

# Unit 1

## LECTURES 1 and 2

### Anatomy

Derivation of the word:

Ana = “apart”

Temmein = “to cut”

Thus, anatomy = “to cut apart”

The study of anatomy is the study of the STRUCTURE of the human body. AND Structure Matches Function!

### Definitions

Physiology - study of the function of the body

Gross Anatomy - involves structures one can see with the naked eye

Histology-the study of microscopic structures

Embryology – the study of development from conception to birth

Two approaches to the study of anatomy

1. Regional approach (used in medical schools)  
Study structures of a particular region of the body at a time (I.e. head, neck, arm, thorax, etc.)
2. Systemic approach (used at undergraduate level)  
Study one entire body system at a time (I.e. cardiovascular, muscular, etc.)

### Anatomic Terminology

Terms refers to the body when it is in **the anatomical position**.

Directional Terms

Regional Terms

Sections, planes, and views

Abdominopelvic Quadrants

Abdominopelvic Regions

#### Directional Terms (Table 1.2, Fig.1.6 )

Anterior (ventral) - the front

Posterior (dorsal) - the back

Cranial (cephalic) - the head end

Caudal - the tail end

Superior - towards the top

Inferior - towards the bottom

Medial - towards the midline

Lateral - away from the midline

Superficial - towards the surface

Deep - beneath the surface

Proximal - closer to the attachment point of a limb

Distal - Further from the attachment point of a limb

## Regional Terms (Table 1.3, Fig. 1.7)

Cephalic – head                      Cervical – neck                      Thoracic  
Abdominal                              Pelvic                                      Lumbar  
Dorsum of foot/ Plantar surface of foot  
Carpal/ brachial/ buccal, etc—know table 1.3, Fig. 1.7

## Body Planes and Sections (Fig. 1.4)

Longitudinal Section  
    Frontal (coronal) plane  
        Anterior or posterior view  
    Sagittal plane -- midsagittal or parasagittal  
        Lateral or medial view  
Transverse Section  
    Horizontal plane  
        Superior or inferior view  
Oblique Section

## Abdominopelvic Quadrants (Fig. 1.10)

Most often used clinically  
4 Quadrants  
Right upper, Right lower, Left upper, Left lower

## Abdominopelvic Regions (Fig. 1.10)

More specific  
9 Regions  
U – umbilical  
EG – epigastric  
HG - hypogastric  
RH and LH - right. hypochondriac and left. hypochondriac  
RI and LI - right iliac and left iliac  
RL and LL -right lumbar and left lumbar

By the end of the term, you will know what region and/or quadrant each major organ in the cavity is found.

Example: stomach: Epigastric region or Right and left upper quadrants

## Body Cavities (Fig. 1.8, 1.9)

Posterior Cavities  
    Cranial, vertebral canal  
Ventral Cavities  
    Thoracic- pericardial, pleural, mediastinum  
    Abdominopelvic  
    Lined with Serous membranes  
        Parietal  
        Visceral

## LECTURES 3 and 4 Histology—The study of microscopic tissues

### Four Basic Tissue Types (Table 4.1)

Epithelial	Body coverings and linings;	ectoderm, endoderm, and mesoderm
Connective	Supporting tissues and blood;	mesoderm
Muscular	Contractive and excitable;	mesoderm
Nervous	Excitable;	ectoderm

## Epithelial Tissues

### Cellular Junctions (Fig. 4.1)

1. Tight Junctions
2. Desmosomes (anchoring junctions)
3. Gap (communicating) junctions

### Characteristics

1. Cellular  
mostly cells, little extracellular material
2. Polarity  
Apical (“top”) and Basal (“bottom”) surfaces
3. Basement Membrane  
thin extracellular membrane on basal surface which binds epithelia to underlying tissues

### Classification of Epithelia

1. Number of Layers  
Simple - one layer thick  
Stratified - more than one layer thick  
Pseudostratified - appear to be many layers thick, but really are only one layer thick. All cells touch the basal surface, but not all cells reach the apical surface
2. Cell Shape  
Squamous - flattened cells  
Cuboidal - as tall as they are wide  
Columnar - taller than they are wide  
Transitional - change shape between cuboidal and squamous
3. Surface Modifications  
Cilia - motile “hairs” on the apical surface of cells  
actively move to propel substances across an epithelial sheet  
  
