LAB · WEEK 1

Laboratory Orientation & Safety

Anatomy I — Practical · Department of Prosthetics & Orthotics Technology

Assist. Lect. Redha Dawood Abdul-Redha · م.م. رضا داود عبد الرضا

Specialty: Pathological Analysis Techniques (تقنيات التحليلات المرضية)

Session objectives

- Understand laboratory rules and safe handling of specimens and models.
- Learn how to use anatomical models, charts and (where available) microscopes.
- Apply anatomical position and directional terms to models.

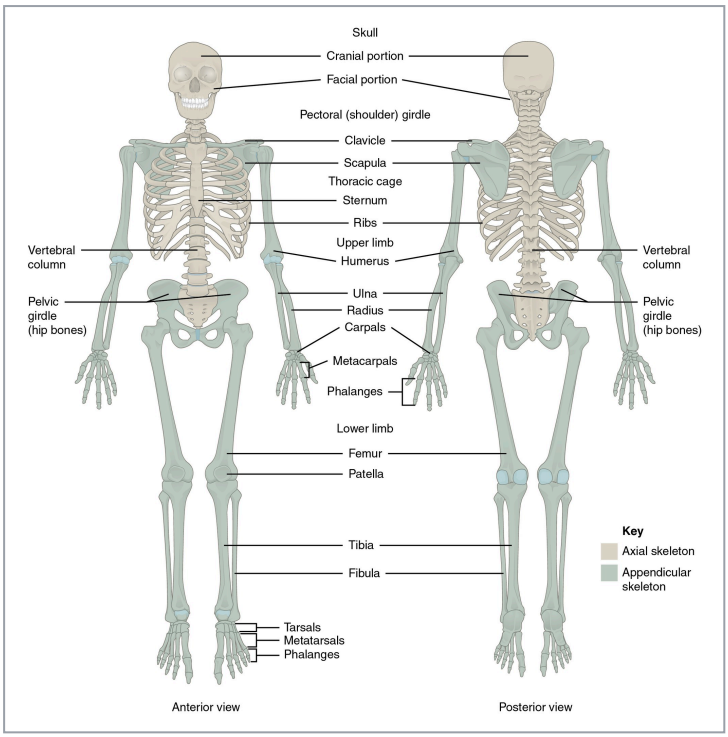
1. Laboratory Safety Rules

- Wear a lab coat; tie back long hair; follow the instructor's directions at all times.
- Handle bone models and specimens gently with clean, dry hands — they are fragile and shared.
- No food or drink in the laboratory; wash hands before and after the session.
- Report any breakage or injury immediately; know the location of the first-aid kit.
- Return every model to its correct place, correctly oriented, at the end of the session.

2. Using Anatomical Resources

You will work with **articulated and disarticulated skeletons**, individual bone models, organ and tissue models, wall charts, and microscope slides for histology. Always orient a bone in the **anatomical position** before describing it.

3. Orientation Exercise



Use the articulated skeleton to rehearse directional terms.

Procedure

1. Place a long-bone model in the anatomical position.
2. Identify its proximal and distal ends, and its anterior and posterior surfaces.
3. Describe one feature using *medial/lateral* and one using *superior/inferior*.
4. Repeat for a vertebra and for the skull.

P&O relevance

Careful, safe handling and correct orientation are professional habits: the same precision is required when casting a residual limb, taking measurements, and fitting a device.

LAB · WEEK 2

Classification of Bones & Long-Bone Structure

Anatomy I — Practical · Department of Prosthetics & Orthotics Technology

Assist. Lect. Redha Dawood Abdul-Redha · **م.م. رضا داود عبد الرضا**

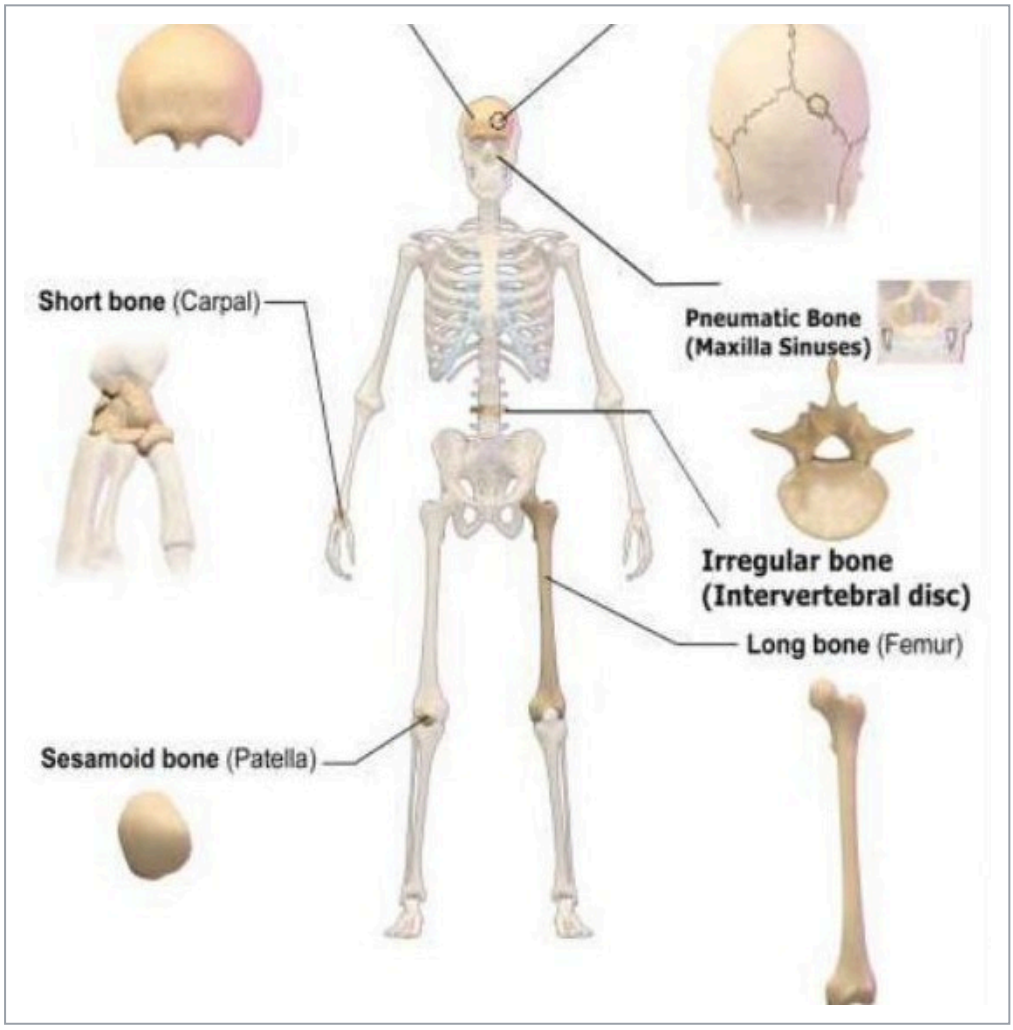
Specialty: Pathological Analysis Techniques (تقنيات التحليلات المرضية)

Practical material prepared by Assist. Lect. Redha Dawood Abdul-Redha.

Session objectives

- Identify the five classes of bone on models and name examples of each.
- Identify the external and internal parts of a long bone.
- Distinguish compact from spongy bone.

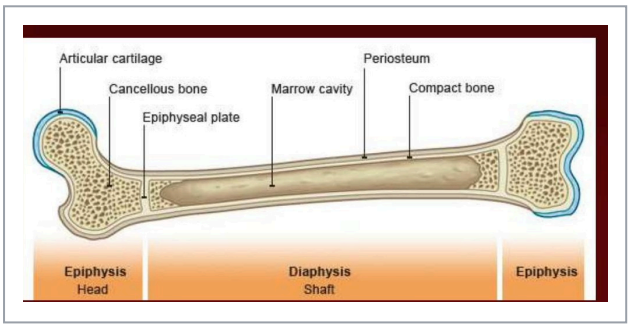
1. Bone Shapes



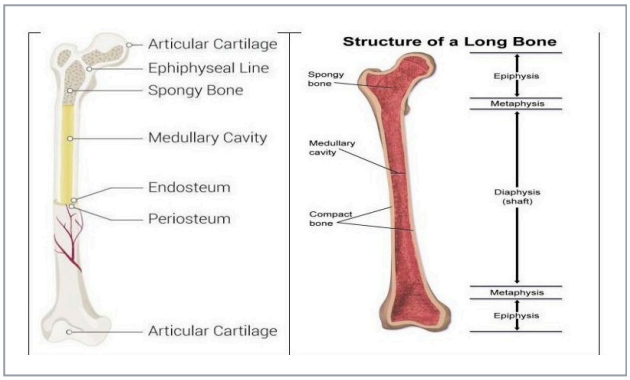
The classes of bone by shape, with examples.

Class	Identify on the model	Examples
Long	Shaft + two ends	Femur, humerus
Short	Cube-shaped	Carpals, tarsals
Flat	Thin, plate-like	Scapula, sternum, skull
Irregular	Complex shape	Vertebra
Sesamoid	Within a tendon	Patella

2. Long-Bone Structure



Diaphysis, epiphysis & medullary cavity.



Compact & spongy bone; periosteum.

Procedure

1. Sort the bone models into the five shape classes.
2. On a long-bone model, point out the diaphysis, both epiphyses, and the medullary cavity.
3. Find regions of compact vs spongy bone and note where red marrow would lie.
4. Record your identifications in the worksheet table.

P&O relevance

Recognising bone shape and structure on sight underpins understanding of amputation levels and the bony landmarks that a socket must accommodate.

