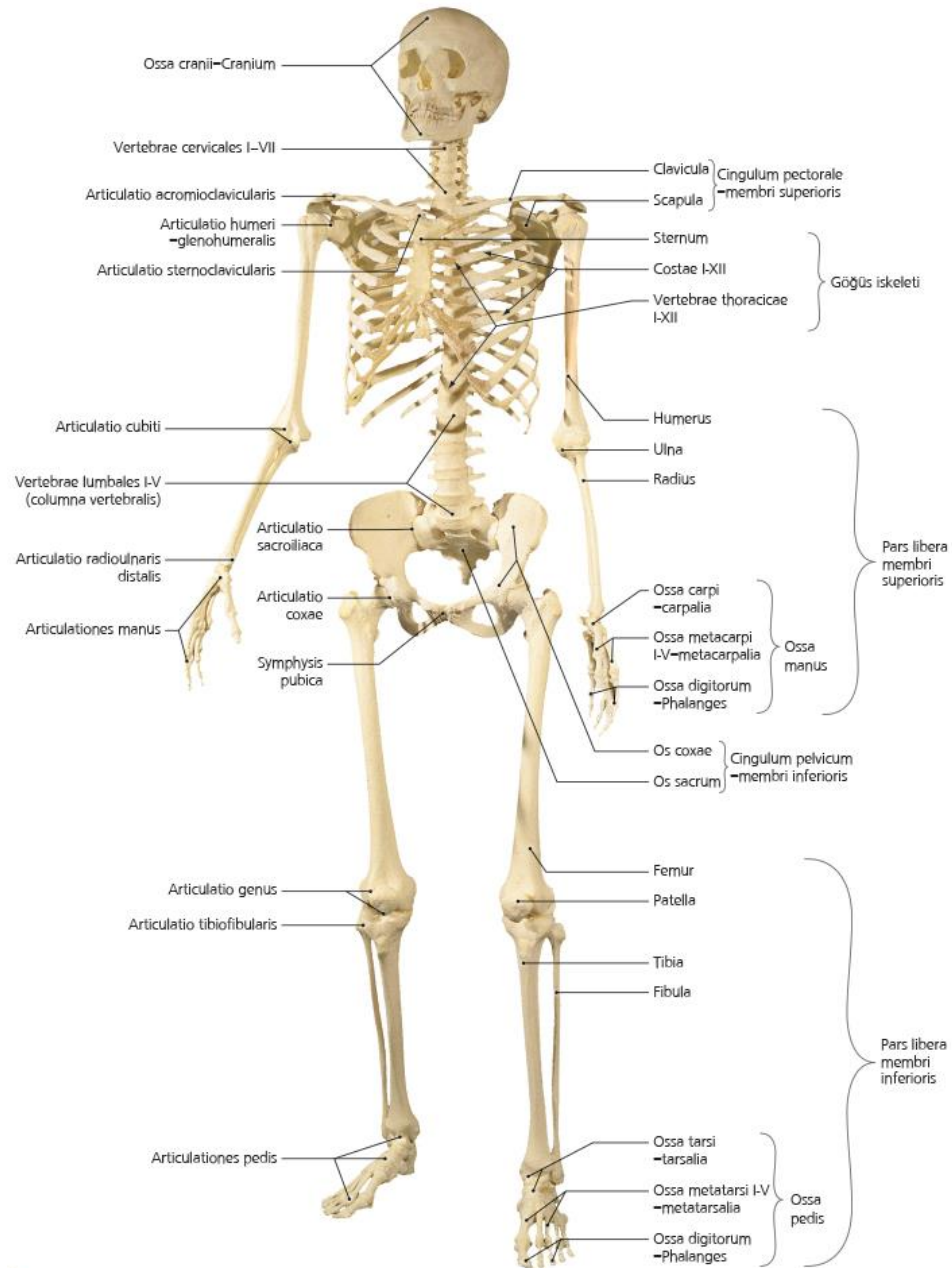


LOCOMOTOR SYSTEM OSTEOLOGY

Prof. Gülgün Şengül

- Osteology – the study of the structure and function of the skeleton and bony structures.
- Myology- muscles
- Arthrology – joints



There are 206 bones in the adult.

Functions:

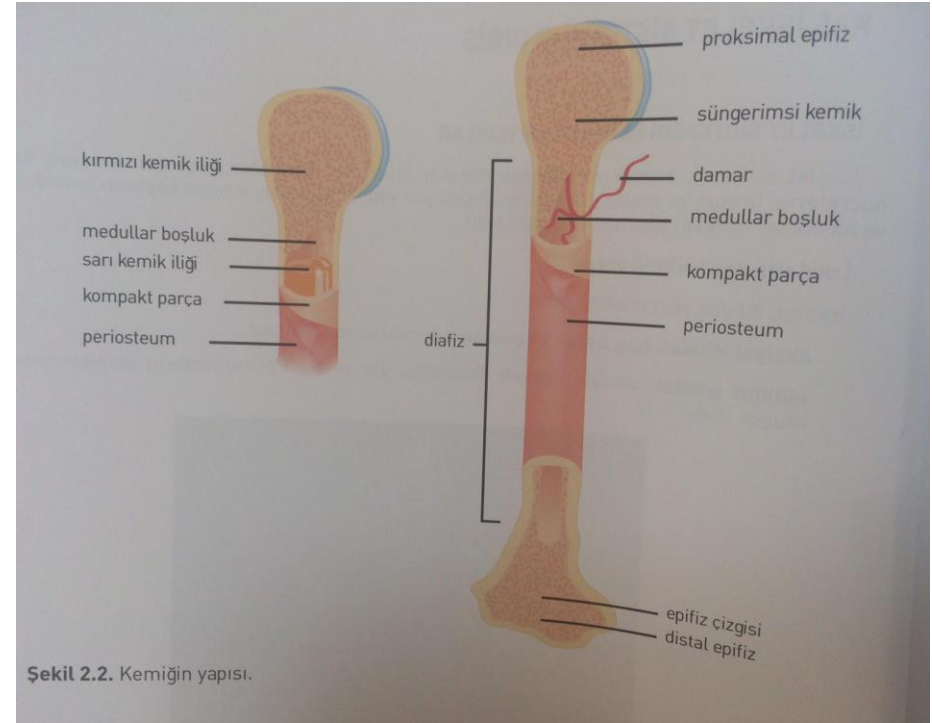
- Support
- Protection
- Movement
- Mineral supply
- Erythropoiesis

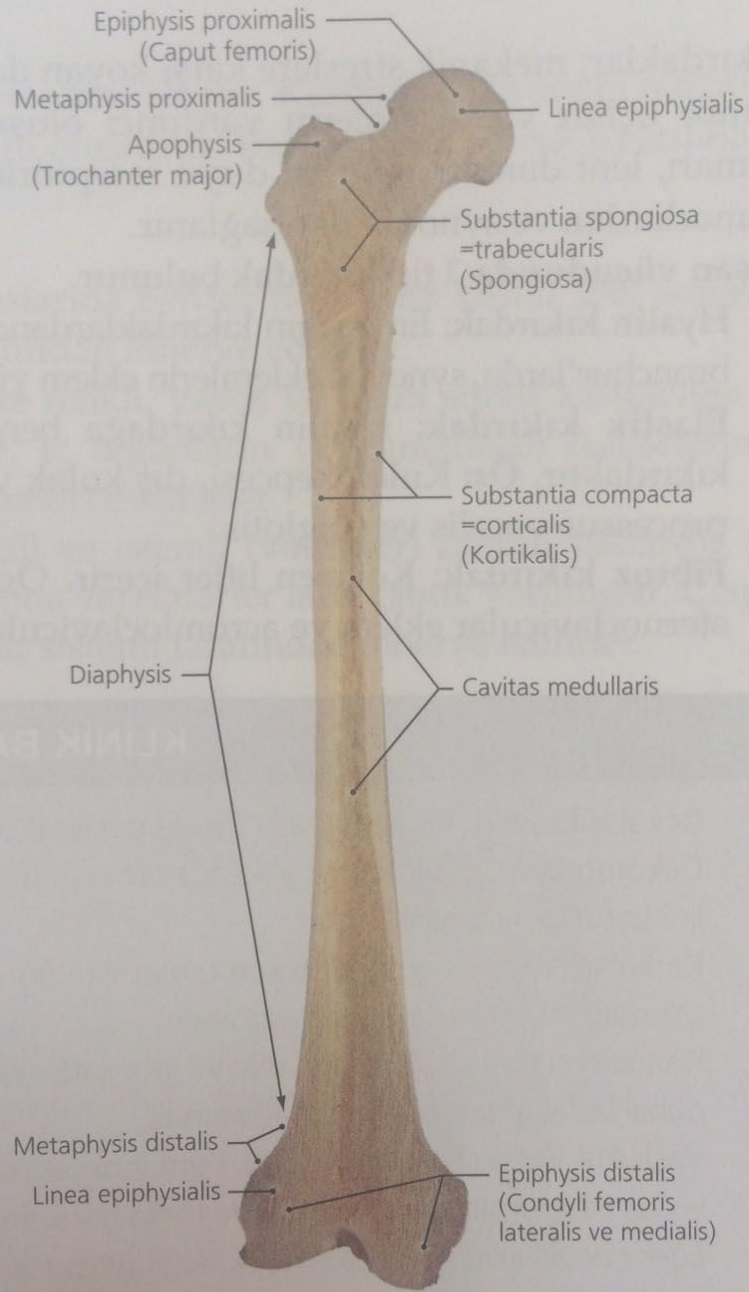
- 1/3 organic, 2/3 inorganic material.
- Spongioid
- Compact
- Ossification starts at the 9-10th week in the embryo, finishes at the age of 22-25

Bones are divided into 5 groups based on their shape :

- Long bones: Femur, humerus.
- Short bones: Ossa carpi et tarsi.
- Flat bones: calvaria bones, ribs, scapula, sternum.
- Irregular bones: Maxilla, ethmoid, sphenoid, pneumatic bones, vertebra, mandibula.
- Sesamoid bones: Patella, Os pisiforme
- Appendicular bones: Os trigonum, Os vesalinum, Os tibia externum

- The **epiphysis** is the rounded end of a long bone, at its joint with adjacent bone(s).
- **Between the epiphysis and diaphysis** (the long midsection of the long bone) lies the **metaphysis**, including the epiphyseal plate (growth plate)



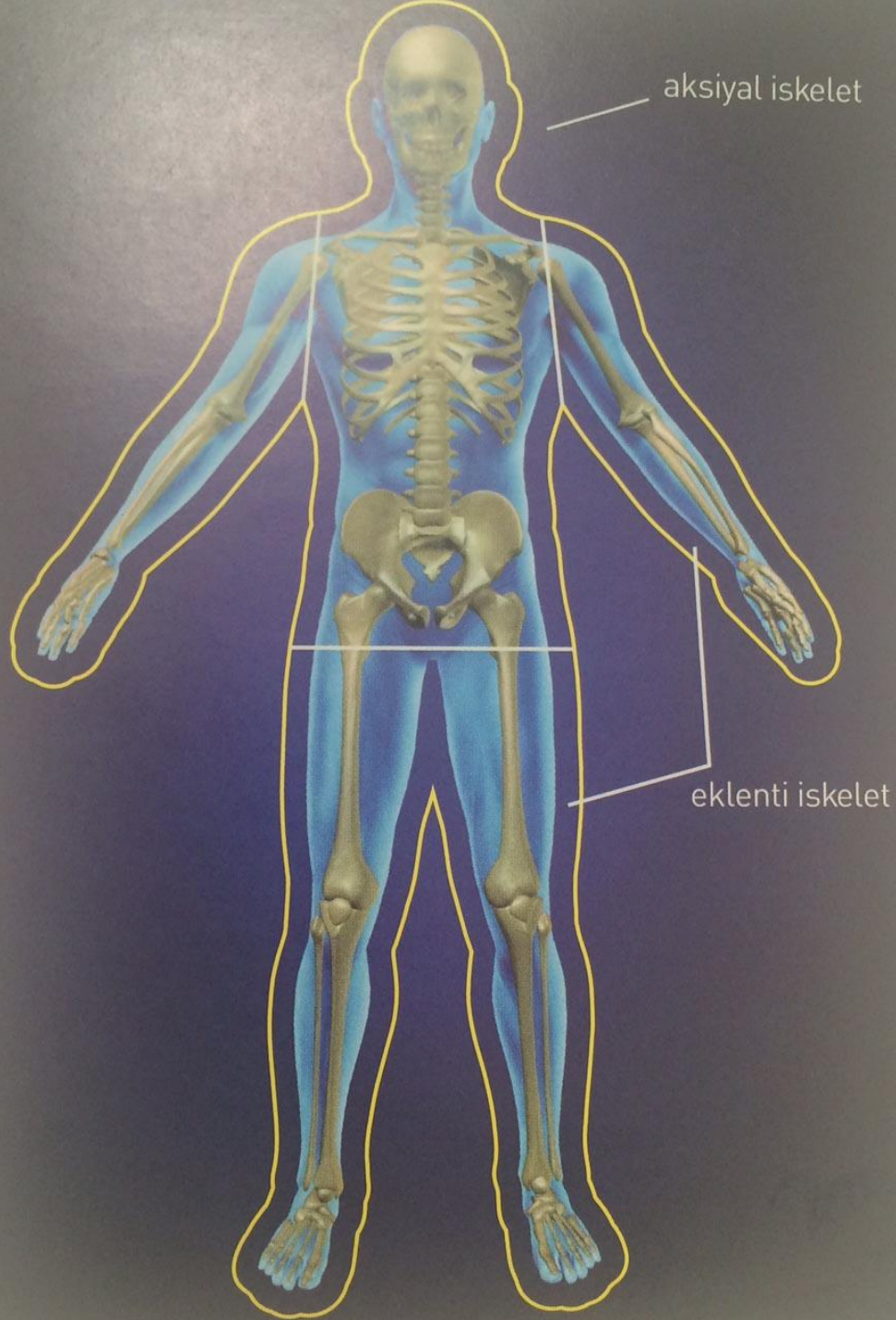


Şekil 2.3.