Microvilli - fingerlike projections of the plasma membrane of the apical surface of a cell  
increase the surface area of the cell for absorption  
Keratinization - provides waterproofing and protection

The protein keratin is produced by epithelial cells in thick skin

Goblet Cells - Shaped like water goblets (think wine glass)  
secrete mucus

Recognize examples, know functions and locations of all epithelial types in Tables 4.3-4.5

### **Naming Conventions**

Named in the following order:

1. number of layers
2. cell shape (of cells on the apical surface)
3. “with” surface modifications

Example

pseudostratified columnar epithelium with cilia and goblet cells  
(otherwise known as “respiratory” epithelium)

### **Special Epithelial Terms**

Transitional - found only in the urinary system

Cutaneous Membrane=skin=epidermis + dermis

Mucous Membranes—line every hollow organ (Fig. 26.9 and 26.13a)  
Epithelium (sitting on the basal lamina) + CT (called lamina propria)

Serous Membranes- Line the body cavities, blood vessels, and heart;  
Cover the visceral organs,

Epithelium (sitting on the basal lamina) + a thin layer of areolar CT

Endothelium - simple squamous epithelium

found lining the inside of all blood vessels and the heart.

Mesothelium - simple squamous epithelium

found lining body cavities (Parietal) and covering visceral organs (visceral)

# LECTURE 5

# Integument

## Functions

Protection against UV light, abrasion, dehydration and pathogens

Thermoregulation - BV's, adipose, etc.

Sensation - touch receptors

Metabolism - fat cells, vitamin D synthesis

## Skin Coloration

Carotene - yellowish

in subcutaneous fat and stratum corneum

Hemoglobin - reddish

concentration in blood and degree of oxygenation (cyanosis)

hematoma—black, green, yellow

Melanin - brownish

concentration determines skin color

produced by melanocytes and transferred to keratinocytes

## Skin Layers

Epidermis

Stratified squamous keratinized epithelium

Primary cell type is the keratinocyte (epithelial cell which produces keratin)

Dermis

Contains BV's, sensory receptors, etc.

Hypodermis

not technically part of the skin, but discussed here

## Epidermis

### Epidermal Layers

Deepest (Innermost) layer (Stratum Basale)

Contains new cells undergoing mitosis which then move up towards the surface.

Contains melanocytes which produce brown/black pigment.

Contains Merkel cells

Middle Layers

2<sup>nd</sup> and 3<sup>rd</sup> layers

Cells in process of growth and early keratin synthesis

Contain Langerhans cells

4<sup>th</sup> Layer

Only present in very thick skin

5<sup>th</sup> Layer—Superficial Layer (Stratum Corneum)

Consists of dead cells composed mostly of keratin

## Special Epidermal Cell Types

### Langerhans Cells

Are macrophages (derived from monocytes in the blood)

### Merkel Cells

Associated with a Merkel disc (nerve ending)

Sensory receptors for touch

Found at the dermal-epidermal junction

## Epidermis + Dermis = Cutaneous Membrane

### Epidermal Ridges

Found above the dermal ridges and anchored by the dermal papillae

Cause increased adhesion between dermis and epidermis and thus are more prominent in skin where there is a lot of friction (I.e. fingers)

### Dermis-the “hide”

Consists of CT, BV's and sensory organs

Fibroblasts, macrophages, mast cells, WBCs

Consists of 2 layers:

Papillary layer-areolar CT

Reticular layer – dense irregular CT

Cleavage lines—bundles of collagen

Elastic fibers—allow recoil

Striae—tears in the collagen

Flexure lines—from use

### Papillary Layer – Areolar connective tissue

Where dermal papillae are found

Dermal and Epidermal ridges form finger prints and toe ridges

Contain Meissner's corpuscles

Sensory receptors for fine touch

### Reticular Layer Dense irregular connective tissue

Named for reticulated (network-like) appearance, NOT for the presence of reticular fibers. Dense irregular connective tissue

Hair follicles    Sweat Glands    Sebaceous glands    Pacinian corpuscles

#### **Hair Follicles**

Hair is modified epithelium

Shape of follicle determines hair characteristics

### **Sweat Glands**

Coiled tubular glands

Merocrine (Eccrine) - open to surface, most numerous

Apocrine - open to hair follicle,

axillary, areolar, anal, pubic regions

odor causing

### **Sebaceous glands**

Secrete Sebum (oily)

