ANATOMY

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PhD Pharmacology

- Human anatomy is the science which deals with the structure of the human body
- The term anatomy is derived from the Greek word “anatome” which means to cut. The term dissection is a Latin equivalent of Greek anatome. How ever, the two word anatomy and dissection are not synonymous, dissection is a mere technique while anatomy is a wild field of study.

Subdivisions of Anatomy

- Initially anatomy was studied mainly by dissection but the scope of modern anatomy has become very wide because its now studied by all possible techniques which can enlarge the boundaries of anatomical knowledge. The main subdivision of anatomy are:

Cadaveric Anatomy

- Is studied on dead embalmed bodies usually with the naked eye. Two approaches are made in this anatomy one is regional and other is systemic.
- **Regional**: body is studied in parts like upper limb, lower limb, thorax, abdomen
- **Systemic**: body is studied in systems like muscular system, vascular system, nervous system, Osteology.

Living Anatomy

- Is studied by inspection, palpation, percussion, auscultation, endoscopy, radiography and electromyography.

Embryology

- Also called developmental anatomy. It is the study of prenatal developmental changes in an individual.
- **Histology**: is the study of structure with the aid of microscope.
- **Topographic anatomy** (surface anatomy):

  Is the study of deeper part of the body in relation to the skin surface, it is helpful in clinical practice and in surgical operations.

Radiographic or imaging anatomy

- The study of bones and deeper organs by plain or contrast radiography by ultrasounds an CT Scans.
- **Comparative Anatomy:** is the study of anatomy of other animals to explain the changes in form, structure and function of different part of human body.

- **Physical anthropology**: deals with the external features and measurement of different races and groups of people and with the study of prehistoric remains.
- **Applied Anatomy**: Deals with the application of anatomical knowledge to the medical and surgical practice.

Experimental anatomy

- Is the study of factors which influences and determine the form, structure and function of different parts of the body.

Anatomical Nomenclature

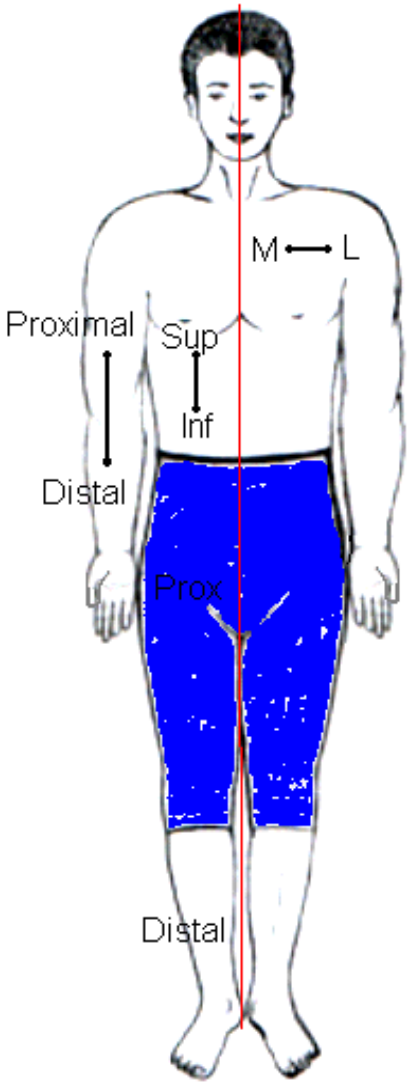
- The German Anatomical society in 1896 decided upon a list of 5000 terms known as Basle Nomina Anatomica (BNA)
- It made several recommendations regarding Anatomical terminology

Recommendations

- Each part shall have only one name
- Each term shall be in Latin
- Each term shall be as short and simple as possible
- The terms shall be merely memory signs
- Related terms shall be similar
- Adjectives shall be arranged as opposites e.g. Anterior and posterior

Anatomical position

- Person stands erect
- Feet flat on floor
- Arms at sides
- Palms, eyes & face facing forward
- Standard frame of reference for anatomical descriptions & dissection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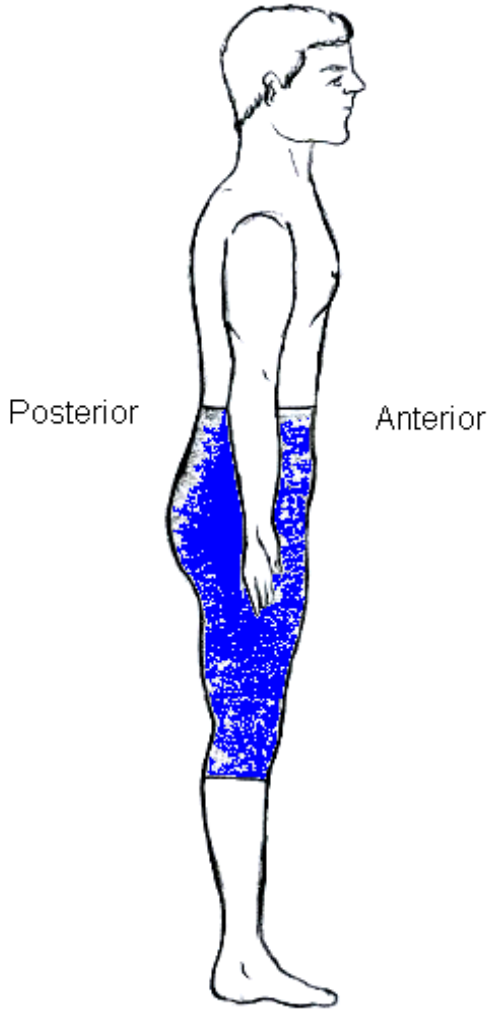

Posterior
Anterior

Anatomical sections

- ✓ TRANSVERSE SECTION – (also called CROSS-SECTION) refers to a part cut crosswise/ ”width wise”

- ✓ LONGITUDINAL SECTION – is a cut made along the long axis (length wise) of the organ.

- ✓ OBLIQUE SECTION – refers to a cut neither longitudinal nor transverse. They lie on a slightly oblique plane.

Anatomical planes

PLANE

A plane is geometrical concept referring to an imagined flat surface. They are used to describe the sections of the body. There are **3 main anatomical planes**;

1. SAGITTAL PLANE
2. CORONAL PLANE (FRONTAL PLANE)
3. HORIZONTAL PLANE (TRANSVERSE PLANE)

Planes

- ❑ SAGITTAL PLANE – it is an imaginary vertical plane (extending from front to back and top to bottom), dividing the body into left and right portions.

- ✓ MIDSAGITTAL PLANE – (also called MEDIAN PLANE) refers to a sagittal plane that divides the body into exactly equal right and left portions.

- ✓ PARASAGITTAL – any plane parallel to the medial plane (often used by neurologists)

- FRONTAL PLANE – (also called the CORONAL PLANE)

  A vertical plane passing through the body (at right angles to sagittal plane) and divides the body into front (anterior) and back (posterior) portions

- HORIZONTAL PLANE – (also called a TRANSVERSE plane)

  It divides the body into top (superior) and bottom (inferior) portions

Anatomical Directions

- ✓ ANTERIOR – Toward the front of the body.
  E.g. The nose is on the anterior of the head.

- ✓ POSTERIOR – Toward the back (rear) of the body
  E.g. The heel is posterior to the toes.

- ✓ SUPERIOR – Toward the top of the body.
  E.g. The shoulders are superior to the hips.

- ✓ INFERIOR – Toward the bottom of the body.
  E.g. The stomach is inferior to the heart.

- ✓ DORSAL – Along (or toward) the vertebral surface of the body.
  E.g. Her scar is along the dorsal surface.

- ✓ VENTRAL – Along (toward) the belly surface of the body.
  E.g. The navel is on the ventral surface.

- ✓ CAUDAL (caudal) – Toward the tail.
  E.g. The neck is caudal to the skull.

- ✓ CEPHALAD –Toward the head.
  E.g. The neck is cephalic to the tail.

- ✓ DEEP – Toward the inside of a part; away from the surface.

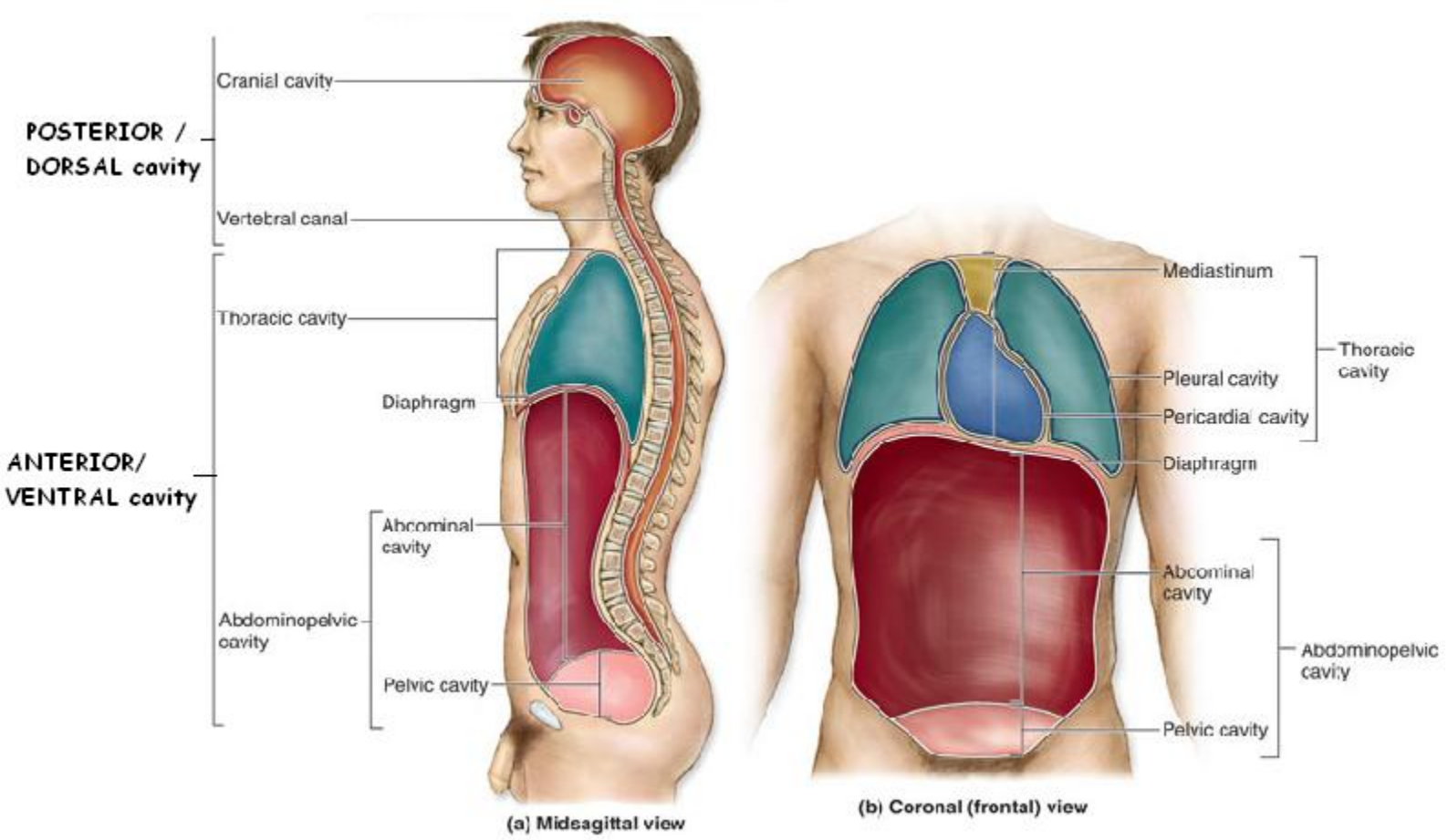
  E.g. The thigh muscles are deep to the skin
- ✓ SUPERFICIAL – Toward the surface of a part; away from the inside.

