

# AXIAL SKELETON

## Vertebral column

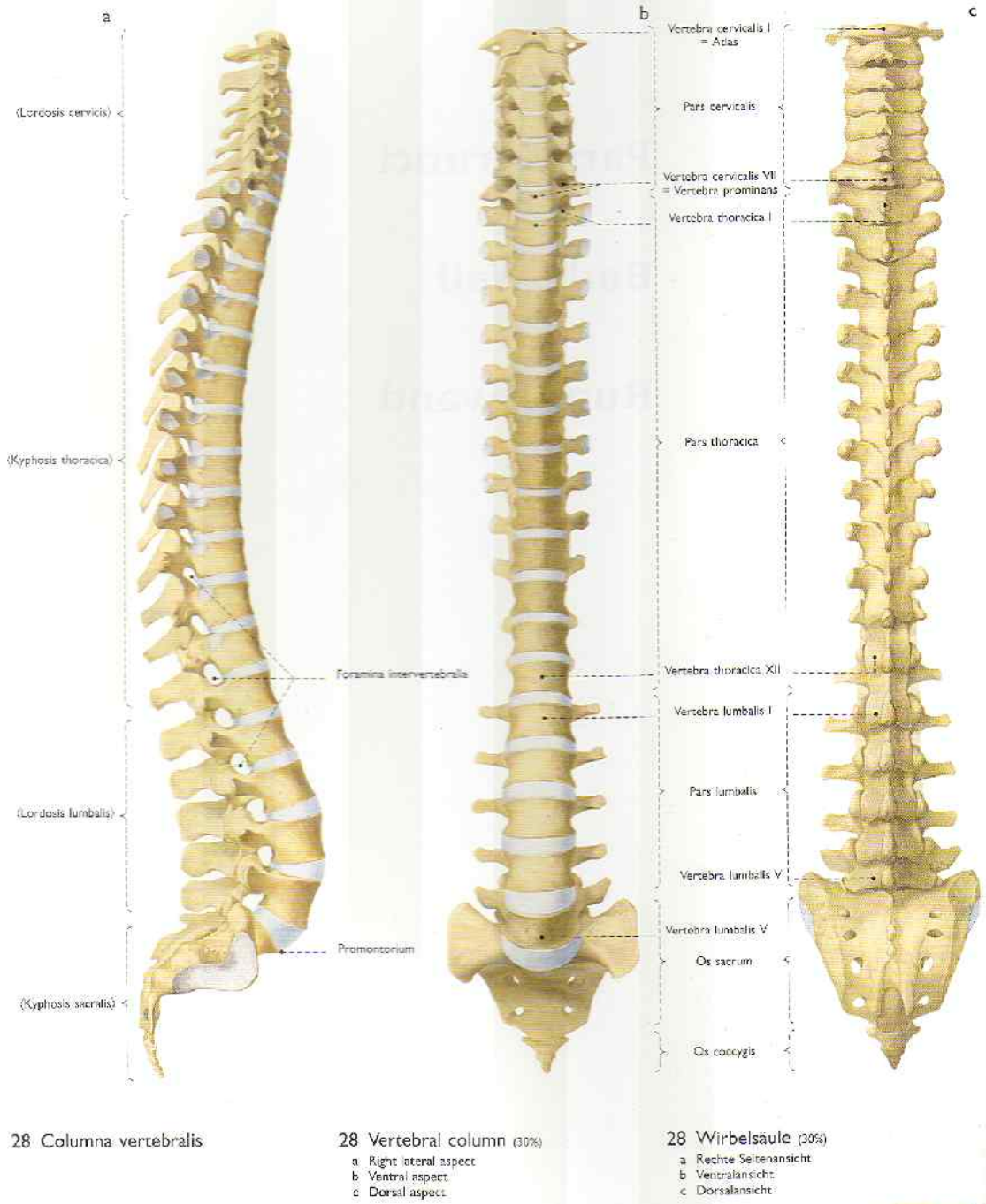
Rastislav Druga

The background of the slide features several decorative elements consisting of concentric circles in a lighter shade of blue, resembling ripples in water. These circles are positioned in the lower half of the slide, with one set in the bottom left, one in the bottom center, and a larger set in the bottom right.

**Presacral part**  
**Sacrum**

- C – 7
- Th – 12
- L – 5
- S – 5
- Co – 4-5

33  
vertebrae



C, L  
lordosis

Th  
kyphosis

C – when  
the infant  
begins to  
lift his  
head

L – when  
the child  
starts to  
walk

28 Columna vertebralis      28 Vertebral column (30%)      28 Wirbelsäule (30%)  
 a) Right lateral aspect      a) Rechte Seitenansicht  
 b) Ventral aspect      b) Ventralansicht  
 c) Dorsal aspect      c) Dorsalansicht

# VERTEBRAE

cervicales

thoracicae

lumbales

os sacrum

os coccygis



TH

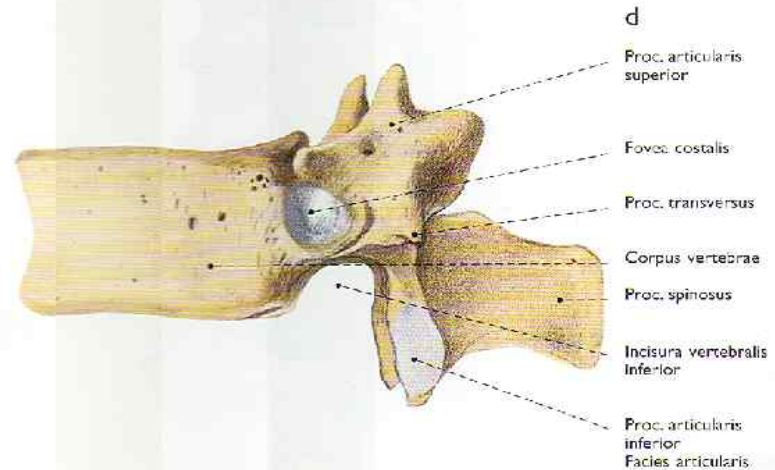
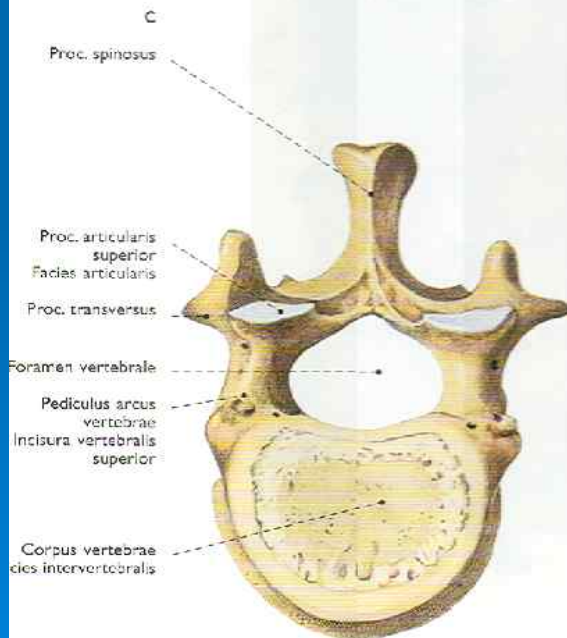
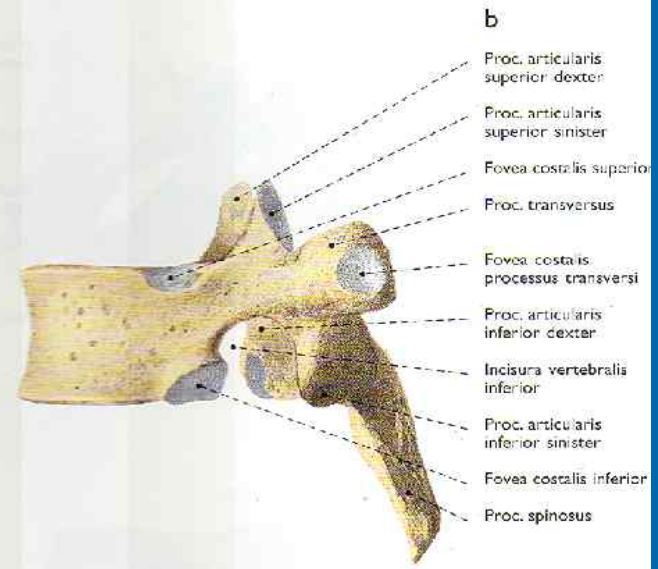
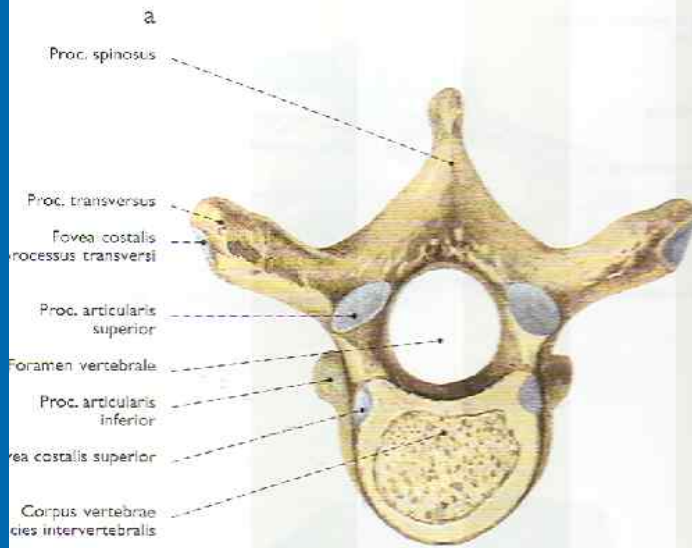
Corpus

Arcus

Processus

Pediculus

Vertebral  
notches  
(incisurae)



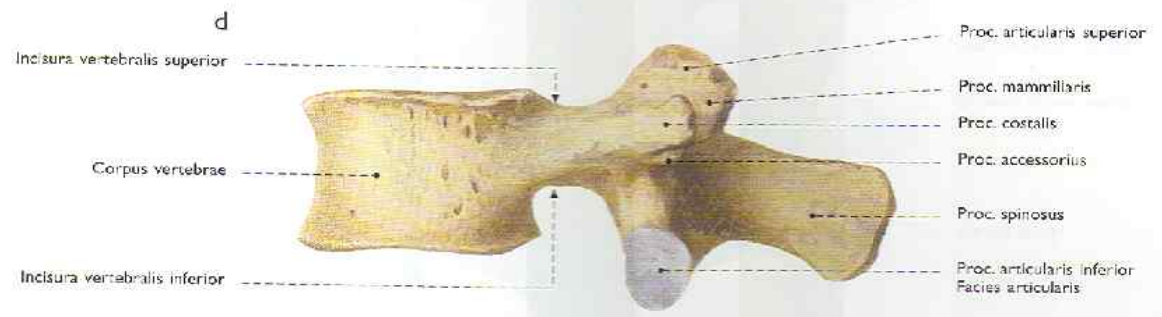
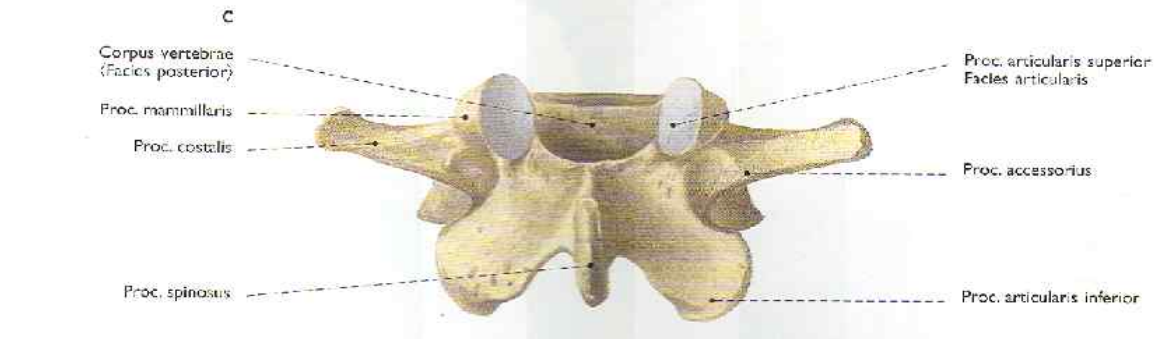
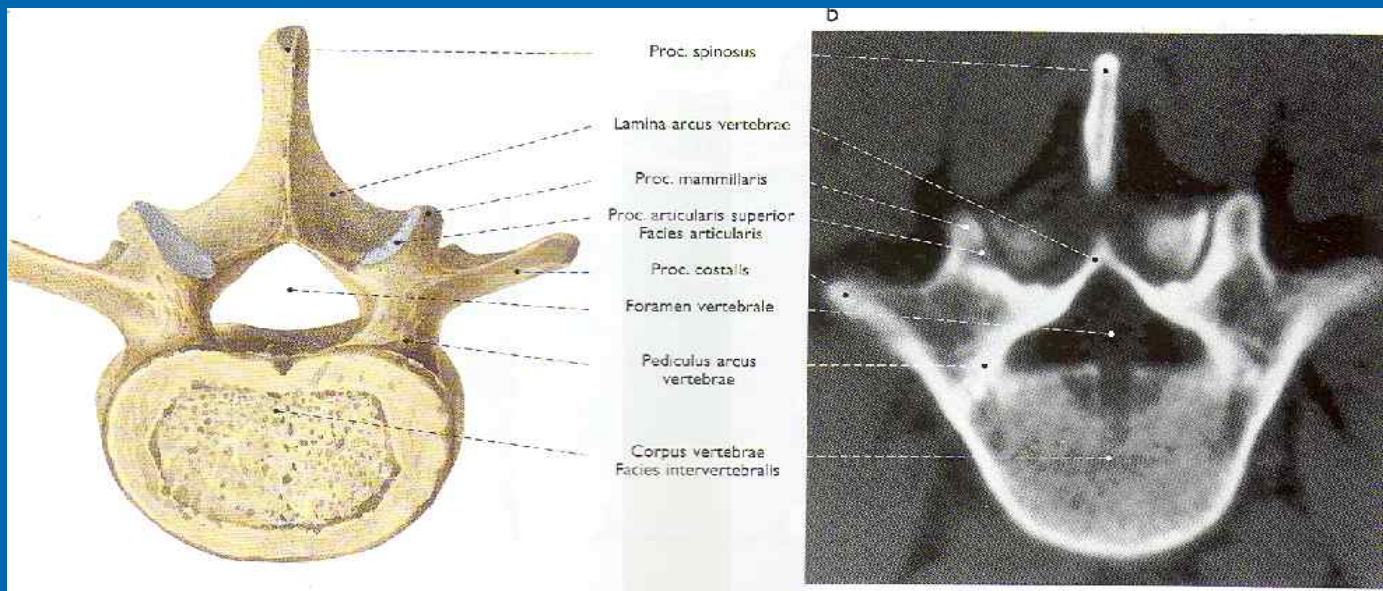
L

Foramen  
vertebrae  
AP 13 mm

Recessus  
lateralis

AP 4 mm

Lamina



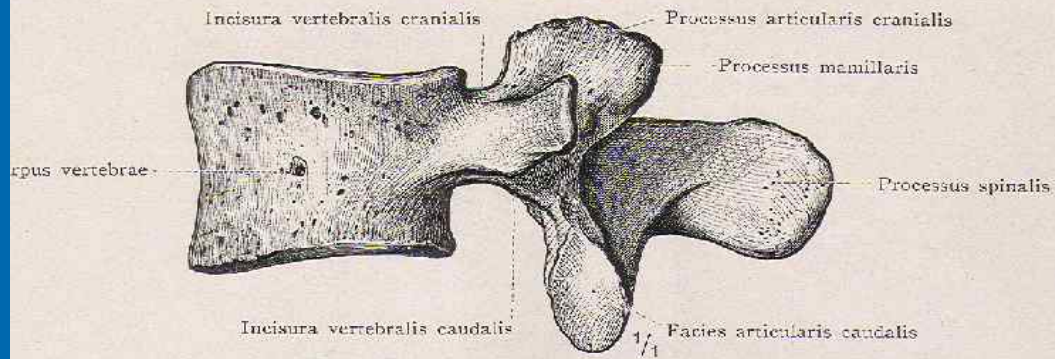


Fig. 46. Ansicht von der linken Seite.

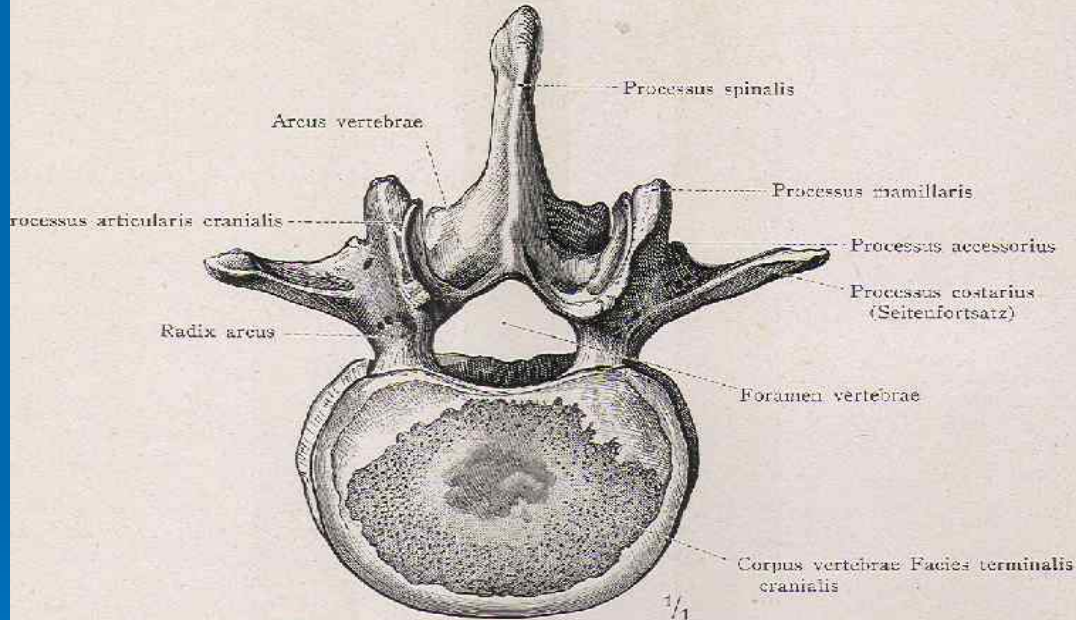


Fig. 47. Ansicht von der kranialen Seite.