Holocrine Glands - discharge whole cells into the tubes of the gland

### **Pacinian Corpuscles**

Look like onions (several layers of cells wrapped around a nerve ending)

Sensory receptors for deep pressure

### **Hypodermis**-not part of skin

Consists of fascia and various amounts of subcutaneous adipose tissue

Also may contain Pacinian corpuscles

### **Skin Disorders**

#### **Burns**

1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> degree

Rule of 9's

#### **Cancer**

Basal cell carcinoma

Squamous cell carcinoma

Melanoma

ABCDE rule

## LECTURE 6

### Connective Tissues

CT proper Cartilage Bone Blood

### General CT Functions

Bind together, support, and strengthen other tissues (i.e. bone and cartilage)  
Protect and insulate internal organs  
Compartmentalize structures (i.e. muscle)  
Transport substances (i.e. blood)  
Store energy reserves (i.e. adipose)

### Characteristics of CT

Composed of cells separated by an extracellular matrix (ECM)

ECM consists of:

Ground substance

Fibers—collagen, elastic, reticular

ECM has various characteristics

Hard (bone), gel-like (cartilage), or liquid (blood)

Connective tissue proper and Bone have a rich blood supply

Cartilage is avascular

### CT cells

Derived from mesenchyme (embryonic tissue)

Immature cells

End in -blast (i.e. osteoblast)

Retain the capacity for cell division

Major role is to secrete the matrix

Mature cells

End in 'cyte (i.e. osteocyte)

Major role is maintaining the matrix

### Fibers of Connective Tissues

Collagen Fibers

Secreted by cells called fibroblasts

Very good at resisting tensile forces (stretch)

Collagen fibers are the most abundant type of CT fiber in the body.

Elastic Fibers

Secreted by cells called fibroblasts

Extensible fibers which can be stretched and will recoil back to original shape (within reason)

Reticular Fibers

Made of a fine, thin variety of collagen.

Compose the inner supporting framework for organs such as spleen, liver and lymph nodes

## Classification of Connective Tissues

CT Proper

Loose CT

Areolar

Adipose

Reticular

Dense CT

Dense regular

Dense regular elastic

Dense irregular

Cartilage

Bone

Blood

## Connective Tissue Proper

The “glue” which holds the body together and “stuffing” which takes up space.

**Loose CT** - Has a loose arrangement of fibers and cells

### 1. Areolar CT

Predominant cell type is the fibroblast

Predominant fibers are collagen and elastic

Location:

in the lamina propria under mucous membranes

reticular layer of dermis

surrounds and protects organs

Immune Cells found in areolar CT:

Mast cells - large, dark staining cells

Secrete histamine, heparin and serotonin

Histamine - makes capillaries “leaky” which leads to swelling (edema).

Heparin - prevents coagulation of blood

Serotonin – regulates smooth muscle contraction

Macrophages - (“big eater”)

Derived from blood cells called monocytes

Function in phagocytosis (engulfing dead tissue or foreign substances, etc.)

Plasma Cells

Derived from blood cells called B-lymphocytes

Secrete antibodies (substances which fight infection)

### 2. Adipose

Predominant cell type is the adipocyte (fat cell)

Loose arrangement of collagen fibers hold the adipocytes together.

Some Functions: Insulation, Protection, Energy storage

Location: hypodermis, abdominal mesenteries, surrounding some organs, yellow bone marrow

### 3. Reticular CT

Cells: fibroblasts

Fibers: reticular

Function: Compose the inner supporting framework for organs such as spleen, liver, bone marrow, and lymph nodes

**Dense CT** - Fibers and cells are packed tightly together with little space in between them

#### 1. Dense regular

Fibroblasts located between parallel bundles of collagen fibers

Forms tendons and ligaments

Tendon - muscle to bone

Ligament - bone to bone

#### 2. Dense Regular Elastic CT

Contains both collagen and elastic fibers

Found in large arteries close to the heart (I.e. aorta) which must stretch to receive blood from the heart.

#### 3. Dense irregular

Fibroblasts located between bundles of collagen fibers which run in more than one direction

Forms organ capsules (outer coverings)

Also forms periosteum (around bone)

Found in the dermis of the skin.