LAB · WEEK 3

The Skull: Bones, Sutures & Fontanelles

Anatomy I — Practical · Department of Prosthetics & Orthotics Technology

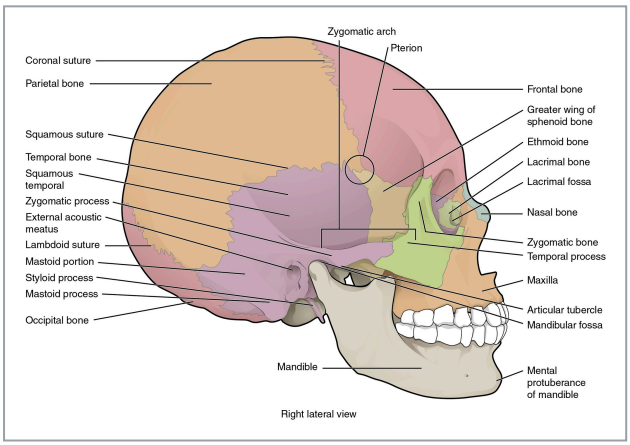
Assist. Lect. Redha Dawood Abdul-Redha · م.م. رضا داود عبد الرضا

Specialty: Pathological Analysis Techniques (تقنيات التحليلات المرضية)

Session objectives

- Identify the cranial and facial bones on a skull model.
- Locate the major sutures and fontanelles.

1. Skull Bones



Skull — lateral view (cranial & facial bones).

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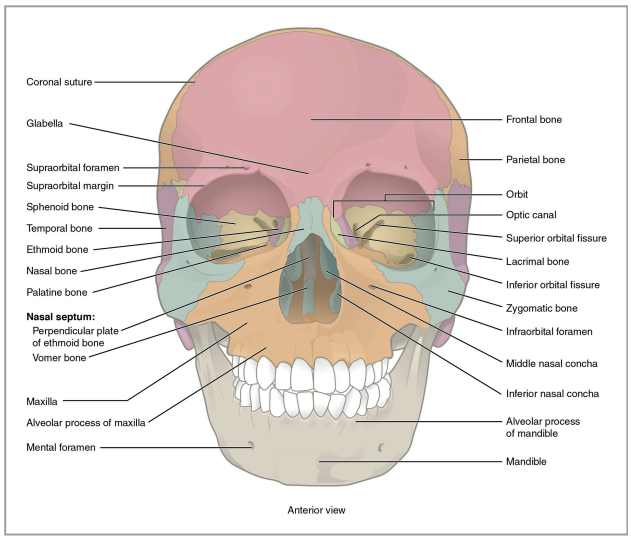

Skull — anterior view.

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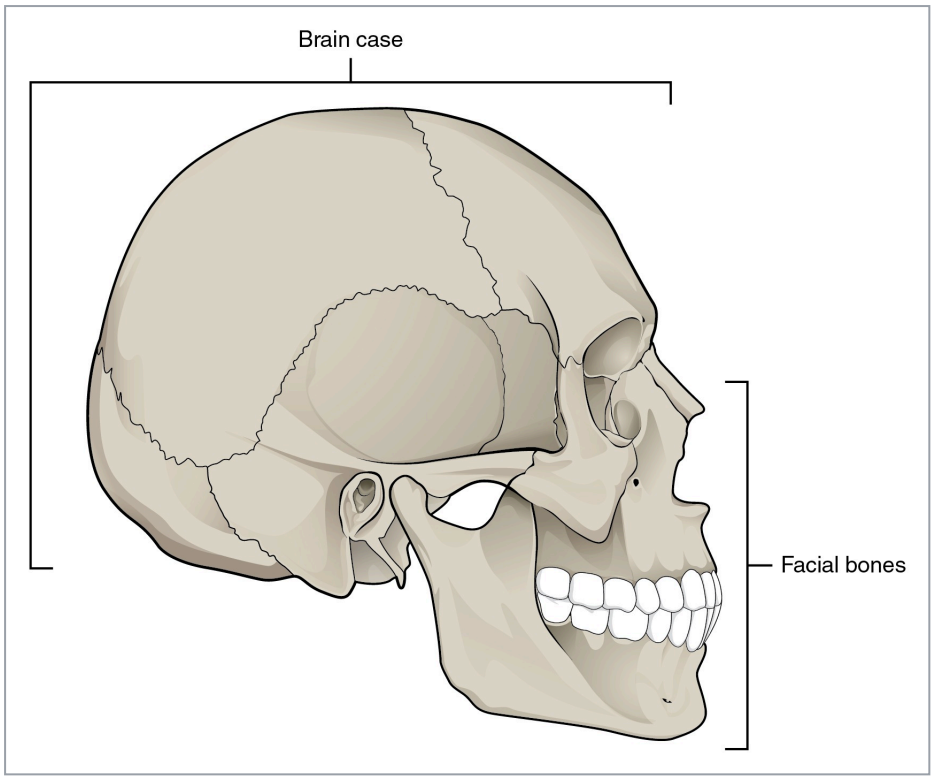

The skull divided into the brain case (8 cranial bones) and the facial skeleton (14 facial bones).

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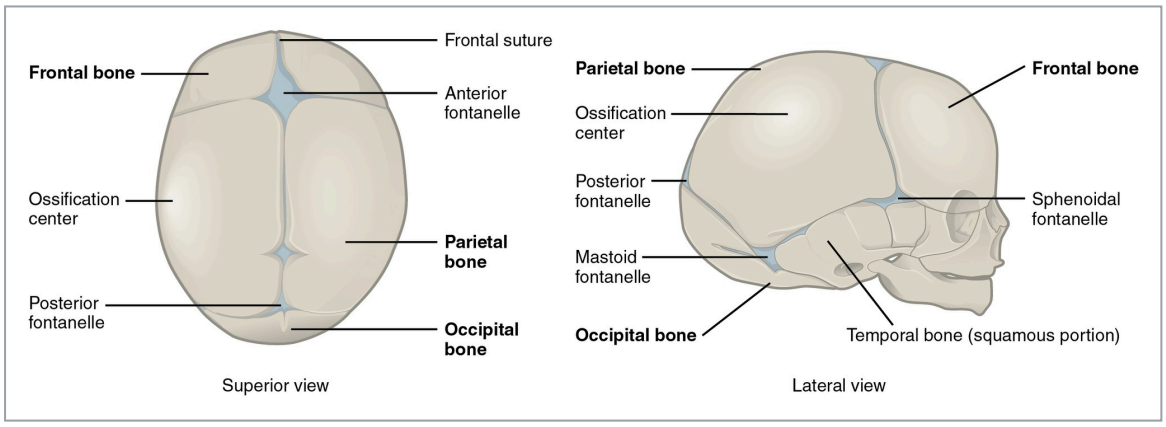
2. Sutures & Fontanelles



The newborn skull — sutures and the anterior & posterior fontanelles (superior & lateral views).

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Procedure

1. On the skull model, identify the frontal, parietal, temporal, occipital, sphenoid and ethmoid bones.
2. Trace the coronal, sagittal, lambdoid and squamous sutures with a finger.
3. On an infant-skull model, locate the anterior and posterior fontanelles.

P&O relevance

Skull and suture anatomy underpins the fitting of **cranial remoulding orthoses (helmets)** used to treat positional plagiocephaly in infants while the fontanelles and sutures are still open.

LAB · WEEK 4

Identifying Vertebrae

Anatomy I — Practical · Department of Prosthetics & Orthotics Technology

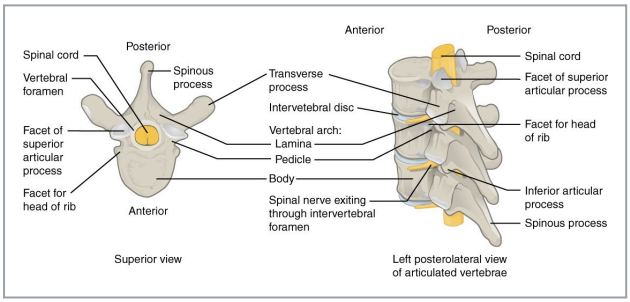
Assist. Lect. Redha Dawood Abdul-Redha · م.م. رضا داود عبد الرضا

Specialty: Pathological Analysis Techniques (تقنيات التحليلات المرضية)

Session objectives

- Identify the parts of a typical vertebra.
- Distinguish cervical, thoracic and lumbar vertebrae by their features.
- Recognise the atlas, axis, sacrum and coccyx.

1. A Typical Vertebra



Parts of a typical vertebra.

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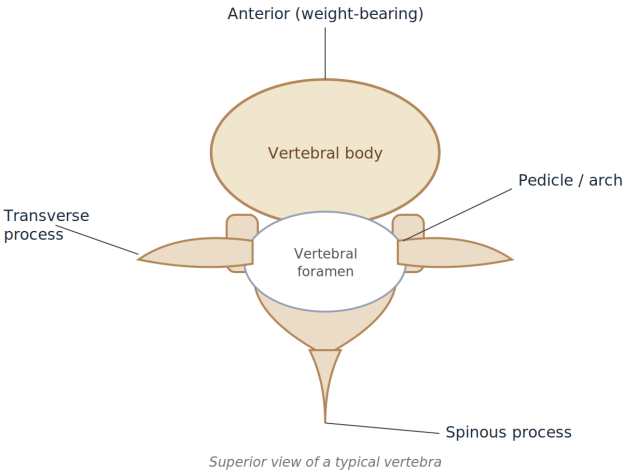
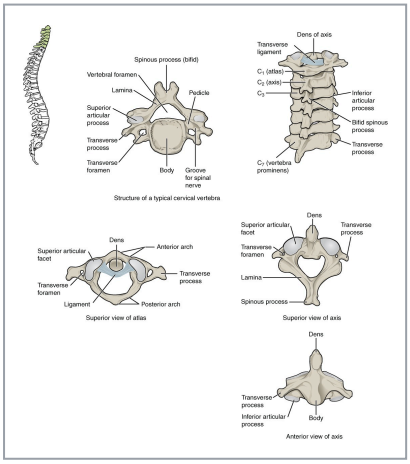


Superior view of a typical vertebra

Superior view (diagram).

