

**Anatomy
Histology
Embryology**

Academic year 2021/2021

David Kachlík

Anatomy

😊 Our love 😊

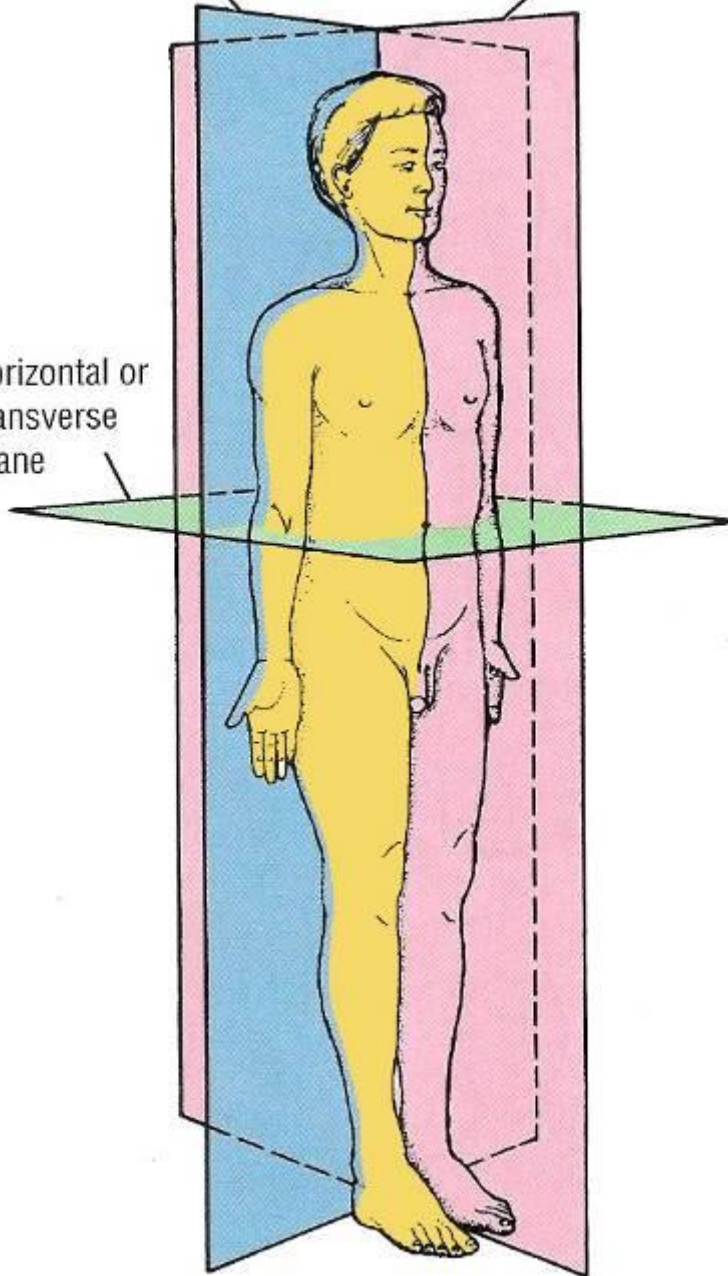
Teachers and examiners

- Prof. Rastislav Druga
- Doc. Jiří Šedý
- MUDr. Azzat Al-Redouan
- MUDr. Martin Salaj
- MUDr. Adam Whitley
- MUDr. Martina Farolfi
- MUDr. Václava van der Meijs
- Mgr. Šárka Salavová
- Doc. Ondřej Naňka
- MUDr. Veronika Němcová
- lecturers
- MUDr. Jiří Uhlík
- MUDr. Andrea Felšöová
- MUDr. Alžběta Blanková
- MUDr. Richard Becke
- lecturers



coronal plane median sagittal plane

horizontal or
transverse
plane

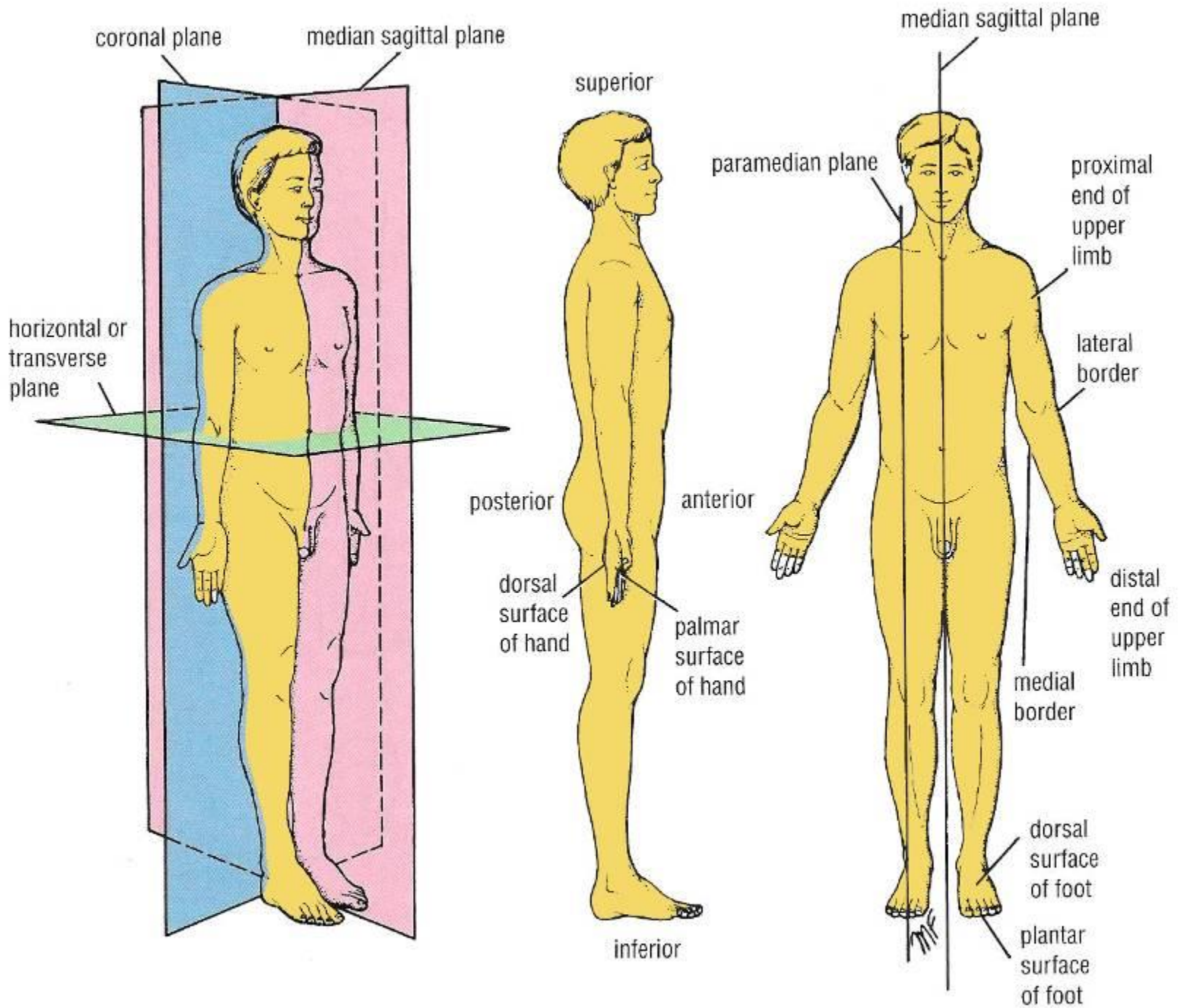


Basic anatomical position

- standing upright
- upper limb along the body with palms forwards
- feet close to each other

Basic planes

- sagittal (*planum sagittale*)
 - median
 - paramedian
- frontal (*planum frontale*)
- transverse (*planum transversale*)

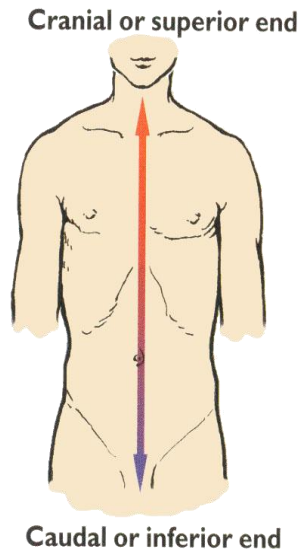
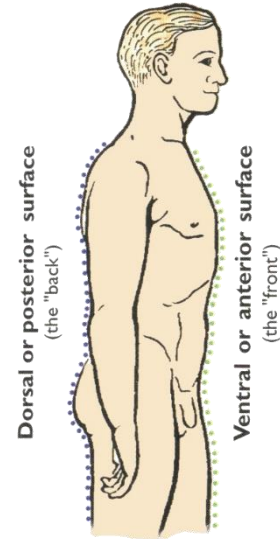
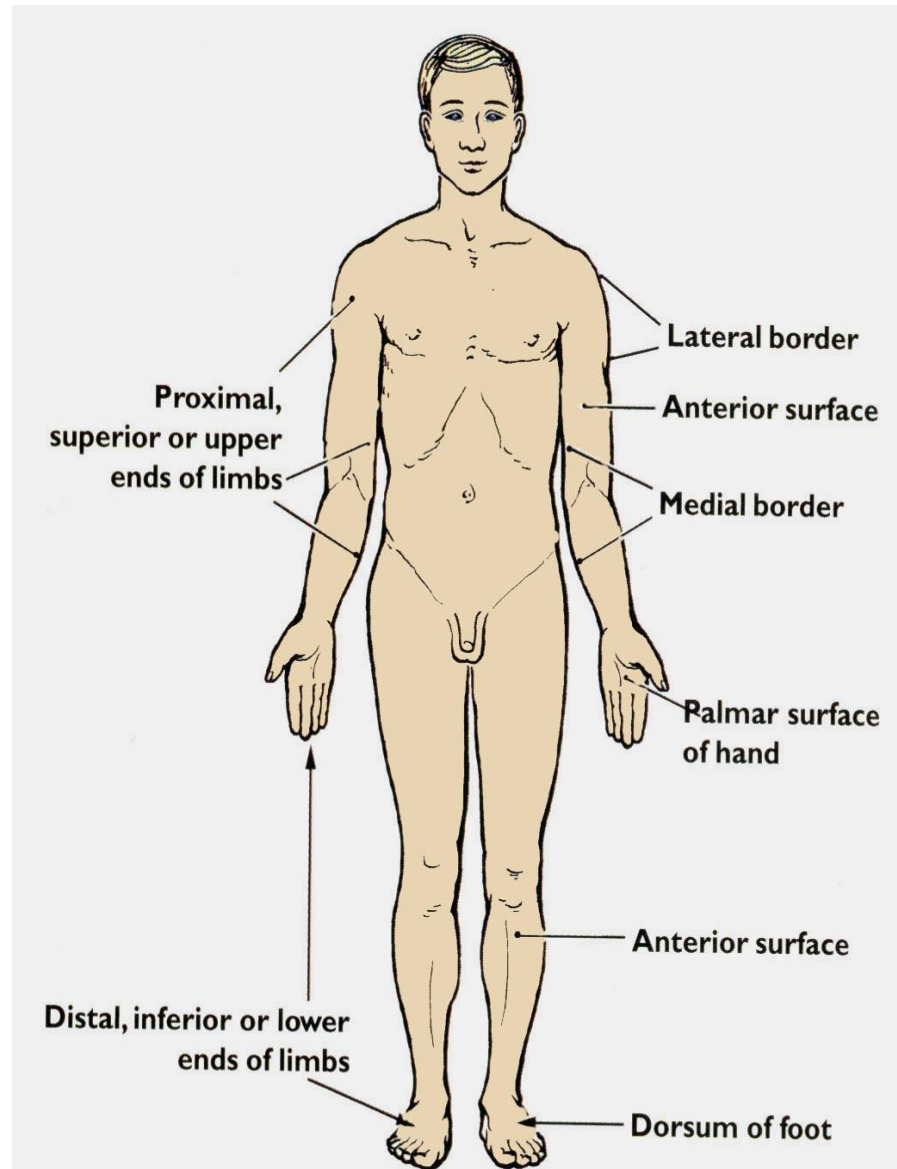


Directions

Cranialis – Caudalis
Medialis – Lateralis
Anterior – Posterior
Superior – Inferior

Proximalis – Distalis
Superficialis – Profundus
Ventralis – Dorsalis

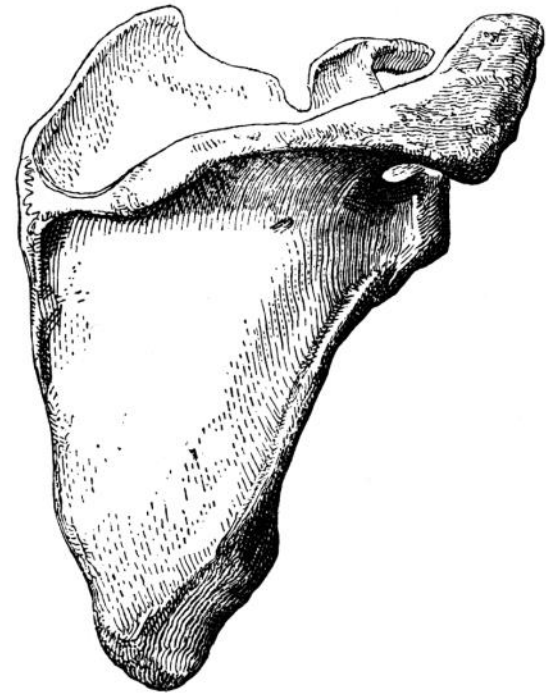
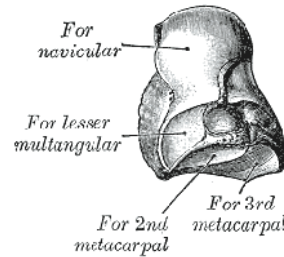
Internus – Externus
Palmaris – Dorsalis
Plantaris – Dorsalis



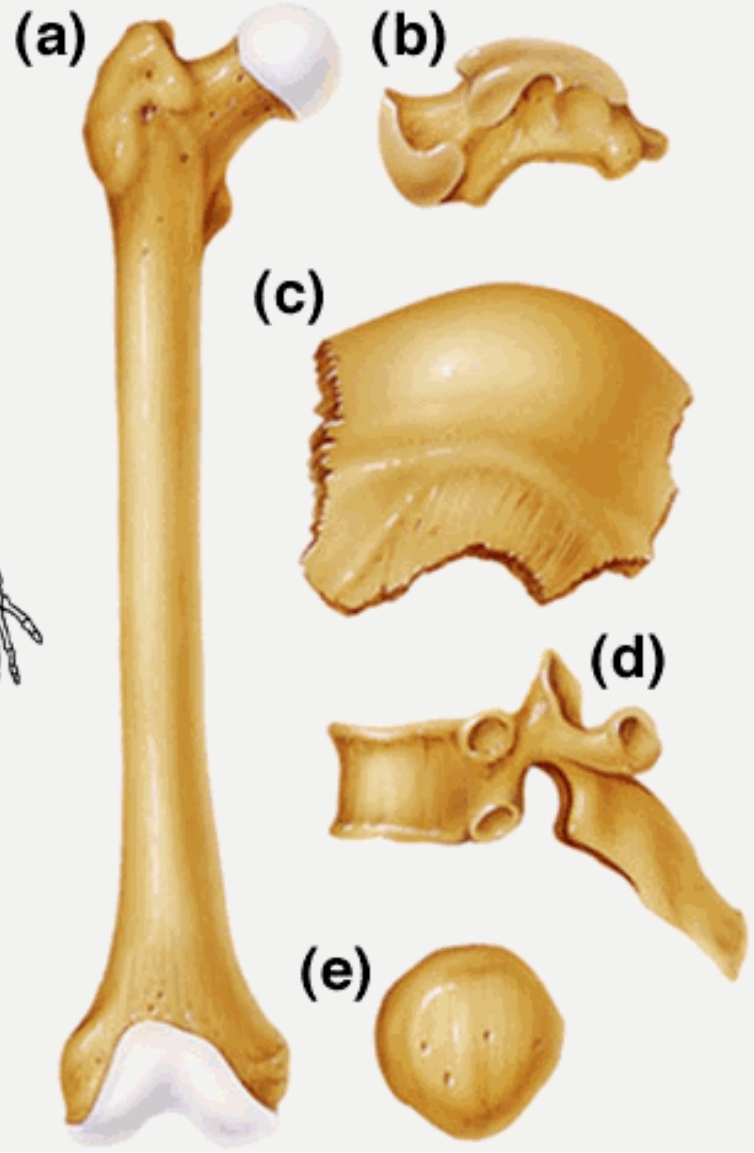
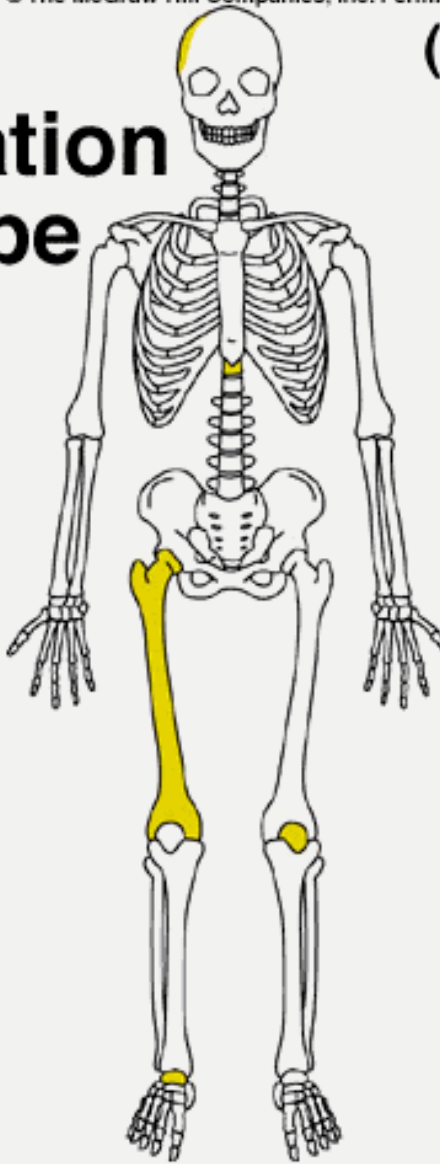
General osteology and skeleton of upper limb