## LECTURE 7

### Cartilage

#### Properties of Cartilage

Avascular - Thus, slow to grow, repair

Cells - Chondroblasts - secrete matrix

Chondrocytes - maintain matrix

Usually one or two chondrocytes sit in each lacuna ("little lake")

ECM

Ground Substance - consists of glycoproteins which make it semi-rigid

Fibers - the type and arrangement of fibers determines the type of cartilage.

Perichondrium - The outer covering of cartilage made of Dense irregular CT

Outer layer - Consists of fibroblasts and collagen fibers.

Inner layer - Consists of chondroblasts, which secrete fibers and ground substance.

## **Types of Cartilage**

### 1. Hyaline Cartilage

Most common type

Contains diffuse collagen fibers in ECM

Glossy appearance

Somewhat brittle

Locations: nasal septum, tracheal rings, articular surfaces of bone

### 2. Fibrocartilage

ECM contains collagen fibers which are arranged into bundles.

Thus, chondrocytes appear lined up in rows.

Good at resisting compressive forces

Locations: Pubic symphysis, Intervertebral discs, Menisci

### 3. Elastic Cartilage

Contains elastic fibers in ECM

Flexible and pliable

Locations: Eustachian tube, External ear, Epiglottis, External auditory canal

Notice all the “E”s as a memory device.

## **LECTURE 8**

### **Bone Tissue—A specialized connective tissue**

#### **A. Cells**

Osteoblasts

Form new bone matrix

Osteocytes

Located within lacunae, maintain matrix

Osteoclasts

Macrophages of bone

Function to breakdown bony matrix

Are NOT derived from osteoblasts/cytes, but ARE derived from monocytes.

#### **B. Extracellular Matrix (ECM)**

Ground substance

Made up of mineral salts (hydroxyapatite - contains Calcium and Phosphate ) which gives bone its rigidity

Unlike cartilage, the ground substance of bone does not allow substances to diffuse through it.

Thus, bone is highly vascularized and has an intimate internal network for moving nutrients around

Fibers

Abundance of collagen fibers

These give bone its flexibility

## **Parts of a Long Bone**

### **Epiphysis**

The ends of the bone

### **Diaphysis**

The shaft of the bone

### **Metaphysis**

Where the shaft meets the ends (growth plates/lines located here)

Compact bone/spongy bone

Bone marrow

Periosteum/endosteum

## **Two Types of Bone Tissue**

### **Compact Bone**

Found on the outside of the bone; thickest in the diaphysis

Structural and functional unit is the OSTEON (Haversian System)

No spaces in the matrix

### **Spongy (Trabecular, Cancellous) Bone**

Found inside the bone

Particularly in the epiphyses of the bone

Small trabeculae of matrix separated by marrow spaces

## **Compact Bone--Haversian System (Osteon)**

A Column of bone that consists of concentric rings of bony matrix (lamellae) surrounding a central canal (Haversian canal)

Inside the canal are blood vessels, nerves and lymphatic vessels.

Along the lamellae are lacunae

Each lacuna contains an osteocyte

Osteocytes communicate with each other via small canals called canaliculi.

Three types of lamellae: circumferential, interstitial, and concentric

### **Canaliculi**

Contain cytoplasmic extensions of osteocytes

Osteocytes communicate with each other via gap junctions

### **Volkman's Canals**

“perforating” canals

Contain BV's that are traveling from periosteum into the Haversian canals

## **Spongy Bone**

**Similar to compact bone in that it contains:**

Lacunae, Lamellae, Canaliculi, Osteocytes

**However, it DOES NOT contain Haversian canals**

This is because each trabecula of spongy bone is thin enough that nutrient supply on the outside works fine.

The nutrients are only passed through two or three lamellae

- Spaces within contain red bone marrow

- Involved in hematopoiesis (blood cell formation)

- Non hematopoietic marrow spaces are filled with adipose tissue and are called yellow marrow

## **Bone Marrow**

### **Fetal Bone**

In the fetus, most marrow spaces are hematopoietic

### **Adult Bone**

In adult, hematopoietic tissue is limited to the proximal ends of the humerus and femur, the sternum and the iliac crest

## **Periosteum**

**The outer covering of bone consisting of two layers**

Outer Layer

- Dense irregular CT

- “ties in” with tendons and ligaments

- Sharpey’s fibers – Collagen fibers that perforate the bone to tie the periosteum to the bone, particularly in areas of high stress.

Inner Layer

- Contains osteoprogenitor cells—become osteoblasts and grow new bone.

