

Planes and directions of the body, introduction to the X-ray anatomy, axial skeleton

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	LECTURES	SEMINARS
1.	Planes and directions of the body, introduction to the X-ray anatomy, axial skeleton	Planes and directions of the body, introduction to the X-ray anatomy, axial skeleton
2.	Bones of the extremities	Bones of the extremities
3.	Bones of the neurocranium	Bones of the neurocranium
4.	Bones of the facial skeleton	Bones of the facial skeleton
5.	Skull as whole	Skull as whole
6.	General arthrology, joints	General arthrology, joints
7.	General myology, muscles and fascias of the head and neck	General myology, muscles and fascias of the head and neck
8.	Muscles of the trunk (back, thorax and abdomen)	Muscles of the trunk (back, thorax and abdomen)
9.	Muscles of the extremities	Muscles of the extremities
10.	Digestive system I	Digestive system I
11.	Digestive system II	Digestive system II
12.	Respiratory system, thyroid and parathyroid glands	Respiratory system, thyroid and parathyroid glands
13.	Urinary system, male genital system	Urinary system, male genital system
14.	Female genital system	Female genital system

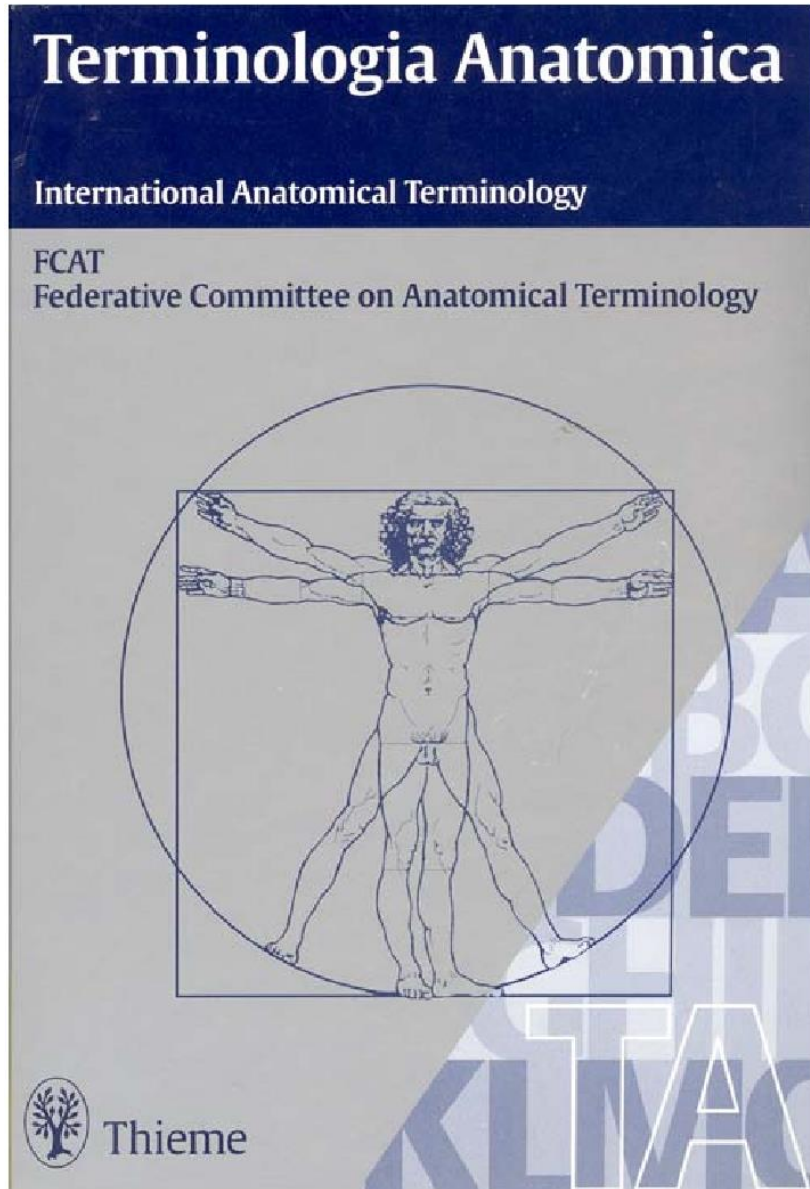
Hair pinned back



Lock and key

Pointer (a piece of wire, paper clip ...)

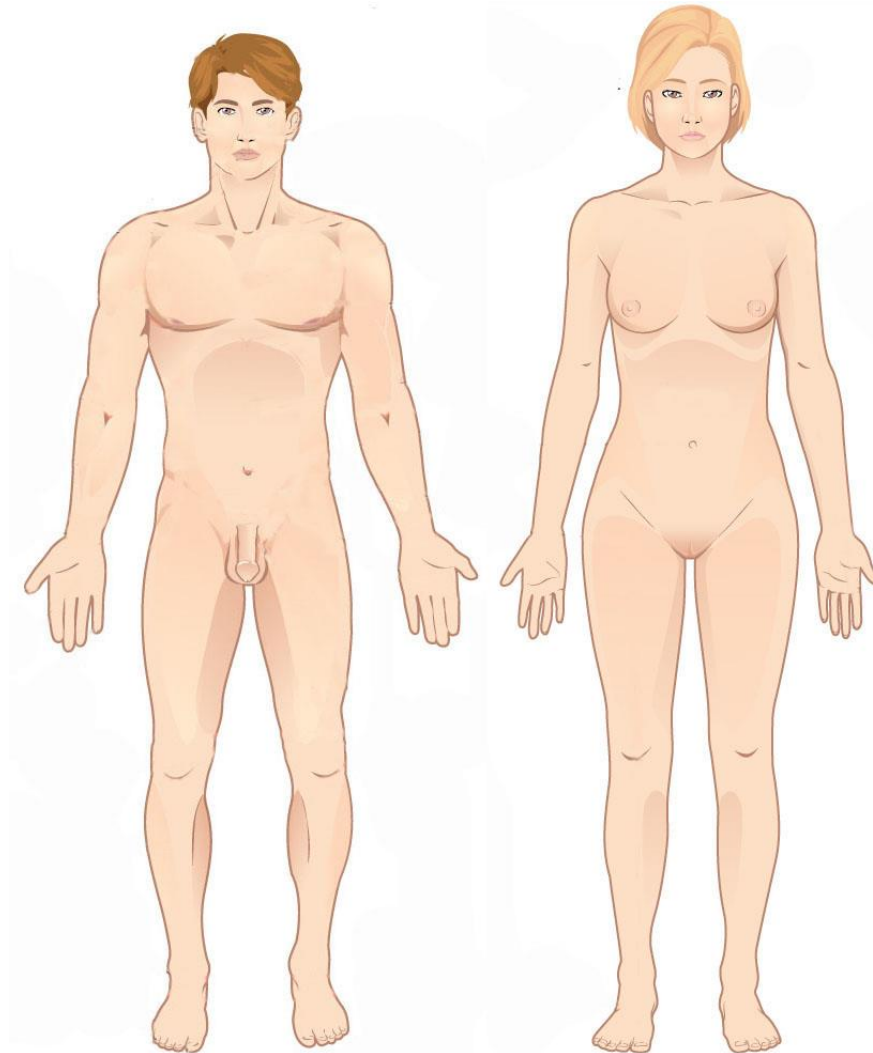




August 1997 at São Paulo, Brazil

about 7500 human anatomical structures

Standard anatomical position



PARTS OF HUMAN BODY

Head – caput

Neck – collum (cervix)