Shape of bones

- *os longum* (long bone)
- *os breve* (short bone)
- *os planum* (flat bone)
- *os irregulare* (irregular bone)
- *os pneumaticum* (pneumatized bone)
 - inside there is a cavity or cavities, lined by mucosa and filled with air
- *os sesamoideum* (sesamoid bone)
 - little bones (ossicles) located within tendons



Bone Classification by Shape



pneumatizovaná kost



Irregular bone

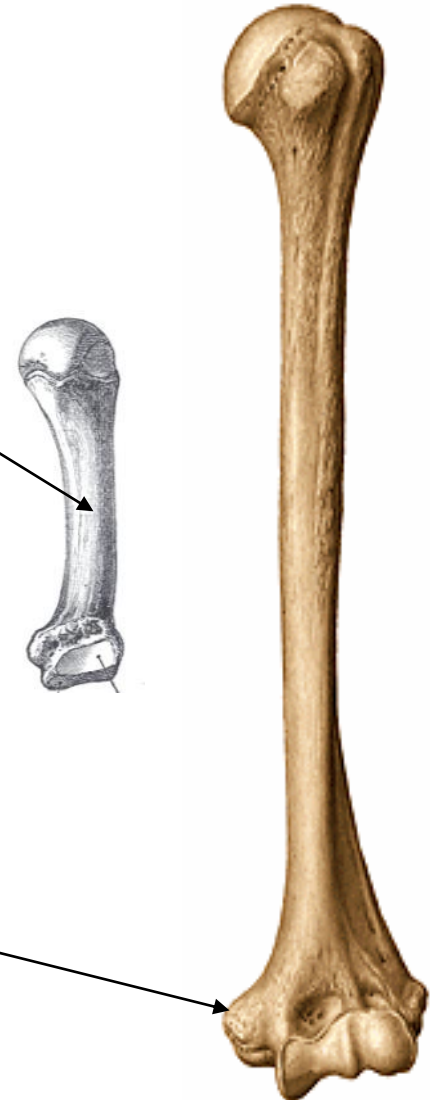
Os longum (Long bone) I

- body
 - thick layer of compact bone
- articular ends
 - thin layer of compact bone
 - spongy bone inside
- epiphysis
 - terminal rounded part
 - during development separated by growth cartilage/plate
- metaphysis
 - segment between epiphysis and diaphysis
 - in childhood place of a growth cartilage
 - supplied by its own vessels



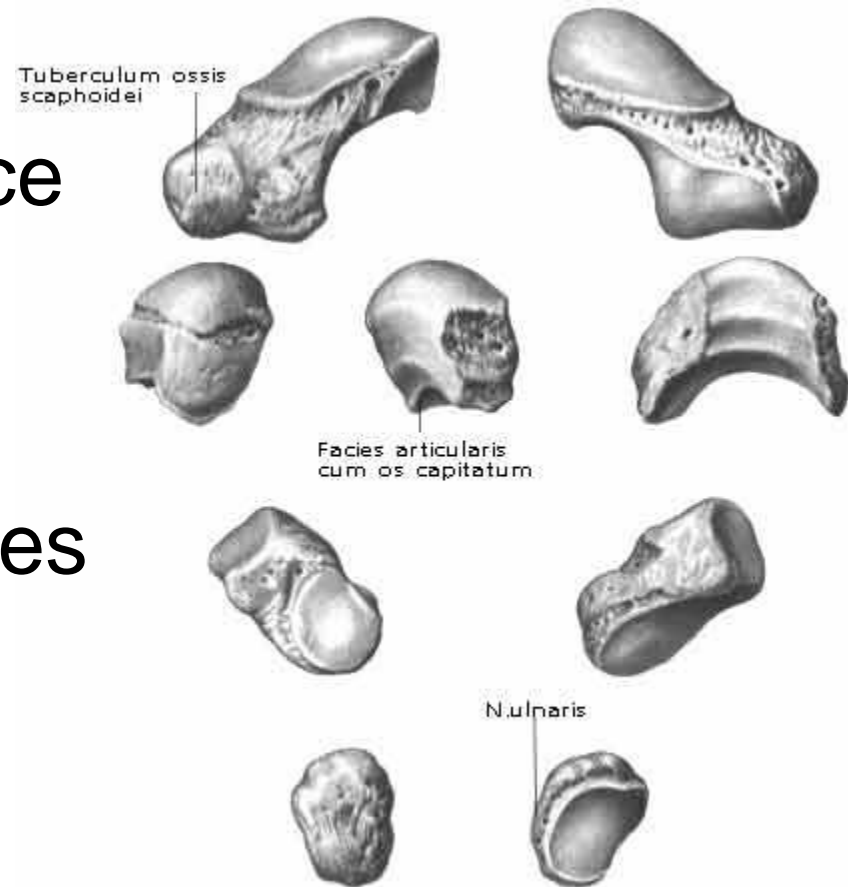
Os longum (Long bone) II

- diaphysis
 - middle part (body/shaft)
- apophysis
 - part of a bone with separate ossification centre
 - bone protuberance for insertion of a tendon
 - e.g. epicondylus medialis humeri



Os breve (Short bone)

- substantia corticalis (thin layer of a substantia compacta) on the surface
- spongy bone inside
- irregular shape
- irregular articular surfaces
- carpal and tarsal bones
- vertebrae



Os planum (Flat bone)

- substantia compacta
 - lamina externa
 - lamina interna
- substantia spongiosa
 - diploe
- scapula
- sternum
- bones of cranial vault



Bony medulla (*Medulla ossium*)

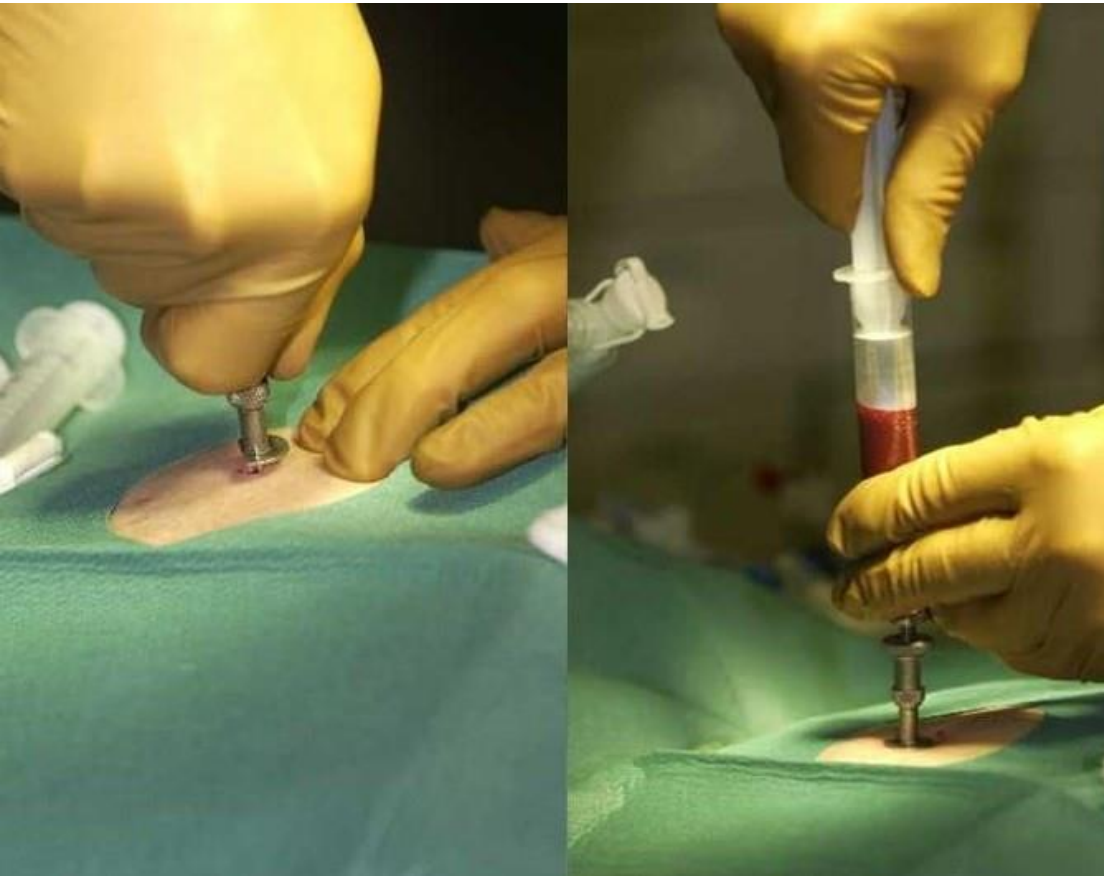
- fills all the spaces in a spongy bone and marrow (medullary) cavities of the diaphyses of long bones
- red bone marrow (*medulla ossium rubra*)
 - spatial network of **reticular connective tissue**
 - weaved with large capillaries (sinusoids)
 - **haemopoiesis**
- yellow bone marrow (*medulla ossium flava*)
 - replaces the red bone marrow by penetrating the adipose/fat cells

Distribution of red bone marrow before birth and in adulthood



Sternal puncture

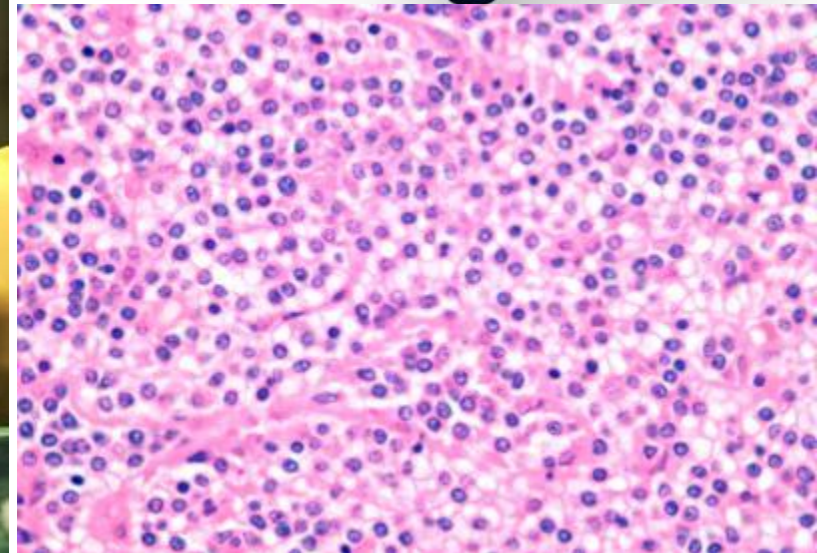
- cytological examination of bone marrow



<http://www.biomedcentral.com/1471-2342/6/7/figure/F1?highres=y>



<http://www.miltusa.com/>



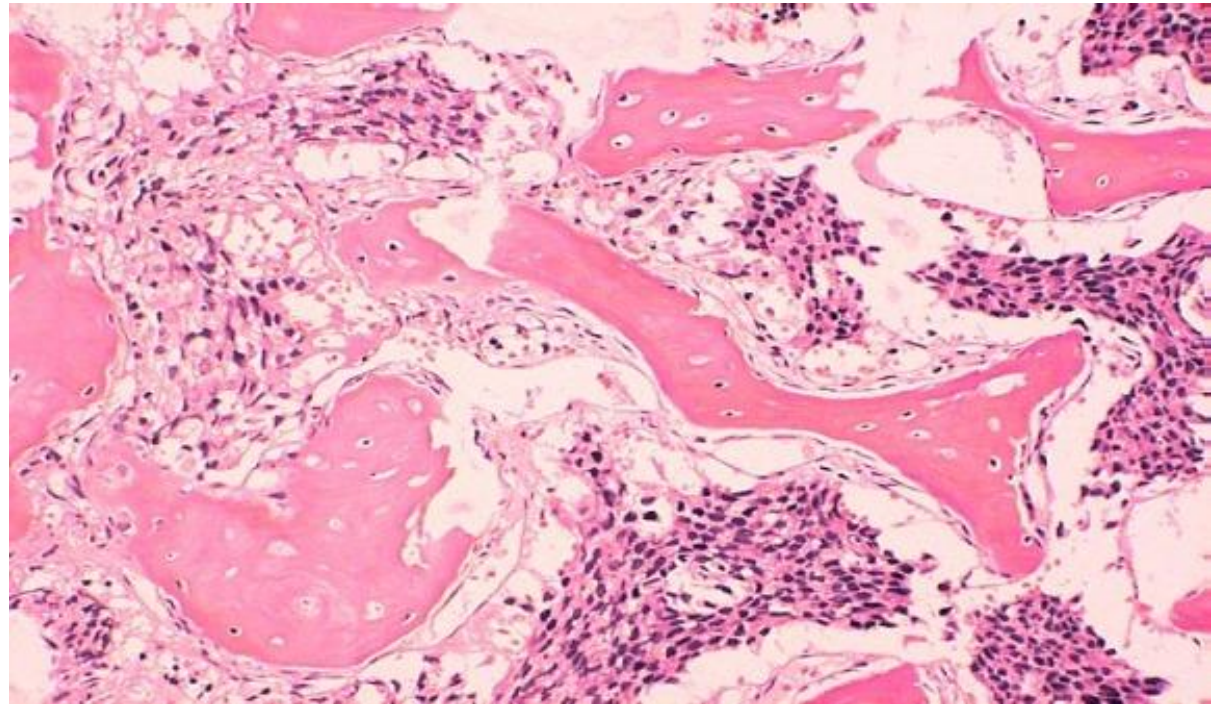
<http://www.fnmotol.cz/kliniky-a-oddeleni/spolecne-vysetrovaci-a-lecebne-slozky/ustav-patologie-a-molekularni-mediciny-uk-2lf-a-fn/lymfomova-skupina/patologie-lymfomu-detail/m-98113/>

Trepanobiopsy

- biopsy of the part of the bone marrow with spongy bone and bone marrow for histological analysis
- taken from ala ossis ilii



<http://portal.med.muni.cz/clanek-22-postup-pri-provadeni-trepanobiopsie.html>



<http://zdravi.e15.cz/clanek/priloha-lekarske-listy/diferencialni-diagnostika-pancytopenie-449915>

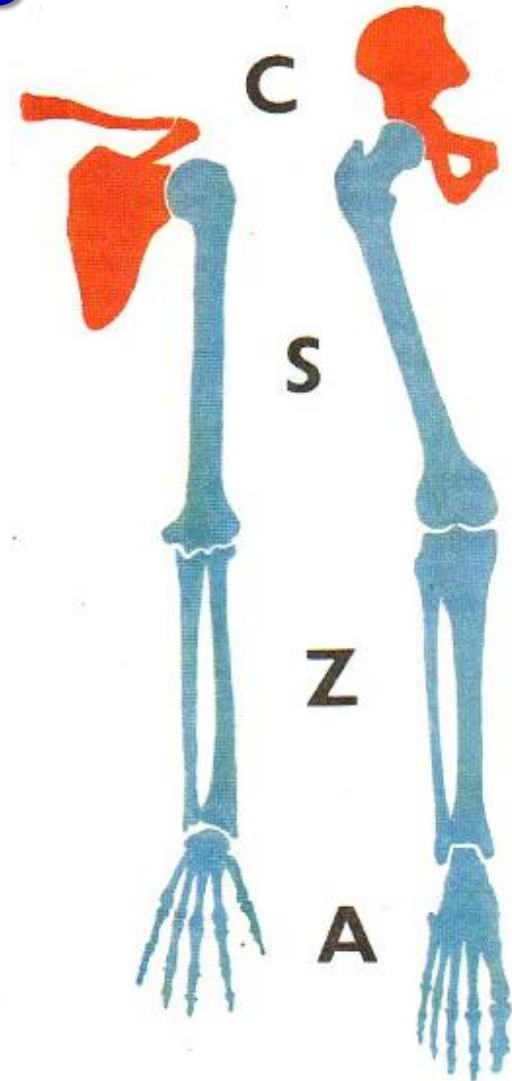
General scheme of limb structure

cingulum – girdle

stylopodium – 1 bone

zeugopodium – 2 bones

autopodium – more bones



Bones of upper limb (*Ossa membri superioris*)

- pectoral girdle (*cingulum membri superioris, cingulum pectorale*)
 - *scapula, clavícula*
- free upper limb (*pars libera membri superioris*)
 - *humerus, radius, ulna, ossa carpi, ossa metacarpi, phalanges*
 - (*ossa sesamoidea*)

How to approach?