## **Endosteum**

**The inner covering of bone**

Made up of an incomplete layer of cells

- Osteoprogenitor (OPG) cells

- important in the process of bone remodeling

Lines all structures inside the bone

- Includes all trabeculae of spongy bone

- Includes the inside of Haversian canals

## **Bone Formation (Ossification)**

**Occurs as bony tissue replaces other types of CT      Two types**

Intramembranous    Skull bones, clavicle and mandible form this way

- Fibrous CT membranes replaced w/bone

Endochondral    All other bones form this way

- Hyaline cartilage bone models replaced by bone

## **Intramembraneous Ossification**

Ossification centers form in the mesenchyme

- Calcification occurs

- Woven bone and periosteum form

- Blood vessels grow in

- Lamellar bone replaces woven bone—both compact and spongy

Skull, Clavicle, Mandible

## **Endochondral Ossification**

### **Primary Ossification Center**

Start with a bone model made of hyaline cartilage

Bone Collar forms around diaphysis

Chondrocytes in middle of diaphysis enlarge and then die.

This allows a BV (nutrient artery) to grow into the diaphysis and form the Primary Ossification Center.

Bone tissue begins to replace cartilage in the diaphysis of the bone

As ossification continues, cartilage model continues to grow in length and thickness

### **Secondary Ossification Center**

Chondrocytes in middle of epiphysis enlarge and then die.

This allows a BV (epiphyseal artery) to grow into the epiphysis and form the Secondary Ossification Center.

Bone tissue begins to replace cartilage in the epiphysis of the bone

### **Epiphyseal Disc (Growth Plate)**

Eventually, cartilage is limited to the ends of the bone (articular cartilages) and the epiphyseal growth plate

Bone growth in length continues as long as the discs persist (about 18 years of age).

On the epiphyseal side of the disc, new cartilage is deposited.

On the diaphyseal side of the disc, bone replaces cartilage

Thus, the disc does not change width, although it is in a constant state of turnover within the bone.

### **Bone Remodeling**

Remodeling of bone is a continuous process

It allows the bone to adapt to new stresses placed on the bone.

It requires the action of both osteoblasts and osteoclasts.

- Osteoblasts lay down new bone along stress lines

- Osteoclasts remove bone from the “old” stress areas.

### **Appositional Growth**

Increases in width

- Osteoblasts lay down new bone just deep to the periosteum

  - Circumferential lamellae

Osteoclasts resorb bone at the endosteum

  - Marrow cavity enlarges

## LECTURE 9

### The Human Skeleton

Two Divisions:

**Axial skeleton** Includes skull, vertebral column, ribs and sternum.

**Appendicular Skeleton** Includes pelvic and pectoral girdles, arm and leg bones.

Note Regarding Bones

You are responsible for ALL bones and bone markings listed here and in the handout downloaded from the lab handout web page. Use the figures in your text (indicated below) and the figures in your lab manual.

### The Axial Skeleton (Fig. 7.1)

Skull

Cranium (8) + Facial Bones (14) (Fig. 7.4, 7.6, 7.7, 7.8, 7.9)

6 Auditory ossicles

1 Hyoid bone

Sutures

Sinuses

Vertebral Column

Ribs and Sternum

#### Cranium (8 bones)

Frontal (1)

Frontal Sinus, Supraorbital foramen

Parietal (2)

Temporal (2)

Squamous, petrous, tympanic, and mastoid regions

Mastoid process, styloid process, zygomatic process

External and internal auditory meatus

Mandibular Fossa

Stylomastoid foramen, Jugular foramen

Occipital (1)

Occipital Condyles, Foramen Magnum

Hypoglossal Canals

External Occipital protuberance and crest

Superior and Inferior nuchal lines

Sphenoid (1)

Sphenoid sinuses

Greater and Lesser wings

Sella Turcica

Pterygoid process

Foramen rotundum, ovale, and spinosum

Optic foramina

Ethmoid (1)  
Ethmoid sinuses  
Crista galla, Cribriform plate, Perpendicular plate-superior and middle nasal conchae

Sutures (Fig. 7.5, 7.27)  
Coronal    Sagittal    Lambdoid    Squamous

**Facial Bones** (Fig. 7.22)

Nasal (2)  
Lacrimal (2)  
Zygomatic (2)  
Maxilla (2)  
    Maxillary sinuses  
    Alveoli, incisive fossa, inferior orbital fissure, infraorbital foramen  
Mandible (1)  
    Coronoid process, Mandibular condyles, Alveoli, Mental and Mandibular foramina  
Vomer (1)  
Palatine (2)