  E.g. The skin is a superficial organ
- ✓ MEDULLARY – Refers to an inner region, or medulla

  E.g. The medullary portion of the kidney contains collecting ducts
- ✓ CORTICAL – Refers to an outer region, or cortex.

  E.g. The cortical area of adrenal glands produces hormones

Body cavities



Body Cavities

- **<u>VENTRAL BODY CAVITIES</u>** – are cavities in the "front" half of the body.

1. THORACIC CAVITY
2. PLEURAL CAVITY
3. MEDIASTINUM
4. ABDOMINOPELVIC CAVITY
5. ABDOMINAL CAVITY
6. PELVIC CAVITY

1. THORACIC CAVITY – within the rib cage

2. PLEURAL CAVITY – Left one third and right one third of the thoracic cavity

   Organ: lung

3. MEDIASTINUM – Middle one third of thorax

   Organ: Heart, Trachea and oesophagus

Ventral Body Cavities

4. ABDOMINOPELVIC CAVITY – From the diaphragm to the bottom of the trunk
5. ABDOMINAL CAVITY – From the diaphragm to the rim of the pelvic bones

    Organs: stomach, liver, most of the intestines, pancreas, spleen and kidneys

6. PELVIC CAVITY – From the pelvic rim to the floor of the trunk

    Organs: Portions of the intestines, ovaries, uterus, urinary bladder.

Surface regions

ANTERIOR ASPECT

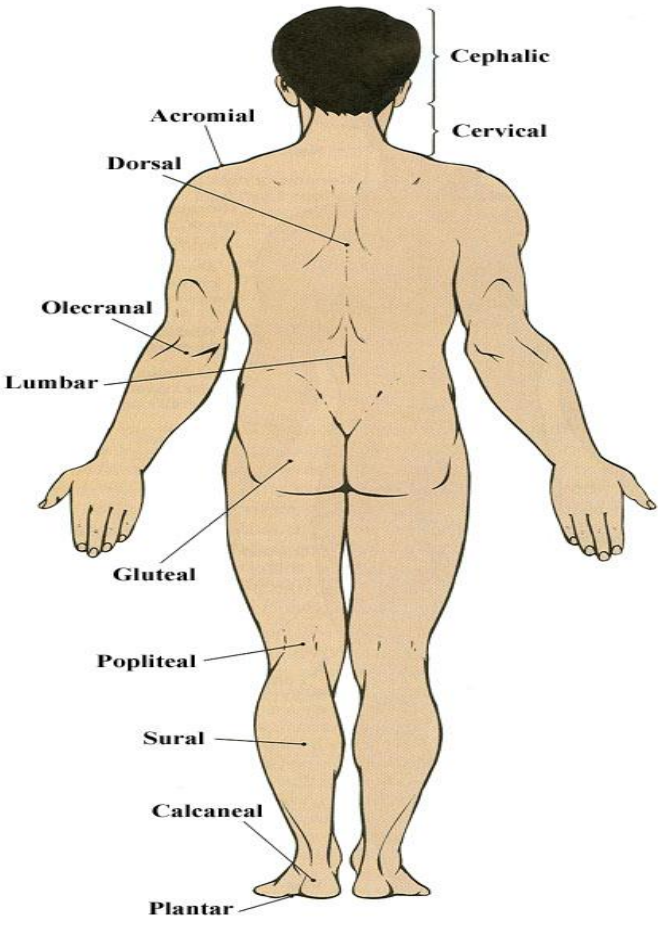
1. ABDOMINAL Area overlying the abdominal cavity
2. ANTEBRACHIAL – forearm
3. AXILLARY – Armpit
4. BRACHIAL – Upper arm
5. BUCCAL – cheek
6. CARPAL – wrist
7. CERVICAL – Neck
8. COXAL - Hip

ANTERIOR ASPECT

9. CRURAL – Anterior lower legs (shin)
10. CUBITAL – Anterior elbow joint
11. FEMORAL – Upper leg (thigh)
12. MENTAL – Chin
13. ORBITAL – Eye
14. PATELLAR – Anterior knee joint
15. PUBIC – Lower front of trunk, between legs
16. TARSAL – ankle
17. THORACIC - Chest

POSTERIOR ASPECT

1. CERVICAL – Neck
2. GLUTEAL – Buttocks
3. LUMBAR – lower back
4. OCCIPITAL – Posterior of head
5. POPLITEAL – Posterior knee joint
6. SCAPULAR – shoulder blade
7. SURAL – calf
8. THORACIC – upper back


Cephalic
Cervical
Acromial
Dorsal
Olecranal
Lumbar
Gluteal
Popliteal
Sural
Calcaneal
Plantar

movements

- Movements take place at joints where two or more bones or cartilages articulate with one another.The different types of movements are;
  1. FLEXION
  2. EXTENSION
  3. DORSIFLEXION
  4. PLANTARFLEXION
  5. ABDUCTION
  6. ADDUCTION
  7. ROTATION – MEDIAL and RADIAL ROTATION
  8. OPPOSITION

Movements

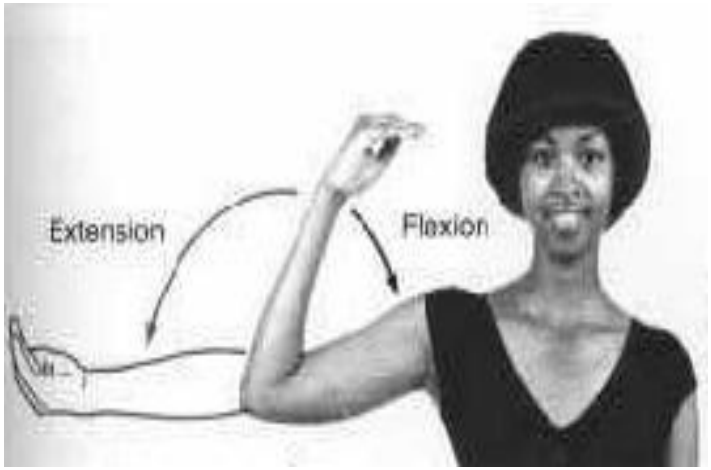
9. PROTRACTION
10. RETRACTION
11. ELEVATION
12. DEPRESSION
13. EVERSION
14. INVERSION
15. PRONATION
16. SUPINATION
17. PRONE
18. SUPINE

✓FLEXION – **Bending or decreasing the angle** between the bones or parts of the body.

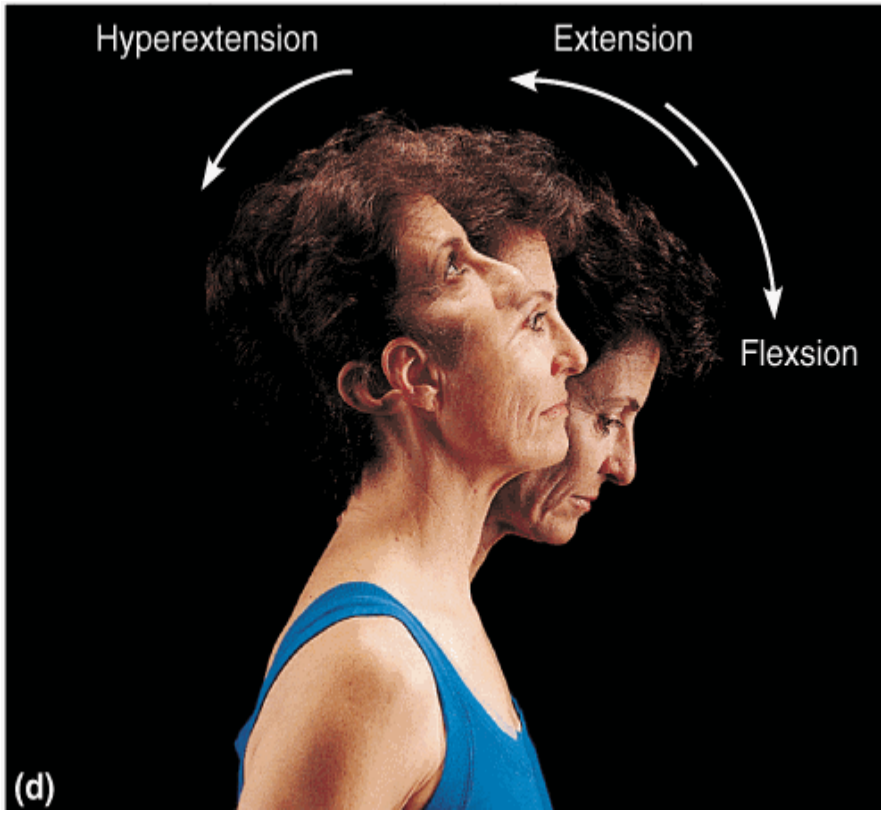
E.g. Flexion of the upper limb at elbow joint is an anterior bending; Flexion of the knee at the knee joint is a posterior bending.

Extension

- ✓ EXTENSION – indicates **straightening or increasing** the **angle** between the bones or parts of the body. E.g. Extension at elbow joint occurs at posterior direction. Extension at knee joint occurs in anterior direction.
- ✓ HYPEREXTENSION – (OVER EXTENSION beyond anatomical limit) - can cause injury E.g. Whiplash – hyperextension of the neck during rear- end automobile collision.



