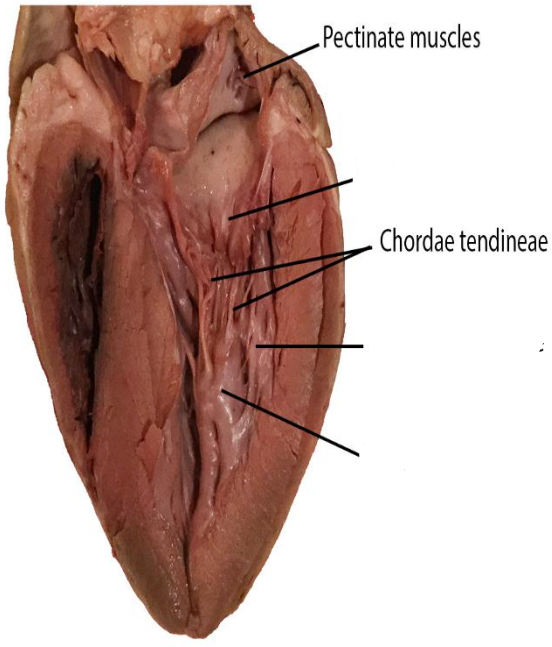
4. Heart Diagram Labeling

Label the structures:

A: _____

B: _____

C: _____



Home Activity: Virtual (Interactive Simulation)

Exercise: Animate blood flow through the heart in Visible Body.

Students' Names and Group:	
College: Pharmacy	Date:
Course Name: Human Anatomy	Topic: **THE DIGESTIVE SYSTEM**
Semester / Year: Semester 2 / Year 1	Practical Session Instructor: Dr. Abeer Abdullah

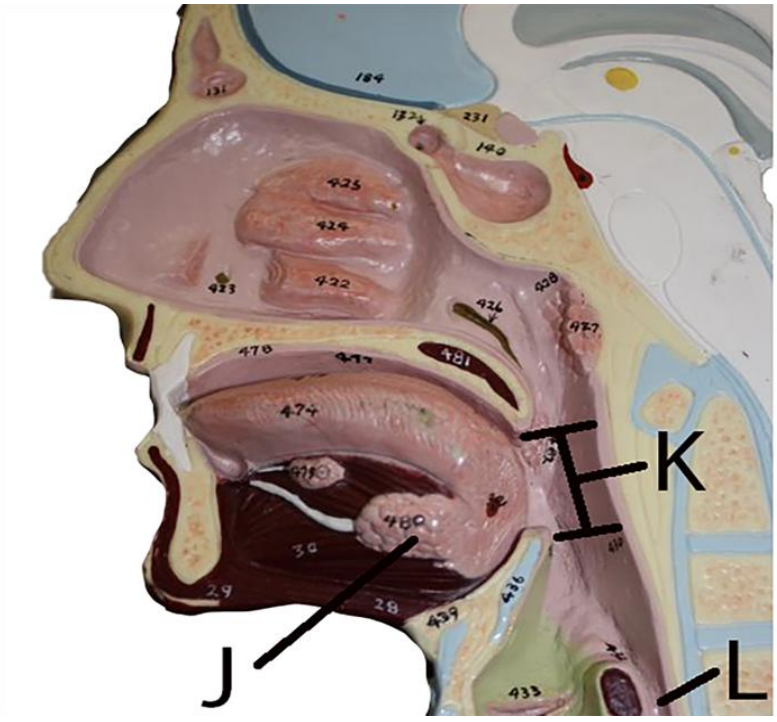
STATIONS: DIGESTIVE SYSTEM

Objective: Identify digestive organs and functions.

1. Structure Matching

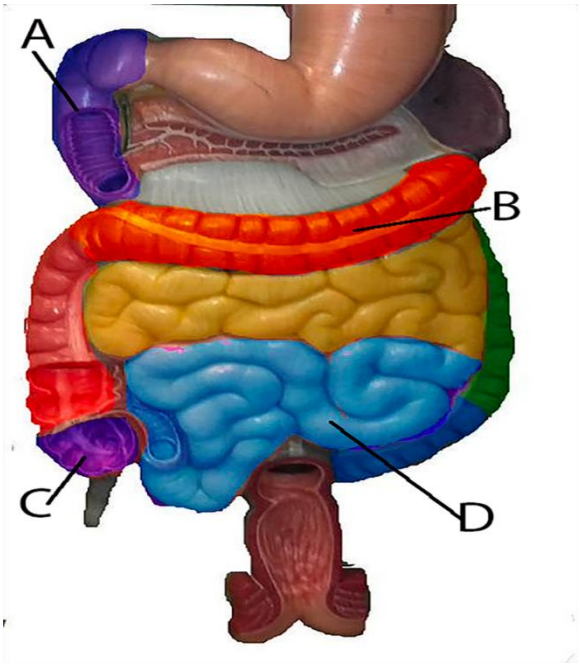
Match the letters on the model to:

- Oropharynx
- Submandibular gland
- Esophagus



2. Diagram Labeling

Label the digestive tract:



- **A:** _____
- **B:** _____
- **C:** _____
- **D:** _____

3. In Lab Activity: The Digestive System Model

Instructions: Identify on the digestive system model these structures:

- **Oropharynx** (Drug administration site for sublingual tablets)
- **Submandibular gland** (Produces saliva containing drug-metabolizing enzymes)
- **Esophagus** (Caution: NSAIDs may cause irritation here)

4. Multiple Choice Questions

i. **What structure closes off the nasopharynx during swallowing?**
   a) Tongue
   b) Epiglottis
   c) Uvula
   d) Hard palate

ii. **The pyloric sphincter is between the?**
   a) Oesophagus and stomach
   b) Pharynx and esophagus
   c) Small intestine and large intestine
   d) stomach and duodenum

iii. **Which of the following lists the sections of the large intestine in the correct sequence?**
   a) Colon, cecum, rectum, anal canal
   b) Cecum, colon, anal canal, rectum
   c) Cecum, colon, rectum, anal canal
   d) Colon, cecum, anal canal, rectum