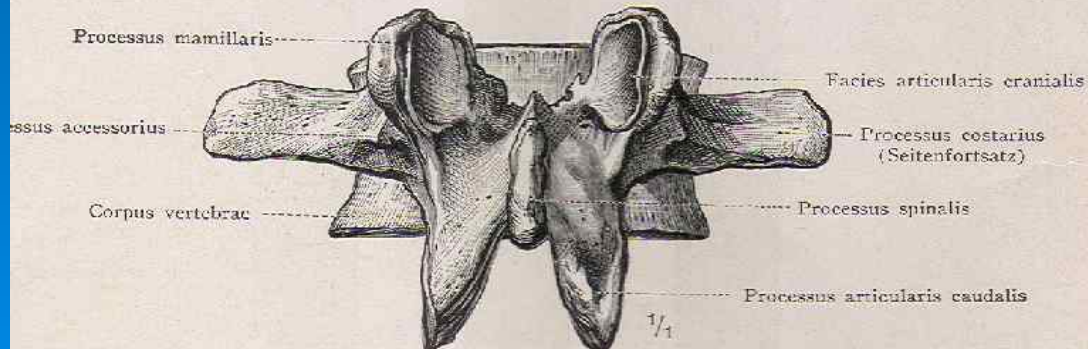
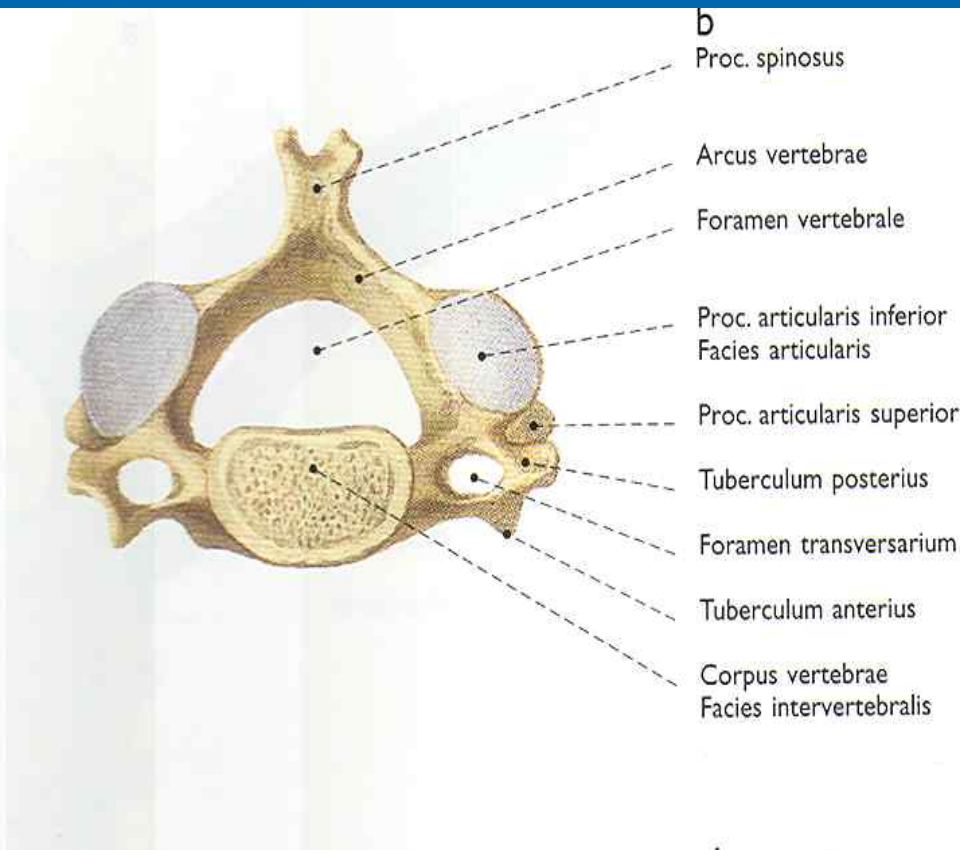
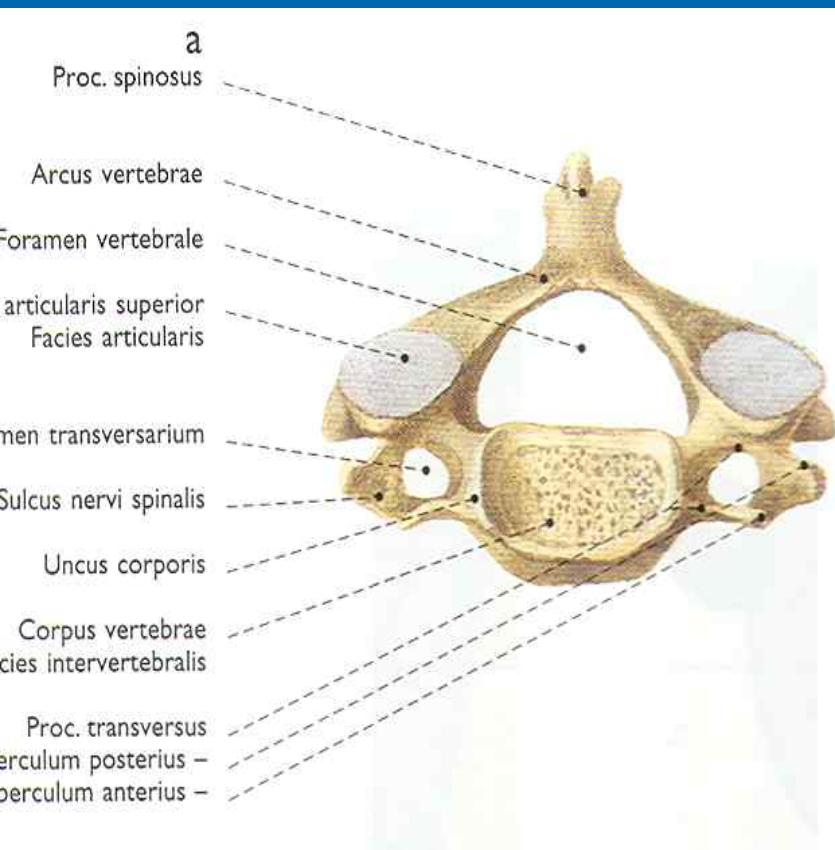


Fig. 48. Ansicht von der hinteren Seite.

# Vertebrae cervicales

# Cervical vertebra



C6 tuberculum anterius = tuberculum caroticum

C7 vertebra prominens

# Vertebrae cervicales C 1 – C7

d

as

xis

us

VI

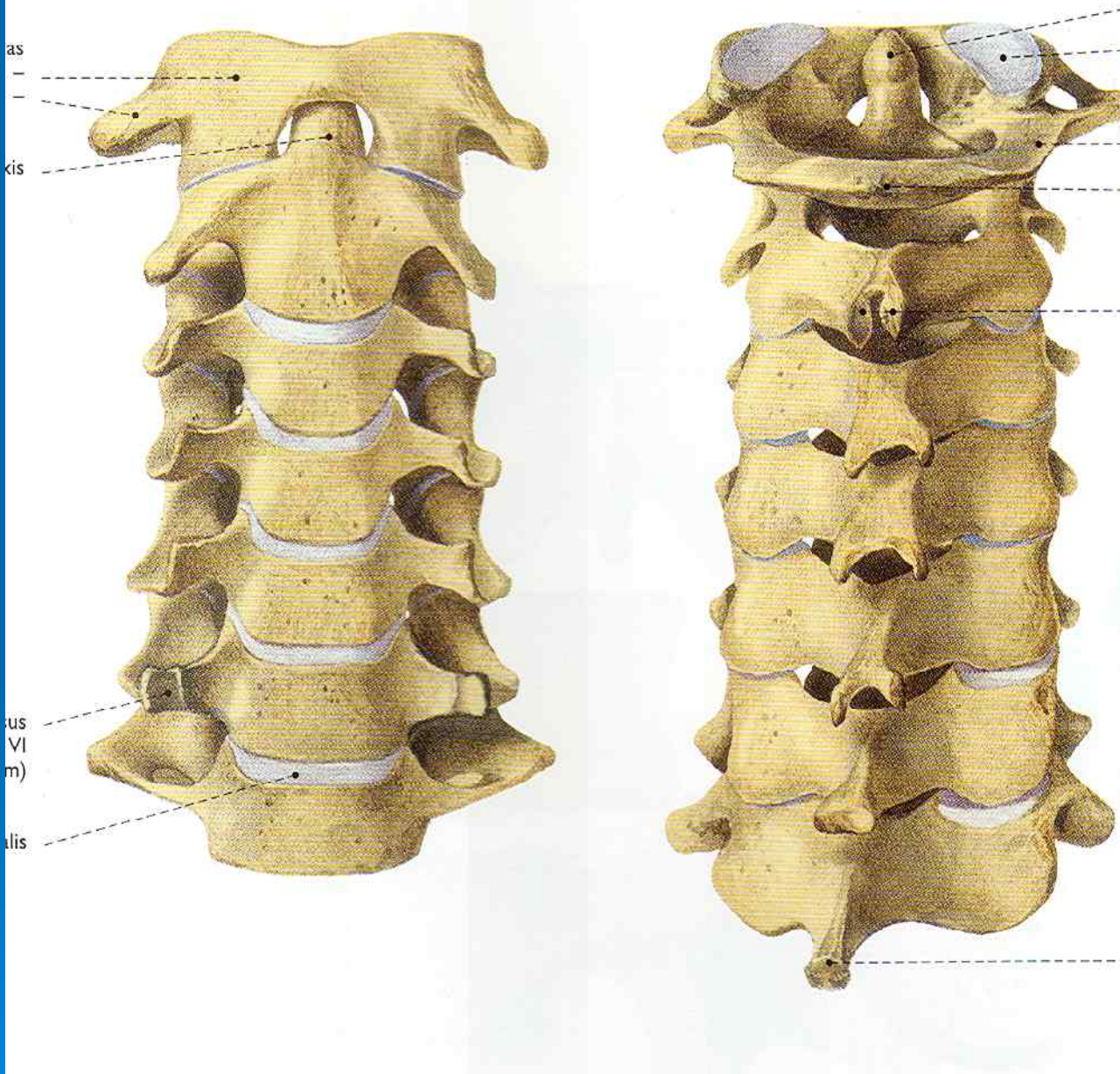
m)

ilis

ATLAS

AXIS

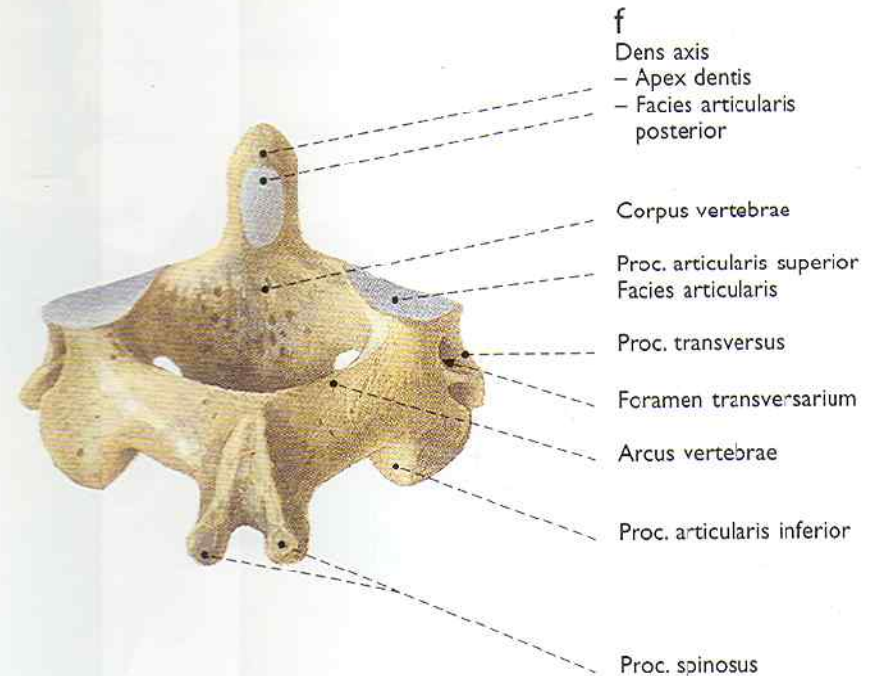
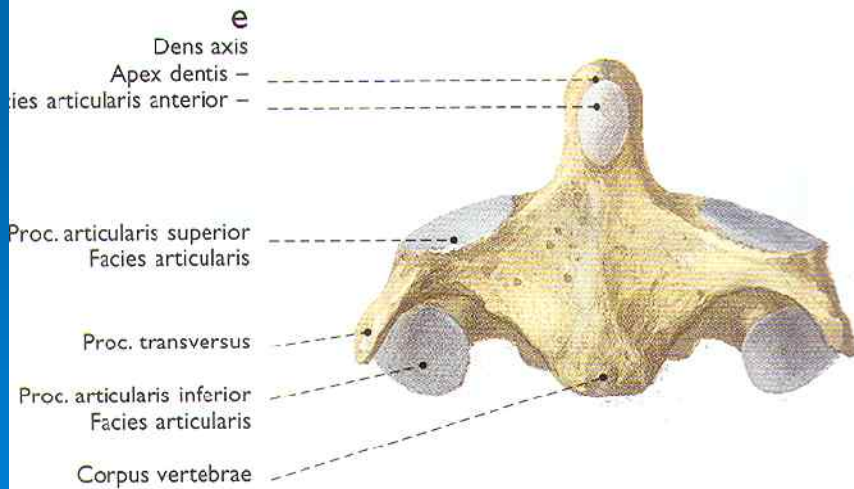
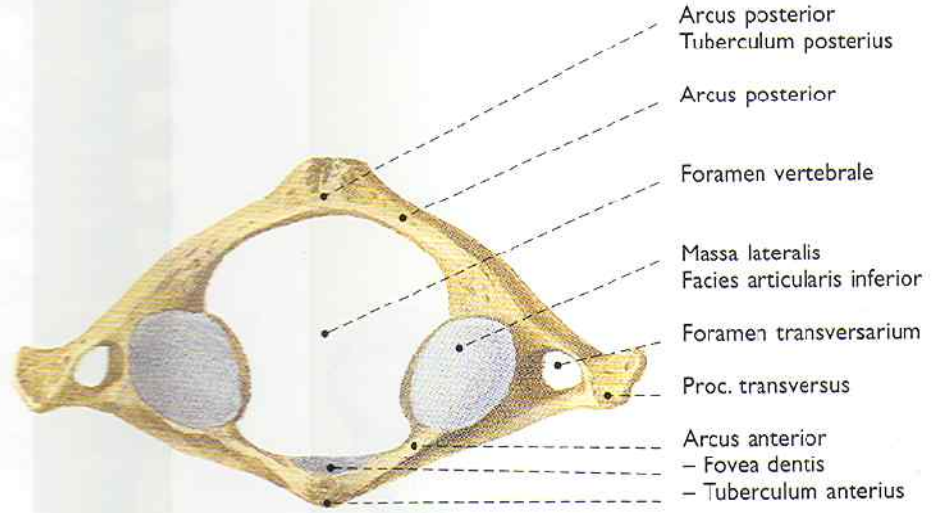
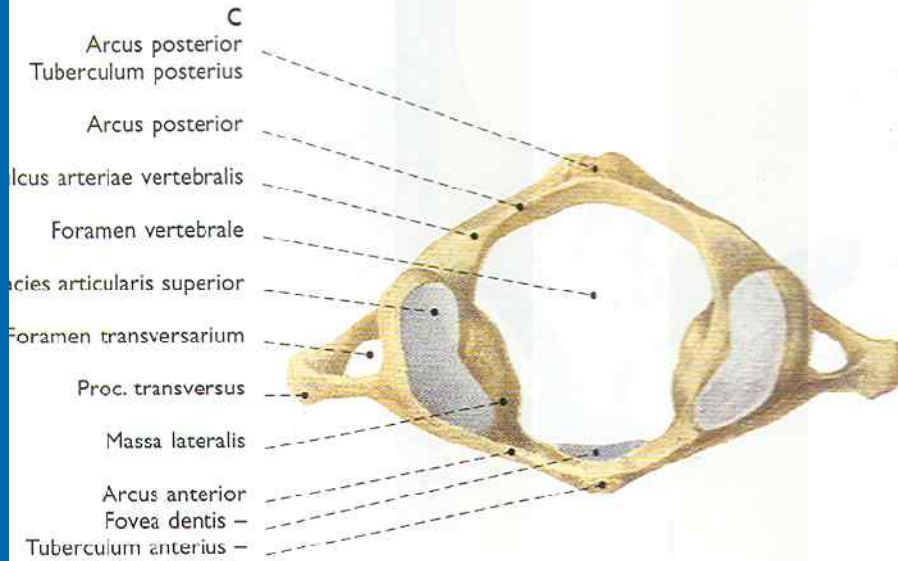
Nízke intervert.  
Disky





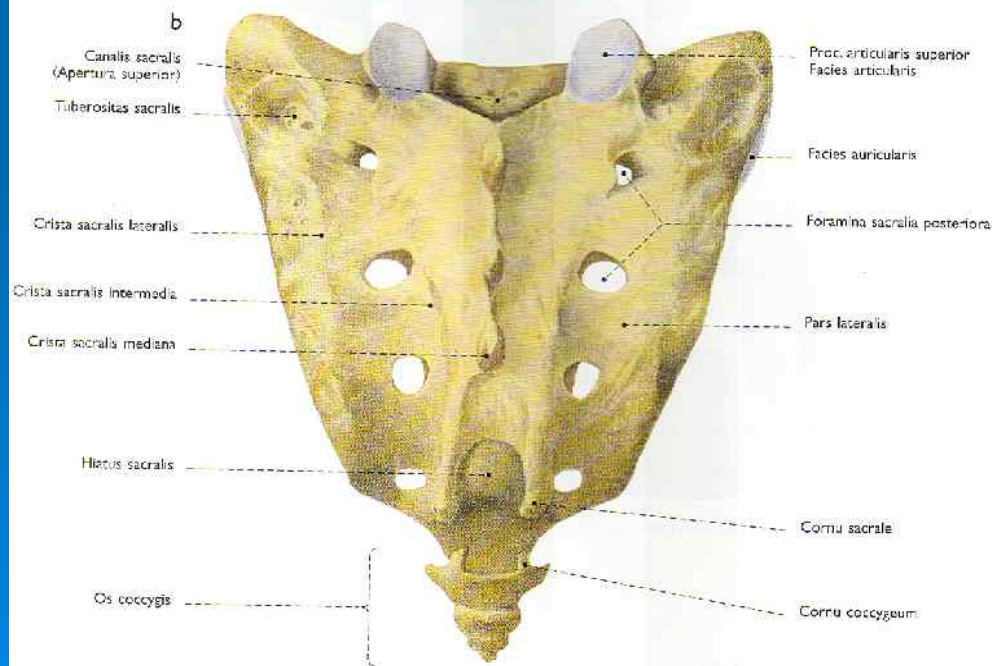
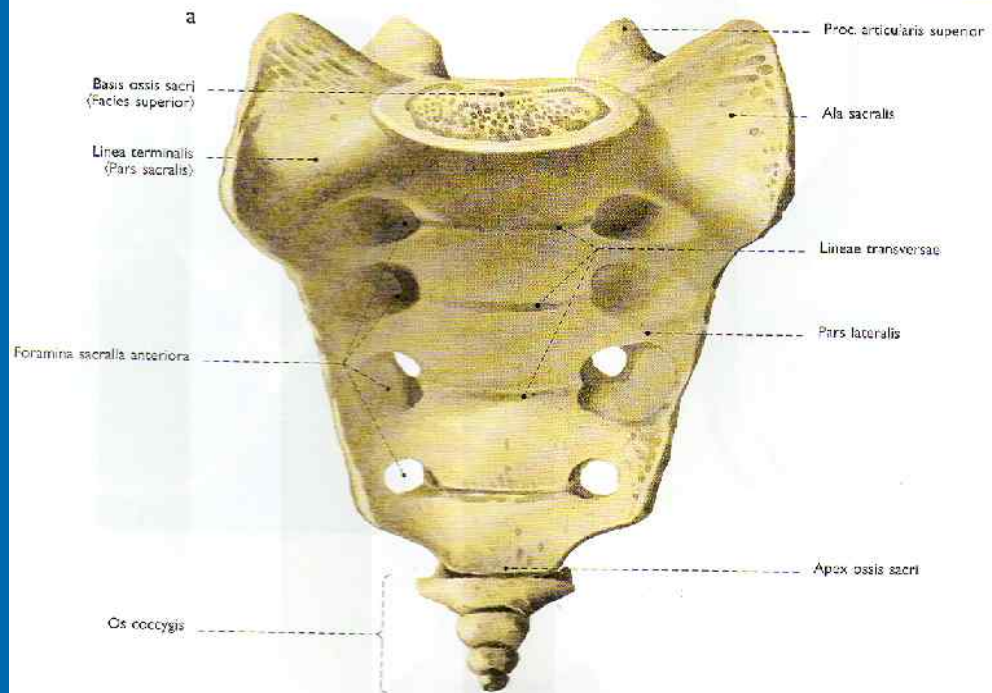
# ATLAS