Kemiklerin makroskopik yapısı

Kemiklerle İlgili Sık Kullanılan Terimler

Terim	Anlamı
os	kemik
margo	kenar
foramen	delik
angulus	açı, köşe
canalis	kanal
fossa	çukur
sulcus	oluk
incisura	çentik
spina	diken gibi çıkıntı
processus	belirgin uzantı
tuberositas	kabartılı, pürtüklü yüzey
tuberculum	küçük tümsek
fissura	yarık
crista	çizgi halinde belirgin çıkıntı
linea	çizgi
caput	baş
collum	boyun
corpus	gövde



Axial skeleton (skeleton axiale)

- Columna vertebralis (26)
- Cranium (22)
- Os hyoideum (1)
- Costae-sternum (25)

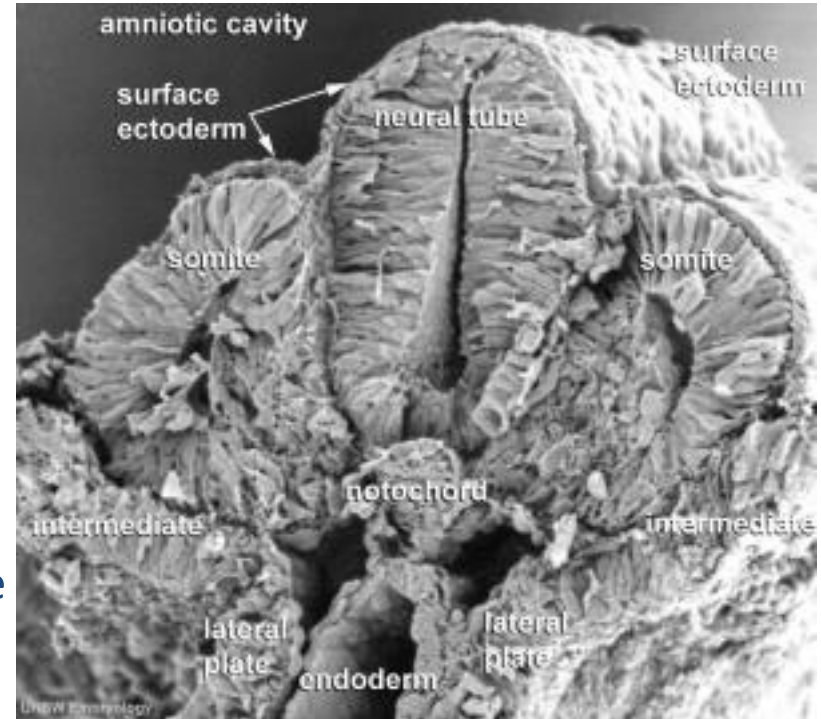
Skeleton appendiculare (extremiteler)

- Ossa membri superius (64)
- Ossa membri inferius (62)

Kulak kemikçikleri (6)

DEVELOPMENT OF THE MUSCULOSKELETAL SYSTEM

- The mesoderm forms nearly all the connective tissues of the musculoskeletal system. Each tissue (cartilage, bone, and muscle) goes through many different mechanisms of differentiation.
- The intraembryonic mesoderm can be broken into paraxial, intermediate and lateral mesoderm relative to its midline position. During the 3rd week the paraxial mesoderm forms into "balls" of mesoderm paired either side of the neural groove, called somites.
- Different regions of the somite differentiate into dermomyotome (dermal and muscle component) and sclerotome (forms vertebral column). An example of a specialized musculoskeletal structure can be seen in the development of the limbs.



AXIAL SKELETON

Vertebral column (Columna vertebralis)

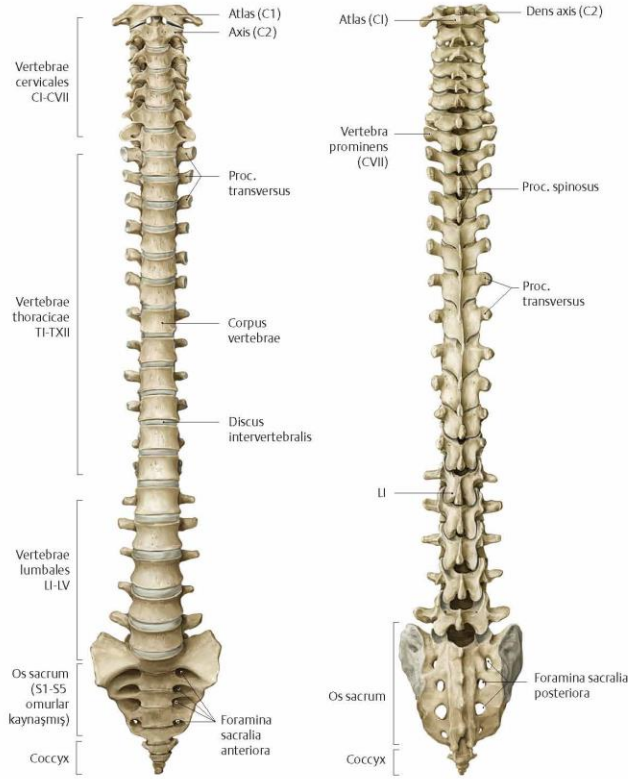
26 bones

- Cervical (boyun) vertebrae (7)
- Thoracal vertebrae omur (12)
- Lumbar vertebrae (5)
- Sacrum (5 fused vertebrae) (1)
- Coccyx (4 fused vertebrae) (1)

Omurga: Öğeler

Sirt

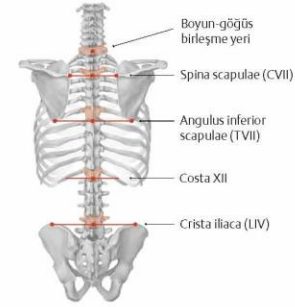
Şekil 1.3 Omurganın kemikleri



A Önden görünüş.

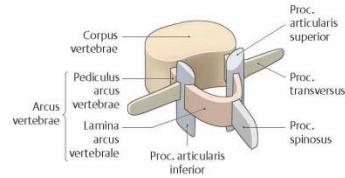
B Arkadan görünüş.

Şekil 1.4 Kılavuz noktası olarak elle hissedilebilen processus spinosus'lar
Arkadan görünüş. Fizik muayene sırasında kolayca hissedilen processus spinosus'lar önemli kılavuz noktalarıdır.

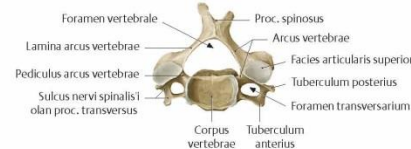
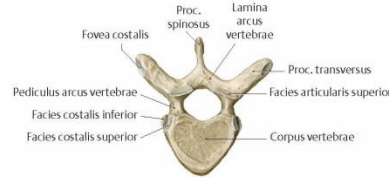
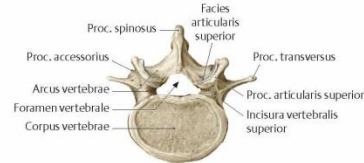
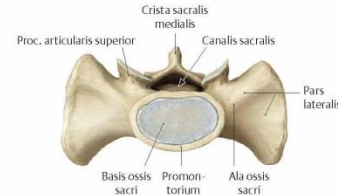


Şekil 1.5 Bir omurun yapısal öğeleri

Sol arka üstten görünüş. Atlas (C1) ve axis (C2) hariç tüm omurlar aynı yapısal öğelerden oluşur.

**Şekil 1.6 Tipik omur**

Üstten görünüş

**A** Boyun omuru (CIV).**B** Göğüs omuru (TVI).**C** Bel omuru (LIV).**D** Kuyruksokumu.

Tablo 1.1 Omurların yapısal öğeleri					
Vertebrae	Corpus	Foramen vertebrale	Proc. transversus	Proc. articularis	Proc. spinosus
Boyun omurları CIII [*] -CVII	Küçük (böbrek şekilli)	Büyük (üçgen)	Küçük (C7'de olmayabilir); tuberculum anterius ve posterius'lar foramen transversarium'u çevreler	Üst arkaya ve alt öne doğru; eğişik eklem yüzleri; çoğunlukla hemen hemen yatay	Kısa (CIII-CV); çatalı (CIII-CVI); uzun (CVII)
Göğüs omurları T1-TXII	Orta (yürek şekilli); kaburga yüzleri içerir	Küçük (dairesel)	Büyük ve kuvvetli; uzunluk T1'den TXII'ye doğru azalır; kaburga yüzleri (T1-TX)	Arkaya (hafif dişyana) ve öne (hafif içyana); eklem yüzleri dikkey düzlemde	Uzun, arka aşağıya doğru, eğimli; ucu bir aşağıdaki omur gövdesine kadar uzanır
Bel omurları L1-LV	Büyük (böbrek şekilli)	Orta (üçgen)	Uzun ve ince; arka yüzünde proc. accessorius var	Arka içyana (veya içyana) ve ön dişyana (veya dişyana) doğru; eklem yüzleri hemen hemen oksal düzlemde; her proc. articularis superior'um arka yüzünde proc. mammillaris vardır	Kısa ve geniş
Kuyruksokumu kemijü S1-SV (kaynaşmış)	Tabandan tepeye doğru azalır	Canalis sacralis	Gelişmemiş kaburgalarla kaynaşmış (kaburgalar, bak. s. 44-47)	Sağırın dışının üst yüzü üst arkaya (S1) doğrudur-facies auricularis	Crista sacralis mediana

*C1 (atlas) ve C2 (axis) atıpkı sayılır (bak. s. 6-7).

Omurga (Columna Vertebralis): Genel Bakış

SIRT



Omurga 4 bölgeye ayrılır: boyun, göğüs, bel ve kuyruksokumu omurgası. Boyun ve bel omurları lordosis (içbükey eğrilik), göğüs

ve kuyruksokumu omurları kyphosis (dışbükey eğrilik) gösterir.

Şekil 1.1 Kuyruk sokumu omurları

Sol yandan görünüş.

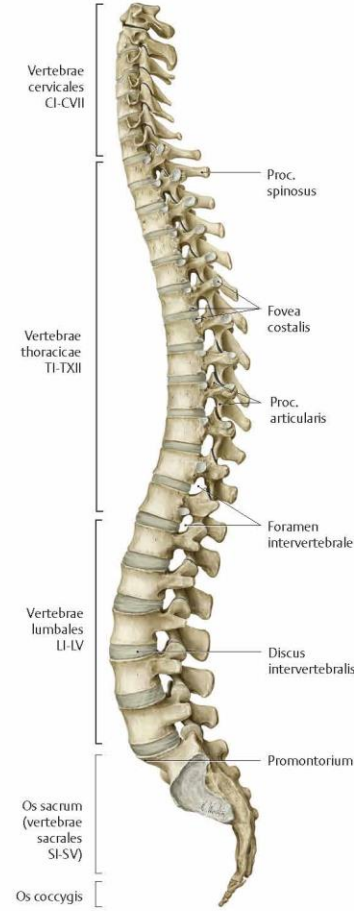
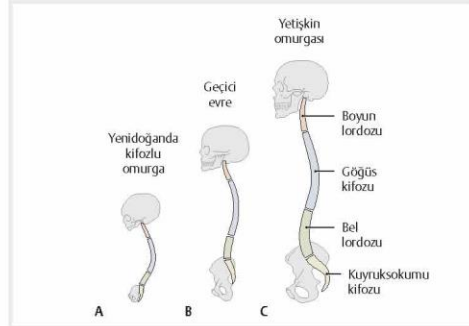


A Omurganın bölümleri.

Klinik

Omurga Gelişimi

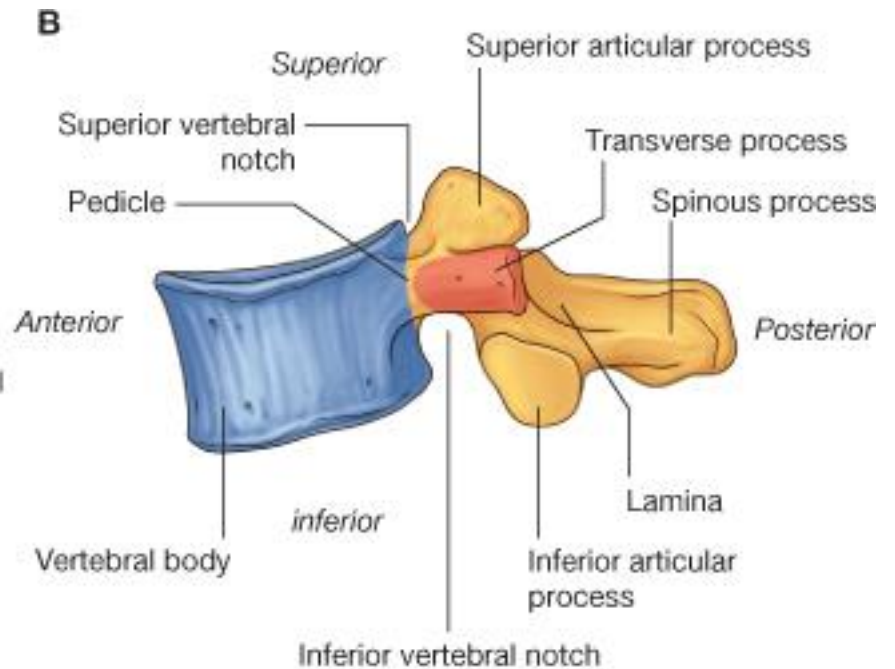
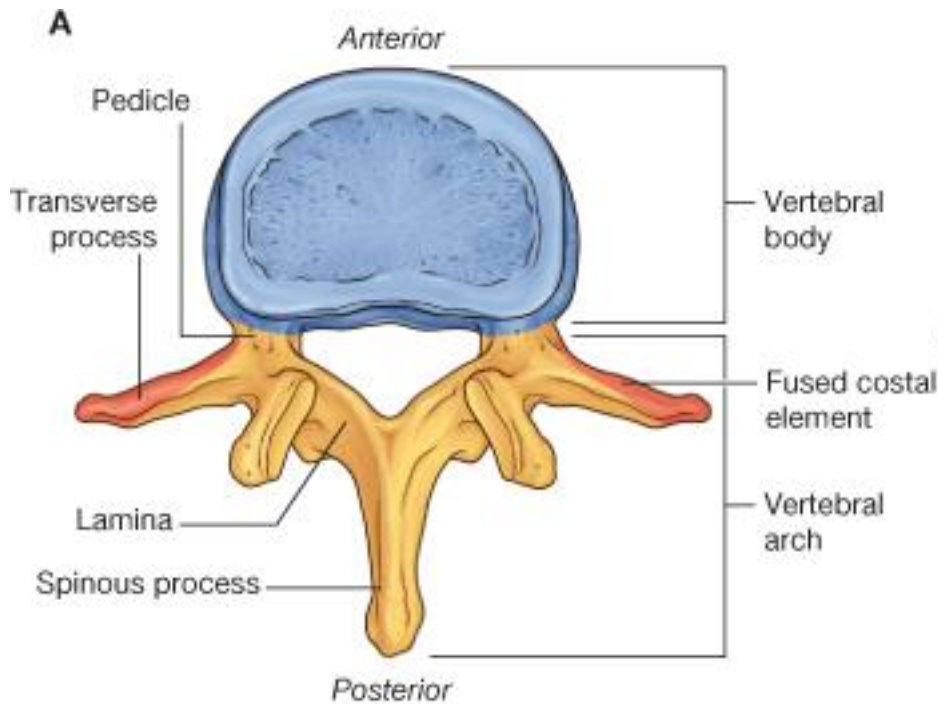
Yetişkin omurgasının karakteristik eğriliği doğum sonrası gelişim boyunca ortaya çıkar, yenidoğanda kısmen oluşmuştur. Yenidoğan kyphosis şeklinde omurga eğriliğine sahiptir (A); sonra lordosis lumbalis gelişir (elsik) ve oluşumunu pubertede tamamlar (C).



B Ossa columna vertebralis.

- There are 24 **presacral vertebrae**
-
- Thoracic and sacral curvatures (kyphosis) are primary curvatures, cervical and lumbar lordosis are secondary curvatures.
- Scoliosis is a pathological deviation in the sagittal plane



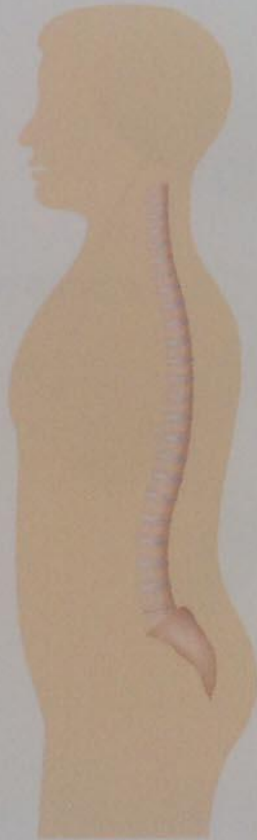


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Every vertebra has a body and a vertebral arch which has several processes (articular, transverse, and spinous) for articular and muscular attachments.