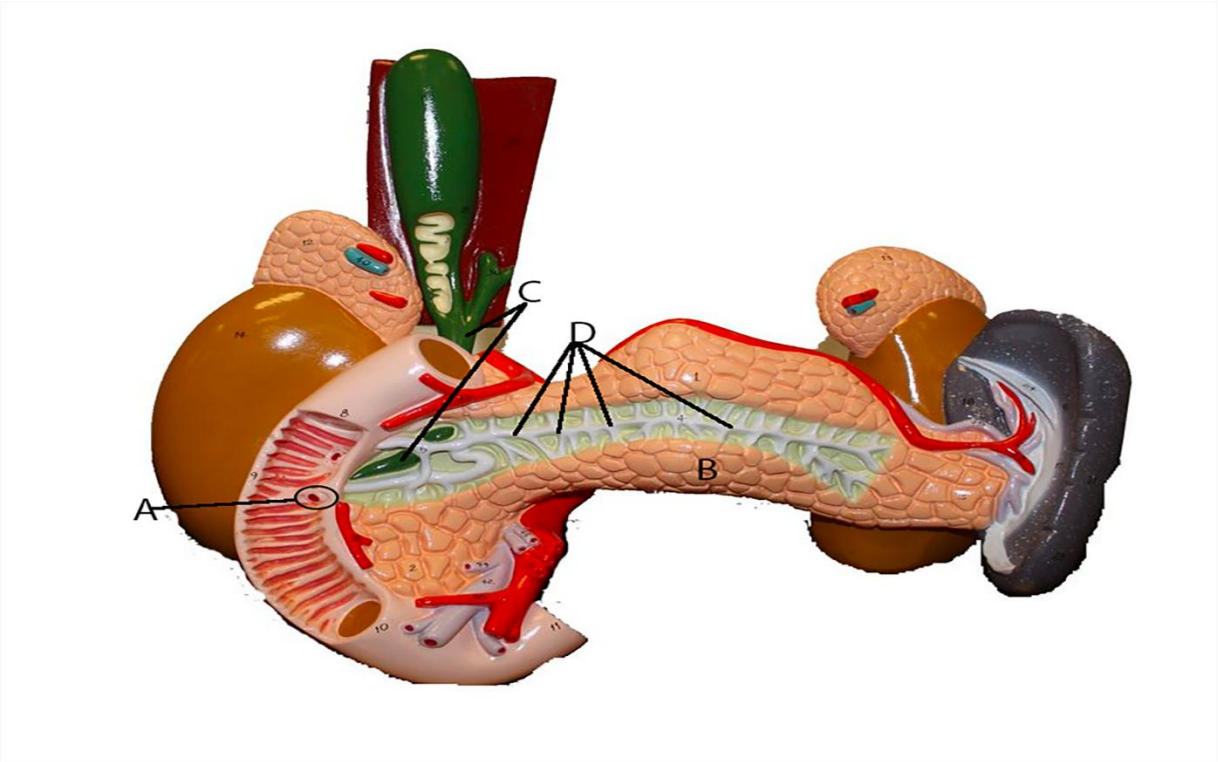
iv. **Identify examples of accessory organs of the digestive system?**
   a) Esophagus, liver, pancreas and spleen

b) Gallbladder, liver, pancreas and salivary glands
c) Gallbladder, liver, pancreas and spleen
d) Liver, pancreas, salivary glands and stomach

4. Diagram Labeling

Identify the marked structures:

- **A:** _____ (3 words)
- **B:** _____ (e.g., organ name)
- **C:** _____ (3 words)
- **D:** _____ (3 words, pointing to the white line)



Students' Names and Group:	
College: Pharmacy	Date:
Course Name: Human Anatomy	Topic: **THE RESPIRATORY SYSTEM**
Semester / Year: Semester 2 / Year 1	Practical Session Instructor: Dr. Abeer Abdullah

STATIONS: RESPIRATORY SYSTEM

Learning Objective:

Identify respiratory structures and explain their clinical significance in drug delivery and pulmonary diseases.

Activity 1: Anatomical Terminology

Fill in the blanks with these terms (use each once):

A. Alveolar duct
B. Respiratory bronchiole
C. Terminal bronchiole

- _____ (Last airway segment without alveoli)
- _____ (First airway segment where gas exchange occurs)
- _____ (Passageway connecting bronchioles to alveolar sacs)

Pharmacy Focus: Which structure would be the primary target for inhaled corticosteroid deposition (treatment of inflammation in asthma)?

(Select Answer: A or B or C)

Activity 2: Multiple Choice Questions

i. A section of the lung that receives its own tertiary bronchus is called the?

a) Pulmonary lobule
b) Bronchopulmonary segment
c) interpulmonary segment
d) respiratory segment

ii. The pleura that surrounds the lungs consists of two layers, the?

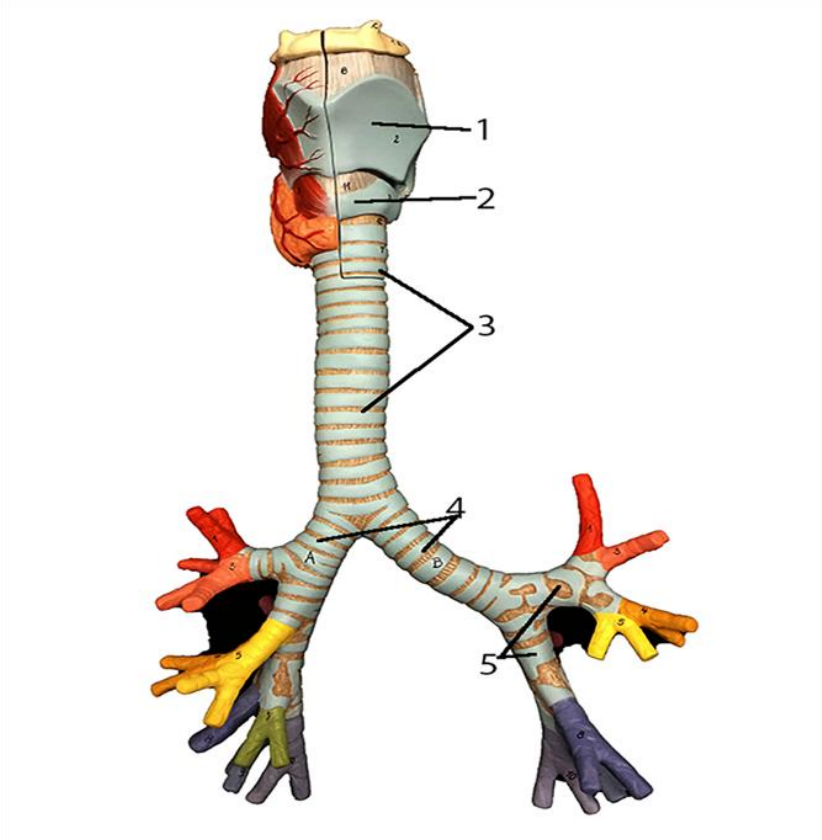
a) Visceral and mediastinum pleurae
b) Mediastinum and parietal pleurae
c) Visceral and parietal pleurae
d) None of the above

iii. The structure where the bronchi and vessels enter the lung is called the:

