General arthrology

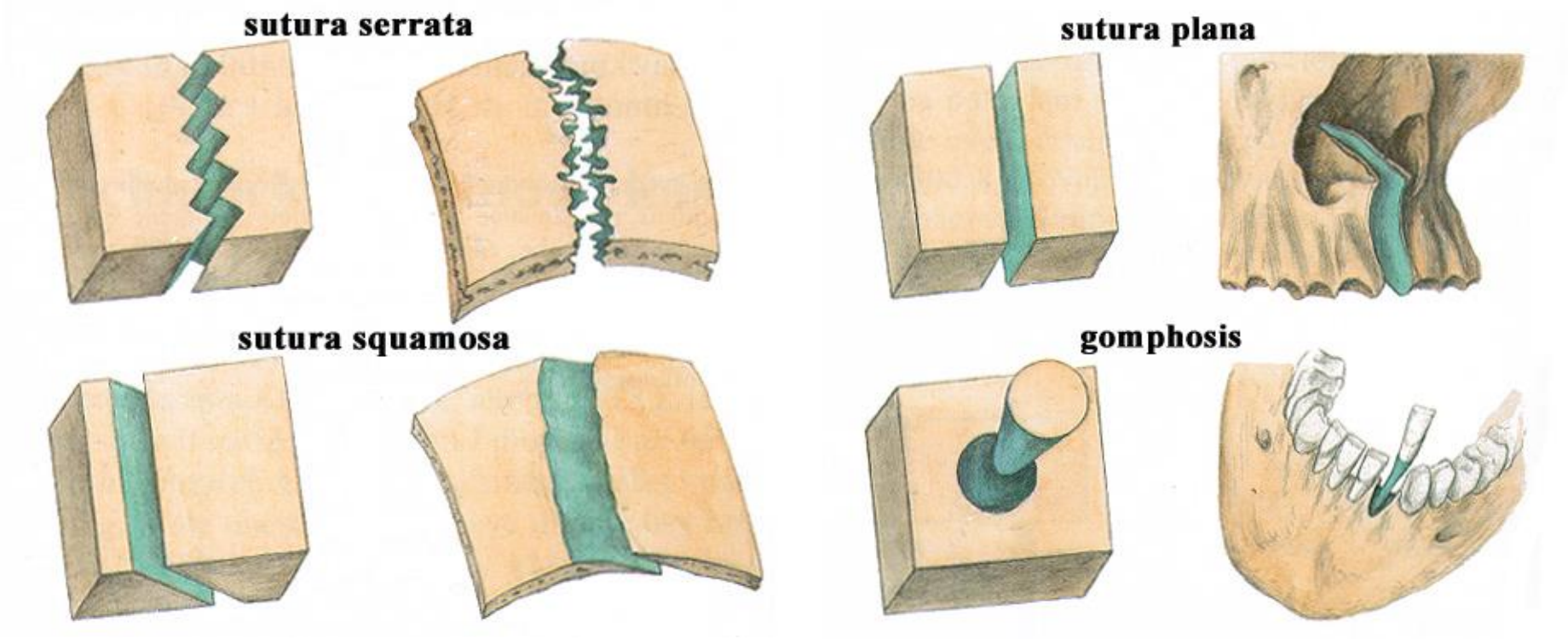
Juncturae *seu* **Systema articulare**
Joint or **Articular system**

- **synathrosis** (immovable joints)
  - connection by means of connective tissue
    - fibrous (junctura fibrosa) - *syndesmosis*
    - cartilage (junctura cartilaginea) - *synchondrosis*, *symphysis*
    - bony (junctura ossea) – *synostosis*
  - no joint cavity
- **diarthrosis** (synovial joint)
  - connecting surfaces with a cavity

Synarthrosis

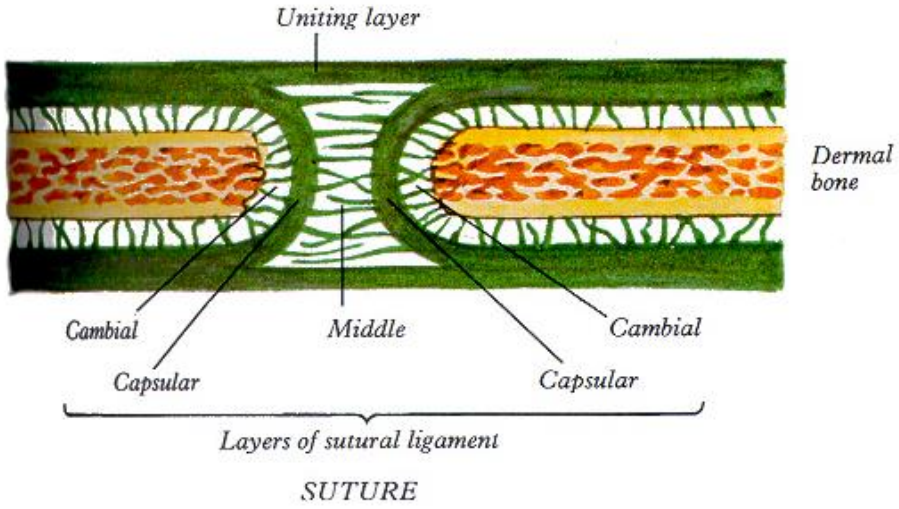
junctura fibrosa /fibrous joints/	syndesmosis	ligamenta /ligaments/	all extra-articular ligaments
		gomphosis /socket/	syndesmosis dentoalveolaris /dento-alveolar syndesmosis/
		membrana /membrane/	membrana interossea antebrachii et cruris, intercostalis externa et interna, obturatoria
	sutura /suture/	sutura plana, squamosa, limbosa, serrata et denticulata, schindylesis	33 cranial sutures
junctura cartilaginea /cartilaginous joint/	synchondrosis		cranial synchondrosis, epiphysial joint /primary cartilaginous joint, growth plate/, artt. costochondrales, interchondrales
	symphysis /secondary cartilaginous joint/		symphysis intervetebralis, pubis, sacrales, mandibulae, manubriosternalis, xiphisternalis
junctura ossea /bony union/	synostosis		os coxae /hip bone/ (os ilium + os ischii + os pubis), os sacrum /sacral

Junctura fibrosa I

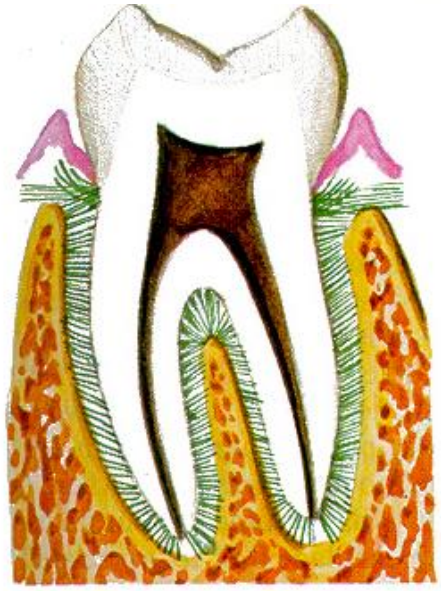


Čihák R., Anatomie 1, Grada Publishing a.s. 2001

Junctura fibrosa II

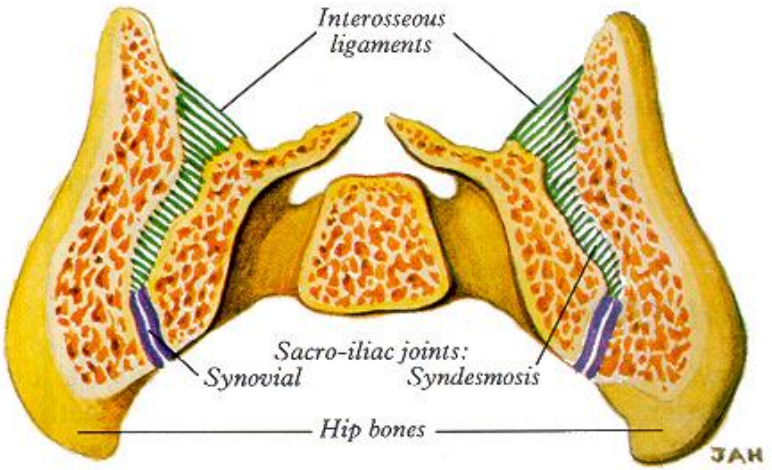


SUTURE



GOMPHOSIS
(Dentoalveolar joint)