# AXIS

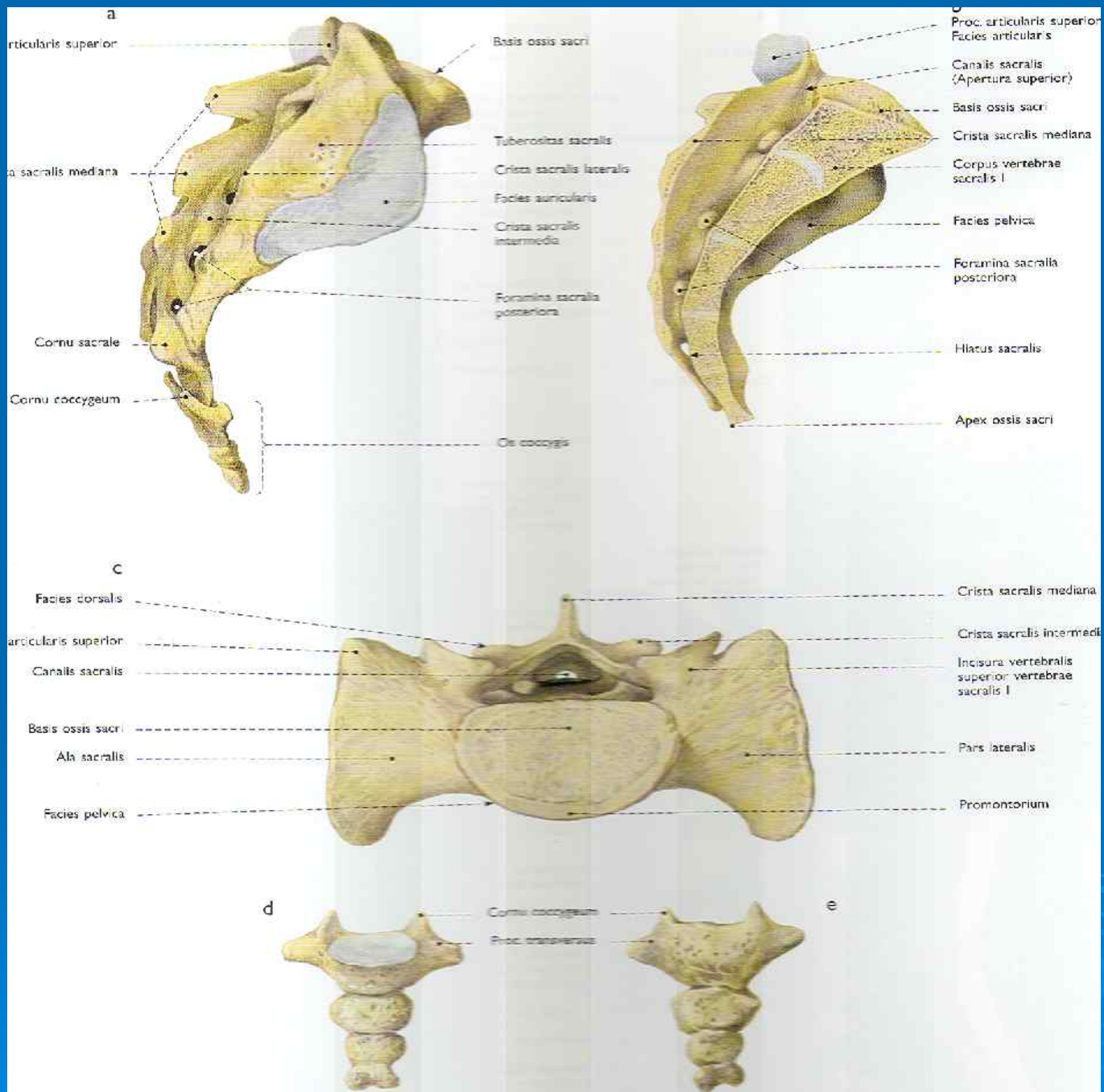


# SACRUM

S1 – S5

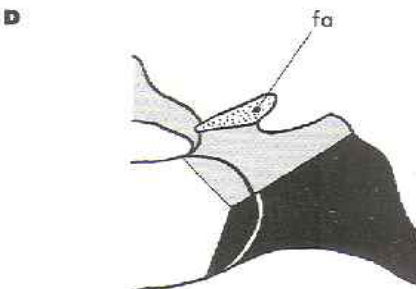
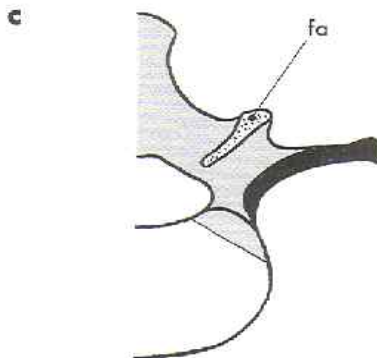
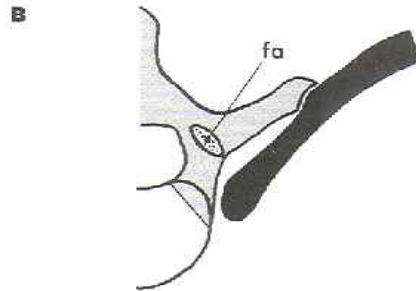
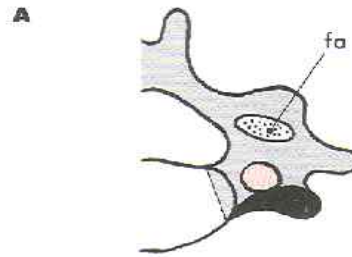


# Articulatio sacroiloaca



## Homologous parts oéf vertebrae

Black = costal  
element



C – proc. transversus

Th – costa vera

L – proc. costalis

S – crista sacralis  
lateralis

# Articulaciones intervertebrales

The joints of the vertebral column



# Intervertebral discs

**Two cartilage endplates**

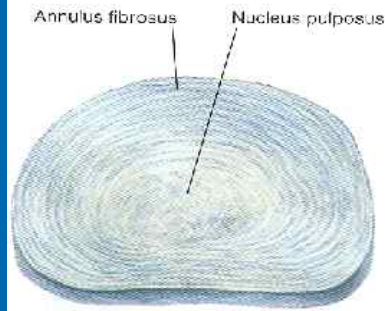
**Nucleus pulposus**

**Annulus fibrosus**

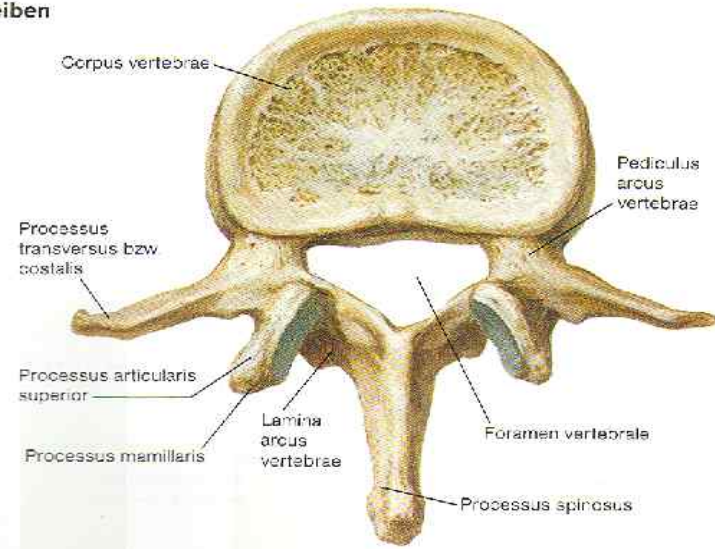


# DISCI INTERVERT.

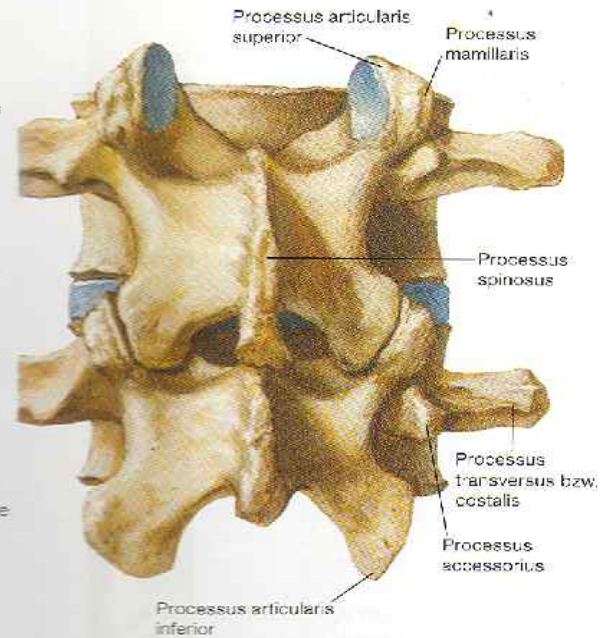
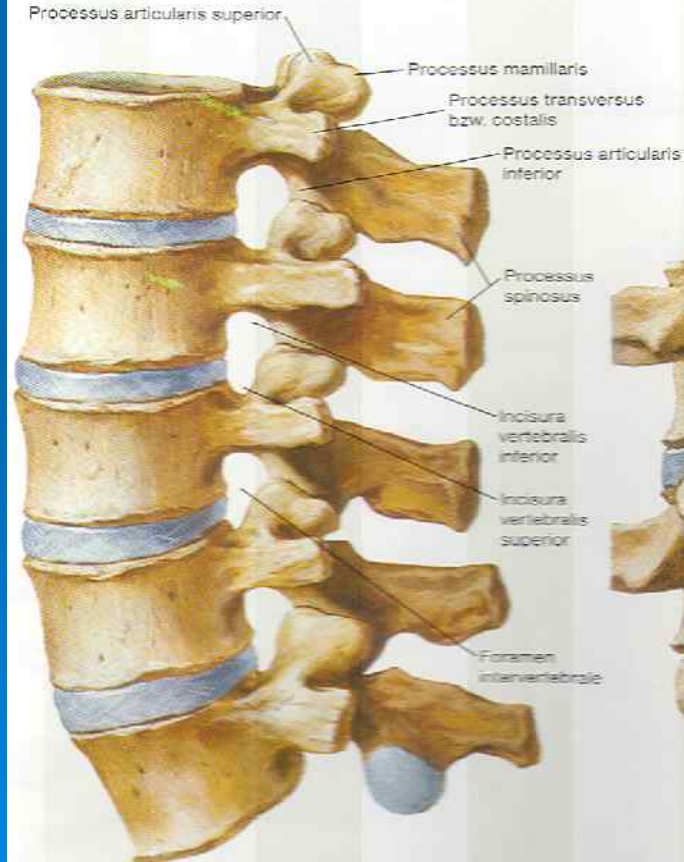
## Lendenwirbel und Zwischenwirbelscheiben



Discus intervertebralis



2. Lendenwirbel  
(von oben)

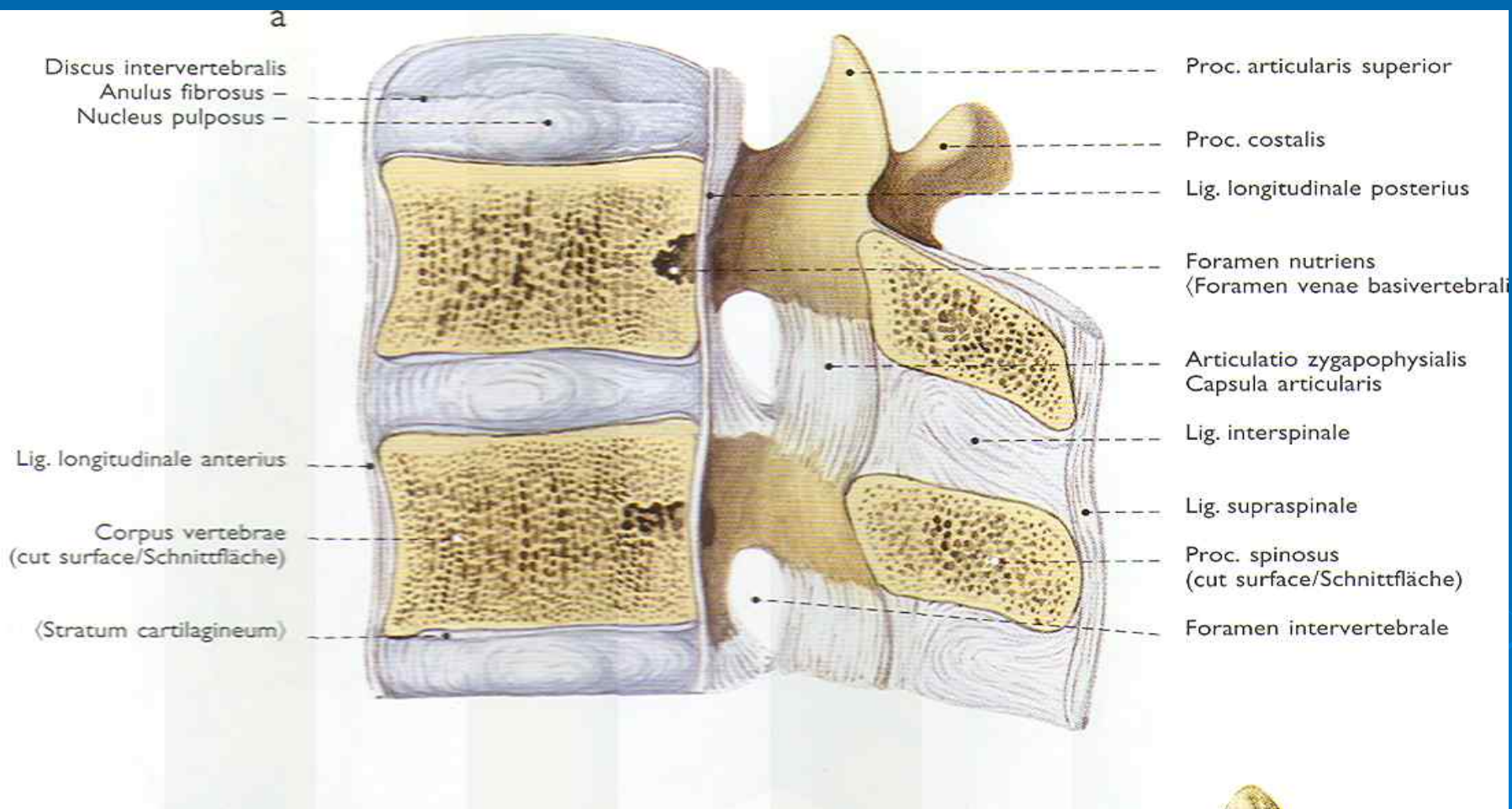


3. und 4. Lendenwirbel  
(von hinten)

# DISCUS – Anulus fibrosus, nucleus pulposus

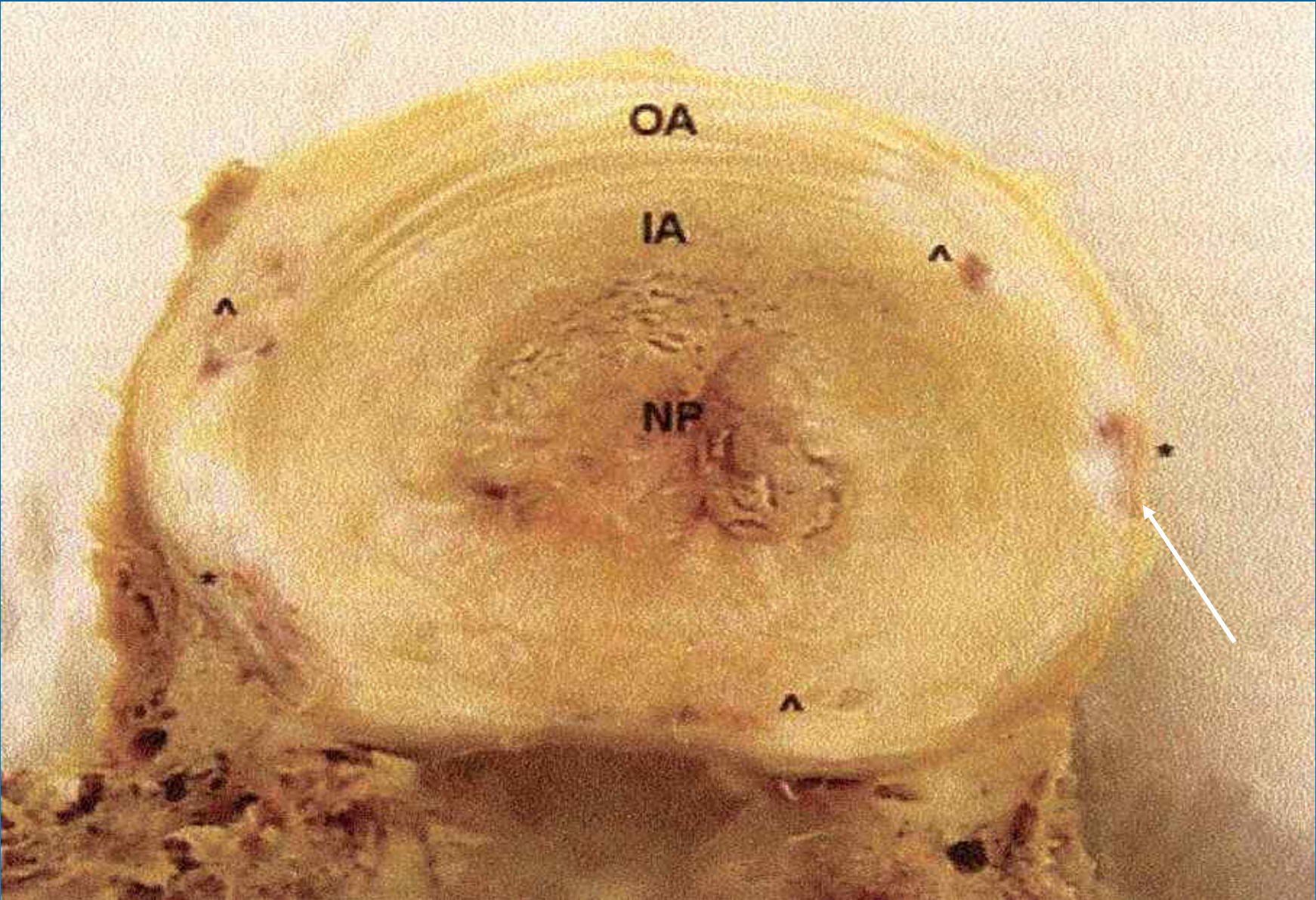
Anulus fibrosus – vazivová chrupavka, kolagenní fibrily

