Musculoskeletal assessment

Presented by
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Minia University
2015

Musculoskeletal assessment

- Mobiles off
- Share ideas
- Ask questions
- Listen actively

Introduction

The musculoskeletal system is the supporting framework and collectively the largest system in the body.

It is word of 2 syllables

Muscle + Skeletal

So it Consists of:

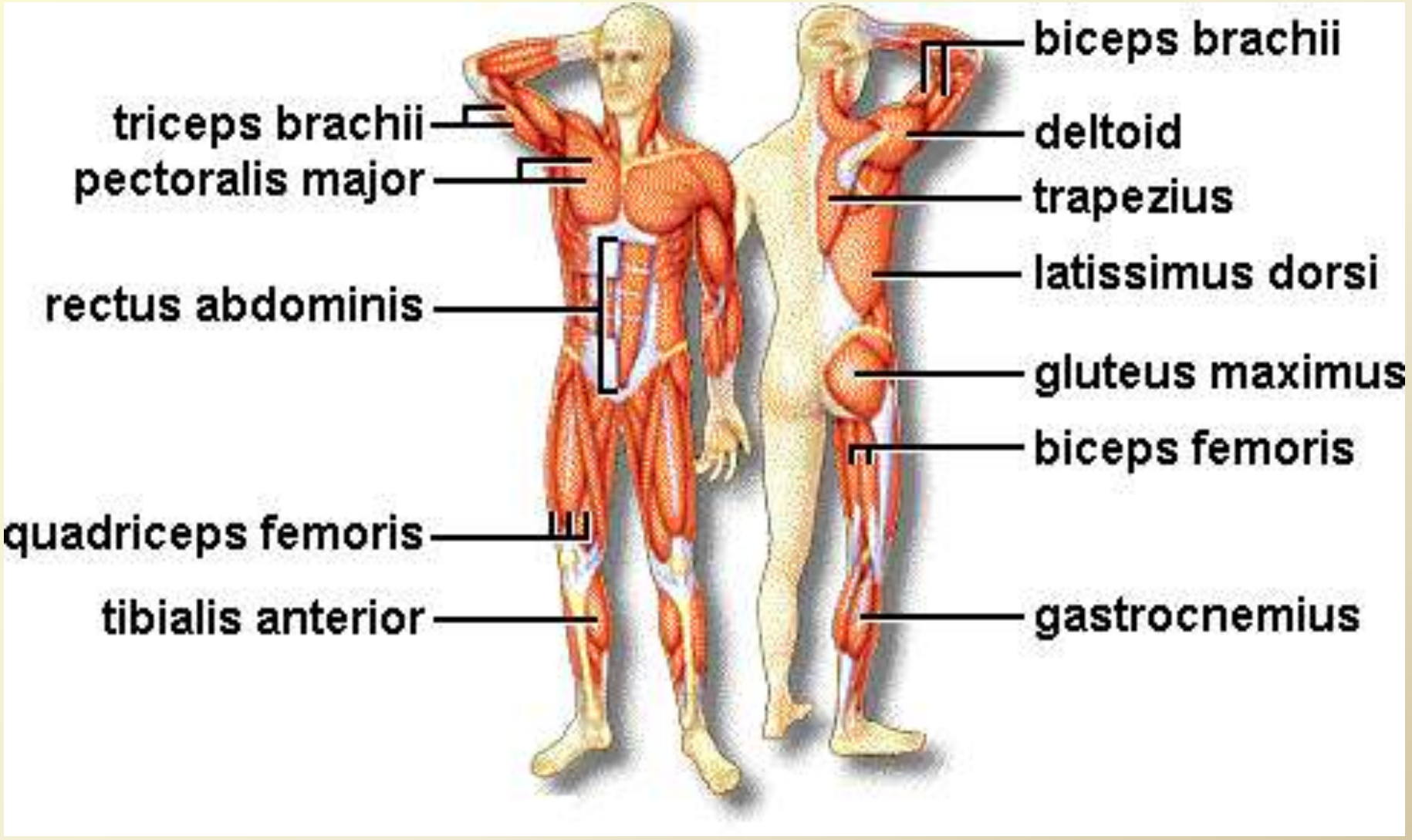
- **A. Muscles (accounts for approximately 50% of the body weight):**
- **B. Bony structures and connective tissue (accounts for approximately 25% of the body weight):**
  - 1-The Skeleton
  - 2-Supportive connective tissues
  - 3-Articular system(Joints)


1-Muscles

1-Types

1. **Skeletal** muscles (voluntary and striated),
2. **Cardiac** muscles (involuntary and striated)
3. **Smooth**/visceral muscles (involuntary and non-striated)

Skeletal muscles



Types of Muscle Contractions:

- **1-isometric contraction**, the length of the muscles remains constant but the force generated by the muscles is increased; an example of this is when one pushes against an immovable wall.
- **2- Isotonic contraction**, is characterized by shortening of the muscle with no increase in tension within the muscle; an example of this is flexion of the forearm.

- **NB:** Many muscle movements are a combination of isometric and isotonic contraction. For example, during walking, isotonic contraction results in shortening of the leg, and isometric contraction causes the stiff leg to push against the floor

The function of muscles is

- Movement of body parts: by isotonic & isometric contractions
- Maintenance of posture
- Production of body heat


Skeletal System

SKELETAL FUNCTION

- **Movement**
- **Support**: protects the internal body organs
- **factory** which produces red blood cells from the bone marrow of certain bones and white cells from the marrow of other bones
- **a storehouse** for minerals - calcium, for example - which can be supplied to other parts of the body

Skeletal System

◆**Consists of:**

1. **The Skeleton (bones)**
2. **Articular system (Joints)**
3. **Supportive connective tissues**

(Cartilage, ligaments, tendons)

1-The Skeleton(Bones):

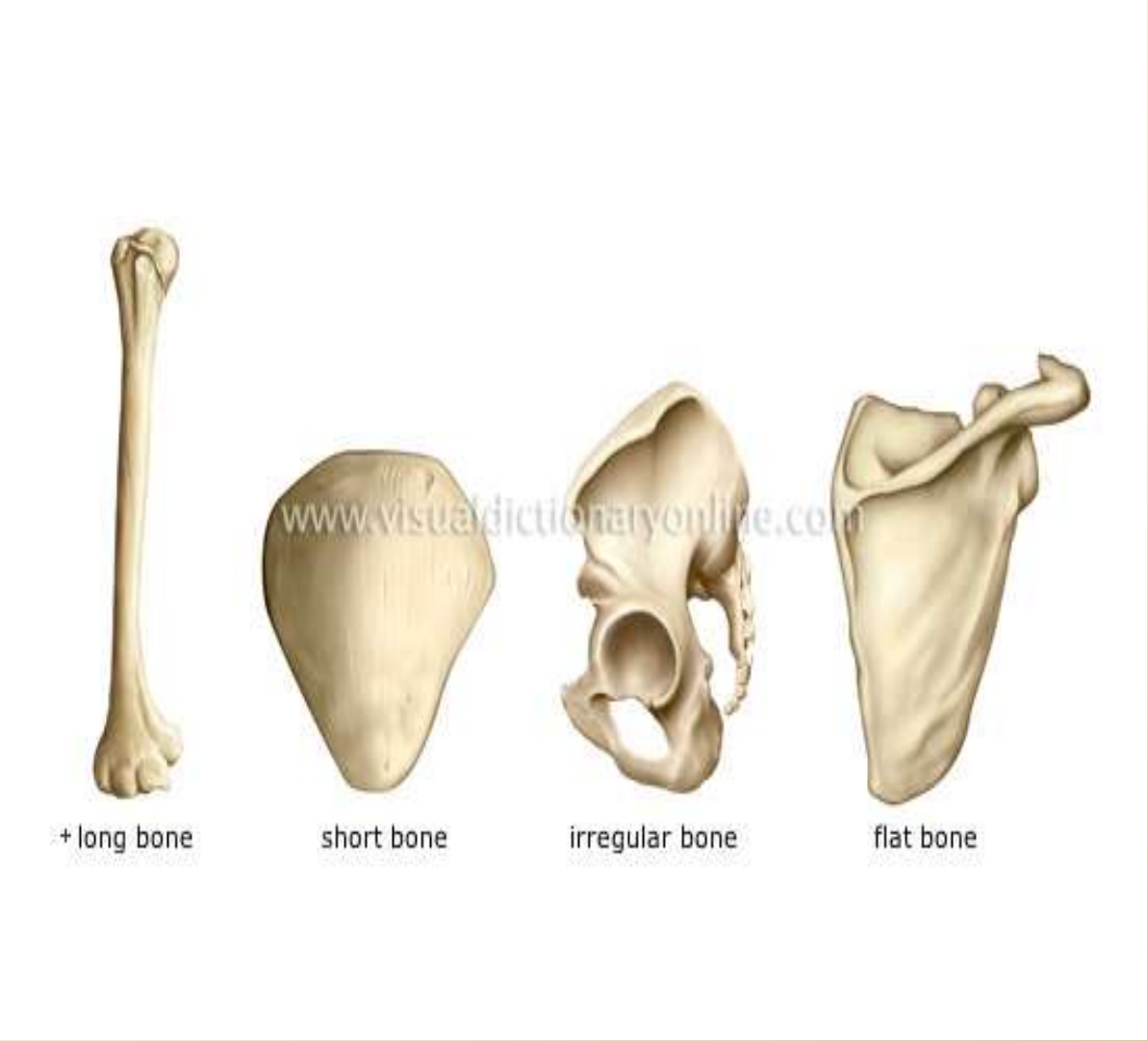
- Mobility and weight-bearing capacity are directly related to the bone's size and shape.
- **Bones: *composed of* :** *cells, protein matrix, and mineral deposits*.

Typs of bones cells:

- **1-Osteoblasts :**function in bone formation by secreting bone matrix.
- **2-Osteocytes** are mature bone cells involved in bone-maintenance functions.
- **3-Osteoclasts:** involved in destroying, resorbing, and remolding bone.

Types of bones:

- *Long bones*
- *Short bones*
- *Flat bones*
- *Irregular bones*



Osteogenesis:

- **Ossification** is the process by which the bone matrix (collagen fibers and ground substance) is formed and hardening minerals (eg, calcium salts) are deposited on the collagen fibers. The collagen fibers give tensile strength to the bone, and the calcium provides compressional strength.

regulating factors for Bone Maintenance:

- ***1-Local stress (weight bearing)*** acts to simulate bone formation and remodeling. prolonged bed rest?
- ***2- vitamin D:*** promoting absorption of calcium from the gastrointestinal tract. It also facilitates mineralization of osteoid tissue.
- ***3-Blood supply:*** With diminished blood supply or hyperemia (congestion), osteogenesis (bone formation) and bone density decrease

- ***4-Parathyroid hormone and calcitonin*** : calcium homeostasis. demineralization of bone, and the formation of bone cysts. Calcitonin, secreted by the thyroid gland in response to elevated blood calcium levels, inhibits bone resorption and increases the deposit of calcium in bone.
- ***5-Gerontologic Considerations:***

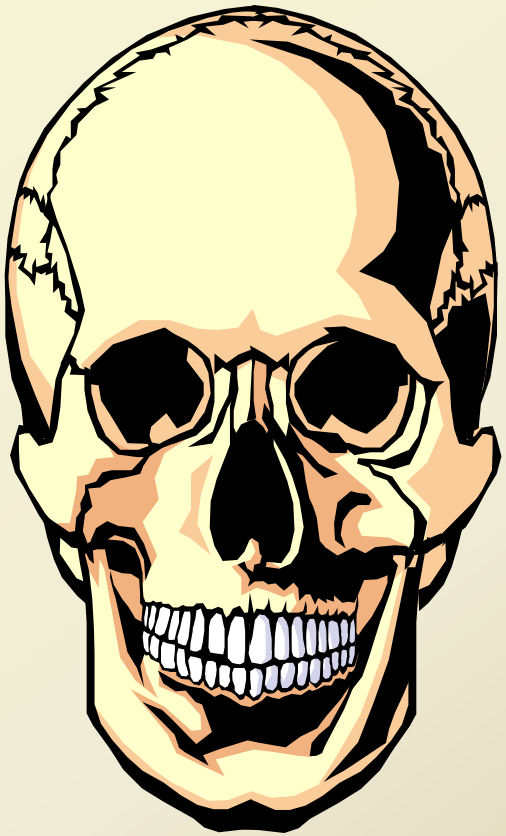
aged person become prone to fracture(vertebrae, hip, wrist), Weakness,Fatigue and Falls.

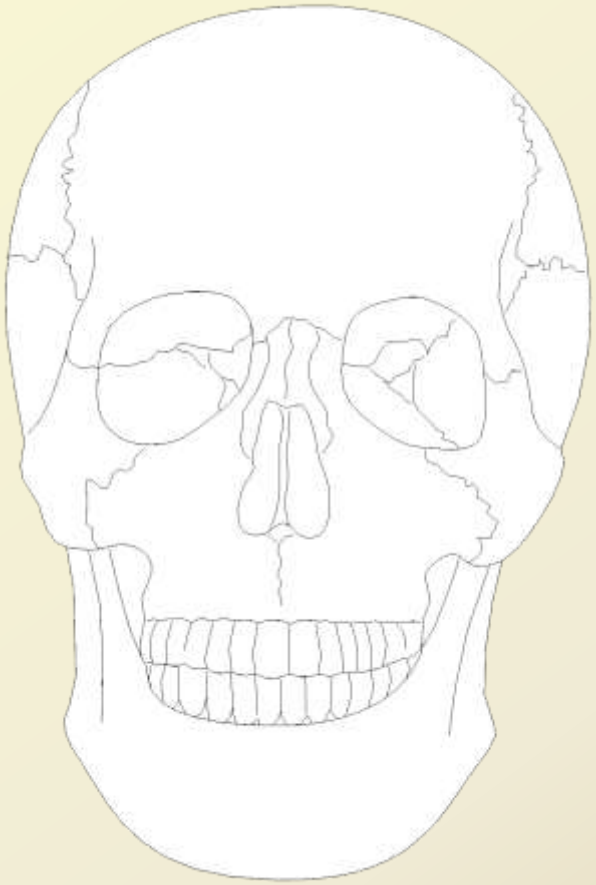
Anatomy of the Skeletal System

Part I: Bones of the Cranium

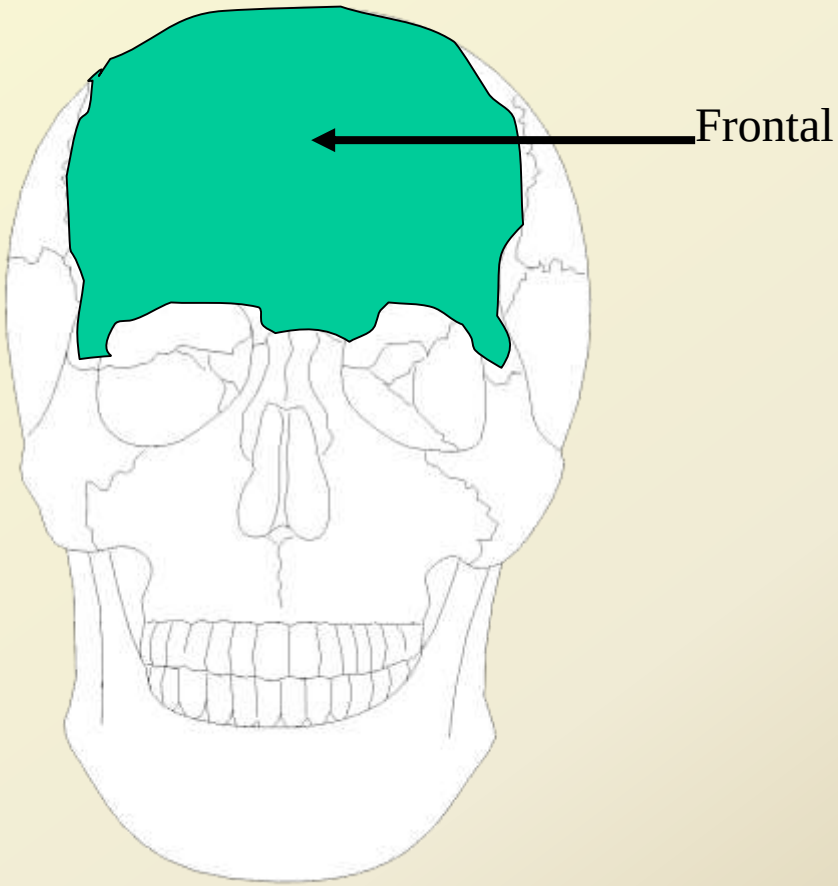
Part II: Bones of the Appendicular Skeleton