2. Regional Identification



Cervical — incl. atlas & axis.

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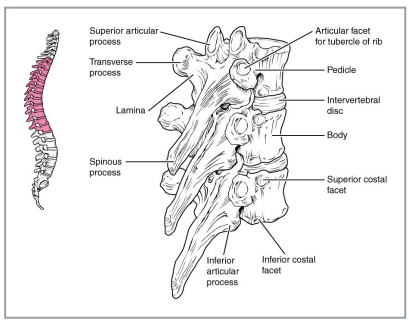

Thoracic — costal facets.

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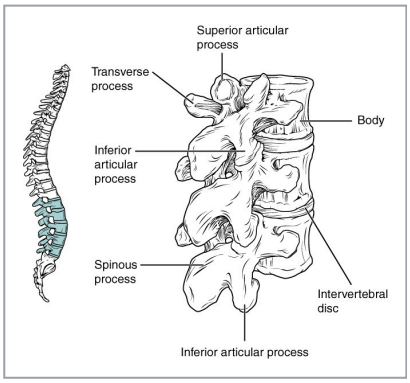

Lumbar — large body.

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Procedure — step-by-step identification

1. **Look at the transverse processes.** Transverse foramina present → *cervical*.
2. **Look for costal facets** on the body/transverse processes → *thoracic*.
3. **Check the body size.** Large, robust body with no foramen/facets → *lumbar*.
4. Identify special vertebrae: ring-like *atlas* (C1), dens-bearing *axis* (C2), fused *sacrum* and *coccyx*.

P&O relevance

Identifying vertebral levels and recognising normal vs abnormal curvature underpins the design and fitting of spinal orthoses (e.g. TLSO for scoliosis, lumbosacral supports).

LAB · WEEK 5

The Thoracic Cage

Anatomy I — Practical · Department of Prosthetics & Orthotics Technology

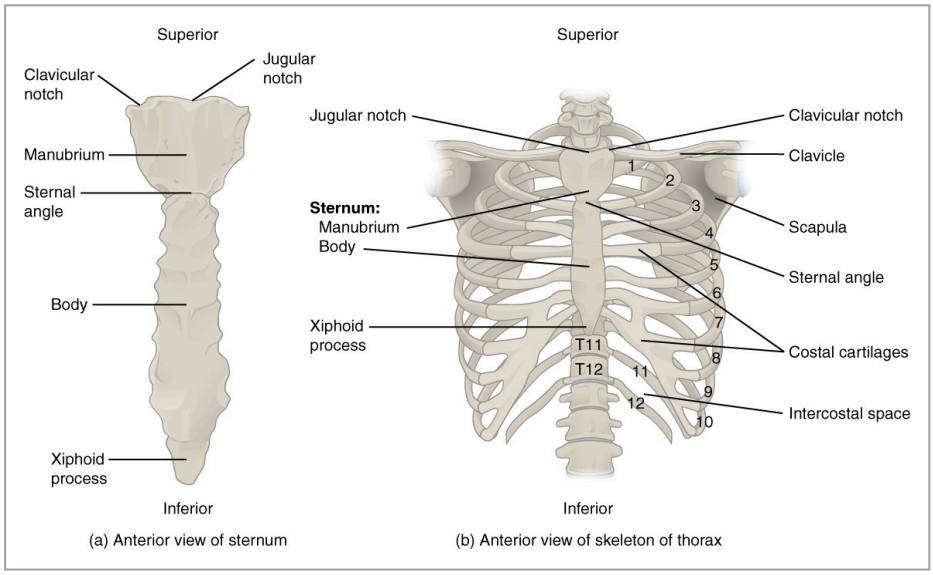
Assist. Lect. Redha Dawood Abdul-Redha · م.م. رضا داود عبد الرضا

Specialty: Pathological Analysis Techniques (تقنيات التحليلات المرضية)

Session objectives

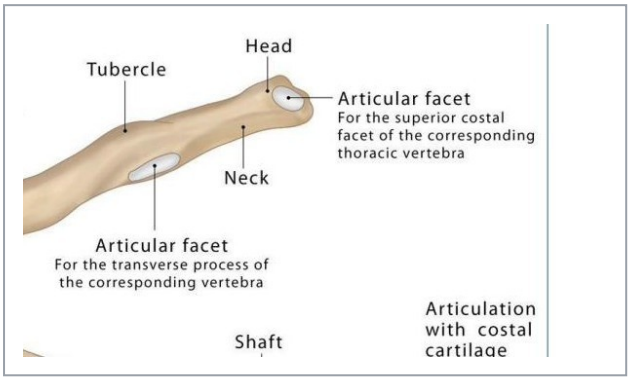
- Identify the ribs, costal cartilages, sternum and thoracic vertebrae on a model.
- Classify ribs as true, false or floating.
- Identify the parts of a typical rib and of the sternum.

1. The Cage as a Whole

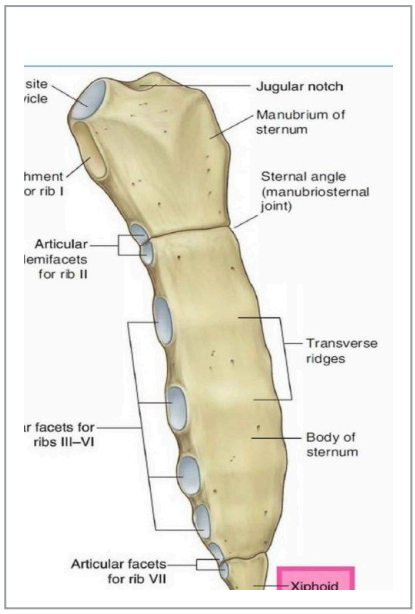


The thoracic cage — sternum, ribs & costal cartilages.

2. A Typical Rib & the Sternum



Head, neck, tubercle, shaft.



Manubrium, body, xiphoid; sternal angle.

Procedure

1. On the model, count the 12 rib pairs and locate their attachment to the thoracic vertebrae.
2. Classify ribs 1–7, 8–10 and 11–12 as true, false and floating.
3. On a single rib, identify the head, neck, tubercle and shaft.
4. On the sternum, identify the manubrium, body, xiphoid process and sternal angle (level of rib 2).

P&O relevance

The sternal angle and rib levels are landmarks for trunk measurements and for positioning spinal/thoracic orthoses.

LAB · WEEK 6

Upper Limb: Humerus, Radius & Ulna, Hand

Anatomy I — Practical · Department of Prosthetics & Orthotics Technology

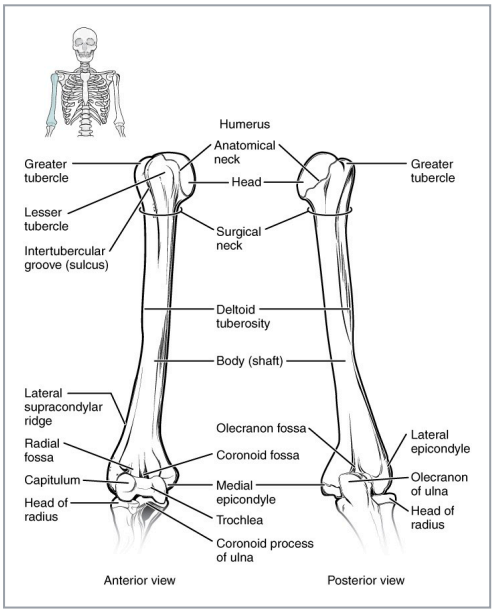
Assist. Lect. Redha Dawood Abdul-Redha · م.م. رضا داود عبد الرضا

Specialty: Pathological Analysis Techniques (تقنيات التحليلات المرضية)

Session objectives

- Identify the humerus, radius, ulna, carpals, metacarpals and phalanges.
- Locate key landmarks used in upper-limb orthotics.

1. Arm & Forearm



Humerus & elbow — head, tubercles, condyles.

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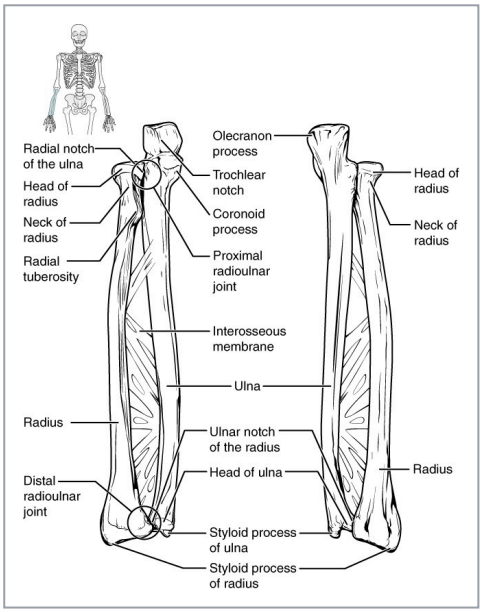

Radius & ulna — olecranon, styloid processes.

