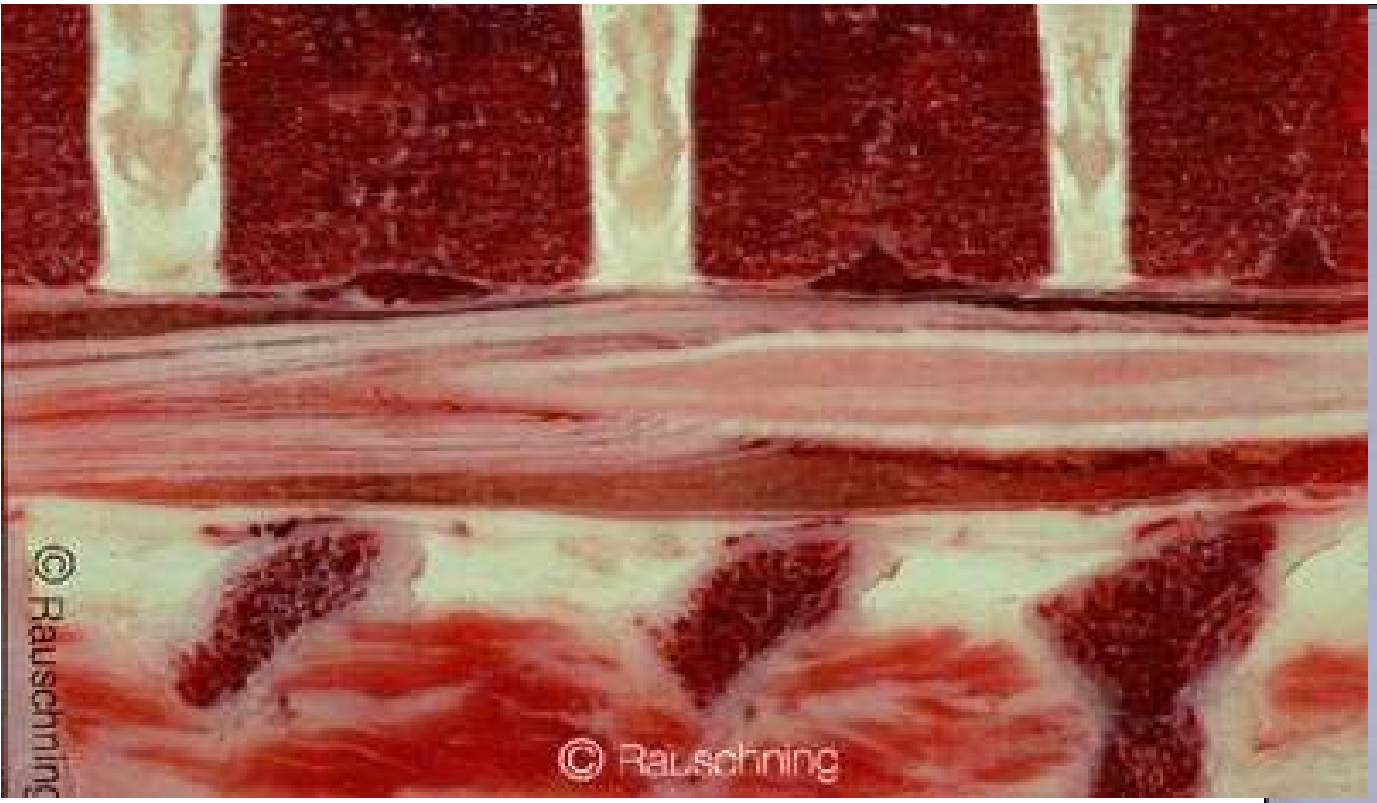
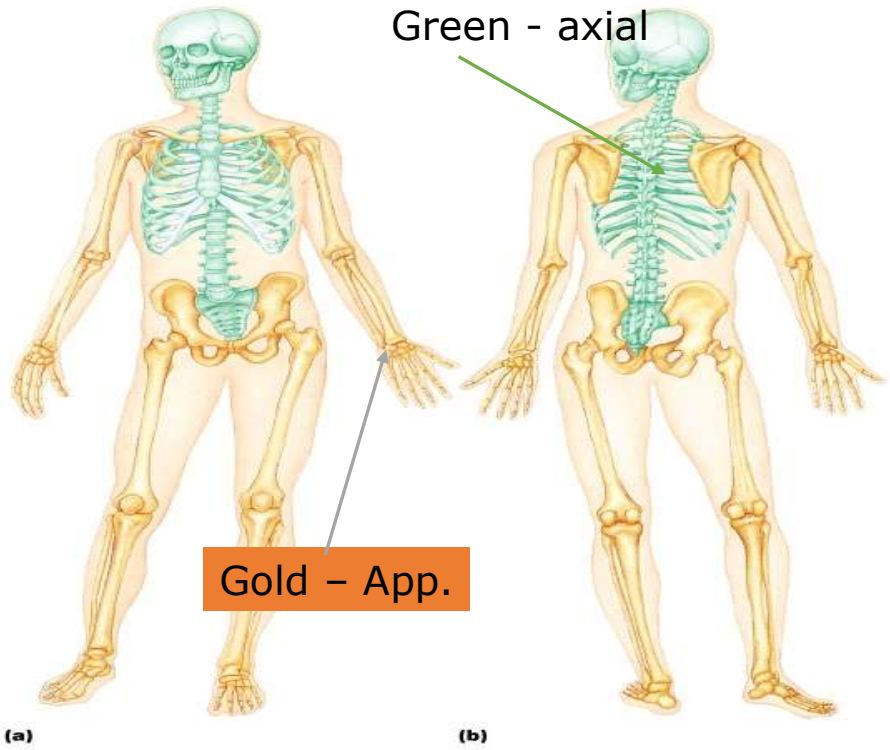


SPINE

D.Hammoudi, MD

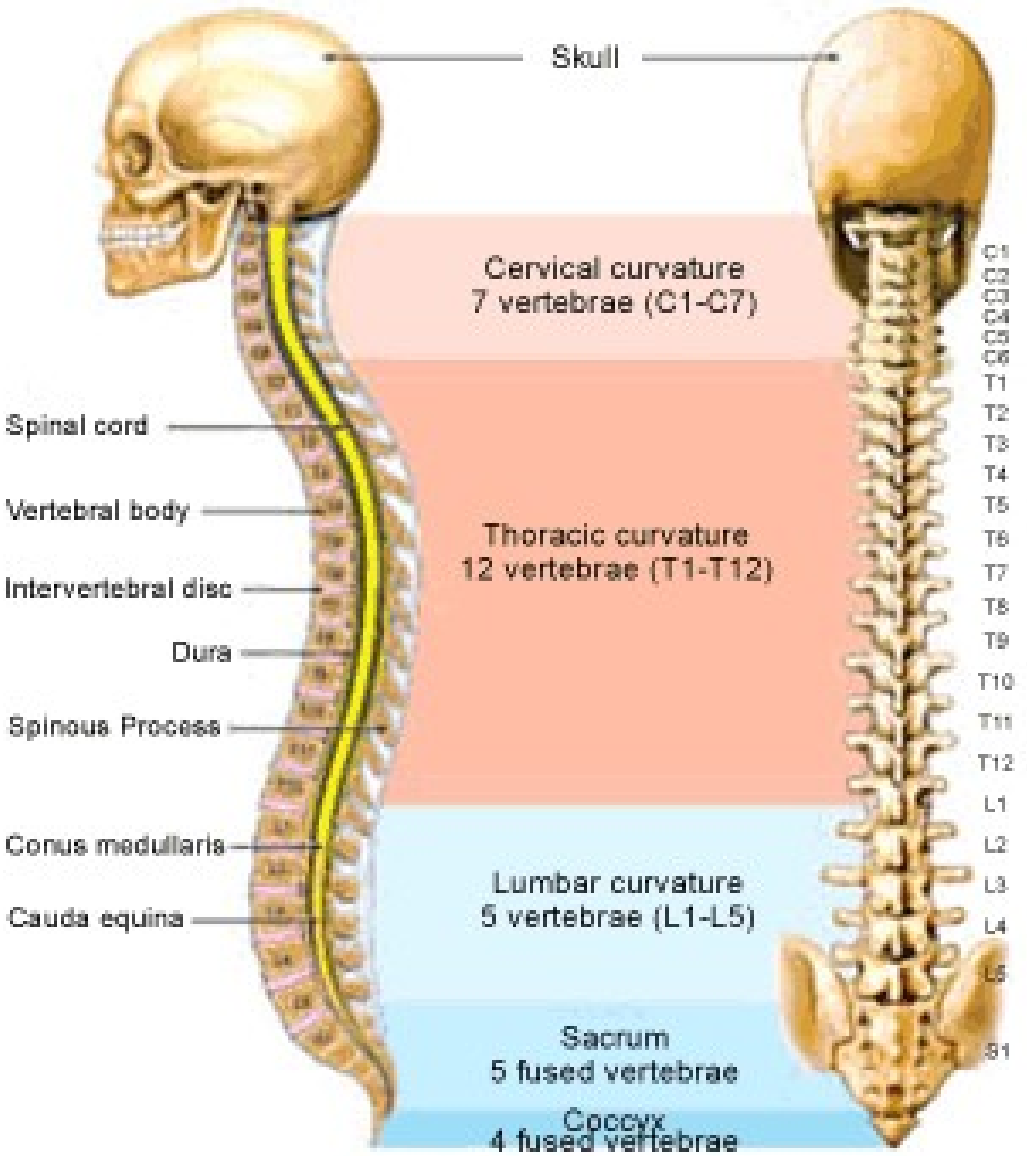
Axial v. Appendicular Skeleton



Copyright © 2005 Pearson Education, Inc., publishing as Benjamin Cummings.

- Axial Skeleton
  - Skull
  - Vertebral column
  - Thoracic cage
    - Ribs and sternum
- Appendicular Skeleton
  - Bones of the upper and lower limbs
  - Plus, pectoral and pelvic girdles


SKULL
LARYNGEAL SKELETON
VERTEBRAL COLUMN
THORACIC CAGE
AXIAL SKELETON
www.visiblebody.com



The spine, or vertebral column, is composed of 5 main segments:

- ***the cervical,***
- ***thoracic,***
- ***and lumbar curvatures,***
- ***the sacrum,***
- ***and the coccyx.***

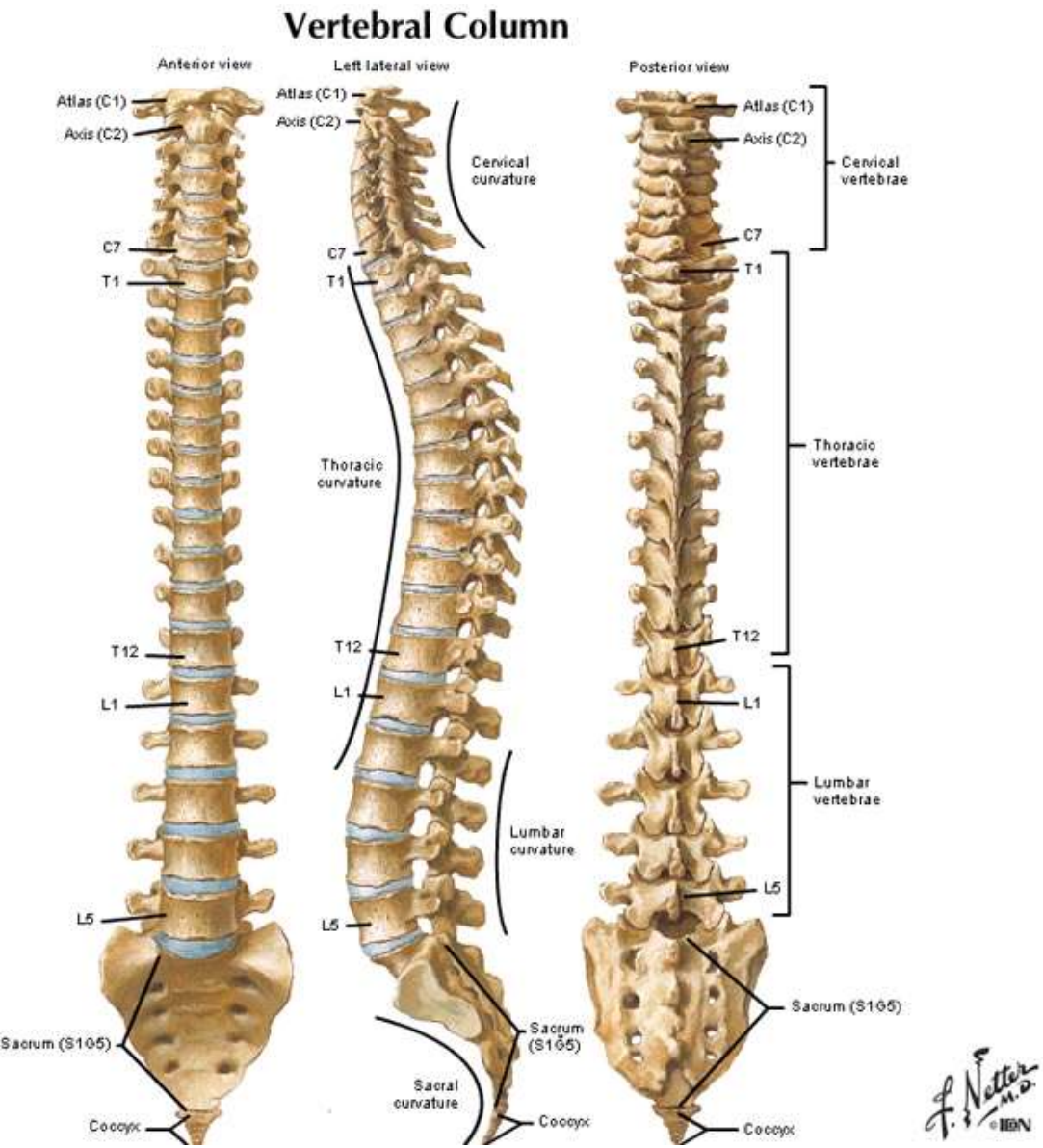
Each of these curvatures is composed of individual vertebrae, which provide structural support and protection for the spinal cord.

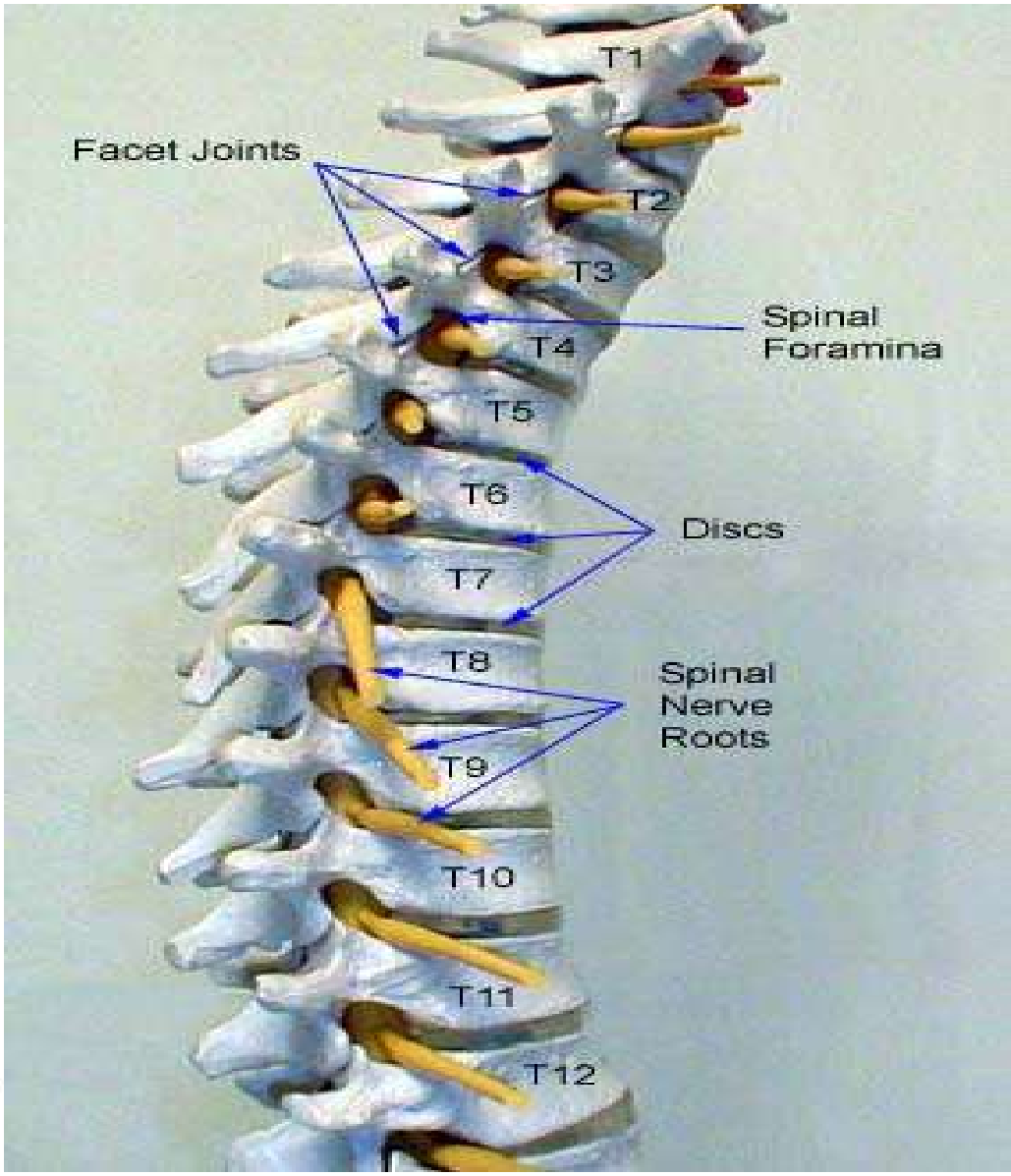
-There are ***24 movable*** vertebrae in the spine;

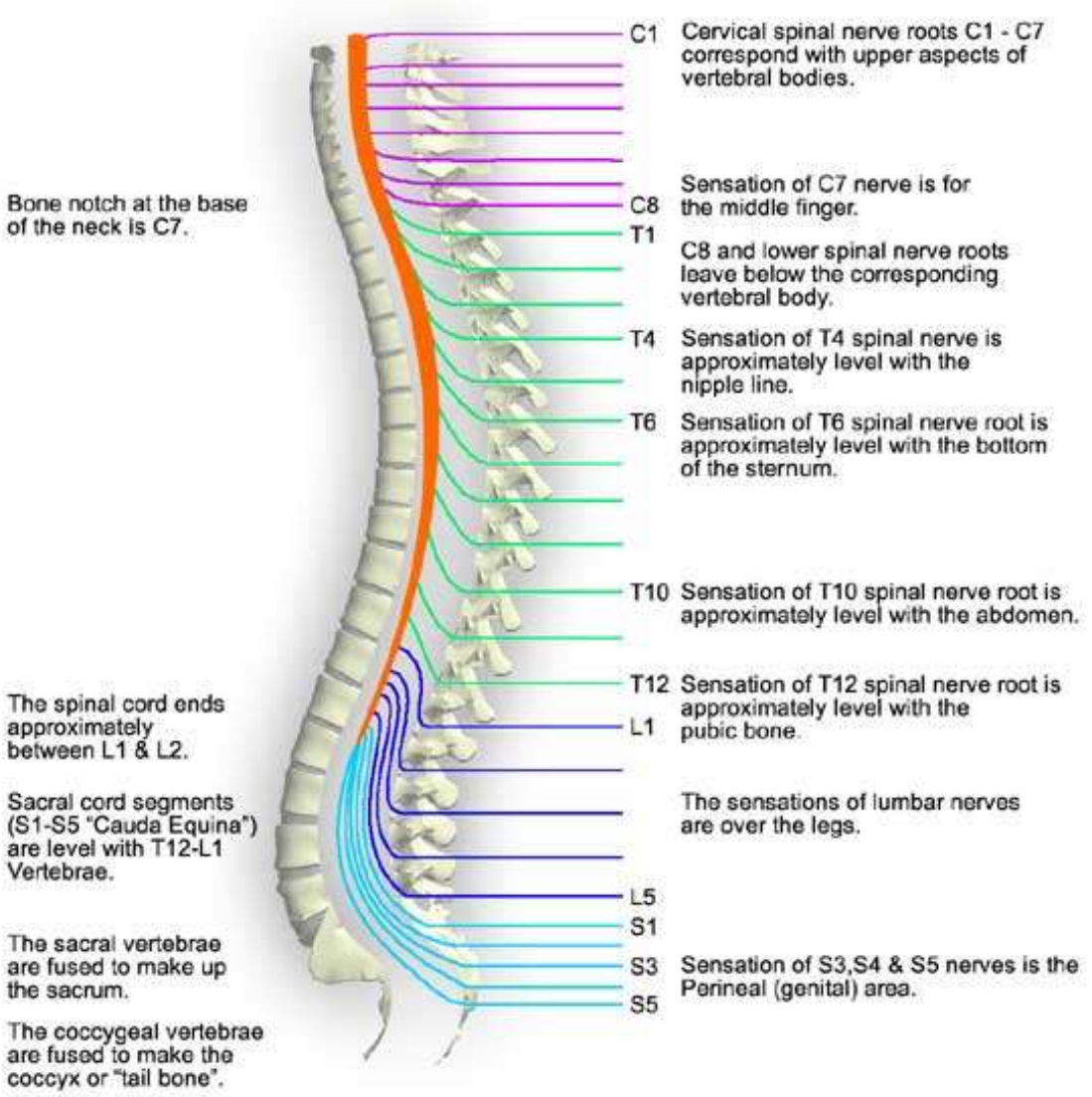
- **7 in the cervical curvature,**
- **12 in the thoracic curvature,**
- **5 in the lumbar curvature.**

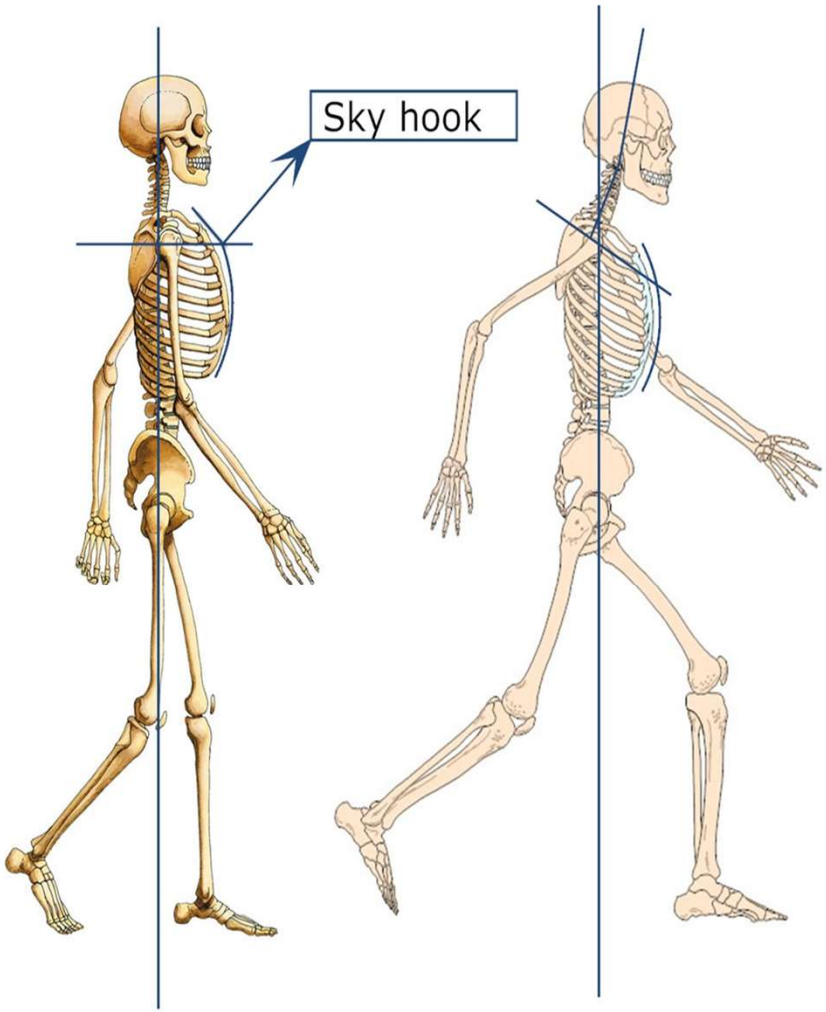
•Additionally, **the sacrum consists of 5 fused vertebrae**

•the **coccyx is composed of three to five fused vertebrae**.

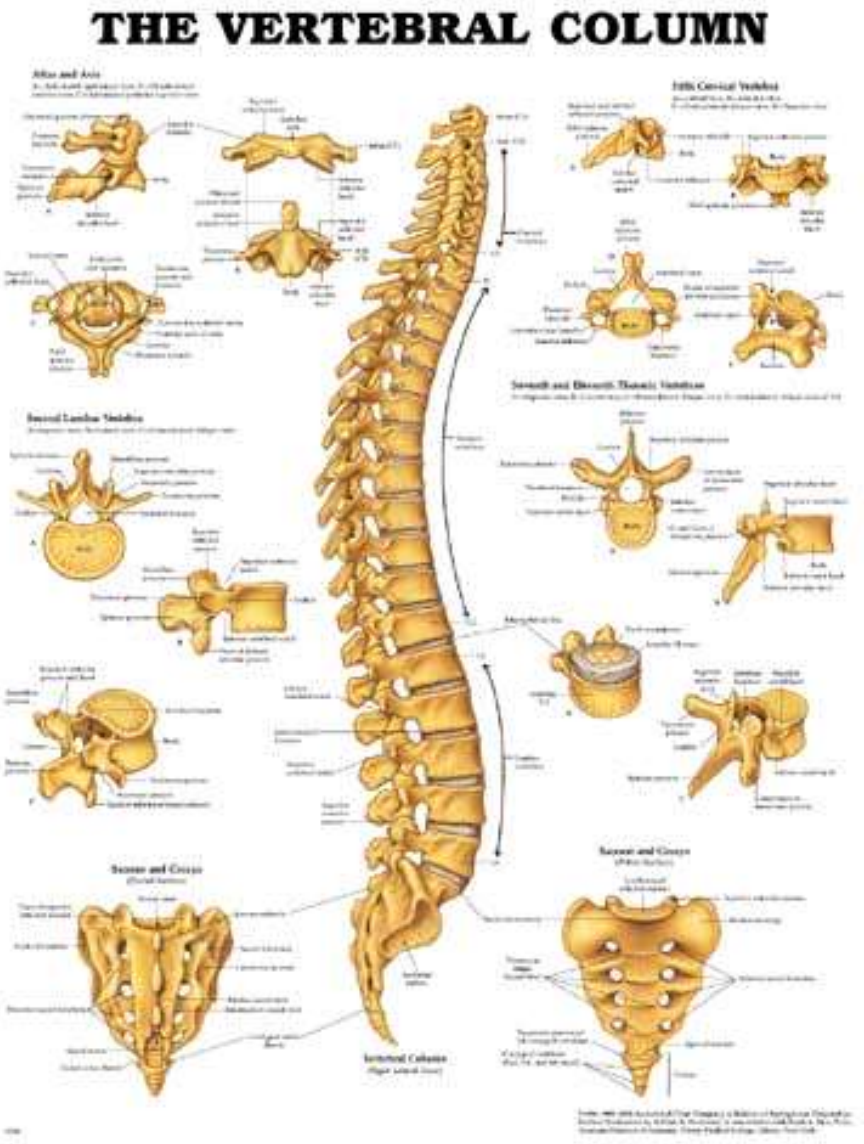

Vertebral Column
Anterior view
Left lateral view
Posterior view
Atlas (C1)
Axis (C2)
C7
T1
T12
L1
L5
Sacrum (S1-S5)
Coccyx
Cervical curvature
Thoracic curvature
Lumbar curvature
Sacral curvature
Cervical vertebrae
Thoracic vertebrae
Lumbar vertebrae
F. Netter M.D.

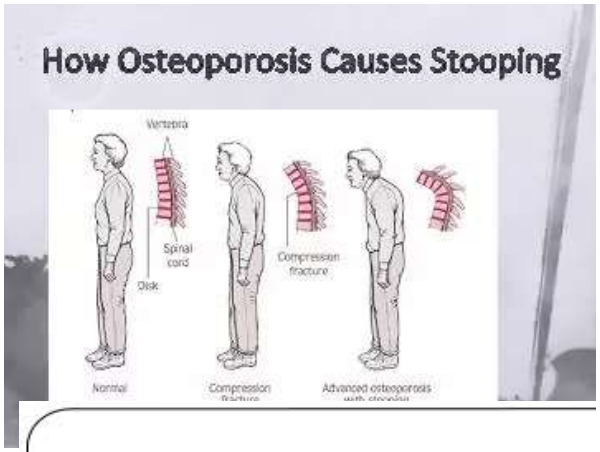

Facet Joints
Spinal Foramina
Discs
Spinal Nerve Roots
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12

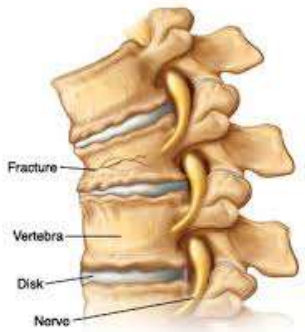




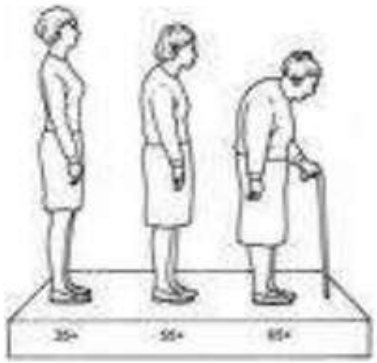
© www.apparelyzed.com

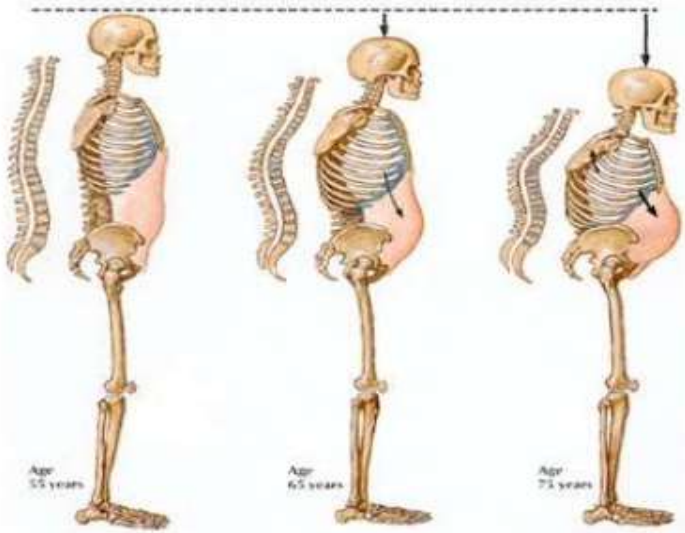






Backbone collapse





Term	# of Vertebrae	Body Area	Abbreviation
Cervical	7	Neck	C1 – C7
Thoracic	12	Chest	T1 – T12
Lumbar	5 or 6	Low Back	L1 – L5
Sacrum	5 (fused)	Pelvis	S1 – S5
Coccyx	3	Tailbone	None

Functions of the Vertebral or Spinal Column Include:

Protection	•Spinal Cord and Nerve Roots •Many internal organs
Base for Attachment	•Ligaments •Tendons •Muscles
Structural Support	•Head, shoulders, chest •Connects upper and lower body •Balance and weight distribution
Flexibility and Mobility	•Flexion (forward bending) •Extension (backward bending) •Side bending (left and right) •Rotation (left and right) •Combination of above
Other	•Bones produce red blood cells •Mineral storage

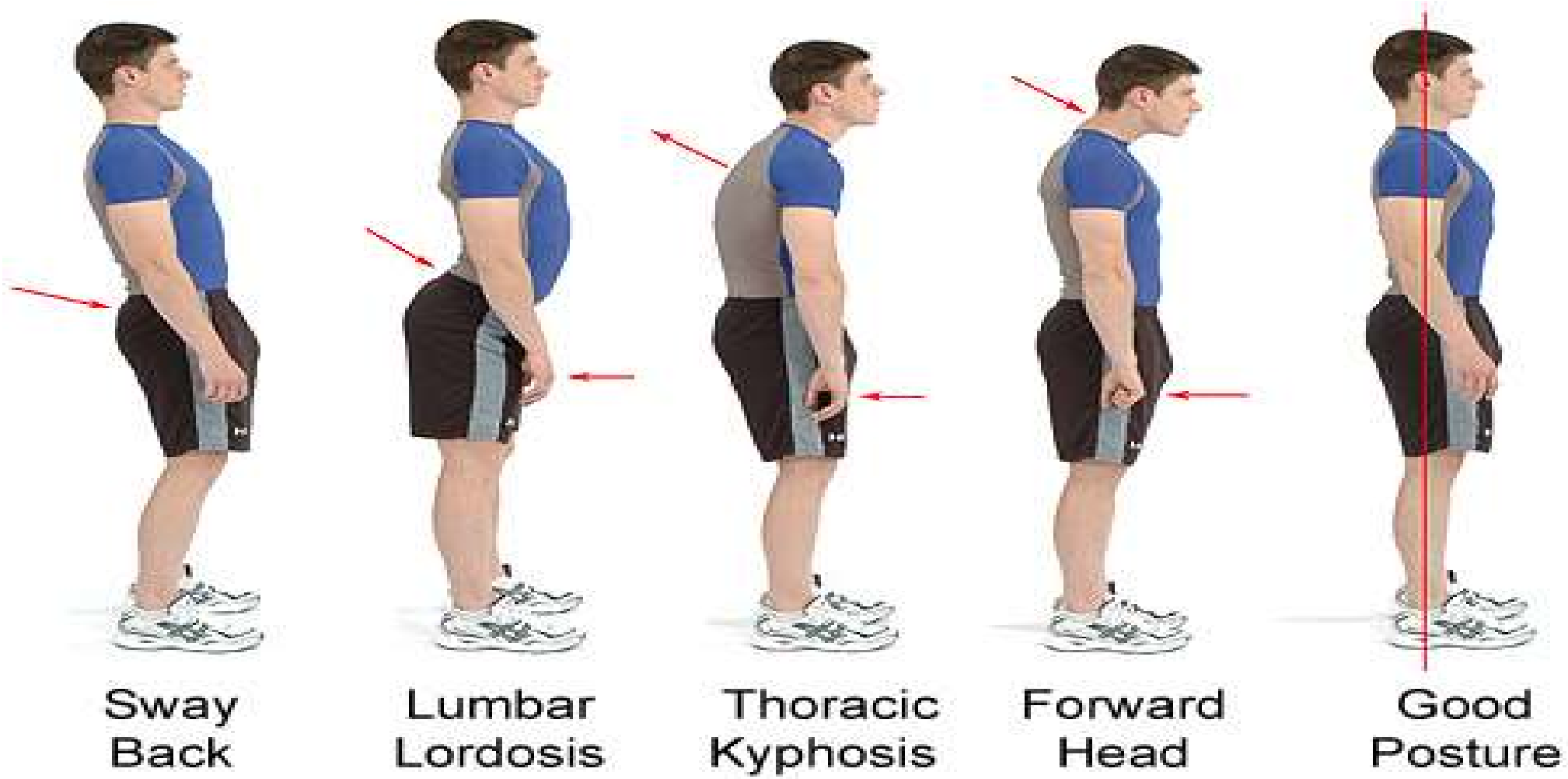
The primary curvatures (fetal) are the thoracic and sacral curvatures. They are convex posteriorly

The secondary curvatures (develop after birth), are the cervical and lumbar curvatures. They are convex anteriorly.

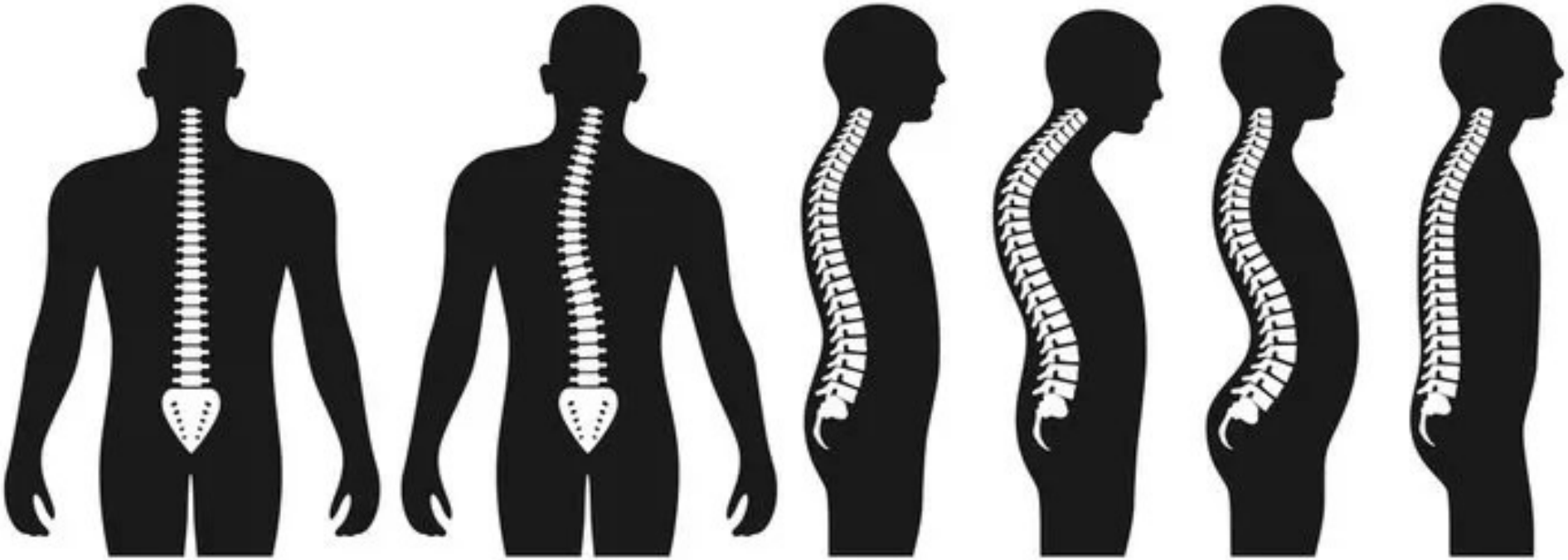
Kyphosis or hunchback. An increase in the thoracic curvature posteriorly.

Scoliosis. Abnormal lateral curvature, often localized in the thoracic region.

Lordosis. An increase in the lumbar curvature anteriorly


Sway Back
Lumbar Lordosis
Thoracic Kyphosis
Forward Head
Good Posture

Spinal deformity types



Regions of Vertebral Column

Cervical	7	**Lordosis**
Thoracic	12	**Kyphosis**
Lumbar	5	**Lordosis**
Sacral	5 fused	**Lordosis**
Coccygeal	4 fused	

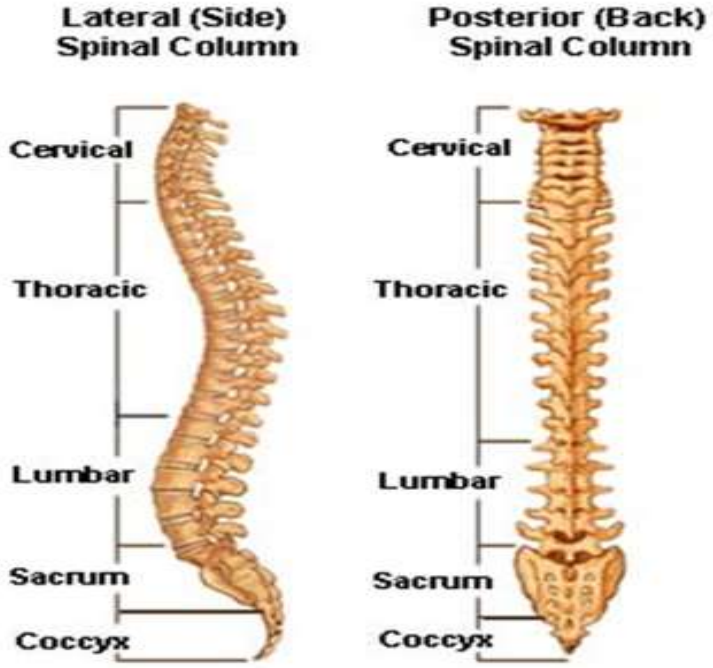
The four curves function to:

a.increase the strength of the spine

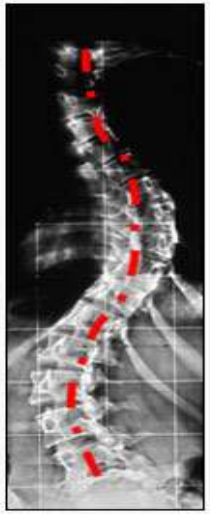
b.help maintain balance in the upright position

c.absorb shocks from walking and jumping

d.help protect the spine from fracture.



A normal spine appears without curves in the frontal plane.

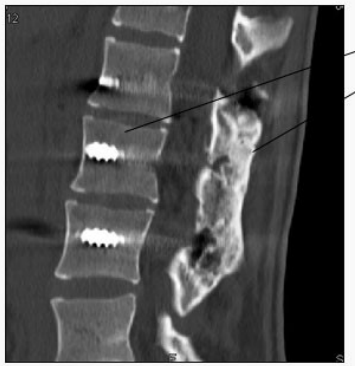


Scoliosis is a lateral deviation in the frontal plane associated with rotation.

Thoracic scoliosis

Lumber scoliosis

Differentiation of curves according to the anatomical region.



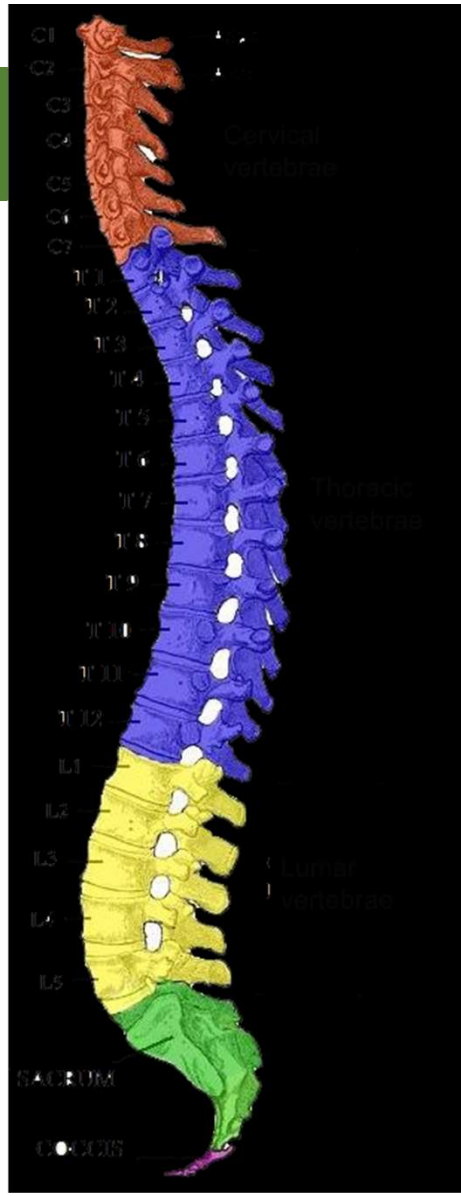
Posterior fusion mass (bone)

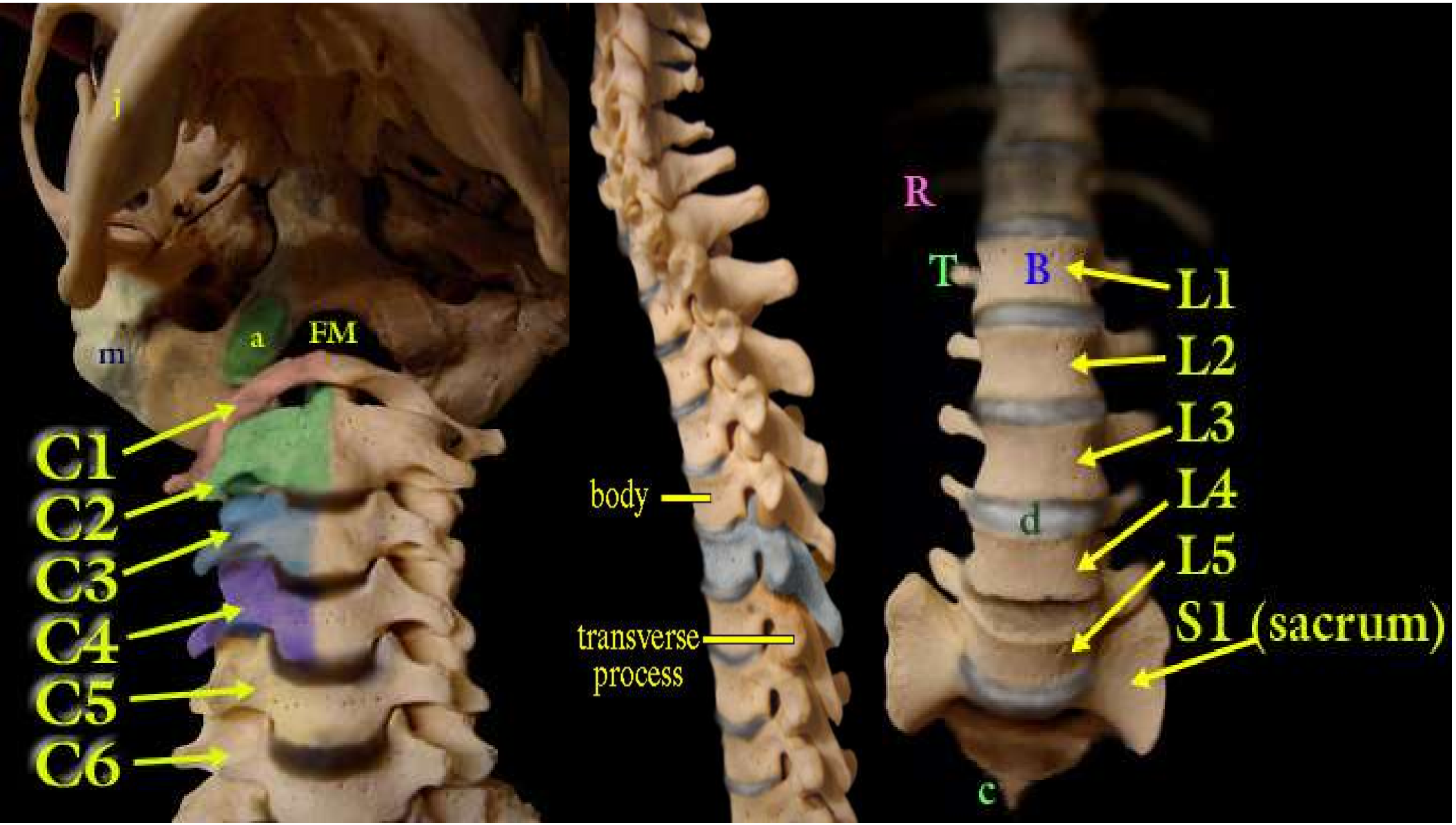
Tips of pedicular screws

The surgical strategy aims at correction and immobilization (fusion) of the curve, thus preventing progression.

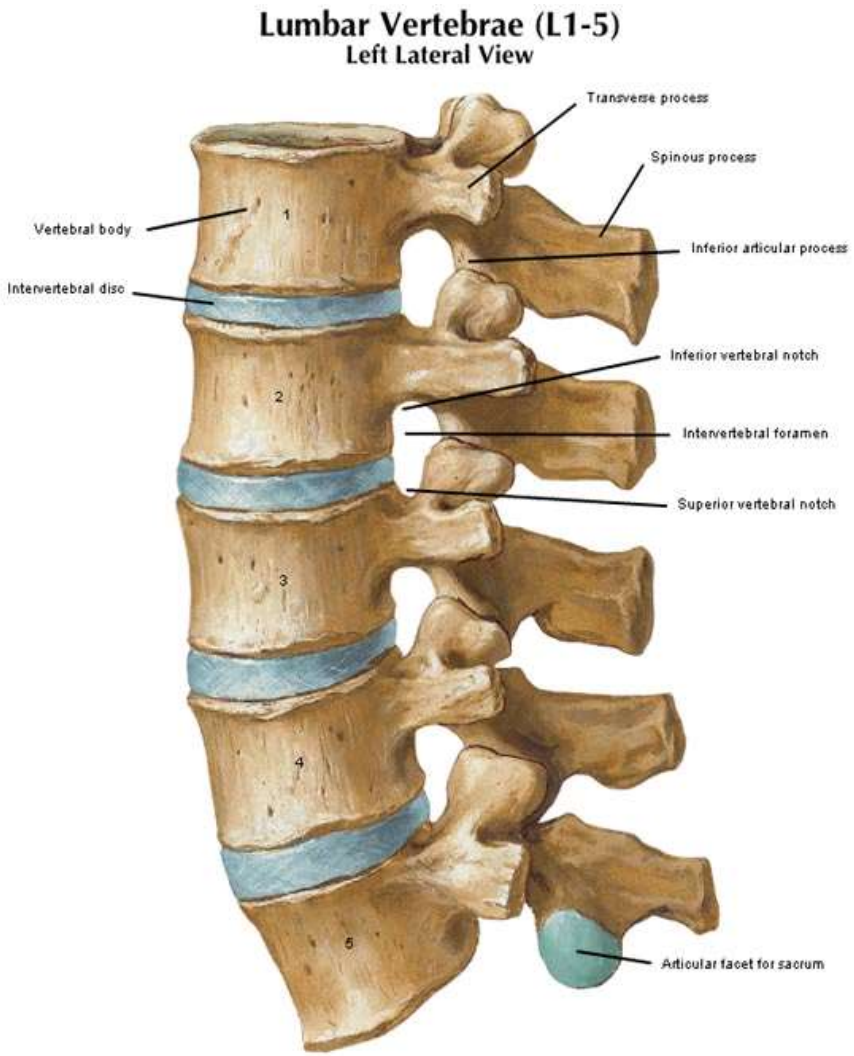
Vertebral Column

- Formed from 26 irregular bones (vertebrae) connected in such a way that a flexible curved structure results
  - Cervical vertebrae – 7 bones of the neck
  - Thoracic vertebrae – 12 bones of the torso
  - Lumbar vertebrae – 5 bones of the lower back
  - Sacrum – bone inferior to the lumbar vertebrae that articulates with the hip bones




j
m
a
FM
C1
C2
C3
C4
C5
C6
body
transverse process
R
T
B
L1
L2
L3
L4
L5
S1 (sacrum)
d
c

Vertebral Column



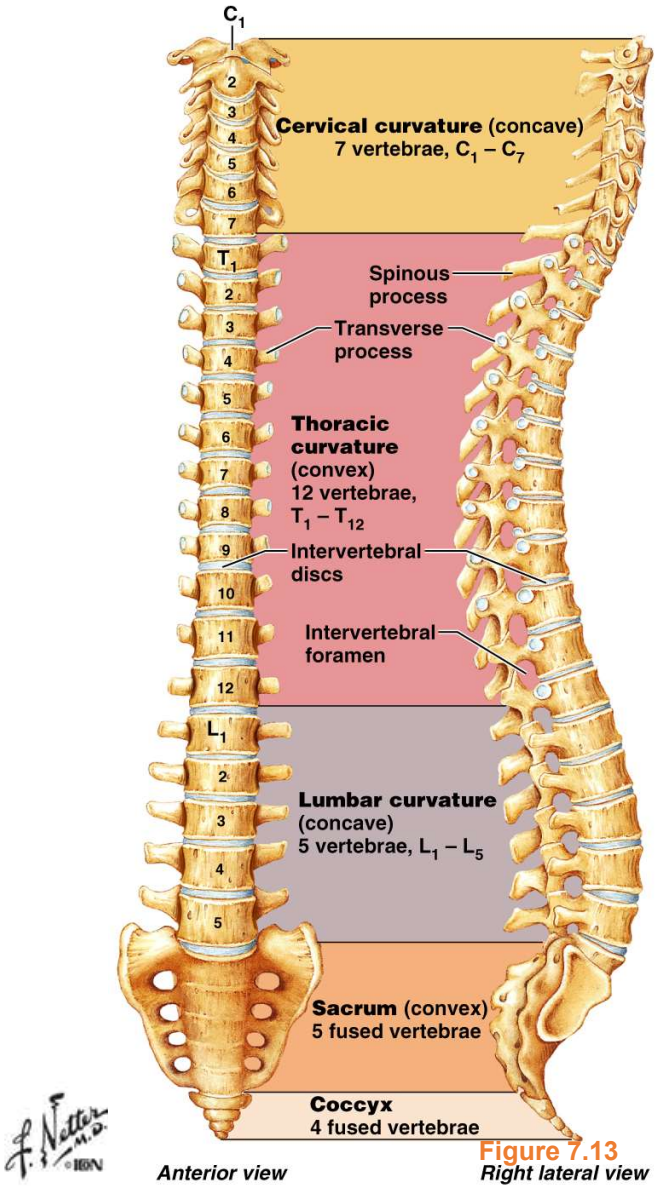
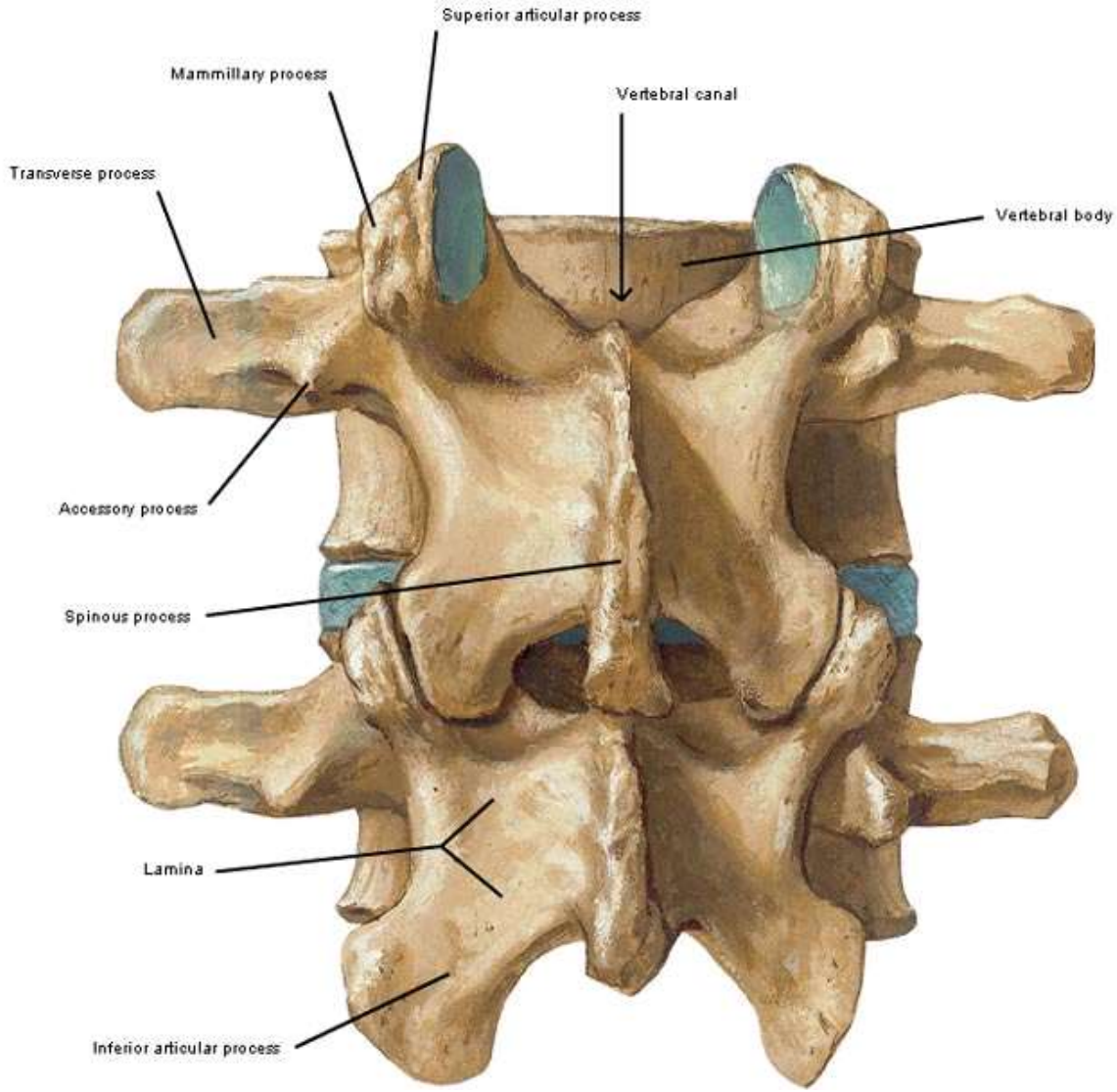


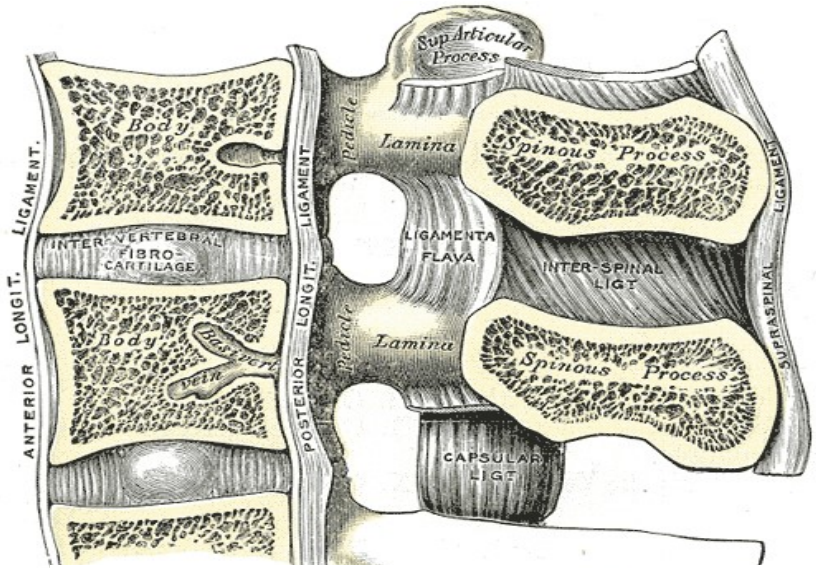
Figure 7.13

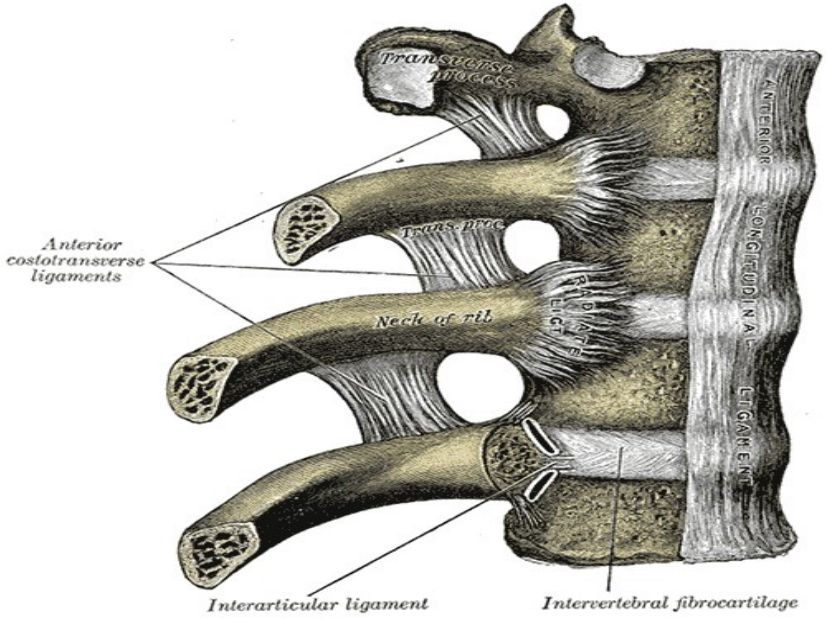
Lumbar Vertebrae (L3-4) - Assembled

Posterior View



F. Netter M.D. ©IBN

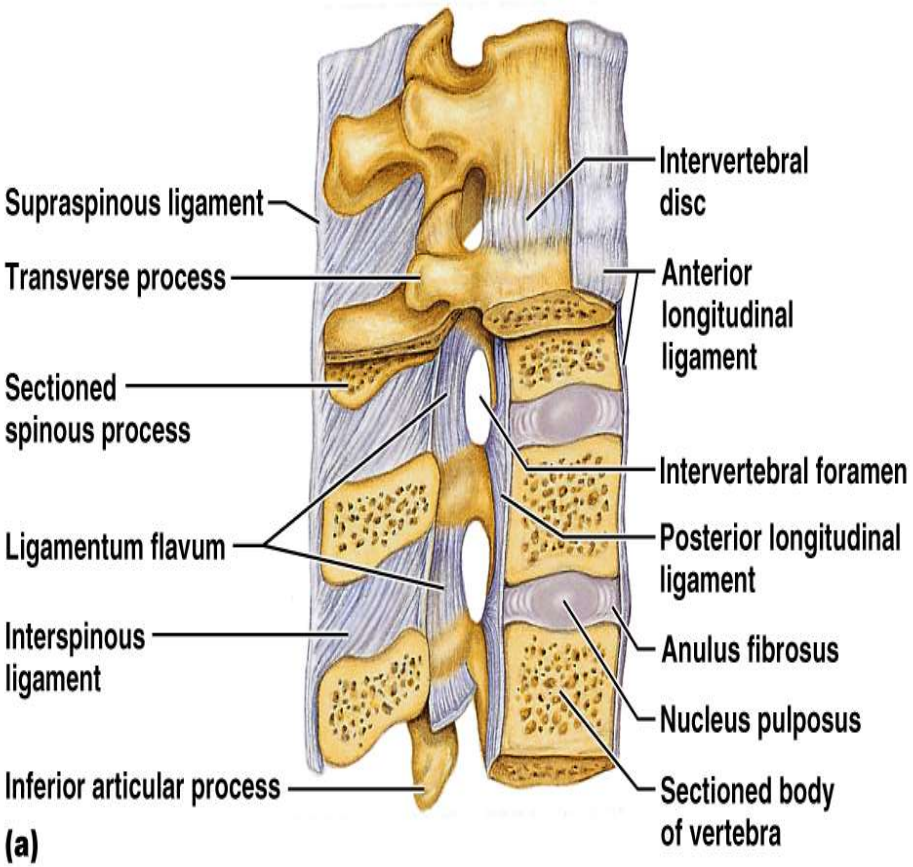


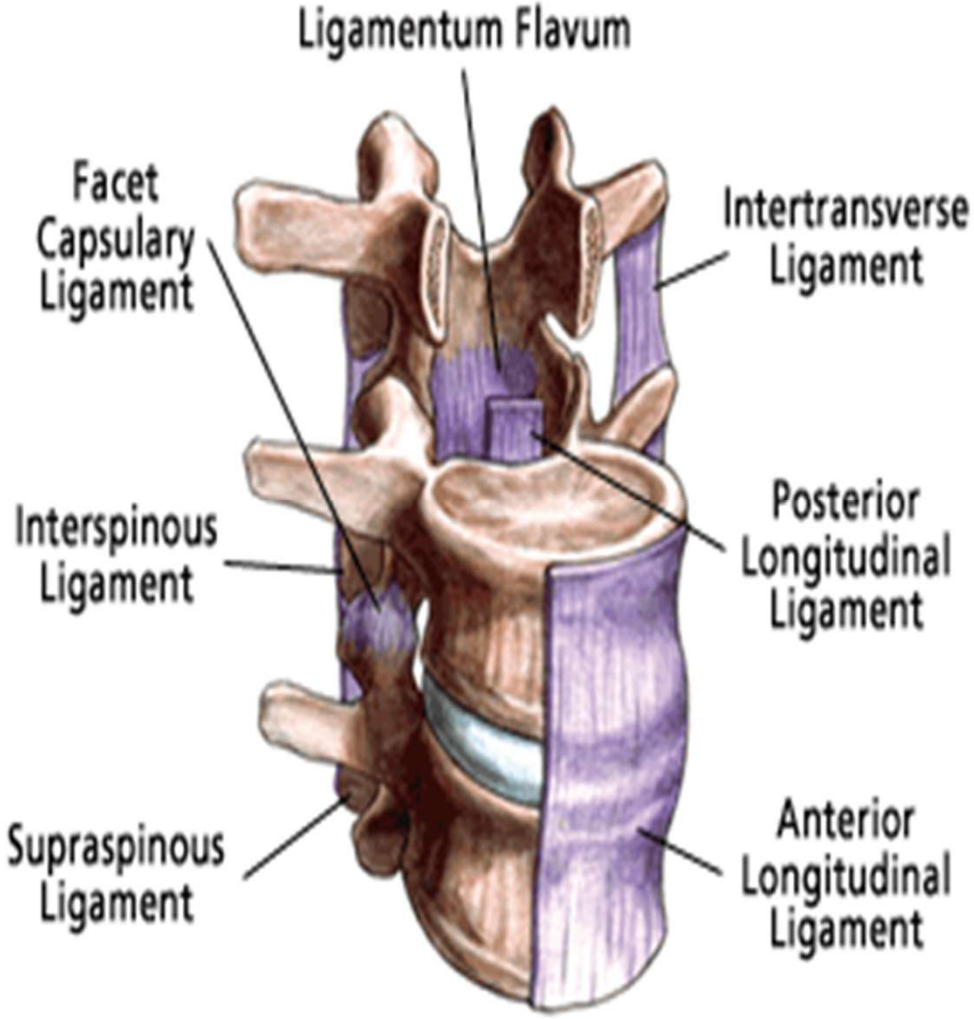


Vertebral Column: Ligaments

- **Anterior and posterior longitudinal ligaments** – continuous bands down the front and back of the spine from the neck to the sacrum
- **Short ligaments connect** adjoining vertebrae together

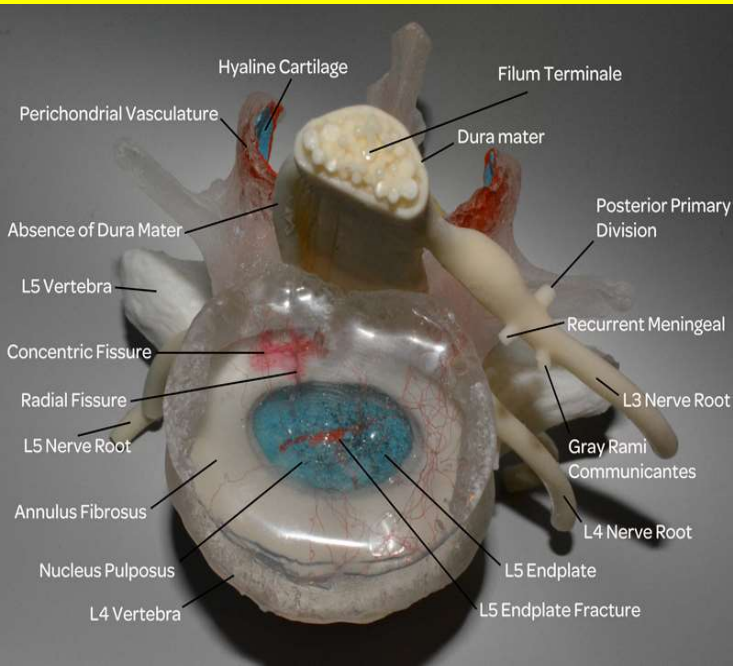
Vertebral Column: Ligar

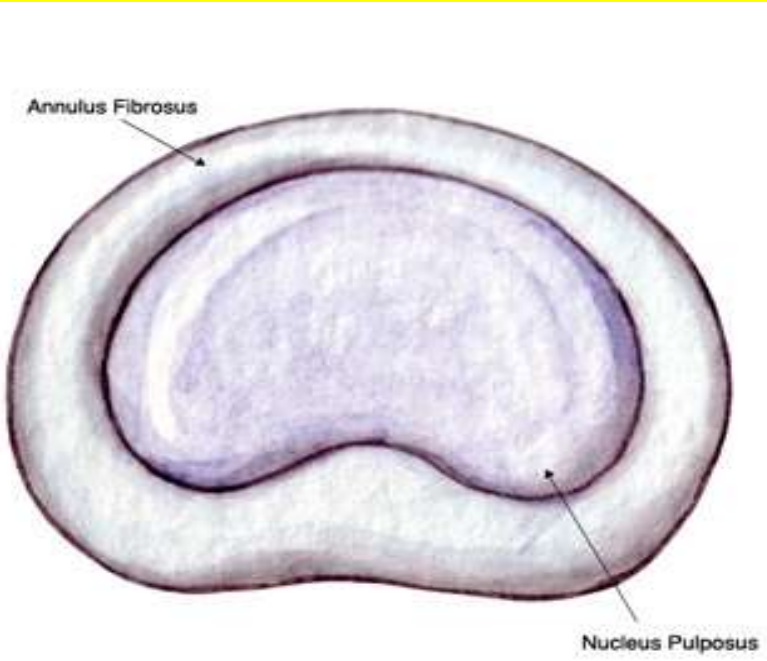


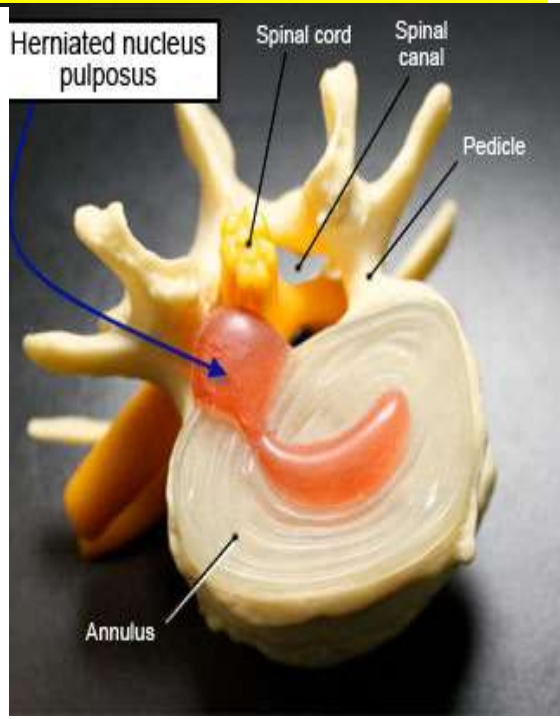


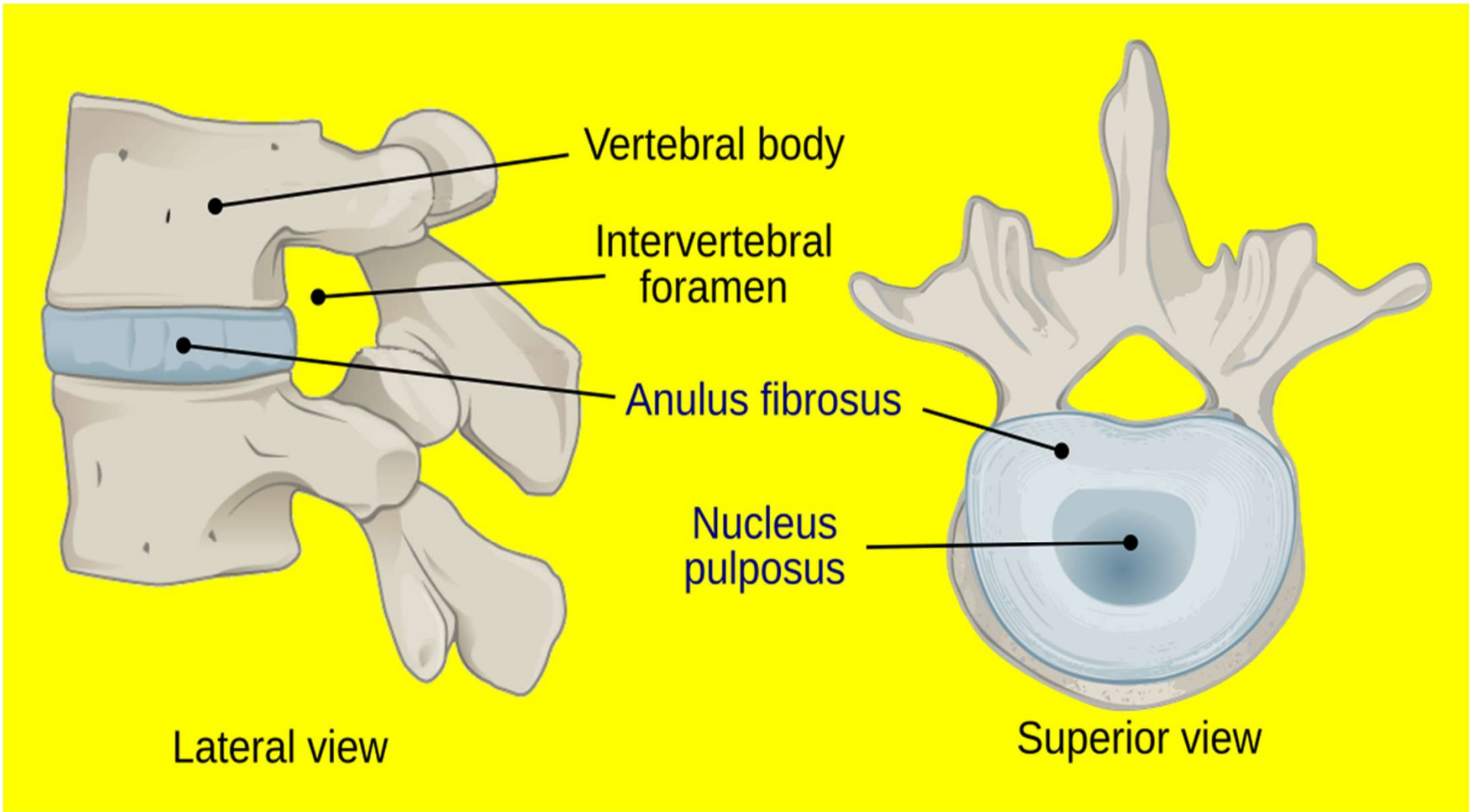
Vertebral Column: Intervertebral Discs

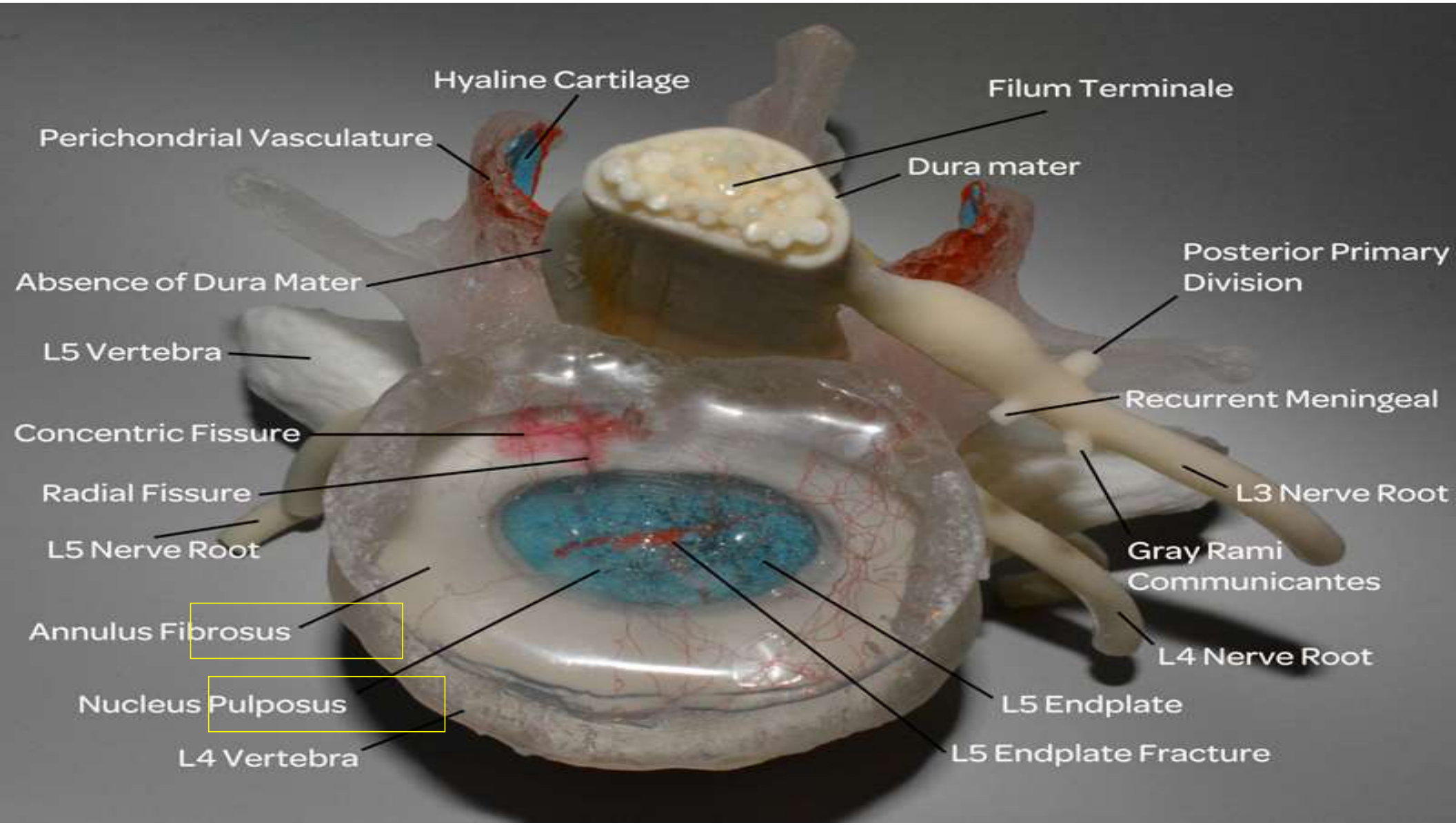
- Cushion-like pad composed of two parts
  - **Nucleus pulposus** – inner gelatinous nucleus that gives the disc its elasticity and compressibility
  - **Annulus fibrosus** – surrounds the nucleus pulposus with a collar composed of collagen and fibrocartilage



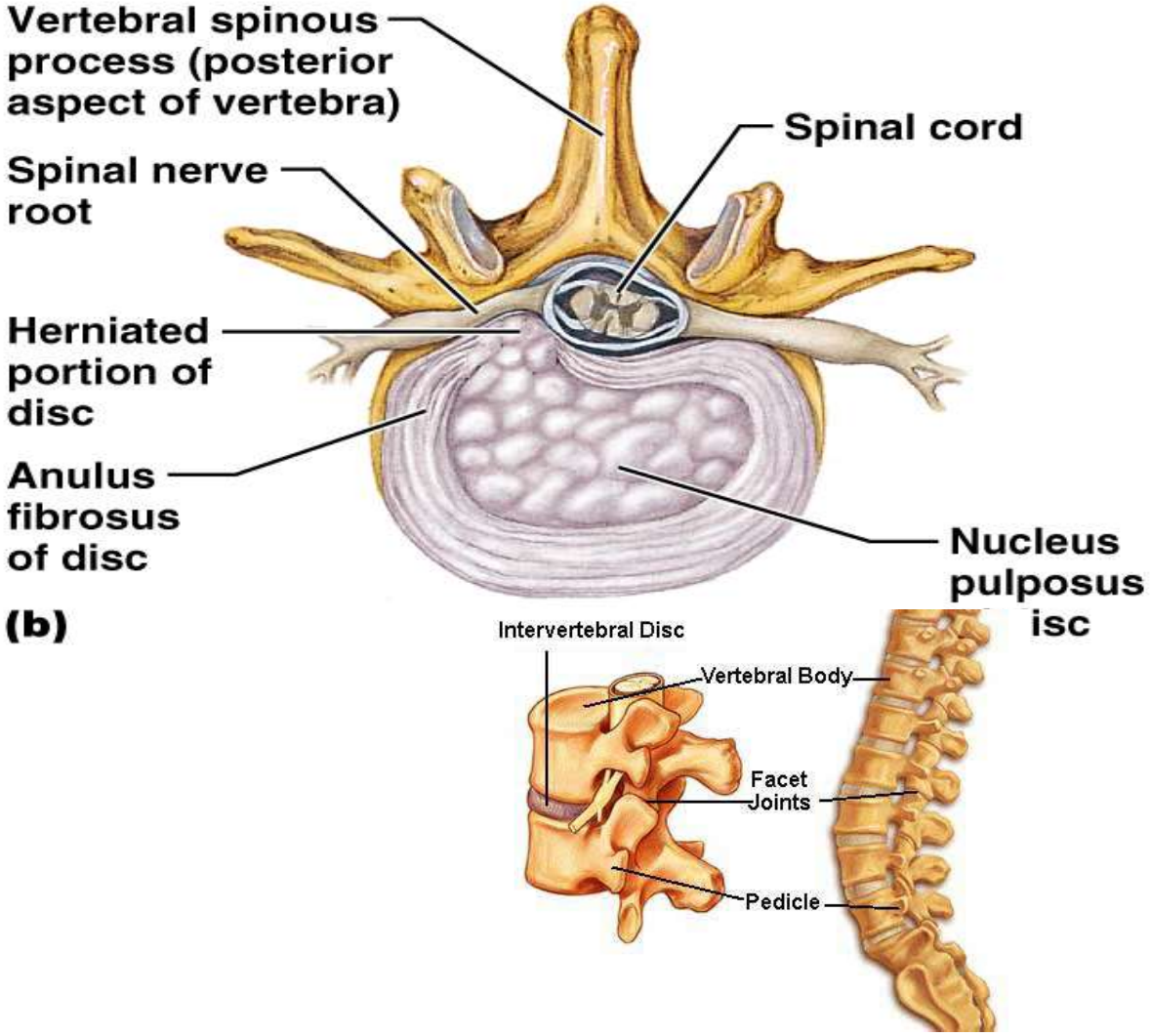





Vertebral body
Intervertebral foramen
Anulus fibrosus
Nucleus pulposus
Lateral view
Superior view