Trunk – truncus

Chest – thorax

Belly – abdomen

Pelvis – pelvis

Back – dorsum

Upper limb – membrum superius

arm – brachium

forearm – antebrachium

hand – manus

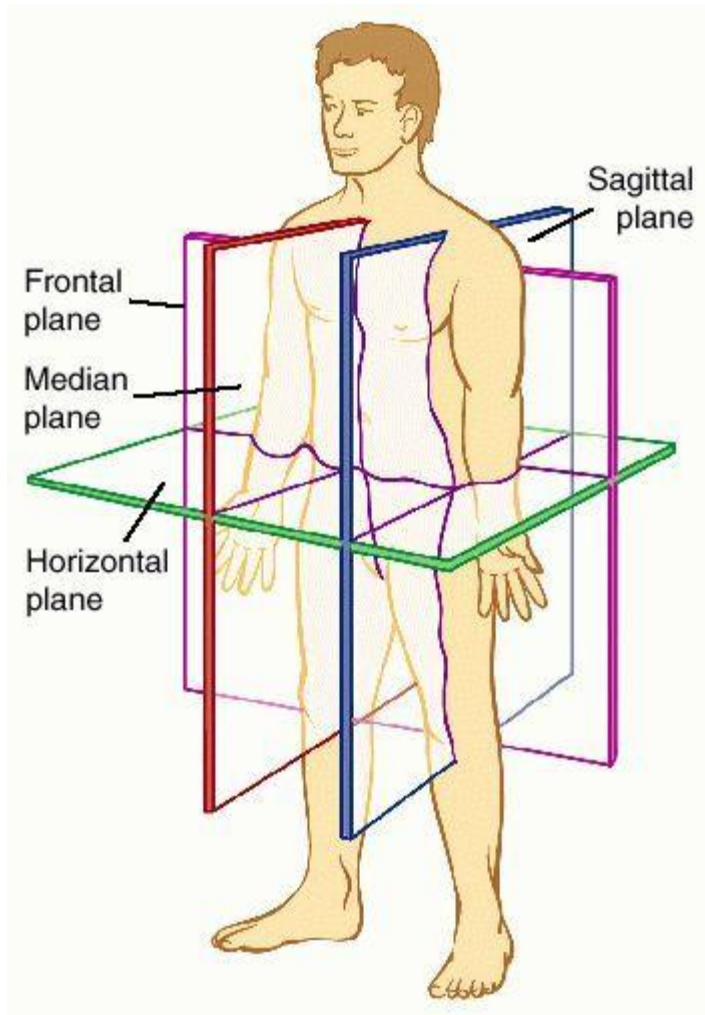
Lower limb – membrum inferius

thigh – femur

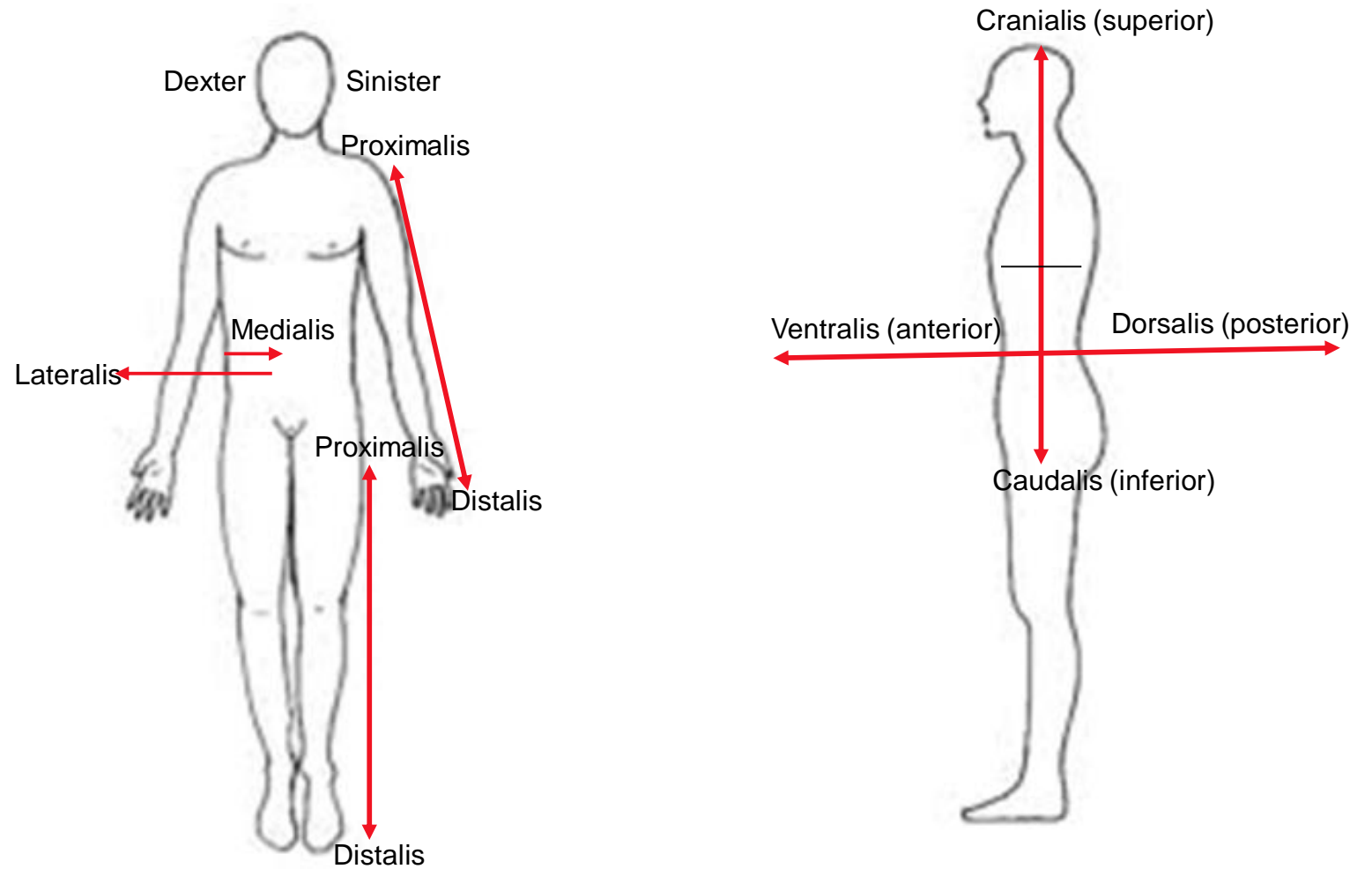
leg – crus

foot- pes

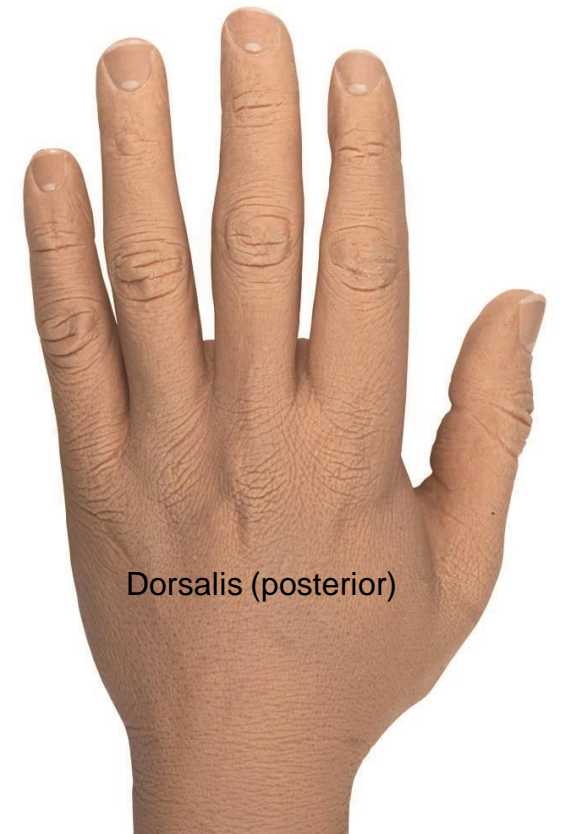
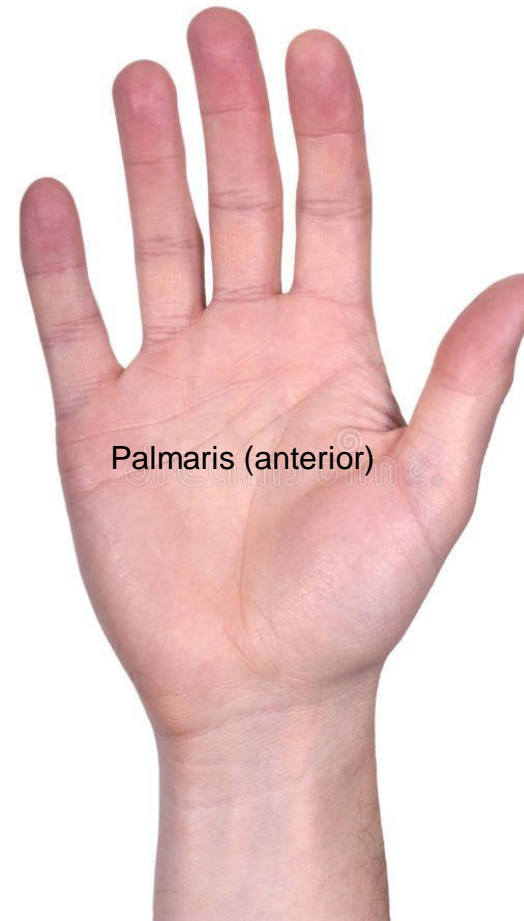
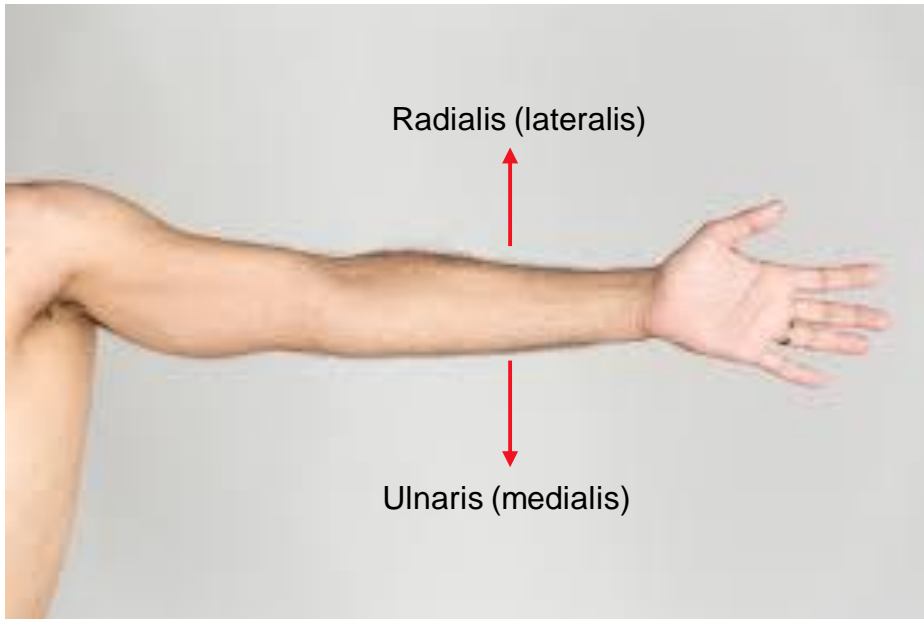
Planes



Directions



Upper limb



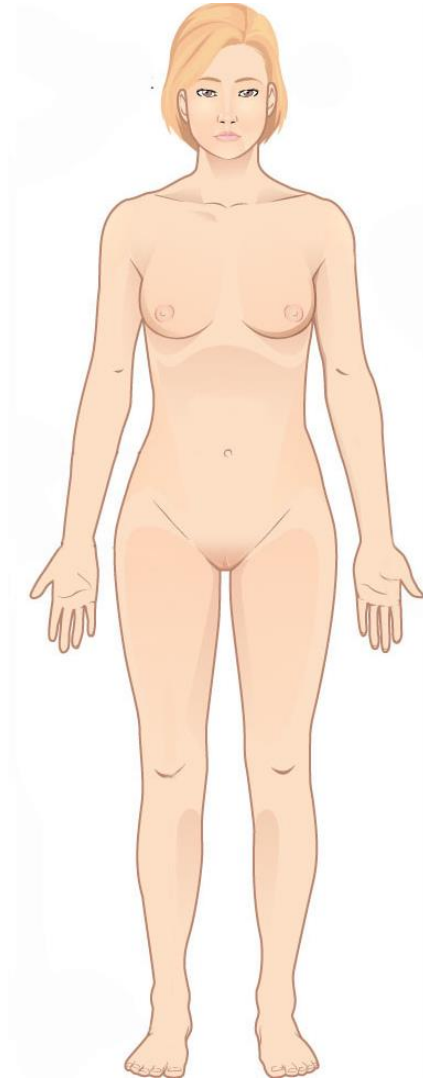
Lower limb



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MUNI
MED

Superficialis (externus)



Profundus (internus)



Maximus



Medius (intermedius)



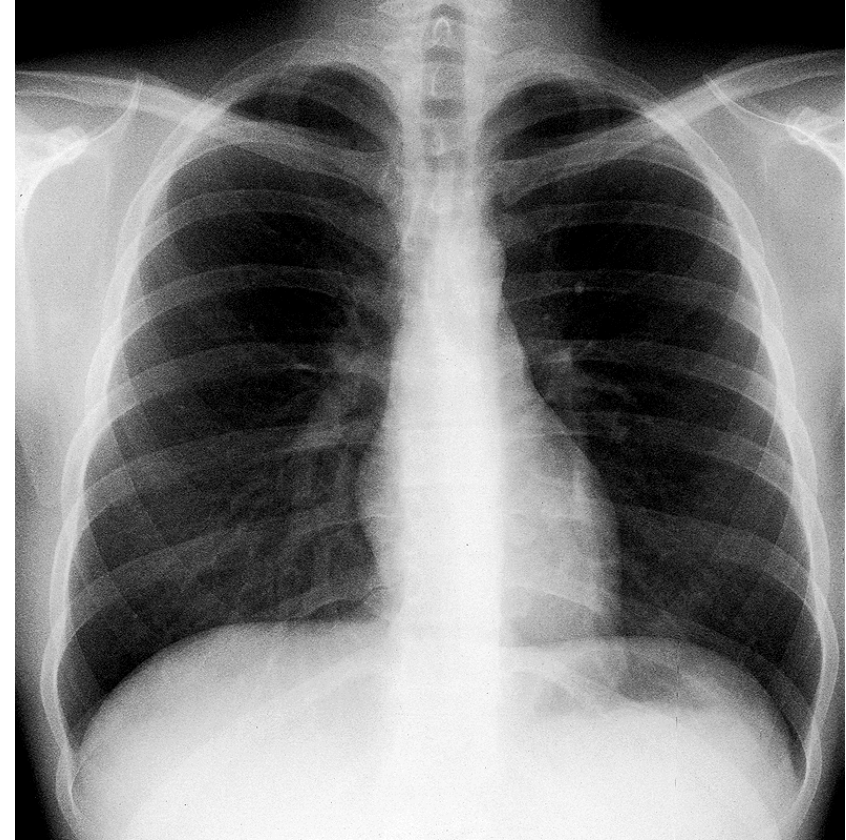
Minimus



Introduction to the X-ray anatomy

Plain X-ray Image

- 2D image of 3D object
- poor differentiation between soft tissues
- bone – radiopaque (white), cavity – radiolucent (dark)
- scans of bones, dental images, chest radiography, mammography
- two basic views (AP/PA, L)