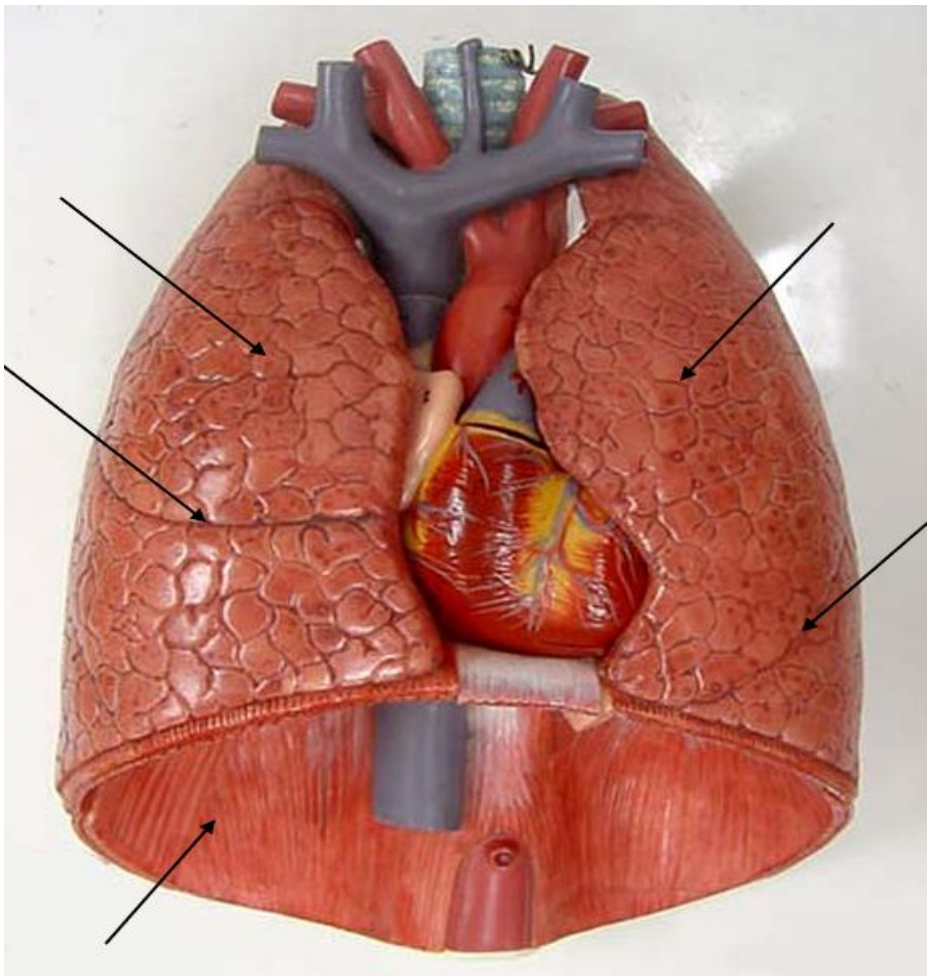
a) Fissure
b) Root
c) Pleura
d) Mediastinum

Activity 3: Diagram Labeling

A: Label the structures on the respiratory tract diagram.



B: Label the structures arrows on the respiratory tract diagram.

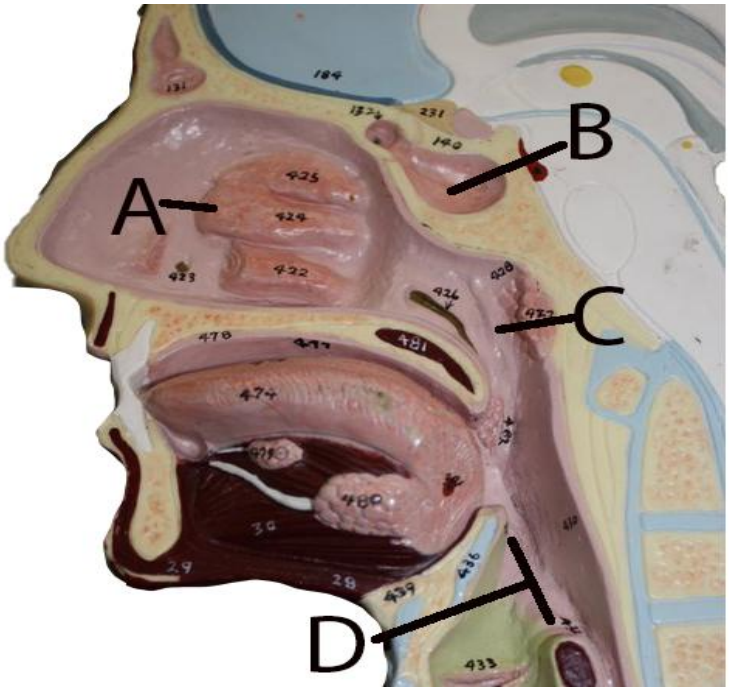


Home Activity: Why must nebulized particles be 1-5 µm to reach the alveoli?

Activity 4: Upper Respiratory Matching

Match letters (A-D) on the head model to these structures:

Letter	Structure	Clinical Relevance
	Nasopharynx	Route for nasal vaccine administration
	Sphenoid sinus	Potential site for antifungal delivery
	Glottis	Protected during intubation
	Concha	Increases surface area for nasal drug absorption



Students' Names and Group:	
College: Pharmacy	Date:
Course Name: Human Anatomy	Topic: **THE ENDOCRINE SYSTEM**
Semester / Year: Semester 2 / Year 1	Practical Session Instructor: Dr. Abeer Abdullah

STATIONS: ENDOCRINE SYSTEM

Learning Objective:

Identify endocrine glands and explain their hormonal regulation of metabolic processes relevant to pharmacotherapy.