Hyaline Cartilage
Perichondrial Vasculature
Filum Terminale
Dura mater
Absence of Dura Mater
Posterior Primary Division
L5 Vertebra
Recurrent Meningeal
Concentric Fissure
Radial Fissure
L3 Nerve Root
L5 Nerve Root
Gray Rami Communicantes
Annulus Fibrosus
L4 Nerve Root
Nucleus Pulposus
L5 Endplate
L4 Vertebra
L5 Endplate Fracture

Vertebral Column: Intervertebral Discs



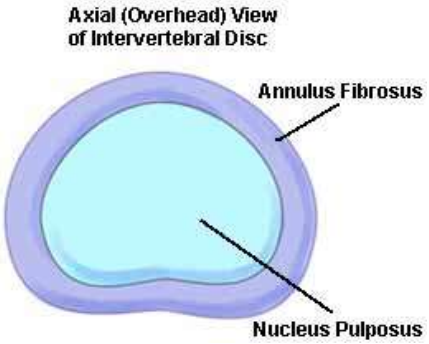


Figure 7.14b

General Structure of Vertebrae

A typical vertebra has the following structural features:

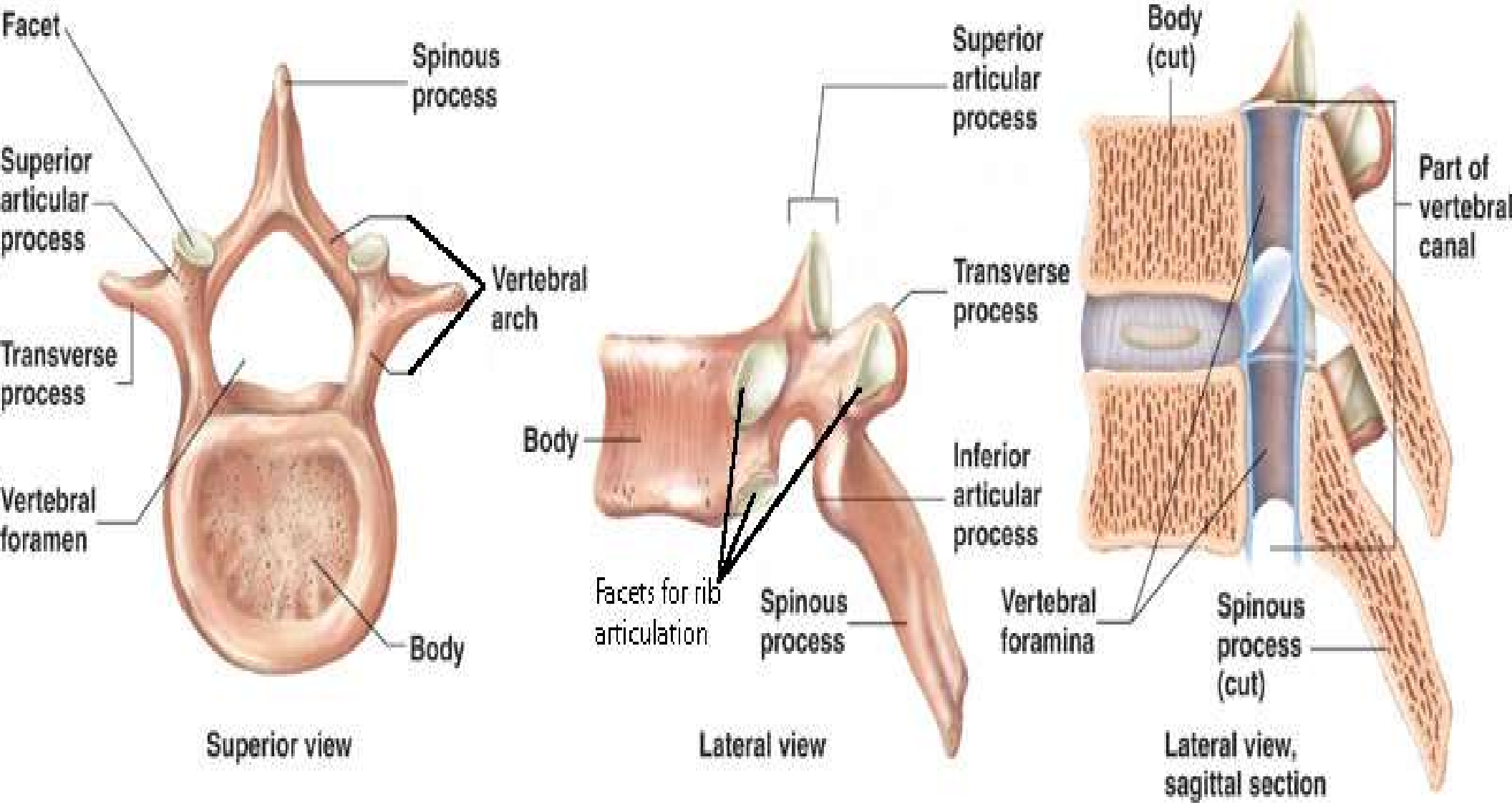
i. **body**

ii. **vertebral arch,** which consists of:
a. two **pedicles**
b. two **laminae**

iii. 7 processes:

a. two **transverse processes**
b. one **spinous process (spine)**
c. two **superior articular processes** with **facets**
d. two **inferior articular processes** with **facets**

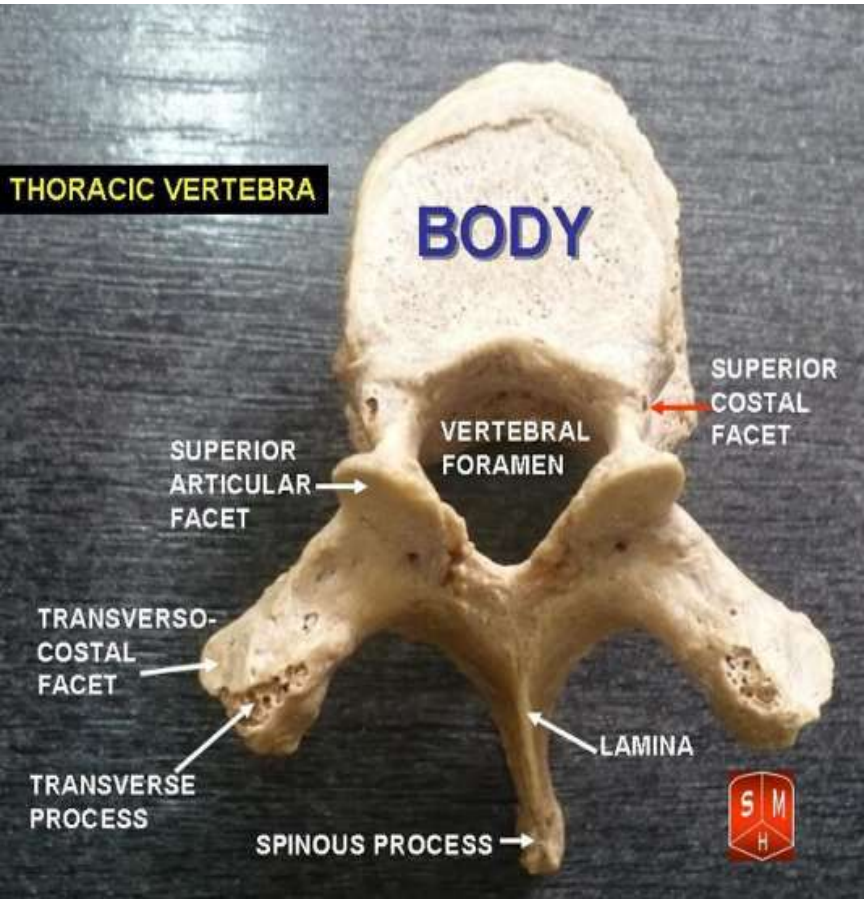
Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



General Structure of Vertebrae

- **Body or centrum** – disc-shaped, weight-bearing region
- **Vertebral arch** – composed of pedicles and laminae that, along with the centrum, enclose the vertebral foramen
- **Vertebral foramina** – make up the vertebral canal through which the spinal cord passes
- **Spinous processes** project posteriorly, and transverse processes project laterally
- **Superior and inferior articular processes** – protrude superiorly and inferiorly from the pedicle-lamina junctions
- **Intervertebral foramina** – lateral openings formed from notched areas on the superior and inferior borders of adjacent pedicles

General Structure of Vertebrae



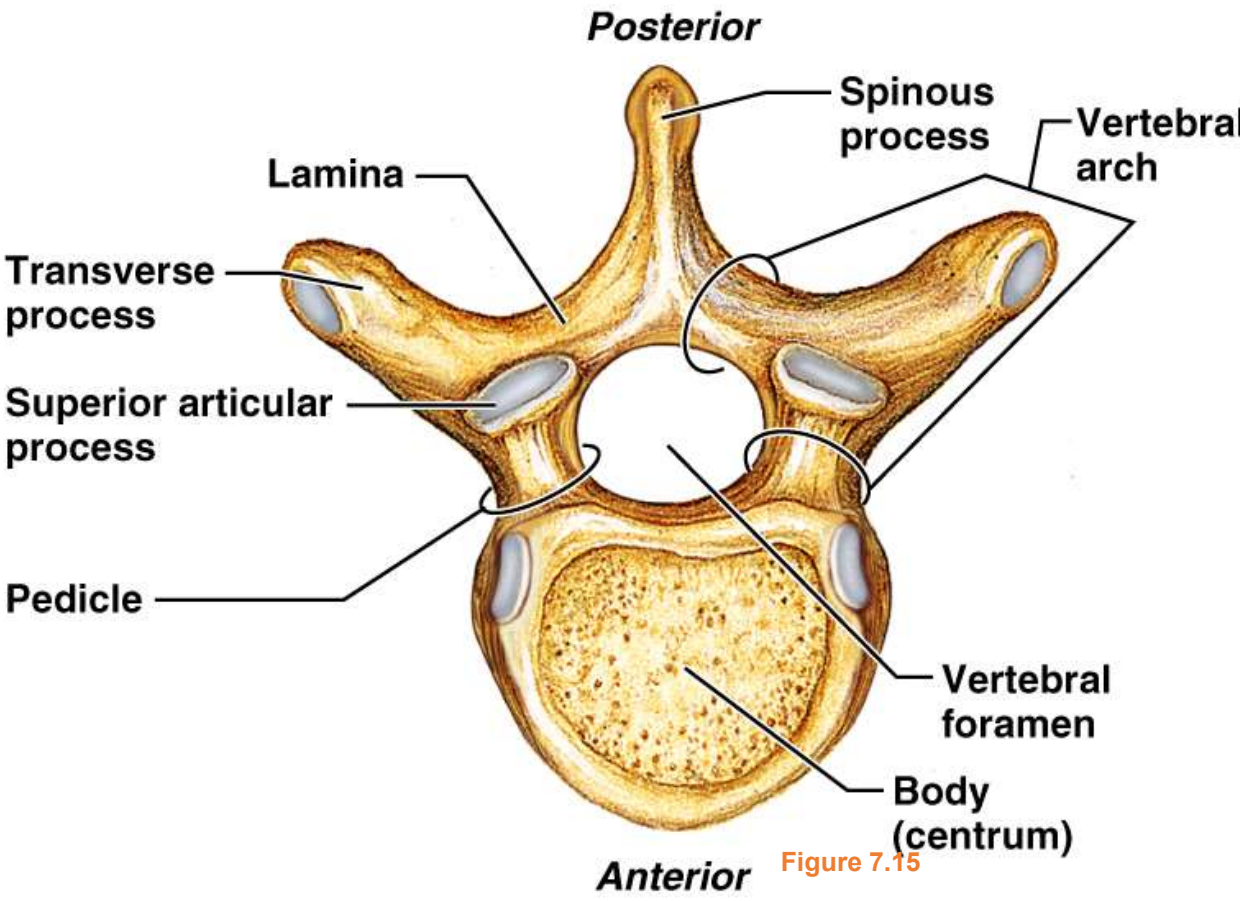
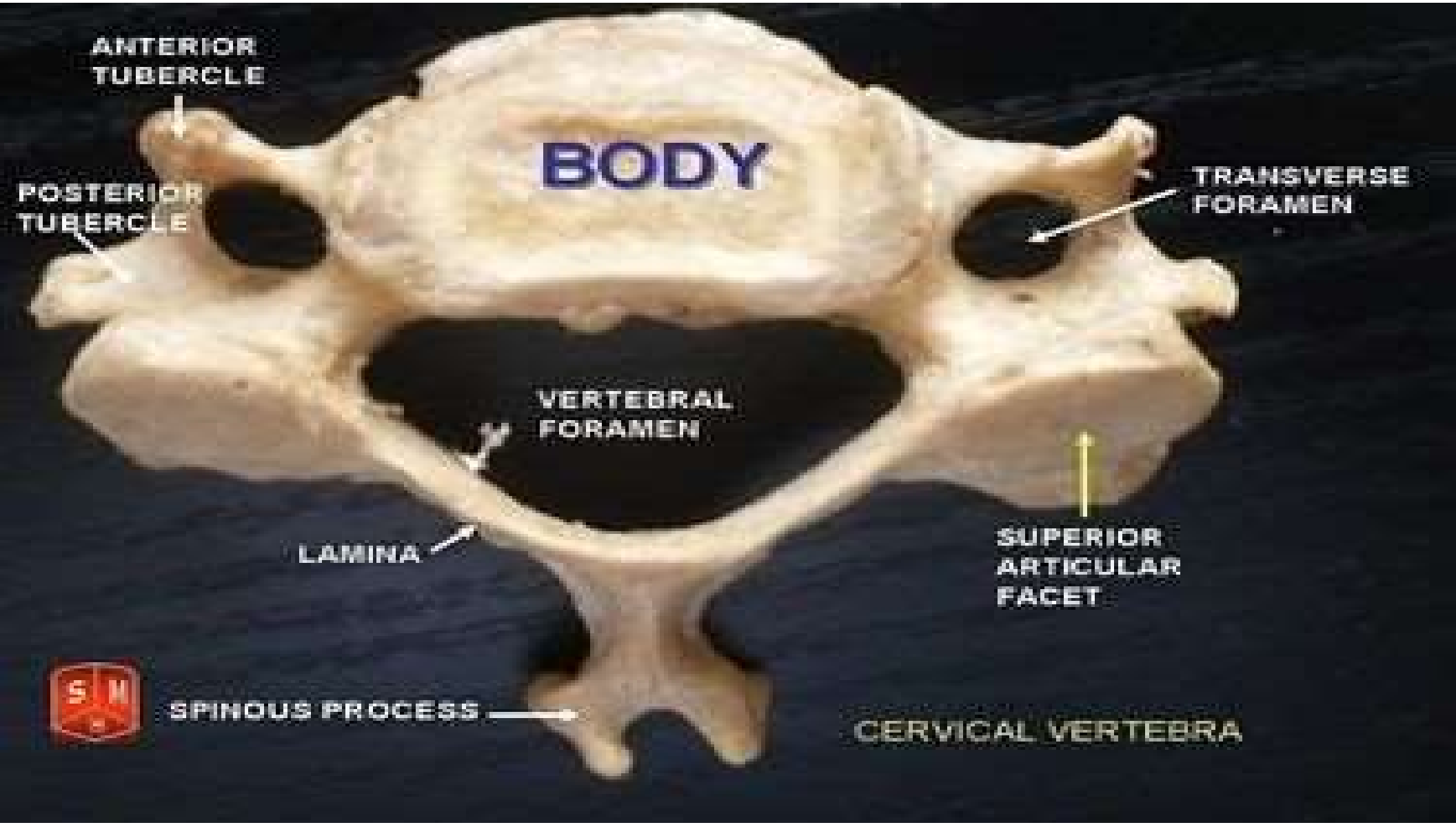
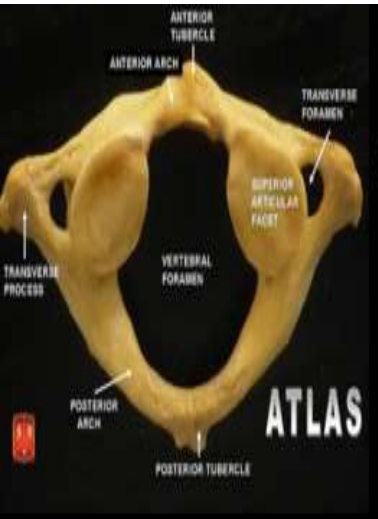
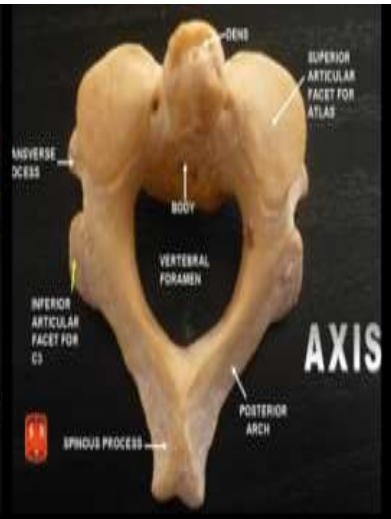
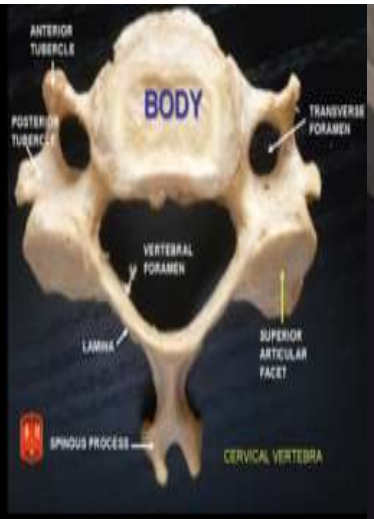


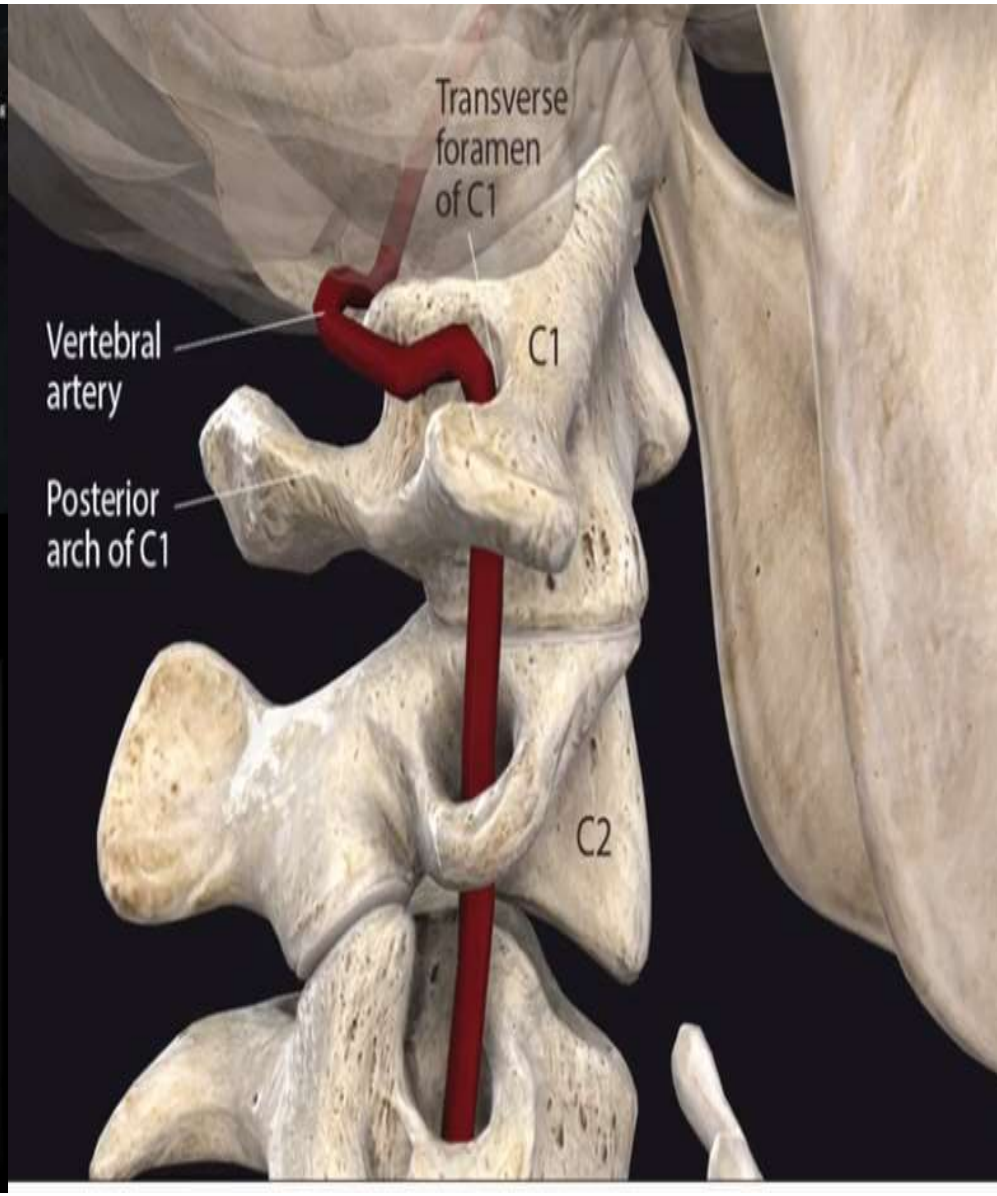
Figure 7.15


ANTERIOR TUBERCLE
BODY
POSTERIOR TUBERCLE
TRANSVERSE FORAMEN
VERTEBRAL FORAMEN
LAMINA
SUPERIOR ARTICULAR FACET
SPINOUS PROCESS
CERVICAL VERTEBRA





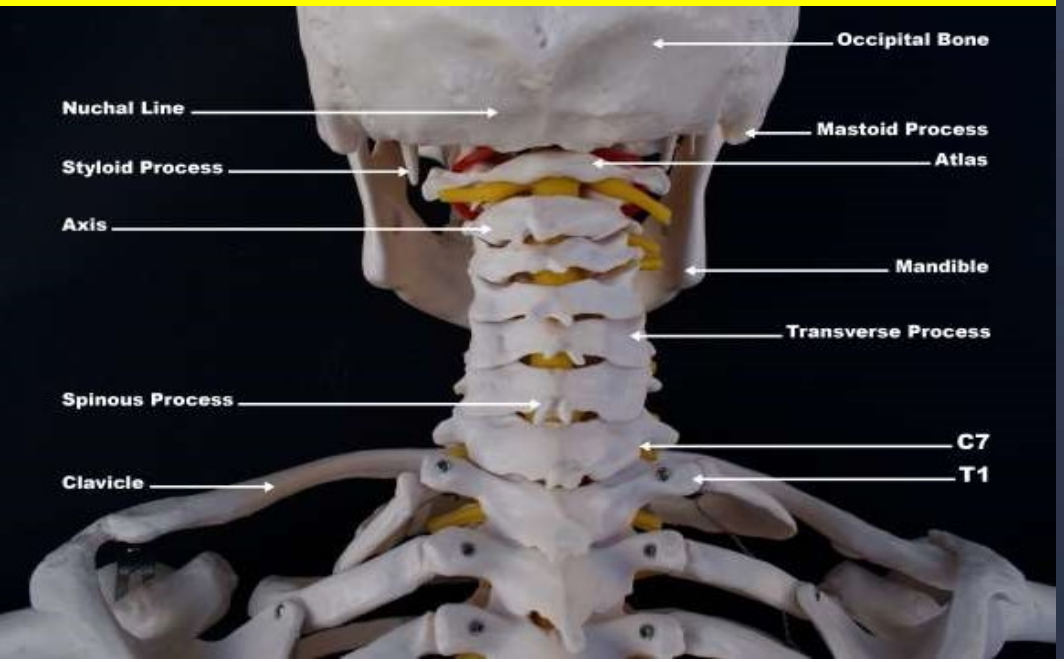


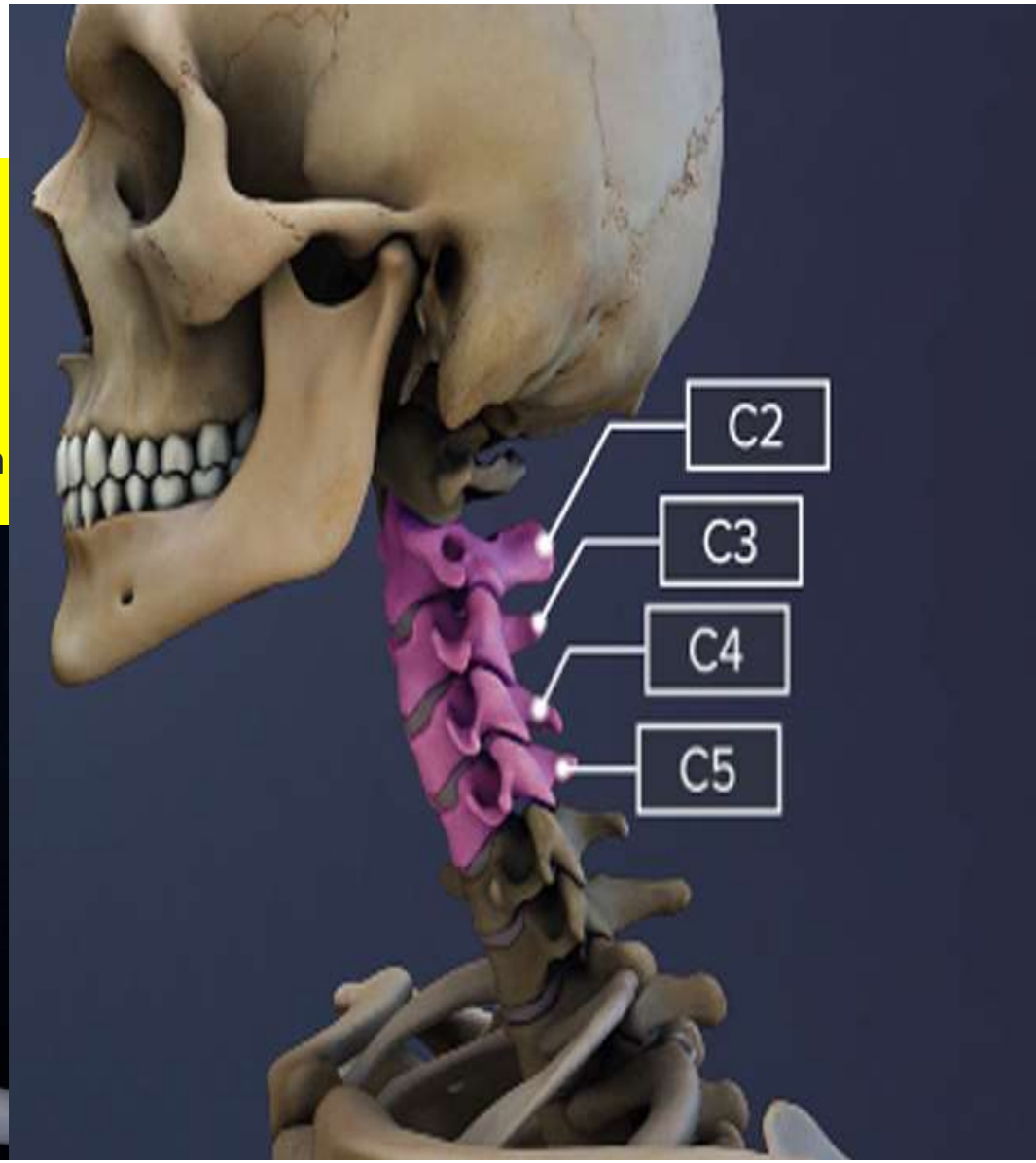


Thoracic vertebra

Cervical Vertebrae

- **Seven vertebrae (C_1-C_7) are the smallest, lightest vertebrae**
- **C_3-C_7 are distinguished with an oval body, short spinous processes, and large, triangular vertebral foramina**
- **Each transverse process contains a transverse foramen**

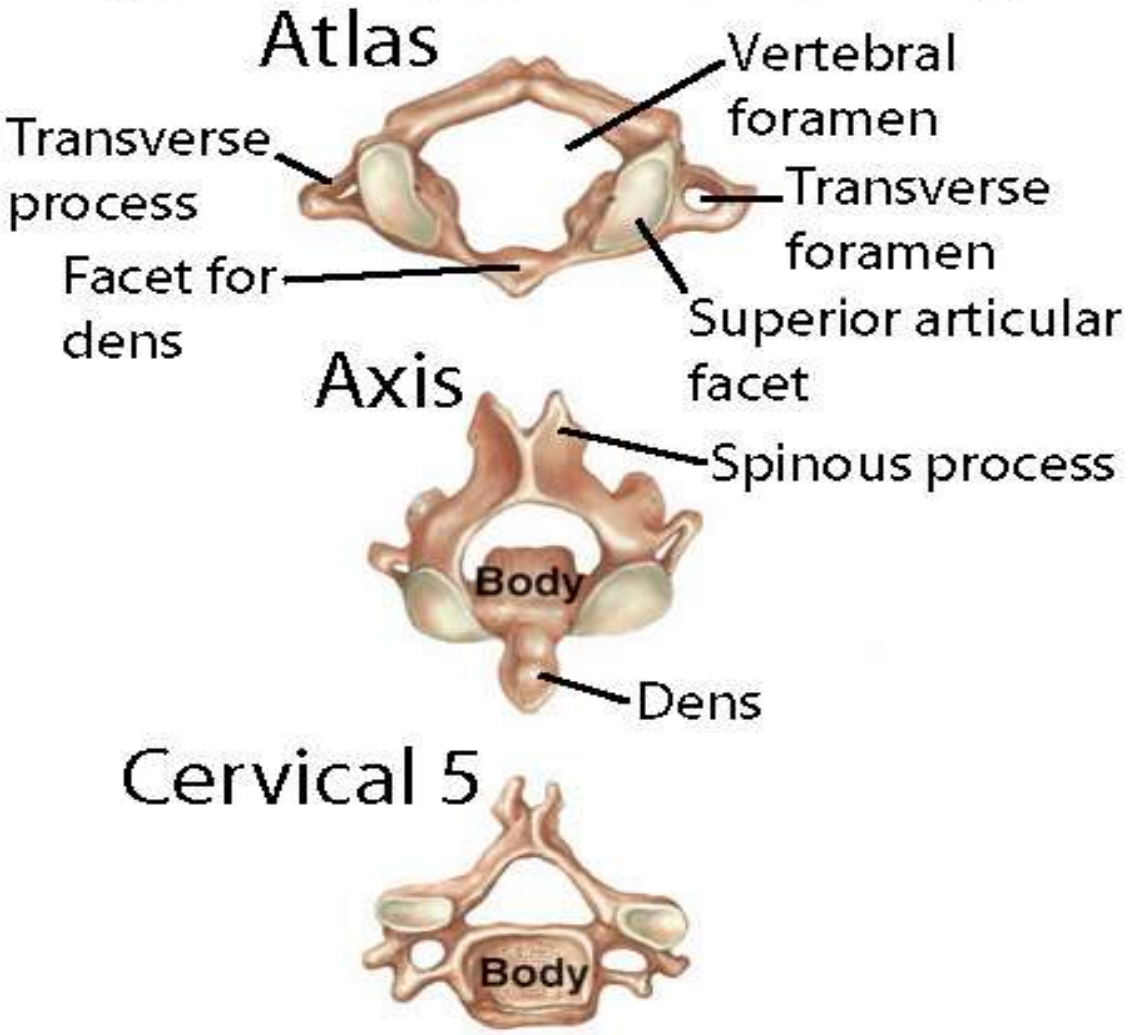


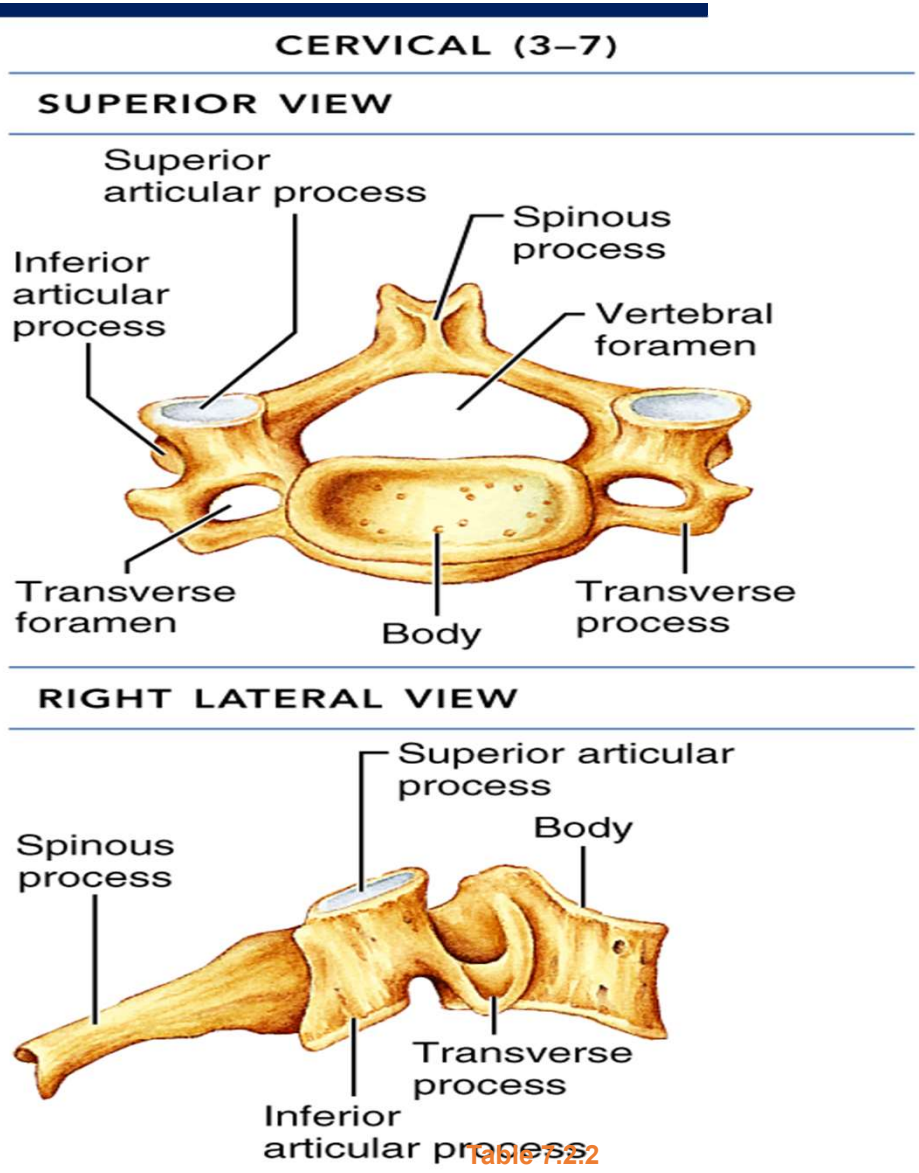


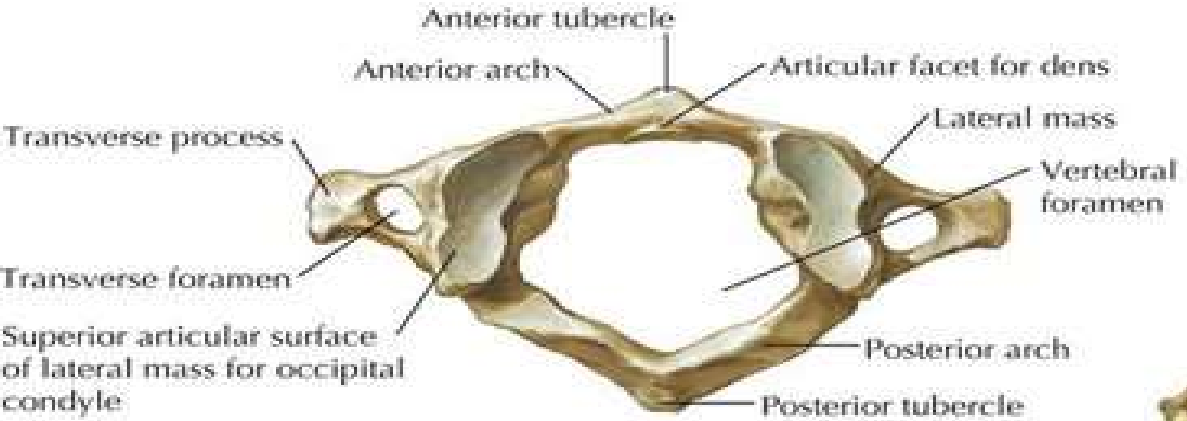

1363


Cervical Vertebrae

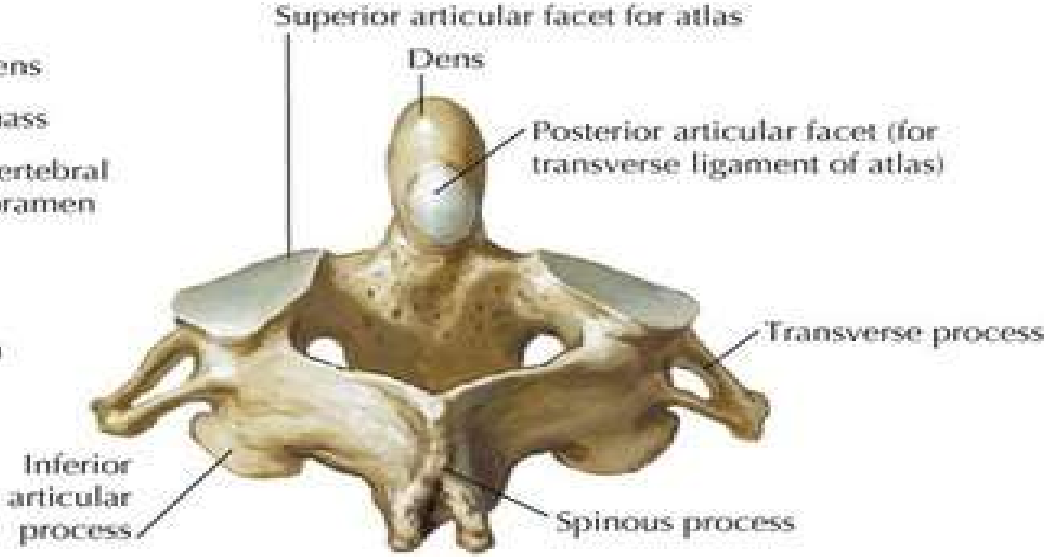
Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



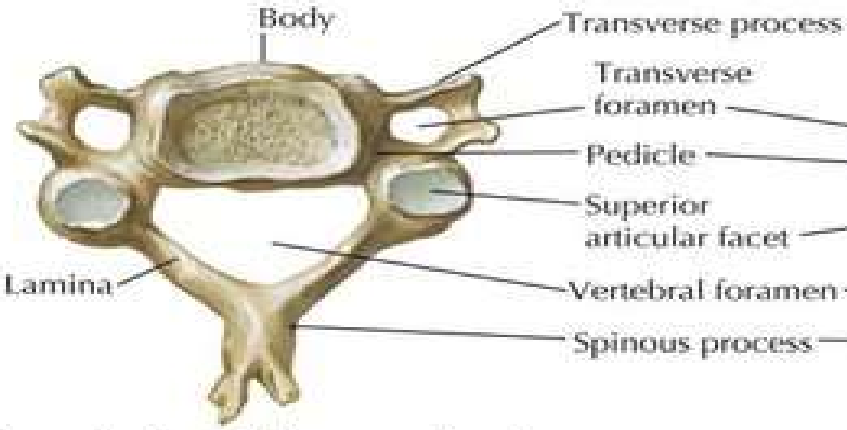




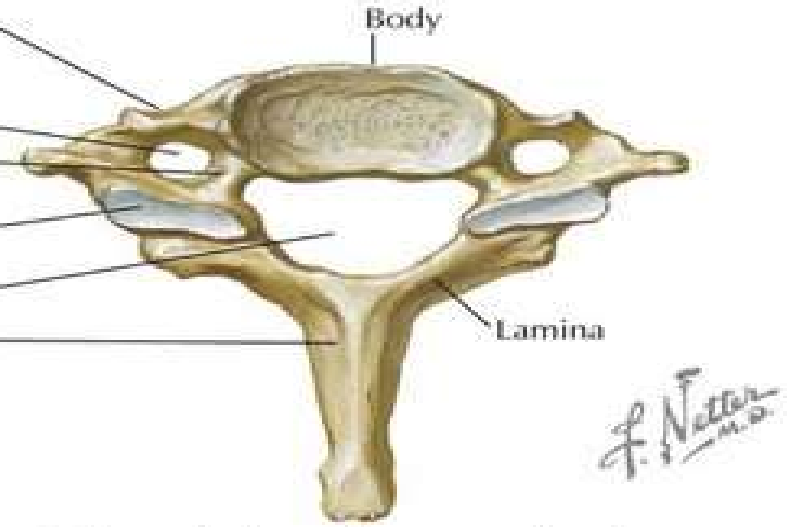
Atlas (C1): superior view



Axis (C2): posterosuperior view



4th cervical vertebra: superior view



7th cervical vertebra: superior view

Cervical Vertebrae: The Atlas (C_1)

- The atlas has no body and **no spinous process**
- It consists of **anterior and posterio arches, and two lateral masses**
- The superior surfaces of lateral masses articulate with the occipital condyles

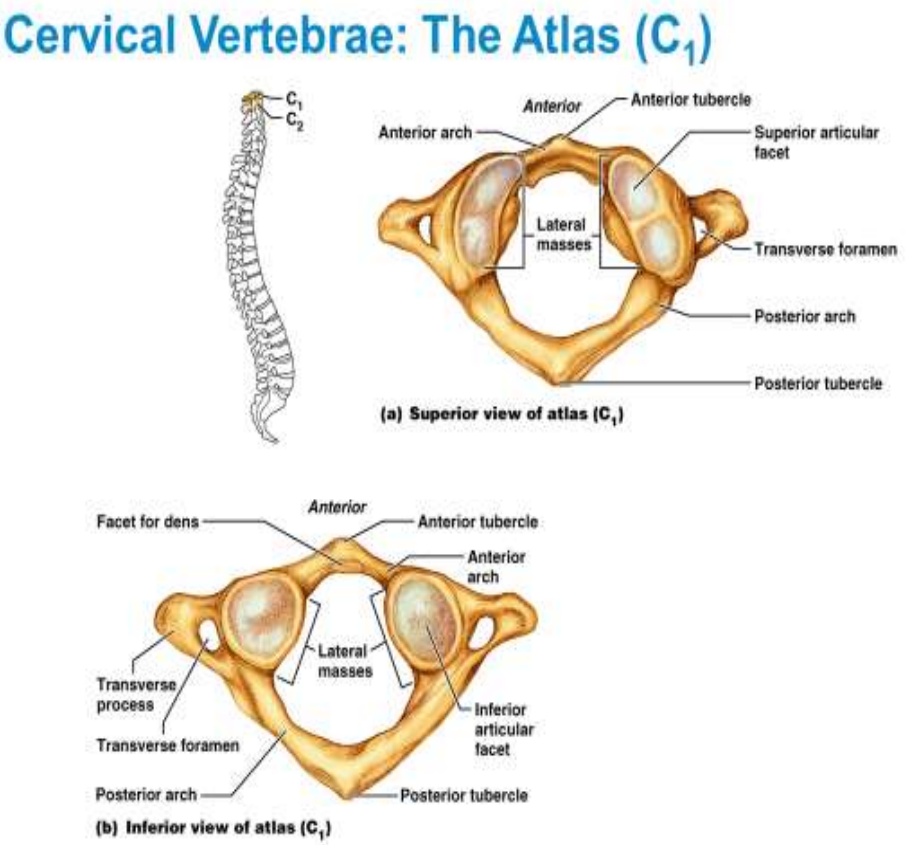
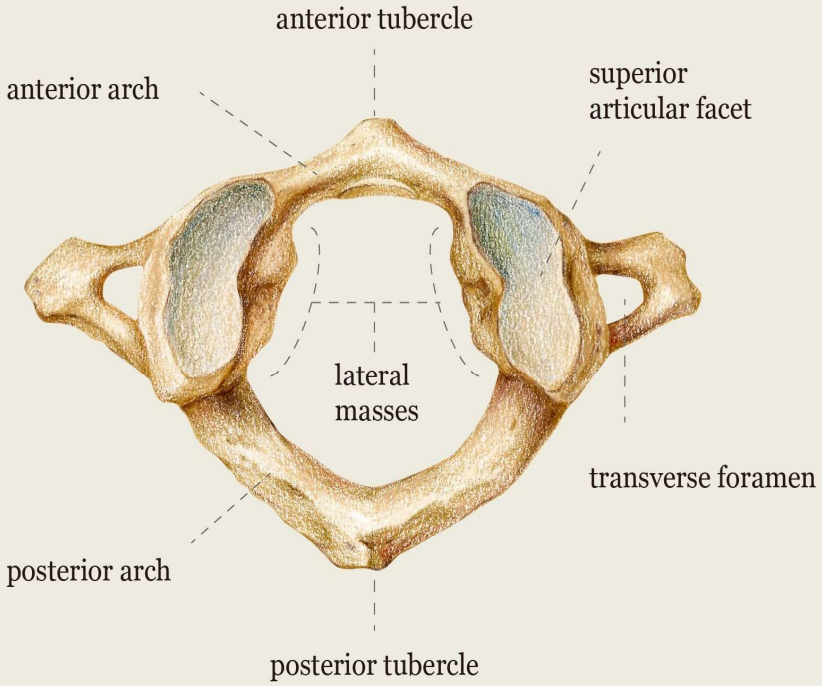
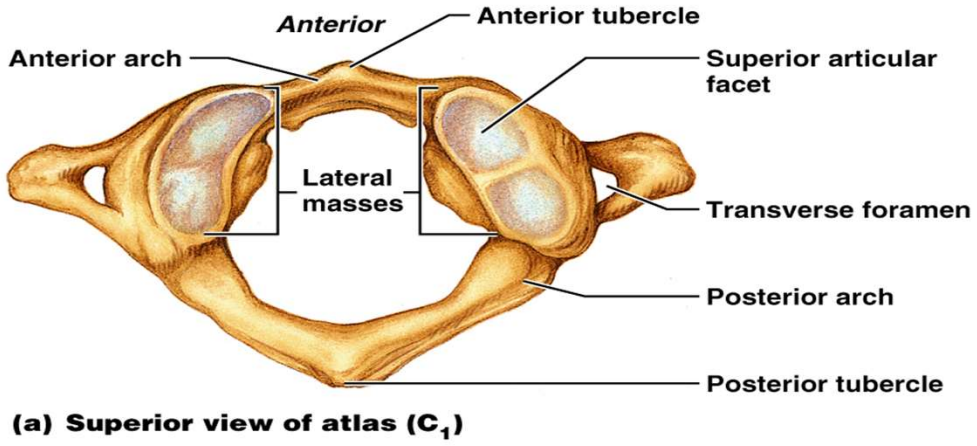


Figure 7.16a, b

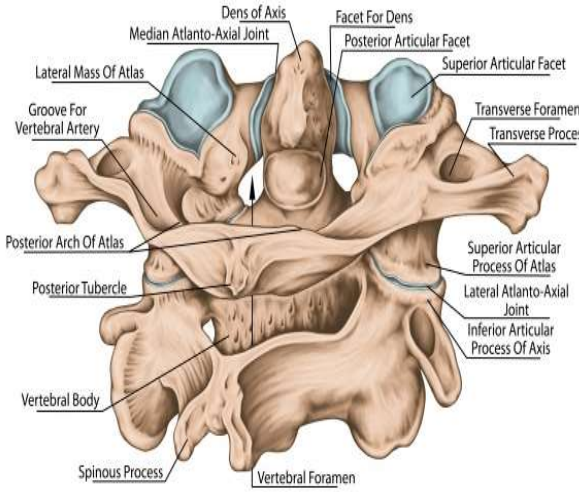


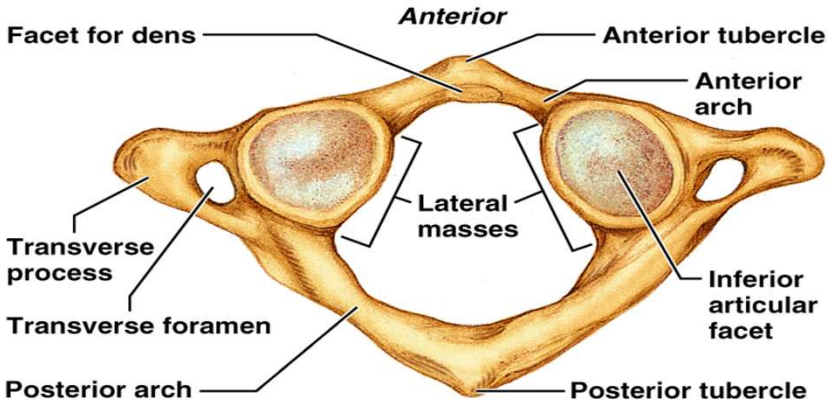
the 1st cervical vertebra

Cervical Vertebrae: The Atlas (C_1)

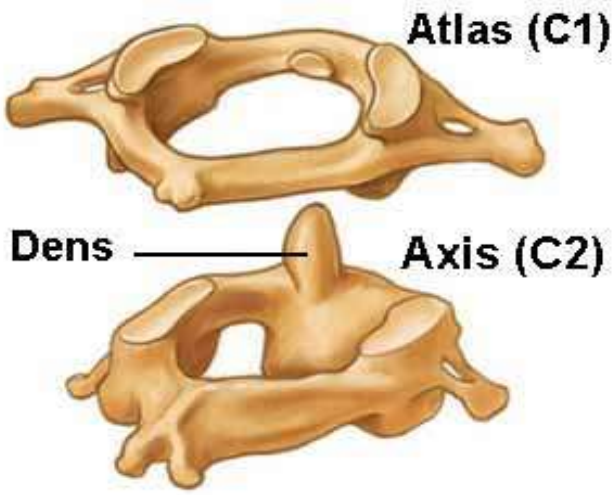


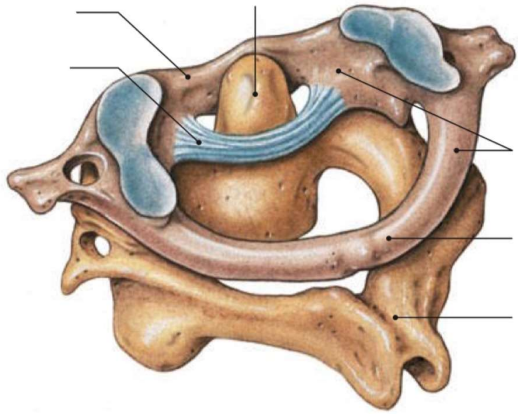
(a) Superior view of atlas (C_1)





(b) Inferior view of atlas (C_1)

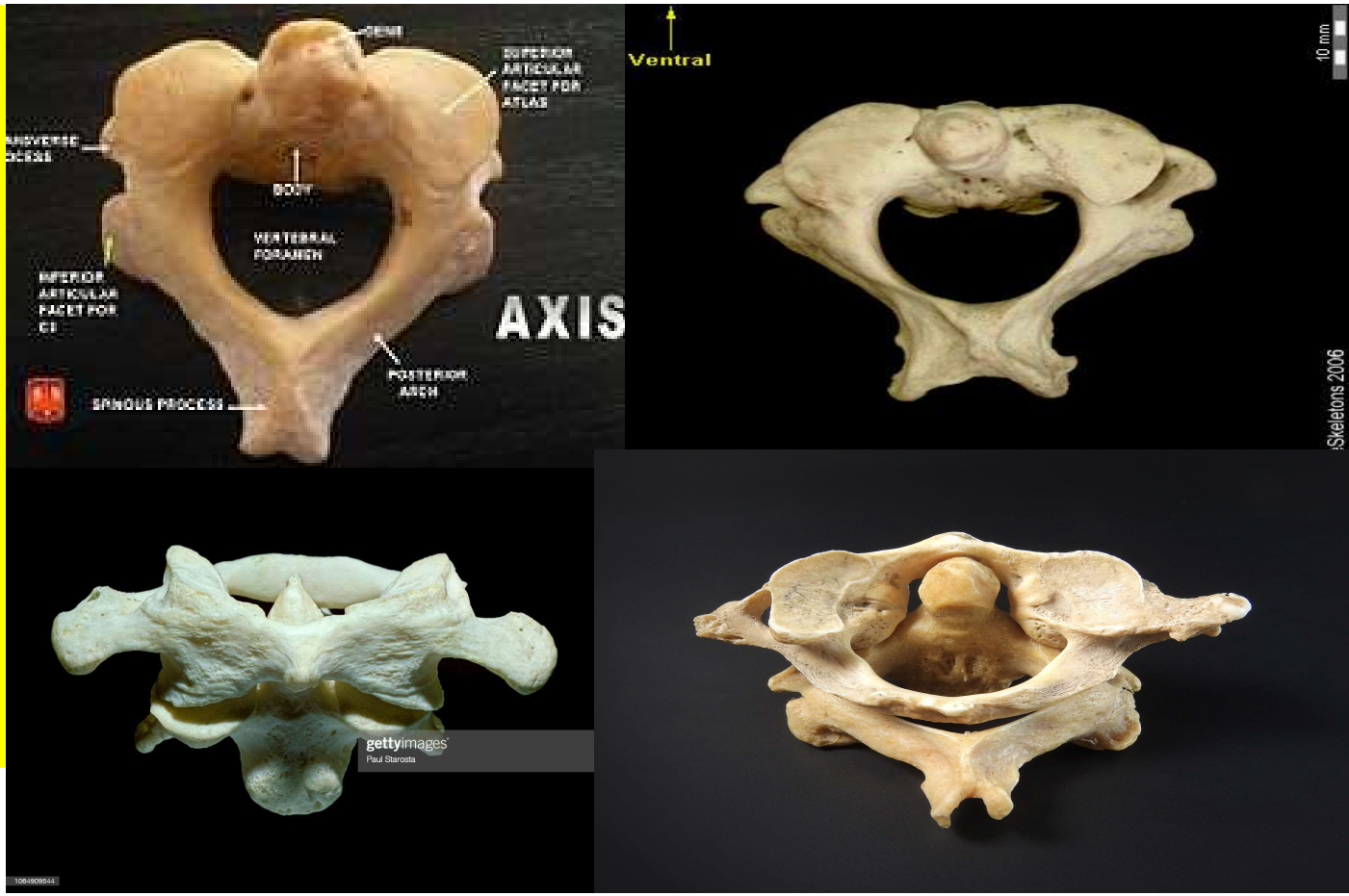




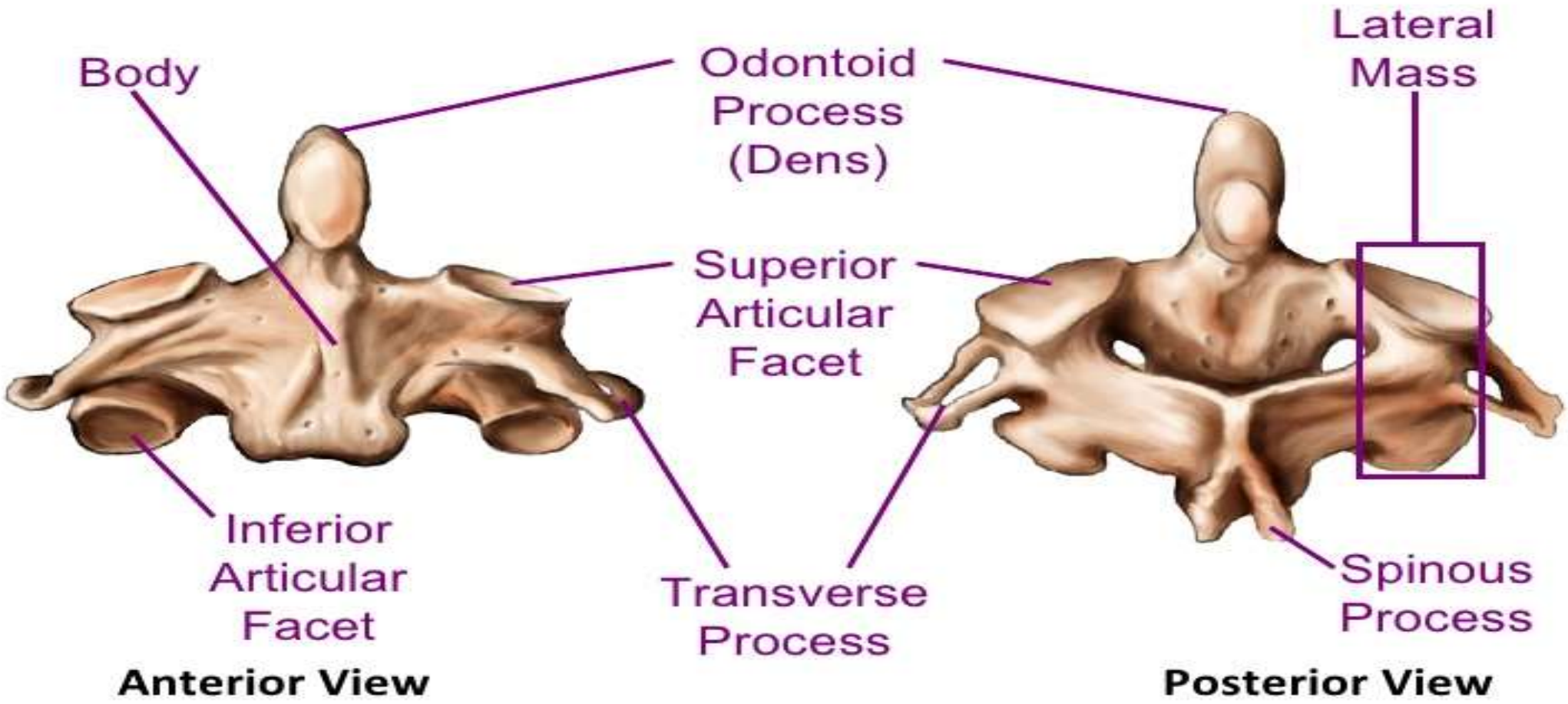
d The atlas (C_1) and axis (C_2).

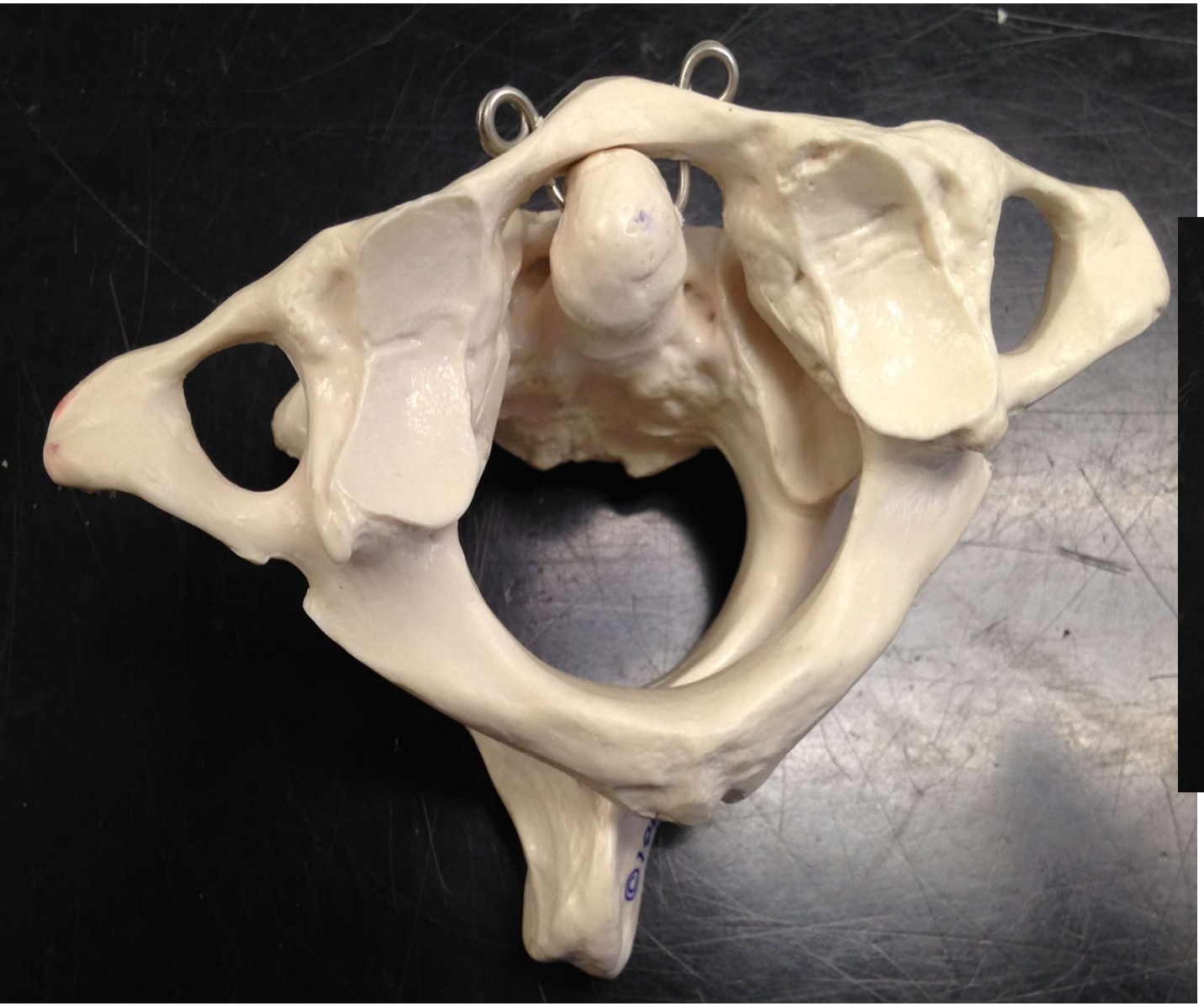
Cervical Vertebrae: The Axis (C_2)

- The axis has a body, spine, and vertebral arches as do other cervical vertebrae
- Unique to the axis is the dens, or odontoid process, which projects superiorly from the body and is cradled in the anterior arch of the atlas
- The dens is a pivot for the rotation of the atlas

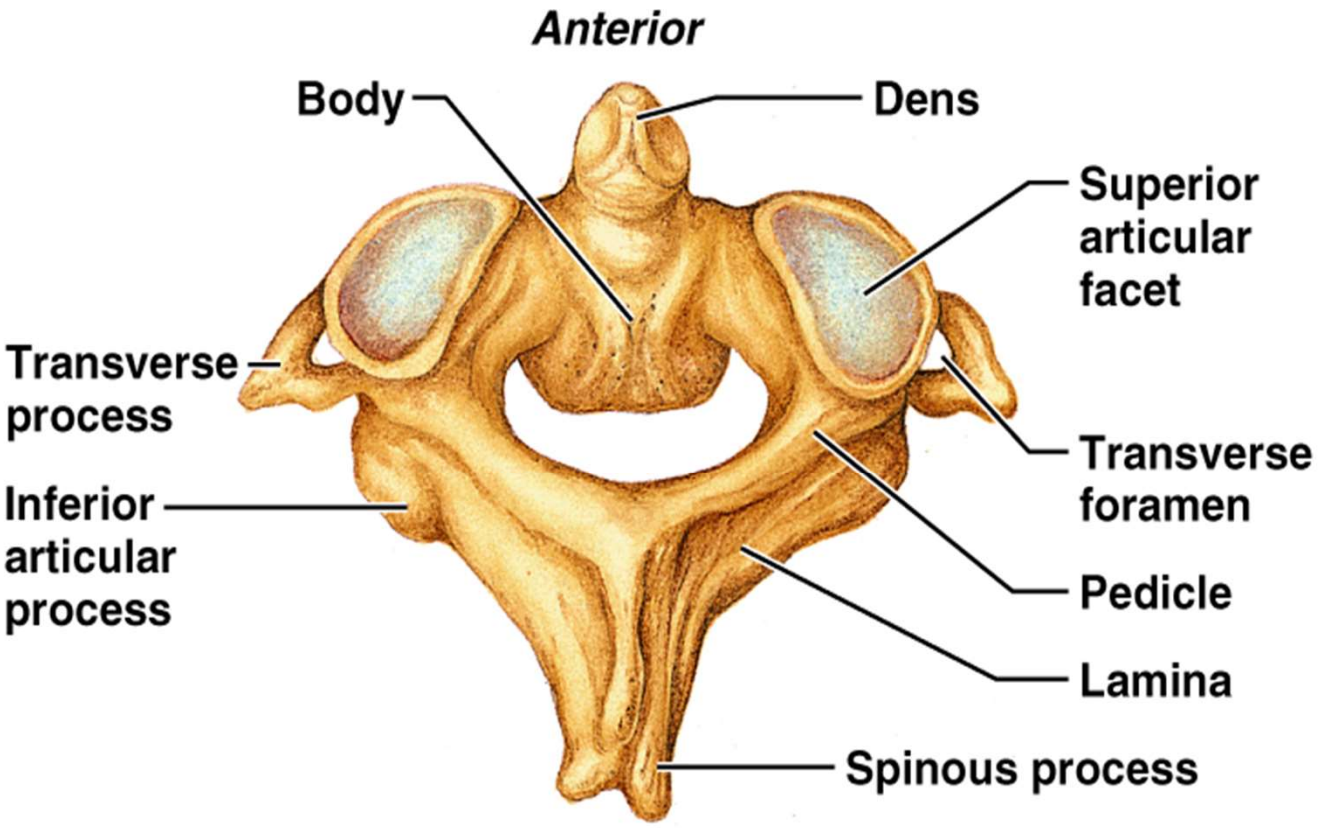


The Axis (C2)


Body
Odontoid Process (Dens)
Lateral Mass
Superior Articular Facet
Inferior Articular Facet
Transverse Process
Spinous Process
Anterior View
Posterior View



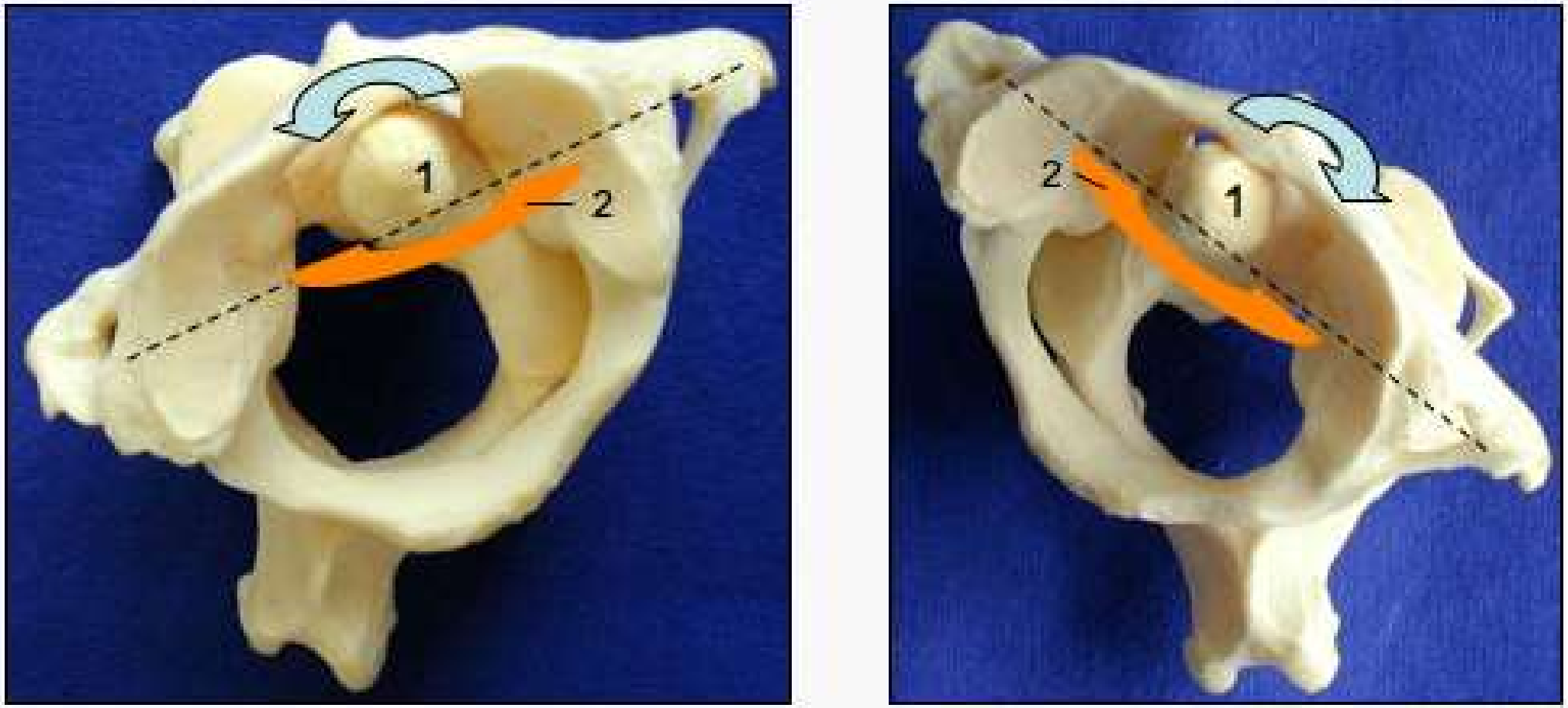
Cervical Vertebrae: The Axis (C_2)



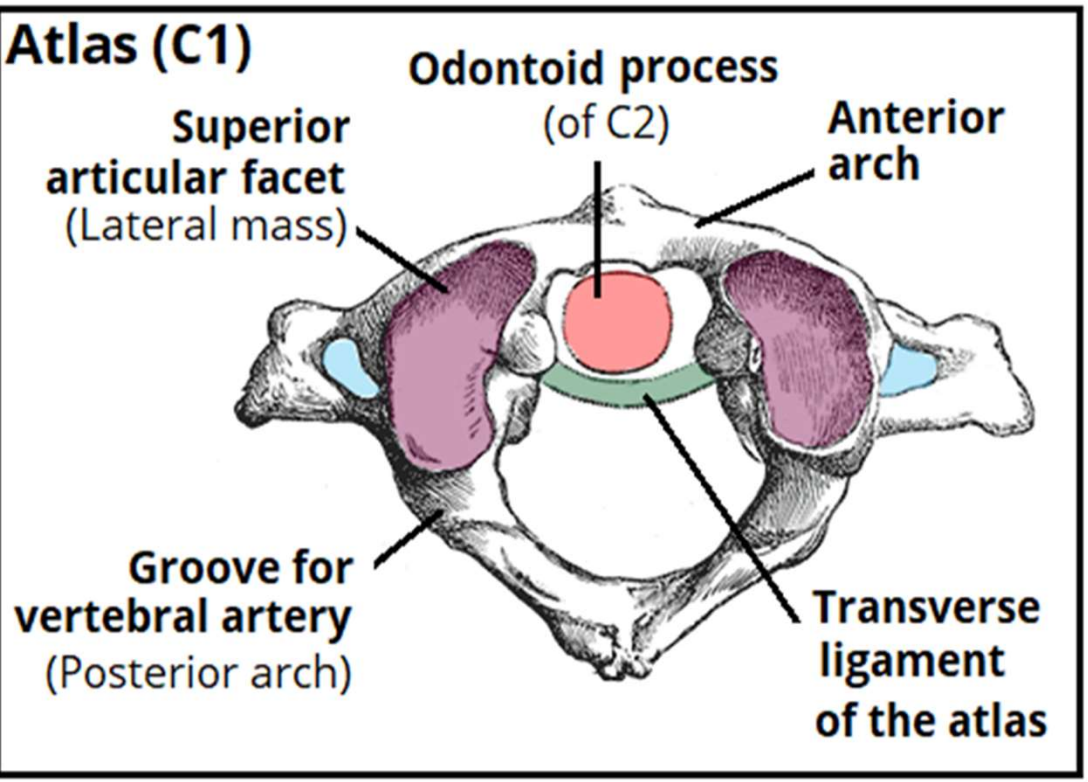
(c) Superior view of axis (C_2)

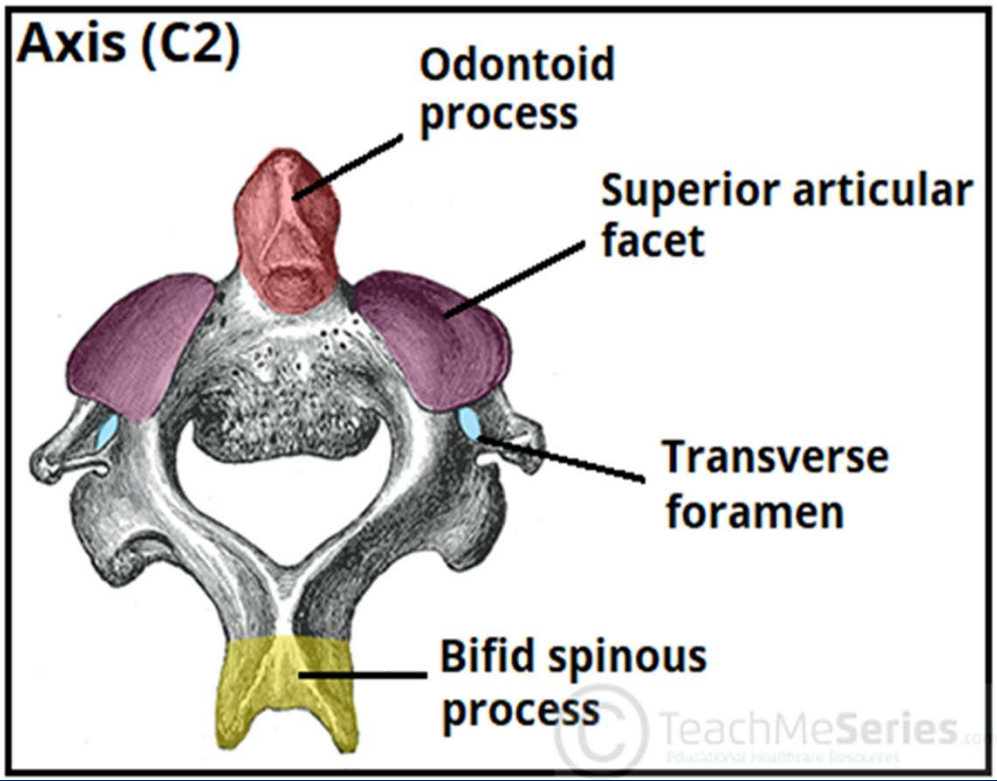
- Like the atlas, the axis is distinct in appearance and function from the rest of your vertebrae.
- Between C1 and C2, there two synovial joints called the atlanto-axial joint. These joints facilitate rotation at this level.
- The axis has a superior extension (upward), which is a peg-like bone called the dens. The dens fits within the ring of the atlas and with the axis, allows your head to rotate.
- So, when you shake your head "no," that's the axis at work.

Figure 7.16c



The main rotation of the head is performed in the atlantoaxial (C1/2) segment between the first and the second vertebrae. The odonoid peg (1) acts as an axis of rotation. The transverse ligament (2) is an important stabilizor.



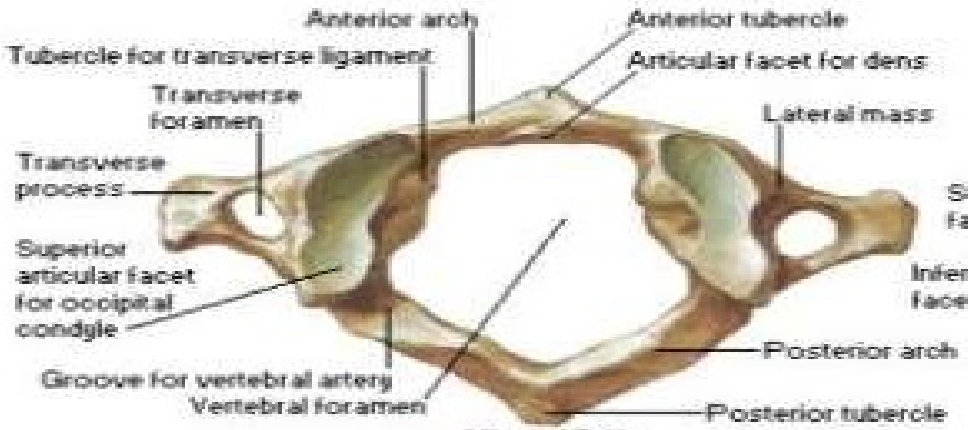


The atlas' shape allows the head to nod "yes" and the axis' shape allows the head to shake "no".