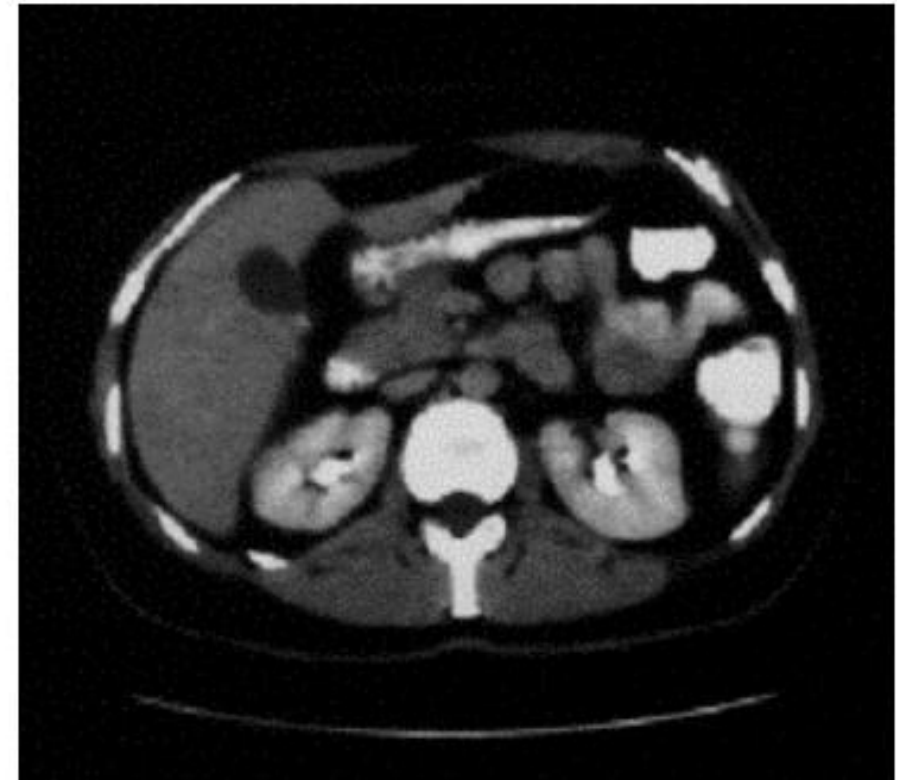
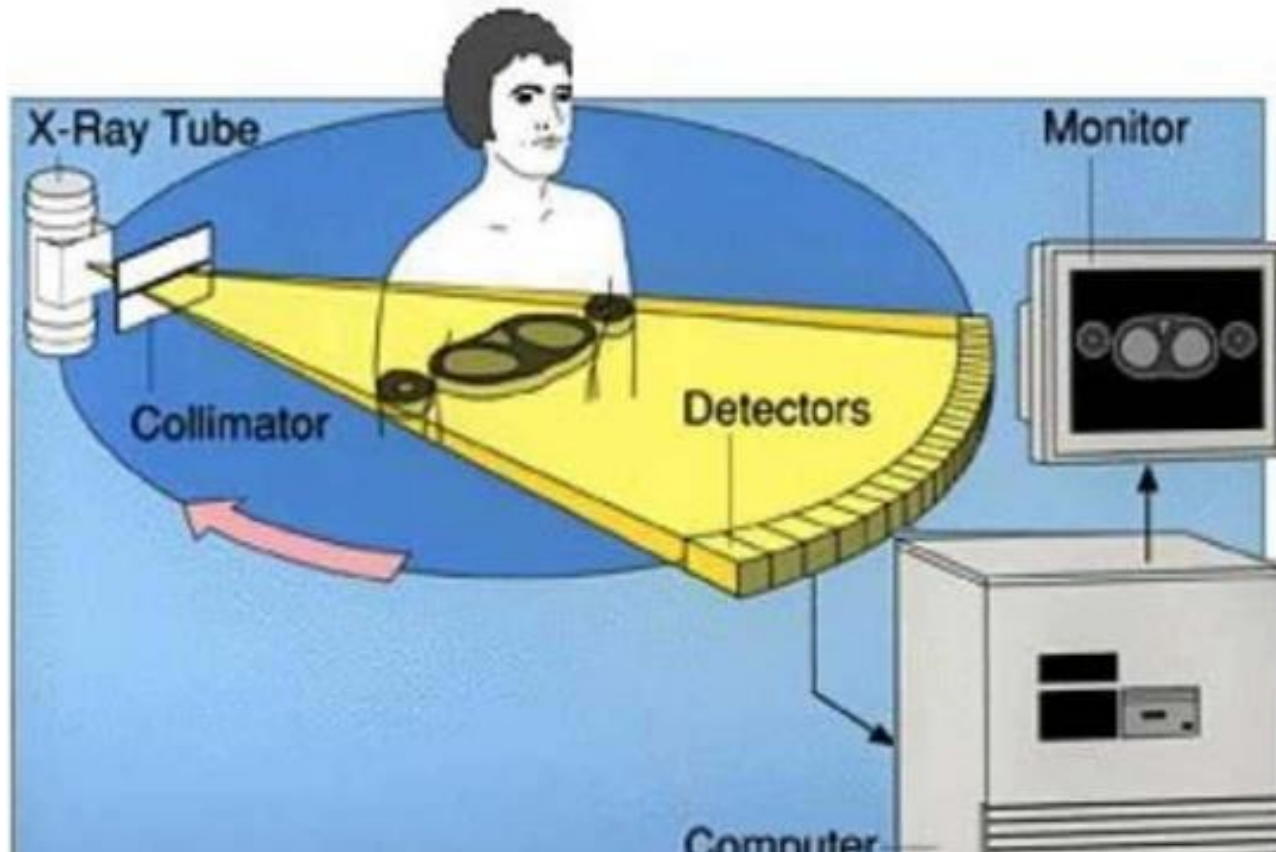


Contrast Agents

- enhance tissue visualization when there is no natural contrast
- positive – high density – barium sulfate (BaSO_4)
 - salts of iodine
- negative – low density – gas, fluids
- single-contrast or double-contrast



Tomographic images provide better anatomic localization of an abnormality.

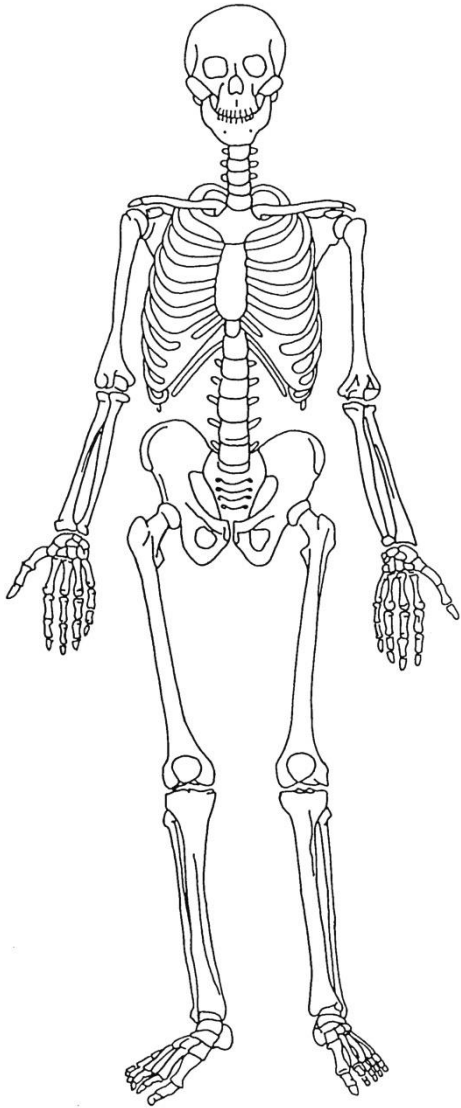


Magnetic Resonance Imaging (MRI)

- uses magnetic fields and radiofrequency pulses to produce anatomical images, hydrogen atoms create a signal
- no risk of ionizing radiation
- contraindications include medical devices and implants
- contrast agents are based on chelates of gadolinium
- signal intensities – high (bright), intermediate, low (dark)



Introduction to osteology

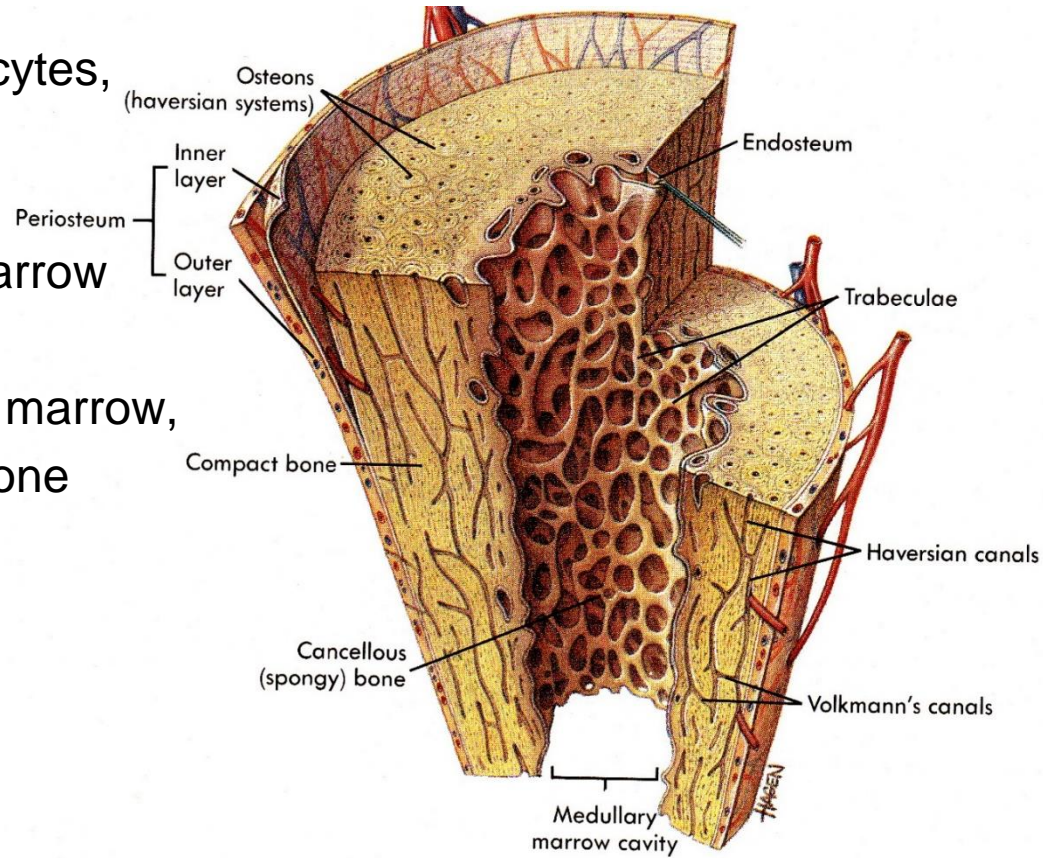


Human skeleton

- serves as a framework for the body
- consists of many individual bones and cartilages
- bands of fibrous connective tissue are in intimate relationship with the parts of the skeleton
- is composed of 1) **the axial** (the skull, vertebral column and thorax) and 2) **the appendicular** (bones of the upper and lower limb) **skeleton**
- support, protection of vital organs, movements, storage of calcium, source of blood cells

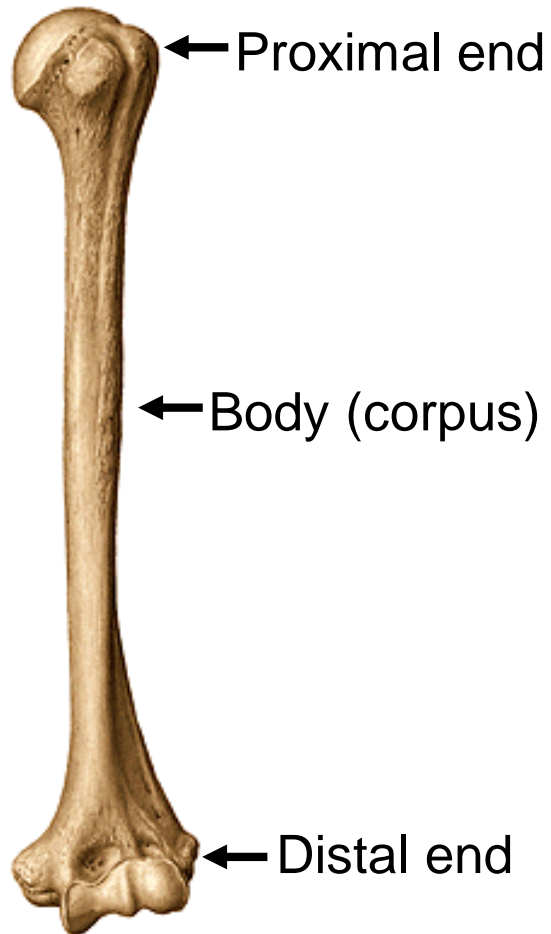
Structure of a bone

- osteoblasts, bone lining cells, osteocytes, and osteoclasts
- compact and spongy bone
- medulla ossium rubra – red bone marrow (active hematopoietic tissue), medulla ossium flava – yellow bone marrow, medulla ossium gelatinosa – grey bone marrow.

