BASES OF ANATOMY

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Recommended literature

- **LECTURES**

- **Gray´s Basic Anatomy, Churchill Livingstone, 2013**

- **Instant Anatomy, Wiley-Blackwell, 2010**

- **Anatomy atlases: Netter, Sobotta, Pocket atlas etc.**

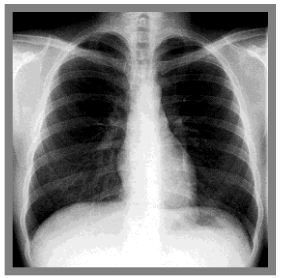
- **http://www.dartmouth.edu/~humananatomy/**

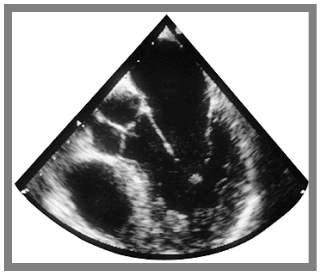
INTRODUCTION INTO ANATOMY

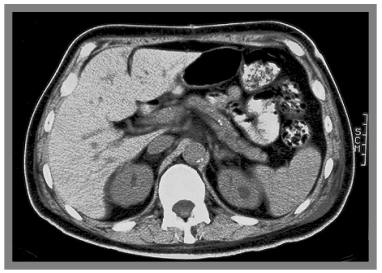
History, surface planes and directions on human body, tissues

Anatomy

- **Science of form, organisation, structure and posture of human body and its parts**
- **Macroscopic anatomy (systemic, general anatomy, special, topographical)**
- **Comparative anatomy, experimental anatomy, applied anatomy**
- **„Anatemnein“= to cut, dissection**



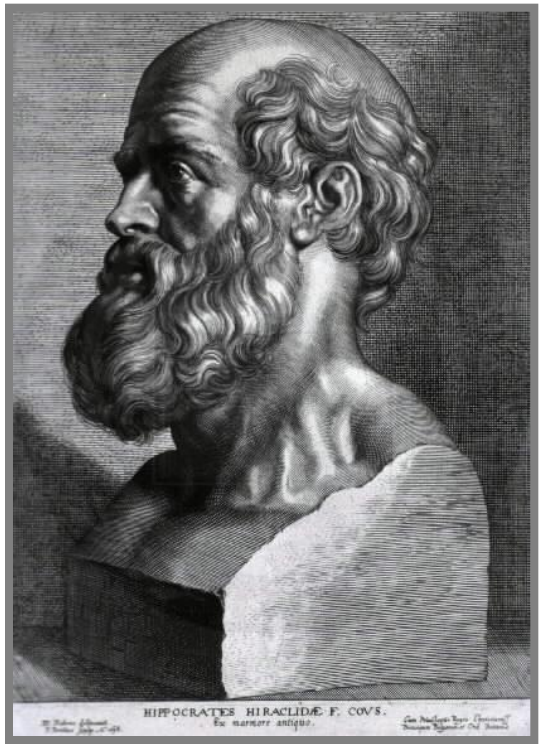




History

Egypt – mummification

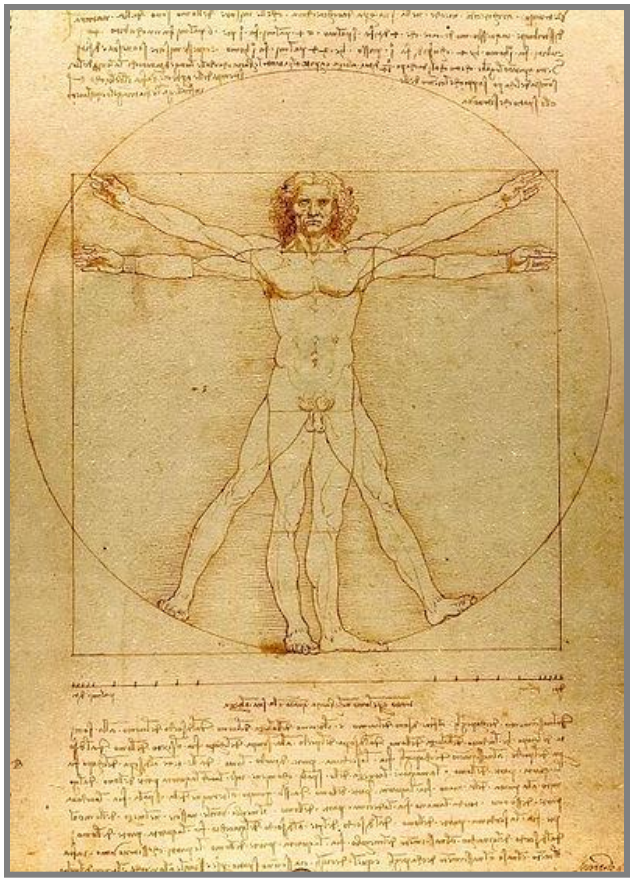
Greece – Hippocrates (460 B.C.) and his disciples – *„Corpus Hippocraticum“*
Aristoteles (384 B.C.) – tendons, nerves, joints
Hérofilos (335 B.C.) – dissection of human body (several terms, e.g. duodenum)
Galen of Pergamon (2nd century) – anatomy is a basic, dissection of animals

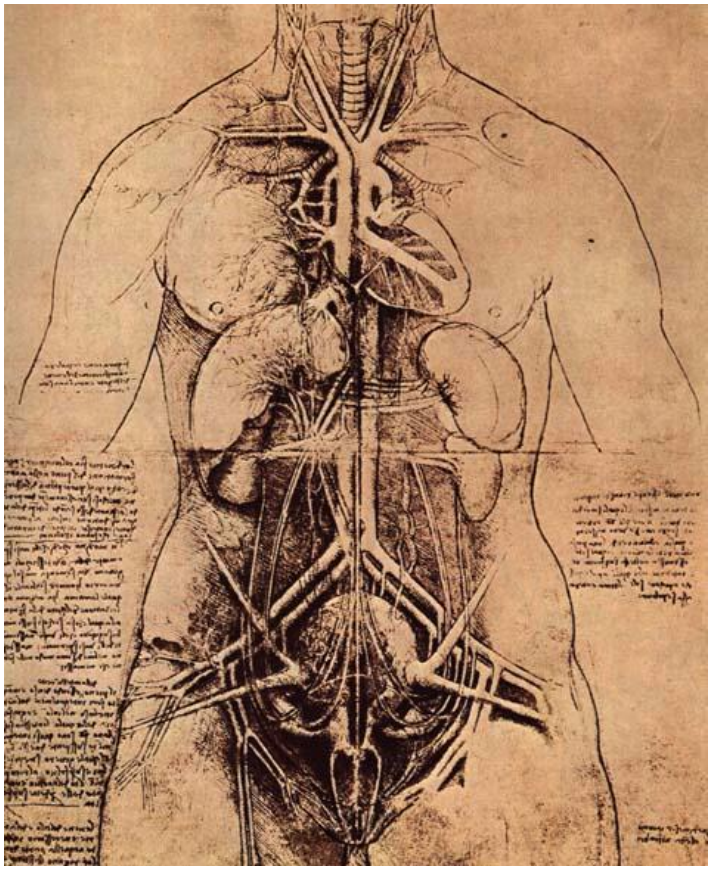


Middle Ages – stagnation, dissection is prohibited, Galen´s medicine

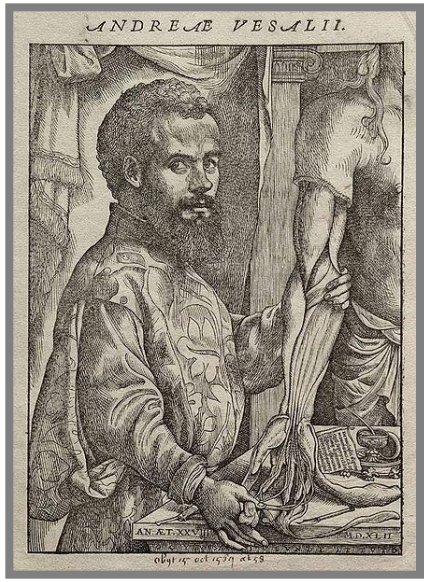
Rennaisance – letterpress, dissections in faculties of medicine

Leonardo da Vinci (1452) – dissection, locomotor system, cardiovascular system





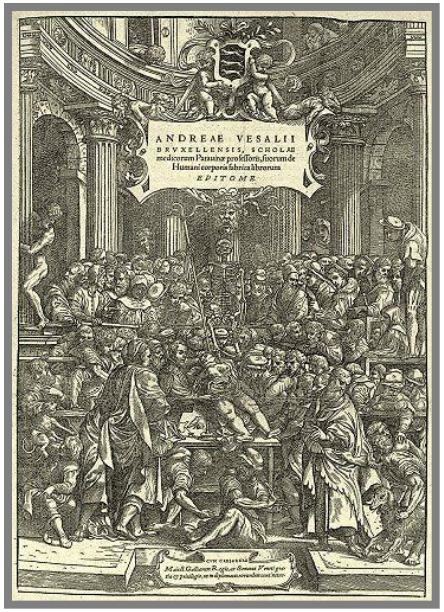
Andreas Vesalius (1514 – 1564)



„De humanis corporis fabrica libri septem“

- The first public dissection

„Tabulae anatomicae sex“



Ján Jesenský (1655 – 1621)

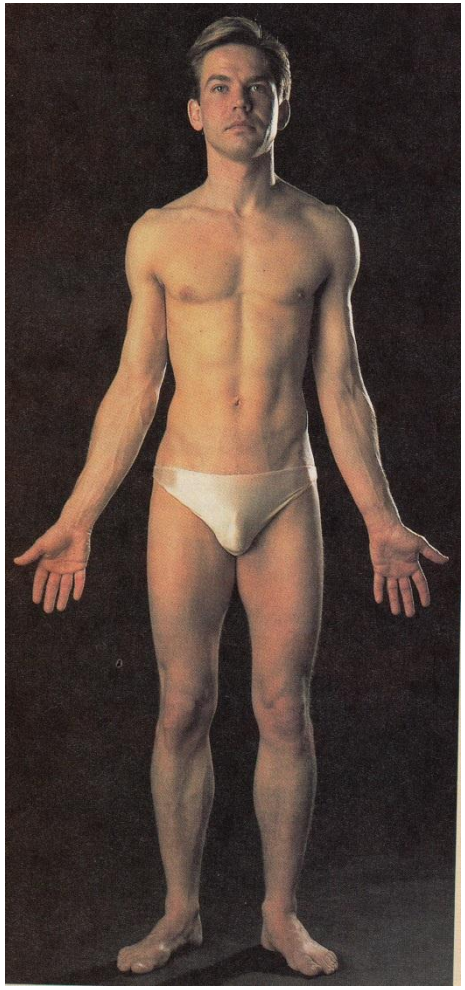
1600 the first public dissection in Prague

William Harvey (1578) – Blood circulation

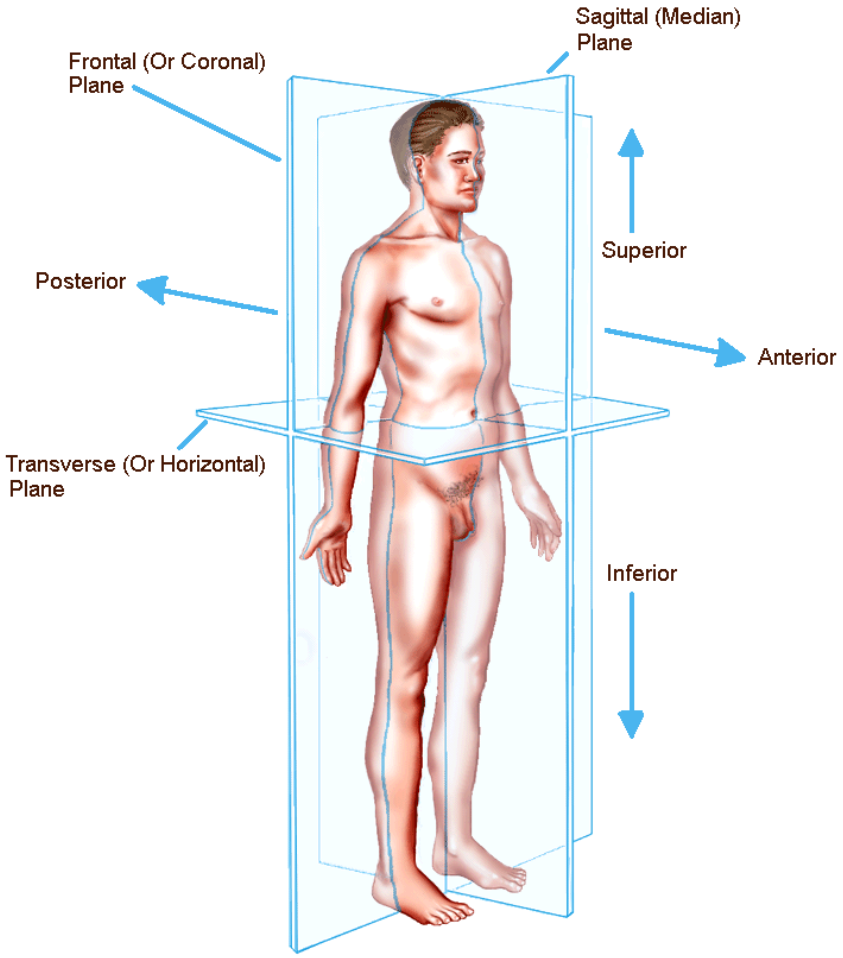
Jan Evangelista Purkyně (1787) – Purkyně´s fibres, cells

Anatomical orientation

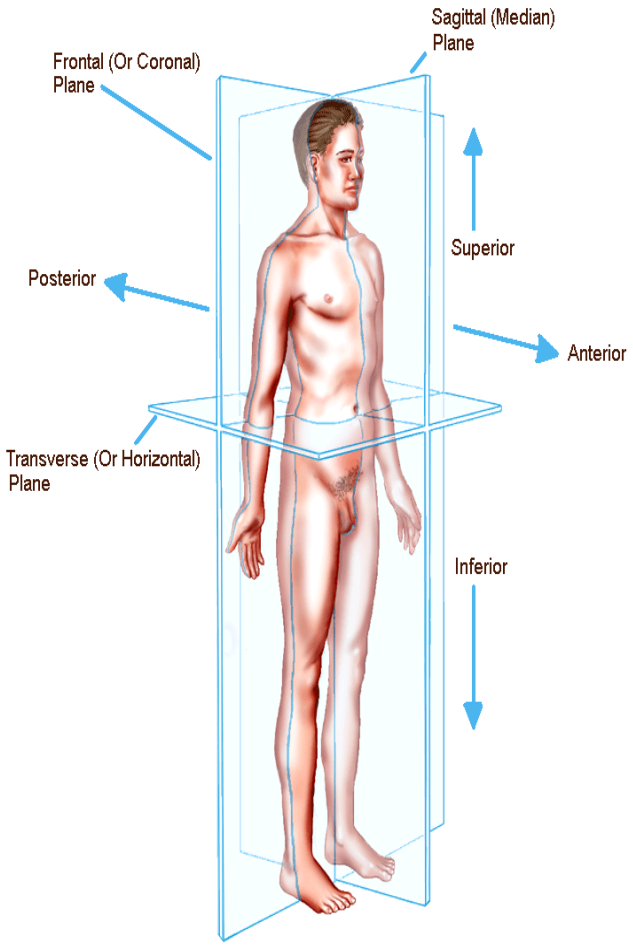
Anatomical position



Surface planes



Directions:



Longitudinal axis:

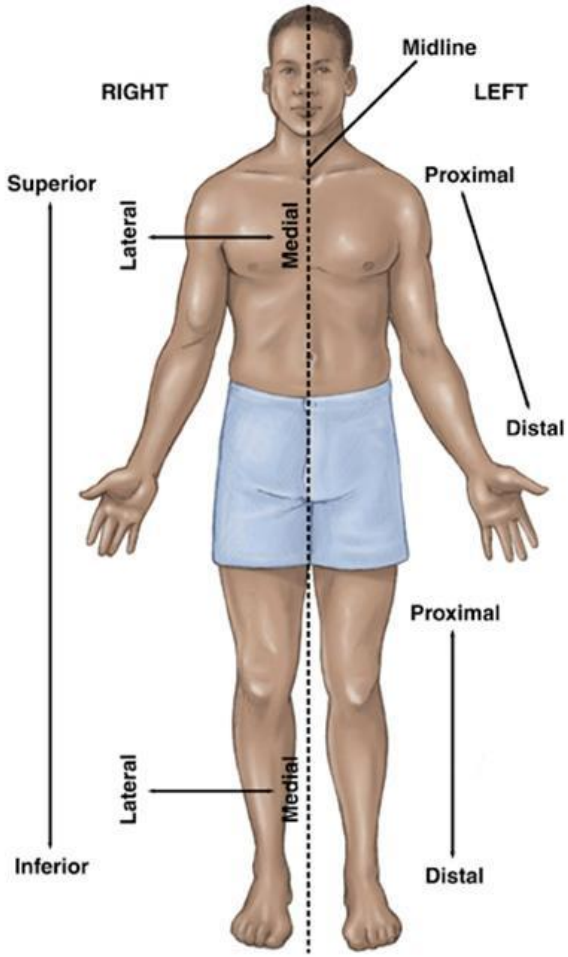
- *Cranial (superior)*
- *Caudal (inferior)*

Transverse axis:

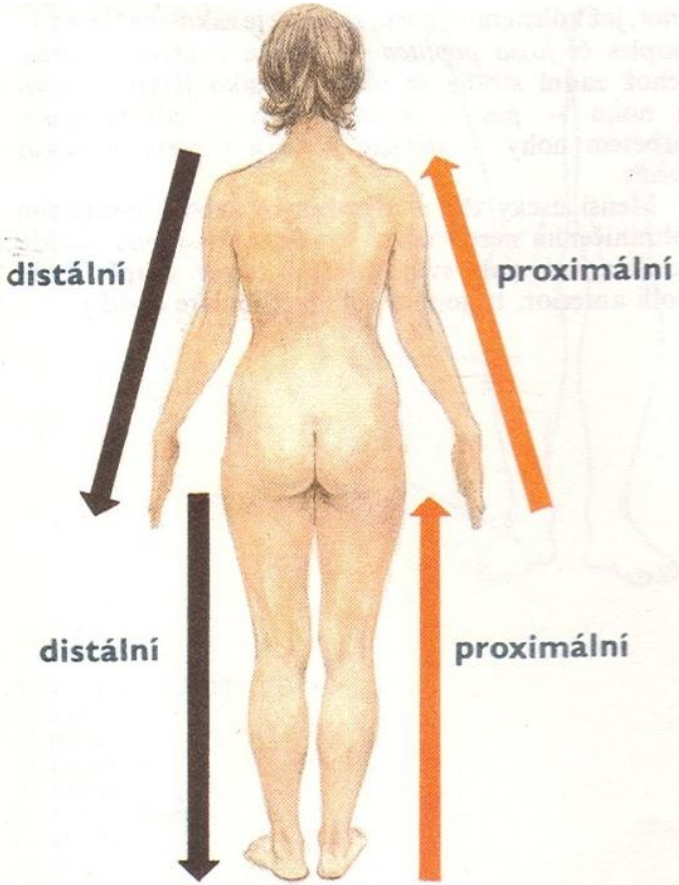
- *Medial*
- *Lateral*
- *Medius*
- *Medianus*
- *Dexter*
- *Sinister*

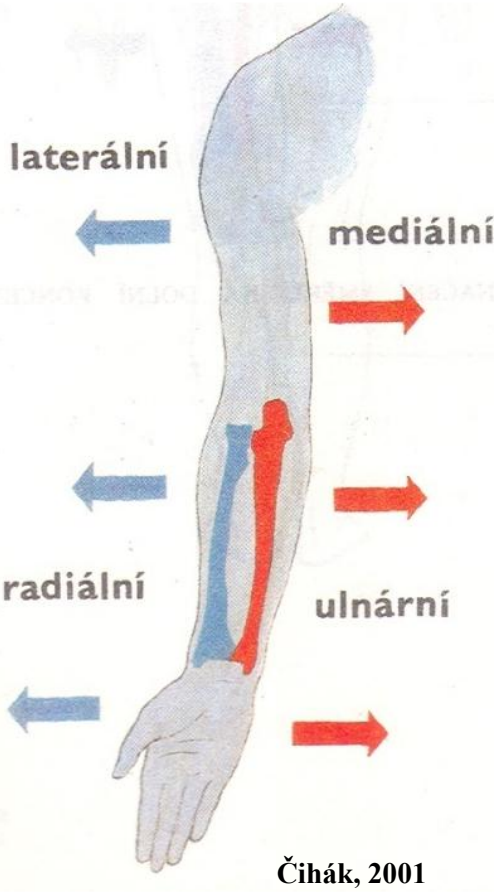
Sagittal axis:

- *Ventral (anterior)*
- *Dorsal (posterior)*
- *Internus (profundus)*
- *Externus (superficial)*

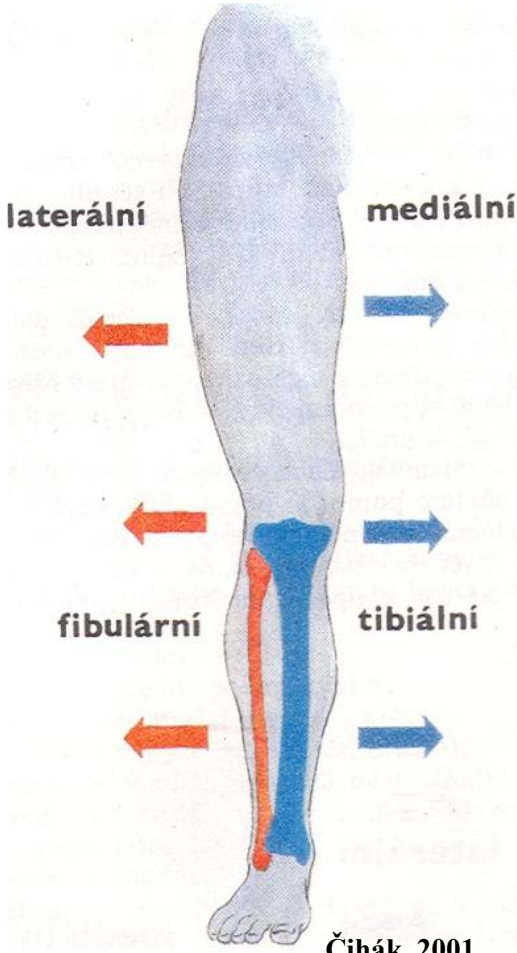


http://www.emsjunkie.com/anatomy-physiology/anatomical-position-directions-planes/





Čihák, 2001



Čihák, 2001

Extremities

Proximal

Distal

Upper limb:

Radial (lateral)

Ulnar (medial)

Palmar

Dorsal

Lower limb:

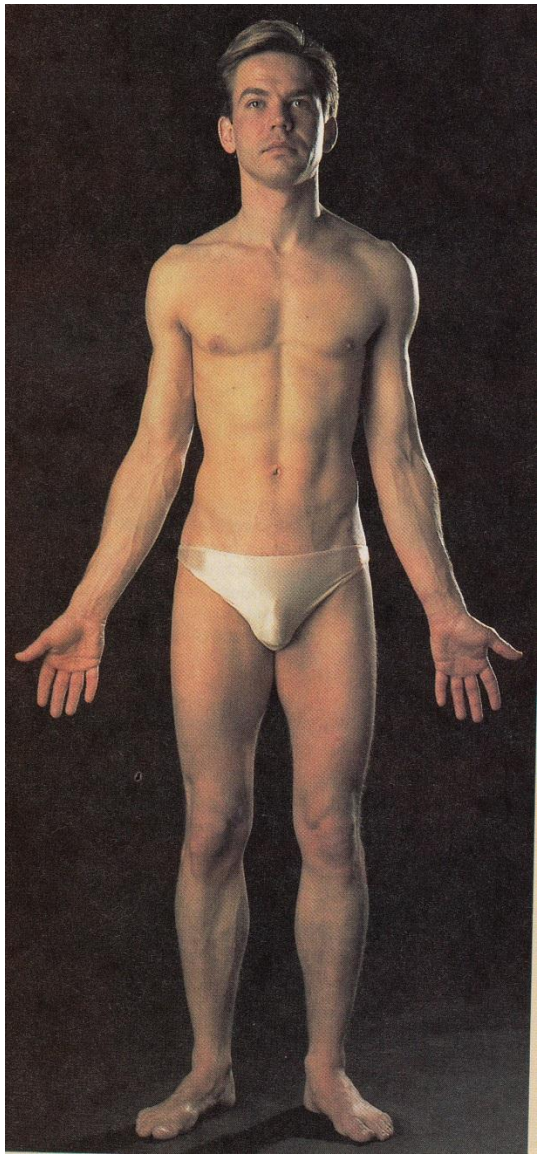
Tibial (medial)

Fibular (lateral)

Plantar

Dorsal

Parts of body



head – *caput*

neck – *collum (cervix)*

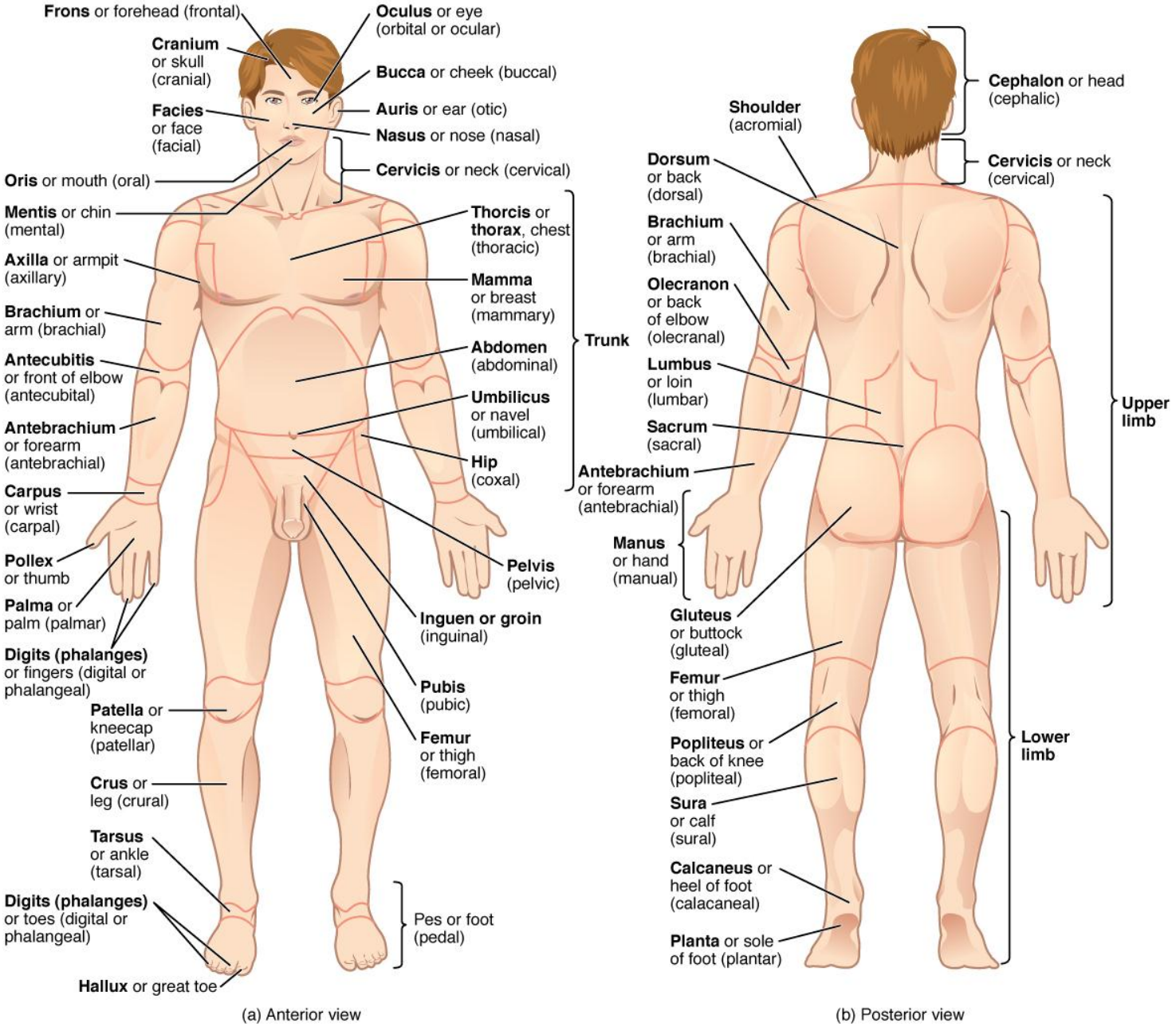
trunk – *truncus*
- ***thorax***
- ***abdomen***

back – *dorsum*

pelvis

Upper extremity – *membrum superius*
- **arm – *brachium***
- **forearm – *antebrachium***
- **hand – *manus***

Lower extremity – *membrum inferius*
- **thigh – *femur***
- ***crus***
- **Foot - *pes***



http://www.paradoja7.com/human-body-parts-back-side/human-body-parts-back-side/

Tissue

A part of an organism consisting of a large number of cells having a similar structure and function.

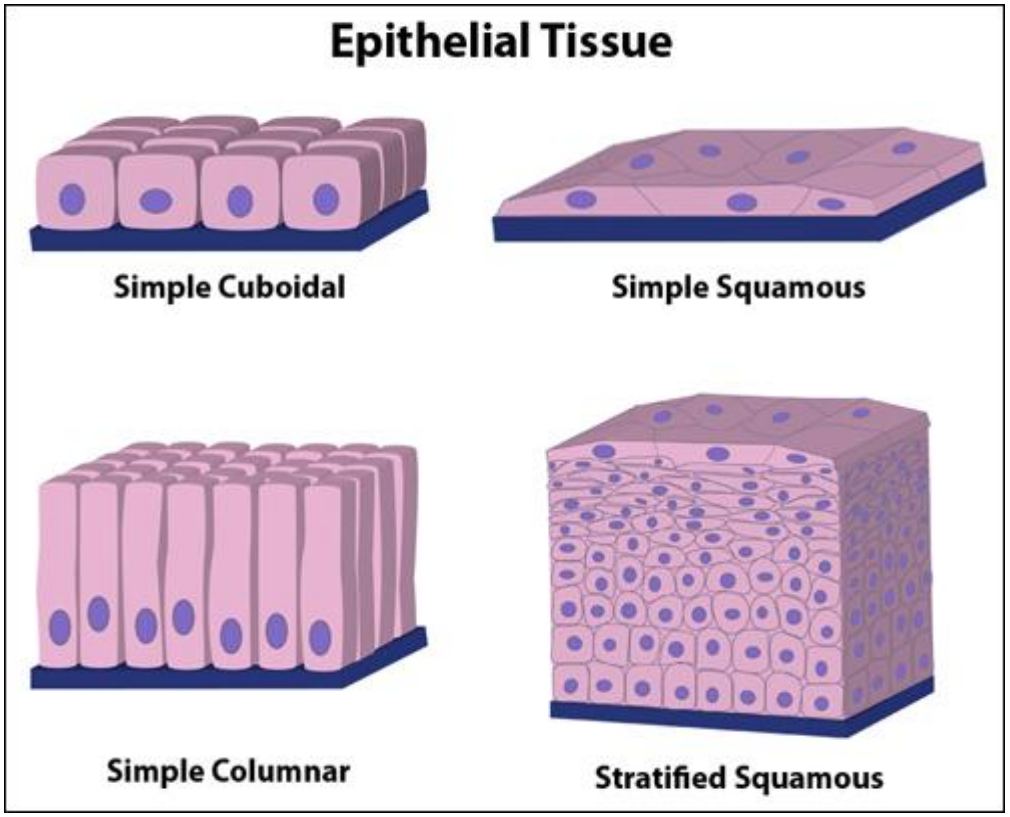
1. **Epithelial tissue**
2. **Connective tissue**
3. **Muscular tissue**
4. **Nervous tissue**

Epithelial tissue

Covers the body, lines the cavities of the body and composes the glands

Simple epithelium: single layer of cells

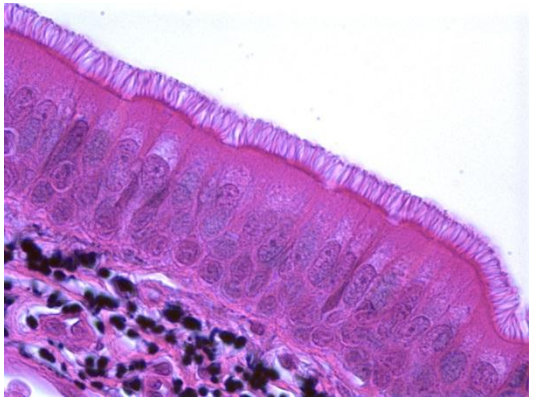
- **Simple squamous: thin squamous cells, lining of cavities (the mouth, blood vessels and lungs)**
- **Simple cuboidal: cuboidal cells, found in glands, duct and portions of the kidney tubules.**
- **Simple columnar: A single layer of tall, skinny cells (column shaped), found in places like the lining of the intestine and gallbladder**



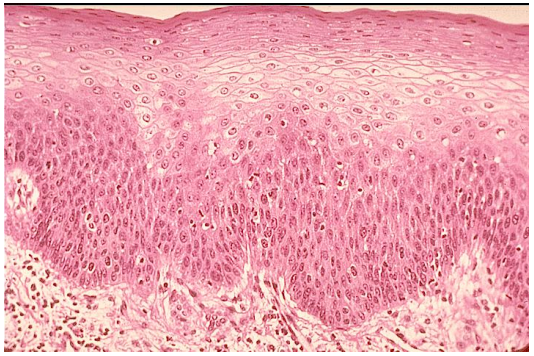
http://www.hartnell.edu/tutorials/biology/tissues.html

Stratified epithelium: the tissue is two or more cells thick

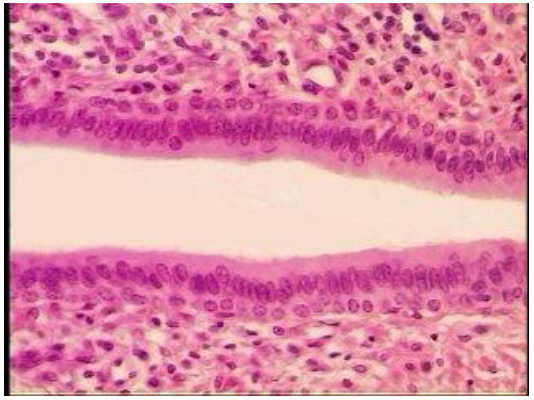
- **Pseudostratified columnar: appears to be composed of layers of cells, but is in fact composed of just a single layer of cells, as each cell touches the basement membrane, line the nasal cavity, bronchi and trachea.**



- **Stratified squamous: Many layers of cells are present, the topmost layer is made up of squamous cells, makes up the skin surface and lining of the mouth, through and esophagus.**

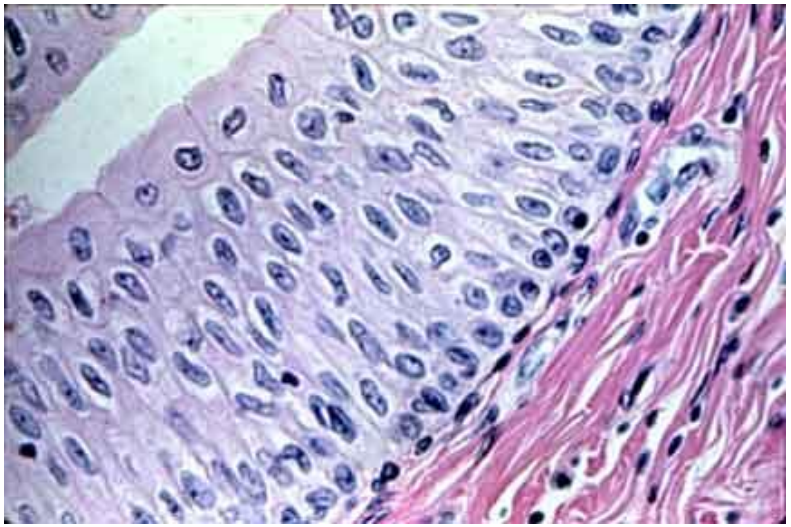


- **Stratified columnar: Many layers of cells, the topmost layer is made up of columnar cells, found in the mammary ducts and epididymis.**



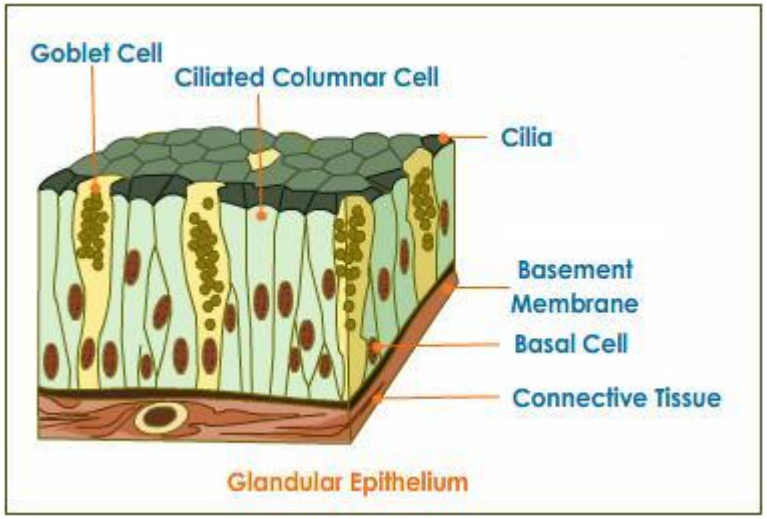
http://www.proprofs.com/flashcards/cardshowall.php?title=anatomy-histology-lab-1

- **Transitional: Multiple layers of cells, but surface cells change from rounded to flat to permit expansion when needed, found in the urinary bladder, renal pelvis and ureters.**



http://www.hartnell.edu/tutorials/biology/tissues.html

- **Glandular: Columnar and cuboidal cells often become specialized as gland cells which are capable of secreting substances such as enzymes, hormones, mucus, sweat and saliva; e.g. salivary, sweat and adrenal glands.**



http://www.tutorvista.com/content/science/science-i/tissues/epithelial-tissue.php

Connective tissue

Connects and supports the structures of the body, providing structural support and binding organs together.