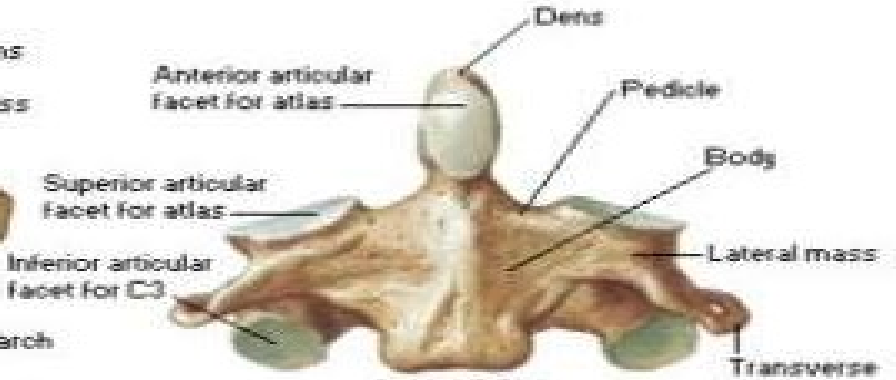
HOME

Cervical Vertebrae

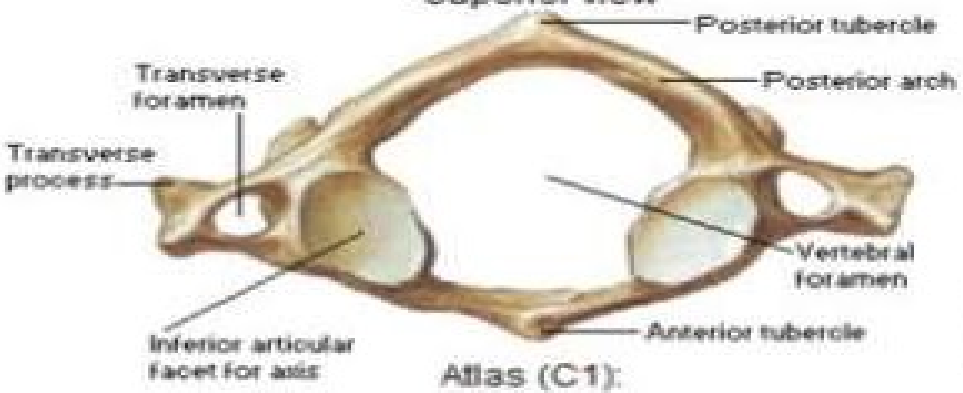
Atlas and Axis



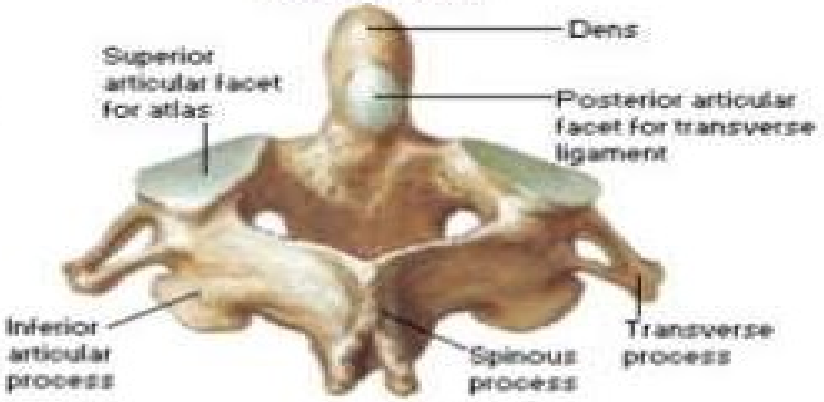
Atlas (C1): superior view



Axis (C2): anterior view



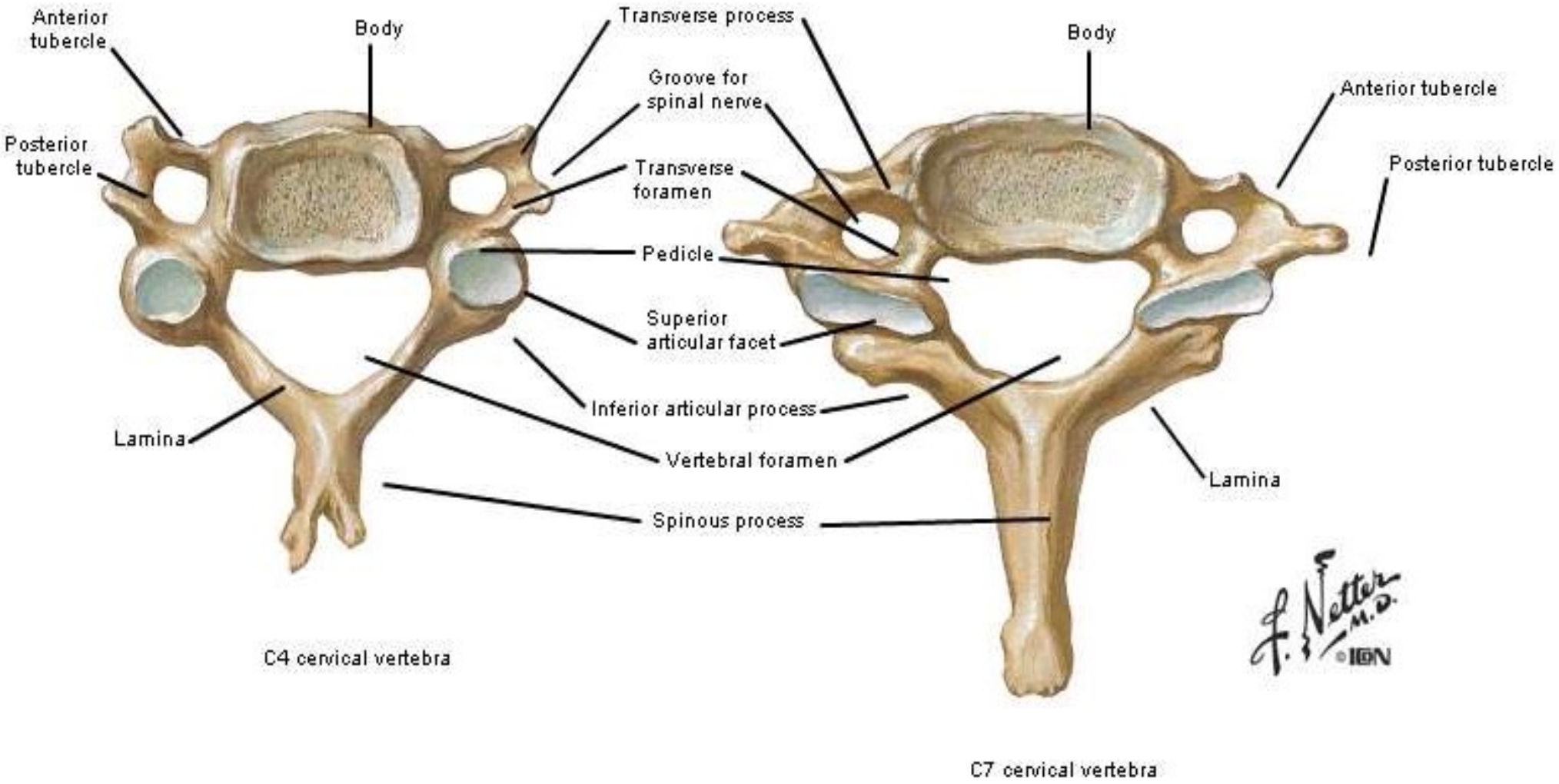
Atlas (C1): inferior view

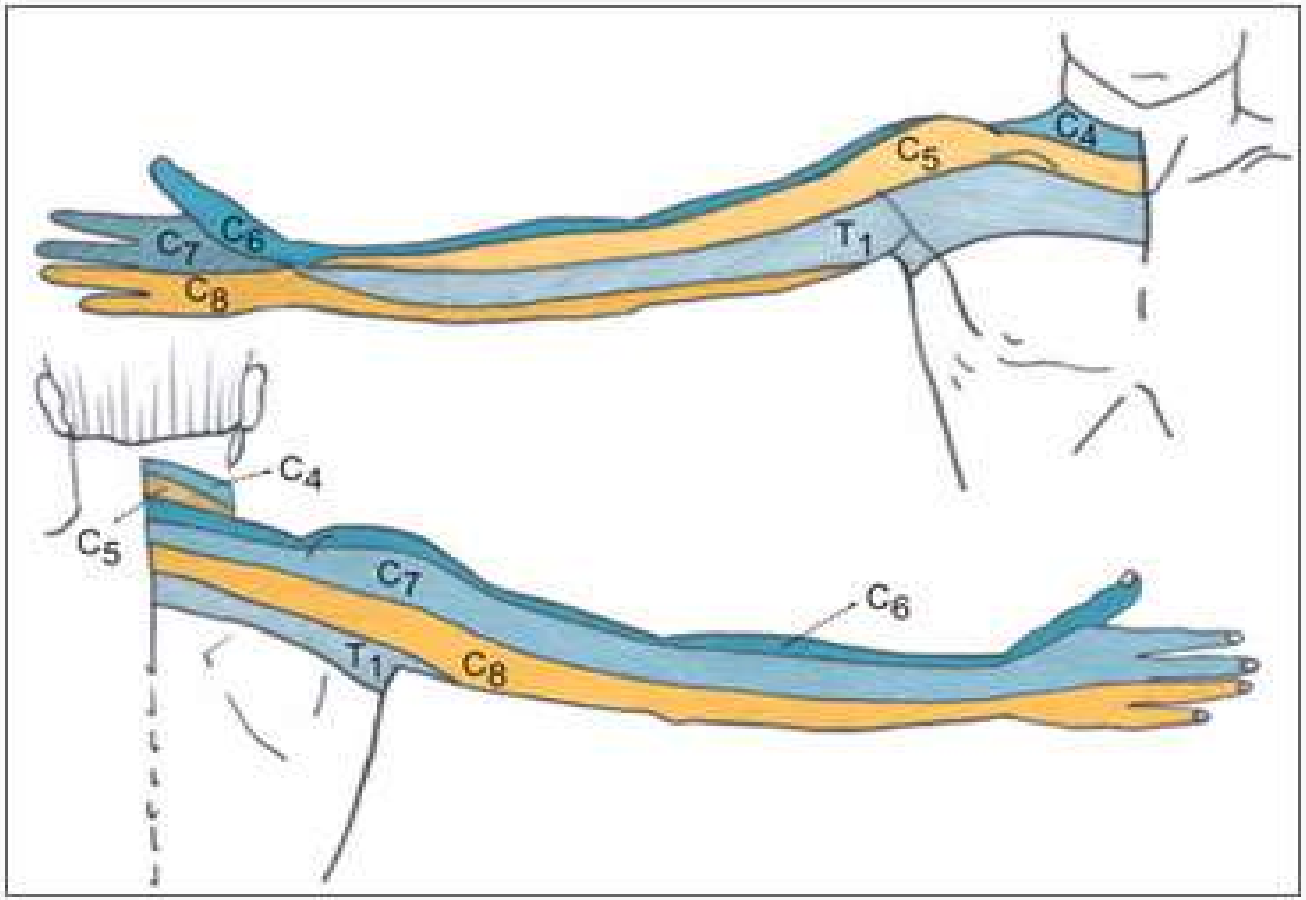


Axis (C2): posterosuperior view

Cervical Vertebrae (C4 and C7)

Superior Views



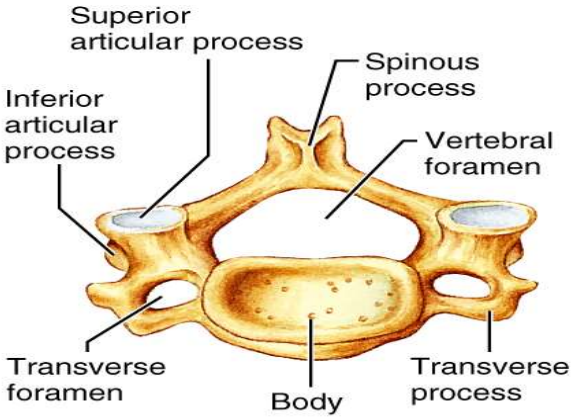
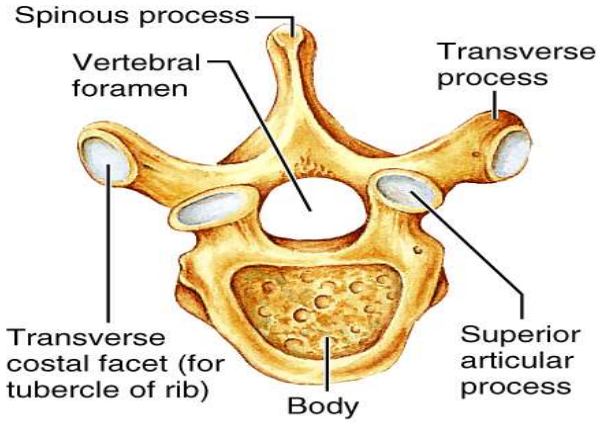
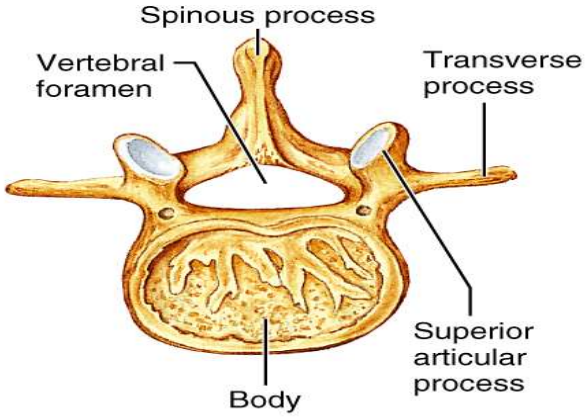
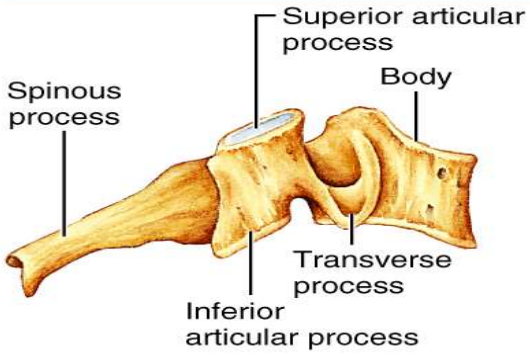
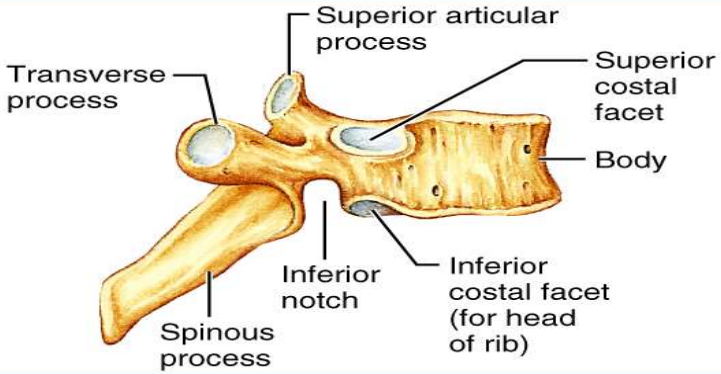
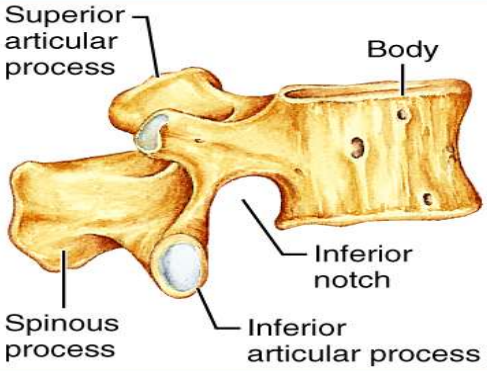


Nerve roots leave the spine between two corresponding vertebrae. The anatomical distribution of sensory disturbance/pain indicate the nerve root involved.

Differences	Cervical	Thoracic	Lumbar
1- Size and shape of the body	Small, oval	Medium, heart-shaped	Large, kidney-shaped
2- Transverse foramen for vertebral arteries	Present	Absent	Absent
3- Spinous process	Short, bifid	Long, slender and overlapping	Quadrangular, horizontal
4- Vertebral foramen	Large, triangular (cervical bulging of the spinal cord due to the origin of the brachial plexus)	Small, circular	Large, oval or triangular (lumbar bulging of the spinal cord due to the origin of the lumbosacral plexus)
5- Costal fovea	Absent	Present	Absent
6- Articular processes	Flat, rather horizontal	Flat, in a frontal plane	Concave, in a sagittal plane

Regional Characteristics of Vertebrae

TABLE 7.2 Regional Characteristics of Cervical, Thoracic, and Lumbar Vertebrae

CERVICAL (3–7)	THORACIC	LUMBAR
SUPERIOR VIEW		
		
RIGHT LATERAL VIEW		
		

Thoracic Vertebrae

- There are twelve vertebrae (T_1-T_{12}) all of which articulate with ribs
- Major markings include two facets and two demifacets on the heart-shaped body, the circular vertebral foramen, transverse processes, and a long spinous process
- The location of the articulate facets prevents flexion and extension, but allows rotation of this area of the spine

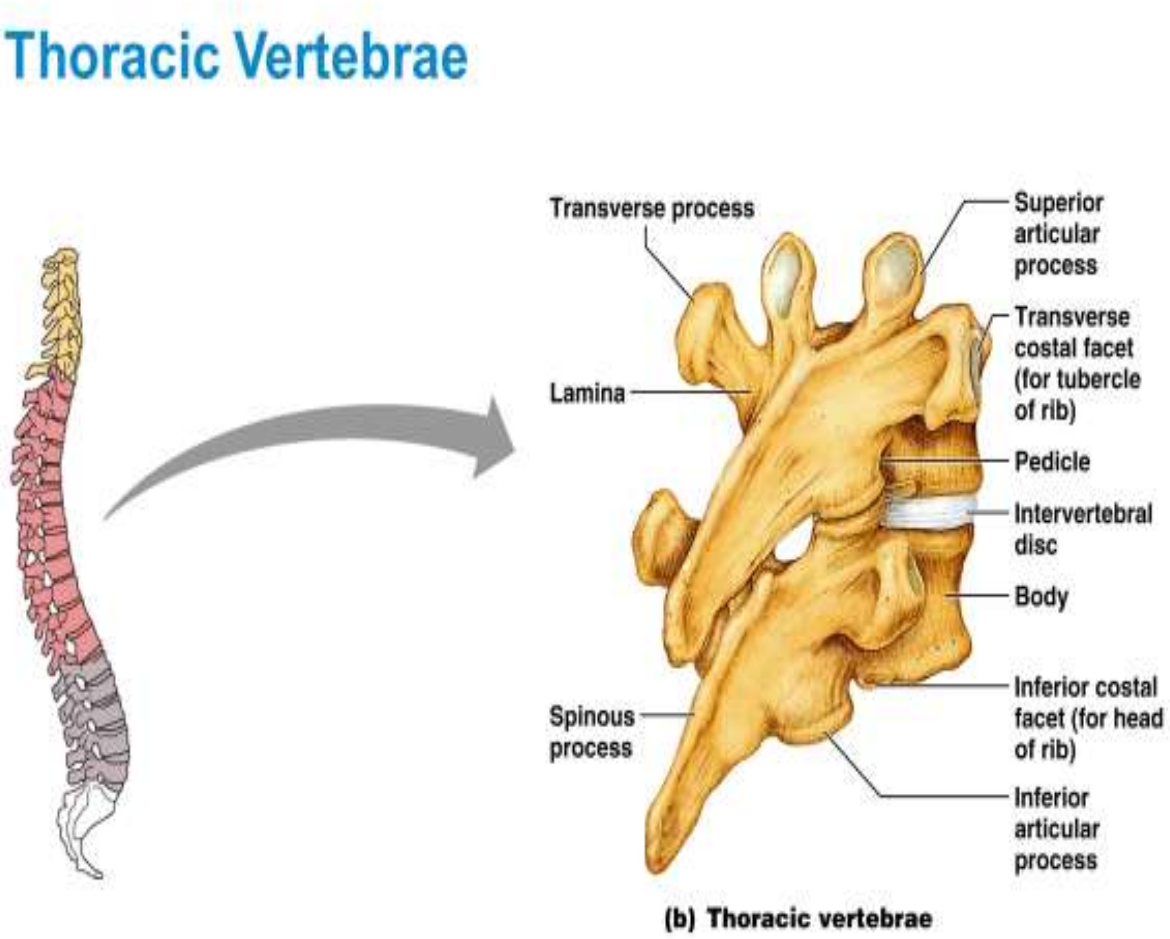
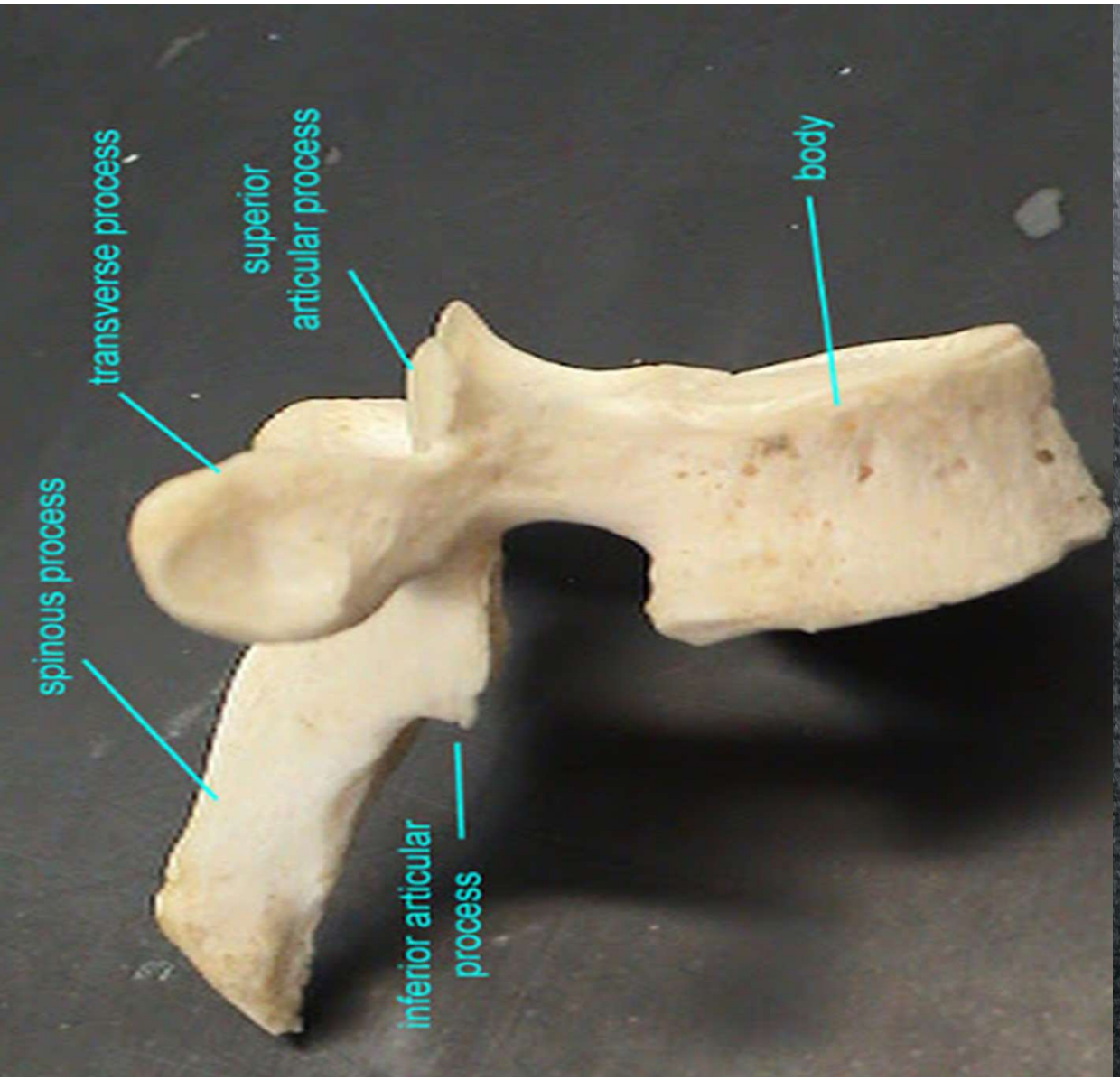
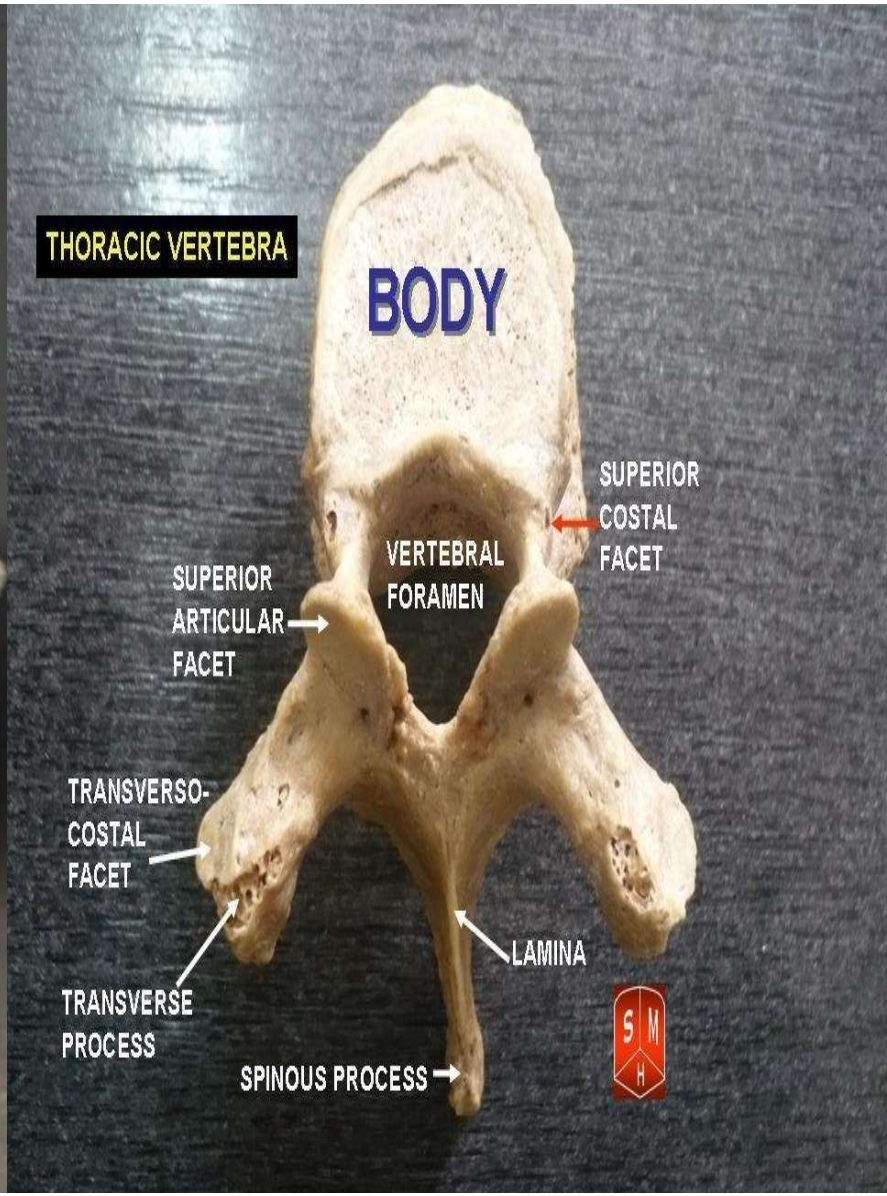


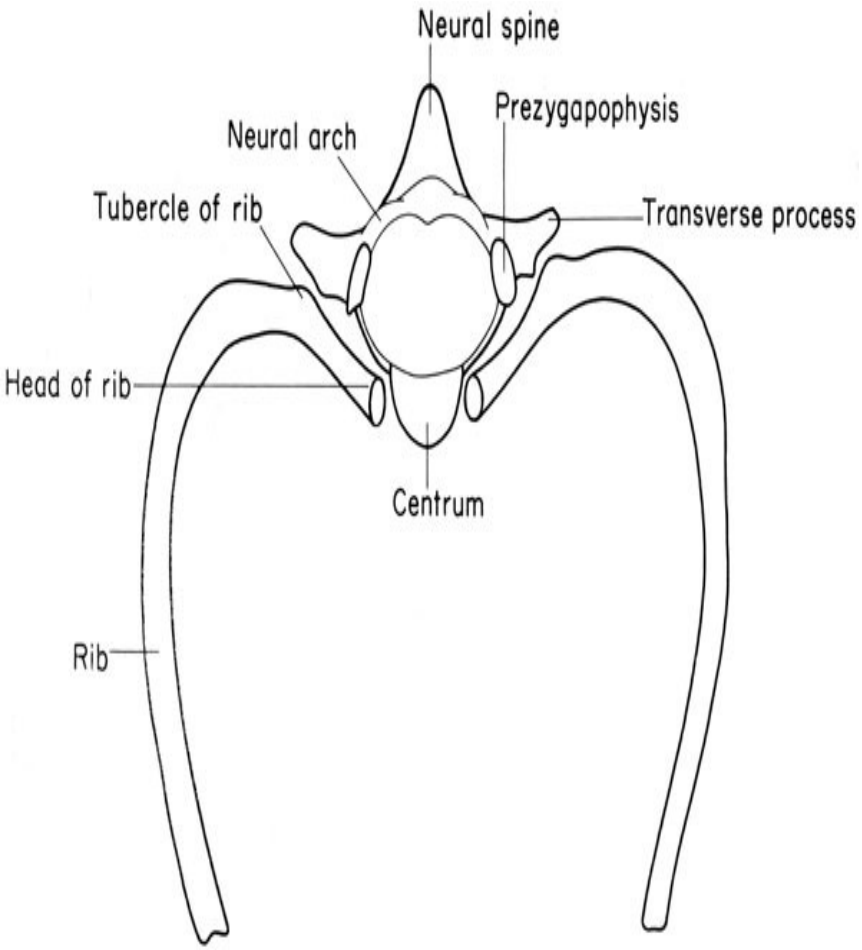
Figure 7.17b

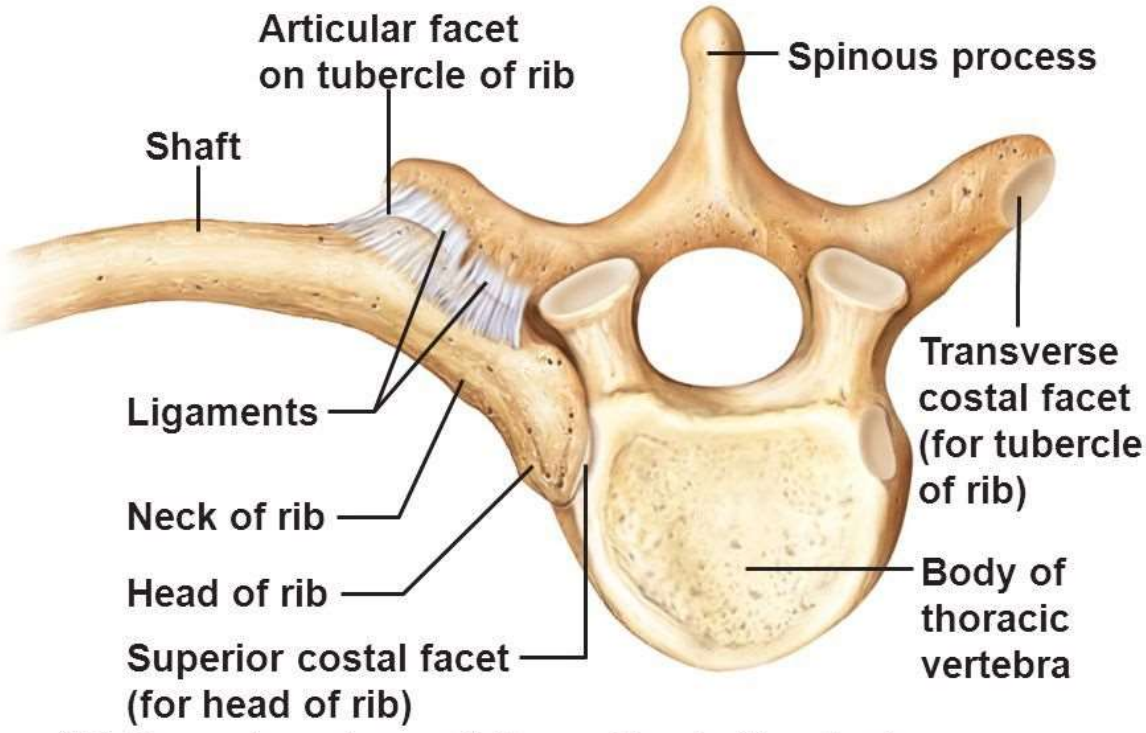

transverse process
superior articular process
body
spinous process
inferior articular process


THORACIC VERTEBRA
BODY
SUPERIOR COSTAL FACET
VERTEBRAL FORAMEN
SUPERIOR ARTICULAR FACET
TRANSVERSO-COSTAL FACET
LAMINA
TRANSVERSE PROCESS
SPINOUS PROCESS

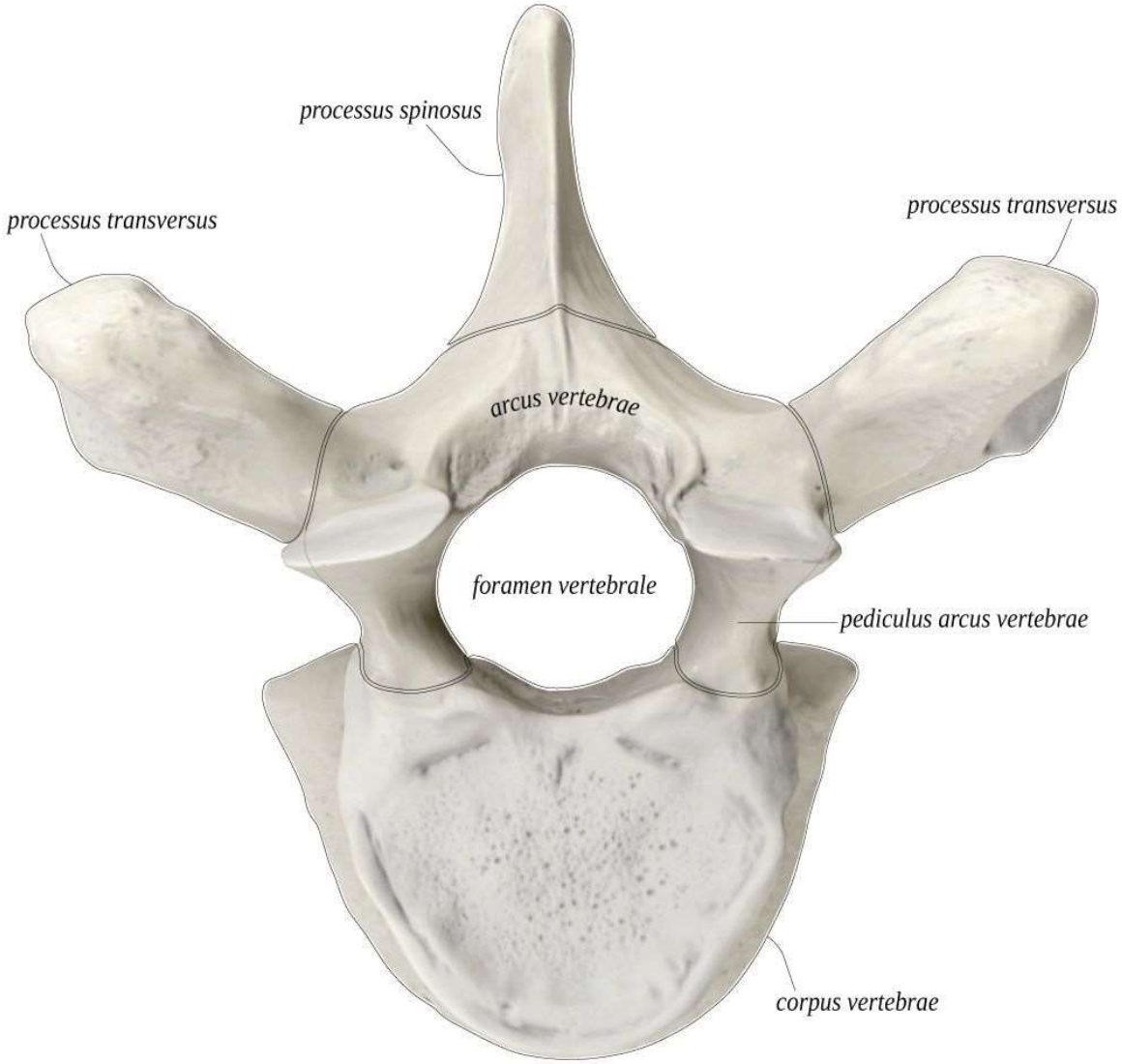

spinous process
transverse process
articular process
body

5th thoracic vertebra with rib. Anterior aspect.

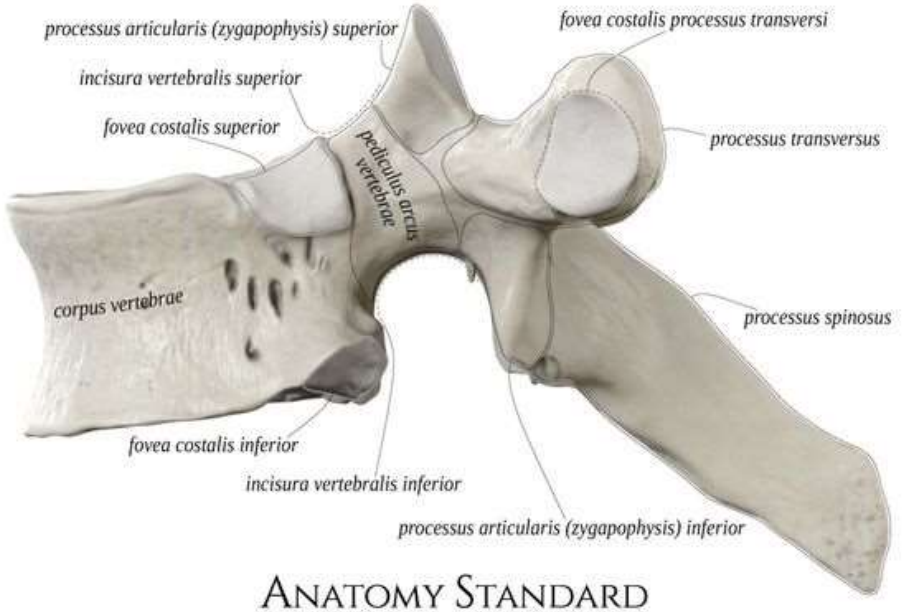




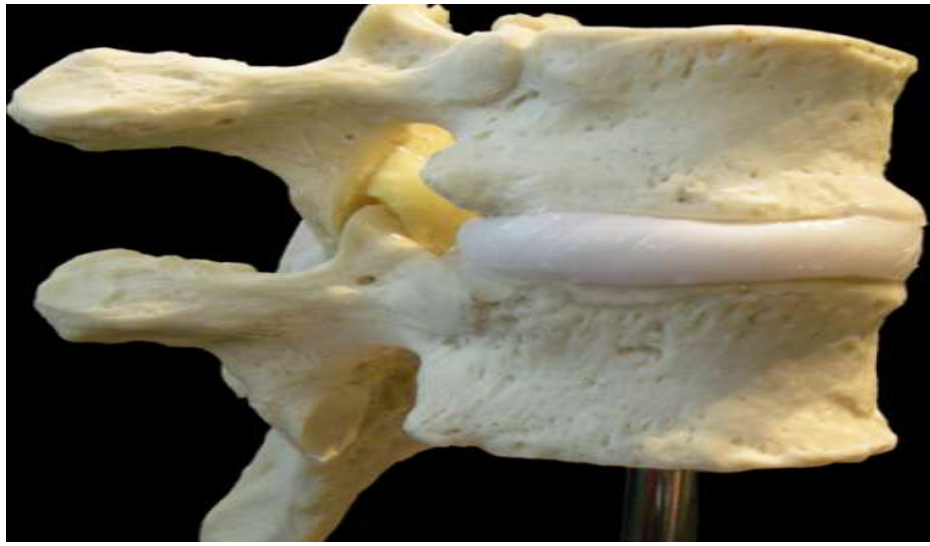
(b) Superior view of the articulation between a rib and a thoracic vertebra



ANATOMY STANDARD



ANATOMY STANDARD

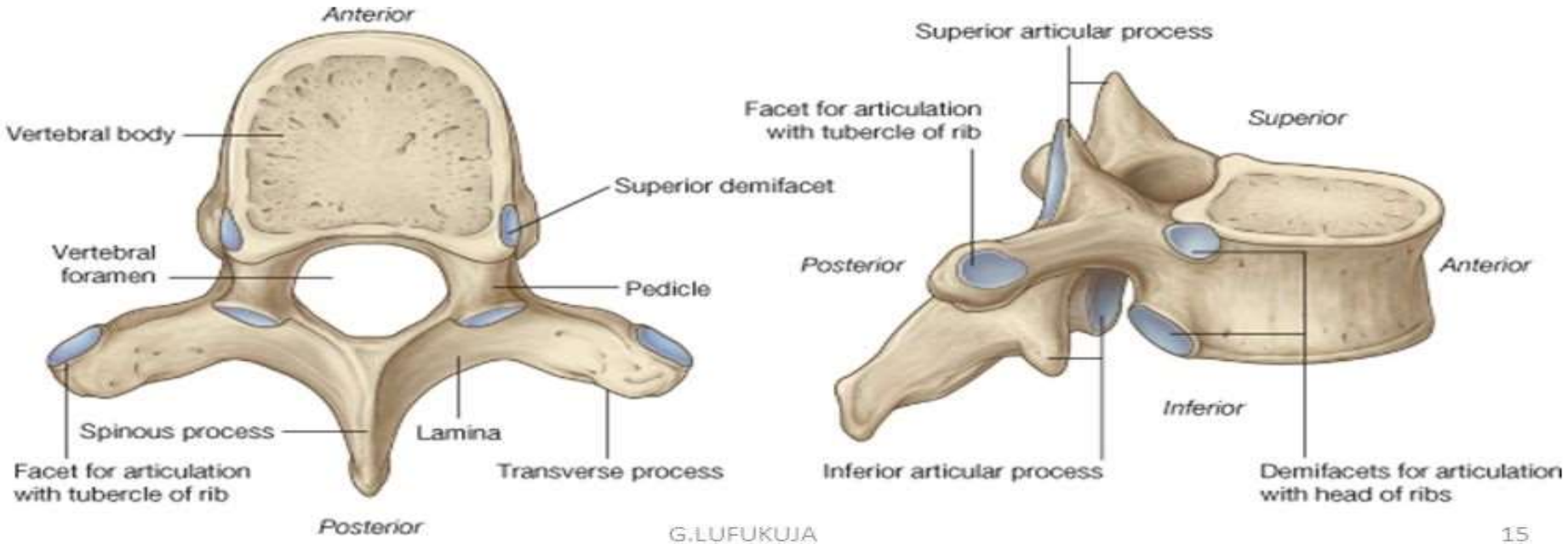


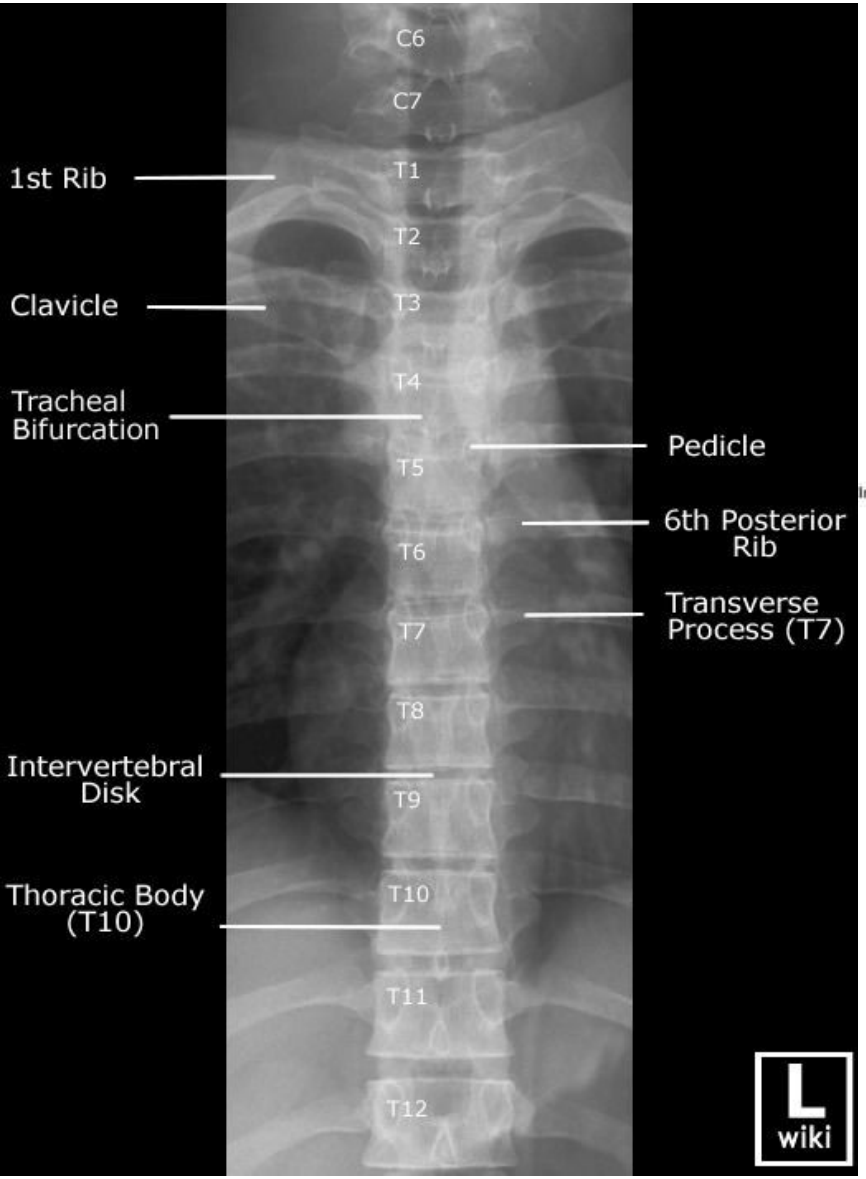
Features of typical thoracic vertebra:

Body: It is heart shaped; Presence of **two costal demifacets**

The transverse process: Tips bear oval **costal facets**

Spinous process: Long and slopes downward



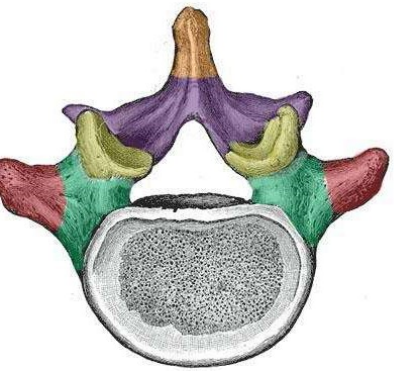

C6
C7
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
1st Rib
Clavicle
Tracheal Bifurcation
Intervertebral Disk
Thoracic Body (T10)
Pedicle
6th Posterior Rib
Transverse Process (T7)
L
wiki


Vertebral body
Intervertebral disc
Intercostal vessels
Bony end plate
Dorsal root ganglion
Inferior articular process
Intervertebral foramen
Pedicle
Superior articular process
Zygapophysial joint


R

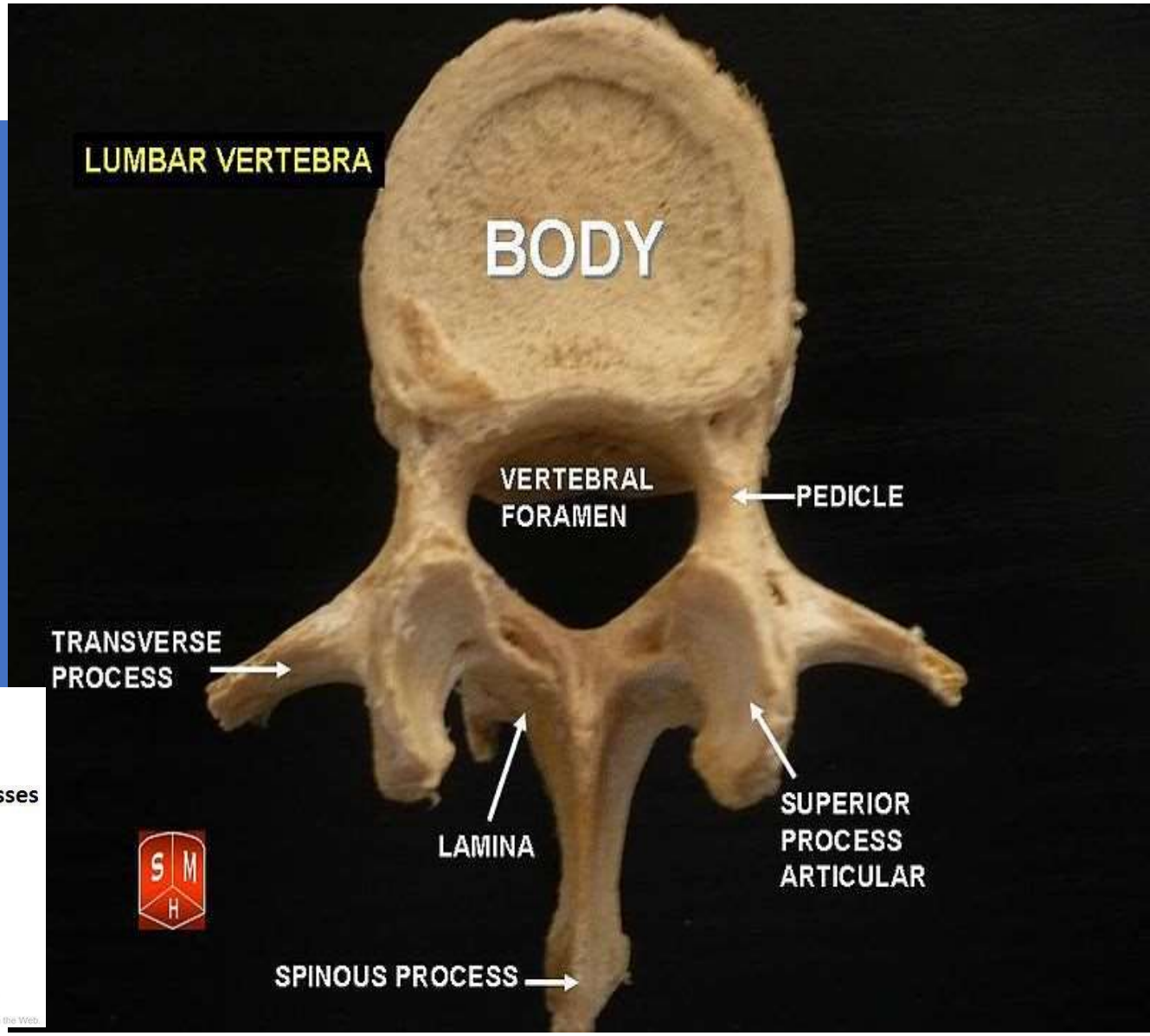
Lumbar Vertebrae

- The five lumbar vertebrae (L_1-L_5) are located in the small of the back and have an enhanced weight-bearing function
- They have short, thick pedicles and laminae, flat hatchet-shaped spinous processes, and a triangular-shaped vertebral foramen
- Orientation of articular facets locks the lumbar vertebrae together to provide stability



Spinous process
Lamina
Superior articular processes
Pedicles
Transverse processes

© teachmeanatomy
The #1 Applied Human Anatomy Site on the Web

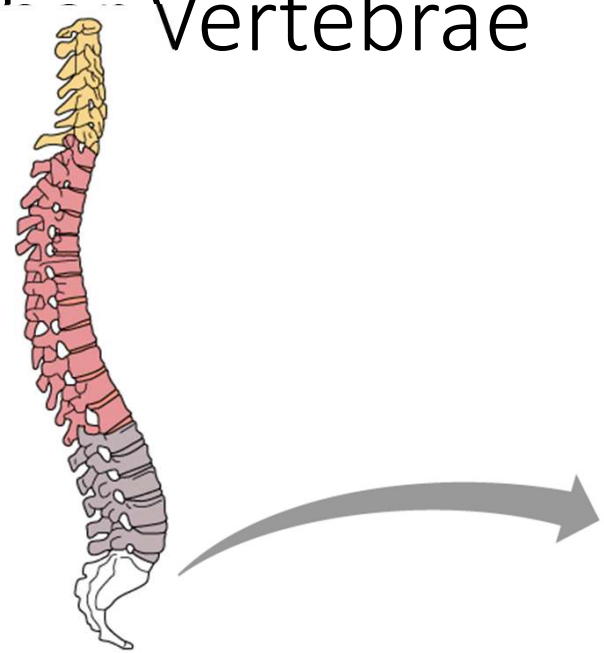


heavy centra,

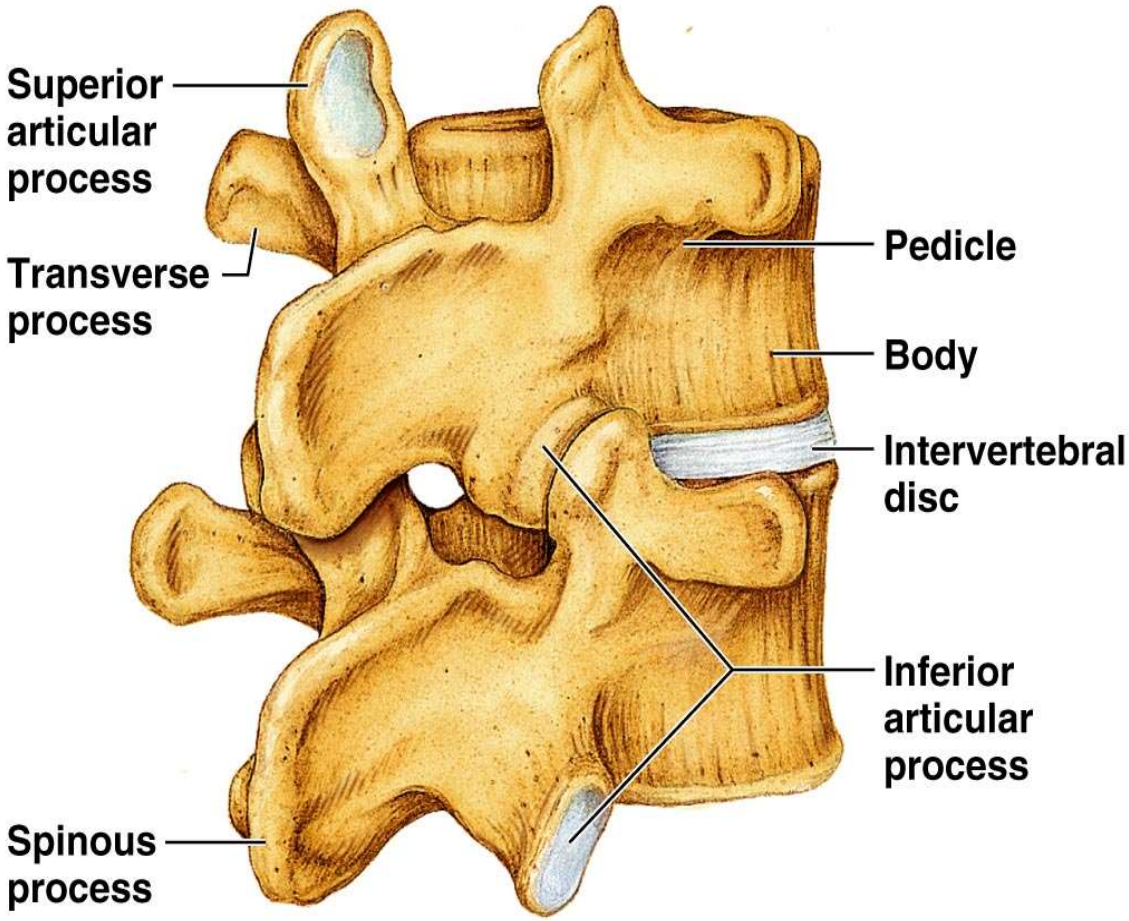
broad heavy spinous process,

transverse process lacks facets

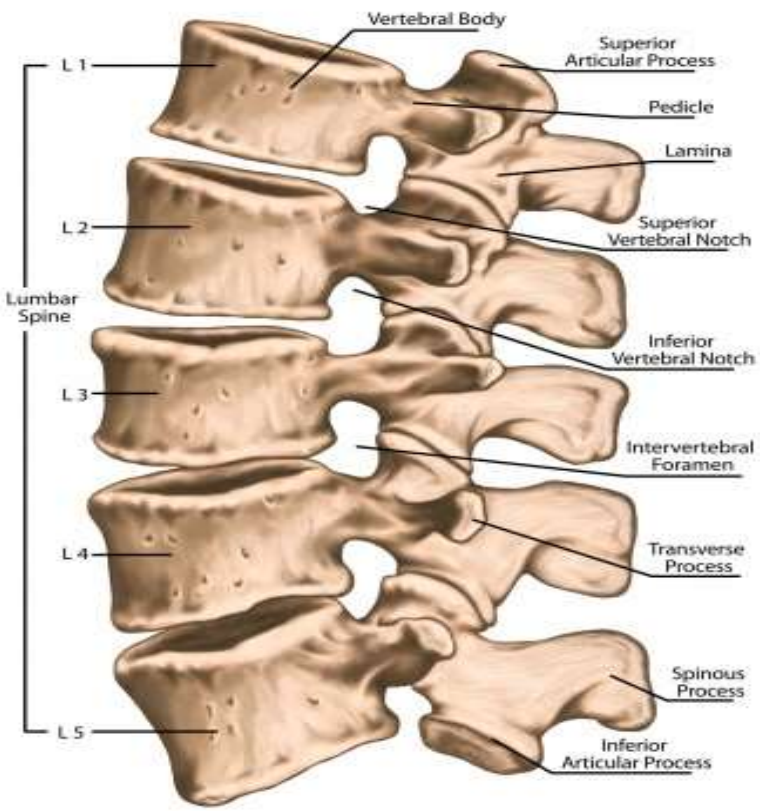
Lumbar Vertebrae

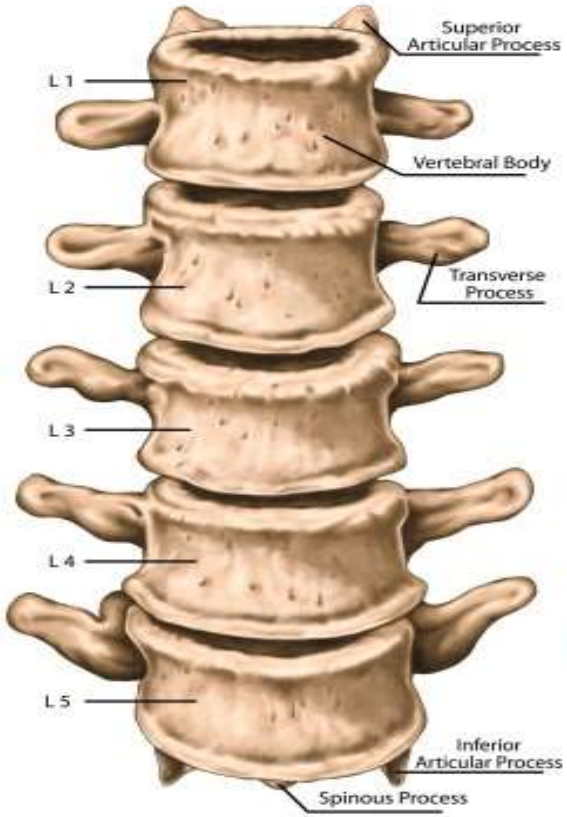


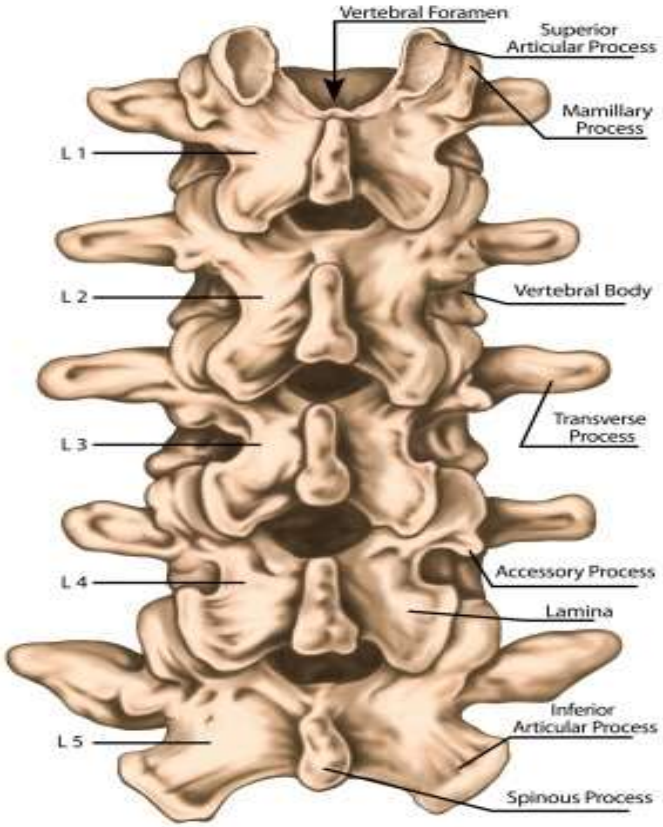
The lumbar spine is the lower back that begins below the last thoracic vertebra (T12) and ends at the top of the sacral spine, or sacrum (S1). Most people have 5 lumbar levels (L1-L5), although it is not unusual to have 6. Each lumbar spinal level is numbered from top to bottom—L1 through L5, or L6.

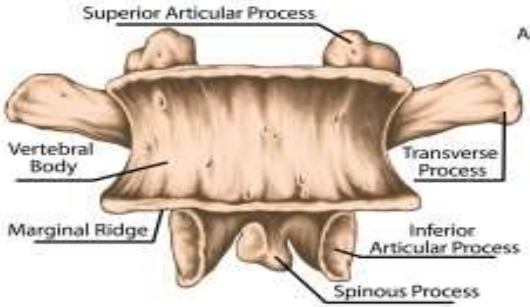


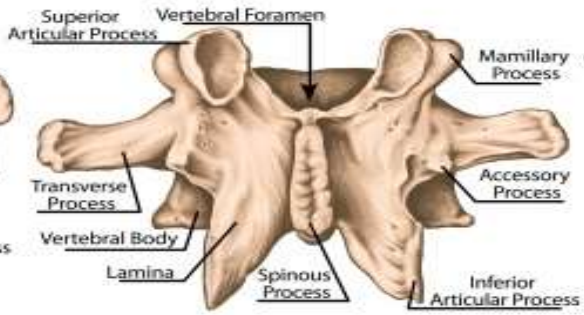
(c) Lumbar vertebrae

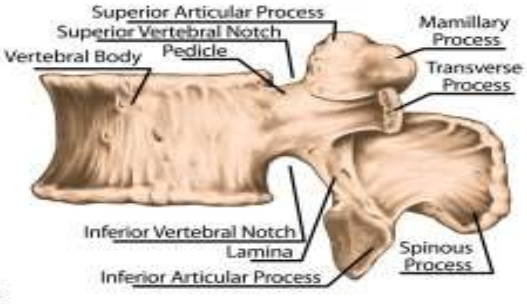

Vertebral Body
Superior Articular Process
Pedicle
Lamina
Superior Vertebral Notch
Inferior Vertebral Notch
Intervertebral Foramen
Transverse Process
Spinous Process
Inferior Articular Process
L 1
L 2
L 3
L 4
L 5
Lumbar Spine

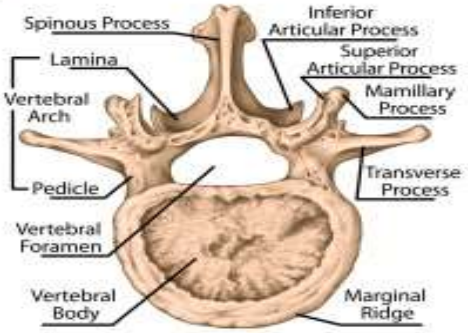

Superior Articular Process
Vertebral Body
Transverse Process
Inferior Articular Process
Spinous Process
L 1
L 2
L 3
L 4
L 5

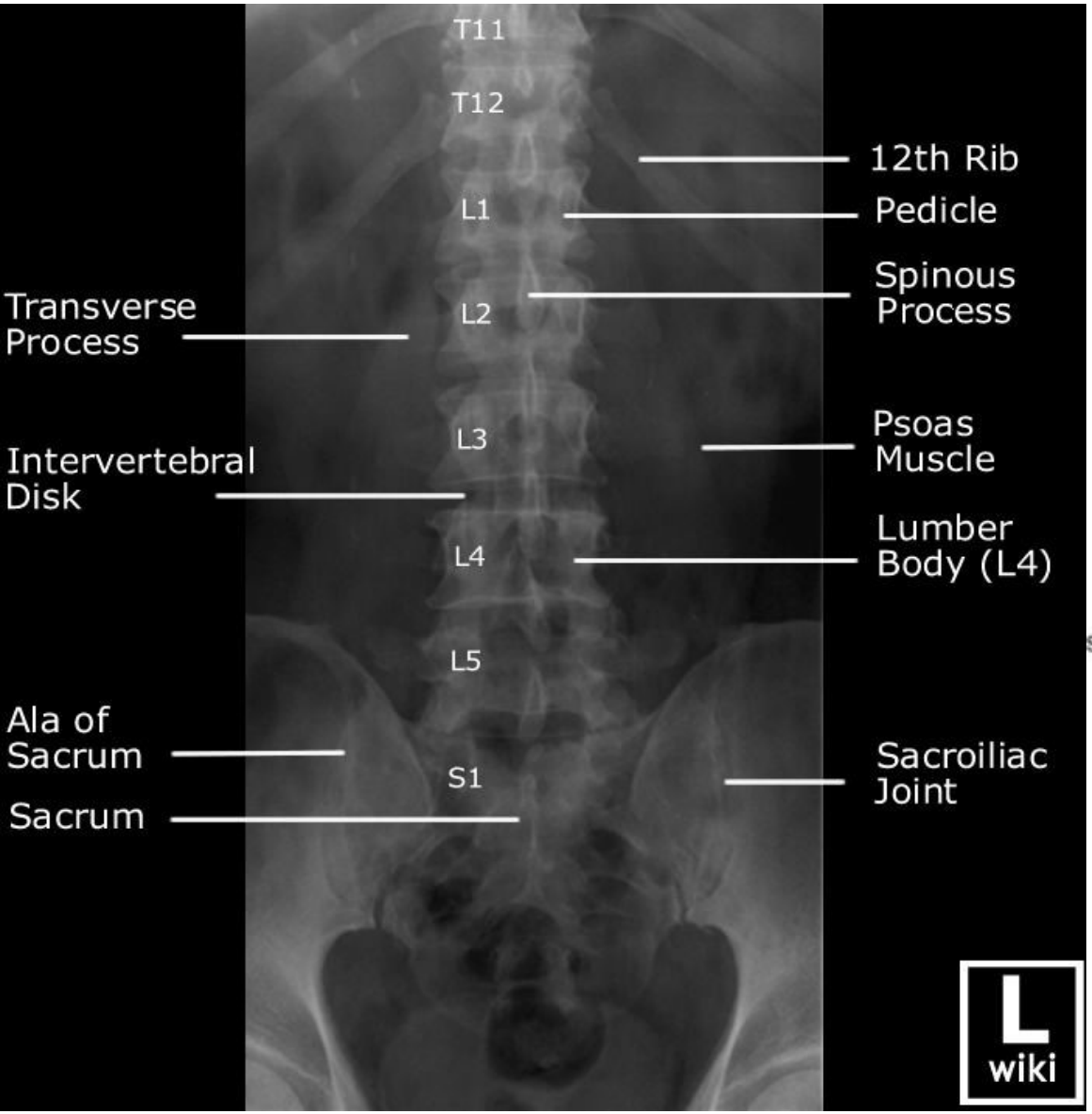

Vertebral Foramen
Superior Articular Process
Mamillary Process
Vertebral Body
Transverse Process
Accessory Process
Lamina
Inferior Articular Process
Spinous Process
L 1
L 2
L 3
L 4
L 5

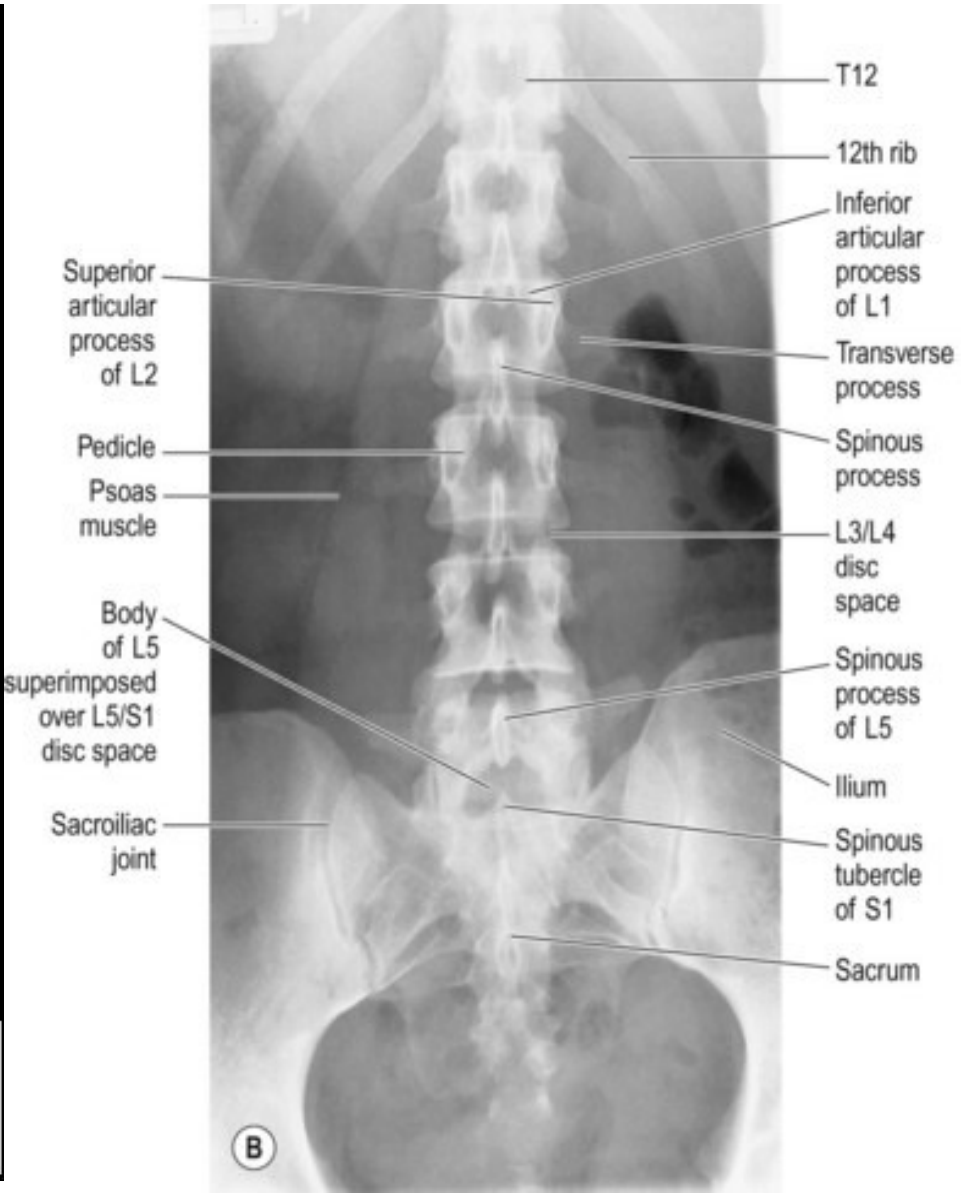

Superior Articular Process
Vertebral Body
Transverse Process
Marginal Ridge
Inferior Articular Process
Spinous Process

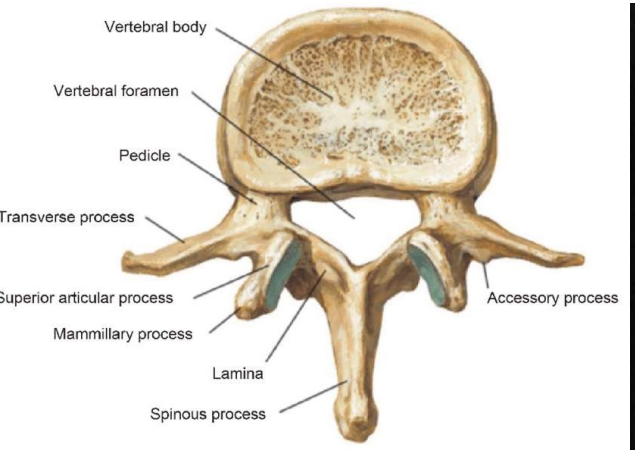

Superior Articular Process
Vertebral Foramen
Mamillary Process
Transverse Process
Accessory Process
Vertebral Body
Lamina
Spinous Process
Inferior Articular Process


Superior Articular Process
Superior Vertebral Notch
Vertebral Body
Pedicle
Mamillary Process
Transverse Process
Inferior Vertebral Notch
Lamina
Inferior Articular Process
Spinous Process

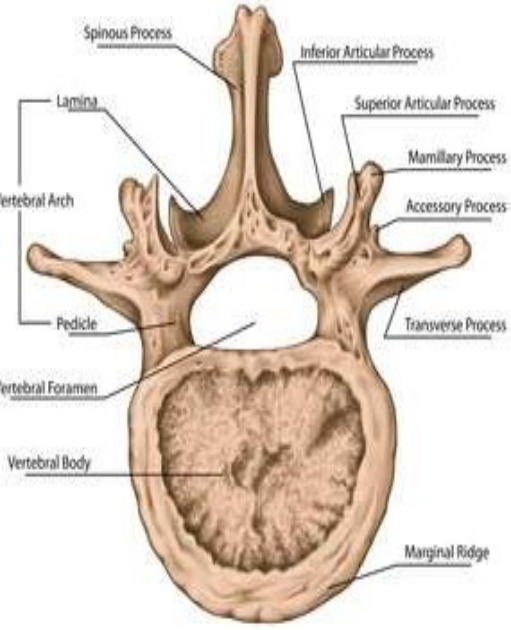

Spinous Process
Inferior Articular Process
Lamina
Superior Articular Process
Vertebral Arch
Mamillary Process
Pedicle
Transverse Process
Vertebral Foramen
Vertebral Body
Marginal Ridge


T11
T12
12th Rib
L1
Pedicle
Spinous Process
Transverse Process
L2
L3
Psoas Muscle
Intervertebral Disk
L4
Lumber Body (L4)
L5
Ala of Sacrum
S1
Sacroiliac Joint
Sacrum
L wiki


T12
12th rib
Inferior articular process of L1
Superior articular process of L2
Transverse process
Spinous process
Pedicle
Psoas muscle
L3/L4 disc space
Body of L5 superimposed over L5/S1 disc space
Spinous process of L5
Ilium
Sacroiliac joint
Spinous tubercle of S1
Sacrum
B



L2 vertebra:
superior view

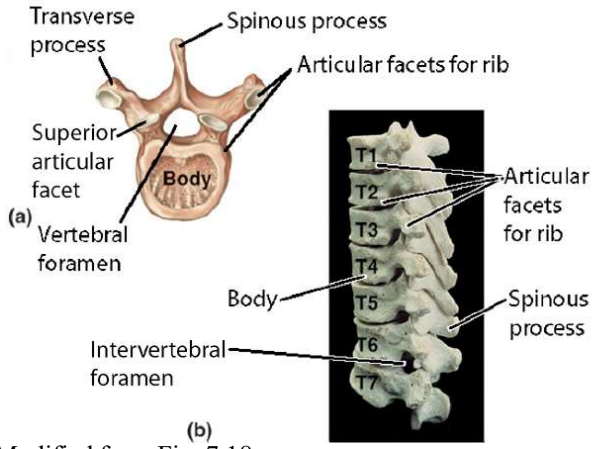


shutterstock.com · 265644461

FIG. 61-2 Lateral osteophytes (*arrow*) of spondylosis deformans are visible on a ventrodorsal view of a dog's lumbar spine. Lateral osteophytes can be mistaken for a calcified or herniated disk on a lateral radiographic view of the spine.