Sinuses Fig.  
Frontal  
Maxillary  
Sphenoid  
Ethmoid

## **The Vertebral Column (Fig. 7.28, 7.29)**

**Cervical** = 7

All vertebrates have only 7 cervical vertebrae

**Thoracic** = 12

Each articulates with a rib (so there are also 12 ribs)

**Lumbar** = 5

**Sacral** = 5 (fused)

**Coccygeal** (2 - 5)

## **Curvatures of The Vertebral Column**

**Cervical** = secondary

**Thoracic** = primary

**Lumbar** = secondary

**Sacral** = primary

## **Parts of a “typical” Vertebra (Fig. 7.29a)**

Spinous Process, Lamina, Transverse Process, Pedicle, Body  
Spinal Foramen

Superior and Inferior Articular facets

## **Ligaments and intervertebral discs (Fig. 9.13)**

Anterior longitudinal ligament

Posterior longitudinal ligament

Supraspinous ligament

Ligamentum flavum

Disc = nucleus pulposus and annulus fibrosus

Intervertebral foramen

## **Typical Cervical Vertebrae (Fig. 7.30, Table 7.6)**

Transverse foramina (for vertebral arteries)

bifid spinous process, large vertebral canal

Articular facets of lamina face superoposterior/ inferoanteriorly

Greatest range of movement

Nuchal Ligament over spinous processes

C7 = vertebra prominens

## **Atlas and Axis (Fig. 7.30)**

C1 = Atlas No body, articulates with occipital condyles

C2 = Axis Dens (body of C1)

## **Thoracic Vertebrae (Table 7.6, Fig. 7.33)**

Heart shaped bodies, circular vertebral foramen

3 Facets for ribs: 1 on transverse process and 2 demi-facets on body

Articular facets face posterior/anterior

Rotation, little lateral flexion, no flexion or extension

## **A Middle Rib (Fig. 7.33)**

- Superior and inferior facets
- Tubercle
- Costal Angle
- Costal groove
- Junction with costal cartilage (sternum)

## **Lumbar Vertebrae (Table 7.6)**

- Large bodies, small vertebral foramen, blunt spines, thin transverse processes
- Articular facets face medially/laterally
- flexion and extension, some lateral flexion, no rotation

## **Sacrum & Coccyx (Fig. 7.31)**

- Base/apex
- Superior articular process (facet), sacral promontory
  - Promontory determines size of pelvic inlet
- Auricular surface (Sacral iliac joint)—\*Not labeled in Text
- Anterior and posterior sacral foramina
- Sacral canal and hiatus
  - Spina bifida

## **Sternum (Fig. 7.32)**

1. Manubrium
  - Jugular Notch
    - Clavicle and First rib articulate here
  - Sternal Angle
2. Body
  - Ribs 2-7 (True Ribs)
  - Ribs 8-10 (False Ribs)
    - Ribs 11 and 12 are floating ribs
3. Xiphoid Process

### **Sternal Landmarks**

- Heart sits between sternal angle and xiphisternal joint. (deep to the body)
- Aortic arch is between sternal angle and jugular notch (deep to the manubrium)
- Diaphragm is even with xiphisternal joint