SCHINDYLESIS
(Ridge and groove)

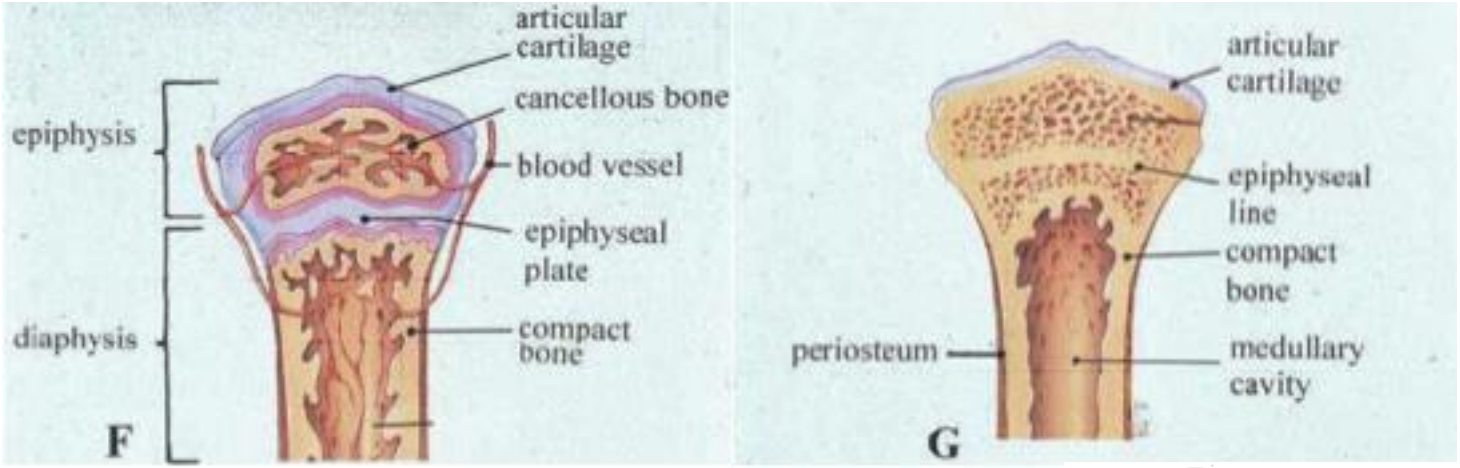


SYNDESMOSES

Gray´s anatomy, 37th edition, Churchill Livingstone 1989

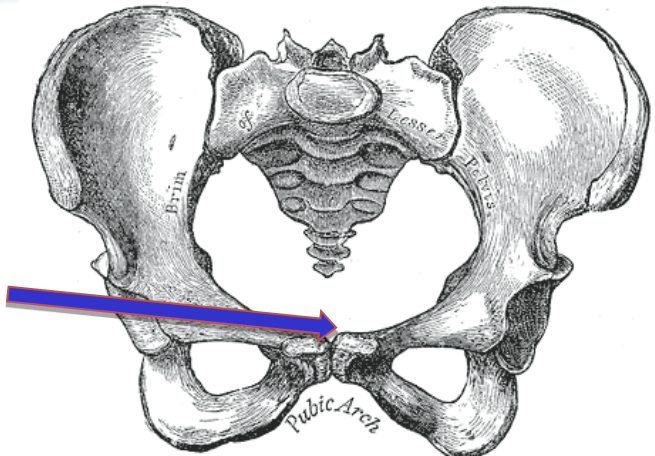
Junctura cartilaginea I

- **synchondrosis** (connection by hyaline cartilage)

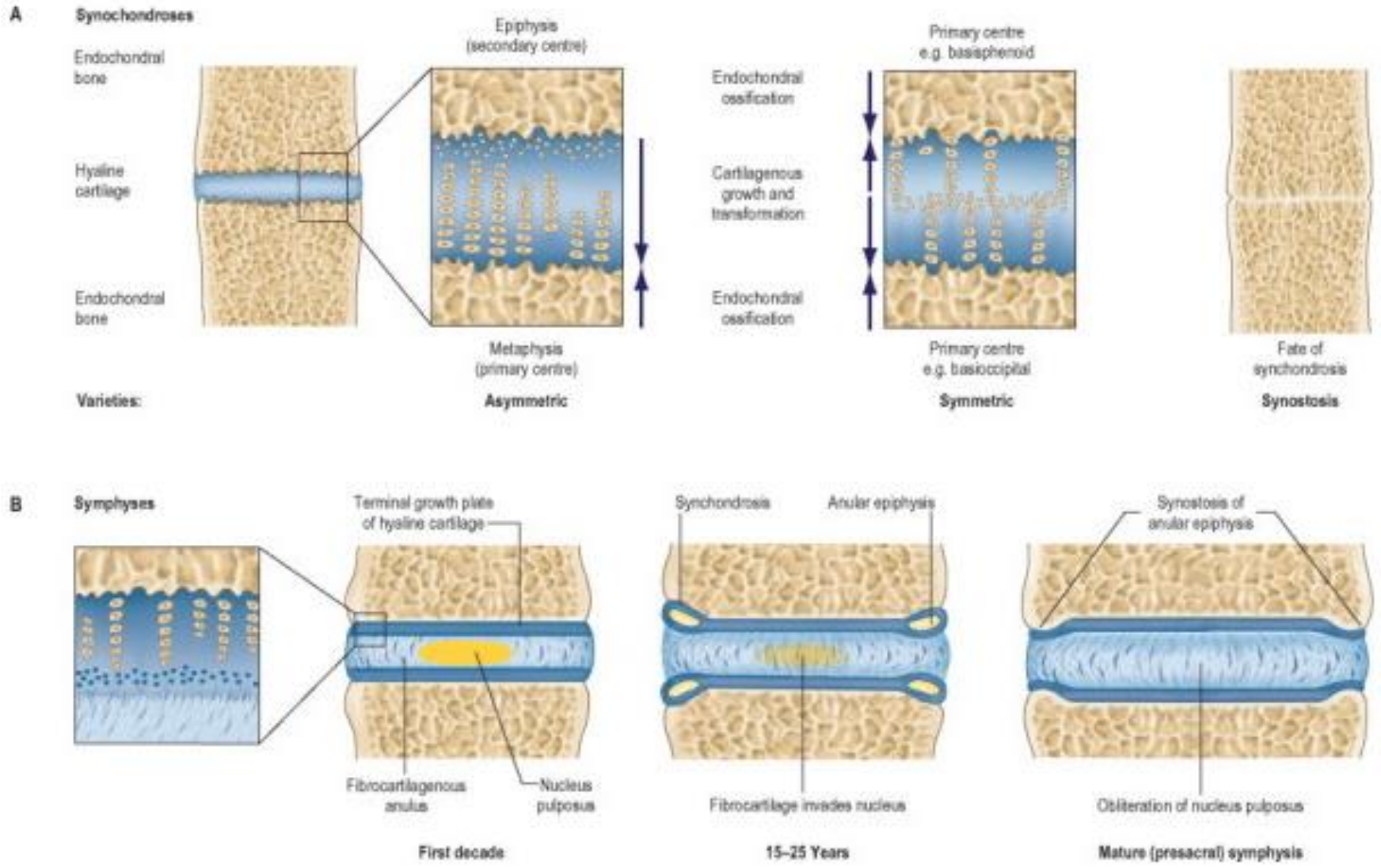


- **symphysis** (connection by fibrous cartilage)