1. **Multiple Choice Questions:**

i. **Which gland is often referred to as the "master gland" because it regulates other endocrine glands?**
a) Thyroid gland
b) Adrenal gland
c) Pineal gland
d)Pituitary gland

ii. **Where is the thyroid gland located?**
a) Behind the sternum
b) In the neck, around the trachea
c) On top of the kidneys
d) Near the brainstem

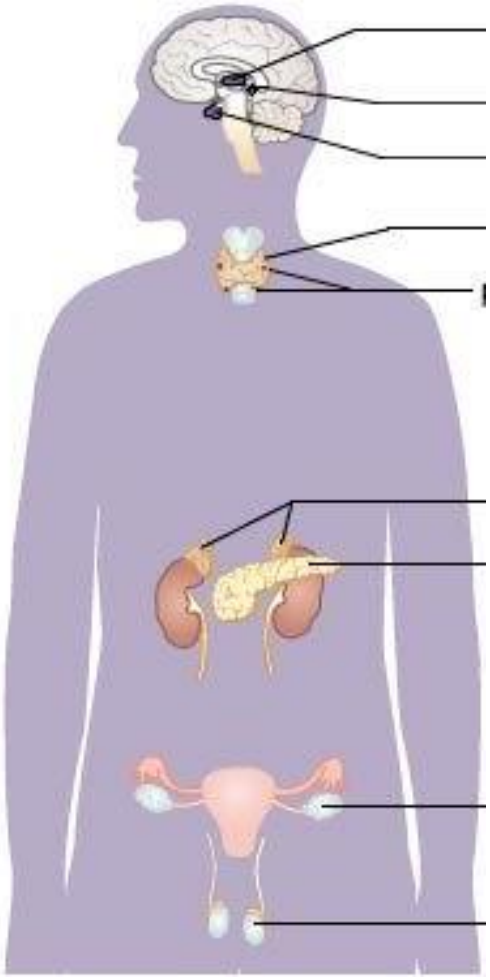
iii. **Which of the following endocrine glands is located atop the kidneys?**
a) Pancreas
b) Adrenal glands
c) Thymus
d) Hypothalamus

iv. **The pineal gland is primarily responsible for secreting which hormone?**
a) Melatonin
b) Cortisol
c) Growth hormone
d) Insulin

v. Which structure connects the hypothalamus to the pituitary gland?

a) The spinal cord
b) The corpus callosum
c) The infundibulum (pituitary stalk)
d) The cerebellum

2. Label the picture with the correct answer and state the main function of three different glands:



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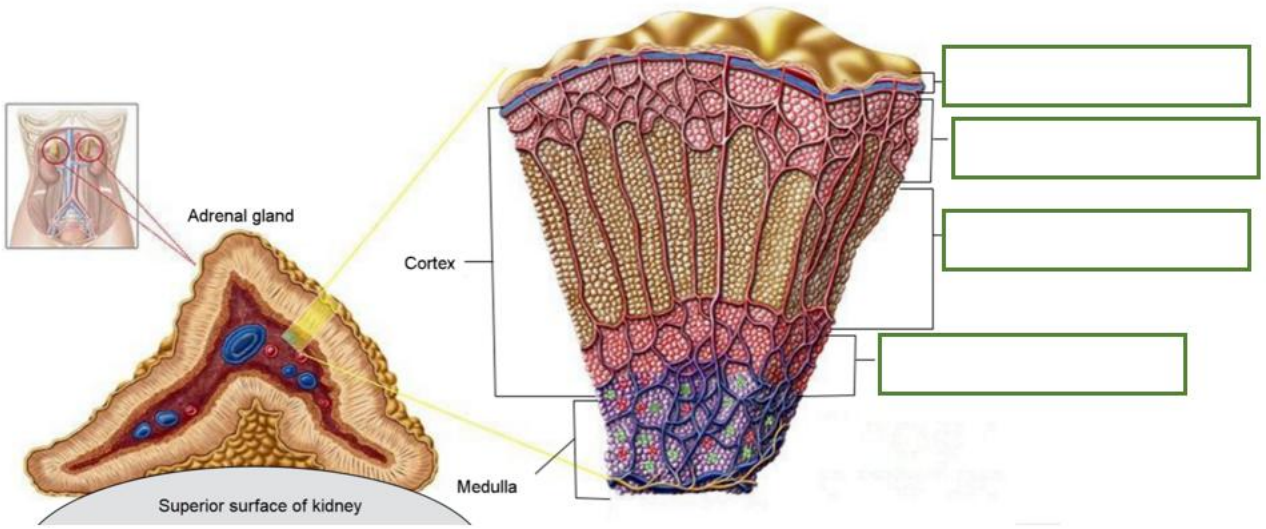
3. **Fill the empty boxes with the correct answer:**



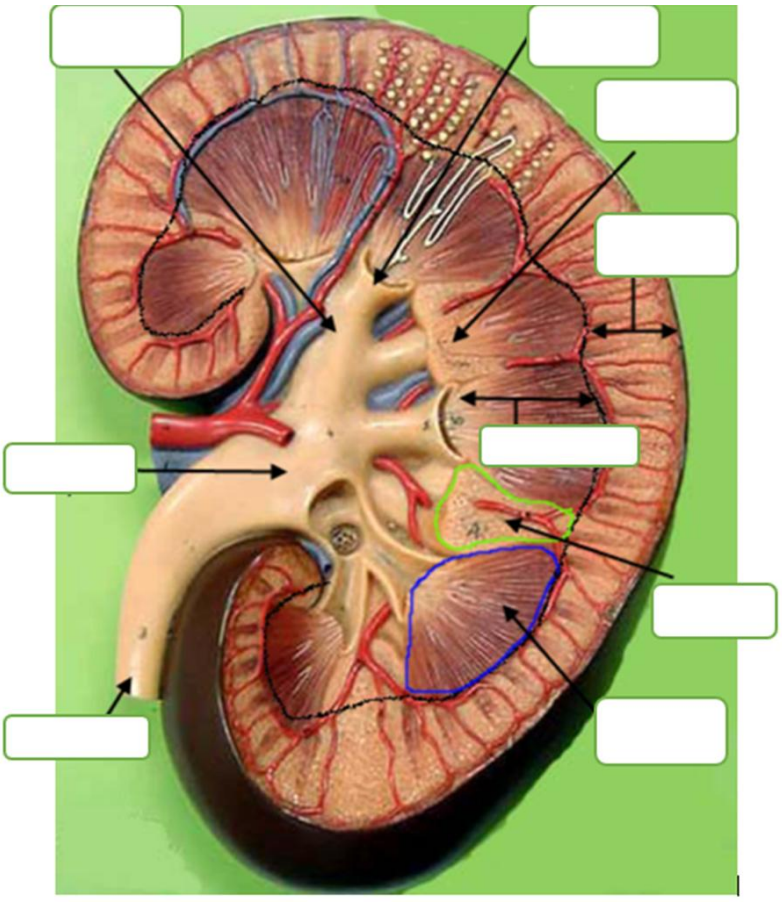
Students' Names and Group:	
College: Pharmacy	Date:
Course Name: Human Anatomy	Topic: **THE URINARY SYSTEM**
Semester / Year: Semester 2 / Year 1	Practical Session Instructor: Dr. Abeer Abdullah

STATIONS: URINARY SYSTEM

Learning Objective:

Identify renal structures and explain their roles in drug excretion, filtration, and related pharmacotherapeutic considerations.