Bones of the Cranium

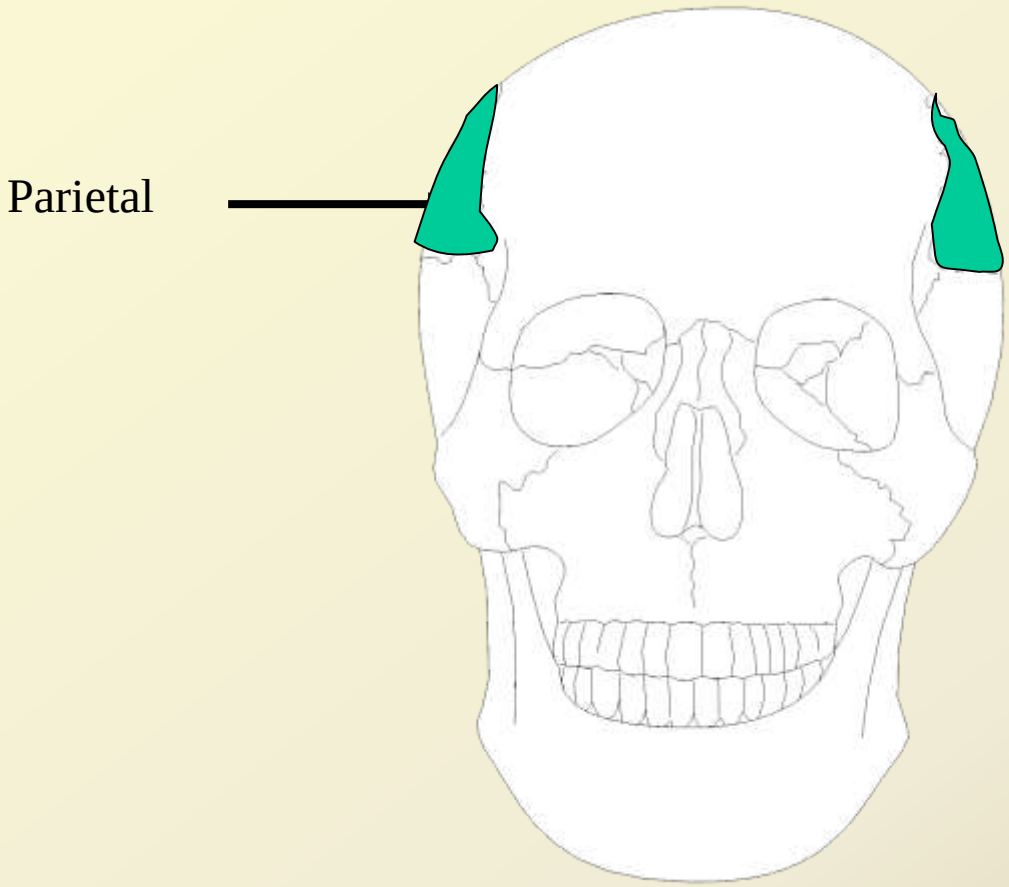




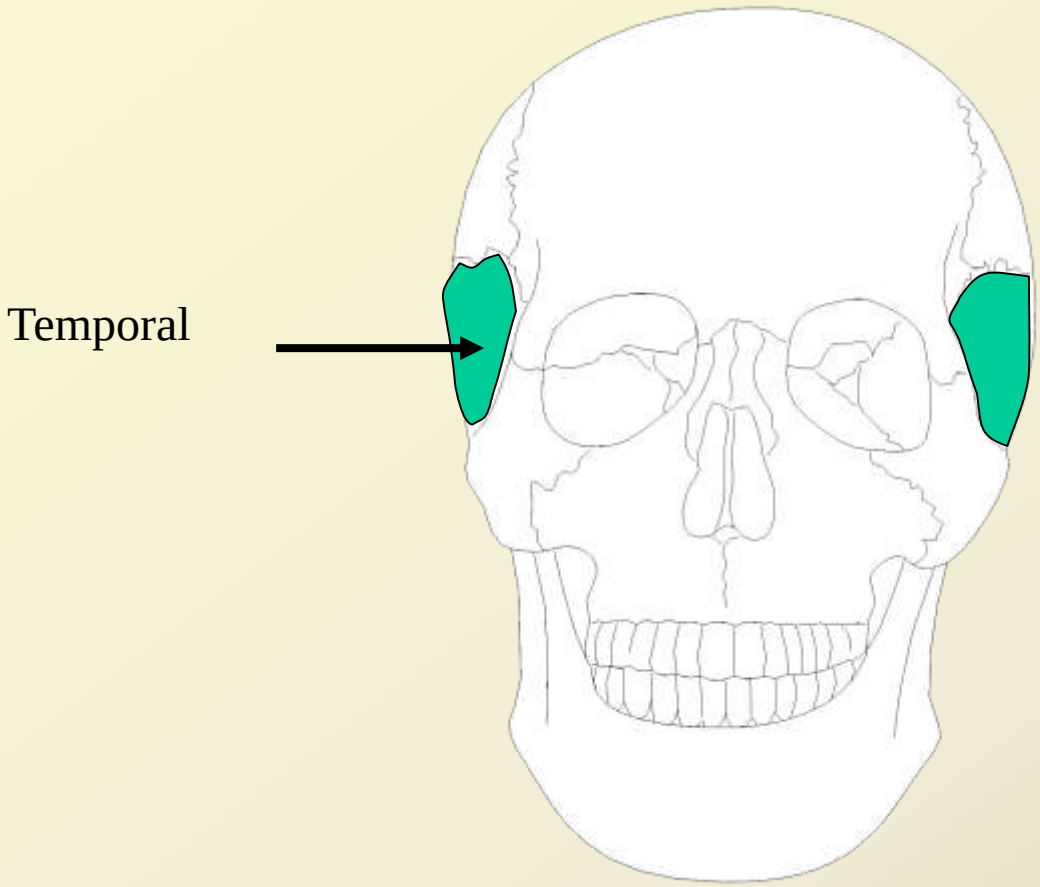
Frontal View



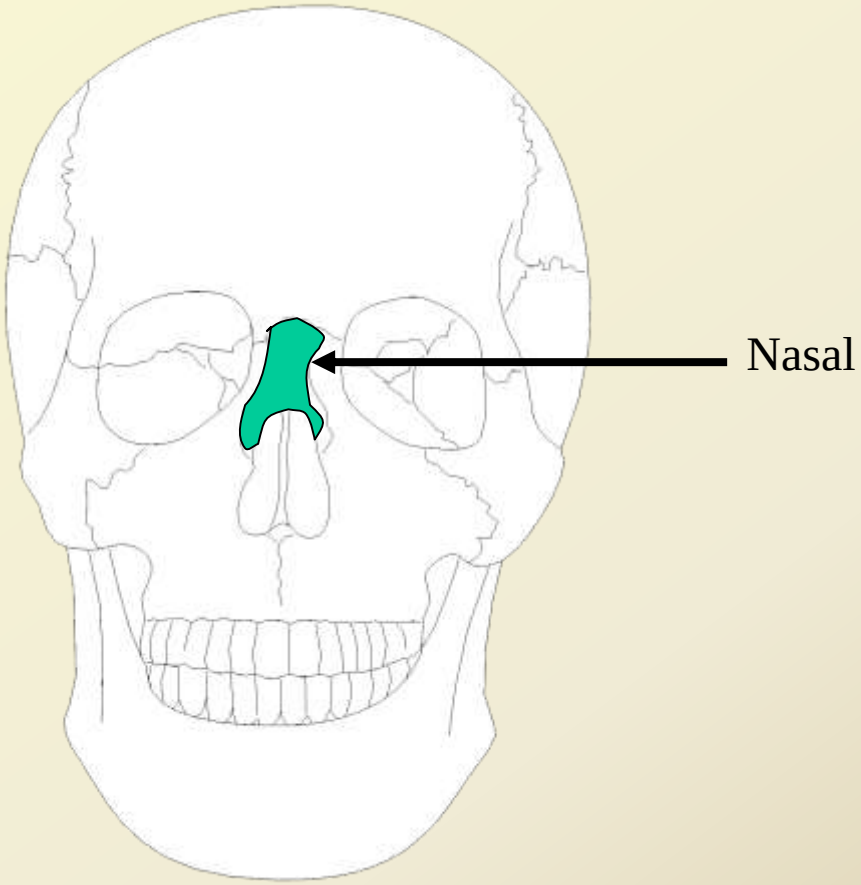
Frontal View



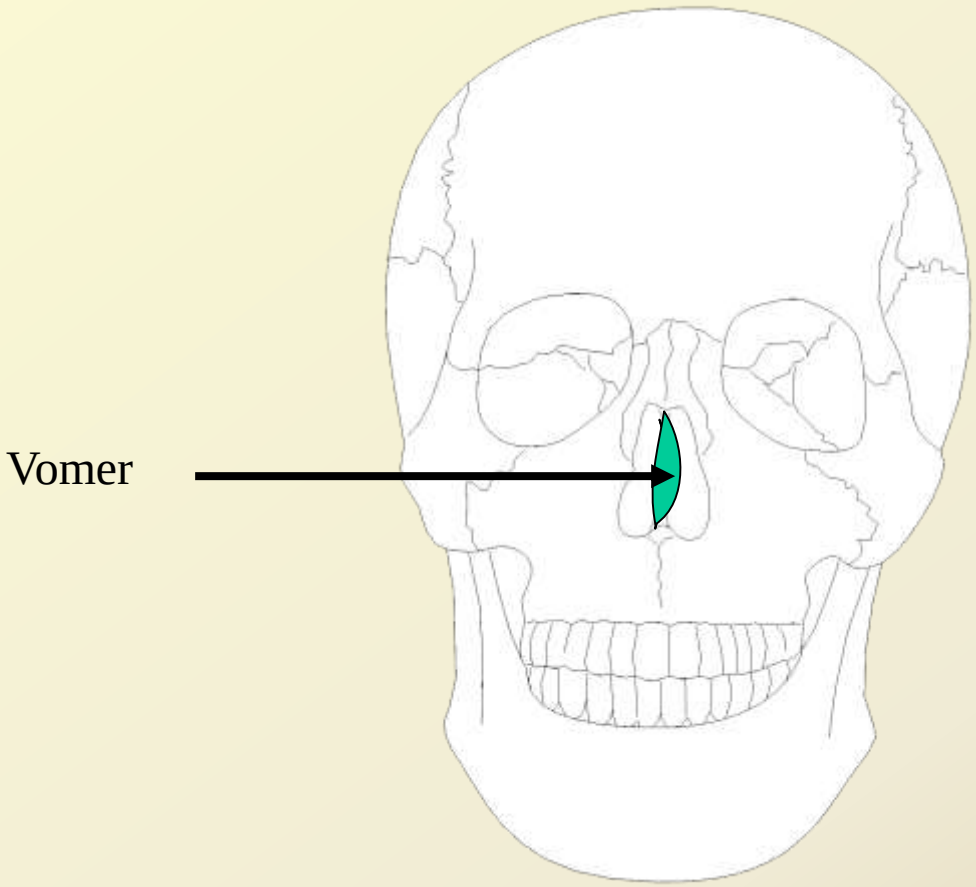
Frontal View



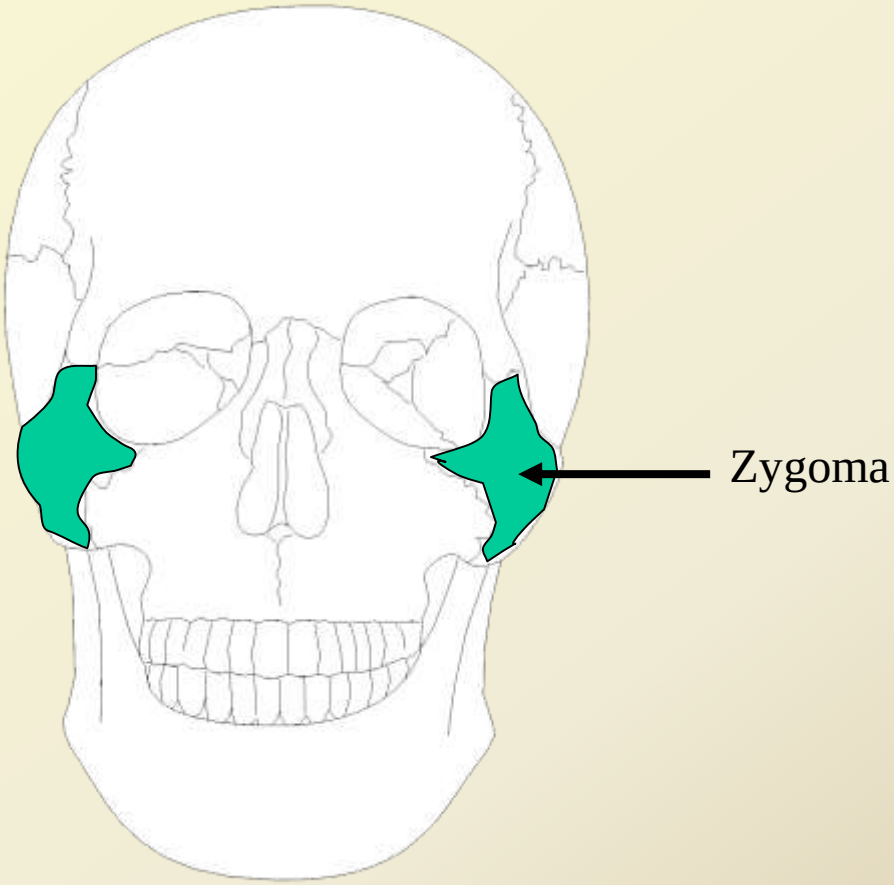
Frontal View



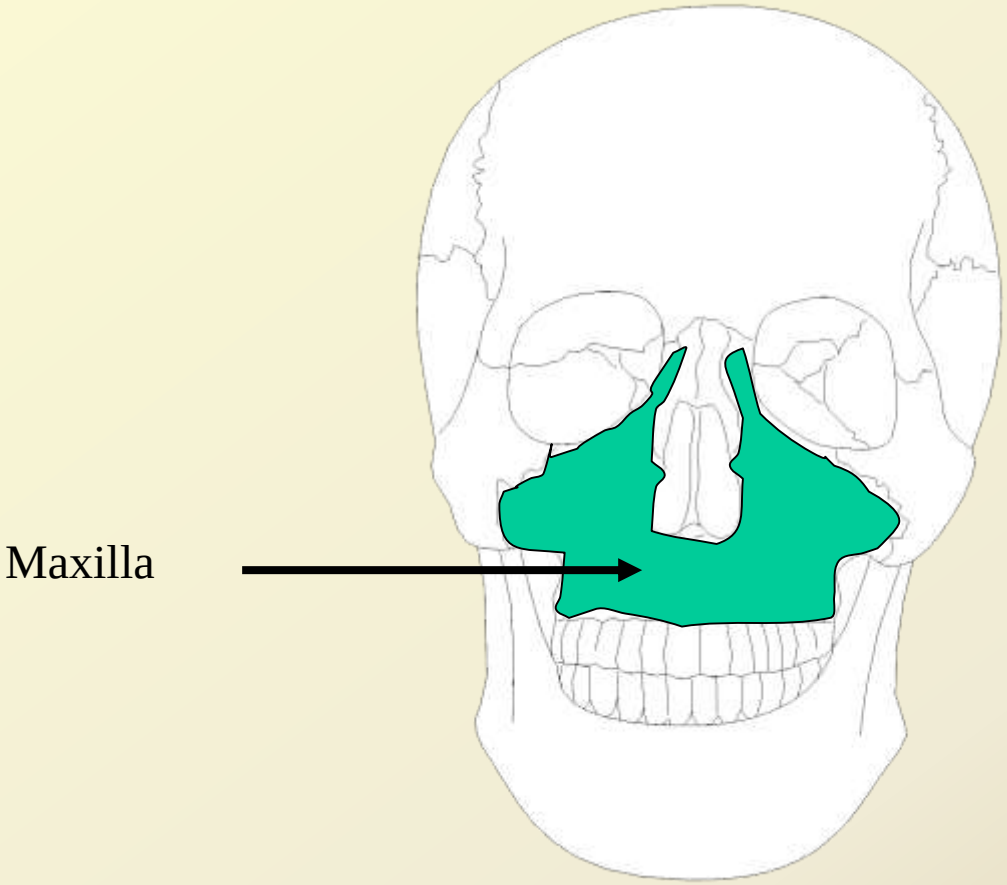
Frontal View



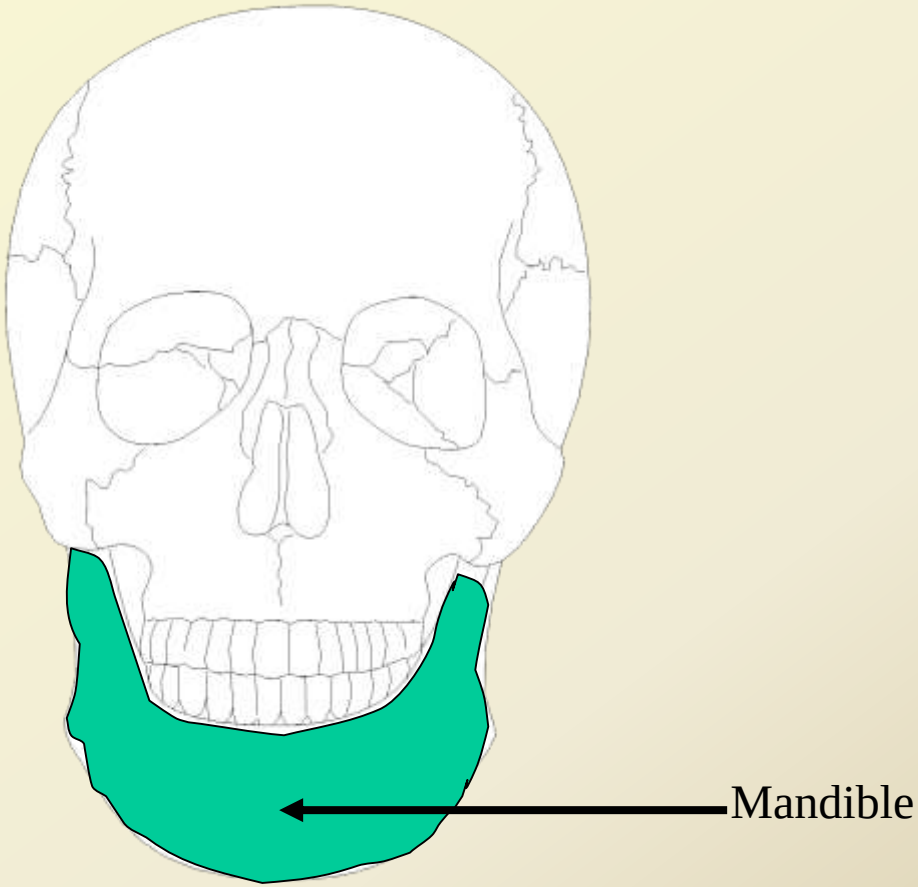
Frontal View



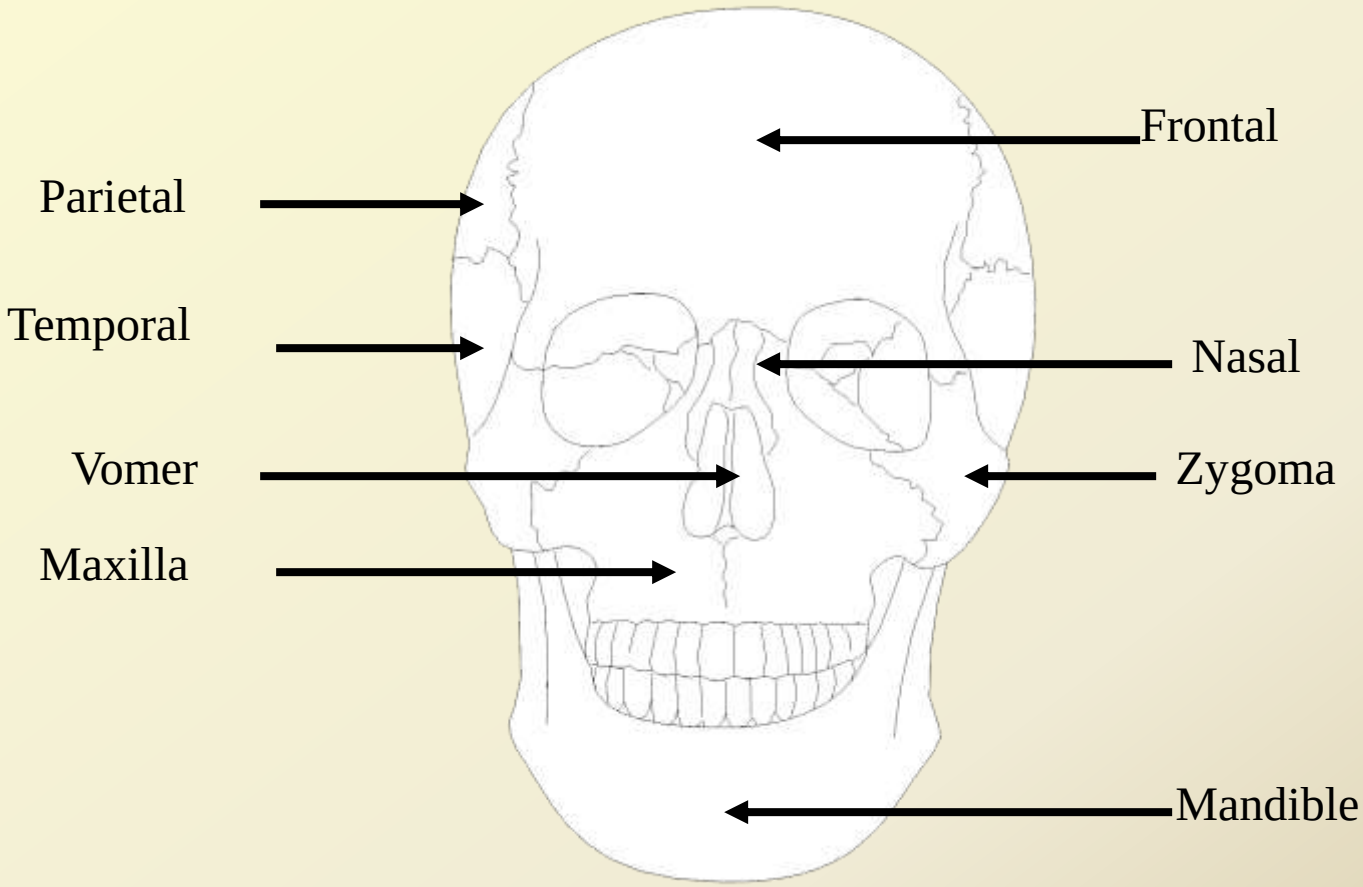
Frontal View



Frontal View



Frontal View



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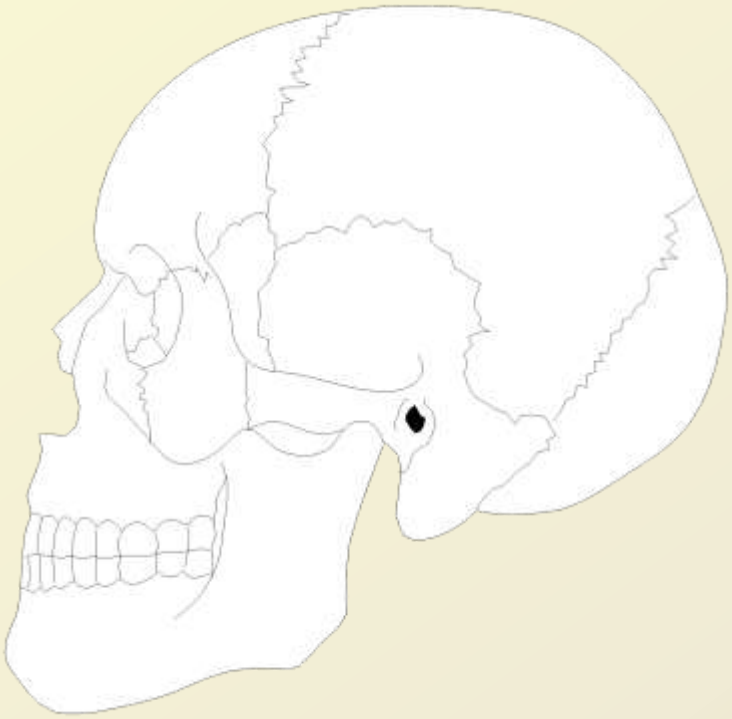
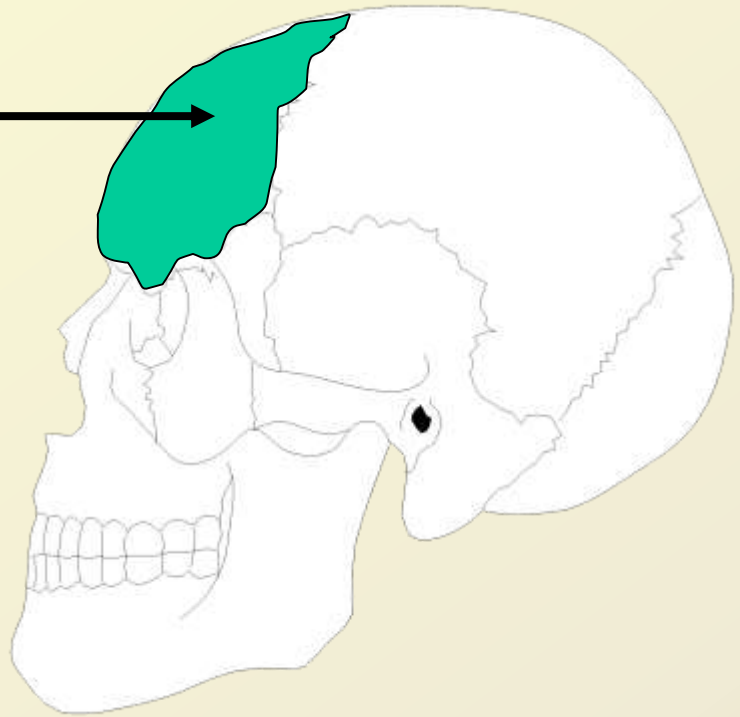


Lateral View

Frontal



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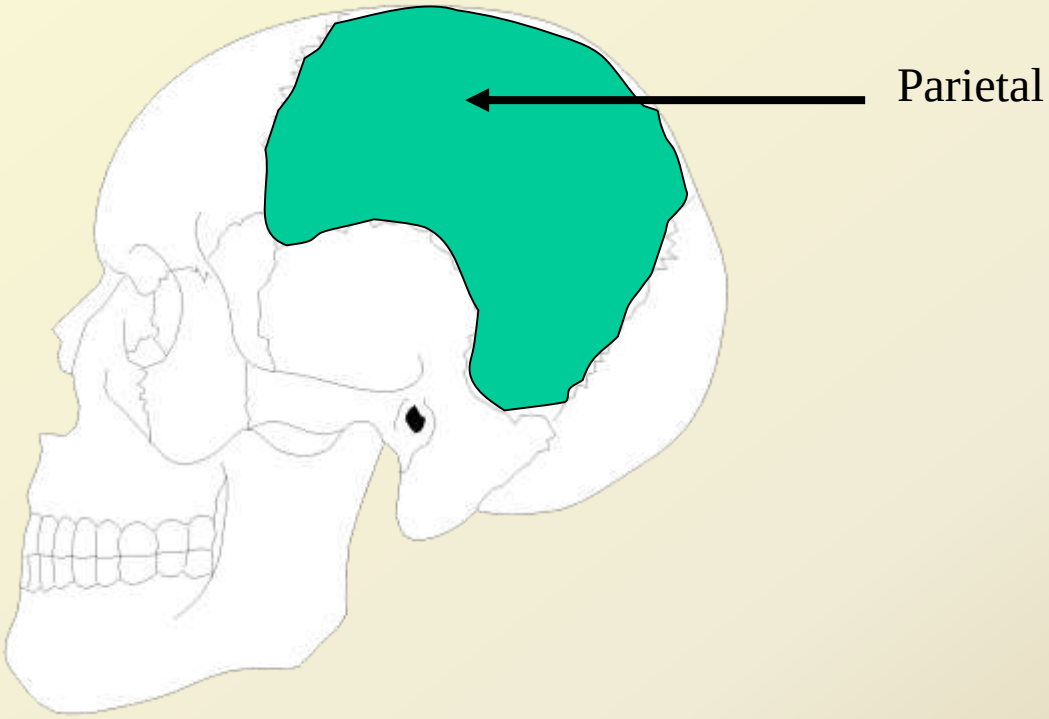

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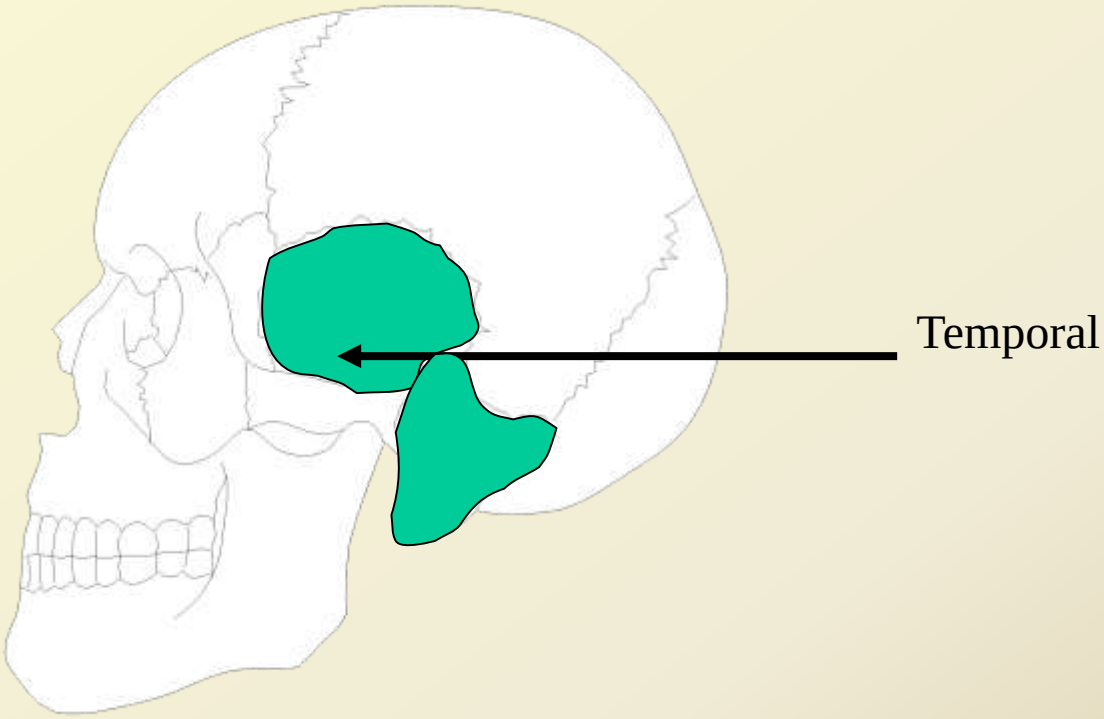
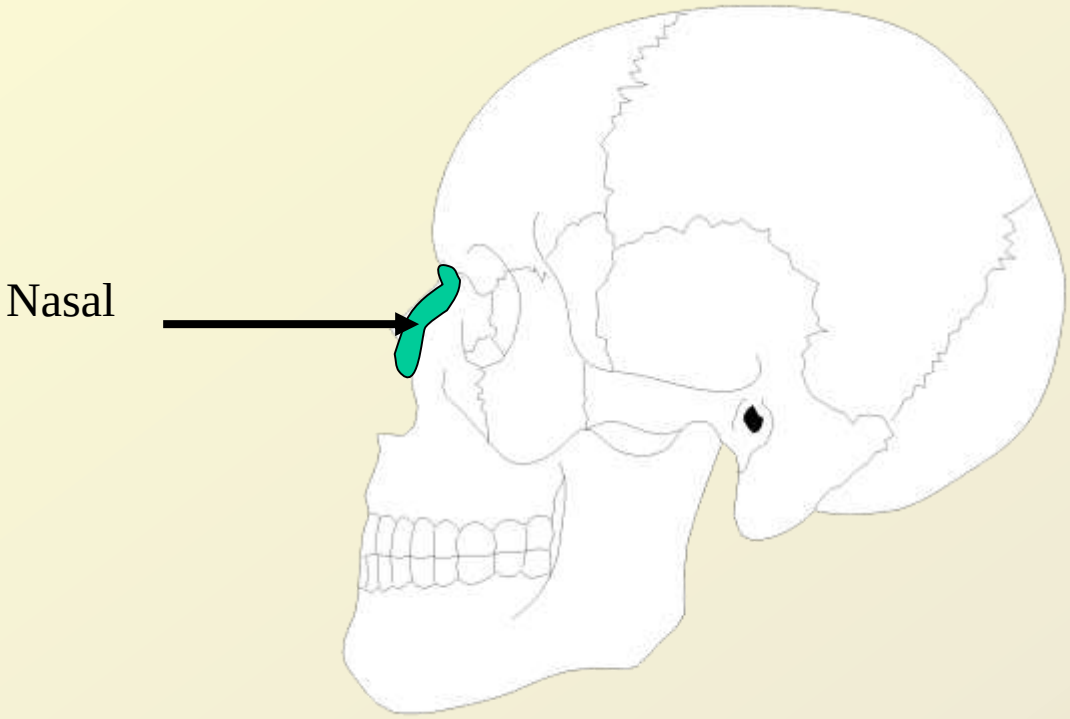