5 points for easy study of anatomy:

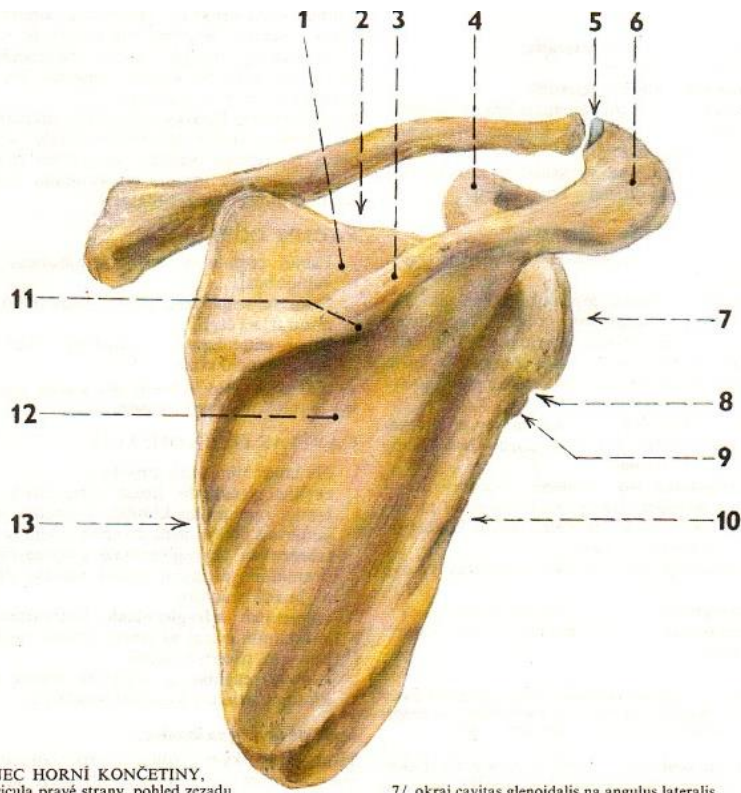
- **Latin term**
- **English term** (resp. synonyms, eponym)
- **What is it?**
- **For what is it?**
- **What is the clinical relevance?**

Bone:

- **Latin term**
- **English term** (resp. synonyms)
- **How is it placed in the body?**
- **Which side?**
- **What is the clinical relevance?**

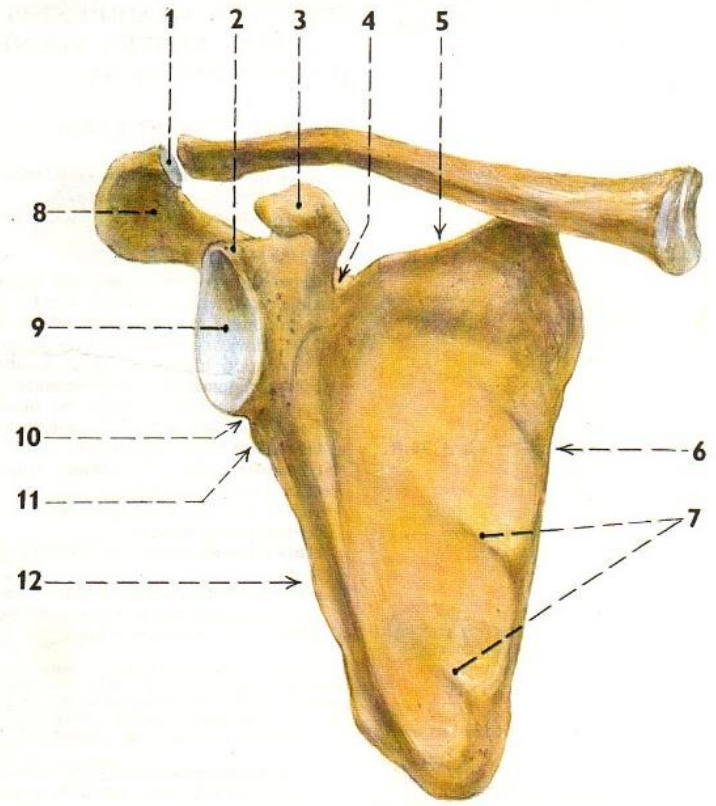
„Shoulder blade“ (*Scapula*)

„Collarbone“ (*Clavicula*, Kleis)



241. PLETENEC HORNÍ KONČETINY,
scapula a clavicula pravé strany, pohled zezadu
1/ fossa supraspinata
2/ margo superior
3/ spina scapulae
4/ processus coracoideus
5/ facies articularis acromii
6/ acromion

7/ okraj cavitas glenoidalis na angulus lateralis
8/ collum scapulae
9/ tuberculum infraglenoidale
10/ margo lateralis
11/ tuberositas triangularis spinae
12/ fossa infraspinata
13/ margo medialis



242. PLETENEC HORNÍ KONČETINY, scapula a clavicula pravé strany, pohled zředu
1/ facies articularis acromii
2/ tuberculum supraglenoidale
3/ processus coracoideus
7/ lineae musculares na facies costalis
8/ acromion
9/ cavitas glenoidalis

Scapula

- facies anterior (s. costalis)
- facies posterior
- margo medialis scapulae
- margo lateralis scapulae
- margo superior scapulae
- angulus superior scapulae
- angulus inferior scapulae
- angulus lateralis scapulae



Scapula

- fossa subscapularis
- lineae musculares
- spina scapulae
- tuberculum deltoideum
- fossa supraspinata
- fossa infraspinata
- acromion
- facies articularis clavicularis acromii
- angulus acromii



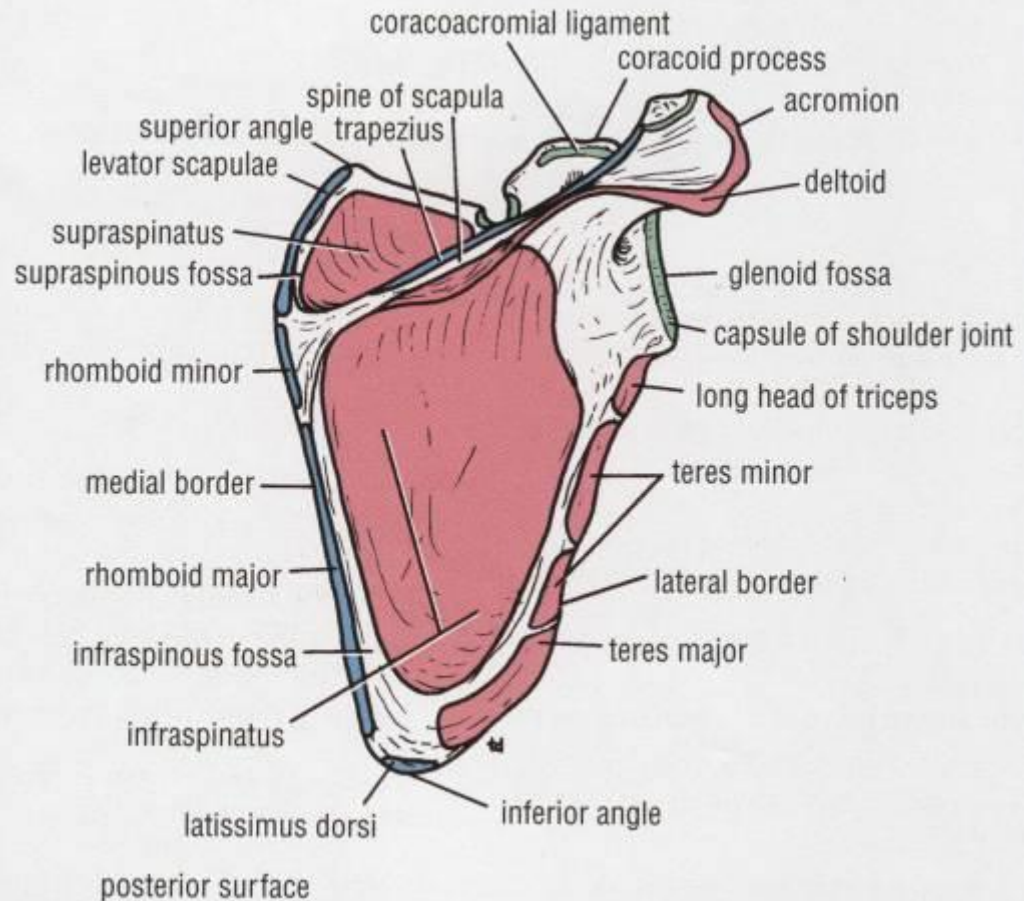
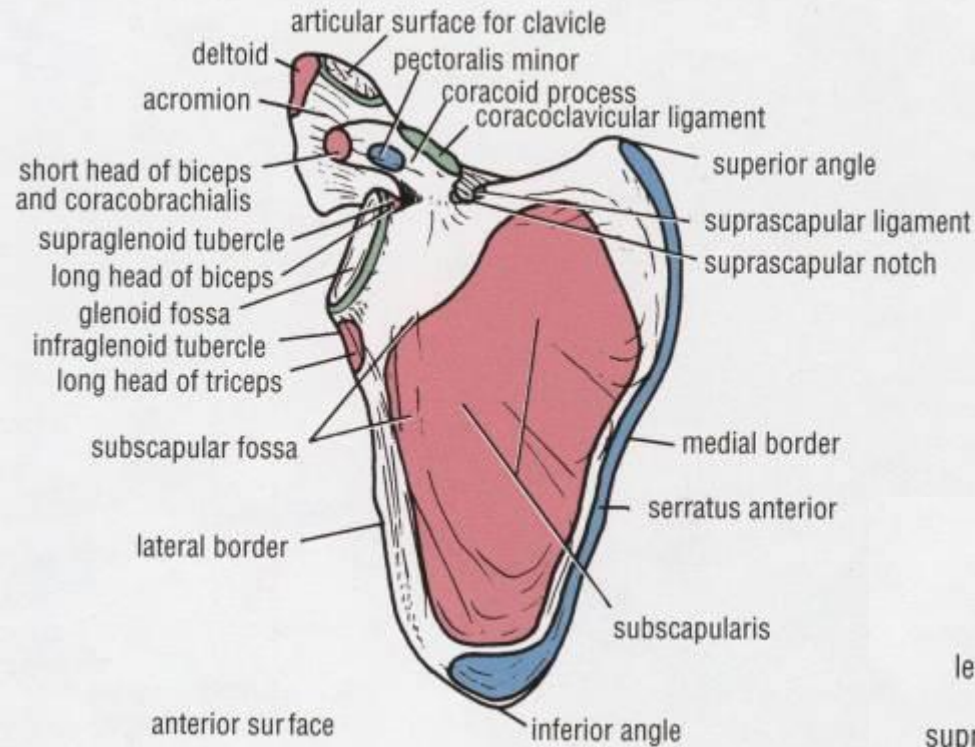
Scapula

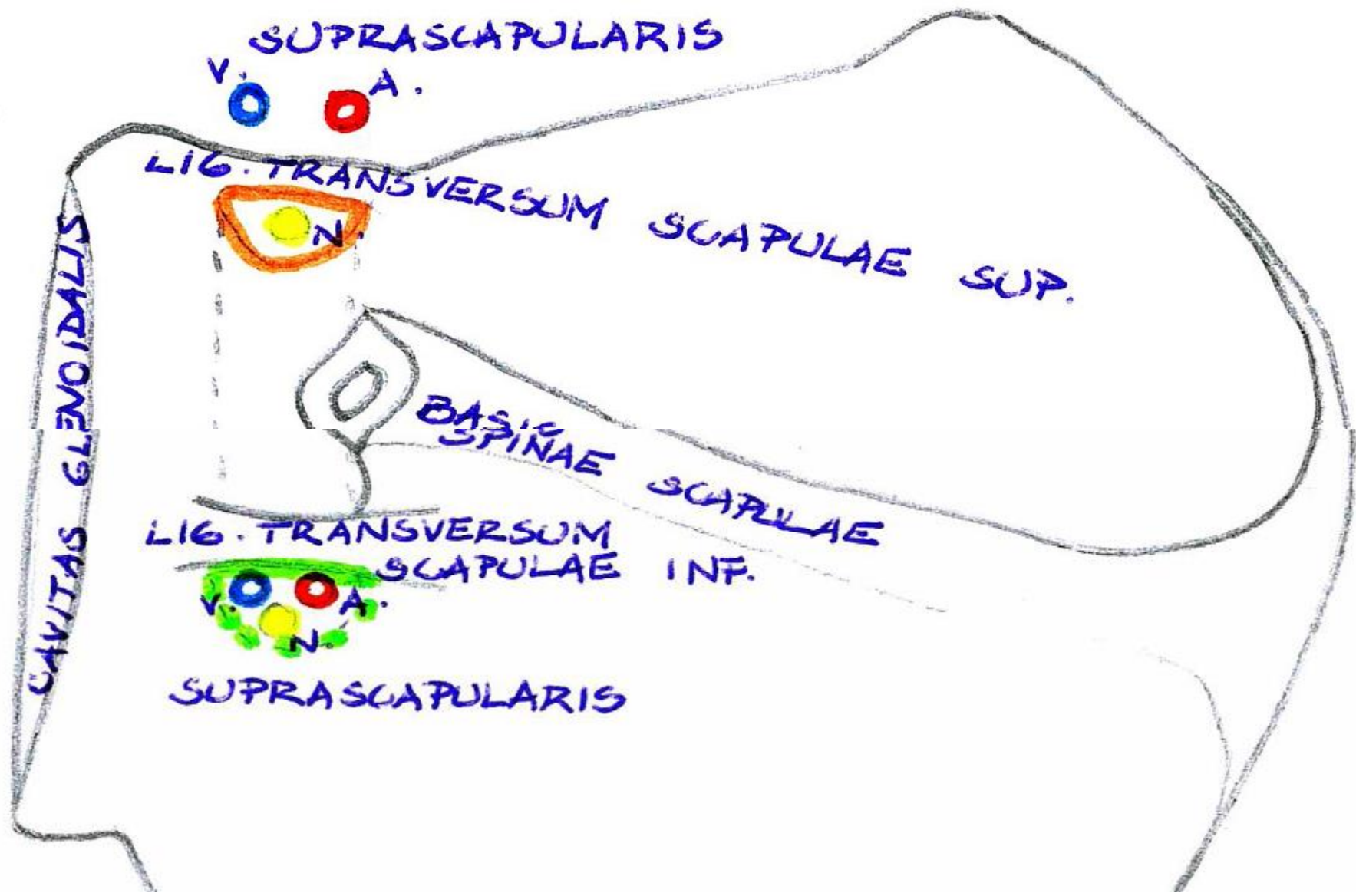
- processus coracoideus
- incisura scapulae
- incisura spinoglenoidalis

- cavitas glenoidalis
- collum scapulae
- tuberculum supraglenoidale
- tuberculum infraglenoidale



Origin and insertions of ligaments and muscles





CAVITAS GLENOIDALIS

SUPRASCAPULARIS

V. A.

LIG. TRANSVERSUM SCAPULAE SUP.

N.

BASIS SPINAE SCAPULAE

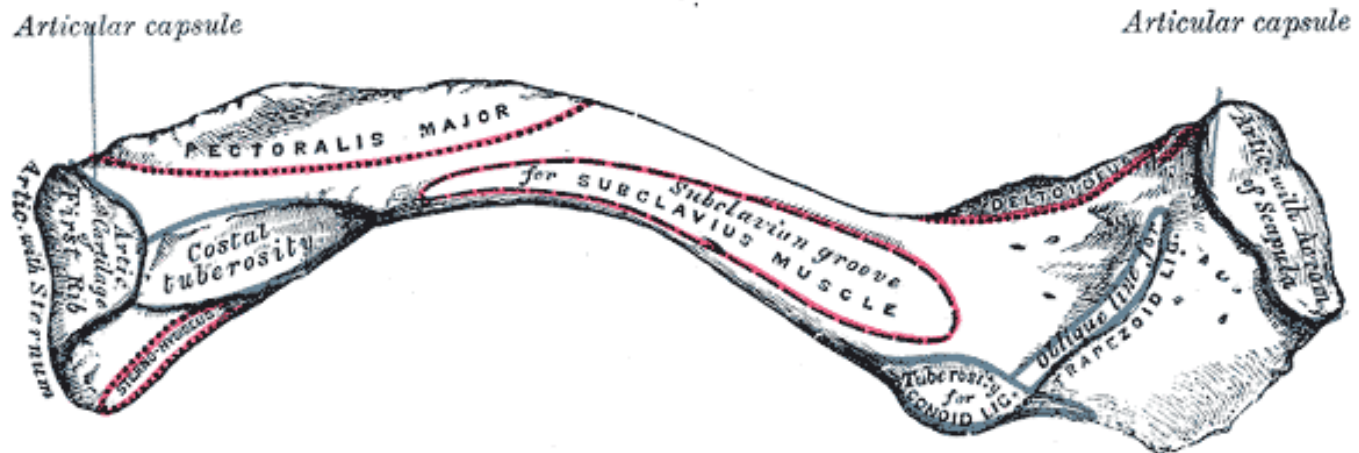
LIG. TRANSVERSUM SCAPULAE INF.