Activity 1: Kidney Anatomy Labeling



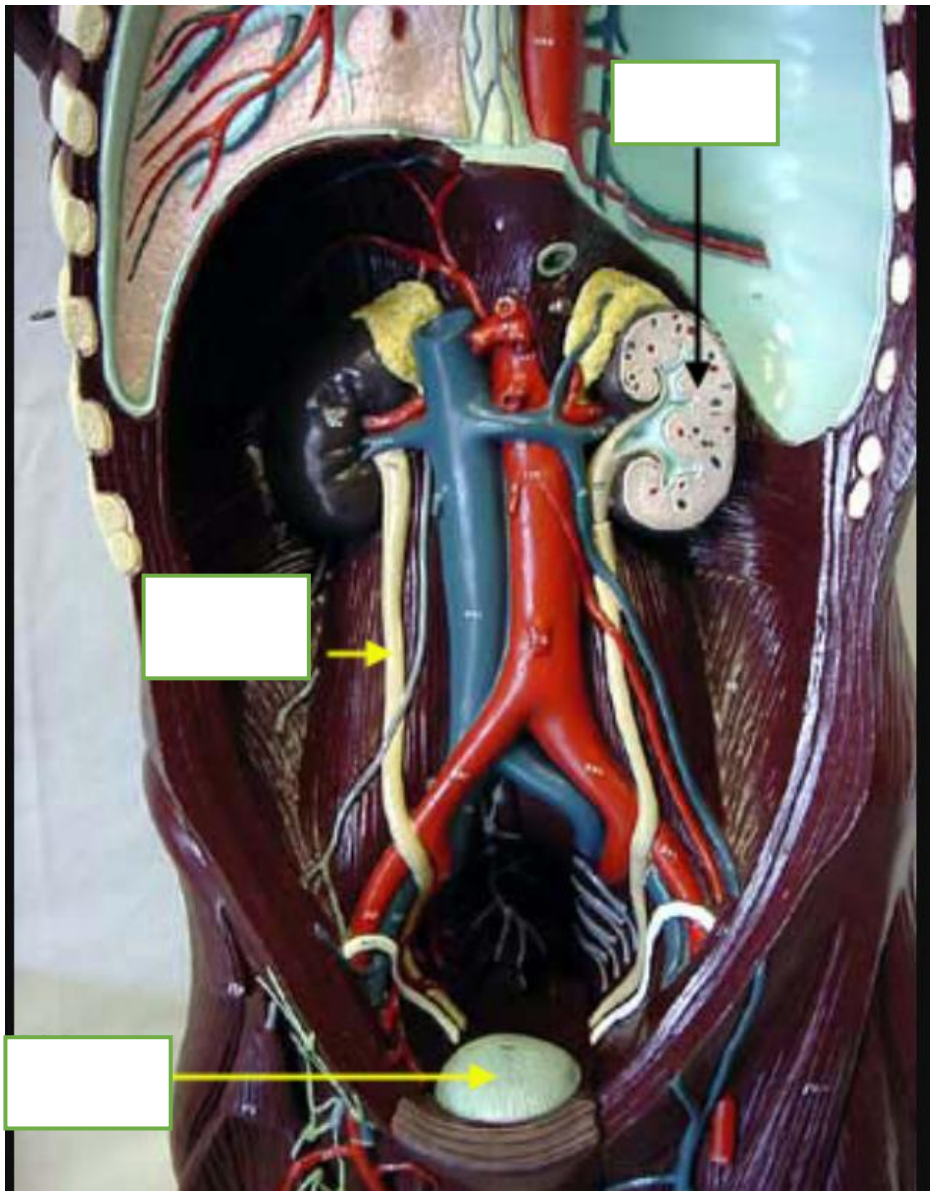
Activity 2: Multiple Choice Questions

1. **Which specific part of the kidney is responsible for the filtration of blood and formation of urine?**
    a. Renal cortex
    b. Renal medulla
    c. Renal corpuscle (glomerulus and Bowman's capsule)
    d. Renal pelvis
2. **Is the structure that connects the renal papillae to the renal pelvis called?**
    a. Minor calyx
    b. Major calyx
    c. Ureter
    d. Urethra
3. **What is the name of the blood vessel that supplies blood to the kidneys?**
    a. Inferior vena cava
    b. Aorta
    c. Ureteric artery
    d. Renal artery
4. **Which layer of the kidney is responsible for maintaining the kidney's shape and protection?**
    a. Renal capsule
    b. Renal cortex
    c. Renal medulla
    d. Renal pelvis