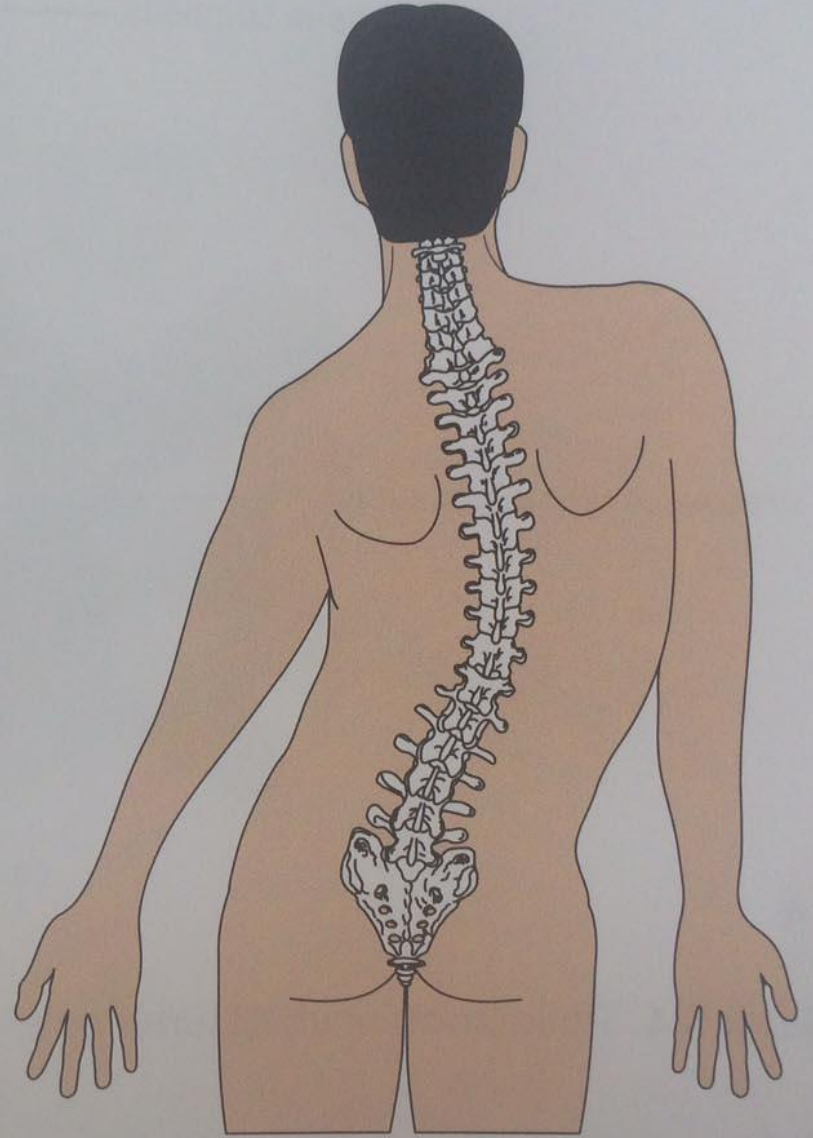
KIFOZ



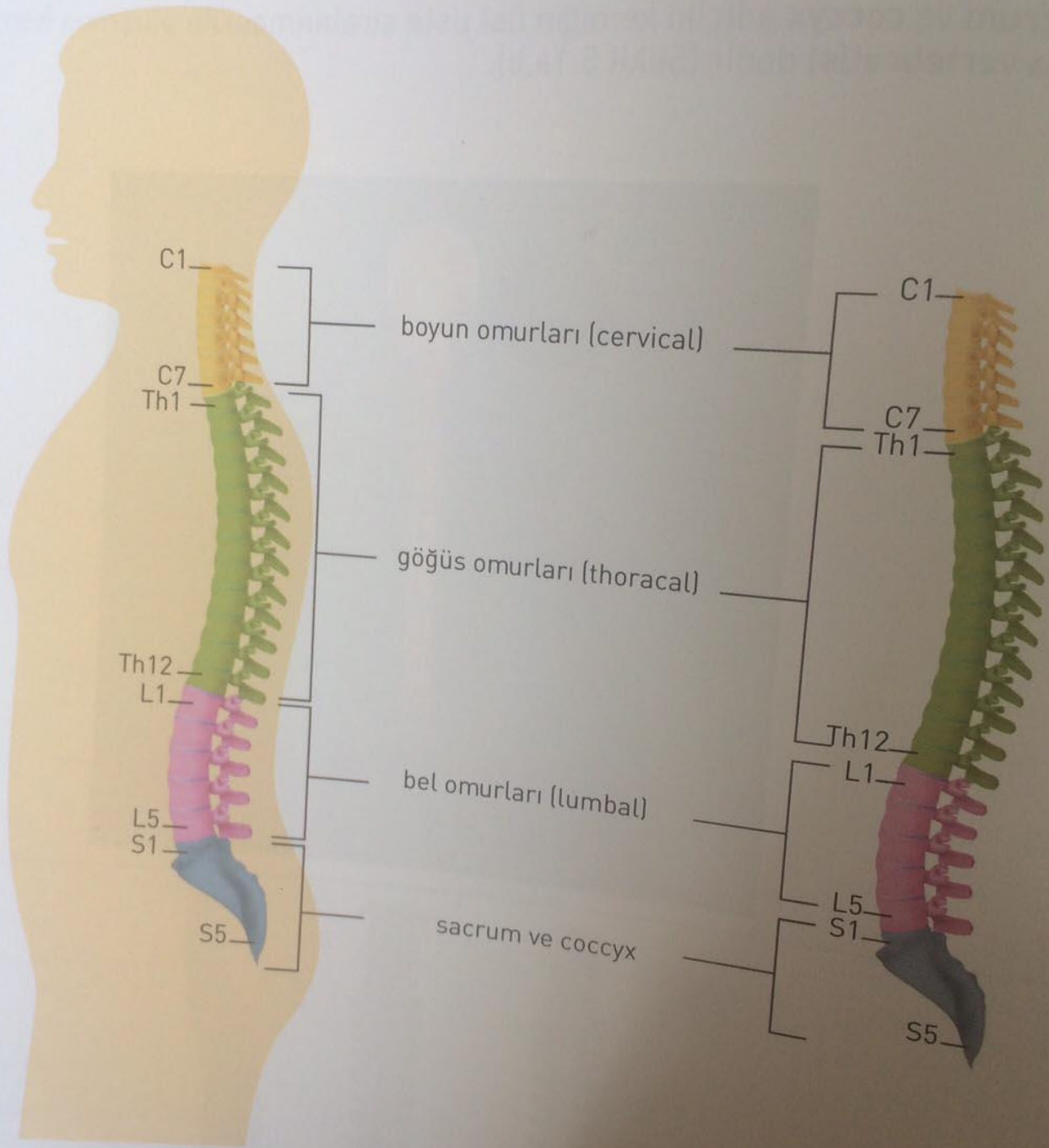
NORMAL

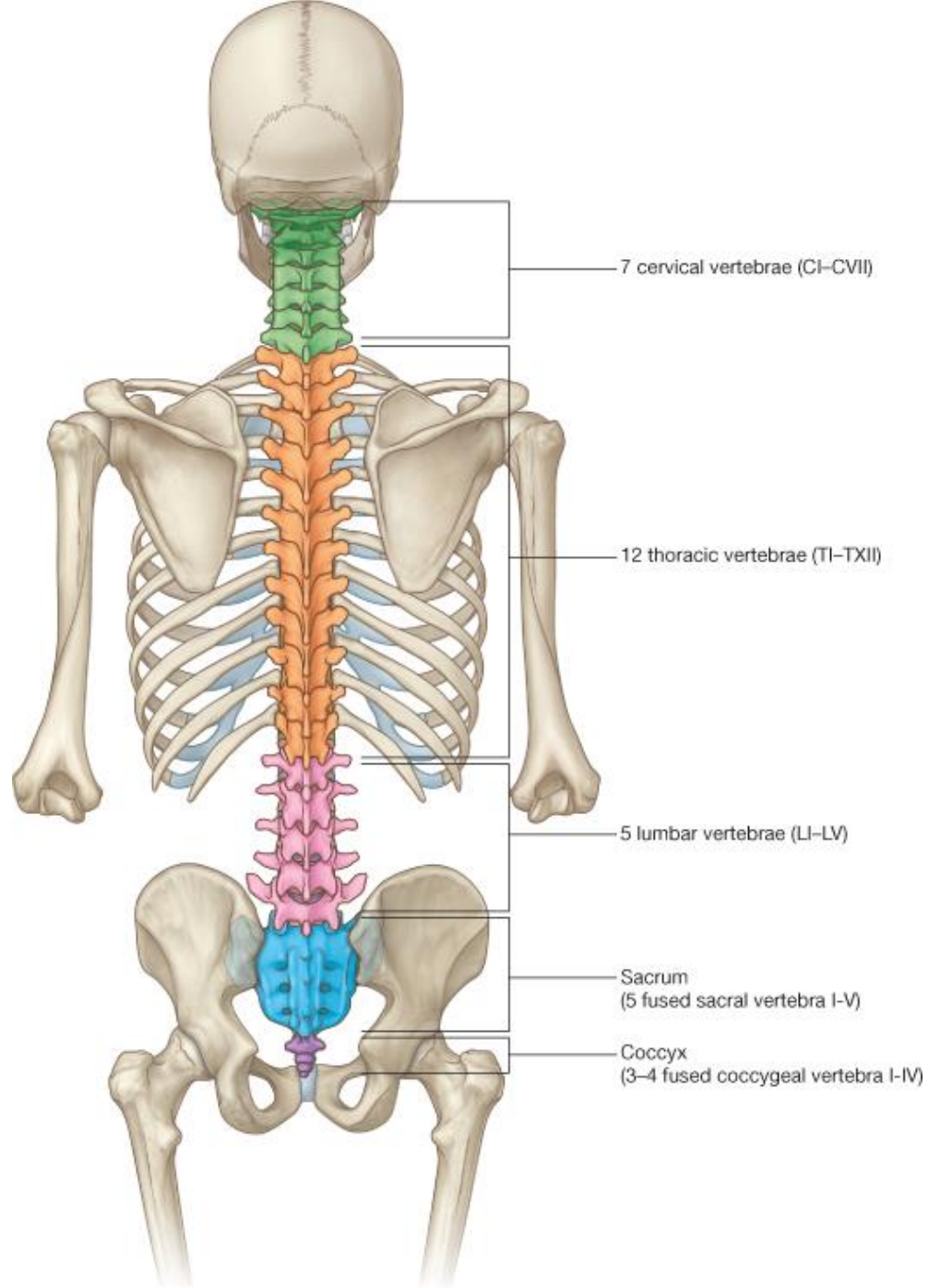


LORDOZ

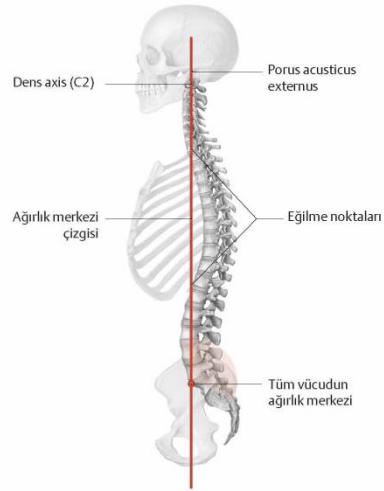


SKOLYOZ

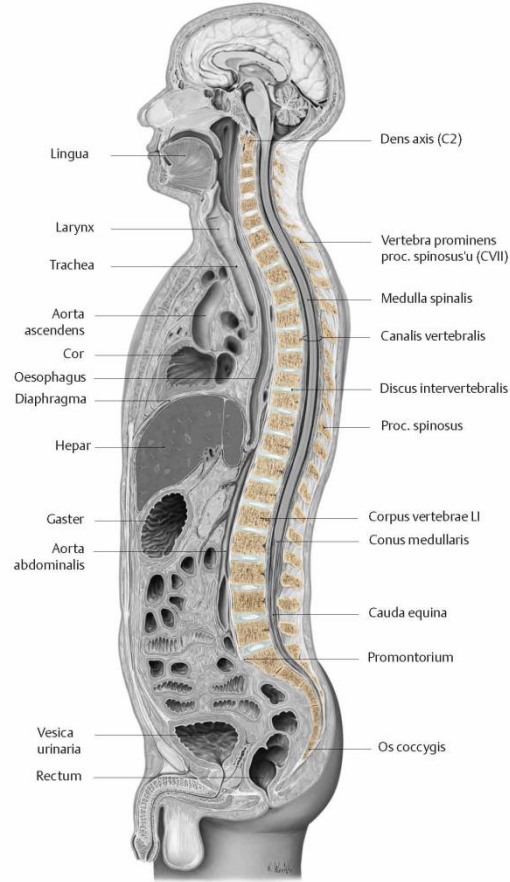




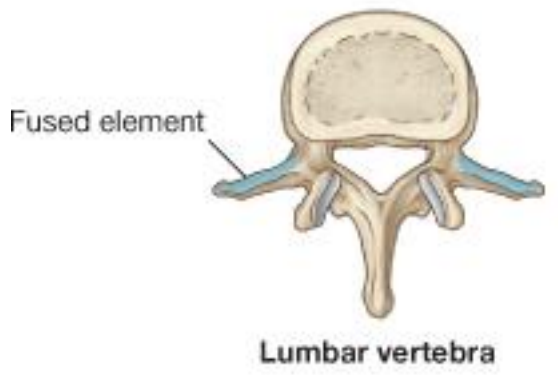
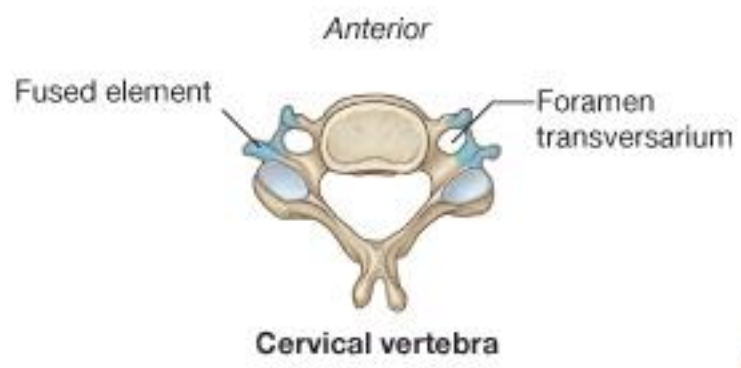
Şekil 1.2 Omurganın normal anatomik konumu
Sol yandan görünüşü.