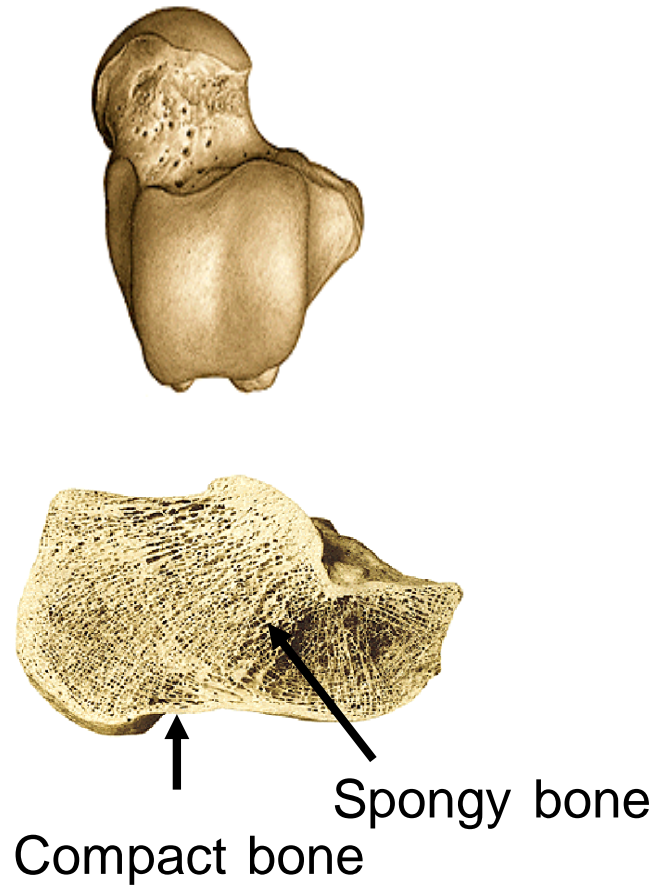


Classification of bones according to shape

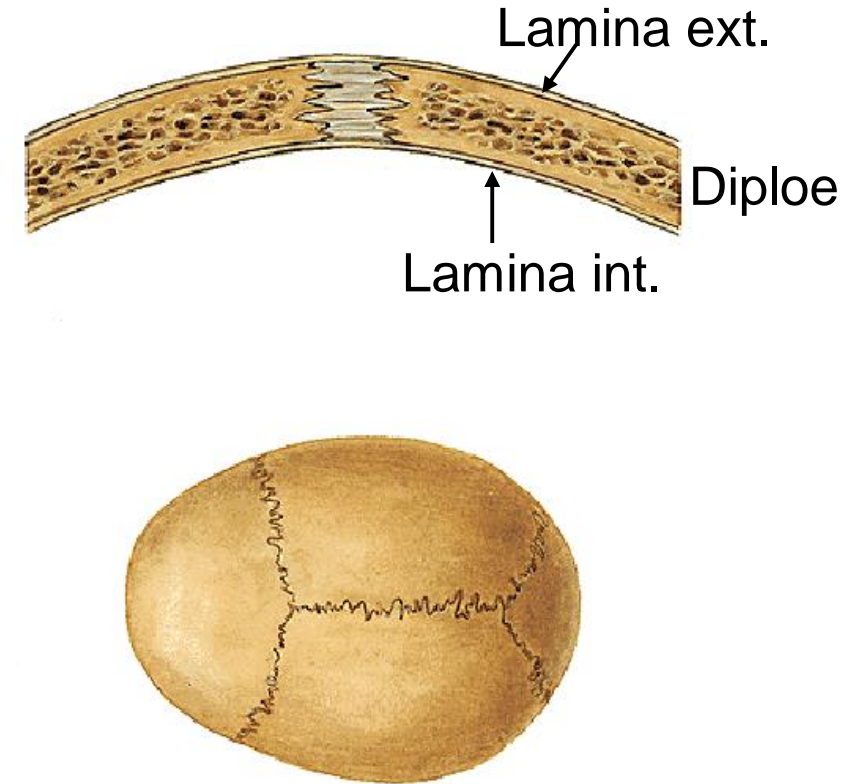
Ossa longa (long bones)



Ossa brevia (short bones)



Ossa plana (flat bones)

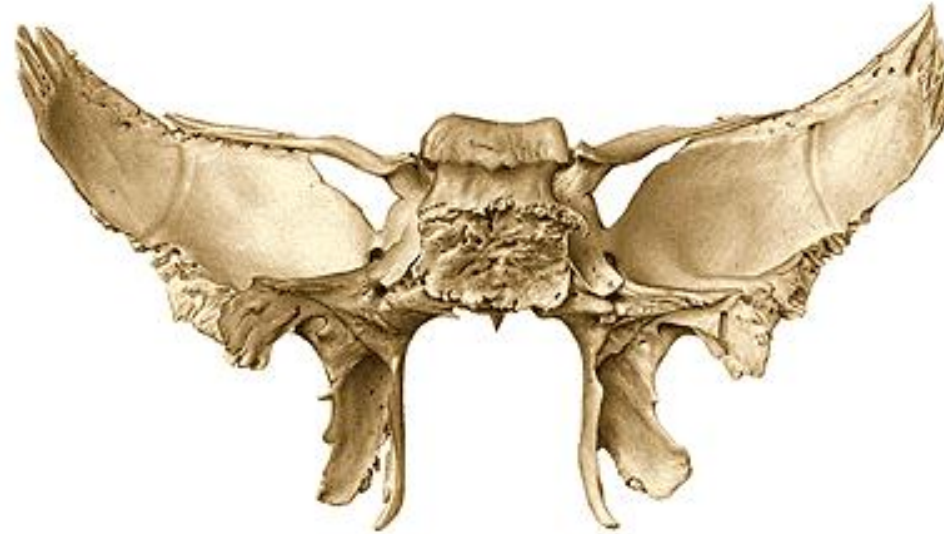


Classification of bones according to shape

Ossa pneumatica
(pneumatised bones)



Ossa irregularia (irregular bones)



Ossa sesamoidea (sesamoid bones)

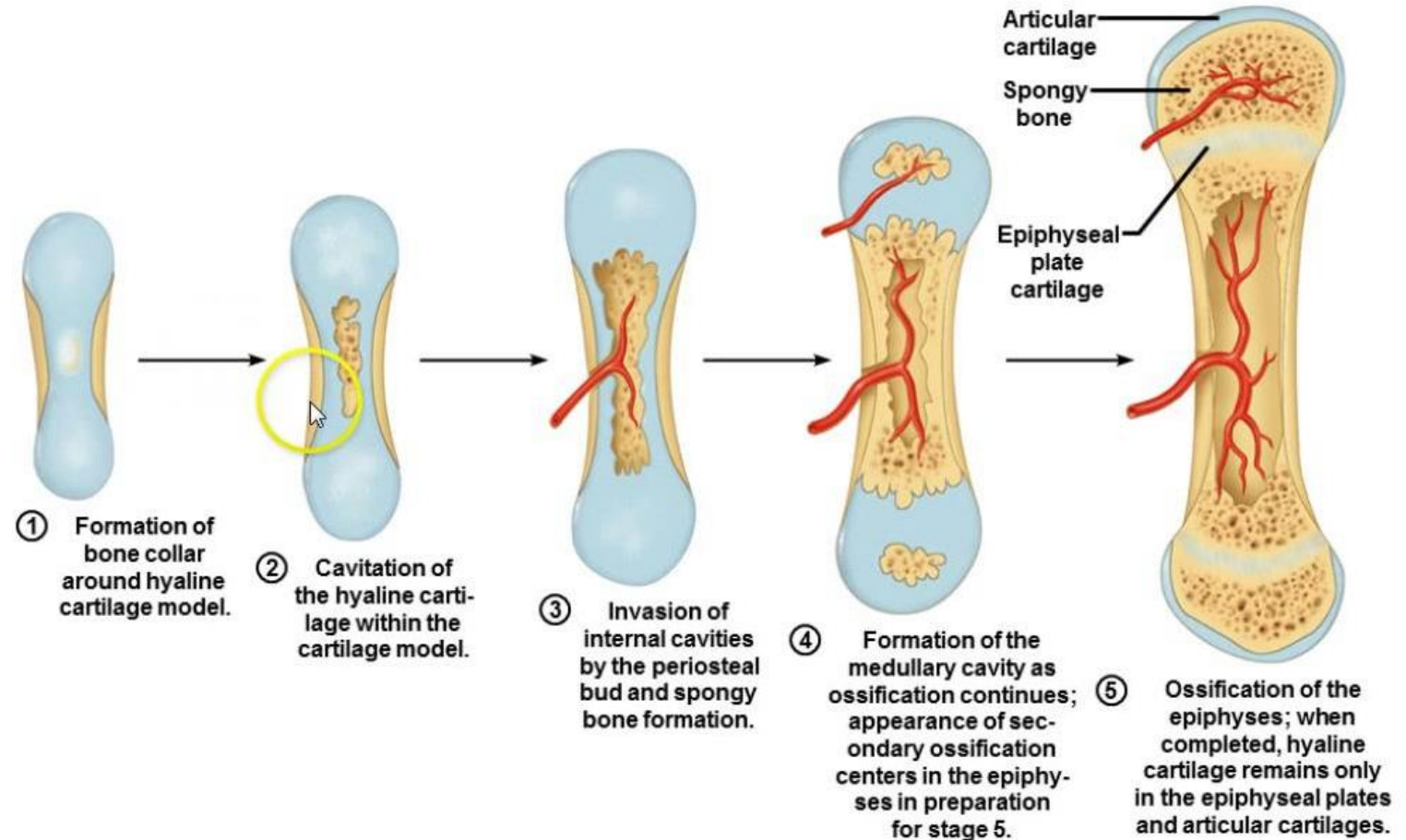


Bone development (ossification)

Intramembranous ossification

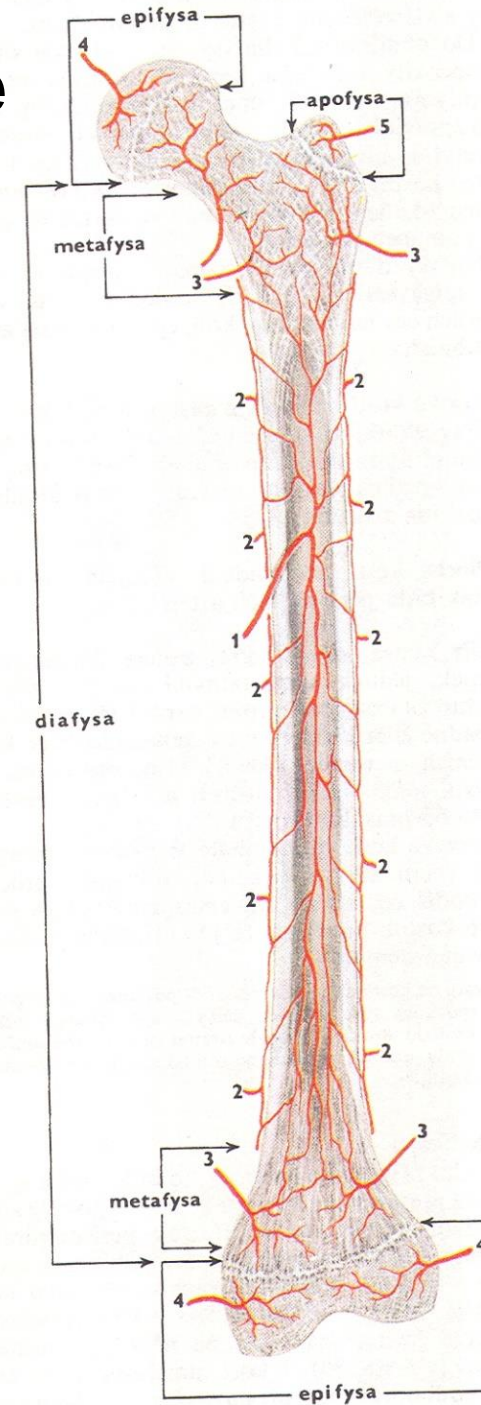
Endochondral ossification

Stages of Endochondral Ossification



Blood supply to bone

- Nutrient artery (one or more, through the diaphysis)
- Periosteal arteries (supply the compact bone)
- Metaphyseal arteries
- Epiphyseal arteries
- Apophyseal arteries



How to describe bones

1. Name of the bone (English, Latin) **Arm bone, Humerus**
2. Type of the bone (long, short) **Long type of bone**
3. What part of the skeleton it is included in? **Free upper limb - left**
4. Dividing into main parts (ends, body, surfaces, borders....) **Body, proximal and distal ends.**
5. Description of details - the positive and negative relief (tubercle, fossa...) **Greater and lesser tubercles, intertubercular groove, medial and lateral epicondyles, coronoid and radial fossae....**



How to describe bones

Latin terminology: **Collum chirurgicum humeri**

The first word is the name of a described detail (collum = neck).