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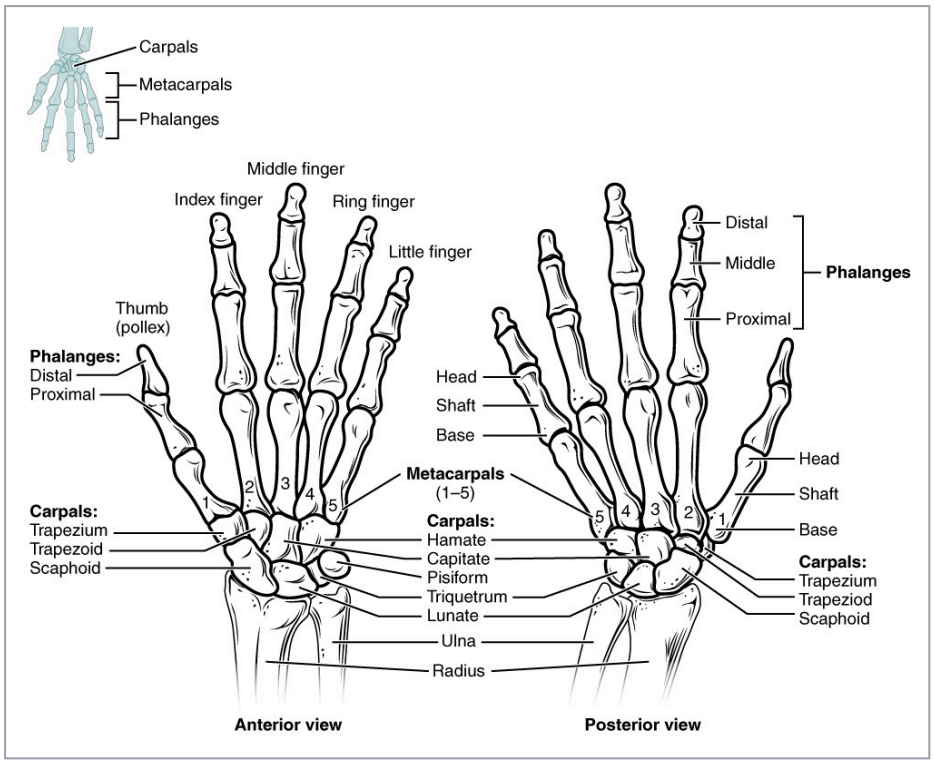
2. The Hand



Carpals, metacarpals & phalanges.

Procedure

1. Orient the humerus: identify the head, greater/lesser tubercles, and distal condyles (trochlea & capitulum).
2. Distinguish the radius (lateral) from the ulna (medial); find the olecranon and the styloid processes.
3. On the hand, count 8 carpals (2 rows), 5 metacarpals and 14 phalanges.

P&O relevance

The olecranon, epicondyles and styloid processes are trim-line landmarks for elbow and wrist–hand orthoses (WHO), and reference points for trans-radial and trans-humeral prosthetic sockets.

LAB · WEEK 7

Lower Limb: Femur, Tibia & Fibula, Foot

Anatomy I — Practical · Department of Prosthetics & Orthotics Technology

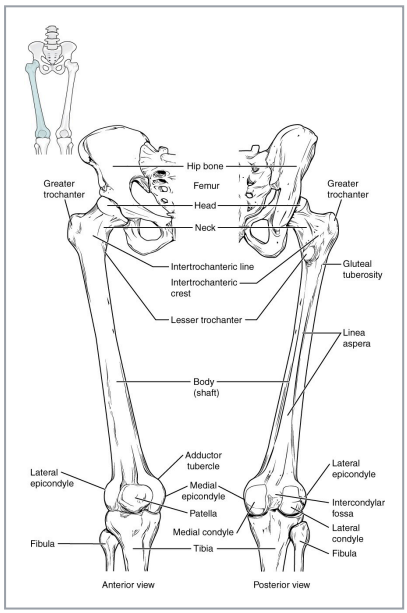
Assist. Lect. Redha Dawood Abdul-Redha · م.م. رضا داود عبد الرضا

Specialty: Pathological Analysis Techniques (تقنيات التحليلات المرضية)

Session objectives

- Identify the femur, patella, tibia, fibula and the bones of the foot.
- Locate landmarks critical to lower-limb prosthetics.

1. Thigh & Leg



Femur & patella.

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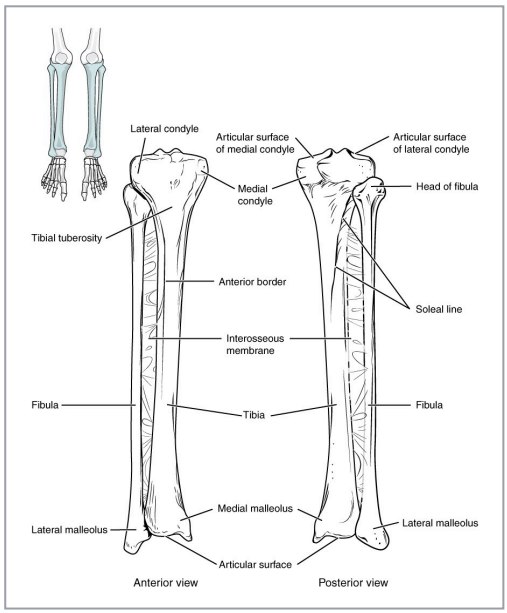

Tibia & fibula.

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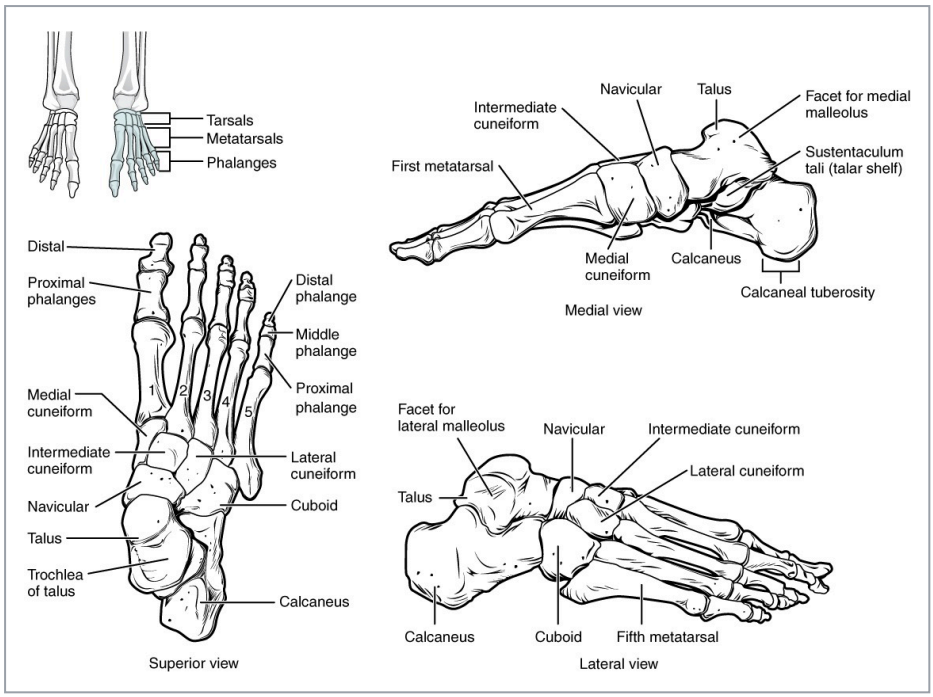
2. The Foot



Tarsals, metatarsals, phalanges & arches.

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Procedure

1. On the femur, identify the head, neck, greater/lesser trochanters, linea aspera and condyles.
2. On the tibia, find the tuberosity, anterior crest and medial malleolus; on the fibula, the head and lateral malleolus.
3. On the foot, identify the calcaneus, talus and the three arches.
4. Mark, on the model, the pressure-tolerant and pressure-sensitive areas for a trans-tibial socket.

P&O relevance

These landmarks define socket trim-lines and load distribution: the patellar tendon and medial tibial flare are loaded, while the tibial crest, fibular head and malleoli are relieved.

LAB · WEEK 8

Midterm Practical Examination

Anatomy I — Practical · Department of Prosthetics & Orthotics Technology

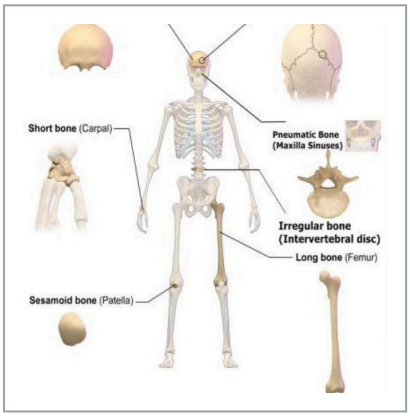
Assist. Lect. Redha Dawood Abdul-Redha · م.م. رضا داود عبد الرضا

Specialty: Pathological Analysis Techniques (تقنيات التحليلات المرضية)

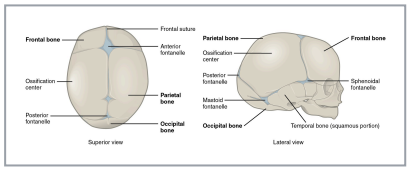
The midterm practical tests **identification and orientation** of the structures studied in Labs 1–7, typically as a timed "station" (spot) examination.

What you will be asked to do

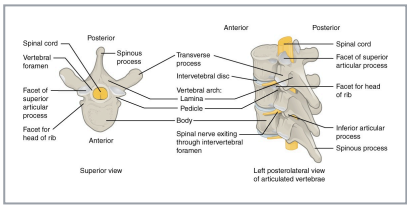
- Identify a bone, classify it by shape, and orient it correctly (left/right, anterior/posterior).
- Name pinned features on bones, the skull, and vertebrae.
- Identify a vertebra's region from its features.
- Point out a named landmark and state its P&O relevance.



Bone classes.



Skull sutures.



Vertebra parts.

Preparation checklist

1. Can you orient any long bone (left vs right) within a few seconds?
2. Can you name the cranial and facial bones and the four main sutures?
3. Can you classify any vertebra and identify the atlas, axis, sacrum and coccyx?
4. Can you locate the major upper- and lower-limb landmarks and state their P&O use?