V. A. N.

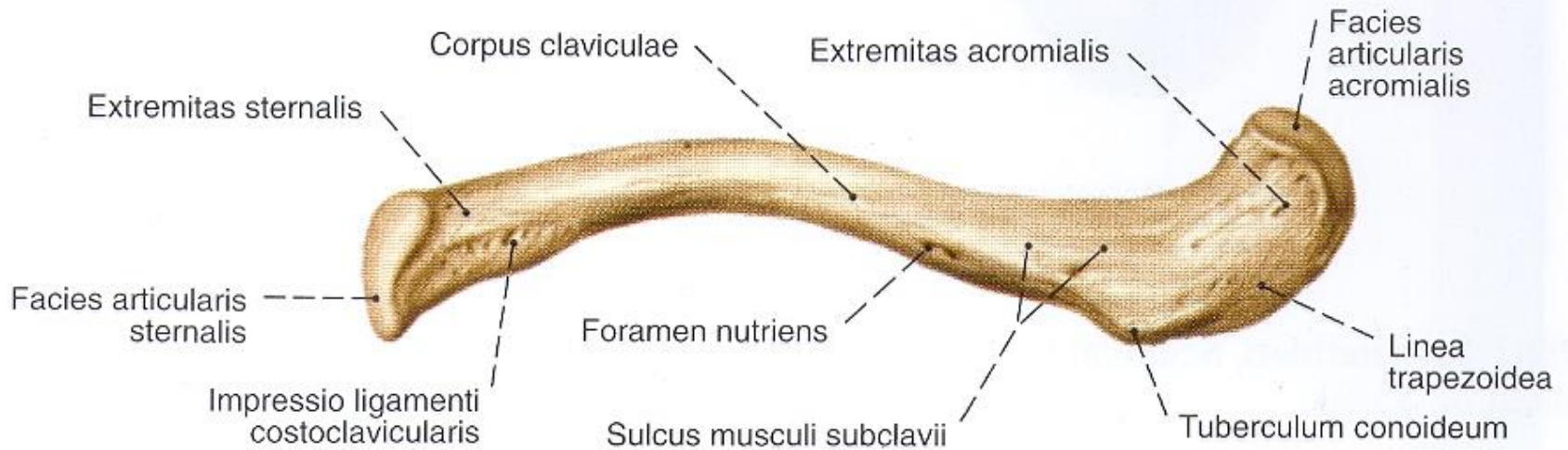
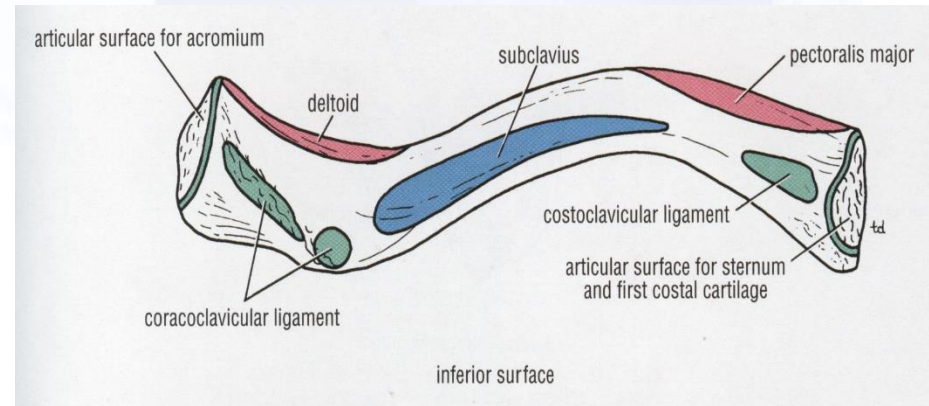
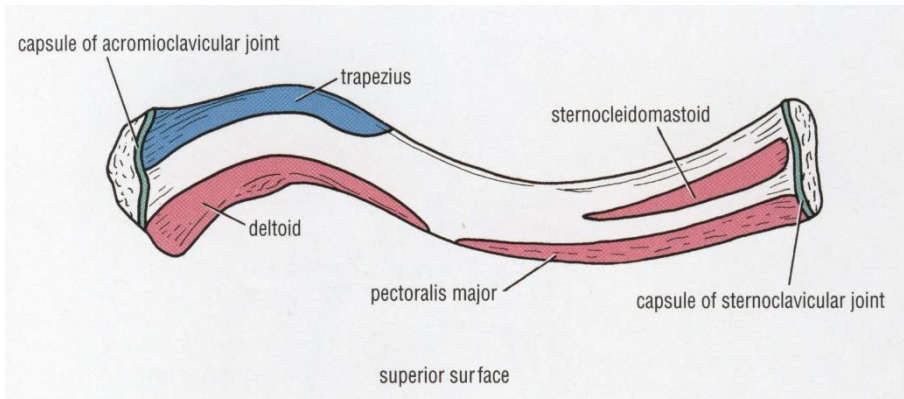
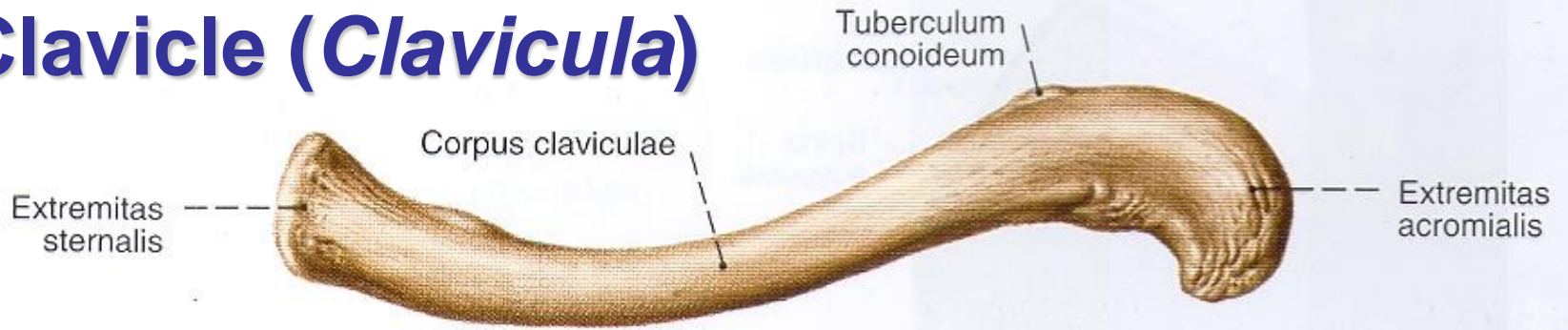
SUPRASCAPULARIS

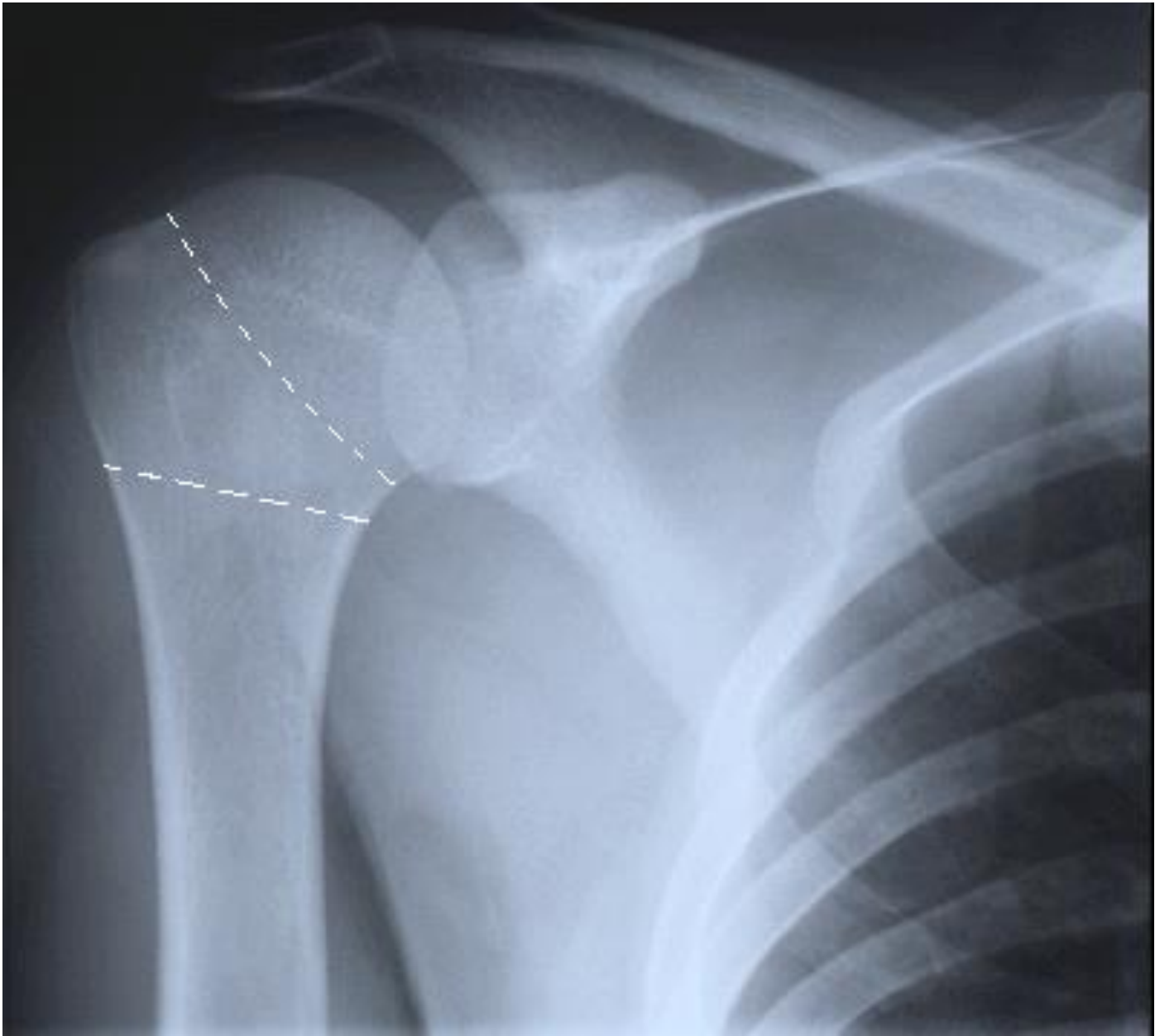
Clvaicle (*Clavicula*)

- Extremitas sternalis & acromialis
- Tuberositas ligamenti coracoclavicularis
 - Tuberculum conoideum (*dorsomediály*) + Linea trapezoidea (*ventrolaterally*)
- Corpus claviculae
 - Sulcus musculi subclavii
 - Impressio ligamenti costoclavicularis
- Facies articularis sternalis & acromialis
- *Palpable laong its whole lenght*
- *Frequent fractures (60% in its middle third)*



Clavicle (*Clavicula*)





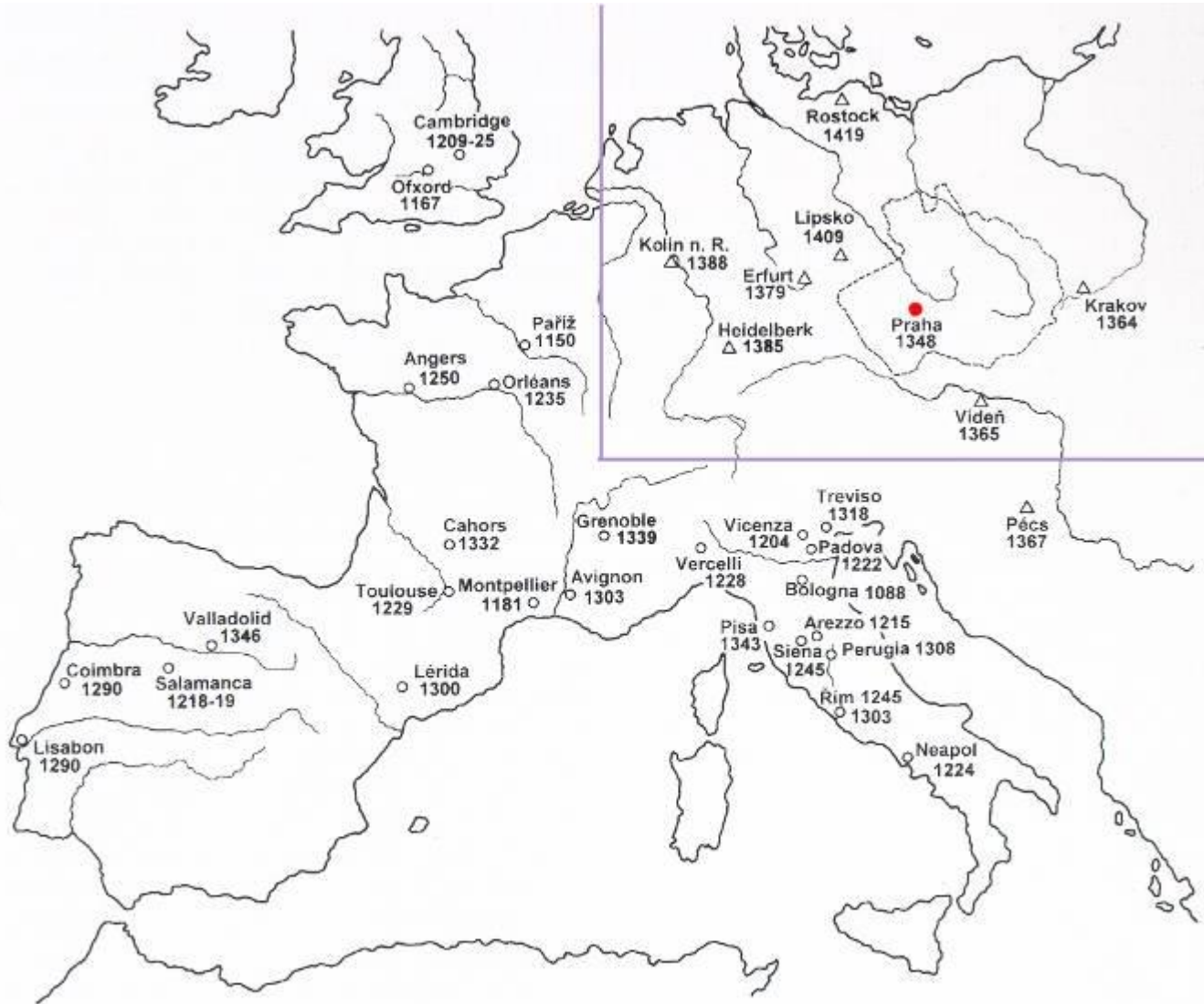
Fracture of scapula



CT reconstruction of fracture of scapula



Oldest European universities



Charles (Karel) IV.

(14.5. 1314 – 29.11. 1378)



7. 4. 1348

Founding charter by pope Clement VI.



lost
by Nazi
in 1945

re-issued
by pope
John Paul II.

7. 4. 1348

Founding charter by pope Clement VI.