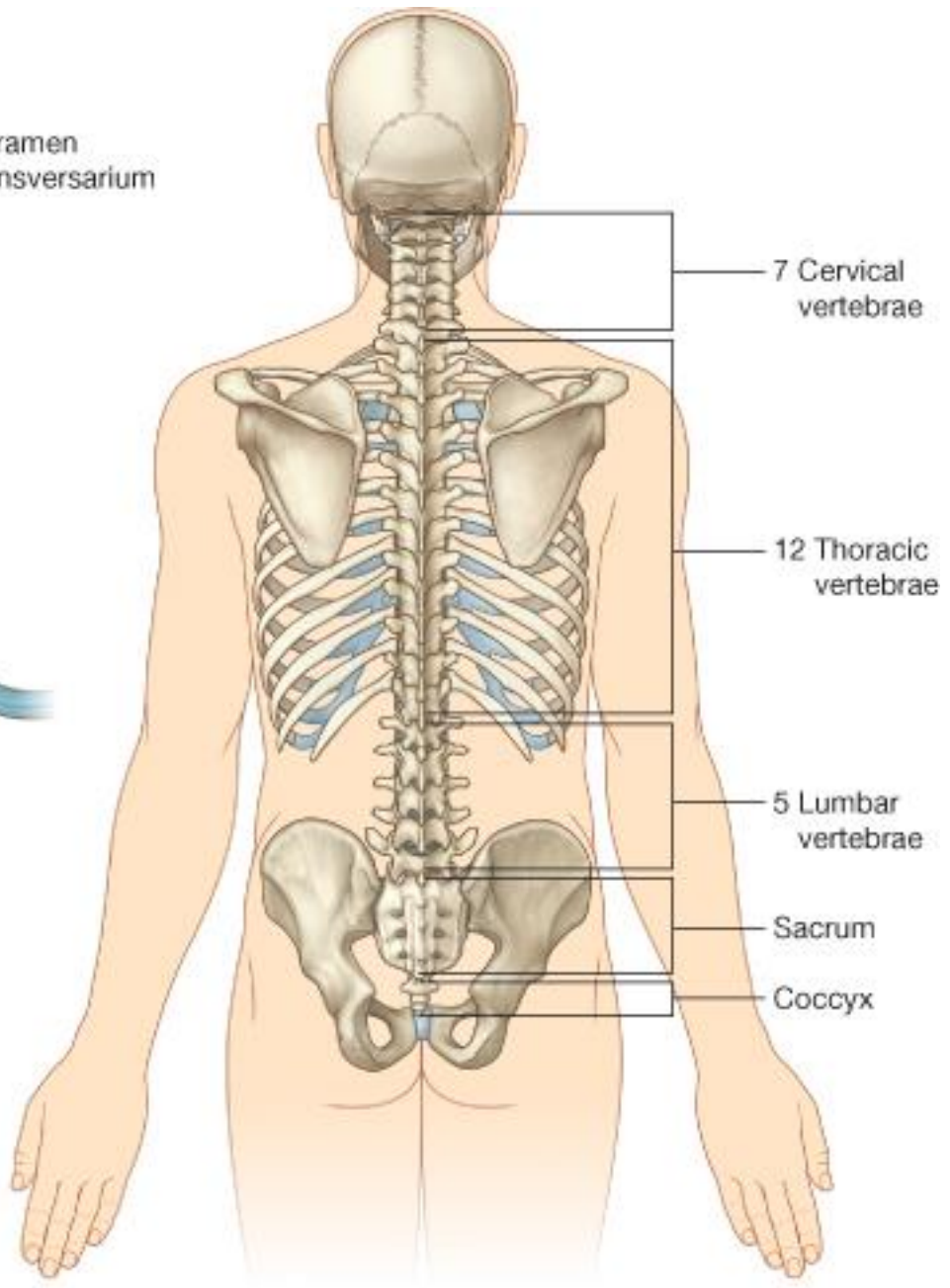
A Ağırılık merkezi çizgisi. Ağırılık merkezi çizgisi, boyun-göğüs ve torakolumbar göğüs-bel birleşme yerlerindeki eğilme noktalarını kapsayan belli anatomik noktalardan geçer. Kalça eklemi, diz ve ayak bileğinden geçmeden önce, promontorium ossis sacri'nin ön tarafındaki ağırılık merkezinden geçer.



B Yetişkin erkekte orta oksal kesit.

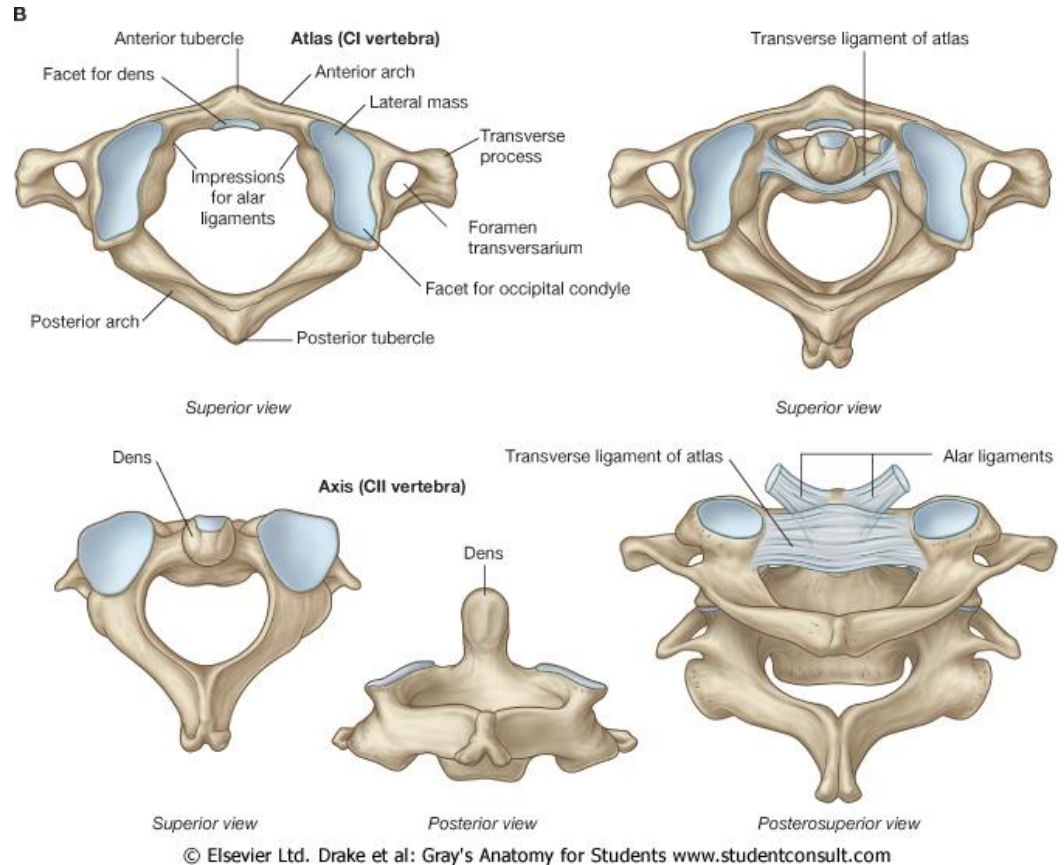


Posterior



Cervical Vertebrae

- There are seven cervical vertebrae in the human body.
- C1 and C2 (called the atlas and axis respectively), are specialised to allow for the movement of the head.



Atlas articulates with the occipital bone. It has no vertebral body and no spinous process.

It also has an articular facet anteriorly, which articulates with the dens of the axis. and does not have a body.



- The axis (C2) is easily identifiable due to its dens (odontoid process – dens axis) which extends superiorly from the anterior portion of the vertebra.
- The dens articulates with the articular facet of the atlas, in doing so creating the medial atlanto-axial joint.
- This allows for rotation of the head independently of the torso.



Cervical vertebrae: 7

1st cervical vertebra atlas,

2nd cervical vertebra: axis

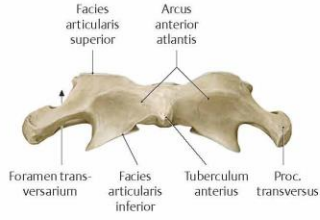


Boyun omurgası yaralanmaları

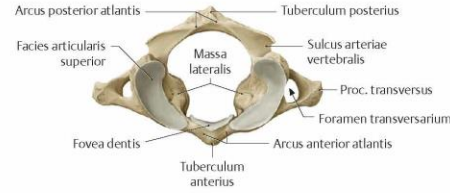
Boyun omurgası "kamçı darbesi" gibi hiperekstansiyon yaralanmalarına eğilimlidir, araba kazalarında olduğu gibi baş normalde olduğundan çok daha fazla ekstansiyona gelir. En yaygın boyun omurgası zedelenmeleri dens axis kırıkları, travmatik spondilolistesis (omur gövdesinin öne kayması) ve atlas kırıklarıdır. Hastalığın süresi ve gelişimi büyük oranda zedelenmenin düzeyine bağlıdır (s. 600).



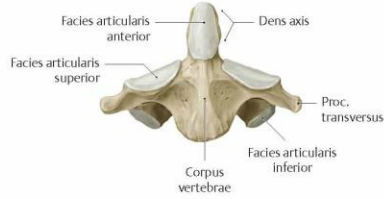
Emniyet kemerini takmamış bu hasta, arabaasının gösterge paneline çarpmıştır. Hiperekstansiyonun neden olduğu CII'de travmatik spondilolistesis ile birlikte arcus vertebra kırığı ve CII-CIII arasındaki bağlarda yırtılma oluşmuştur. Bu zedelenme "celat kırığı" olarak bilinir.



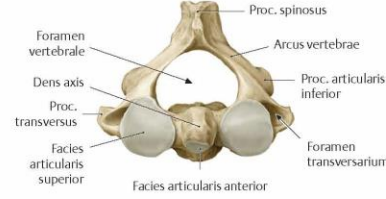
B Önden görünüş.



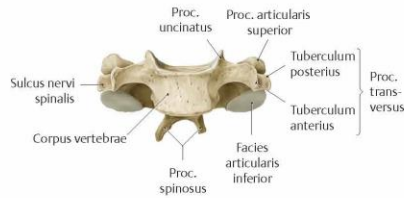
C Üstten görünüş.



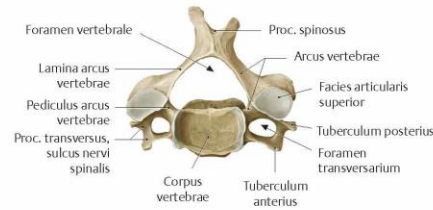
B Önden görünüş.



C Üstten görünüş.



B Önden görünüş.



C Üstten görünüş.

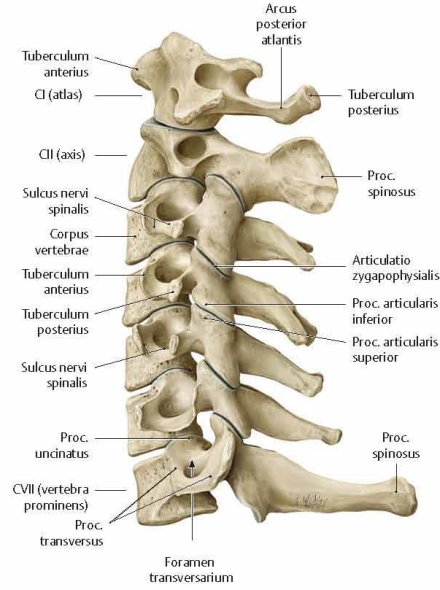
Boyun Omurları (Vertebrae Cervicales)

Sirt

Şekil 1.7 Boyun omurgası genel omur yapısından belirgin olarak farklıdır. Başın ağırlığını taşımak için ve bütün yönlerde boyun hareketine izin vermek için özelleşmişlerdir. C1 ve C2 sırasıyla atlas ve axis

olarak bilinir. CVII uzun ve elle hissedilen processus spinosus'u nedeniyle vertebra prominens olarak isimlendirilir.

Şekil 1.7 Boyun omurgası
Soldan görünüşü.

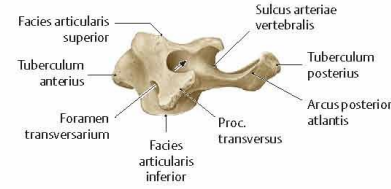


A Boyun omurgası, sol yandan görünüşü.



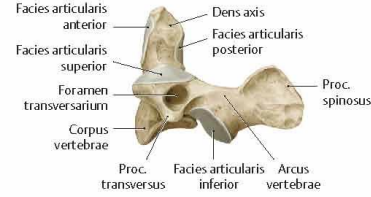
B Boyun omurga radyografisi, sol yandan görünüşü.

Şekil 1.8 Atlas (C1)



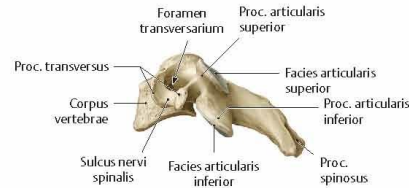
A Sol yandan görünüşü.

Şekil 1.9 Axis (C2)



A Sol yandan görünüşü.

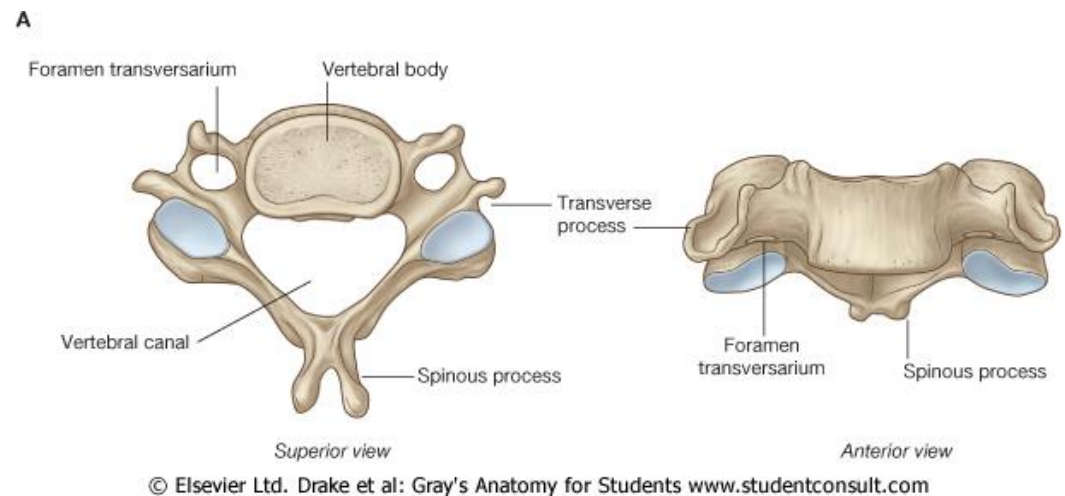
Şekil 1.10 Tipik boyun omuru (CIV)



A Sol yandan görünüşü.

- The C7 vertebrae has a much longer spinous process, which does not bifurcate.
vertebrae prominens

- Foramen transversarium is found only in cervical vertebrae.
- Vertebral artery and vein pass through the vertebral foramina.

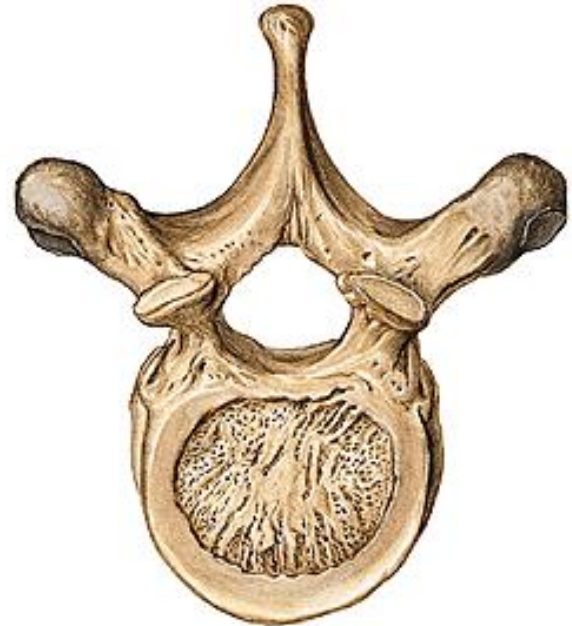


Thoracic vertebrae

12

Lumbar vertebrae

5

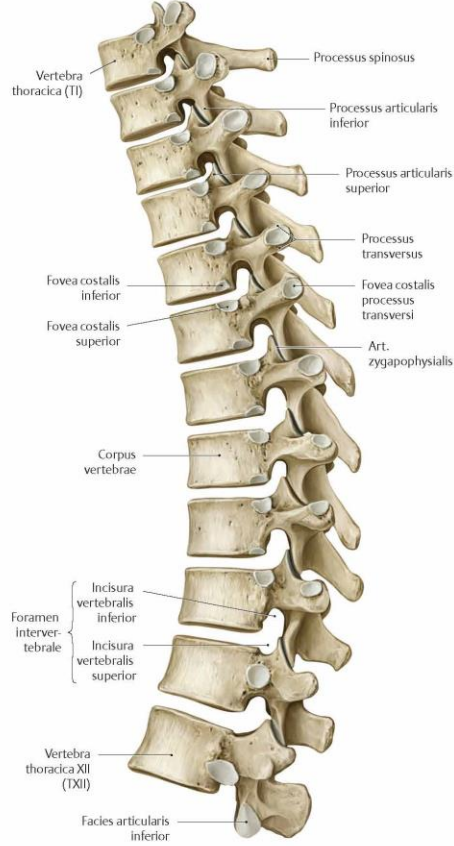


- The twelve thoracic vertebrae are medium-sized, and increase in size as they move down the back. Their main function is to articulate with ribs, producing the bony thorax.
- Each thoracic vertebrae has two demi facets (**fovea costalis** superior and inferior) on each side of its vertebral body. These articulate with the head of the respective rib, and the rib inferior to it. On the transverse processes of the thoracic vertebrae there is a costal facet for articulation with its respective rib.