symphysis pubis



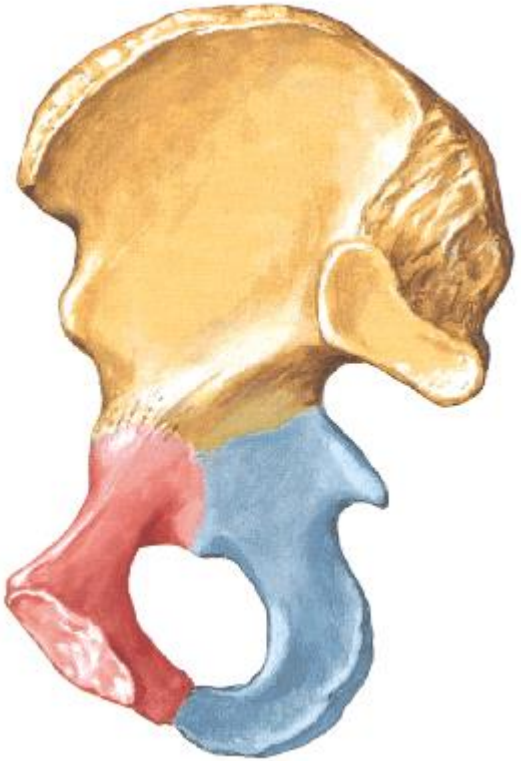
Junctura cartilaginea II



Gray´s anatomy, 40th edition, Churchill Livingstone Elsevier 2008

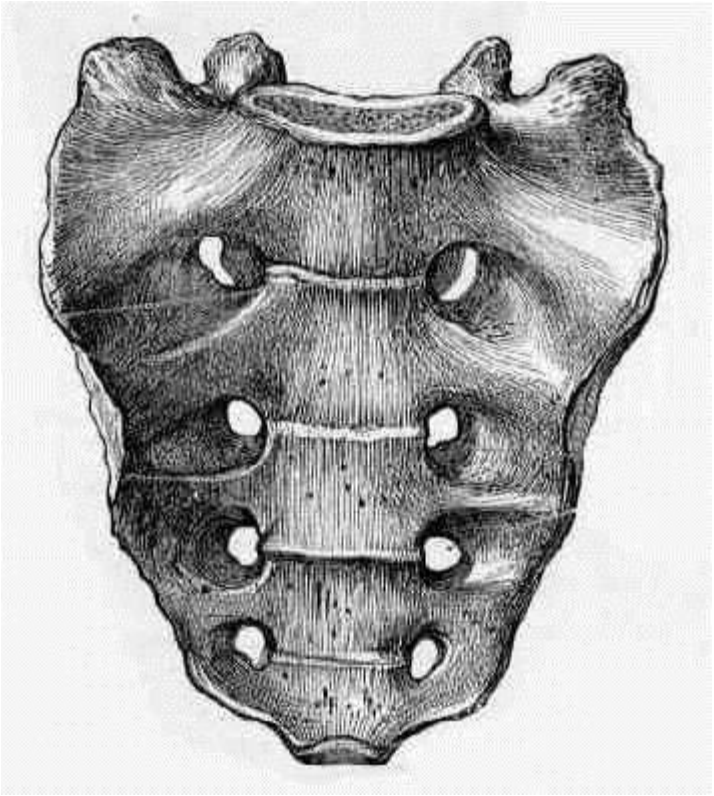
Junctura ossea

os coxae



Netter, Atlas of Clinical Anatomy

os sacrum



http://www.wheelessonline.com/ortho/sacrum_and_sacral_fractures

Diarthrosis = Junctura synovialis = Articulatio = Synovial joint

- facies articulares (articular surfaces)
  - fossa (*fossa articularis*) x head (*caput articulare*)
- capsula articularis (joint capsule)
  - stratum fibrosum (externally)
  - stratum synoviale (little differentiated synovialocytes → hyaluronic acid)

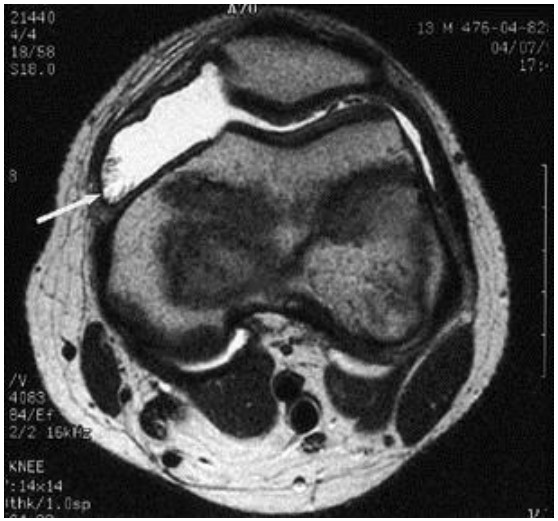
  plicae synoviales (synovial folds), corpus adiposum intraarticulare (intraarticular fat pad)
- cavitas articularis (articular cavity)
  - capillary slit
  - contains synovia (synovial fluid) = plasma transsudate + hyaluronic acid + a few leukocytes
- special joint structures

Membrana synovialis (Synovial membrane)

- lines the whole articular cavity
  - apart from articular surfaces
- protrudes in plicae synoviales and villi synoviales
- well supplied by vessels and nerves
- 3 types
  - fibrous
  - areolar
  - adipose

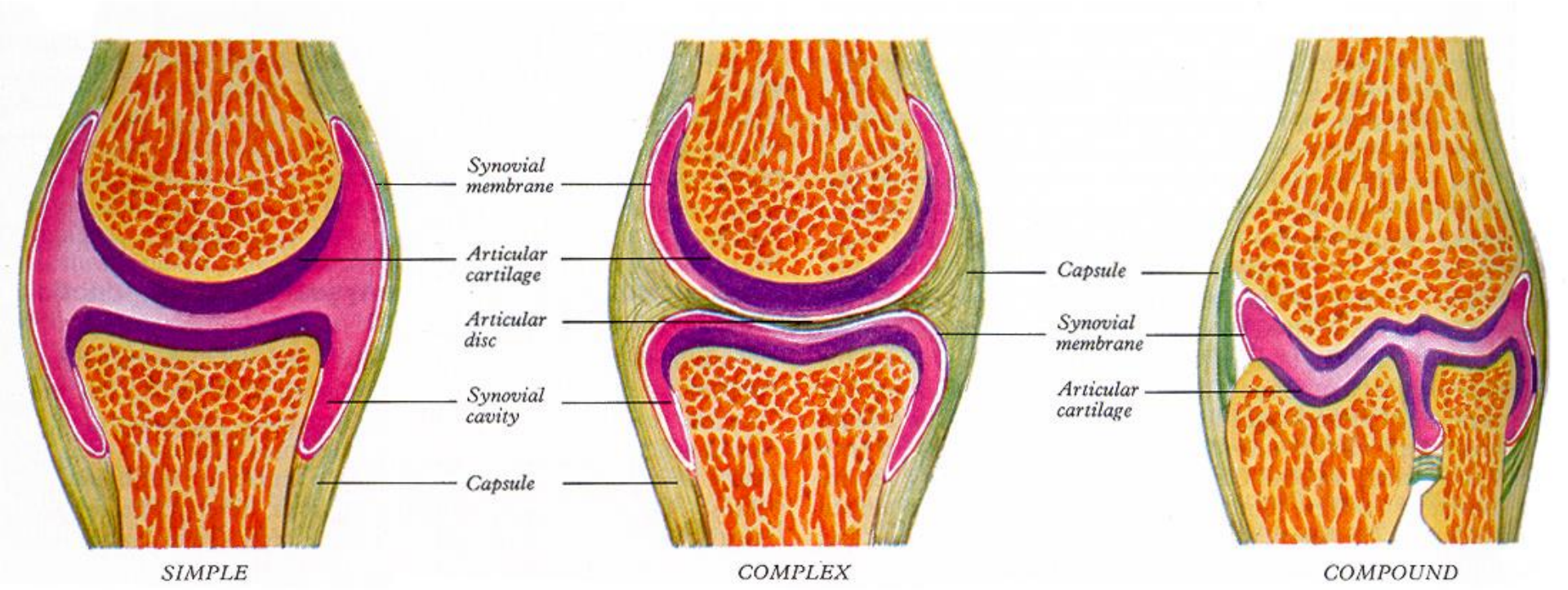
Synovitis

- inflammation of the synovial membrane
- production of effusion into the articular cavity