Nucleus pulposus – hydratované proteoglykany, kolagenní fibrily, vazivové buňky

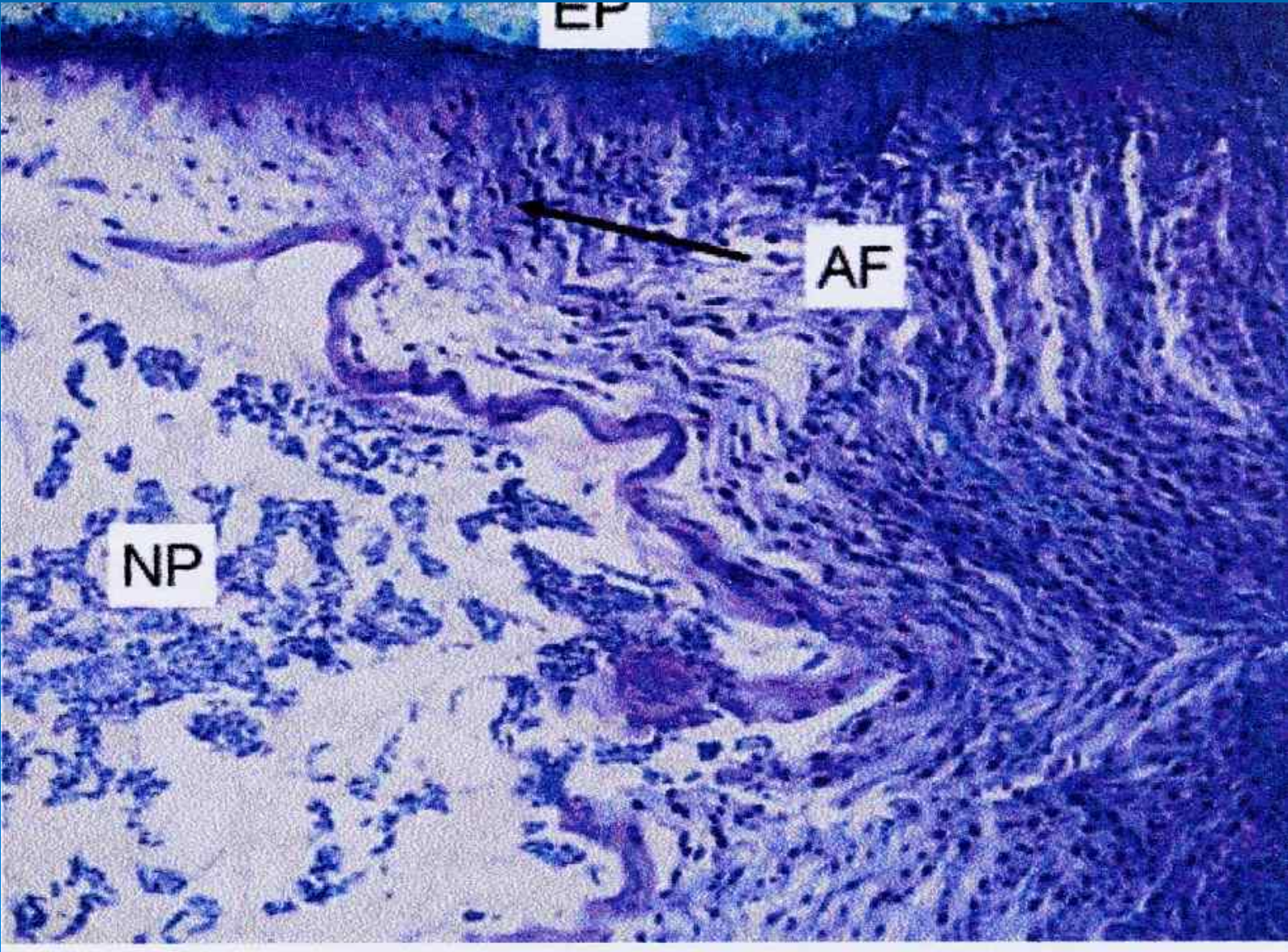


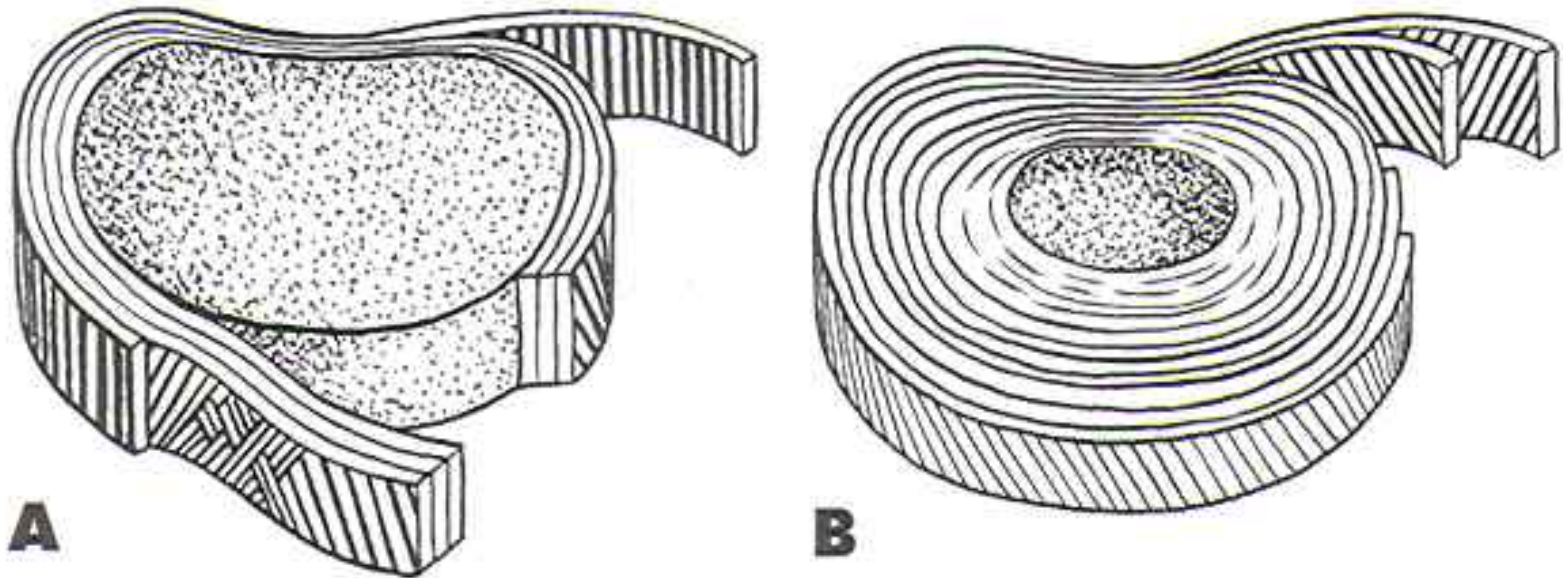


L3/L4 intervertebral disc – defect in the outer annulus



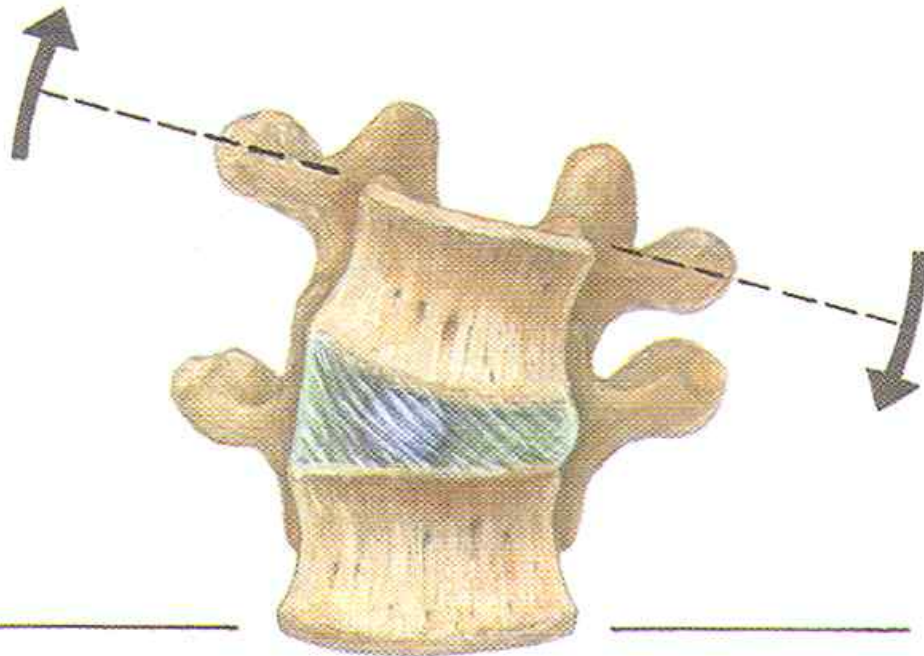
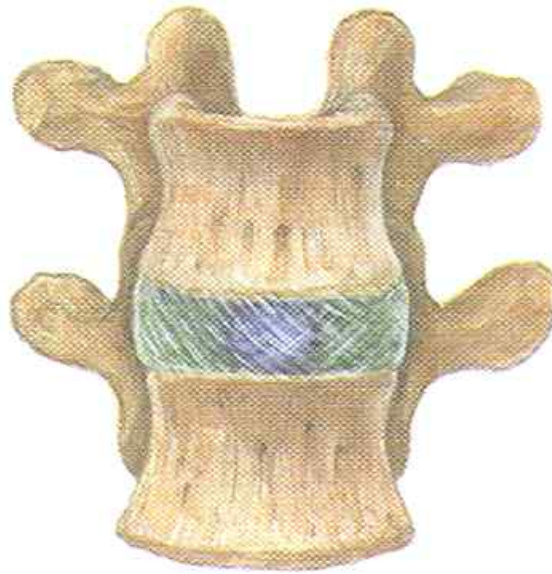
Intervertebral disc – toluidine blue





Obr. 1.21. Stavba meziobratlové ploténky v krční (A) a bederní (B) páteři. Je patrná rozdílná velikost nucleus pulposus a anulus fibrosus. Anulus fibrosus se liší i uspořádáním svazků kolagenních fibril v lamelách

Nucleus  
pulposus  
-movements



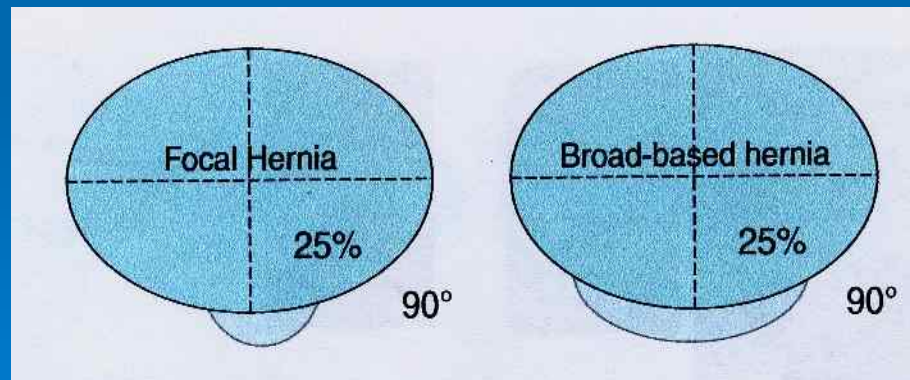
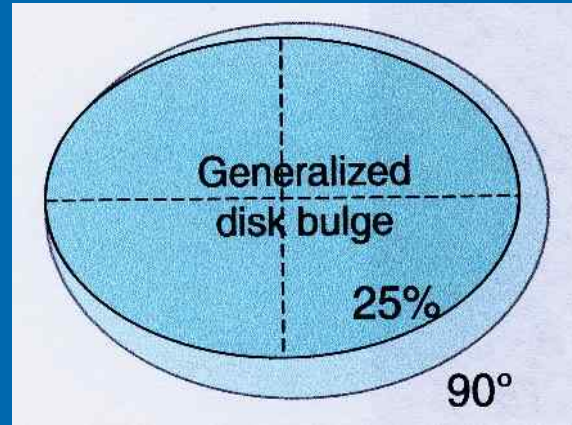
# Intervertebral disc

- **Annulus fibrosus**
  - Laminate structure- type I, II collagen fibers, 15 – 25 concentric layers
  - Interlaminar septae - proteoglycan aggregates
  - Inner AF – layers are more widely spaced, more collagen II, more hydrated, chondrocyte-like cells
  - Outer AF - layers adhere, fibres penetrate to the bone, more collagen I, fibroblast-like cells, less hydrated
  - Water, collagen, proteoglycans, elastin
- **Nucleus pulposus**
  - Highly hydrated aggrecan-containing gel
  - Chondrocyte-like cells, collagenous fibres



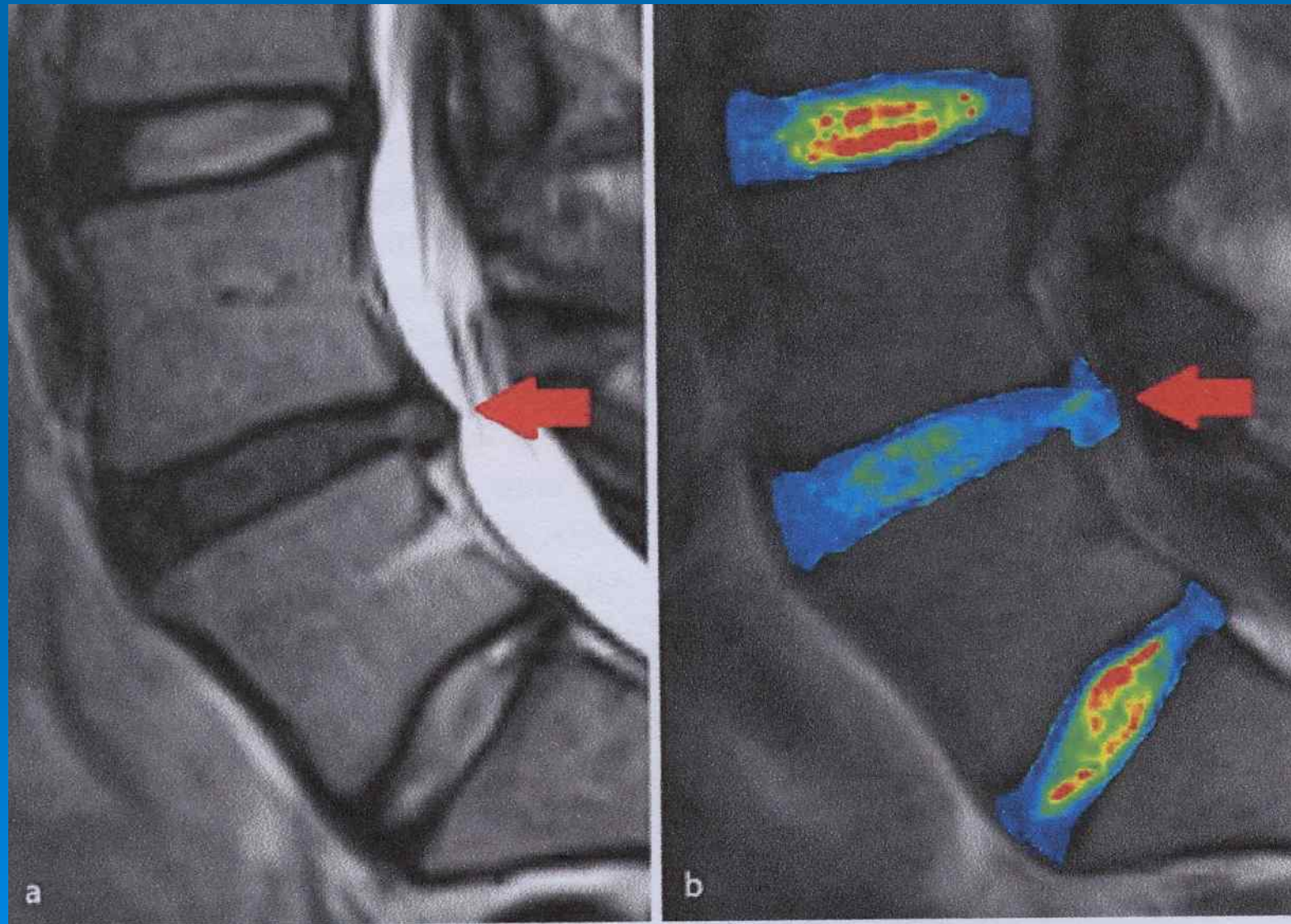


# Degenerative lesions of discs





MRI of intervertebral discs – level of hydration DW (D. Stelzeder et al. 2010)