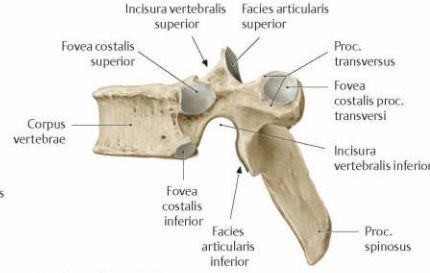
Göğüs ve Bel Omurları (Vertebrae Thoracicae & Lumbales)

Sirt

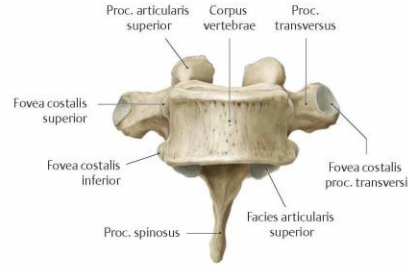
Şekil 1.11 Omurganın göğüs bölümü
Sol yandan görünüş.



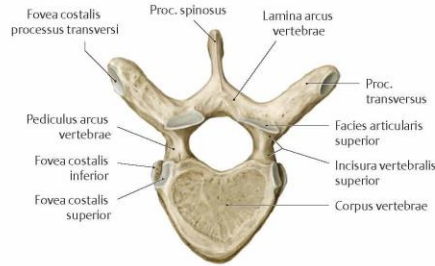
Şekil 1.12 Tipik bir göğüs omuru (TVI)
A Sol yandan görünüş.



A Sol yandan görünüş.



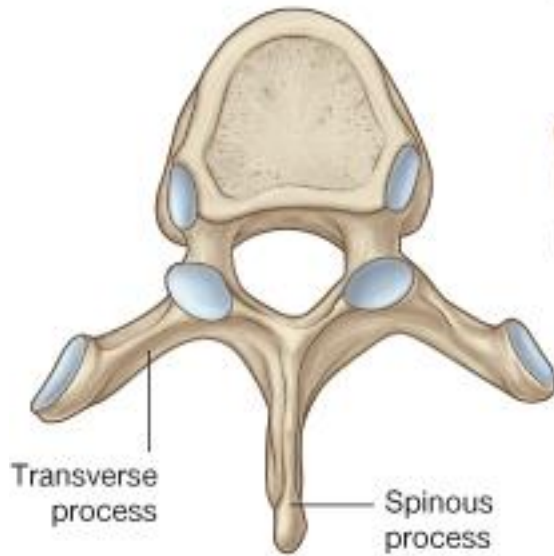
B Önden görünüş.



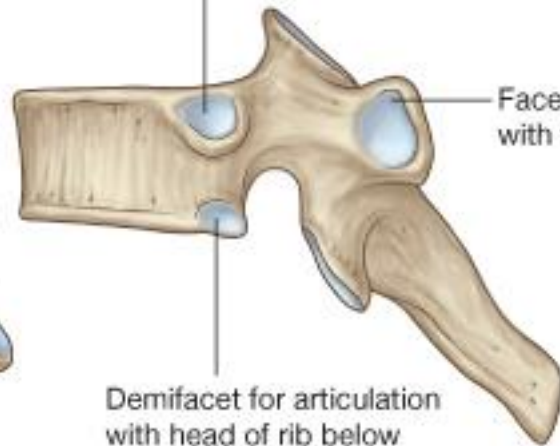
C Üstten görünüş.

C

Demifacet for articulation with head of rib



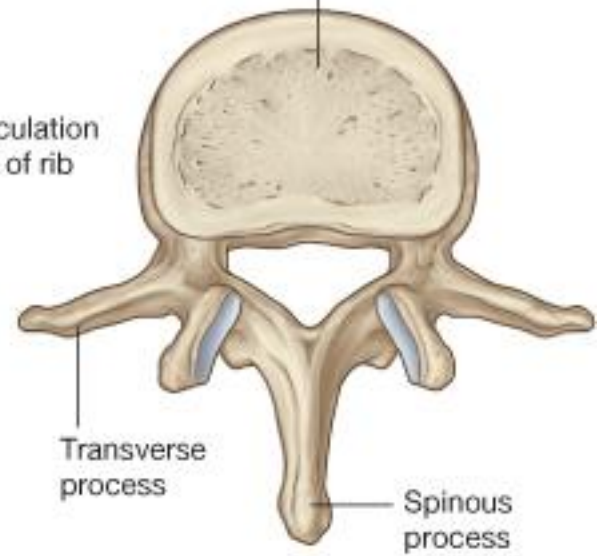
Superior view



Lateral view

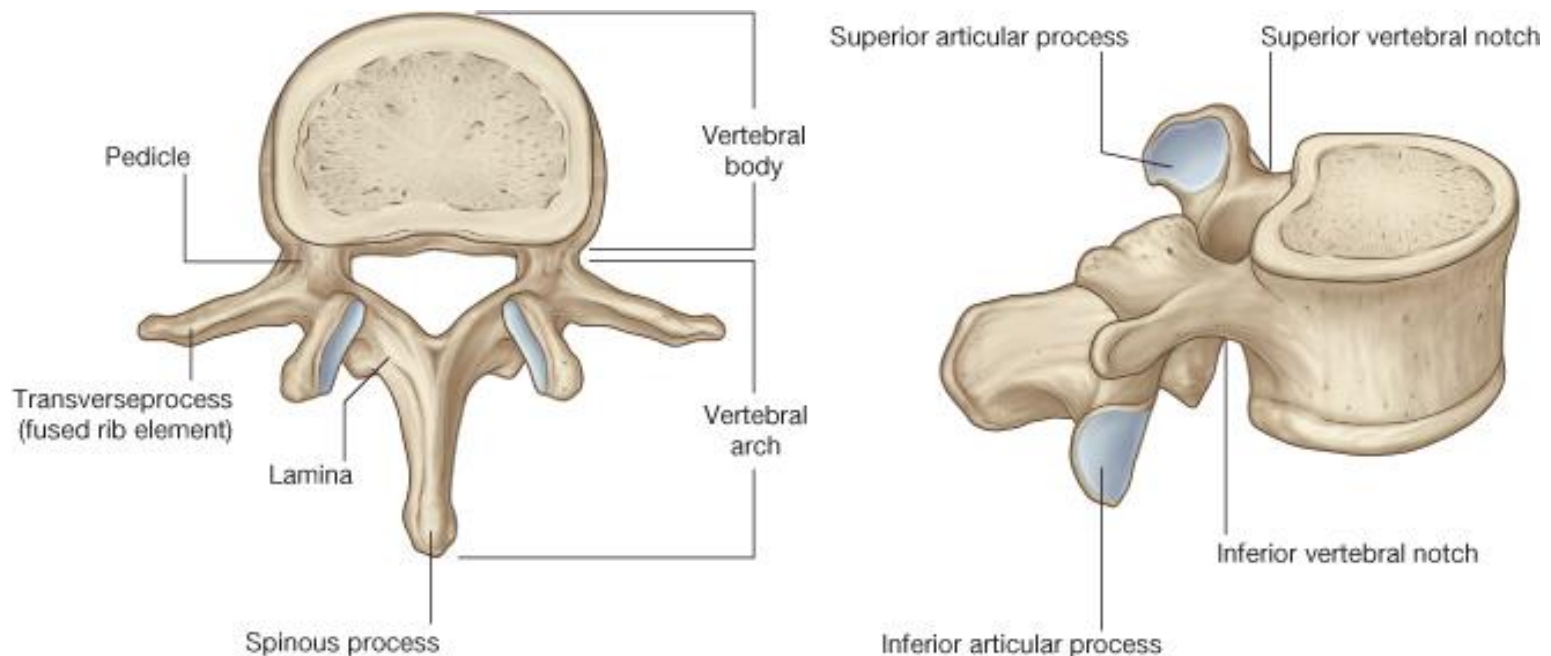
D

Vertebral body

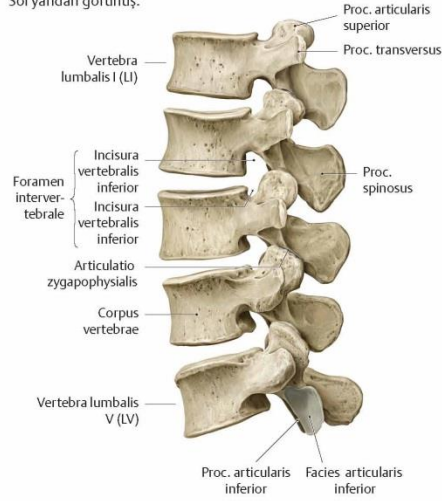


Superior view

- **Lumbar vertebrae have very large vertebral bodies, which are kidney-shaped.**
- They act to support the weight of the upper body.



Şekil 1.13 Omurganın bel bölümü
Sol yandan görünüş.



Klinik

Osteoporoz

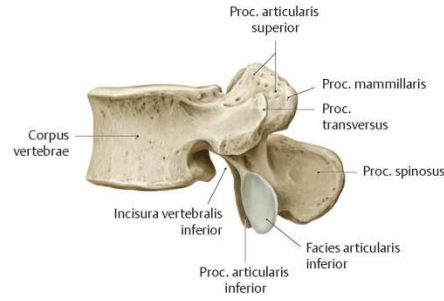
İskelet sisteminde artroz ve osteoporoz gibi dejeneratif hastalıklardan en çok etkilenen yapı omurgadır. Osteoporozda kemik maddesi üretildiğinden daha fazla yıkılır, bu da kemik kütesinin kaybına yol açar. Belirtilerden biri sırt ağrısına neden olan basınç kırıklardır.



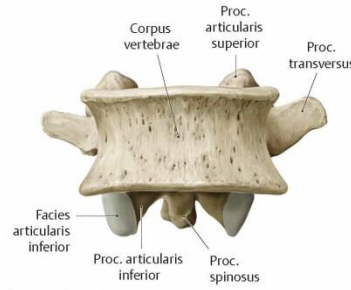
A Normal bel bölgesi radyografisi, sol yandan görünüş.

B Osteoporozlu bir omurganın radyografisi. Omur gövdeleri özkütle olarak azalmış ve iç trabeküler yapı kabalaşmıştır. Alt ve üst uçtaki kemik ince katdan kılınmıştır.

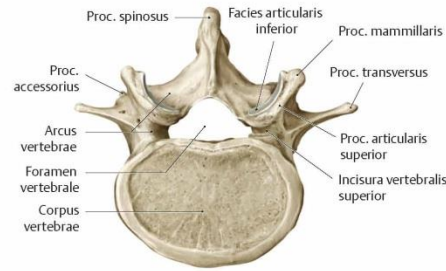
Şekil 1.14 Tipik bir bel omuru (LIV)



A Sol yandan görünüş.



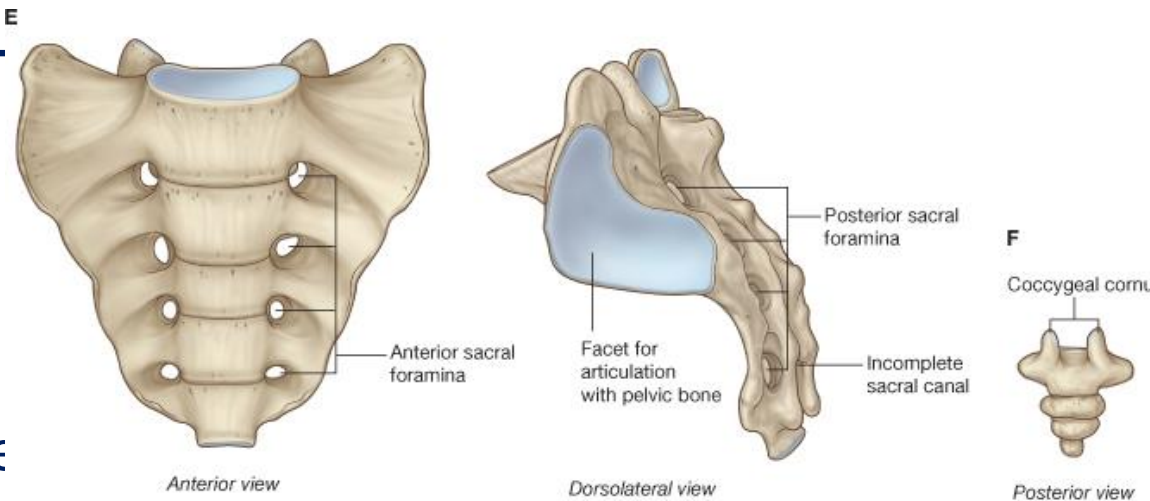
B Önden görünüş.



C Üstten görünüş.

Sacrum

- The sacrum is a collection of five fused vertebrae. It is described as an upside down triangle, with the apex pointing inferiorly. The first 3 vertebrae are larger.
- **Foramina sacralis pelvina** – ventral roots of spinal nerves exit from here.
- **Foramina sacralis dorsalia** – dorsal roots of spinal nerves exit from here.
- The basis connects with the 5th lumbar vertebrae and makes the promontorium..
- The last 2 sacral vertebrae does not have vertebral arches.