Loose connective tissue – fibrocytes, skin

Dense connective tissue – regular (tendons), irregular (dermis)

Cartilage – chondrocytes, extracellular matrix, collagen and elastic fibres

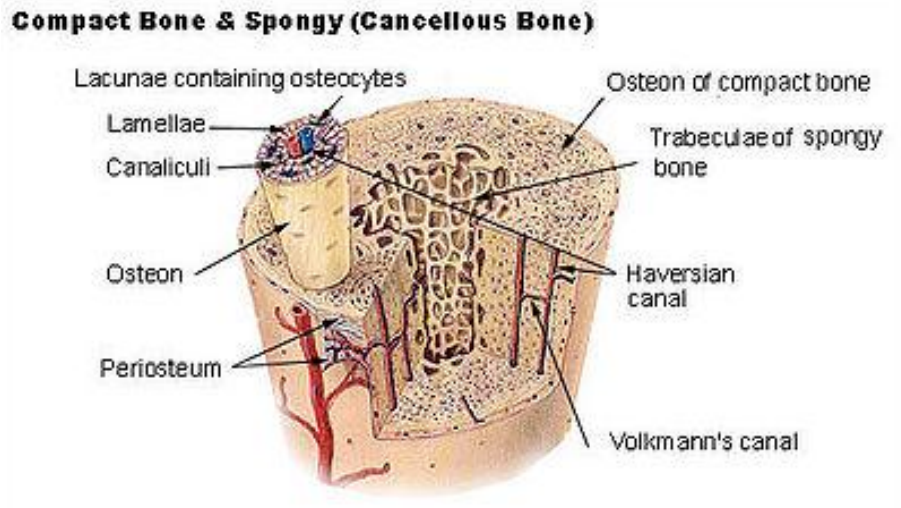
1. **hyaline cartilage – the most common type of cartilage, contains many collagen fibers; joints**
2. **elastic cartilage - many elastic fibers in the matrix; auricular cartilage**
3. **fibrocartilage - tough and contains many collagen fibers; intervertebral disc**

Bone

Bone

1. **Osteocytes**
2. **Bone matrix – organic substances (osein), 20-40%**
   anorganic substances (Ca, P, F…), 60-75%

Lamellar organization – Havers canals
Spongy bone – trajectories, arcitecture
Compact bone

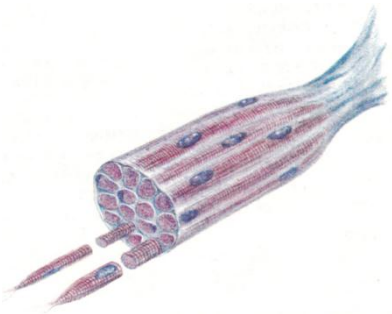


http://www.studyblue.com/notes/note/n/lab-ex-7-bone--cartilage/deck/10093140

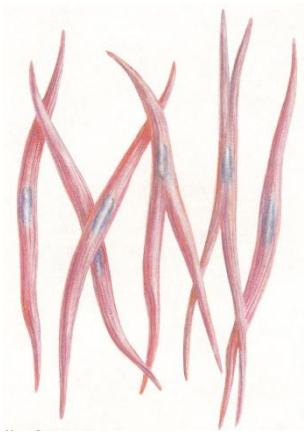
Muscle tissue

Muscle tissue is characterized by the ability to contract when stimulated.

1. **Skeletal muscle: long, multinucleate cells with visible striations, voluntary muscle**



2. **Smooth muscle: short, cylindrical cells, involuntary muscle; e.g. digestive tract, walls of blood vessels**

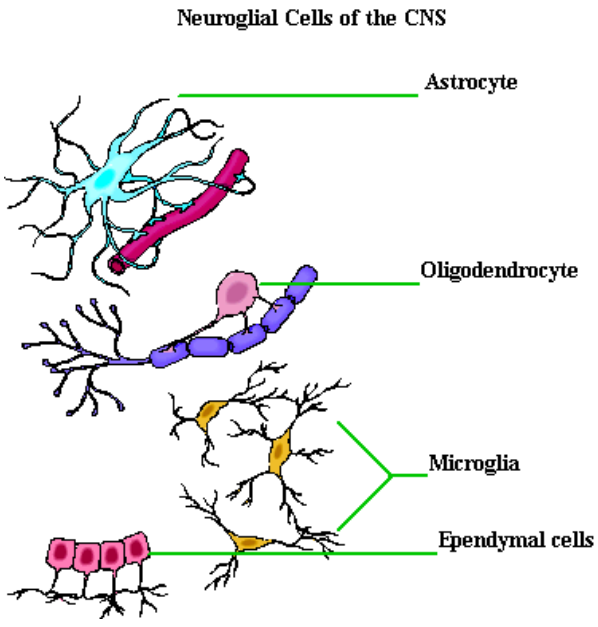


3. **Cardiac (heart) muscle: short, branched, striated cells, with one nucleus at the center of each cell, joined to their neighbors by intercalated discs, involuntary muscle**

Čihák, 2001

Nervous tissue

Highly specialized tissue, characterized by irritation, conduction and integration.

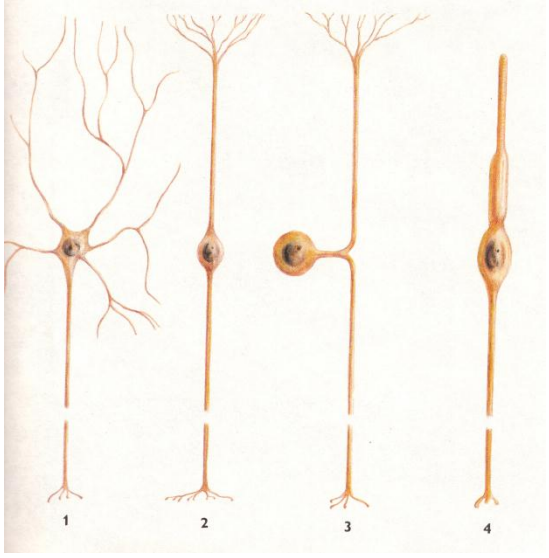


http://www.tutorvista.com/biology/types-of-neuroglial-ce

Neuroglia - do not send or receive electrical impulses, but support neurons (physical support, providing nutrients, removing debris and providing electrical insulation)

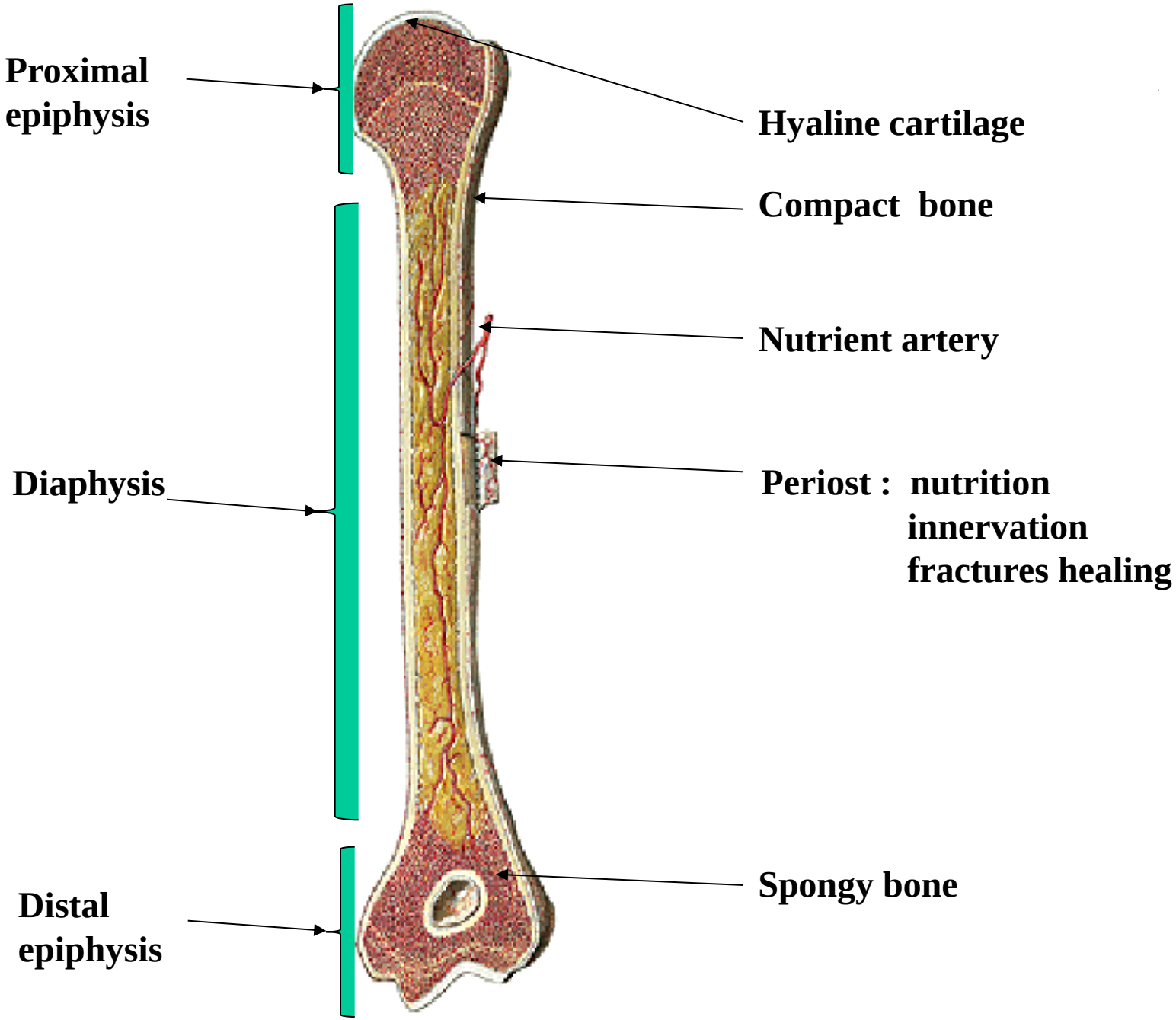
Neurons: carry electrical impulses.
Three main types of neurons:

1. **Sensory neurons - conduct impulses from the sensory organs (eyes, nose, ears, etc) to the central nervous system (brain and spinal cord).**
2. **Motor neurons - responsible for conducting impulses from the central nervous system to the effector organs (muscles and glands)**
3. **Interneurons are those neurons that connect sensory neurons to motor neurons.**

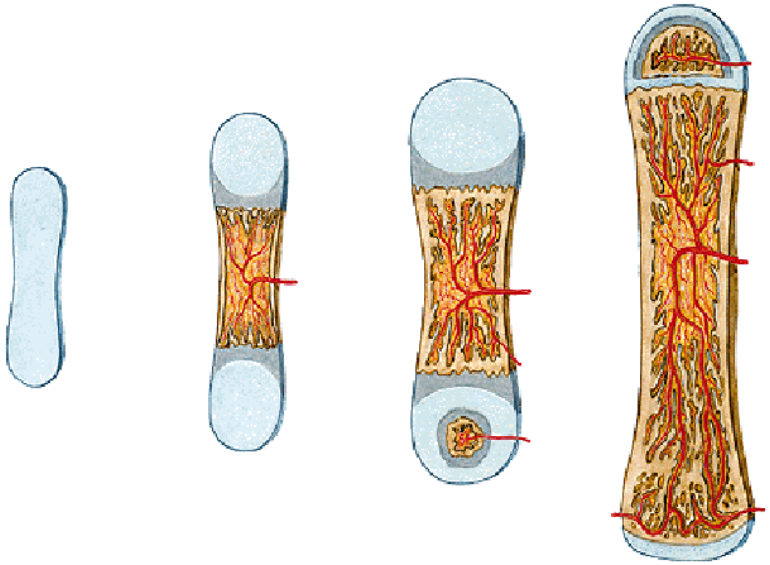


Čihák, 2001

OSTEOLOGY AND ARTHROLOGY


Proximal epiphysis
Hyaline cartilage
Compact bone
Nutrient artery
Diaphysis
Periost : nutrition
innervation
fractures healing
Spongy bone
Distal epiphysis

Ossification and bone growth



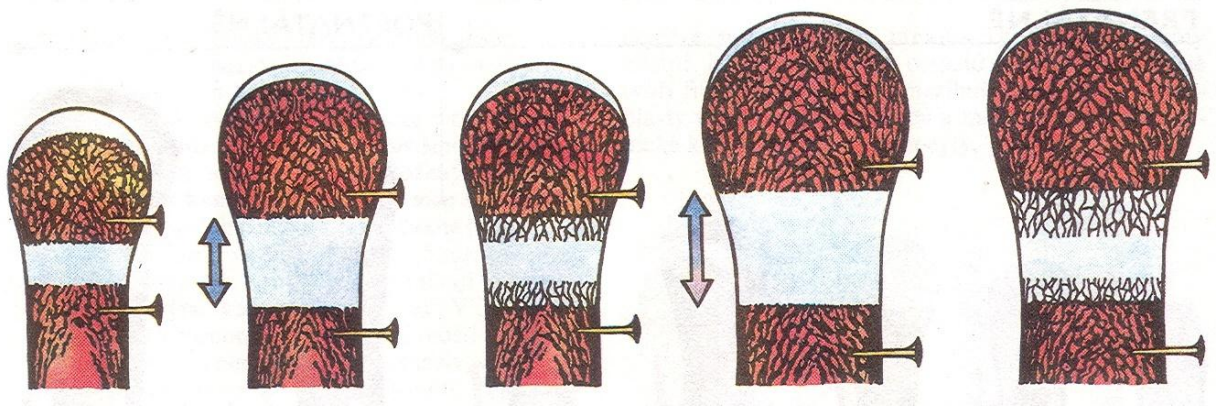
Chondral ossification – long bones

perichondral ossification

enchondral ossification

ossification centre

Desmogenous ossification – bone of skull



Čihák, 2001

Growth plate – longitudinal growth

Periosteum– width growth

STH – hypofýza – nanism – gigantism

thyroid gland, parathyroid gland, calcium, sexual hormons etc.