The second word is the adjective that specifies it (chirurgicum = surgical)

The third word is the genitive of the name of the bone (humeri = of humerus)



How to describe bones

Negative relief:

Sulcus –groove
Incisura – notch
Canalis – canal
Fossa – pit, hollow
Fovea – shallow pit, hollow
Foramen – opening, orifice, gap
Facies – surface

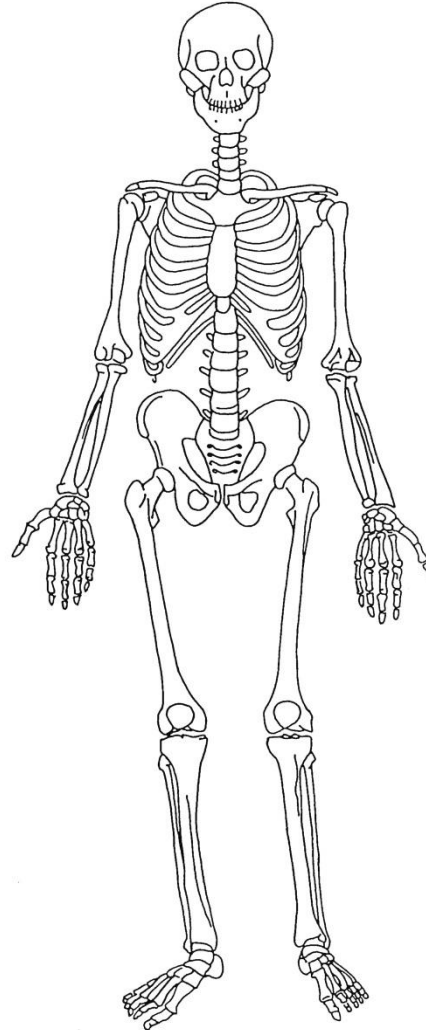
Positive relief:

Caput – head
Capitulum – small head
Condylus - condyle
Processus – projection, prominence
Spina – thorn
Tuberculum – tubercle
Tuber – greater tubercle
Tuberositas – tuberosity, large rounded eminence

Skeleton

Axial skeleton:
(80)

Skull
Vertebral column (spine)
Ribs
Sternum



Appendicular skeleton:

Upper limb:
(64)

Shoulder girdle
Skeleton of free upper limb

Lower limb:
(62)

Pelvic girdle
Skeleton of free lower limb

Columna vertebralis



24 vertebrae:

7 cervical (C) – vertebrae cervicales

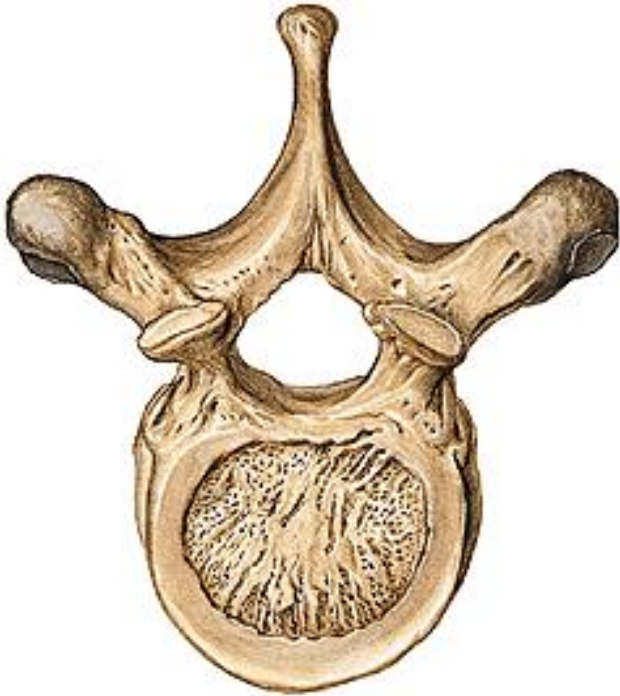
12 thoracic (T) – vertebrae thoracicae

5 lumbar (L) – vertebrae lumbales

Sacrum – os sacrum

Coccyx – os coccygis

General features of a vertebra



Corpus vertebrae – facies terminalis superior et inferior

Arcus vertebrae – pediculus et lamina

Foramen vertebrale (canalis vertebralis)

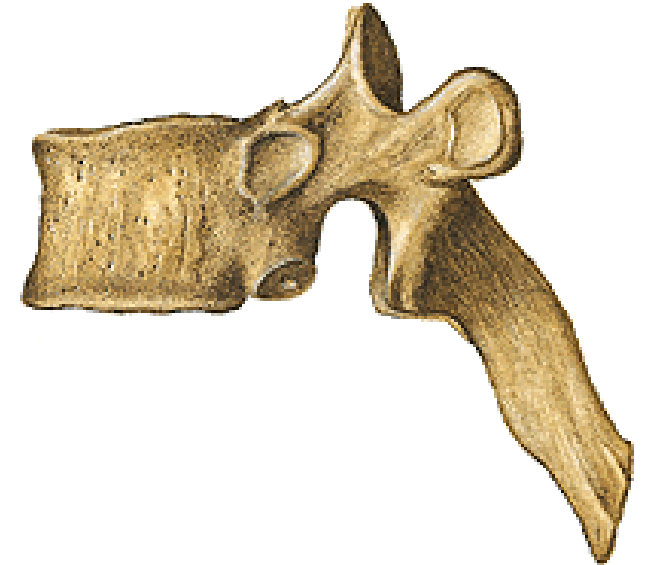
Incisura vertebralis superior et inferior
(foramen intervertebrale)

Processus:

articulares (4) – superiores et inferiores

transversi (2) – dexter et sinister

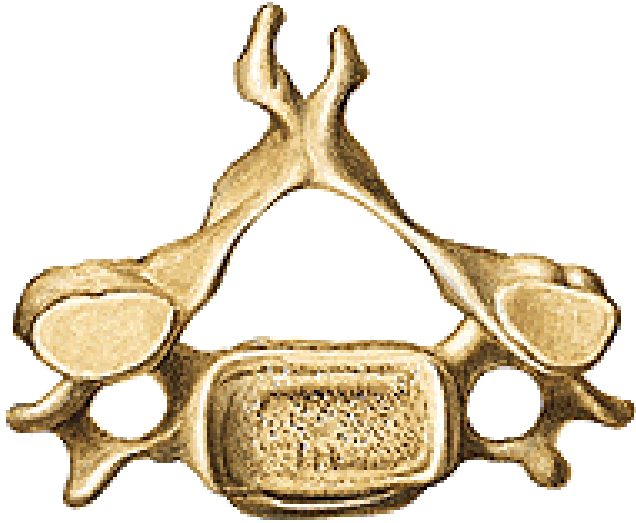
spinosis (1)



Processus articulares



Vertebrae cervicales



Foramen processus transversi

Tuberculum anterius et posterius processus transversi (C6 – tuberculum caroticum)

Uncus corporis vertebrae

Oblique processus articulares

Bifurcations of the spinous process (C2 – C6)



Vertebra prominens (C7)

Atlas (C1)



Arcus anterior et posterior
Tuberculum anterius et posterius
Fovea dentis
Massa lateralis
Fovea articularis superior
Sulcus arteriae vertebralis
Fovea articularis inferior

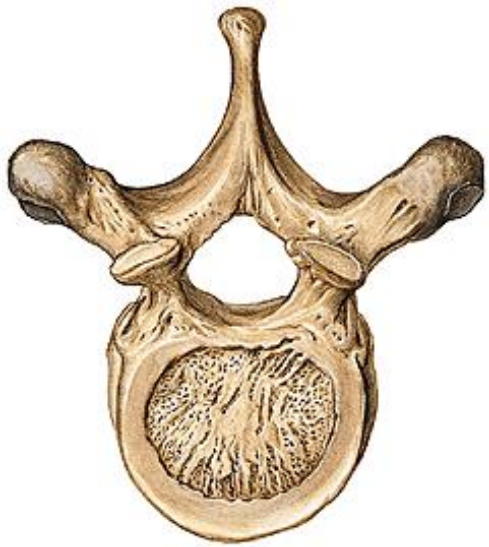


Axis (C2)

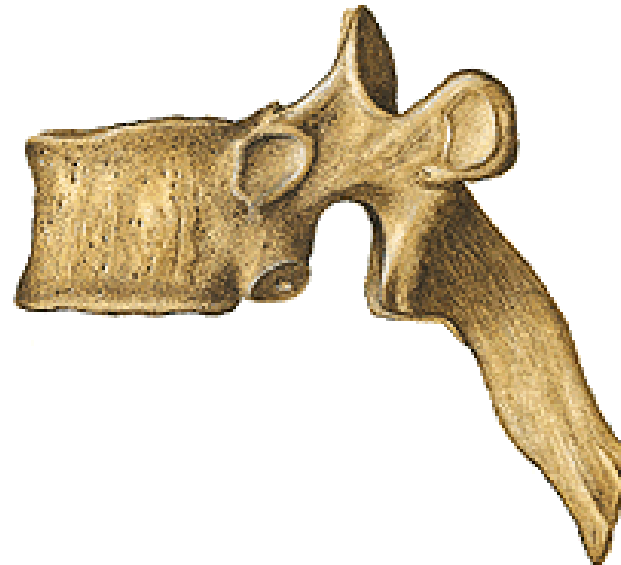
Dens axis - facies articularis anterior et posterior dentis
- apex dentis



Vertebrae thoracicae (T1 – T12)



Fovea costalis superior et inferior
Fovea costalis processus transversi
Oblique processus spinosus
Processus articulares in the frontal plane



Vertebrae lumbales (L1 – L5)

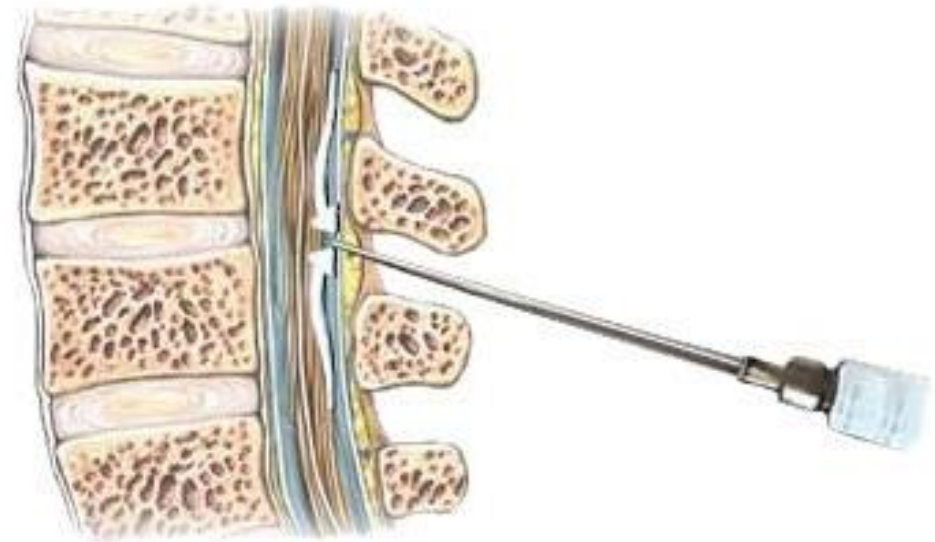
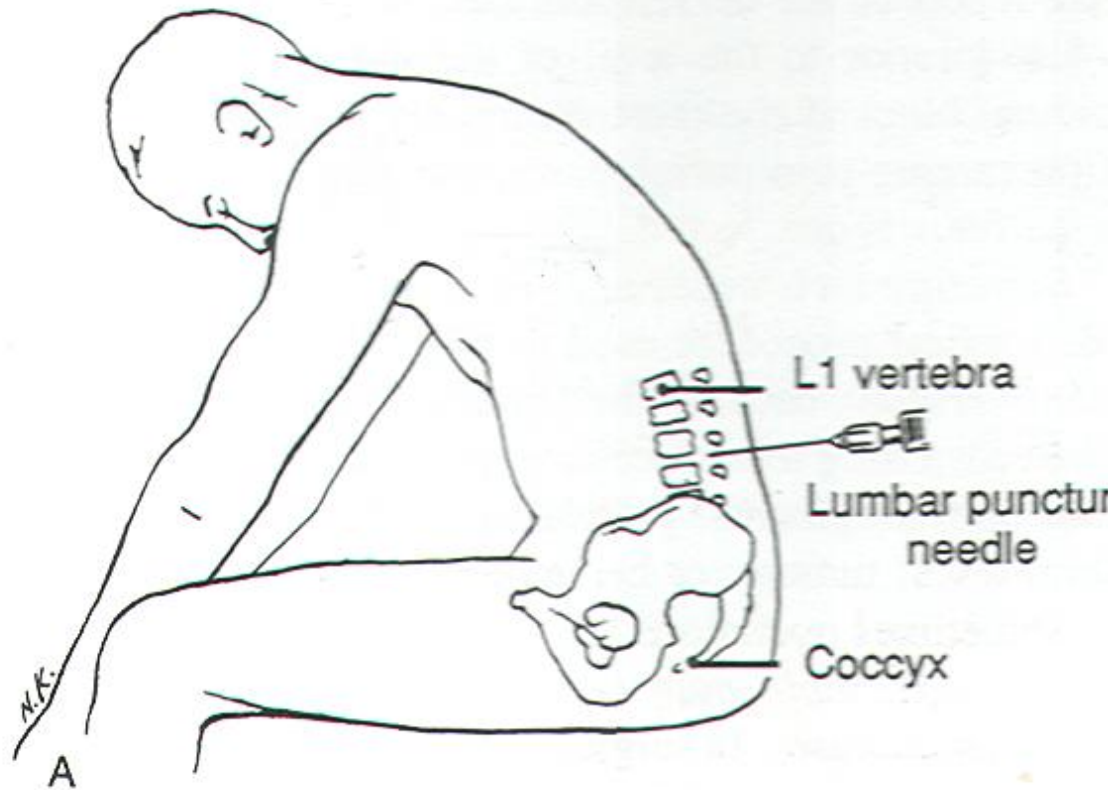


Processus costalis
Processus mammillaris
Processus accessorius
Straight processus spinosus
Processus articulares in the sagittal plane



Vertebrae lumbales

Lumbar puncture (spinal tap) –
between L4-5 or L3-4



Os sacrum

The sacral bone (sacrum) is formed by fusion of 5 sacral vertebrae.