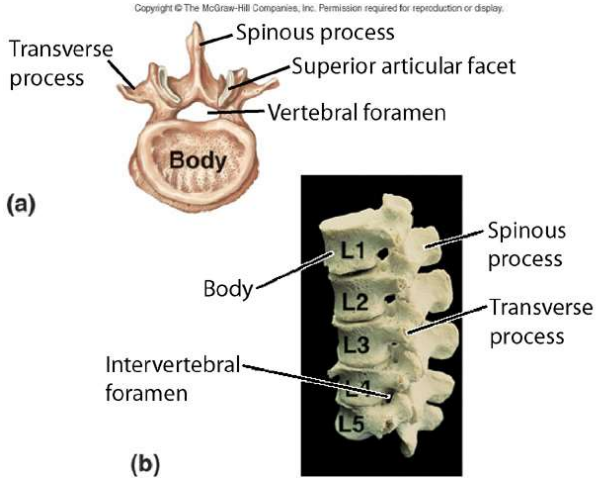
Thoracic and Lumbar Vertebrae

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

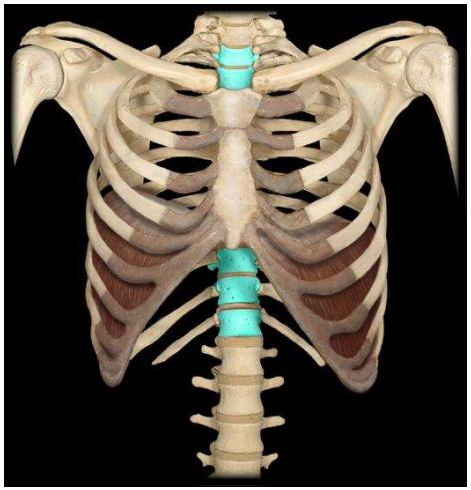


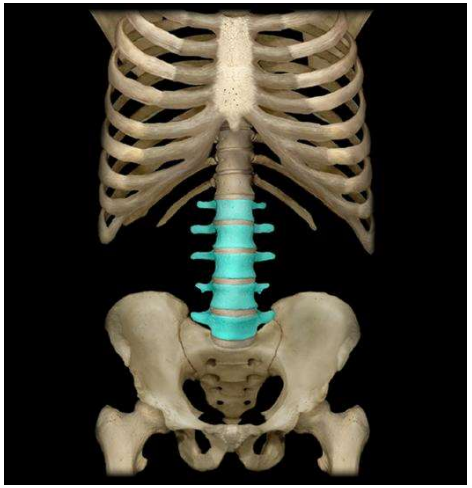
Modified from Fig. 7.18

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



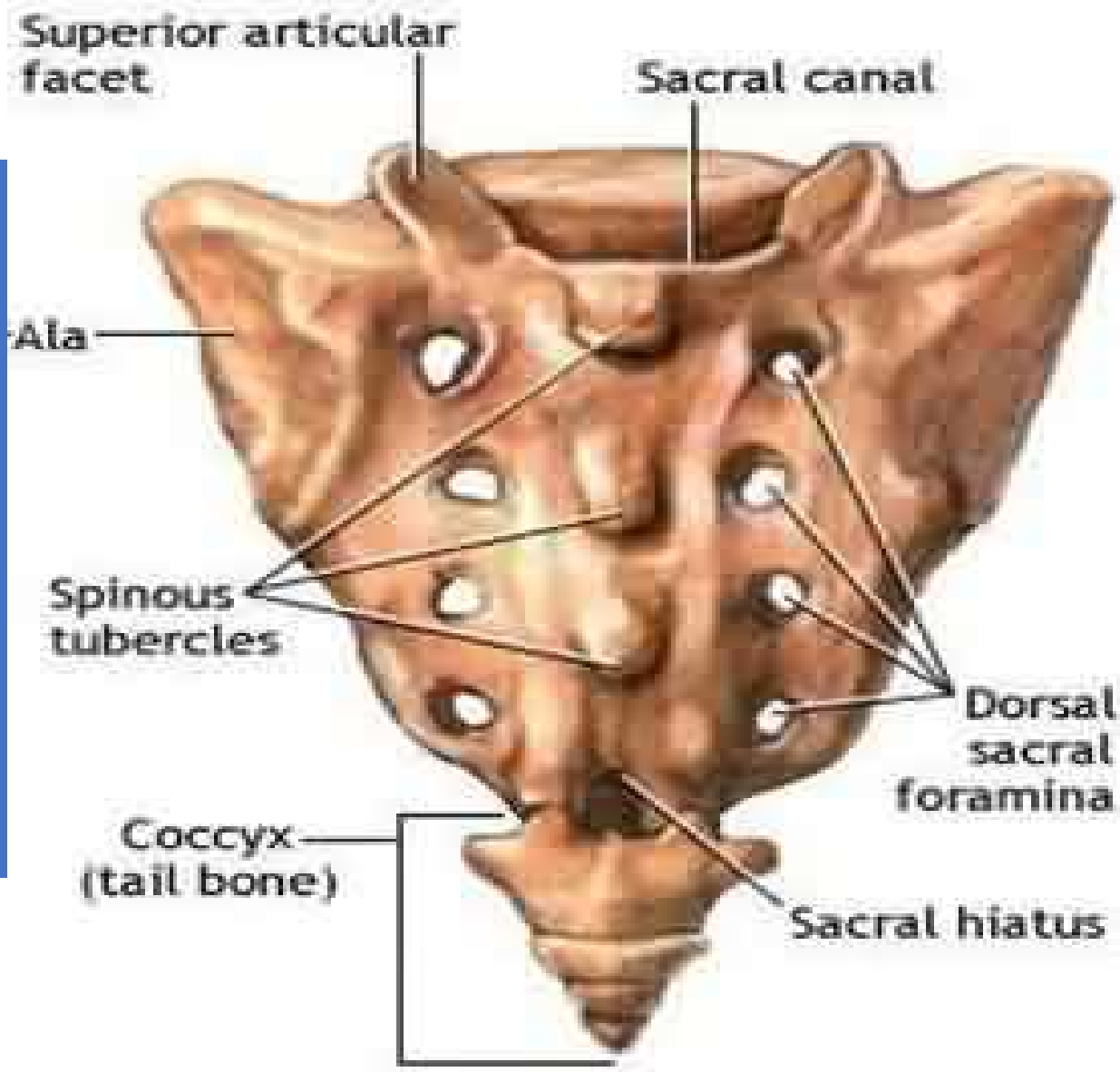
Modified from Fig. 7.19



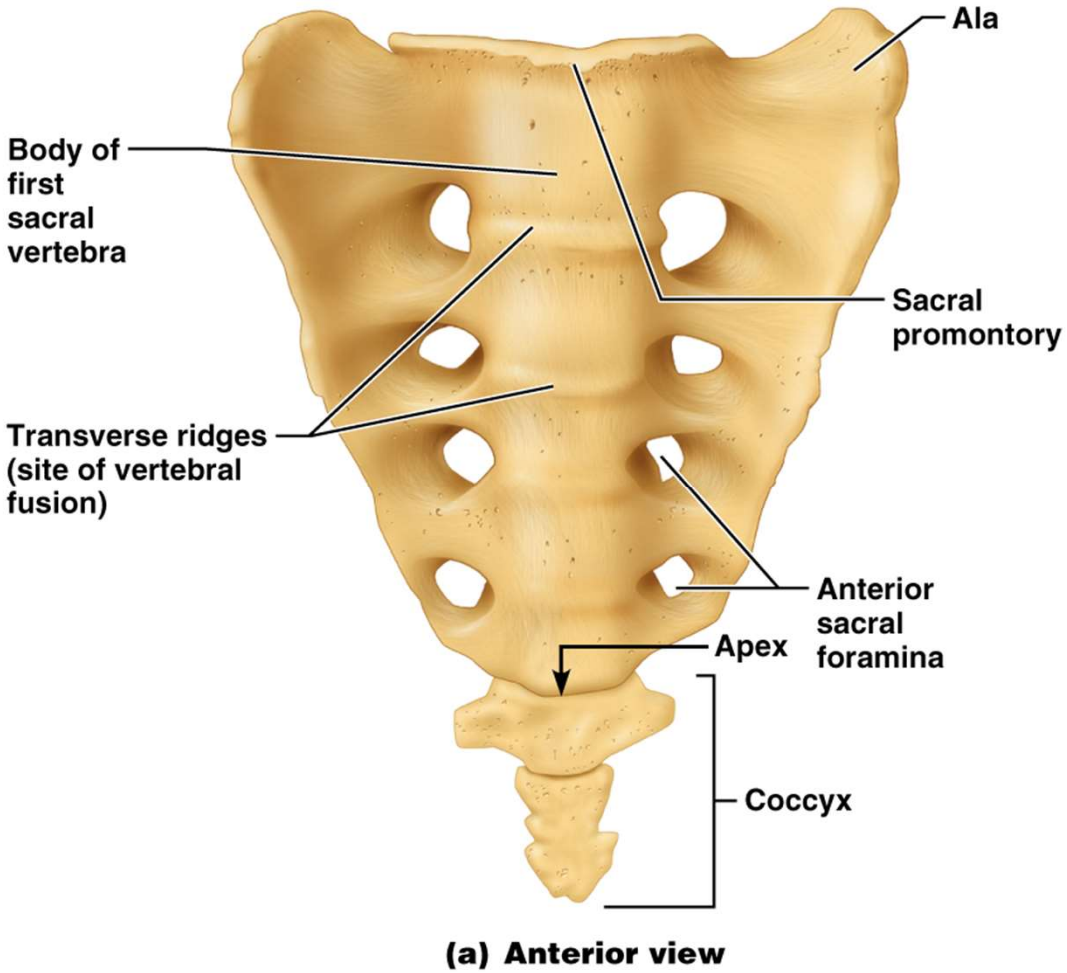


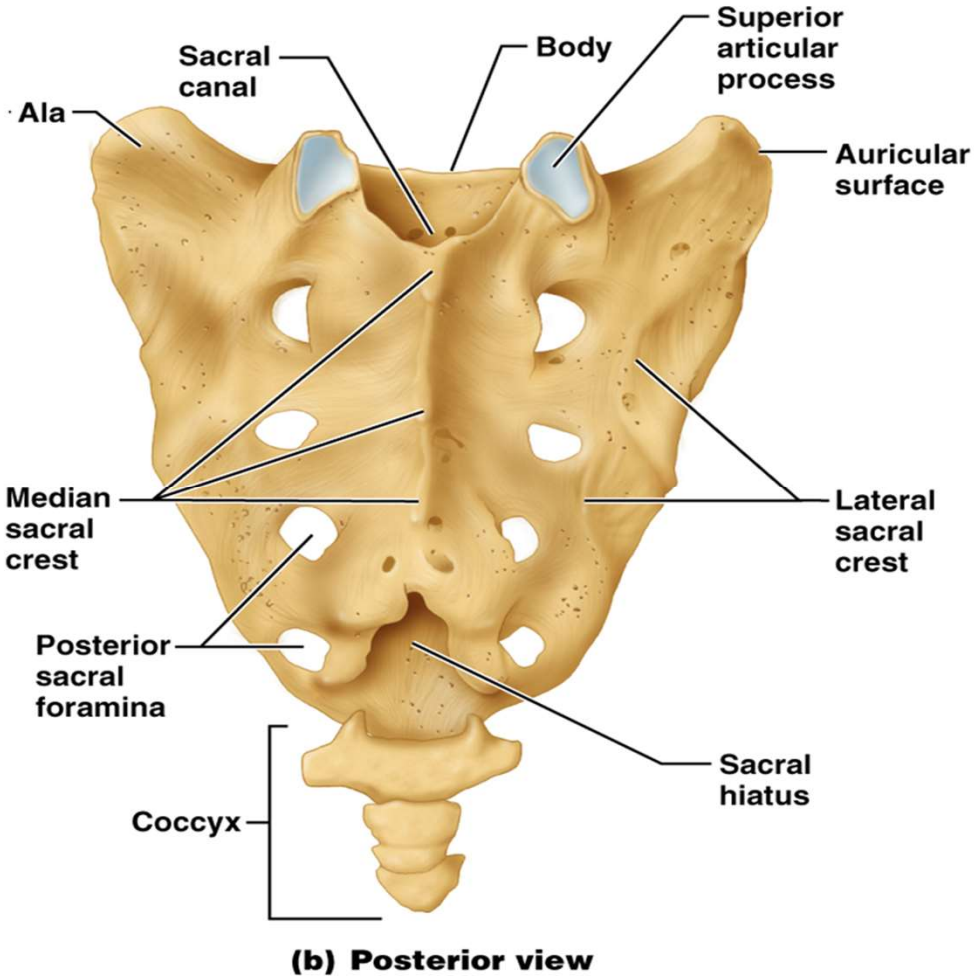
Sacrum

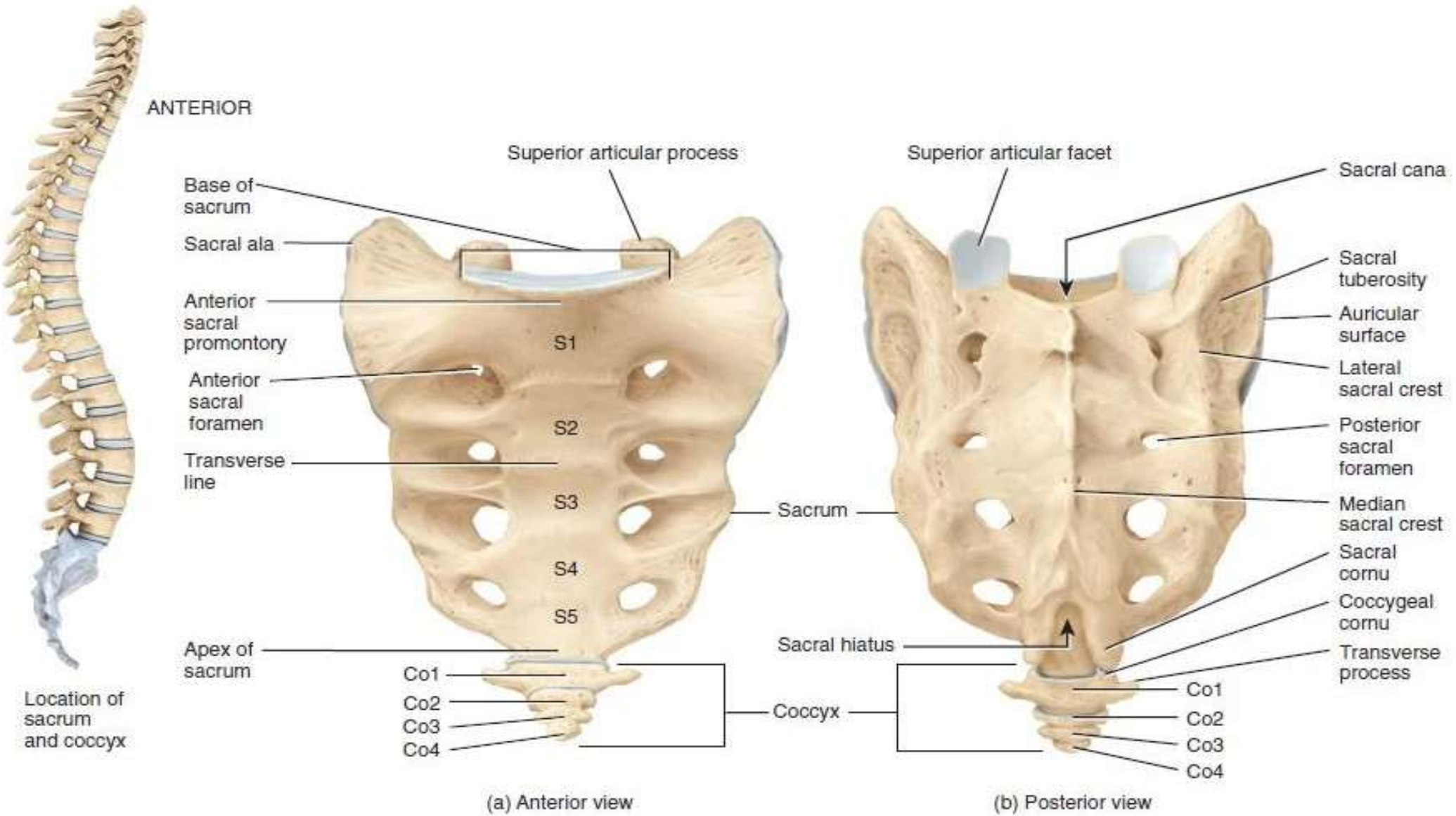
- Sacrum
  - Consists of five fused vertebrae (S_1-S_5), which shape the posterior wall of the pelvis
  - It articulates with L_5 superiorly, and with the auricular surfaces of the hip bones
  - Major markings include the sacral promontory, transverse lines, alae, dorsal sacral foramina, sacral canal, and sacral hiatus

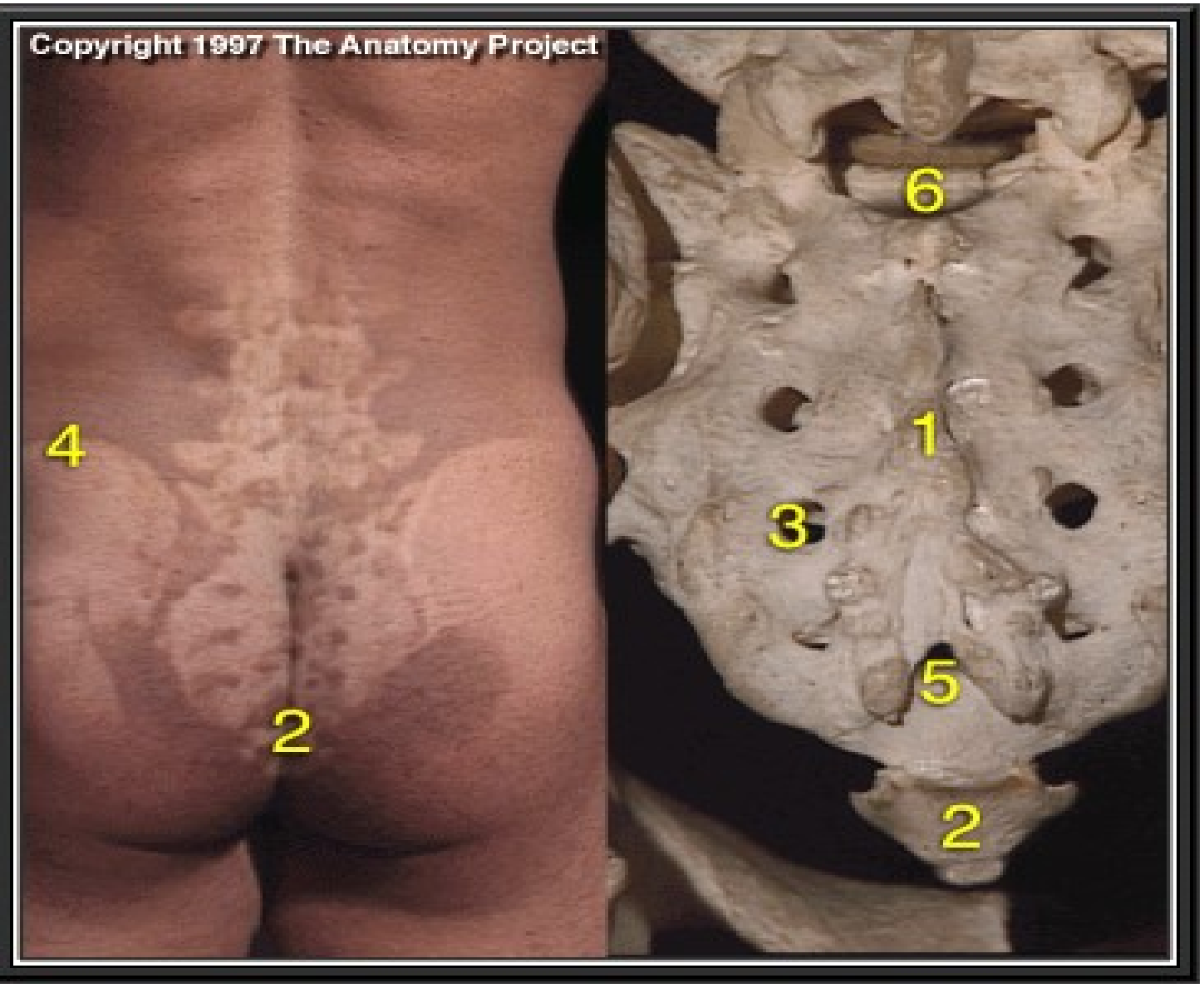


Sacrum and Coccyx:



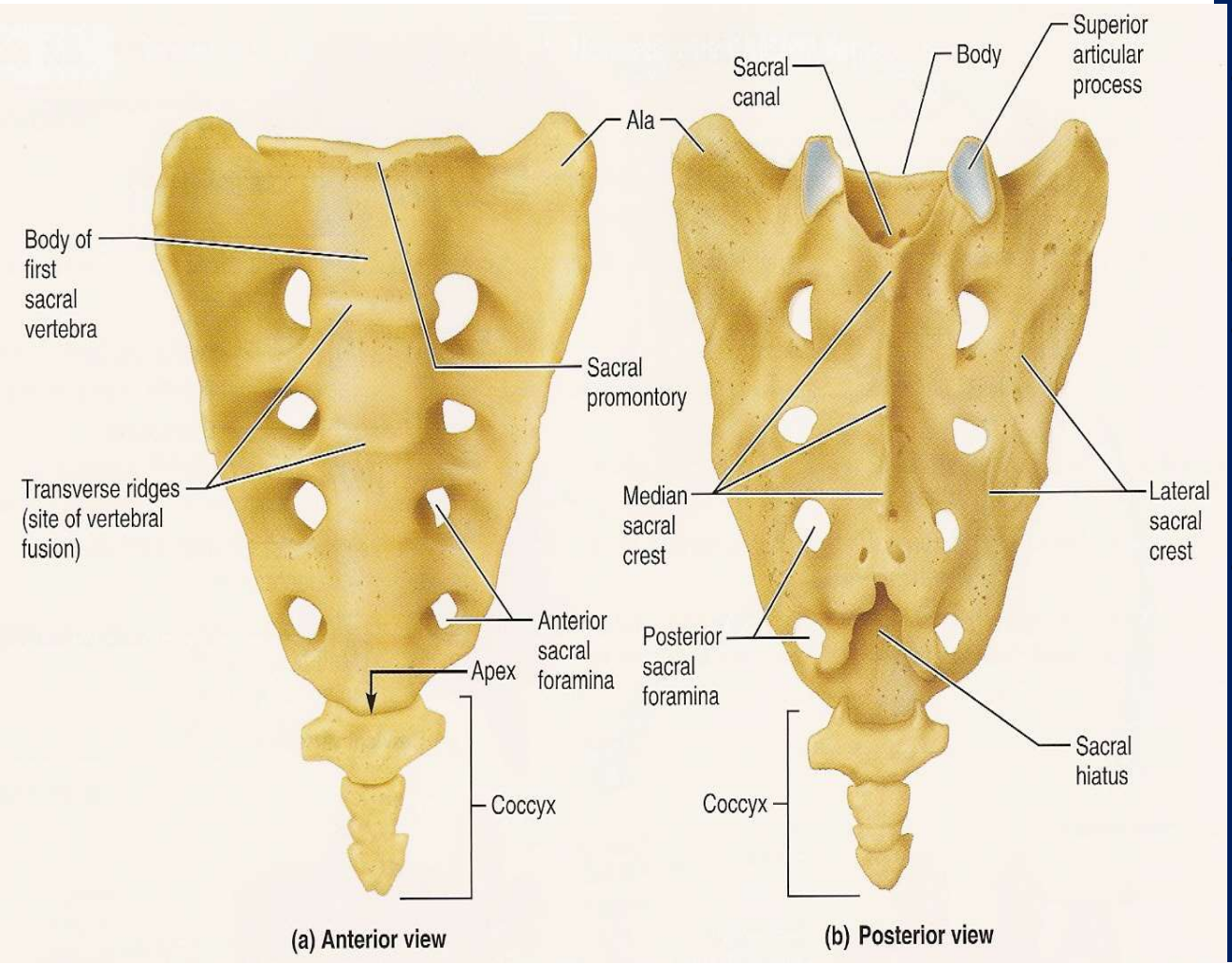



ANTERIOR
Location of sacrum and coccyx
Base of sacrum
Sacral ala
Anterior sacral promontory
Anterior sacral foramen
Transverse line
Apex of sacrum
Superior articular process
S1
S2
S3
S4
S5
Co1
Co2
Co3
Co4
Sacrum
Coccyx
(a) Anterior view
Superior articular facet
Sacral cana
Sacral tuberosity
Auricular surface
Lateral sacral crest
Posterior sacral foramen
Median sacral crest
Sacral cornu
Coccygeal cornu
Transverse process
Sacral hiatus
Co1
Co2
Co3
Co4
(b) Posterior view

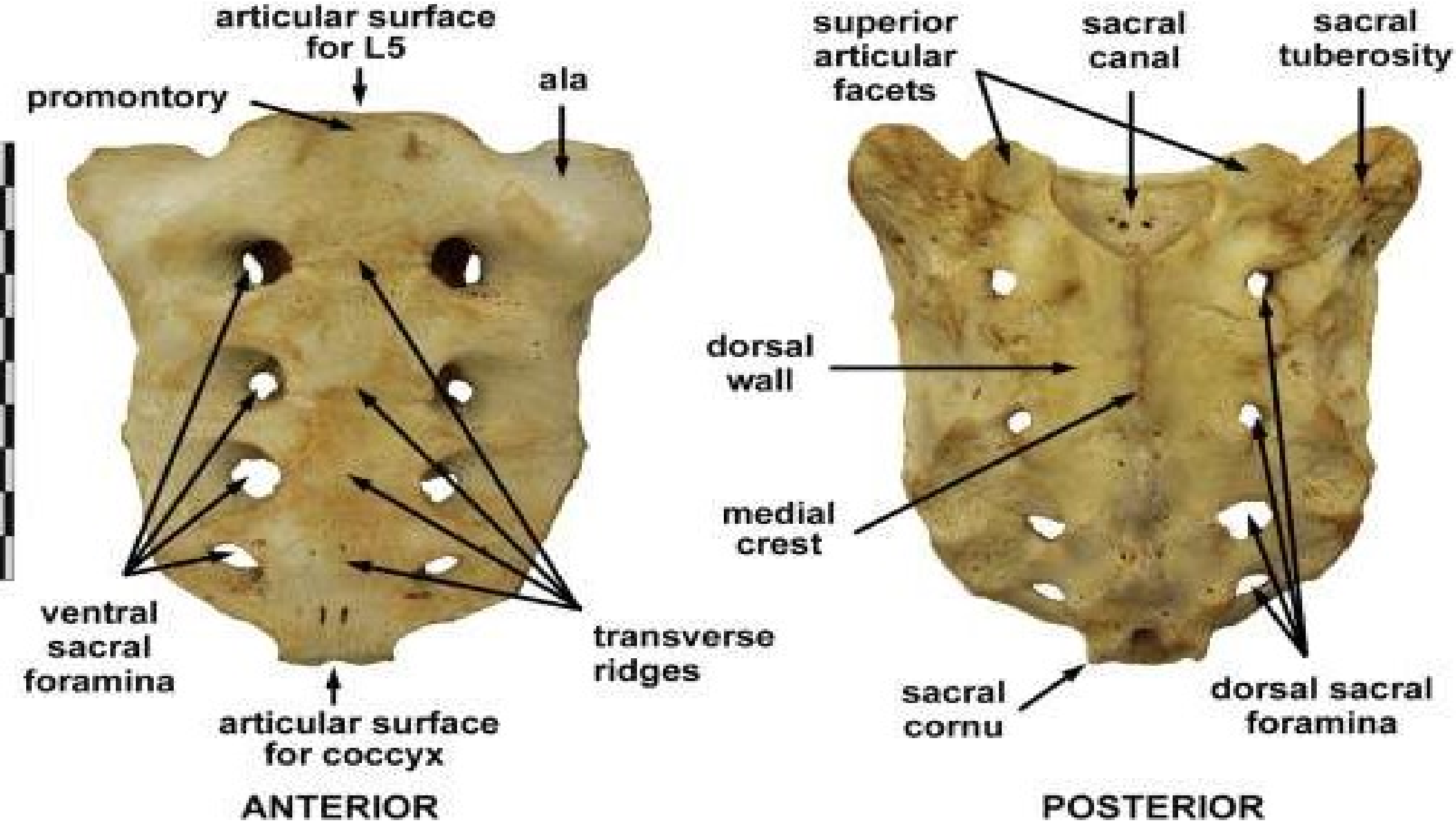


1. Sacral crest
2. Coccyx
3. Posterior sacral foramen
4. Iliac crest
5. Sacral hiatus
6. Vertebral foramen

Sacrum



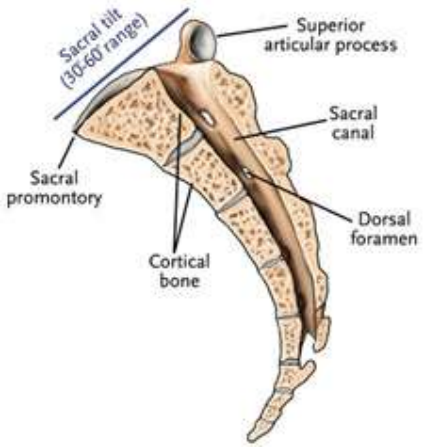
- 5 vertebrae fuse together to form a single bone
- Articulates with:
  - L5 (through SAP)
  - Coccyx
- Functions in weight transfer
- Anterior surface
  - Sacral promontory
  - Transverse ridges
  - Anterior sacral foramina
- Posterior surface
  - Median and lateral sacral crest
  - Posterior sacral foramen

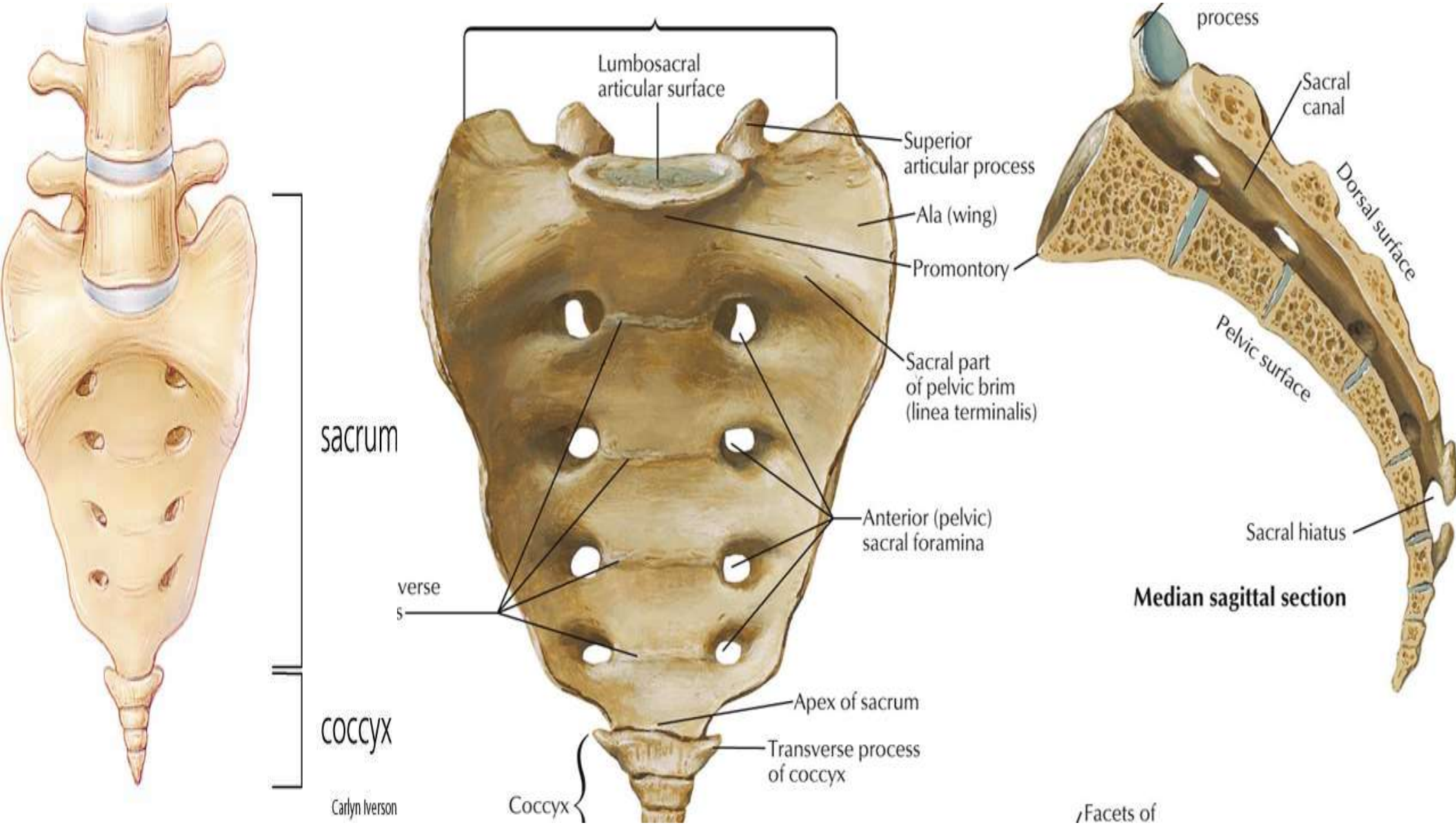

articular surface for L5
promontory
ala
ventral sacral foramina
transverse ridges
articular surface for coccyx
ANTERIOR
superior articular facets
sacral canal
sacral tuberosity
dorsal wall
medial crest
sacral cornu
dorsal sacral foramina
POSTERIOR

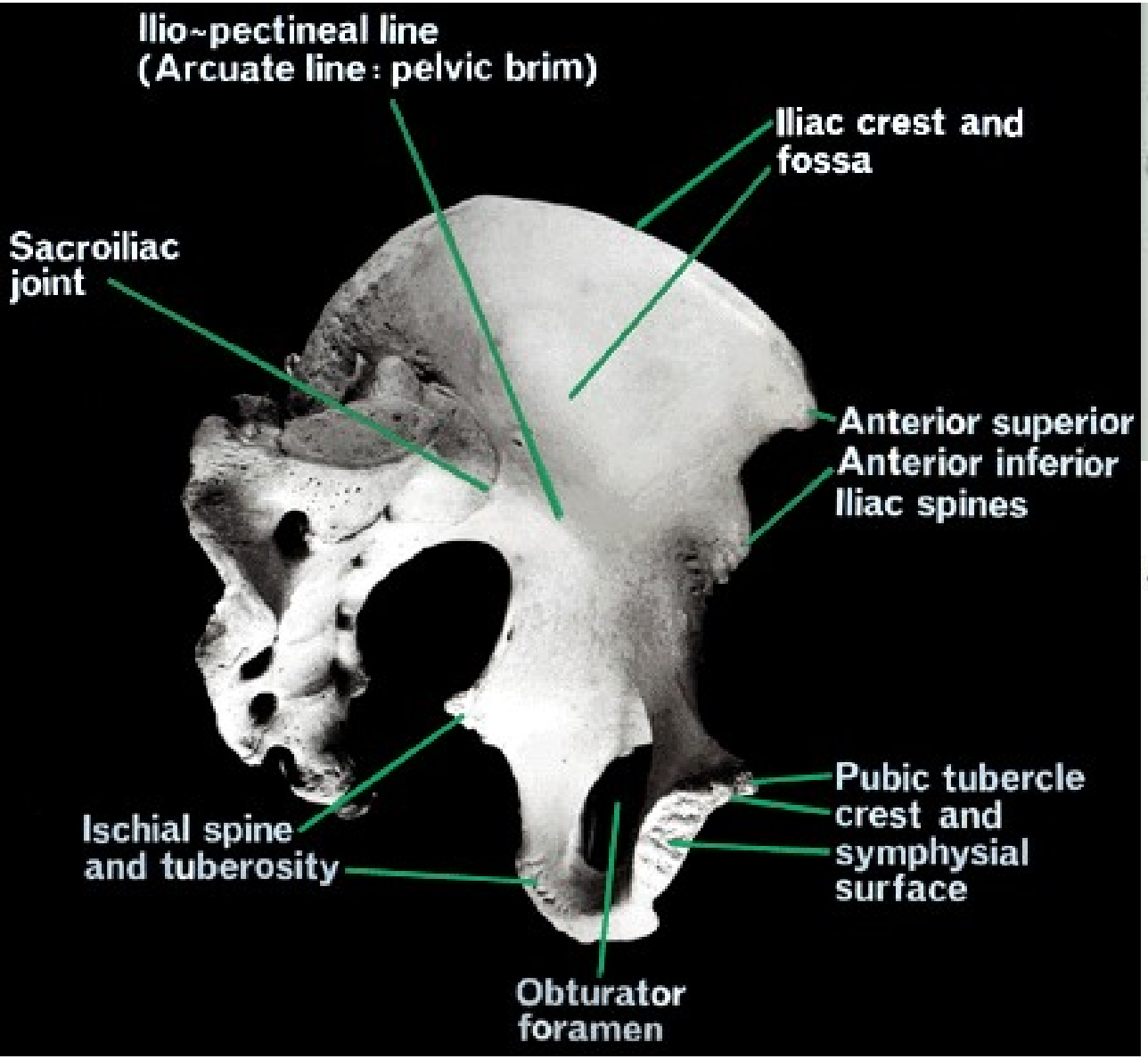
SACRUM

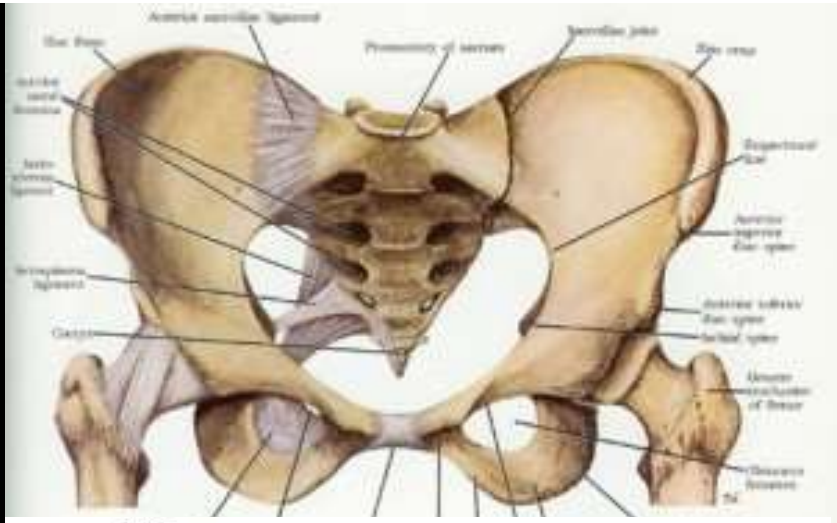
(posterior view):

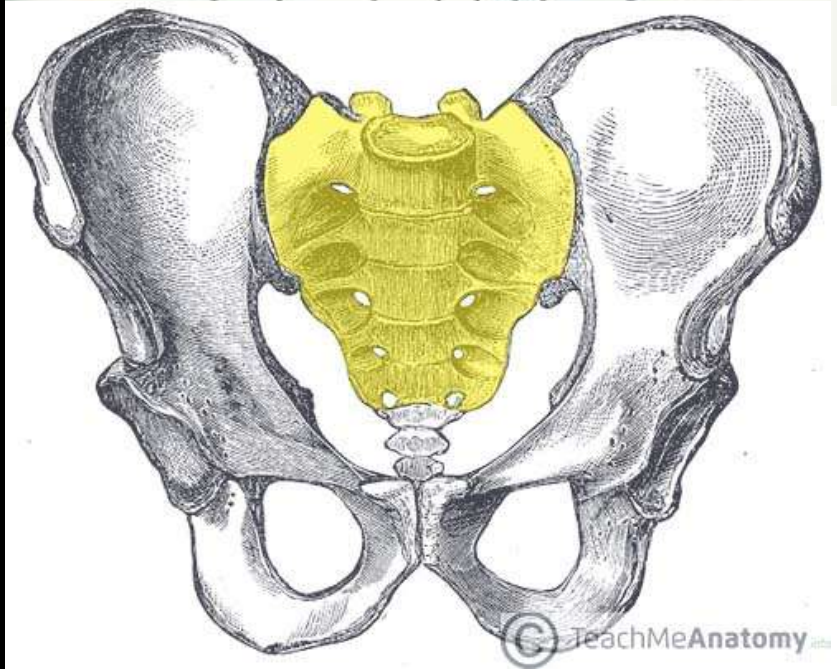
- dorsal sacral foramina, superior articular facet,
- auricular surface (on sides, for os coxa),
- (ala),
- median sacral crest,
- sacral canal,
- sacral hiatus.

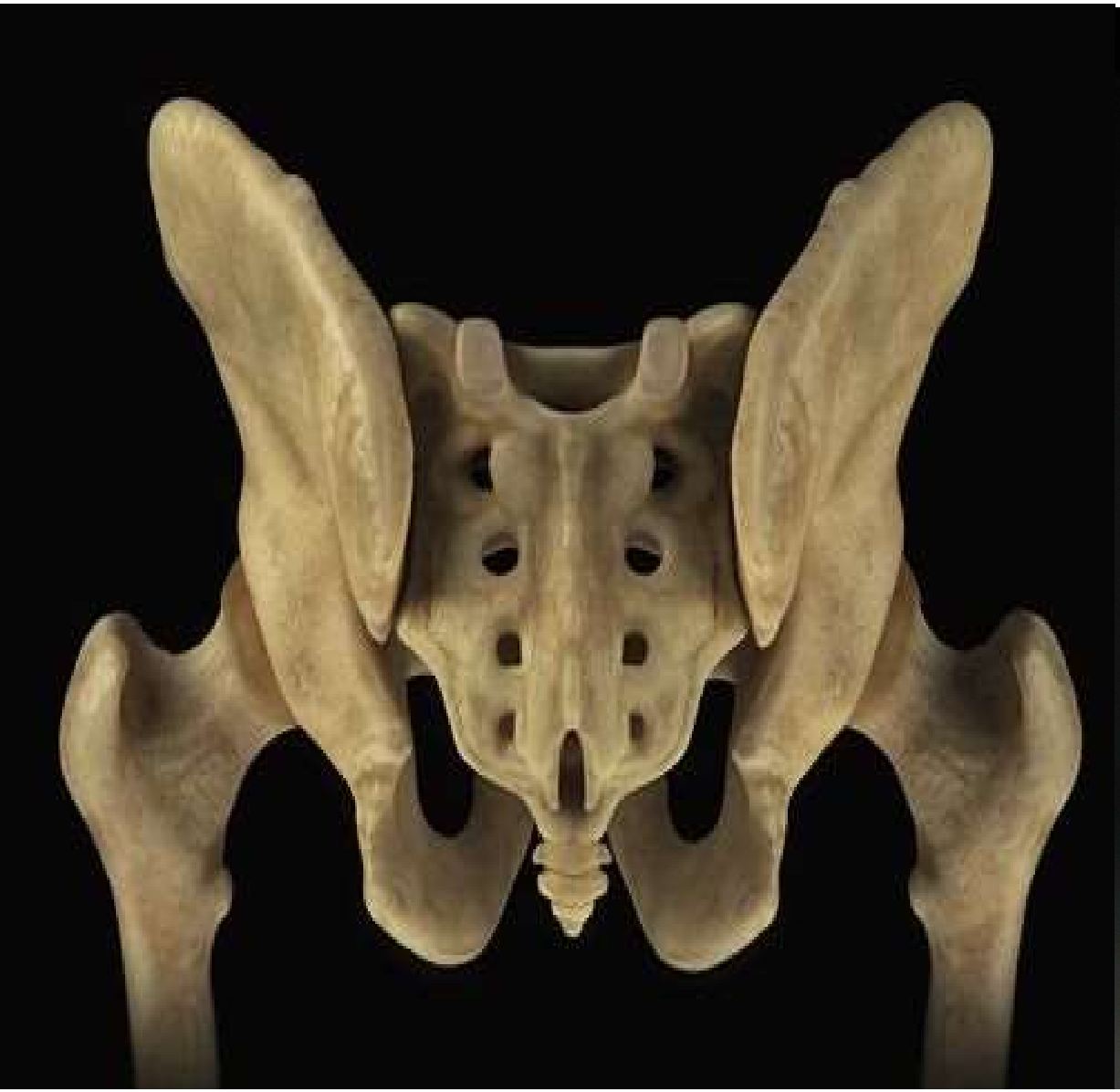


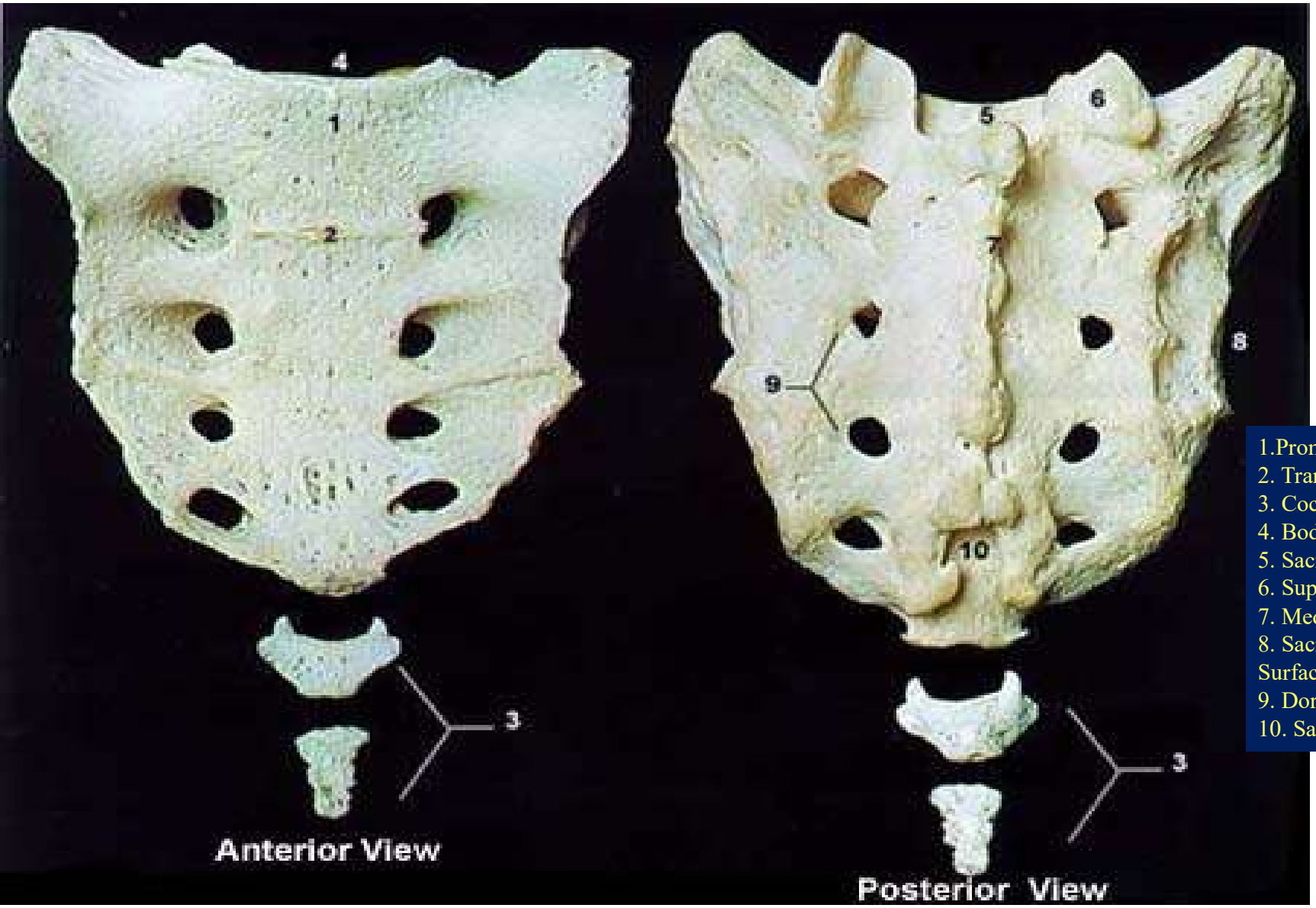

sacrum
coccyx
Carlyn Iverson
Lumbosacral articular surface
Superior articular process
Ala (wing)
Promontory
Sacral part of pelvic brim (linea terminalis)
Anterior (pelvic) sacral foramina
verse
s
Apex of sacrum
Transverse process of coccyx
Coccyx
process
Sacral canal
Dorsal surface
Pelvic surface
Sacral hiatus
Median sagittal section
Facets of


Ilio~pectineal line
(Arcuate line : pelvic brim)
Iliac crest and
fossa
Sacroiliac
joint
Anterior superior
Anterior inferior
Iliac spines
Pubic tubercle
crest and
symphysial
surface
Ischial spine
and tuberosity
Obturator
foramen



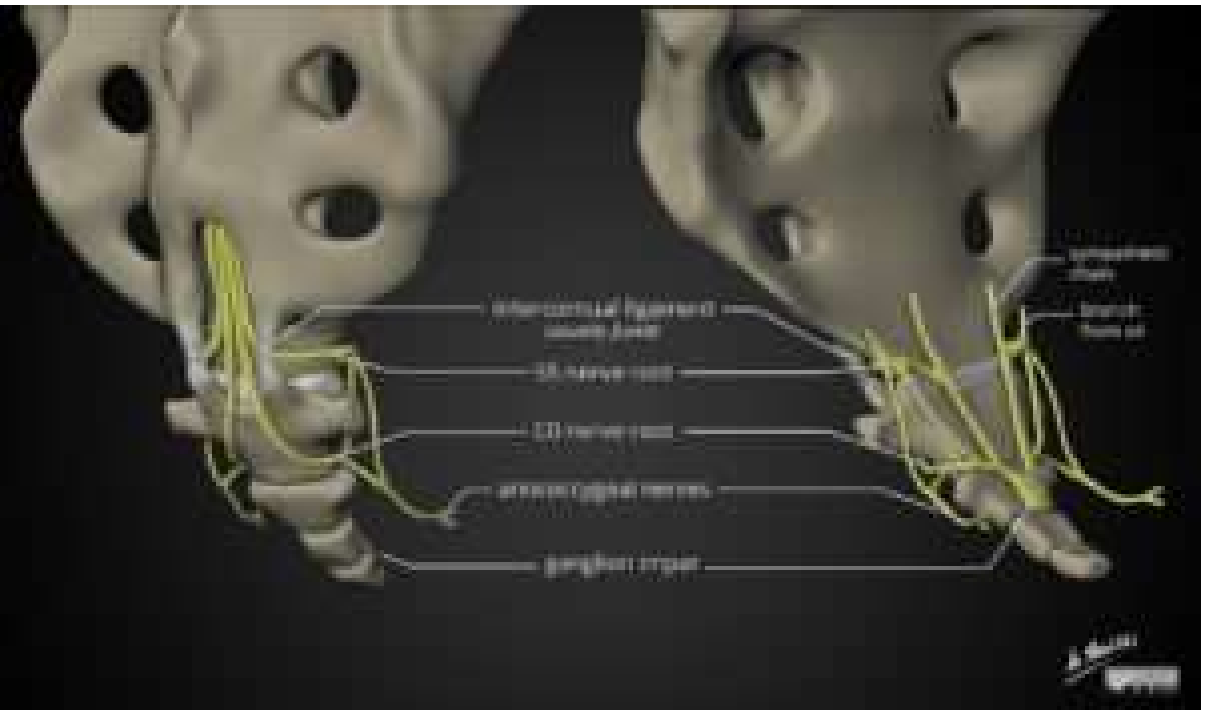

TeachMeAnatomy

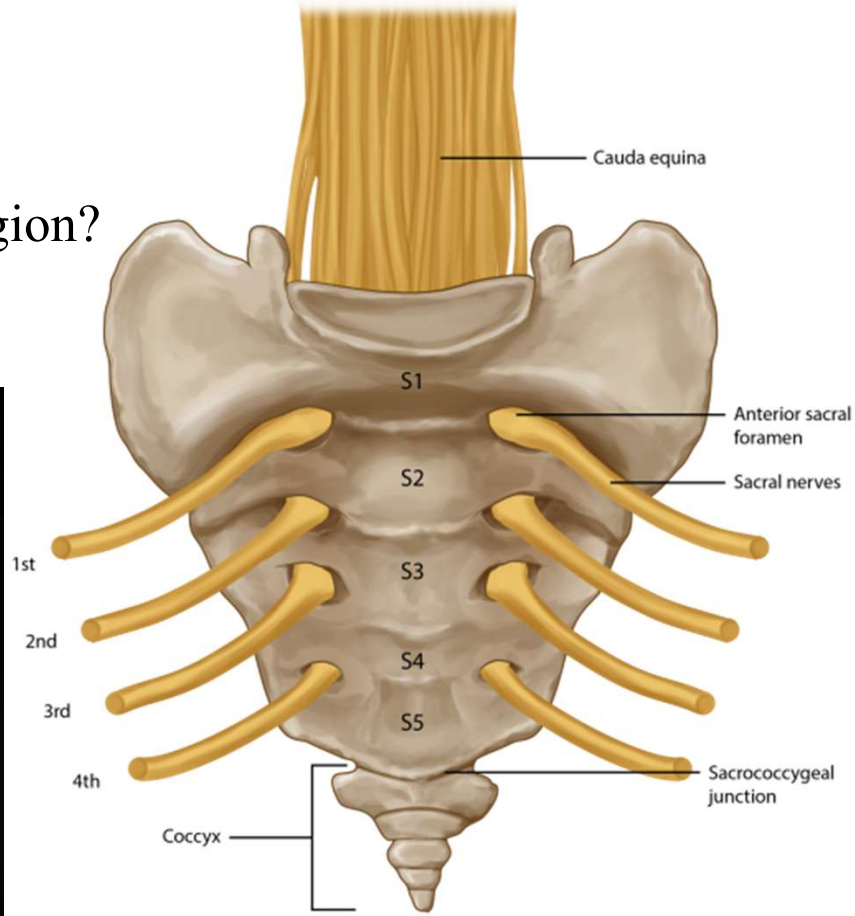


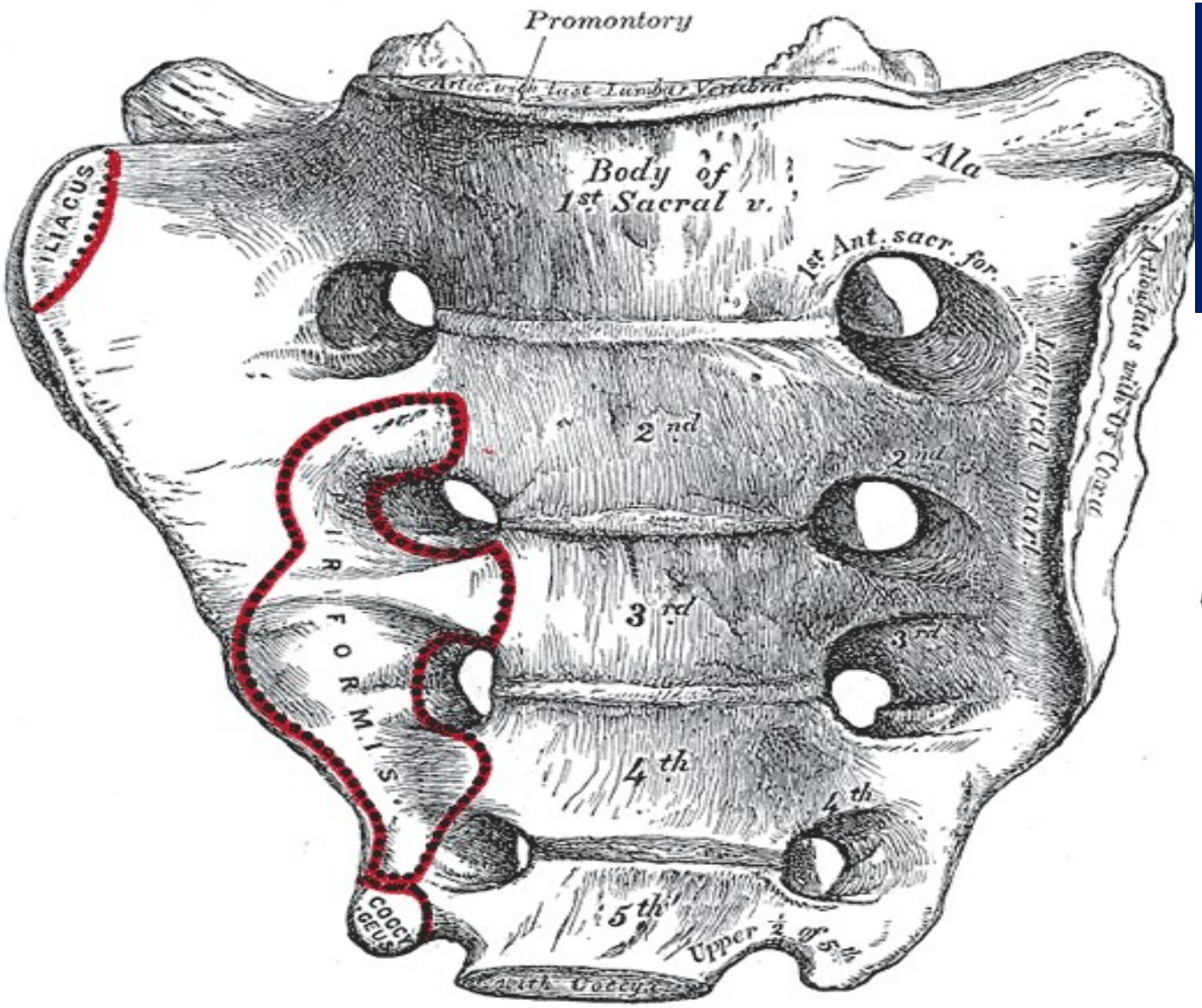


1.Promontory
2. Transverse Ridges
3. Coccyx
4. Body of Sacrum
5. Sacral Canal
6. Superior Articular Surface
7. Median Sacral Crest
8. Sacrum to Ilium Articular Surface
9. Dorsal Sacral Foramina
10. Sacral Hiatus

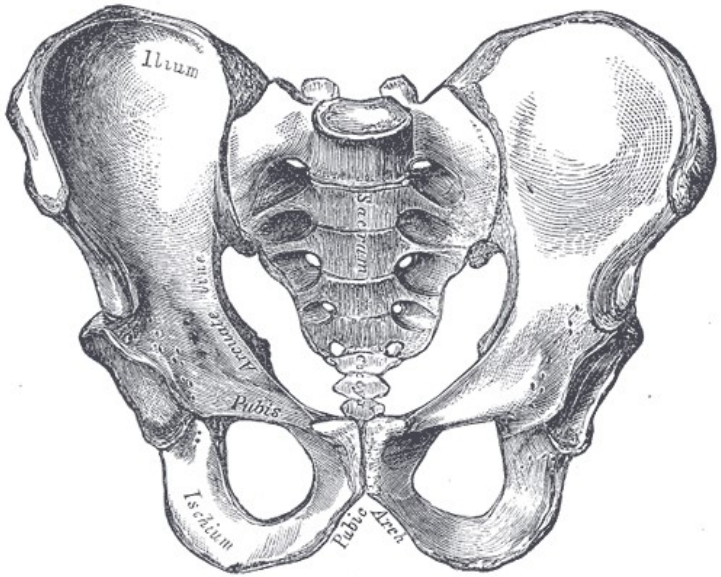
Home work ? What are the sciatica?
What are the sacral joints?
What are ligaments around the vertebra?
What are the causes of hyperkyphosis?
What are the dermatomes for breast and umbilical region?

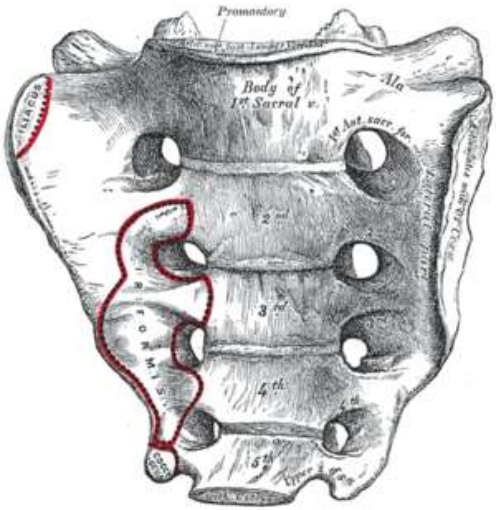


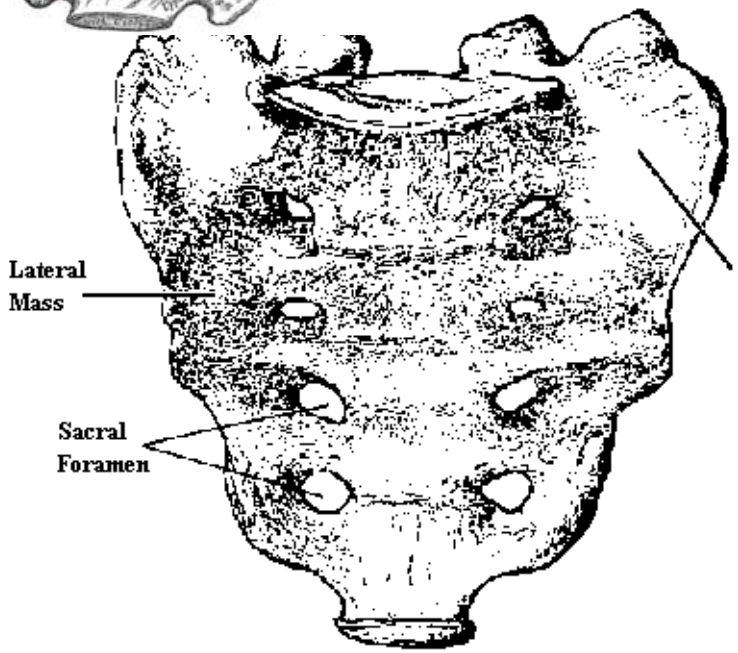


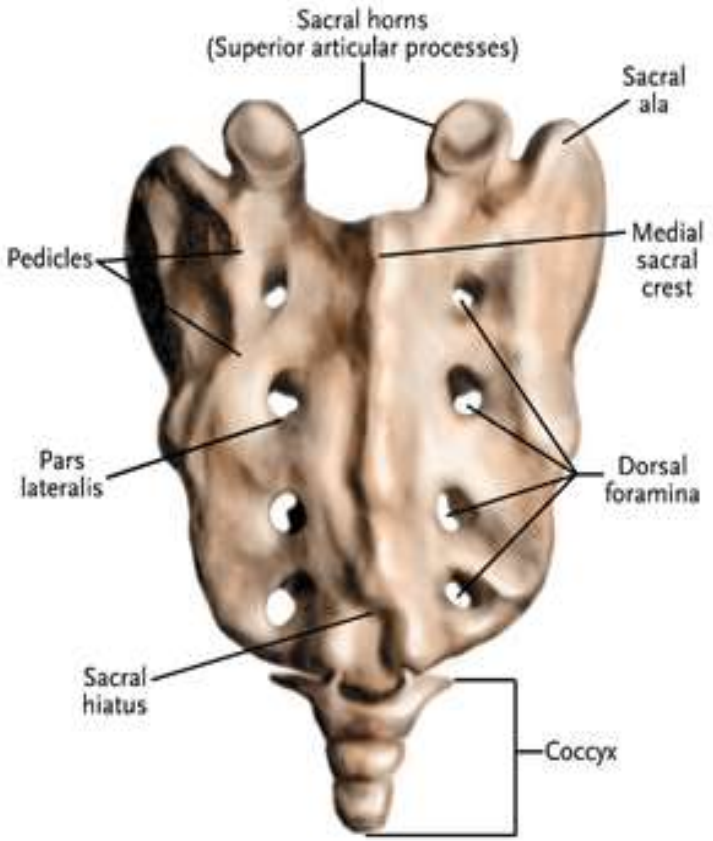


The sacrum articulates with four bones: the last lumbar vertebra above, the coccyx below, and the hip bone on either side. Although in most people the sacro-iliac joints are tightly bound and immobile, some are able to rotate the sacrum forward a few degrees vis-à-vis the ilia. This motion is sometimes called "nutation", and the reverse motion "counter-nutation




Promontory
Body of 1st Sacral v.
Ala
1st Ant. sacr. for.
2nd
3rd
4th
5th


Lateral Mass
Sacral Foramen


Sacral horns
(Superior articular processes)
Sacral ala
Pedicles
Medial sacral crest
Pars lateralis
Dorsal foramina
Sacral hiatus
Coccyx

Coccyx

- Coccyx (Tailbone)
  - The coccyx is made up of four (in some cases three to five) fused vertebrae that articulate superiorly with the sacrum

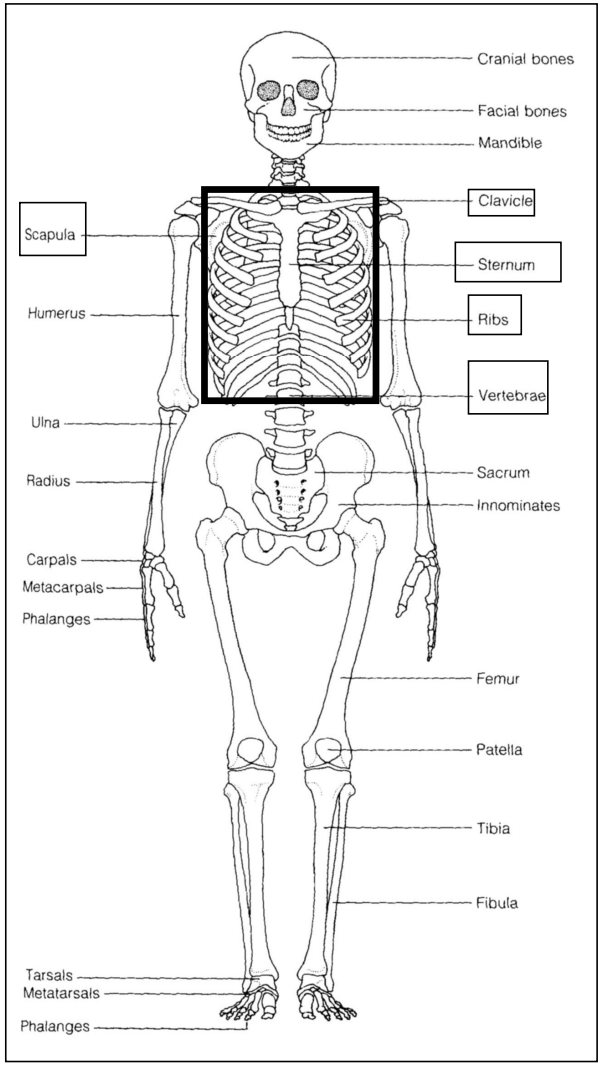
Coccyx (3-5 fused)

- "**Tail**bone"
- Useless bone……..
  - But painful!
- Slight support to pelvic organs and ligament attachment
- Articulates superiorly with sacrum
- Anterior concave
- Posterior convex

- Anterior angulation of the coccyx?

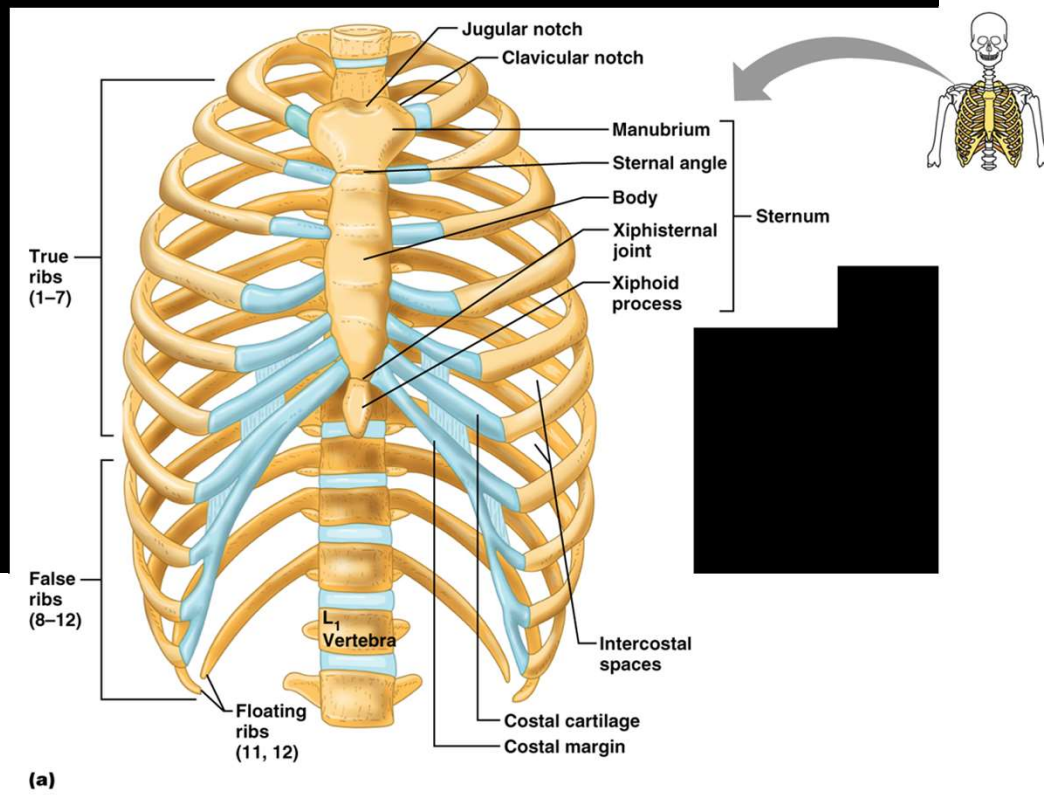
The Bony Thorax

- Sternum (3 parts)
- Ribs
- Clavicle
- Scapula
- Vertebrae (5 parts)

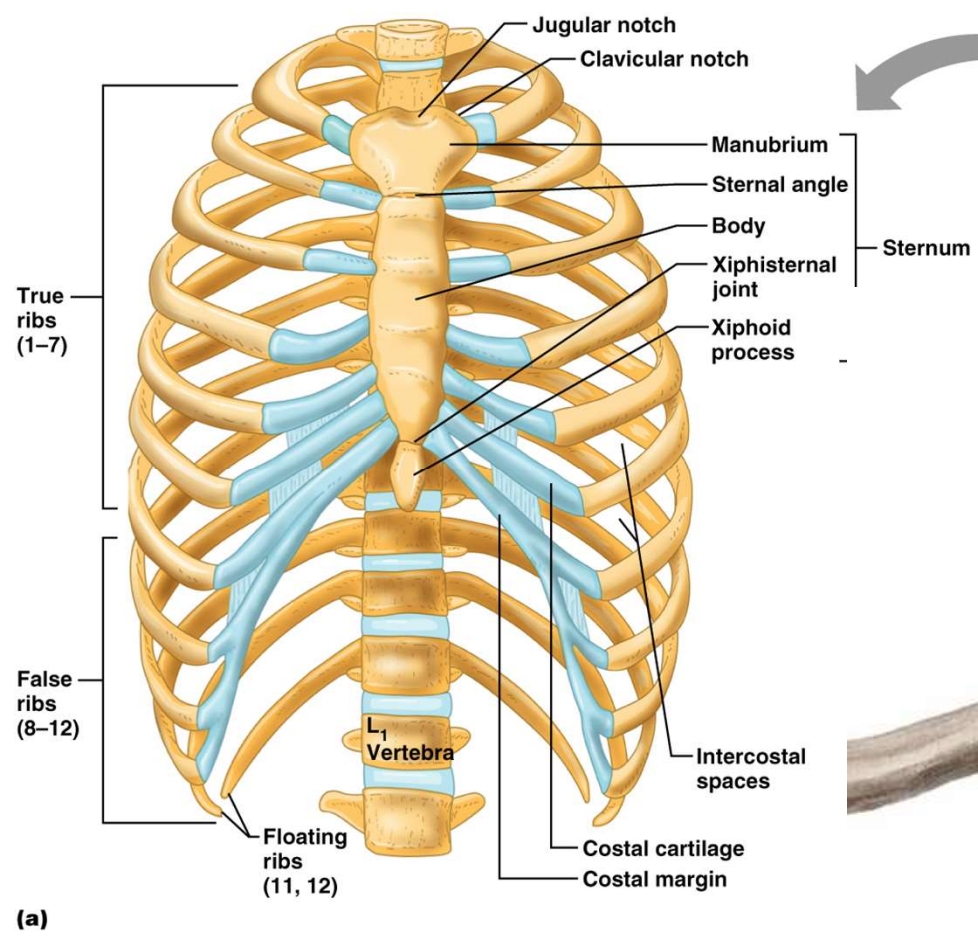


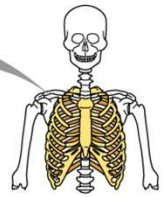
Bony Thorax (Thoracic Cage)

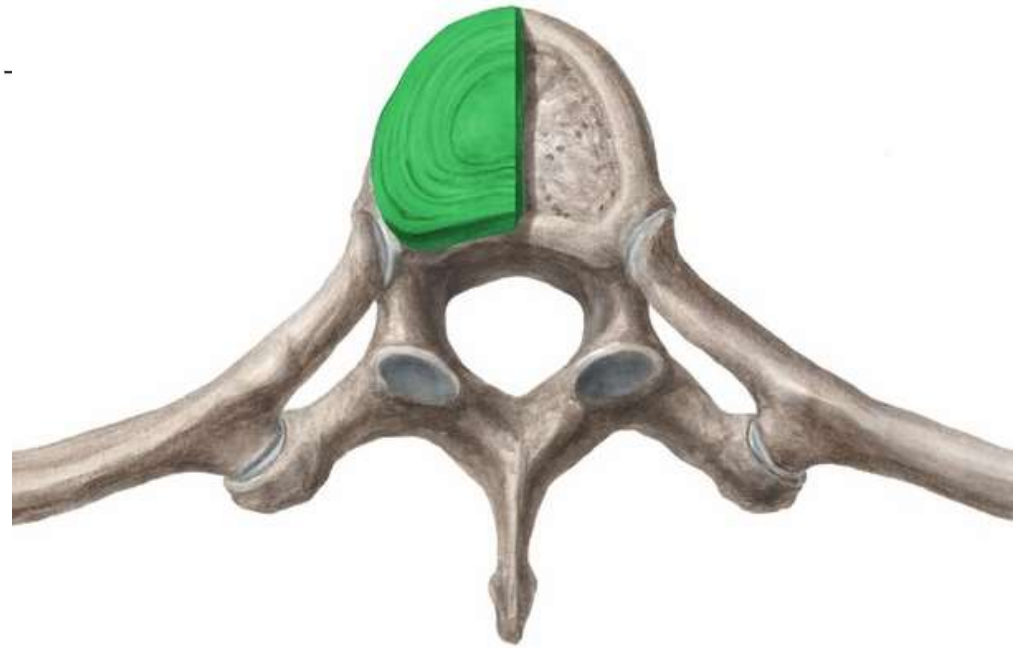
- [redacted]
  - [redacted]
  - [redacted]
  - [redacted]
  - [redacted]



Bony Thorax (Thoracic Cage)







Bony Thorax (Thoracic Cage)

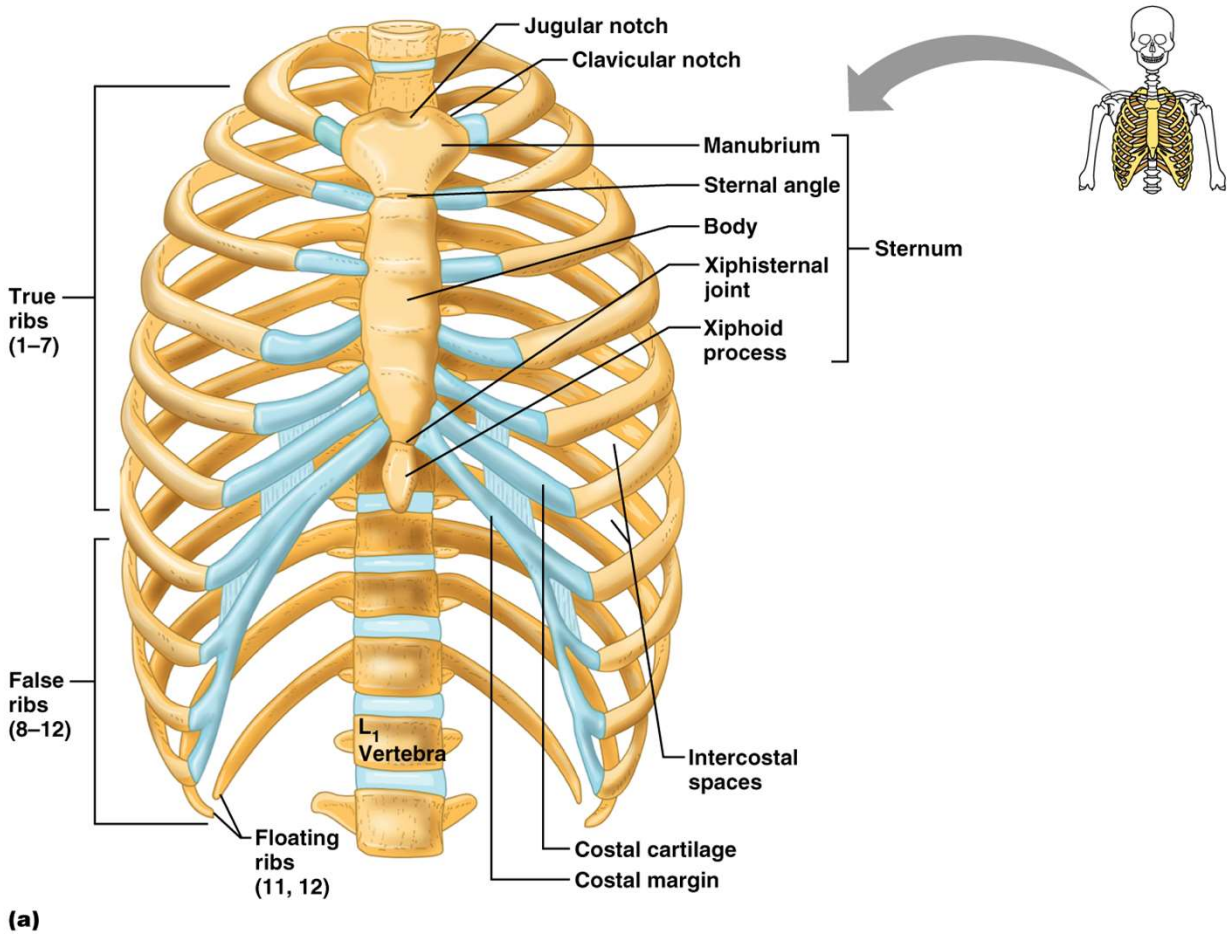
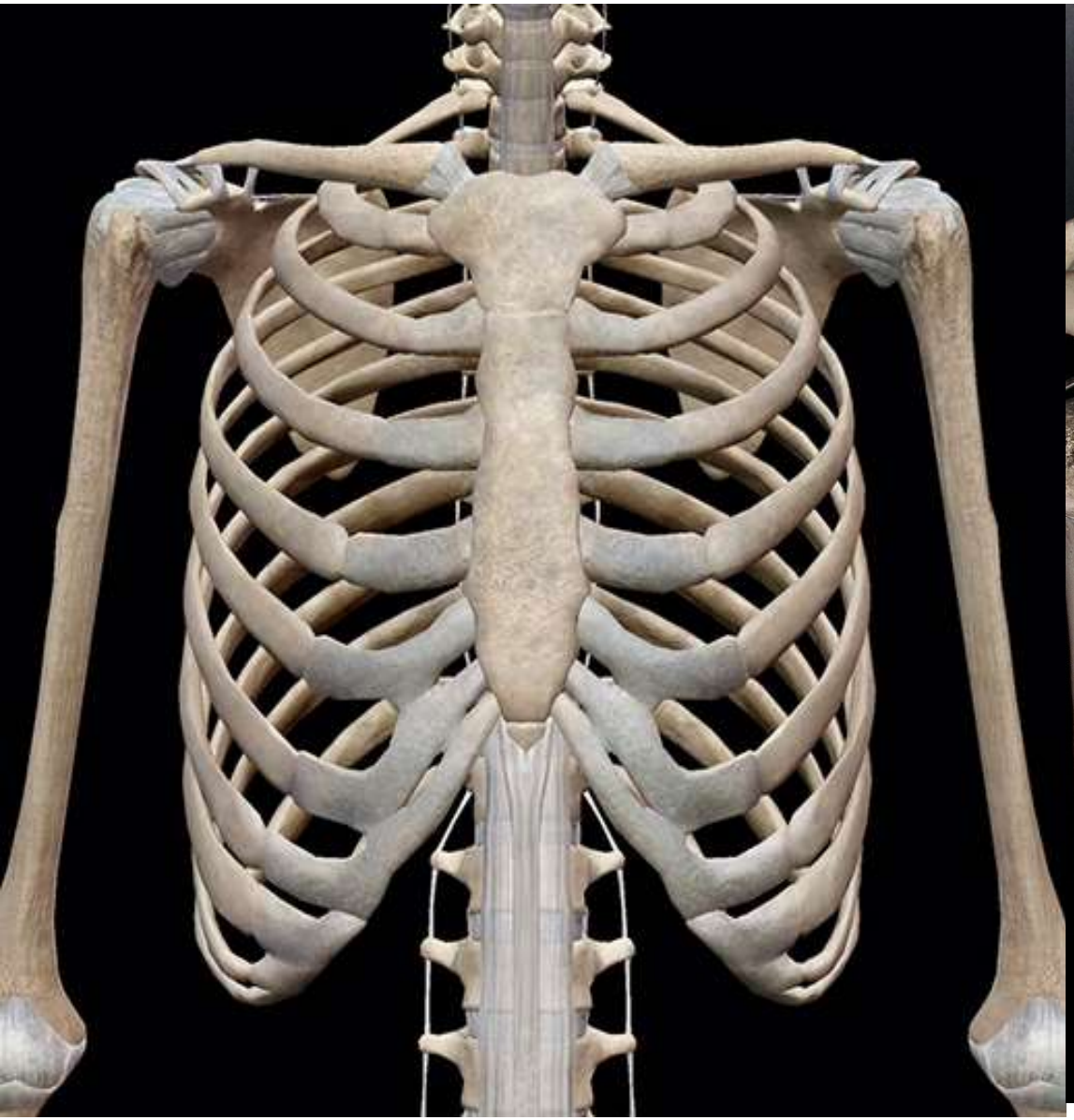
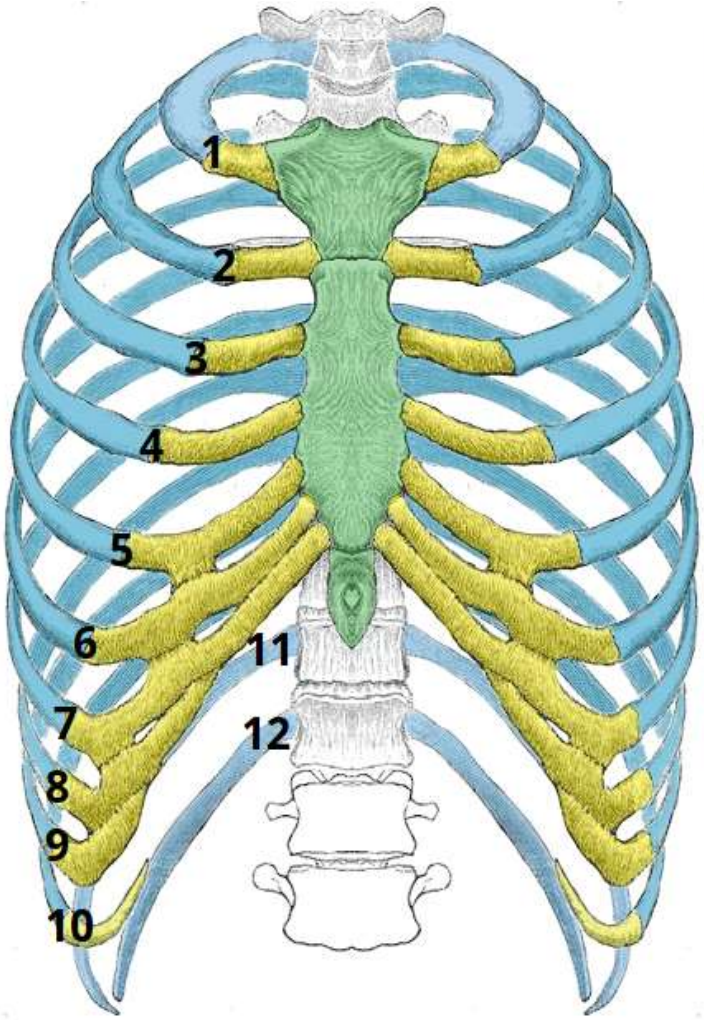


Figure 7.19a



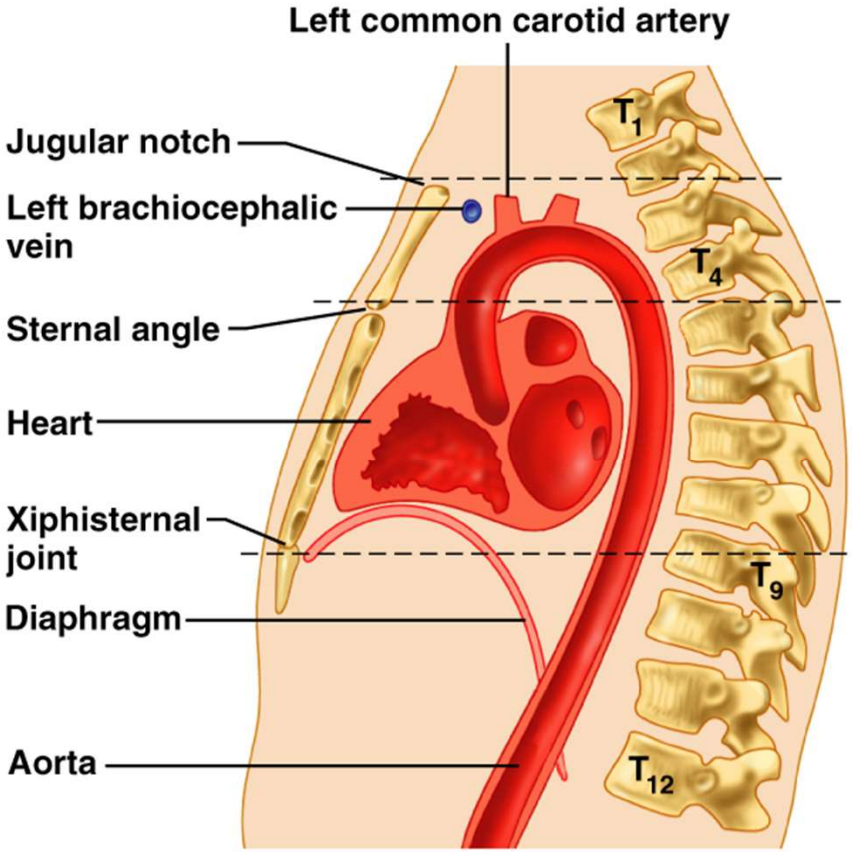
Bony Thorax (Thoracic Cage)



Ribs

Costal Cartilage

Sternum



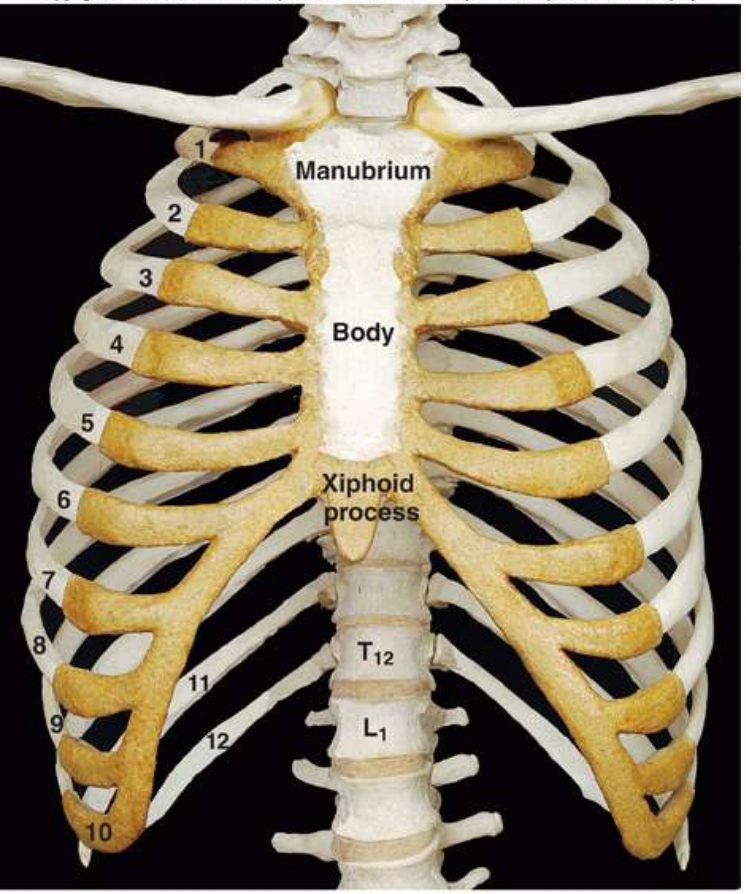
TeachMe Anatomy

(b)