X-ray picture of 4 year old children

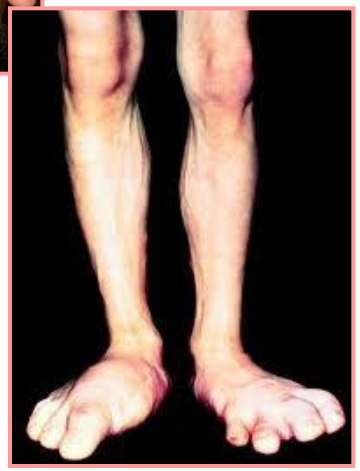
Ossification centres

Adenohypophysis dysfunction

(higher or lower hormon production or cell receptors miss)

STH

a) gigantism



b) Nanism

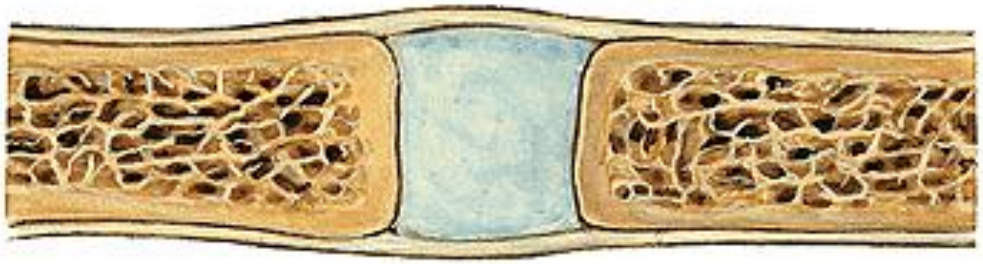
Bone connections

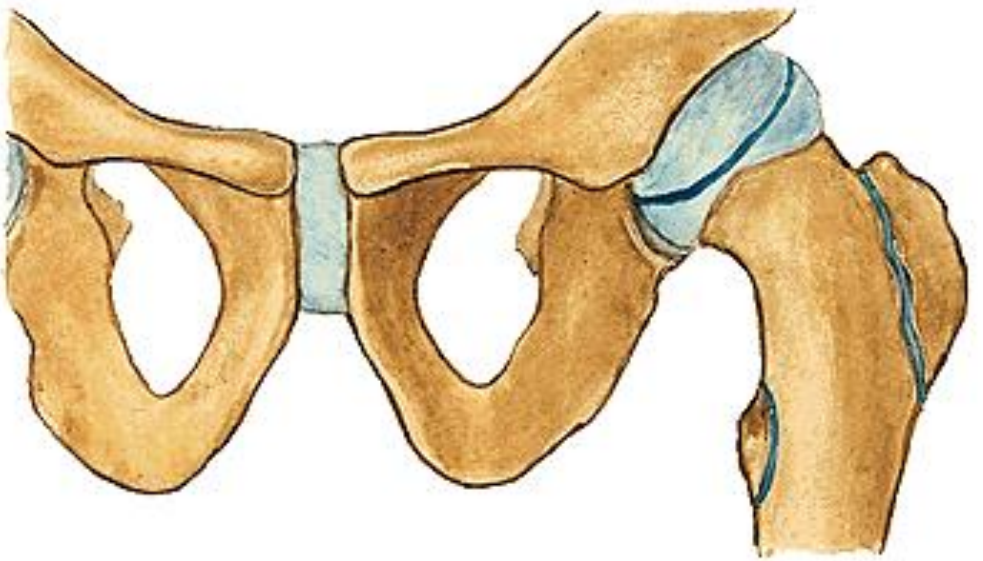
A) Synarthroses
(connective tissue, unmoveable)

1) Syndesmosis - suture

Čihák, 2001

2) Synchondrosis: cartilage, *symphysis pubica*





Sobotta, 2007

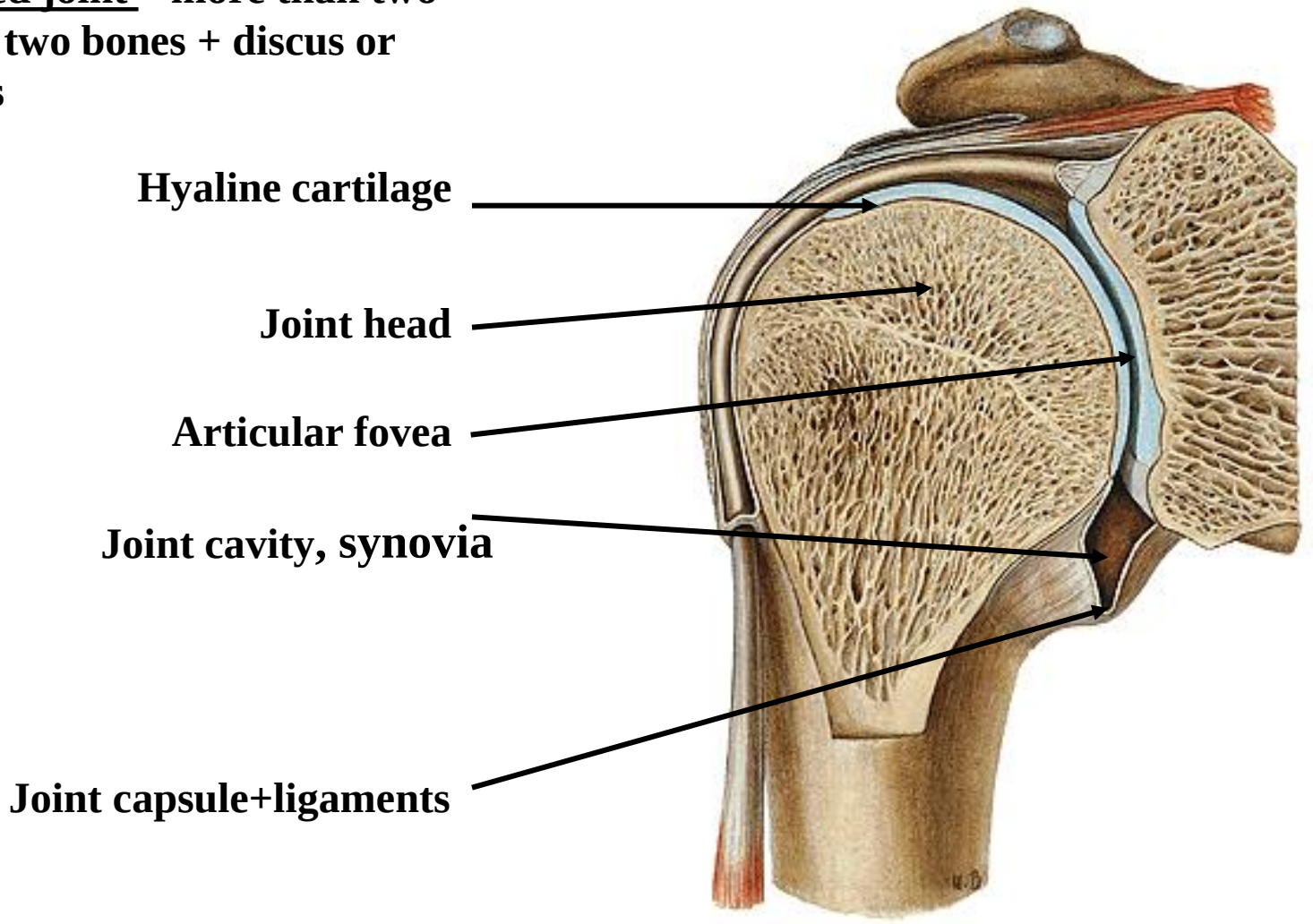
3) Synostosis – bone, e.g. sacral bone

Sobotta, 2007

B) Diarthroses

(joint connection with contact, moveable)

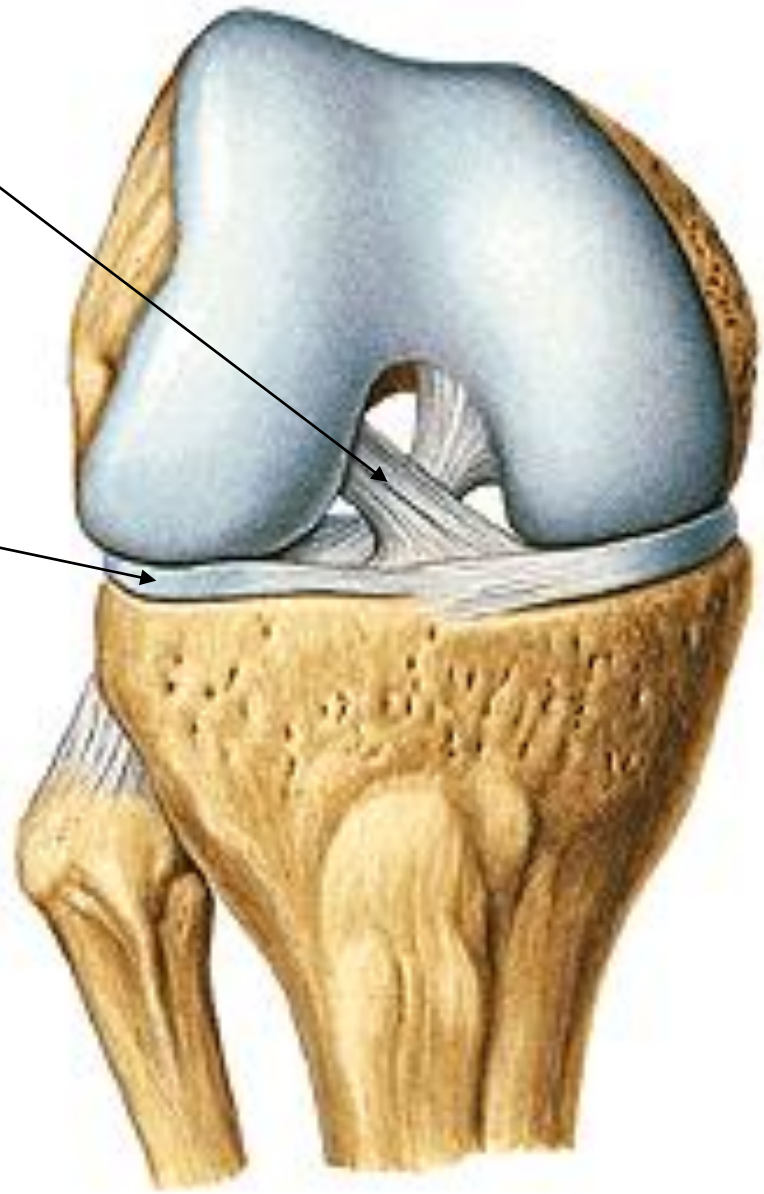
1. **<u>Simple joint</u> – two bones**
2. **<u>Composed joint</u> – more than two bones or two bones + discus or meniscus**



Sobotta, 2007

Cruciate ligaments

Meniscus lateralis



Sobotta, 2007

Meniscus med.

Tendo m. quadricip.

Meniscus lat.

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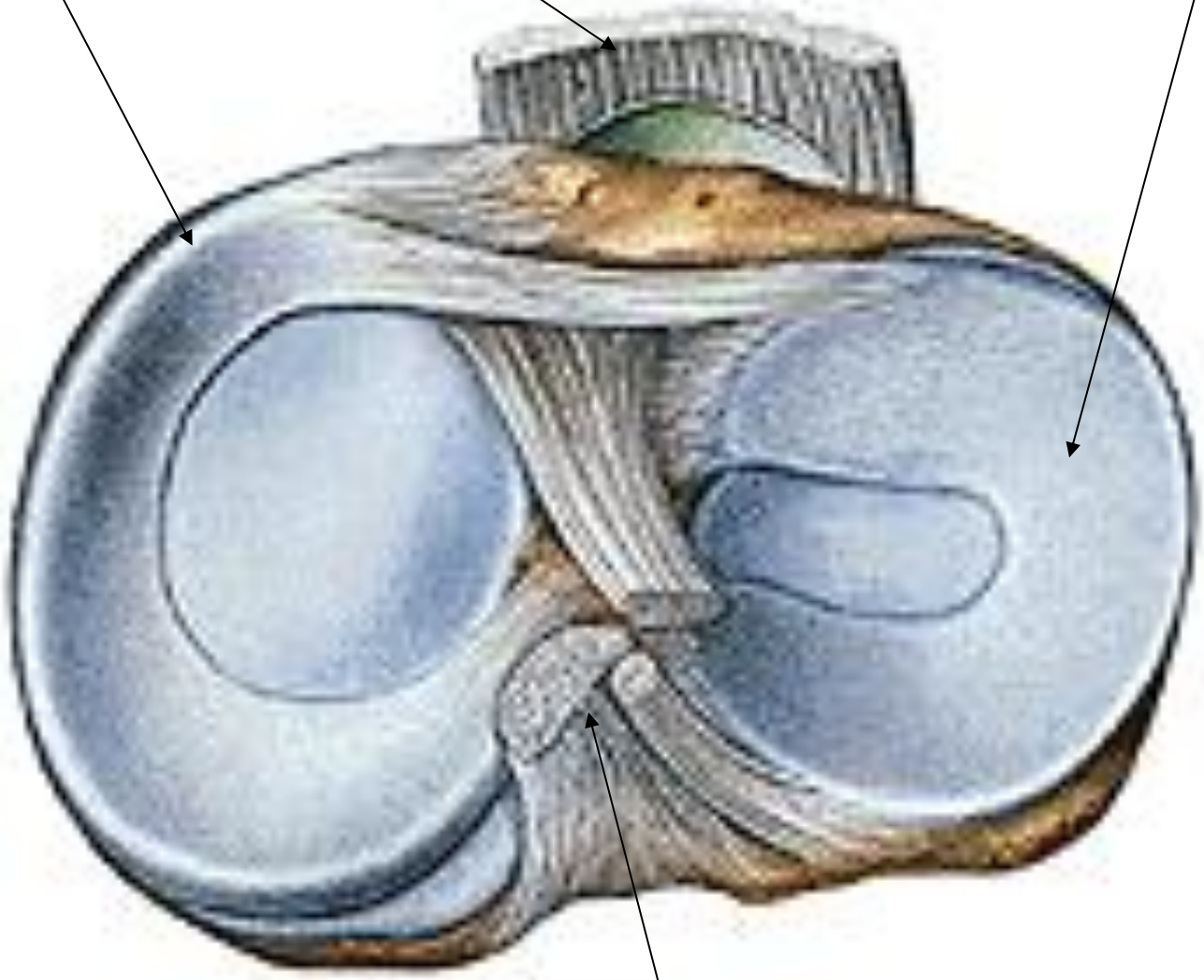


Sobotta, 2007

Lig. cruciata, cruciformia

AXIAL SKELETON

Columna vertebralis (vertebral column)

Costae (ribs)