http://mskcases.com/index.php?module=article&view=39

http://www.health-pic.com/pigmented-villonodular-synovitis-knee/



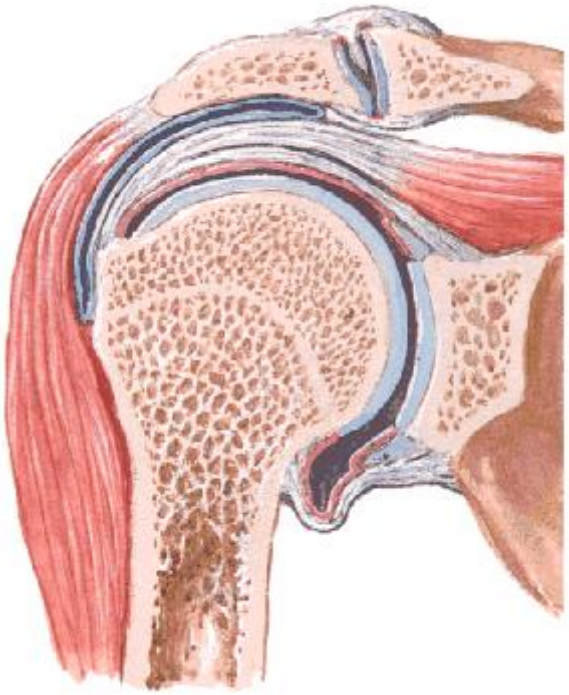
Gray´s anatomy, 37th edition, Churchill Livingstone 1989

Special joint structures I

- labrum articulare (labrum)
  - enlarges the area of articular fossa
  - *art. humeri*, *art. coxae*

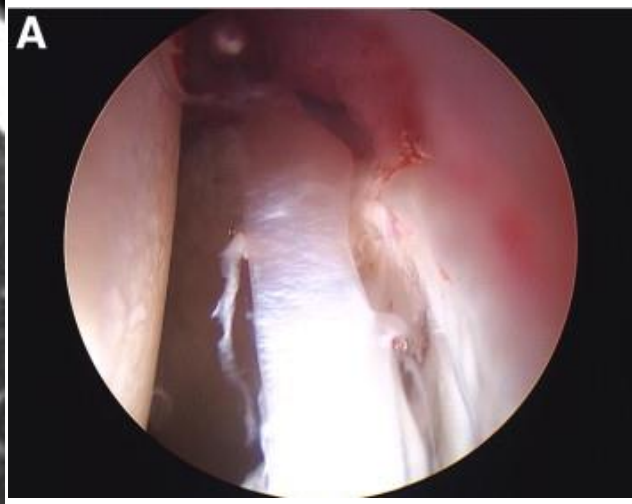
- disci et menisci articulares (articular discs and menisci)
  - they level articular incongruations
  - elastic liner/pad
  - disc divides articular cavity in two
    - *art. temporomandibularis*, *art. sternoclavicularis*
  - meniscus is becoming flatter in the inner direction, has free inner margin
    - *art. genus*

Labrum articulare



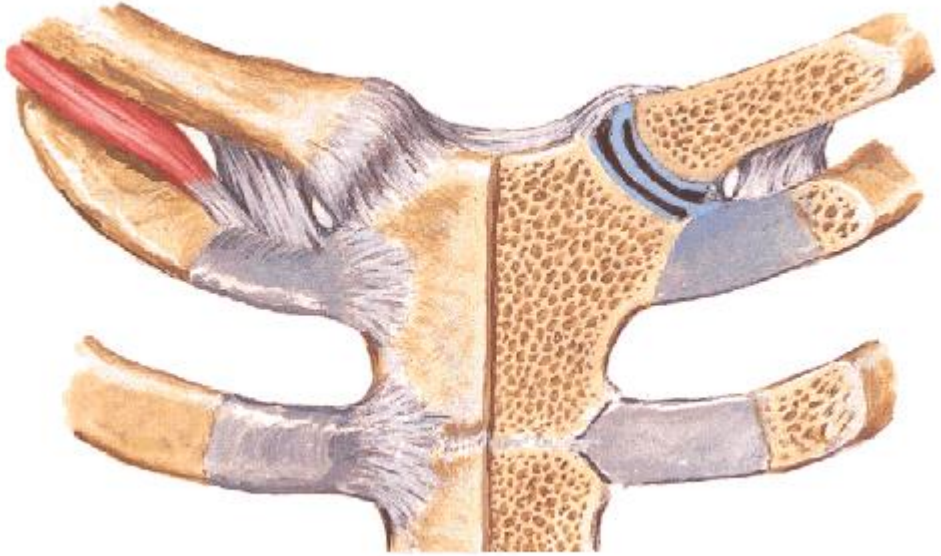
Netter, Atlas of Clinical Anatomy

http://www.mypacs.net/cases/SHOULDER-PAIN-4096677.html



http://www.sciencedirect.com/science/article/pii/S0749806310000988

Discus et meniscus articularis



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Special joint structures II

- ligamenta (ligaments)
  - capsular (*ligg. capsularia*), extracapsular (*ligg. extracapsularia*) and intracapsular (*ligg. intracapsularia*)
  - strenghten the capsule
  - support the movements of the joint
  - limit the movement of the joint
- bursae synoviales (synovial bursae)
  - cavities lined by synovial membrane
  - inside there is a fluid similar to synovia
  - place of pathological changes
- musculi articulares (joint muscles)
  - prevent joint capsule strangulation