Lateral View



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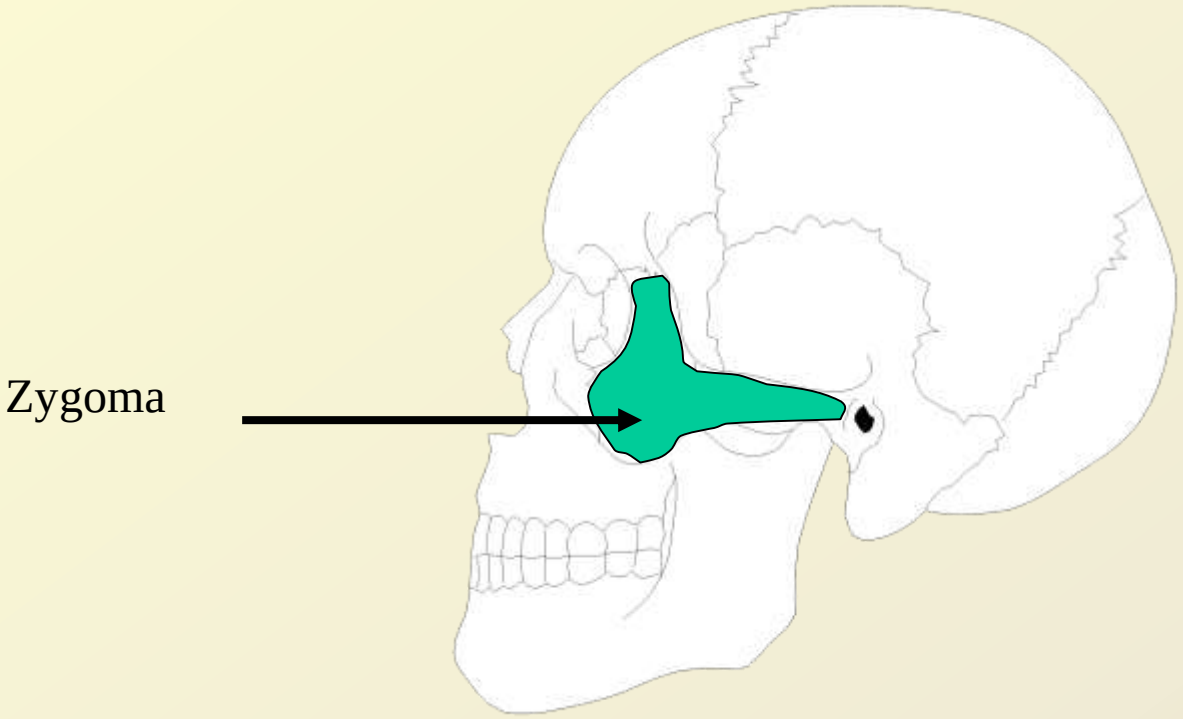
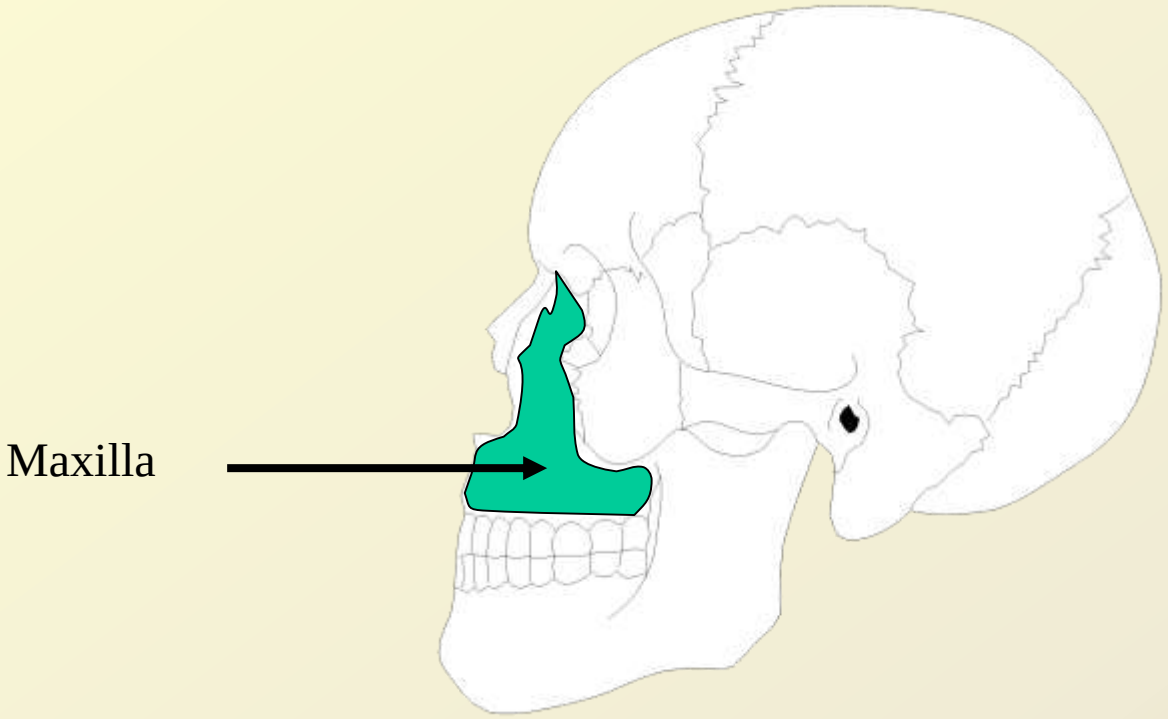


Lateral View



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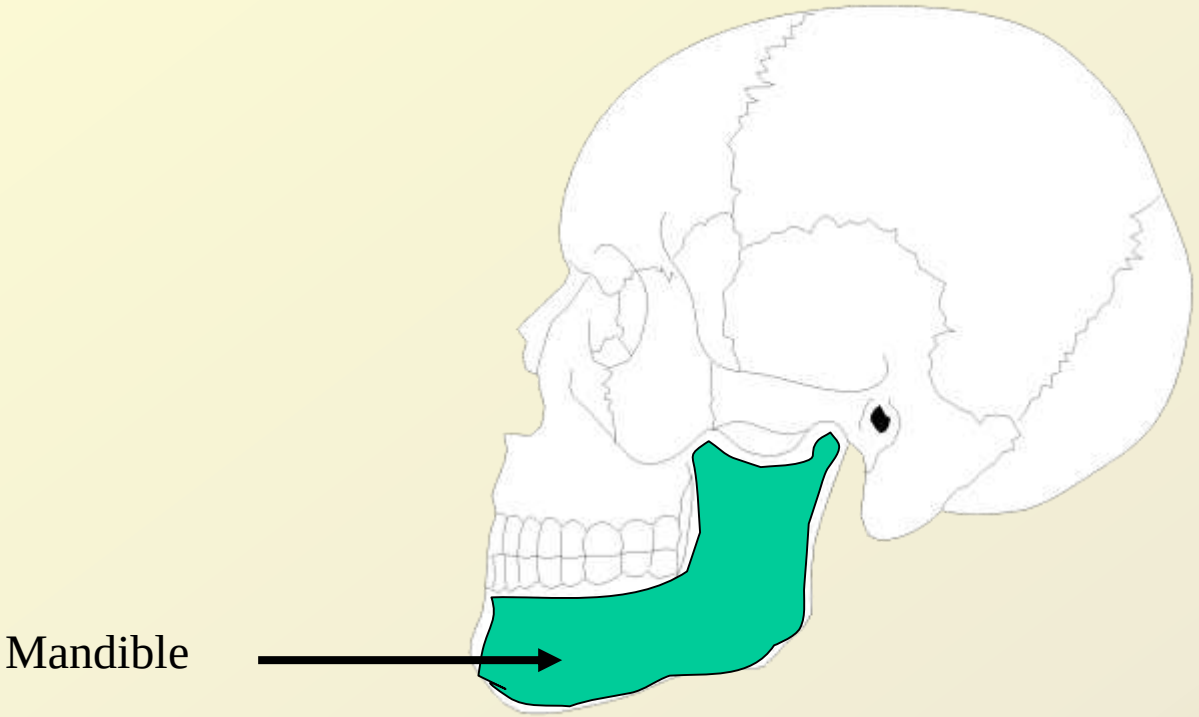

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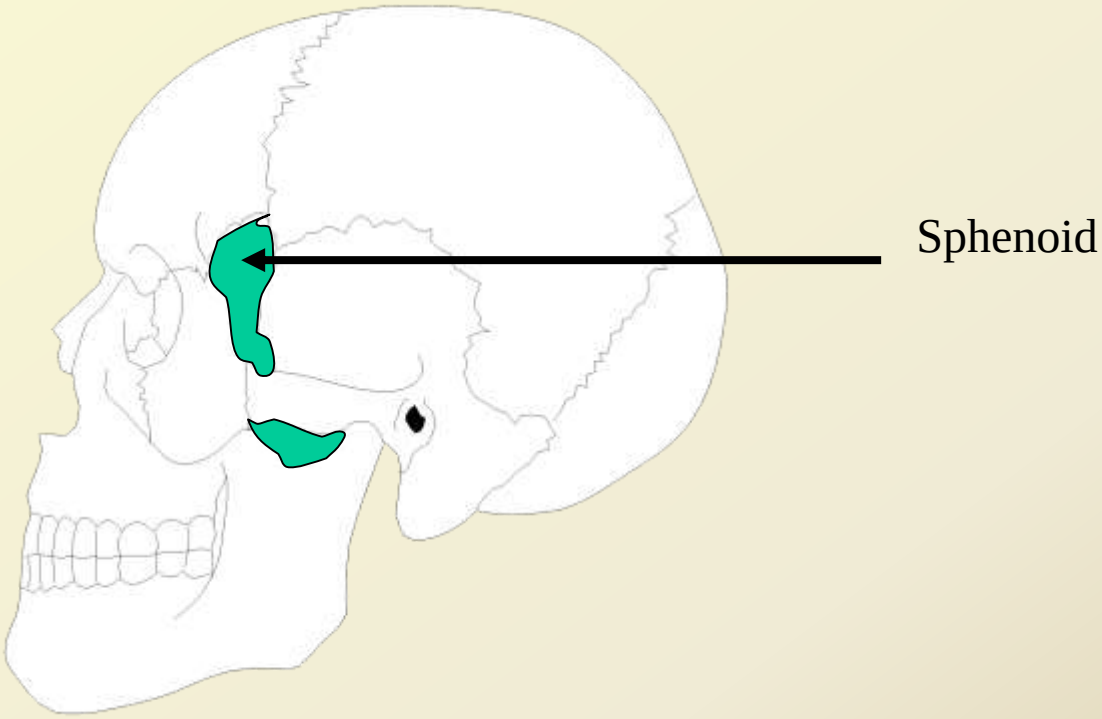

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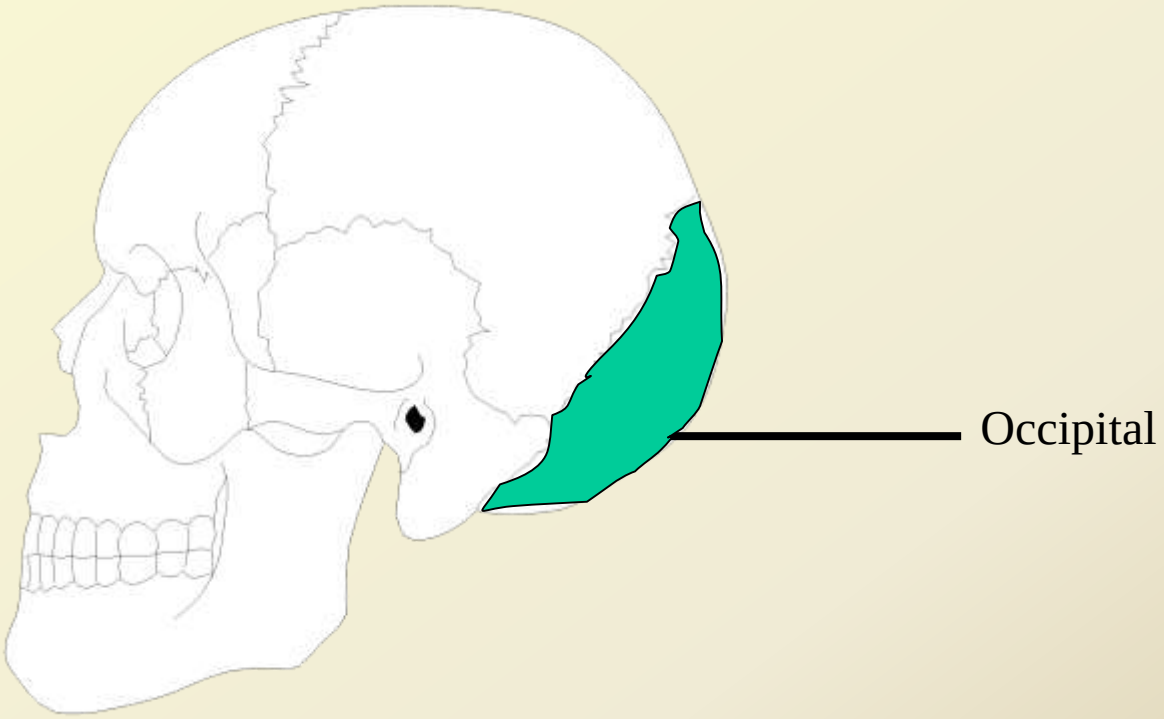

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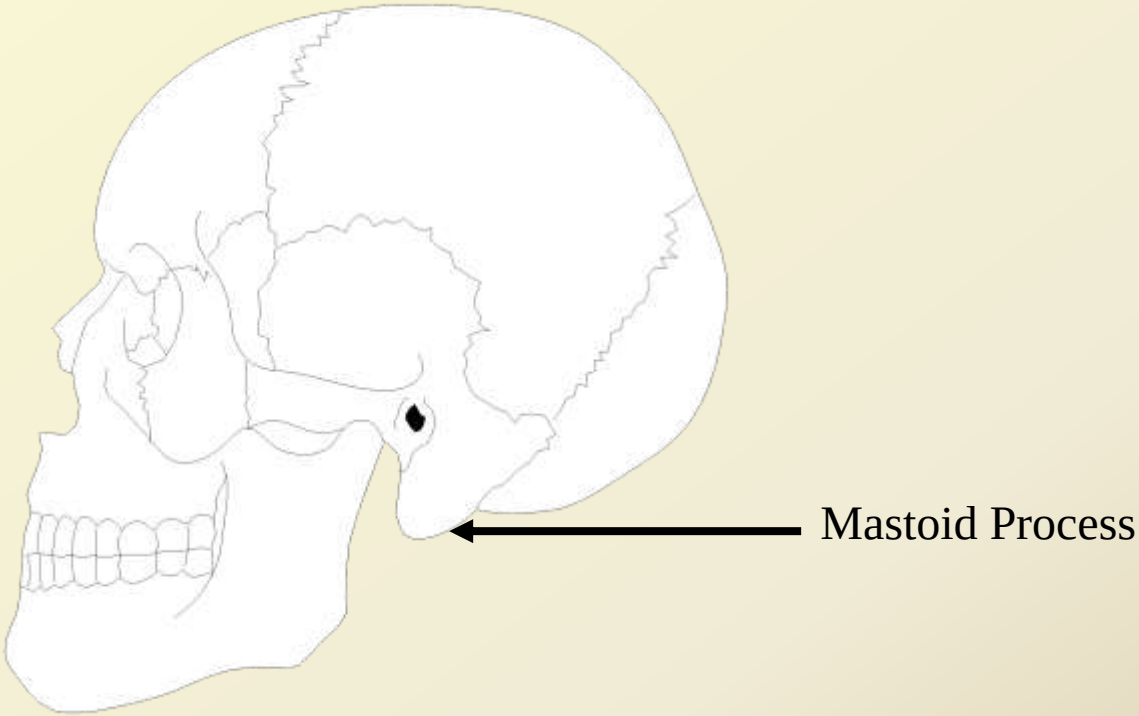

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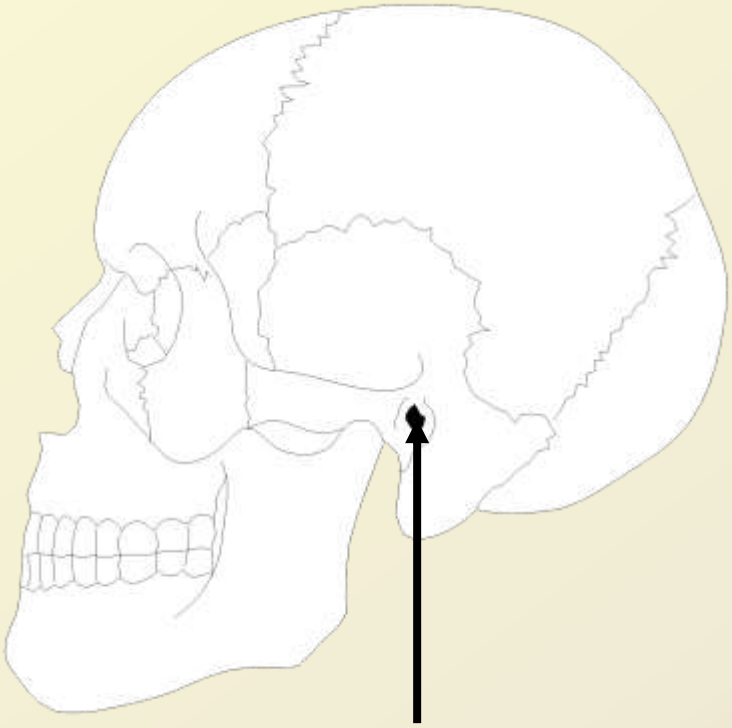
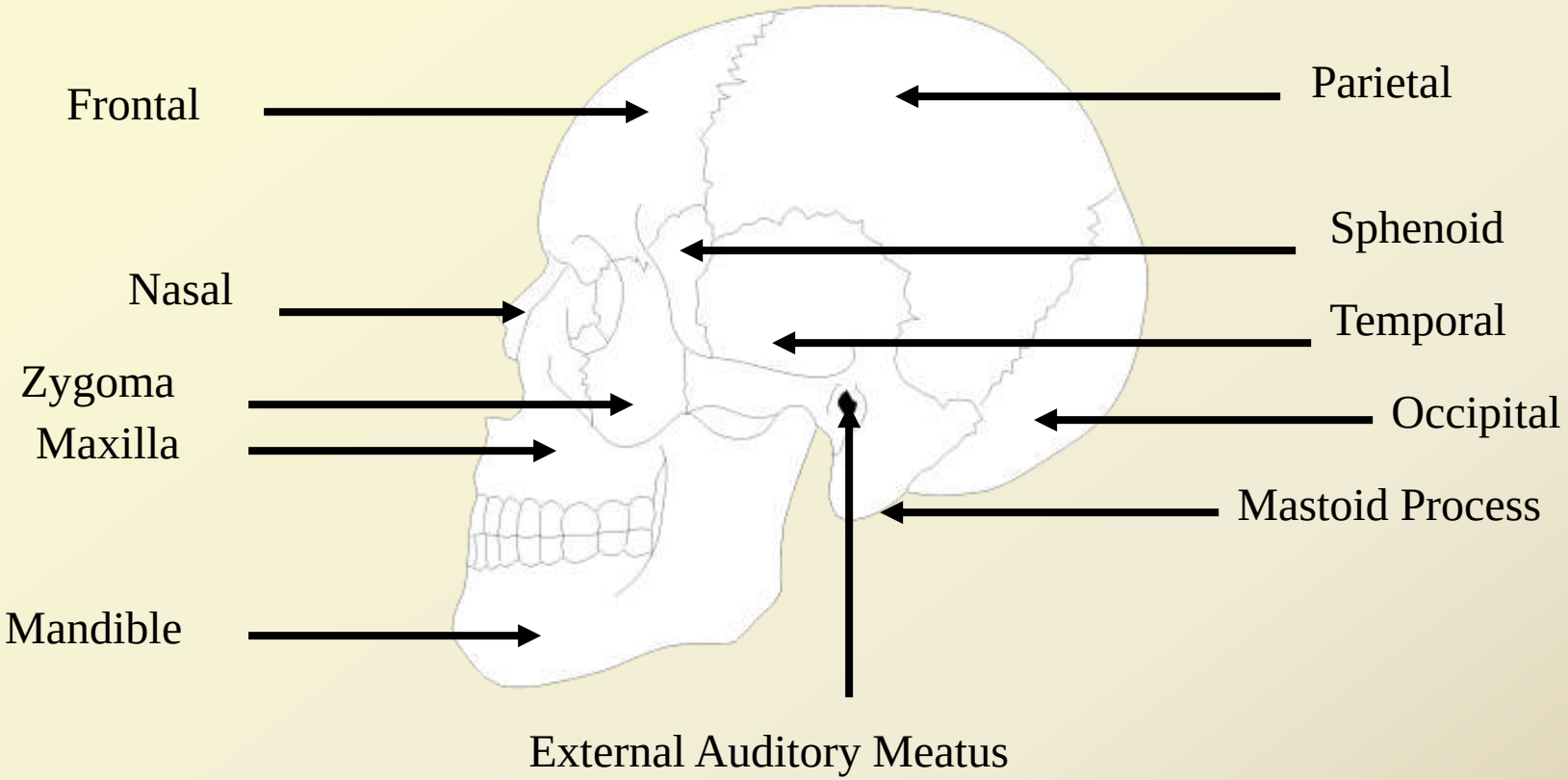
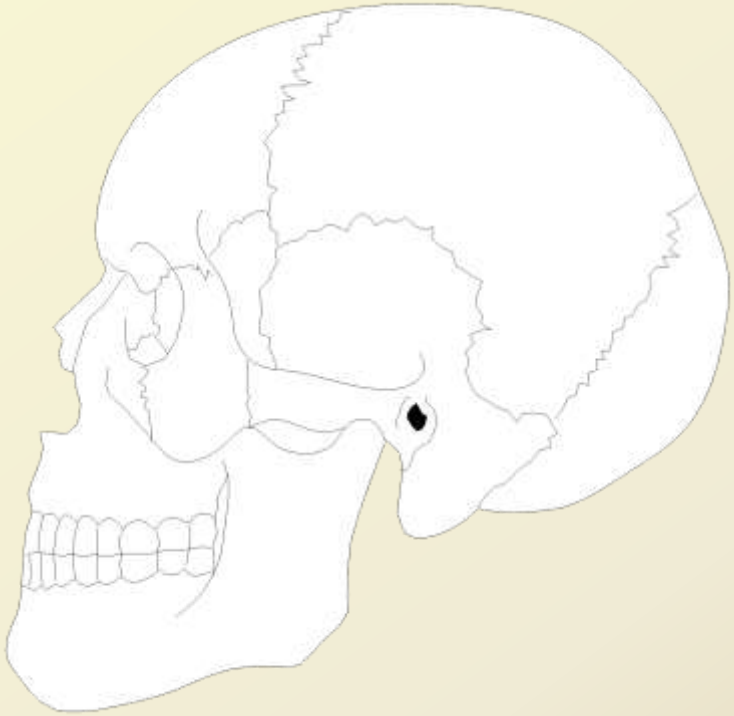