Sternum

33-34 originally, 24 free

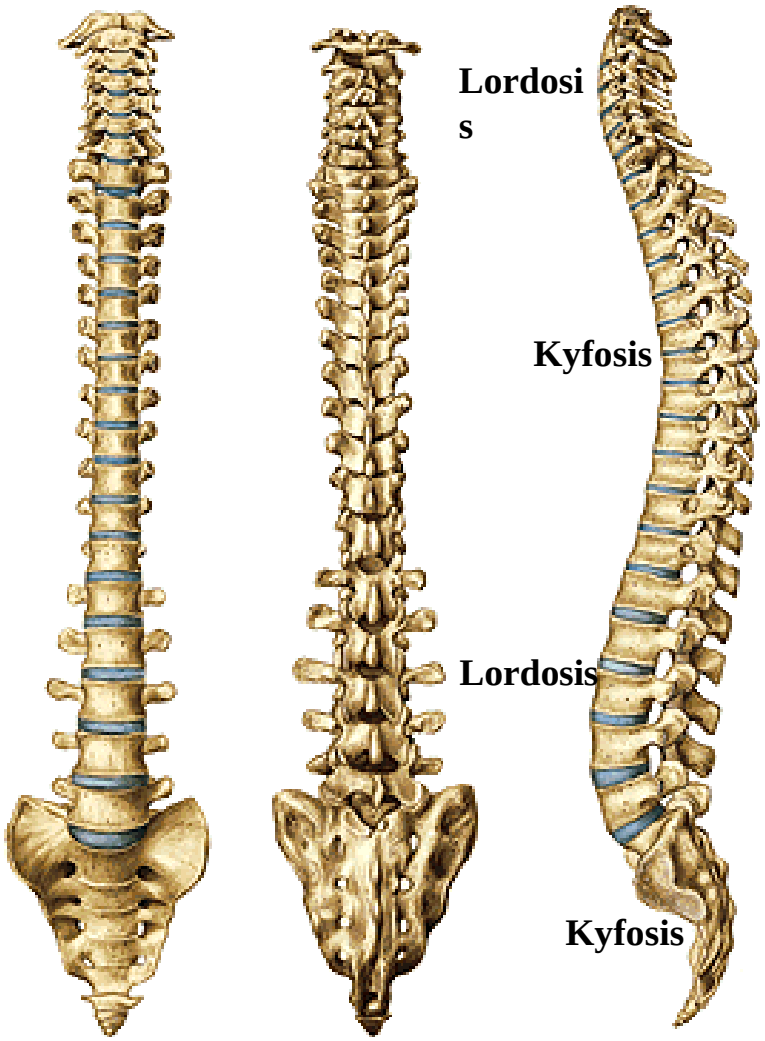
7 vertebrae **cervicales**

12 vertebrae **thoracicae**

5 vertebrae **lumbales**

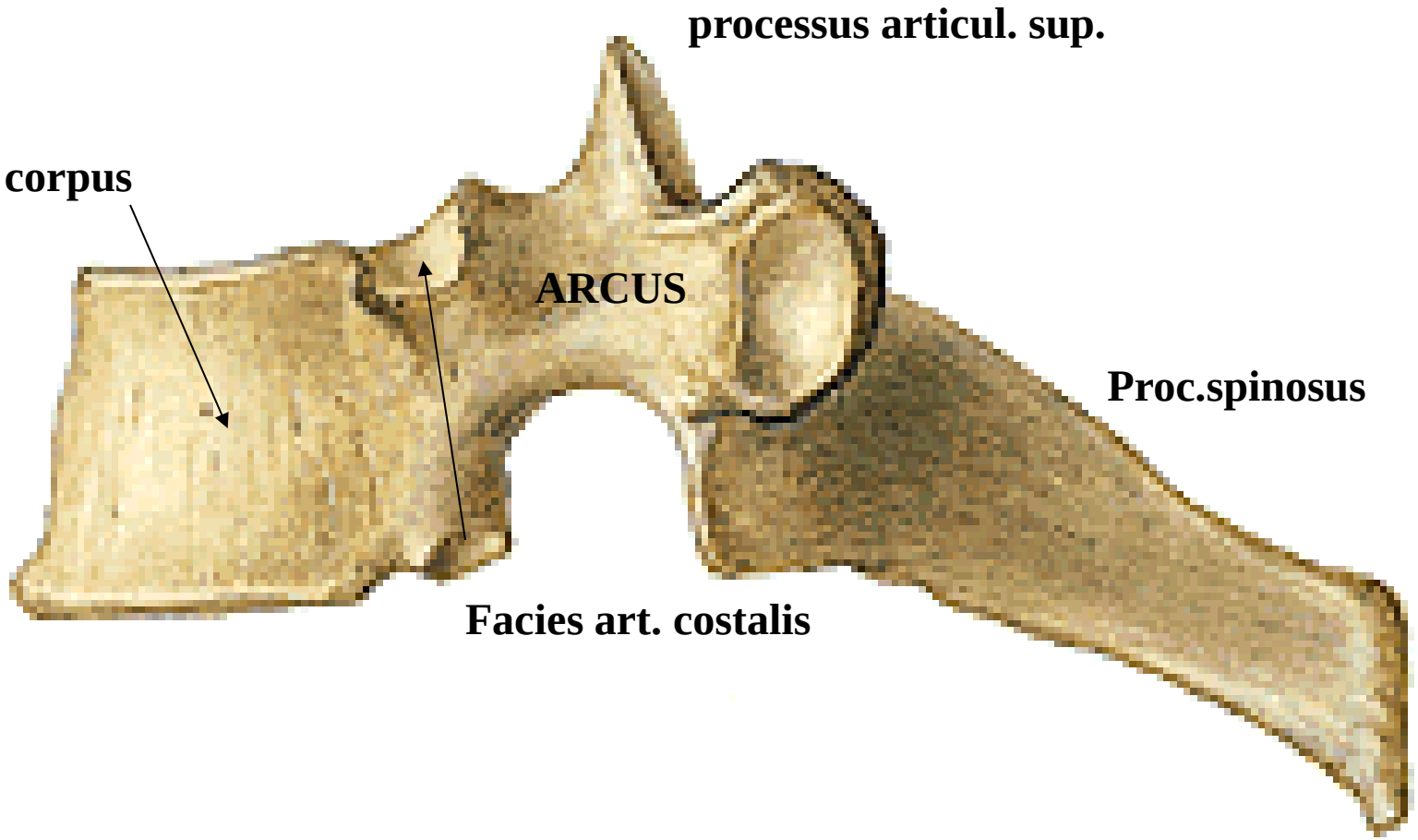
5 vertebrae sacrales – **os sacrum**

4–5 vertebrae coccygeae – **os coccygis**



Sobotta, 2007

VERTEBRA



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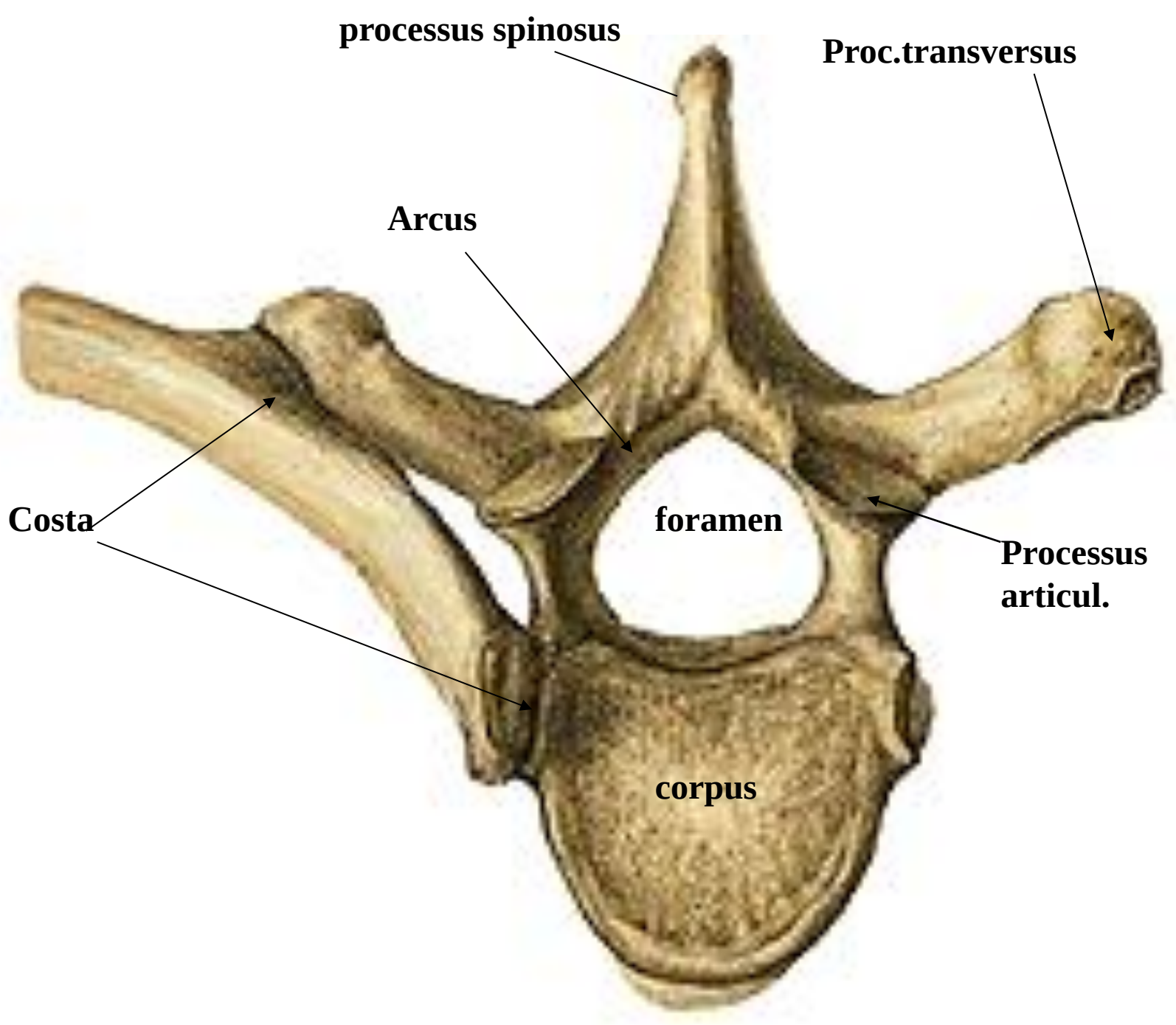
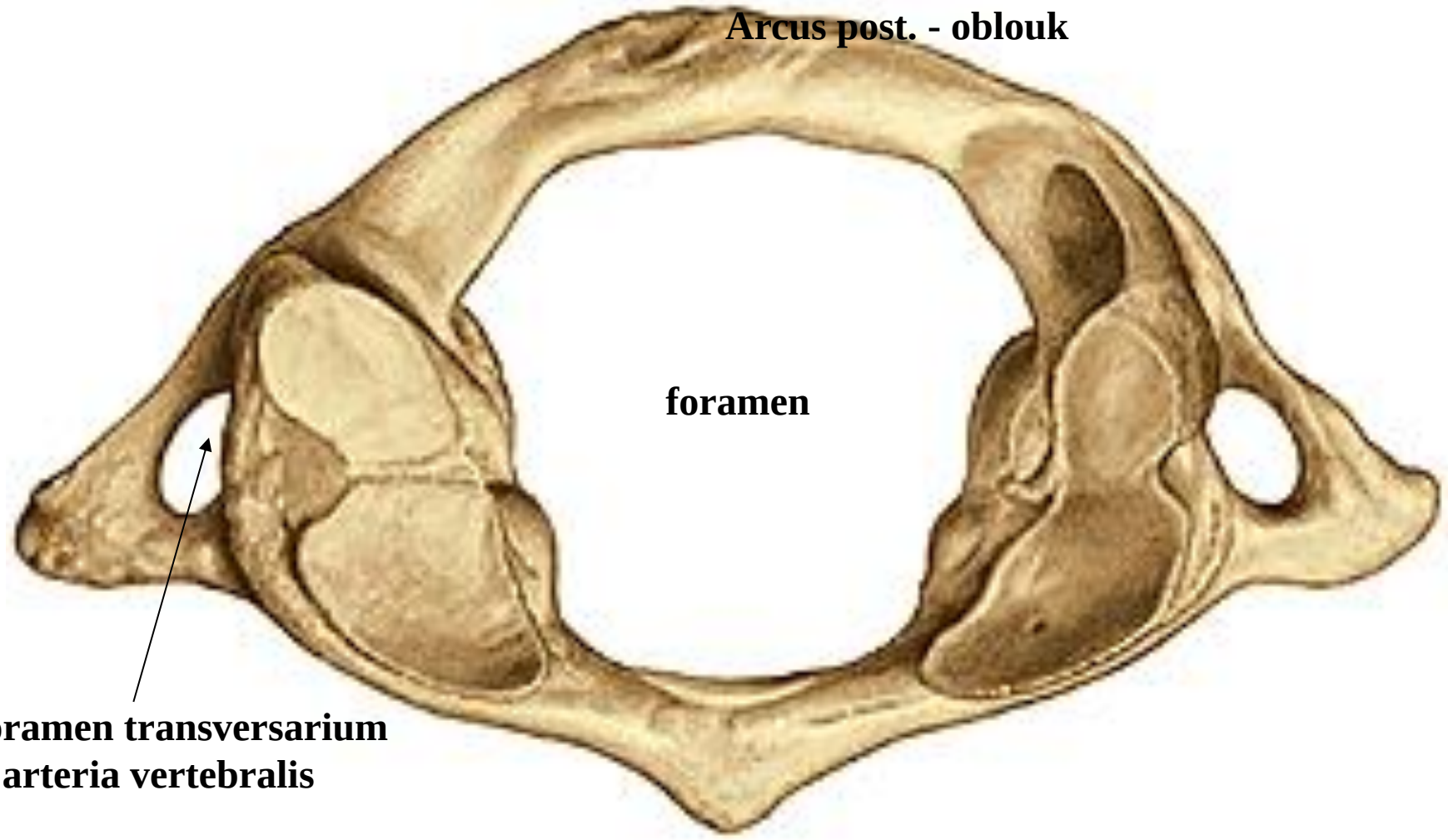