Figure 7.19b

2. Thoracic Cage

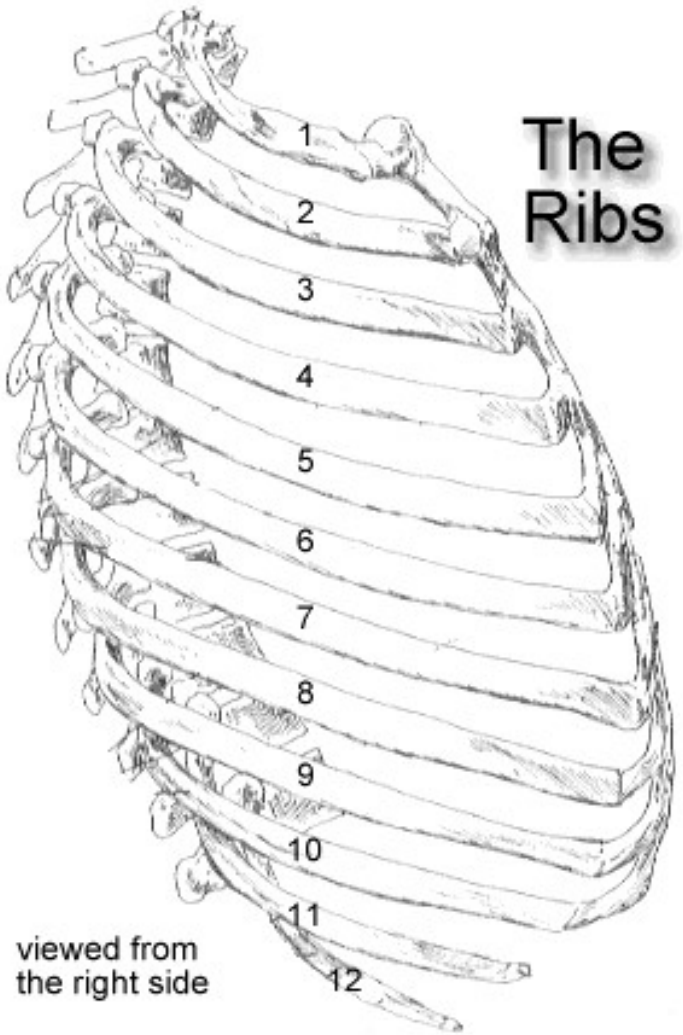
Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

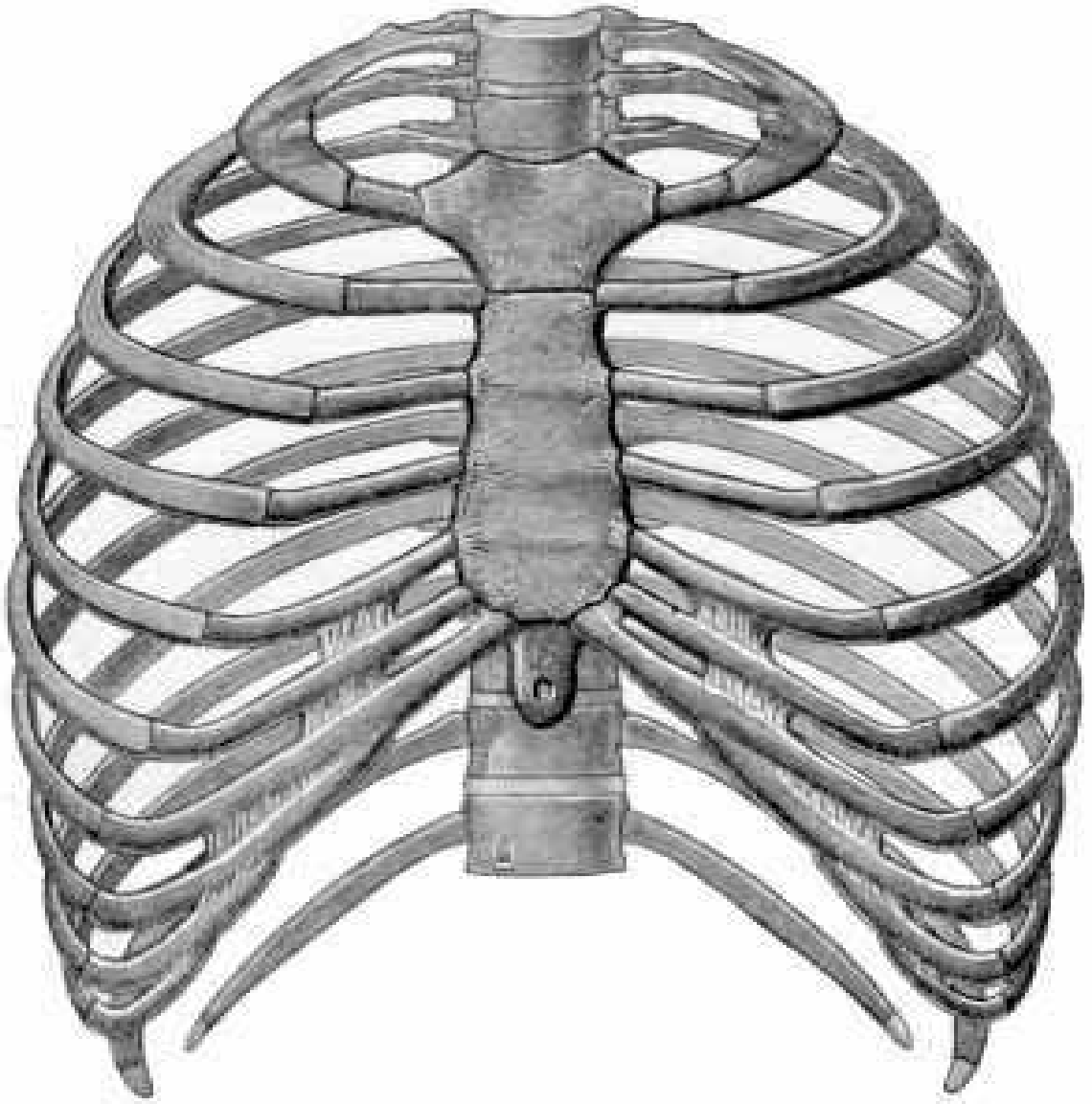


Anterior view

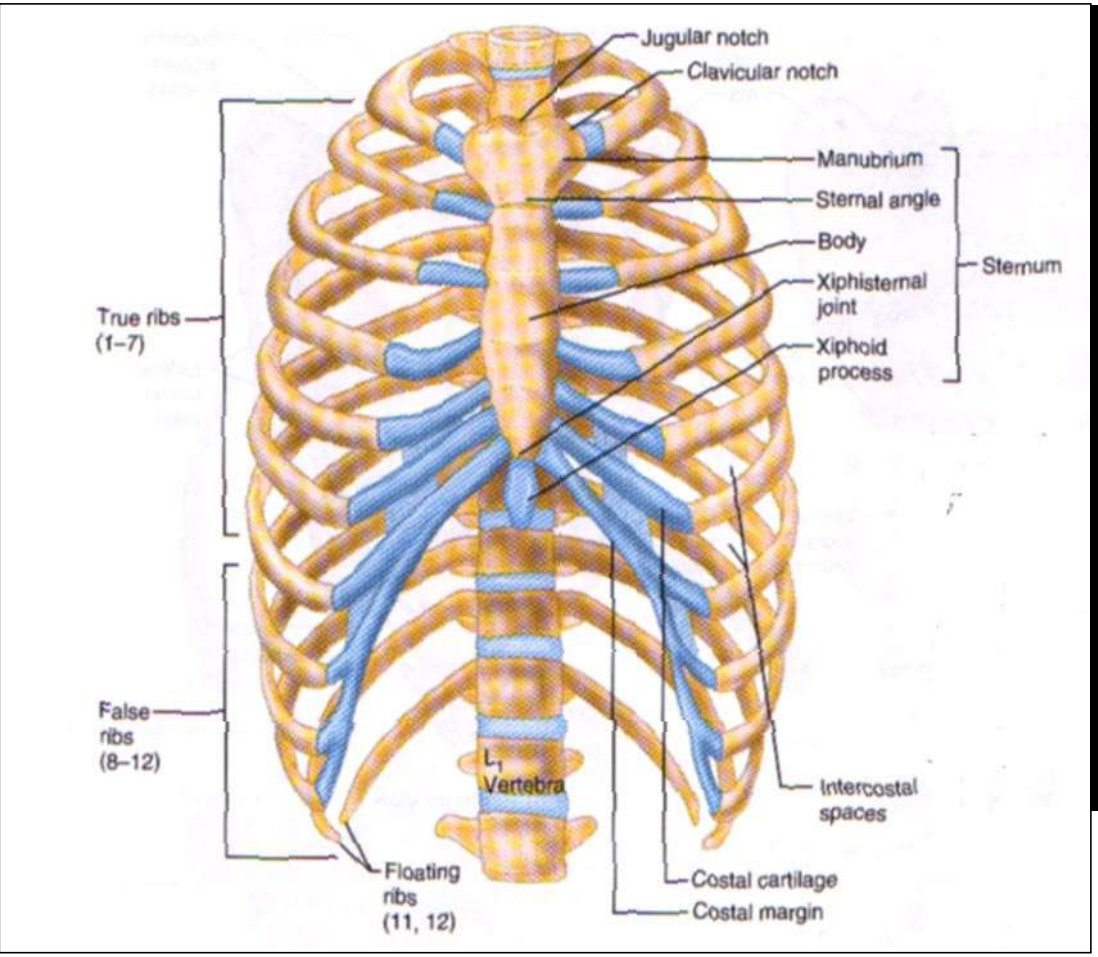
- Borders:
  - Thoracic vertebrae posteriorly
  - Ribs laterally
  - Sternum and costal cartilages anteriorly
- Forms protective cage @ heart, lungs, and other organs
- Composed of:
  - Sternum
  - Ribs

RIBS

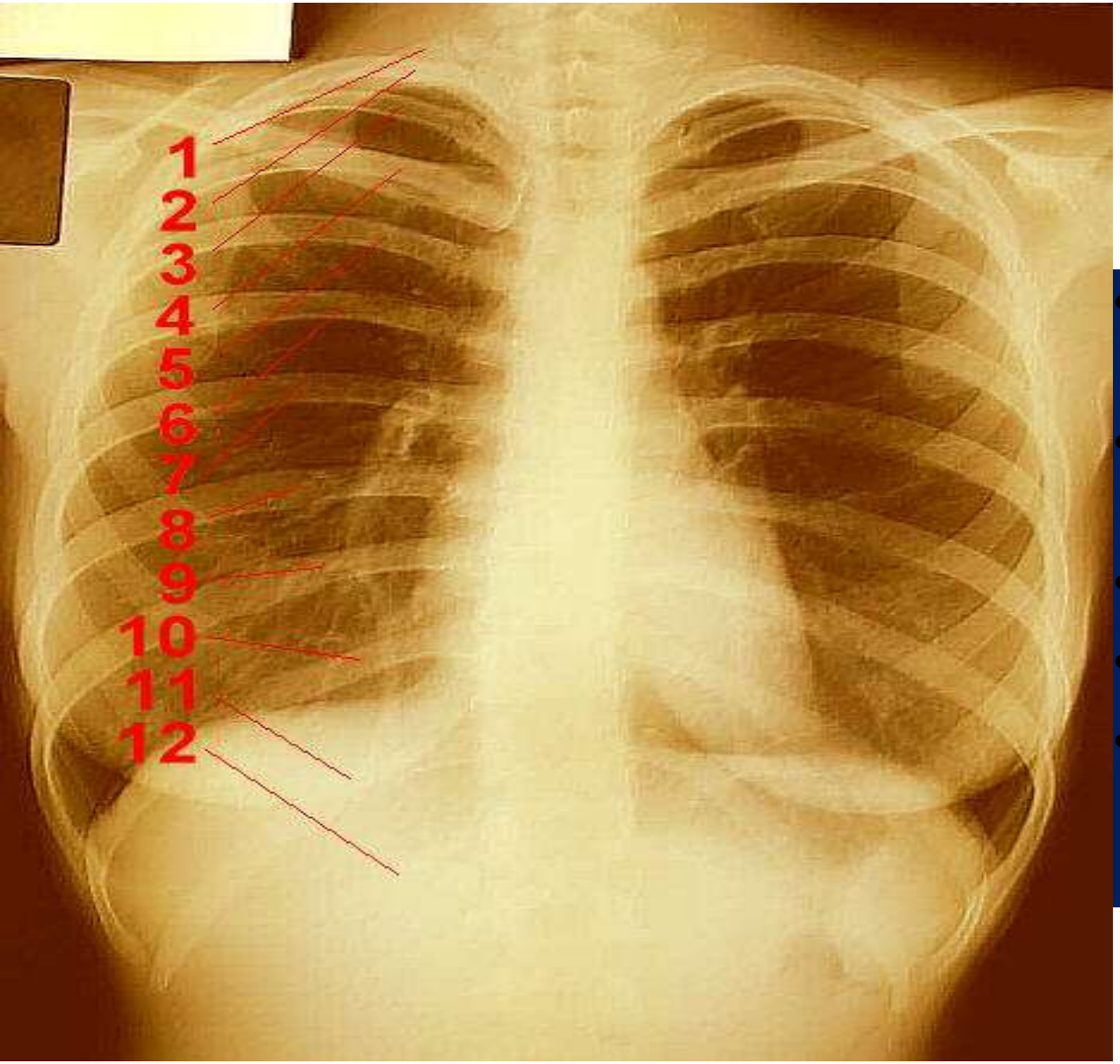




Thoracic Cage - Ribs



- 12 pairs
  - True ribs
    - Superior 7 pairs that attach directly to sternum by CC
  - False ribs (8-12)
    - Inferior 4 pairs (8-10) and attach indirectly to sternum
    - **Floating ribs**
      - **Ribs 11 and 12** and have no anterior attachments (muscles)

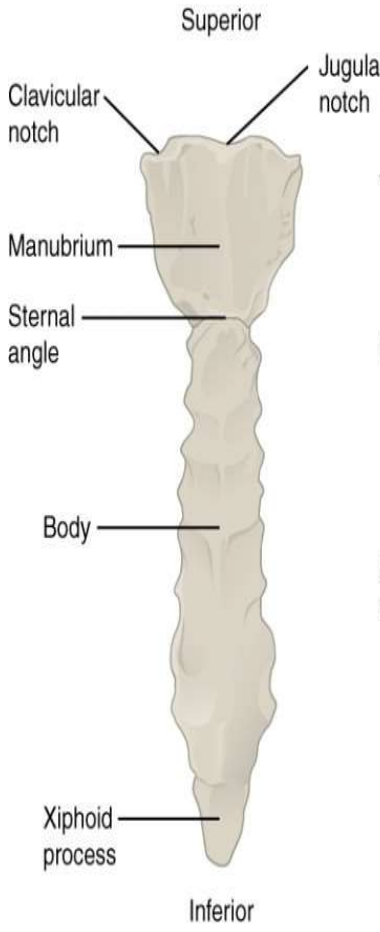


Ribs

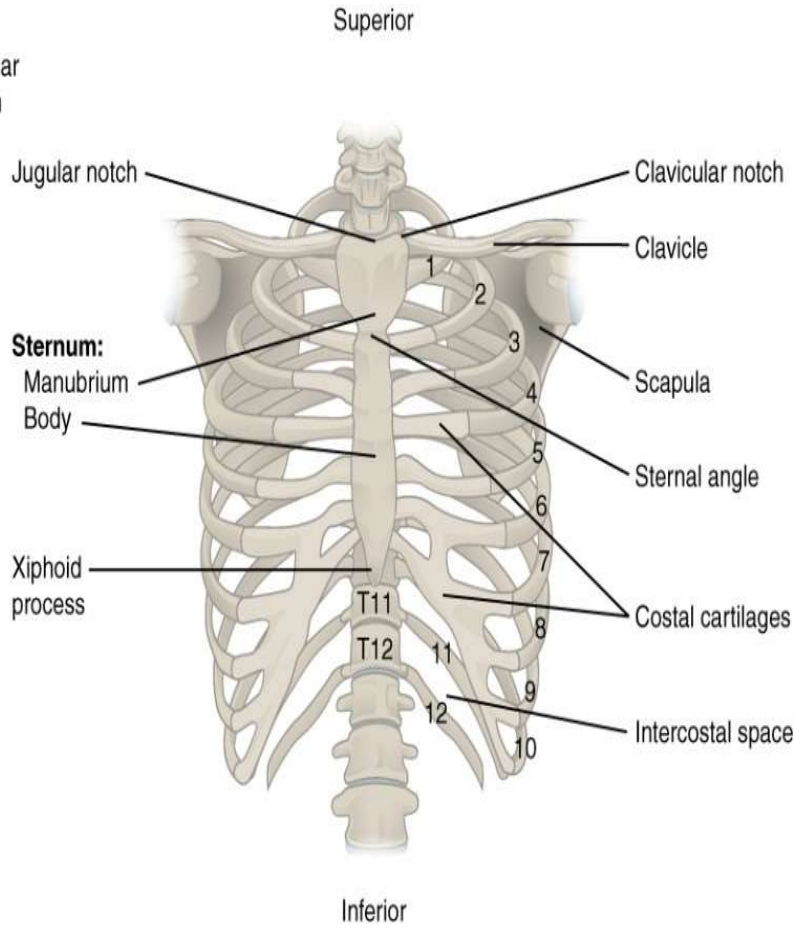
- Typical ribs
  - # 2-9
- Atypical ribs
  - # 1, 10-12
- Increase in length from 1-7
- Decrease in length from 8-12
- Costal margin

Sternum (Breastbone)

- A dagger-shaped, flat bone that lies in the anterior midline of the thorax
- Results from the fusion of three bones –
  - **the superior manubrium,**
  - **the body,**
  - **the inferior xiphoid process**
- **Anatomical landmarks include**
  - **the jugular (suprasternal) notch,**
  - **the sternal angle,**
  - **the xiphisternal joint**



(a) Anterior view of sternum



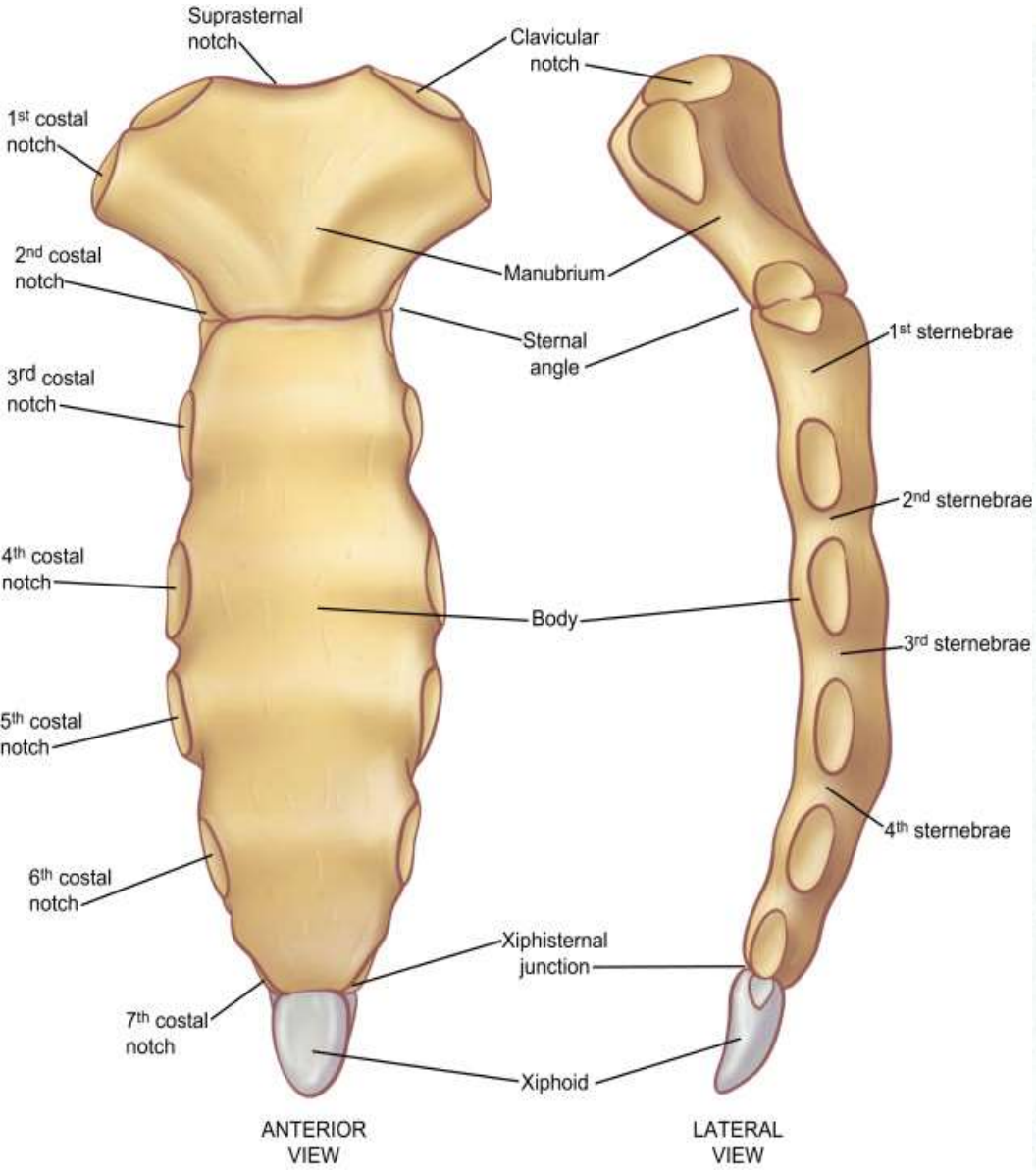
(b) Anterior view of skeleton of thorax

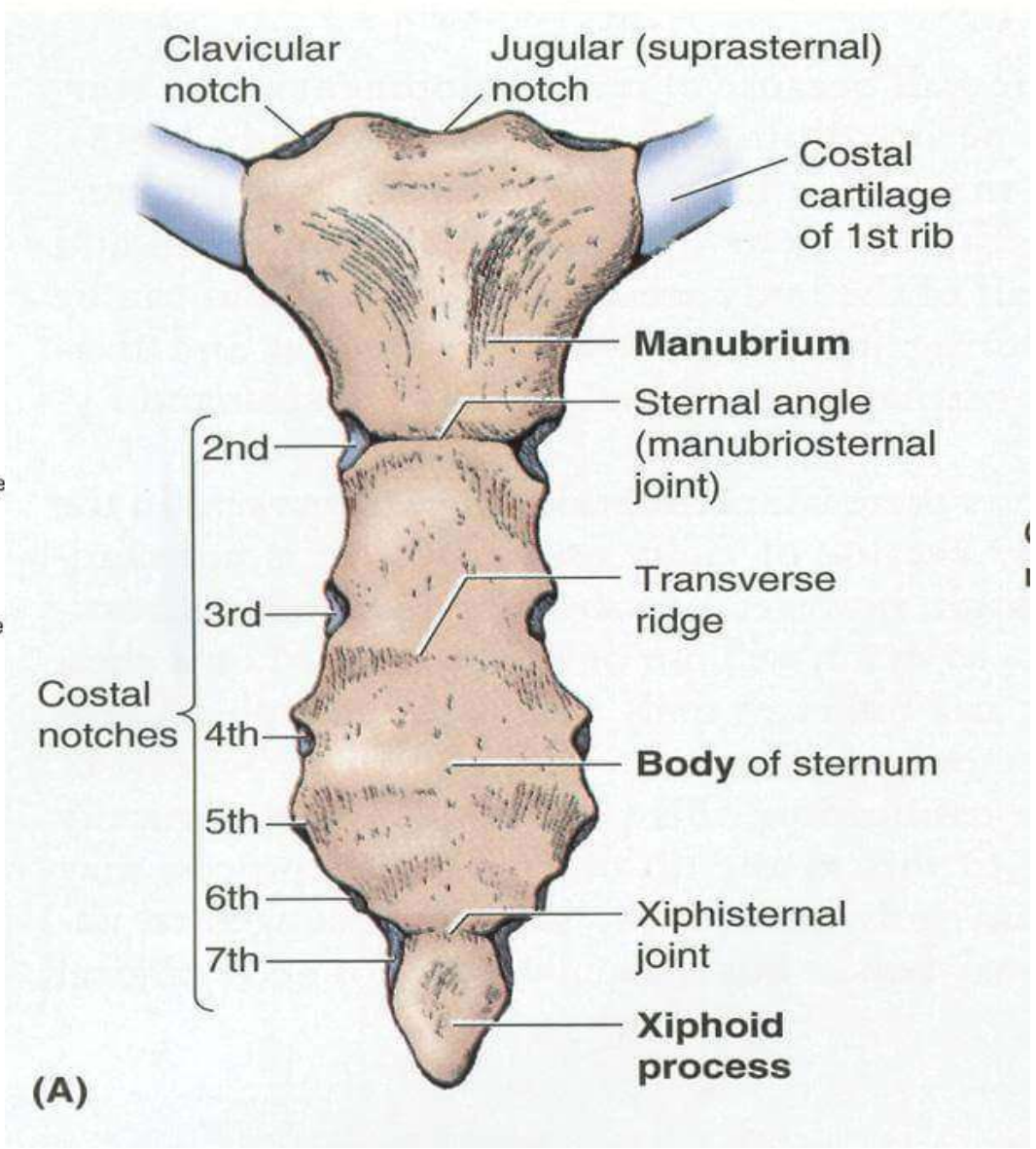
Protection: The sternum provides protection to vital organs in the chest, including the heart, lungs, and major blood vessels. Its position in the front of the thoracic cavity shields these organs from external trauma.

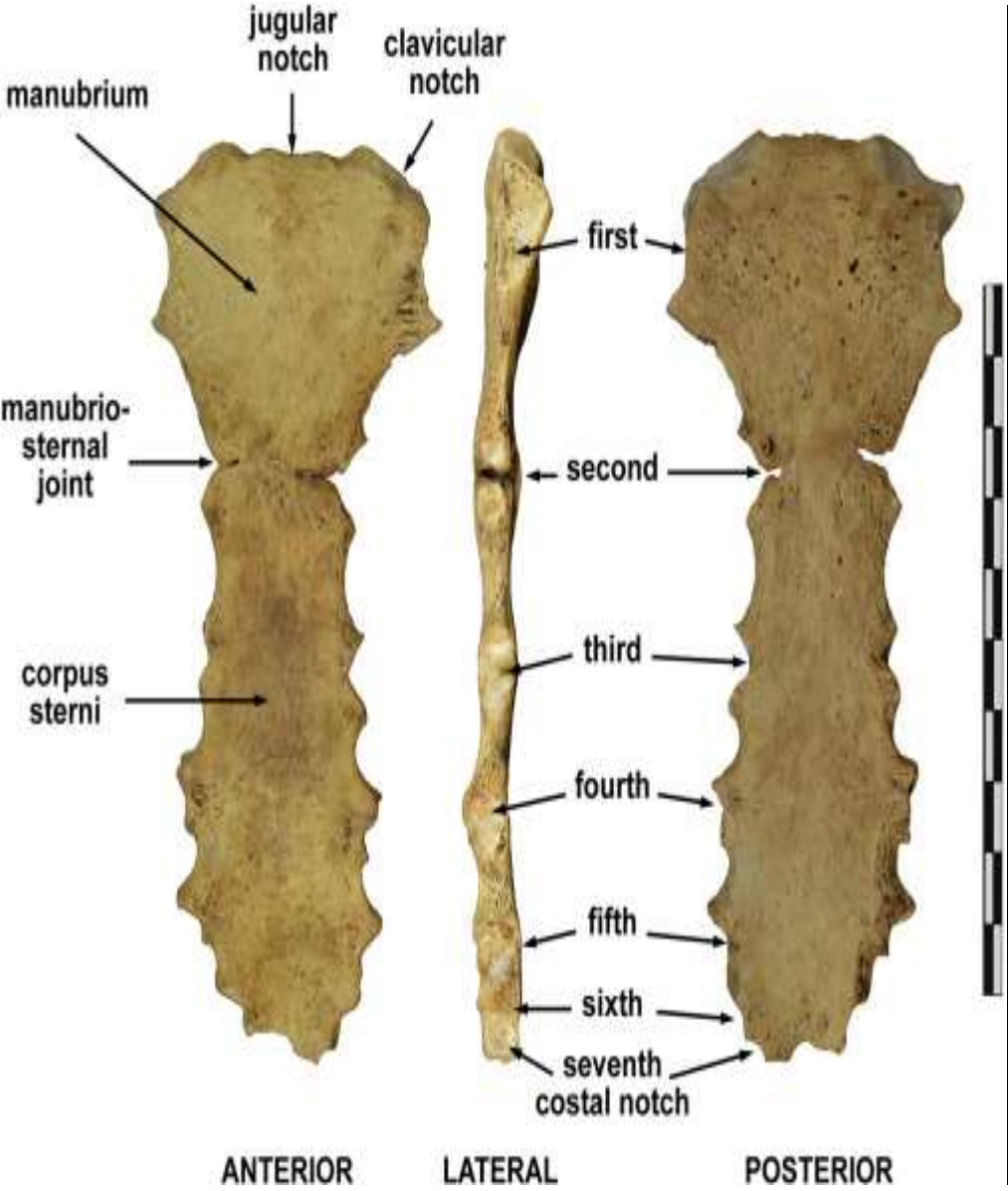
Attachment point for ribs: The sternum serves as the attachment point for the ribs via cartilage. The ribs articulate with the sternum to form the rib cage, which encloses and protects the thoracic organs while allowing for respiratory movement.

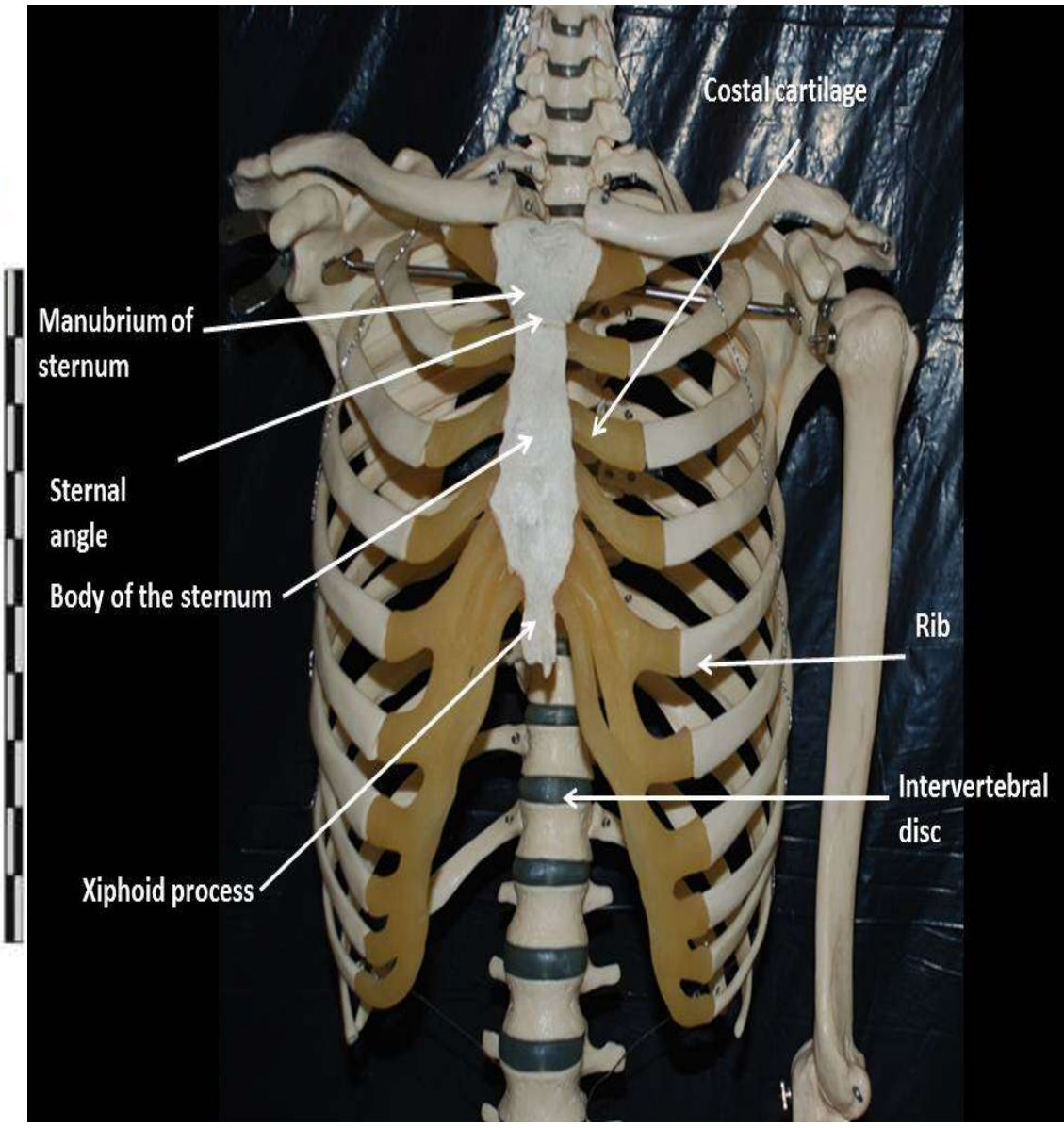
Support for the shoulder girdle: The sternum also provides support for the shoulder girdle and upper limbs. It articulates with the clavicles (collarbones) at its superior end, forming the sternoclavicular joints, which help stabilize the shoulder joints.

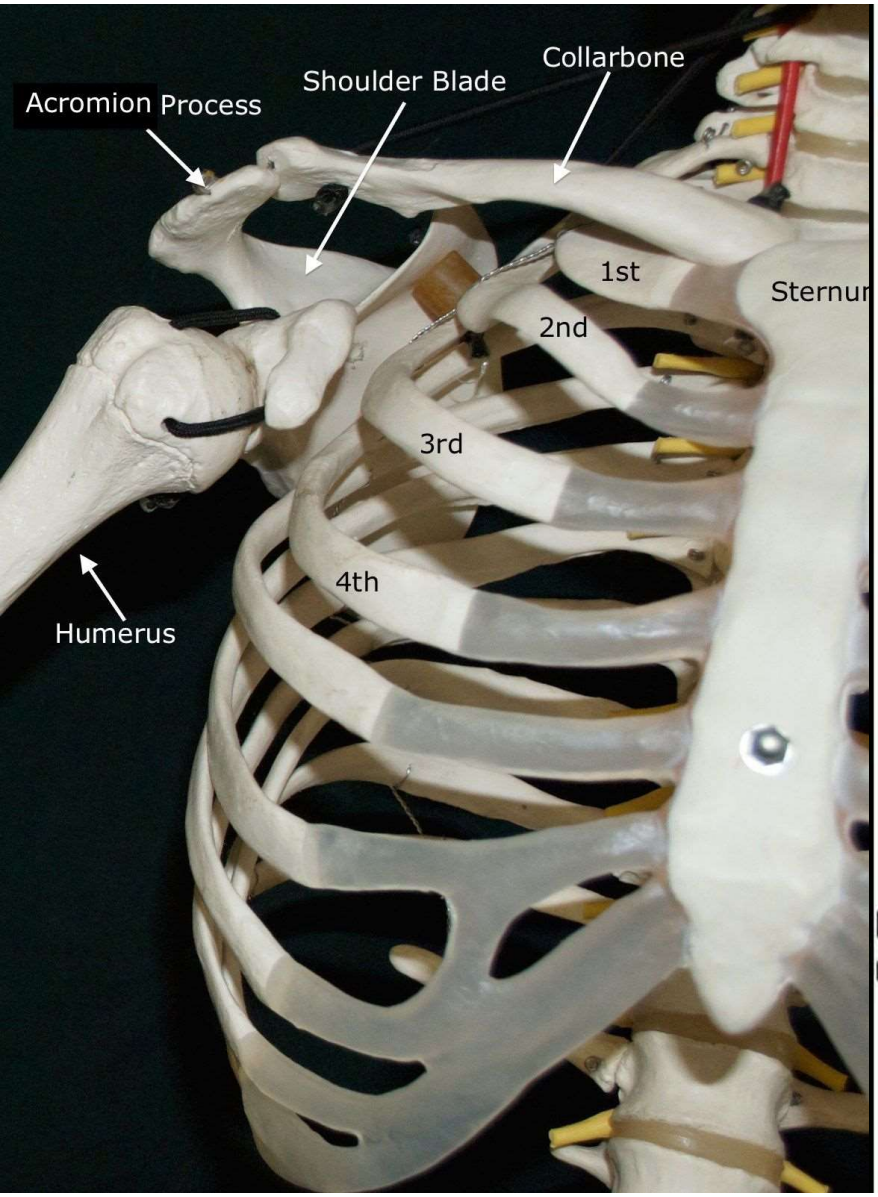
Muscle attachment: Various muscles of the chest, abdomen, and neck attach to the sternum, providing support for posture and facilitating movements such as breathing, arm elevation, and neck flexion.

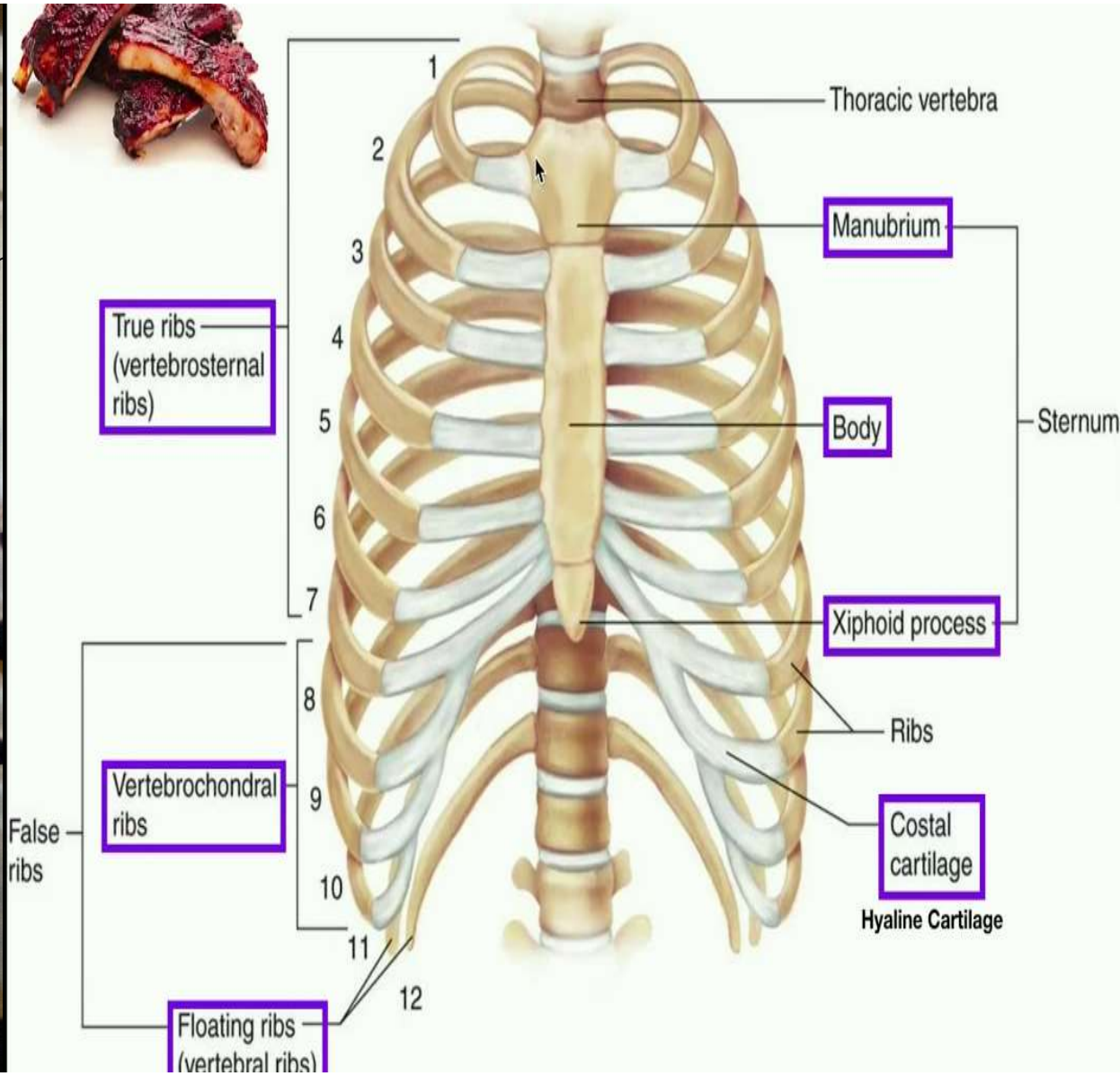

Suprasternal notch
Clavicular notch
1st costal notch
2nd costal notch
Manubrium
Sternal angle
3rd costal notch
1st sternebrae
2nd sternebrae
4th costal notch
Body
3rd sternebrae
5th costal notch
4th sternebrae
6th costal notch
Xiphisternal junction
7th costal notch
Xiphoid
ANTERIOR VIEW
LATERAL VIEW


Clavicular notch
Jugular (suprasternal) notch
Costal cartilage of 1st rib
Manubrium
Sternal angle (manubriosternal joint)
2nd
3rd
Transverse ridge
Costal notches
4th
Body of sternum
5th
6th
Xiphisternal joint
7th
Xiphoid process
(A)

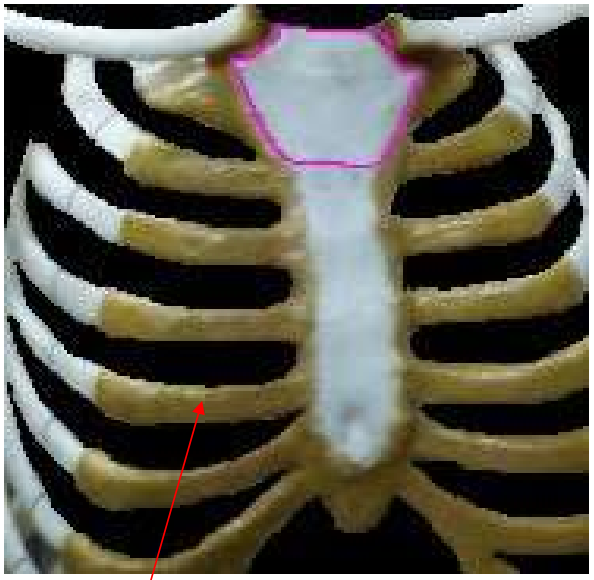

jugular notch
clavicular notch
manubrium
manubrio-sternal joint
corpus sterni
first
second
third
fourth
fifth
sixth
seventh costal notch
ANTERIOR
LATERAL
POSTERIOR


Costal cartilage
Manubrium of sternum
Sternal angle
Body of the sternum
Rib
Intervertebral disc
Xiphoid process


Acromion Process
Shoulder Blade
Collarbone
1st
2nd
3rd
4th
Sternum
Humerus


1
2
3
4
5
6
7
8
9
10
11
12
Thoracic vertebra
Manubrium
Body
Xiphoid process
Sternum
Ribs
Costal cartilage
Hyaline Cartilage
True ribs (vertebrosternal ribs)
False ribs
Vertebrochondral ribs
Floating ribs (vertebral ribs)

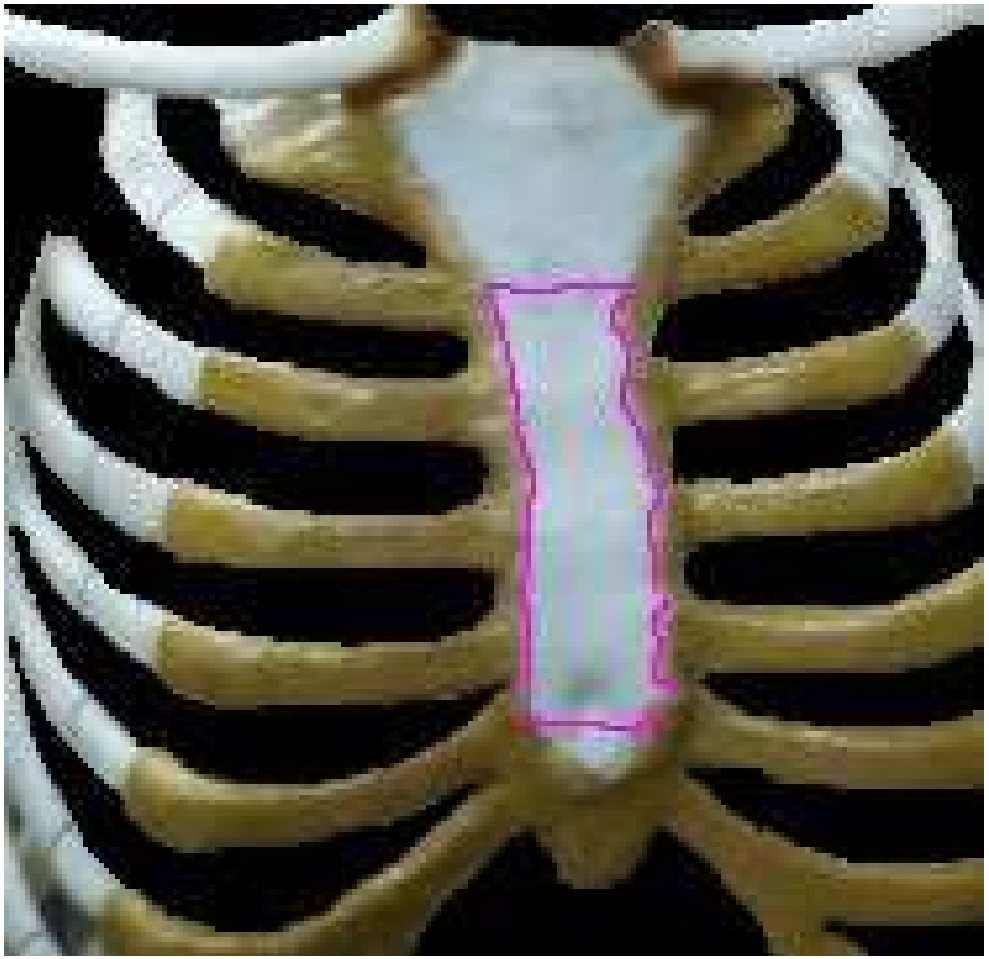
Sternum - Manubrium



Costal Cartilage

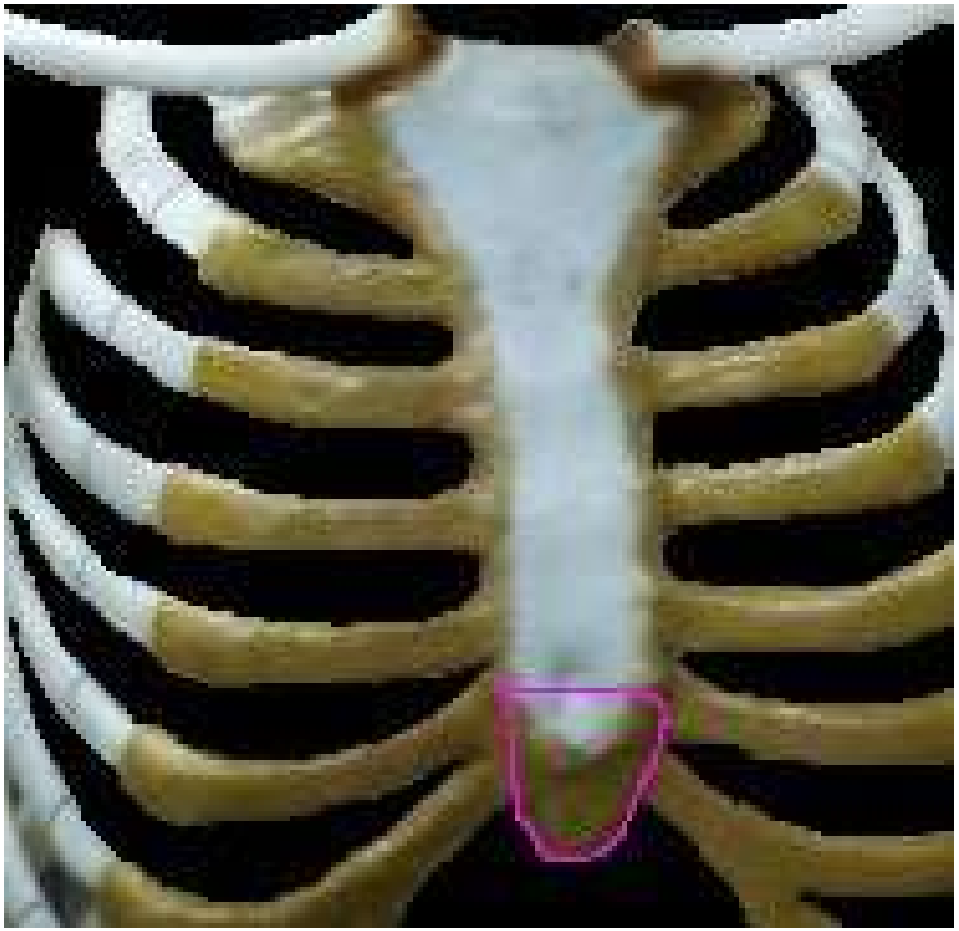
- “Handle”
- Connected to the first 2 ribs
- Clavicular notches articulate with clavicles (collarbone)
- Clavicular Articular facets

Sternum - Body



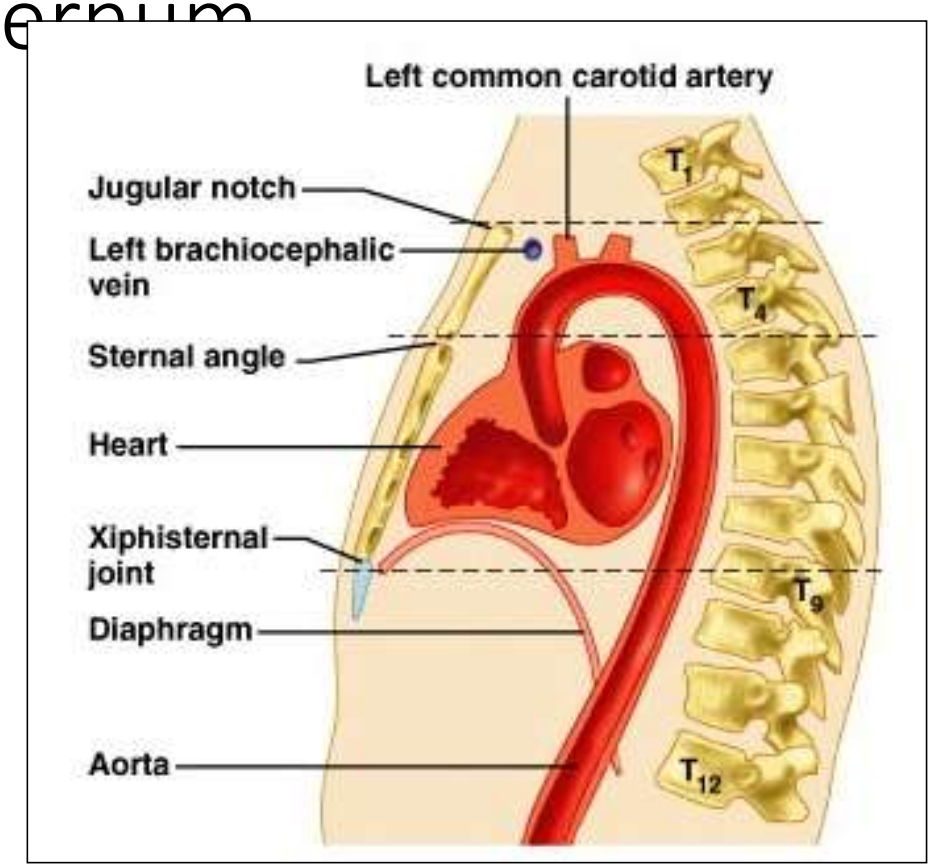
- “Blade” or “gladiolus”
- Connects with ribs 2-7
- Sides are notched where it articulates with the costal cartilages
- 4 separate parts until after puberty

Sternum – Xiphoid Process

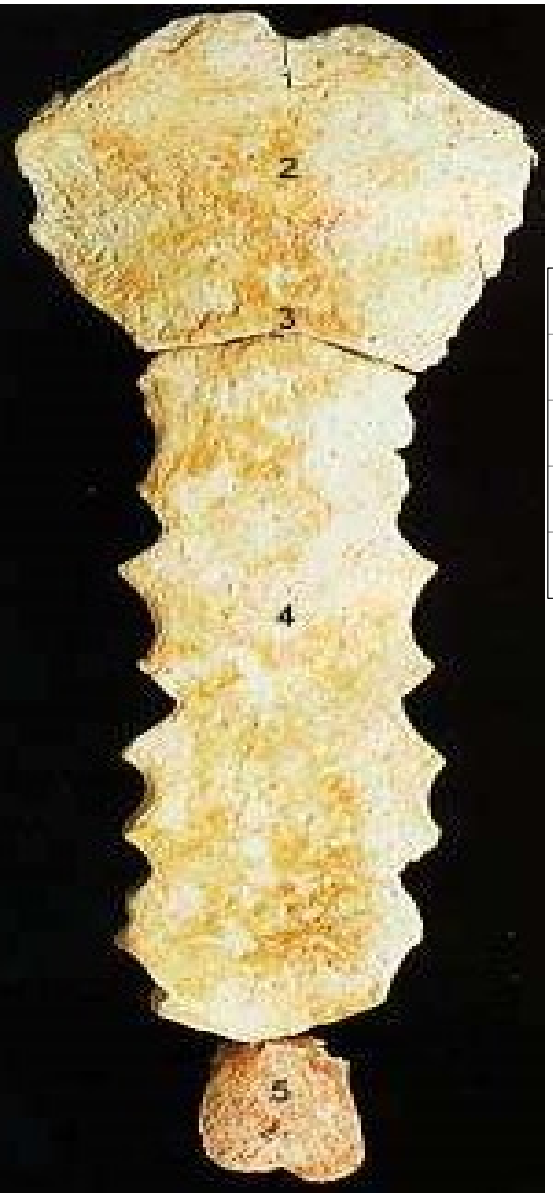


- “Tip”
- Cartilaginous (hyaline) that becomes bony over the years (@40)
- Partial attachment of many muscles

Sternum



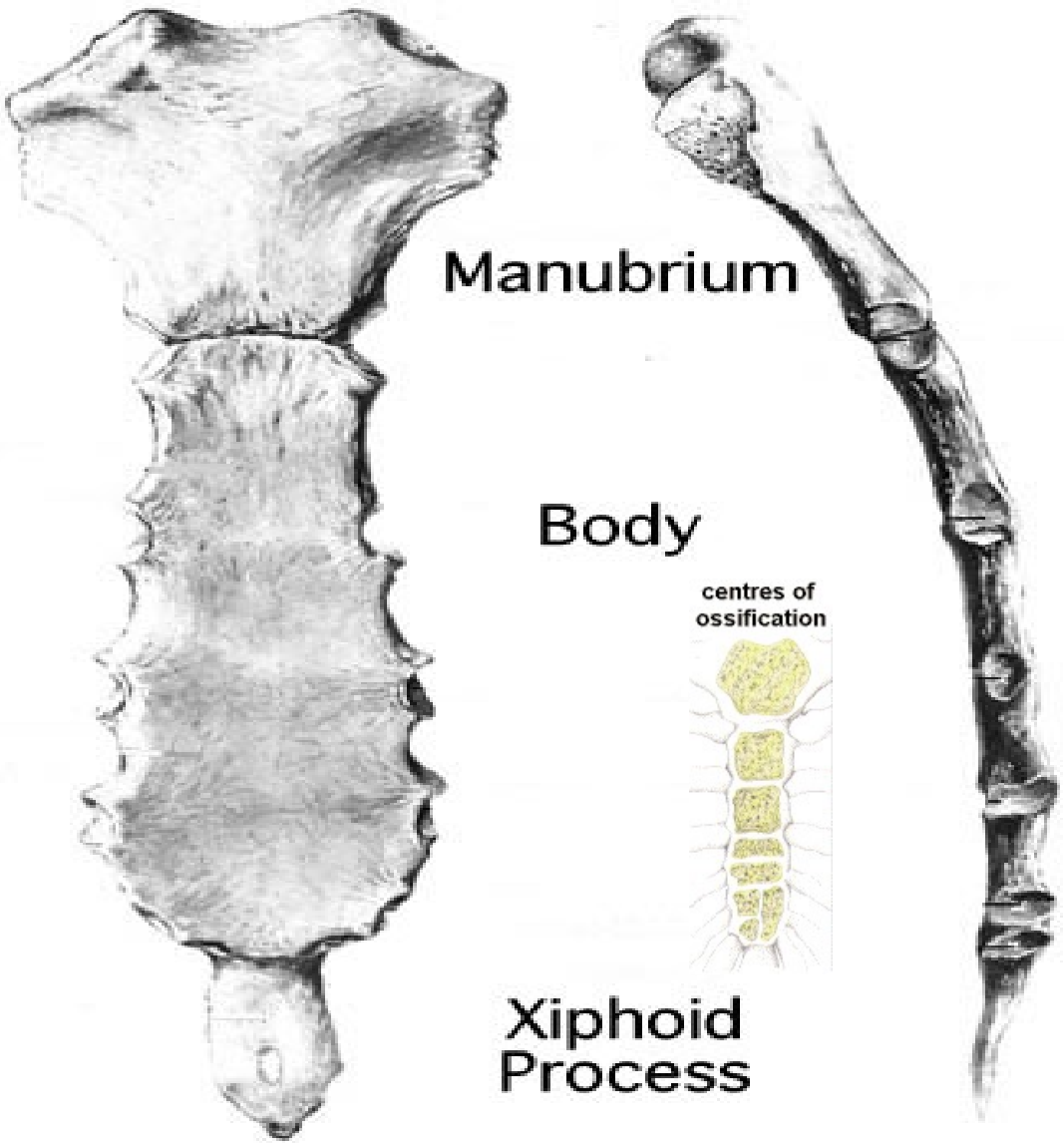
- 3 major anatomical landmarks:
  - 1. Jugular notch
    - Central indentation in manubrium
  - 2. Sternal angle
    - Manubrium joins the body
  - 3. Xiphisternal joint
    - Cartilaginous union between xiphoid process and body

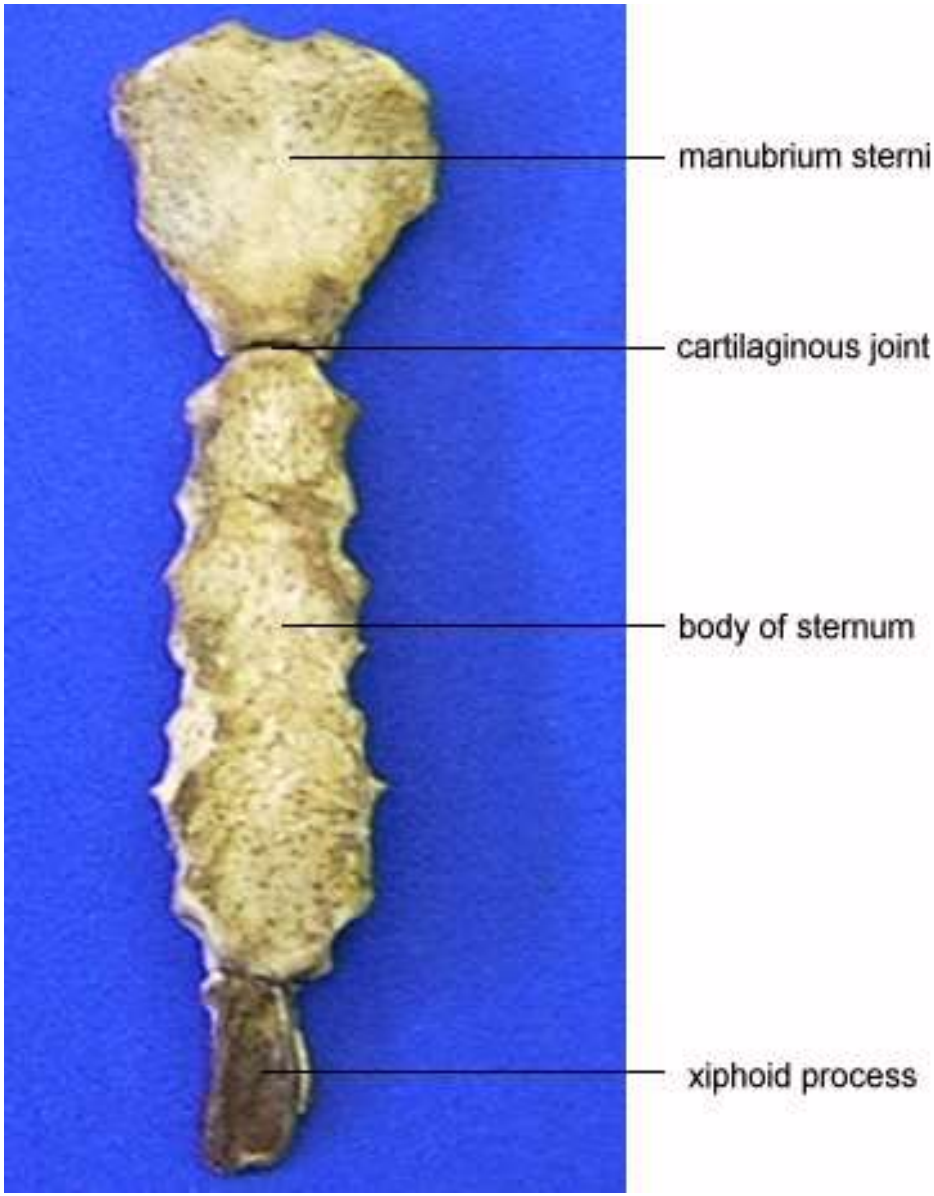


STERNUM

1.	Jugular Notch
2.	Manubrium
3.	Sternal Angle
4.	Body (Gladiolus)
5.	Xiphoid Process

The sternum is composed of three parts:
•The manubrim, also called the "handle", is located at the top of the sternum and moves slightly. It is connected to the first two ribs.
•The body, also called the "blade" or the "gladiolus", is located in the middle of the sternum and connects the third to seventh ribs directly and the eighth through tenth ribs indirectly.
•The xiphoid process, also called the "tip", is located on the bottom of the sternum. It is often cartilaginous (cartilage), but does become bony in later years.
These three segments of bone are usually fused in adults.
The sternum serves an important function in the body. The ribs are connected to it by the costal cartilage. Without the sternum, there would be a hole in the bone structure in the middle of your chest, right above your heart and lungs. The sternum protects this vital area and completes the circle of the rib cage.


Manubrium
Body
centres of ossification
Xiphoid Process


manubrium sterni
cartilaginous joint
body of sternum
xiphoid process

Ribs

- The superior 7 pair (true, or vertebrosternal ribs) attach directly to the sternum via costal cartilages
- Ribs 8-10 (false, or vertebrocondral ribs) attach indirectly to the sternum via costal cartilage
- Ribs 11-12 (floating, or vertebral ribs) have no anterior attachment

Structure of a Typical True Rib

- Bowed, flat bone consisting of a head, neck, tubercle, and shaft

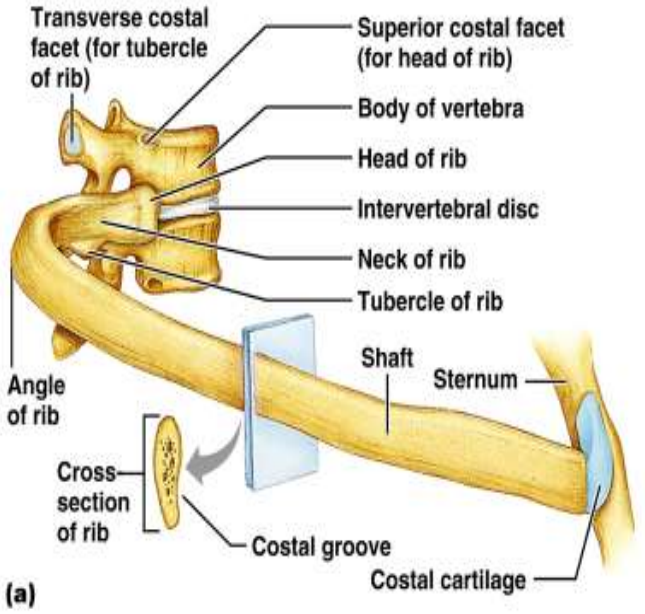
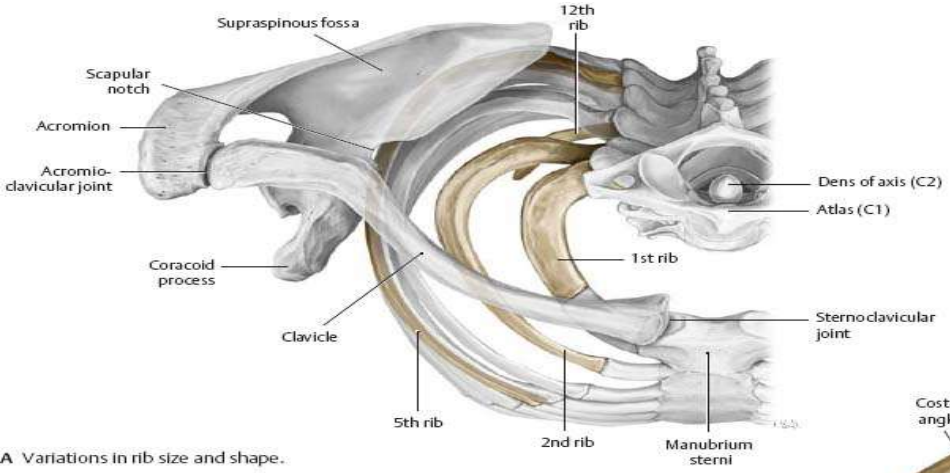
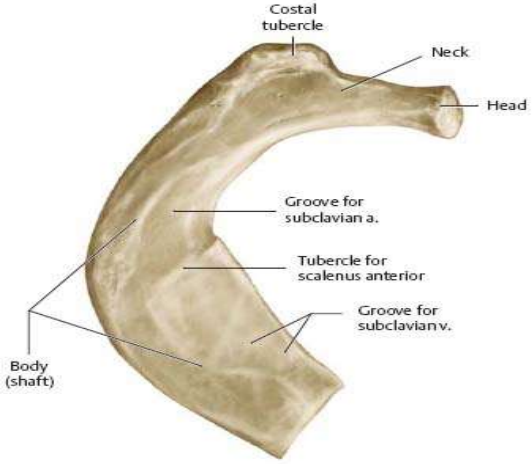


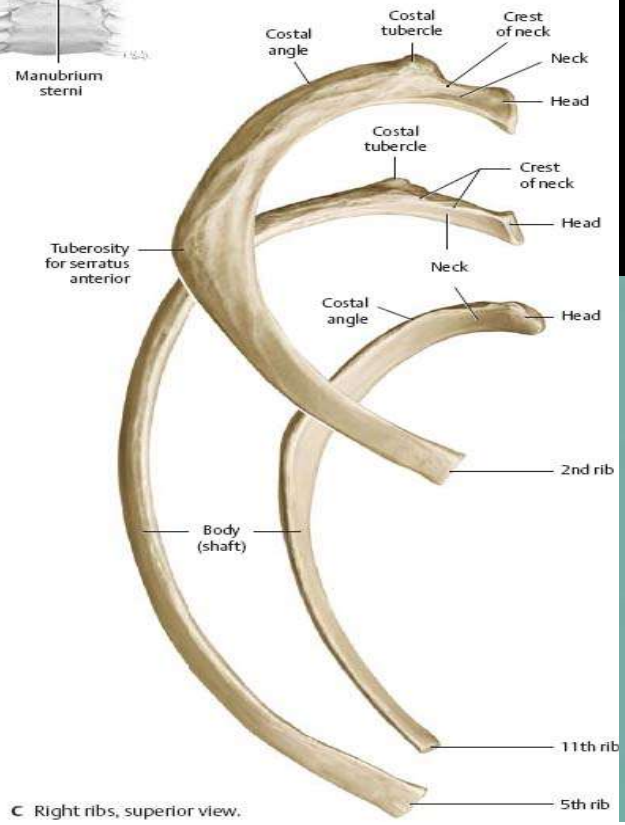
Figure 7.20a



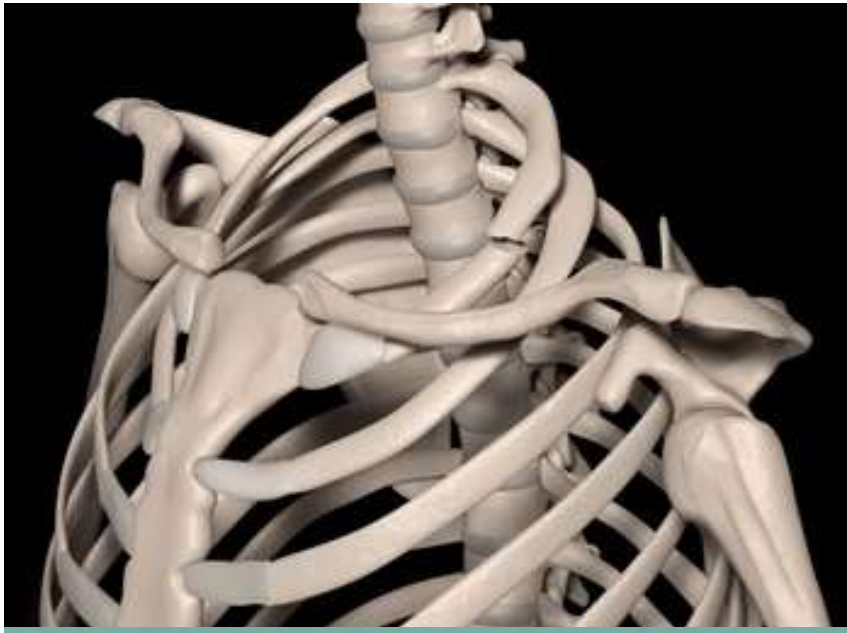
A Variations in rib size and shape.

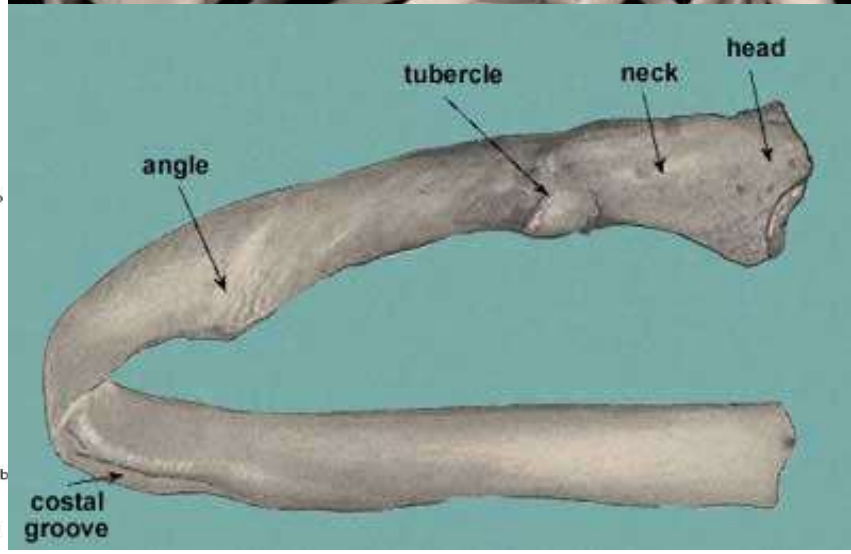


B 1st rib. *Note:* Most ribs have a costal groove along the inferior border (not shown), which protects the intercostal vessels and nerves.



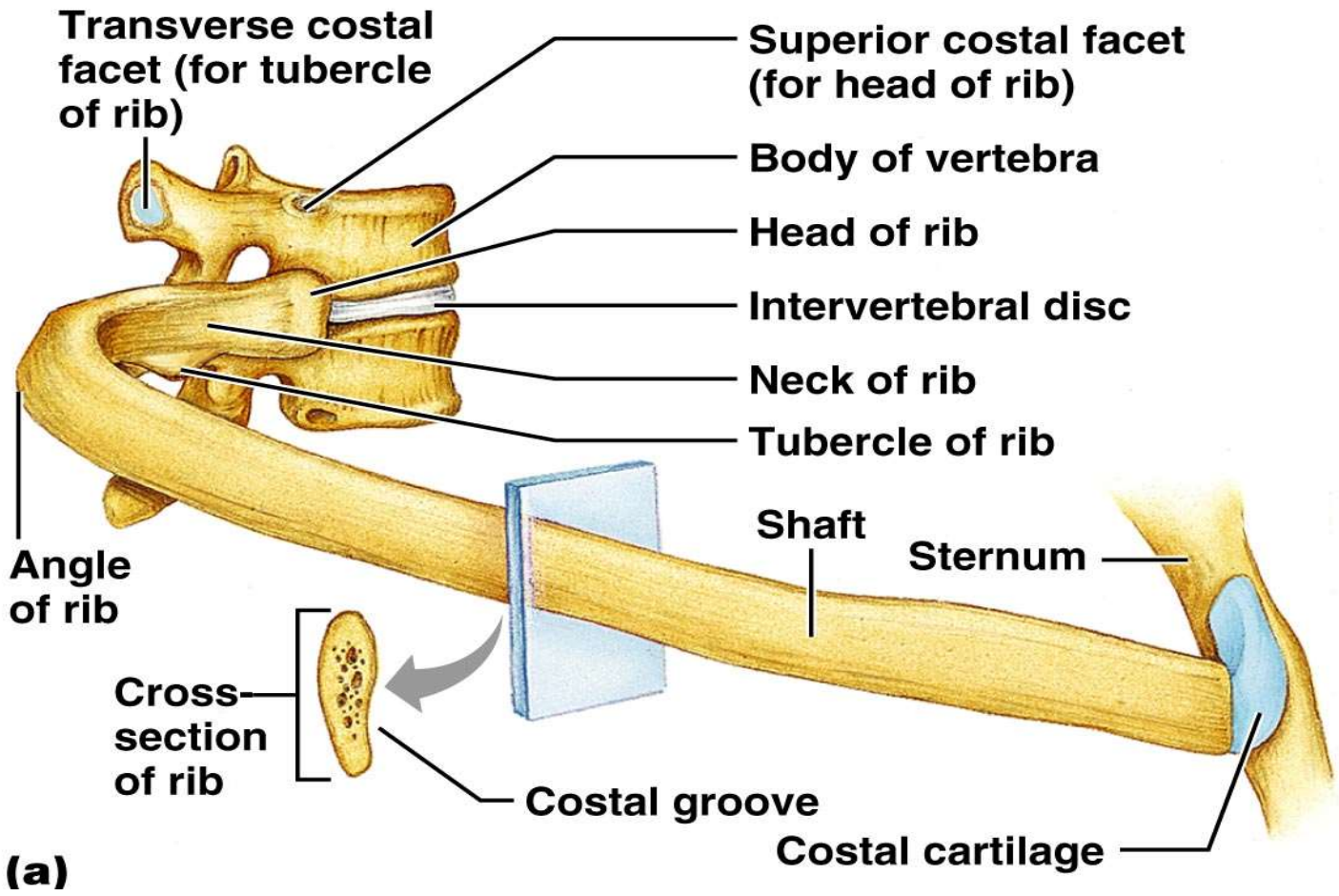
C Right ribs, superior view.