External Auditory Meatus

Lateral View

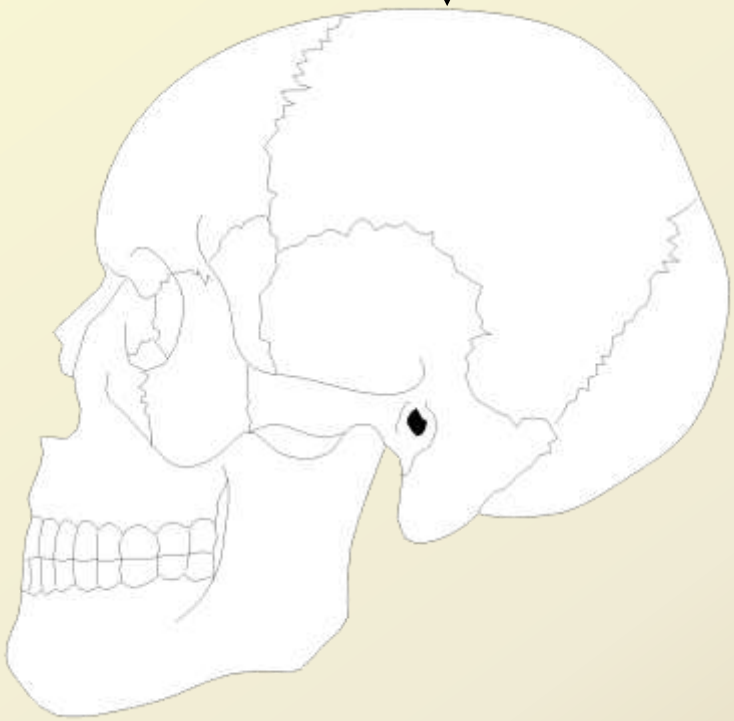


Lateral View



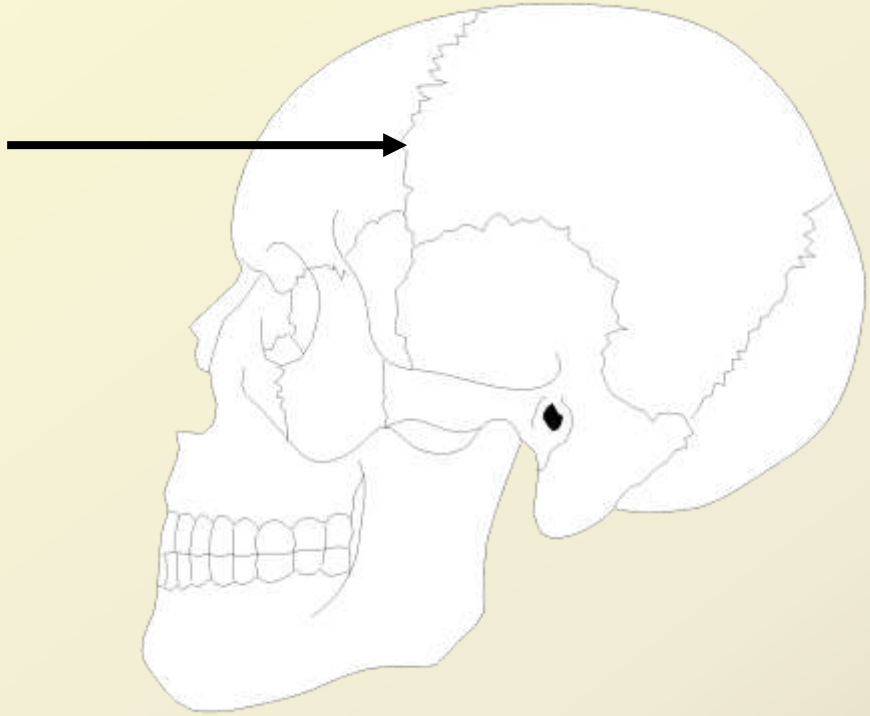
Sutures

Sagittal

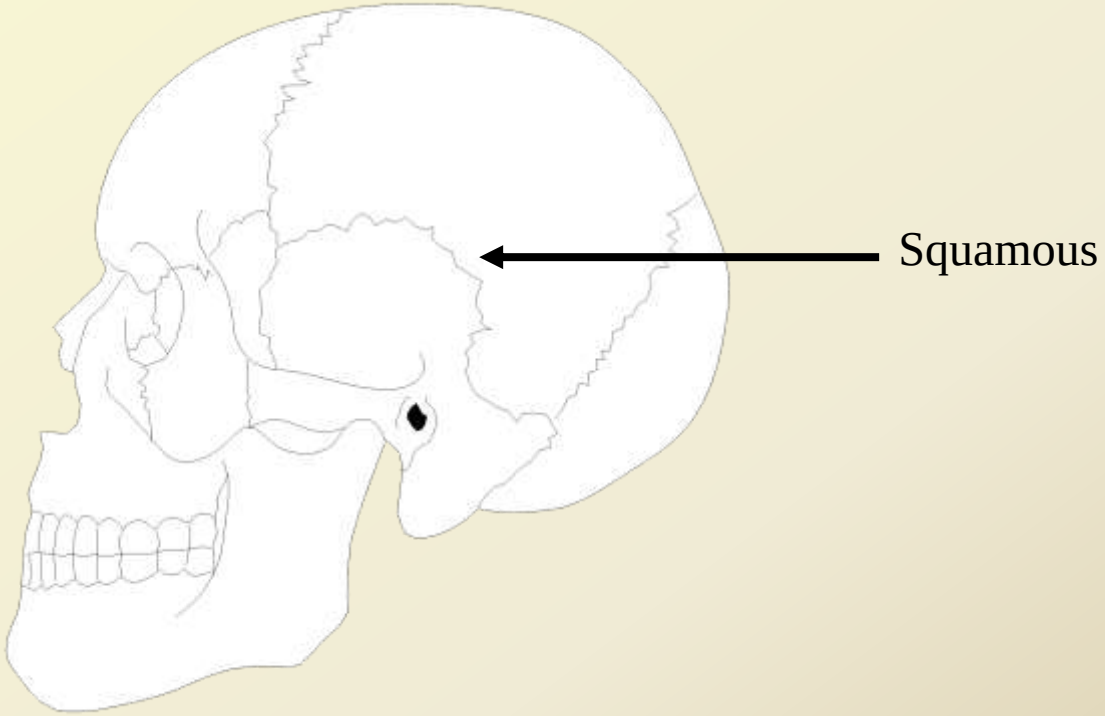


Sutures

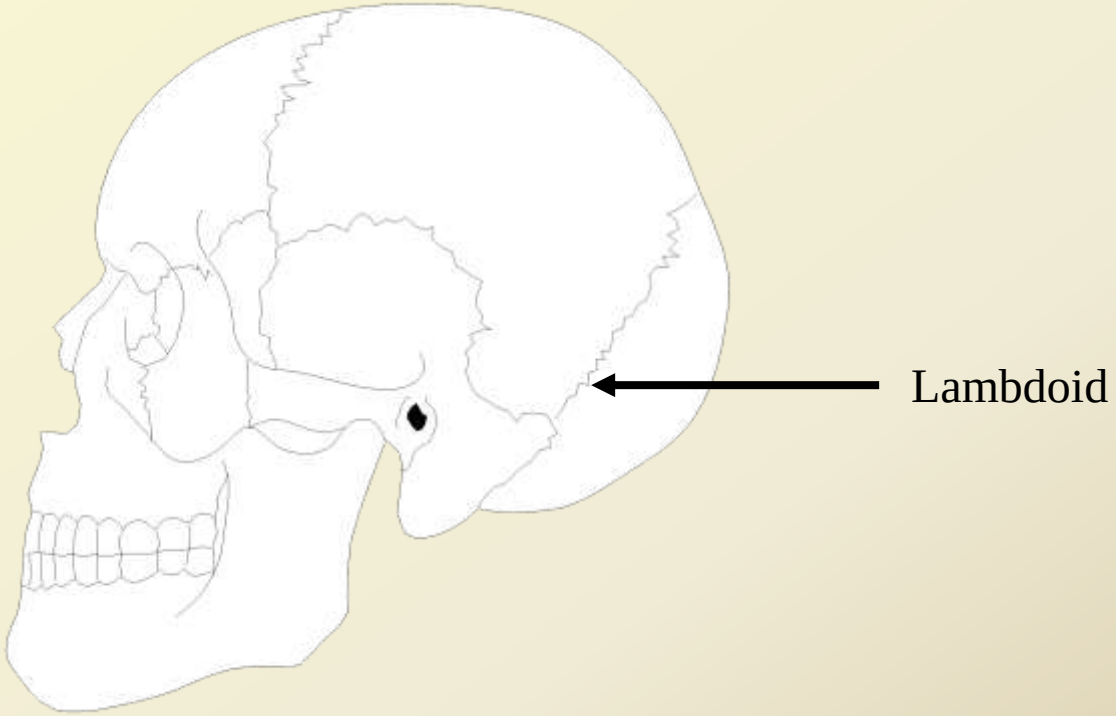
Frontal
(Coronal)



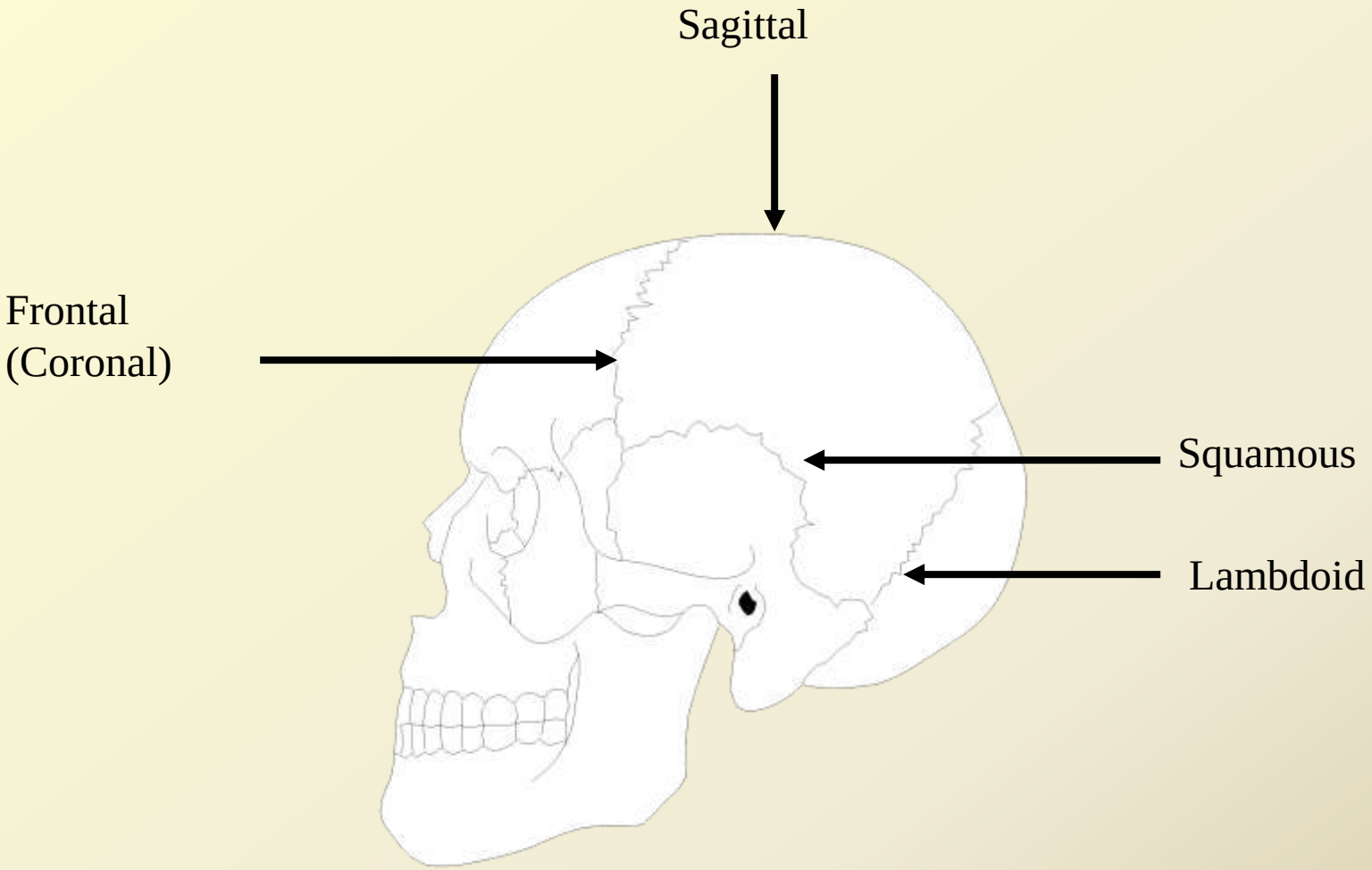
Sutures



Sutures



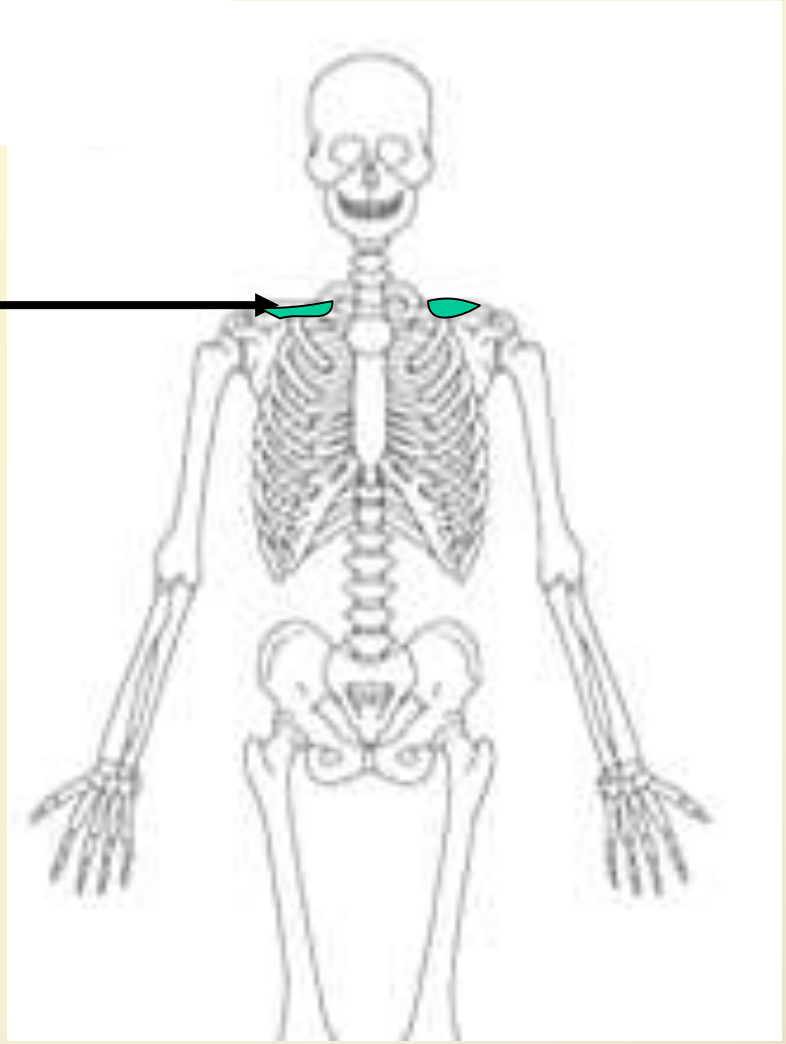
Sutures

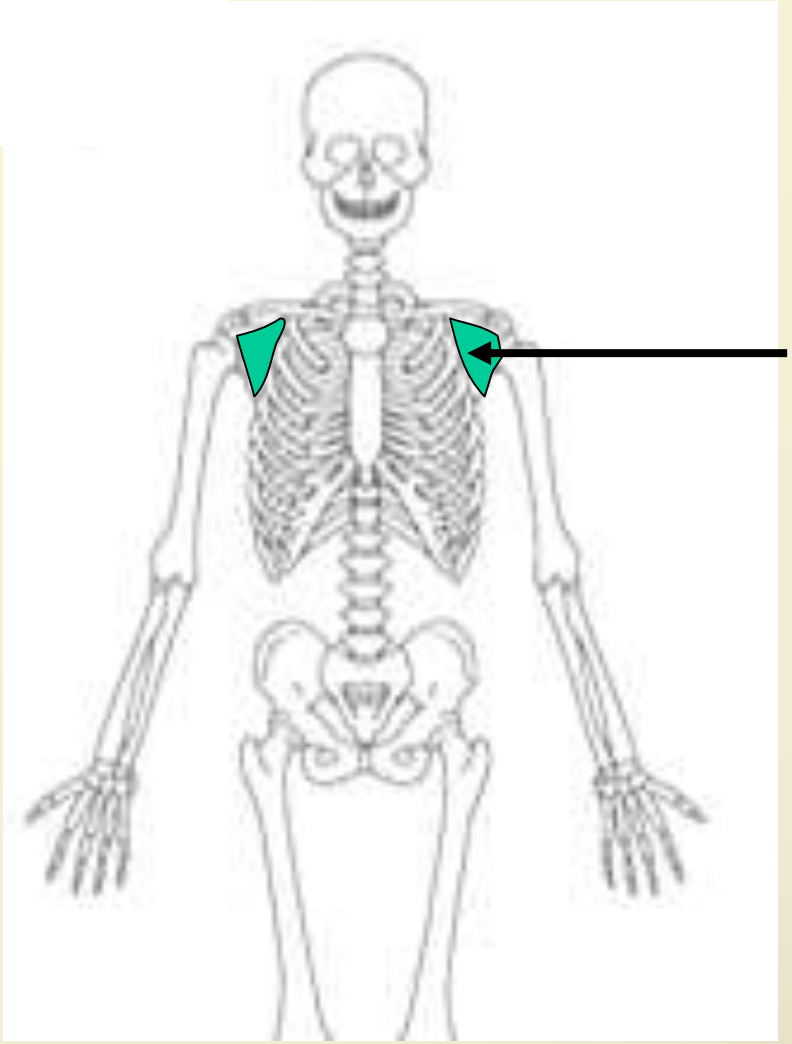


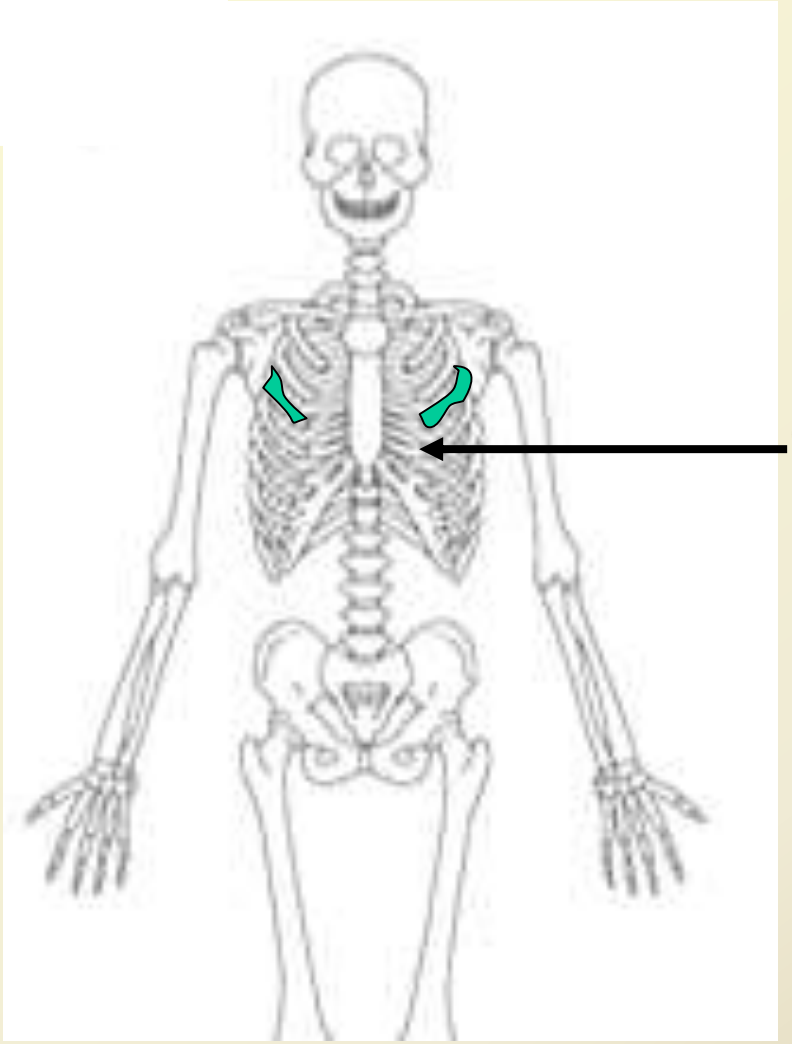
Sutures

Bones of the Appendicular Skeleton

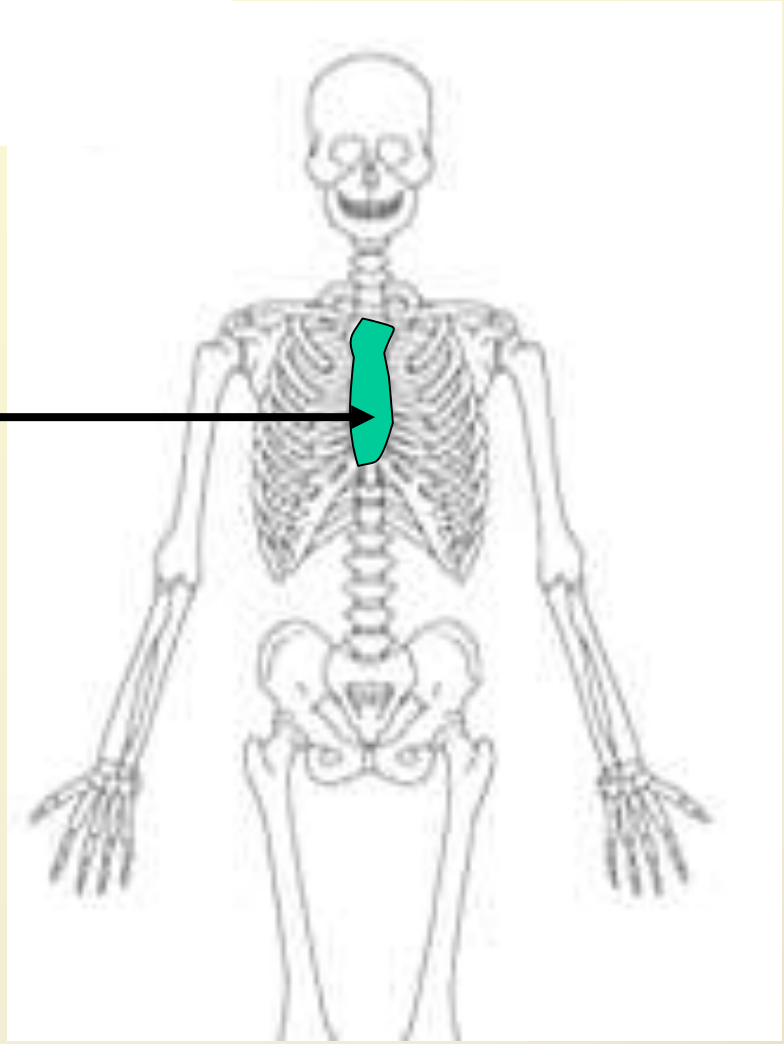
Clavicle

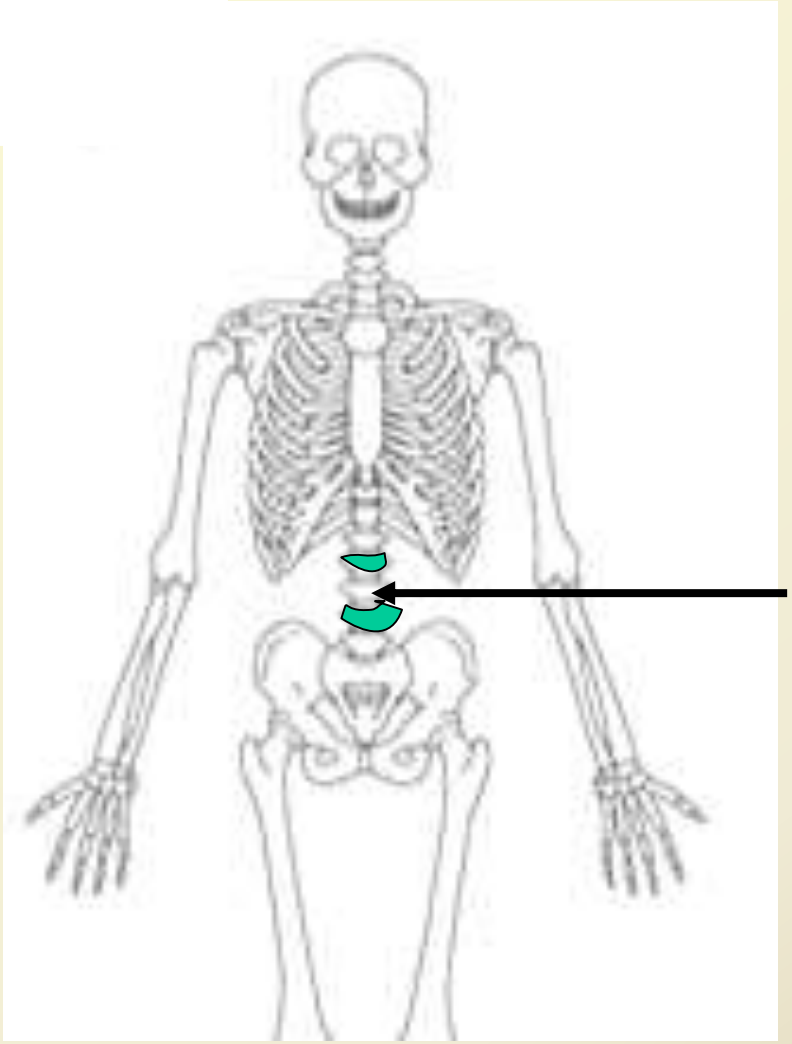



Scapula

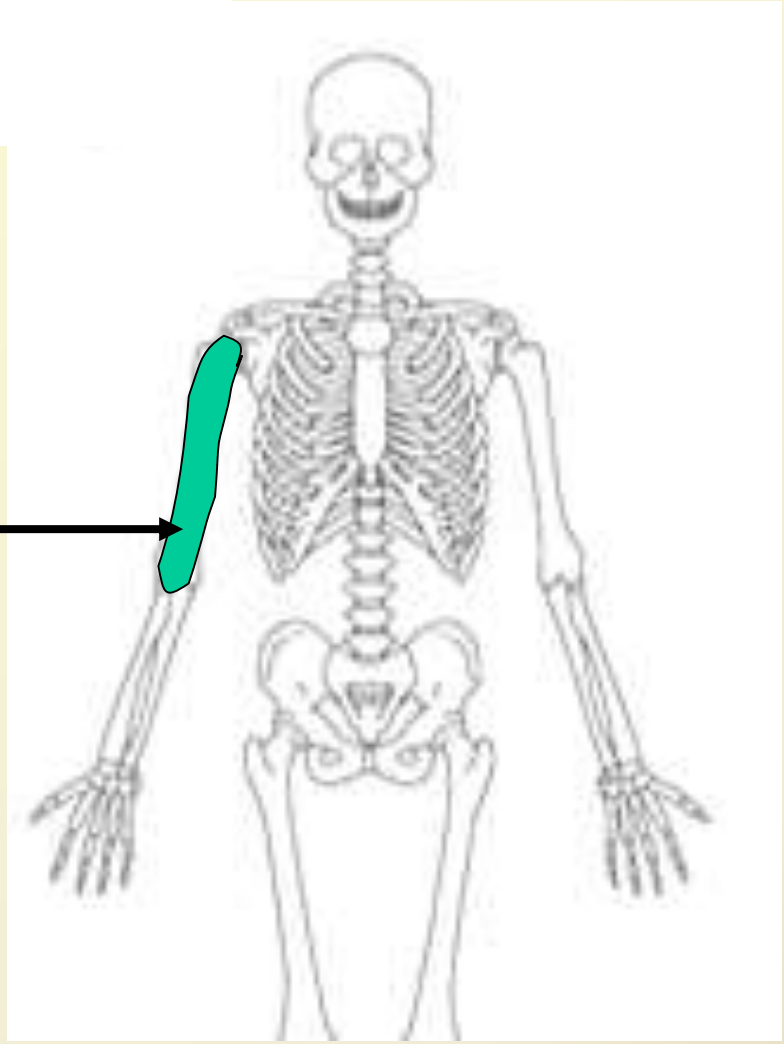

Costals (Ribs)