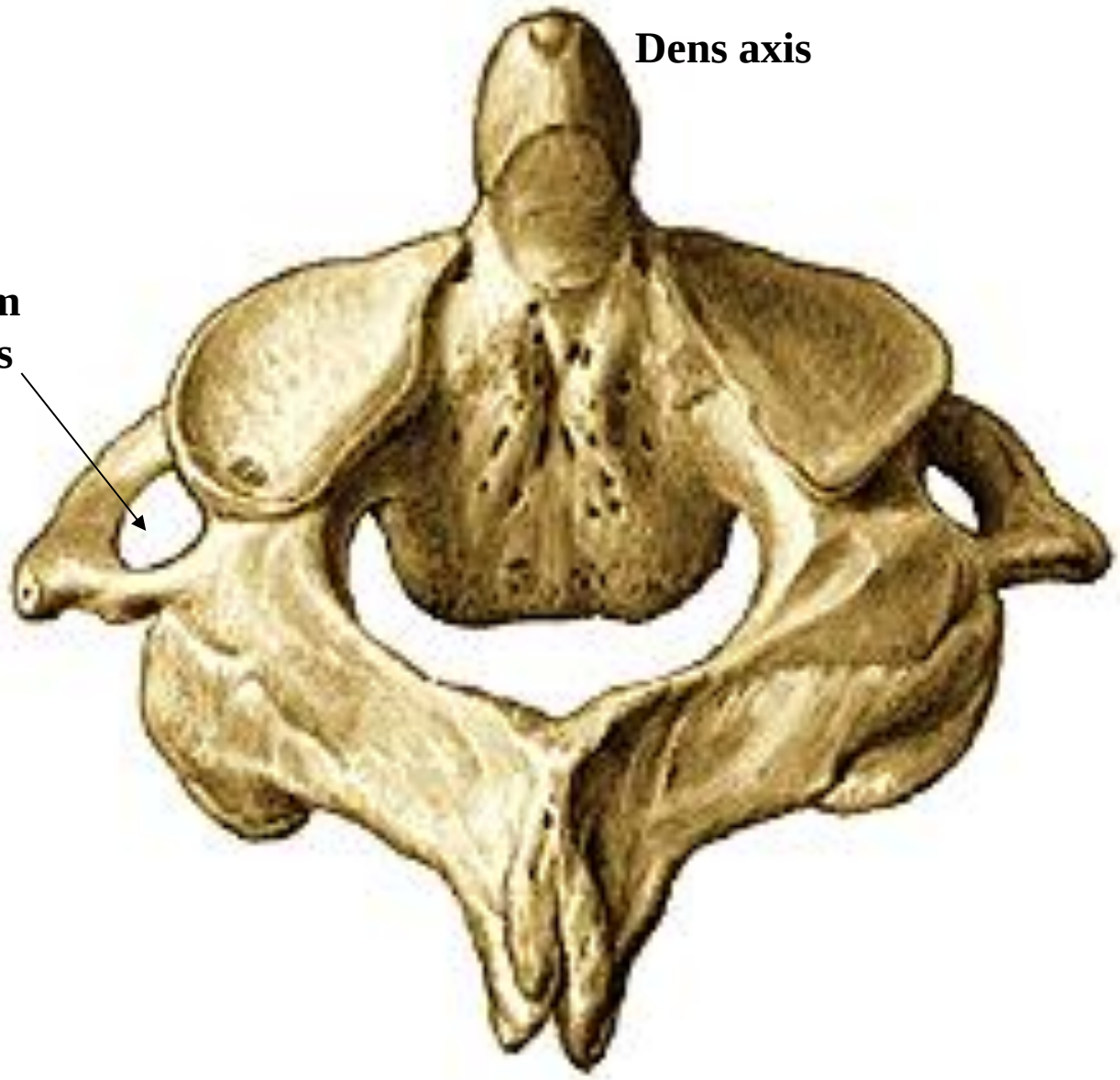
Sobotta, 2007

ATLAS – C1

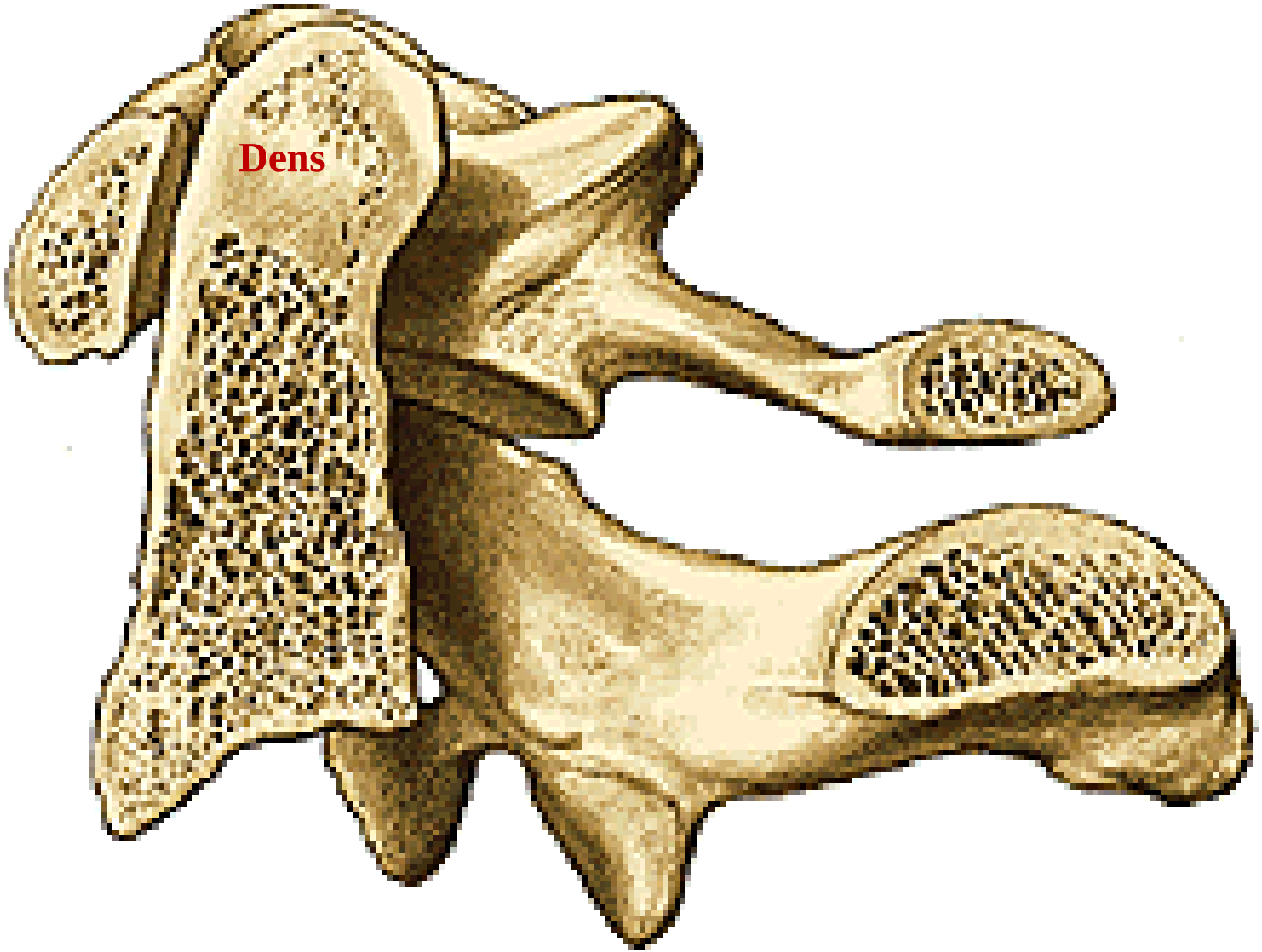


Sobotta, 2007

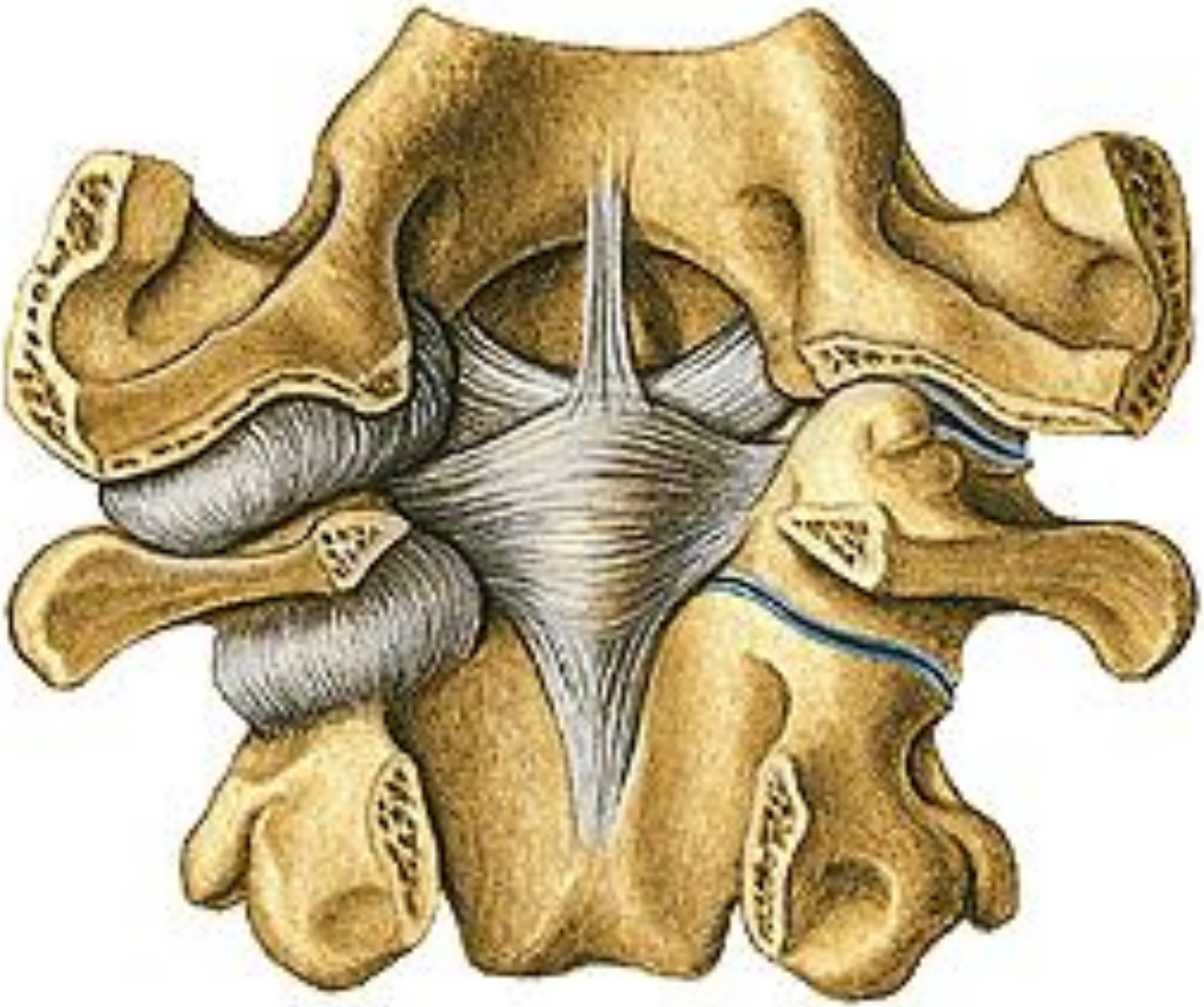
AXIS – C2



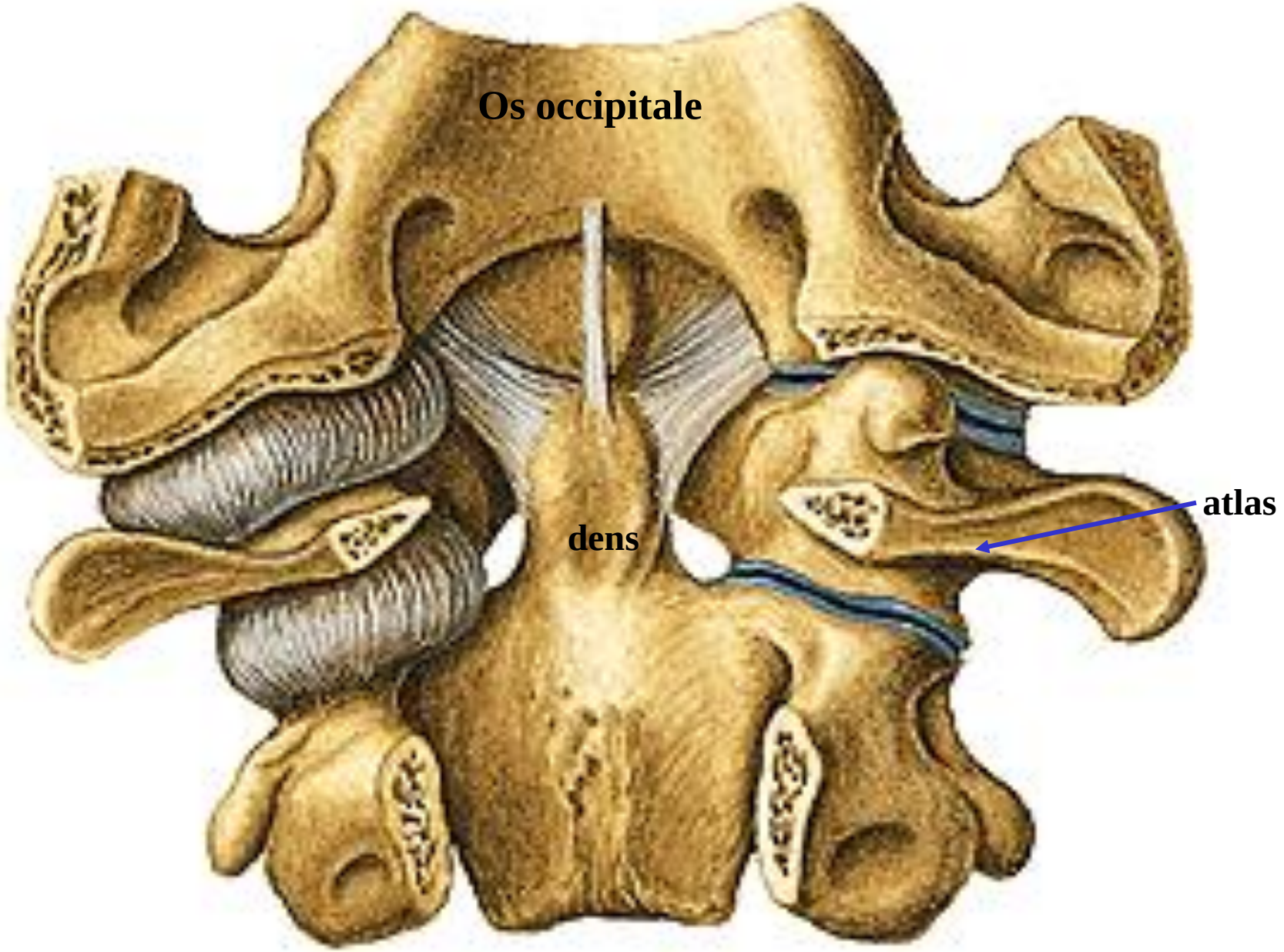
Sobotta, 2007



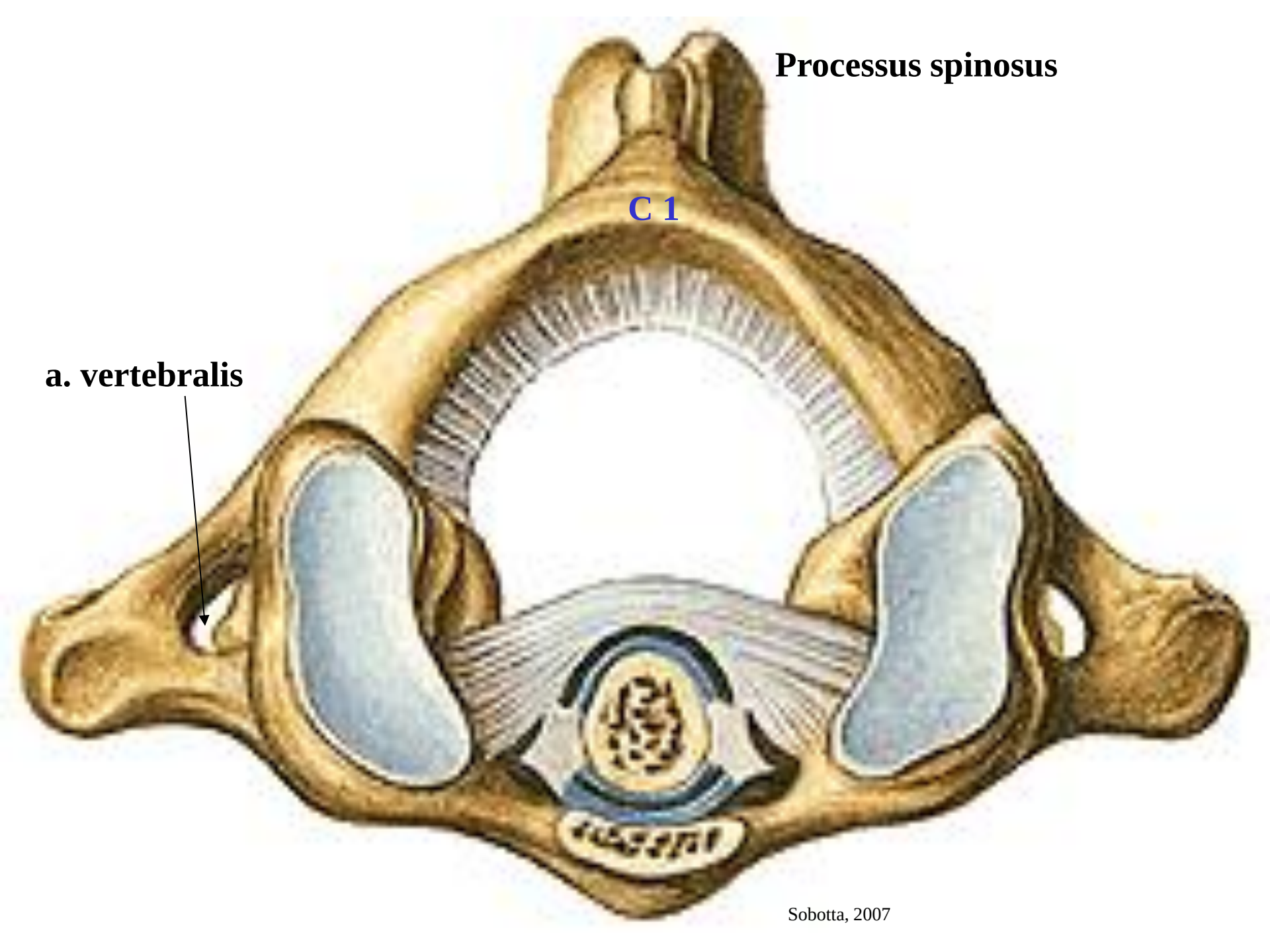
Sobotta, 2007



Sobotta, 2007



Sobotta, 2007

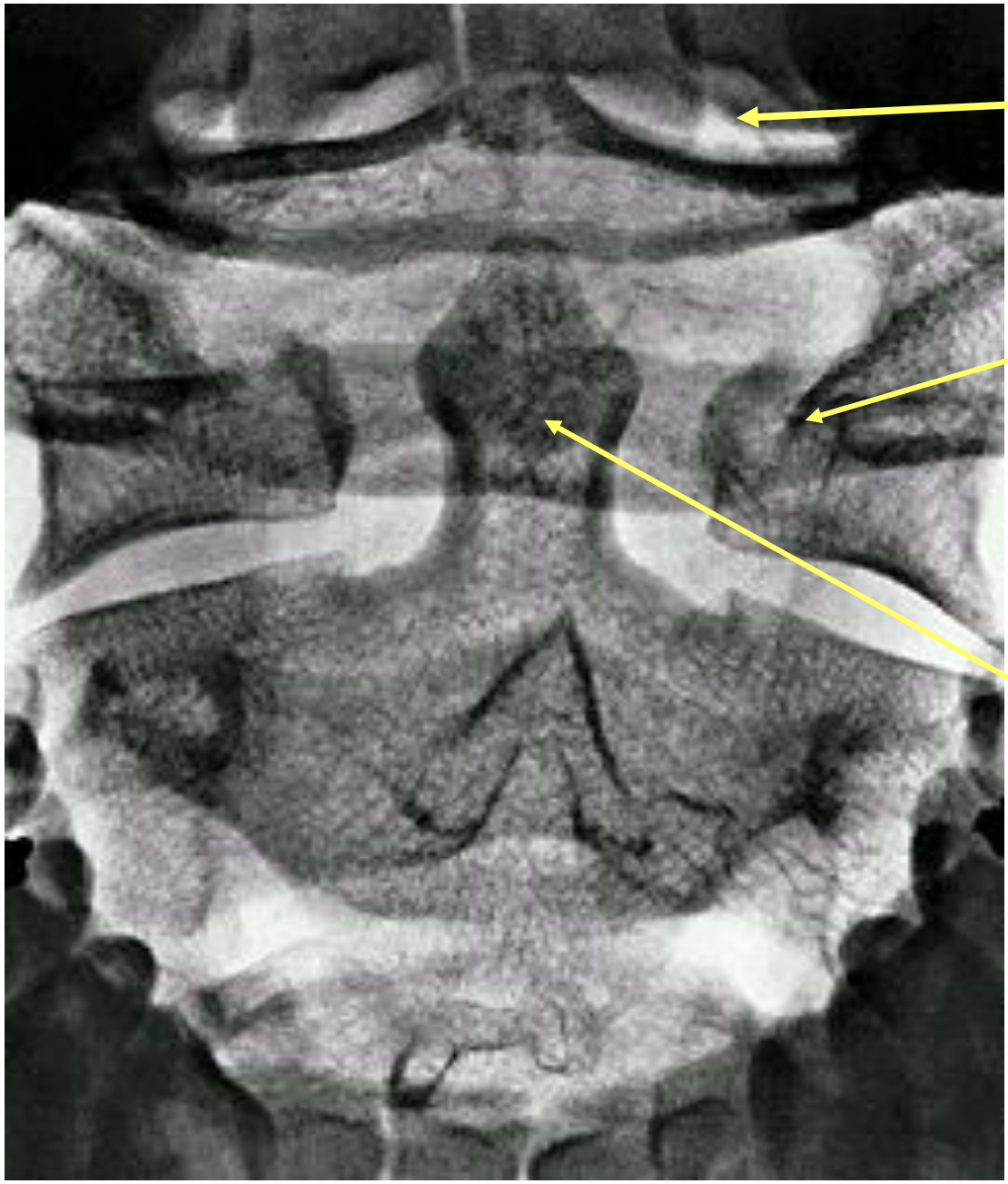


Sobotta, 2007

C 1 – C 7

Cervical part of vertebral column

Sobotta, 2007


Os occipitale
C 1 - arcus
C 2 -dens

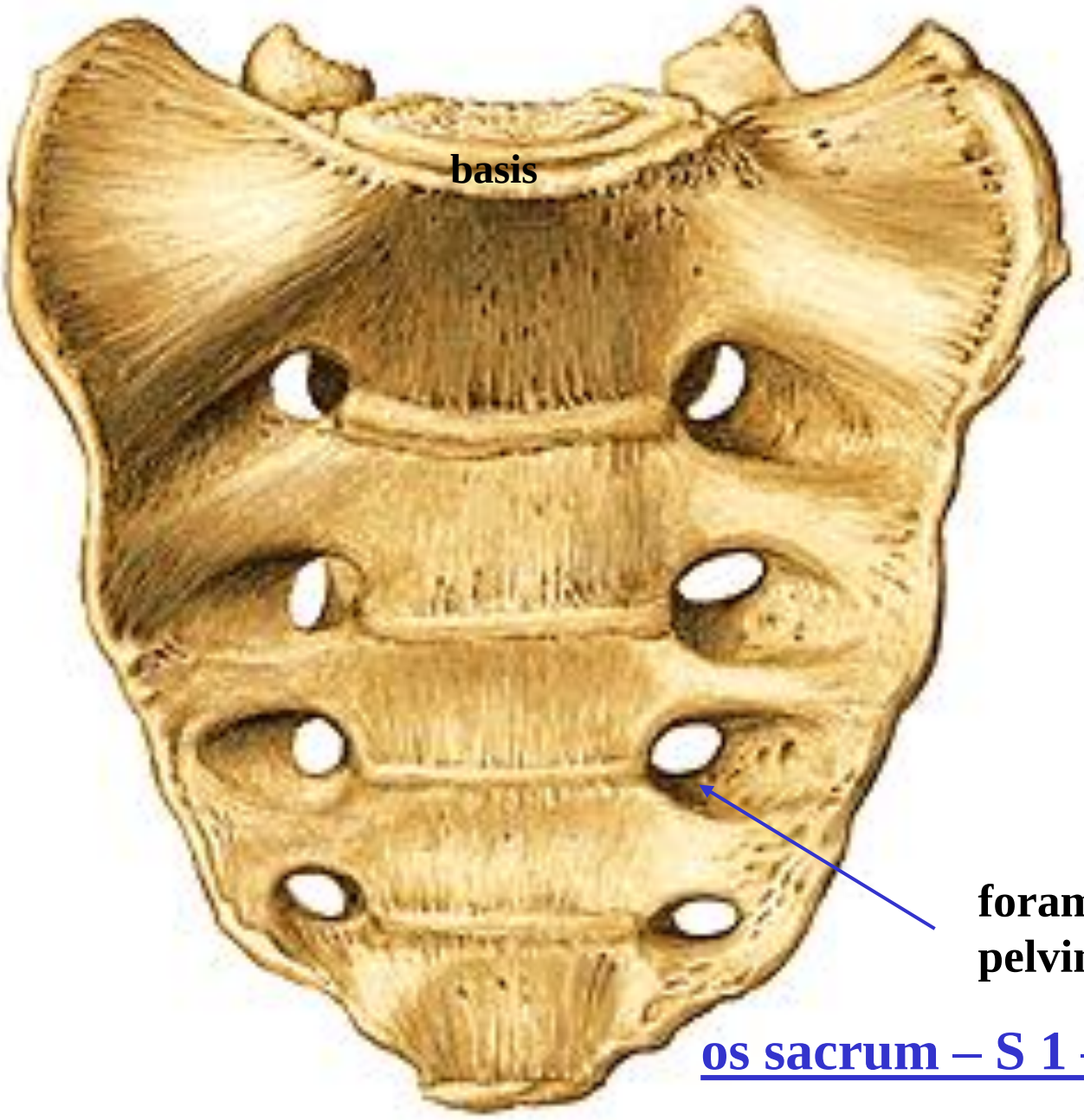

Os hyoideum

vertebrae lumbales

L 1 - 5

Sobotta, 2007

Promontorium
(L5 – S1)