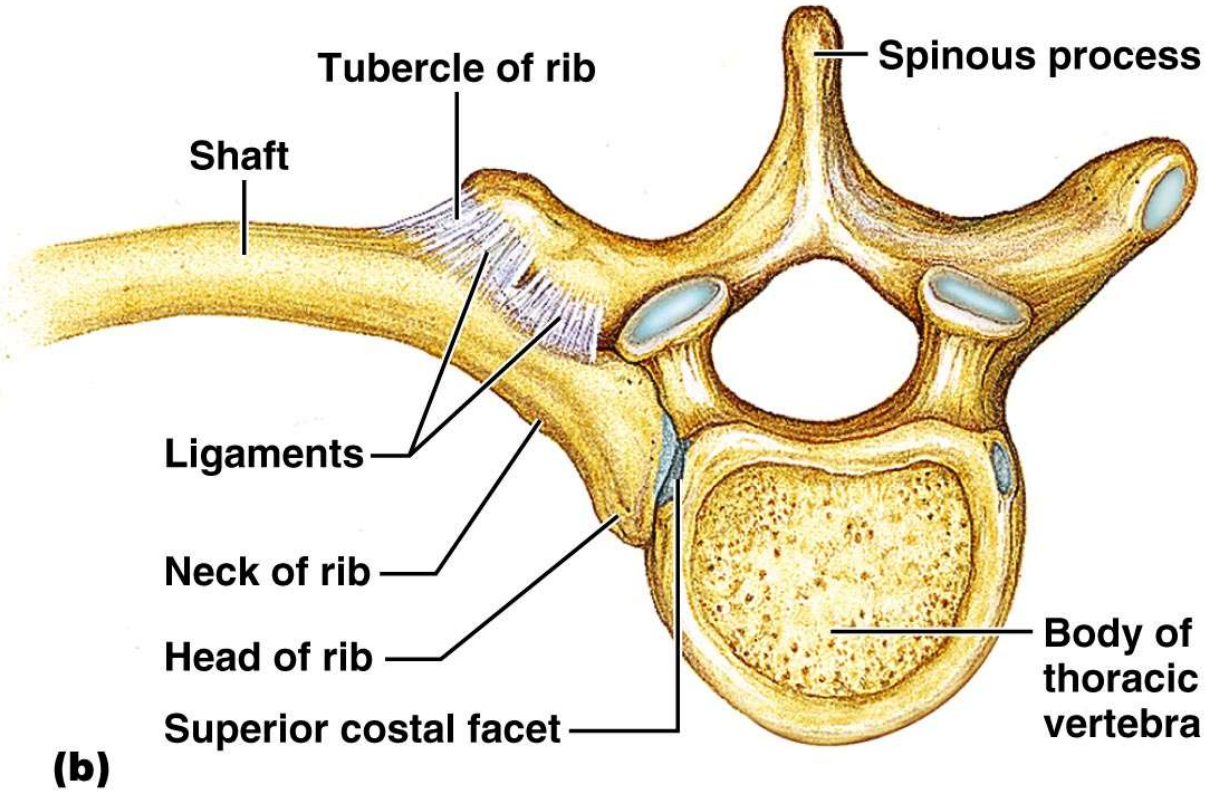


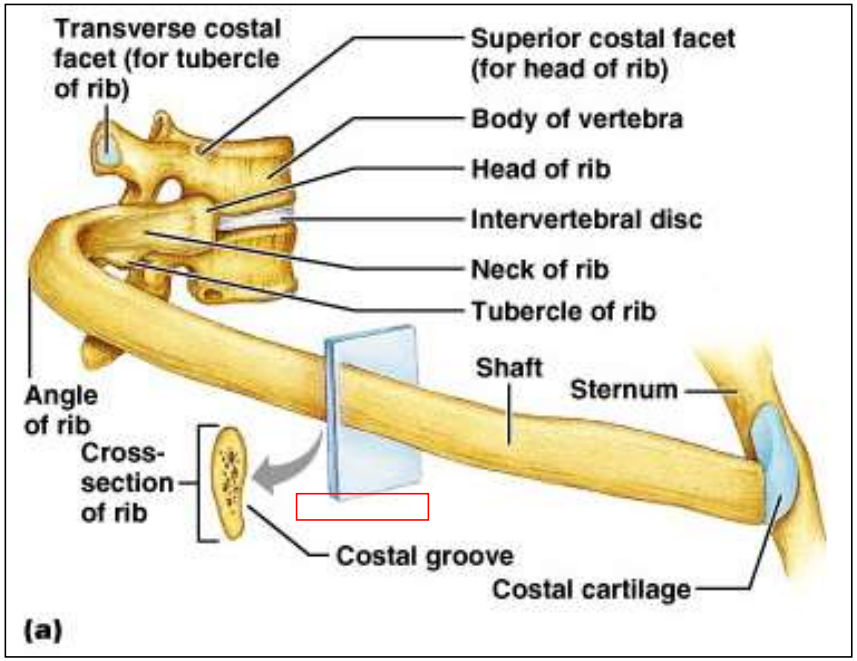
Structure of a Typical True Rib

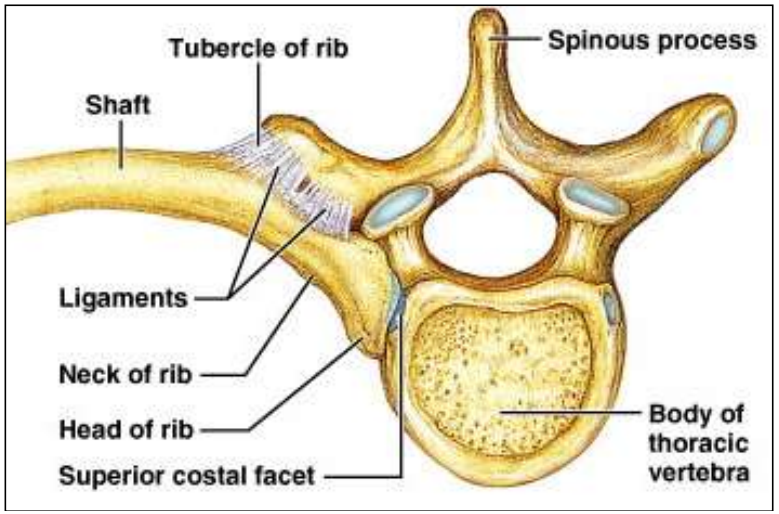
- Bowed, flat bone consisting of a head, neck, tubercle, and shaft



Structure of a Typical True Rib



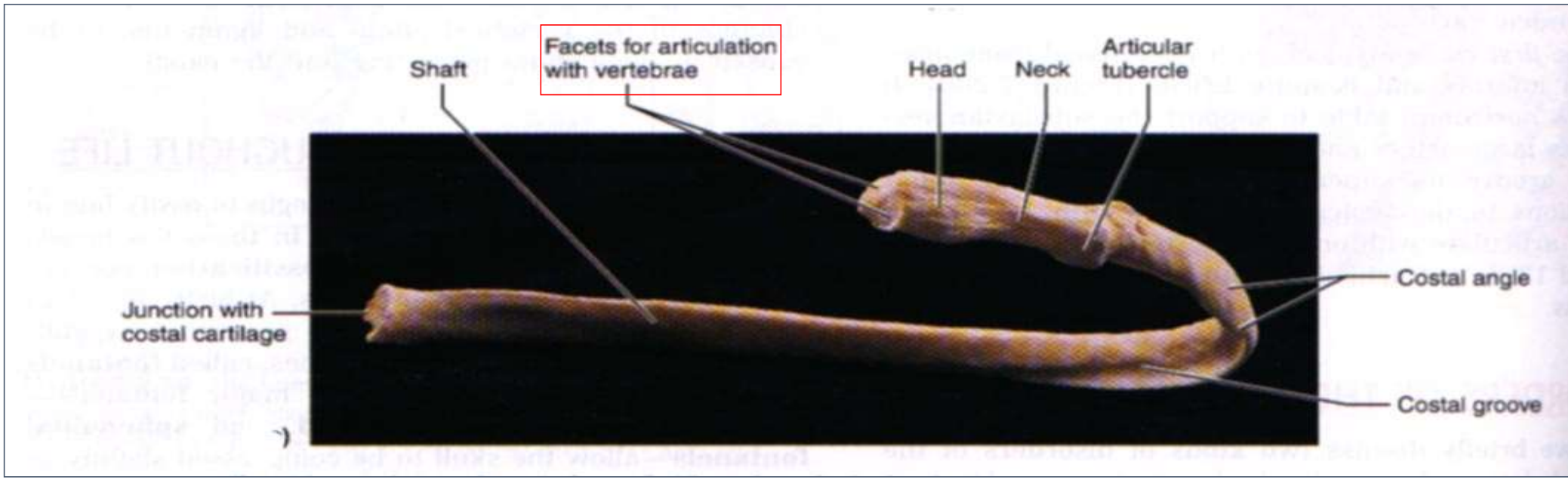




Rib Anatomy – Typical Ribs

- **<u>Dorsal attachment</u>**
  - Head of Rib → 2 Demifacets
    - Superior demifacet
    - Inferior demifacet of vertebra above it
    - Intervertebral disc
  - Tubercle of Rib
    - Articulates with Transverse Costal Facet (Thoracic vertebra)
  - Ex. Rib #4 articulates with Superior Demifacet and Transverse Costal Facet of T4 & Inferior demifacet of T3
- **<u>Ventral attachment</u>**
  - Costal cartilage

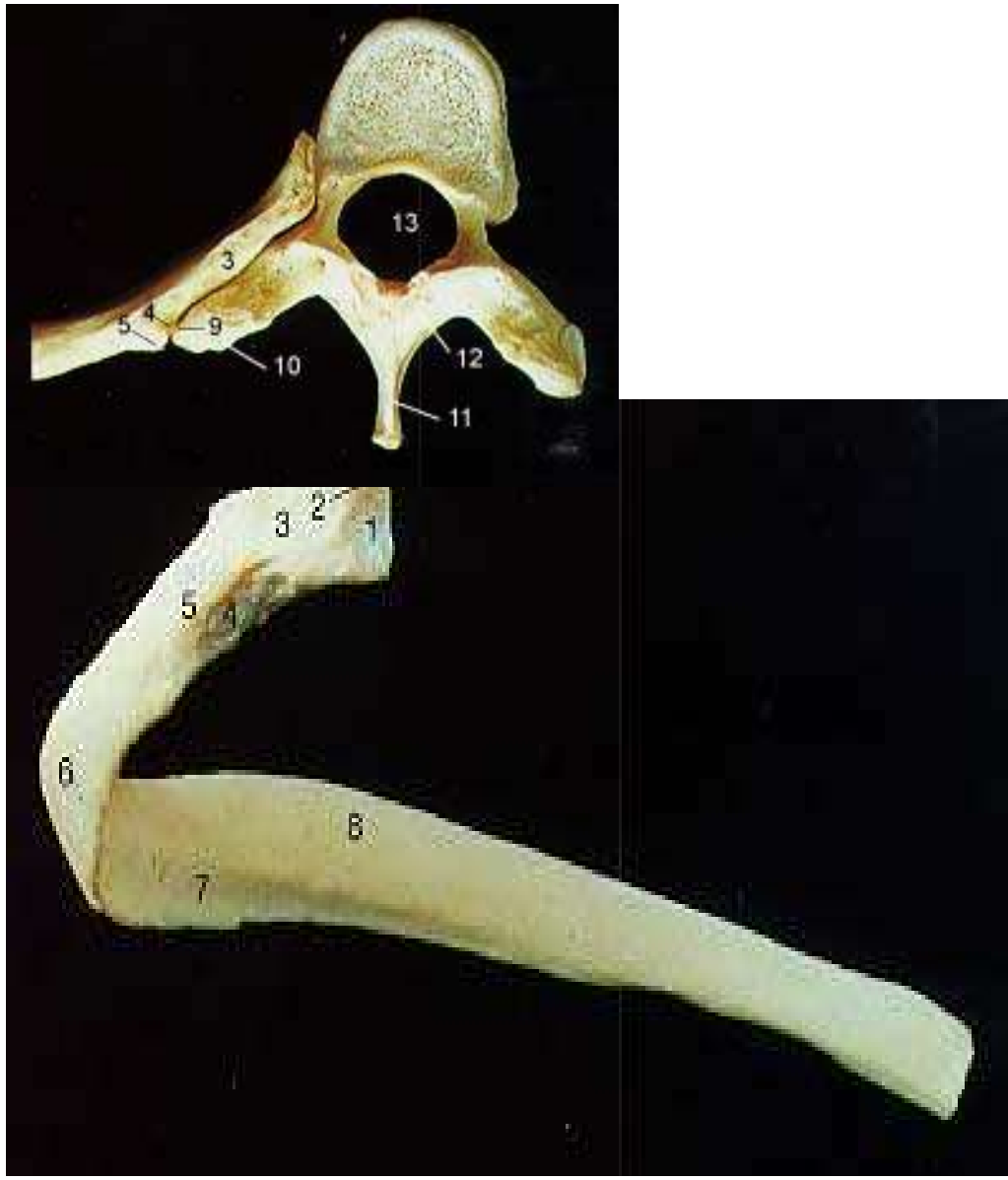
Rib Anatomy – Atypical Ribs

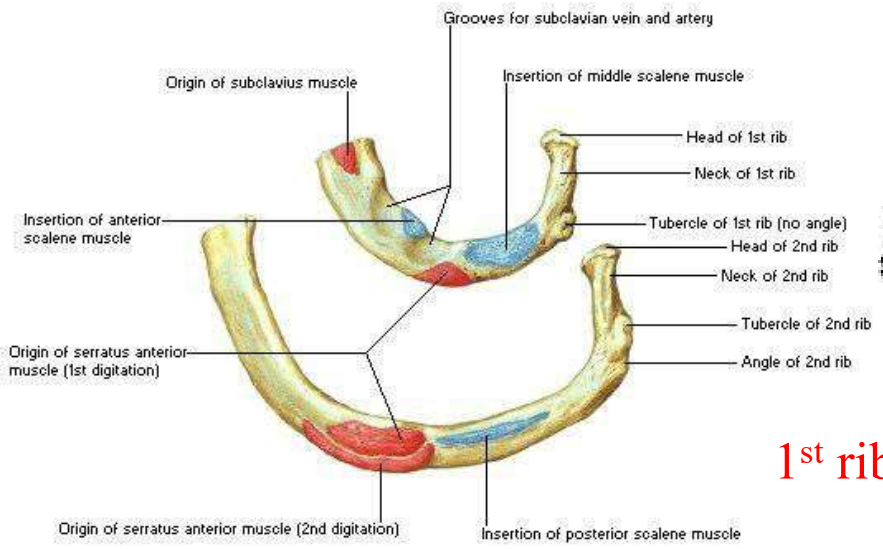


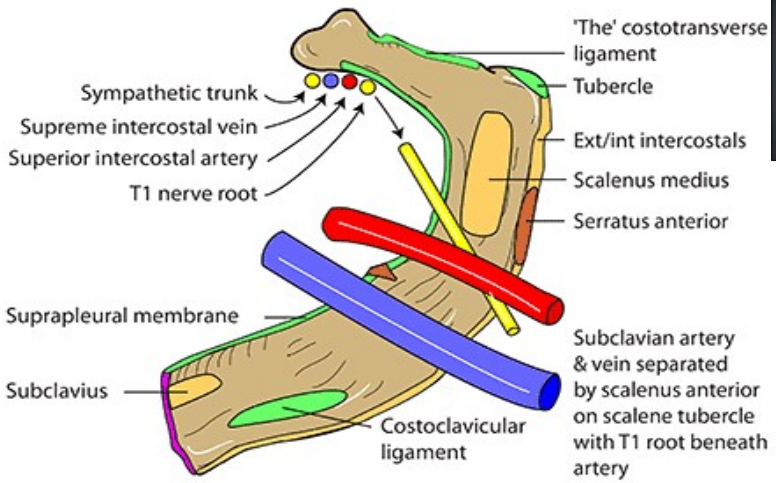
- #1 – flat and broad, supports subclavian vessels
- #1, and 10-12 – articulate with only 1 vertebral body
- #11 and 12 – do not articulate with a vertebral transverse process

RIBS

1.	Articular Facet of Rib
2.	Interarticular Crest
3.	Neck
4.	Articular Portion of Tubercle
5.	Nonarticular Portion of Tubercle
6.	Angle of Rib
7.	Costal Groove
8.	Body of Rib
9.	Articular Facet of Transverse Process
10.	Transverse Process
11.	Spinous Process
12.	Lamina
13.	Vertebral Foramen

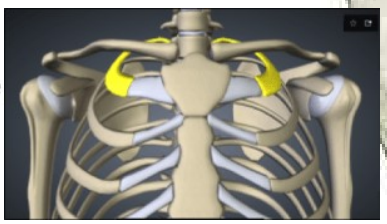




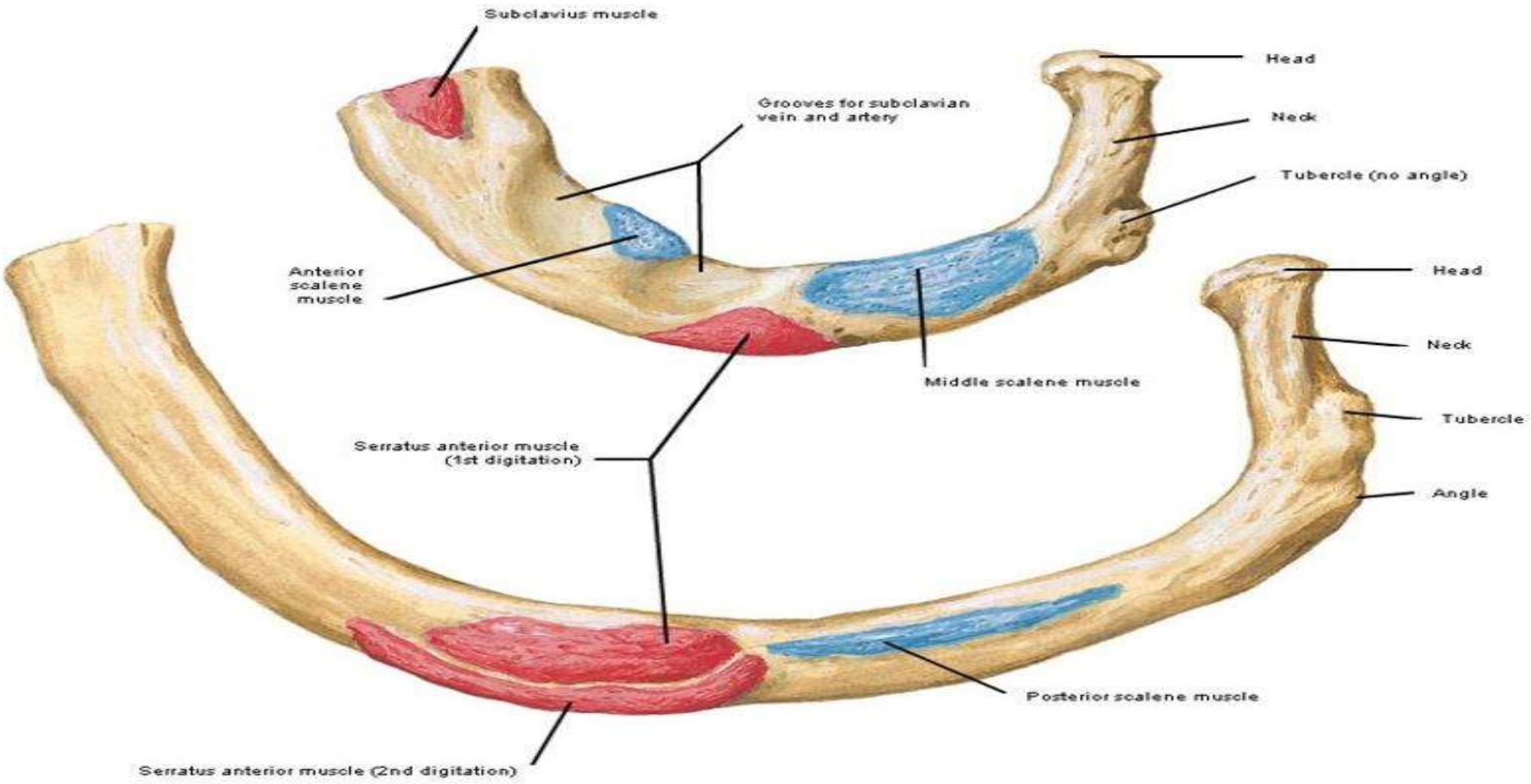


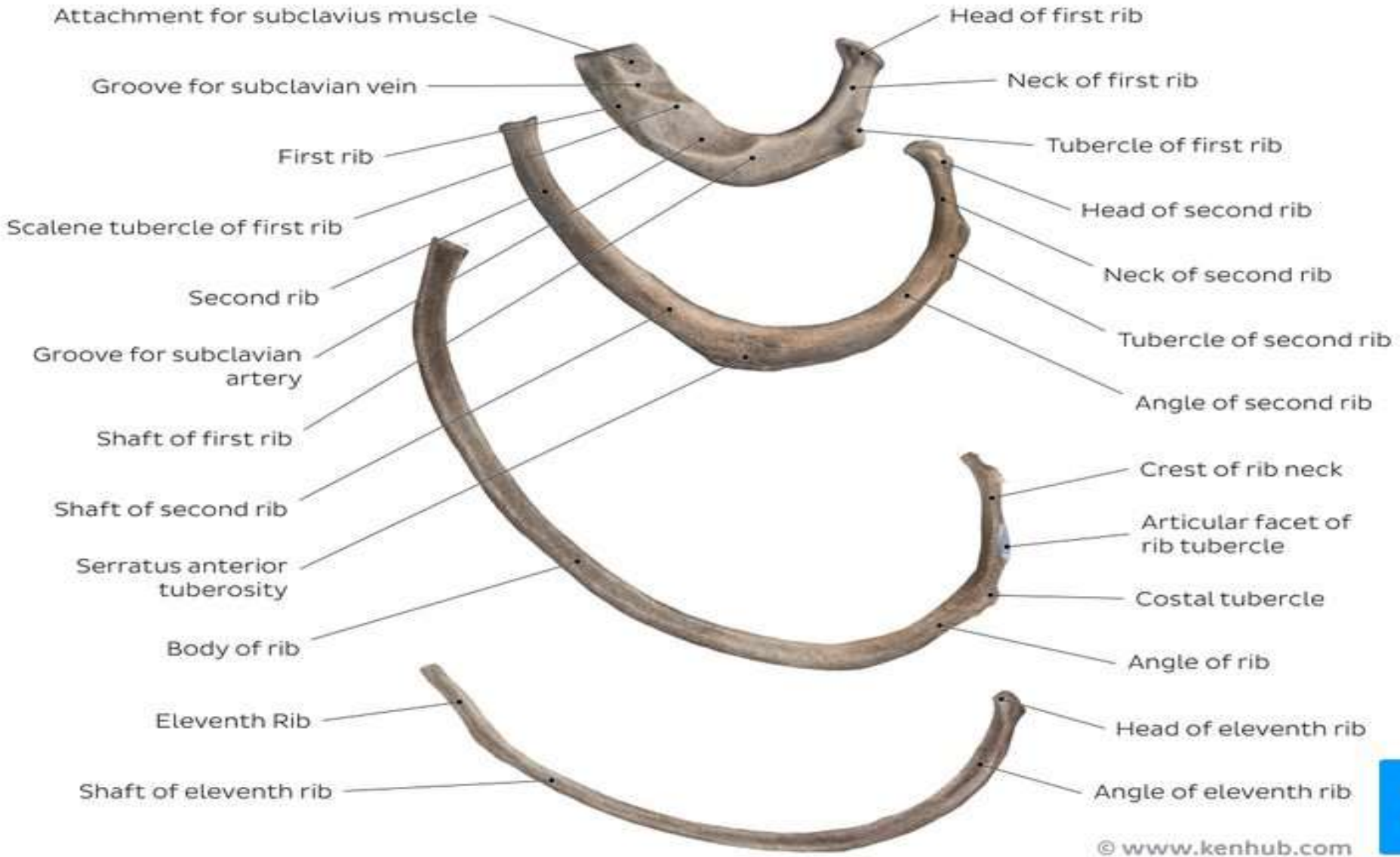
The under surface of the 1st rib is smoother. When the rib is laid on a flat surface, the head touches the flat surface when the rib is the correct way up

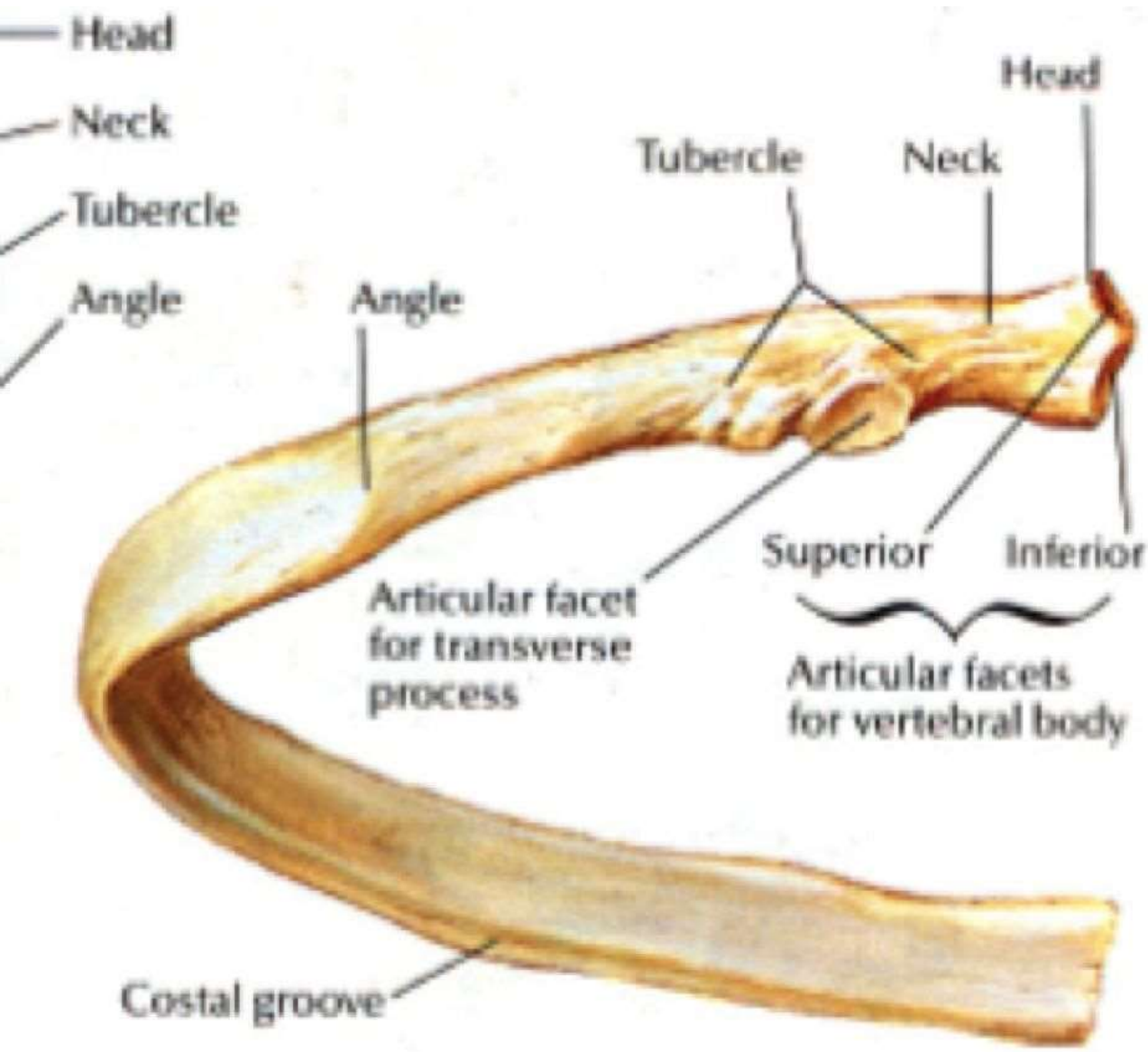
1st rib



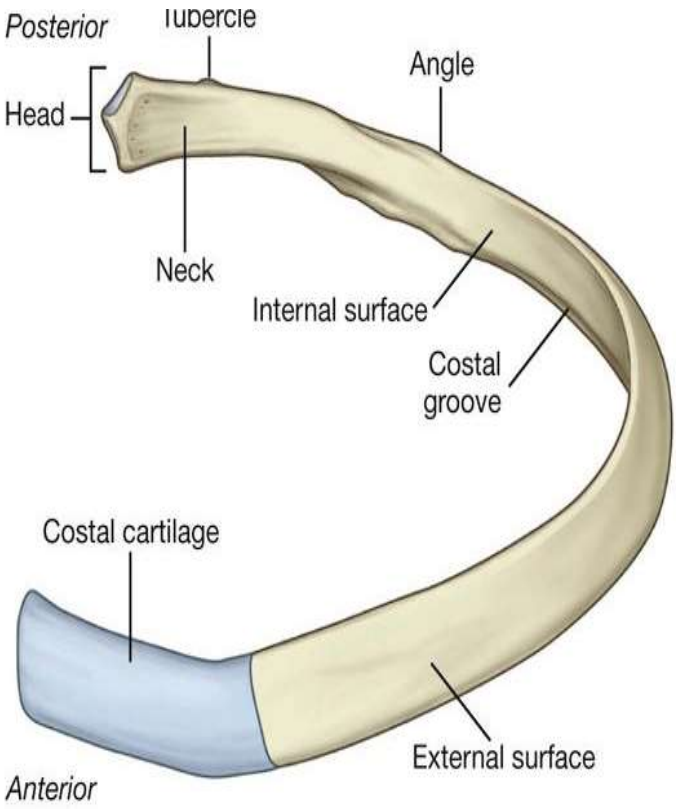
Left 1st and 2nd Ribs
Superior View



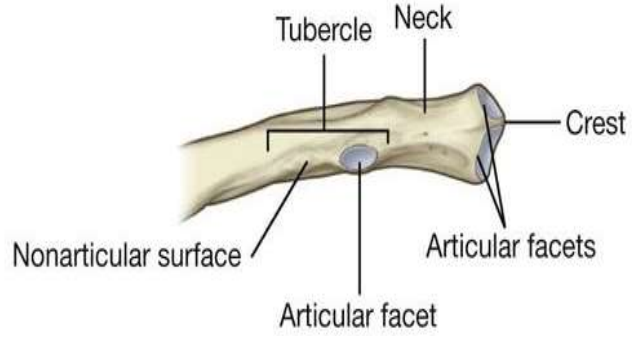

Attachment for subclavius muscle
Groove for subclavian vein
First rib
Scalene tubercle of first rib
Second rib
Groove for subclavian artery
Shaft of first rib
Shaft of second rib
Serratus anterior tuberosity
Body of rib
Eleventh Rib
Shaft of eleventh rib
Head of first rib
Neck of first rib
Tubercle of first rib
Head of second rib
Neck of second rib
Tubercle of second rib
Angle of second rib
Crest of rib neck
Articular facet of rib tubercle
Costal tubercle
Angle of rib
Head of eleventh rib
Angle of eleventh rib
© www.kenhub.com
KEN HUB

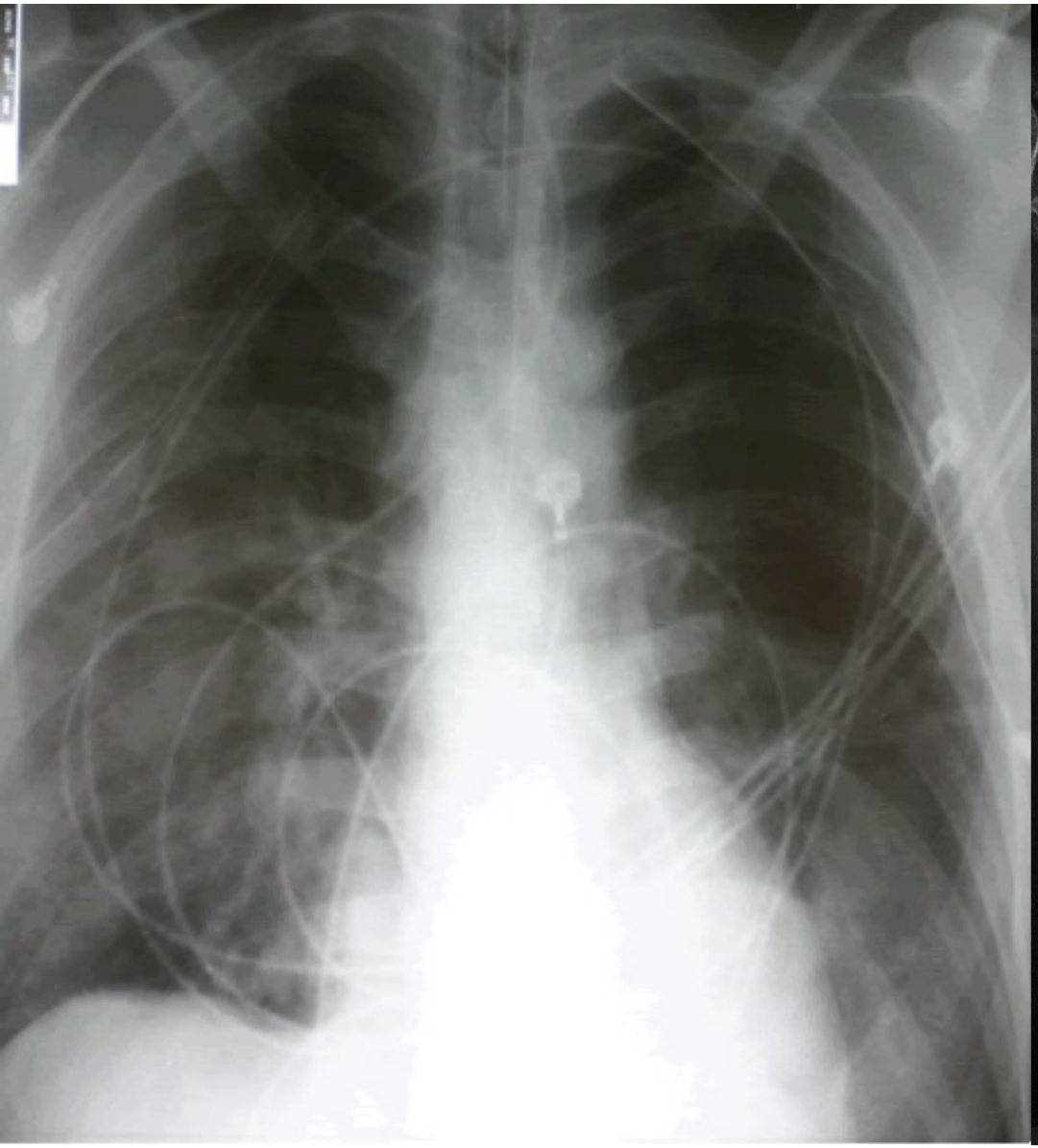

Head
Neck
Tubercle
Angle
Head
Tubercle
Neck
Angle
Articular facet for transverse process
Superior
Inferior
Articular facets for vertebral body
Costal groove

B

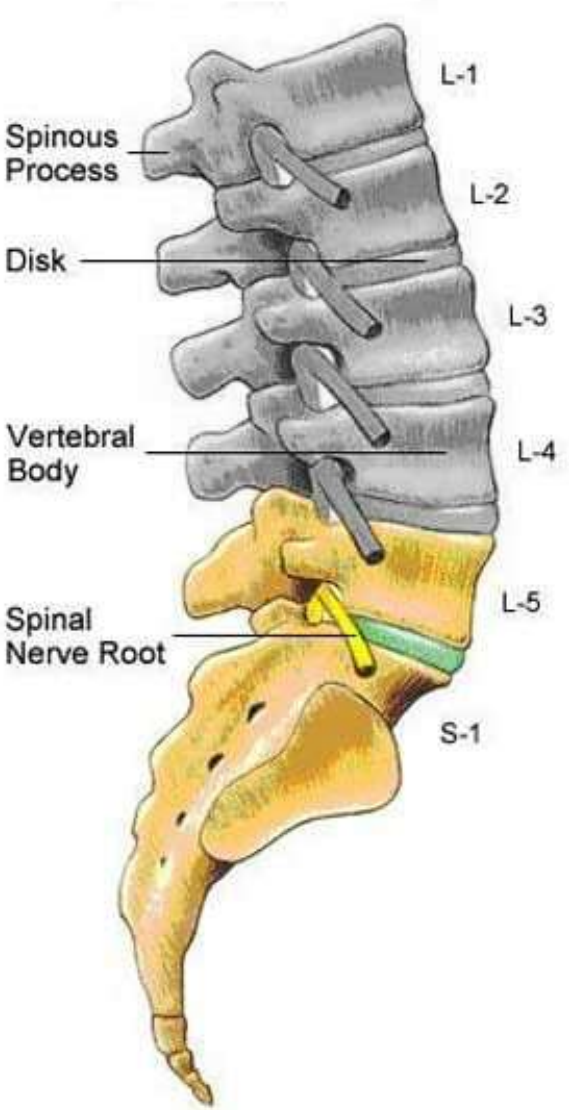

Posterior
Tubercle
Angle
Head
Neck
Internal surface
Costal groove
Costal cartilage
External surface
Anterior

A

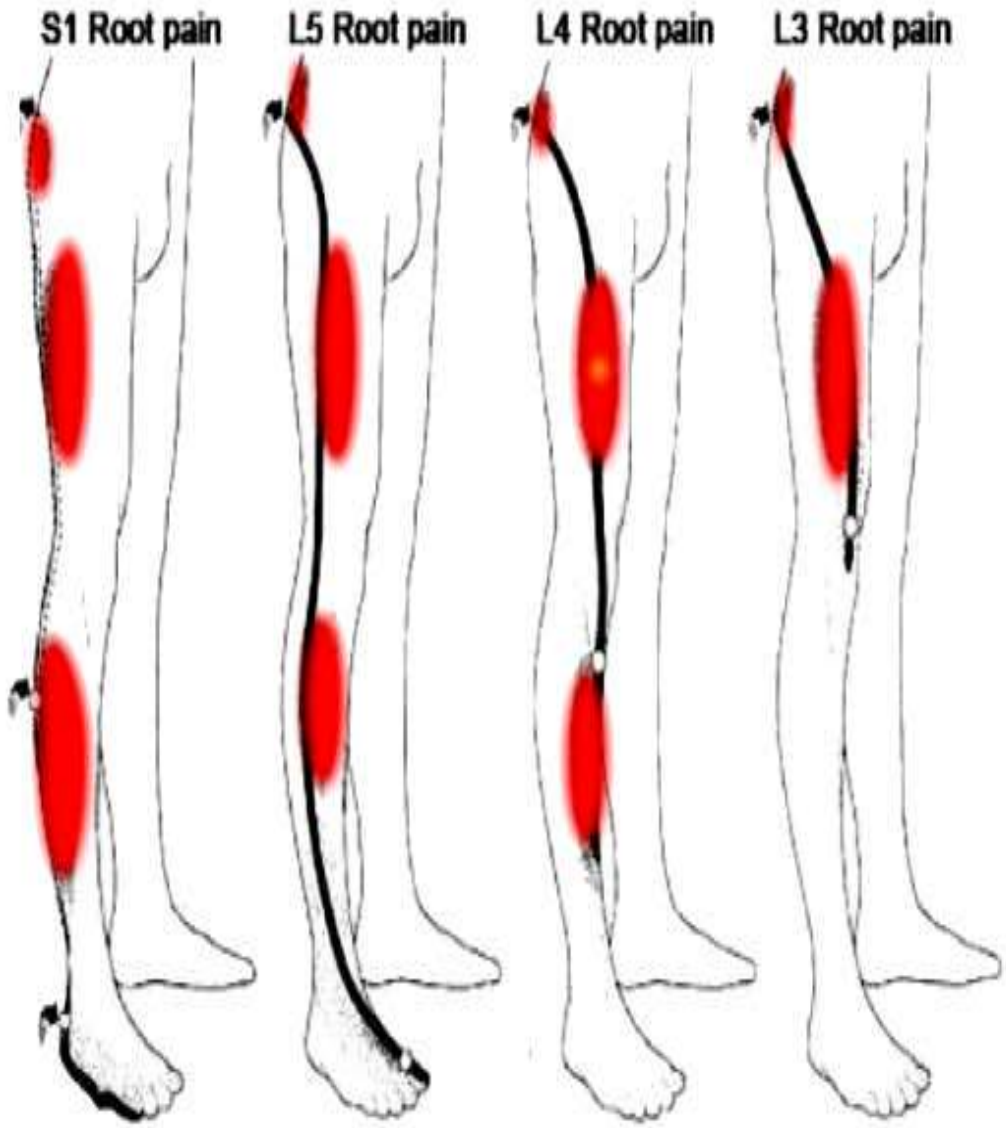

Tubercle
Neck
Crest
Nonarticular surface
Articular facets
Articular facet

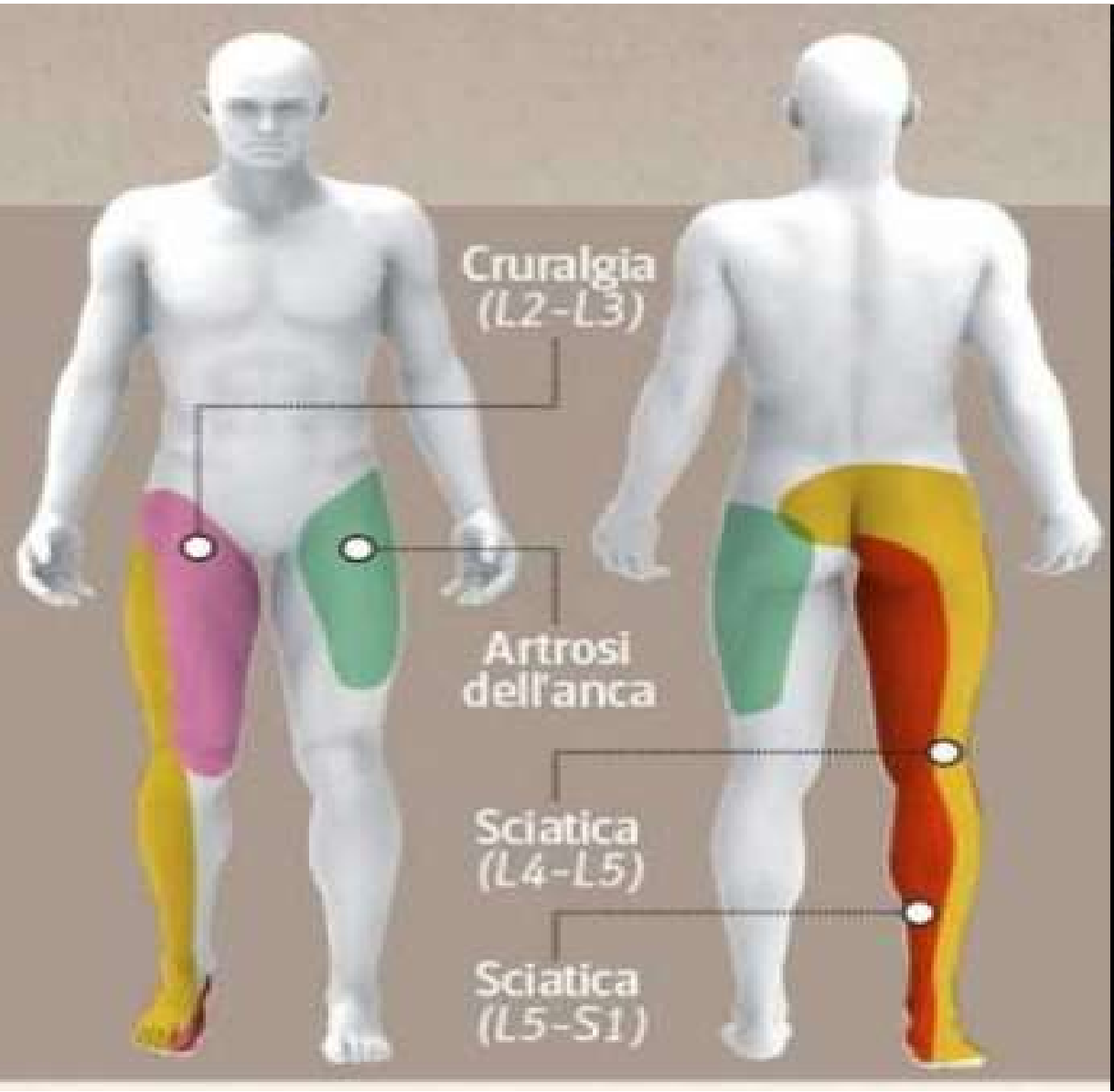



右


L-1
Spinous Process
L-2
Disk
L-3
Vertebral Body
L-4
L-5
Spinal Nerve Root
S-1

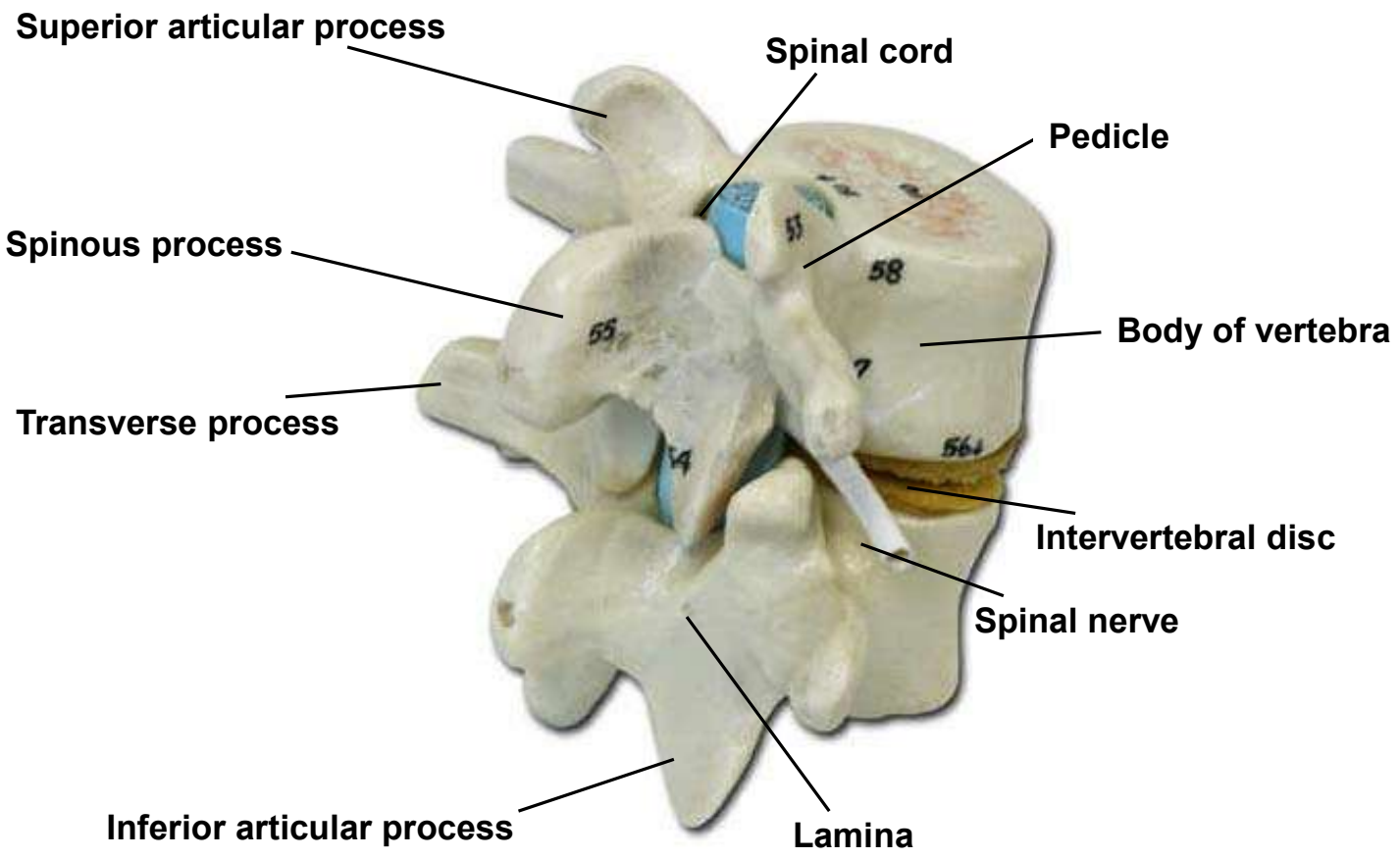

Sciatic Nerve Pain


S1 Root pain
L5 Root pain
L4 Root pain
L3 Root pain

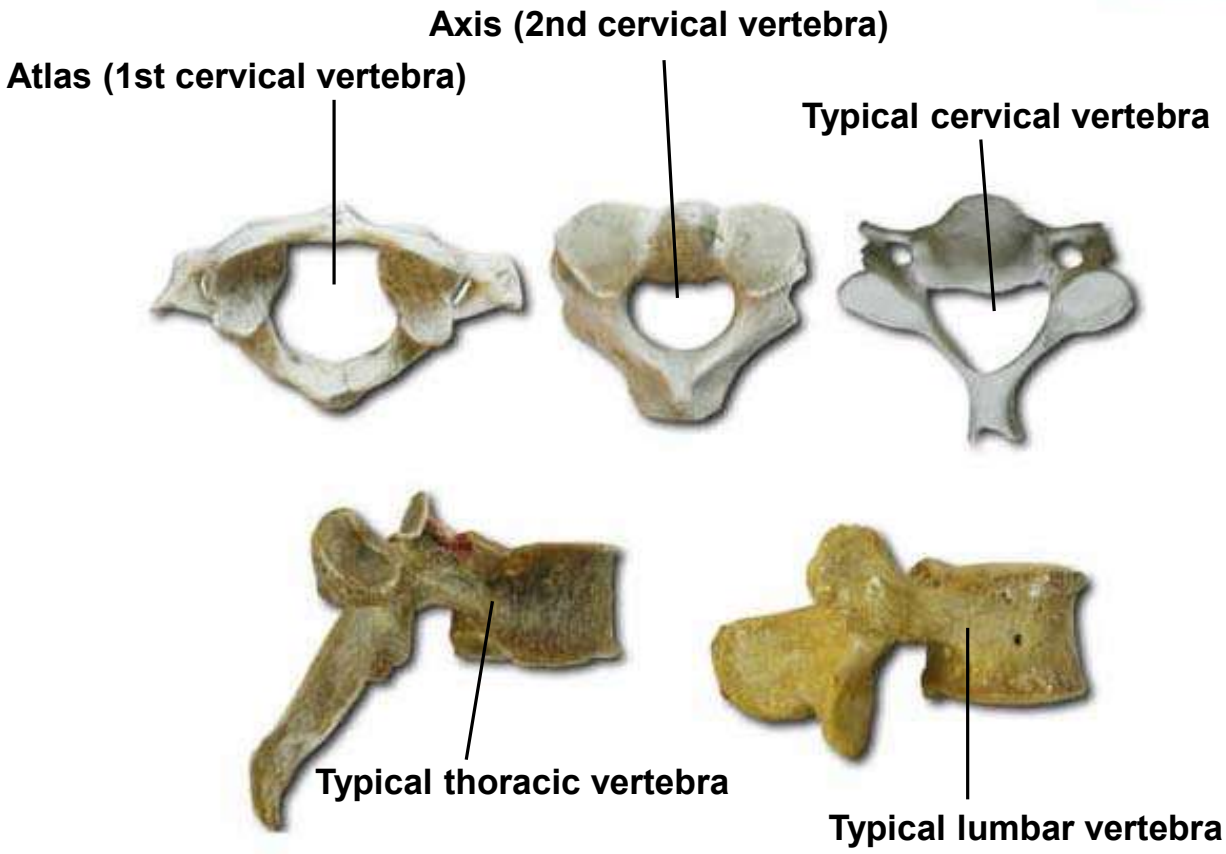

Cruralgia
(L2-L3)
Artrosi
dell'anca
Sciatica
(L4-L5)
Sciatica
(L5-S1)

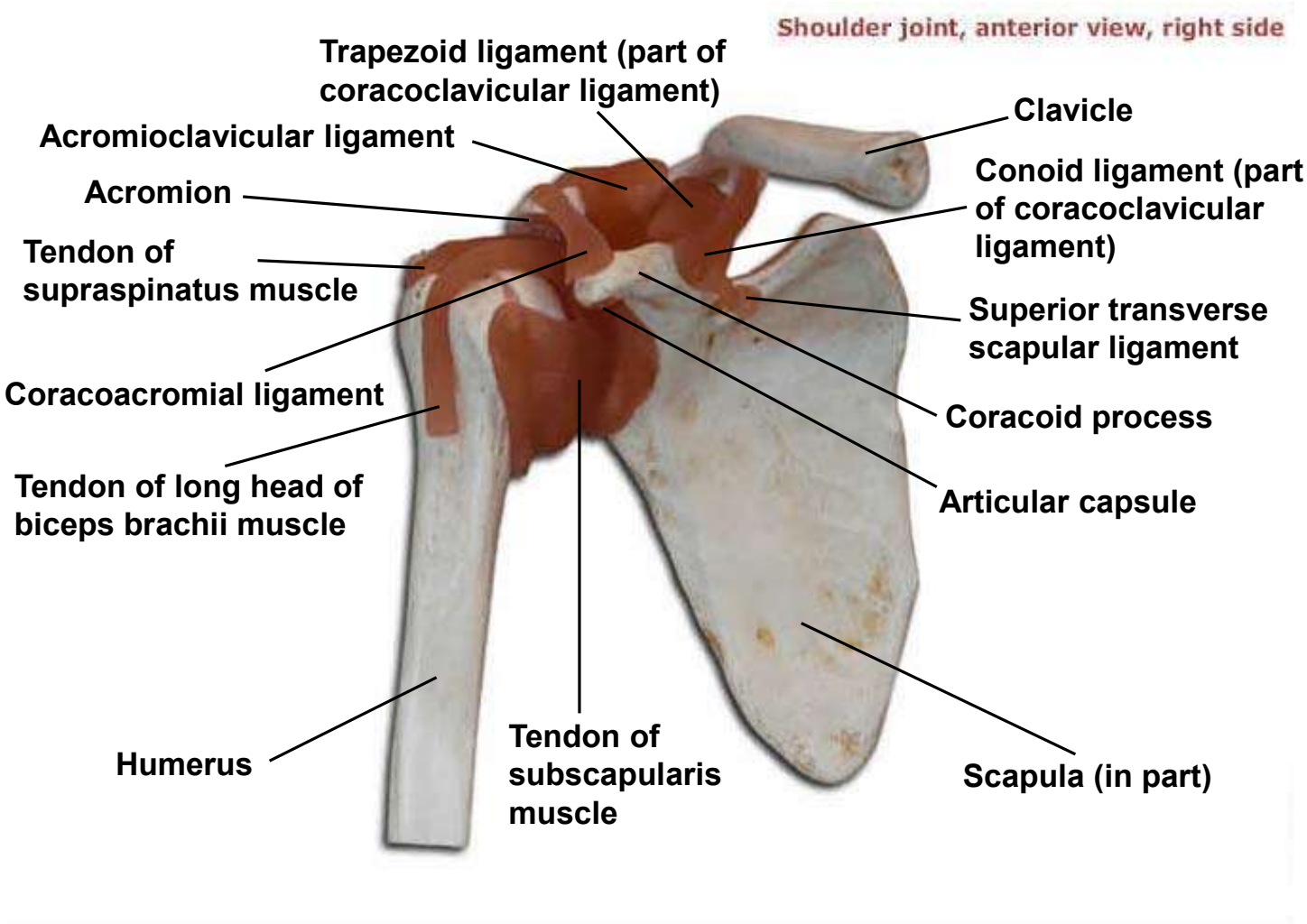

The Lumbosacral Plexus
Lumbosacral Plexus
BRANCHES
Superior Gluteal N.
(L4, L5, S1)
Inferior Gluteal N.
(L5, S1, S2)
SCIATIC N.
Posterior Cutaneous
N. of the Thigh
(S1, S2, S3)
Pudendal N.
(S2, S3, S4)
L4
L5
S1
S2
S3
S4

Articulated vertebrae

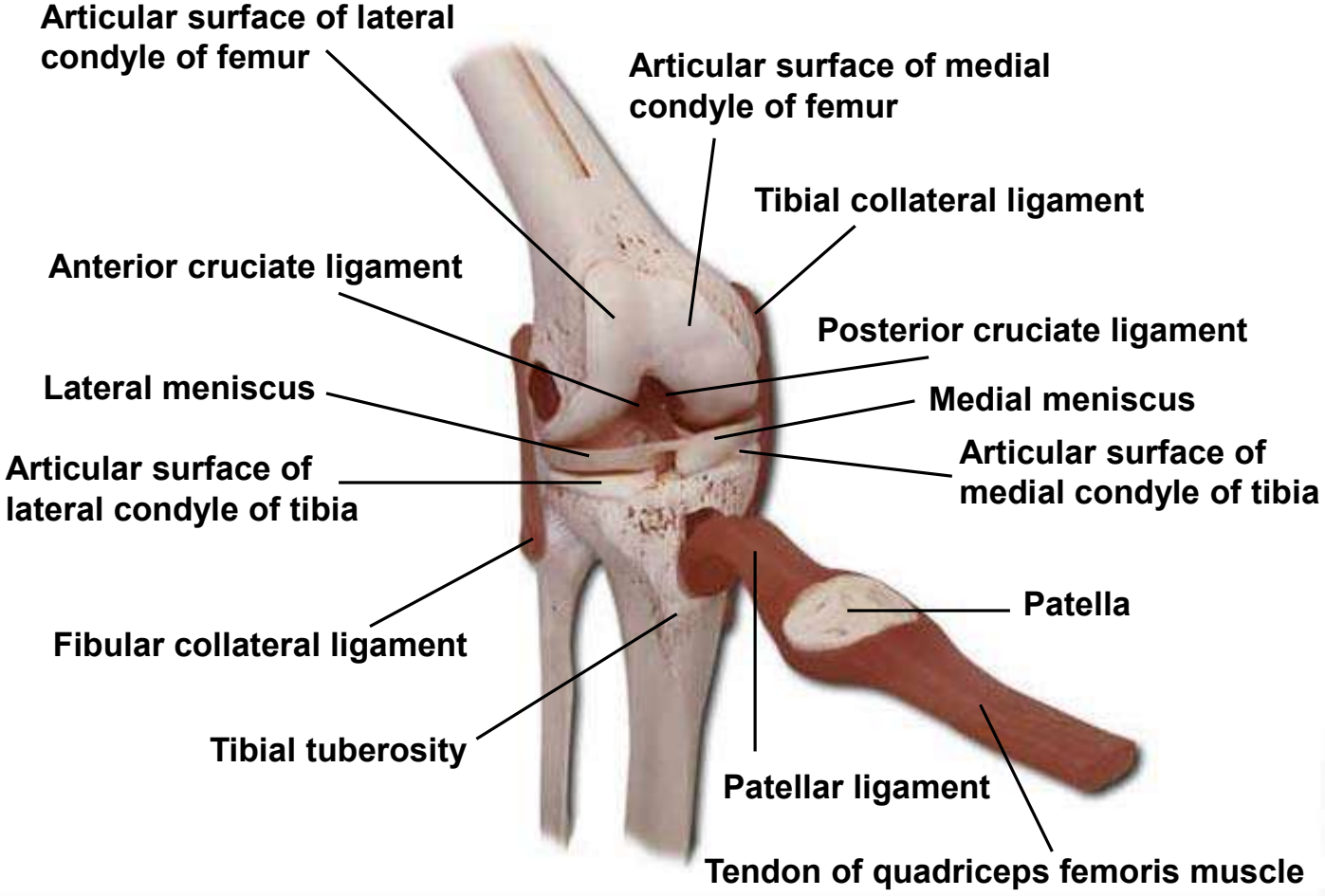


Types of vertebrae

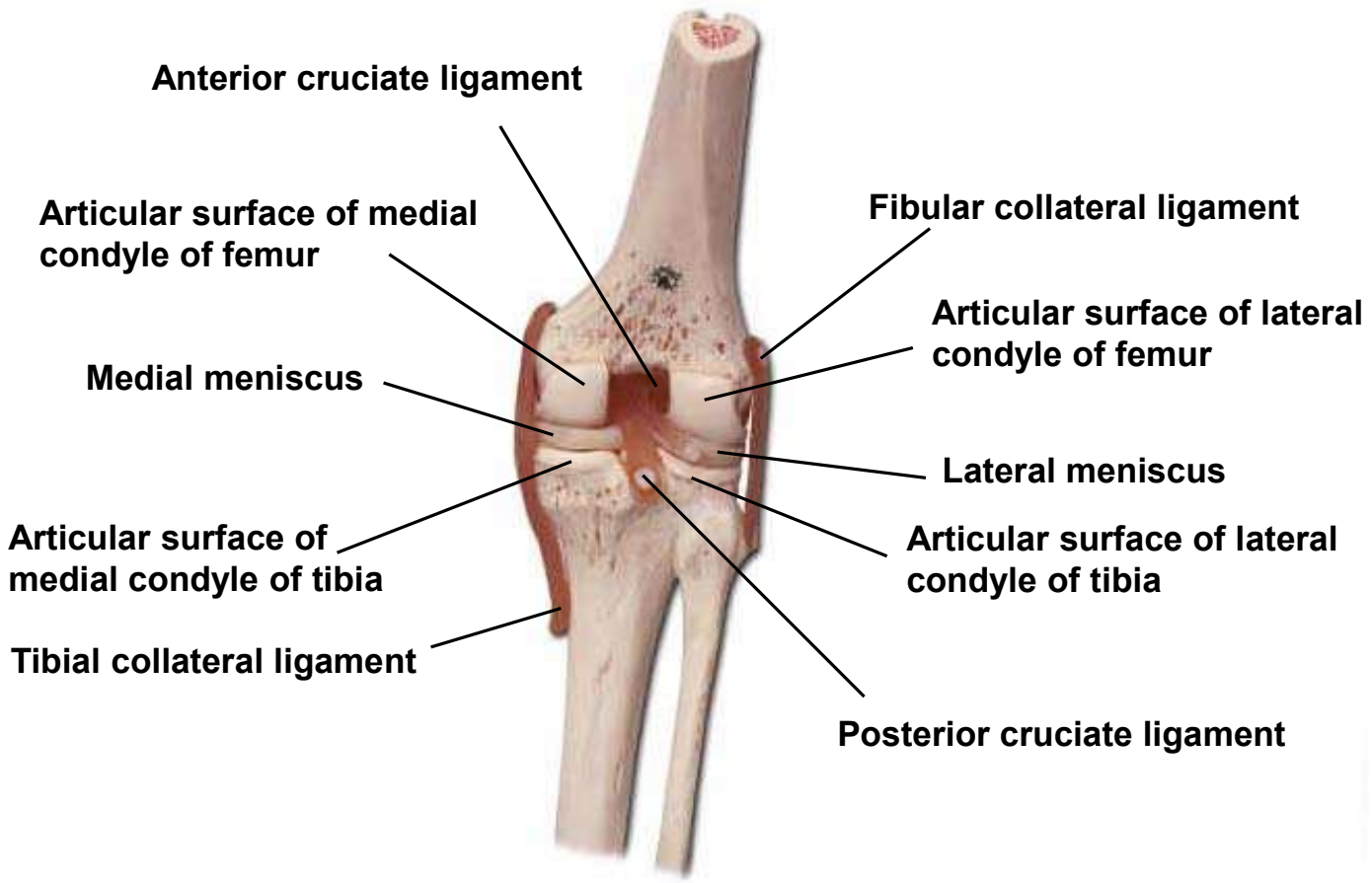


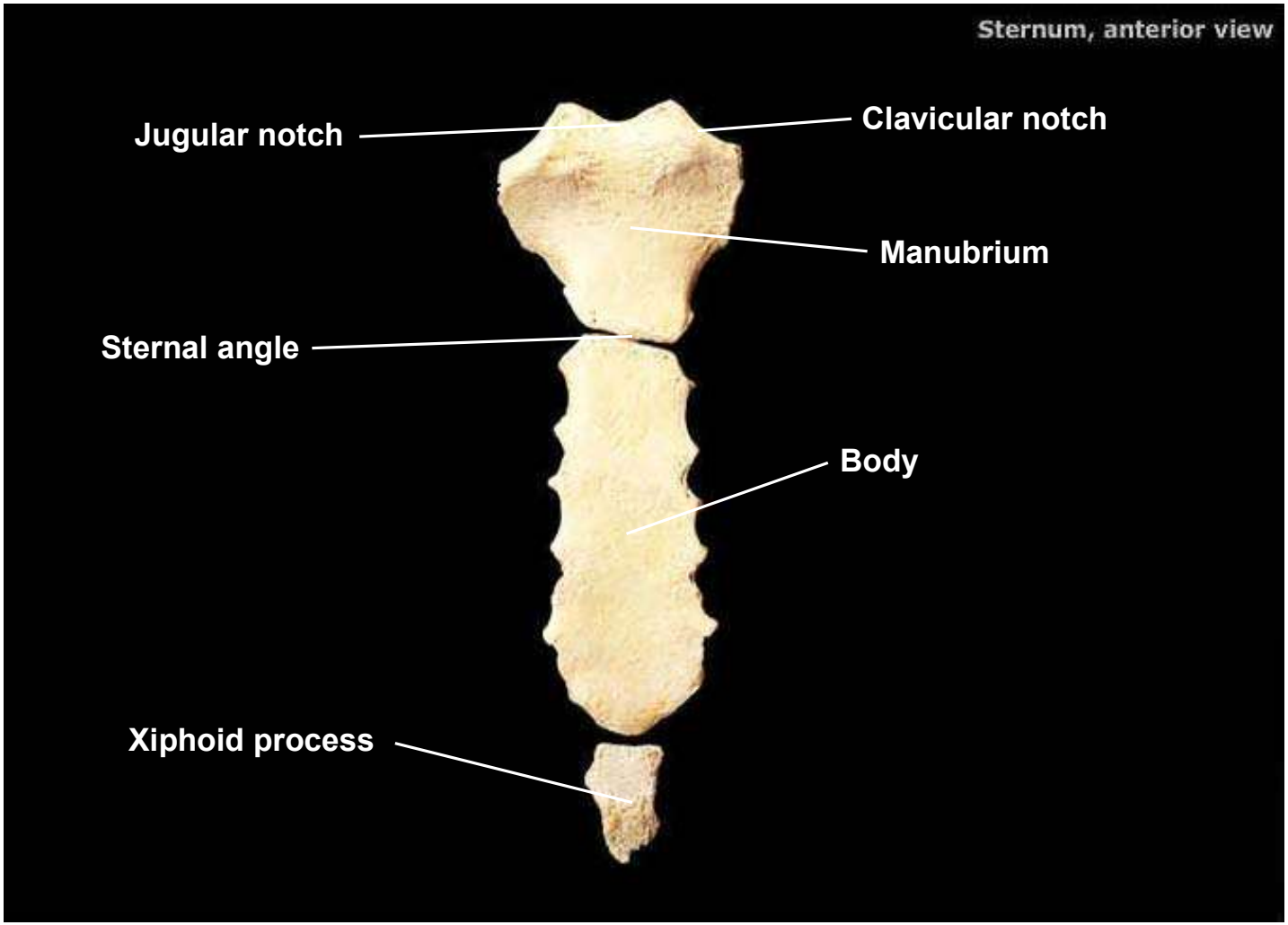

Shoulder joint, anterior view, right side
Trapezoid ligament (part of coracoclavicular ligament)
Clavicle
Acromioclavicular ligament
Conoid ligament (part of coracoclavicular ligament)
Acromion
Tendon of supraspinatus muscle
Superior transverse scapular ligament
Coracoacromial ligament
Coracoid process
Tendon of long head of biceps brachii muscle
Articular capsule
Humerus
Tendon of subscapularis muscle
Scapula (in part)

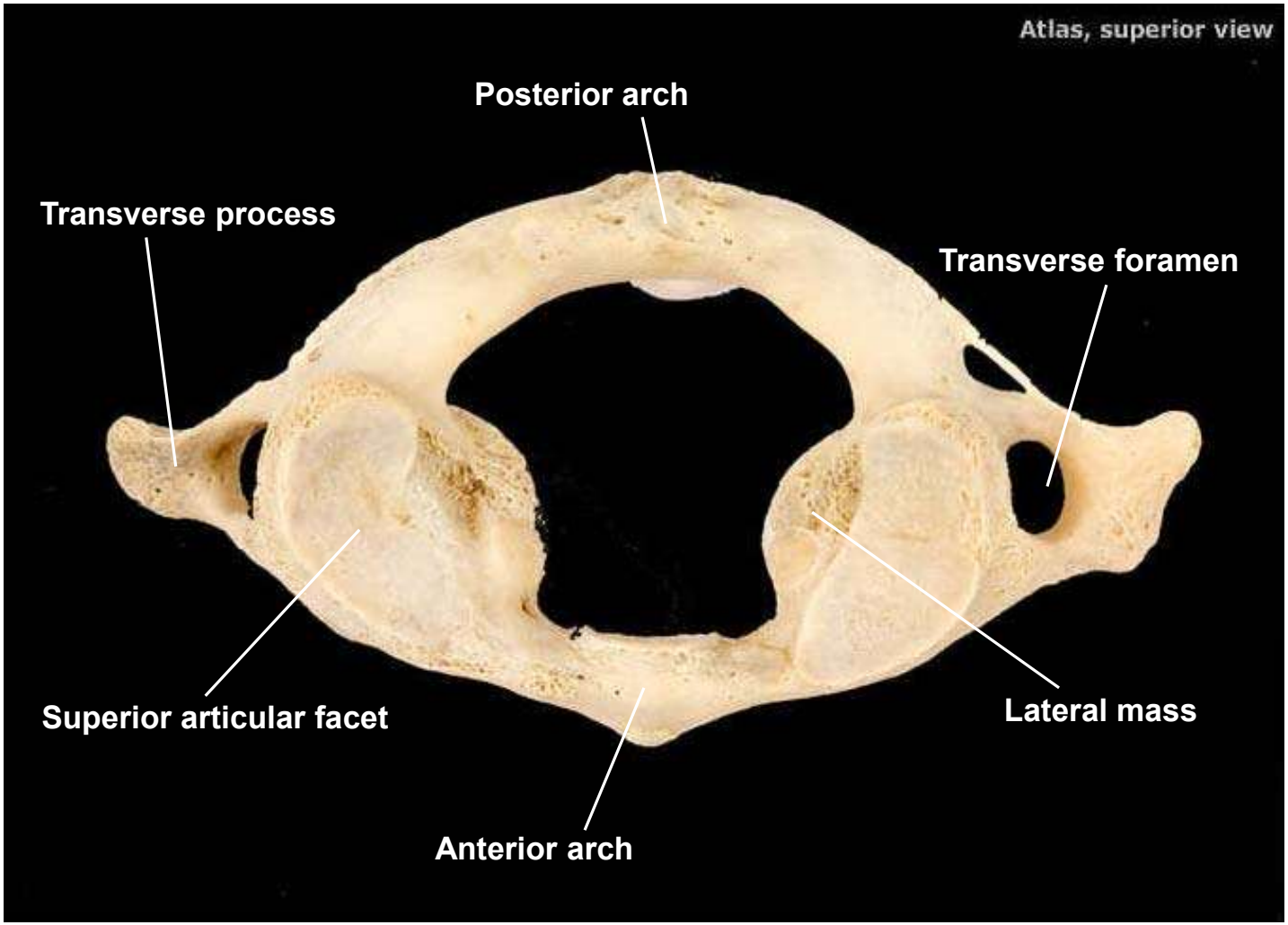
Knee joint, anterior view

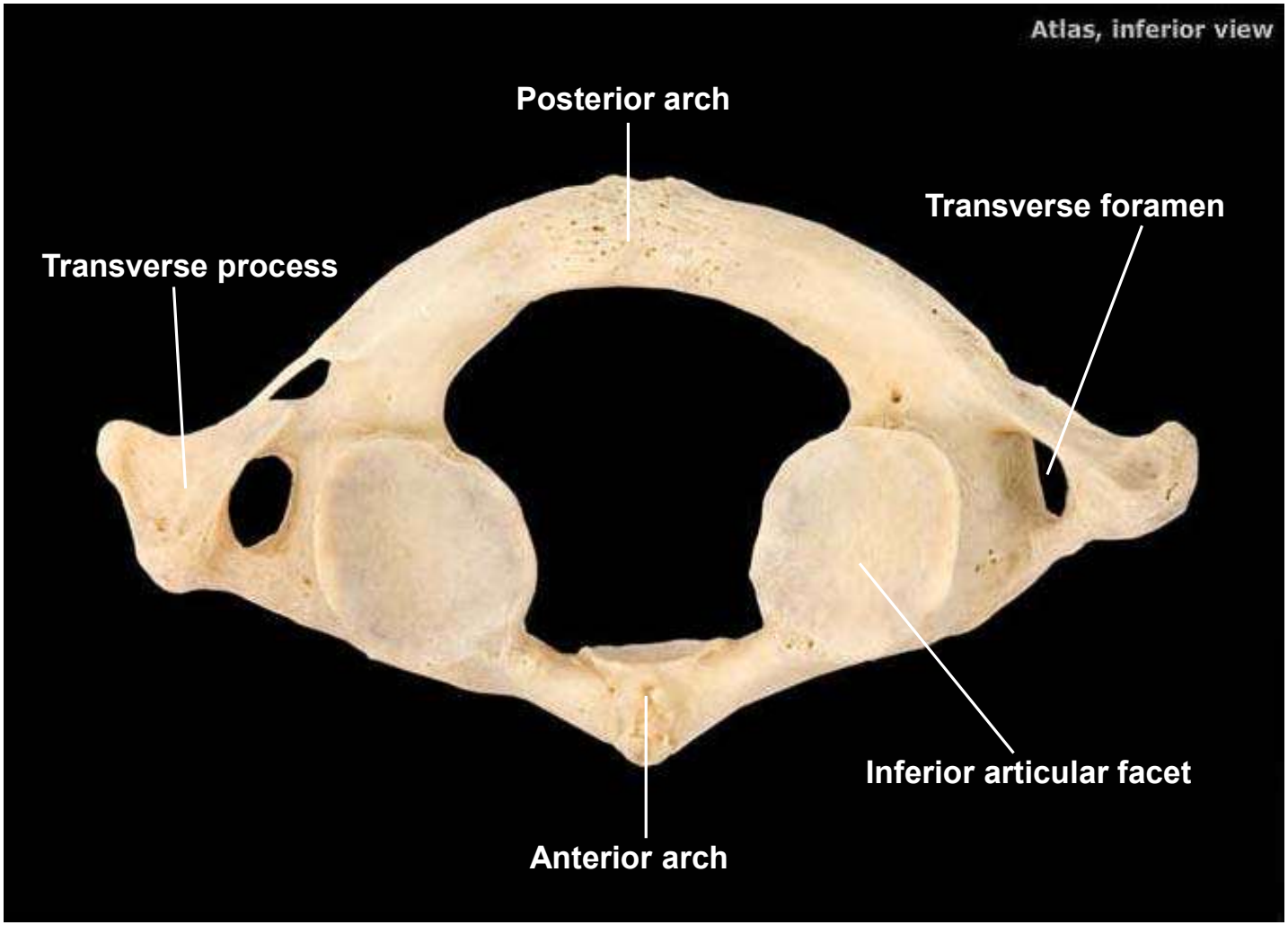


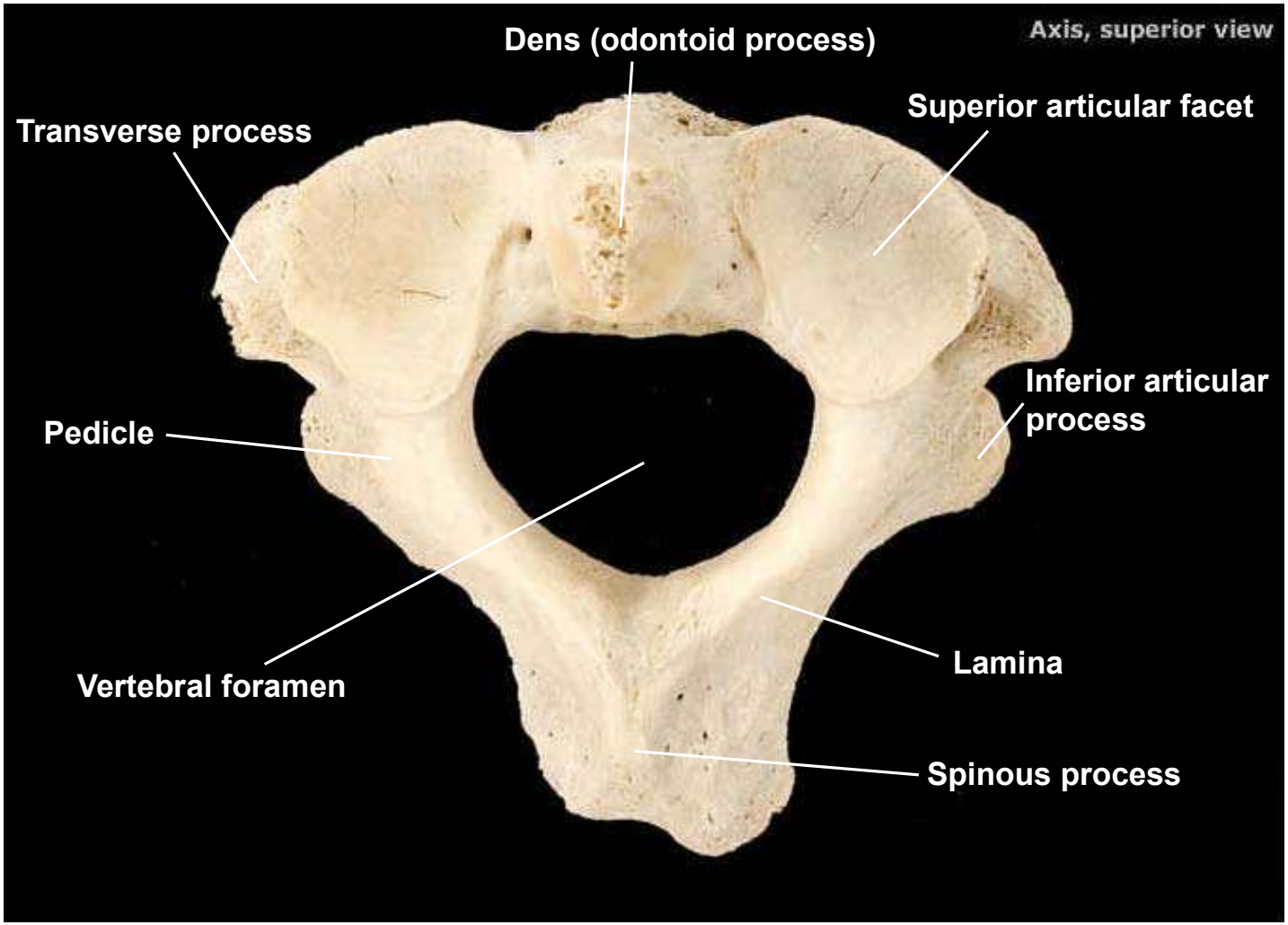
Knee joint, posterior view

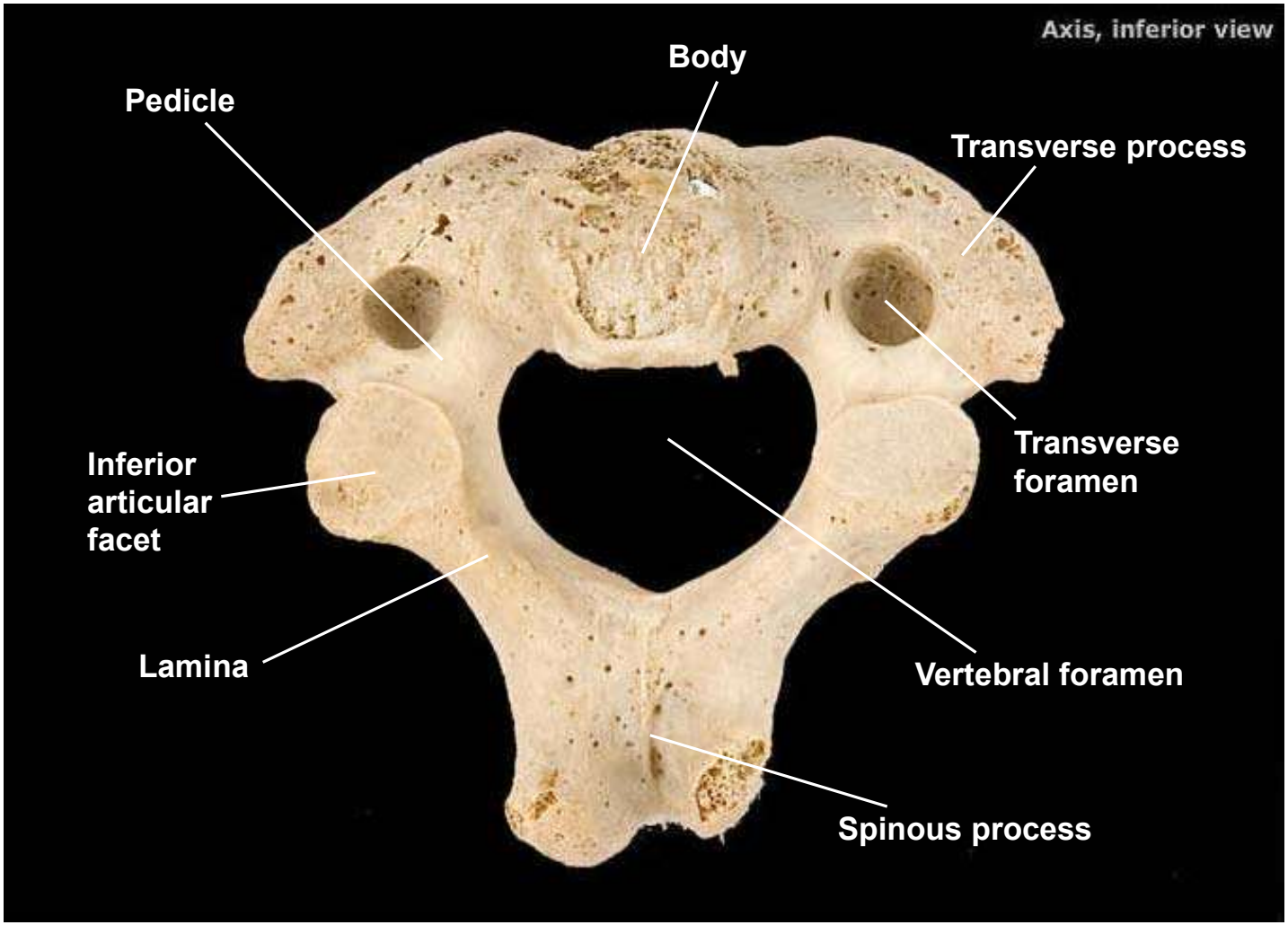


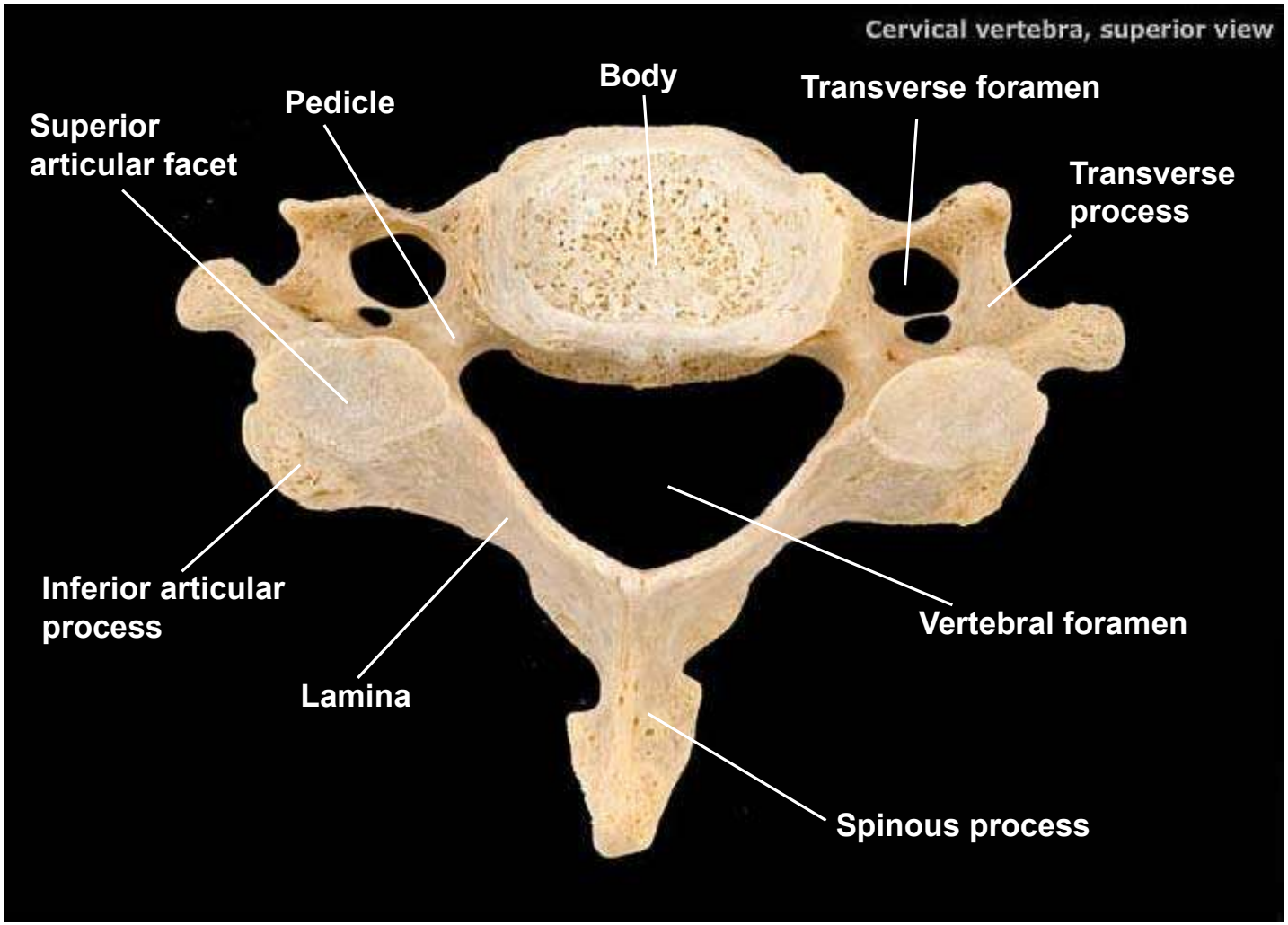

Sternum, anterior view
Jugular notch
Clavicular notch
Manubrium
Sternal angle
Body
Xiphoid process