Facies pelvica



Foramina sacralia anteriora et posteriora

Lineae transversae

Crista sacralis -

mediana, intermedia et lateralis

Processus articularis superior

Tuberositas sacralis

Hiatus canalis sacralis

Cornu sacrale

Facies dorsalis



Os sacrum

Basis – facies terminalis superior

Promontorium

Apex - facies terminalis inferior

Canalis sacralis

Pars lateralis - facies auricularis



Pars lateralis



Os coccygis

The coccygeal bone (coccyx) is formed by fusion of 4 - 5 coccygeal vertebrae (Co1 – Co 4 – 5).

Facies anterior

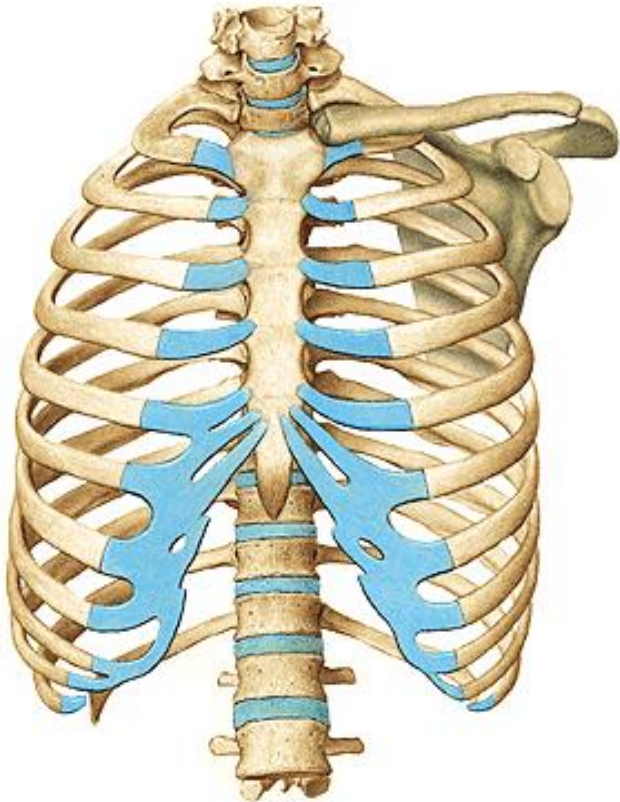


**Basis – facies terminalis superior
Cornu coccygeum**

Facies posterior



Thorax



Vertebrae thoracicae T1 – T12

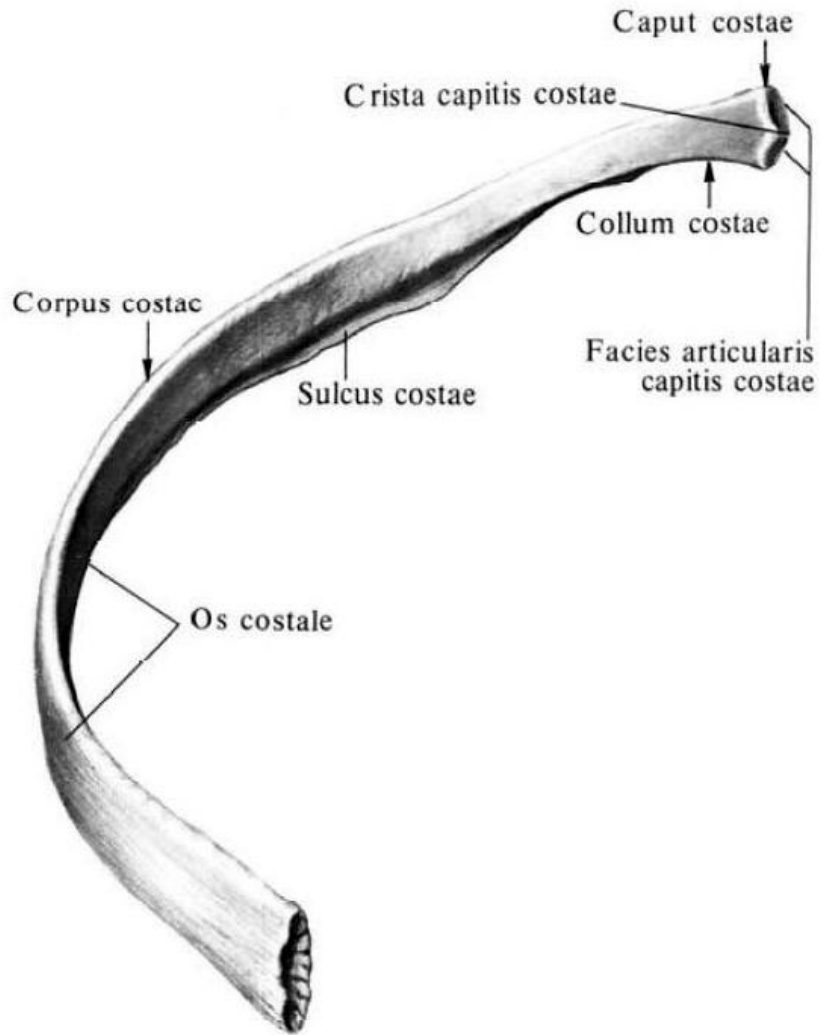
Costae – 12 pairs: Costae verae (1. – 7. pair)

Costae spuriae (8. – 10. pair)

Costae fluctuantes (11., 12. pair)

Sternum

Costa



Os costae – caput, collum, corpus

Cartilago costae

Caput – facies articularis

– crista capitis costae (2. – 10. pair)

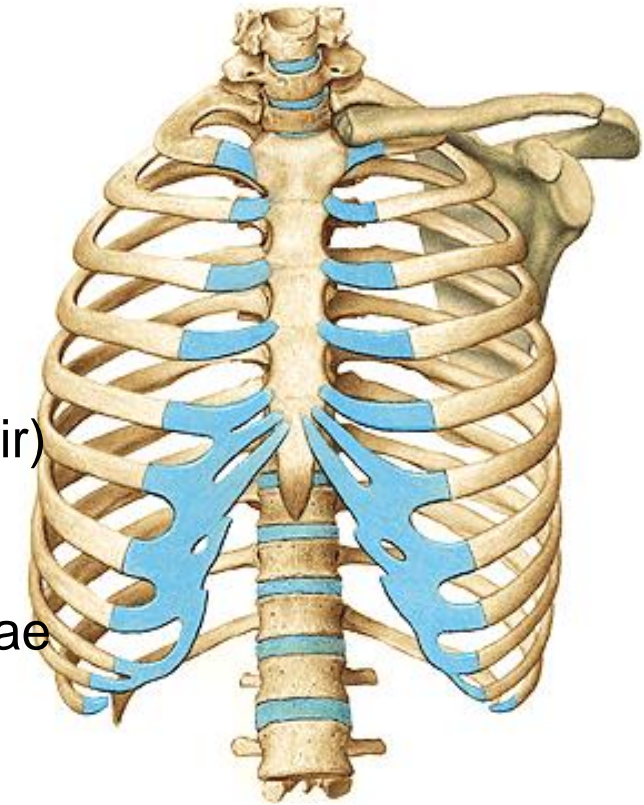
Collum – tuberculum costae

– facies articularis tuberculi costae

Corpus – angulus costae

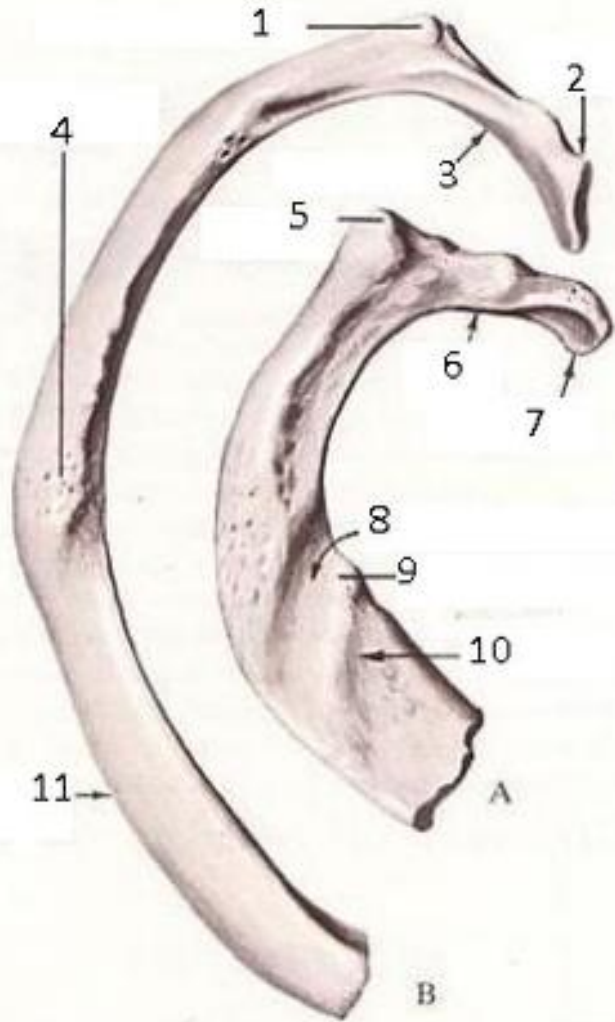
– crista costae

– sulcus costae



Costa 11 et 12 – no angle, neck and tubercle

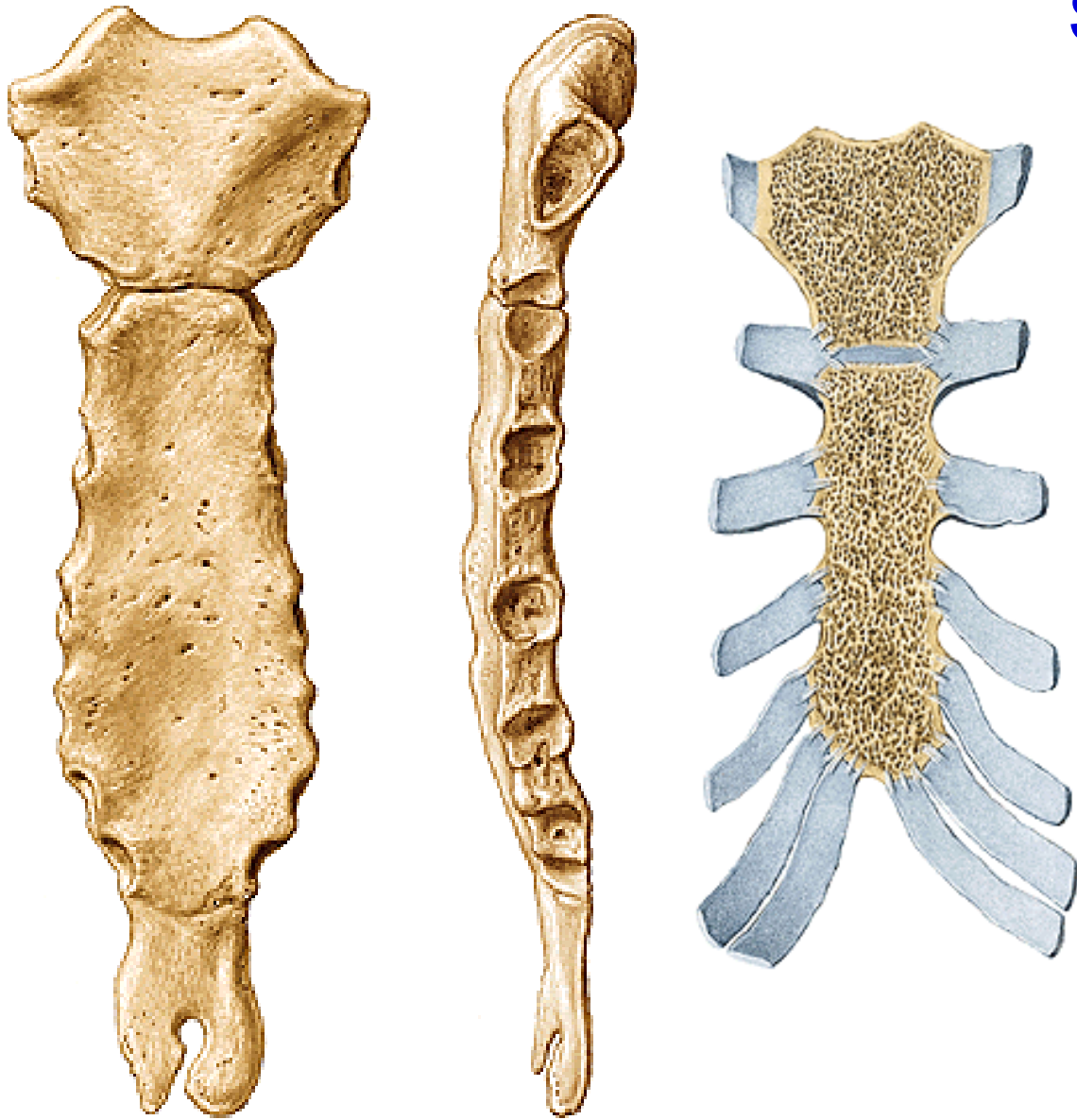
Costa prima et secunda



Costa prima – tuberculum m. scaleni anterioris
– sulcus arteriae subclaviae
– sulcus venae subclaviae

