

## ANATOMY vs PHYSIOLOGY

- **Anatomy** = study of structure (what it is)
- **Physiology** = study of function (what it does)

## LEVELS OF ORGANIZATION (DETAILED)

- 1. Chemical Level**
  - Atoms → molecules (water, proteins, DNA)
- 2. Cellular Level**
  - Smallest living unit capable of independent function
- 3. Tissue Level**
  - Specialized cells performing a common function
- 4. Organ Level**
  - Example: Heart (muscle + connective + nervous tissue)
- 5. System Level**
  - Organs working together
- 6. Organism Level**
  - Entire human body

## CELL STRUCTURE

- **Cell membrane**
  - Semi-permeable
  - Maintains homeostasis
- **Nucleus**
  - Contains DNA
  - Controls replication
- **Mitochondria**
  - Produces ATP (energy)
  - “Powerhouse”
- **Ribosomes**
  - Protein synthesis
- **Endoplasmic Reticulum (ER)**
  - Rough ER → proteins
  - Smooth ER → lipids
- **Golgi Apparatus**
  - Packages and distributes proteins

## TISSUES (FUNCTION + LOCATION)

- 1. Epithelial**
  - Covers surfaces
  - Lines organs
  - Functions: protection, absorption, secretion
- 2. Connective**
  - Most abundant
  - Includes: bone, cartilage, blood, fat
  - Function: support + transport

### 3. Muscle

- **Skeletal** (voluntary)
- **Smooth** (involuntary, organs)
- **Cardiac** (heart only)

### 4. Nervous

- Neurons transmit impulses
- Controls body communication

## ORGAN SYSTEMS

### Integumentary System

- **Epidermis** (outer layer)
- **Dermis** (blood vessels, nerves)
- Functions:
  - Protection
  - Temperature regulation
  - Sensation

### Muscular System

- Produces movement
- Maintains posture
- Generates heat

### Nervous System

- **CNS:** brain + spinal cord
- **PNS:** nerves outside CNS
- Controls:
  - Reflexes
  - Voluntary movement
  - Consciousness

### Endocrine System

- Hormone-producing glands:
  - Pituitary (master gland)
  - Thyroid (metabolism)
  - Adrenal (stress response)
- Slow but long-lasting effects

### Circulatory System

- Heart pumps blood
- Arteries = away from heart
- Veins = toward heart
- Capillaries = exchange

### Lymphatic System

- Returns fluid to bloodstream
- Fights infection
- Contains lymph nodes

## **Respiratory System**

- Airway → lungs → alveoli
- Gas exchange:
  - O<sub>2</sub> in
  - CO<sub>2</sub> out

## **Digestive System**

- Mechanical + chemical breakdown
- Absorption in small intestine

## **Urinary System**

- Kidneys filter blood → urine
- Maintains fluid/electrolyte balance

## **Reproductive System**

- Produces gametes
- Hormonal regulation

## **SKELETAL SYSTEM**

- Support
- Protection (brain, lungs)
- Movement (with muscles)
- Hematopoiesis (blood cell production)
- Mineral storage (calcium)

## **BONE STRUCTURE**

- **Diaphysis** – shaft
- **Epiphysis** – ends
- **Periosteum** – outer covering (vascular, pain-sensitive)
- **Endosteum** – inner lining
- **Medullary cavity** – marrow

## **BONE TISSUE TYPES**

- **Compact bone** → dense, strong
- **Spongy bone** → trabecular, lightweight

## **BONE MARKINGS**

### **Projections (attachment points)**

- **Tuberosity** – large, rough
- **Trochanter** – femur only
- **Crest** – ridge
- **Spine** – sharp projection

### **Depressions/Openings**

- **Foramen** – hole for nerves/vessels
- **Fossa** – shallow depression
- **Meatus** – canal

## JOINTS & MOVEMENT

### JOINT TYPES

#### Fibrous

- No movement
- Example: skull sutures

#### Cartilaginous

- Limited movement
- Example: spine discs

#### Synovial (MOST IMPORTANT)

- Freely movable
- Contains:
  - Synovial fluid
  - Joint capsule
  - Articular cartilage

## RADIOGRAPHIC POSITIONING

### BODY POSITIONS

- **Supine** – lying on back
- **Prone** – lying face down
- **Erect** – vertical
- **Recumbent** – lying (any)
- **Fowler's** – semi-sitting