## **The Appendicular Skeleton (Fig. 8.1)**

Pelvic and pectoral girdles

Upper Limb bones

Lower Limb bones

### **Pectoral Girdle**

#### **Clavicle (Fig. 8.2)**

Sternal end

Acromial end

Conoid tubercle

Costal tuberosity

#### **Scapula (Fig. 8.3)**

Superior, medial (vertebral), and lateral (axillary) borders

Suprascapular notch

Superior and inferior angles

Spine

Acromion

Coracoid process

Supraspinous, infraspinous, and subscapular fossae

Glenoid fossa

Supraglenoid and infraglenoid tubercles

### **Pelvic Girdle (Fig. 8.7)**

#### **Os Coxae (Fig. 8.7, 8.9, 8.10)**

Acetabulum

Obturator foramen

#### **Ilium**

Iliac crest

Anterior and posterior superior iliac spines

Anterior inferior iliac spine, Posterior inferior iliac spine

Greater sciatic notch

Iliac fossa

Auricular surface

Iliac tuberosity

#### **Ischium**

Body and Ramus

Ischial spine

Lesser sciatic notch

Ischial tuberosity

#### **Pubis**

Body

Pubic tubercle and pubic crest

Superior and Inferior Rami

## **Upper Limb bones**

Humerus

Ulna

Radius

Carpals

Metacarpals

Phalanges

### **Humerus (Fig. 8.4)**

Head

Greater and Lesser tubercles, Intertubercular groove

Anatomical and surgical necks

Deltoid tuberosity

Supracondylar ridges

Coronoid and radial fossa

Trochlea and capitulum

Olecranon fossa

Medial and Lateral epicondyles

### **Ulna (Fig. 8.5)**

Olecranon, coronoid, and styloid processes

Ulnar tuberosity

### **Radius (Fig. 8.5)**

Head and Neck

Radial tuberosity

Styloid process

### **Carpals (Fig. 8.6)**

Scaphoid, Lunate, Triquetrum, Pisiform

Trapezium, Trapezoid, Capitate, Hamate

### **Metacarpals (Fig. 8.6)**

Base, body, and head

### **Phalanges (Fig. 8.6)**

Proximal, middle, and distal

## **Lower Limb bones**

Femur

Patella (Fig. 8.12)

Tibia

Fibula

Tarsals

Metatarsals

Phalanges

**Femur (Fig. 8.11)**

Head (w/ fovea) and neck  
Greater and Lesser trochanters with intertrochanteric crest  
Pectineal line  
Gluteal tuberosity  
Linea aspera  
Adductor tubercle  
Medial and Lateral condyles  
Medial and Lateral epicondyles  
Intercondylar fossa  
Nutrient foramen

**Tibia (Fig. 8.13)**

Medial and Lateral condyles  
Intercondylar eminence  
Tibial tuberosity  
Medial malleolus

**Fibula (Fig. 8.13)**

Head, Neck, Lateral malleolus

**Tarsals (Fig. 8.14)**

Talus, Calcaneus, Navicular  
Medial, Intermediate, and Lateral cuneiform, Cuboid

**Metatarsals**

1 through 5

**Phalanges**

Proximal, middle, and distal

# LECTURES 10 AND 11

## ARTHROLOGY

### **Arthro = “joint”**

-ology = “the study of”

Arthrology is the study of joints.

Example of other terms:

- Arthritis = Inflammation of a joint
- Arthropod = animal with jointed appendages
- Arthroscopic surgery = looking into the joints

### **Classification of joints**

- Based on both structure and movement

### **Classification by movement**

Synarthrosis

- immovable

Amphiarthrosis

- slightly movable

Diarthrosis

- freely movable

### **Classification by structure**

**Fibrous (syn- and amphiarthroses)**

- Composed primarily of fibrous CT
- Sutures (synostoses), Interosseous Membranes (syndesmoses), gomphoses

**Cartilaginous (syn- and amphiarthroses)**

- Composed of cartilage
- Synchondroses, Symphyses

**Synovial (diarthroses)**

- Have a complex structure which includes a joint cavity filled with fluid
- Plane, Hinge, Pivot, Condylod, Saddle, Ball-and-socket

### **Fibrous Joints**

Suture

- Composed of a thin layer of dense CT
- Found exclusively between skull bones
- Synarthrosis
- Coronal, Squamous, Lambdoid, Occipitomastoid

**Interosseus Membranes - Syndesmosis**

- More fibrous CT than sutures
- ex: distal radio-ulnar joint; distal tibiofibular joint
- Amphiarthrosis

## Gomphosis

- Defined as a cone-shaped peg fitting into a socket
- ex: only kind: teeth, connected via periodontal ligaments, to the alveolar processes of maxilla and mandible
- Synarthrosis

## Cartilaginous Joints

### Symphysis

- Composed of hyaline cartilage
- ex: epiphyseal plate; First sternocostal joint, costochondral joints.
- Synarthrosis

### Symphysis

- Composed of fibrocartilage
- Ex: pubic symphysis, intervertebral joints
- Amphiarthrosis

## Synovial Joints

Syn = “together”

Ova = “egg”

Synovial = “together with egg”

Named as such because the fluid inside has the color and consistency of egg white (very slippery)