LAB · WEEK 9

Joints Demonstration

Anatomy I — Practical · Department of Prosthetics & Orthotics Technology

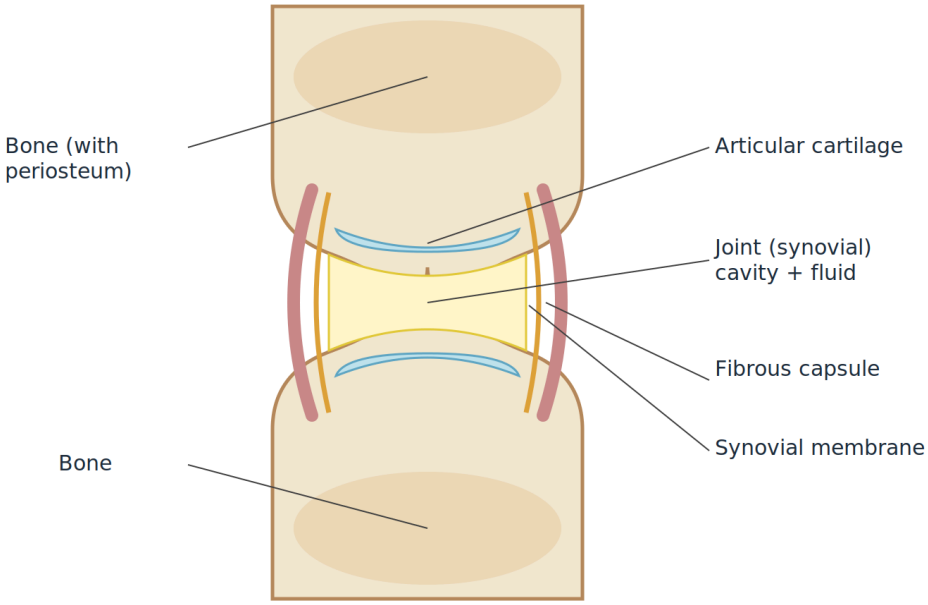
Assist. Lect. Redha Dawood Abdul-Redha · م.م. رضا داود عبد الرضا

Specialty: Pathological Analysis Techniques (تقنيات التحليلات المرضية)

Session objectives

- Identify the structural features of a synovial joint on models.
- Demonstrate the six types of synovial joint and their movements.
- Relate joint type and axis to prosthetic/orthotic joints.

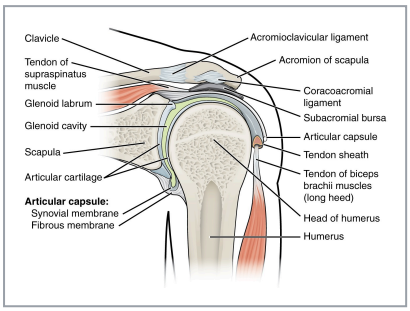
1. Structure of a Synovial Joint



Generalized structure of a synovial (diarthrodial) joint

Articular cartilage, capsule, synovial membrane & cavity.

2. Joint Types on Models



Shoulder — ball & socket.

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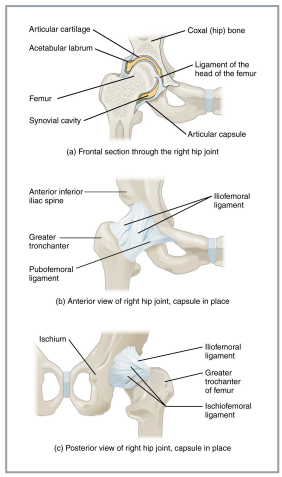

Hip — ball & socket.

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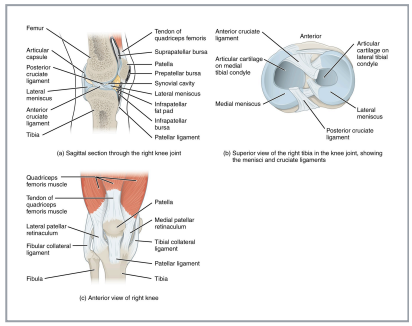

Knee — modified hinge.

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Procedure

1. On a synovial-joint model, identify the articular cartilage, capsule and joint cavity.
2. Demonstrate the movement of a hinge joint (elbow/knee) and a ball-and-socket joint (shoulder/hip).
3. For each, state the plane of motion and the joint axis.
4. Compare each with the corresponding prosthetic/orthotic joint.

P&O relevance

The mechanical axis of a prosthetic/orthotic joint must match the anatomical joint axis to give stable, efficient motion and to avoid abnormal skin pressure.

LAB · WEEK 10

Muscle Models & Major Muscle Groups

Anatomy I — Practical · Department of Prosthetics & Orthotics Technology

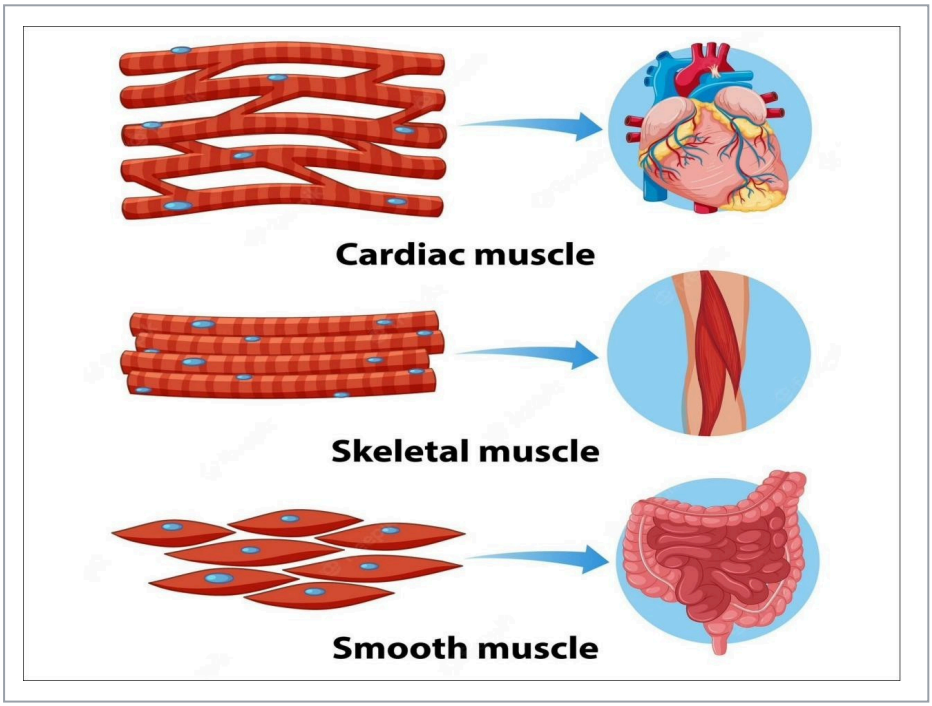
Assist. Lect. Redha Dawood Abdul-Redha · **م.م. رضا داود عبد الرضا**

Specialty: Pathological Analysis Techniques (تقنيات التحليلات المرضية)

Session objectives

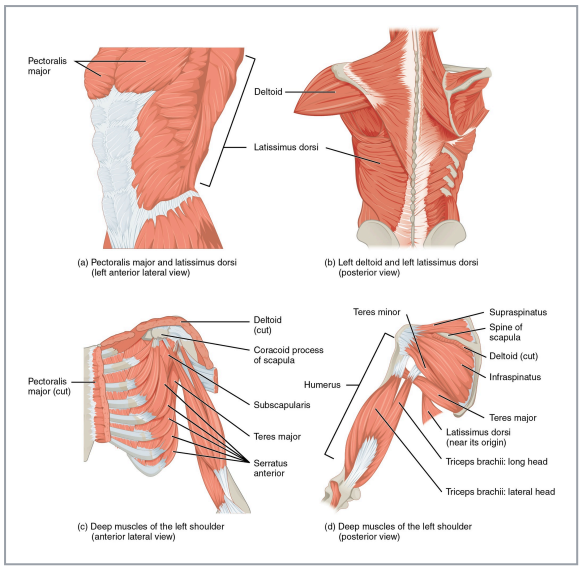
- Identify the three muscle-tissue types under the microscope / on charts.
- Locate the major muscle groups on torso and limb models.
- State the action of each group and its P&O relevance.

1. Muscle Tissue Types



Skeletal, cardiac & smooth muscle.

2. Limb Muscle Groups



Muscles moving the humerus.

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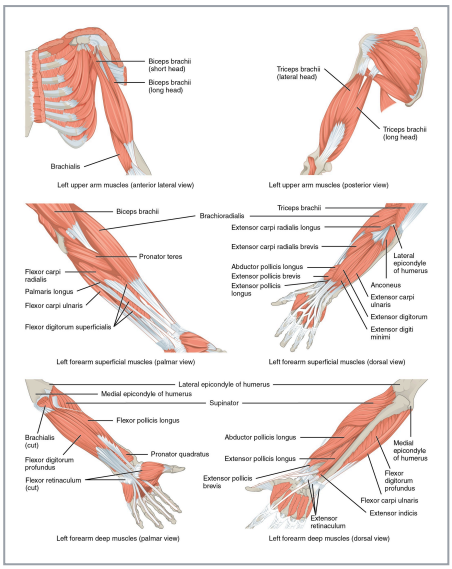

Muscles moving the forearm.