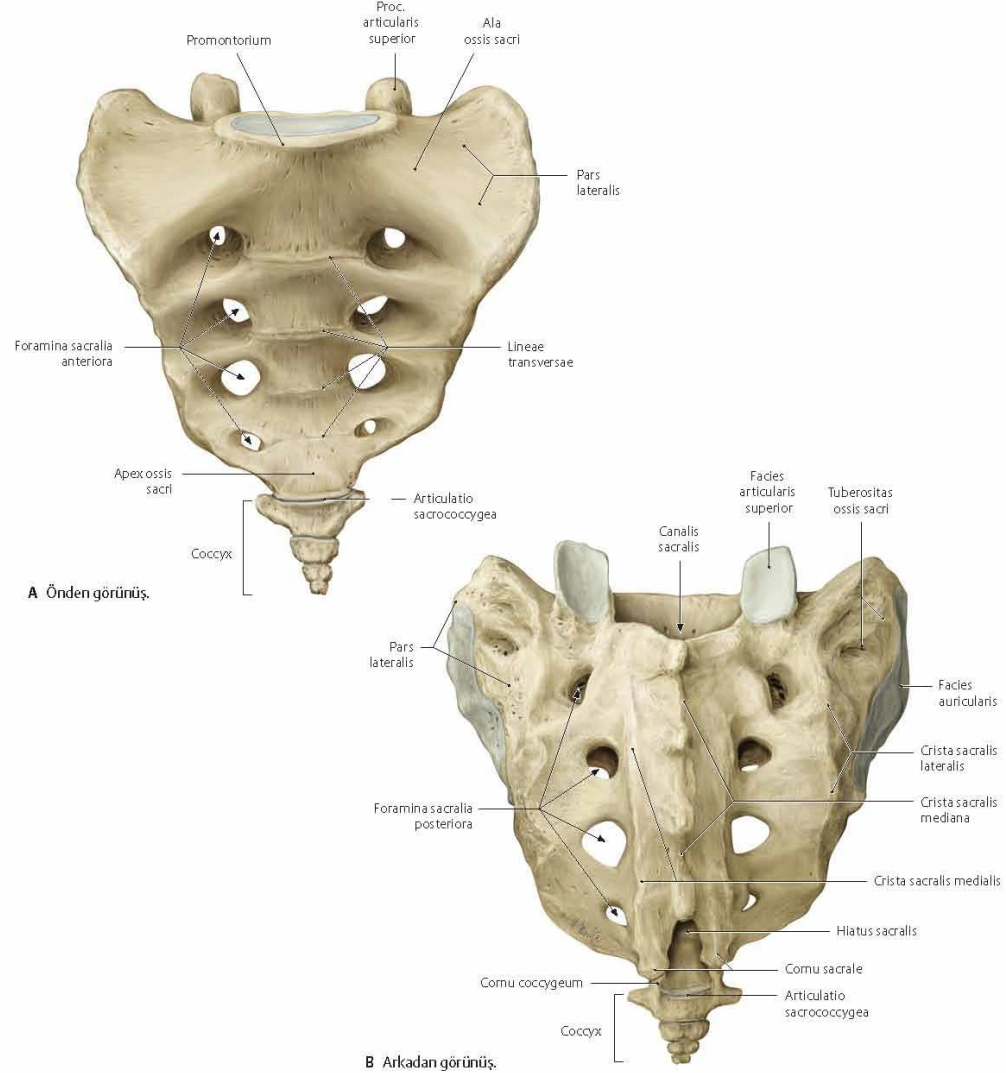
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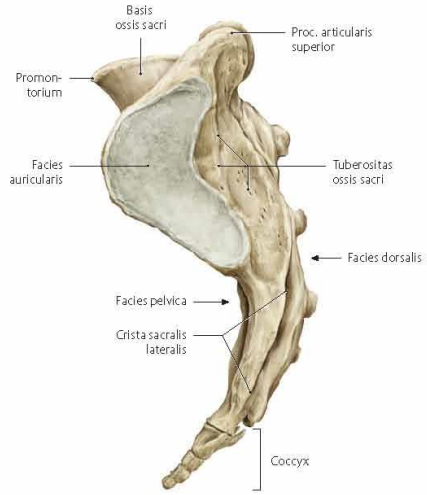
Sağı; Kuyruksokumu Kemiği (Os Sacrum) ve Kuyruk Kemiği (Os Coccygis)

Kuyruksokumu kemiği, doğum sonrası kaynaşmış olan beş sağrı omurundan oluşur. Kuyruksokumu kemiğinin basis'i 5. bel omuru

ile, apex'i üç-dört gelişmemiş omurdan oluşan kuyruk kemiği ile eklem yapar.

Şekil 1.15 Kuyruksokumu kemiği ve kuyruk kemiği



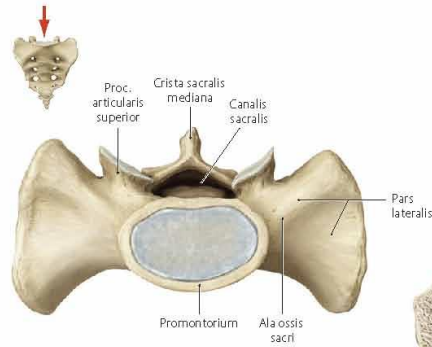


C Sol yandan görünüş.

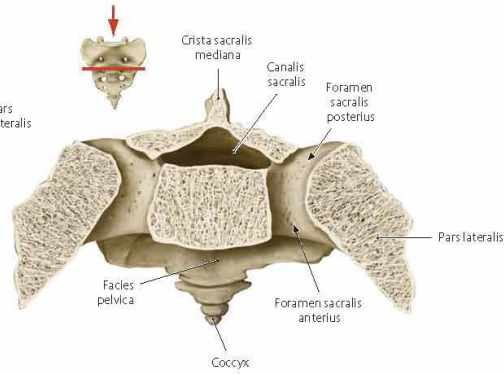


D Kuyruksokumu kemiği (Sacrum), ön-arka görünüş.

Şekil 1.16 Kuyruksokumu kemiği
Üstten görünüş.

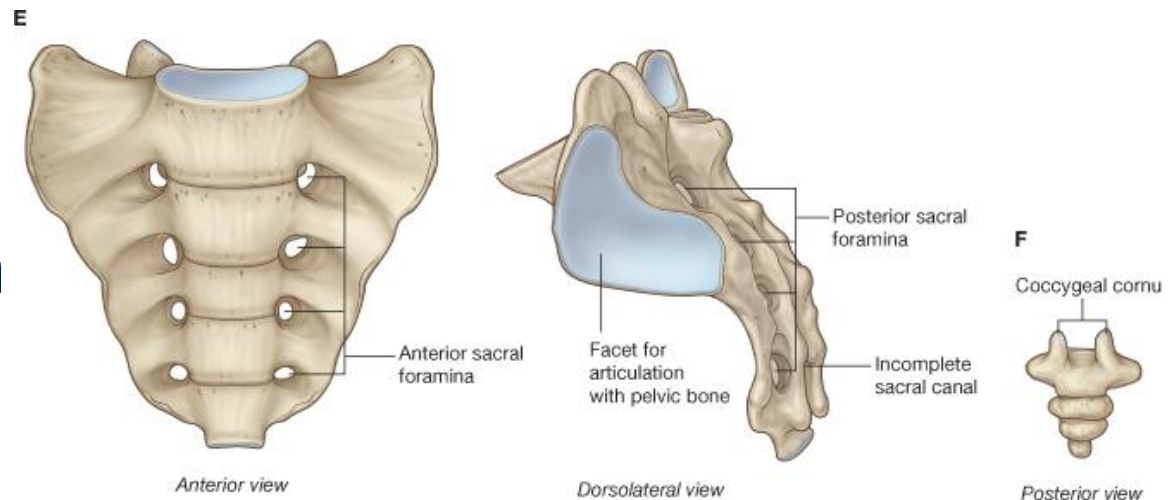


A Basis ossis sacri, üstten görünüş.



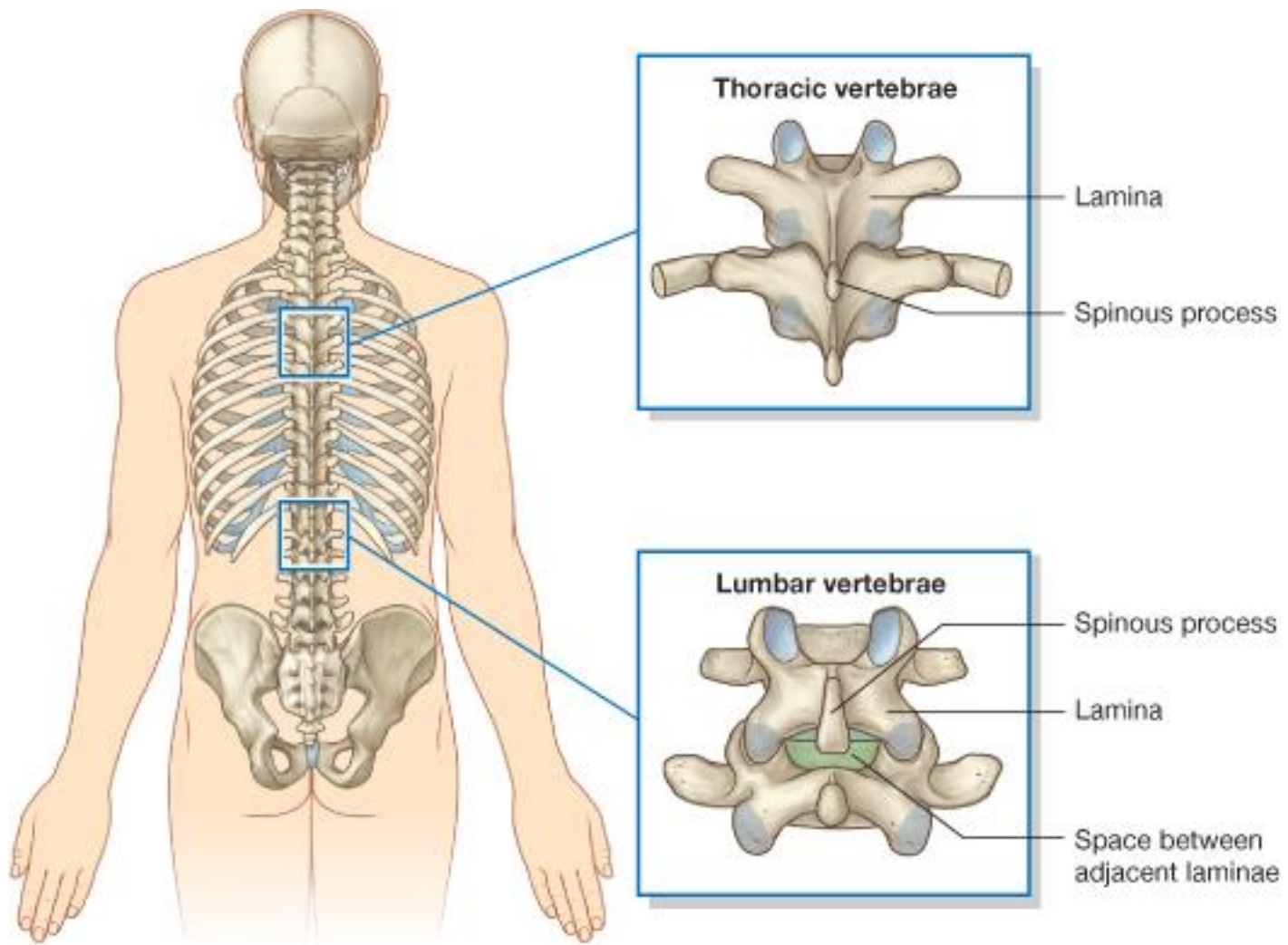
B 2. sağrı omurundan geçen yatay kesitte ön ve arka foramina sacralia görülmektedir. Üstten görünüş.

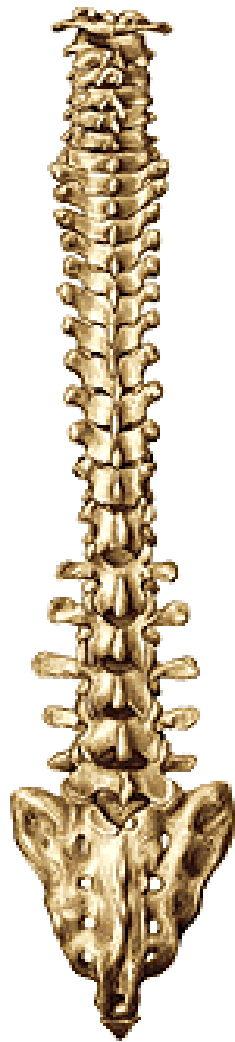
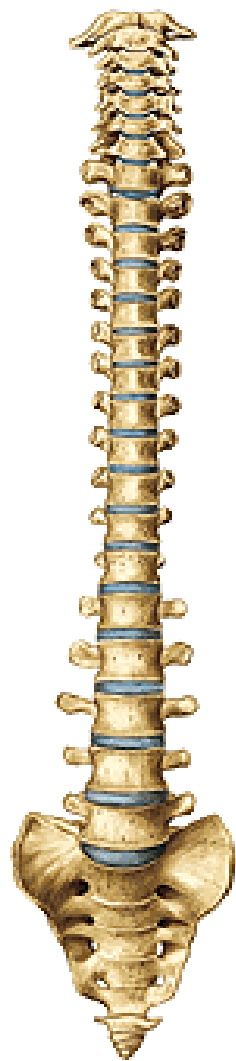
- **Os coccyx** is a small bone, which articulates with the apex of the sacrum.



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Consists of 3-4 fused vertebrae





- . Foramina transversaria are present only in the cervical vertebrae.

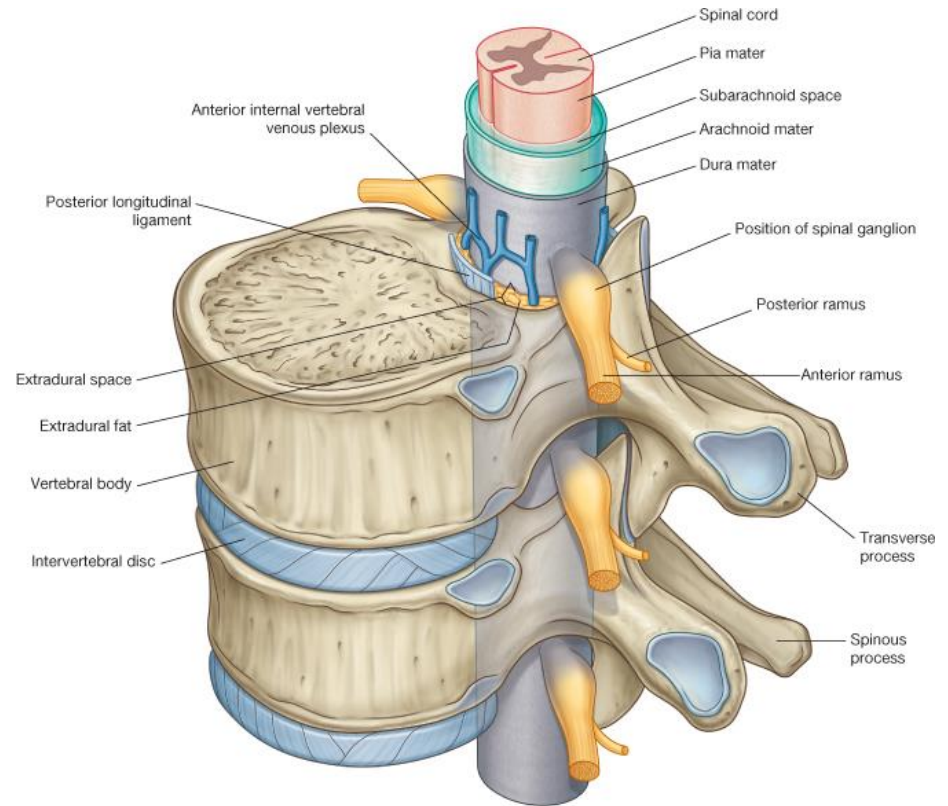
- . Costal facets are present only in thoracal vertebrae.

- . Mammillary processes and accessory processes are found only in lumbar vertebrae.