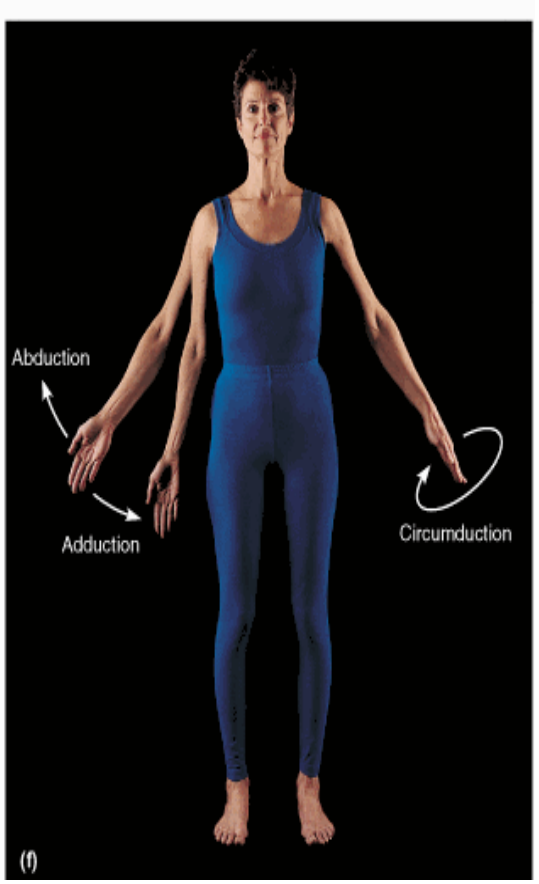

Extension


Hyperextension
Extension
Flexsion
(d)

- ✓ DORSIFLEXION – **Flexion at the ankle joint**, as occurs when walking uphill or lifting the toes off ground
- ✓ PLANTARFLEXION – **Turns the foot or toes** toward the **plantar surface**. E.g. When standing on your toes

- ✓ ABDUCTION – means **moving away** from **body midline**. E.g. Moving an upper-limb away from the side of the body.

- ✓ ADDUCTION – means **moving toward the body midline** E.g. Moving an upper-limb toward the side of the body.

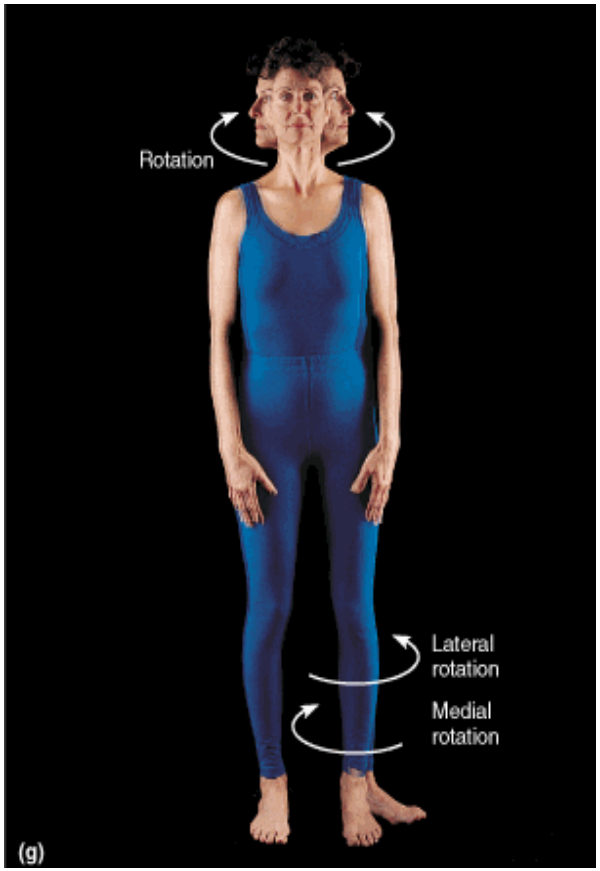


- ✓ ROTATION – involves **turning** or revolving a part of the body **around its longitudinal axis**

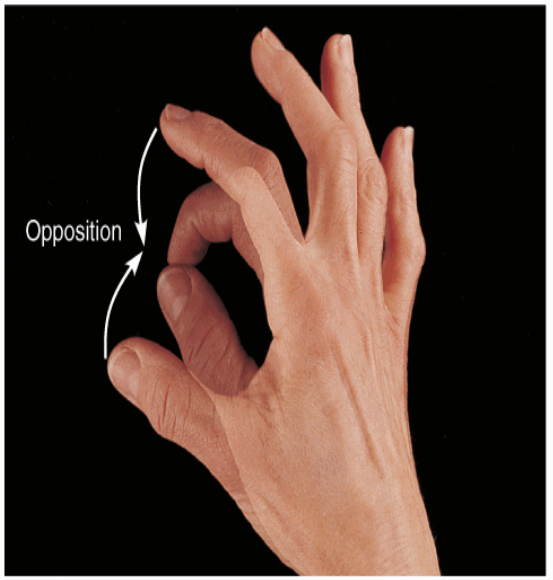
(E.g. turning one's head to the side)

- ✓ MEDIAL ROTATION – **Rotation toward the midline** of the body.

- ✓ LATERAL ROTATION – **Rotation away** from the **midline** of the body



- ✓ OPPOSITION – **Movement** by which the **pad of the thumb** is brought **to another digit pad**. E.g. We use this movement to pinch, or to button a shirt.



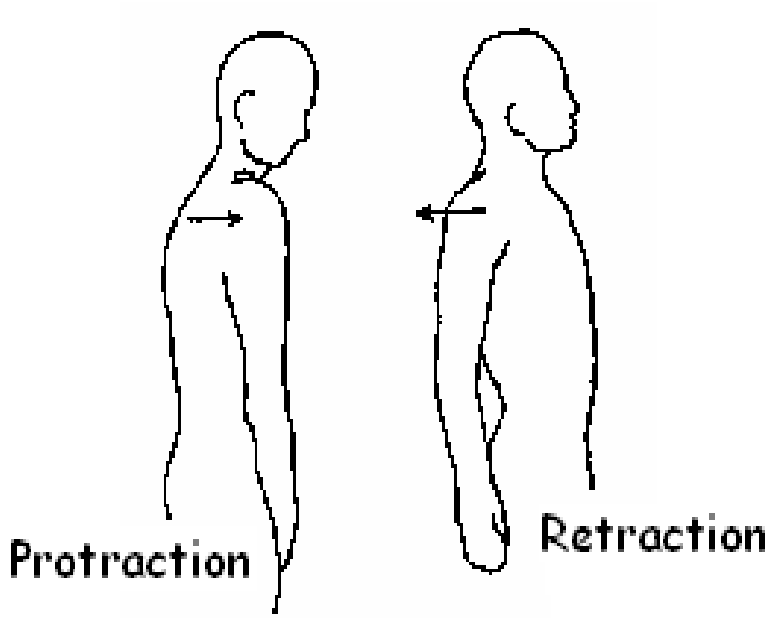
(e) Opposition

- ✓ PROTRUSION – Anterior (forward) movement. E.g. Sticking the chin out.
- ✓ RETRUSION or retraction– Posterior (backward) movement. E.g. Tucking the chin in.

(c) Protraction and retraction

- ✓ PROTRACTION- (SCAPULAR ABDUCTION) Shoulder girdle **moves forward to anatomical position**.

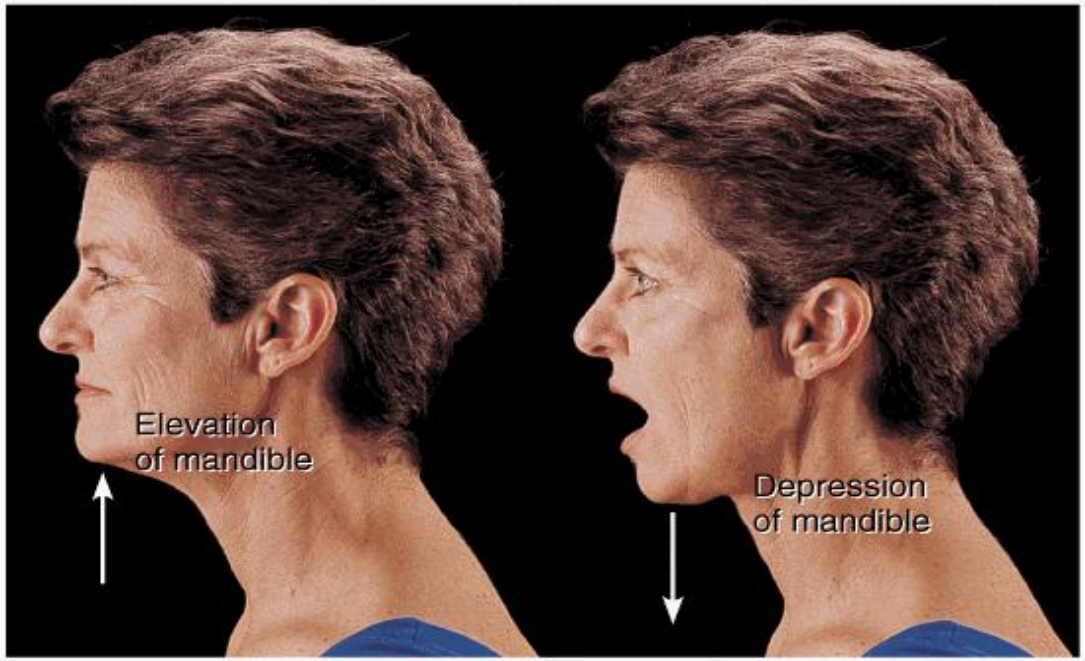
- ✓ RETRACTION – (SCAPULAR ADDUCTION) Shoulder girdle **moves backward from anatomical position**.