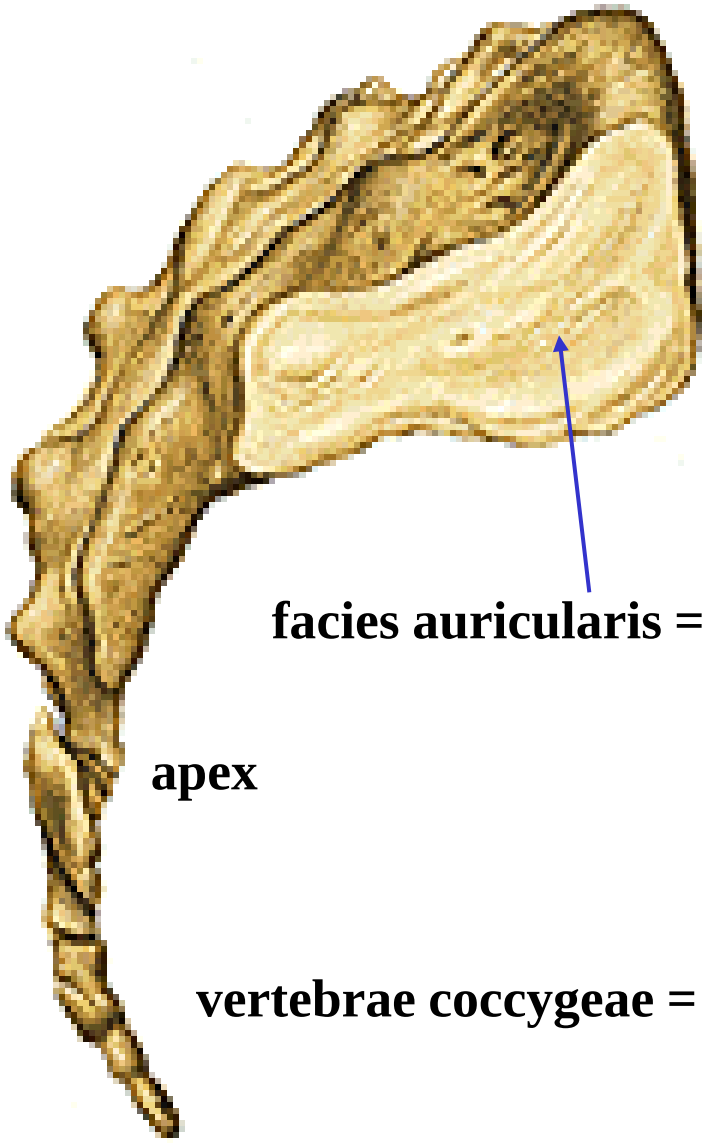
os sacrum – S 1 – 5

Sobotta, 2007

facies auricularis

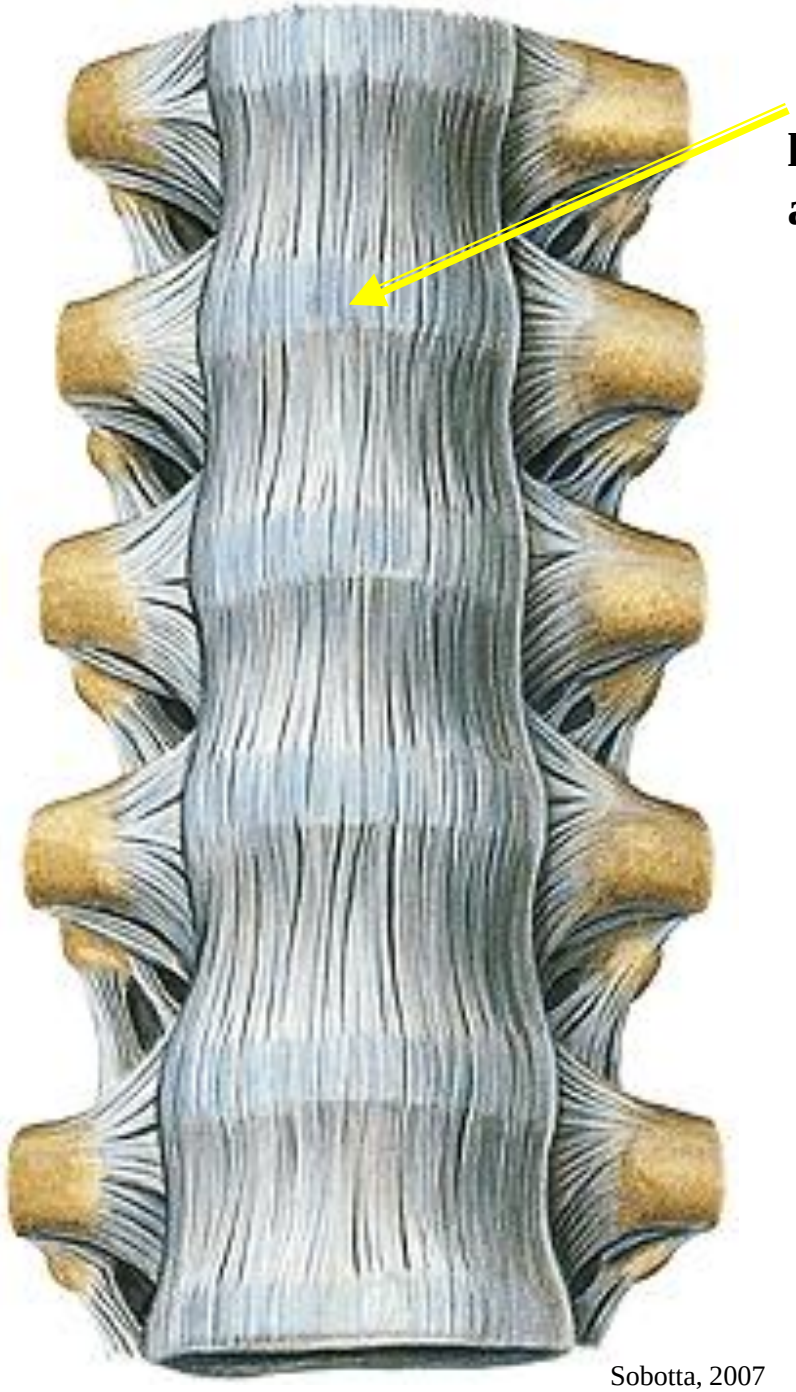
canalis sacralis
(spinal nerves)

Sobotta, 2007



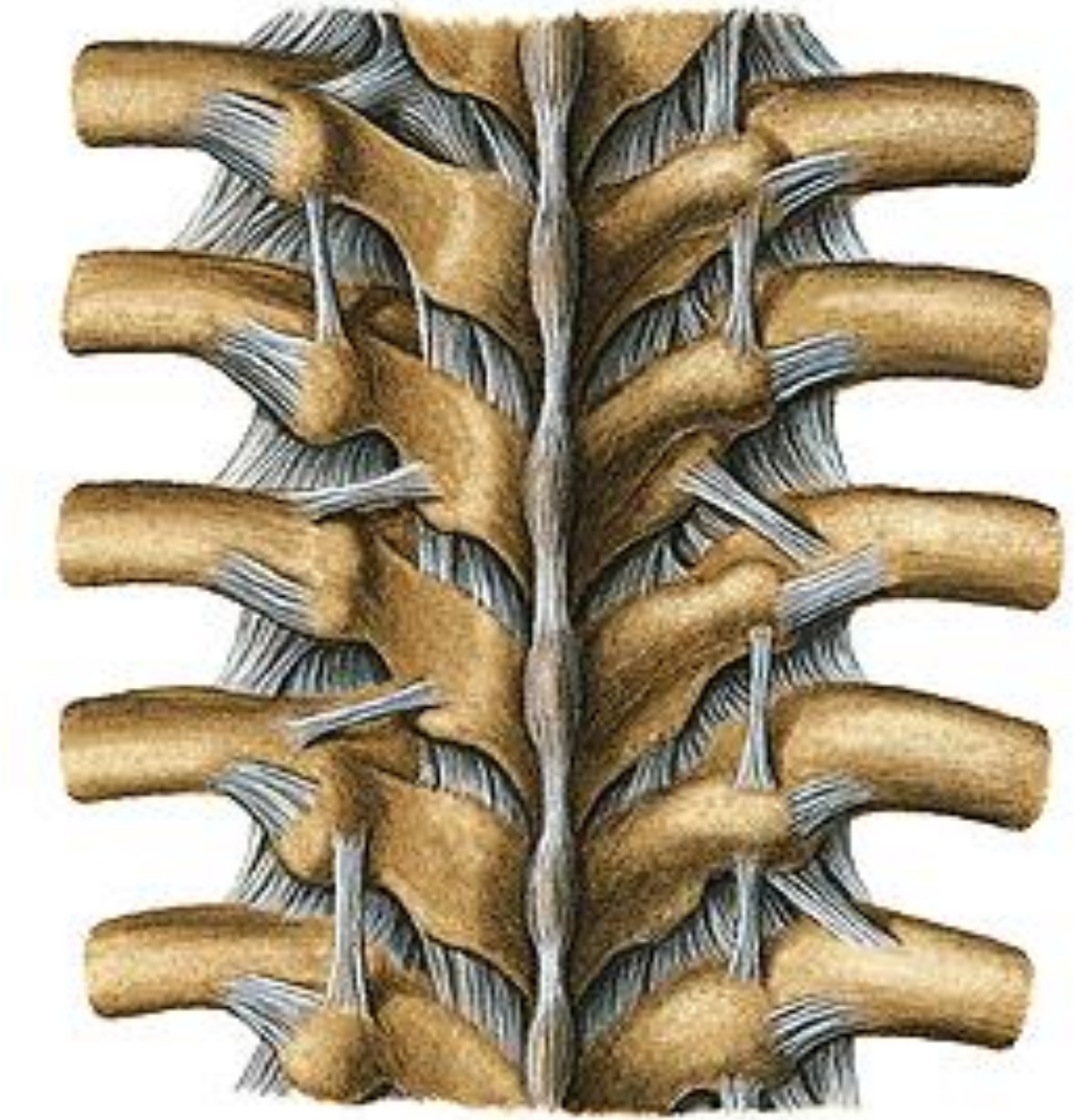
Sobotta, 2007

Connections of the vertebrea



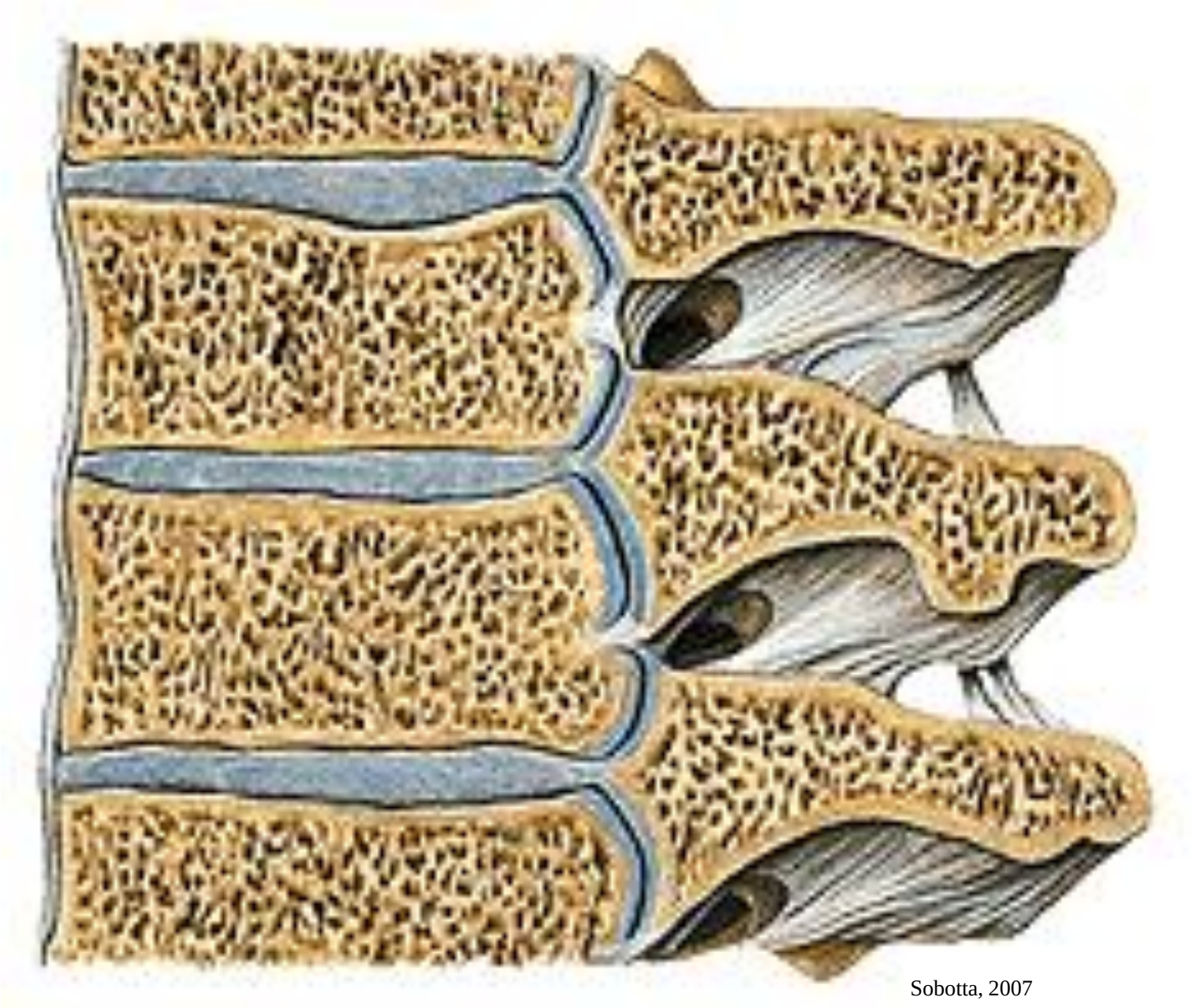
ligamentum longitudinale anterius

Sobotta, 2007



Sobotta, 2007

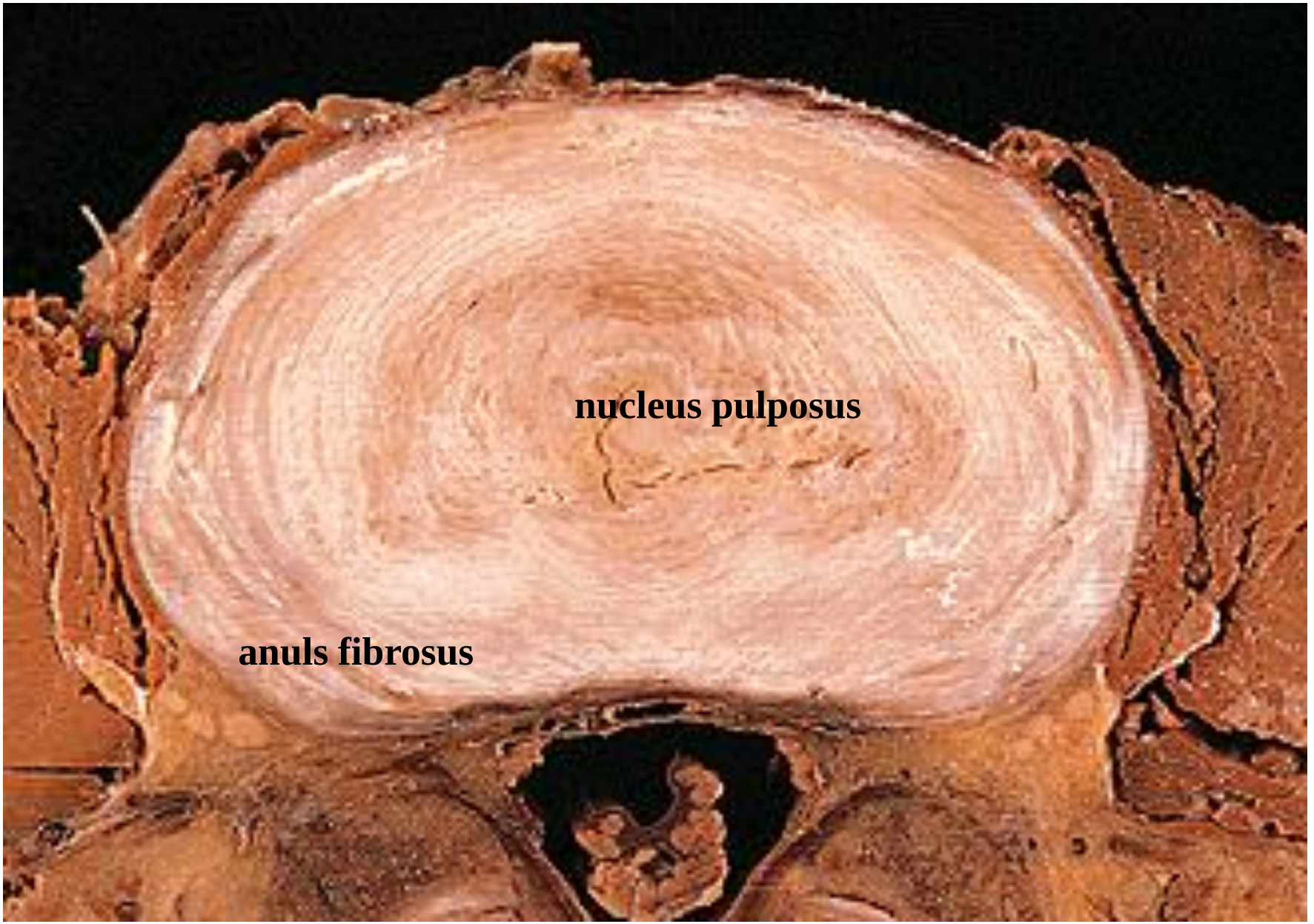
Ligaments of vertebral column– spinal, transverse