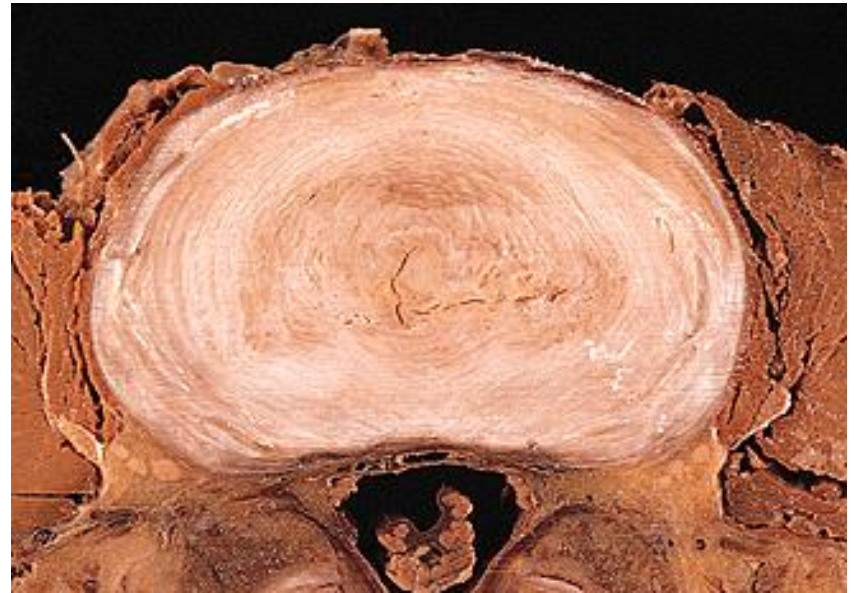
- . Lumbar vertebrae bodies are large

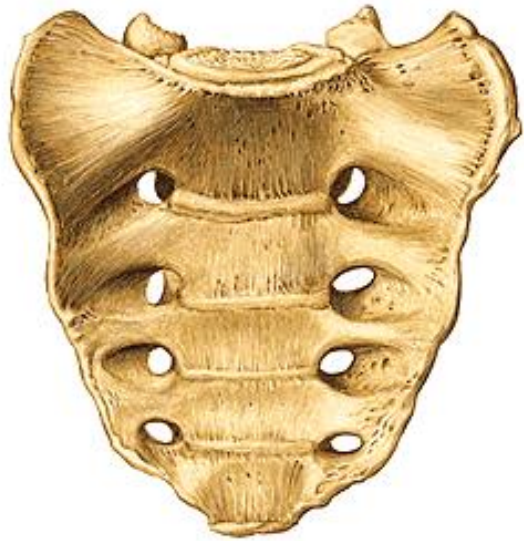
- . Spinous processes of the cervical vertebrae are bifurcated.

- The upper and lower surfaces of the vertebral body are spongy.
- **symphysis type junction between vertebrae**
- Vertebral foramina make the vertebral canal. The spinal cord is in the vertebral canal.
- The spinal nerves exit from the intervertebral foramina.



- There are 23 intervertebral discs
- About $\frac{1}{4}$ of the vertebral column length is discs, $\frac{3}{4}$ vertebral bones.





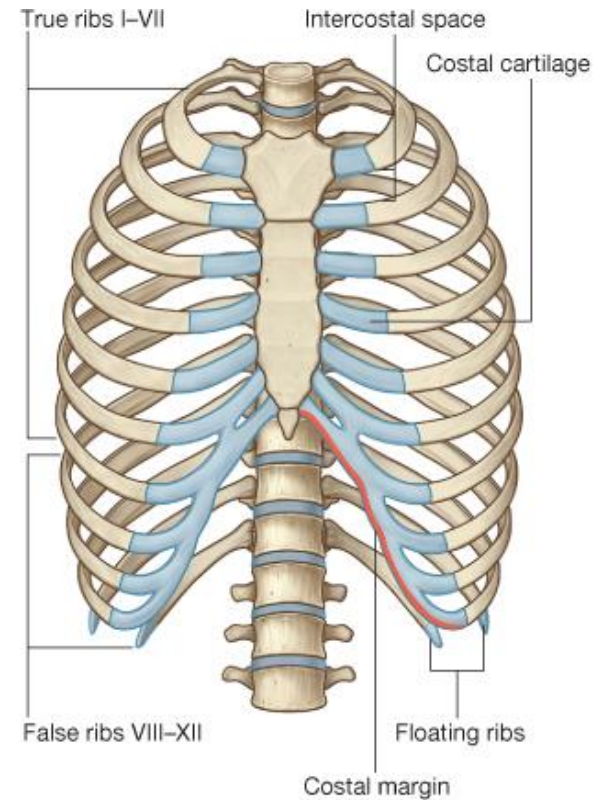
Os sacrum



Os coccygis

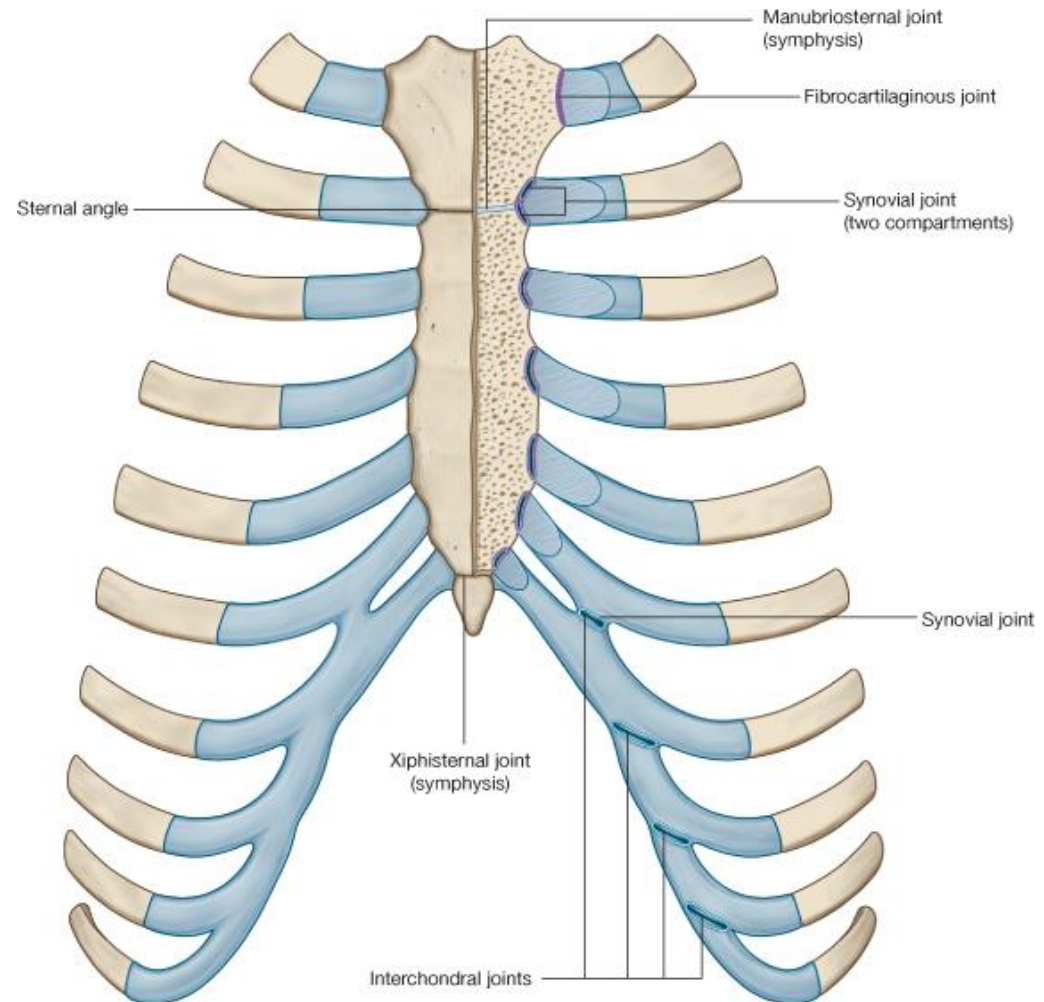
Thorax

Sternum,
12 pairs of ribs,
12 thorakal vertebrae



Ribs (Costae)

- The ribs are a set of twelve bones which form the protective 'cage' of the thorax. They articulate with the vertebral column posteriorly, and terminate anteriorly as cartilage (known as costal cartilage).
- 12 pairs (24)
- Ribs 1-7 attach independently to the sternum (costae verae)
- Ribs 8 – 10 attach to the costal cartilages superior to them (costae spuriae affixa)
- Ribs 11 and 12 do not have an anterior attachment and end in the abdominal musculature. Because of this, they are sometimes called 'floating ribs'. (costae spuriae fluctuantes)



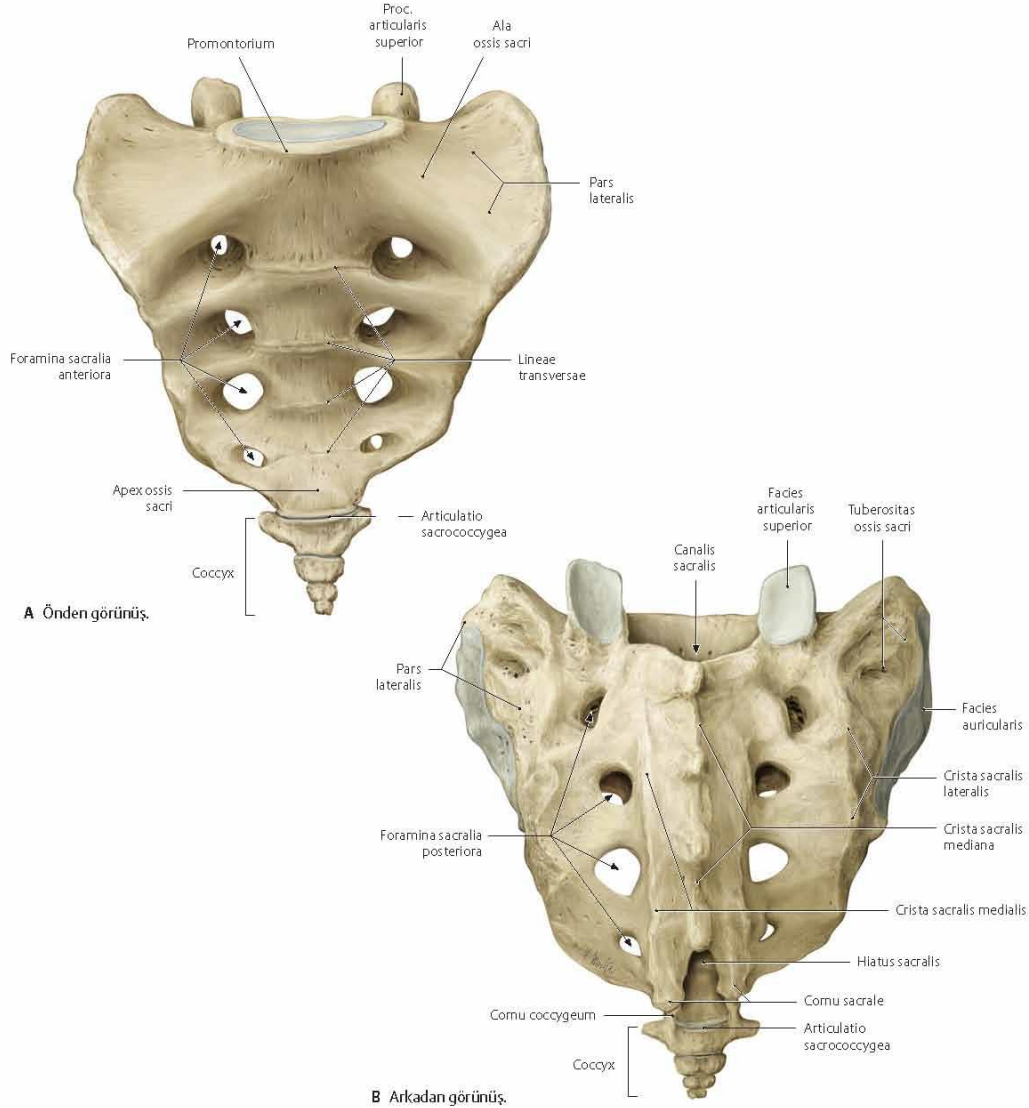
Sağır; Kuyruksokumu kemiği (Os Sacrum) ve Kuyruk kemiği (Os Coccygis)

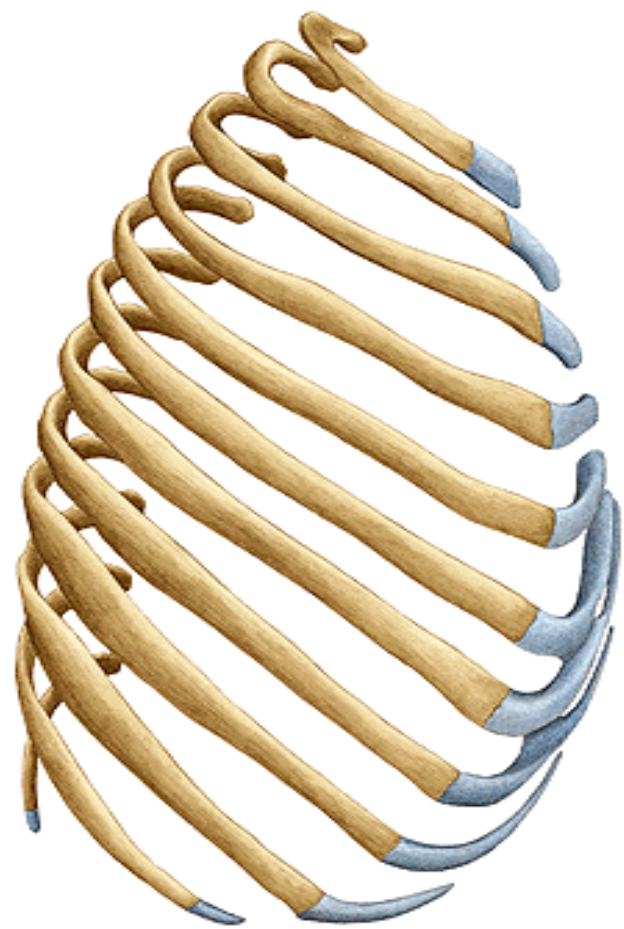
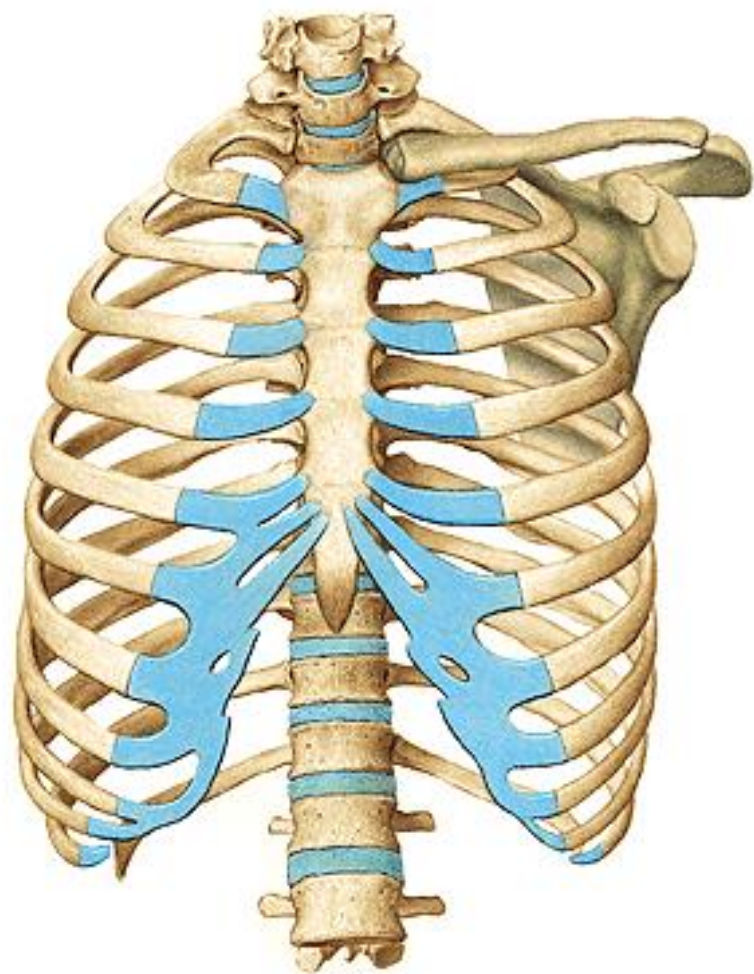
Sirt

Kuyruksokumu kemiği, doğum sonrası kaynaşmış olan beş sağrı omurundan oluşur. Kuyruksokumu kemiğinin baskısı 5. bel omuru

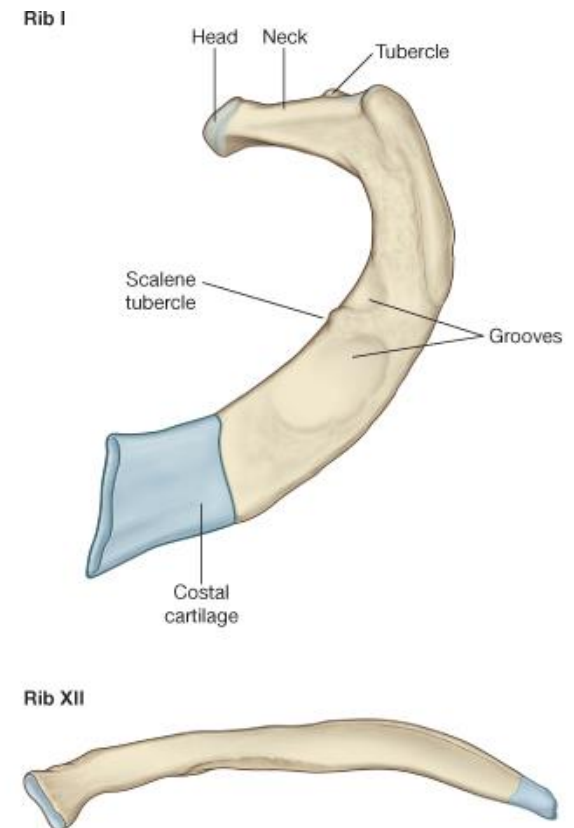
ile, apex'i üç-dört gelişmiş omurdan oluşan kuyruk kemiği ile eklem yapar.