Joint has a synovial cavity filled with fluid and lined by a membrane

## Components of Synovial Joints

Articular Cartilage

Synovial Cavity

Capsule

Fluid

Reinforcing Ligaments

Nerves (proprioception) and Vessels

Some have:

Bursa and tendon sheaths

Menisci

### Articular capsule

- Outer fibrous capsule
  - Dense CT
  - Includes ligaments
- Inner synovial membrane
  - A thin CT membrane (not epithelium)
  - Secretes synovial fluid as a blood filtrate

## Synovial Fluid

- Formed as a filtrate of blood from blood vessels in the articular capsule
- Consists of glycoproteins and hyaluronic acid, which makes it extremely slippery.
- Functions: cushion and nourish the articular cartilages and other joint structures.

## Associated Structures

### Bursae and Tendon sheaths

- Bursa = small sac lined with synovial membrane and filled with synovial fluid.
- Tendon sheath = similar to bursa only long and wraps around a tendon.
- Function: reduce friction

### Menisci

- C-shaped pads of fibrocartilage
- Function to cushion the knee joint

### Ligaments

- Extrinsic—separate from the capsule
- Intrinsic—part of the capsule
- Extracapsular, Intracapsular

## Menisci and Ligaments of the Knee

- Lateral and Medial Menisci
- Anterior and Posterior Cruciate Ligaments

## Most Common knee injury

- A lateral blow damages:
  - medial meniscus,
  - anterior cruciate ligament
  - tibial collateral ligament

## Factors affecting movement and stability of synovial joints

1. Structure or shape of articulating bones
2. Strength and tension of joint ligaments
3. Arrangement and tension of muscles acting around joint Fig. 9-14d, rotator cuff muscles
4. Effect of hormones (i.e. relaxin)
5. Disuse

## **Classification of Synovial Joints**

–Classified by Movement

- Gliding
- Angular
- Rotational

–Classified by Shape

- Plane joints—translational  
gliding
- Hinge joints—uniaxial  
Angular
- Pivot joints—uniaxial  
rotational
- Condyloid joints—biaxial  
Angular
- Saddle joints—biaxial  
Angular
- Ball and socket joints—multiaxial  
Angular and rotational

## **Joint Movements**

**Flexion**

- A decrease in joint angle

**Extension**

- An increase in joint angle

**Hyperextension**

- Extension beyond a joint angle of 180 degrees.

**Abduction**

- Movement of a limb away from the midline

**Adduction**

- Movement of a limb towards the midline

**Circumduction**

- Distal point of a limb draws a circle

**Opposition**

- Special movement of the thumb (pollex)
- Thumb crosses over the palm of the hand (and can touch all fingers)

**Rotation**

- Pivot around a central axis

## **Examples of Synovial Joints**

- Plane Joints -- Gliding, translational
  - Intercarpal
  - Intertarsal
  - Intervertebral
- Hinge Joints -- Angular, uniaxial
  - Elbow
  - Ankle
  - Phalanges
- Pivot Joints -- Uniaxial, rotational
  - Proximal radio-ulnar
  - Atlas/Axis
- Condylloid Joints -- Biaxial, angular
  - Metacarpo-phalangeal
  - Radio-carpal
  - Knee\*
- Saddle Joint -- Biaxial, angular
  - First Carpal-metacarpal
  - Sterno-clavicular
- Ball/Socket Joint -- Multiaxial, angular and rotational
  - Shoulder
  - Hip

## **Movements of Mandible and Scapula**

Elevation

- To move superiorly

Depression

- To move inferiorly

Protraction

- To move anteriorly

Retraction

- To move posteriorly

## **Movements of the Ankle**

Inversion

- The sole of the foot points medially

Eversion

- The sole of the foot points laterally

Dorsiflexion

- Top of foot moves towards head

Plantarflexion

- Top of foot moves away from head

## **Movements of the Wrist**

### **Pronation**

- Palm moves from anterior to posterior
- “pro”fessional basketball player

### **Supination**

- Palm moves from posterior to anterior
- Holding a cup of “soup”

## **Clinical Terms**

- Sprains
  - stretched or torn ligaments
  - Lumbar spine, ankle, knee
- Dislocations
  - bones are forced out of alignment
  - Jaw, shoulder, finger, thumb
- Torn Cartilage
  - Meniscus of the knee
- Bursitis and Tendinitis
- Arthritis