One of
two
copies
acquire
d in
June
2018

Studium generale

4 faculties:

- art
- theology
- law
- **medicine**

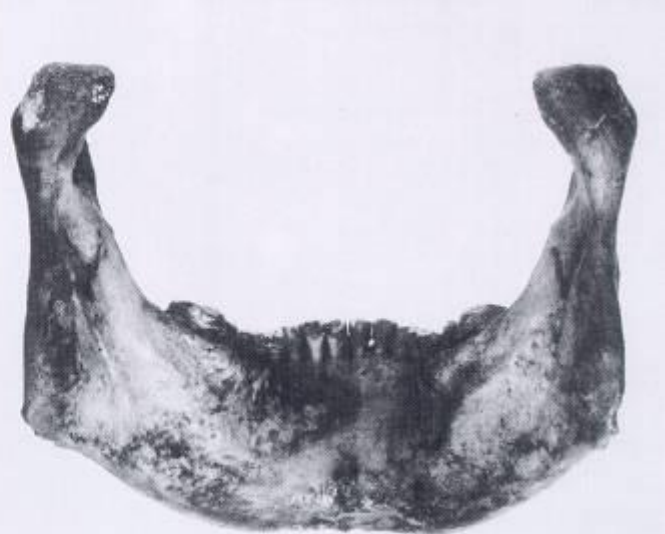
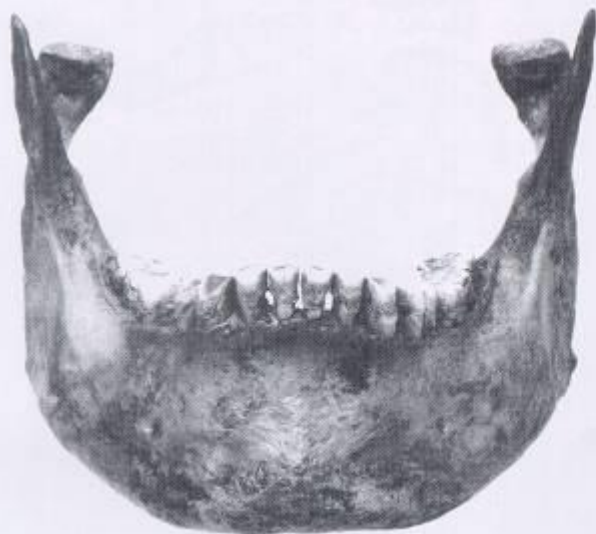


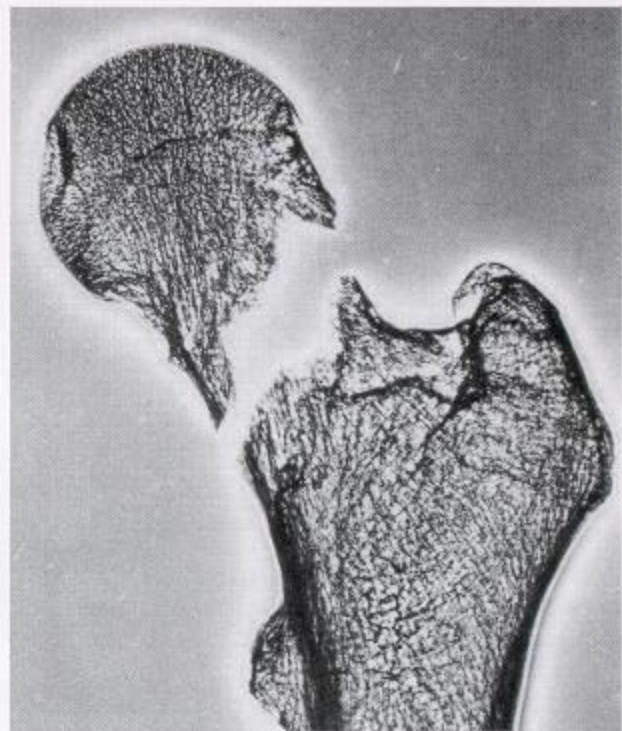
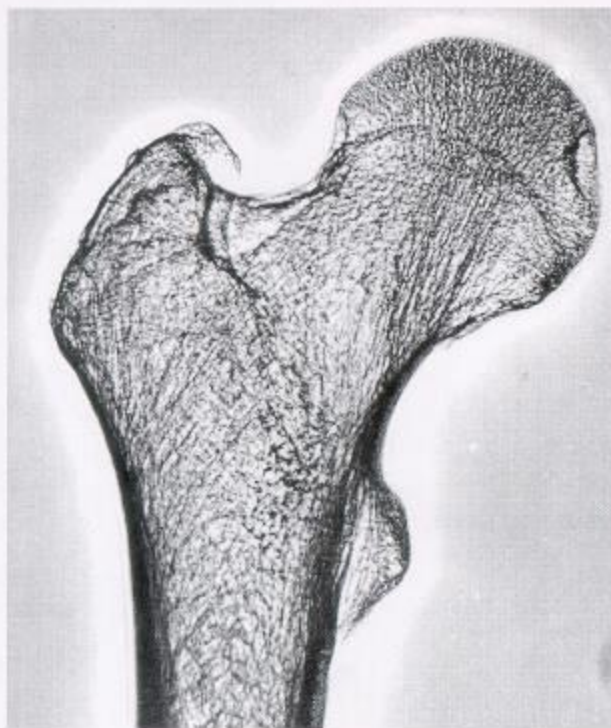
*Socha Karla IV. z průčelí Staroměstské mostecké věže
Karlova mostu (práce pražské parléřovské hutě, 14. století).*





Obr. 9 Vyhojená jízva po sečné ráně na kořenu nosu na lebce Karla IV. (vlevo) a následně vyhnutí kostry nosu na protilehlou stranu (vpravo).

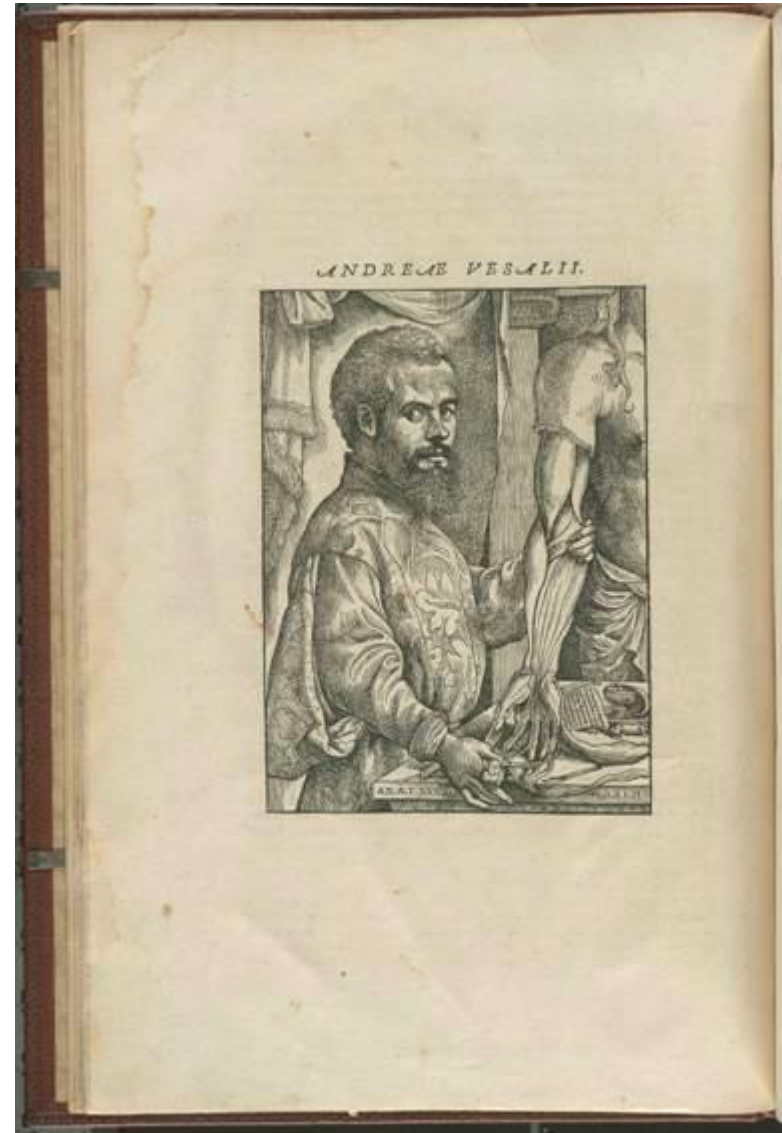




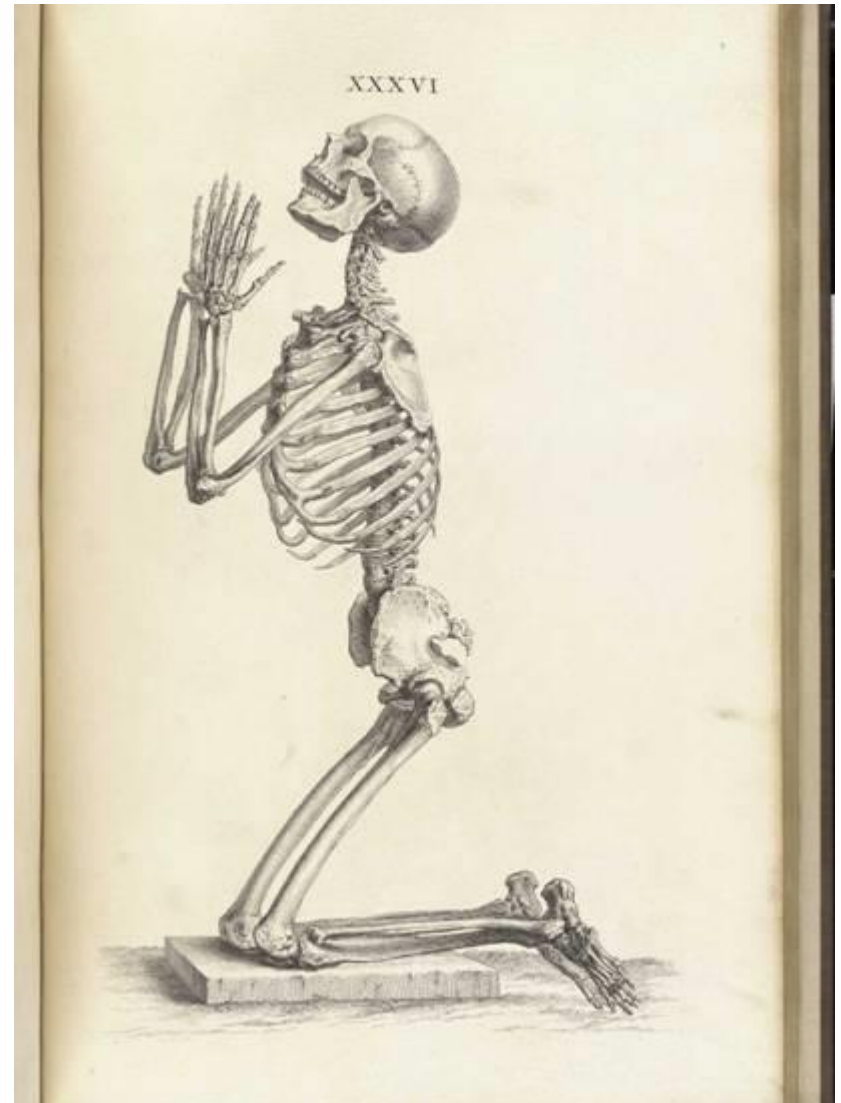
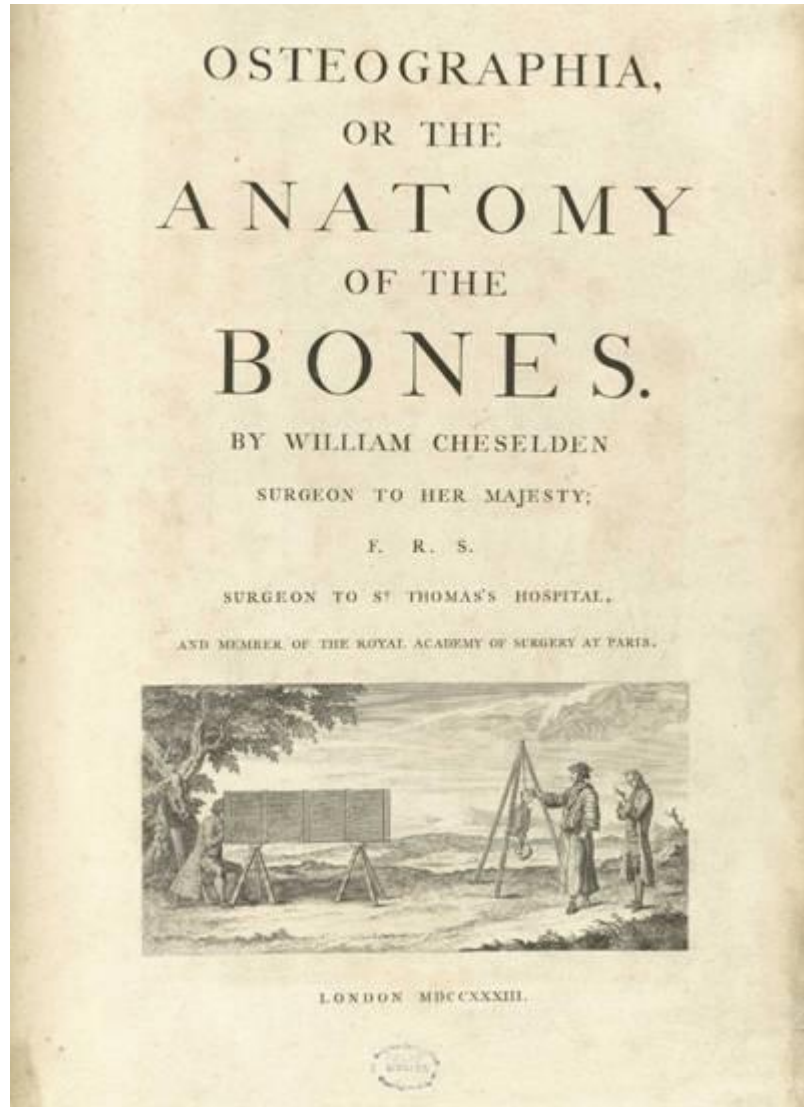
Obr. 12 Rentgenogram ukazující mediální zlomeninu krčku levé stehenní kosti.

Andreas Vesalius (1514-1564)

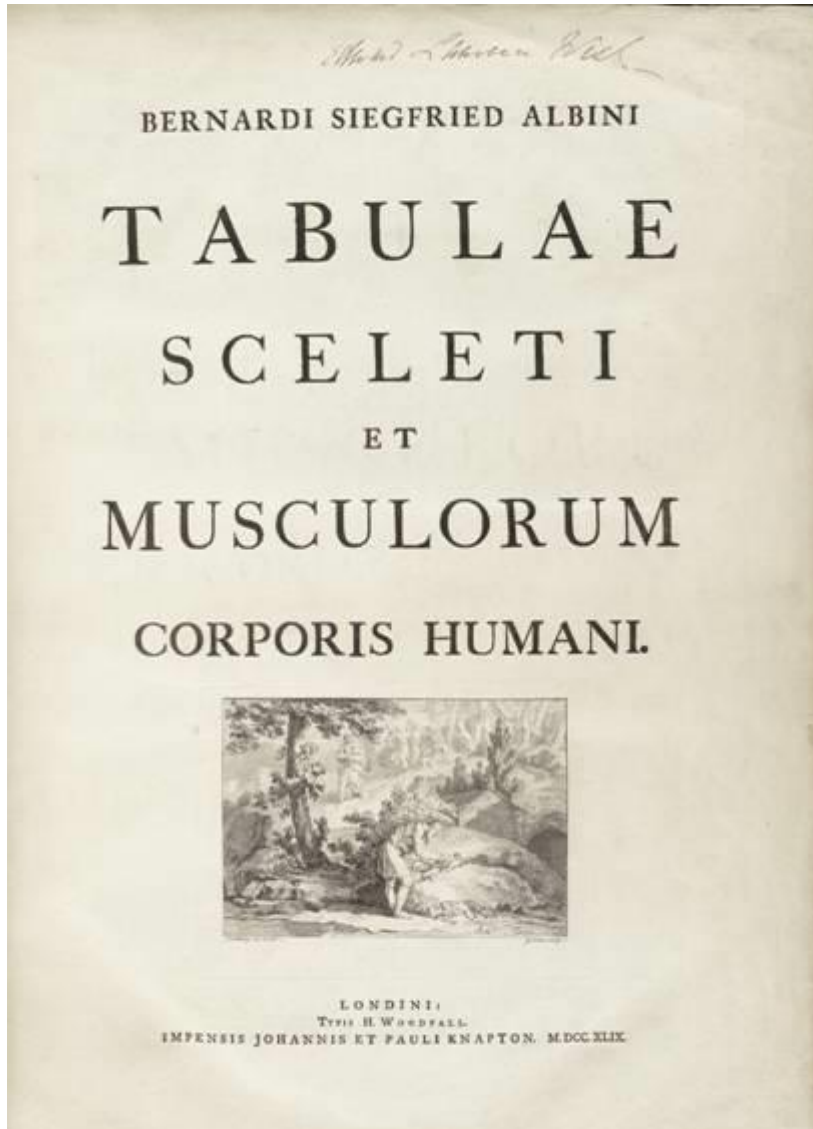
***De humani corporis fabrica libri septem* (Jan Stephanus Calcar),
Basel: Joannes Oporinus, 1543**



Cheselden, William (1688-1752)
Osteographia, or The anatomy of the bones.
London: [William Bowyer], 1733.



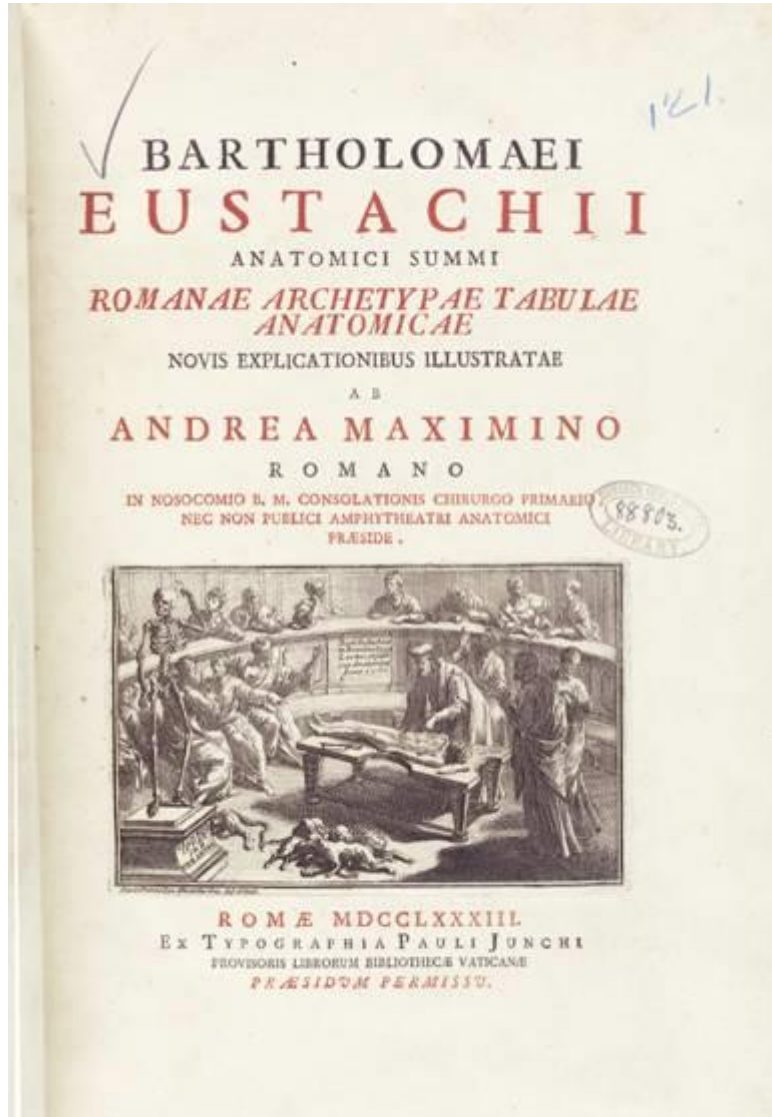
Bernhard Siegfried Albinus (1697-1770)
Tabulae sceleti et musculorum corporis humani.
London: H. Woodfall; J. & P. Knapton, 1749.