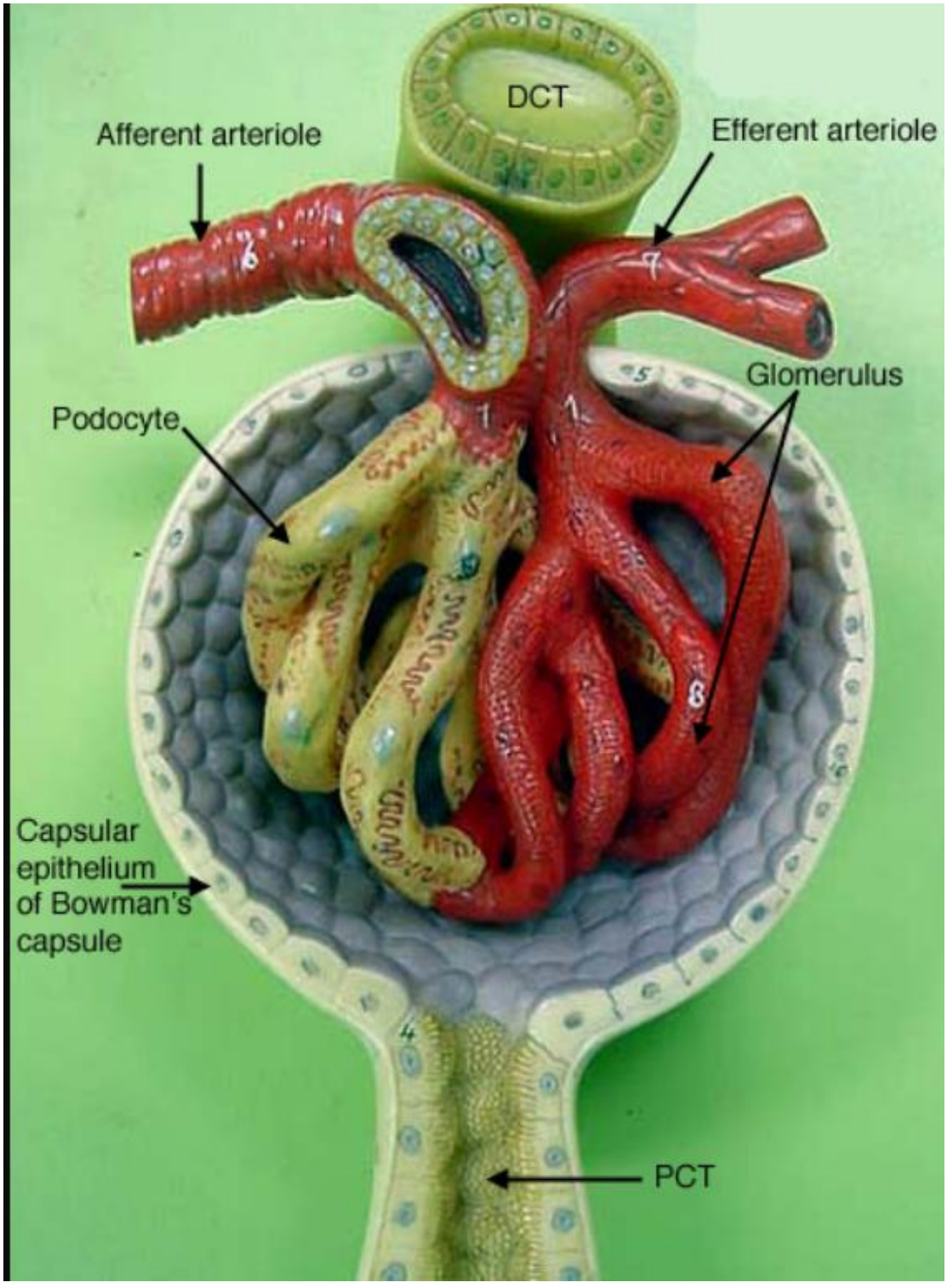
Home Activity 1: Identify renal structures and explain their roles in drug excretion, filtration, and related pharmacotherapeutic considerations. Example below.

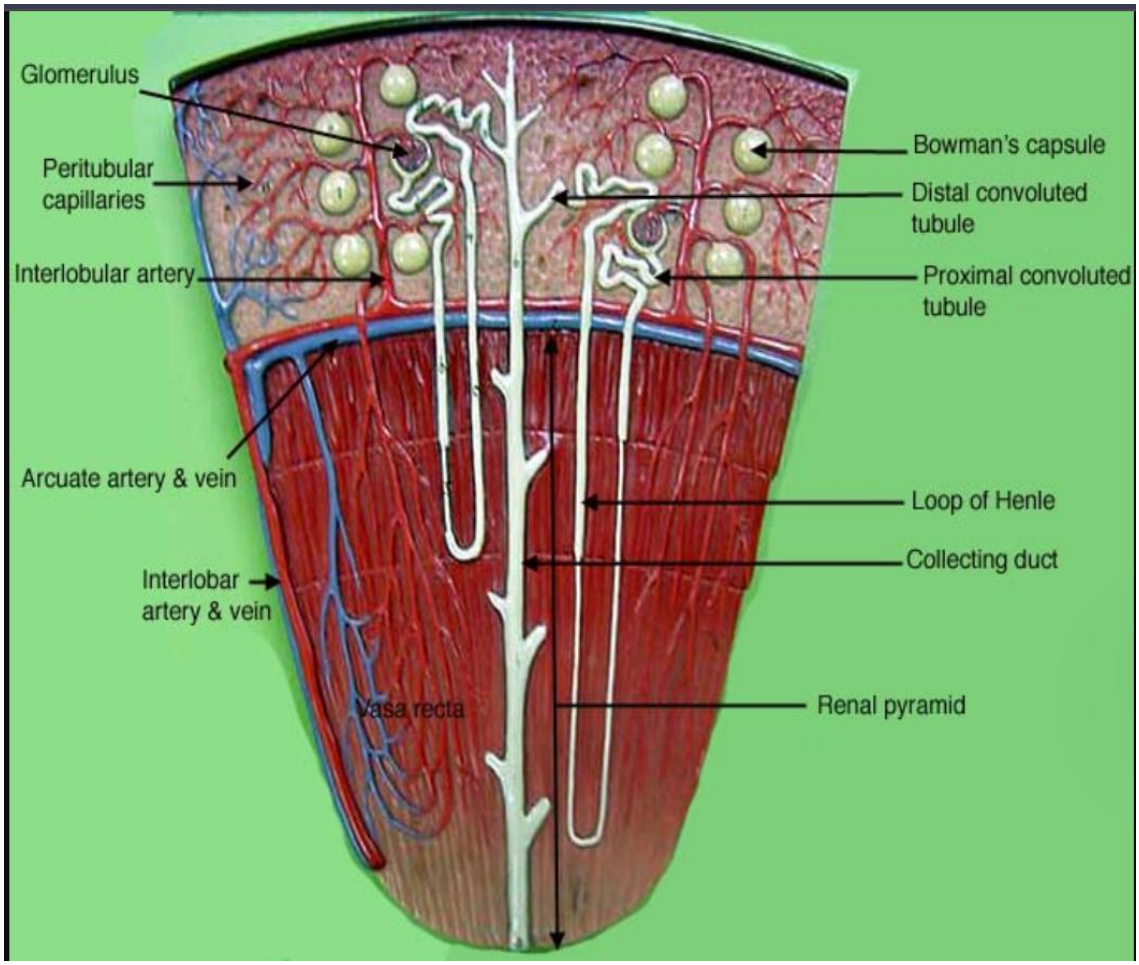
Structure	Pharmacy Relevance
Renal cortex	Contains nephrons where most drug filtration occurs.
Renal medulla	Site of loop diuretic action (e.g., furosemide).
Renal pelvis	Collects urine before ureter transport.
Glomerulus	Filters drugs <20 kDa (e.g., lithium requires monitoring).
Ureter	May develop crystals from sulfa drugs.

Activity 3: Urinary System Model Labeling



Home Activity 2: 3D Models Interaction observe the below models




Glomerulus
Peritubular capillaries
Interlobular artery
Arcuate artery & vein
Interlobar artery & vein
Vasa recta
Bowman's capsule
Distal convoluted tubule
Proximal convoluted tubule
Loop of Henle
Collecting duct
Renal pyramid

Students' Names and Group:	
College: Pharmacy	Date:
Course Name: Human Anatomy	Topic: **THE NERVOUS SYSTEM**
Semester / Year: Semester 2 / Year 1	Practical Session Instructor: Dr. Abeer Abdullah

STATIONS: NERVOUS SYSTEM

Learning Objective:

Identify neuroanatomical structures and observe the nervous in the below models and correlate them with drug targets, neurological disorders, and medication effects.