Sternum

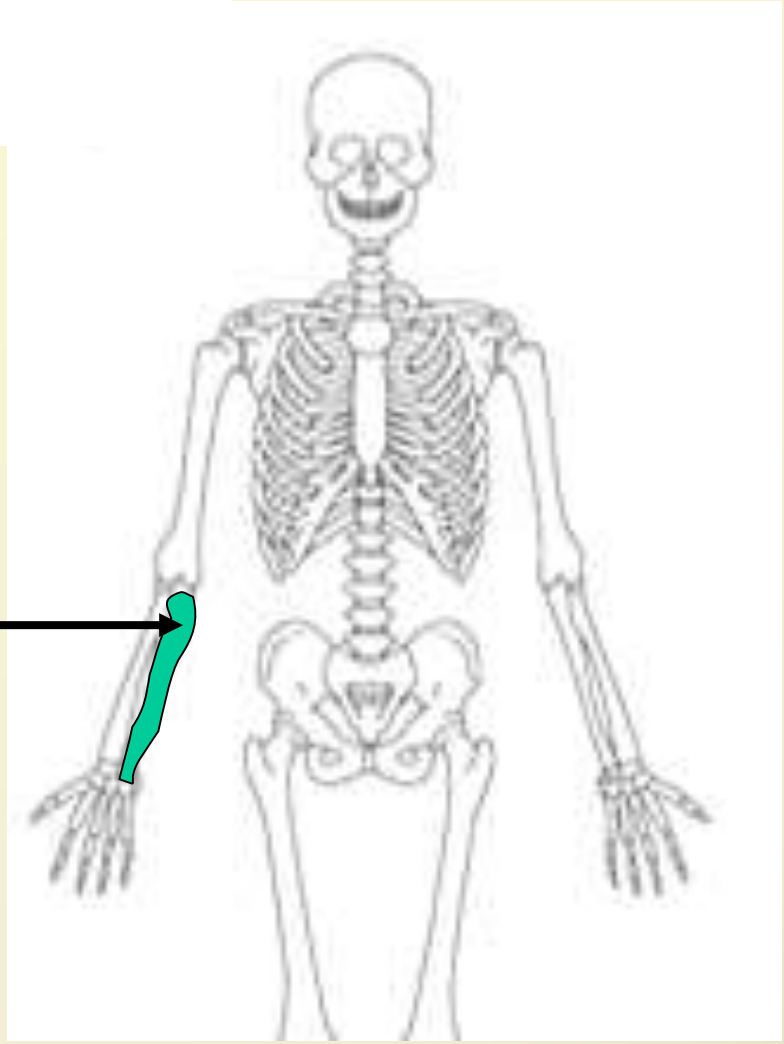


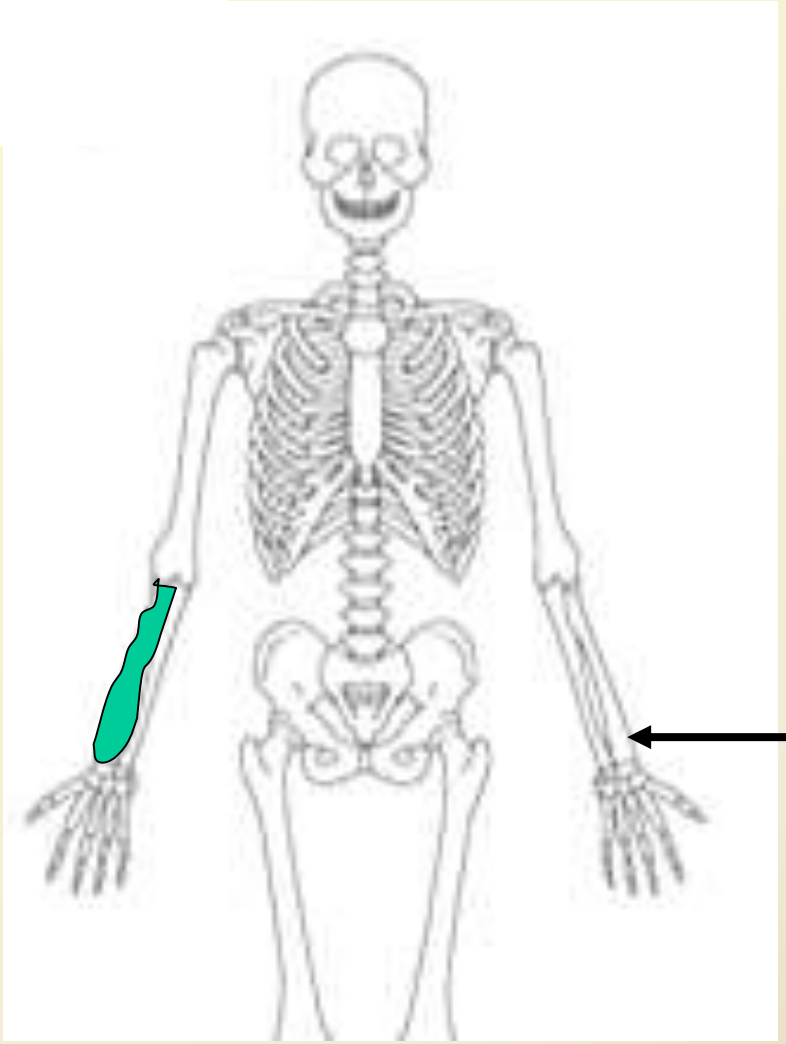

Vertebra

Humerus

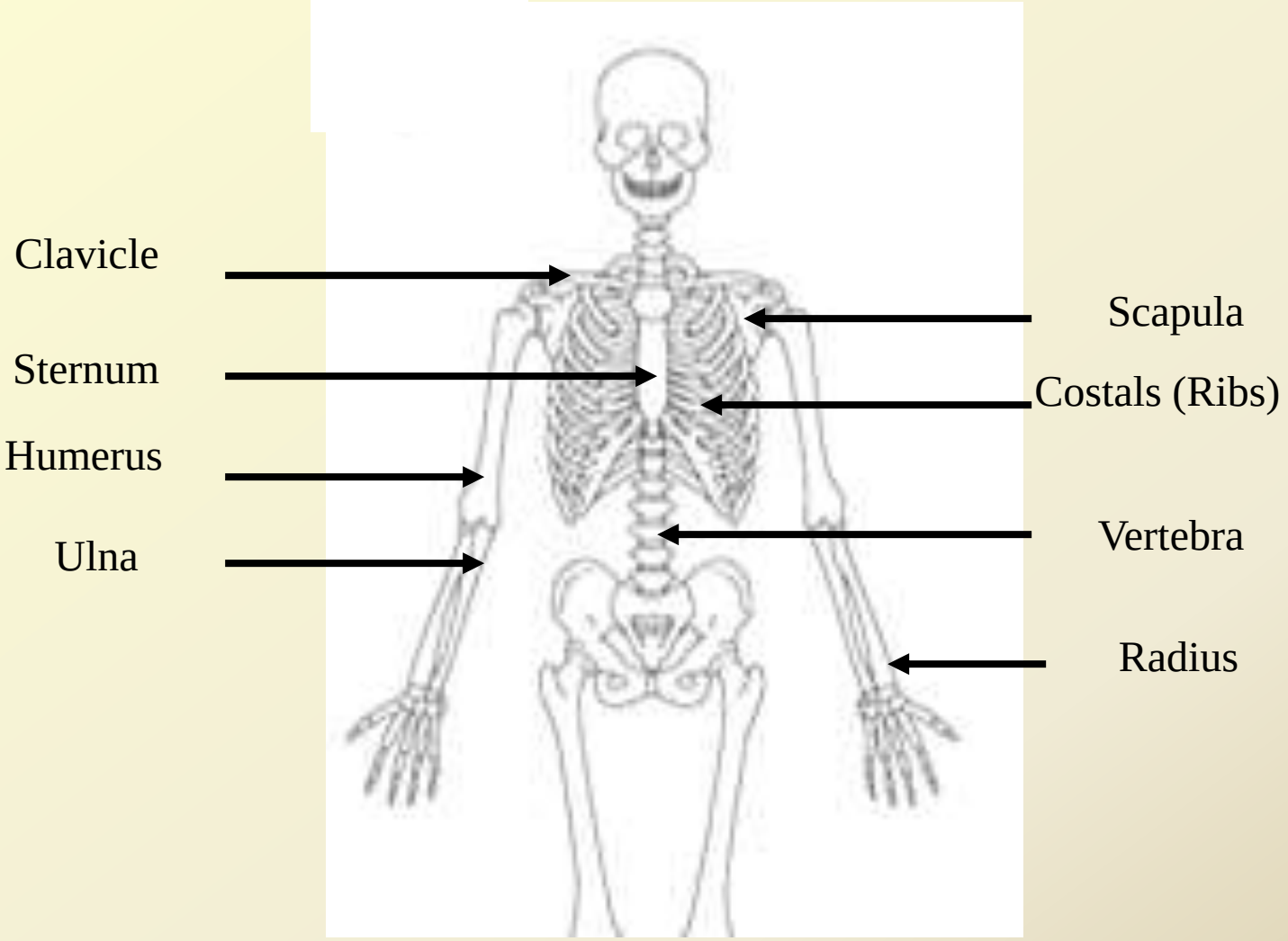


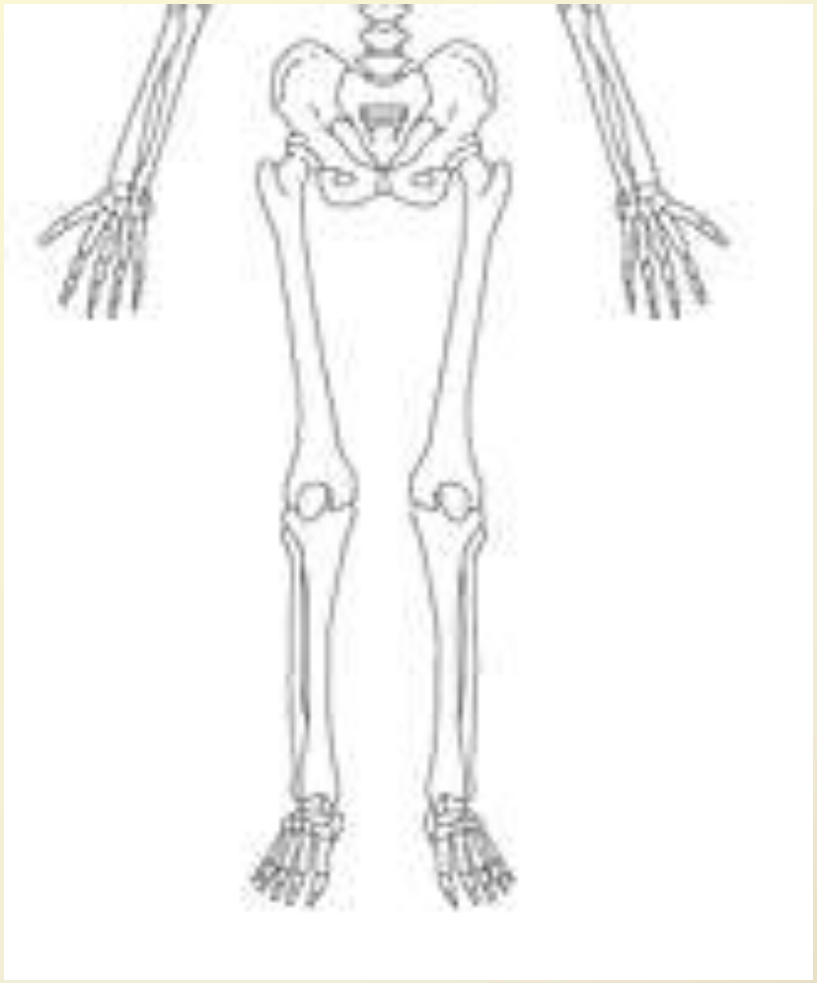
Ulna

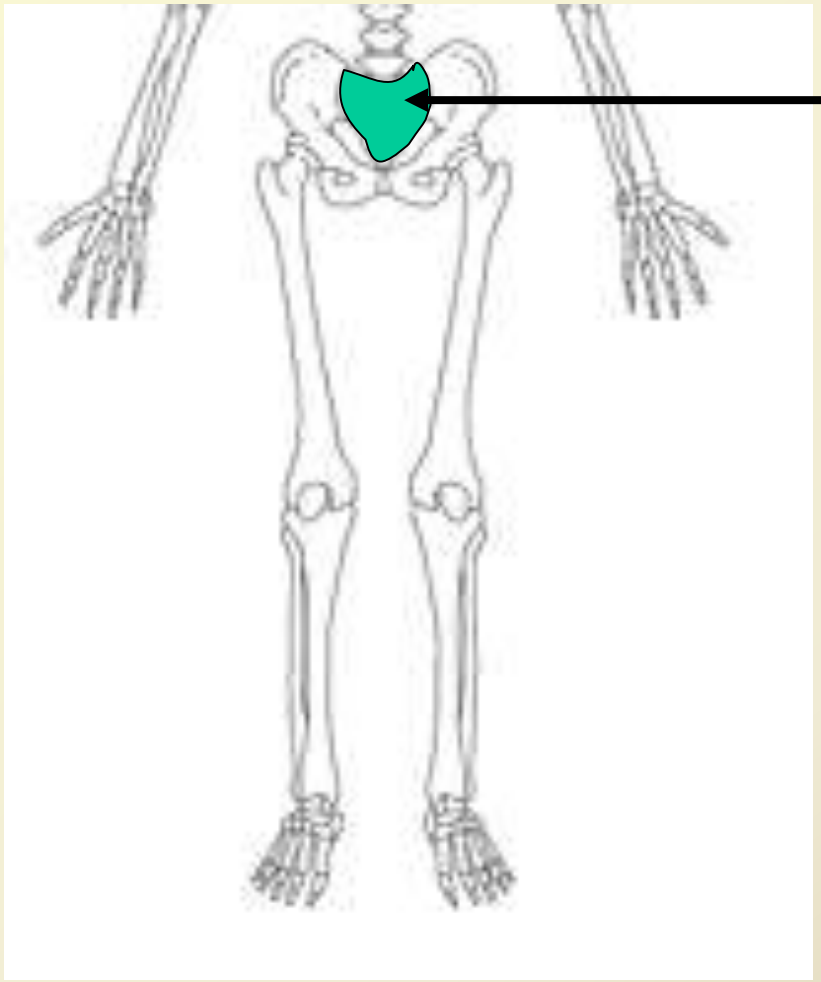




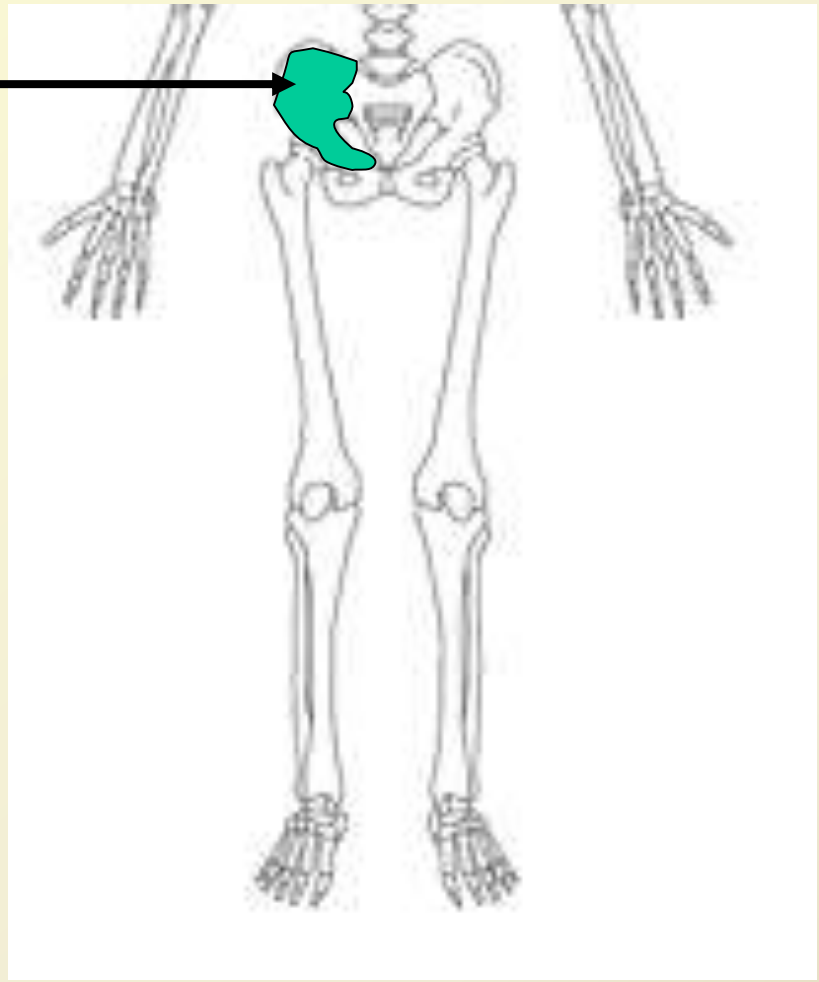
Radius


Clavicle
Sternum
Humerus
Ulna
Scapula
Costals (Ribs)
Vertebra
Radius

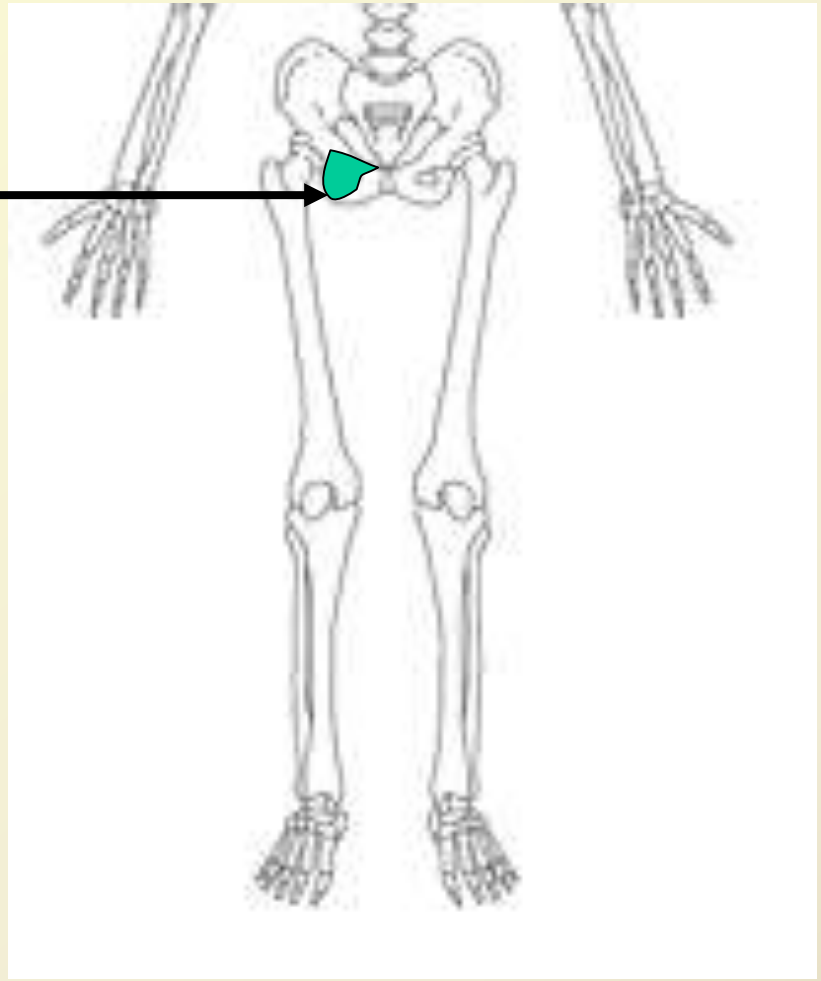


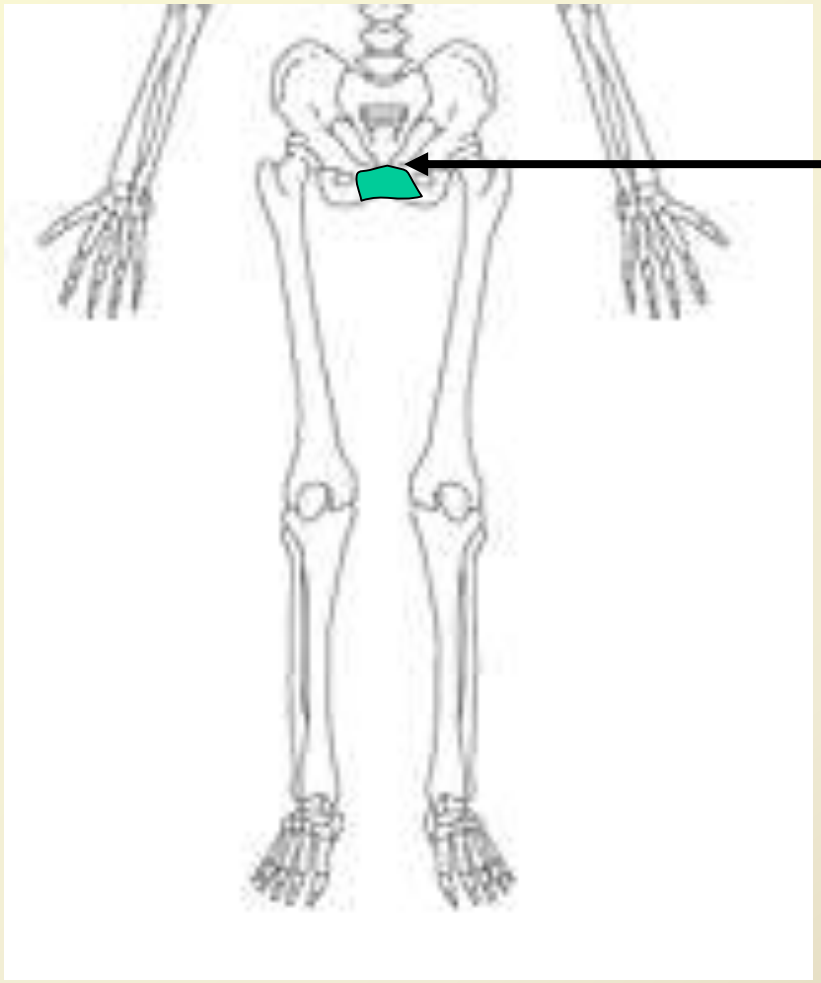

Sacrum

Ilium

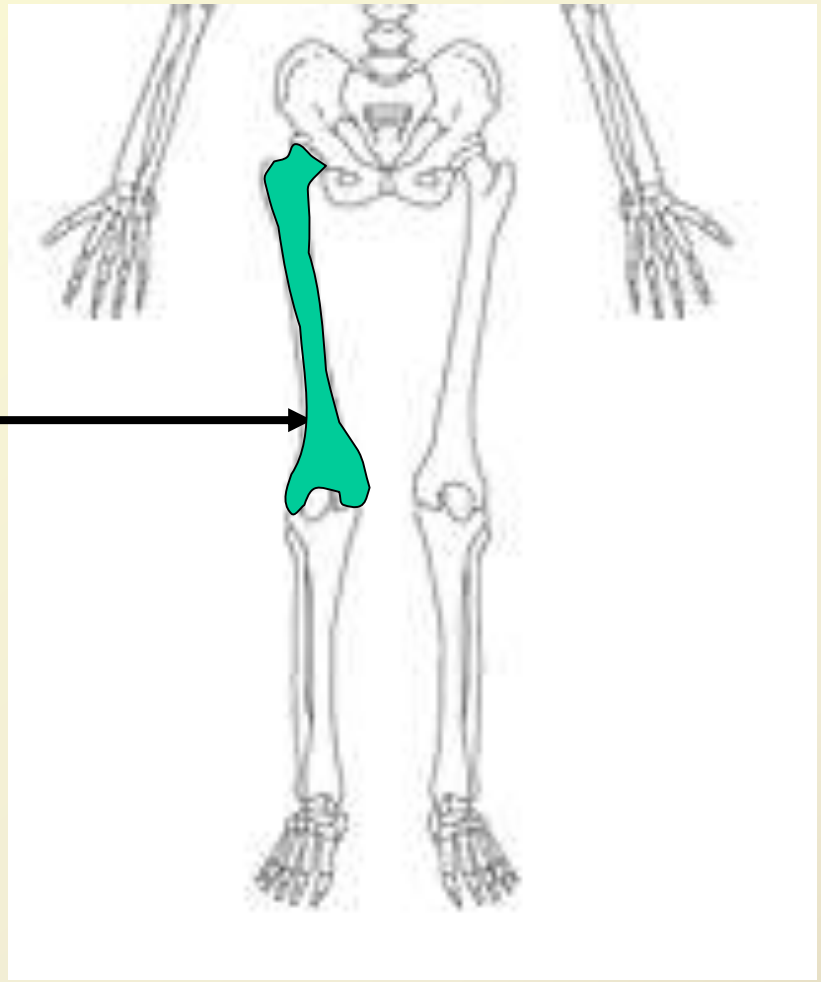


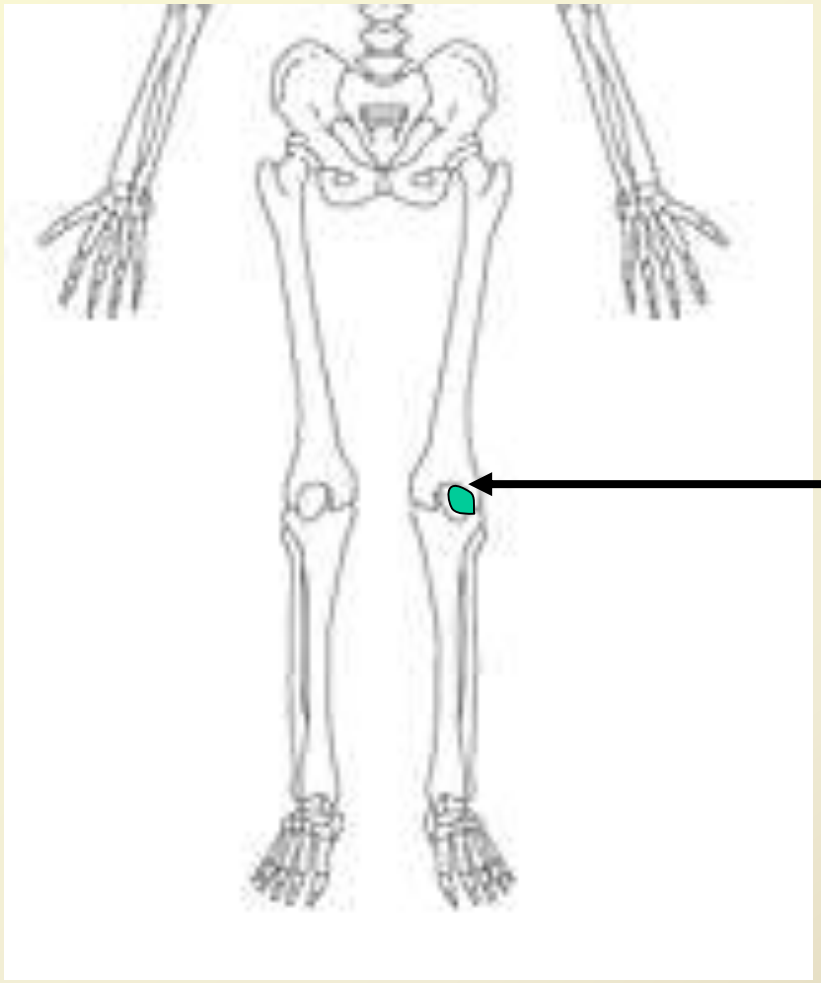
Ischium

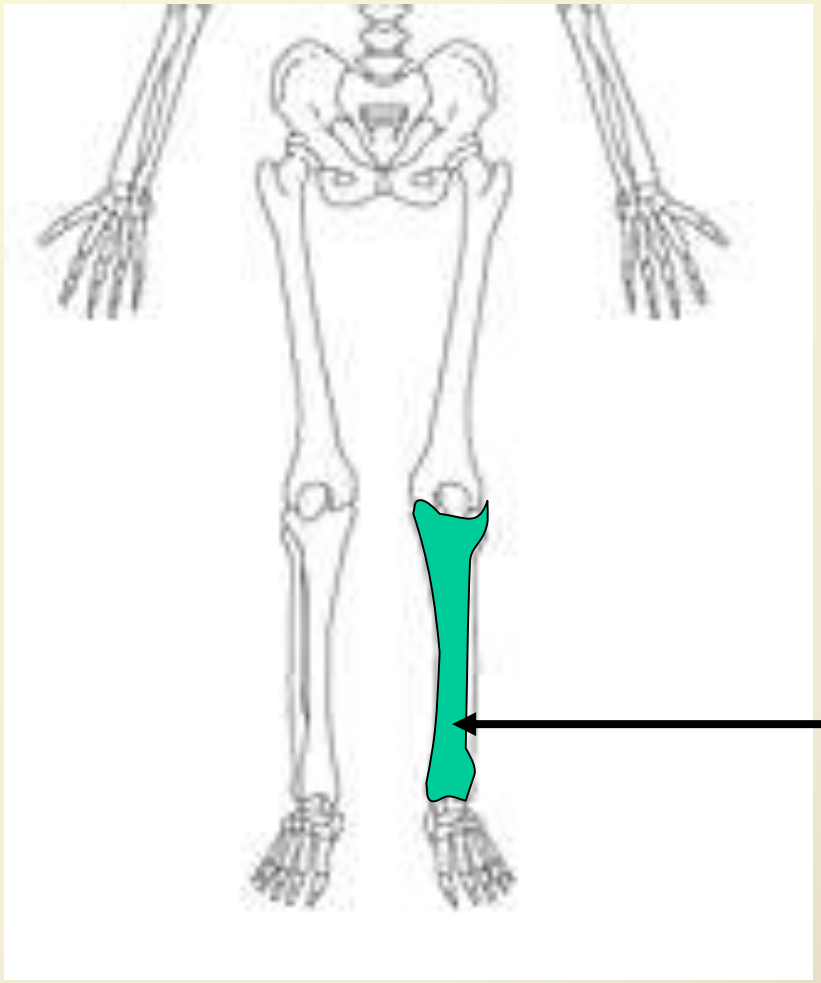



Pubis

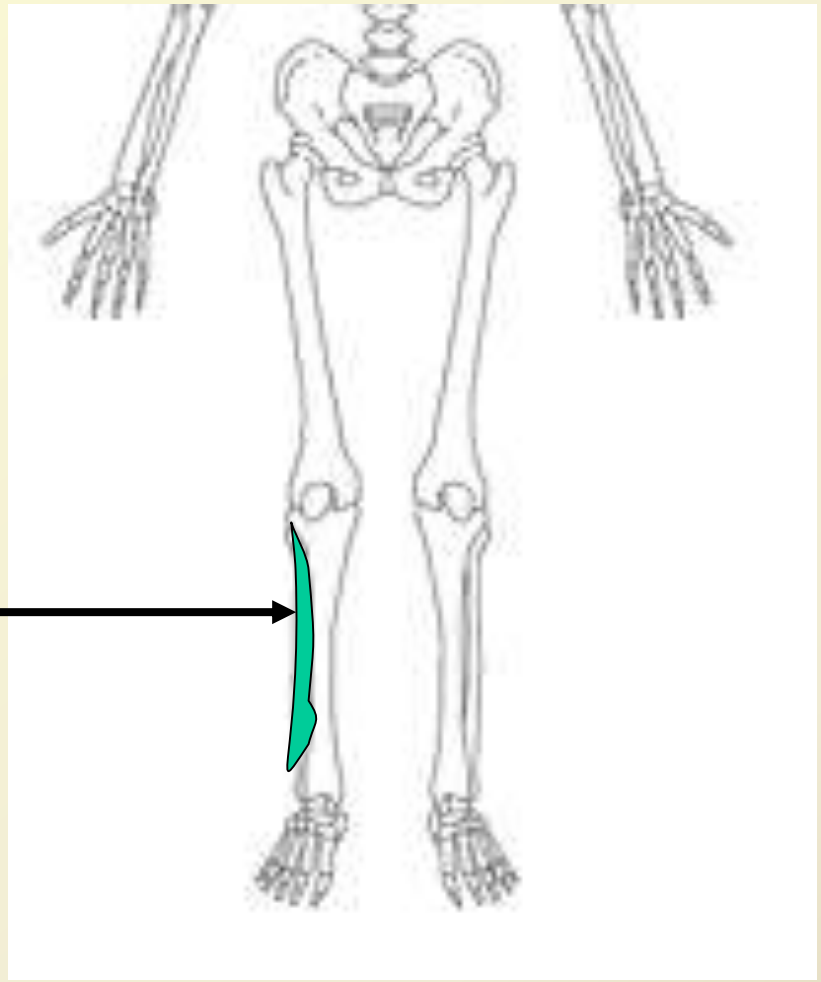
Femur

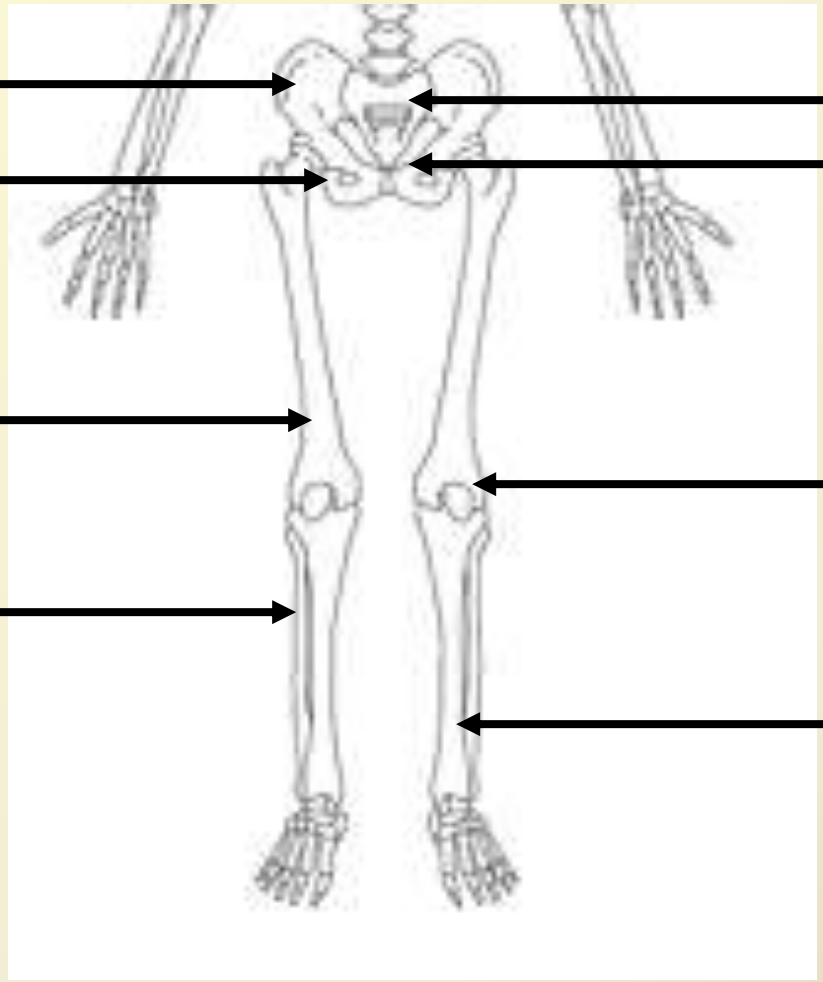


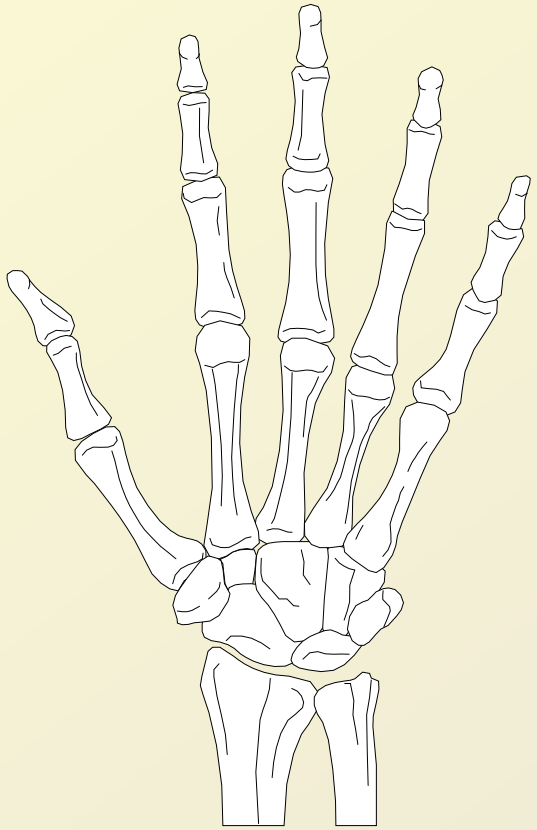

Patella


Tibia

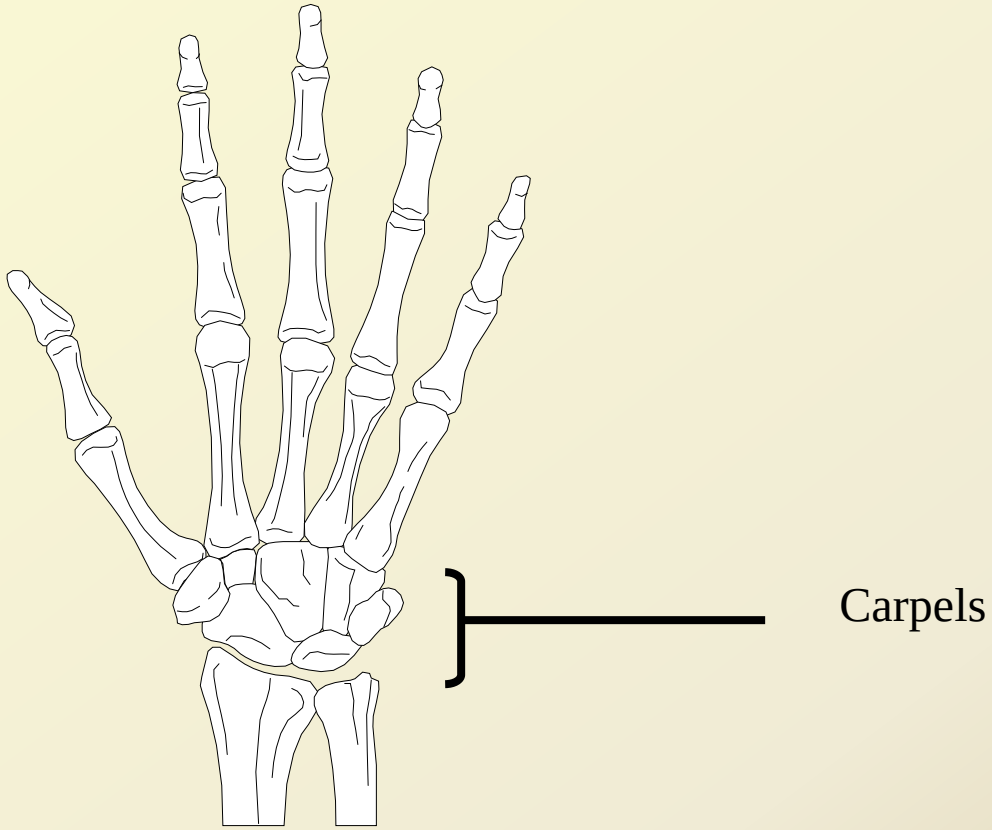
Fibula



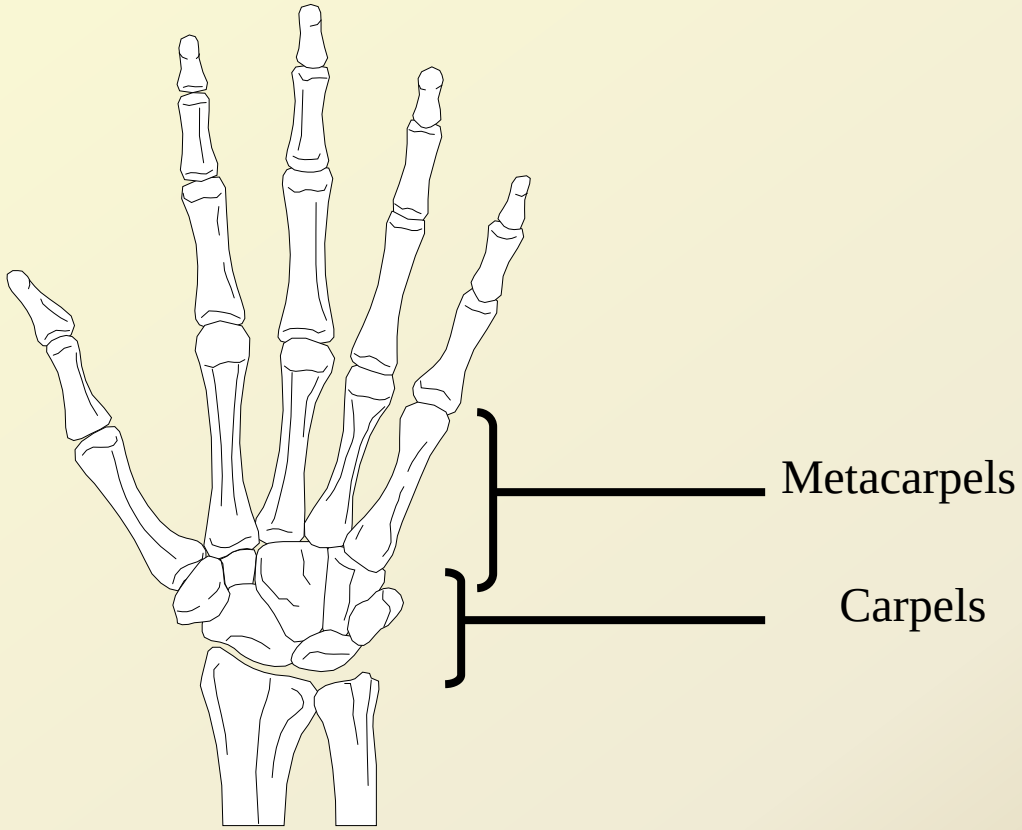

Ilium
Ischium
Femur
Fibula
Sacrum
Pubis
Patella
Tibia



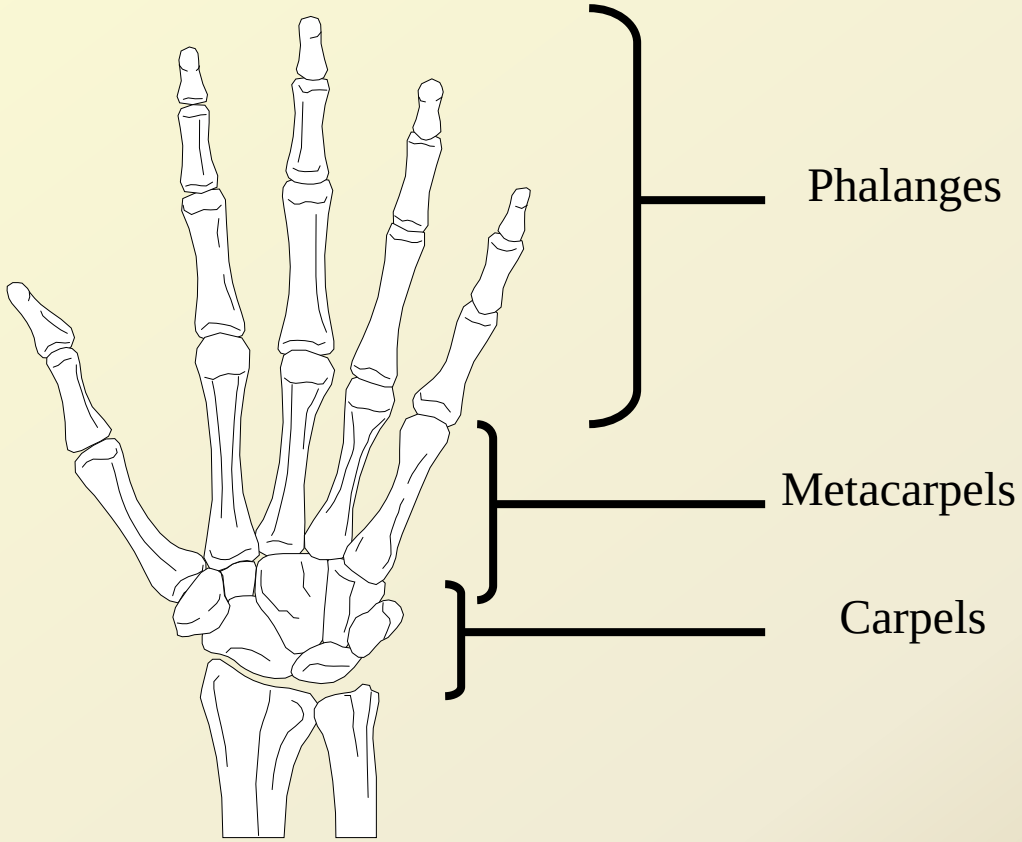
Bones of the Hand



Bones of the Hand

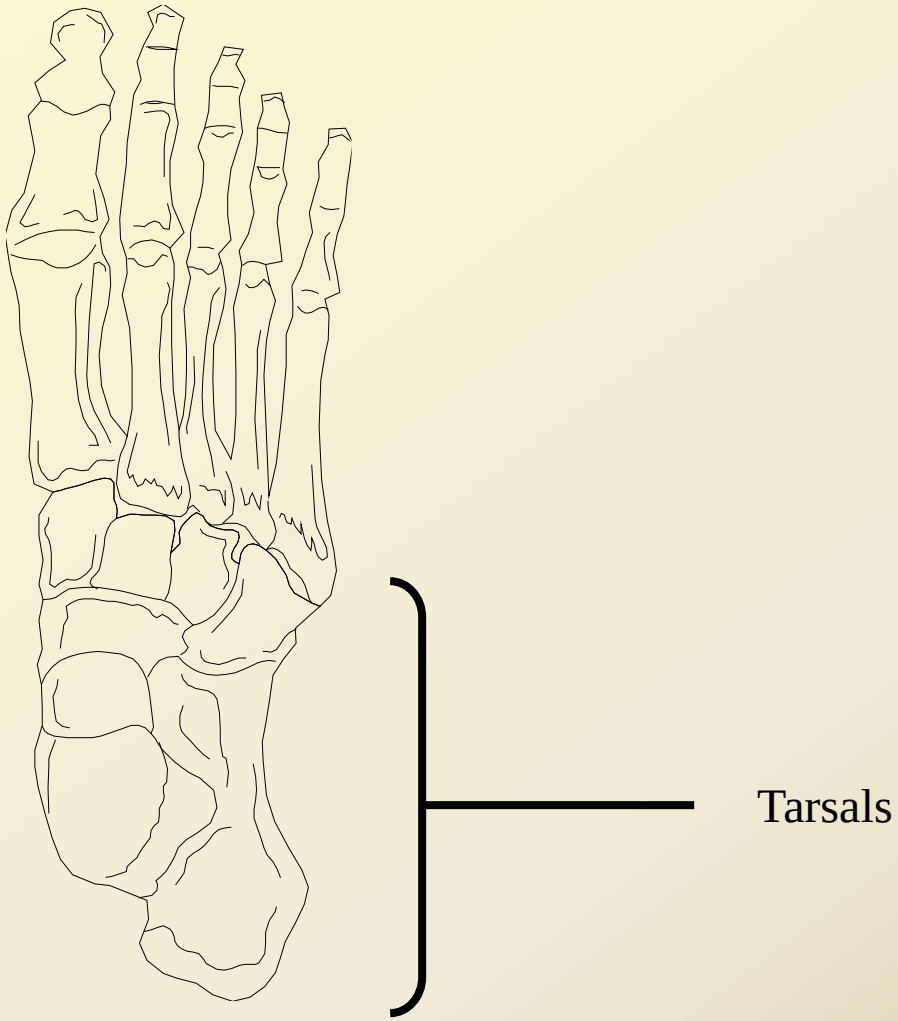


Bones of the Hand

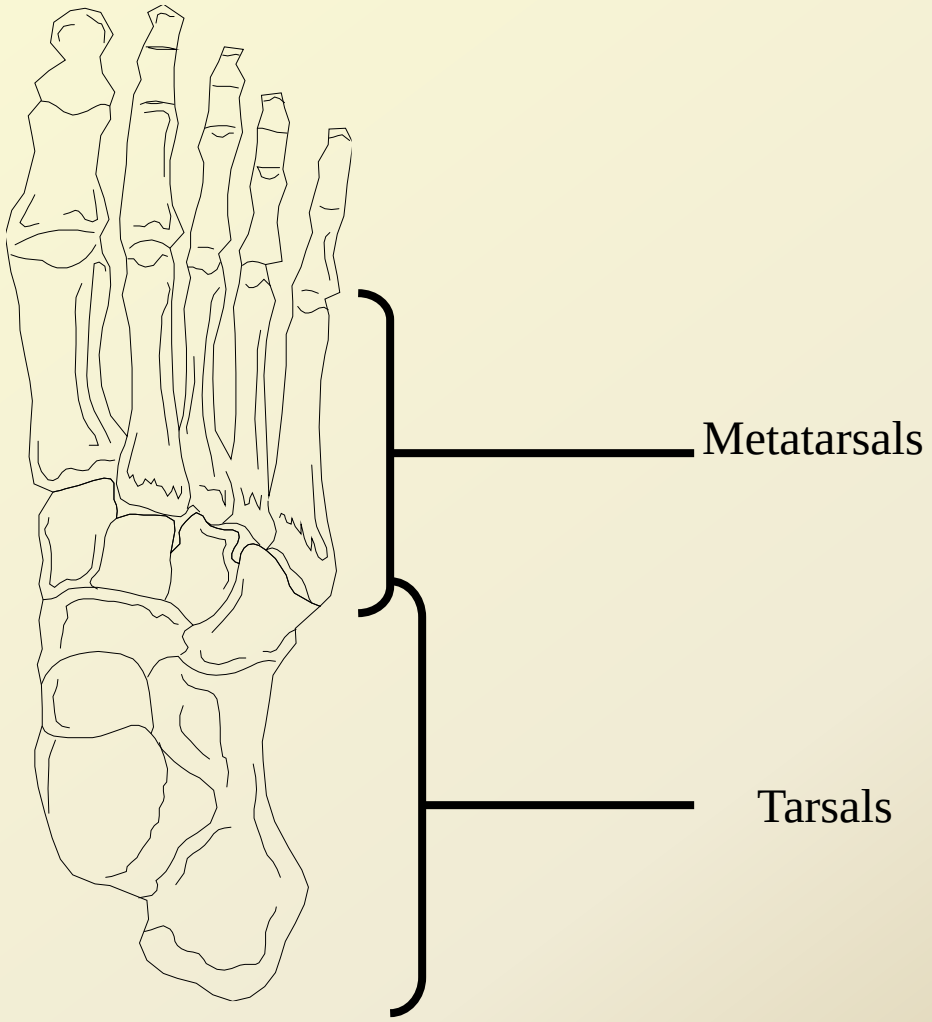


Bones of the Hand

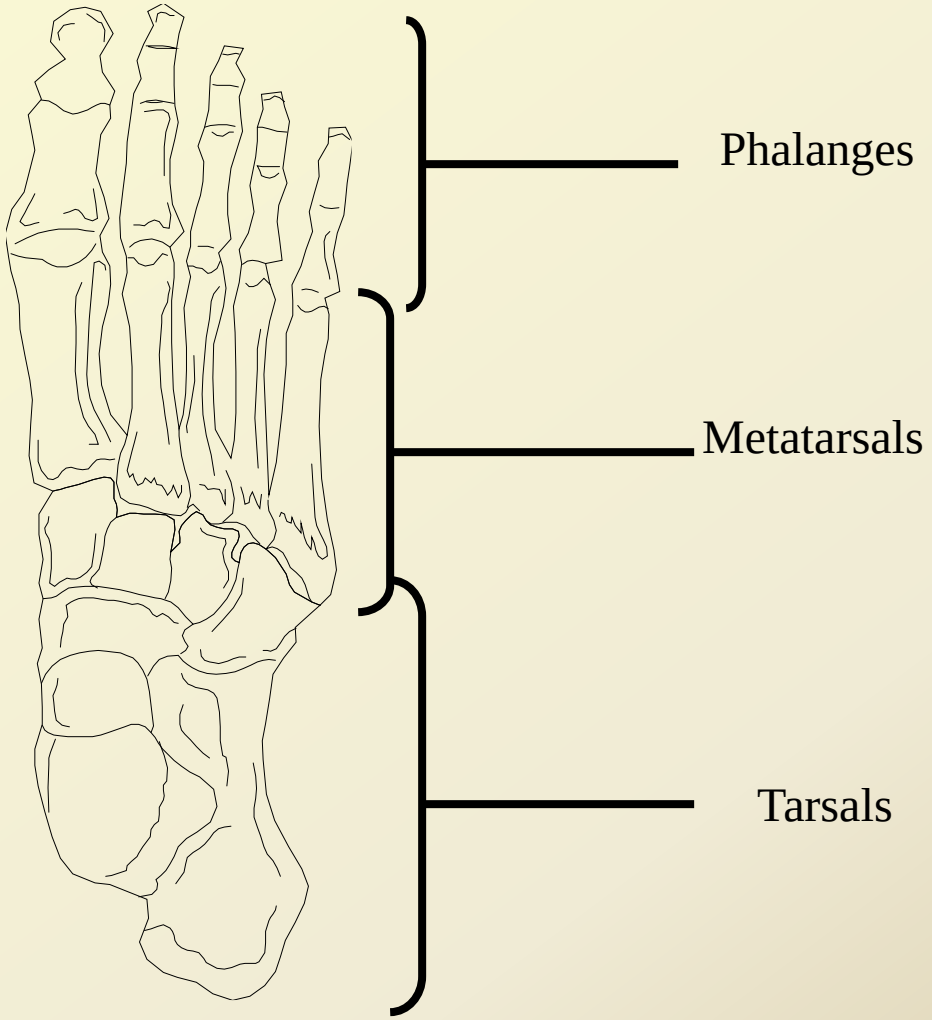
Bones of the Foot



Bones of the Foot



Bones of the Foot

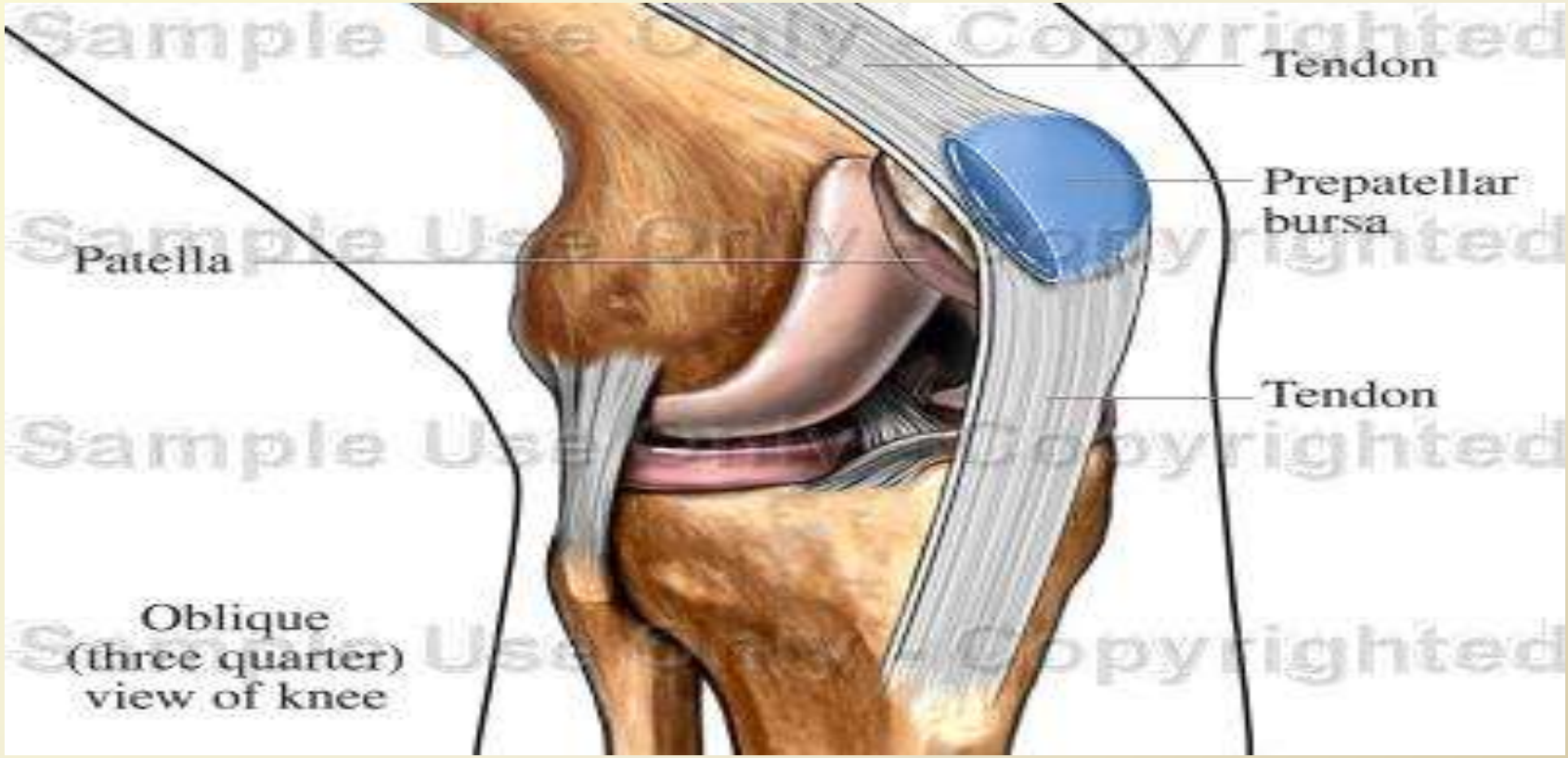


Bones of the Foot

2- Joints

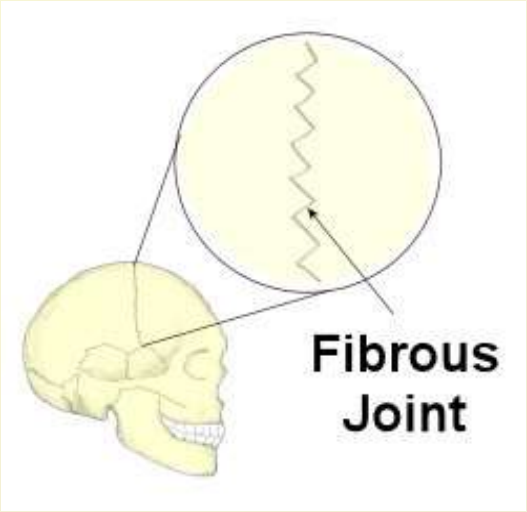
- **Joint:** the point at which two or more bones meet. The synotide membrane lines the joints. It secretes **synovial fluid** that acts as a lubricant so the joint can move smoothly
- **Components: (**Synovial fluid-Cartilage-Tendons-Ligaments-Bursa)

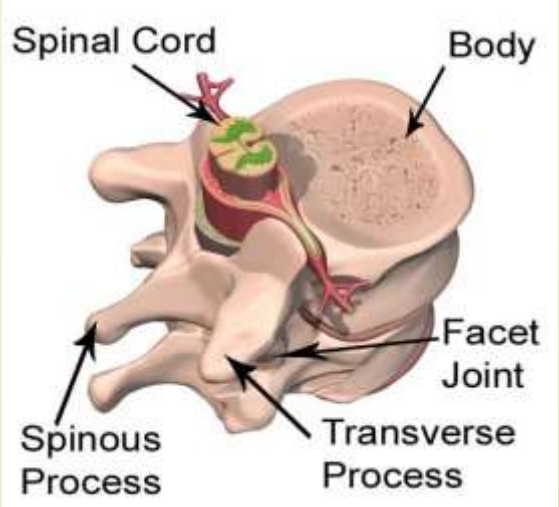
◆**Bursa**: disc shaped, fluid-filled synovial sacs that develop at points of friction around joints, between tendons, cartilage & bone→decrease friction & promote ease of motion

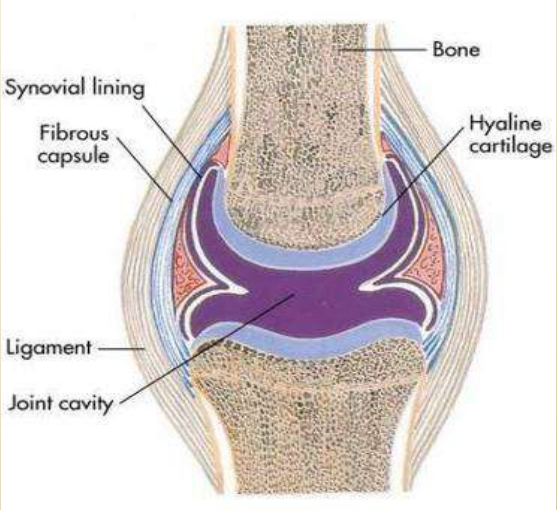


Classification of Joints

- **(1) Synarthroses or fibrous**
- **(2) amphiarthroses or cartilaginous**
- **(3) diarthroses or synovial = movable joints**







Movable joints

Joint motion produced by muscle contraction - terms

- Flexion
- Extension
- Dorsiflexion
- Plantar flexion
- Adduction
- A**b**duction
- Inversion
- Eversion
- Internal rotation
- External rotation
- Pronation
- Suppination

3- Supportive connective tissue

(A)Cartilage : cushioning tissue within a joint so that the bone ends do not rub together

- **-Hyaline cartilages** (trachea, nose and articular surface of bones)
- **Elastic cartilage** (ear, epiglottis, and larynx)
- **Fibrous cartilage** (between the vertebral disks, between bones of the pelvic girdle, knee, and shoulder).

(2)Ligaments

Is a small band of dense, white, fibrous elastic tissue , connect bones to each other at the joint level to limit dislocation and provide stability while permitting controlled movement at the joint.

- Also support many internal organs; including the uterus, the bladder, the liver, and the diaphragm and supporting the breasts.

(3)Tendons:

connect muscles to bones, When muscles contract (shorten), tendons at each end of the muscle cause the bone to move

ASSESMENT OF THE MUSCULO-SKELETAL SYSTEM

Aims of musculoskeletal assessment:

For the patient presenting with a musculoskeletal problem his primary complaint is likely to be that of pain or a decrease in functional ability. Thus, the aim of the musculoskeletal assessment is to **determine the degree to which the patient's activities of daily living are affected, through a systematic assessment.**

General aspects of musculoskeletal assessment:

- **two objective stages together** ; inspection and palpation. rather than inspecting all joints and then returning to palpate.
- **To discover you must uncover** but ensure **privacy** and dignity.
- Always ask whether the patient has any pain and if so, **assess the pain-free side first.**

General aspects of musculoskeletal assessment:

- **position for patient comfort**
- Always **compare** each side.