Costa secunda – tuberositas m. serrati anterioris

Sternum



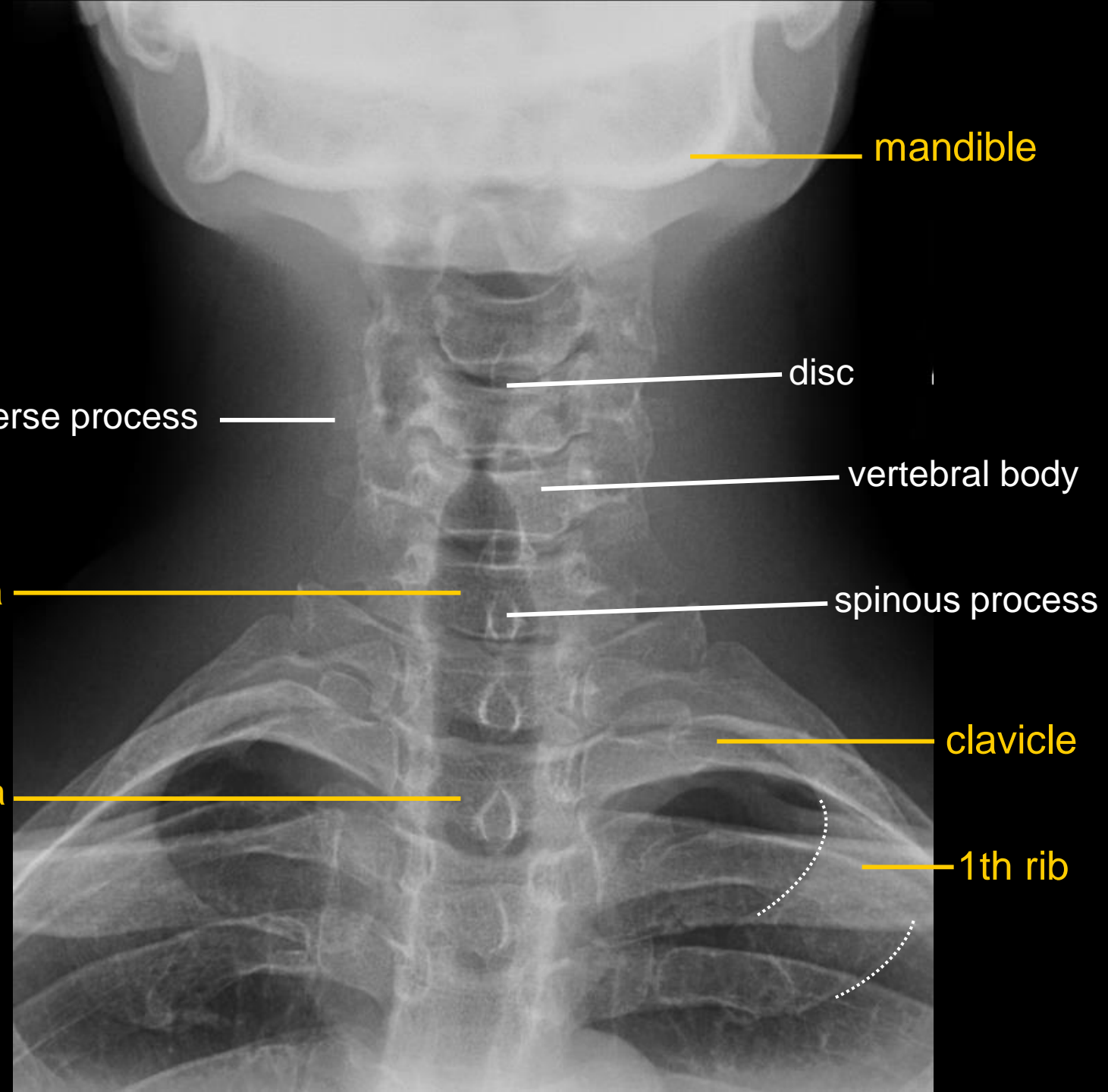
Manubrium sterni – incisura clavicularis
– incisura jugularis
– incisurae costales

Angulus sterni

Corpus sterni – incisurae costales

Processus xiphoideus

SPINE
CERVICAL PART
AP projection



mandible

disc

transverse process

vertebral body

cervical vertebra

spinous process

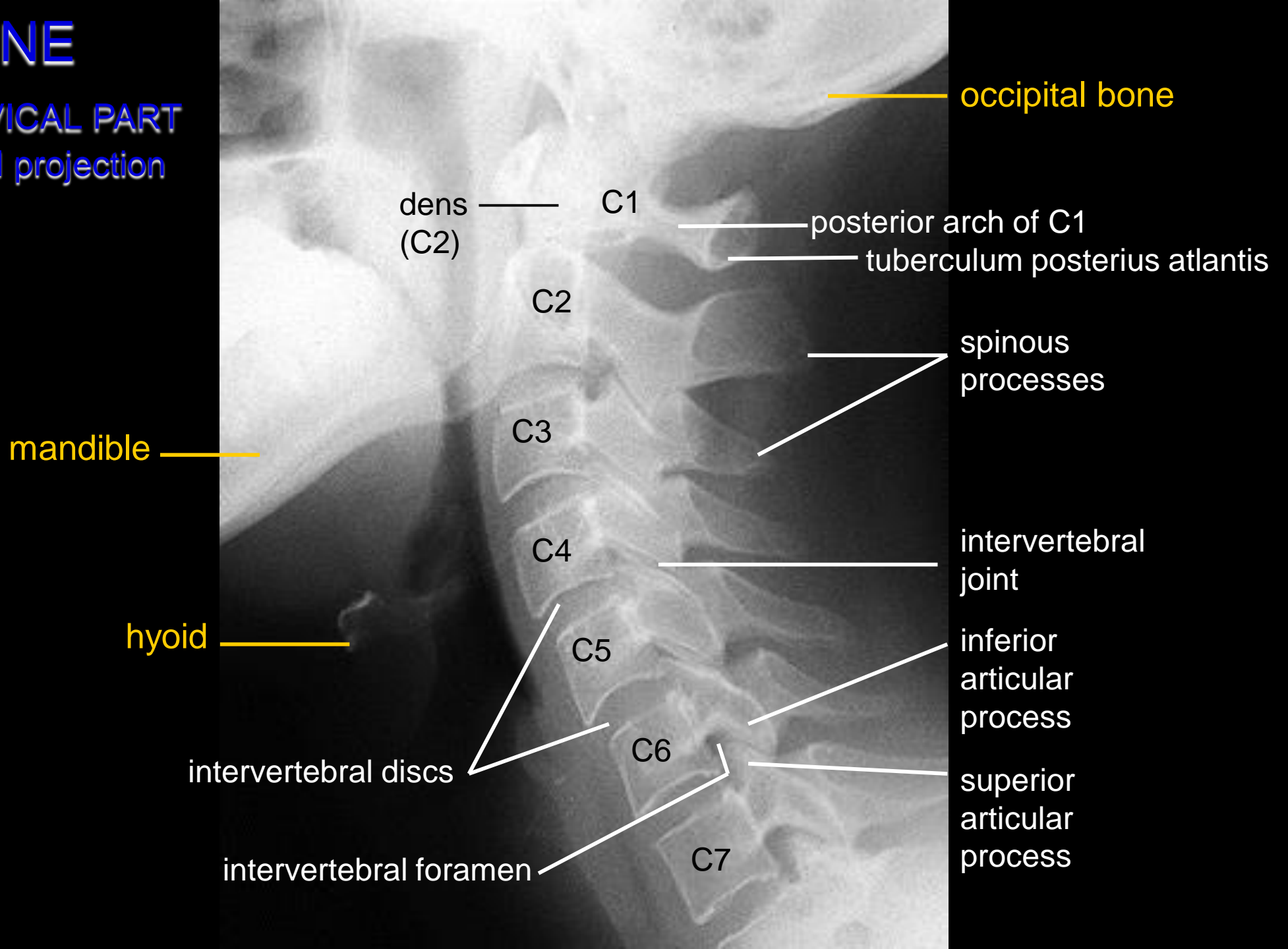
thoracic vertebra

clavicle

1st rib

SPINE

CERVICAL PART
lateral projection



occipital bone

dens (C2)