Activity 1: Multiple Choice Questions

1. **Which part of the nervous system is responsible for voluntary control of body muscles?**
   A) Autonomic nervous system
   B) Somatic nervous system
   C) Central nervous system
   D) Enteric nervous system

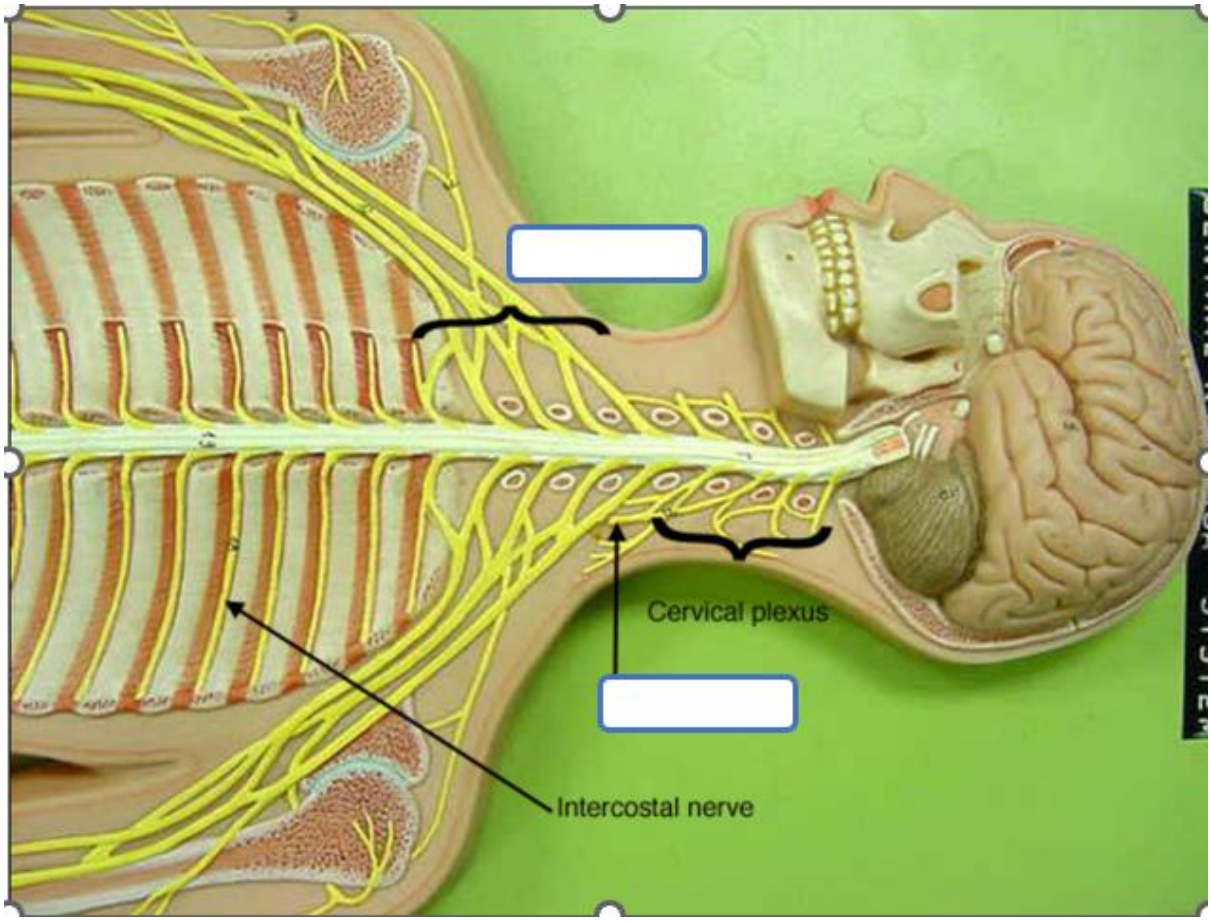
2. **The cerebellum is primarily involved in:**
   A) Sensory processing
   B) Balance and coordination
   C) Speech production
   D) Hormone regulation

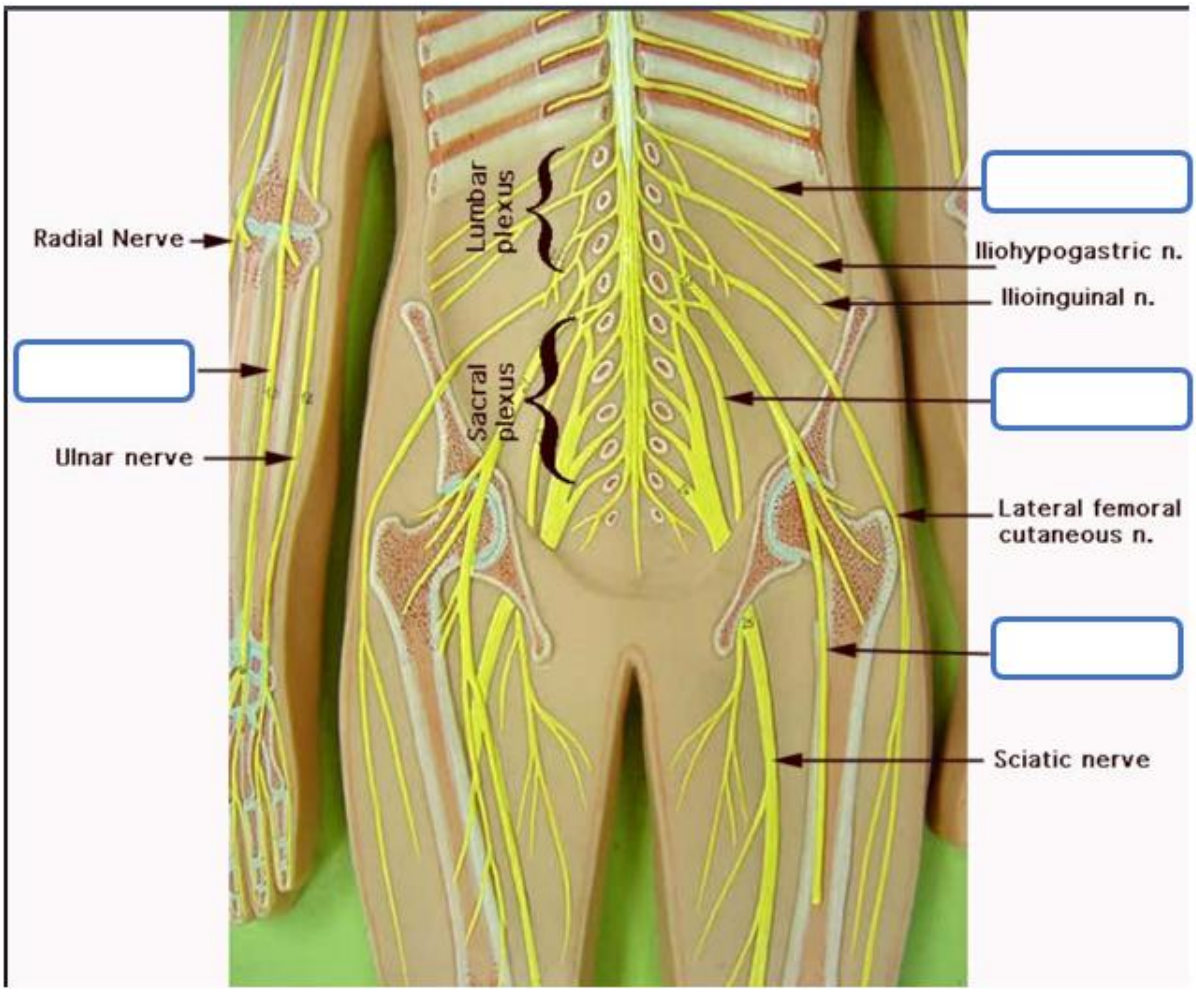
3. **Which cranial nerve is responsible for the sense of smell?**
   A) Olfactory nerve (CN I)
   B) Optic nerve (CN II)
   C) Trigeminal nerve (CN V)
   D) Vagus nerve (CN X)