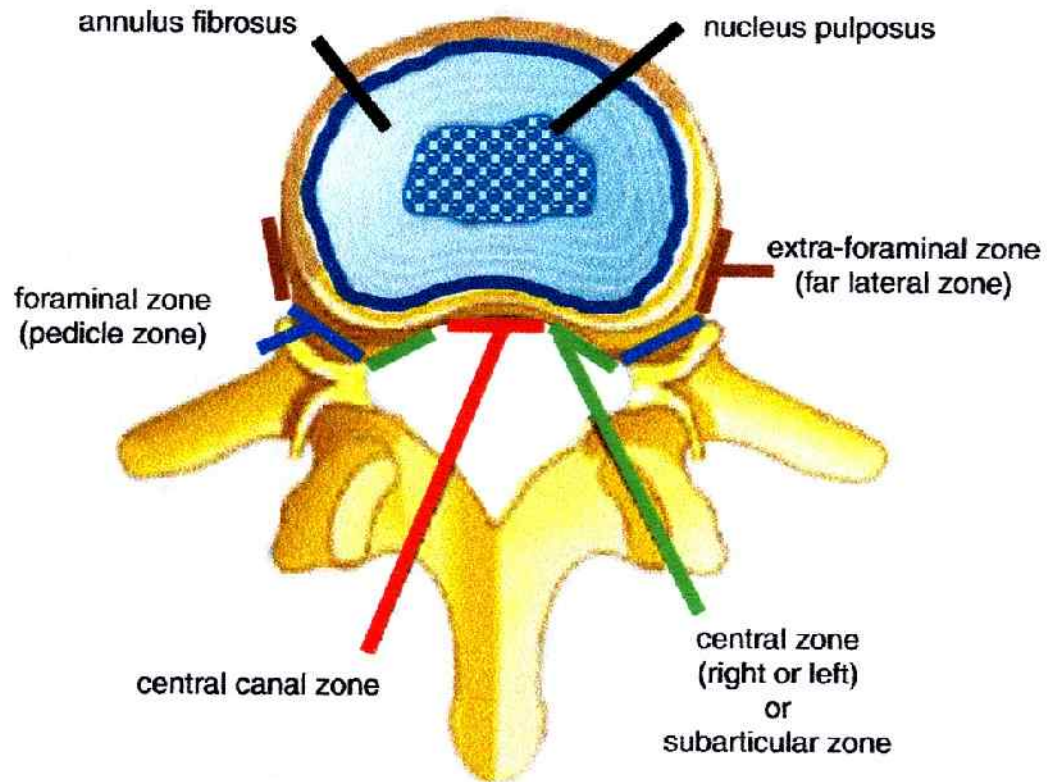


**TABLE 2.** Subcategories of degenerative/traumatic lesions

Annular tear/fissure

Herniation (extrusion/protrusion)

Degeneration (desiccation, spondylosis deformans,  
intervertebral osteochondrosis)



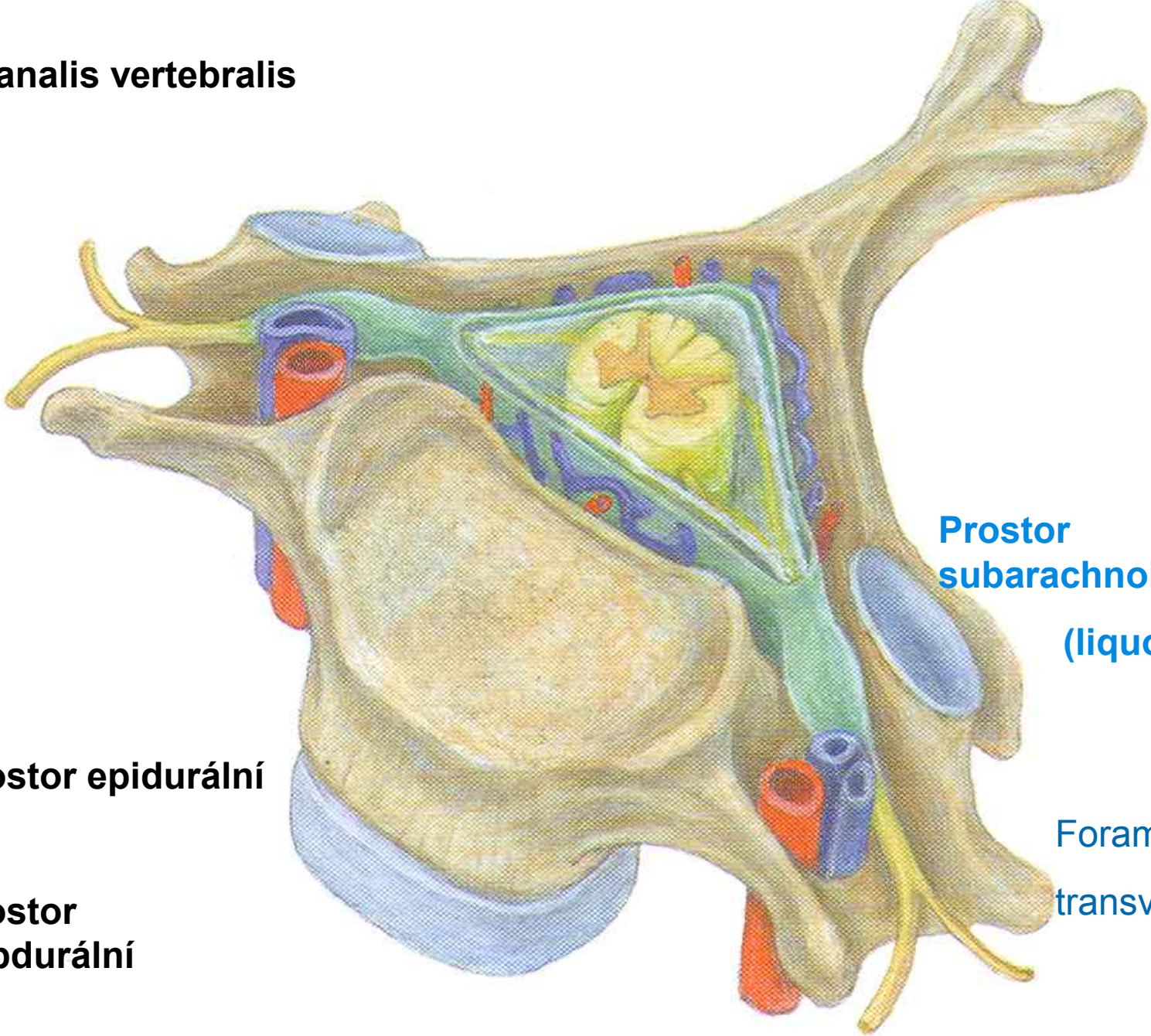
# Canalis vertebralis

Prostor subarachnoideální (liquor)

Prostor epidurální

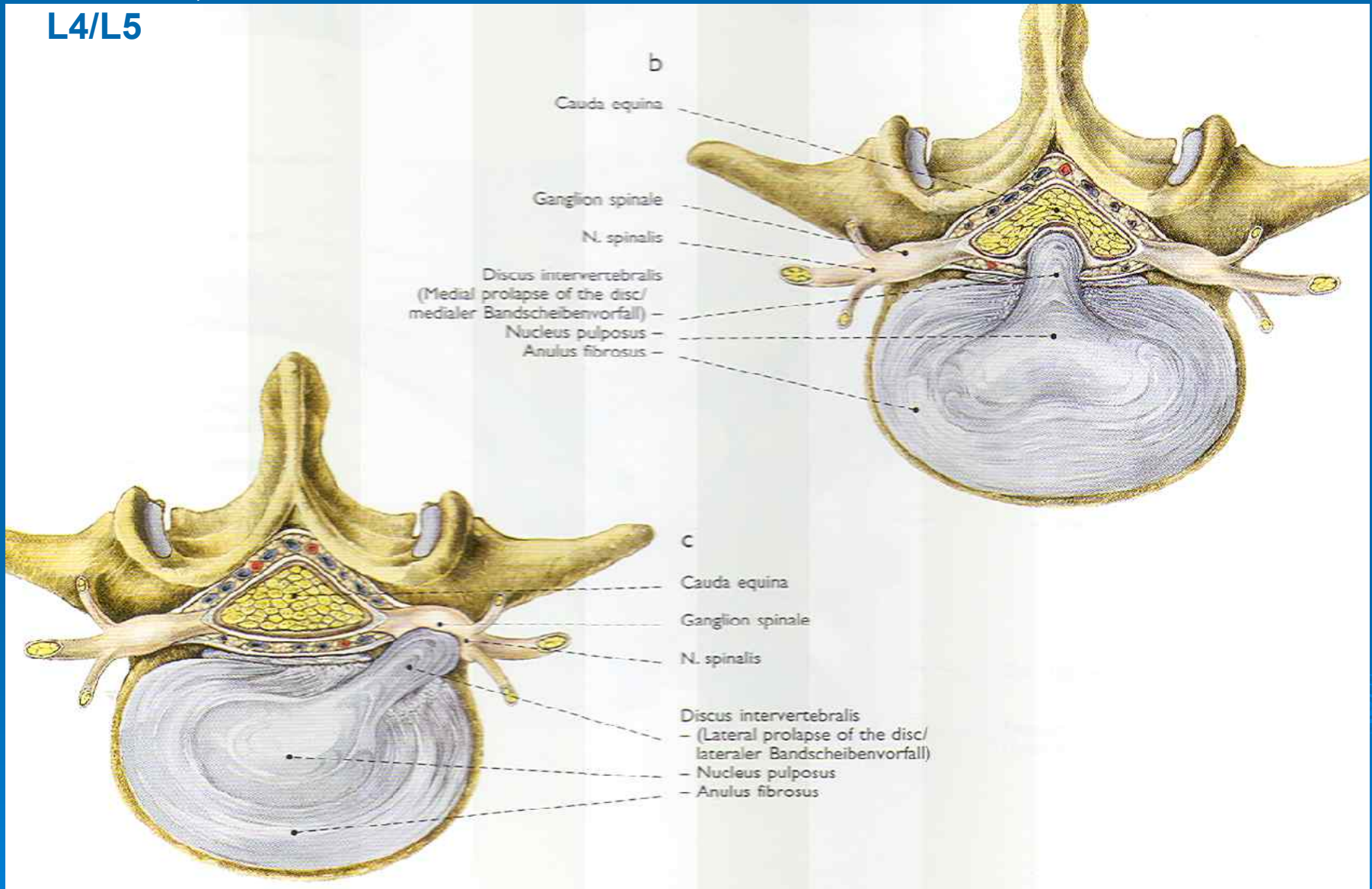
Foramen transversarium

Prostor subdurální



# Protruse intervertebrálního disku – mediální, laterální

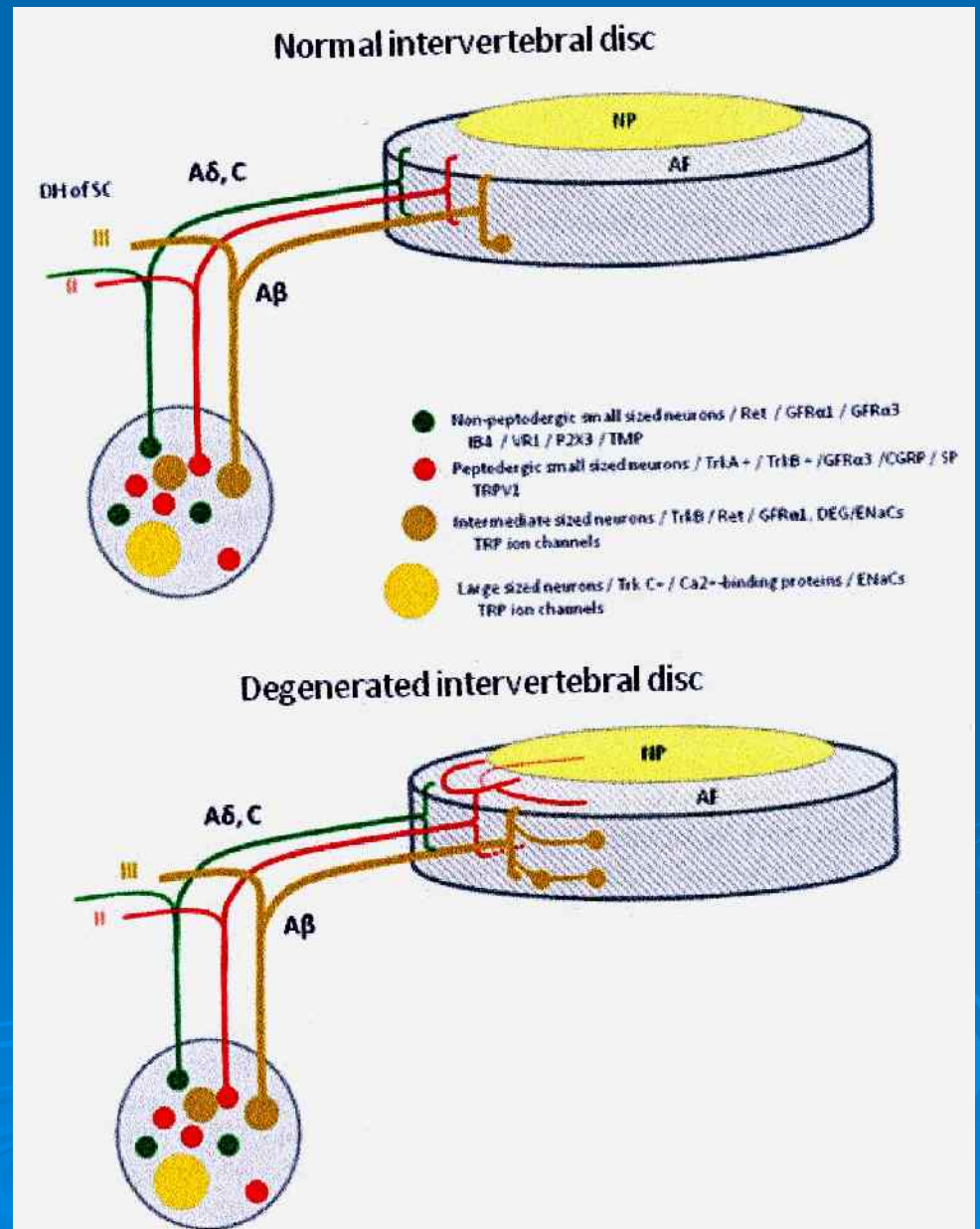
## L4/L5



Protruse laterální

Protruse mediální

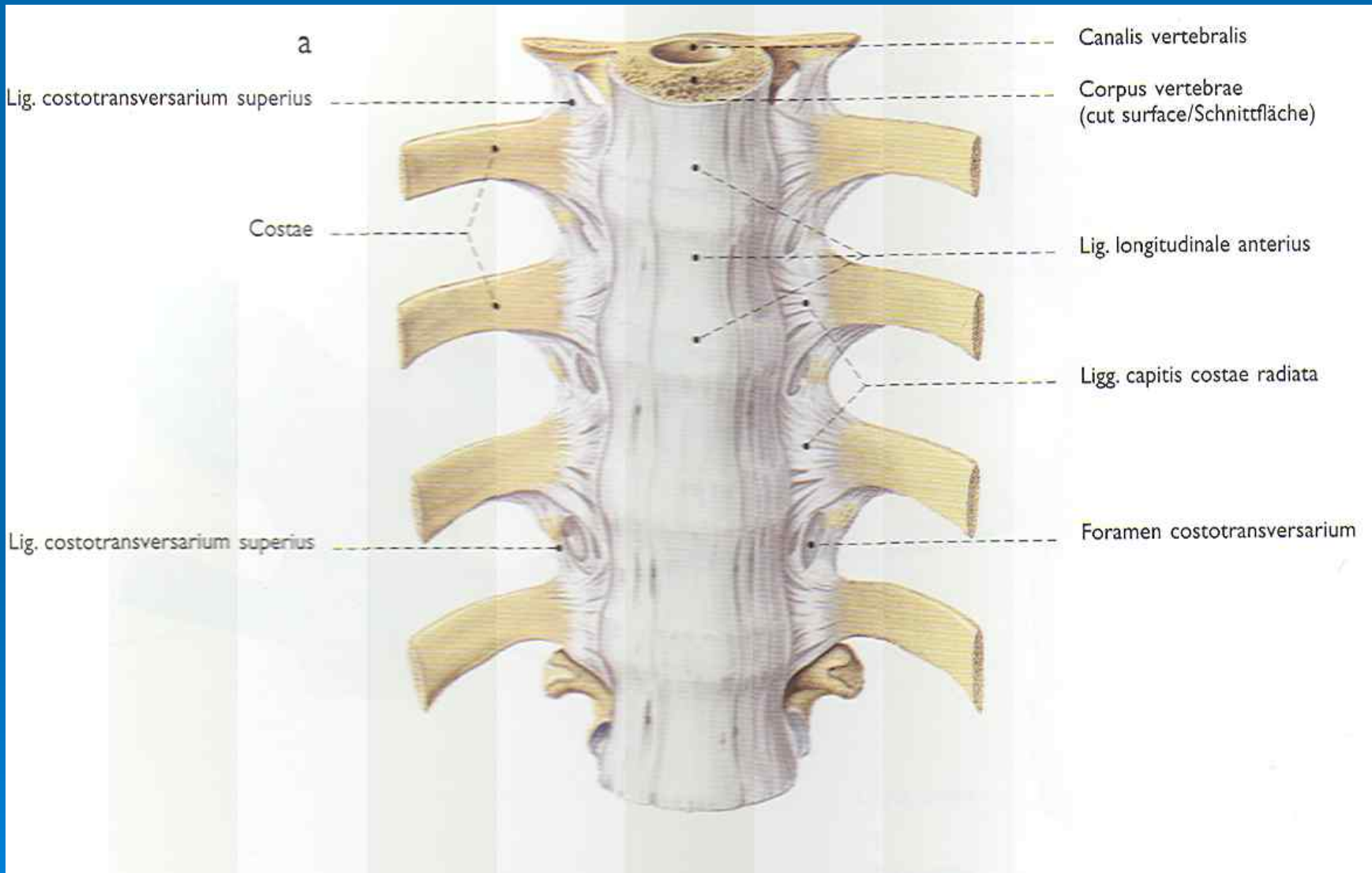
# Sensory innervation of intervertebral disc