**Position = patient position**

**Projection = beam path**

### PROJECTIONS

- **AP** → anterior to posterior
- **PA** → posterior to anterior
- **Lateral** → side
- **Oblique** → angled
- **Axial** → angled CR

## RADIOGRAPHIC PROCEDURE

### Room Preparation

- Warm room
- Equipment ready
- Correct IR loaded
- Check cleanliness

## **Patient Interaction**

- Verify identity (name + DOB)
- Explain procedure clearly
- Gain consent
- Check pregnancy

## **Image Receptor Selection**

- Correct size:
  - Extremities → small IR
  - Chest → large IR
- Orientation:
  - Portrait vs landscape

## **Exposure Factors**

### **kVp**

- Controls **penetration**
- High kVp = lower contrast

### **mAs**

- Controls **density**
- High mAs = darker image

## **Positioning the Patient**

- Align body part
- Use sponges if needed
- Ensure no rotation

## **Alignment (CR–Part–IR)**

- **CR** centered to anatomy
- **Part** centered to IR
- **IR** aligned properly

Misalignment = distortion

## **Collimation**

- Restrict beam to area of interest
- Reduces scatter → improves contrast

## **Marker Placement**

- Must be:
  - Correct side (R/L)
  - Visible
  - Not covering anatomy

## **Patient Instructions**

- “Don’t move”
- “Hold your breath”
- Clear, simple commands

## **Exposure**

- Final check:
  - Position
  - Marker
  - Collimation
- Make exposure

## OBESE PATIENT IMAGING

- Increase **kVp + mAs**
- Use grid (reduce scatter)
- Landmarks harder → rely on anatomy knowledge
- Increase exposure time carefully

## PATHOLOGY (DETAILED)

### DEFINITIONS

- **Pathology** = study of disease
- **Etiology** = cause of disease
- **Signs** = observable
- **Symptoms** = subjective

### STRUCTURAL vs FUNCTIONAL

- **Structural**
  - Physical change
  - Example: fracture, tumor
- **Functional**
  - Organ not working
  - No visible change

### HEREDITARY vs CONGENITAL

- **Hereditary**
  - Genetic (DNA)
  - Passed from parents
- **Congenital**
  - Present at birth
  - Not always genetic

### ACUTE vs CHRONIC

- **Acute**
  - Sudden onset
  - Short duration
  - Severe symptoms
- **Chronic**
  - Long-term
  - Slow progression

### DISEASE CLASSIFICATION

- **Infectious** → bacteria, virus
- **Inflammatory** → swelling
- **Degenerative** → breakdown (arthritis)
- **Neoplastic** → tumors (benign/malignant)
- **Metabolic** → abnormal chemical processes

## FRACTURES

### TYPES

- **Closed (simple)** – skin intact
- **Open (compound)** – skin broken

### PATTERN-BASED

- **Transverse** – straight line
- **Oblique** – diagonal
- **Spiral** – twisting

### SPECIAL TYPES

- **Comminuted** – multiple fragments
- **Greenstick** – incomplete (kids)
- **Impacted** – bones driven together
- **Compression** – vertebra collapse
- **Depressed** – bone pushed inward (skull)

## EXTREMITIES

### What are Extremities?

- **Upper Extremities:** shoulder → fingers
- **Lower Extremities:** hip → toes

### Purpose:

- Movement
- Weight-bearing (lower)
- Manipulation (upper)

## UPPER EXTREMITY ANATOMY

### \*Shoulder Girdle

- **Clavicle**
- **Scapula**

### Scapula Landmarks

- Acromion
- Coracoid process
- Glenoid cavity

### \*Arm

- **Humerus**

### Key Landmarks

- Greater tubercle
- Lesser tubercle
- Epicondyles

### **\*Elbow Joint**

- Humerus + Radius + Ulna

#### **Structures**

- Olecranon process (ulna)
- Radial head
- Trochlea

### **\*Forearm**

- **Radius (lateral/thumb side)**
- **Ulna (medial/pinky side)**

### **\*Wrist & Hand**

- **Carpals (8 bones)**
- **Metacarpals (5)**
- **Phalanges (14)**

## **LOWER EXTREMITY ANATOMY**

### **\*Pelvic Girdle**

- Ilium
- Ischium
- Pubis

### **\*Thigh**

- **Femur**

#### **Landmarks**

- Greater trochanter
- Lesser trochanter

### **\*Knee Joint**

- Femur + Tibia + Patella

#### **Structures**

- Patella (kneecap)
- Tibial plateau

### **\*Lower Leg**

- **Tibia (medial, weight-bearing)**
- **Fibula (lateral)**

### **\*Ankle & Foot**

- **Tarsals (7)**
- **Metatarsals (5)**
- **Phalanges (14)**

### **Positioning Terms**

- **AP (Anteroposterior):** front → back
- **PA (Posteroanterior):** back → front
- **Lateral:** side view
- **Oblique:** angled (usually 45°)