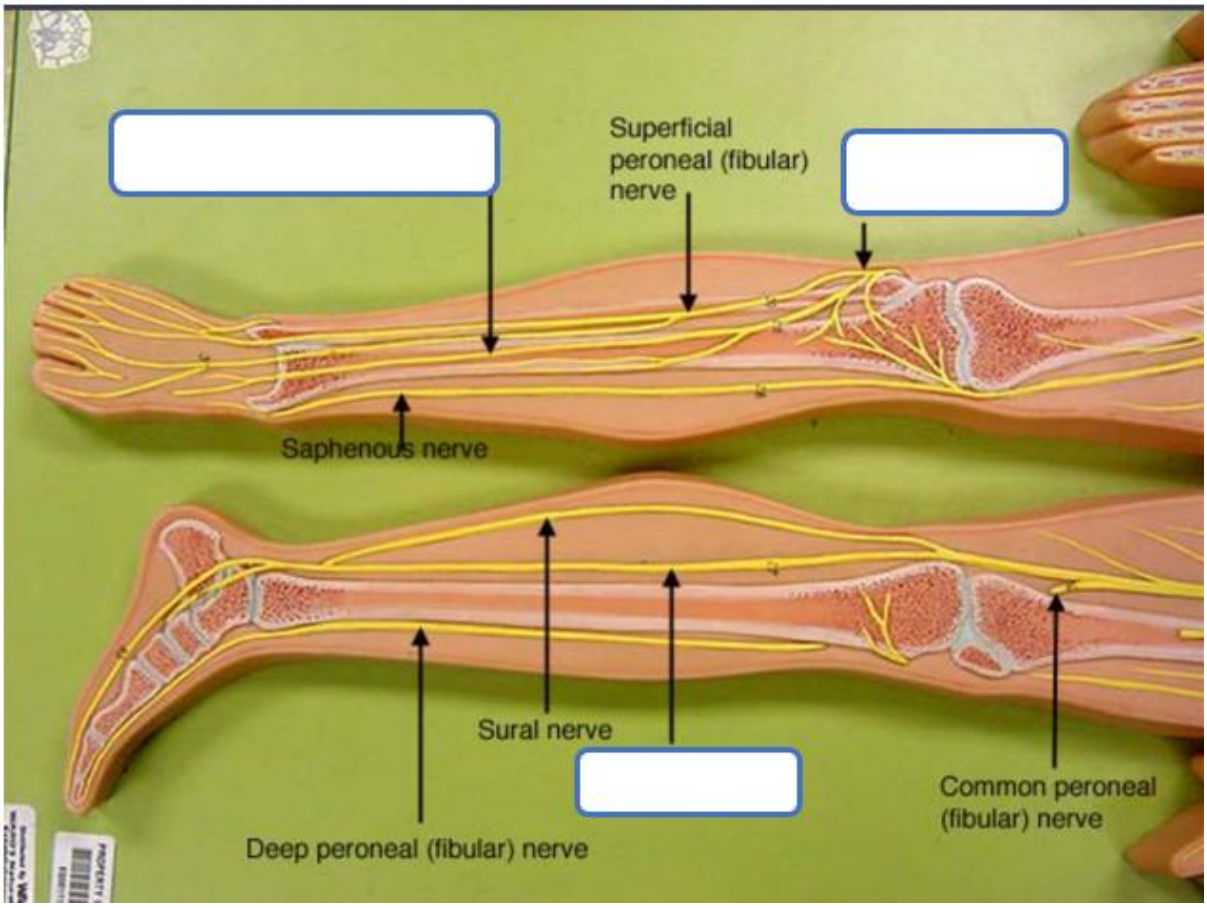
4. **The brain structure that acts as a relay station for sensory and motor signals is called the:**
   A) Hypothalamus
   B) Thalamus
   C) Amygdala
   D) Hippocampus

5. **The peripheral nerves that originate from the spinal cord are called:**
   A) Cranial nerves
   B) Spinal nerves
   C) Autonomic nerves
   D) Vagal nerves

Activity 2: Nervous Anatomy Labeling




Radial Nerve
Ulnar nerve
Lumbar plexus
Sacral plexus
Iliohypogastric n.
Ilioinguinal n.
Lateral femoral cutaneous n.
Sciatic nerve



Home Activity: research about the following topic Neuroanatomy & Pharmacological Applications (Drug Targets). Example below.

Structure	Drug Relevance	Clinical Pearl
Cerebellum	Alcohol impairs function (ataxia)	Monitor gait in benzodiazepine therapy
Thalamus	Relay station for pain signals	Opioids act here to modulate pain
Olfactory bulb (CN I)	Anosmia (loss of smell) from zinc nasal sprays	Caution with intranasal drug delivery
Spinal nerve roots	Site of local anesthetic injections	Epidural anesthesia

END