## Intervertebrál discs

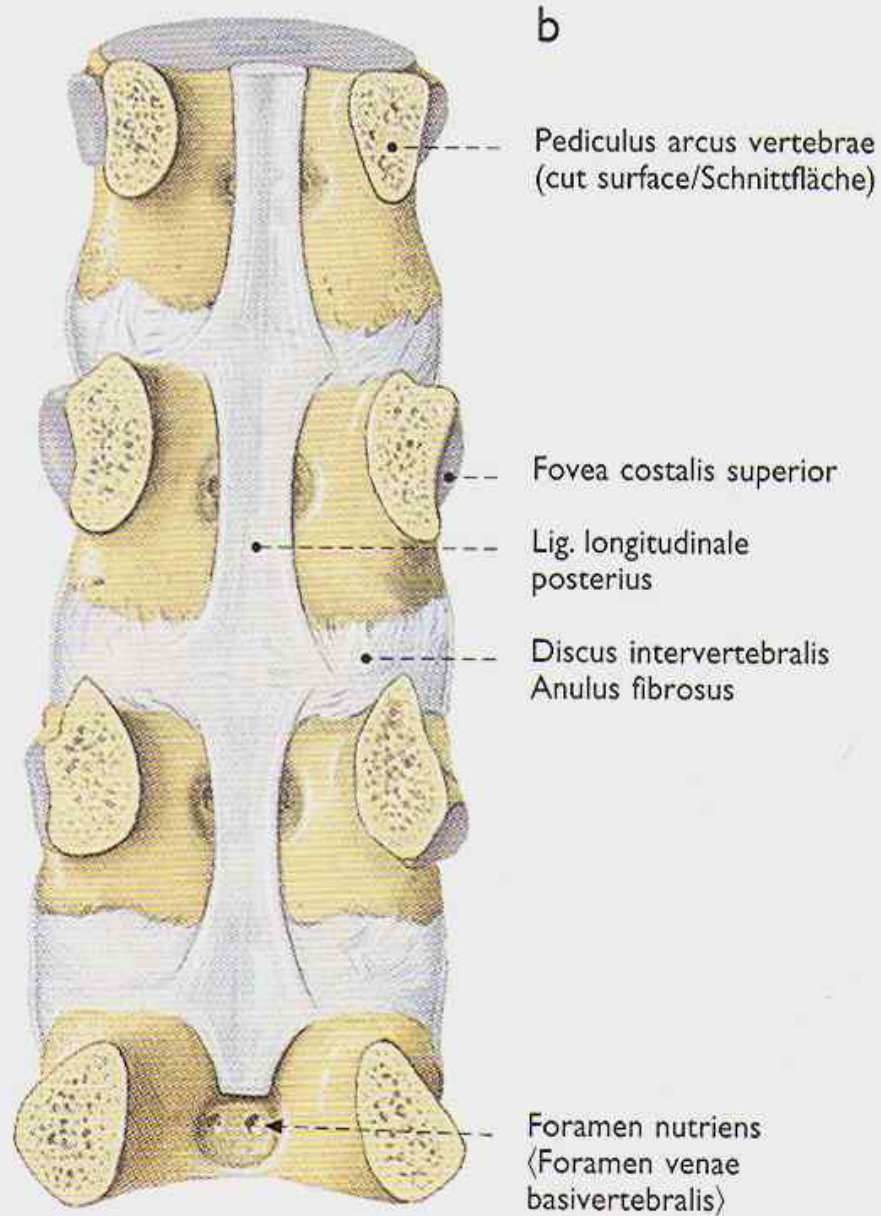
- Avascular, nerve supply at the periphery
- Anuli fibrosi – interconnect vertebral bodies, maintain the stability of vertebral column
- After second decade dehydration of the disc
- Decrease of vertical diameter of the vertebral column, kyphotic posture

# Ligamenta - dlouhá, krátká



Lig. longitudinale  
posterius

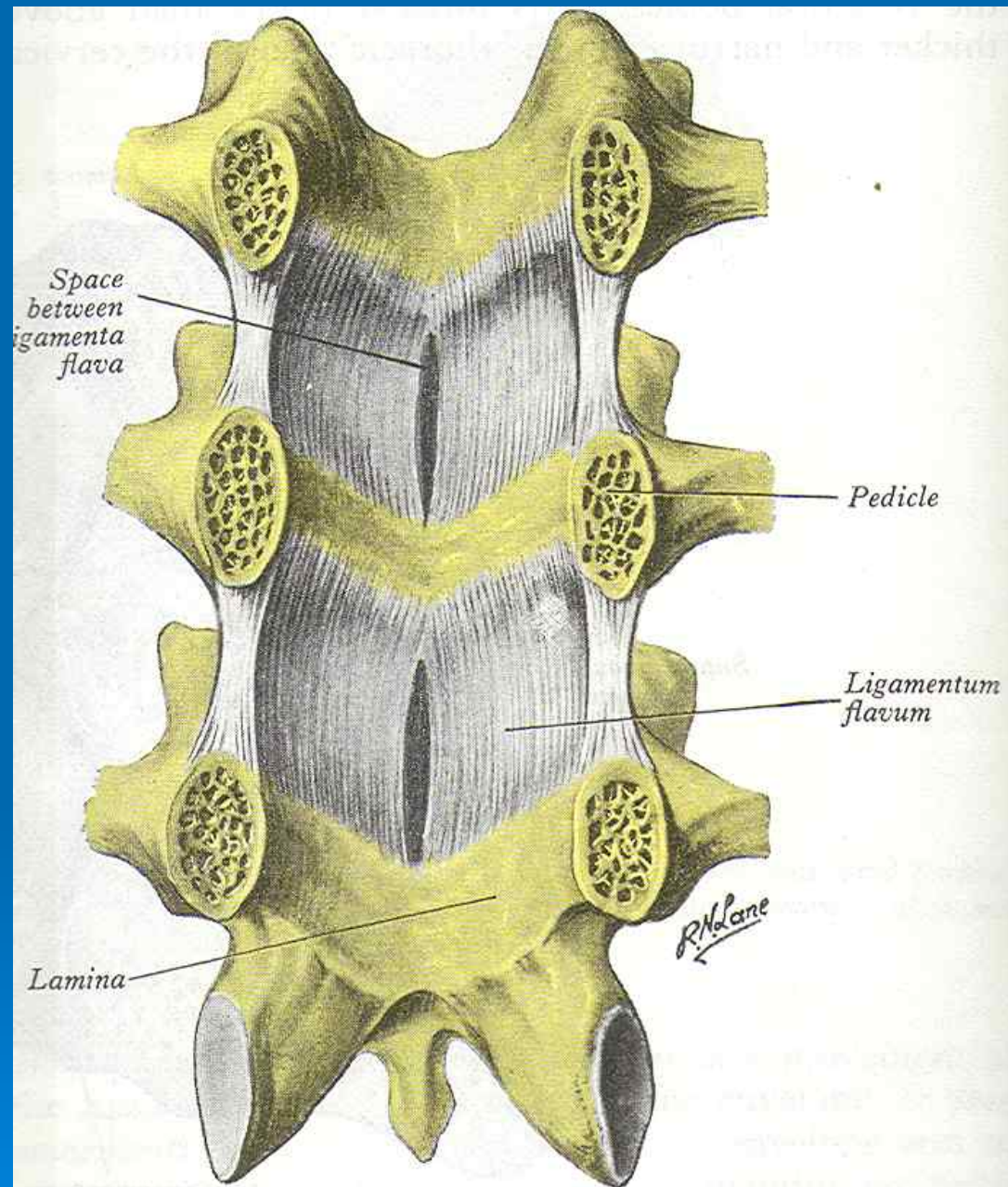
Rupture





Ligamenta  
interarcualia  
s. ligg. Flava

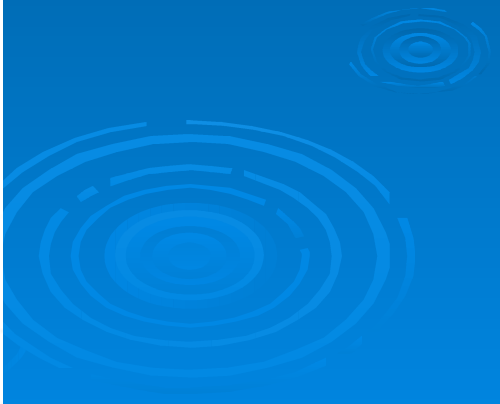
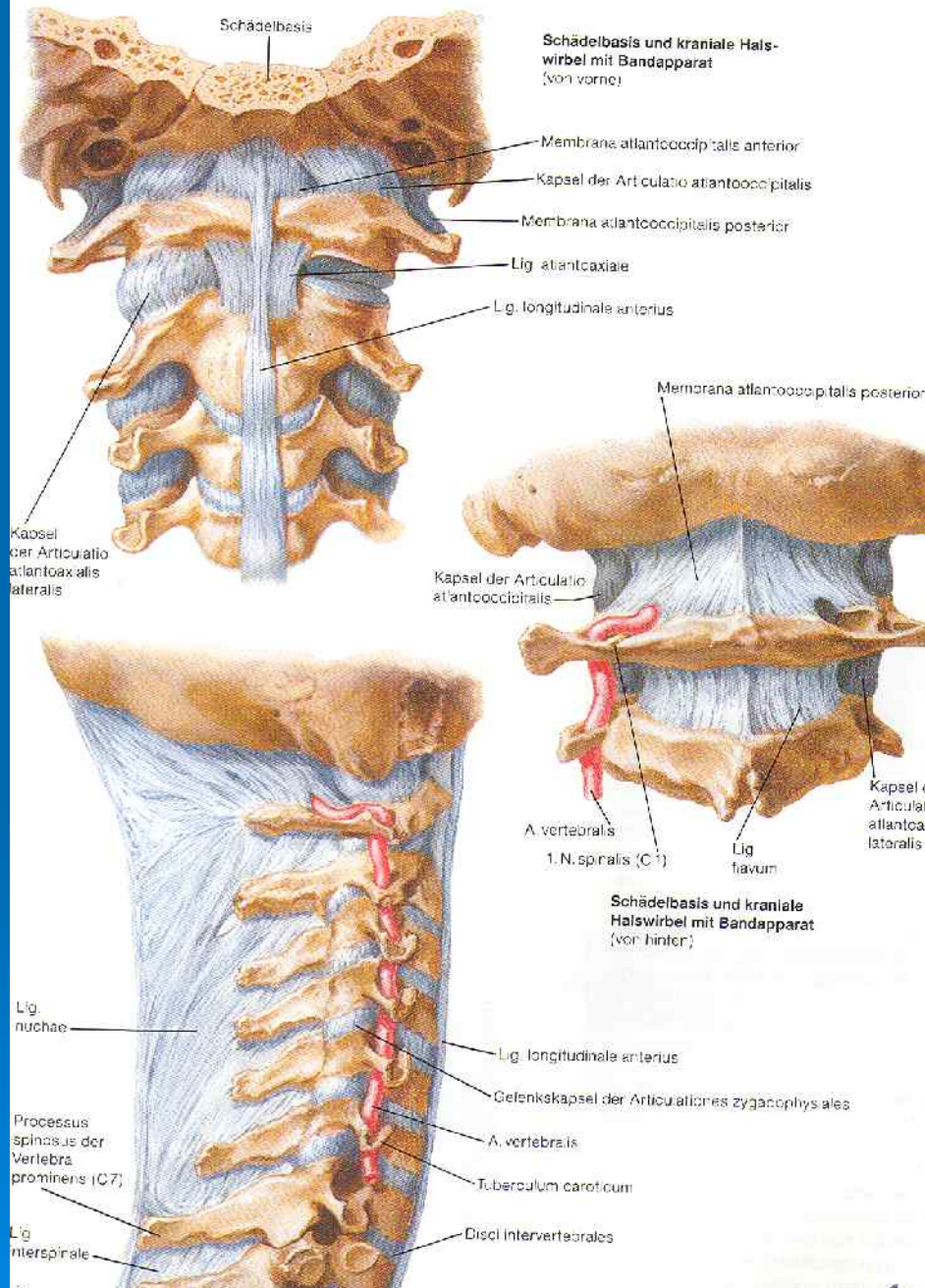
Hypertrophy



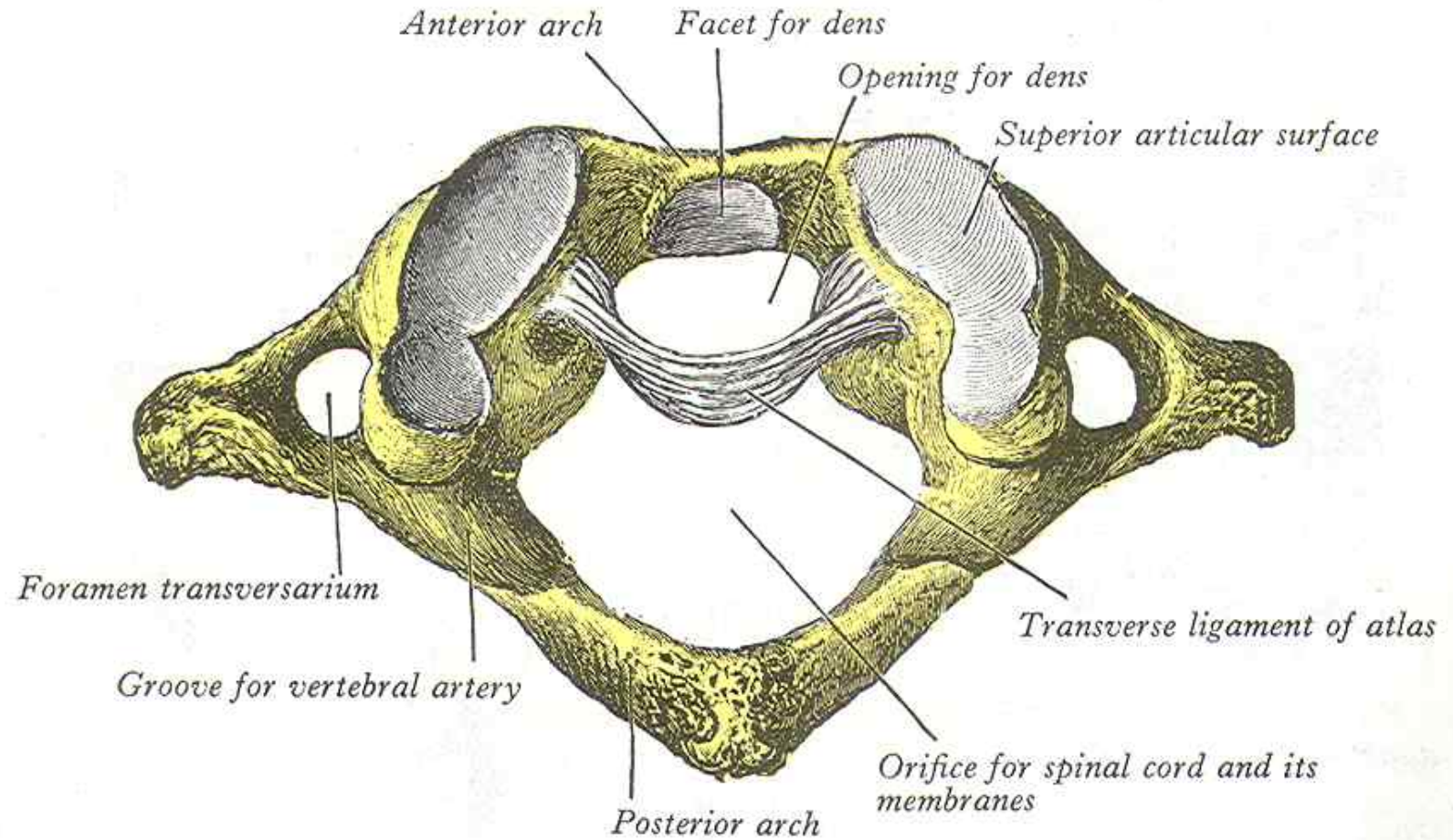
4.25 The ligamenta flava of the lumbar region. Anterior aspect.

# Äußerer kraniozervikaler Bandapparat

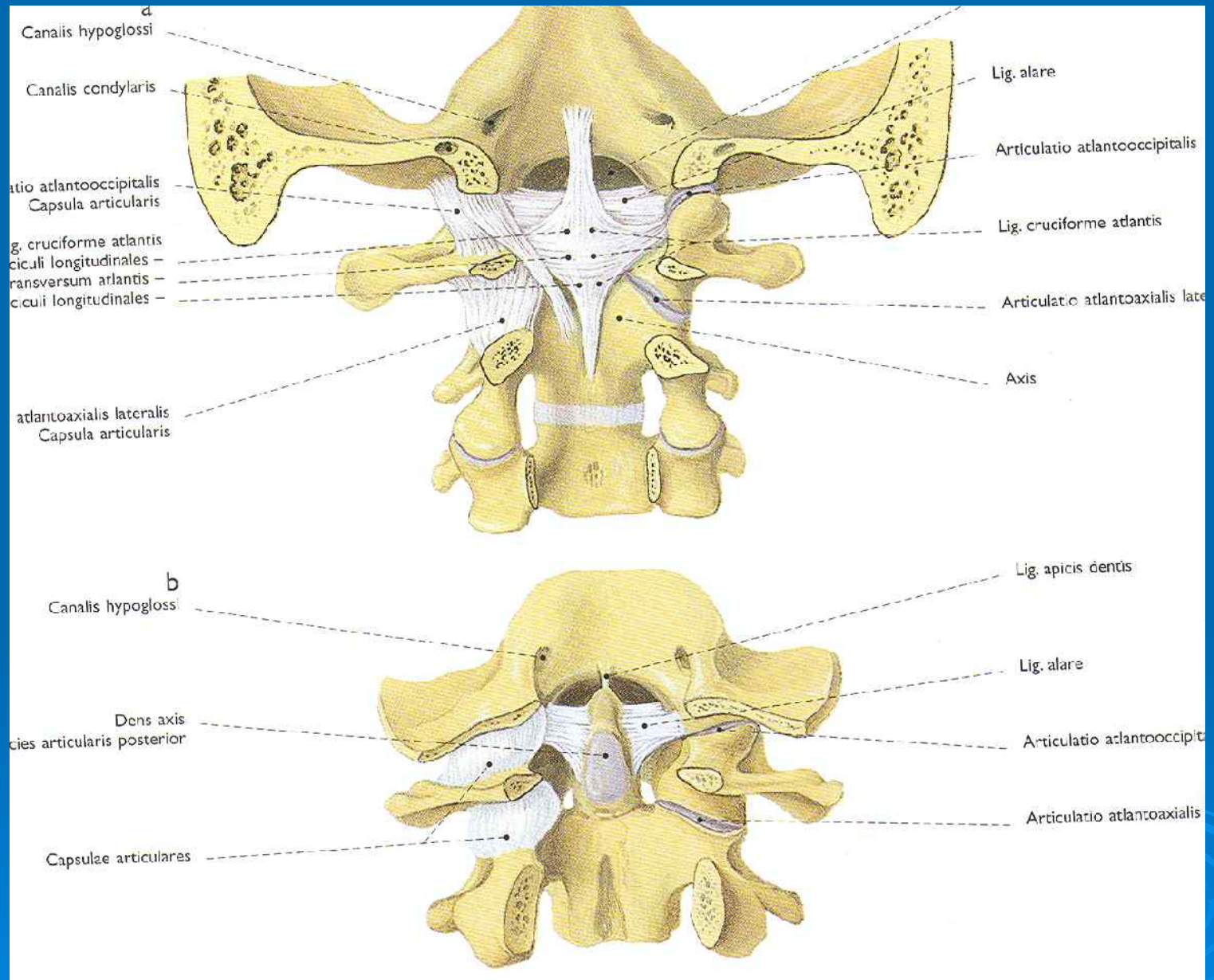
Cervical segment and Vertebral artery for transversaria (C6)