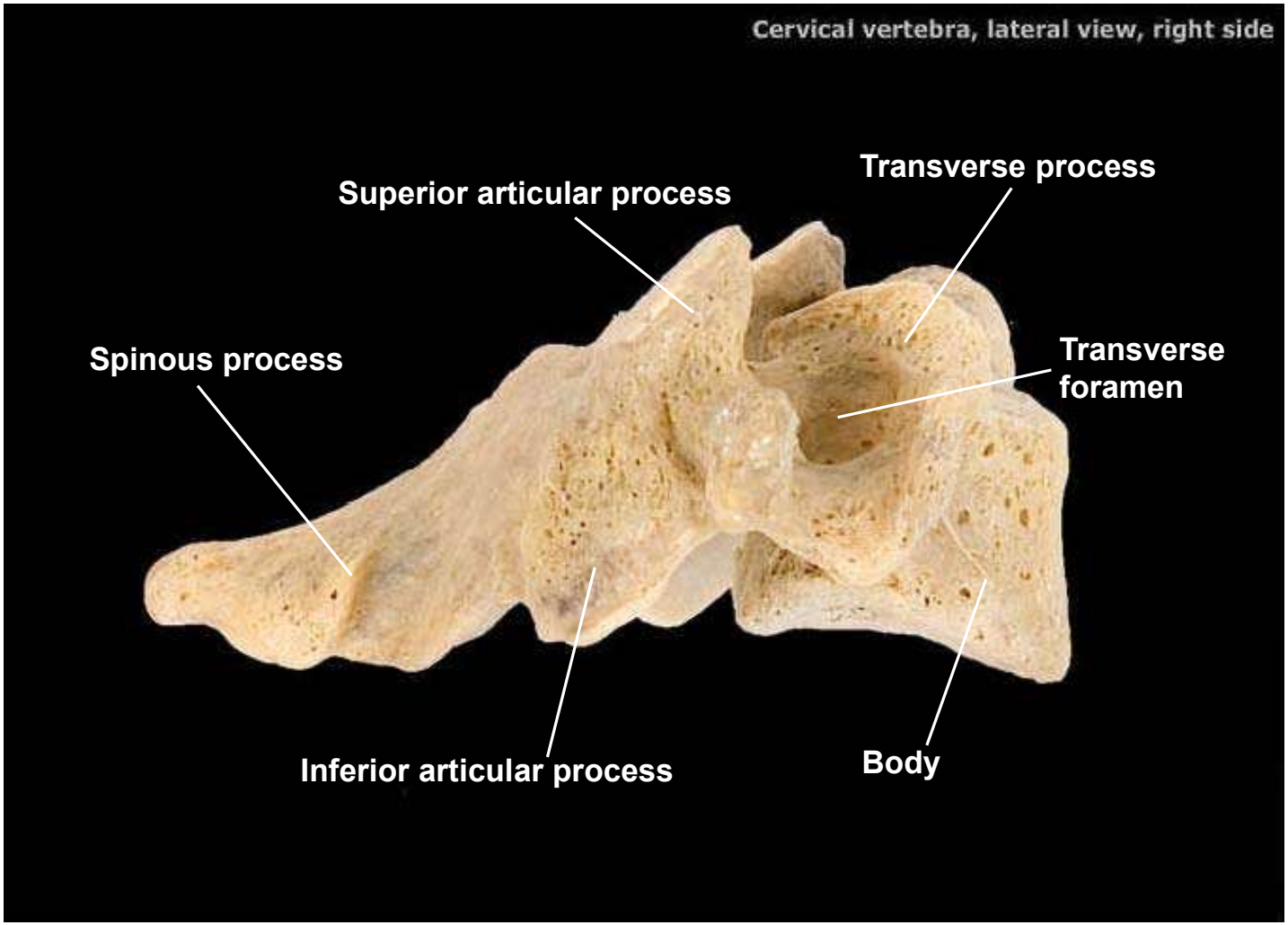

Atlas, superior view
Posterior arch
Transverse process
Transverse foramen
Superior articular facet
Lateral mass
Anterior arch

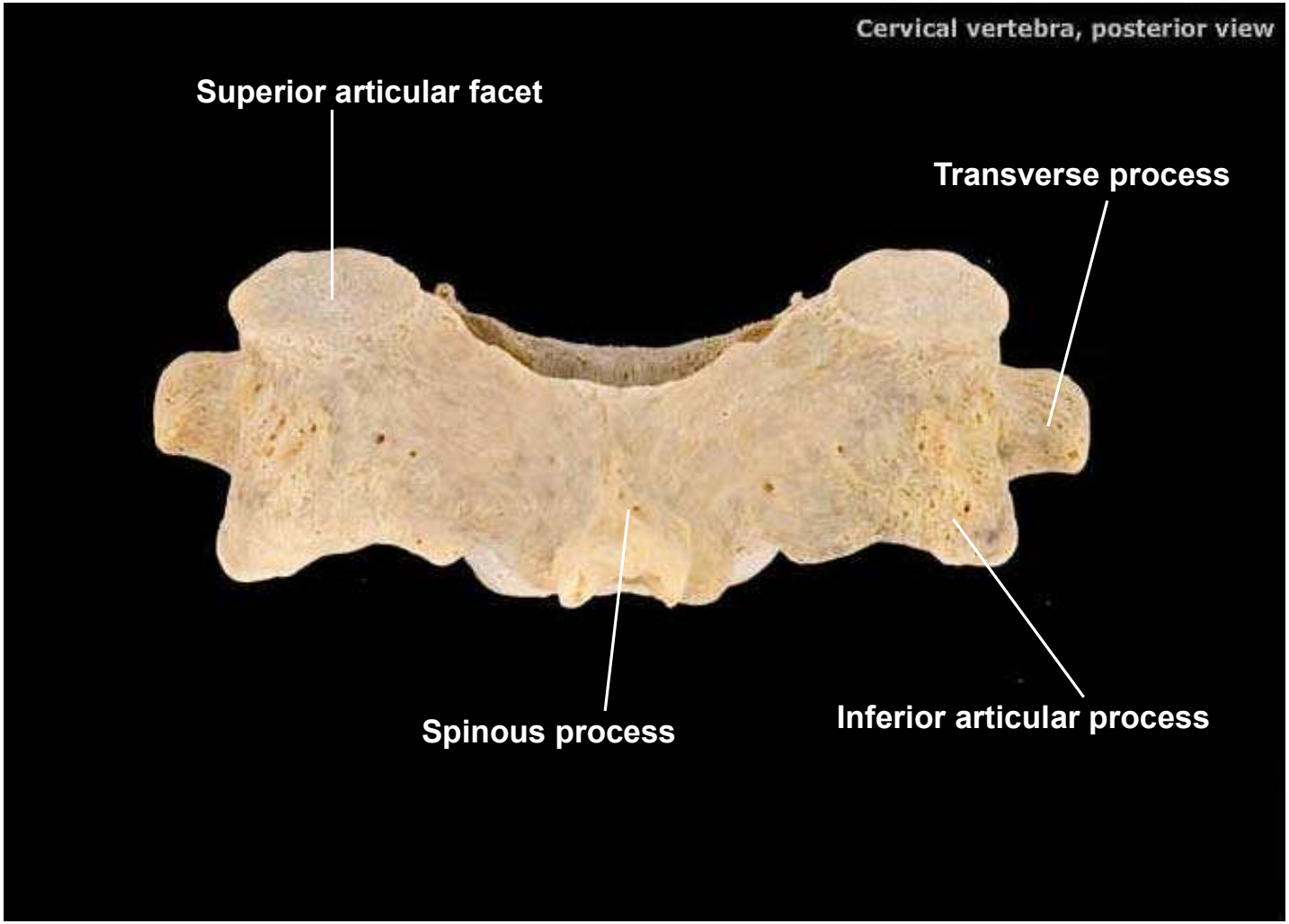

Atlas, inferior view
Posterior arch
Transverse foramen
Transverse process
Inferior articular facet
Anterior arch

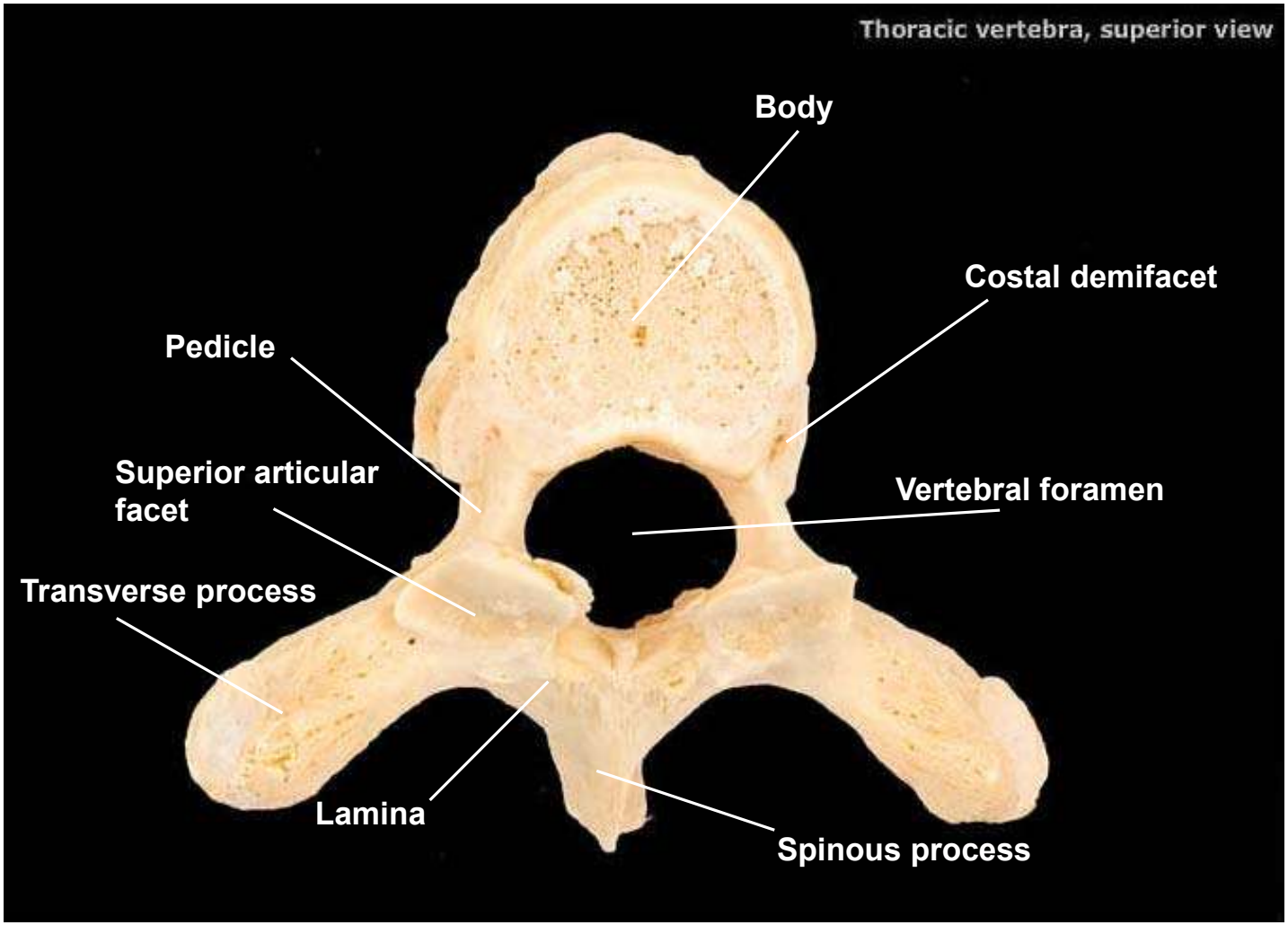

Axis, superior view
Dens (odontoid process)
Transverse process
Superior articular facet
Inferior articular process
Pedicle
Vertebral foramen
Lamina
Spinous process

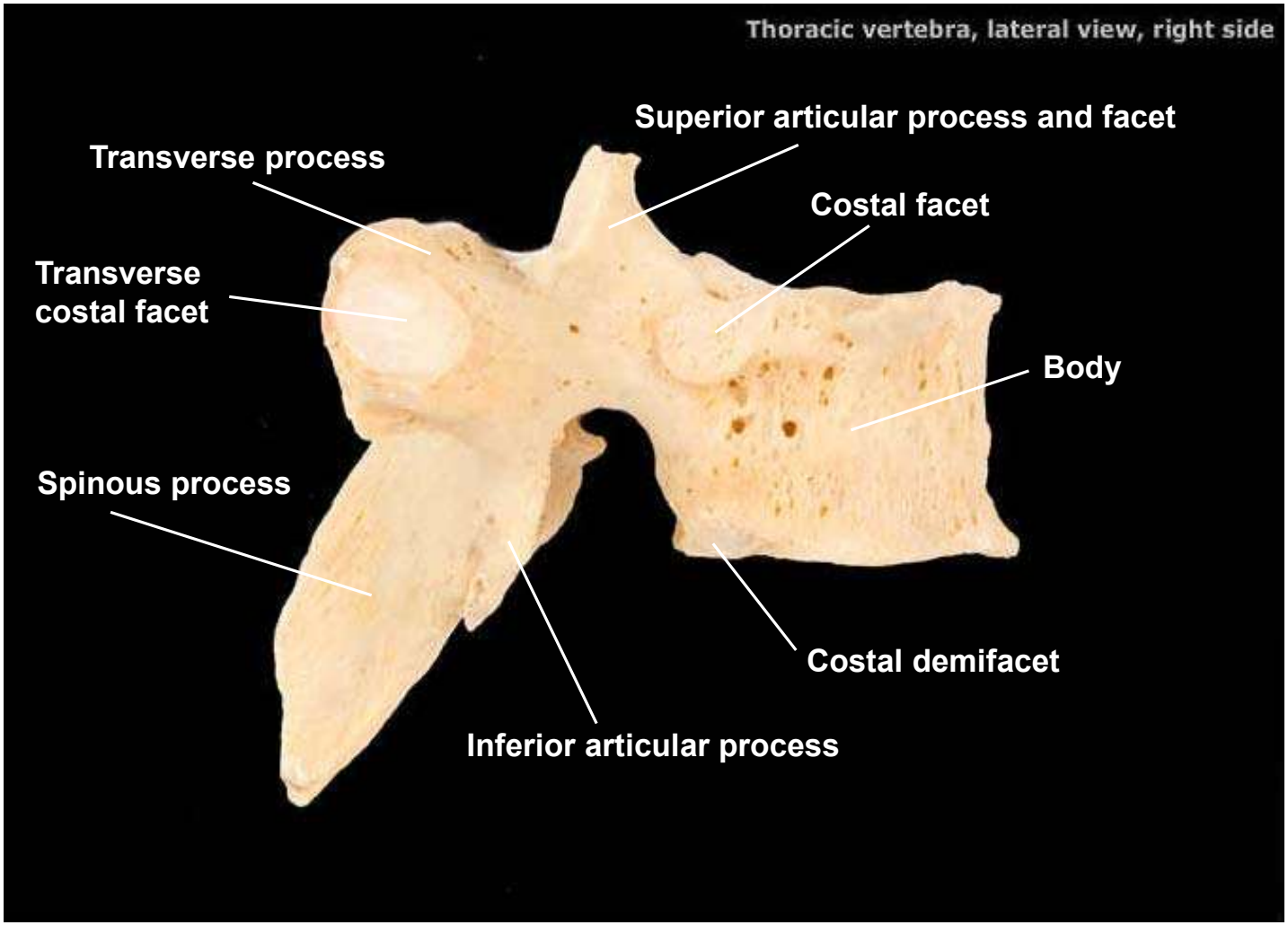

Axis, inferior view
Body
Pedicle
Transverse process
Transverse foramen
Inferior articular facet
Lamina
Vertebral foramen
Spinous process

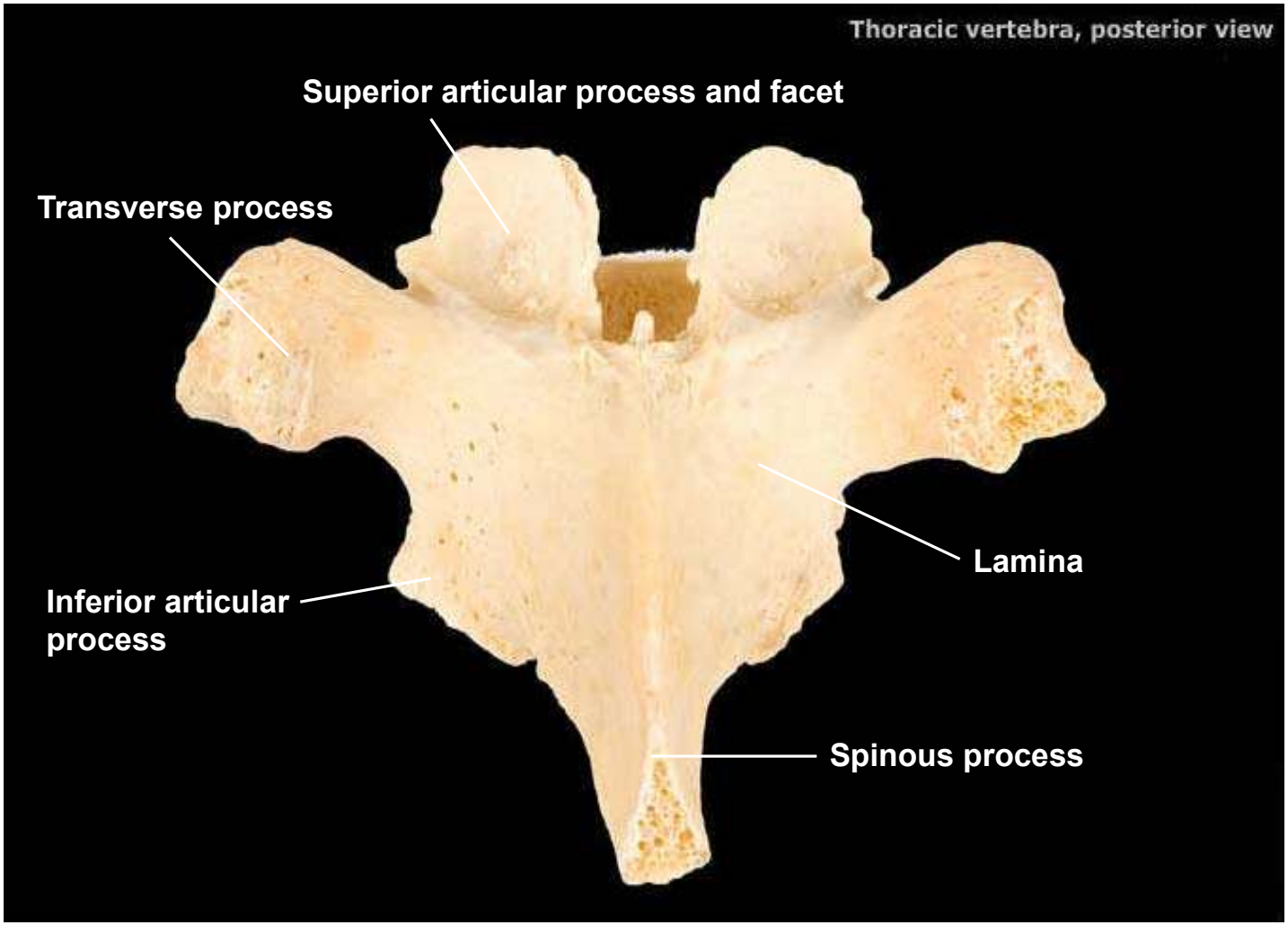

Cervical vertebra, superior view
Body
Pedicle
Transverse foramen
Superior articular facet
Transverse process
Inferior articular process
Vertebral foramen
Lamina
Spinous process

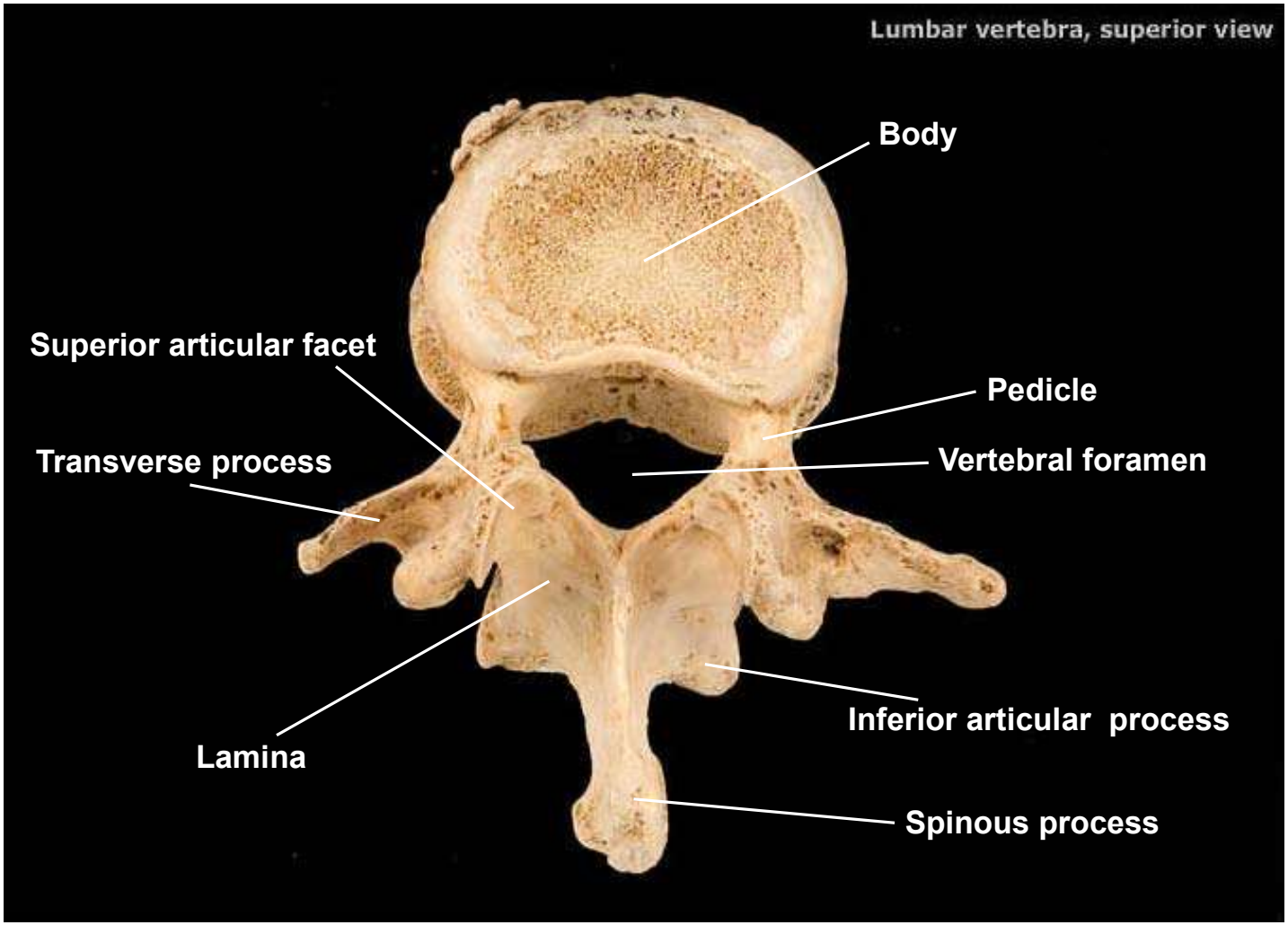

Cervical vertebra, lateral view, right side
Superior articular process
Transverse process
Spinous process
Transverse foramen
Inferior articular process
Body

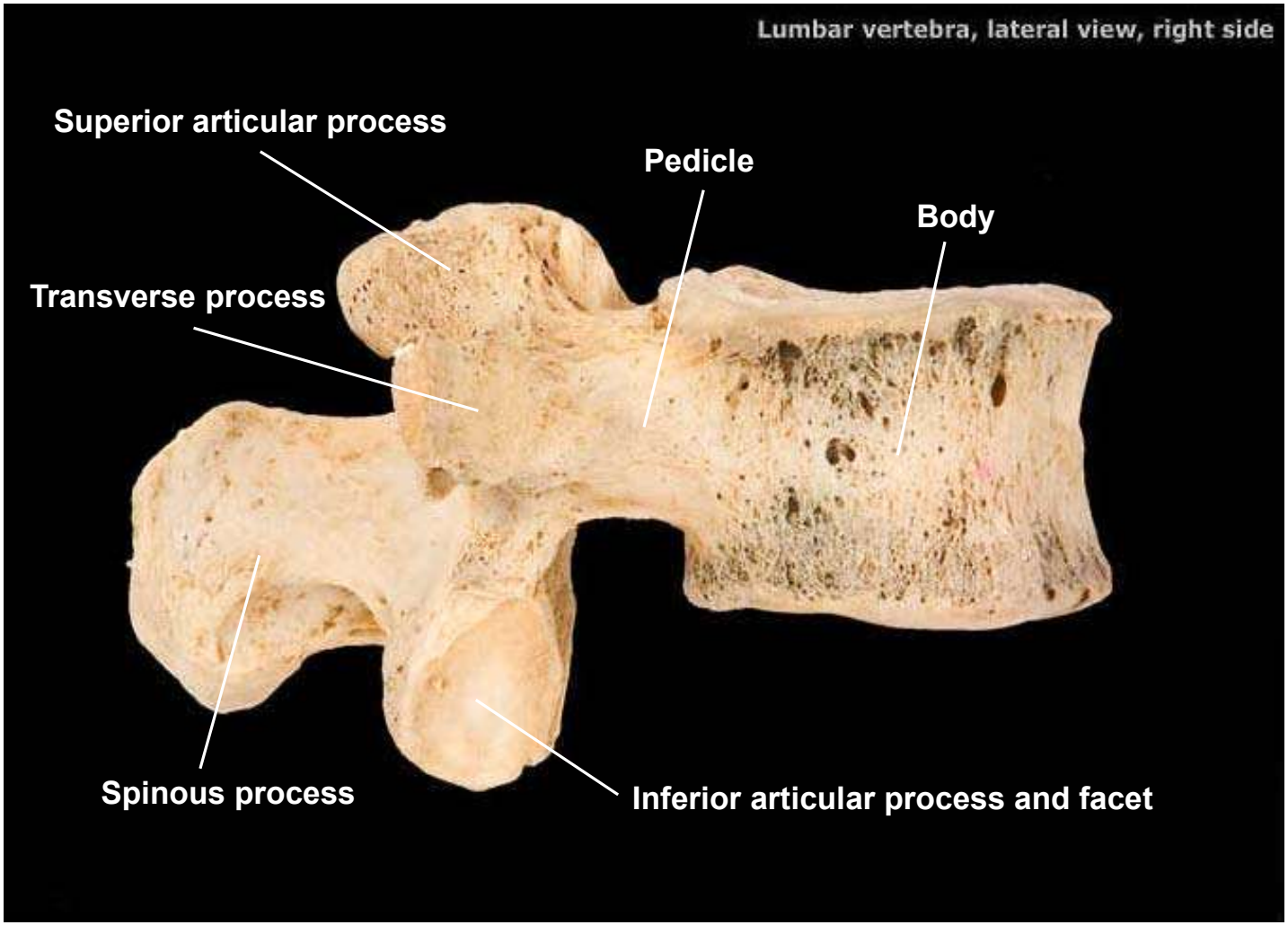

Cervical vertebra, posterior view
Superior articular facet
Transverse process
Spinous process
Inferior articular process

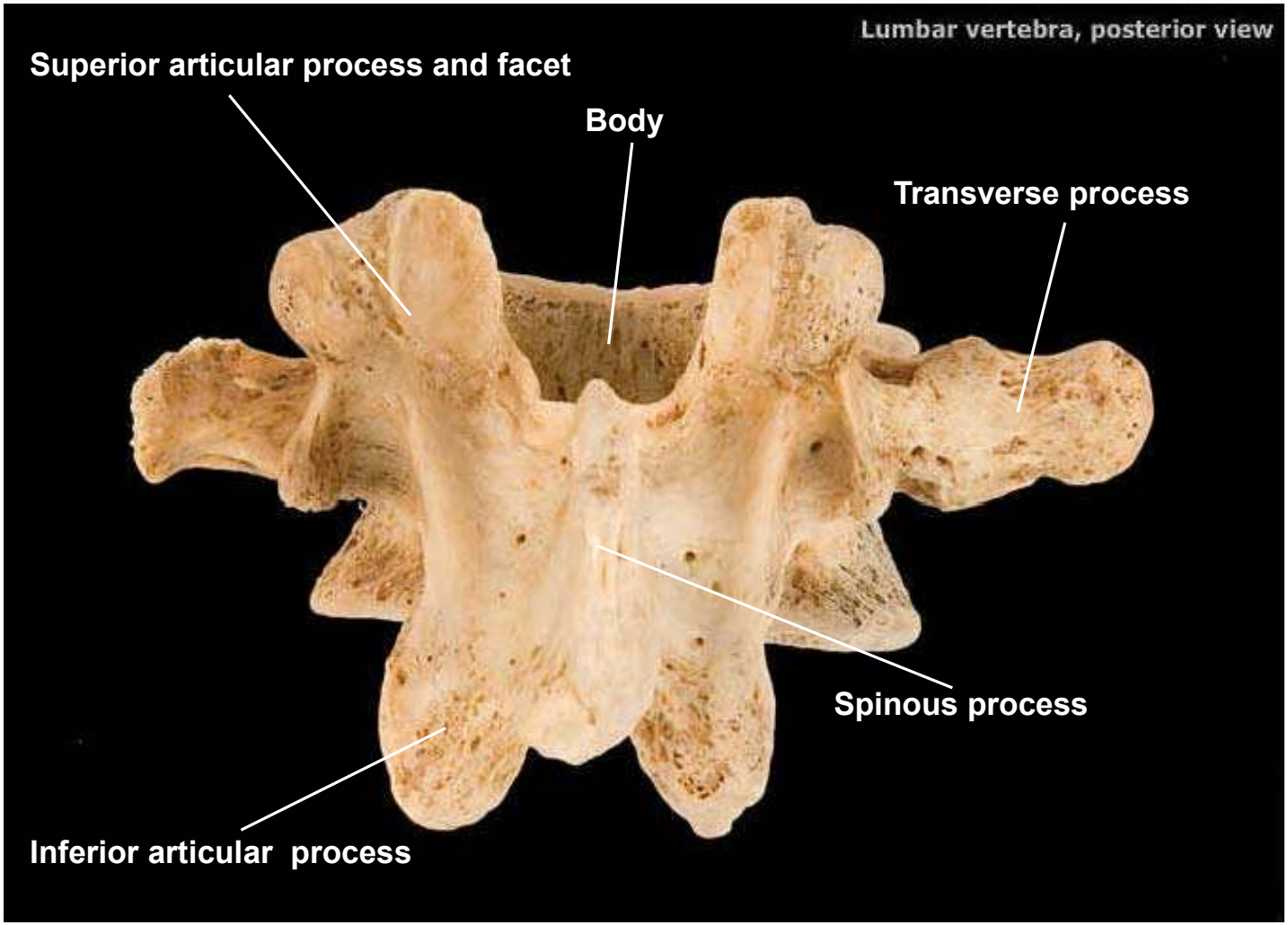

Thoracic vertebra, superior view
Body
Costal demifacet
Pedicle
Superior articular facet
Vertebral foramen
Transverse process
Lamina
Spinous process

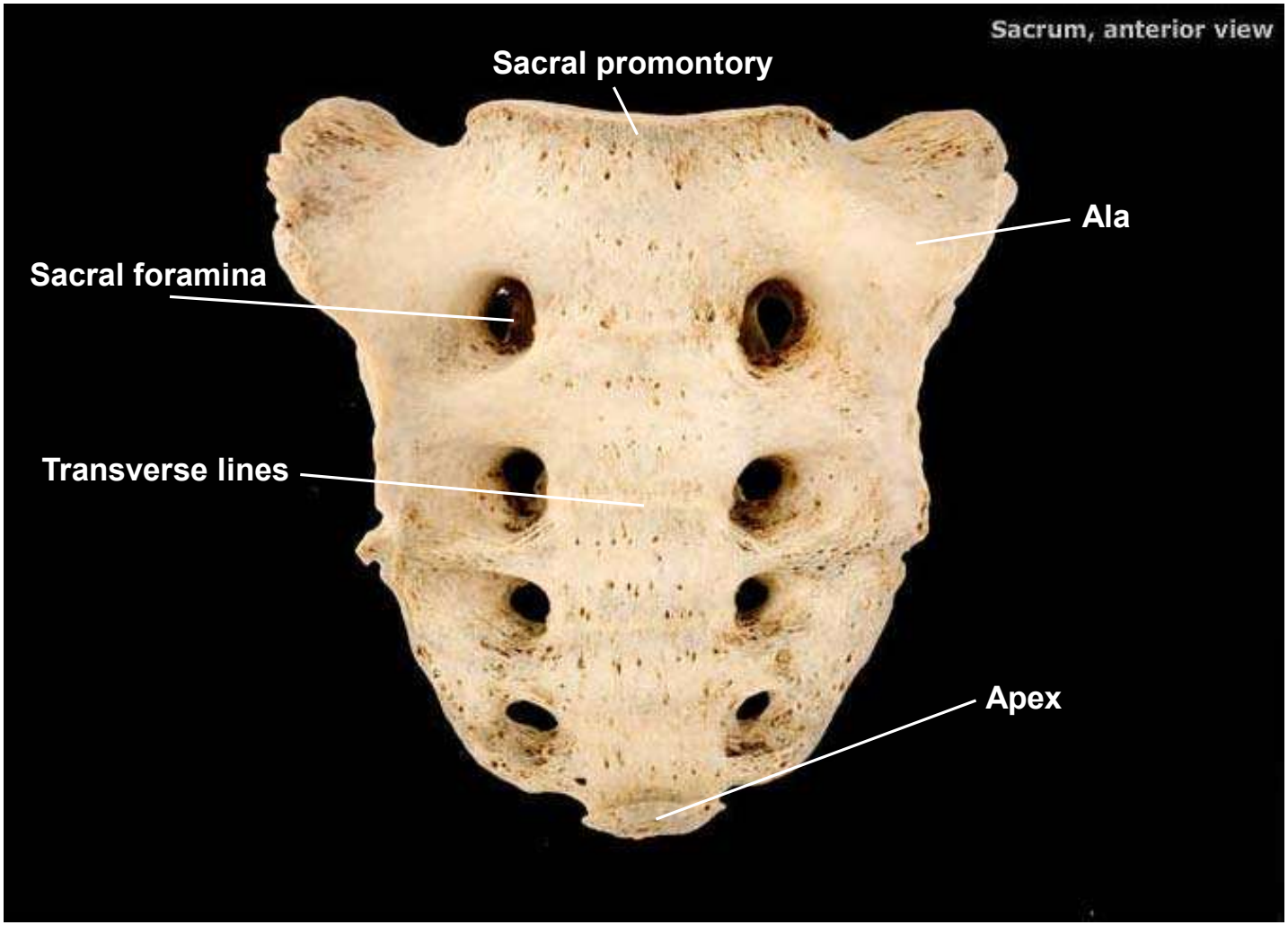

Thoracic vertebra, lateral view, right side
Superior articular process and facet
Transverse process
Costal facet
Transverse costal facet
Body
Spinous process
Costal demifacet
Inferior articular process

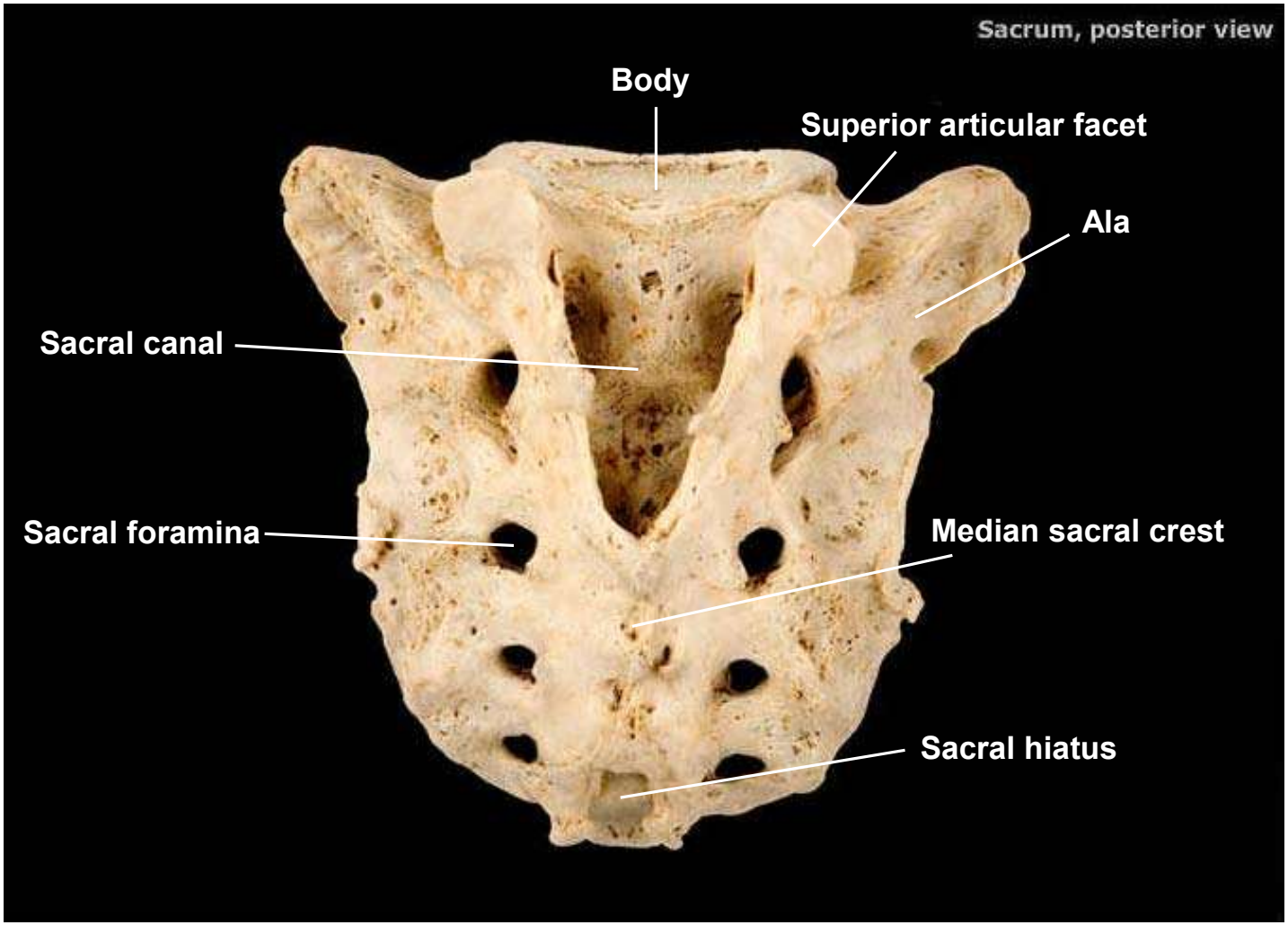

Thoracic vertebra, posterior view
Superior articular process and facet
Transverse process
Lamina
Inferior articular process
Spinous process

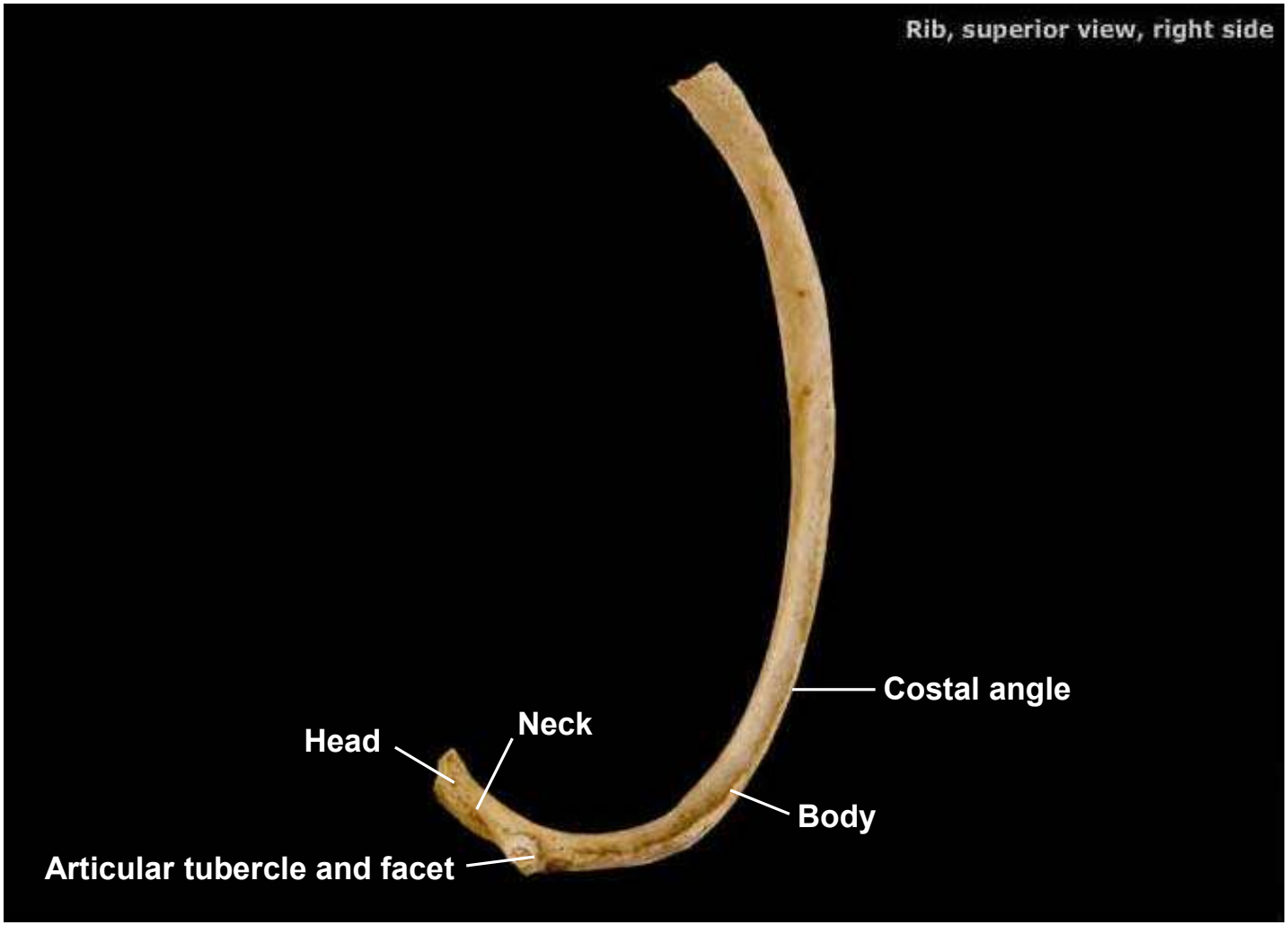

Lumbar vertebra, superior view
Body
Superior articular facet
Pedicle
Transverse process
Vertebral foramen
Lamina
Inferior articular process
Spinous process

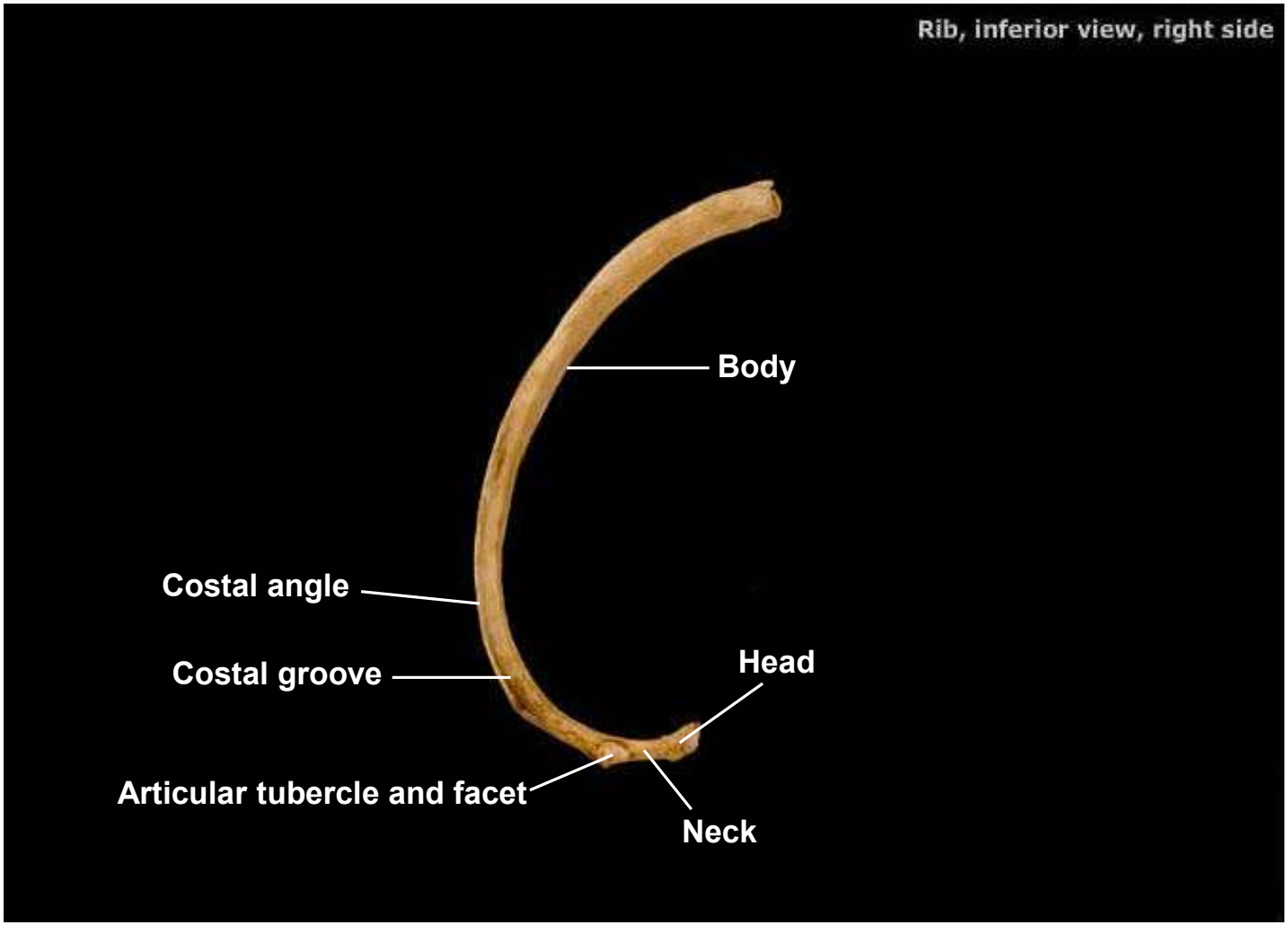

Lumbar vertebra, lateral view, right side
Superior articular process
Pedicle
Body
Transverse process
Spinous process
Inferior articular process and facet

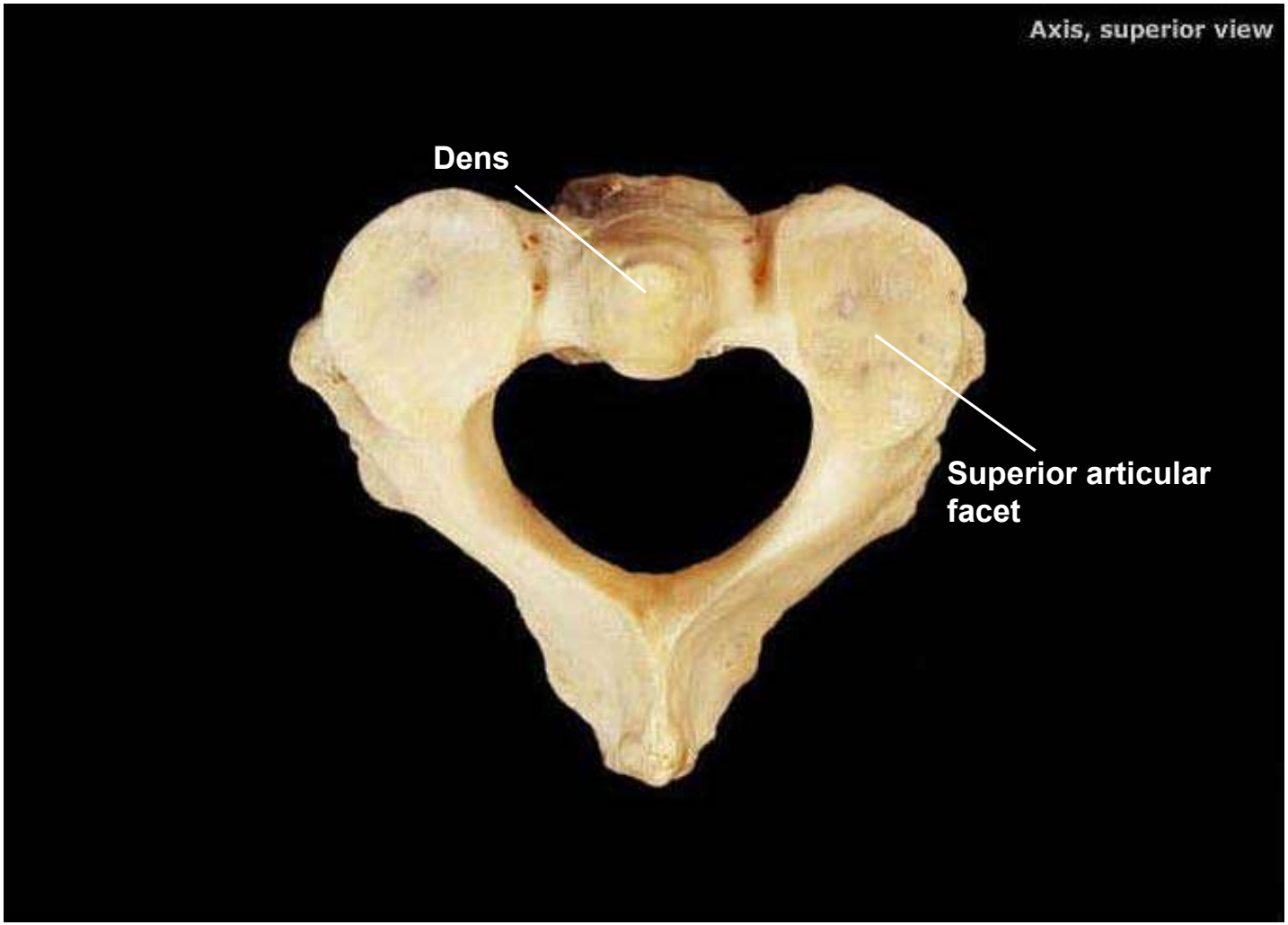

Lumbar vertebra, posterior view
Superior articular process and facet
Body
Transverse process
Spinous process
Inferior articular process

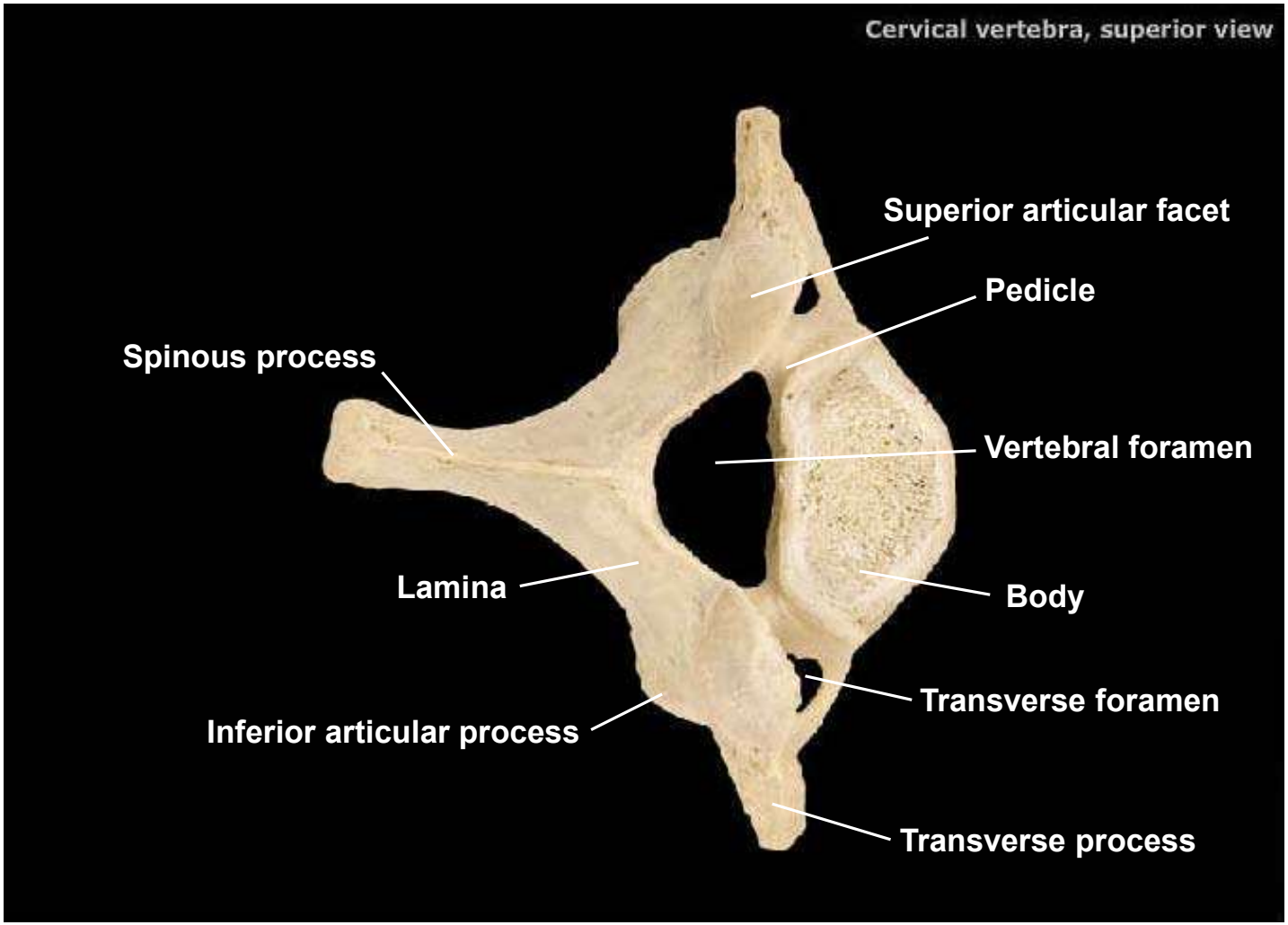

Sacrum, anterior view
Sacral promontory
Ala
Sacral foramina
Transverse lines
Apex

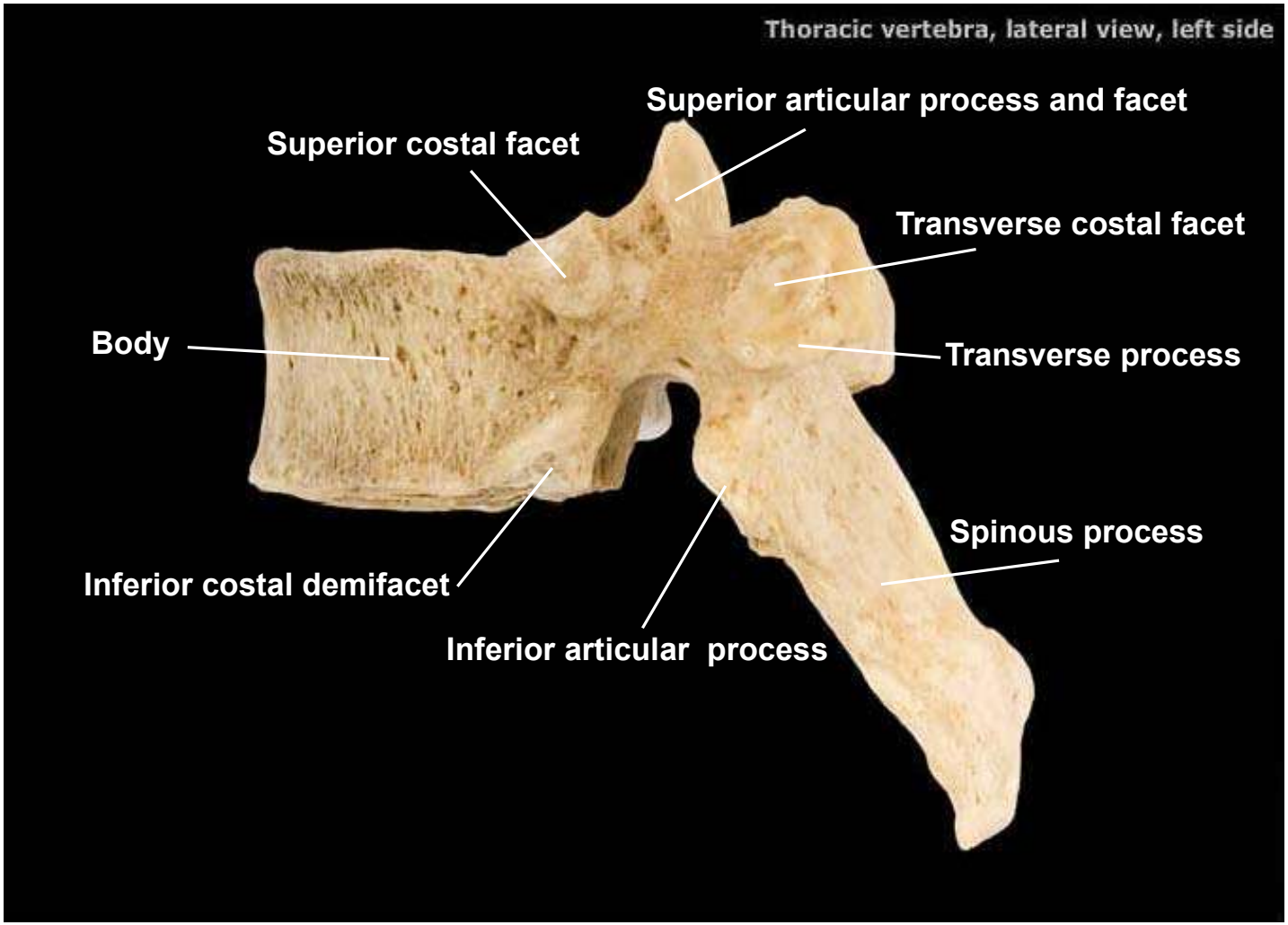

Sacrum, posterior view
Body
Superior articular facet
Ala
Sacral canal
Sacral foramina
Median sacral crest
Sacral hiatus

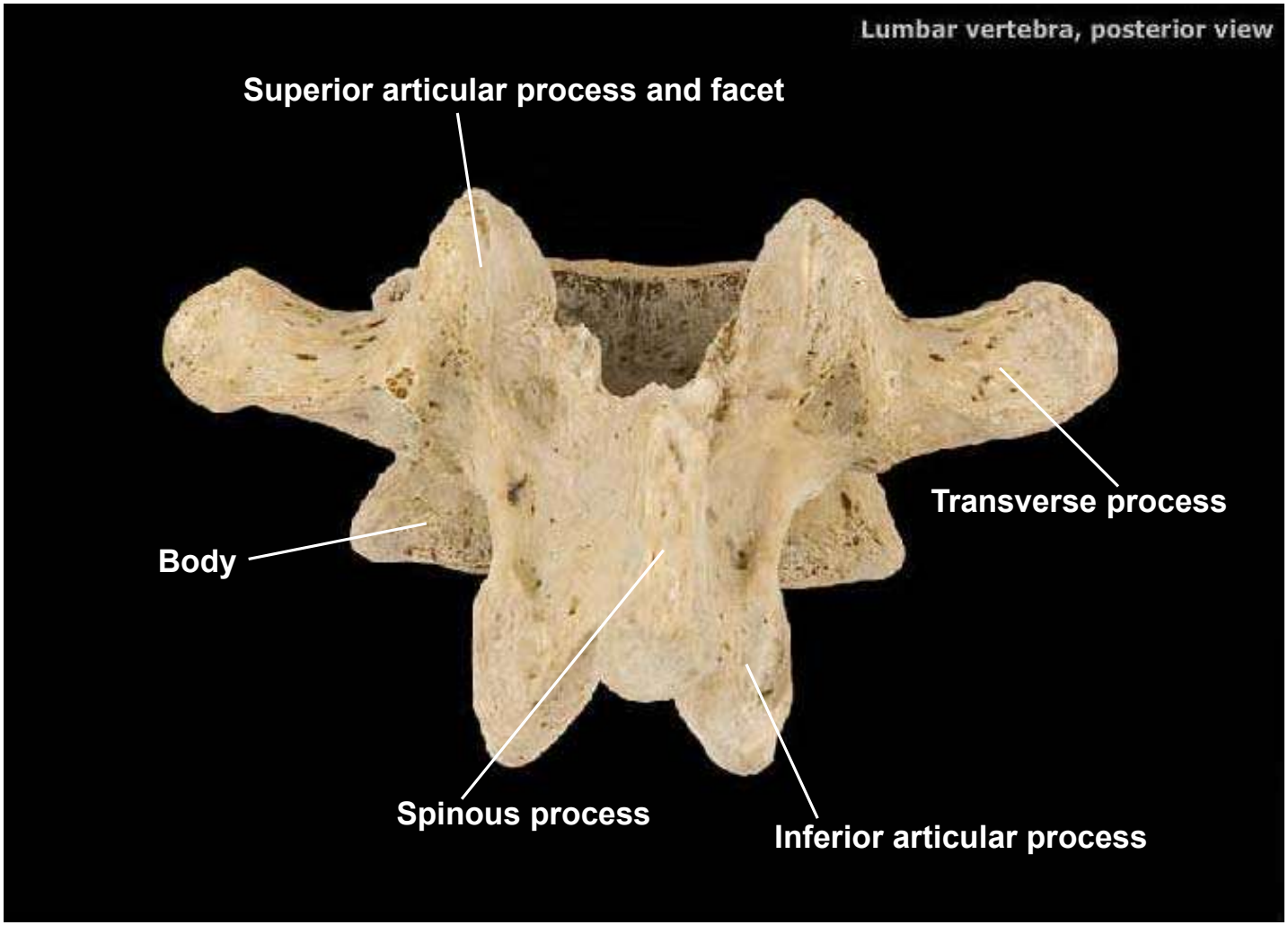

Rib, superior view, right side
Costal angle
Neck
Head
Body
Articular tubercle and facet

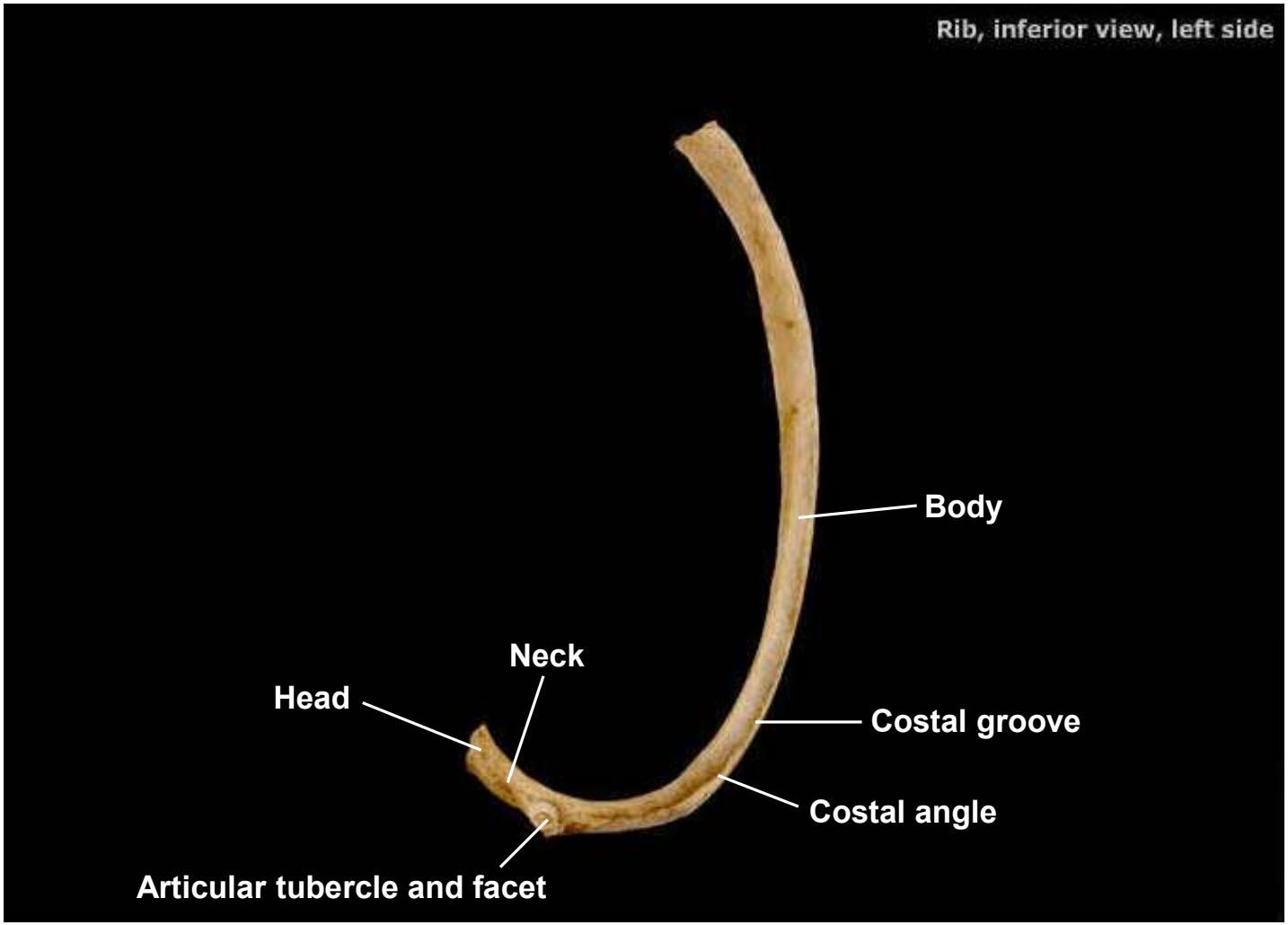

Rib, inferior view, right side
Body
Costal angle
Costal groove
Head
Articular tubercle and facet
Neck

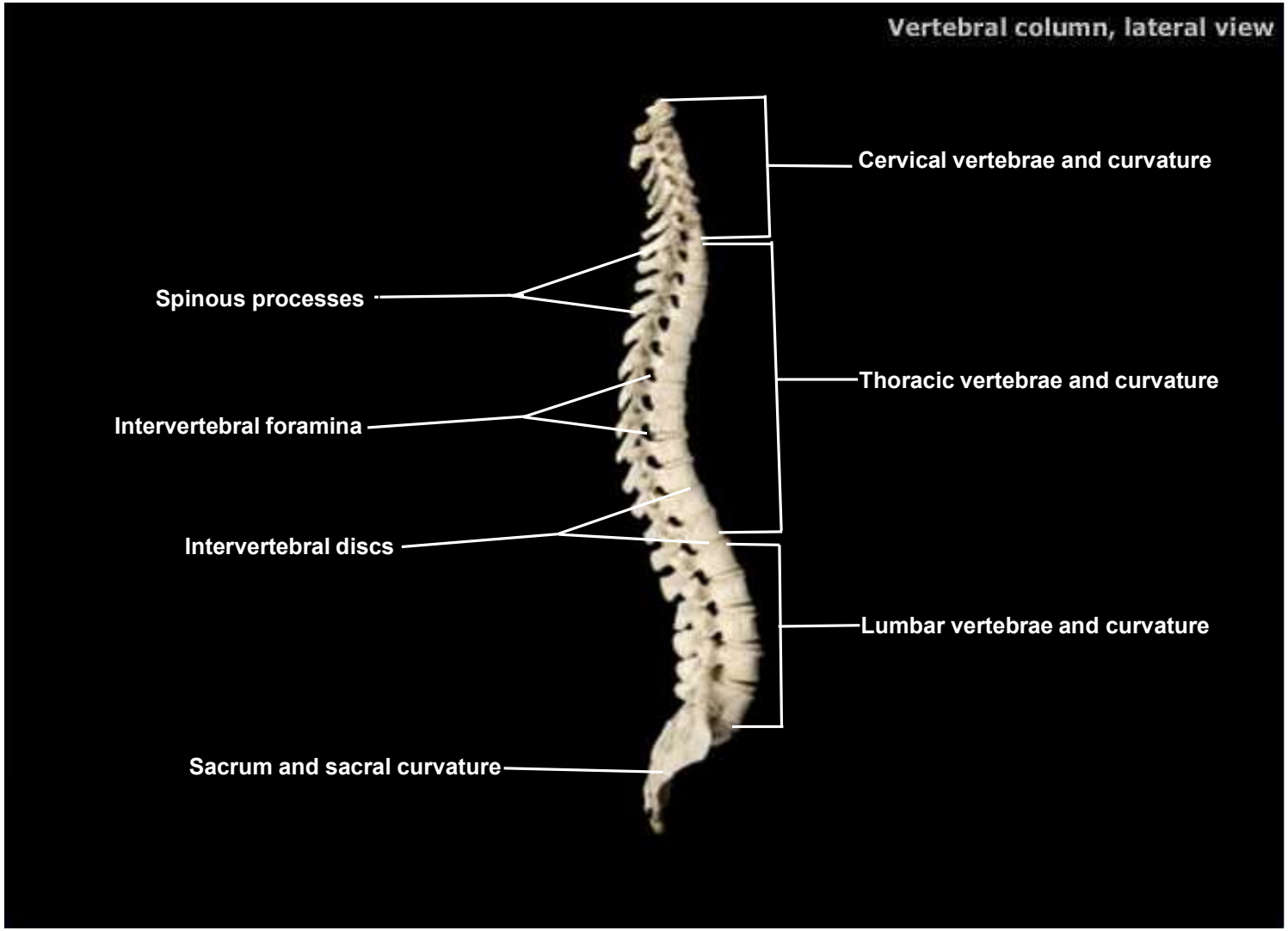

Axis, superior view
Dens
Superior articular facet

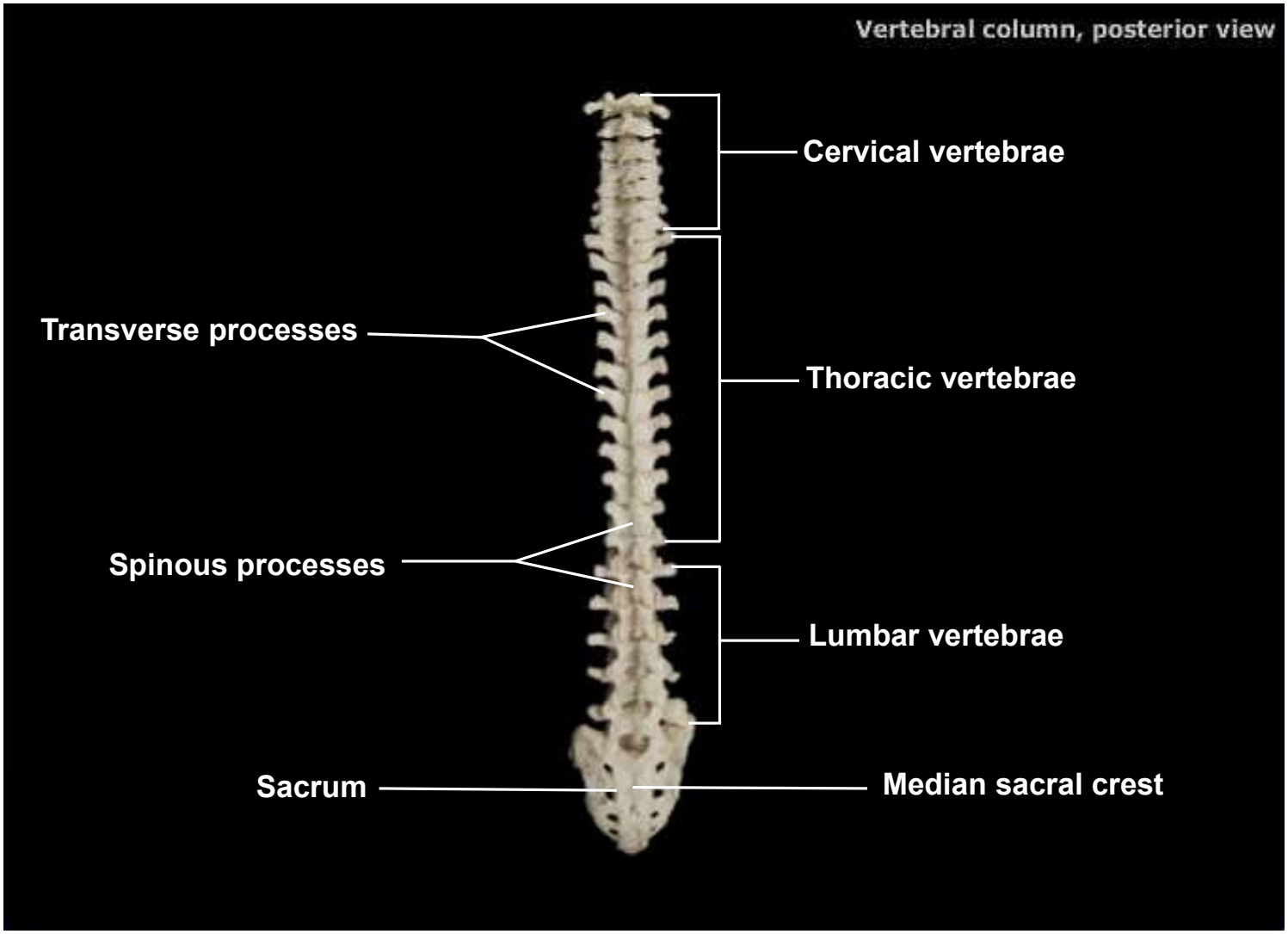

Cervical vertebra, superior view
Superior articular facet
Pedicle
Spinous process
Vertebral foramen
Lamina
Body
Transverse foramen
Inferior articular process
Transverse process

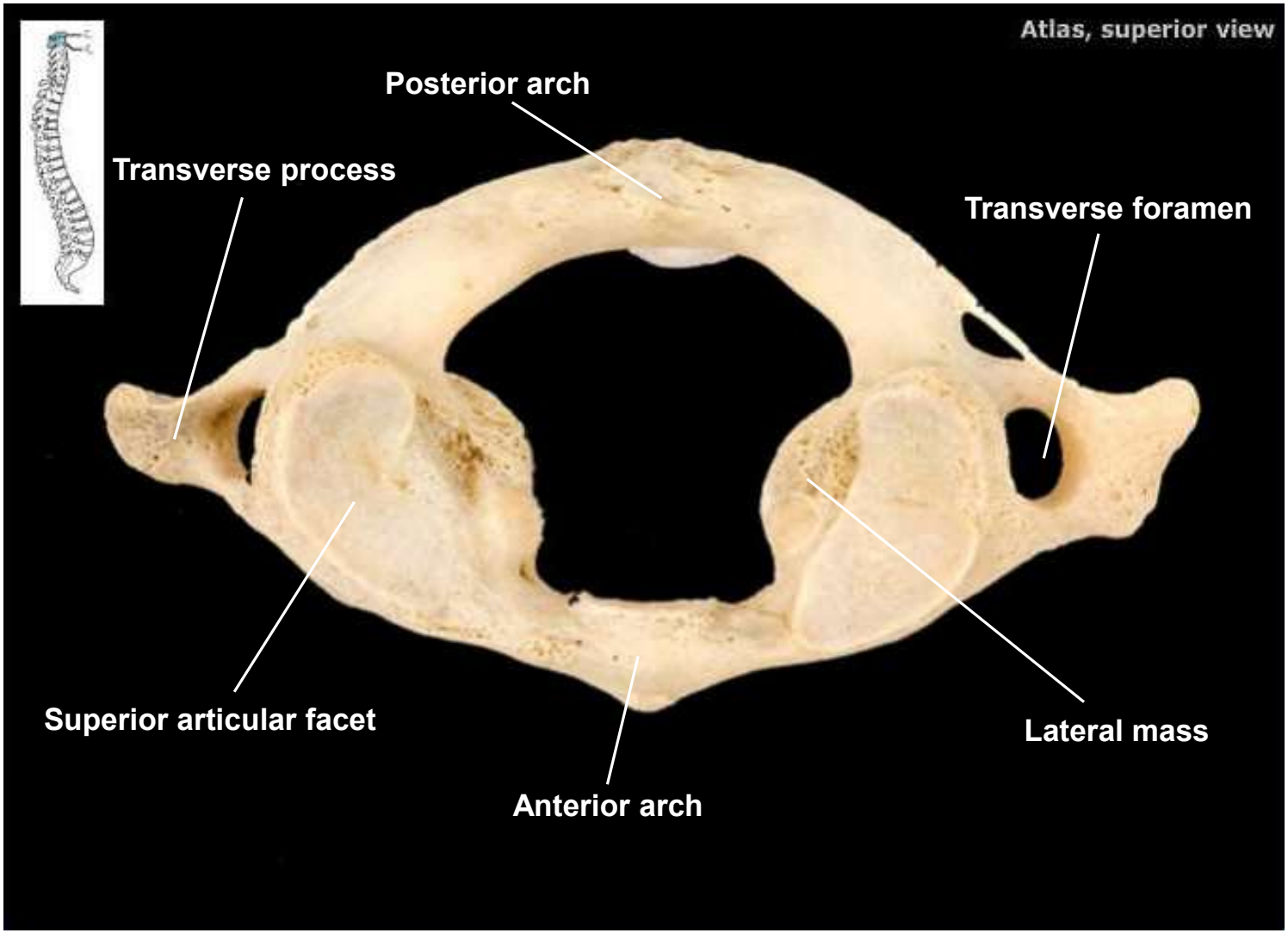

Thoracic vertebra, lateral view, left side
Superior articular process and facet
Superior costal facet
Transverse costal facet
Body
Transverse process
Spinous process
Inferior costal demifacet
Inferior articular process