- ✓ ELEVATION – **Raises** or moves a part **superiorly** (upward)

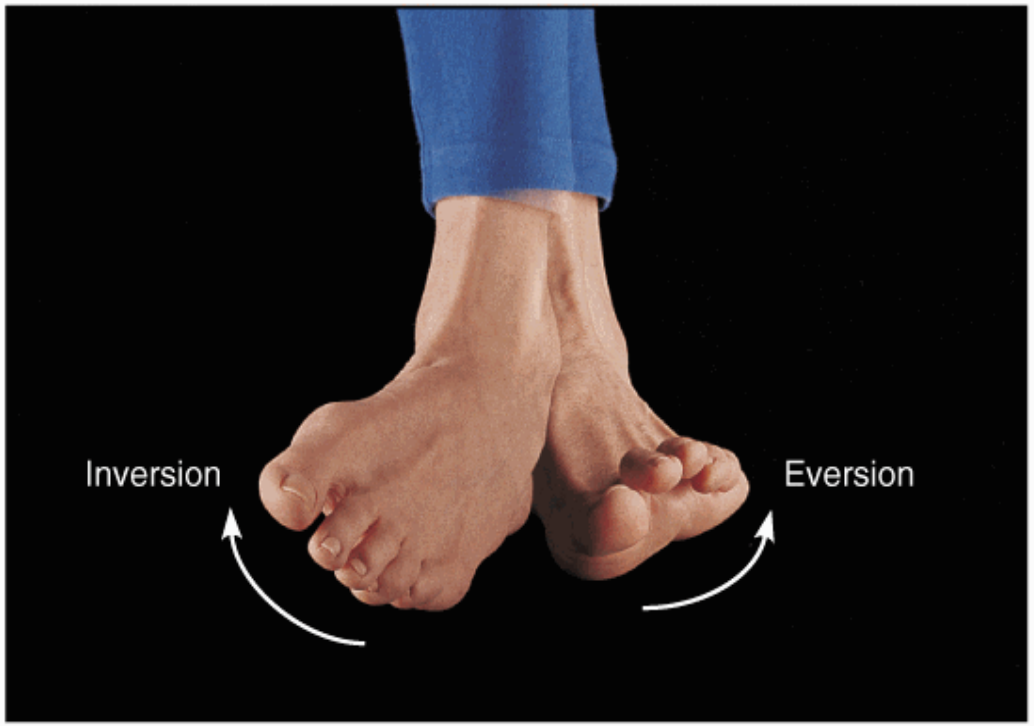
  E.g. Elevating the shoulders when shrugging.
- ✓ DEPRESSION – **Lowers** or moves a part **inferiorly** .

  E.g. Depressing the shoulders when standing at ease.



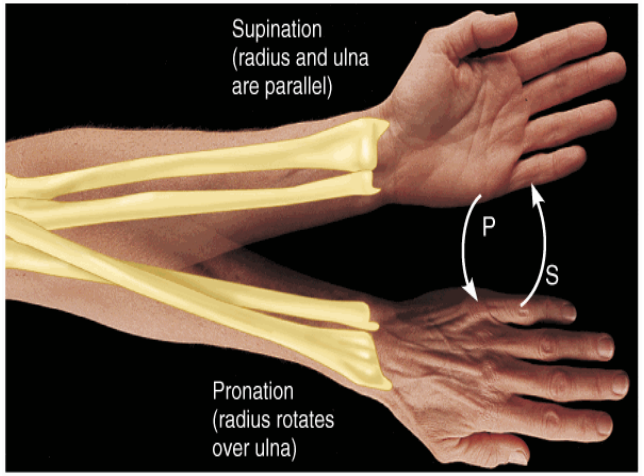
(d) Elevation and depression

- ✓ EVERSION – **Lateral** (outward) **rotation** of sole of foot.
- ✓ INVERSION – **Medial** (inward) **rotation** of the sole of foot.



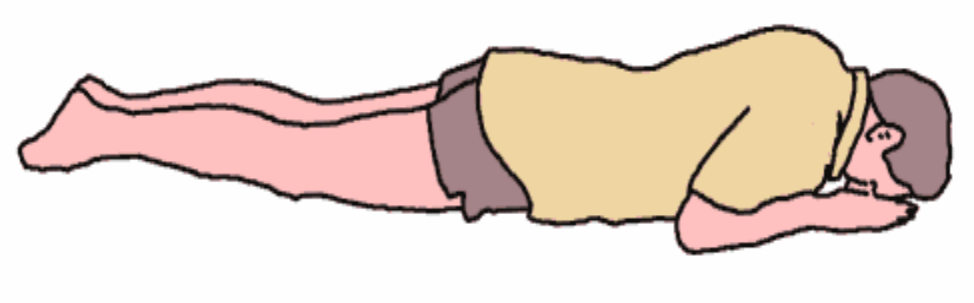
(b) Inversion and eversion

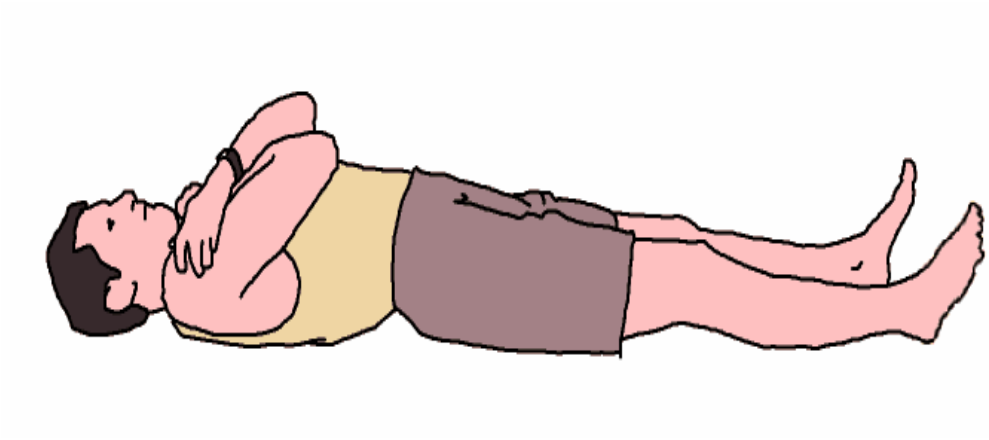
- ✓ PRONATION – Movement of the forearm and hand so that it is rotated medially along the longitudinal axis and the palm of the hand faces posteriorly (backward) and the dorsum of the hand faces anteriorly (frontward).
- ✓ SUPINATION – Movement of the forearm and hand so that it is rotated laterally along the longitudinal axis – and palm of the hand faces anteriorly (frontward) and the dorsum of the hand faces posteriorly (backward)



(a) Supination (S) and pronation (P)

Prone and supine





Bones and Cartilages

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Continue

- The hard and rigid form of connective tissue constituting most of the skeleton of the vertebrates, composed chiefly of calcium salts.
- Despite of its hardness the bone is very much living tissue and it is highly vascular with constant turn over of calcium content.
- Subjected to disease and heals after fracture (#).
- The study of bone is called Osteology

Continue

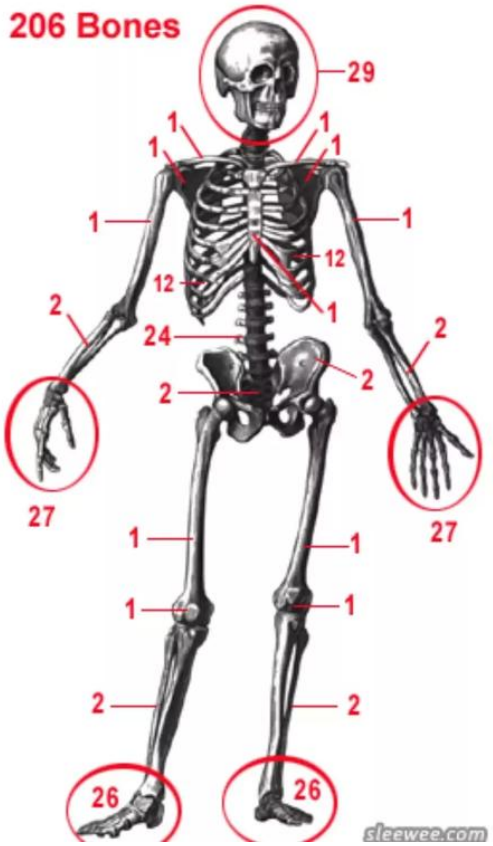
- Bone has greater regenerative power
- Bone also show disuse atrophy and overuse hypertrophy.
- Total number of bone in human body is 206

1. Axial Skeleton contains 74 bones
2. Appendicular skeleton contains 126 bones
3. Auditory Ossicles are 6 in number

Continue

- Axial Skeleton:
  - Vertebral column =26
  - Skull =22
  - Auditory Ossicles =06
  - Hyoid bone= 01
  - Ribs and sternum =25

- Appendicular Skeleton
  - Upper extremities =64
  - Lower extremities =62



Functions

- bones give shape and support to the body and resist stress.
- They provide surface for the attachment of muscles and ligaments.
- Serve as lever for muscles action.
- The bone of the skull, thoracic cage and vertebral column protect brain, heart, lungs and spinal cord.

Continue

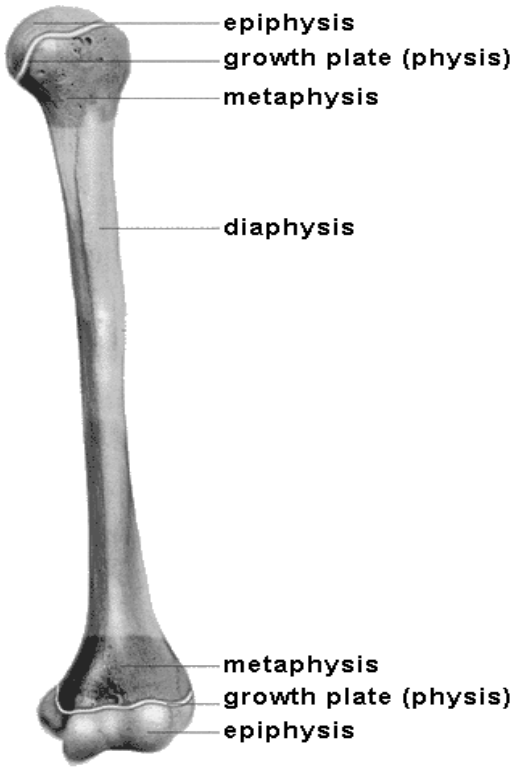
- Bone marrow manufacture blood cells.
- Bones store 97% of body calcium and phosphorus.
- Bone marrow take part in immune response of the body.