Şekil 1.15 Kuyruksokumu kemiği ve kuyruk kemiği

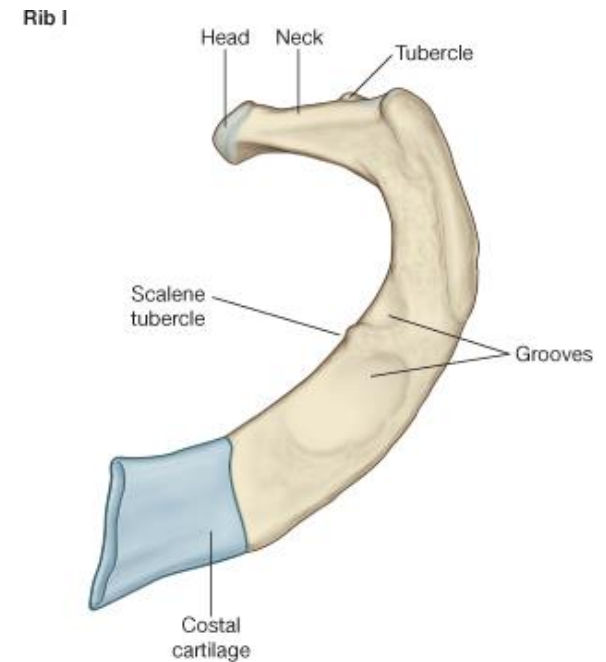




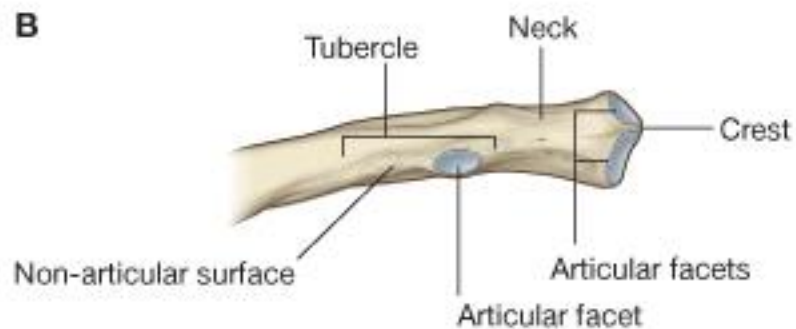
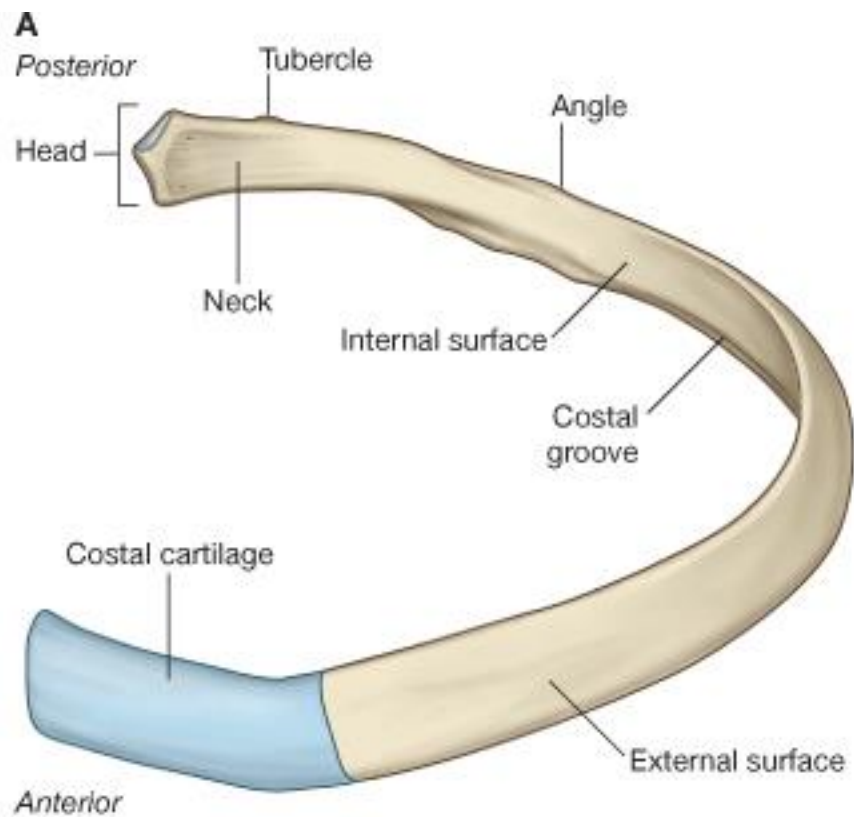
- Costal cartilage is **hyalin cartilage**
- **Caput costae** (head of the costa) articulates with the vertebrae
No costal tubercle in the 11. and 12. costa
- **Costal groove (sulcus costae) on the lower surface of the costae**
- **Interkostal vessels and nerves in the costal groove**



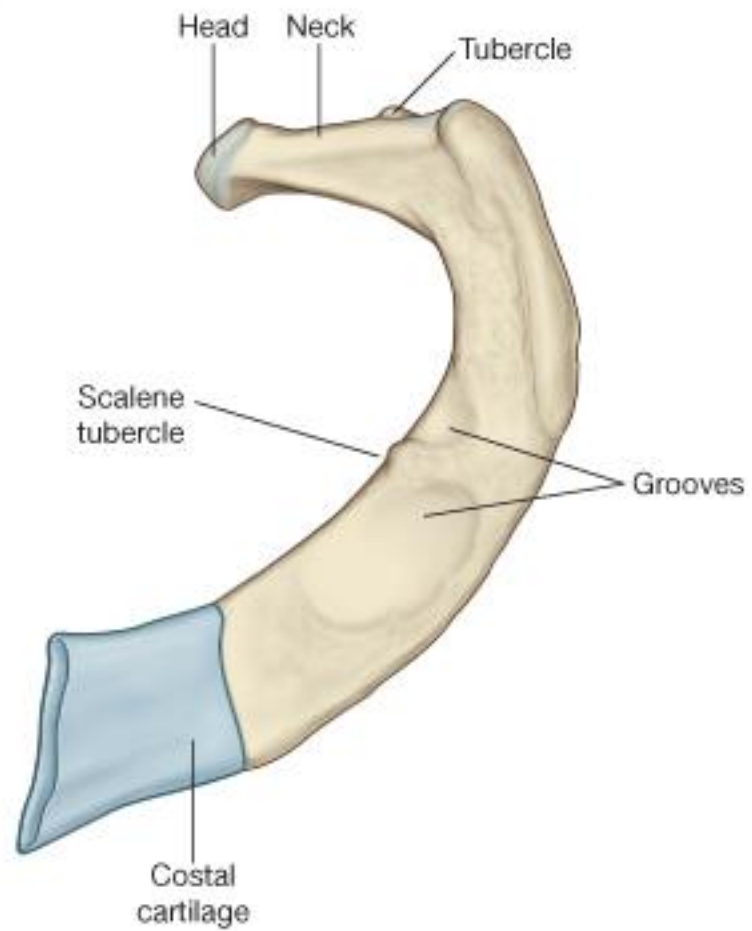
- **The typical rib consists of a head, neck and body**
- **The shortest cartilage is in the 1. costa, the longest in 7. costa**
- **The longest costa is 7.**
- 12. costa does not have an angle



- Rib 1 is shorter, wider and stronger than the other ribs. The superior surface is marked by two grooves, which make way for the subclavian vessels.
- Rib 2 is thinner and longer than rib 1, It has a roughened area on its upper surface, where the serratus anterior and posterior muscles attach.
- Rib 10 only has one facet – for articulation with its numerically corresponding vertebrae.
- Ribs 11 and 12 have no neck, and only contain one facet, which is for articulation with their corresponding vertebrae.

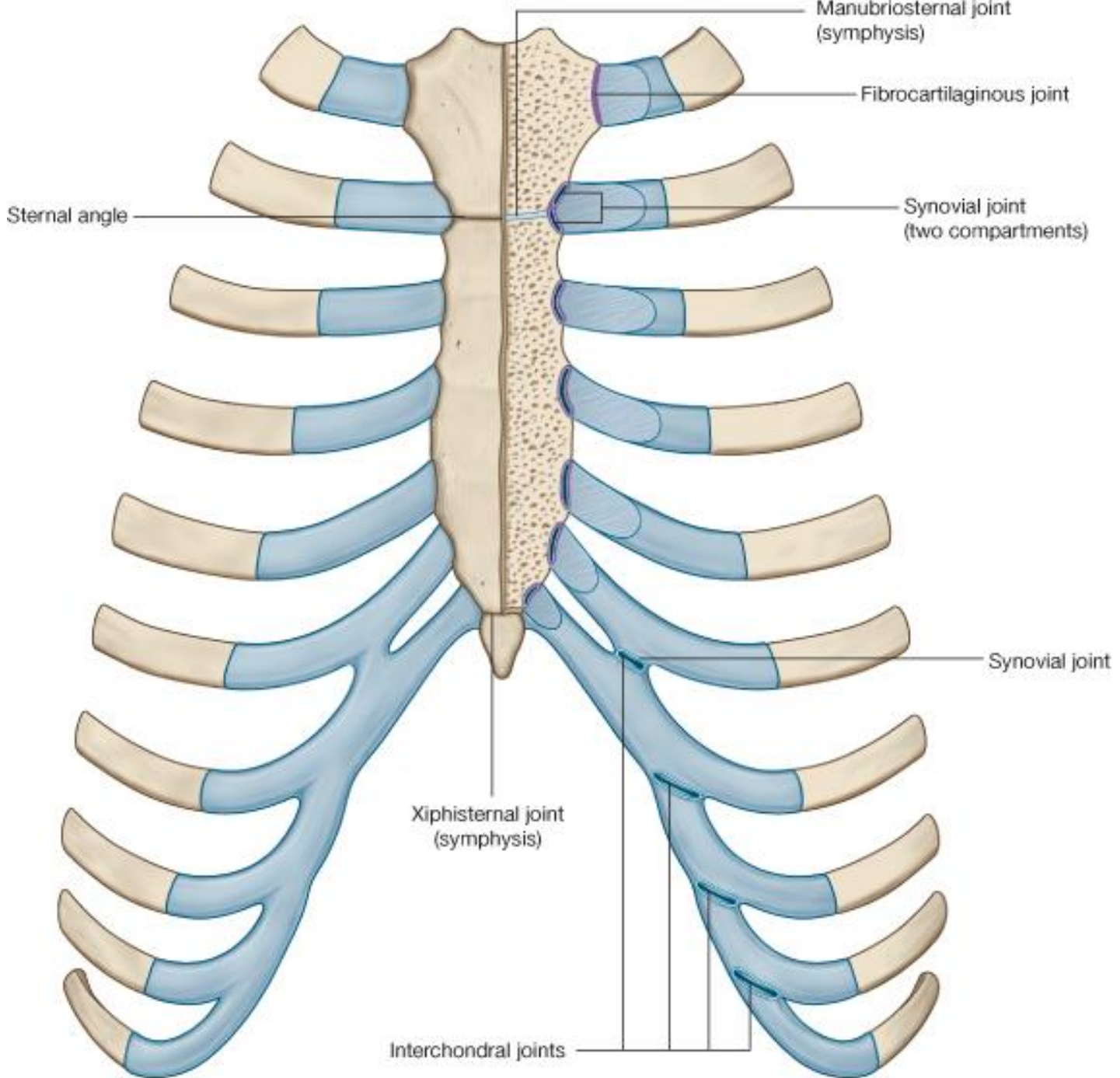


Rib I



Rib XII



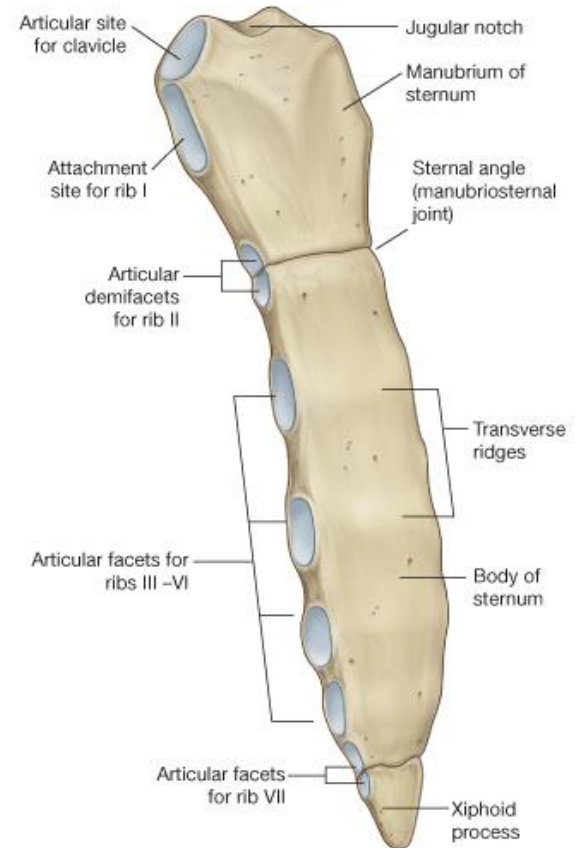


Sternum (breastbone)

The sternum (or breastbone) is a flat bone located at the anterior aspect of the thorax. It lies in the midline of the chest and has a 'T' shape.

As part of the bony thoracic wall, the sternum helps protect the internal thoracic viscera – such as the heart, lungs and oesophagus.

- Manubrium sterni
- Corpus sterni (body)
- Processus xiphoideus (xiphoid process)



- Manubrium sterni, corpus sterni and processus xiphoideus
- Angulus sterni (Louis-Ludwig angle)