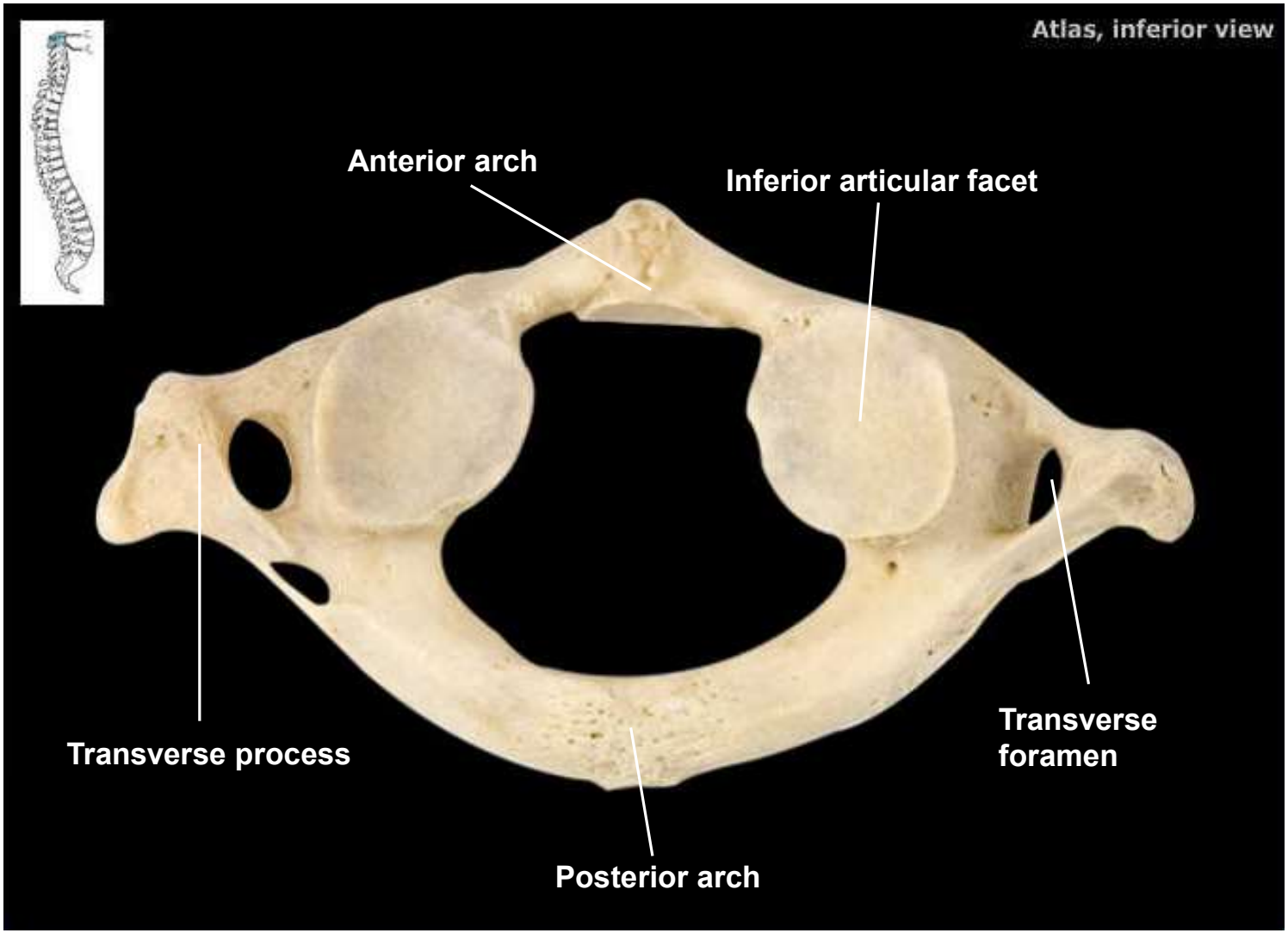

Lumbar vertebra, posterior view
Superior articular process and facet
Transverse process
Body
Spinous process
Inferior articular process

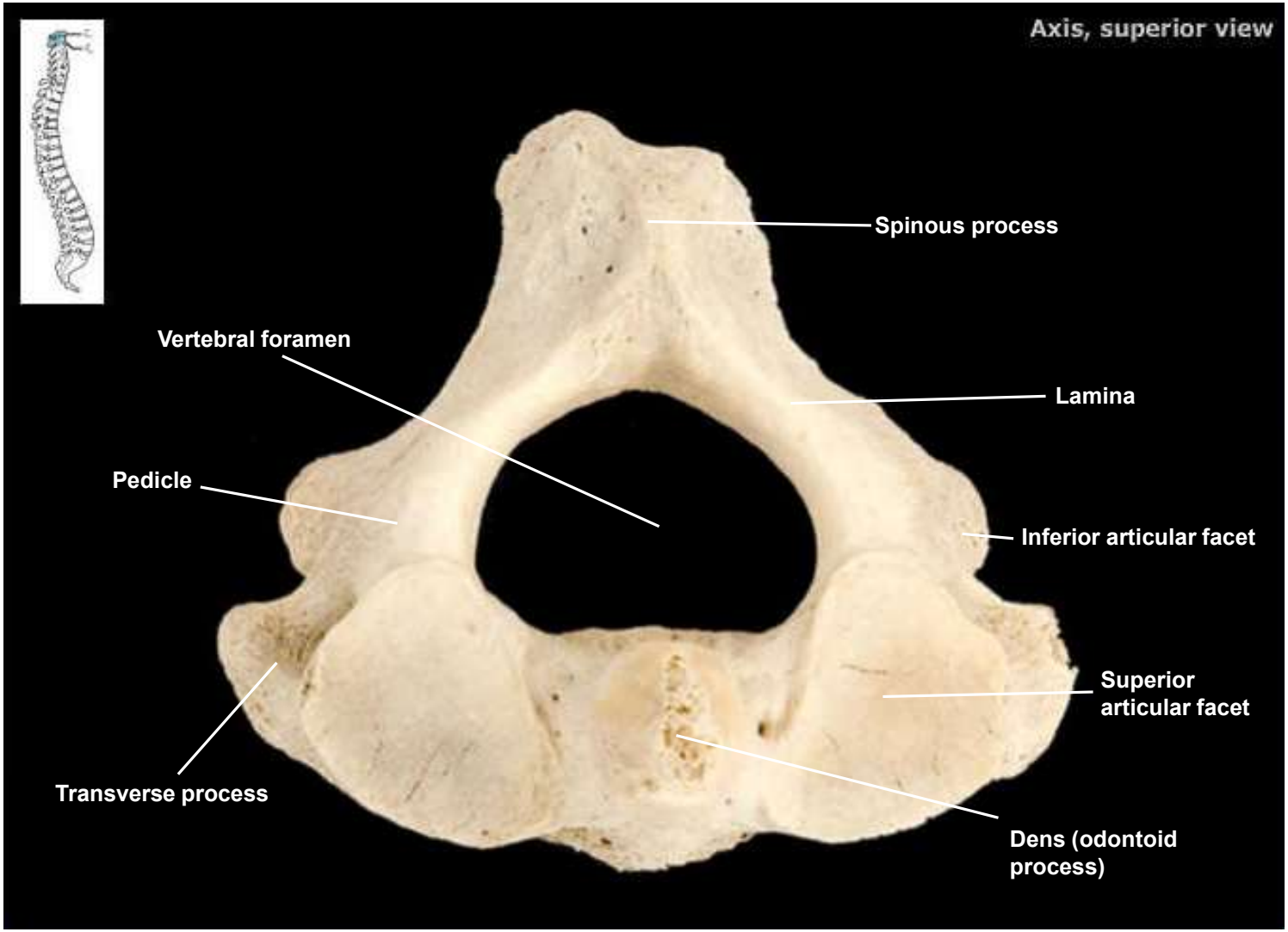

Rib, inferior view, left side
Body
Neck
Head
Costal groove
Costal angle
Articular tubercle and facet

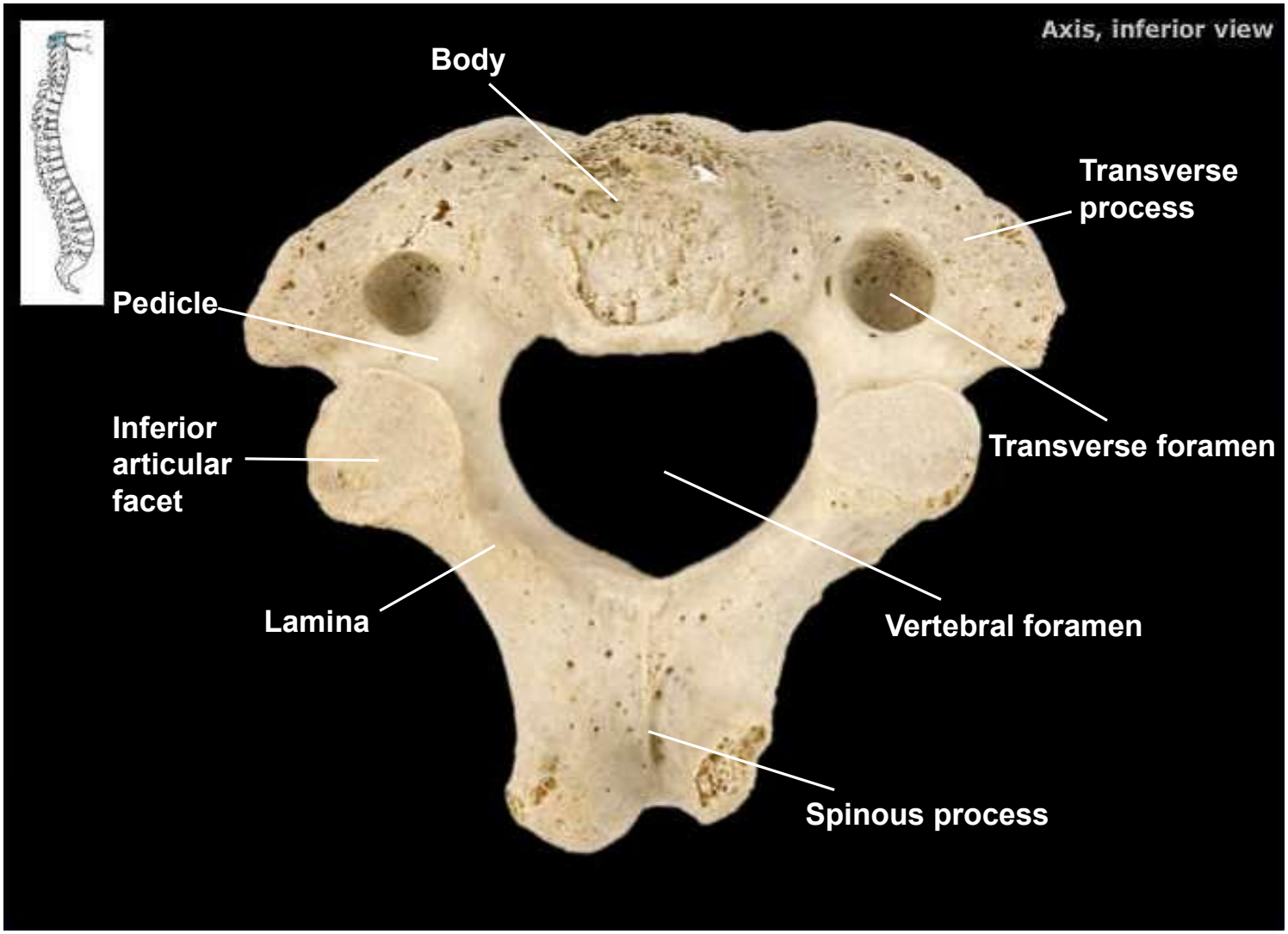

Vertebral column, lateral view
Cervical vertebrae and curvature
Spinous processes
Thoracic vertebrae and curvature
Intervertebral foramina
Intervertebral discs
Lumbar vertebrae and curvature
Sacrum and sacral curvature

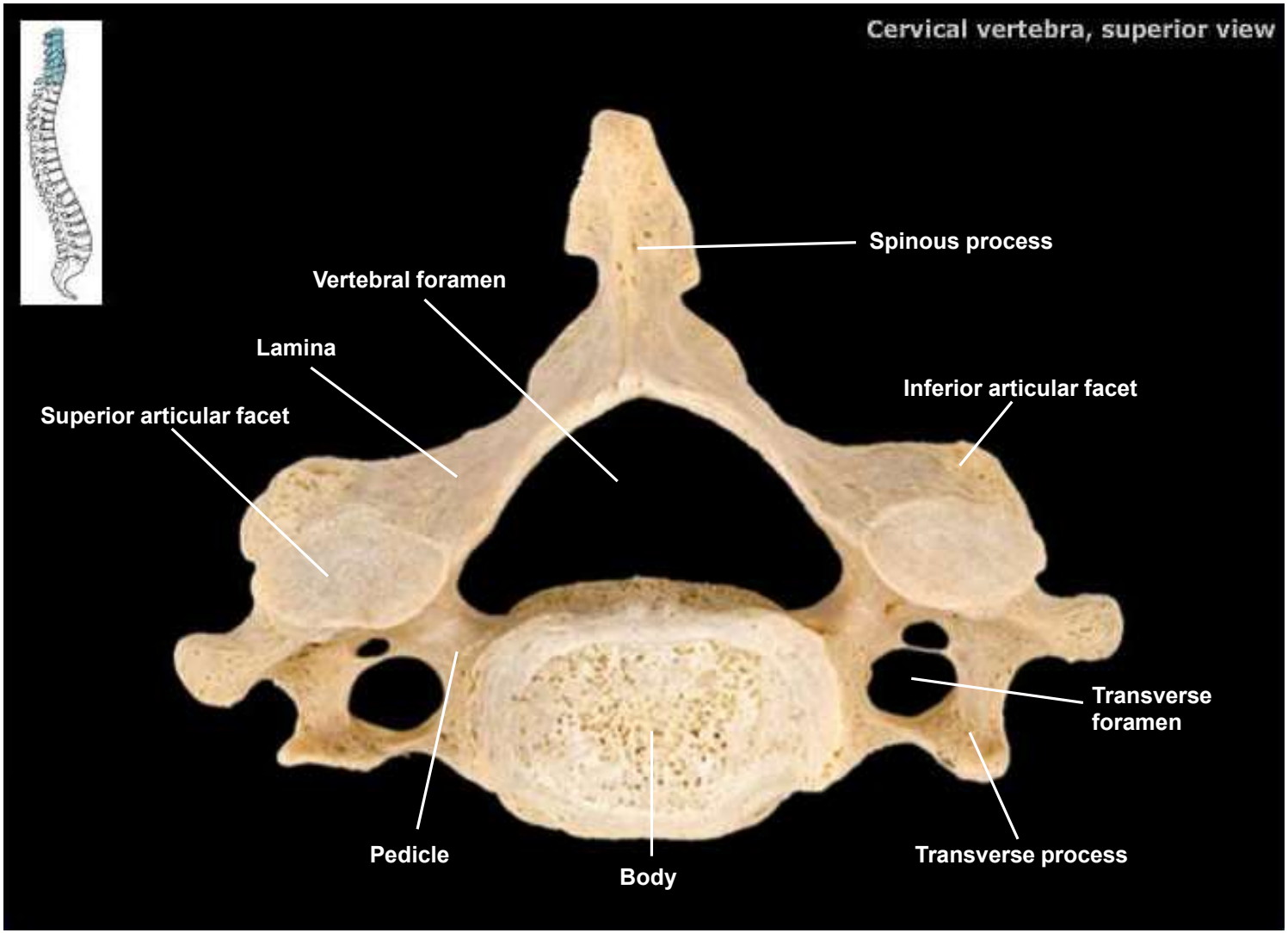

Vertebral column, posterior view
Cervical vertebrae
Transverse processes
Thoracic vertebrae
Spinous processes
Lumbar vertebrae
Sacrum
Median sacral crest

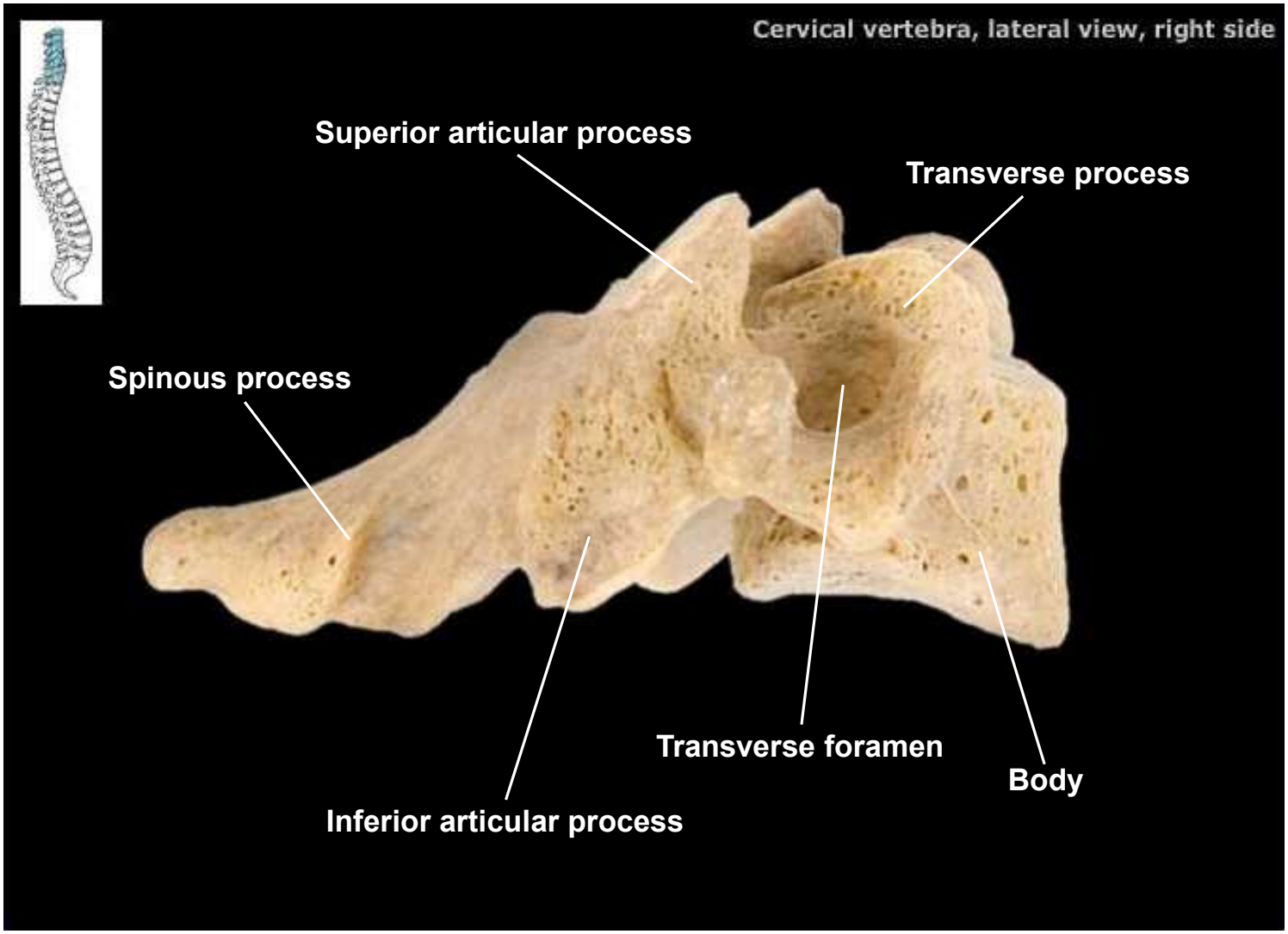

Atlas, superior view
Posterior arch
Transverse process
Transverse foramen
Superior articular facet
Lateral mass
Anterior arch

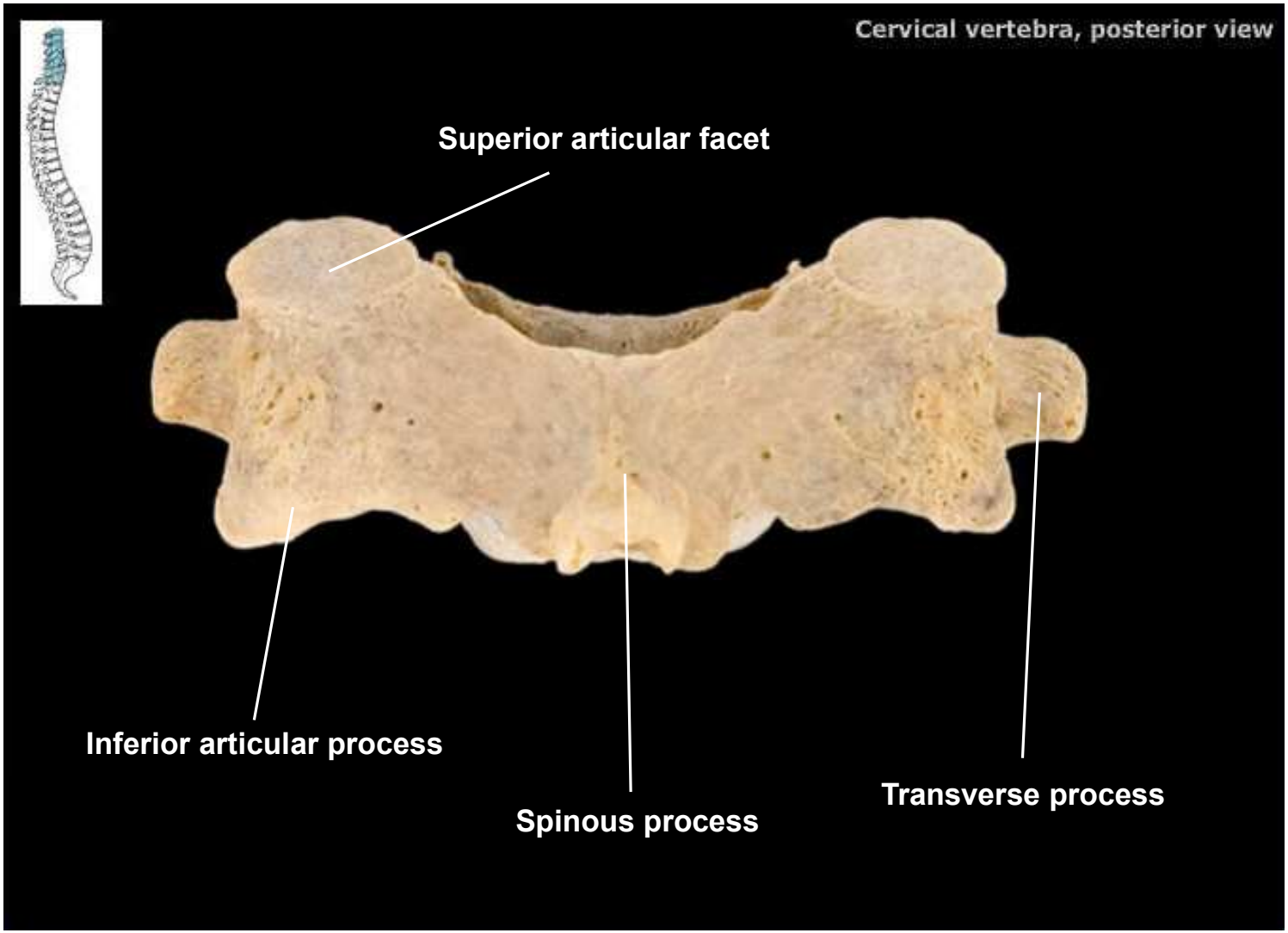

Atlas, inferior view
Anterior arch
Inferior articular facet
Transverse process
Transverse foramen
Posterior arch

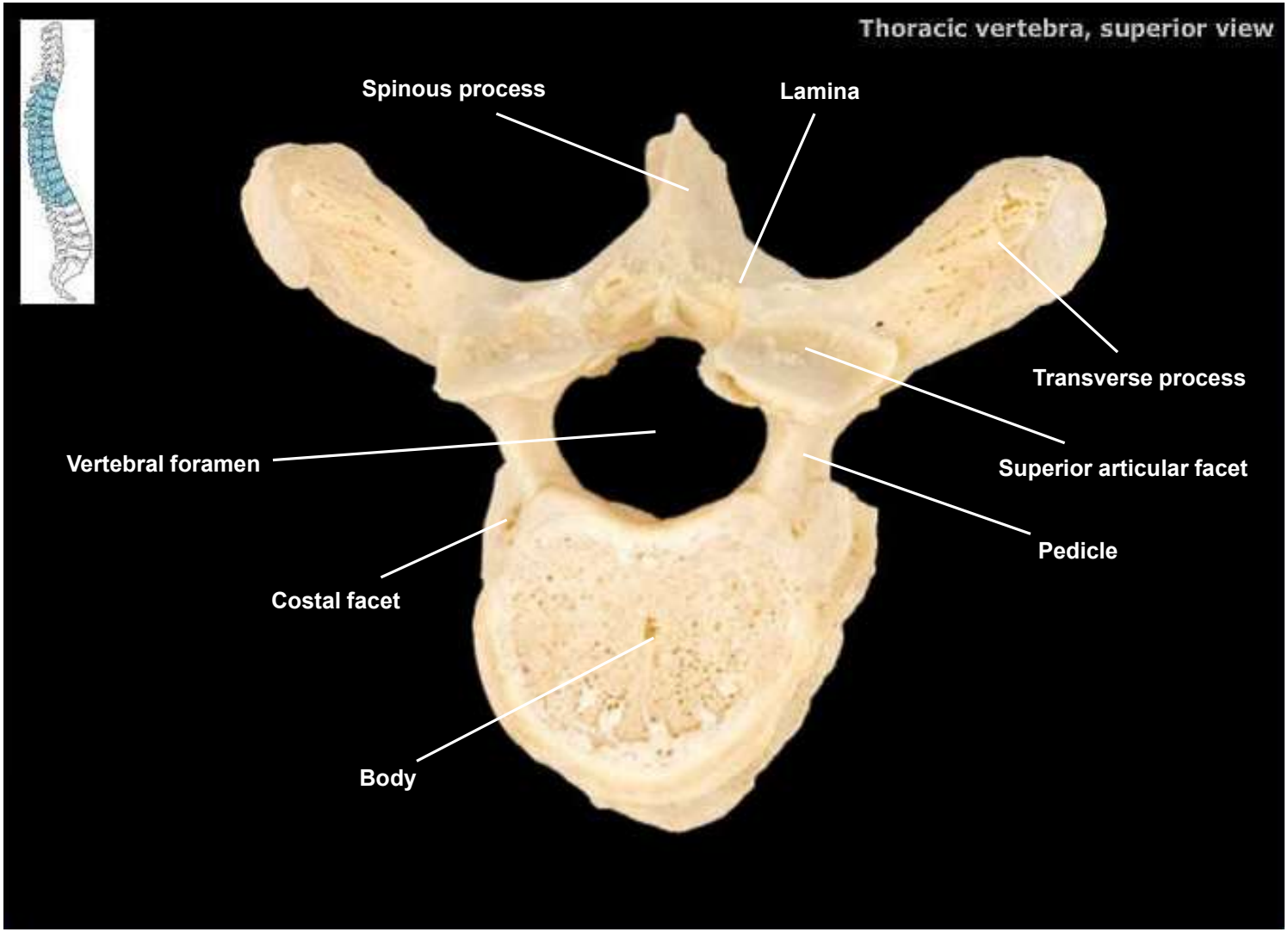

Axis, superior view
Spinous process
Vertebral foramen
Lamina
Pedicle
Inferior articular facet
Superior articular facet
Transverse process
Dens (odontoid process)

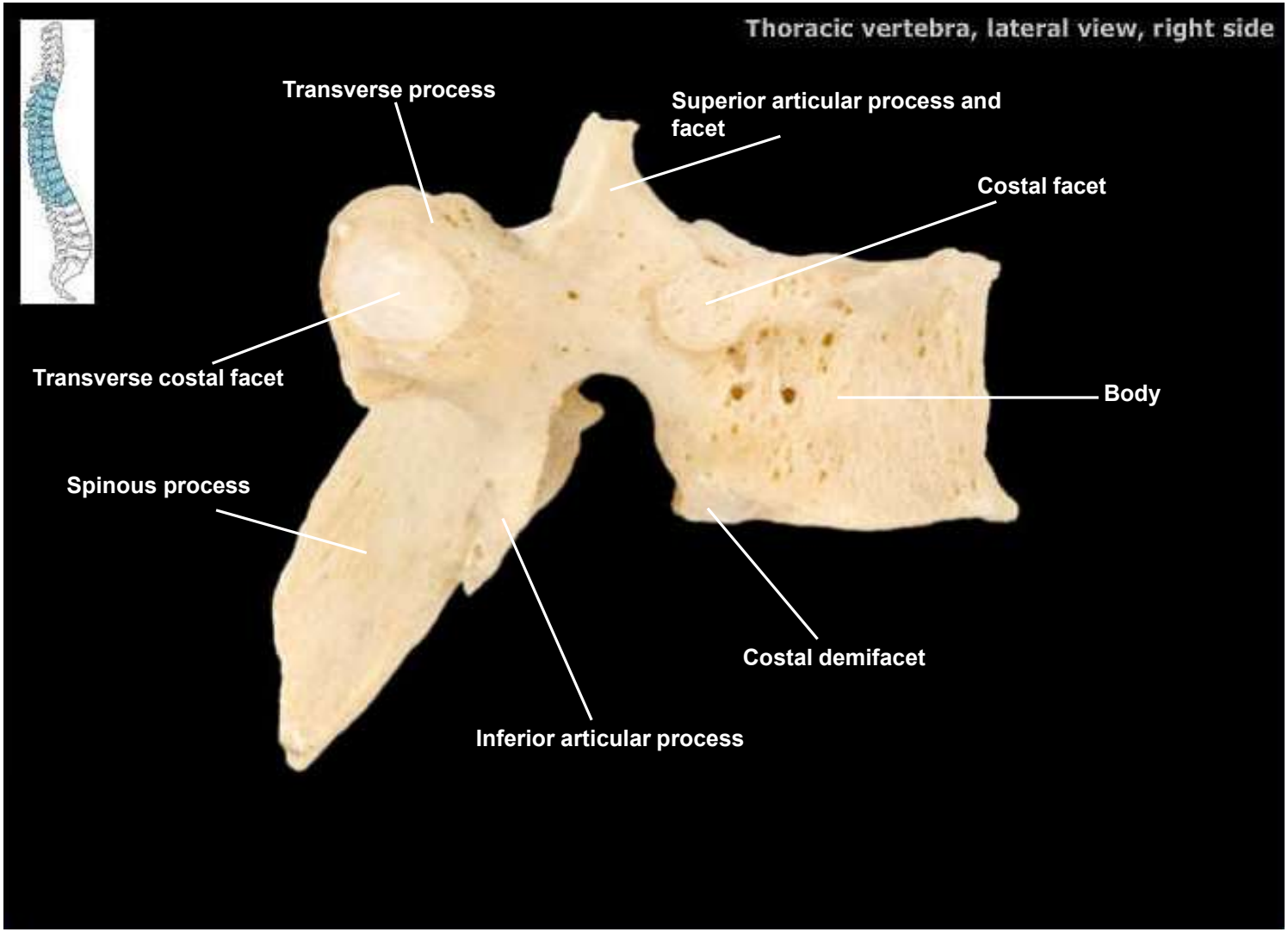

Axis, inferior view
Body
Transverse process
Pedicle
Inferior articular facet
Transverse foramen
Lamina
Vertebral foramen
Spinous process

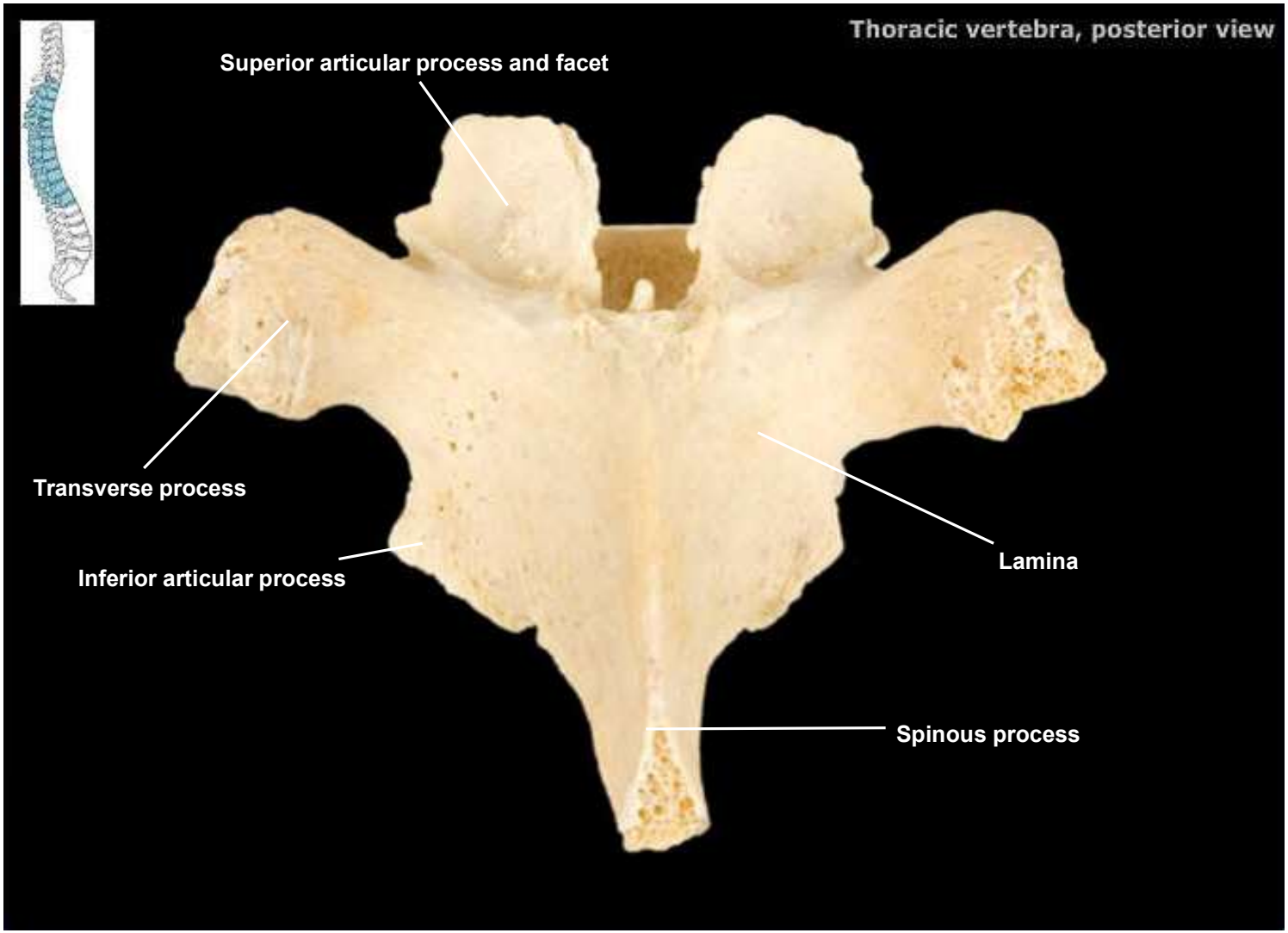

Cervical vertebra, superior view
Spinous process
Vertebral foramen
Lamina
Superior articular facet
Inferior articular facet
Transverse foramen
Pedicle
Body
Transverse process

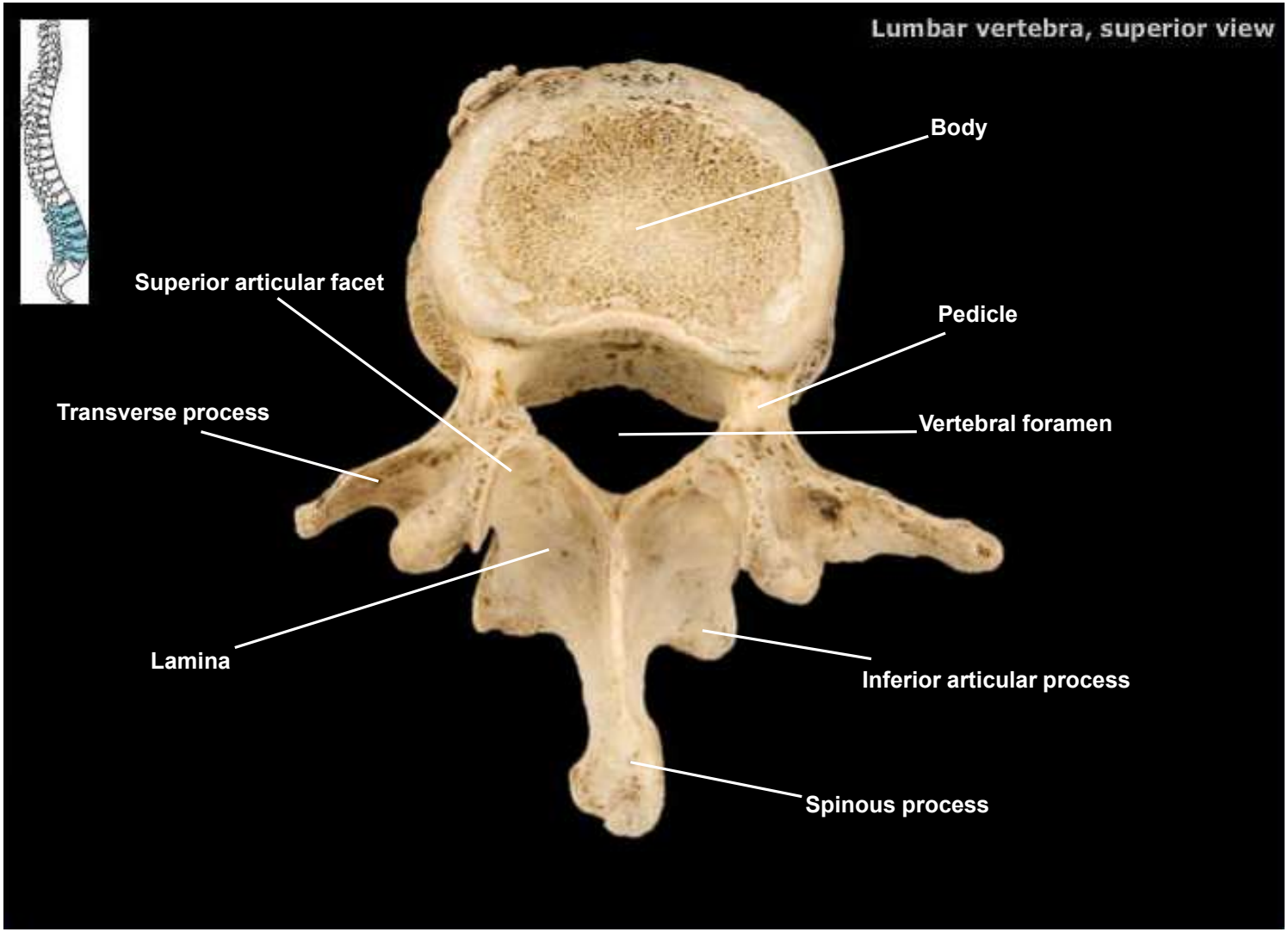

Cervical vertebra, lateral view, right side
Superior articular process
Transverse process
Spinous process
Transverse foramen
Body
Inferior articular process

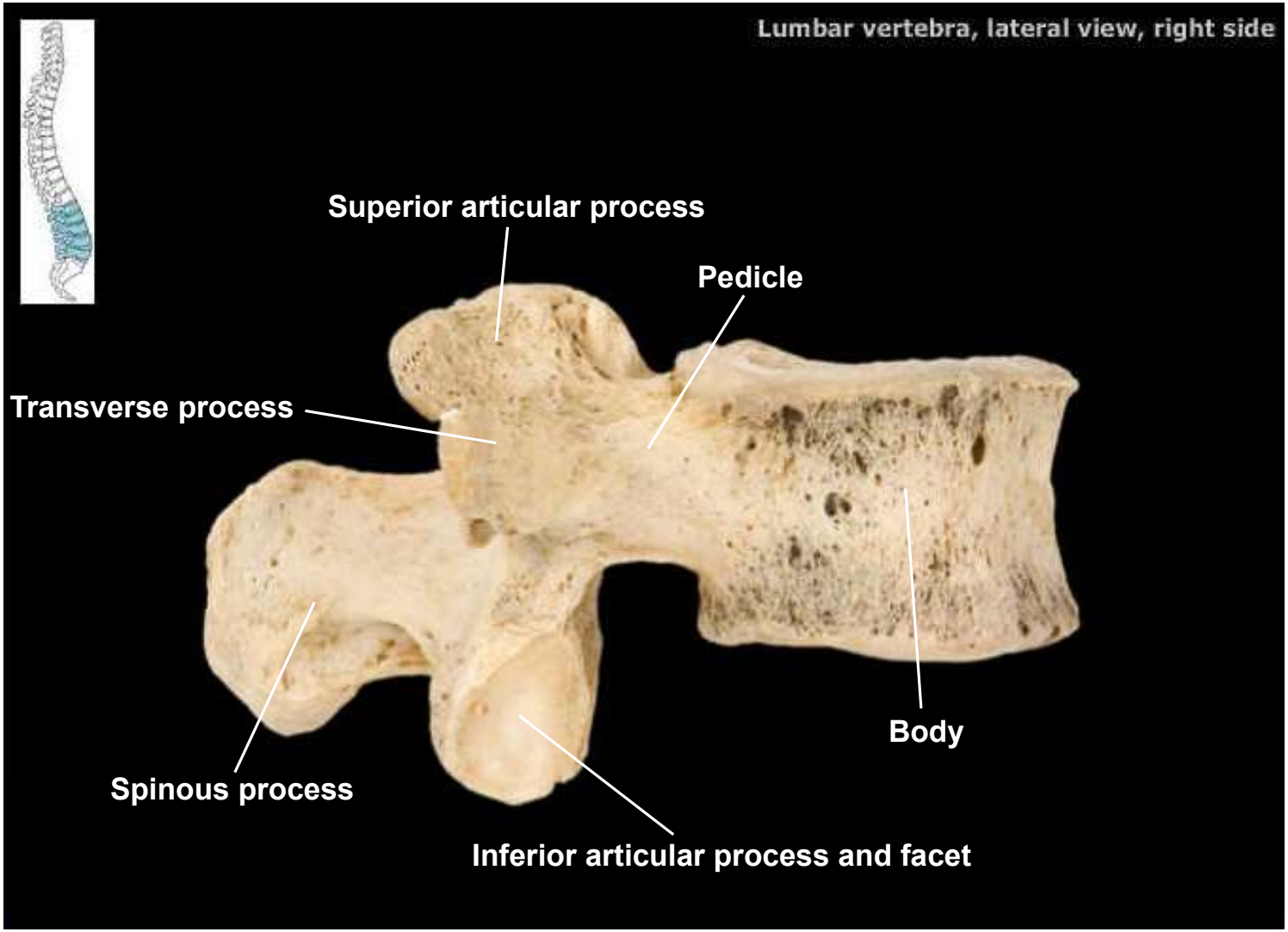

Cervical vertebra, posterior view
Superior articular facet
Inferior articular process
Spinous process
Transverse process

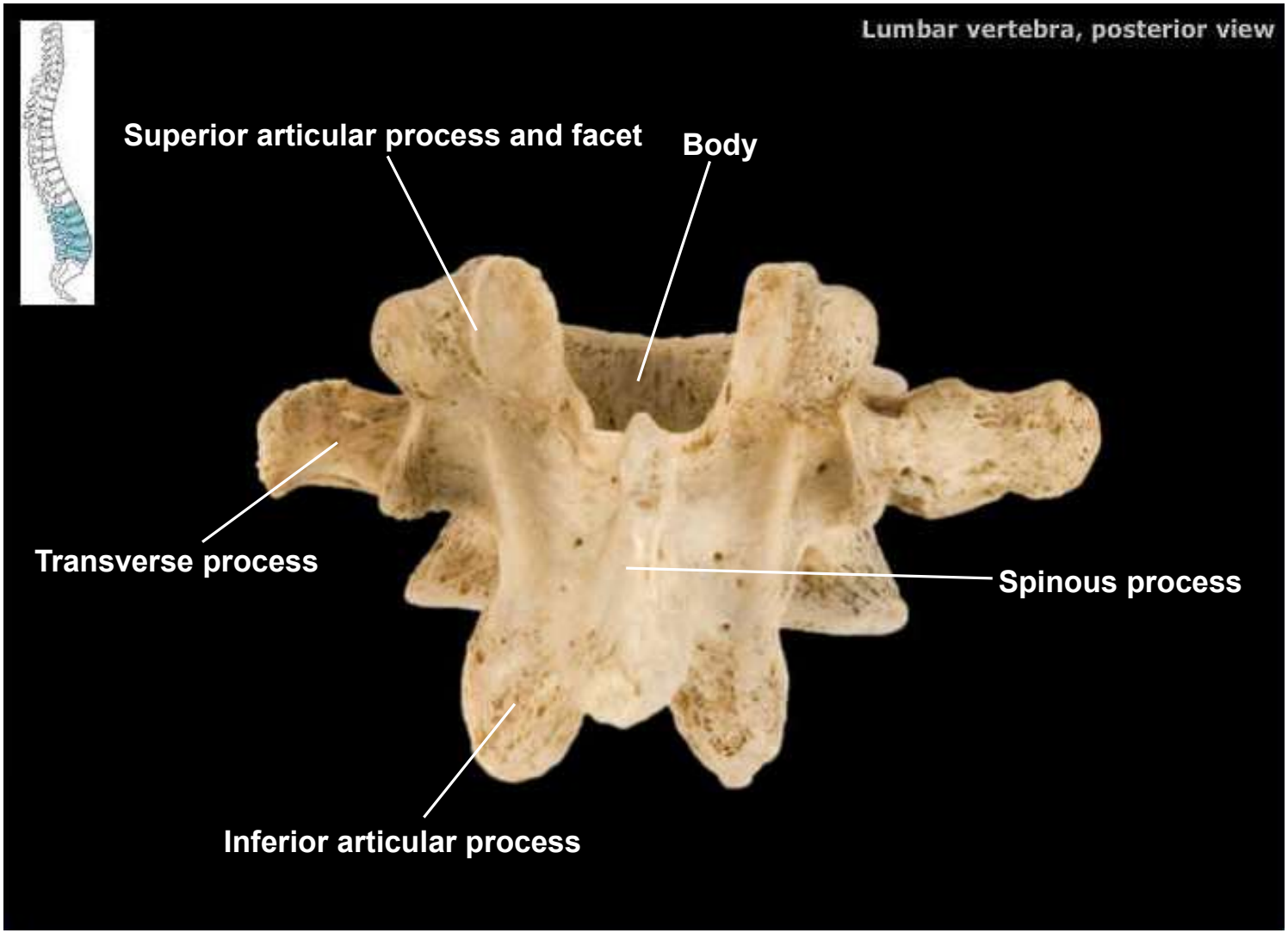

Thoracic vertebra, superior view
Spinous process
Lamina
Transverse process
Vertebral foramen
Superior articular facet
Pedicle
Costal facet
Body

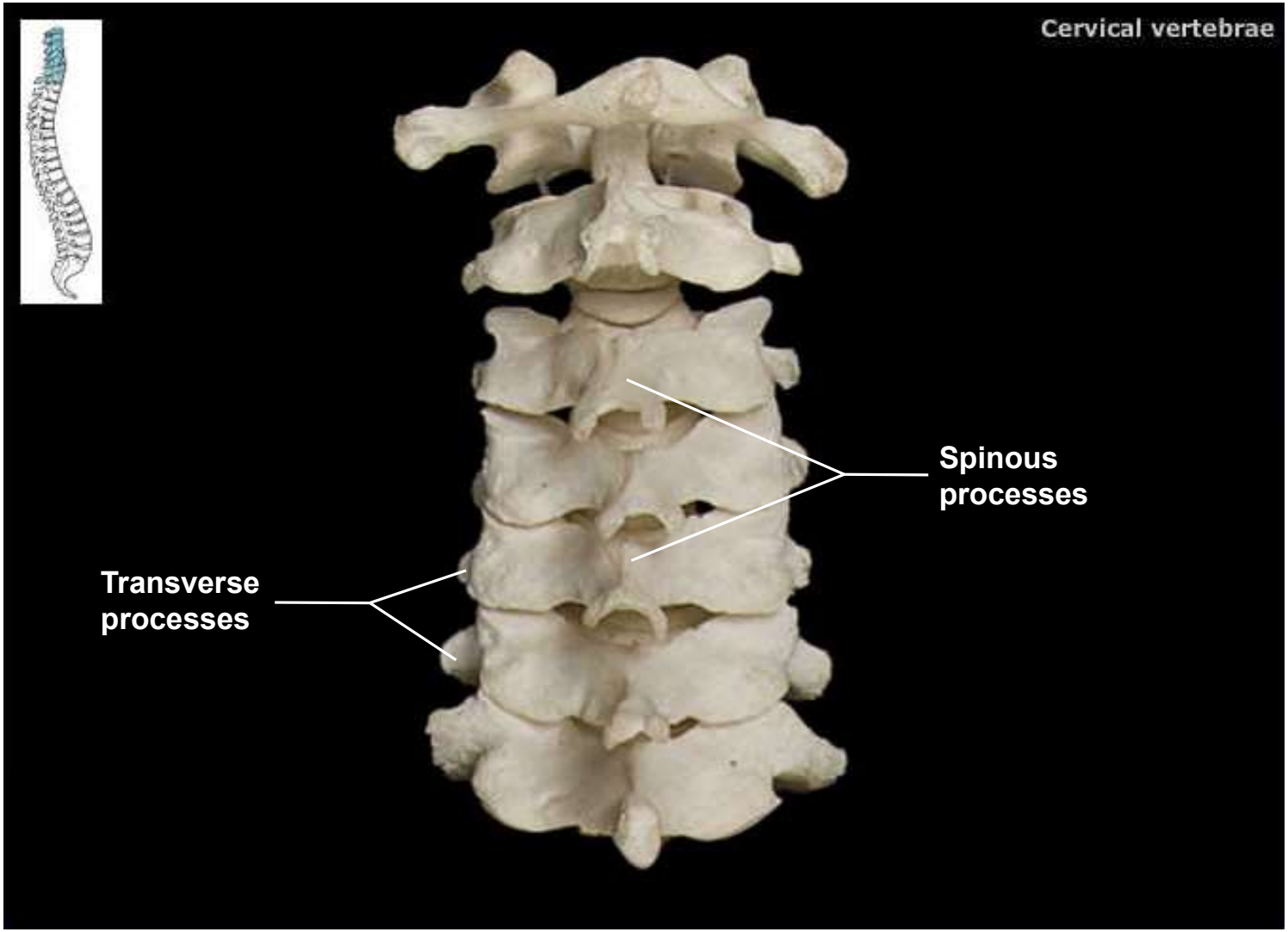

Thoracic vertebra, lateral view, right side
Transverse process
Superior articular process and facet
Costal facet
Transverse costal facet
Body
Spinous process
Costal demifacet
Inferior articular process

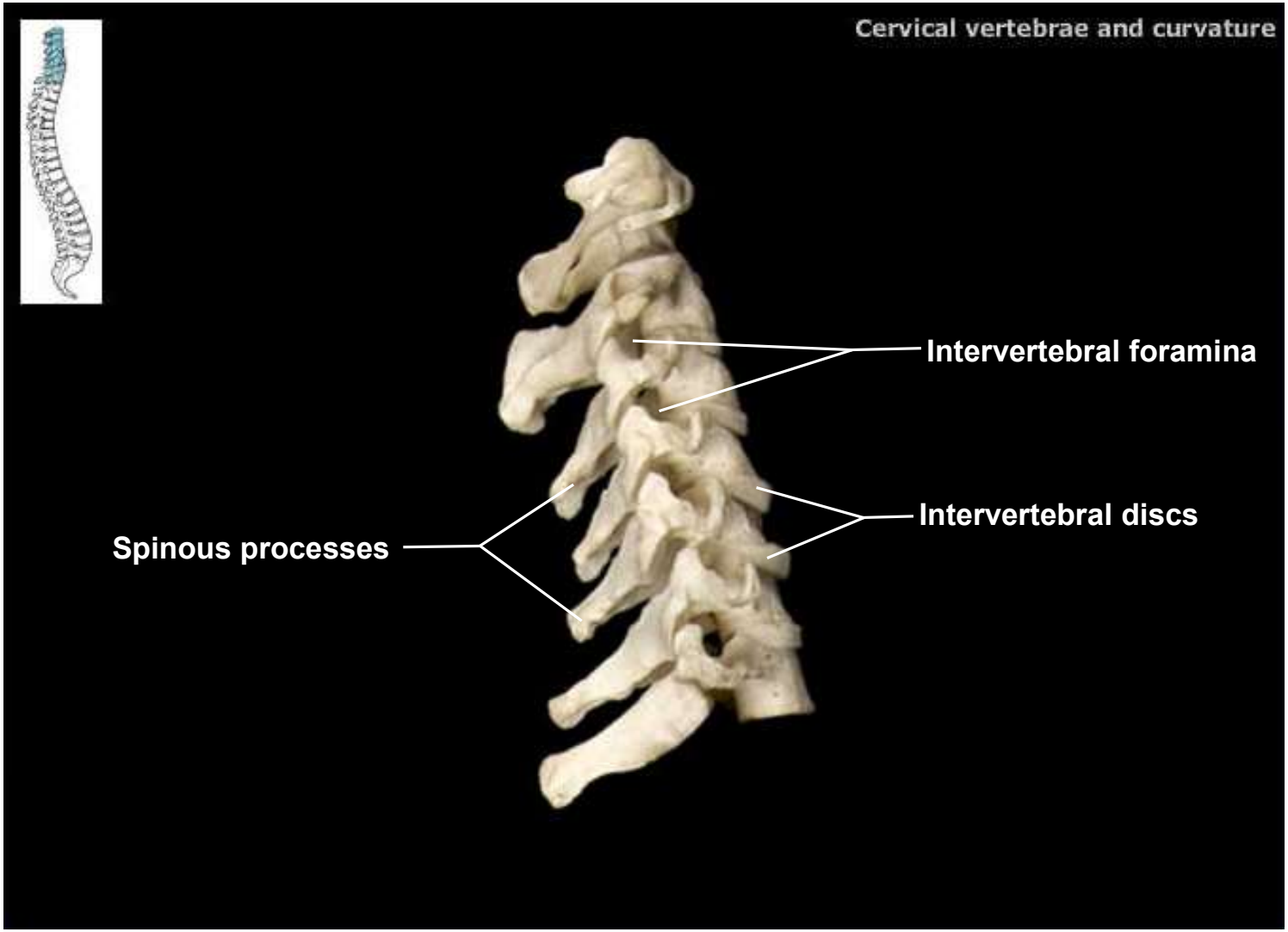

Thoracic vertebra, posterior view
Superior articular process and facet
Transverse process
Inferior articular process
Lamina
Spinous process

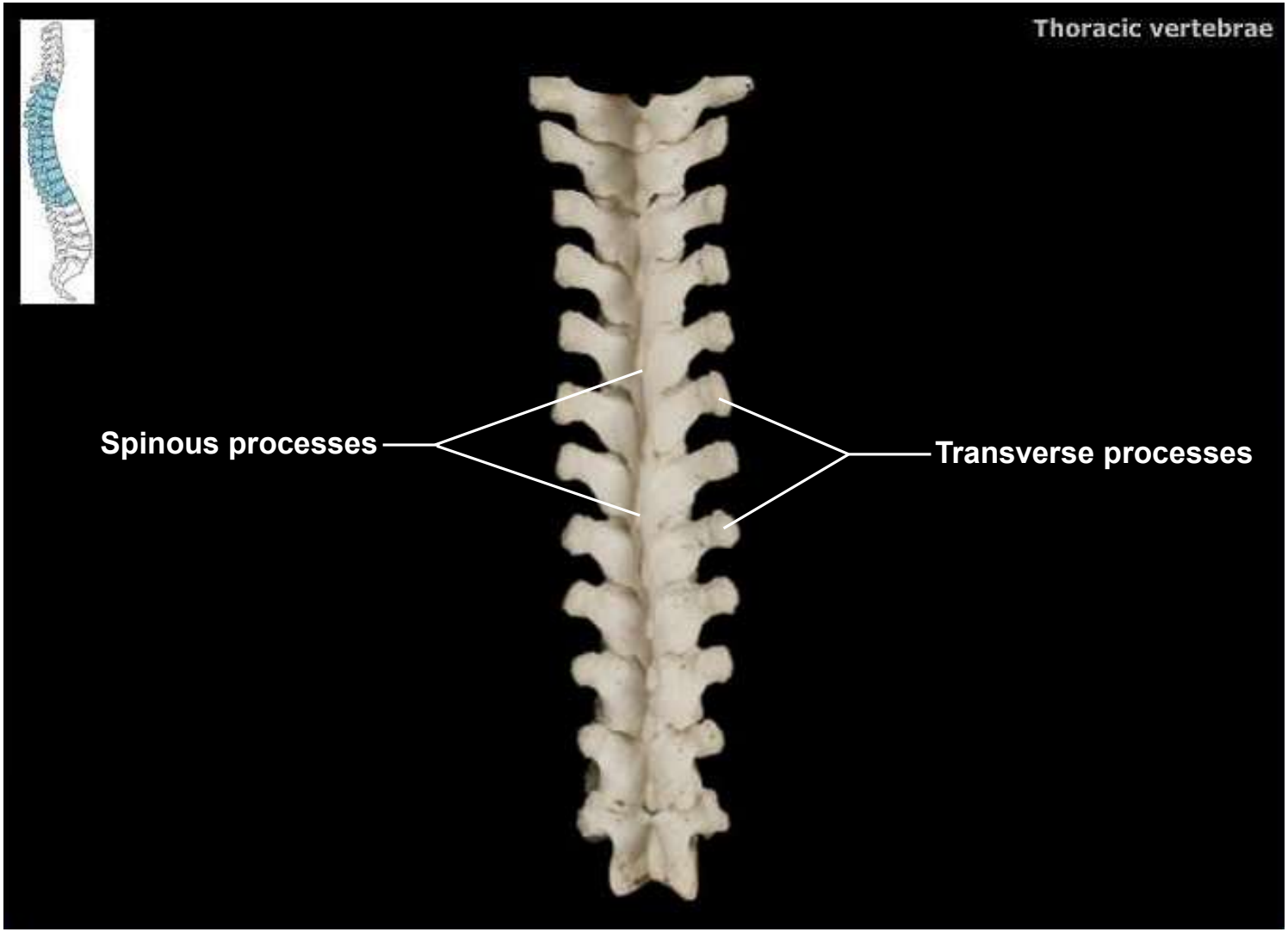

Lumbar vertebra, superior view
Body
Superior articular facet
Pedicle
Transverse process
Vertebral foramen
Lamina
Inferior articular process
Spinous process

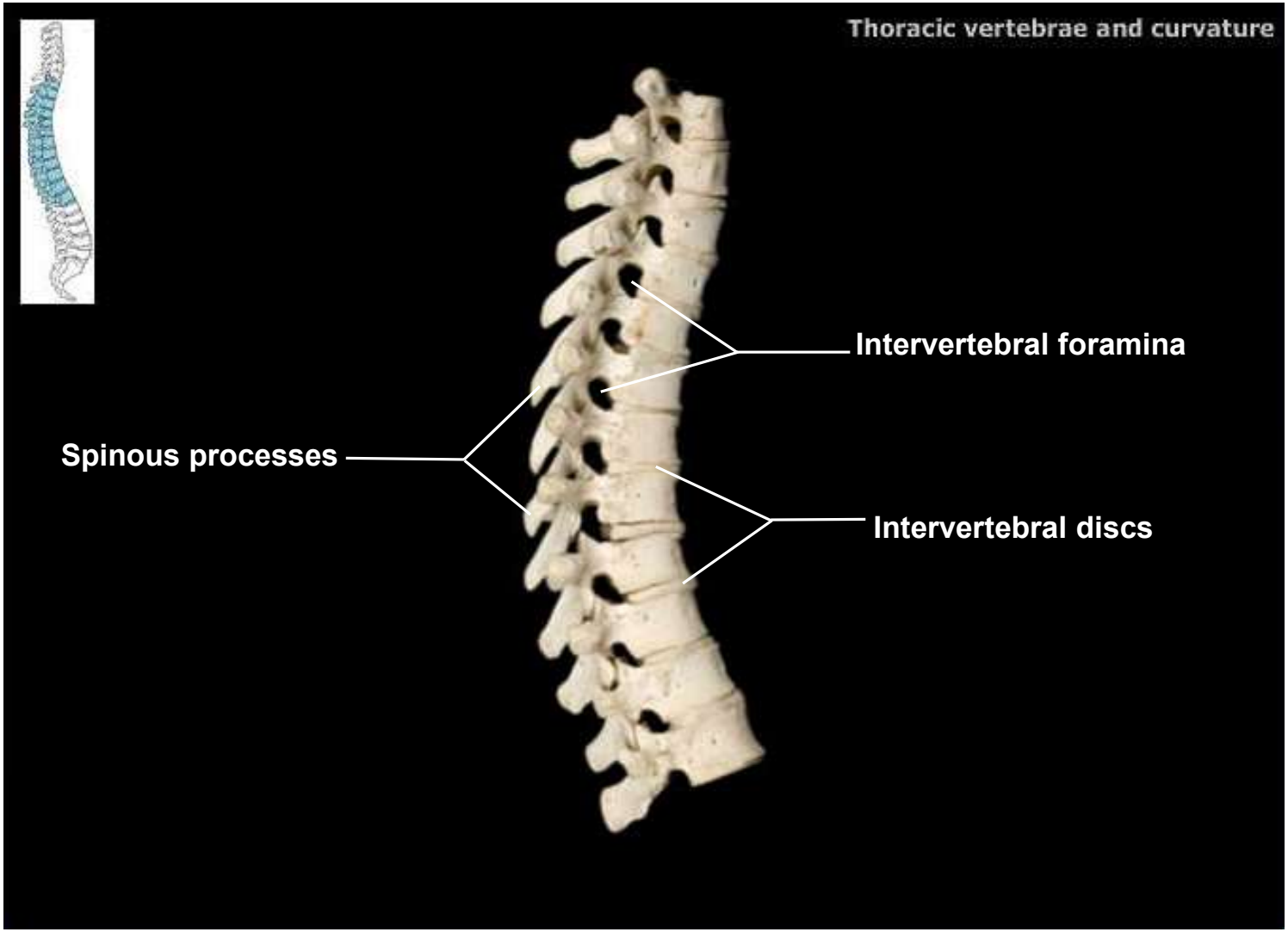

Lumbar vertebra, lateral view, right side
Superior articular process
Pedicle
Transverse process
Body
Spinous process
Inferior articular process and facet

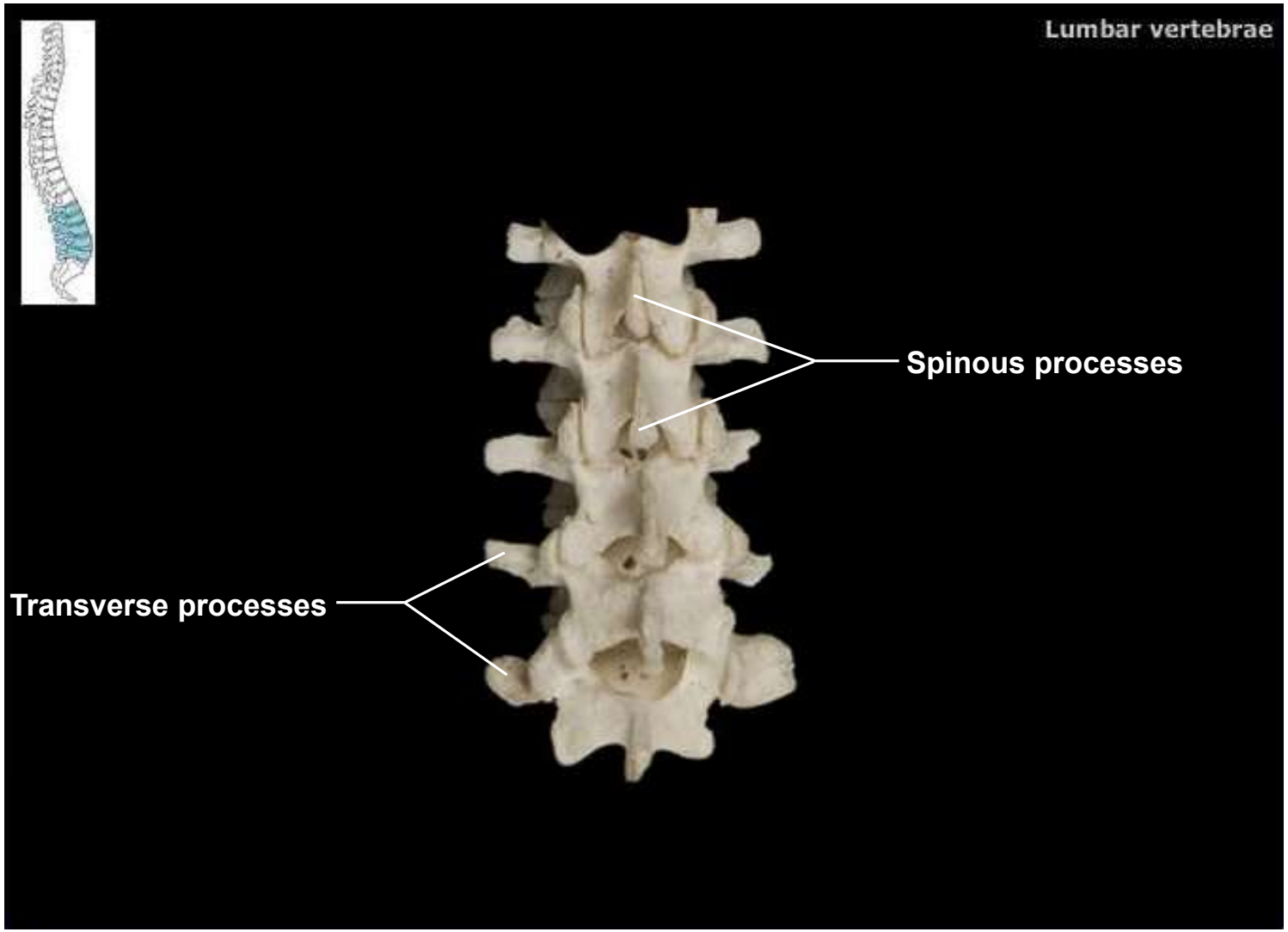

Lumbar vertebra, posterior view
Superior articular process and facet
Body
Transverse process
Spinous process
Inferior articular process

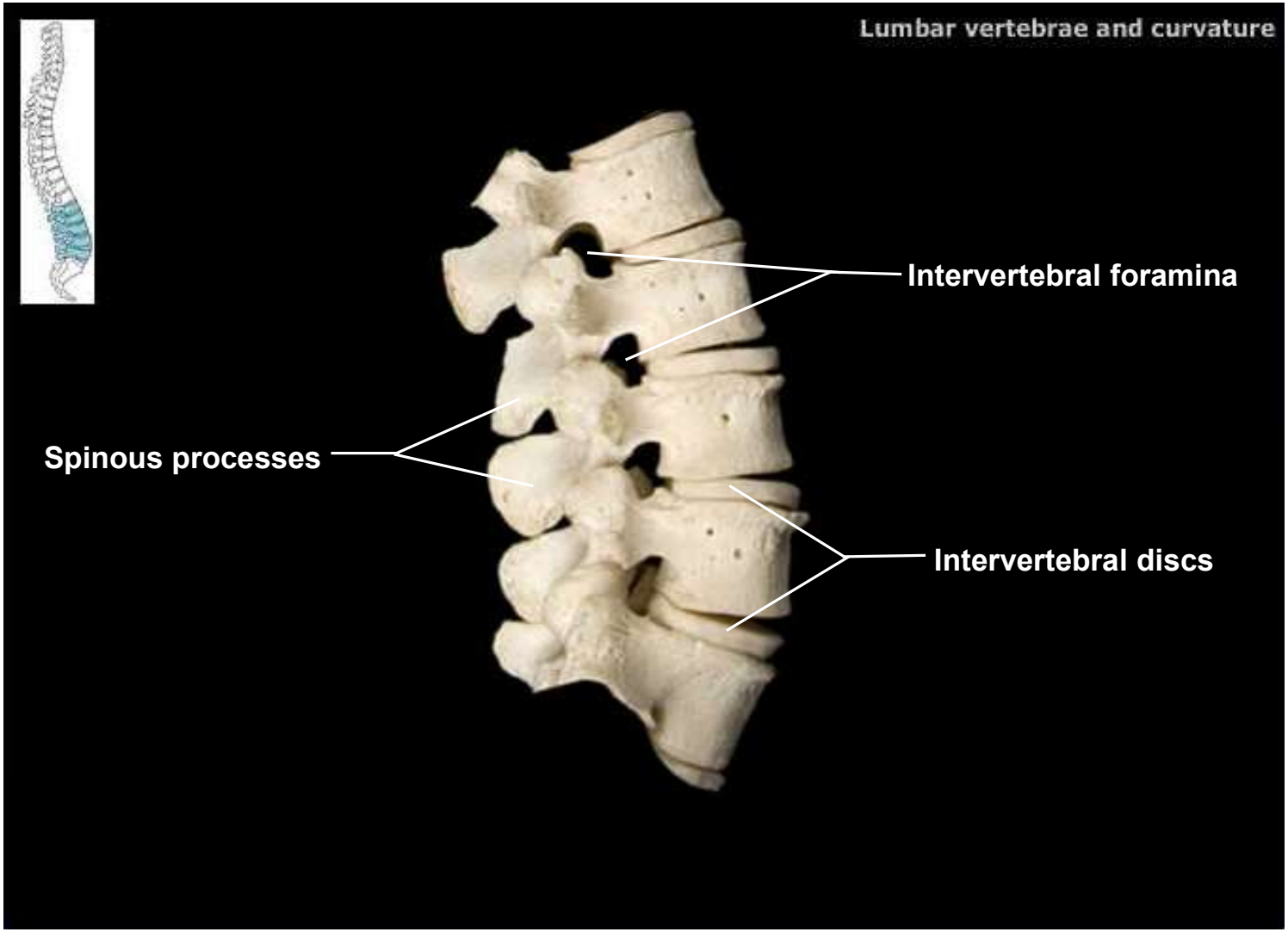

Cervical vertebrae
Spinous processes
Transverse processes

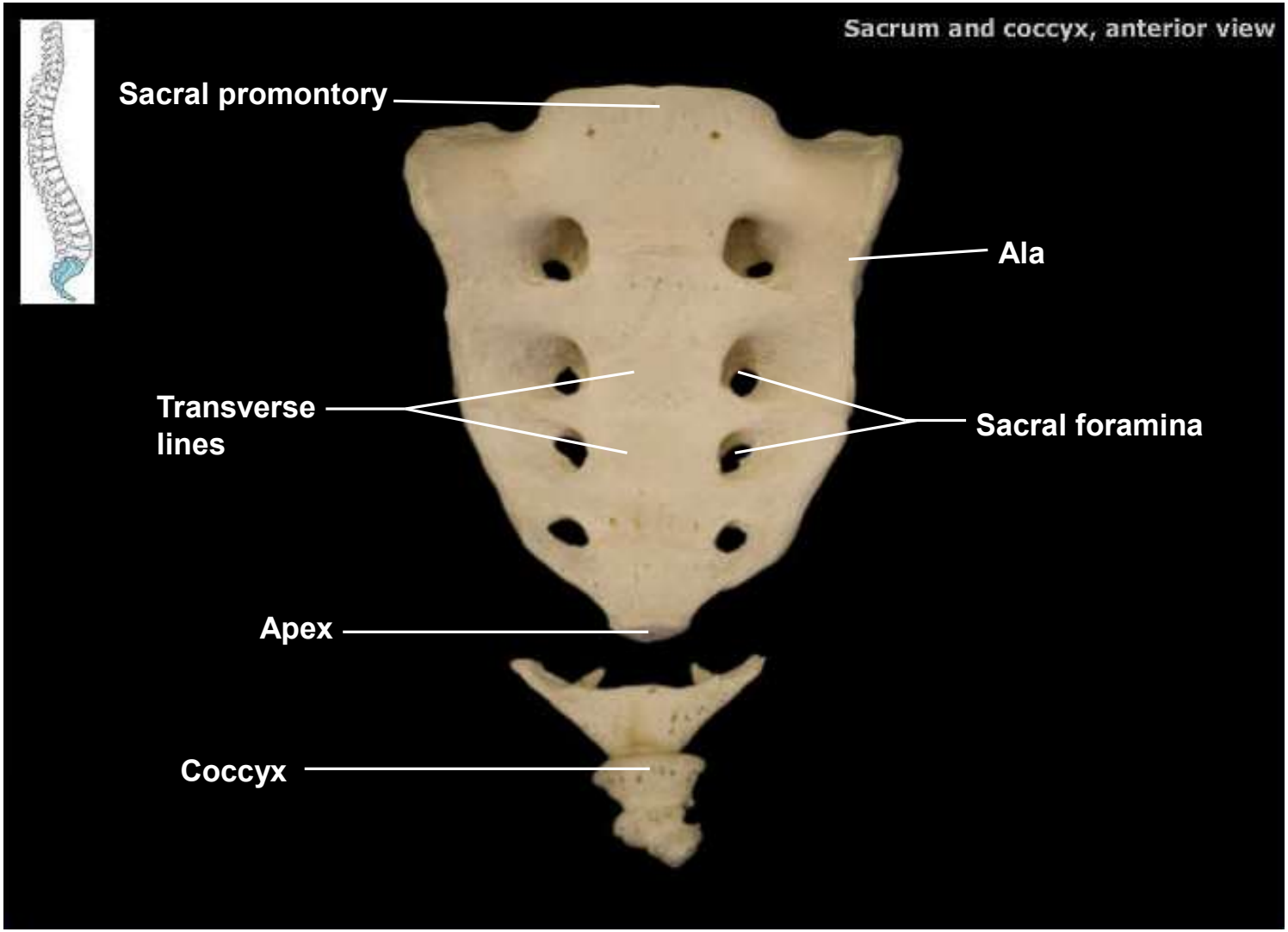

Cervical vertebrae and curvature
Intervertebral foramina
Intervertebral discs
Spinous processes

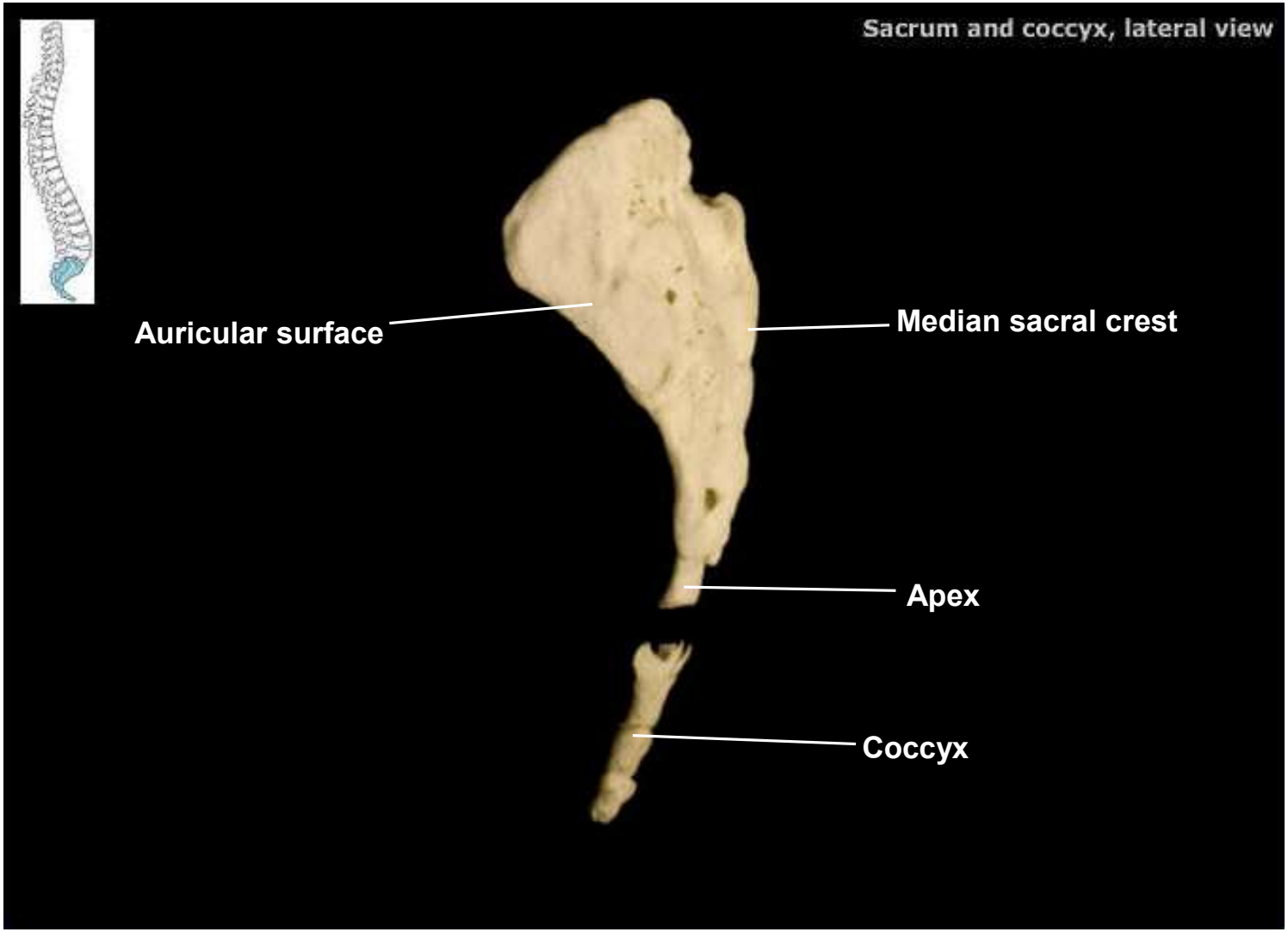

Thoracic vertebrae
Spinous processes
Transverse processes

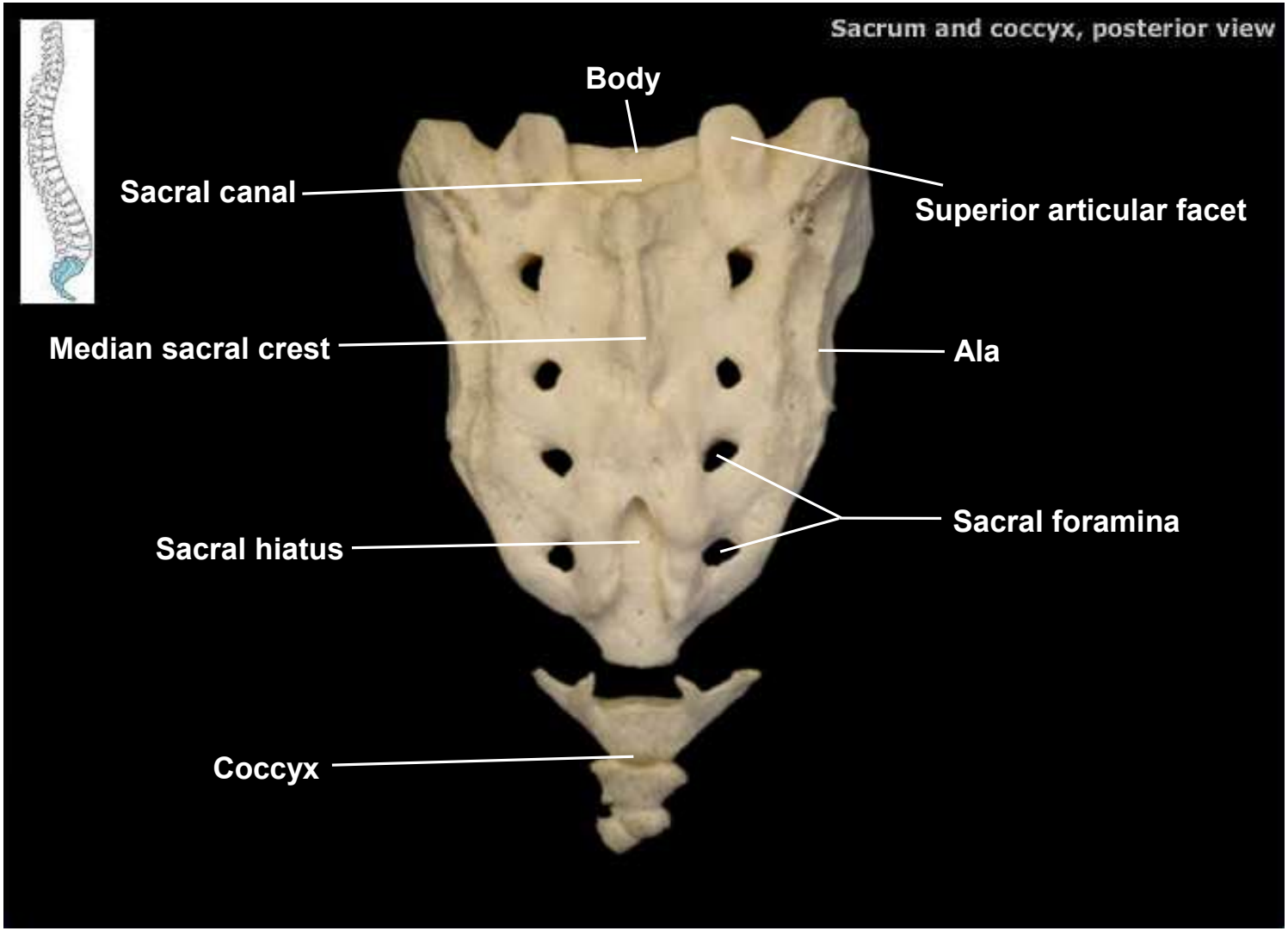

Thoracic vertebrae and curvature
Intervertebral foramina
Spinous processes
Intervertebral discs


Lumbar vertebrae
Spinous processes
Transverse processes


Lumbar vertebrae and curvature
Intervertebral foramina
Spinous processes
Intervertebral discs


Sacrum and coccyx, anterior view
Sacral promontory
Ala
Transverse lines
Sacral foramina
Apex
Coccyx


Sacrum and coccyx, lateral view
Auricular surface
Median sacral crest
Apex
Coccyx


Sacrum and coccyx, posterior view
Body
Sacral canal
Superior articular facet
Median sacral crest
Ala
Sacral foramina
Sacral hiatus
Coccyx