Classification of Bones

According the shape into

- Long bones (Clavicle, radius, humerus,, femur)
- Short bones (Carpal and tarsal bones)
- Flat bones (Ribs, sternum, scapulae)
- Irregular bones (Skull, Vertebrae and Coxa)
- Sisamoid bones (Patella, Pisiform)

Classification according shape



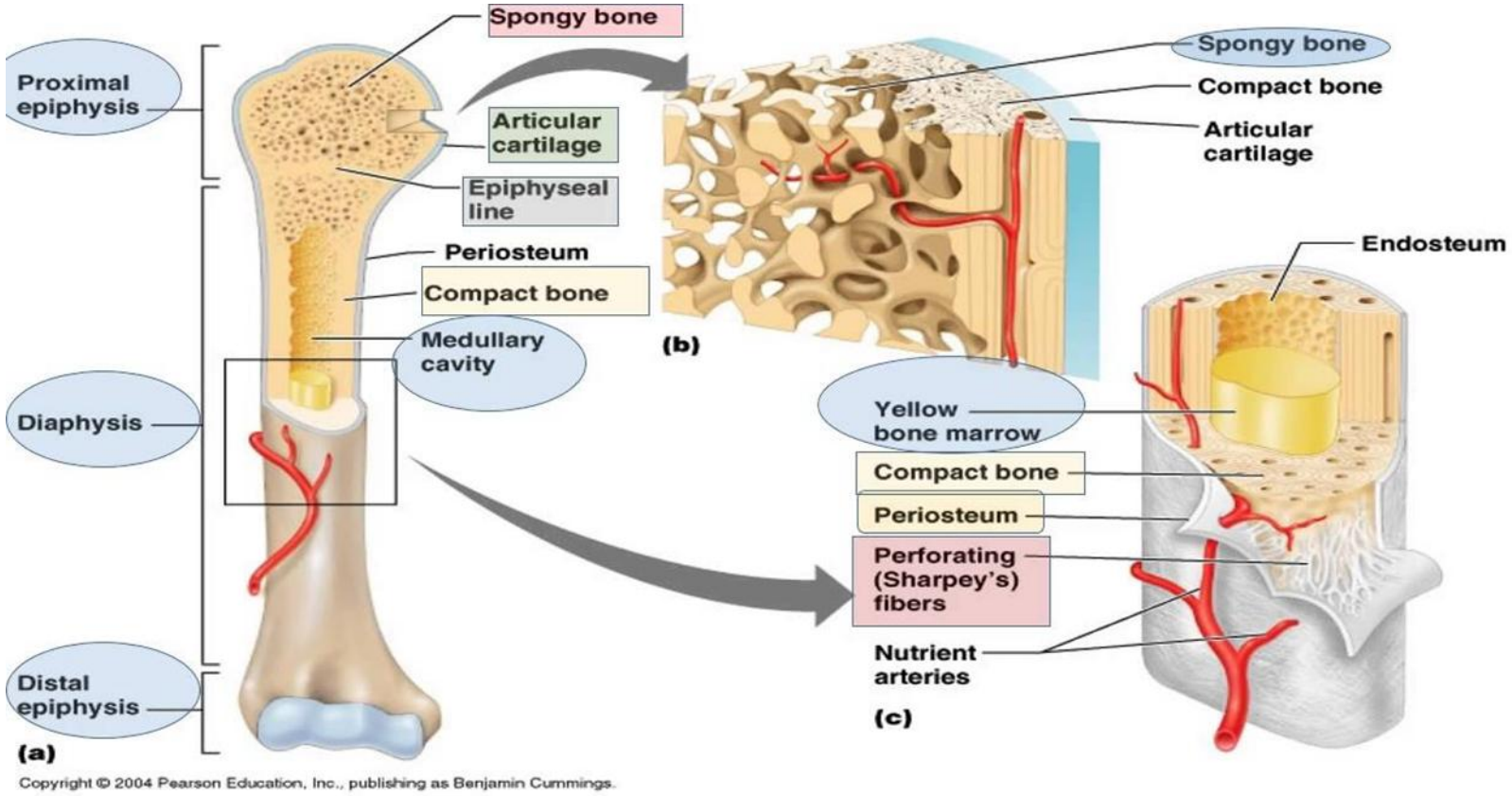
Developmental Classification of the Bones

- Membranous(Dermal) bones
- Cartilaginous bones (Intracartilaginous or endochondral ossification)
- Membrano cartilaginous

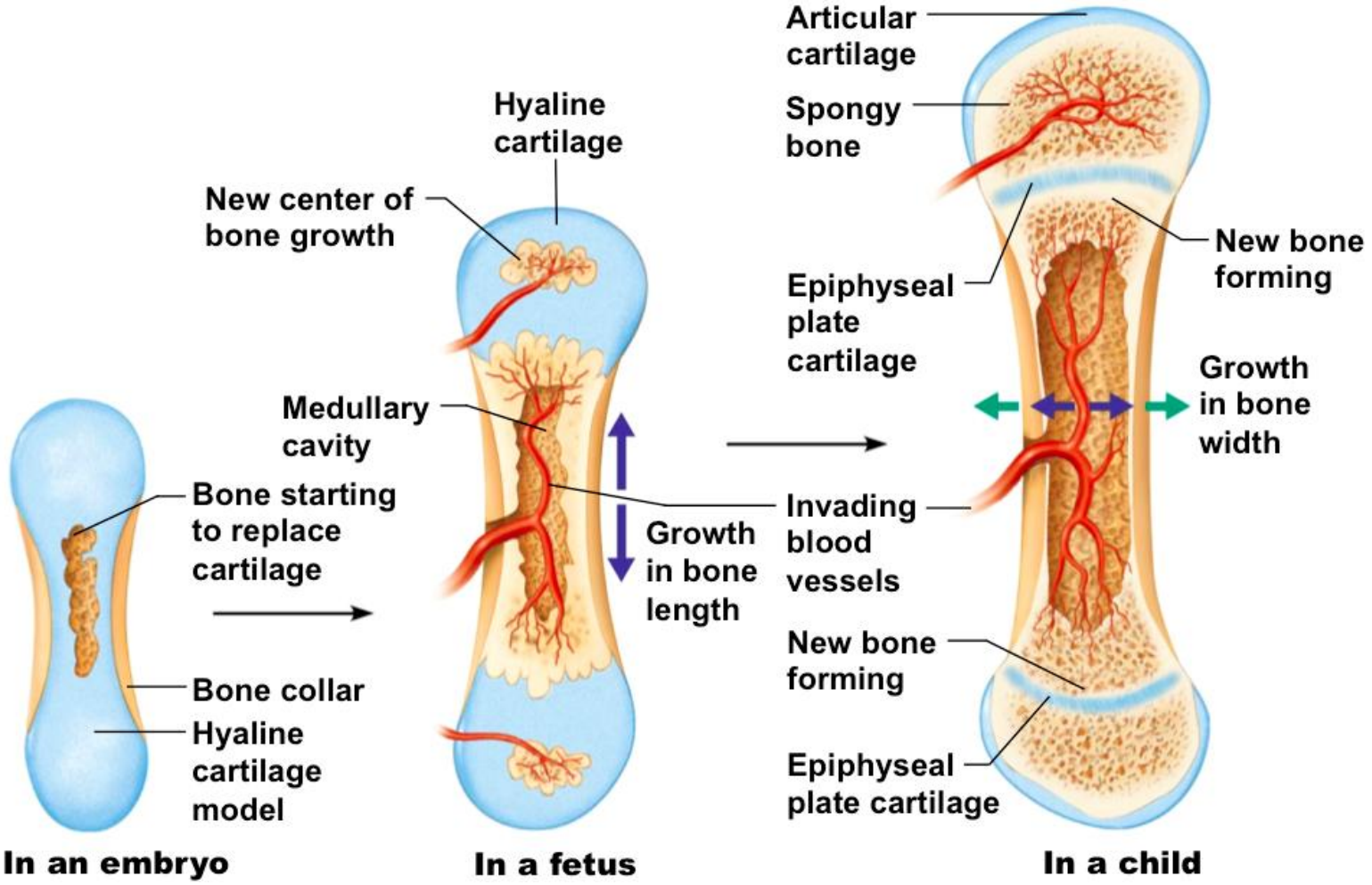
Regional Classification of the Bones

- Axial Skeleton (skull, vertebral Column, thoracic Cage)
- Appendicular Skeleton (Bones of the limb)

Structural Classification (Compact Bone Cancellous spongy or Trabecular bone)



Structure of a Typical Long Bone


Articular cartilage
Spongy bone
Hyaline cartilage
New center of bone growth
New bone forming
Epiphyseal plate cartilage
Growth in bone width
Medullary cavity
Bone starting to replace cartilage
Invading blood vessels
Growth in bone length
New bone forming
Bone collar
Hyaline cartilage model
Epiphyseal plate cartilage
In an embryo
In a fetus
In a child

Structure of Long bone

- Diaphysis (Shaft)
- Metaphysis (Part of the Diaphysis)
- Epiphysis (Expanded articular ends)
- Three borders and three surfaces
- Has a nutrient artery

Terminology of Bones

- *Articular process* A projection that contacts an adjacent bone.
- *Articulation* The region where adjacent bones contact each other—a joint.
- *Canal* A long, tunnel-like foramen, usually a passage for notable nerves or blood vessels.
- *Condyle* A large, rounded articular process.
- *Crest* A prominent ridge.
- *Eminence* A relatively small projection or bump.
- *Epicondyle* A projection near to a condyle but not part of the joint.

- *Facet* A small, flattened articular surface.
- *Foramen* An opening through a bone.
- *Fossa* A broad, shallow depressed area.
- *Fovea* A small pit on the head of a bone.
- *Labyrinth* A cavity within a bone.
- *Line* A long, thin projection, often with a rough surface. Also known as a *ridge*.
- *Malleolus* One of two specific protuberances of bones in the ankle.
- *Meatus* A short canal.

Parts of a long bone

- *Diaphysis* The long, relatively straight main body of a long bone; region of primary ossification. Also known as the *shaft*.
- *Epiphysis* The end regions of a long bone; regions of secondary ossification.
- *Epiphyseal plate* Also known as the *growth plate* In a long bone it is a thin disc of hyaline cartilage that is positioned transversely between the epiphysis and Metaphysis.
- *Head* The proximal articular end of the bone.
- *Metaphysis* The region of a long bone lying between the epiphysis and Diaphysis.
- *Neck* The region of bone between the head and the shaft.