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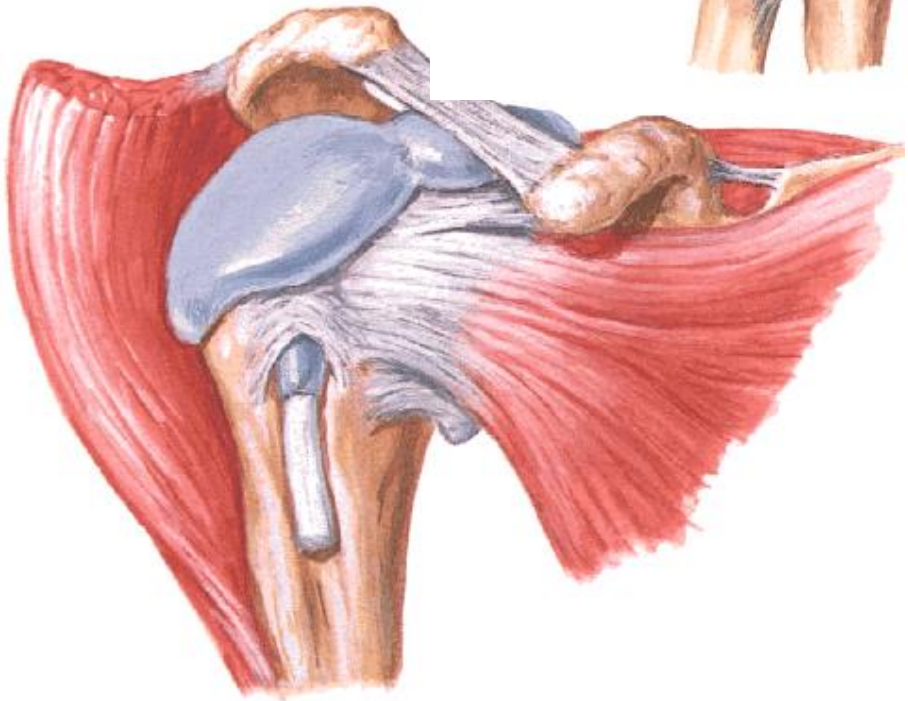
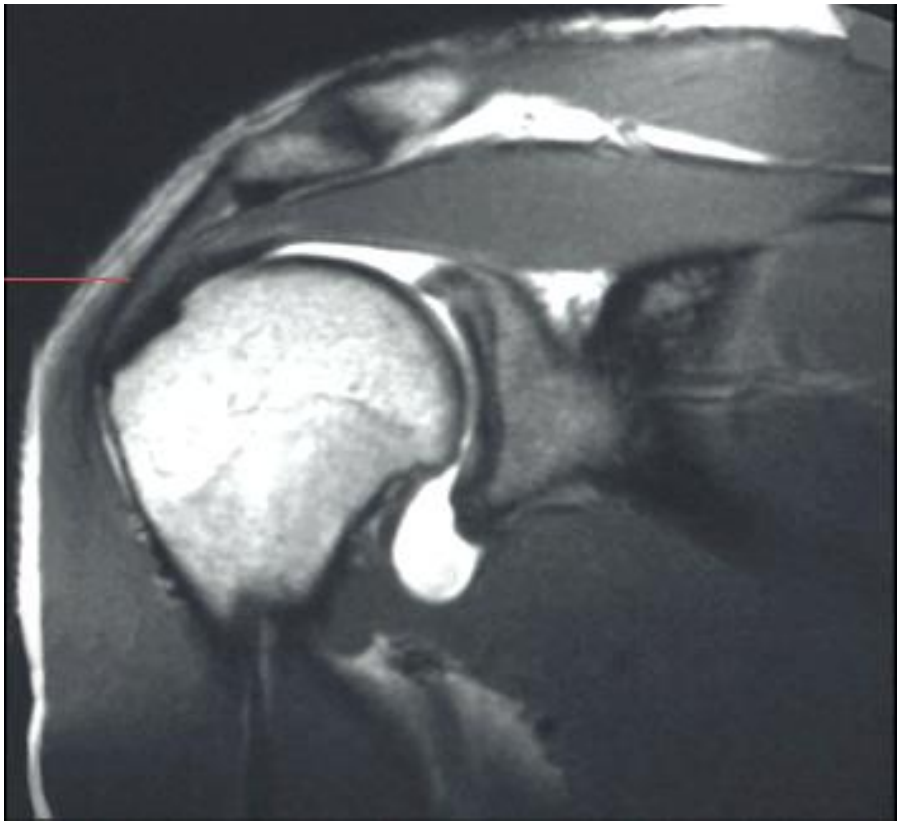




Special joint structures III

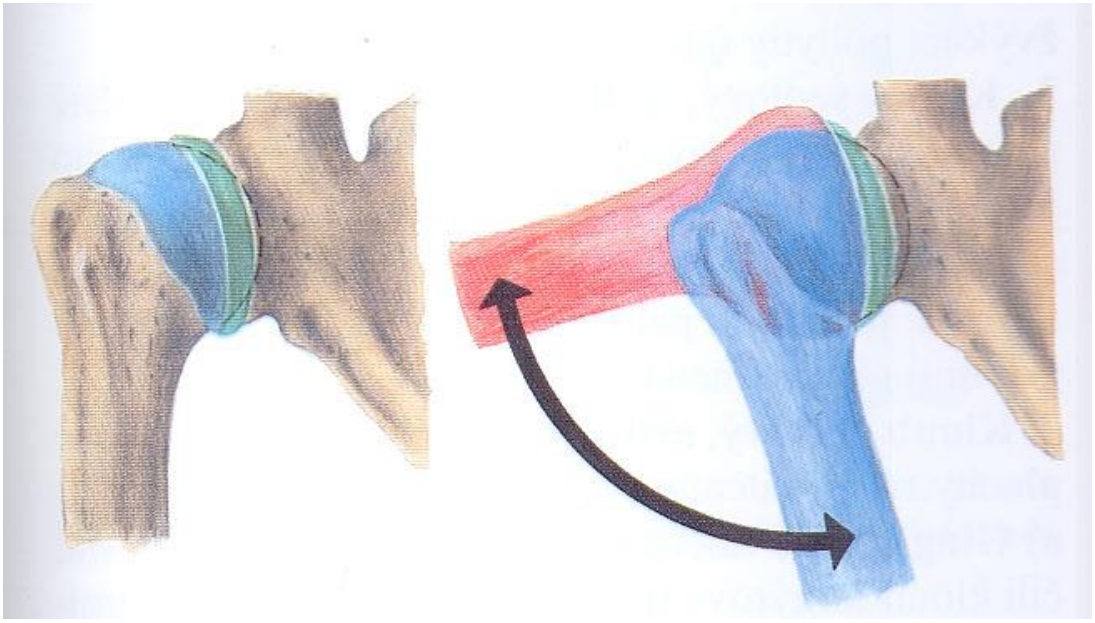
- fibrocartilago (fibrocartilage)
  - enlarge the articular fossa and strengthen the capsule
- corpus adiposum (fat pad)
- plica synovialis
  - level incongruations of the articular surfaces

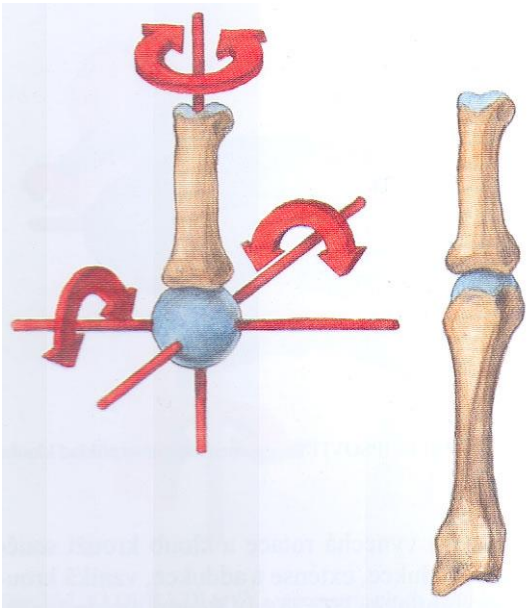
Classification of diarthrosis

- by part number:
  - simple /art. simplices/ - 2 kosti
  - compound /art. compositae/
    - more than 2 bones
    - 2 bones + disc or meniscus
- by movement extension
  - amphiarthrosis (rigid)
  - more movable (all others)
- by shape of connecting surfaces