## **Movement Terms**

- **Flexion:** bending
- **Extension:** straightening
- **Abduction:** away from midline
- **Adduction:** toward midline
- **Rotation:** turning
- **Supination:** palm up
- **Pronation:** palm down
- **Dorsiflexion:** foot upward
- **Plantar flexion:** foot downward

## **Position Accuracy Terms**

- **True AP:** no rotation
- **True lateral:** structures superimposed
- **Oblique:** rotated position

## **RADIOGRAPHIC POSITIONING – UPPER EXTREMITY**

### **Fingers**

#### **AP**

- Hand flat, fingers extended
- CR: PIP joint

#### **Oblique (45°)**

- Shows joint spaces better

#### **Lateral**

- Finger isolated

### **Hand**

#### **PA (preferred)**

- Palm down
- CR: 3rd MCP

#### **Oblique (45°)**

- Demonstrates metacarpals

#### **Lateral (fan or extension)**

- Fingers separated

### **Wrist**

#### **PA**

- CR: midcarpal area

#### **Oblique**

- Shows trapezium/trapezoid

#### **Lateral**

- Radius & ulna superimposed

## **Forearm**

### **AP**

- Includes wrist & elbow

### **Lateral**

- Elbow flexed 90°

## **Elbow**

### **AP**

- Arm extended

### **Lateral**

- 90° flexion

### **Obliques**

- Internal/external rotation

## **Humerus**

### **AP**

- External rotation shows greater tubercle

### **Lateral**

- Elbow flexed

## **Shoulder**

### **AP**

- External rotation (greater tubercle)
- Internal rotation (lesser tubercle)

### **Scapular Y (lateral)**

- Trauma view

## **RADIOGRAPHIC POSITIONING – LOWER EXTREMITY**

## **Toes**

### **AP**

- CR: MTP joint

### **Oblique**

- 30–45° rotation

## **Foot**

### **AP (dorsoplantar)**

- CR: base of 3rd metatarsal

### **Oblique**

- 30° medial rotation

### **Lateral**

- Foot in true lateral

## **Calcaneus**

### **Axial (plantodorsal)**

- Shows calcaneus clearly

## **Ankle**

### **AP**

- No rotation

### **Mortise View**

- 15–20° internal rotation

### **Lateral**

- True lateral

## **Lower Leg (Tibia/Fibula)**

### **AP**

- Includes knee & ankle

### **Lateral**

- Knee slightly flexed

## **Knee**

### **AP**

- CR: ½ inch below patella

### **Lateral**

- 20–30° flexion

### **Sunrise (patella)**

- Patellofemoral joint

## **Femur**

### **AP**

- Includes hip & knee

### **Lateral**

- Requires careful positioning

## **ALIGNMENT PRINCIPLES**

### **CR (Central Ray)**

- Perpendicular unless angled
- Directed to area of interest

### **IR (Image Receptor)**

- Proper size
- Correct orientation

### **Body Part**

- No rotation unless required
- Centered to IR

**Golden Rule:**

CR + IR + Body Part MUST be aligned

**COLLIMATION & MARKERS****Collimation**

- Limits radiation field
- Improves contrast
- Reduces dose

**Markers**

- RIGHT/LEFT
- Must be placed BEFORE exposure
- Never added digitally

**COMMON EXTREMITY PATHOLOGY****Fractures**

- Transverse
- Oblique
- Spiral
- Comminuted
- Greenstick

**Joint Conditions**

- Dislocation
- Subluxation

**Bone Diseases**

- Osteoporosis
- Osteomyelitis
- Arthritis

**SPECIAL CONSIDERATIONS****Trauma Patients**

- Do NOT move injured limb unnecessarily
- Cross-table lateral if needed

**Pediatric Patients**

- Growth plates (epiphyseal plates)
- Higher risk of greenstick fractures

**Obese Patients**

- Increase technique (kVp/mAs)
- Landmarks harder to palpate

- **Mortise view = ankle joint space open**
- **True lateral = superimposition**
- **Oblique = demonstrates structures not seen in AP**
- **Include joint above and below for long bones**
- **Rotation errors = most common mistake**
- **Hand = PA, not AP (frequently tested)**