Bartholomeo Eustachi (1500/1514-1574)

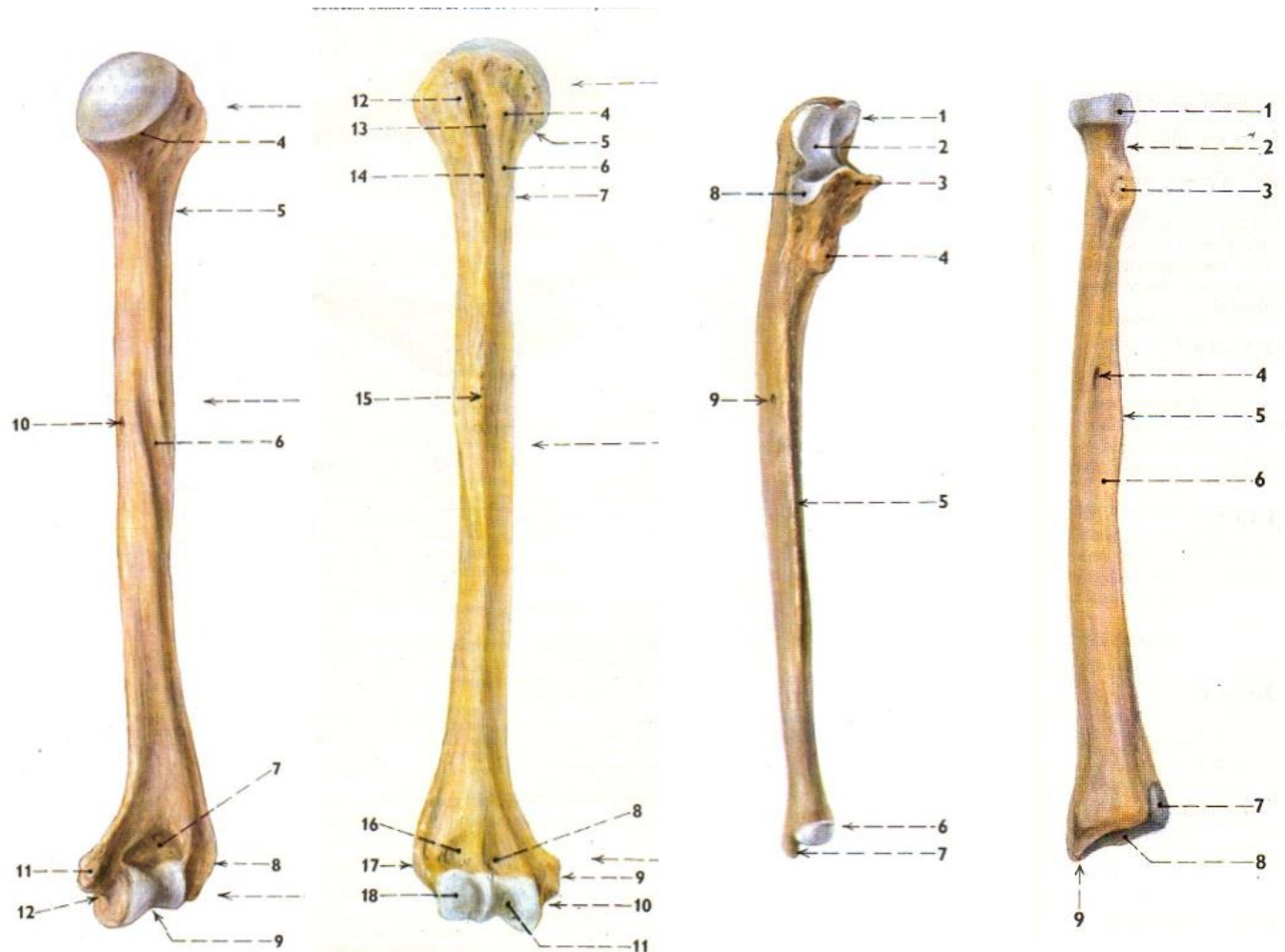
Tabulae anatomicae

Rome: P. Junchus, 1783.



Arm: *Humerus*

Forearm: *Ulna + Radius*



246. HUMERUS pravé strany

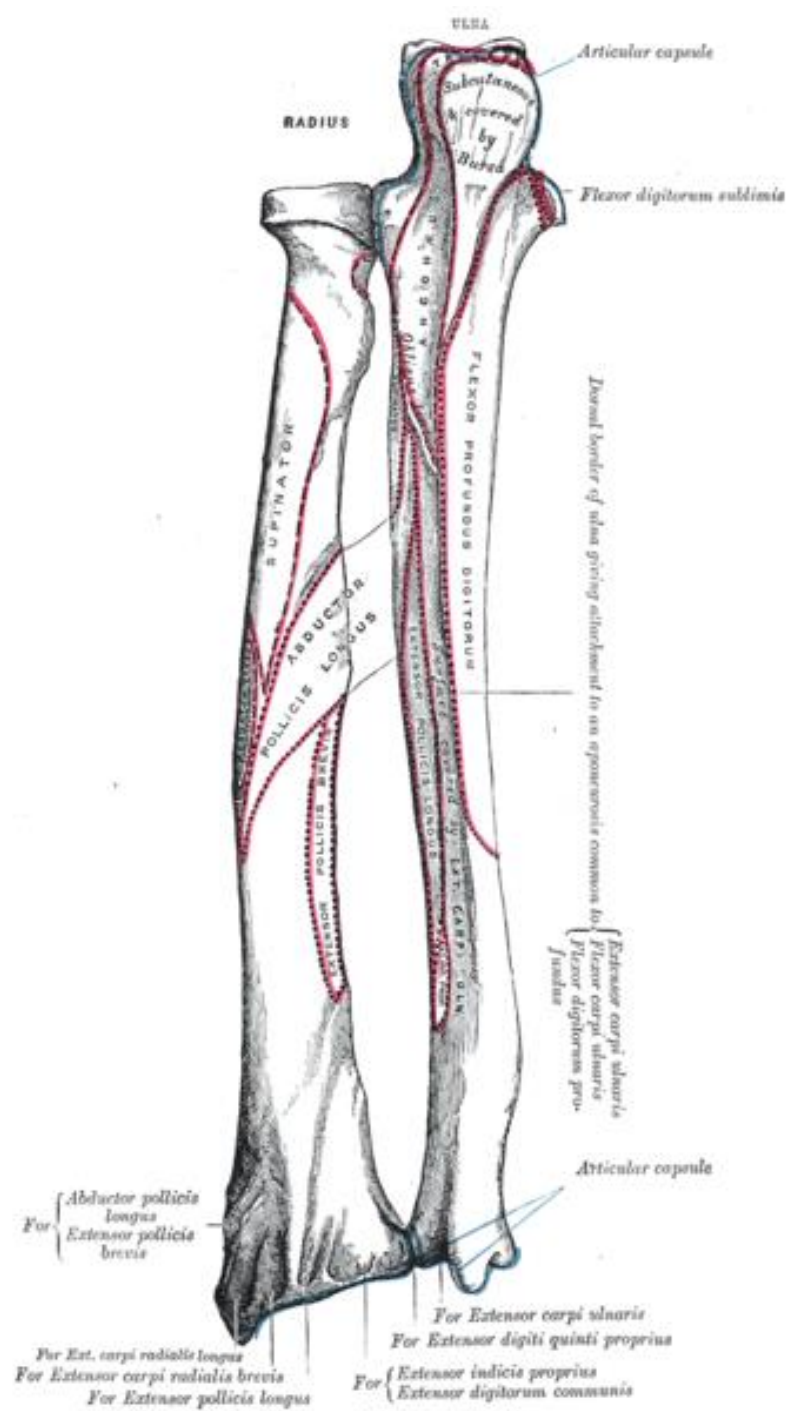
- 1/ caput humeri
- 2/ corpus humeri
- 3/ condylus humeri
- 4/ tuberculum minus
- 5/ collum anatomicum
- 6/ crista tuberculi minoris
- 7/ collum chirurgicum
- 8/ fossa coronoidea
- 9/ epicondylus medialis
- 10/ sulcus nervi ulnaris
- 11/ trochlea humeri
- 12/ tuberculum majus
- 13/ sulcus intertubercularis
- 14/ crista tuberculi majoris
- 15/ tuberositas deltoidea
- 16/ fossa radialis
- 17/ epicondylus lateralis
- 18/ capitulum humeri

Fracture of humerus



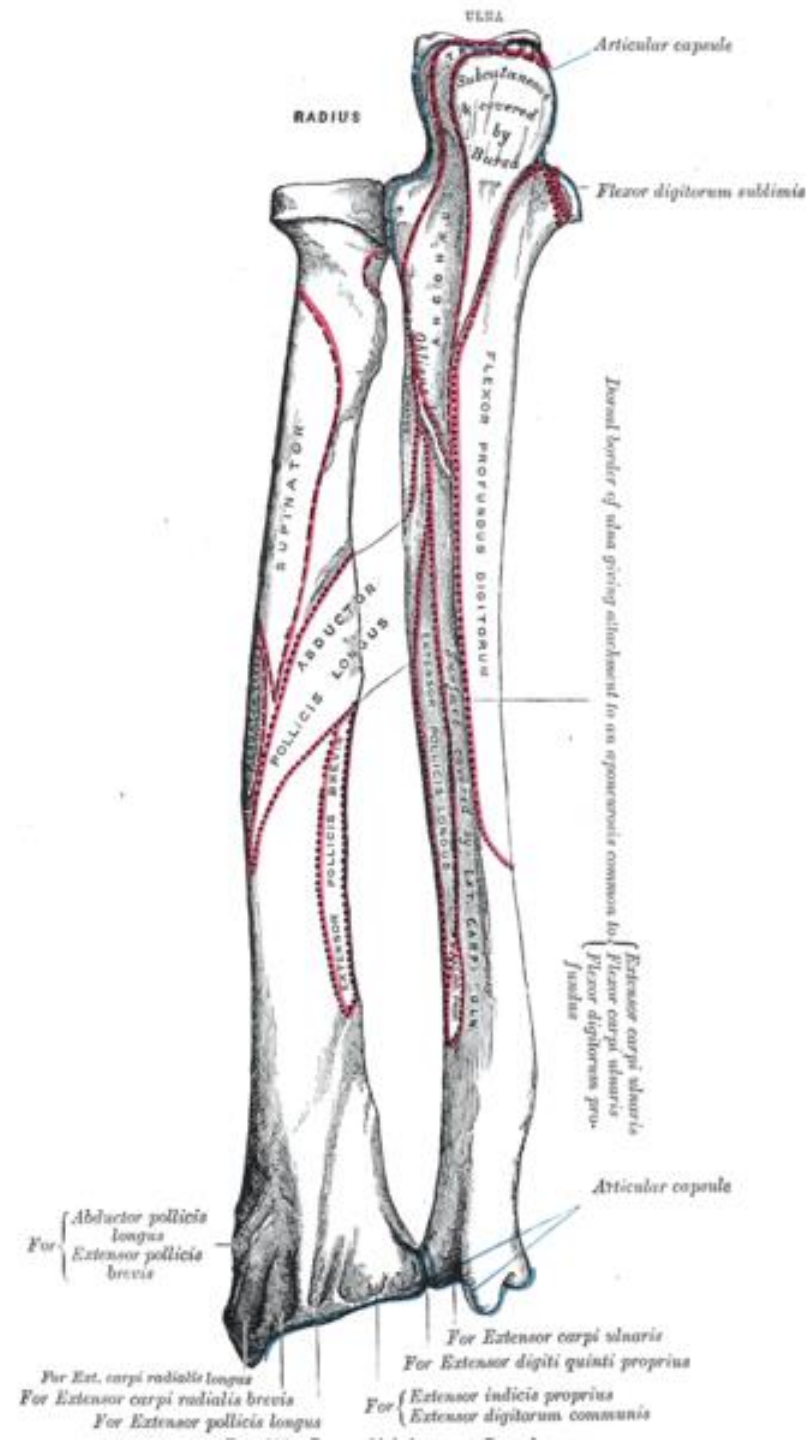
Radius (*Radius*)

- Caput radii
 - Fovea articularis
 - Circumferentia articularis
- Collum radii
- Corpus radii
 - Margo interosseus
 - Tuberositas radii
 - Tuberositas pronatoria
 - Tuberculum dorsale
 - Sulci tendinum musculorum extensorum
 - Crista suprastyloidea
- Processus styloideus

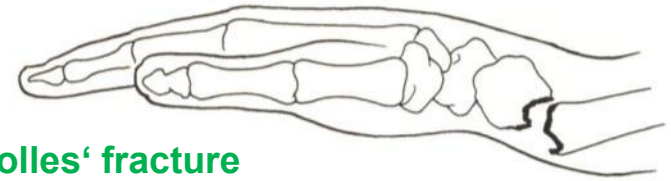


Ulna (*Ulna*)

- Olecranon
- Processus coronoideus
- Tuberositas ulnae
- Incisura radialis
- Incisura trochlearis
- Corpus ulnae
 - Crista musculi supinatoris
 - Margo interosseus
- Caput ulnae
 - Circumferentia articularis
 - Processus styloideus ulnae

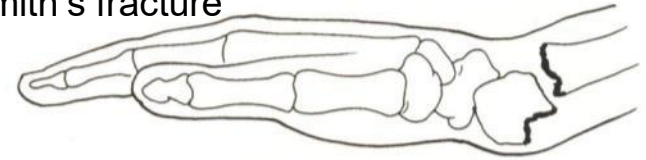


Colles' fracture of distal forearm



Colles' fracture

Smith's fracture



PA projection: transverse fracture radiolucency at the interface of distal epiphysis and radius metaphysis, abruptness of processus styloideus ulnae.

L projection: dorsal inclination of the distal epiphyseal fragment of radius.

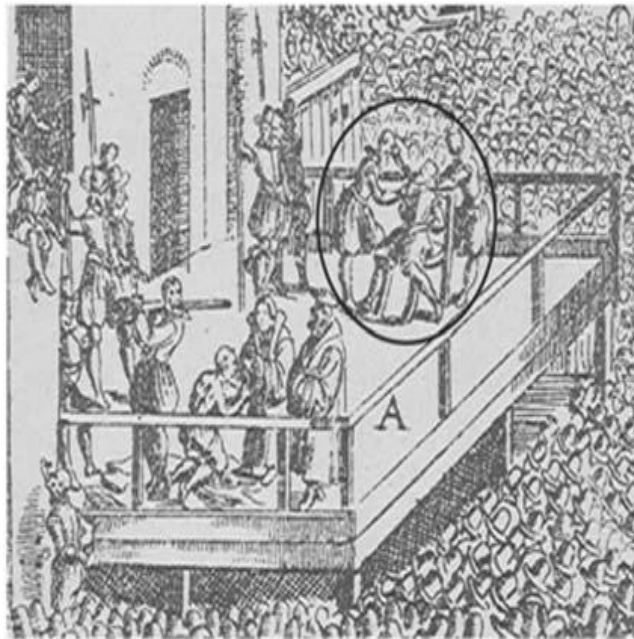
Conclusion: Typical X-ray image of Colles' fracture of the radius – extra-articular fracture with dorsal inclination of the distal epiphysis, abruptness of processus styloideus ulnae caused by traction of lig. collaterale ulnare.