Blood supply of bone

- 1. Nutrient artery
- 2. Periosteal artery
- 3. Artery at the end of long bone
- 4. Nerve supply

Bone Remodeling Cycle

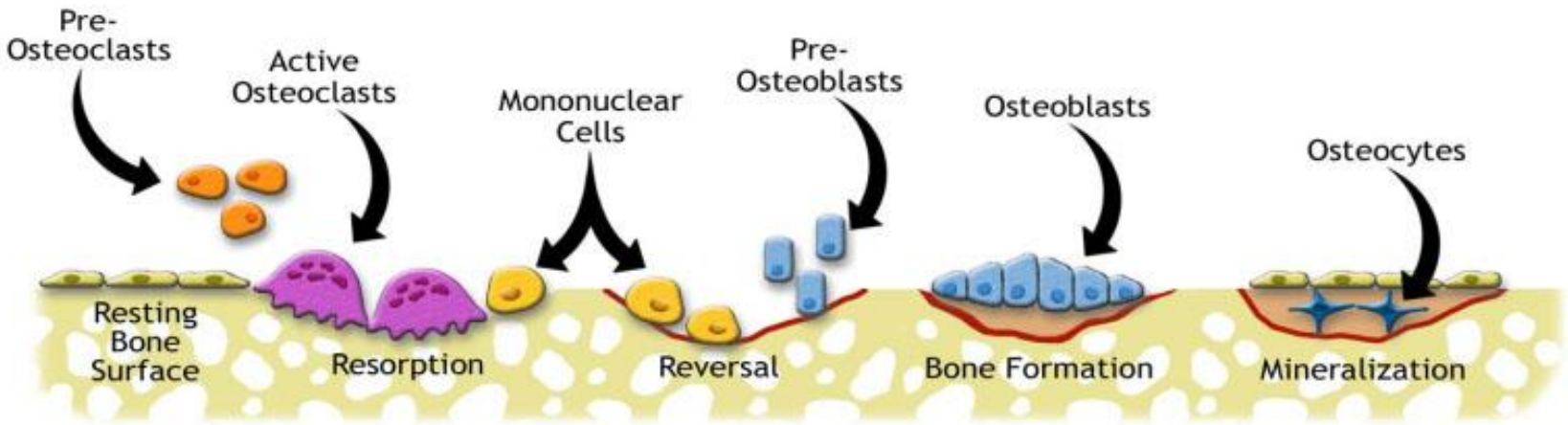
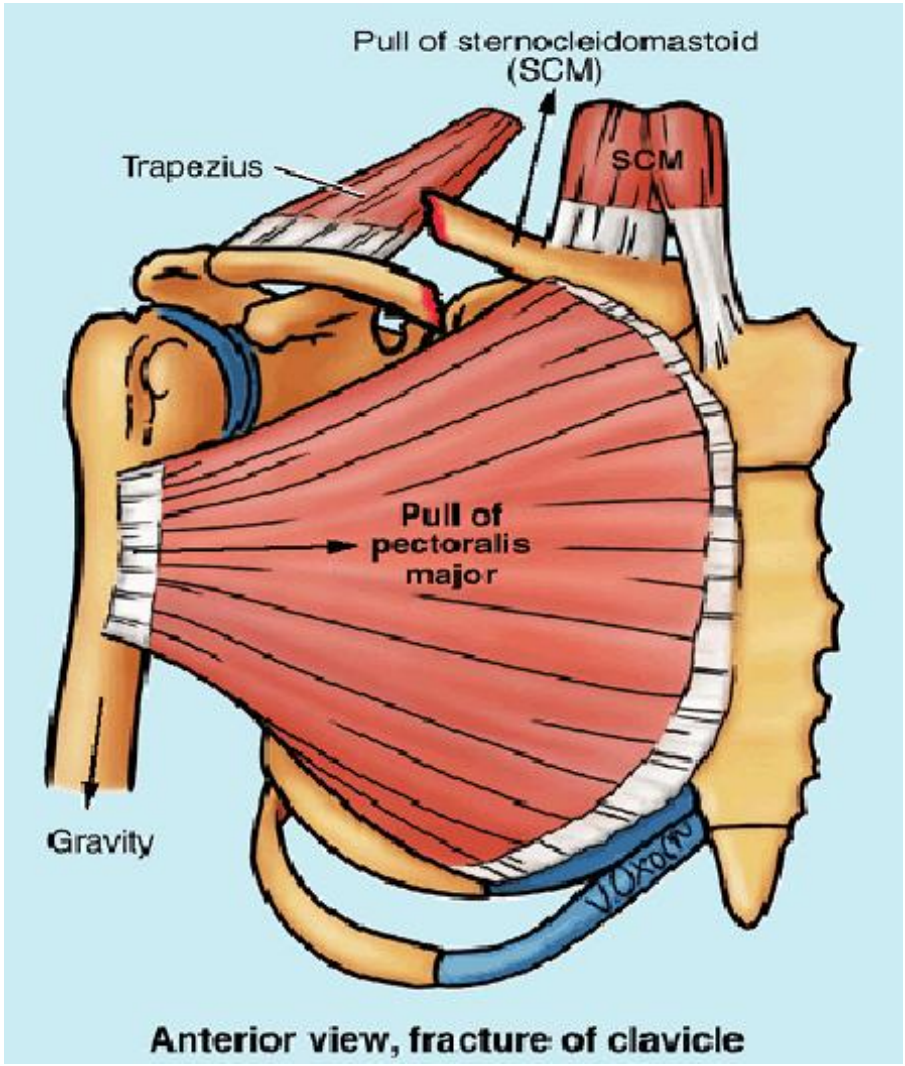


Table **HORMONES INVOLVED IN BONE GROWTH AND MAINTENANCE**

Growth hormone (anterior pituitary gland)	• Increases the rate of mitosis of chondrocytes and osteoblasts • Increases the rate of protein synthesis (collagen, cartilage matrix, and enzymes for cartilage and bone formation)
Thyroxine (thyroid gland)	• Increases the rate of protein synthesis • Increases energy production from all food types
Insulin (pancreas)	• Increases energy production from glucose
Parathyroid hormone (parathyroid glands)	• Increases the reabsorption of calcium from bones to the blood (raises blood calcium level) • Increases the absorption of calcium by the small intestine and kidneys (to the blood)
Calcitonin (thyroid gland)	• Decreases the reabsorption of calcium from bones (lowers blood calcium level)
Estrogen (ovaries) or	• Promotes closure of the epiphyses of long bones (growth stops)
Testosterone (testes)	• Helps retain calcium in bones to maintain a strong bone matrix



Anterior view, fracture of clavicle

Joints

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Joint

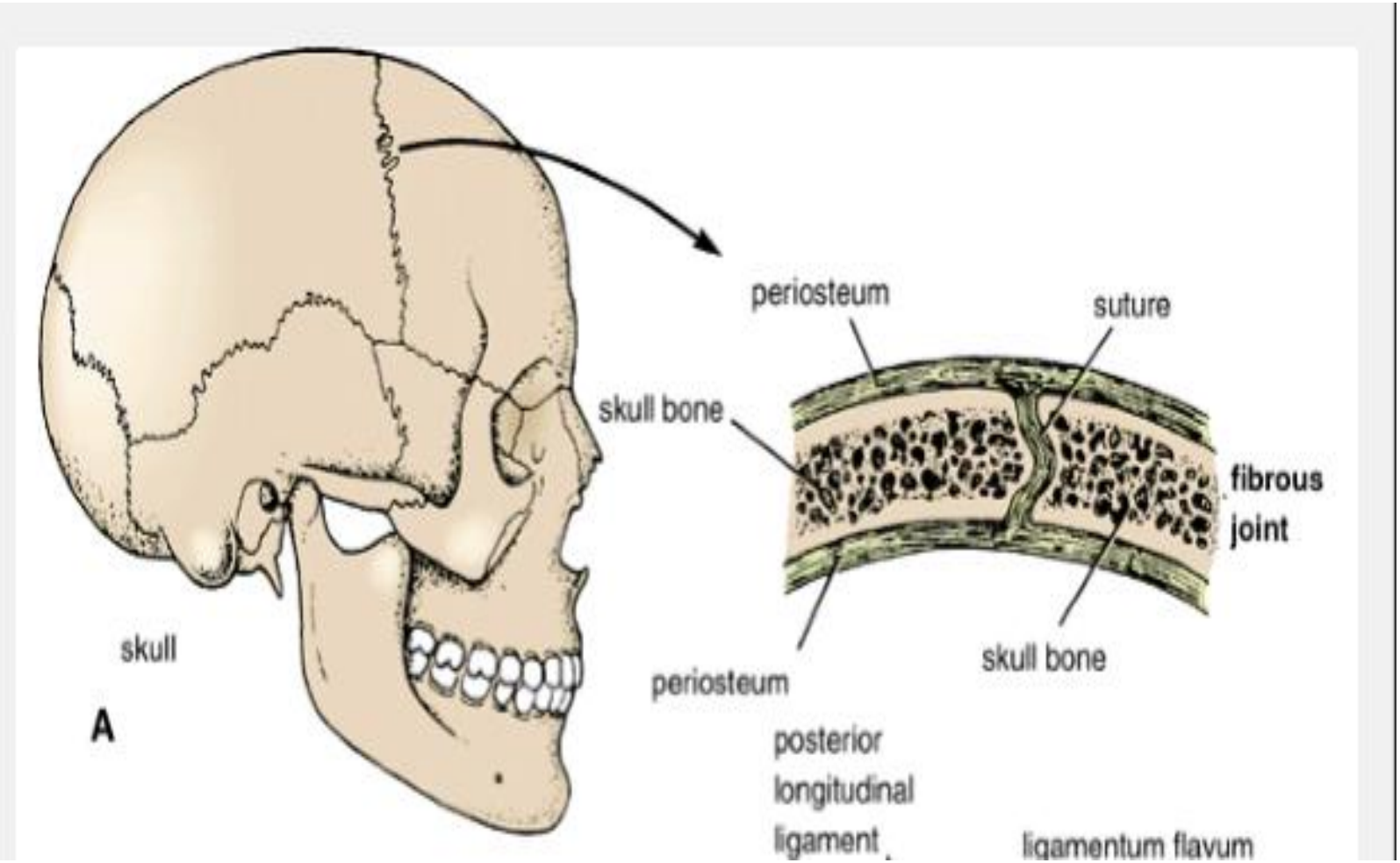
A site where two or more bones come together, whether or not movement occurs between them, is called a joint.

Joints are classified according to the tissues that lie between the bones: fibrous joints, cartilaginous joints, and synovial joints.