Sobotta, 2007

Disci intervertebrales

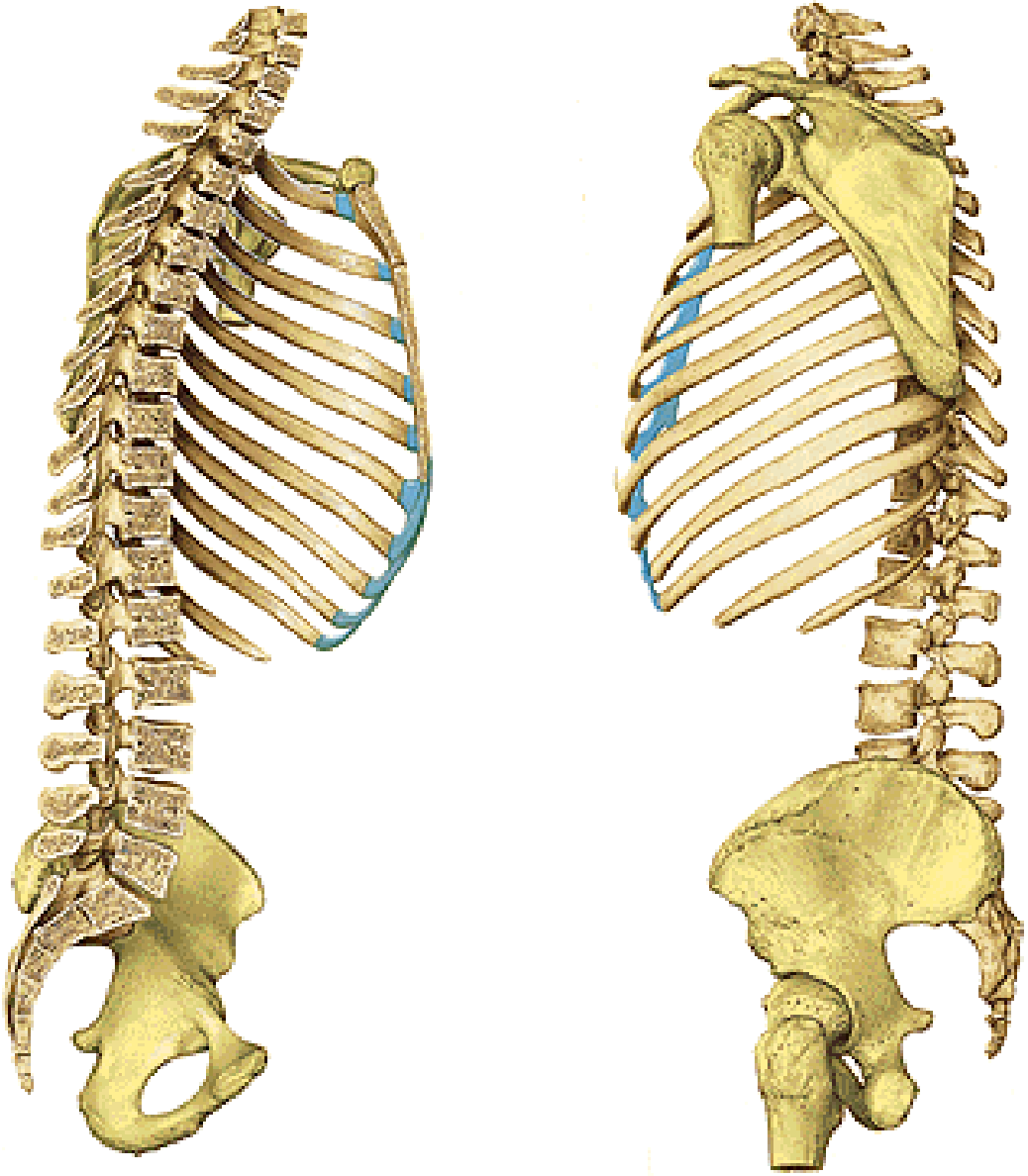
Discus intervertebralis



foramen vertebrale + spinal cord

MRI + perimyelography

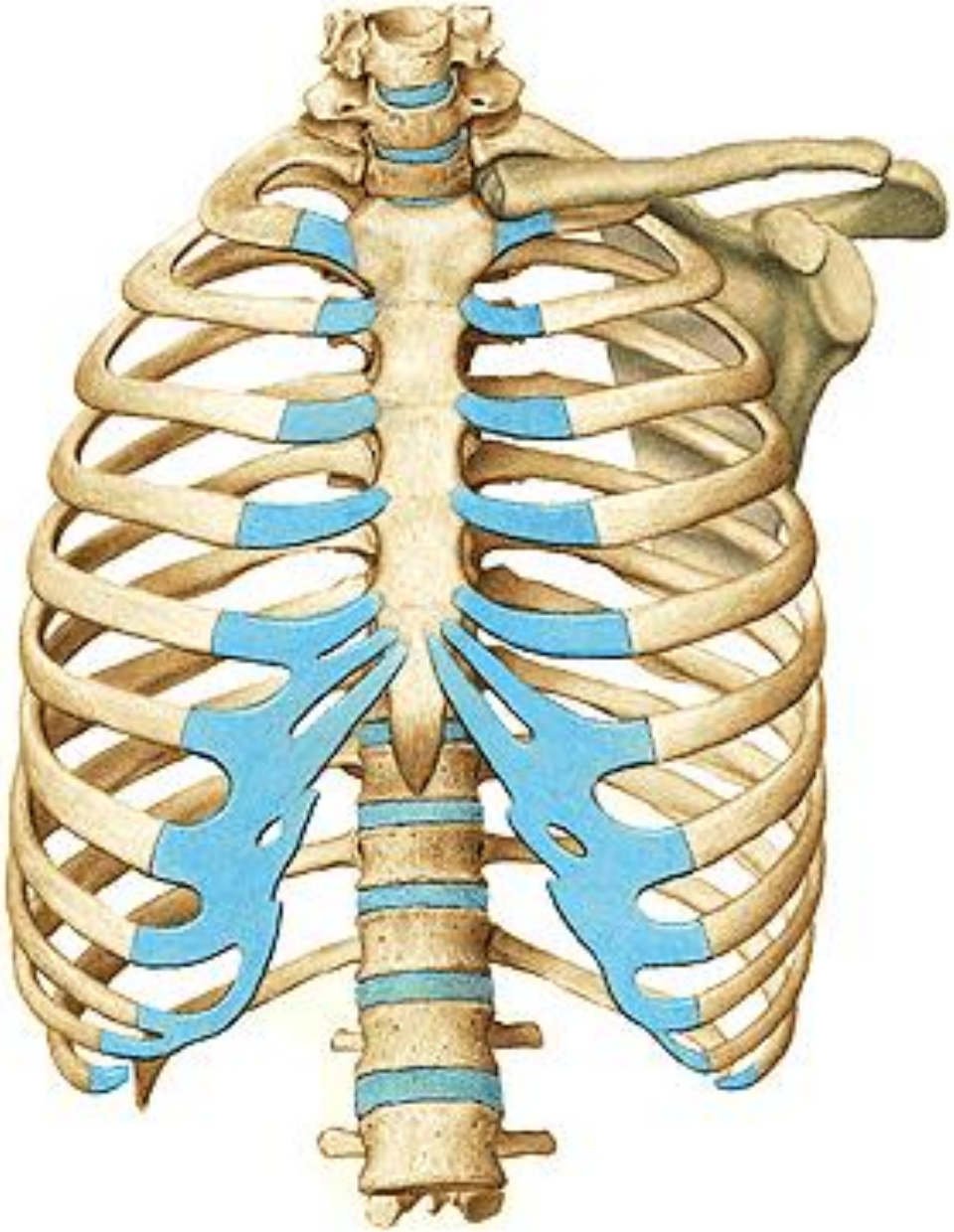
Thorax



Sobotta, 2007

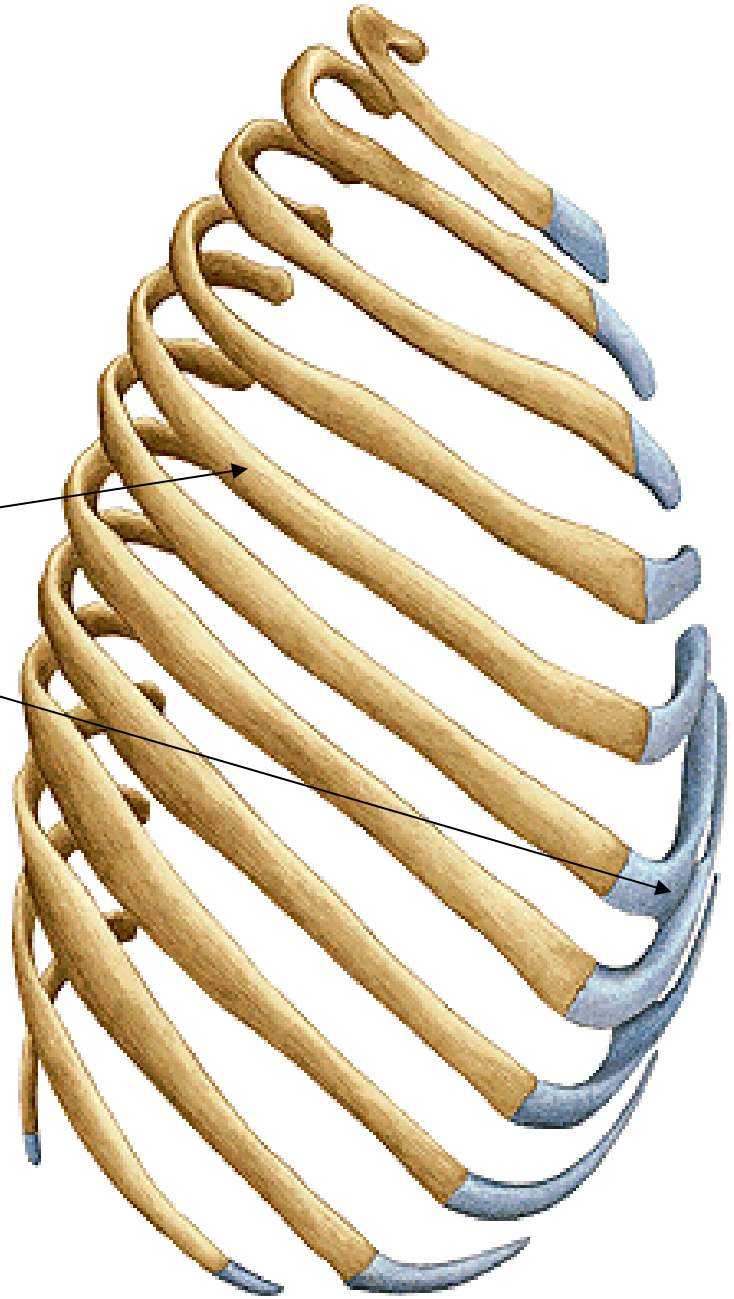
RIBS:

-real 1-7
-false 8-10
-improper 11,12



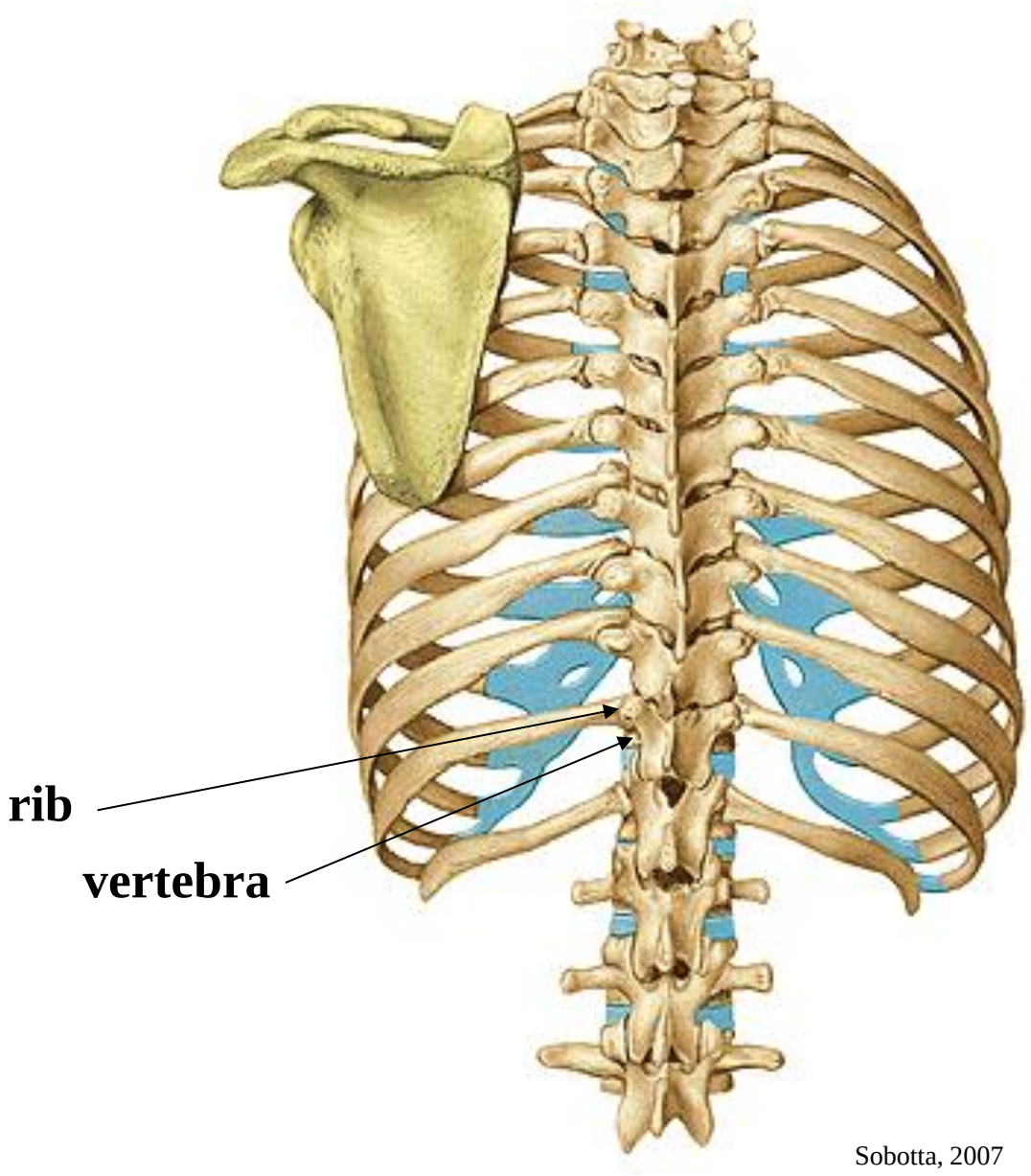
Sobotta, 2007

Costae (ribs):

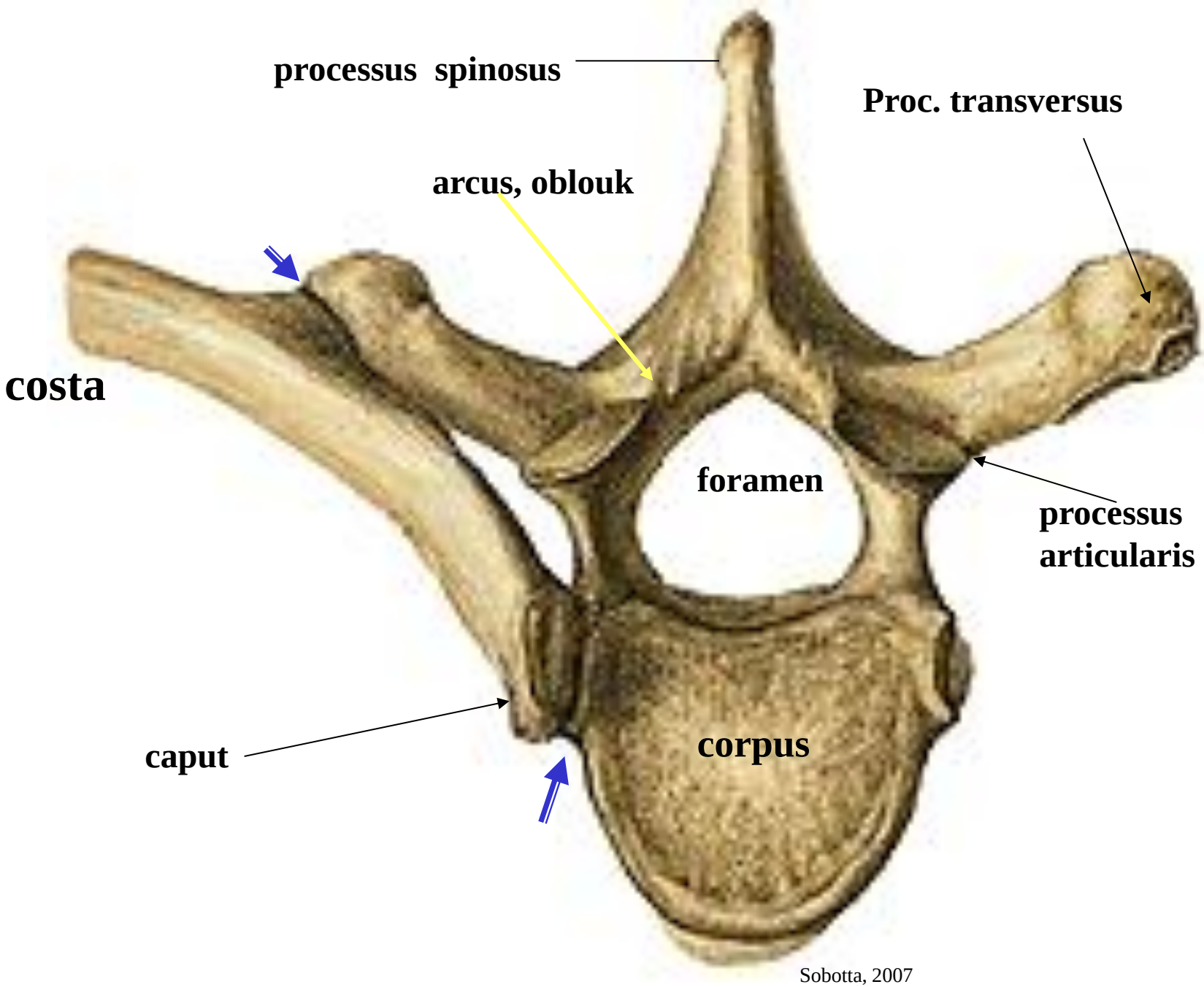


Sobotta, 2007

Costovertebral connections (on the body and transverse processes)



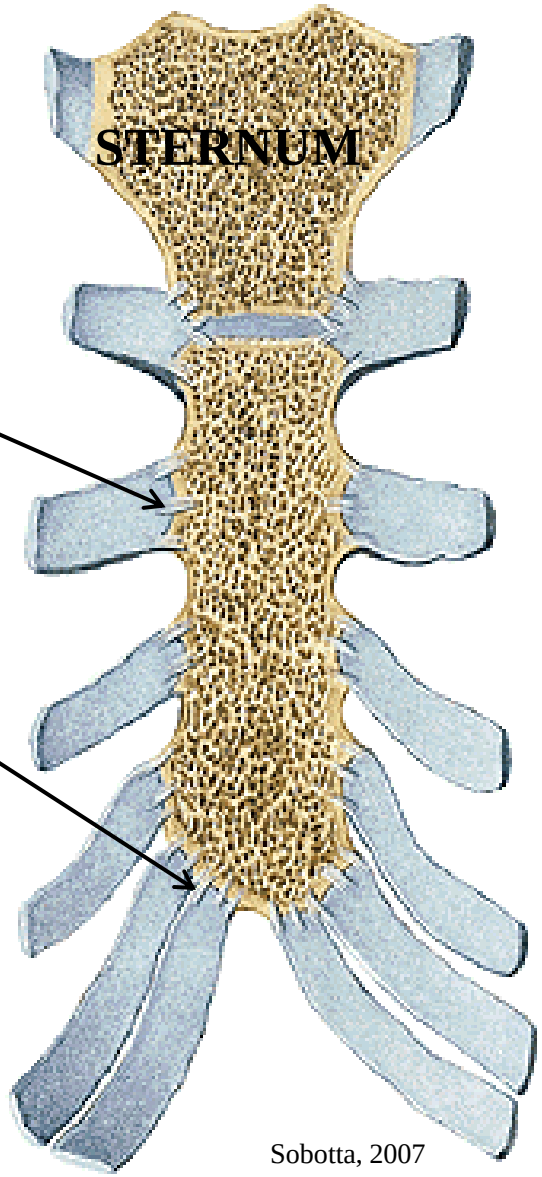
Sobotta, 2007


processus spinosus
Proc. transversus
arcus, oblouk
costa
foramen
processus articularis
caput
corpus
Sobotta, 2007

Sternocostal connections
(on the body and transverse processes)

Artt. sternocostales

Artt. interchondrales



Sobotta, 2007