Johannes Jessenius

(1566–1621)

Anatomia Pragae (1601)

De Ossibus (1601)



IOHANNIS
JESSENI
A IESSEN,
De Ossibus
Tractatus,

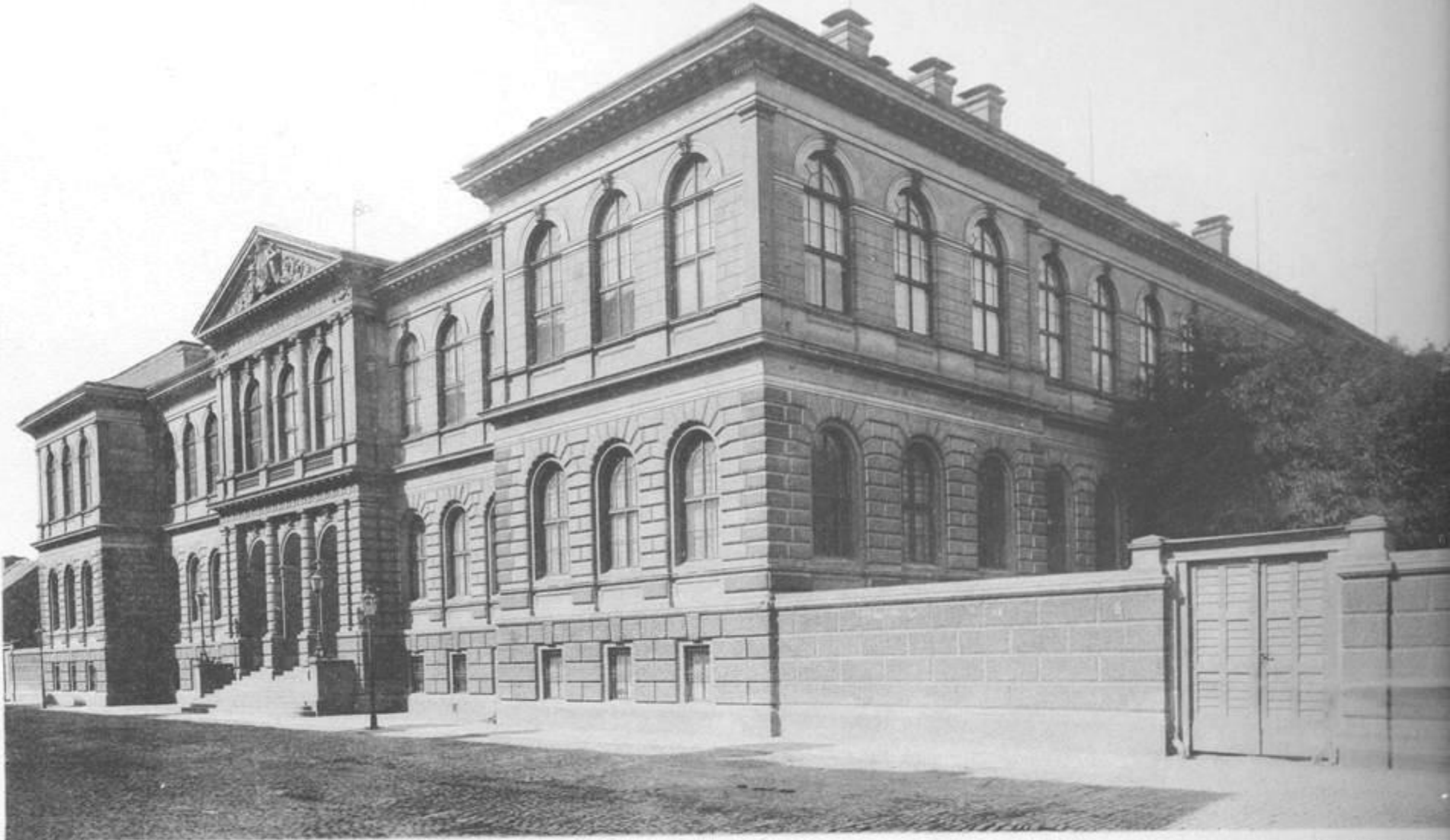


VVITEBERGÆ,
Excudebat Laurentius Senberlich,
Impressi Samuele Selsich,
Anno 1601.

IOHANNIS
JESSENI
A IESSEN,
Anatomix, Pragæ,
Anno M.D.C. abs se Io-
hannese administrata historia.
Accessit eiusdem de ossibus tractatus.



VVITEBERGÆ,
Excudebat Laurentius Senberlich,
Impressi Samuele Selsich,
Anno 1601.

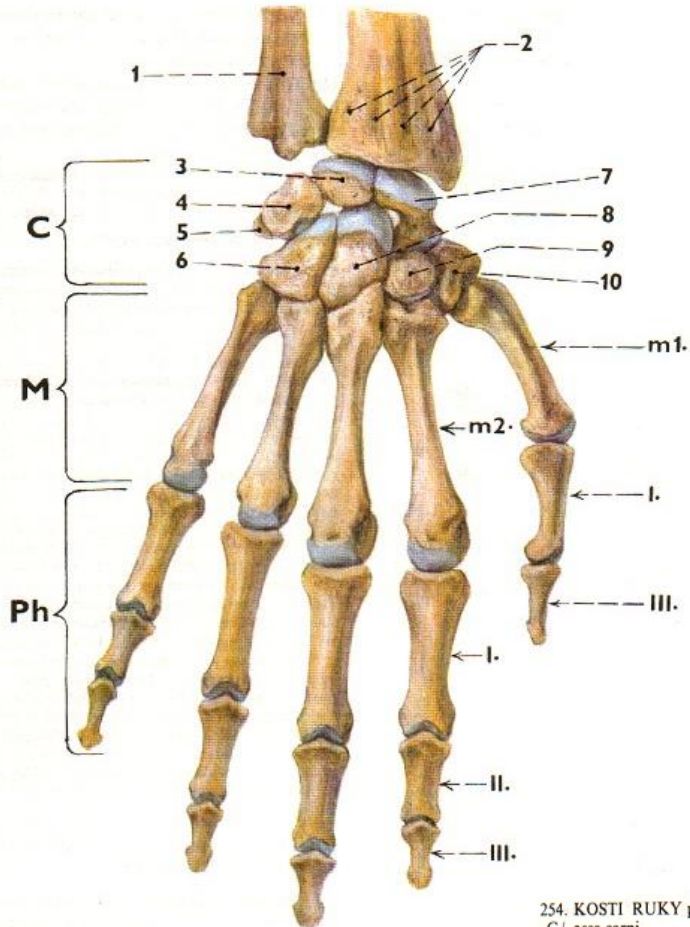


C. BELLMANN PHO

ANATOMISCHES INSTITUT

**First separate building of Anatomy department
of Charles-Ferdinand University built in 1874–1877**

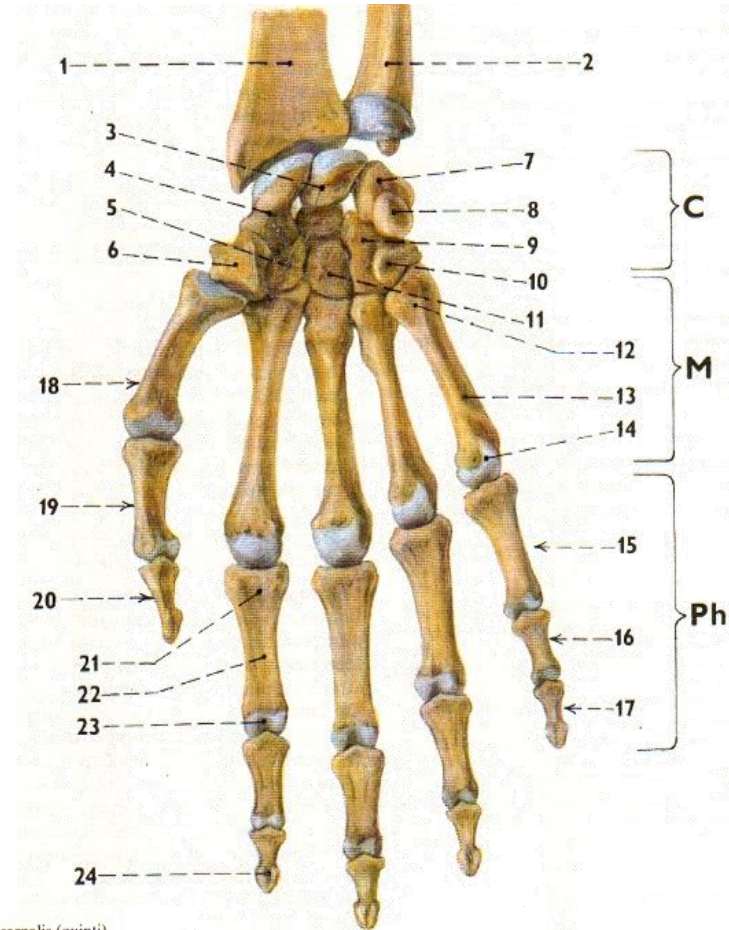
Bones of hand (*Ossa manus*)



Wrist bones (*Ossa carpi*)

Metacarpal bones (*Ossa metacarpi*)

Phalanges (*ossa digitorum manus*)



254. KOSTI RUKY pravé strany, pohled na dlaňovou stranu

C/ ossa carpi
M/ ossa metacarpi
Ph/ phalanges
1/ radius
2/ ulna
3/ os lunatum
4/ os scaphoideum
5/ os trapezoideum
6/ os trapezium
7/ os triquetrum
8/ os pisiforme
9/ os hamatum
10/ hamulus ossis hamati
11/ os capitatum

12/ basis ossis metacarpalis (quinti)
13/ corpus ossis metacarpalis (quinti)
14/ caput ossis metacarpalis (quinti)
15/ phalanx proximalis (digiti quinti)
16/ phalanx media (digiti quinti)
17/ phalanx distalis (digiti quinti)
18/ os metacarpale pollicis (I)
19/ phalanx proximalis pollicis
20/ phalanx distalis pollicis
21/ basis phalangis (proximalis digiti secundi)
22/ corpus phalangis (proximalis digiti secundi)
23/ caput phalangis (proximalis digiti secundi)
24/ tuberositas phalangis distalis (digiti secundi)

Bones of hand

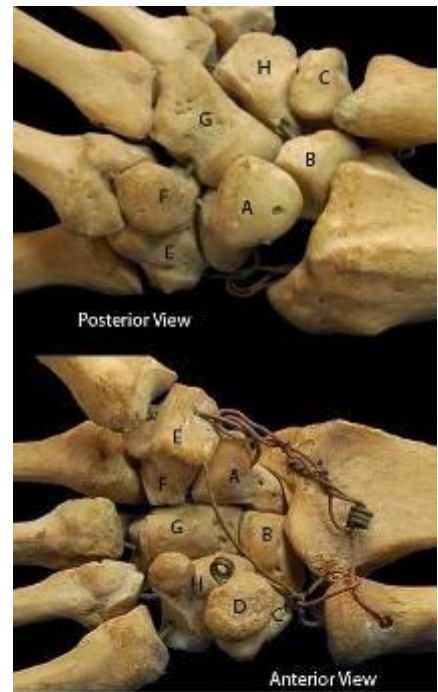
Ossa manus

- wrist/carpal bones (*ossa carpi*) – 8
- metacarpal bones (*ossa metacarpi*) – 5
- phalanges (*ossa digitorum; phalanges*) – 14
 - proximal (*proximalis*)
 - middle (*media*)
 - distal (*distalis*)
- sesamoid bones (*ossa sesamoidea*)



Wrist/Carpal bones (*Ossa carpi*)

- **os scaphoideum** (scaphoid)
 - tuberculum ossis scaphoidei
- **os lunatum** (lunate)
- **os triquetrum** (triquetrum)
- **os pisiforme** (pisiform)
- **os trapezium** (trapezium)
 - tuberculum ossis trapezii
 - sulcus tendinis musculi flexoris carpi radialis
- **os trapezoideum** (trapezoid)
- **os capitatum** (capitate)
 - caput ossis capitati
- **os hamatum** (hamate)
 - hamulus ossis hamati
- (*os centrale*) – *variable*



A = Scaphoid
B = Lunate
C = Triquetrum
D = Pisiform
E = Trapezium
F = Trapezoid
G = Capitate
H = Hamate

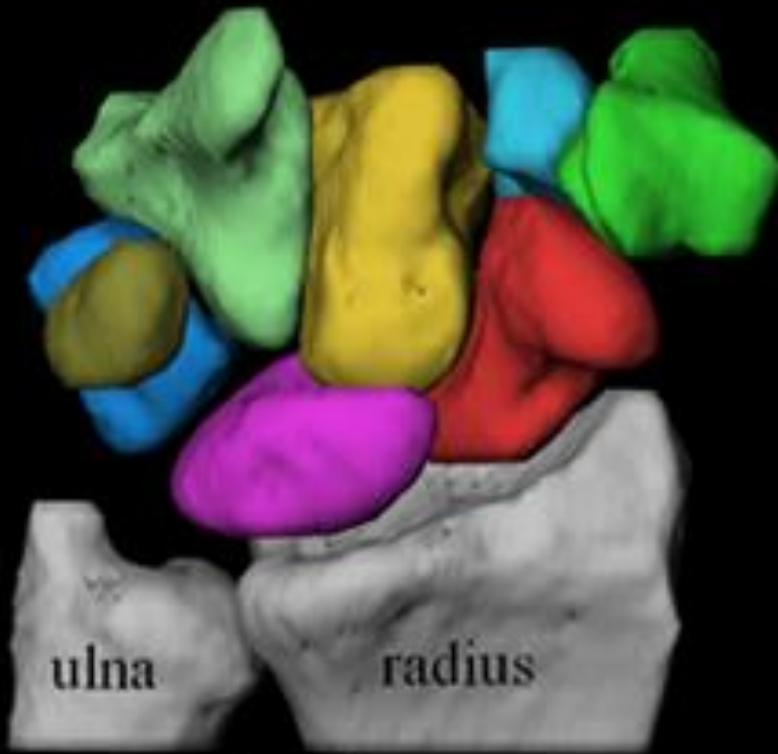
http://www.mananatomy.com/wp-content/uploads/2010/12/carpal_bones.jpg



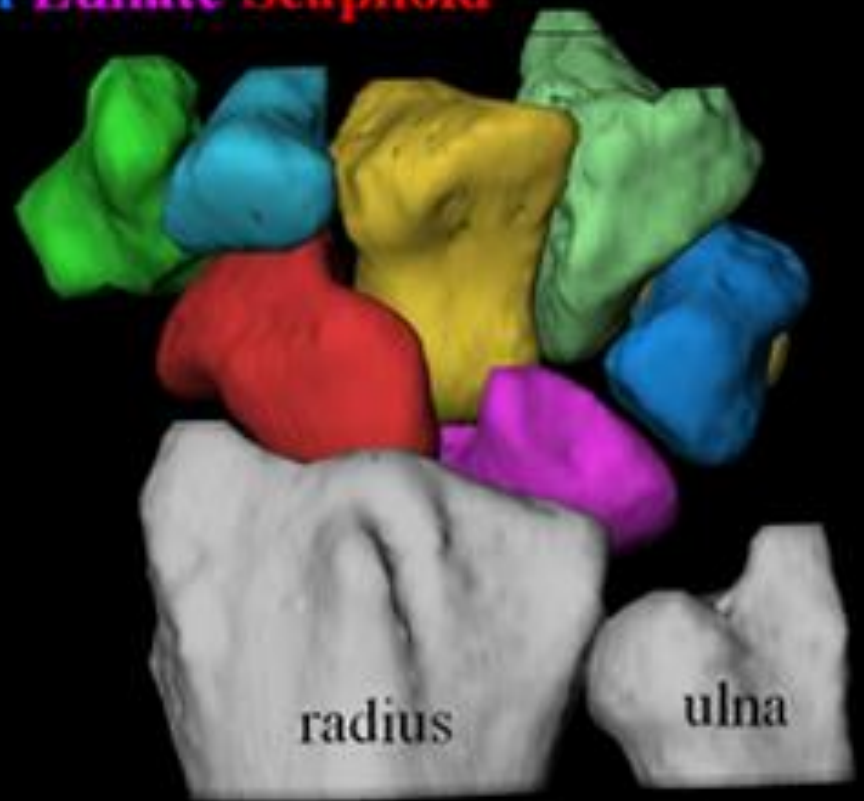
<http://4.bp.blogspot.com/-bBgOqYiWe4/Tr8NX7m32oI/AAAAAAAAAJps/-cdzcknMFeY/s1600/OsCarpiCentrale.jpg>

Wrist/carpal bones (*Ossa carpi*)