Fibrous Joints

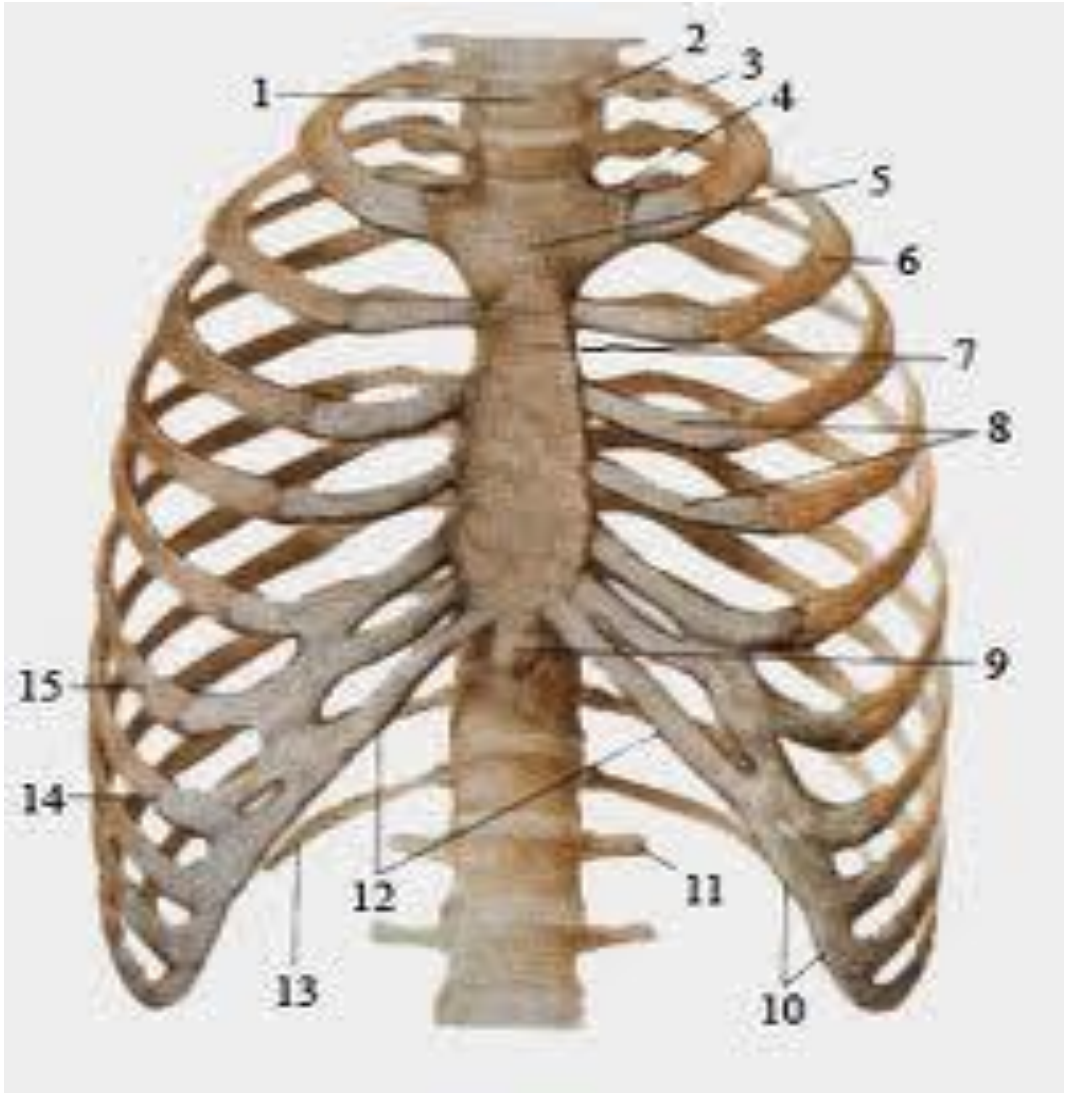
The articulating surfaces of the bones are joined by fibrous tissue, and thus very little movement is possible. The sutures of the vault of the skull and the inferior tibiofibular joints are examples of fibrous joints.

Fibrous Joints



Cartilaginous Joints

- Cartilaginous joints can be divided into two types: primary and secondary.
- A primary cartilaginous joint is one in which the bones are united by a plate or bar of hyaline cartilage. Thus, the union between the epiphysis and the diaphysis of a growing bone and that between the first rib and the manubrium sterni are examples of such a joint. No movement is possible.
- A secondary cartilaginous joint is one in which the bones are united by a plate of fibrocartilage and the articular surfaces of the bones are covered by a thin layer of hyaline cartilage. Examples are the joints between the vertebral bodies and the symphysis pubis. A small amount of movement is possible.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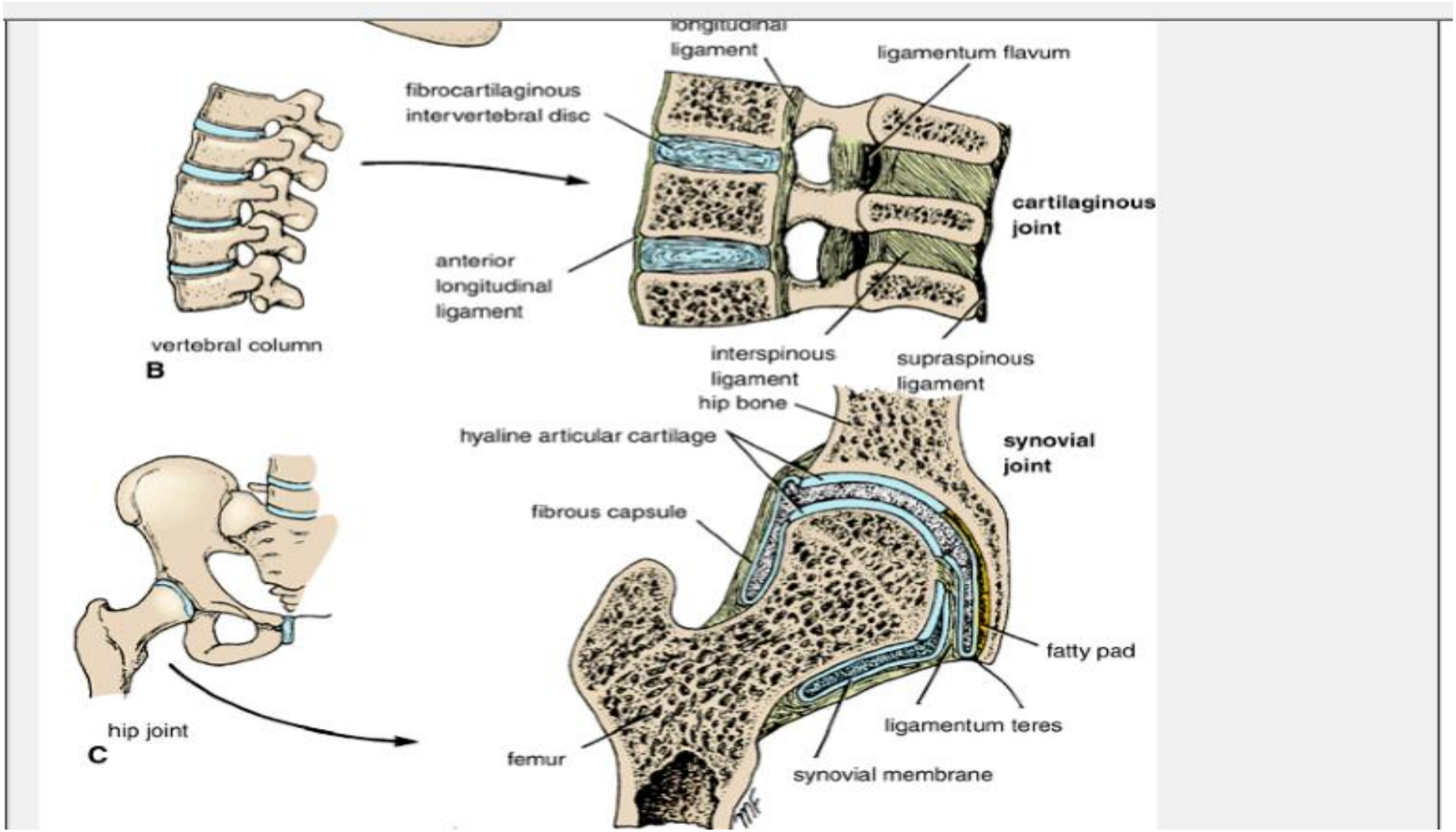
Cartilaginous and Synovial joint



Synovial Joints

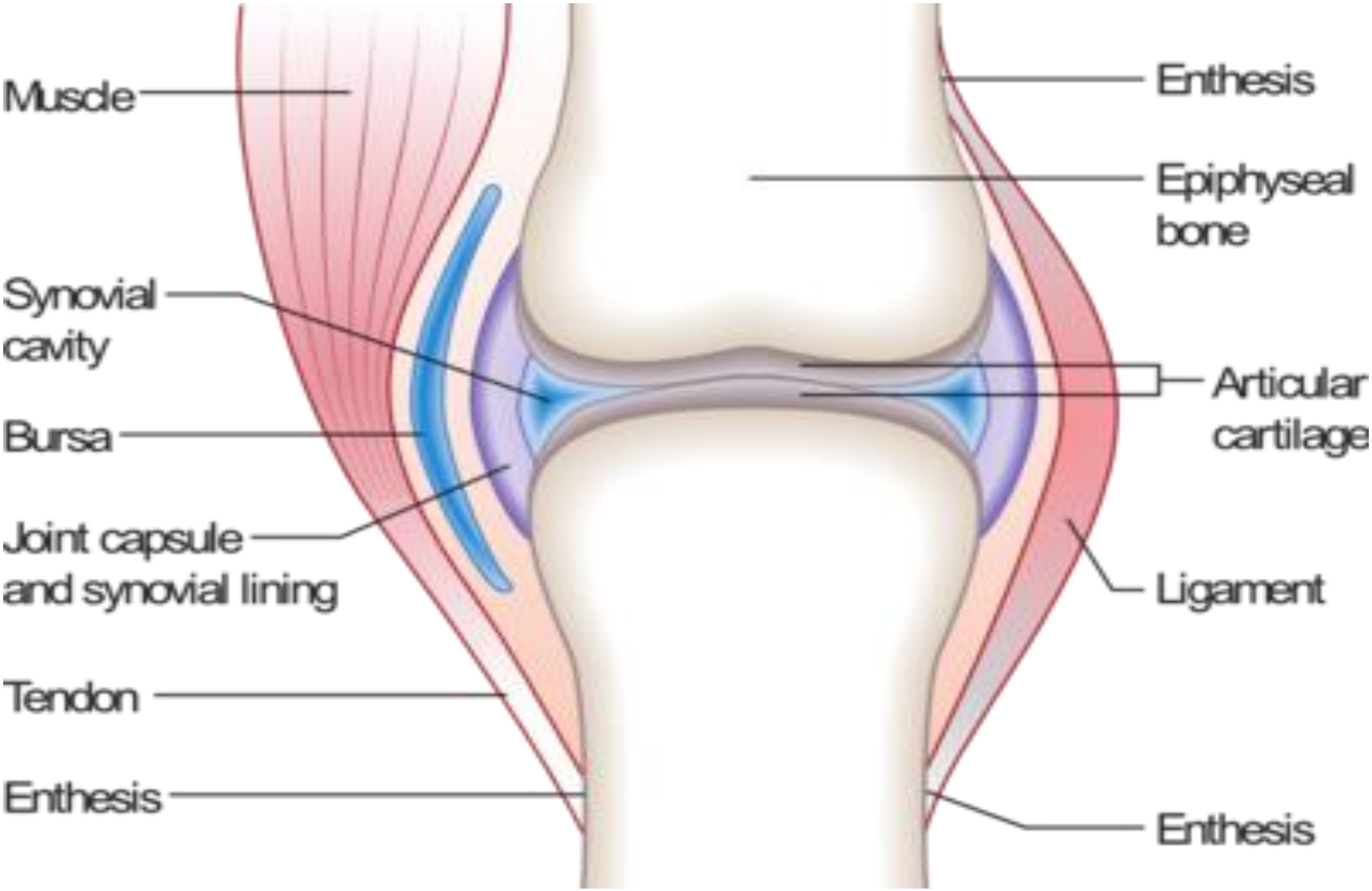
- The articular surfaces of the bones are covered by a thin layer of hyaline cartilage separated by a joint cavity . This arrangement permits a great degree of freedom of movement. The cavity of the joint is lined by synovial membrane, which extends from the margins of one articular surface to those of the other.