- **Organize** your examination of the bones, muscles and joints in a **head-to toe method.** This will help avoid omissions.
- Always start each part of the examination from **the neutral position**

Patient Preparation

- Explain procedure to patient
- Use firm support, gentle movement
- Patient comfortable
- Adequate Lighting

stages of musculoskeletal assessment:

A-Subjective Data;

B-Objective Data;

(Inspection and Palpation) for system and its functions(ROM-limb measurement -Bones- Joints- Muscles) and Diagnostic Studies

A-Subjective Data;

A-Subjective Data;

(1)Demographic data: Age, sex, Weight gain/loss and Work……etc

(2) Present history musculoskeletal complaint:

- ✓what's **functional limitation**?
- ✓-Symptoms in **single** vs **multiple** joints?
- ✓**-Acute** vs **slowly** progressive?
- ✓-If **injury→mechanism**?
- ✓**-Prior problems** w/area?
- ✓**-Systemic** symptoms?

A-Subjective Data;

(3)PQRSTA: useful in gathering data about any complaint/problem/symptom.

Provocative or Palliative

✓What causes the symptom?

✓What makes is better or worse?

✓ What have you done to get relief?

Musculoskeletal assessment

Quality or **Q**uantity

- ✓What is the character of the symptom i.e. pain: is it crushing, piercing, dull, sharp?
- ✓How much of it are you experiencing now?

Region or **R**adiation

- ✓Where is the symptom?
- ✓Does it spread?

Musculoskeletal assessment

- **Severity**

How does the symptom rate on a severity scale of 1 to 10 with 10 being the most intense?

- **T**iming &**T**ime

Timing:

- ✓ When did the symptom begin?
- ✓How long does it last (Identify 24 hour pattern of presenting complaint?

- **T**ime: How often does it occur? Is it sudden or gradual?

Musculoskeletal assessment

- **Associated signs and symptoms** of the chief complaint
- Most common Chief complaint: pain, weakness, and deformity, limitation of movement, stiffness, and joint crepitating , changes in sensation or in the size of a muscle, discomfort , disturbed sleep pattern..

(4) Effects of presenting musculoskeletal complaint on:

- activities of daily living: able to care for himself (independently-with assistance -complete dependence)
- Activity-Exercise Pattern ,Nutritional-Metabolic Pattern, Elimination Pattern, Sleep Pattern, Role-Relationship Pattern

(5) Past Health History and Concurrent health conditions:

(1)Certain illnesses can affect the musculoskeletal system either directly or indirectly :-

- Tuberculosis, poliomyelitis, diabetes mellitus parathyroid problems, hemophilia, rickets, soft tissue infection, and neuromuscular disabilities.
- Arthritic and connective tissue diseases (e.g., gout, psoriatic arthritis, systemic lupus erythematosus)

- **2-History of trauma,** surgery, period of prolonged immobilization , Alcohol use ,Smoking, Family history of osteoporosis
- **3- Diet**: Adequate amounts of vitamins C and D, calcium, and protein are essential for a healthy, intact musculoskeletal system.

4- Medications:

- for any possible side effects include antiseizure drugs(osteomalacia),corticosteroids(vascular necrosis, decrease bone and muscle mass) and potassium depleting diuretics(muscle cramps and weakness)
- A history of medication use and response to pain medication aids in designing medication management regimens

Musculoskeletal Side Effects of Medications/Substances

-**Amphetamines :** Muscle hyperactivity

-**Anticoagulants:** Bleeding into the joints

-**Antipsychotics:** Dystonic movements, altered gait

-**Caffeine:** Muscle hyperactivity

-**Corticosteroids:** Necrosis of femur head

-**Diuretics:** Muscle weakness and cramping

-**Phenothiazines:** Gait disturbances

(B)Objective Data:

(B)Objective Data:(1) Inspection:

(1) Inspection:

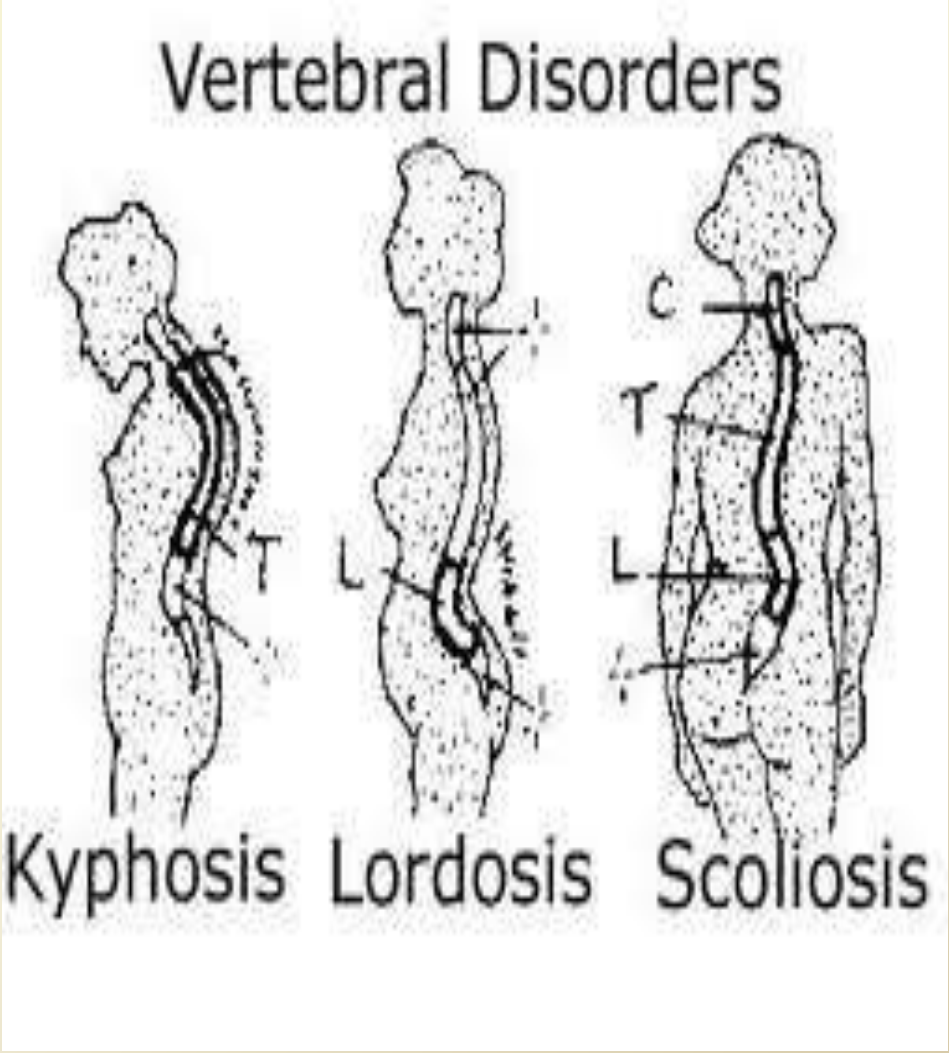
- For a comprehensive assessment, inspection should be carried out observing from anterior, posterior and lateral views. Inspection should assess for:

1-**Shape**: size , contour ,symmetry (Alike on both sides)

2- **structure**:

- Normal or deviated from normal (Deformities ,fracture…)
- muscle configuration: hypertrophy/atrophy (steroid use, malnutrition)
- body build , posture and body alignment : (Standing ,Sitting and recumbent)

Normal vs. Scoliosis



(B)Objective Data:(1) Inspection:

3-structural relationships:(Gait-involuntary movements -Full Rom of all joints)

- Shoulders level, Scapulae level, Iliac crests level

4- **skin condition**

- swelling/edema (effusions, hematoma)
- discoloration (vascular insufficiency, bruising, hematoma)
- pressure sores, necrosis, scarring scars indicating any previous surgery or trauma

In Gait…

Note (joint and muscle symmetry - extremity length and muscle deformity-Body alignment-Use of Assistive devices-Shoes) (type of gait:Unsteady–Shuffling–Limp–Steady)

wing scapula

Varus (bow legs)

Valgus (knock-knees)

ganglion cyst

(2) Palpation

- • Palpate joints, bursal sites, bones and surrounding muscles.
- • During Palpation: Assess the patient for both verbal and non-verbal cues of pain, Ask the patient, ‘Does the pain radiate elsewhere from the initial region?’

Palpation should assess for the following:(TEC)^2

- **T:** increased temperature (use the back of the hand above, below and on the joint and compare with the other side)
- **T:t**enderness
- **E: e**dema/ swelling
- **E: e**nlargement (bone tumor)
- **C: c**repitus (osteoarthritis, listen for crepitus as well as feeling)
- **C:C**onsistency and tone of muscle

During assessment

The part may has :

1. **Muscles**
2. **Bones**
3. **Joints**
4. **Limb to be measured**

so, those must be assessed

1-MUSCLE ASSESSMENT

A-Muscle mass

General view of muscle:

- Atrophy
- Hypertrophy
- Of normal

B-Muscle Measurement:

Muscle mass is measured circumferentially at the largest area of the muscle. When recording measurements, document the exact location at which the measurements were obtained (e.g., the quadriceps muscle is measured 15 cm above the patella). This informs the next examiner of the exact area to measure and ensures consistency during reassessment

3-Muscle Strength:

- 1. Assess each group :Strong & Equal
  2. Compare each side
  3. Scale - 0-5
  - It is considered a disability is muscle strength is less than grade 3.

Muscle strength scale

0	**No detection of muscular contraction.**
1	A barely detectable flicker or trace of contraction with observation
2	Active movement of body part with elimination of gravity
3	Active movement against gravity only and not against resistance
4	Active movement against gravity and some resistance
5	Active movements against full resistance without evident fatigue (normal muscle strength)

4-Joint motion produced by muscle contraction

- Flexion
- Extension
- Dorsiflexion
- Plantar flexion
- Adduction
- Abduction
- Inversion
- Eversion
- Internal rotation
- External rotation
- Pronation
- Suppination

2-Bones

- <u>Examine for:</u>

  1- Deformity 2- Tumors

  3- Pain: is the pain **focal** (fracture/trauma, infection, malignancy, Paget's disease, osteoid osteoma), or **diffuse** (malignancy, Paget's disease, osteomalacia, osteoporosis, metabolic bone disease)?

3-Joint

1- Signs of inflammation, injury (swelling, redness, warmth)? Deformity? Compare w/opposite side

2- activity and Range of motion–what can't they do? Specific limitations? Discrete event (e.g. trauma)? Mechanism of injury?

3-Palpate joint → warmth? Point tenderness? Over what structure(s)?

4-Strength, neuro-vascular assessment.

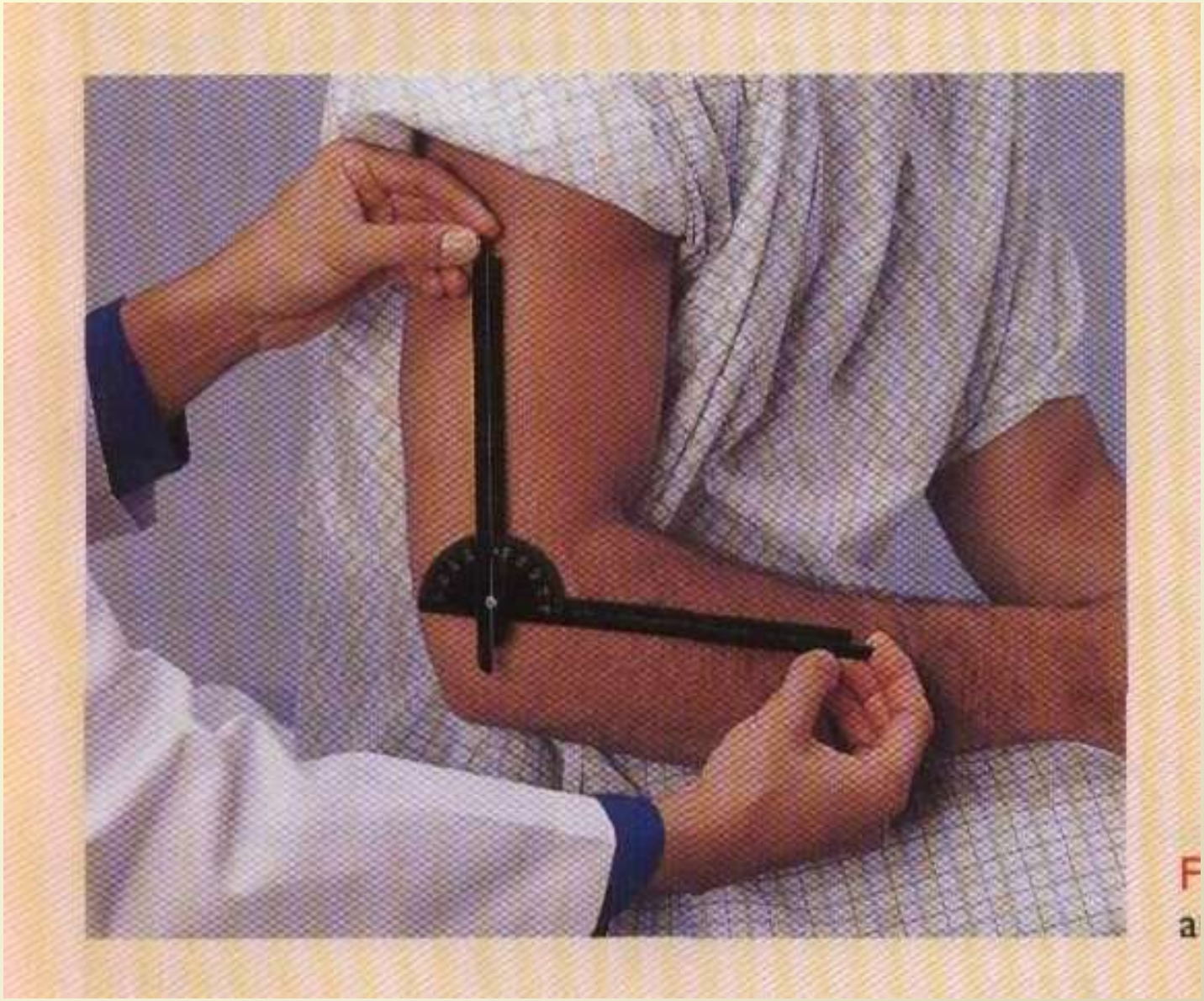
5-If acute injury& pain → difficult to assess as patient

Range of movement (ROM)

- Assess (Type: Active, Passive, Full, Limited, Stiffness, contractures)
- If ROM is limited – determine the cause (excess fluid or any loose bodies in the joint e.g. cartilage, joint surface irregularity e.g. osteoarthritis, contracture of muscle, ligaments or capsule)
- **Range of motion assessed by**:

1-goniometer, most accurate which measures the angle of the joint.