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Movement	Target	Target motion direction	Prime mover	Origin	Insertion
Medial compartment of thigh					
Moves back of lower legs up toward buttocks, as when kneeling; assists in opening thighs	Femur; tibia/fibula	Tibia/fibula: flexion; thigh: adduction	Gracilis	Inferior ramus; body of pubis; ischial ramus	Medial surface of tibia
Anterior compartment of thigh: Quadriceps femoris group					
Moves lower leg out in front of body, as when kicking; assists in raising the knee	Femur; tibia/fibula	Tibia/fibula: extension; thigh: flexion	Rectus femoris	Anterior inferior iliac spine; superior margin of acetabulum	Patella; tibial tuberosity
Moves lower leg out in front of body, as when kicking	Tibia/fibula	Extension	Vastus lateralis	Greater trochanter; intertrochanteric line; linea aspera	Patella; tibial tuberosity
Moves lower leg out in front of body, as when kicking	Tibia/fibula	Extension	Vastus medialis	Linea aspera; intertrochanteric line	Patella; tibial tuberosity
Moves lower leg out in front of body, as when kicking	Tibia/fibula	Extension	Vastus intermedius	Proximal femur shaft	Patella; tibial tuberosity
Moves back of lower legs up and back toward the buttocks, as when kneeling; assists in moving thigh diagonally upward and outward as when mounting a bike	Femur; tibia/fibula	Tibia: flexion; thigh: flexion, abduction, lateral rotation	Sartorius	Anterior superior iliac spine	Medial aspect of proximal tibia
Posterior compartment of thigh: Hamstring group					
Moves back of lower legs up and back toward the buttocks, as when kneeling; moves thigh down and back; twists the thigh (and lower leg) outward	Femur; tibia/fibula	Tibia/fibula: flexion; thigh: extension, lateral rotation	Biceps femoris	Ischial tuberosity; linea aspera; distal femur	Head of fibula; lateral condyle of tibia
Moves back of lower legs up toward buttocks, as when kneeling; moves thigh down and back; twists the thigh (and lower leg) inward	Femur; tibia/fibula	Tibia/fibula: flexion; thigh: extension, medial rotation	Semitendinosus	Ischial tuberosity	Upper tibial shaft
Moves back of lower legs up and back toward the buttocks as when kneeling; moves thigh down and back; twists the thigh (and lower leg) inward	Femur; tibia/fibula	Tibia/fibula: flexion; thigh: extension, medial rotation	Semi-membranosus	Ischial tuberosity	Medial condyle of tibia; lateral condyle of femur

Thigh muscles.

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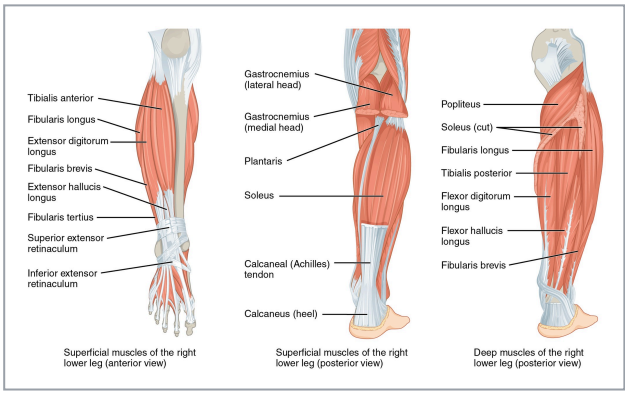

Leg muscles.

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Procedure

1. Examine prepared slides/charts of skeletal, cardiac and smooth muscle; note striations and nuclei.
2. On the torso/limb model, locate the deltoid, biceps, triceps, quadriceps, hamstrings and calf muscles.
3. For each, state its main action and the joint it moves.

P&O relevance

Knowing each group's action shows what is lost after amputation or paralysis and what the device must replace (e.g. calf push-off → energy-storing foot; dorsiflexors → AFO for foot drop).

LAB · WEEK 11

Brain & Spinal Cord Models

Anatomy I — Practical · Department of Prosthetics & Orthotics Technology

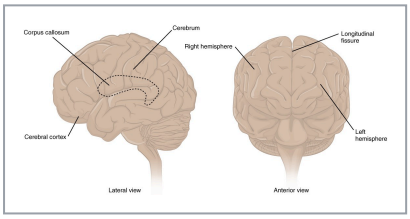
Assist. Lect. Redha Dawood Abdul-Redha · م.م. رضا داود عبد الرضا

Specialty: Pathological Analysis Techniques (تقنيات التحليلات المرضية)

Session objectives

- Identify the major regions of the brain on a model.
- Identify the grey and white matter of the spinal cord in cross-section.

1. The Brain



Cerebrum.

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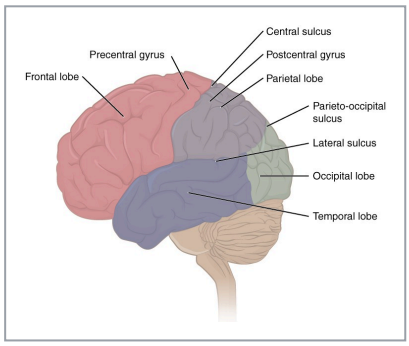

Cortical lobes.

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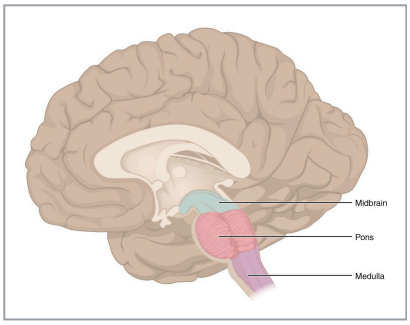

Brain stem & diencephalon.

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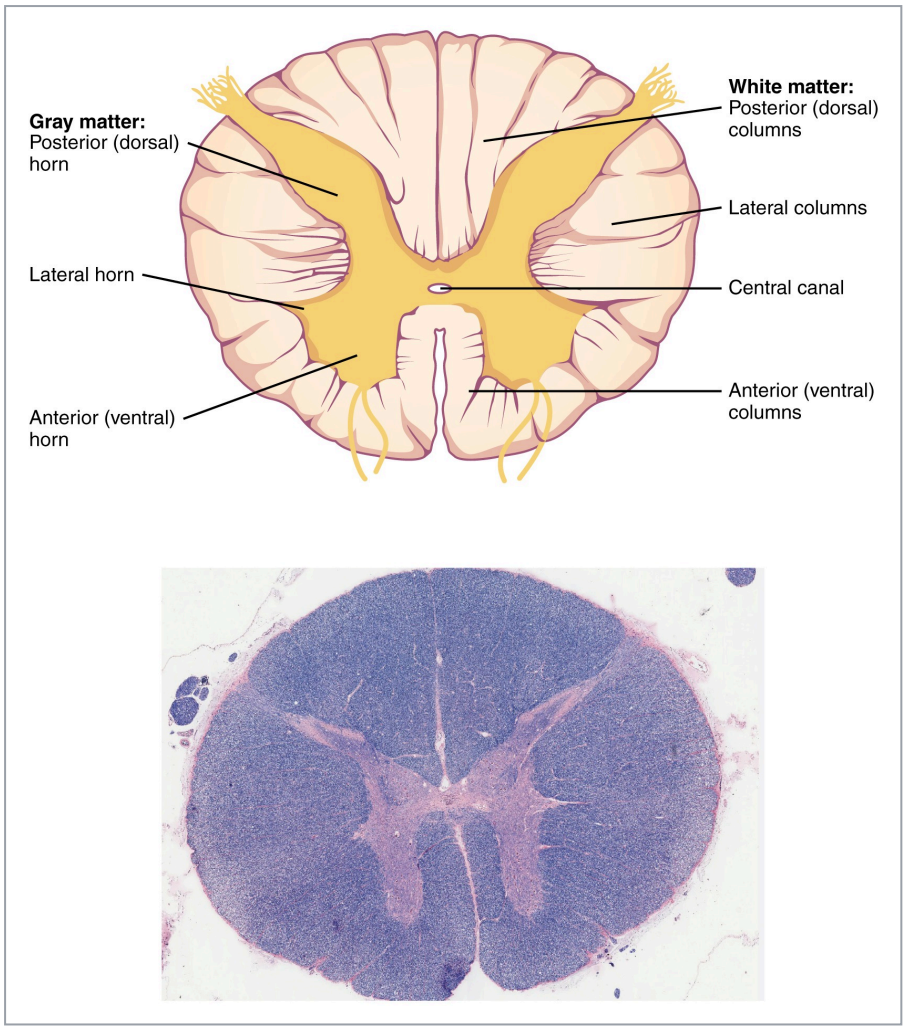
2. The Spinal Cord



Spinal cord cross-section — grey matter (H-shaped) and white-matter columns.

Procedure

1. On the brain model, identify the cerebrum and its four lobes, the cerebellum and the brain stem.
2. On a spinal-cord cross-section, identify the central H-shaped grey matter and the surrounding white matter.
3. Trace where a dorsal (sensory) root and a ventral (motor) root would attach.

P&O relevance

The level and completeness of a spinal-cord injury determines the pattern of paralysis and therefore the orthotic strategy (e.g. KAFOs or RGOs for paraplegia).

LAB · WEEK 12

Peripheral Nerves

Anatomy I — Practical · Department of Prosthetics & Orthotics Technology

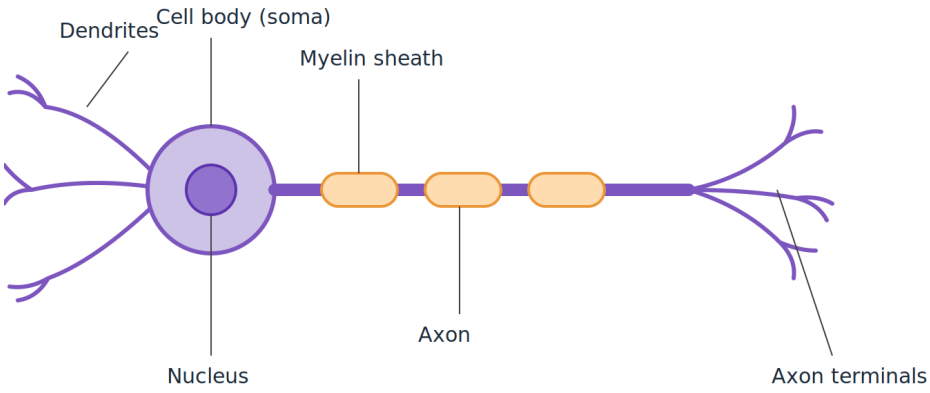
Assist. Lect. Redha Dawood Abdul-Redha · م.م. رضا داود عبد الرضا

Specialty: Pathological Analysis Techniques (تقنيات التحليلات المرضية)

Session objectives

- Describe the structure of a neuron and a peripheral nerve.
- Identify the major peripheral nerves of the upper and lower limbs.
- Relate nerve injury to functional loss and orthotic management.