Diarthrosis division by shape of connecting surfaces

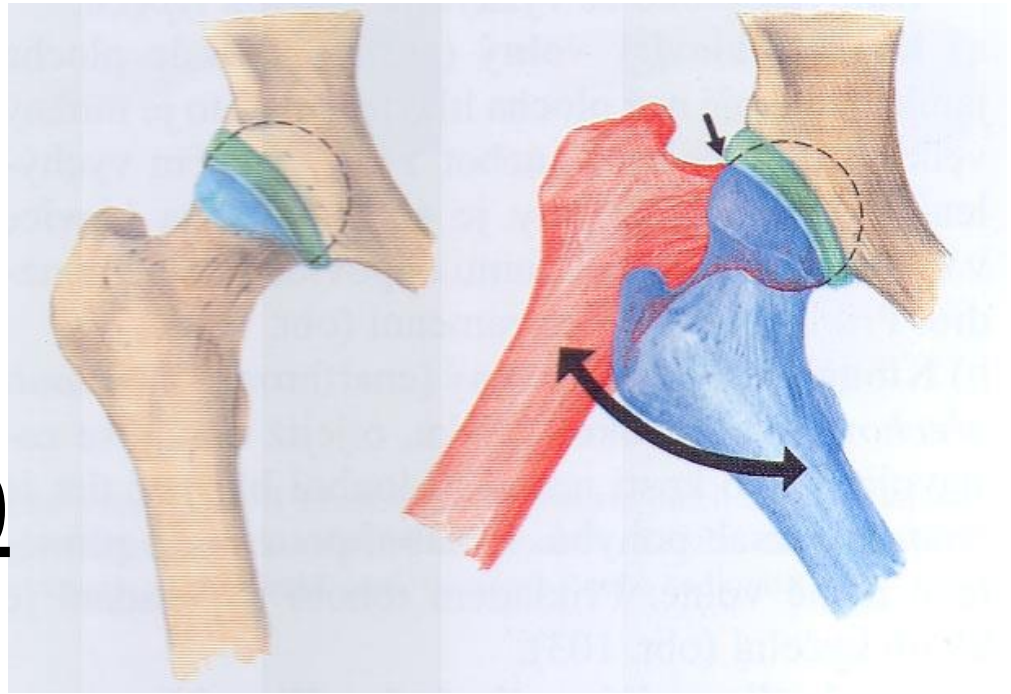
art. plana /plane joint/		art. acromioclavicularis, sacroiliaca, intermetatarsales, zygapophysiales
art. cylindrica /cylindrical joint/	ginglymus /hinge joint/ *including trochler joint*	art. interphalangeae proximales et distales, humeroulnaris, subtalaris
	a. trochoidea /pivot joint/	art. radioulnaris proximalis et distalis, atlantoaxialis mediana
art. bicondylaris /bicondylar joint/		art. genus /knee joint/, temporomandibularis
art. sellaris /saddle joint/		art. carpometacarpalis pollicis
art. ellipsoidea /condylar *or* elipsoid joint/		art. radiocarpalis, metacarpophalangeae, atlantooccipitalis
art. spheroidea /ball-and-socket *or* spheroidal joint/	/*free spheroidal*/	art. humeri /shoulder joint/, humeroradialis, sternoclavicularis
	art. cotylica /cotyloid joint/	art. coxae /hip joint/





Spheroidal

(ball and socket)



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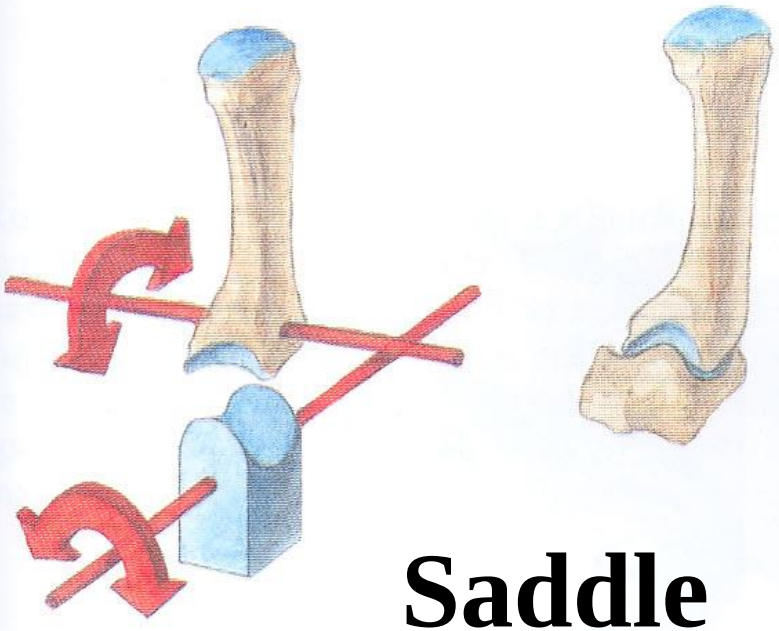
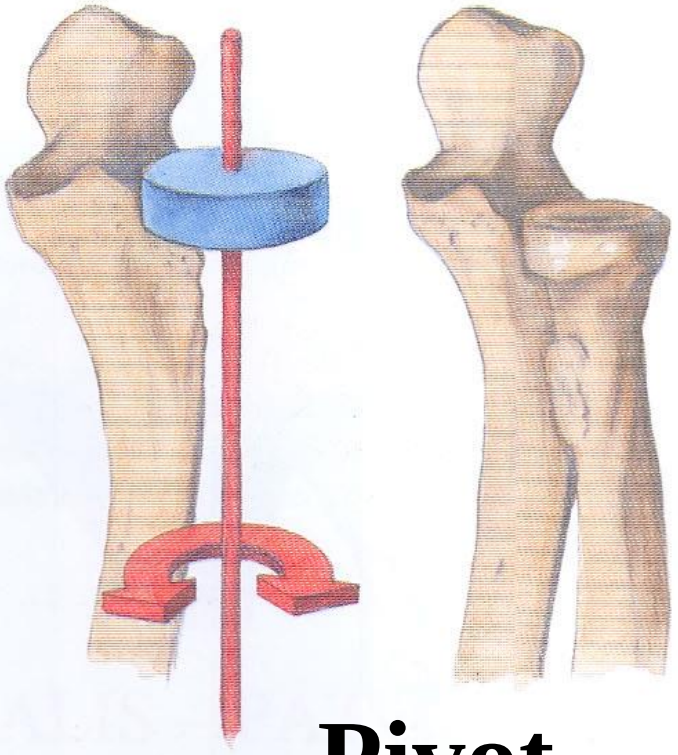
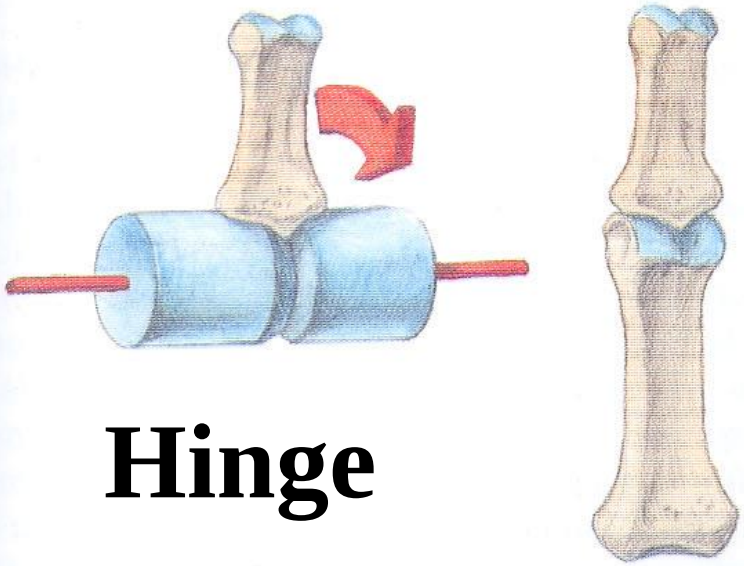