C1

posterior arch of C1

tuberculum posterius atlantis

C2

spinous processes

C3

mandible

intervertebral joint

C4

hyoid

inferior articular process

C5

intervertebral discs

superior articular process

C6

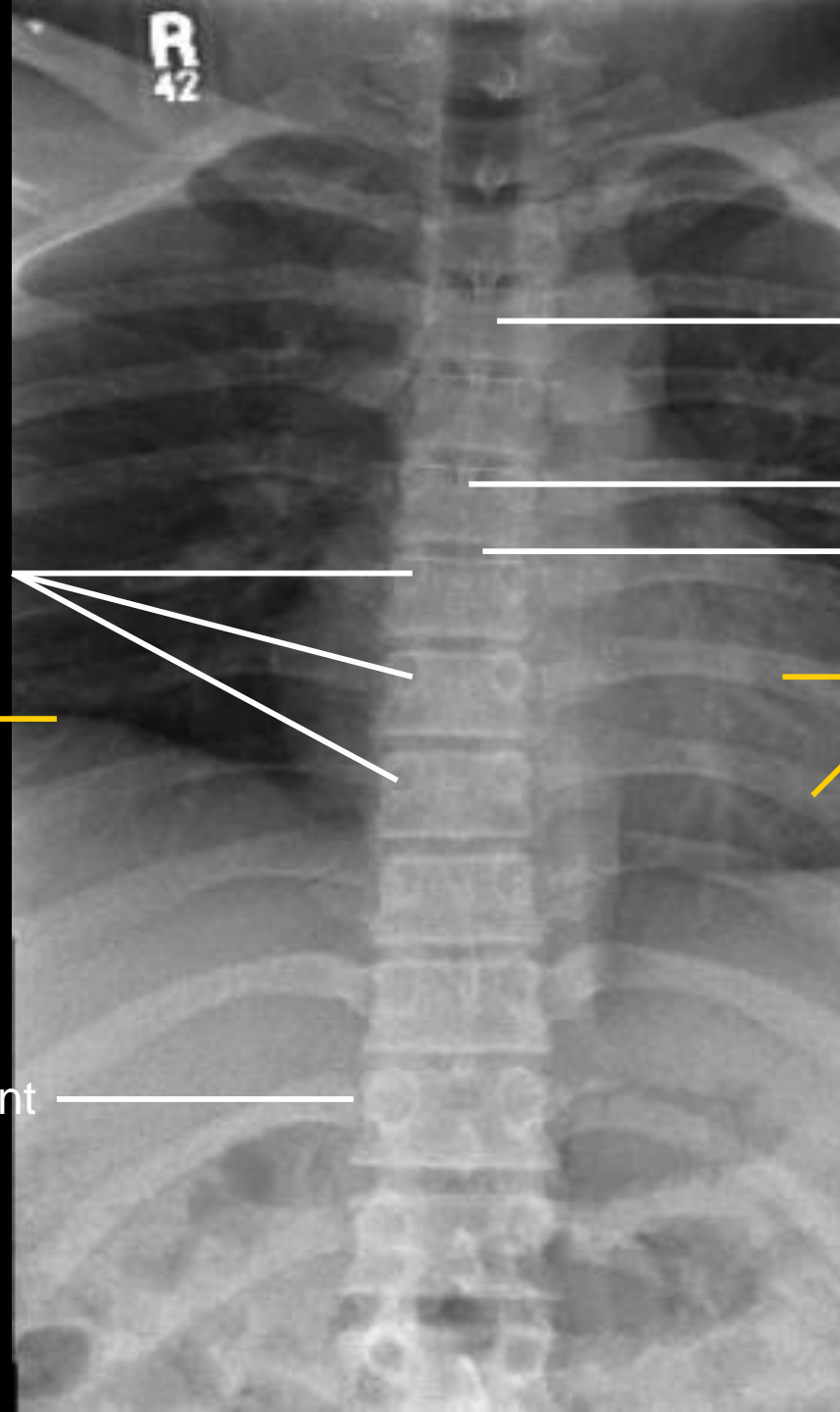
intervertebral foramen

C7

SPINE

THORACIC PART

AP projection



thoracic
vertebral body

spinous process

disc

pedicles

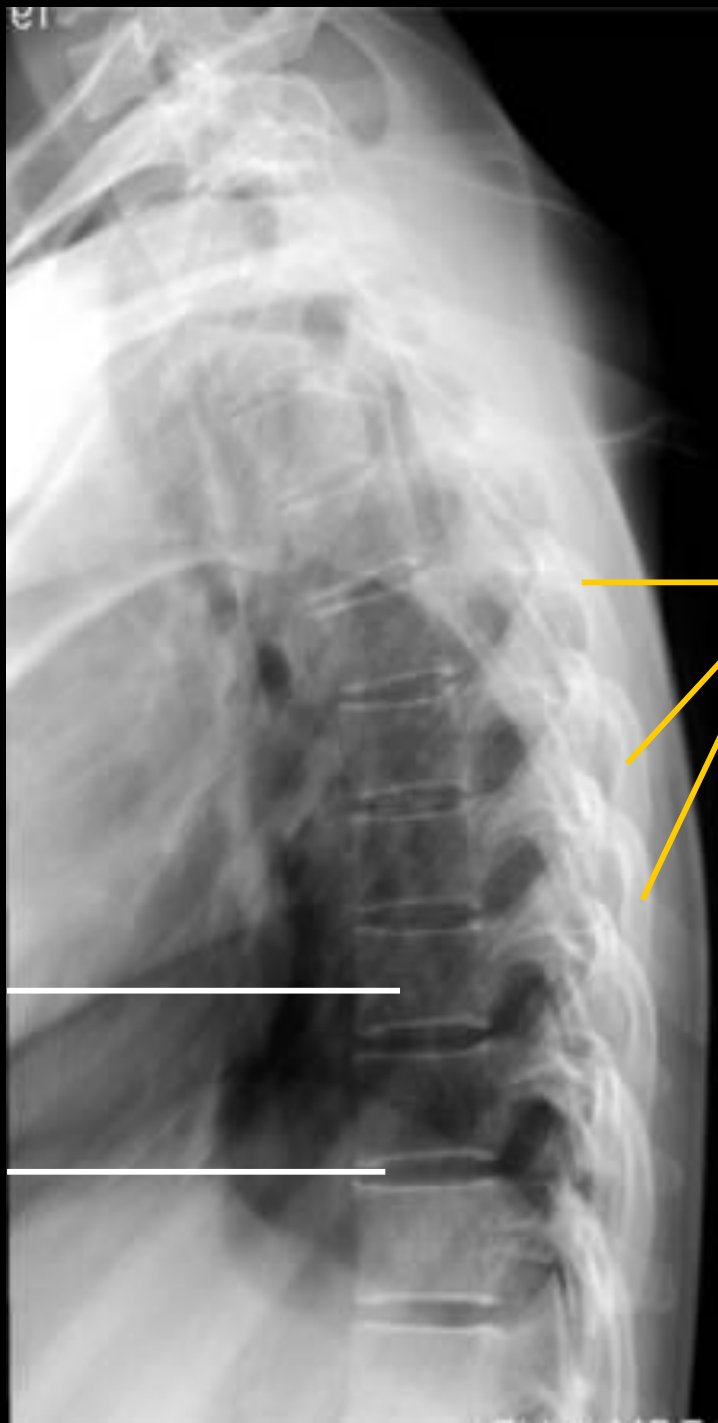
diaphragm

ribs

costovertebral joint

SPINE

THORACIC PART
lateral projection



ribs

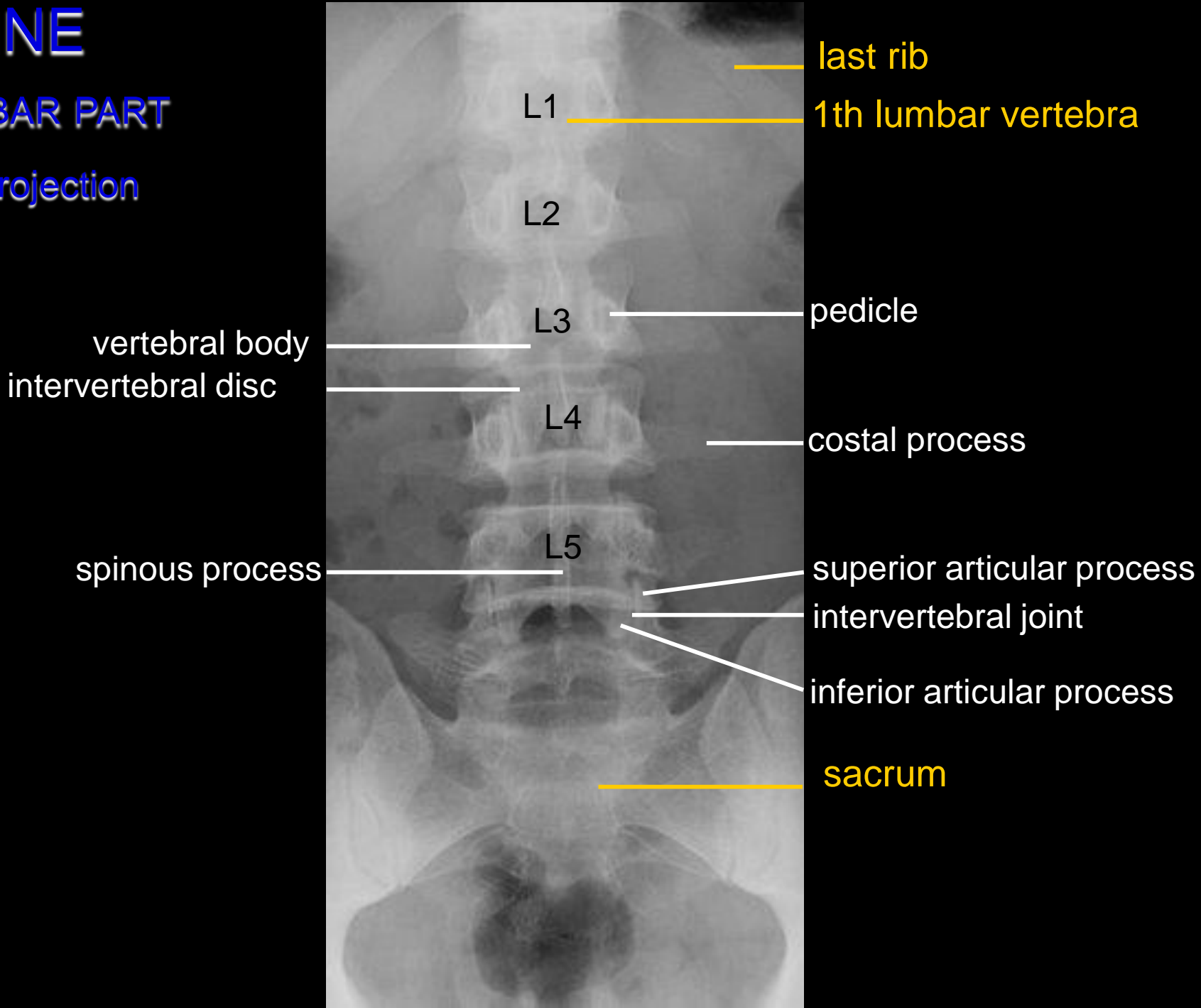
thoracic
vertebral body

intervertebral
disc

SPINE

LUMBAR PART

AP projection



last rib

L1 1st lumbar vertebra

L2

L3 pedicle

vertebral body
intervertebral disc

L4 costal process

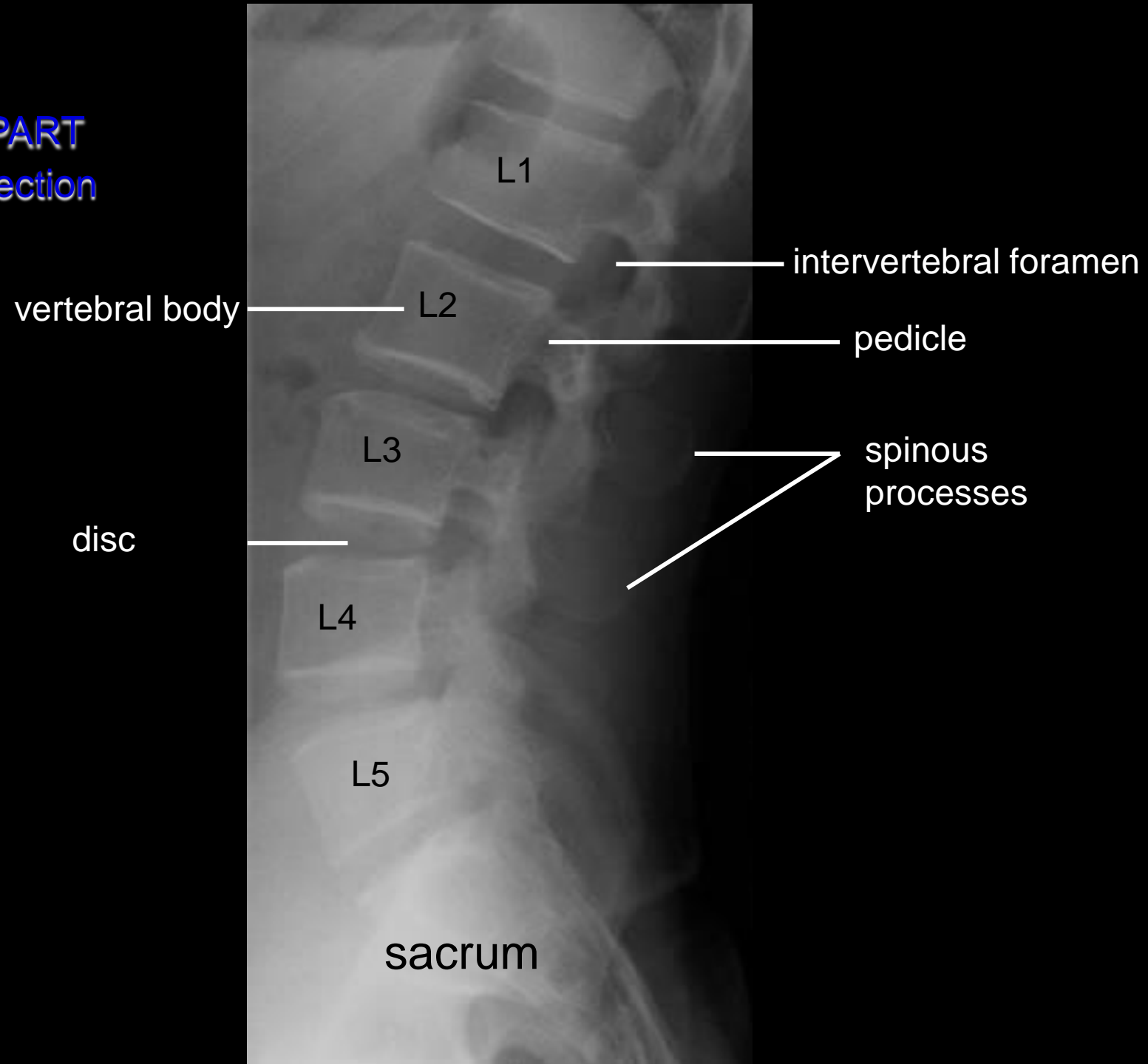
L5
spinous process
superior articular process
intervertebral joint
inferior articular process

sacrum

SPINE

LUMBAR PART

lateral projection



The pictures used in this lecture were taken from following sources:

- **Atlas der Anatomie des Menschen/Sobotta. Putz,R., und Pabst,R. 20. Auflage. München:Urban & Schwarzenberg, 1993**
- **Netter: Interactive Atlas of Human Anatomy.**
- **Naňka, Elišková: Přehled anatomie. Galén, Praha 2009.**
- **Čihák: Anatomie I, II, III.**
- **Drake et al: Gray´s Anatomy for Students. 2010**
- **Sinelnikov: Atlas of Human Anatomy Vol I Moscow 1963**