1. The study of the structure of body parts is known as:

- A. Physiology
- B. Pathology
- C. Anatomy
- D. Histology

2. The function of the heart pumping blood throughout the body is an example of:

- A. Anatomy
- B. Physiology
- C. Morphology
- D. Etiology

3. Which of the following is an example of anatomy?

- A. Oxygen exchange in alveoli
- B. Muscle contraction
- C. Structure of the femur
- D. Hormone secretion

4. Which of the following represents physiology?

- A. Shape of the lungs
- B. Layers of the skin
- C. Blood circulation
- D. Bone markings

5. The chemical level of organization includes:

- A. Organs
- B. Tissues
- C. Molecules
- D. Systems

6. The smallest unit capable of independent life is the:

- A. Atom
- B. Tissue
- C. Cell
- D. Organ

7. A group of similar cells performing a common function is called:

- A. Organ
- B. Tissue
- C. System
- D. Organism

8. The heart is classified as which level of organization?

- A. Tissue
- B. Organ
- C. System
- D. Cellular

9. The integumentary system protecting the body from infection is an example of:

- A. Anatomy
- B. Physiology
- C. Pathology
- D. Etiology

10. The epidermis and dermis are examples of:

- A. Physiology
- B. Function
- C. Structure
- D. Metabolism

11. The cell membrane's role in regulating substances entering and leaving the cell is:

- A. Anatomy
- B. Physiology
- C. Histology
- D. Morphology

12. The nucleus containing DNA is an example of:

- A. Function
- B. Physiology
- C. Structure
- D. Process

13. ATP production by mitochondria represents:

- A. Anatomy
- B. Physiology
- C. Pathology
- D. Morphology

**14.** Ribosomes are responsible for:

- A. Lipid storage
- B. Protein synthesis
- C. DNA replication
- D. Oxygen transport

**15.** Which tissue type is primarily responsible for communication within the body?

- A. Muscle
- B. Epithelial
- C. Nervous
- D. Connective

**16.** Bone providing support to the body is an example of:

- A. Anatomy only
- B. Physiology only
- C. Both anatomy and physiology
- D. Neither

**17.** Which organ system is responsible for long-term regulation through hormones?

- A. Nervous
- B. Circulatory
- C. Endocrine
- D. Respiratory

**18.** The structure of arteries carrying blood away from the heart is classified as:

- A. Physiology
- B. Anatomy
- C. Function
- D. Process

**19.** The movement of oxygen into the bloodstream in the lungs is:

- A. Anatomy
- B. Physiology
- C. Structure
- D. Morphology

**20.** The diaphysis of a long bone refers to:

- A. Function
- B. Shaft structure
- C. Bone marrow activity
- D. Growth process

- 21.** Hematopoiesis (blood cell production) is an example of:
- A. Anatomy
  - B. Physiology
  - C. Structure
  - D. Location
- 22.** The periosteum is best described as:
- A. A bone function
  - B. Outer bone covering
  - C. Bone marrow
  - D. Joint space
- 23.** A foramen in a bone is an example of:
- A. Function
  - B. Movement
  - C. Structure
  - D. Process
- 24.** Flexion and extension are examples of:
- A. Anatomy
  - B. Physiology
  - C. Structure
  - D. Tissue
- 25.** Synovial fluid allowing smooth joint movement represents:
- A. Anatomy
  - B. Physiology
  - C. Morphology
  - D. Histology
- 26.** The arrangement of carpals in the wrist is classified as:
- A. Physiology
  - B. Anatomy
  - C. Function
  - D. Process
- 27.** The kidneys filtering blood to form urine is an example of:
- A. Anatomy
  - B. Physiology
  - C. Structure
  - D. Location

**28.** The presence of alveoli in the lungs is:

- A. Physiology
- B. Function
- C. Anatomy
- D. Process

**29.** Muscle contraction producing movement is classified as:

- A. Anatomy
- B. Physiology
- C. Structure
- D. Location

**30.** Which statement correctly differentiates anatomy and physiology?

- A. Anatomy studies function; physiology studies structure
- B. Anatomy studies structure; physiology studies function
- C. Both study structure only
- D. Both study function only