1. The Neuron & Nerve



Structure of a typical neuron

The neuron — many axons bundle to form a peripheral nerve.

2. Major Peripheral Nerves

Nerve	Region	Effect of injury
Radial	Posterior arm/forearm	Wrist drop (loss of wrist/finger extension)
Median	Anterior forearm/hand	Weak grip; thenar wasting (carpal tunnel)
Ulnar	Medial forearm/hand	Claw hand; weak grip
Sciatic	Posterior thigh	Hamstring & below-knee weakness
Common fibular (peroneal)	Lateral leg	**Foot drop** (weak dorsiflexion)
Tibial	Posterior leg	Weak plantarflexion & toe movement

Procedure

1. On the limb model/chart, trace the radial, median and ulnar nerves in the upper limb.
2. Trace the sciatic, common fibular and tibial nerves in the lower limb.
3. For each, predict the movement lost if the nerve were injured, and name a suitable orthosis.

P&O relevance

Common fibular nerve injury causes foot drop, managed with an **AFO**; **radial nerve** injury causes wrist drop, managed with a **wrist-extension (cock-up) splint**.

LAB · WEEK 13

Cells, Tissues, Skin & Fascia Charts

Anatomy I — Practical · Department of Prosthetics & Orthotics Technology

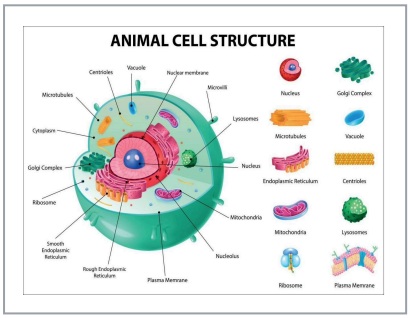
Assist. Lect. Redha Dawood Abdul-Redha · م.م. رضا داود عبد الرضا

Specialty: Pathological Analysis Techniques (تقنيات التحليلات المرضية)

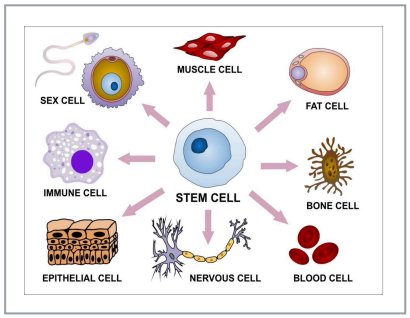
Session objectives

- Identify the basic structure of a cell and the four primary tissue types.
- Identify the layers of the skin and its appendages on charts/slides.
- Distinguish superficial from deep fascia.

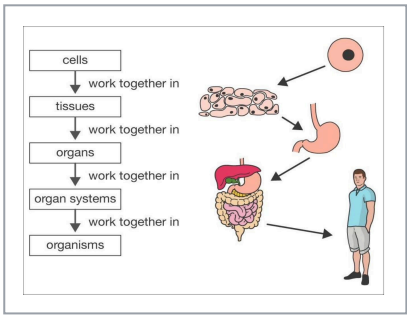
1. Cells & Levels of Organisation



The cell & its organelles.

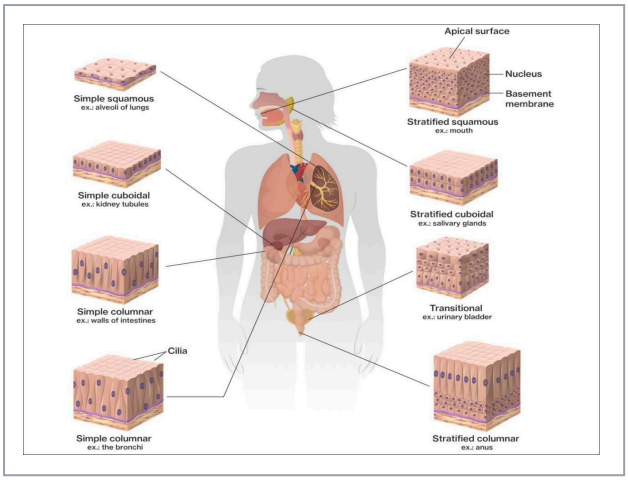


Cell types.

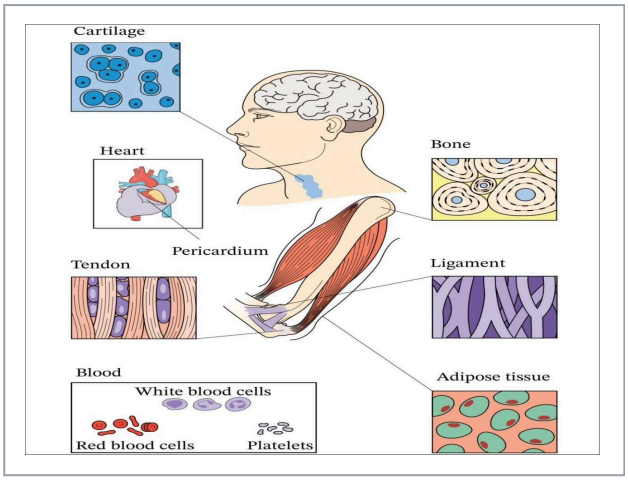


Cells → tissues → organs.

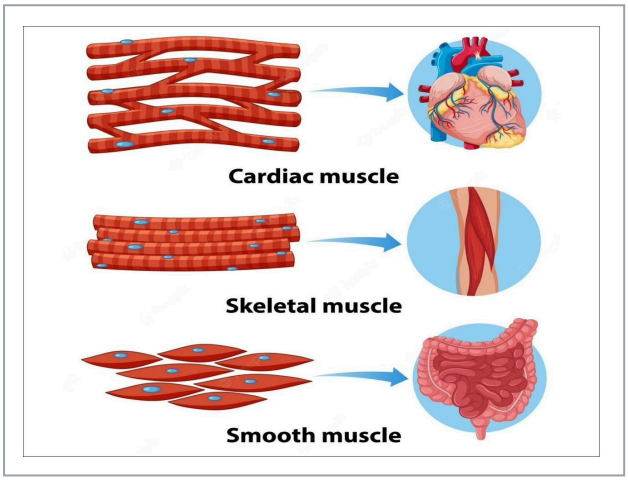
2. The Four Tissue Types



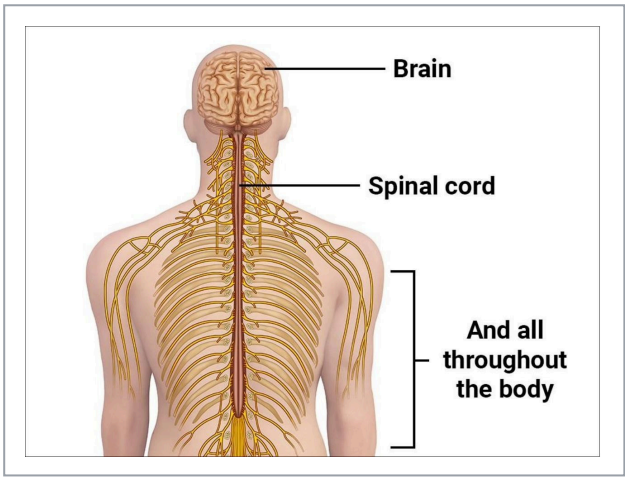
Epithelial tissue.



Connective tissue.

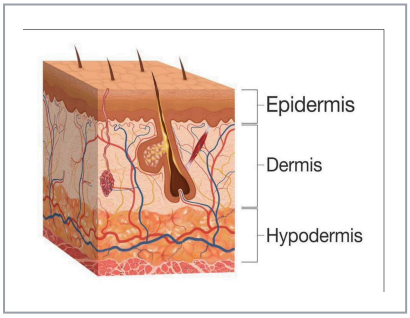


Muscle tissue.

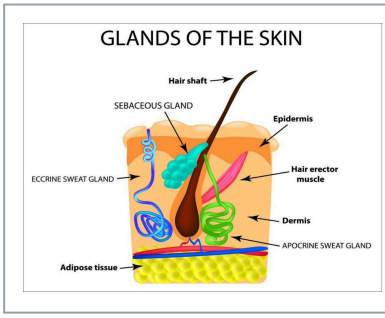


Nervous tissue.

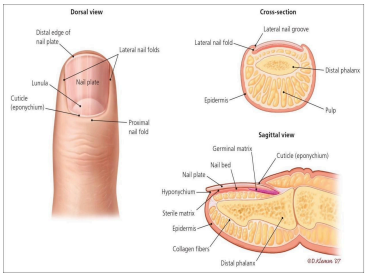
3. Skin & Its Appendages



Skin layers.



Glands.



Nail structure.

Procedure

1. On the cell chart, identify the nucleus, membrane and major organelles.
2. Match each of the four tissue types to its slide/chart and note one location of each.
3. On the skin chart, identify the epidermis, dermis and hypodermis and at least two appendages.

P&O relevance

Skin and fascia form the interface that bears all device loads; recognising healthy tissue helps you spot early pressure damage during follow-up.