Hamate Capitate Trapezoid Trapezium
Pisiform Triquetrum Lunate Scaphoid



volar view



dorsal view

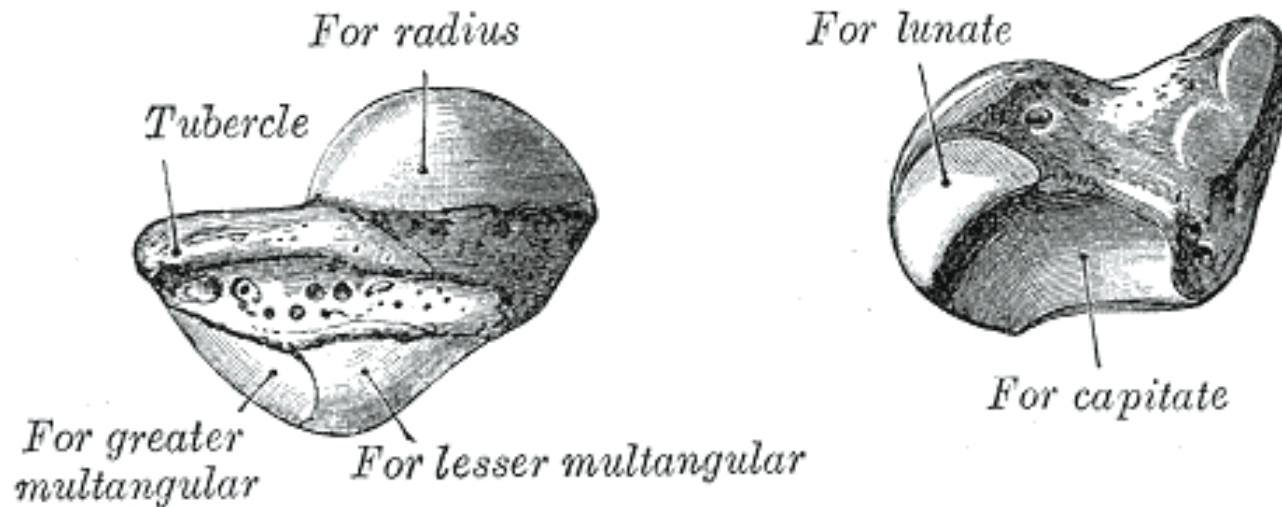
Mnemonics for carpal bones

**Scared Lovers Try Positions
That they Cannot Handle**

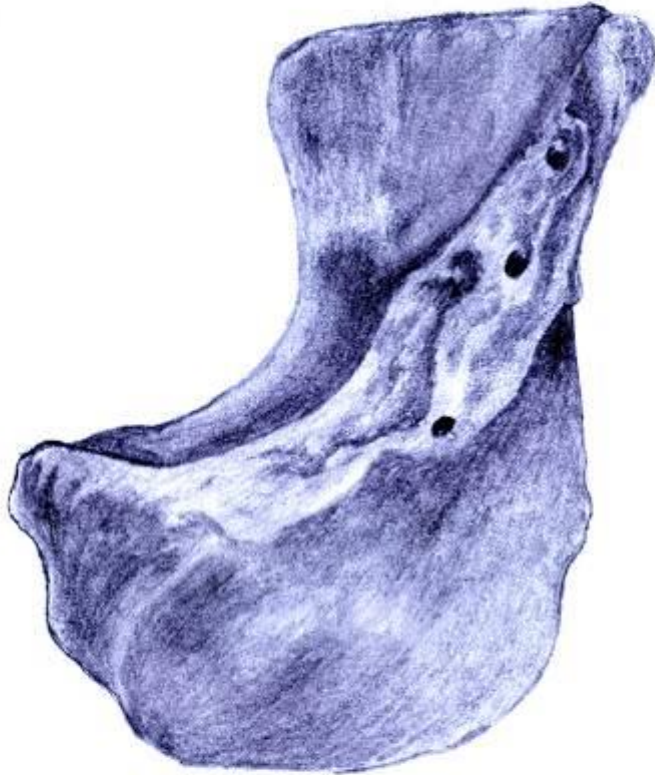
- *from American series Emergency*

Os scaphoideum l. sin.

- obsolete term: *os naviculare*



OS SCAPHOIDEUM l. sin.

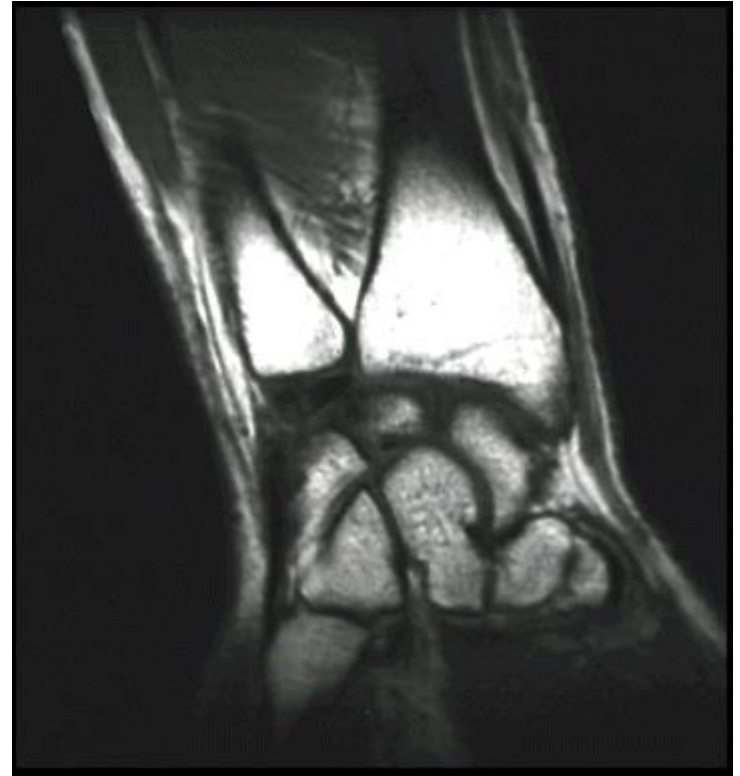


X-ray *versus* MRI

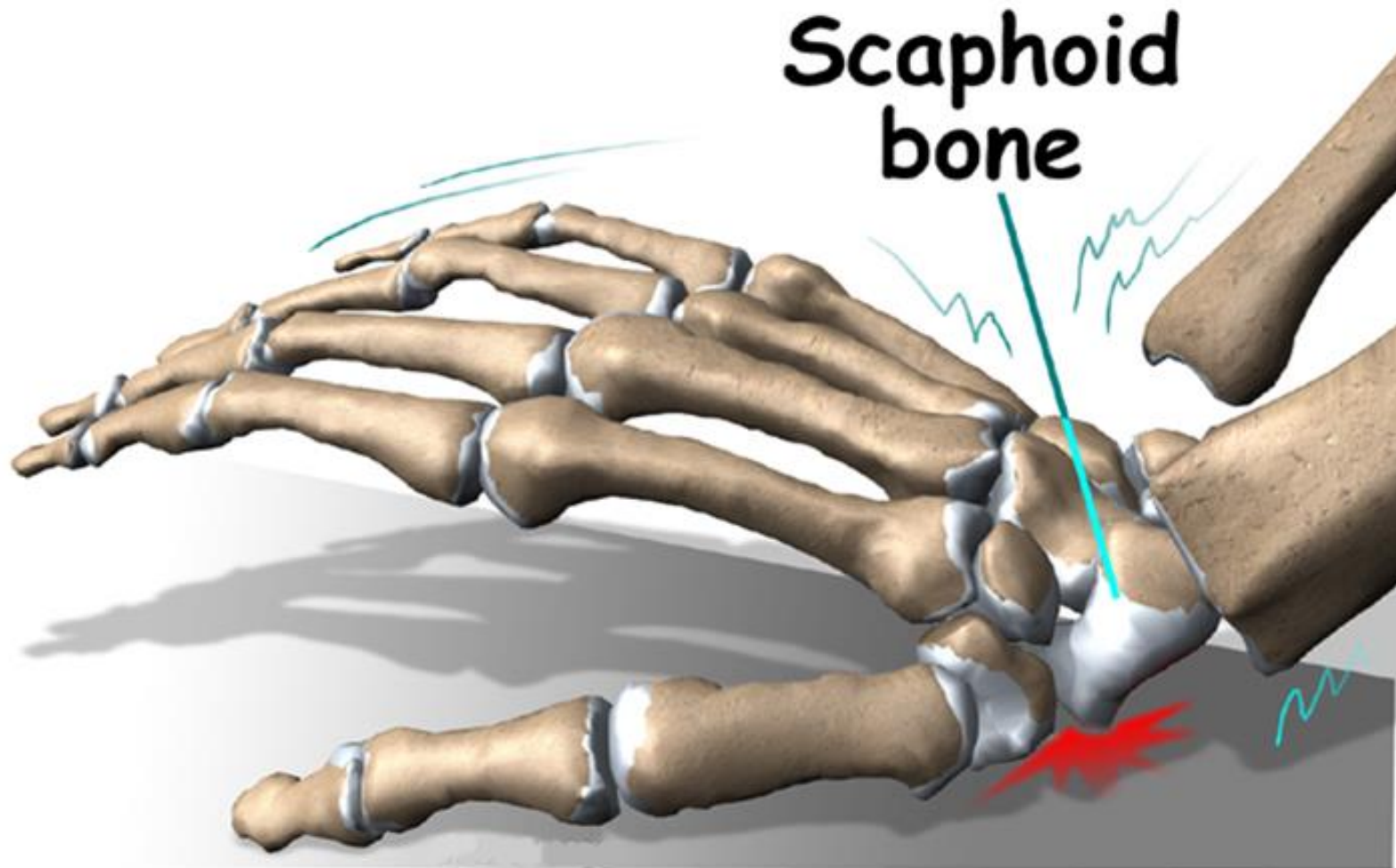
- Antero-posterior (AP)



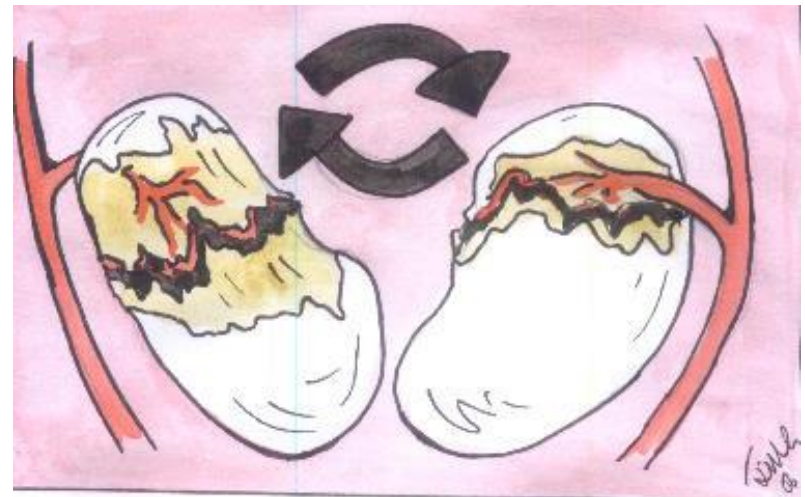
- Frontal (coronal) MRI



Fracture of os scaphoideum I *mode of origin*



Fracture of os scaphoideum II



Fracture of os scaphoideum III



Stabilization surgery of os scaphoideum



a



b



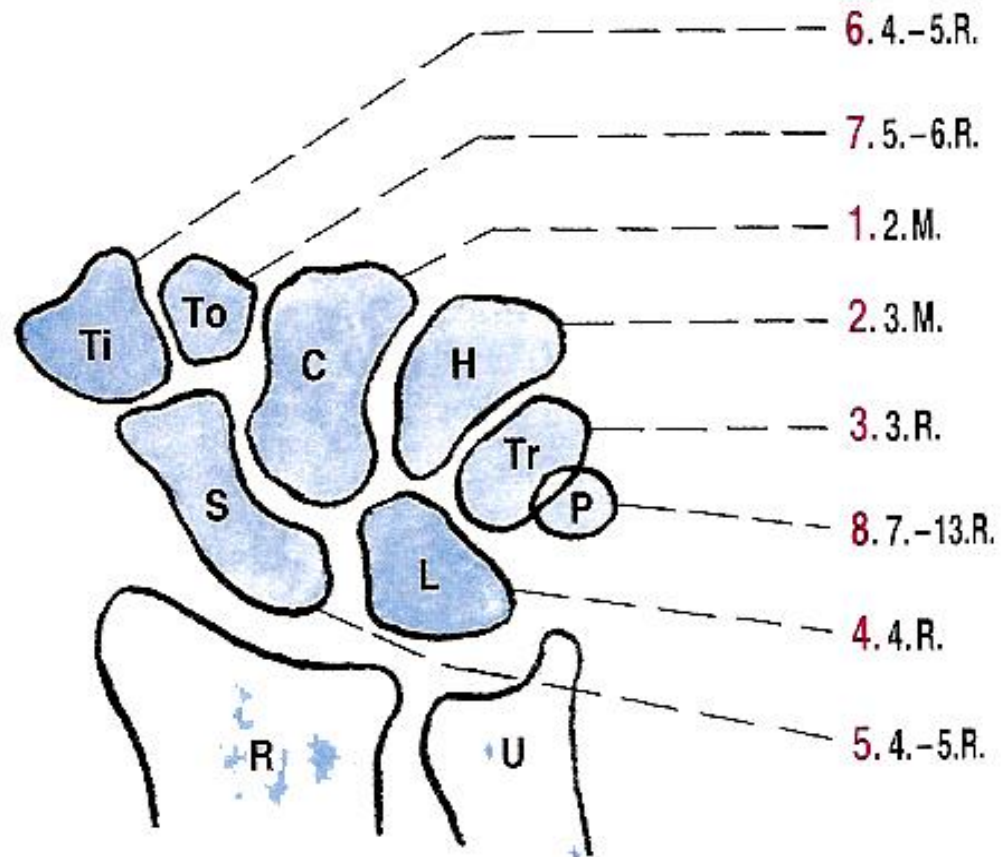
c

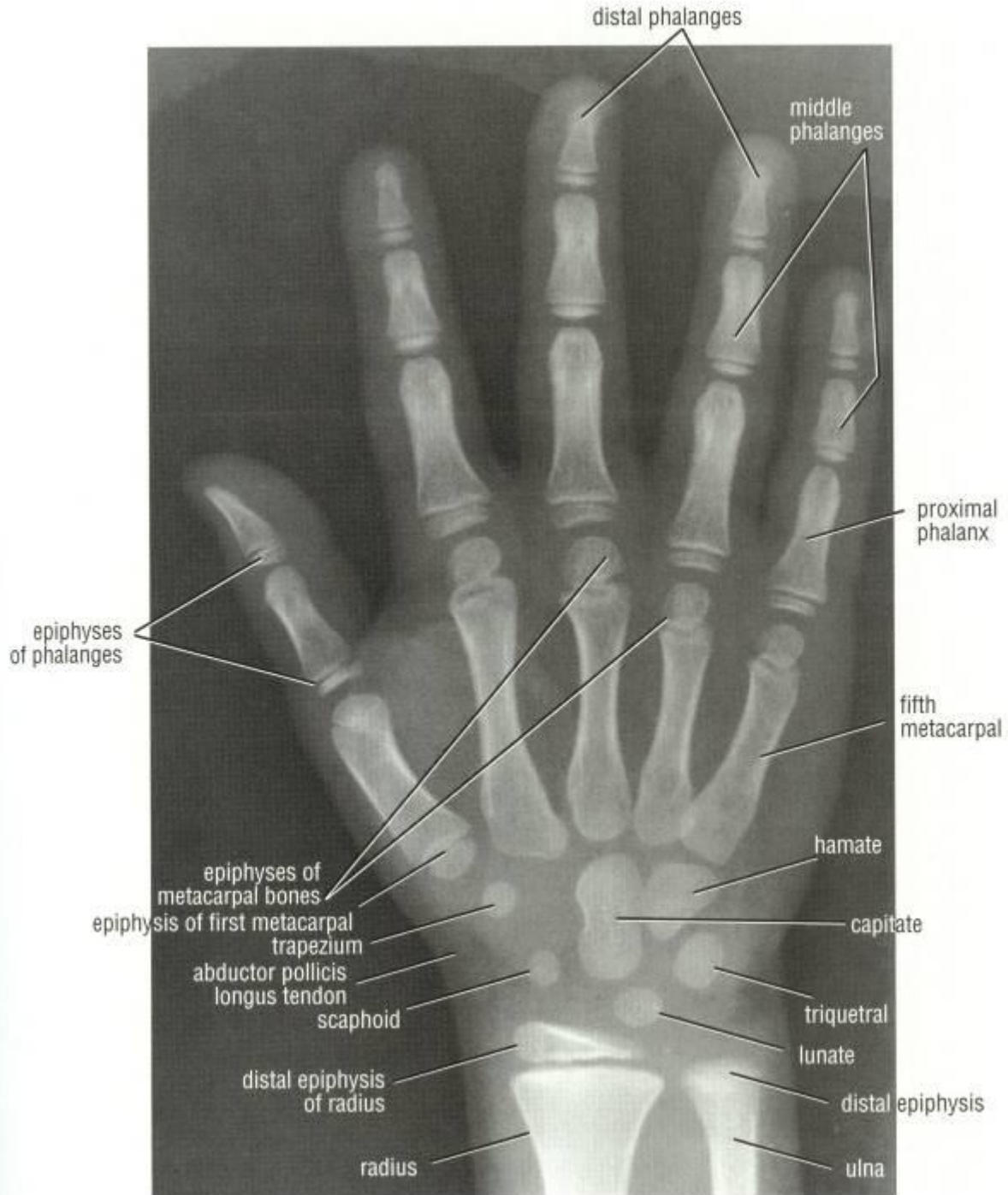


d

stabilization: by means of screws, nails or bone graft

Ossification *bone age*





Sesamoid bones of hand (*Ossa sesamoidea manus*)

- constantly 2 at articulatio metacarpophalangea pollicis
- *os sesamoideum pollicis mediale*
- *os sesamoideum pollicis laterale*

- (other variable)



Andreas van Wesel

Andreas Vesalius Bruxellensis

- 1514 - 1564
- *Padova (Itálie)*
- **zakladatel moderní anatomie**
- základy názvosloví
- zavedl pořadové (ordinální) výrazy
- 700 nových výrazů v nauce o kostech
- nahradil řecké a arabské výrazy latinskými

- „De humani corporis fabrica libri septem“ (Bazilej, Švýcarsko 1543)