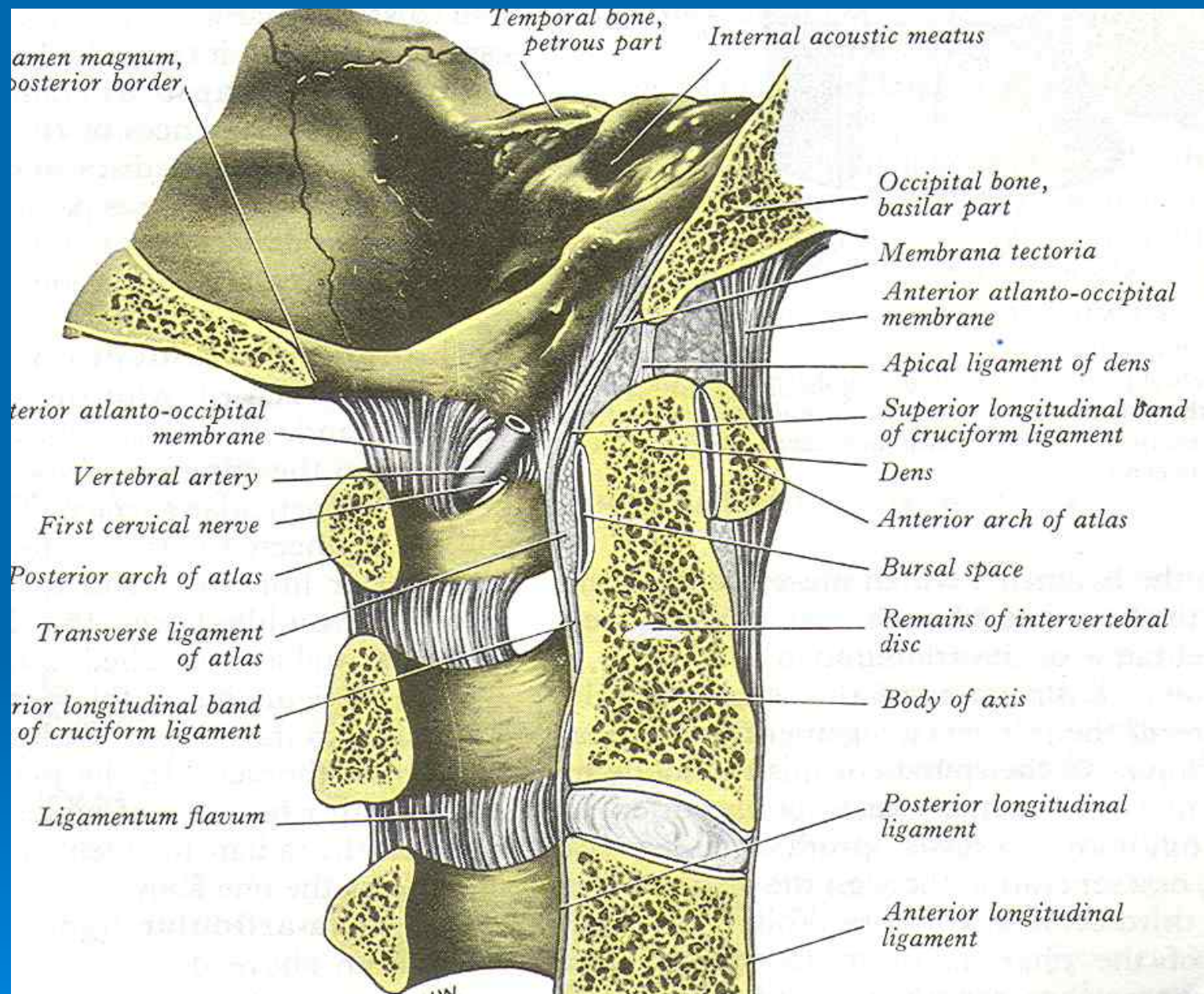


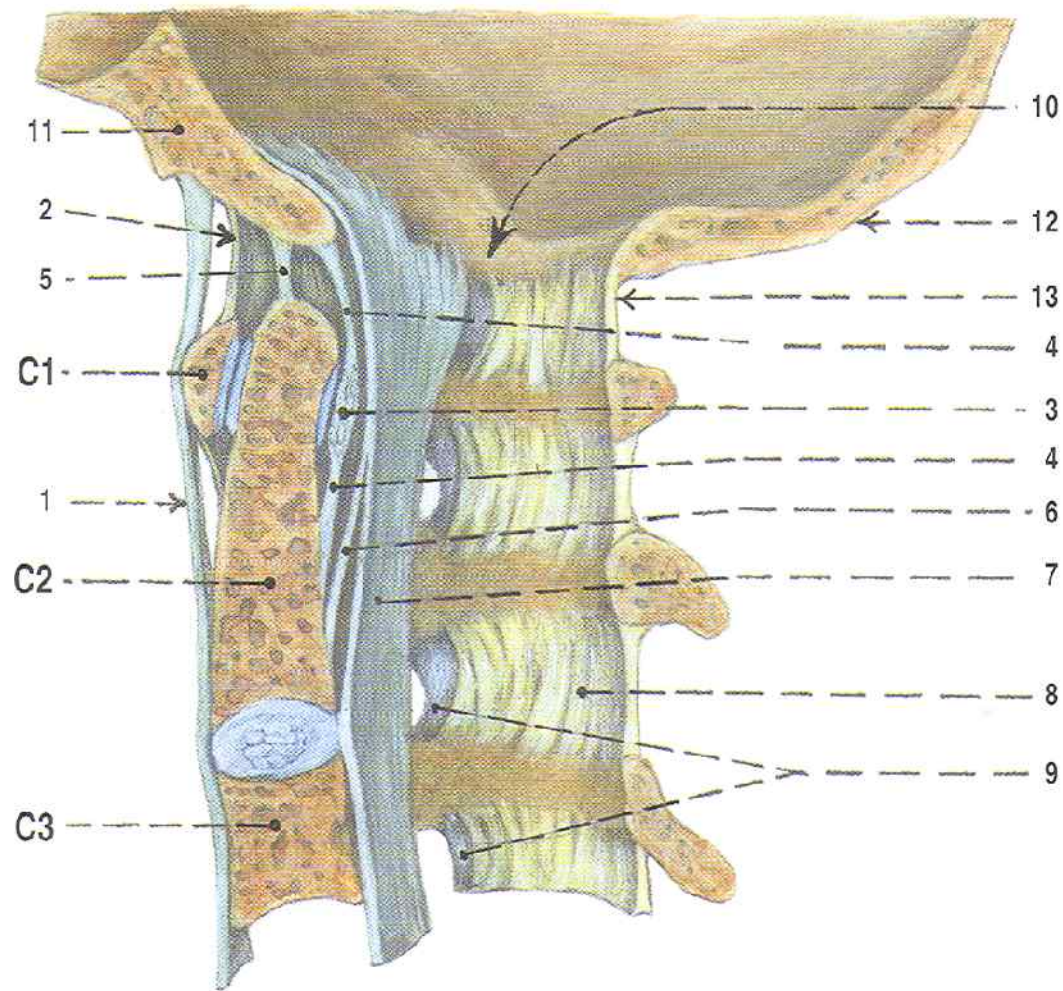
# Atlantooccipitální articulation



# Ligaments of atlantooccipital and atlantoaxial articulation







Obř. 140. PODĚLNÝ ŘEZ KRANIOVERTEBRÁLNÍM SPOJENÍM

až po obratel C3; pohled zleva

- 1 ligamentum longitudinale anterius
- 2 membrana atlantooccipitalis anterior
- 3 ligamentum transversum atlantis
- 4 podélné snopce ligamentum cruciforme
- 5 ligamentum apicis dentis
- 6 membrana tectoria

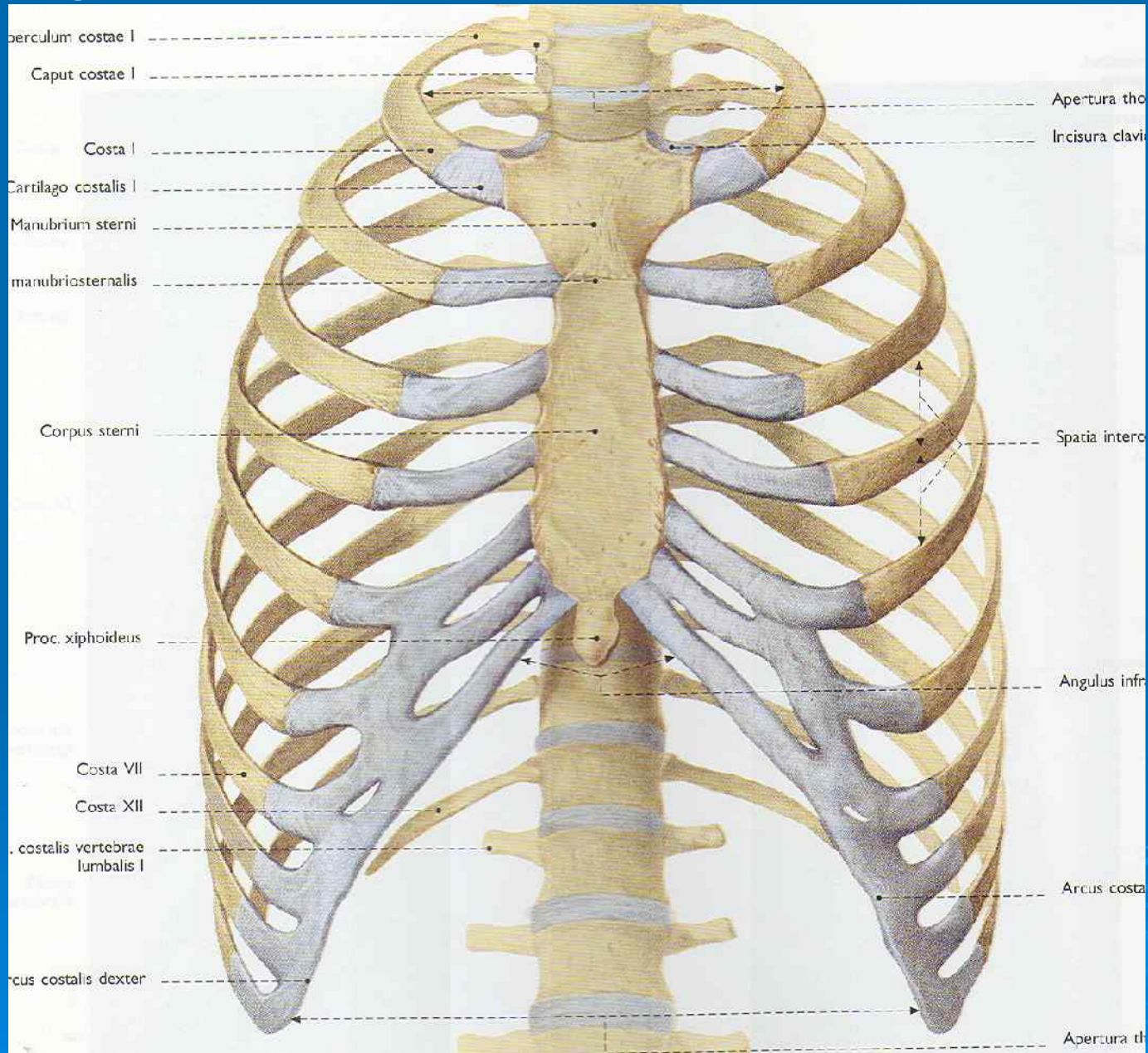
- 7 ligmentum longitudinale posterius
- 8 ligamenta interarcualia
- 9 pouzdra meziobratlových kloubů
- 10 okraj foramen magnum
- 11 tělo kosti týlní
- 12 šupina kosti týlní
- 13 membrana atlantooccipitalis posterior

COSTAE et STERNUM

RIBS and STERNUM

A decorative graphic consisting of several sets of concentric circles in a lighter shade of blue, located in the bottom right corner of the slide.