2- Symmetry



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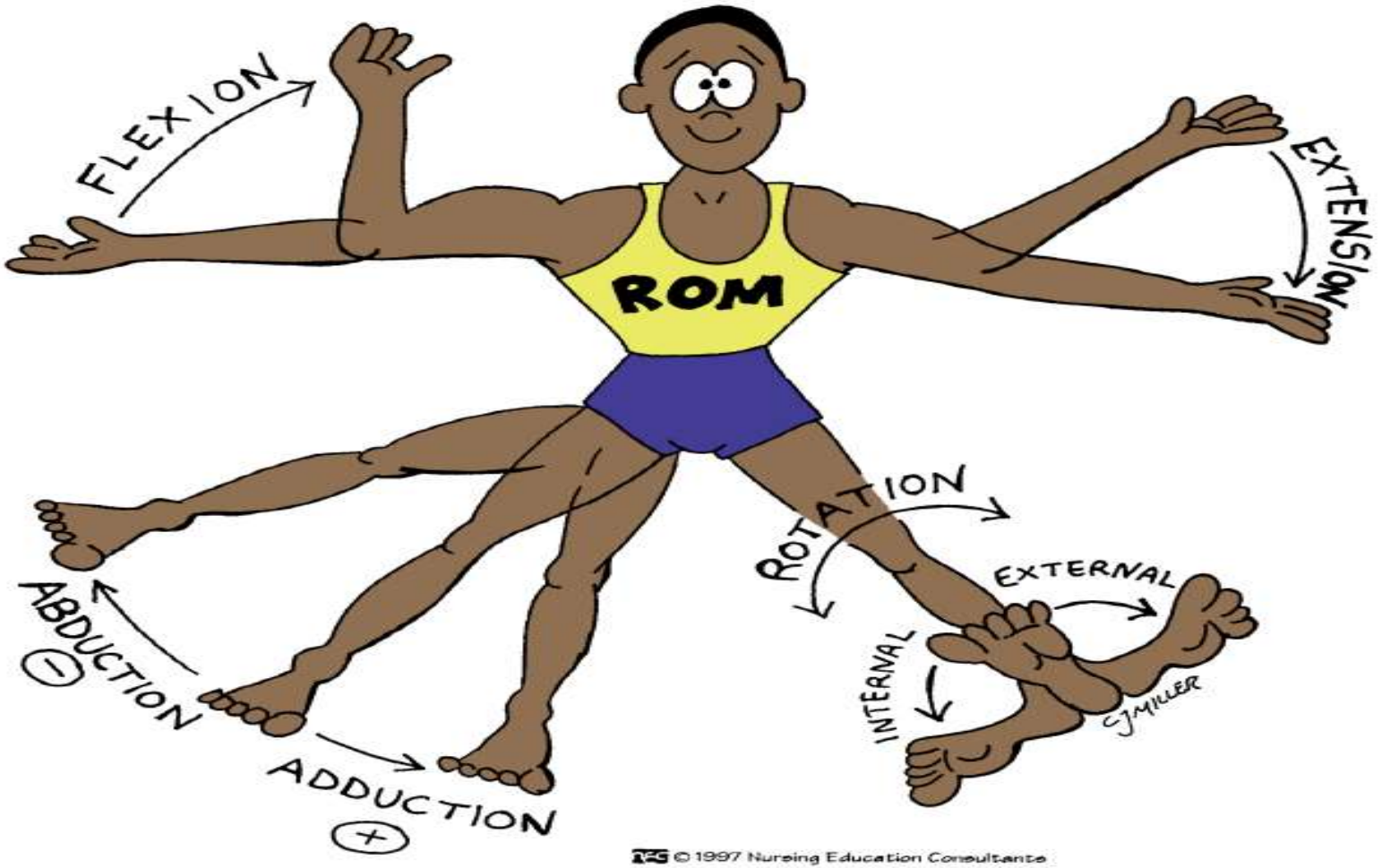
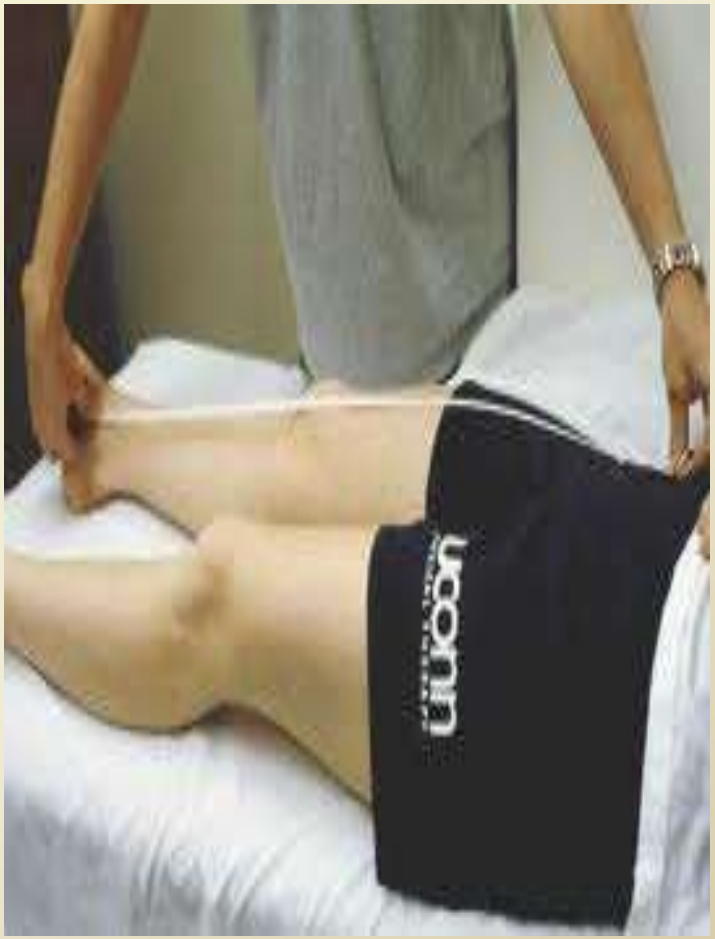
RANGE OF MOTION



4-Limb measurement

- limbs are in the neutral position.
- the patient is lying straight
- Full length upper limb – measure from the acromion process to the end of the middle finger.
- Full length lower limb – lower edge of the ileum to tibial malleolus.



- **Special Tests**

- **Phalen's Test** –Ask the patient to hold the wrist in acute flexion for 60 seconds. Numbness or burning indicate carpel tunnel syndrome.

- **“Bulge sign”** –assess for small amount of fluid on the knee. Milk upward on the medial side of the knee then tap lateral side of the patella. It indicated joint swelling

Diagnostic Studies Of Musculoskeletal System

1-Radiological studies

2- Bone mineral density (BMD) measurements

3-NUCLEAR STUDIES

4-Endoscopic Studies –arthrocentesis, arthroscopy

5-SYNOVIAL FLUID ANALYSIS

6-Muscle Biopsy

7-Laboratory

1-Radiological studies

-X-rays provide information about bone deformity, joint congruity, bone density, and calcification in soft tissue.

-Fracture diagnosis and management are the primary indications for x-ray.

-but it is also useful in the evaluation of hereditary, developmental, infectious, inflammatory, neo-plastic, metabolic, and degenerative disorders

RELATED NURSING CARE

- Maintain **privacy** of patient
- patient is asked to **remove** some or all of his **clothes** and to wear a gown during the exam.
- may also be asked to **remove jewelry**, removable dental appliances, eye glasses and any metal objects or clothing that might interfere with the x-ray images.
- If **contrast medium** is used, assess for **allergy** to shellfish, iodine, or contrast medium used in previous tests. If allergy is present, test will not be performed.

A-Fluoroscopy

- Real-time x-ray images with digital detectors
- X-ray source is underneath table and detector above, thus shield needs to be placed underneath patient

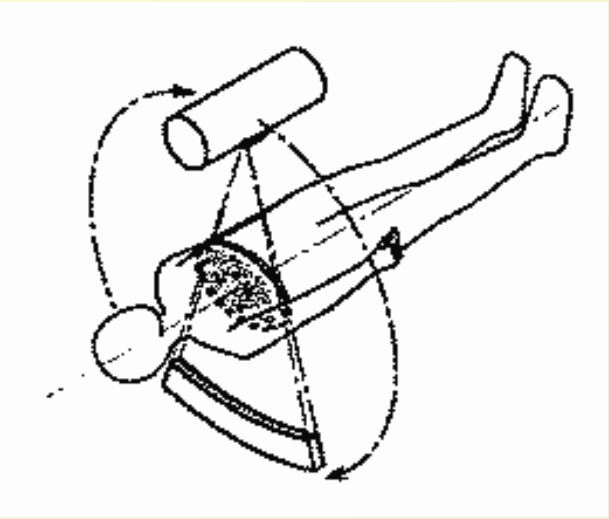
B-Diskogram

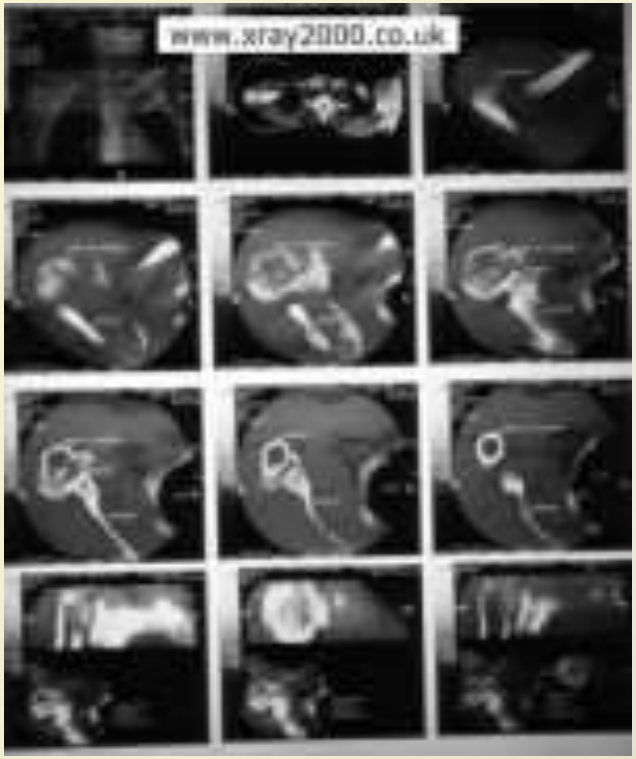
- **X-ray of cervical or lumbar intenvertebral disk is done after injection of contrast media into nucleus pulpous. Permits visualization of intenvertebral disk abnormalities**

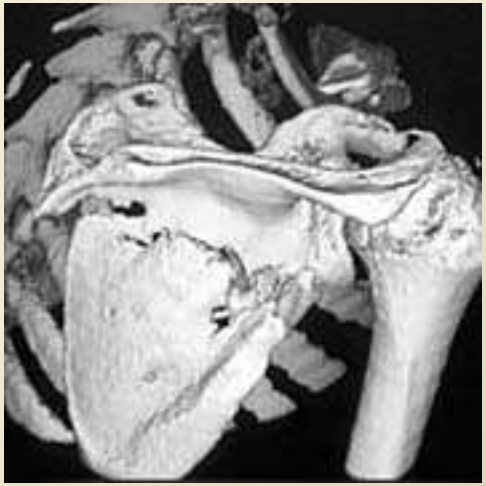
C-Computed Tomography

- **CT uses x-rays to produce cross sectional images**
- X-ray beam is used with a computer to provide a three-dimensional picture.

Computed Tomography







Computed Tomography

- **Principal musculoskeletal indications**
  - Staging of complex fractures
  - Detection of small intra-articular fragments
  - Fracture healing
  - Confirmation of plain film fractures
  - Bone tumor evaluation

D-Magnetic Resonance Imaging (MRI)

D-Magnetic Resonance Imaging (MRI)

- Radio waves and magnetic field are used to view soft tissue. Especially useful in the diagnosis of a vascular necrosis, disk disease, tumors,; ligament tears, land cartilage tears.
- Patient is placed inside scanning chamber.
- Gadolinium may be injected IV to enhance visualization of structures

MRI

- **RELATED NURSING CARE :** Assess for metallic implants or metal on clothing (metallic implants, such as clips on aneurysms, pacemakers, or shrapnel, will prohibit having an MRI)
- *Contraindicated in* patient with eneurysm clips, metallic implants, pacemakers electronic devices, hearing aids, and shrapnel.

E-Myelogram with or without CT

- Involves injecting a radiographic contrast medium: Into sac around nerve roots. CT scan may follow to show how the bone is affecting the nerve foots. **Very sensitive** test for **nerve impingement** and can detect very subtle lesions and injuries.

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2- Bone mineral density (BMD) measurements

A-Quantitative ultrasound (QUS)

- Evaluates density, elasticity, and strength of bone using ultrasound rather than radiation. Common area assessed is **calcaneus's (heel).**

B-Dual energy x-ray Absorptlomatry (DEXA)

- Assesses bone density to diagnose osteoporosis
- -Uses **LOW dose radiation** to measure bone density
- - Painless procedure, non-invasive, no special preparation
- -Advise to remove jewelry

3-NUCLEAR STUDIES:

BONE SCAN:

Imaging study with the use of a contrast radioactive material

-*Pre-test*: Painless procedure, IV radioisotope is used, no special preparation, pregnancy is contraindicated

-*Intra-test*: IV injection, Waiting period of 2 hours before X-ray, Fluids allowed, Supine position for scanning

-*Post-test*: Increase fluid intake to flush out radioactive material

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3-Endoscopic Studies – arthrocentesis, arthroscopy

Arthroscopy

A direct visualization of the joint cavity

-**Pre-test:** consent, explanation of procedure, NPO

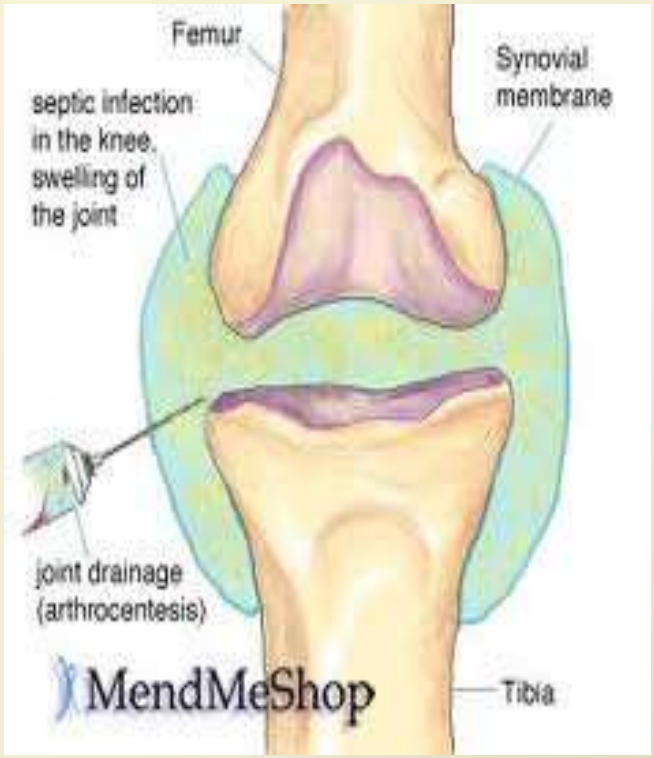
-Intra-test: Sedative, Anesthesia, incision will be made

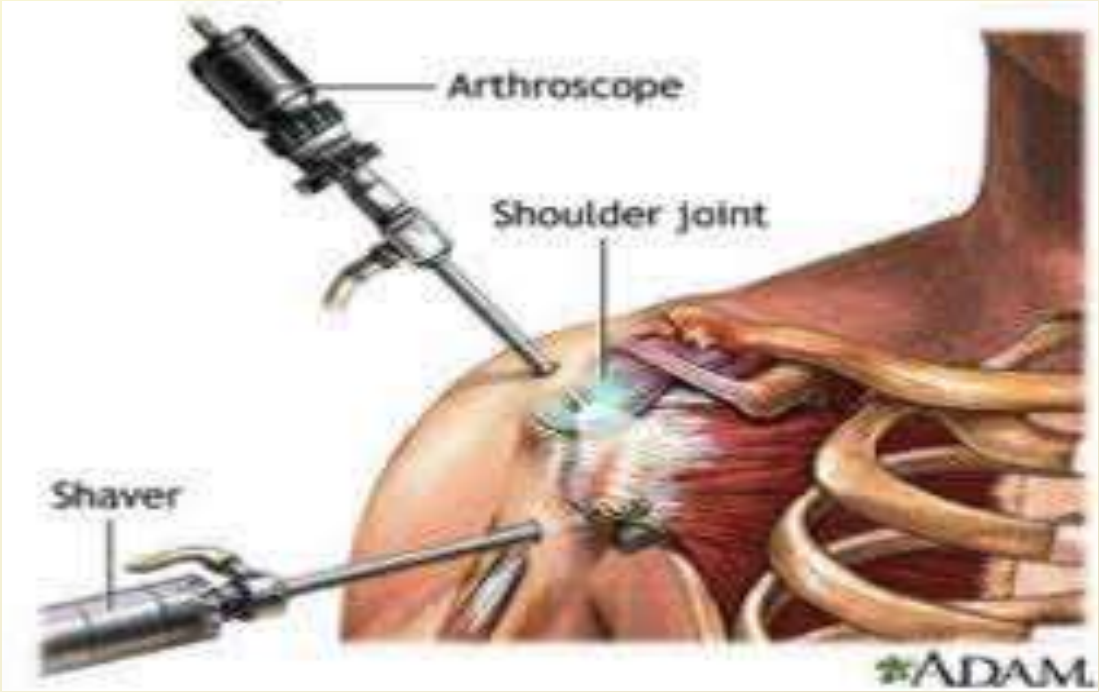
-**Post-test:** maintain dressing, ambulation as soon as awake, mild soreness of joint for 2 days, joint rest for a few days, ice application to relieve discomfort

-NB: If general anesthesia is used, client is NPO after midnight. Following the procedure, assess for bleeding and swelling, apply ice to the area if prescribed, and teach client to avoid excessive use of the joint for 2 to 3 days.

Arthrocentesis

-Done **to obtain synovial fluid** from a joint for diagnosis (such as infections /hemorrhage) or to remove excess fluid. A needle is inserted through the joint capsule and fluid is aspirated


Femur
Synovial membrane
septic infection in the knee, swelling of the joint
joint drainage (arthrocentesis)
MendMeShop
Tibia


Arthroscope
Shoulder joint
Shaver
A.D.A.M.

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(4)Laboratory

Urine Tests

- **24 hour creatine-creatinine ratio:-** (Creatine phosphate is the most important storage form of high-energy phosphate; together with some other smaller sources, this energy reserve is sometimes called the creatine phosphate pool).
- **Urine Uric acid –24 hr specimen**
- **Cancer** of the bone has **increased calcium levels**
- **Urine deoxypyridino-line**

Blood tests:

1-Rheumatoid Factor:

Importantly, **RF is not a 'test for rheumatoid arthritis'.** It is therefore neither sufficient nor necessary for the diagnosis. Its principal **use is as a prognostic marker**; a high titre at presentation associates with a poorer prognosis. IgG RF has greater specificity for major rheumatic disease but the above caveats still remain.

Blood tests:

2-Antinuclear antibodies:

Mainly for diagnoses of SLE

- **a negative ANA** virtually excludes the diagnosis
- **a positive ANA** :lupus is suspected. For lupus, ANA has high sensitivity (virtually 100%) However, the specificity is low (10-40%) so a positive result does not make the diagnosis
- **ANA directed against double-stranded DNA (anti-dsDNA)** is **highly specific for lupus**.

Calcium Total Ionized	8.6–10.3 mg/dl 4.4–5.1 mg/dl	2.2–2.74 mmol/L 1–1.3 mmol/L
Phosphorus	2.5–5 mg/dl	0.8–1.6 mmol/L
Phosphatase (acid), total	0.13–0.63 IU/L	2.2–10.5 IU/L or 2.2–10.5 mckat/L
Phosphatase alkaline2	20–130 IU/L	20–130 IU/L or 0.33–2.17 mckat/L
Creatinine kinase	0–12 IU/L	0–0.2 mckat/L
Hb	13.5-18 g/dl	
HCT	40%-55%	
TLC	5000-1000010^3/Cmm	
RBCs	4.5-6)×106Cmm	

CAUSES OF AN ELEVATED SERUM CREATINE KINASE.

- Inflammatory myositis ± vasculitis
- Muscular dystrophy
- Motor neuron disease
- Alcohol, drugs
- Trauma, strenuous exercise
- Myocardial infarction*
- Hypothyroidism, metabolic myopathy

Invasive investigation

- Synovial fluid analysis
- Bone biopsies
- Musccle biopsies

SYNOVIAL FLUID ANALYSIS

- **For: septic arthritis, crystal-associated arthritis and intra-articular bleeding, and it should be performed in all patients with acute monoarthritis, especially with overlying erythema.**
- **From: sample from most peripheral joints and for diagnostic purposes only a small volume is required**
- **Normal SF: is present in small volume, contains very few cells, is clear and either colourless or pale yellow, and has high viscosity**

Continue..

- **Turbid: joint inflammation, volume increases, the total cell count and proportion of neutrophils rise, and the viscosity lowers (due to enzymatic degradation of hyaluronan and aggrecan). However, because of considerable variation and overlap between arthropathies these features have little diagnostic value.**
- **Frank pus or 'pyarthrosis‘: results from very high neutrophil counts and is not specific for sepsis.**

Continue ..

- **High concentrations of crystals: mainly urate or cholesterol, can make SF appear white Non-uniform blood-staining of SF is common.**
- **Florid: Uniform blood-staining-haemarthrosis-commonly accompanies florid synovitis but may also result from a bleeding diathesis, trauma or pigmented villonodular synovitis.**

Continue..

- **A lipid layer floating: above blood-stained fluid is diagnostic of intra-articular fracture with release of lipid from the bone marrow.**
- **If sepsis is suspected, SF should be sent for urgent Gram stain and culture in a sterile universal container. If gonococcal sepsis or uncommon organisms are suspected, especially in immunocompromised patients, the microbiologist should be consulted to ensure that optimal cultures are established and that molecular techniques of antigen detection are used if appropriate**

BONE BIOPSIES

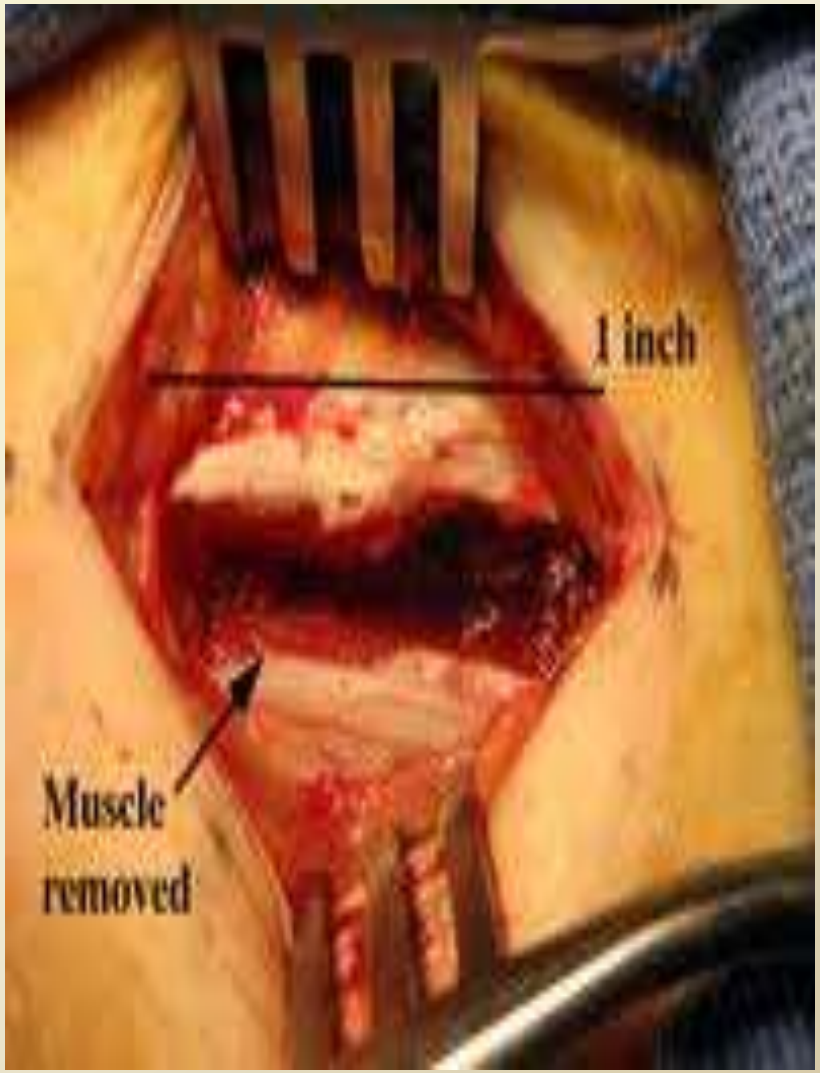
- **BONE BIOPSY:**

in metabolic bone diseases

With patients who are suspected of having osteomalacia

Muscle biopsy

- For myopathy and myositis.
- Needle muscle biopsy of the quadriceps or deltoid
- is preferred to open surgical biopsy because it is a simple procedure which can be repeated for serial monitoring of treatment response




Thank you
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