LAB · WEEK 14

Surface Landmarks & Palpation

Anatomy I — Practical · Department of Prosthetics & Orthotics Technology

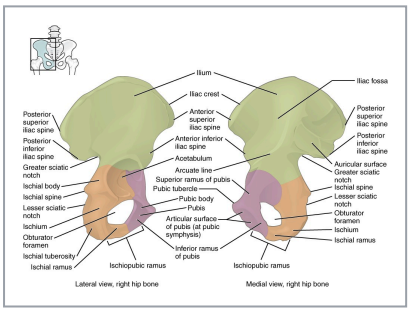
Assist. Lect. Redha Dawood Abdul-Redha · م.م. رضا داود عبد الرضا

Specialty: Pathological Analysis Techniques (تقنيات التحليلات المرضية)

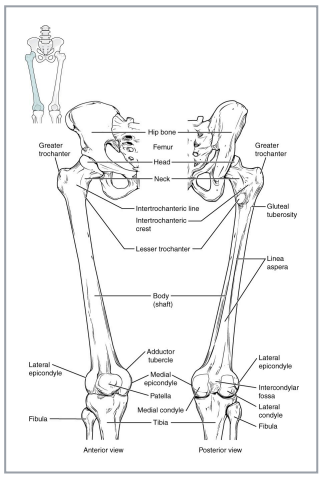
Session objectives

- Locate key bony surface landmarks on models (and by palpation where appropriate).
- Relate each landmark to socket trim-lines and load distribution.

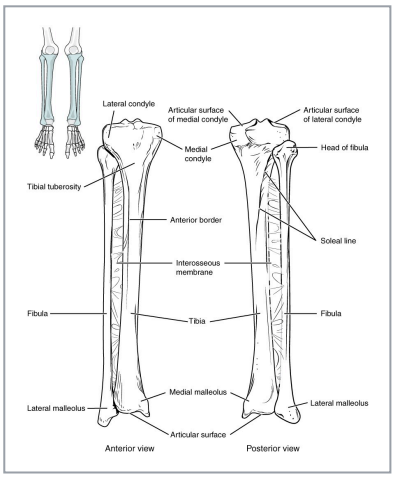
1. Lower-Limb Landmarks



Iliac crest, ASIS, ischial tuberosity.

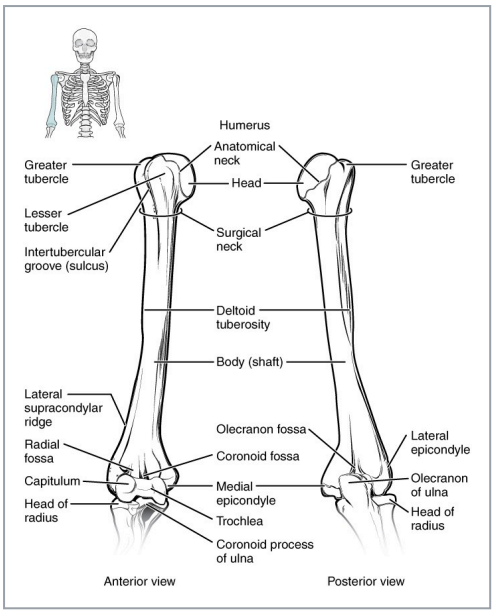


Greater trochanter, condyles.

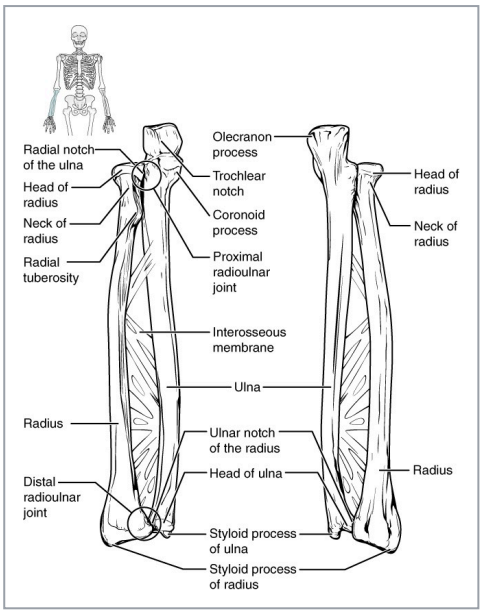


Tibial tuberosity, malleoli.

2. Upper-Limb Landmarks



Epicondyles of the humerus.



Olecranon & styloid processes.

Landmark	P&O use	Tolerance
Patellar tendon	Main load area in a TT (PTB) socket	Tolerant
Ischial tuberosity	Weight-bearing seat in a TF socket	Tolerant
Tibial crest	Relieved in a TT socket	Sensitive
Fibular head	Relieved (common fibular nerve)	Sensitive
Malleoli	Relieved in AFOs & sockets	Sensitive

Procedure

1. On the model, mark each landmark above with a removable sticker or wax pencil.
2. Label each as pressure-tolerant or pressure-sensitive.
3. Sketch trim-lines for a trans-tibial socket relative to these landmarks.

P&O relevance

Accurate landmark location is the basis of casting, measurement and socket modification — the practical core of prosthetic and orthotic fitting.

LAB · WEEK 15

Functional Movements & Joint Axes

Anatomy I — Practical · Department of Prosthetics & Orthotics Technology

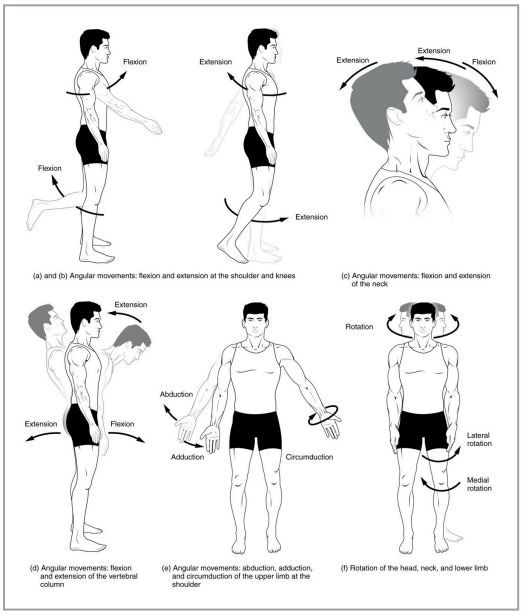
Assist. Lect. Redha Dawood Abdul-Redha · م.م. رضا داود عبد الرضا

Specialty: Pathological Analysis Techniques (تقنيات التحليلات المرضية)

Session objectives

- Demonstrate the major body movements and name them correctly.
- Relate each movement to its plane and joint axis.
- Connect functional movement to the gait cycle and P&O design.

1. Body Movements



Flexion/extension, abduction/adduction, rotation, circumduction.

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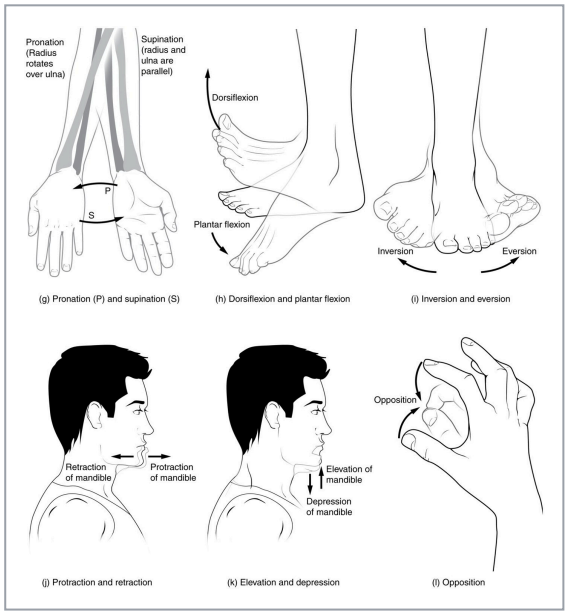

Pronation/supination, dorsi/plantarflexion, inversion/eversion, opposition.

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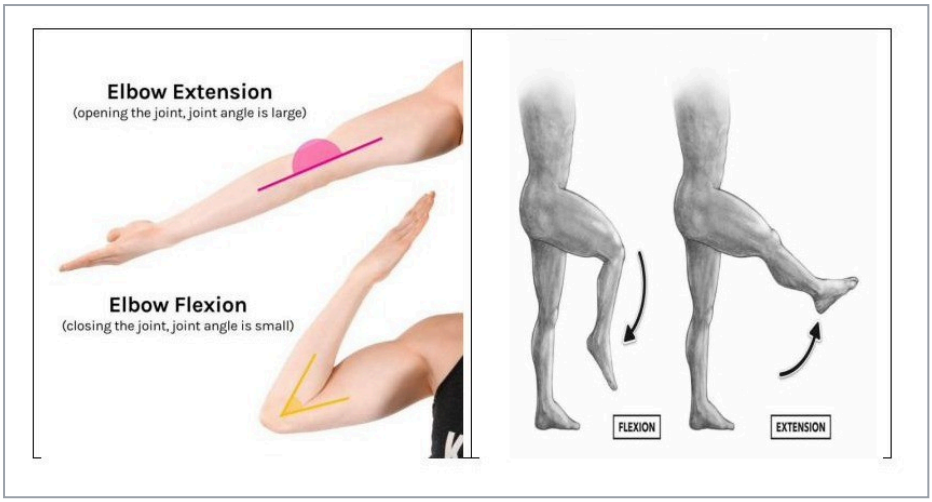

Flexion & extension demonstrated at the elbow.

2. Planes & Axes

Movement	Plane	Axis	Joint
Flexion / extension	Sagittal	Medio-lateral	Knee, elbow
Abduction / adduction	Frontal	Antero-posterior	Hip, shoulder
Rotation	Transverse	Vertical	Hip, neck

3. Application to Gait

Walking combines these movements in a repeating **gait cycle** (stance ≈ 60%, swing ≈ 40%). Hip and knee flexion/extension occur in the sagittal plane; pelvic stability relies on frontal-plane control.

Procedure

1. Demonstrate each named movement on yourself or a partner (where appropriate) and on the model.
2. State the plane and axis for each.
3. Walk through the stance and swing phases, naming the dominant joint movements in each.
4. For one joint, describe how a prosthetic/orthotic component reproduces or controls that movement.

P&O relevance — synthesis

This final session ties the whole course together: bones provide levers, joints provide axes, muscles provide forces, nerves provide control, and skin provides the interface. Prosthetics and orthotics apply this integrated anatomy to restore movement.