# Costa, cartilago costalis



Costae verae  
1 -7 true ribs

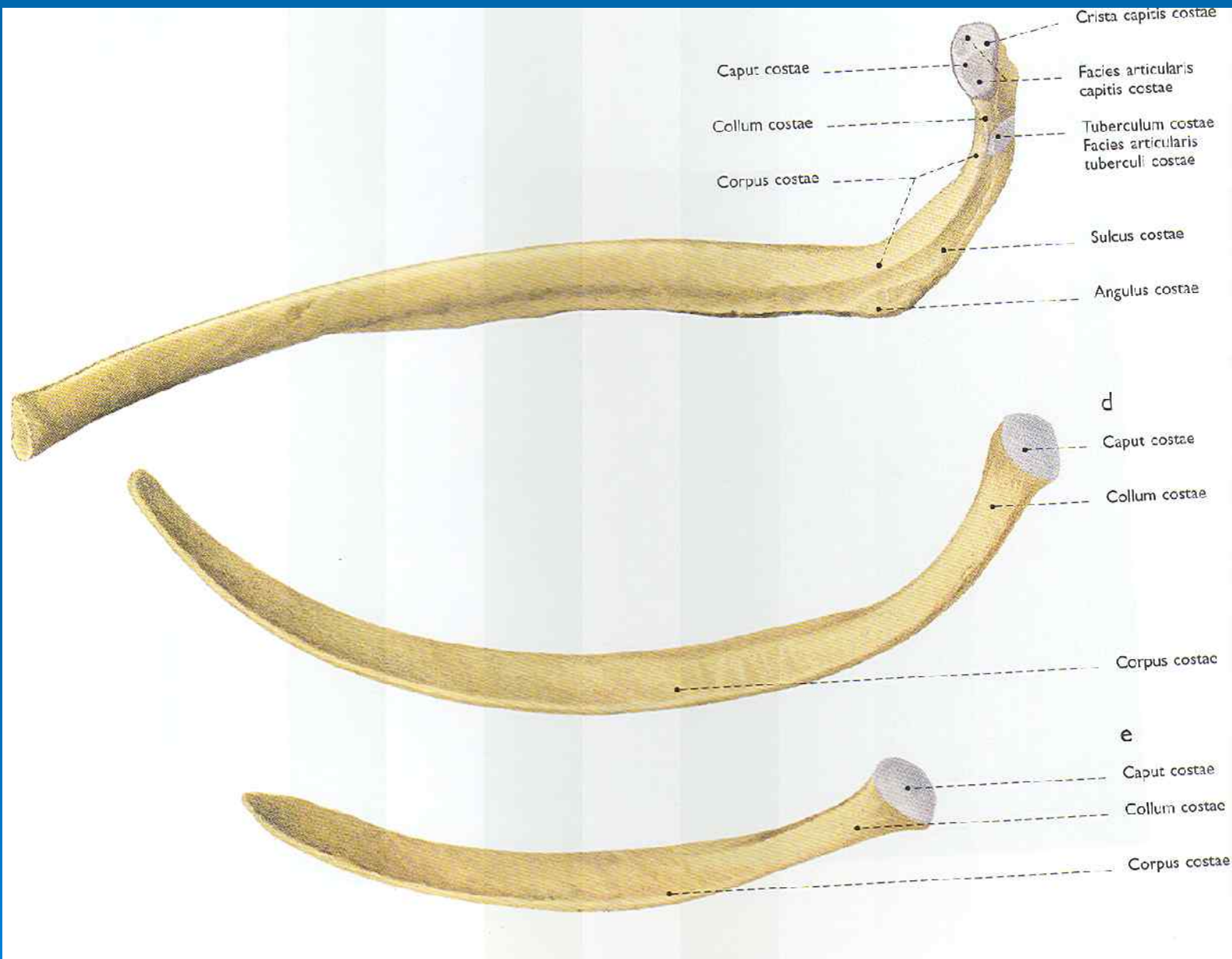
Costae spuriae 8 -10  
False ribs

False ribs

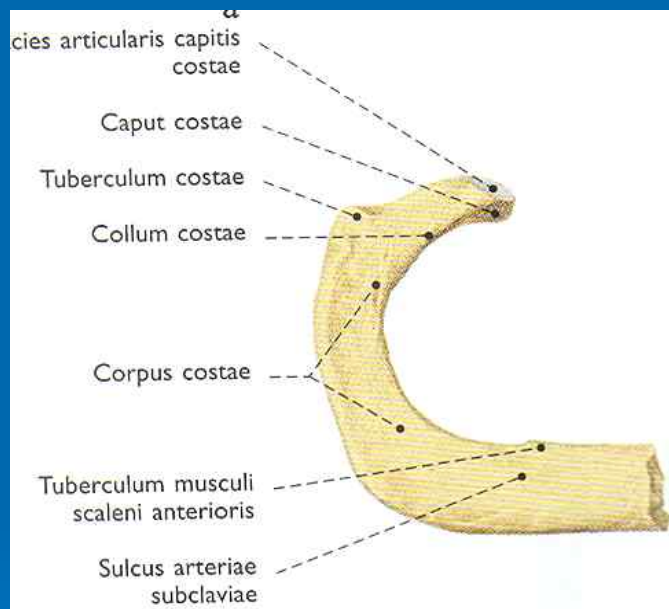
Costae fluctuantes  
Floating ribs

11 - 12

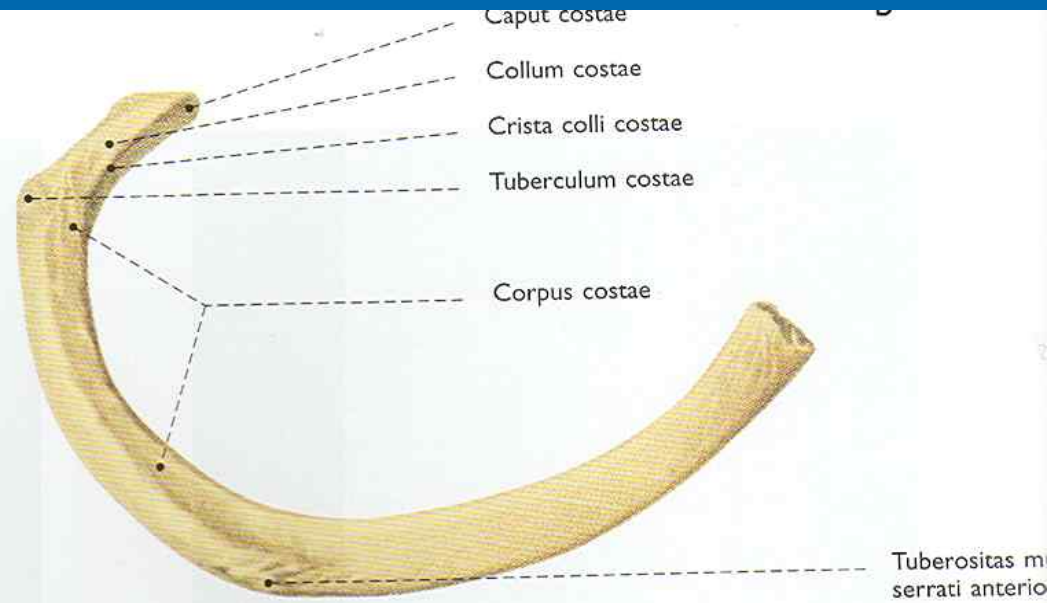


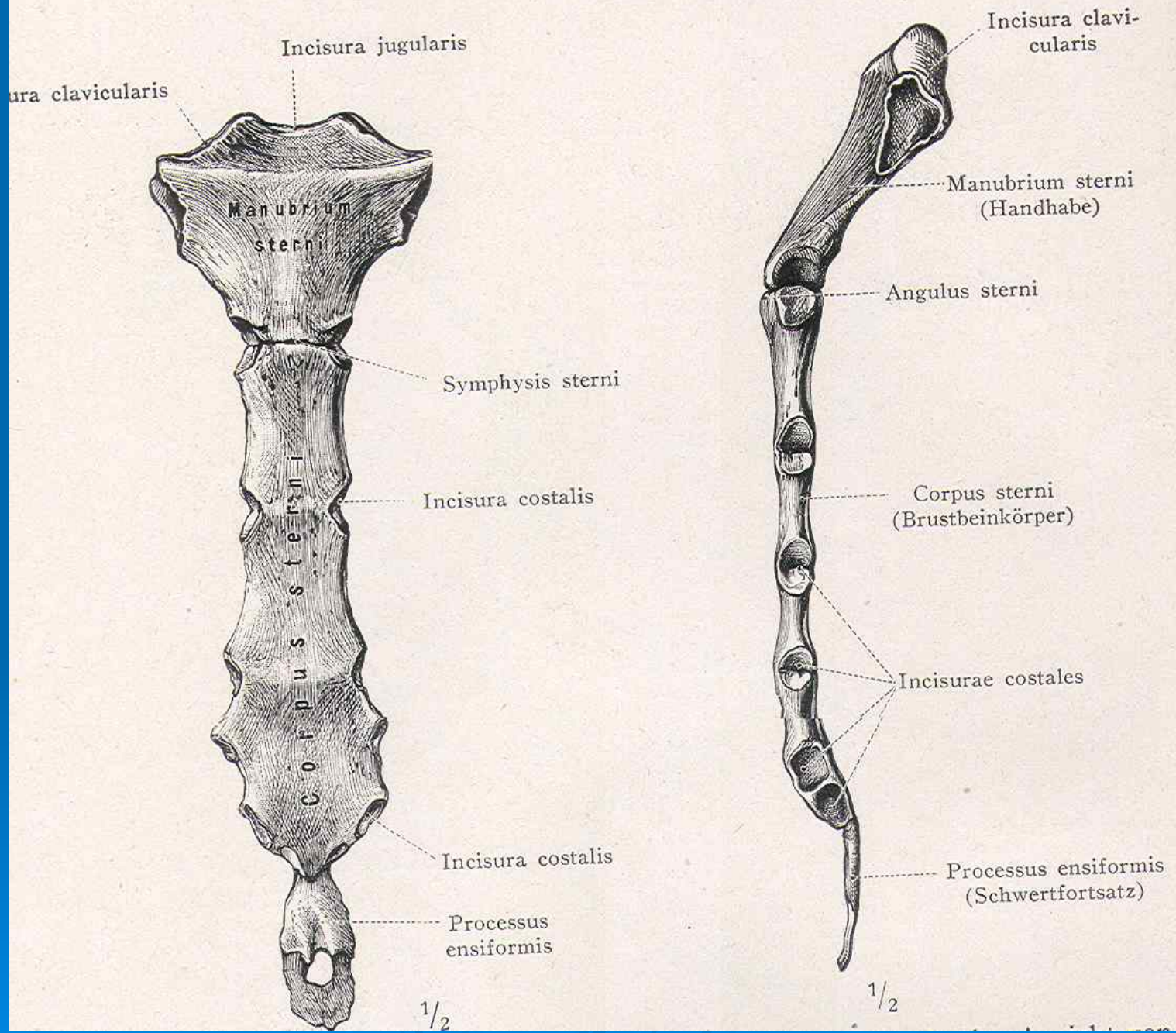


# Costa I



# Costa II

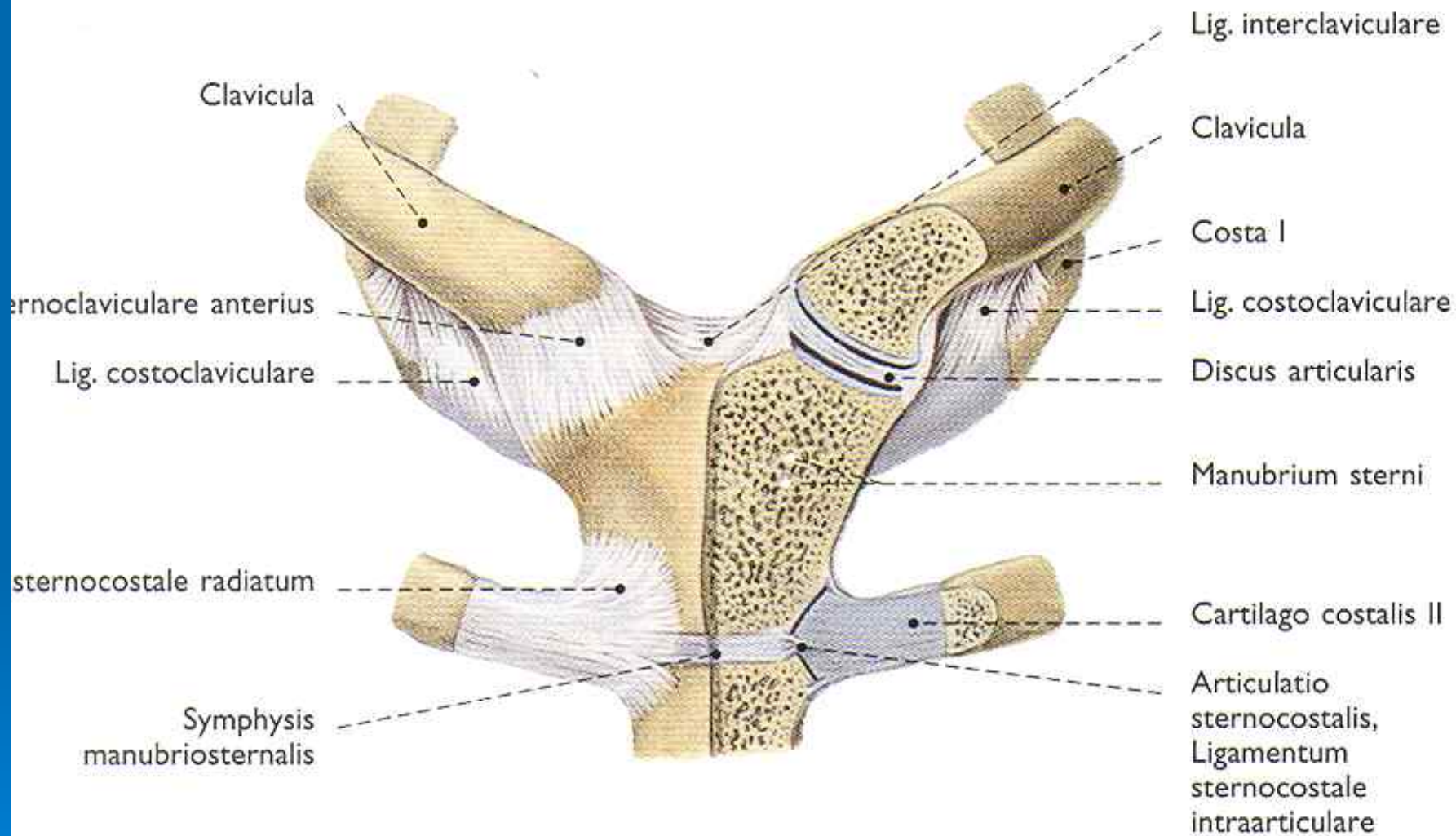




Juncturae thoracis

Joints of the thorax

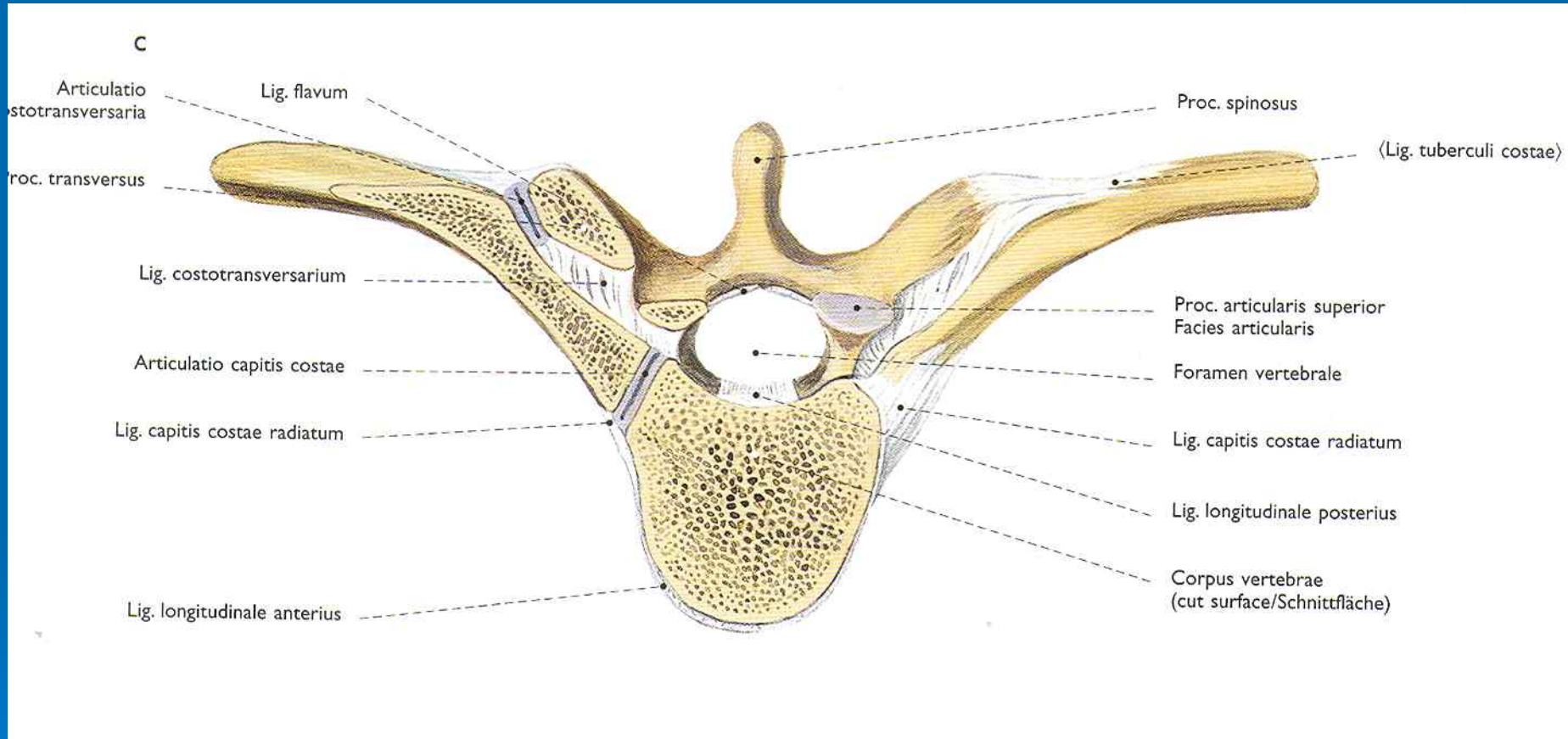




# Articulatio capitis costae

# Articulatio costotransversaria

# Articulationes costovertebrales





# Articulationes sternocostales

- Articulation of cartilage of 2. – 7. rib with sternal socket (incisura costalis). Capsules are short, ligg. sternocostalia radiata

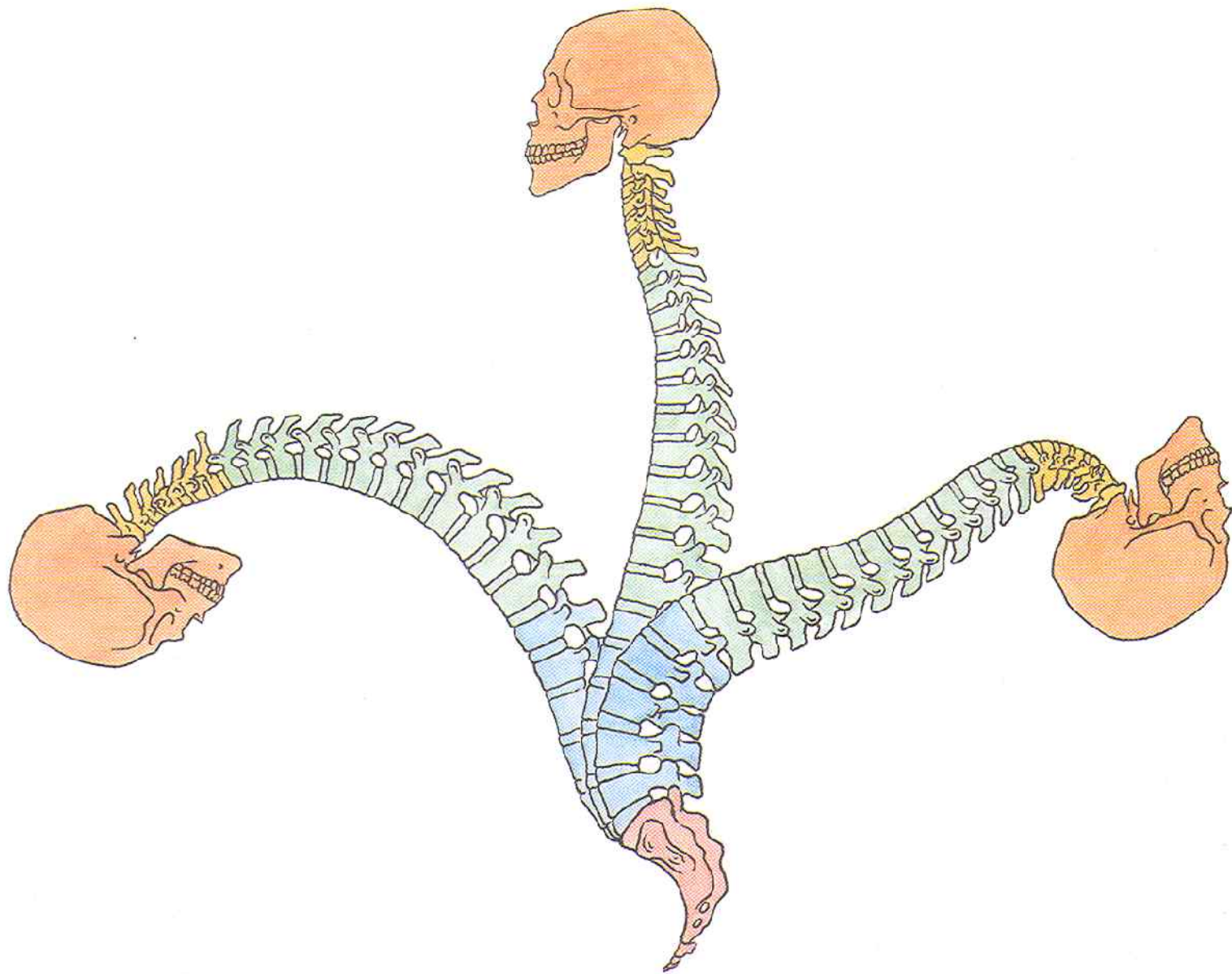
# Articulationes interchondrales

mutual connexion cartilages of 6. – 9. ribs



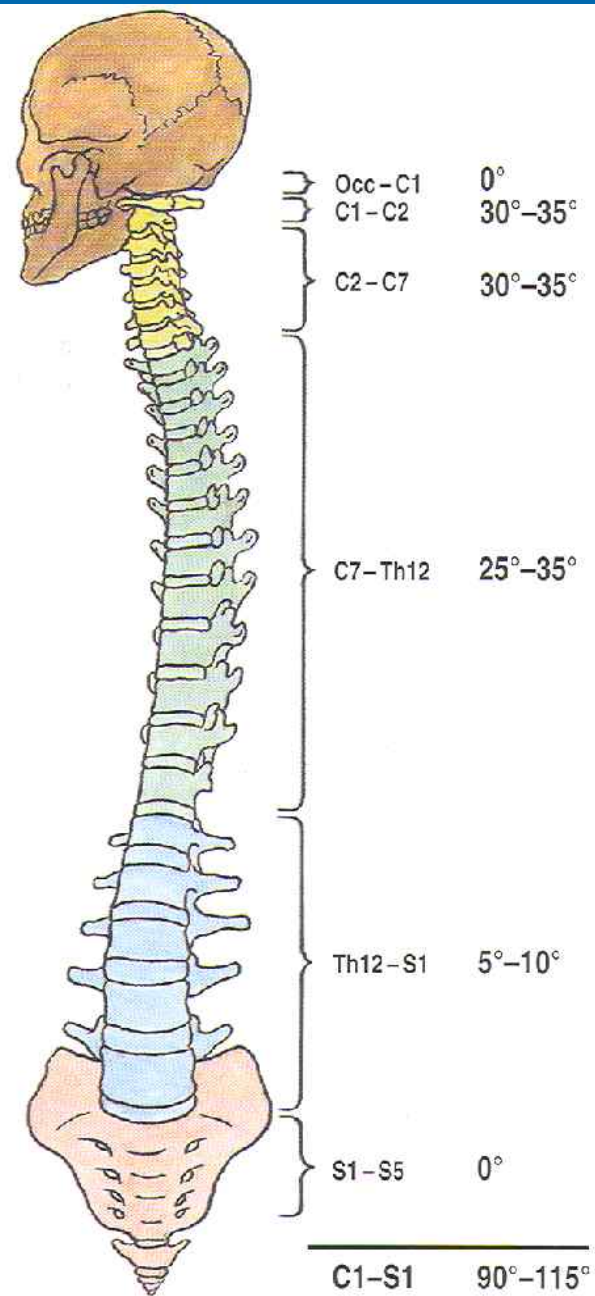
# Movements of vertebral column

- Ventral flexion – cervical segment, lumbal segment
- Lateroflexion – cervical and lumbal cca 30°
- Rotations – cervical segment cca 60 - 70° (30 ° between atlas and axis, thoracic segment 25° - 30°, lumbal segment cca 5° )



Obr. 144. PŘEDKLONY A ZÁKLONY PÁTEŘE; schematické znázornění maximálních možností pohybů v jednotlivých úsecích páteře

# Rotační pohyby



Obr. 146. ROTACE PÁTEŘE; možnosti rotace v jednotlivých úsecích páteře a souhrnné rotace (k jedné straně)