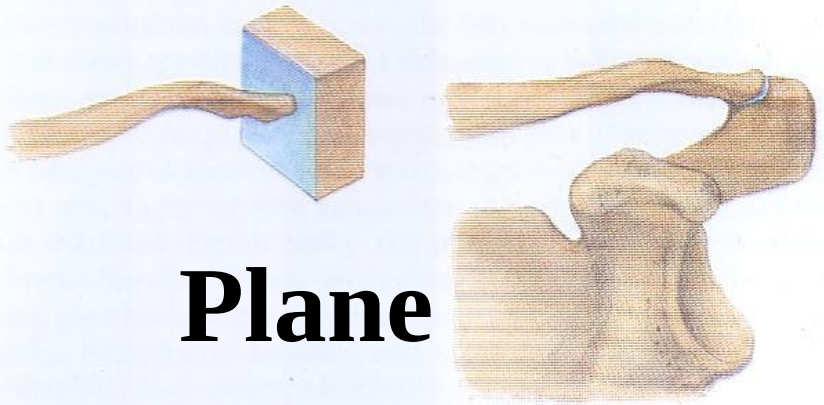
Saddle



Pivot



Hinge



Plane

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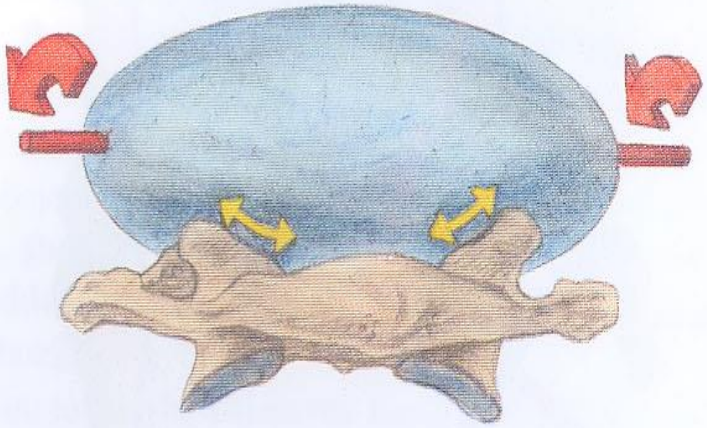
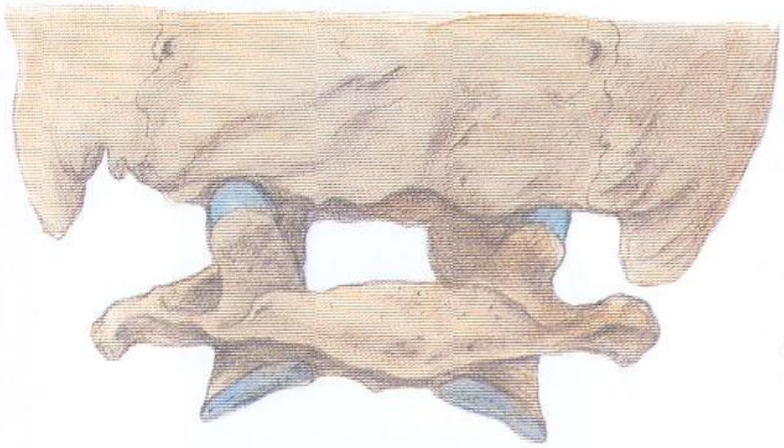
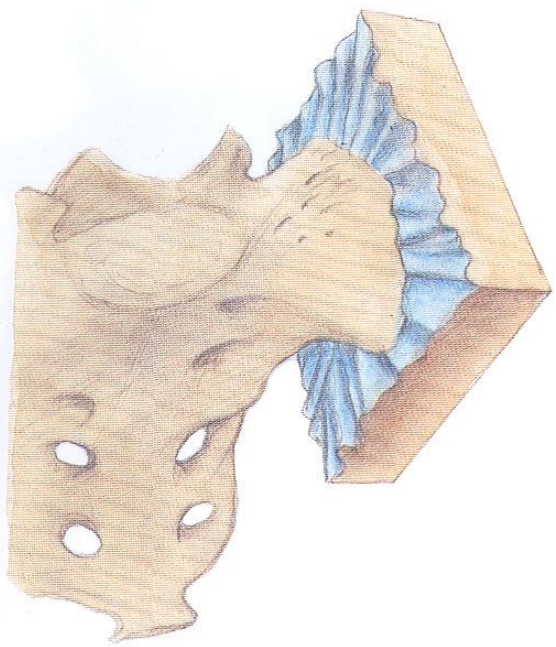
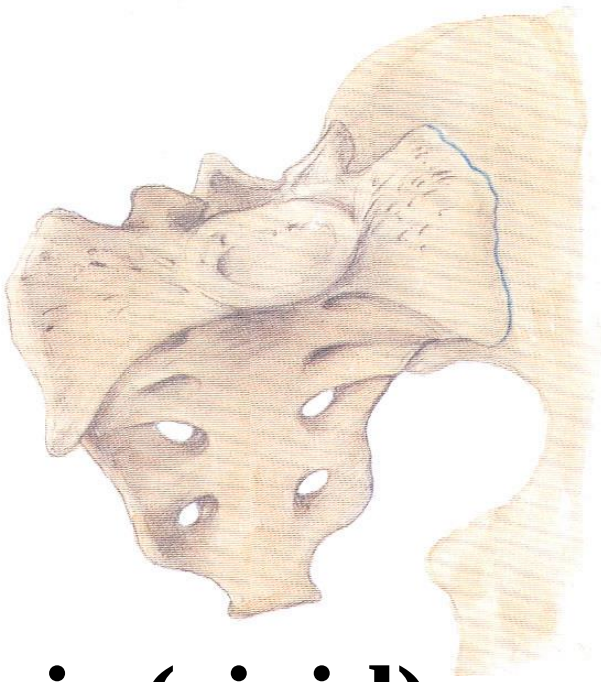




Ellipsoid





Amphiarthrosis (rigid)

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Joint movements I

- **according to axis**
  - mono-, bi- and polyaxial
- **basic position**
  - reflects the basic anatomical position (palms ventrally)
- **loose position**
  - most relaxed articular capsule (releaving position)
- **movement extension**
  - limited by
    - shape of fossa and head
    - ligaments
    - close bony projections
    - soft tissue size in the vicinity (muscles, fat)

Joint movements II

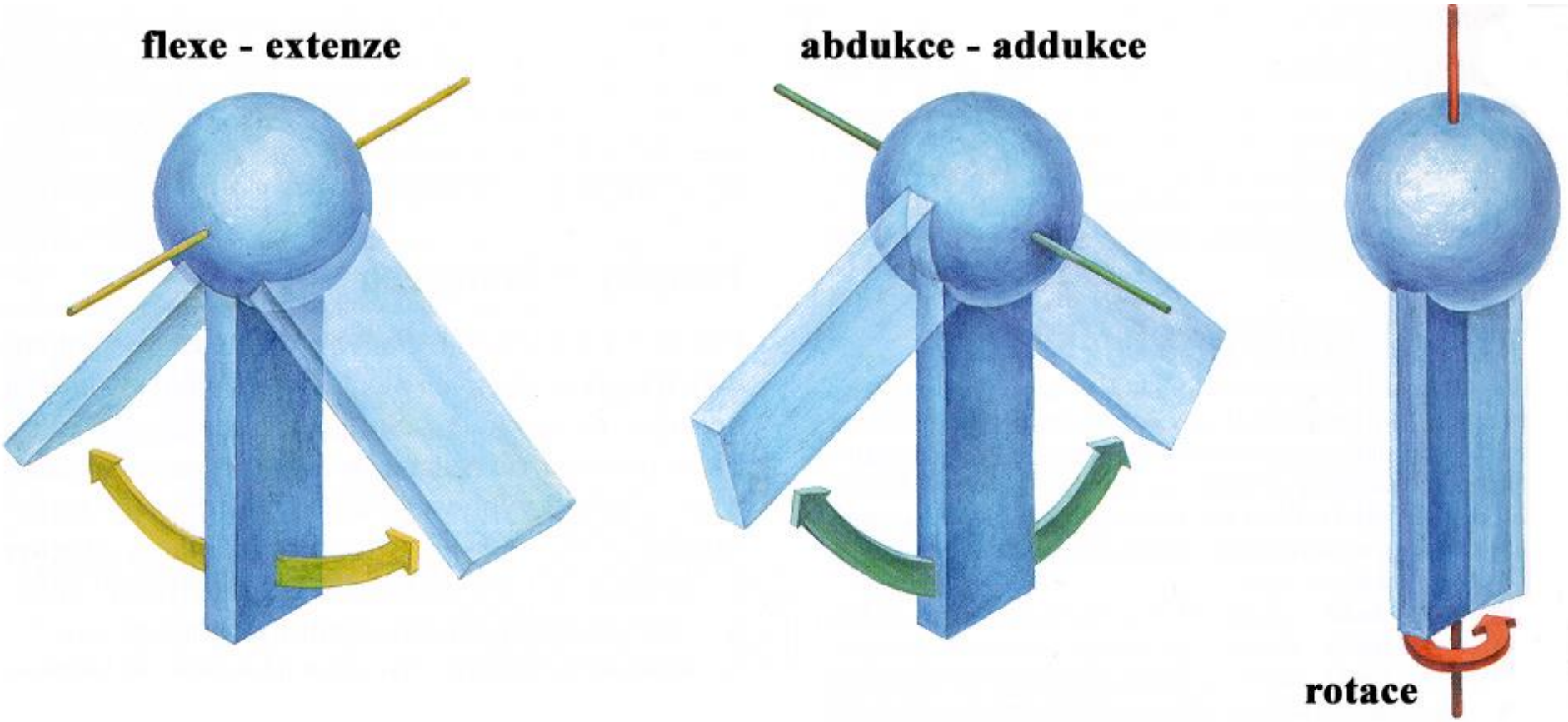
basic

- flexion x extension
- abduction x adduction
- external (lateral) rotation x internal (medial) rotation

basic with special name

ulnar duction x radial duction

= abduction x adduction in carpal joint



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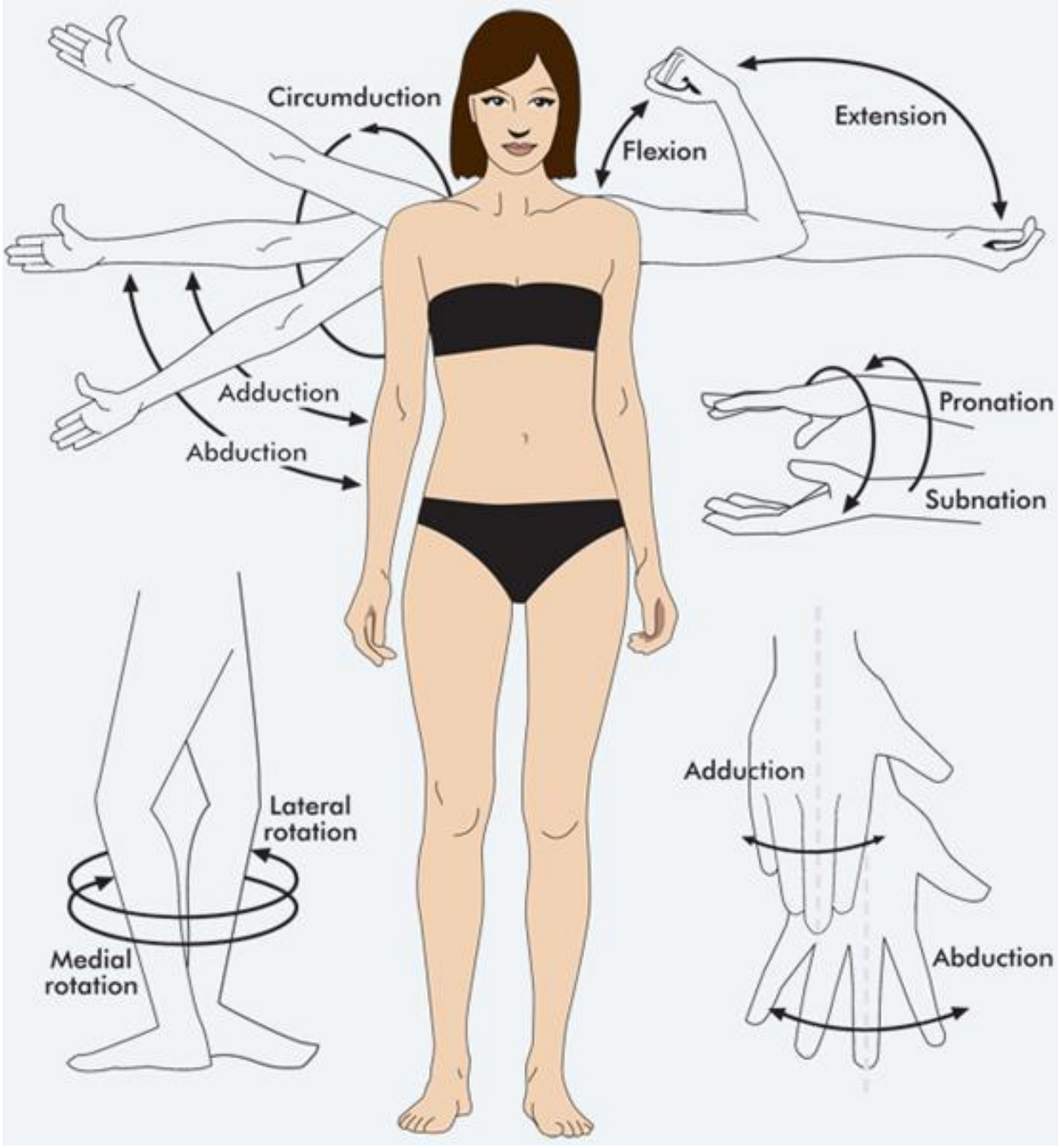
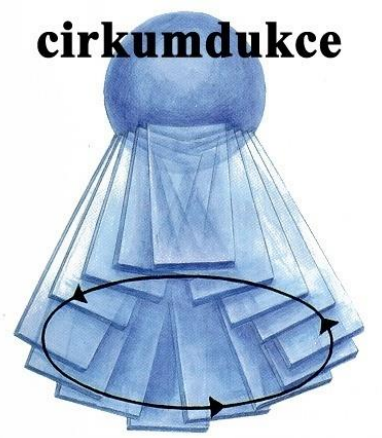
Joint movements III

- pronation x supination
  = special type of radius rotation around ulna
- opposition x reposition
  = special thumb movement to face the other fingers
- elevation x depression
  + protraction x retraction
  = special movement in temporomandibular joint and in loose connection between scapula and thorax (is not an anatomical joint, just functional connection!)



http://tle.westone.wa.gov.au/content/file/969144ed-0d3b-fa04-2e88-8b23de2a630c/1/human_bio_science_3b.zip/content/003_musculo_skeletal_support/page_11.htm

Joint movements IV – *combined*



- <u>circumduction</u>

  = cone surface movement, each side faces the same directon only /no turn!/

- <u>inversion</u> x <u>eversion</u>
  = combined foot motion with planta in or out

- *further*: e.g. hyperadduction (depends on the relevant joint)

Vessels and nerve supply of the joint

- blood vessels: rete articulare from surrounding arteries, capillaries close to the surface
- lymph vessels: blind beginnings (cul-de-sac), deeper in the capsule
- nerves:
  - centripetal sensory fibres
    - information about joint position, movement direction and grade, angular movement speed, ligaments and capsule tension grade (= **proprioception**)
    - pressure and pain informations
  - centrifugal autonomic fibres (vessels´ lumen regulation)

Development of the joint

- plates of mesenchyme between adjacent skeletal elements = *interzonal mesenchyme*
- interzonal mesenchyme becomes trilaminar
  - 2 dense strata
  - intermediate zone
- intermediate stratum merges with general mesenchyme → a cuff condenses creating a fibrous capsule of the joint
- dense strata becomes cartilaginous
- cavitation of intermediate zone establishes the cavity of the joint
- synovial mesenchyme forms synovial membrane and other structures, such as tendons, ligaments, discs and menisci

Osteoarthrosis

- noninflammatory illness of a joint
- destruction of a joint cartilage

http://www.knee-replacement-explained.com/Knee-Pain-diagnosis-xray.html

http://www.wrosc.com/Procedures/Knee_Procedures/Knee_Treatment_Options/Medial_OsteoArthrosis_Description.aspx

Arthritis

- inflammatory illness of a joint
  - autoimunne (rheumatic, psoriatic)
  - septic
  - *gout* – storage of crystals of uric acid to the vicinity of a joint

http://www.abbottdiagnostics.cz/nove-produkty/rok-2009/imunoanalyza/architect-anti-ccp.html

http://www.mojemedunka.cz/clanek.aspx/medunka-informuje/clanek/proc-jsme-nemocni--cast-xxxxi

Joint description

!!! follow general rules !!!

- name (Latin, English)
- type
  - by part number, shape of connecting surfaces, movability, axis number
- head and fossa
- joint capsule insertion
  - close to connecting surfaces – several important exceptions !!!
- special joint structures
  - labrum, disc, meniscus, fibrocartilage, ligaments, synovial bursae, fat pads
- basic and loose position
- movements (+ movements extension in degrees)
  - passive
  - active