- The synovial membrane is protected on the outside by a tough fibrous membrane referred to as the capsule of the joint. The articular surfaces are lubricated by a viscous fluid called synovial fluid, which is produced by the synovial membrane.

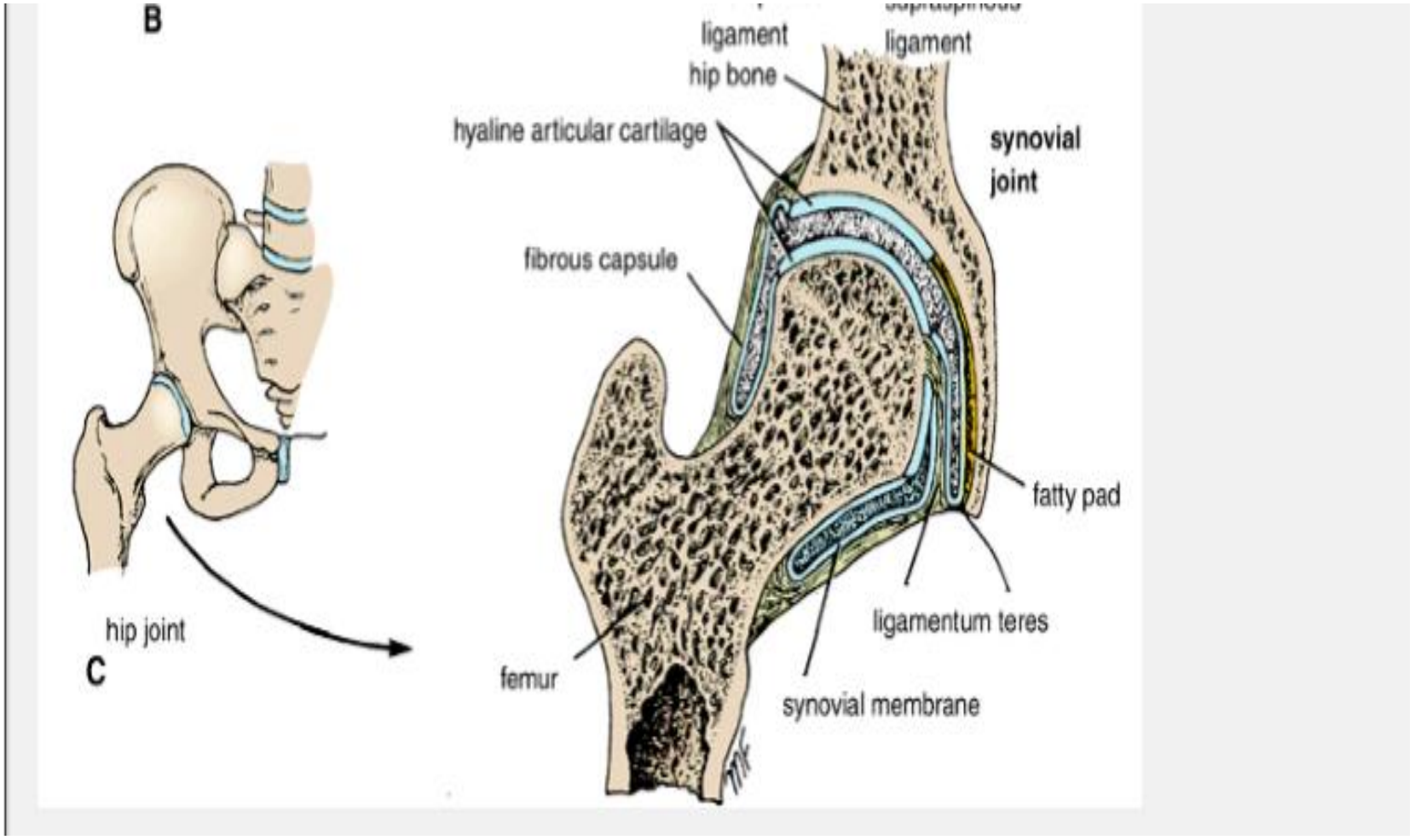
- In certain synovial joints, for example, in the knee joint, discs or wedges of fibrocartilage are interposed between the articular surfaces of the bones. These are referred to as articular discs.

- Fatty pads are found in some synovial joints lying between the synovial membrane and the fibrous capsule or bone. Examples are found in the hip and knee joints.

Structure of Synovial joint



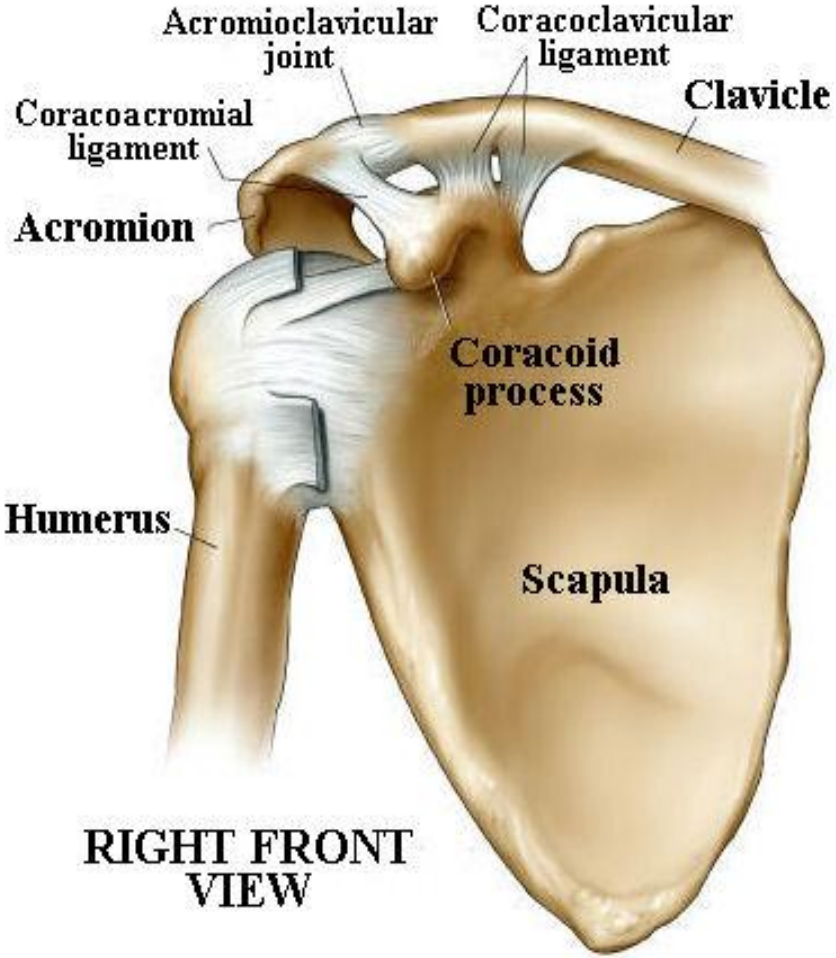
Fatty Pad inside synovial joint

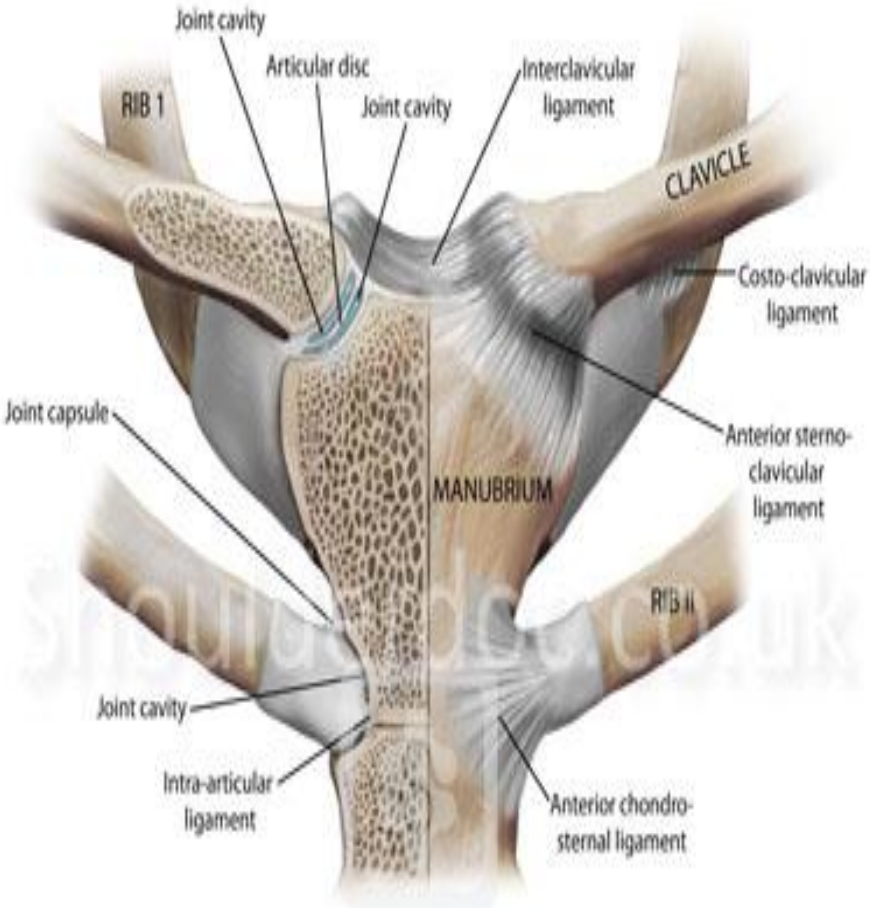


Types of synovial joints

Plane joints:

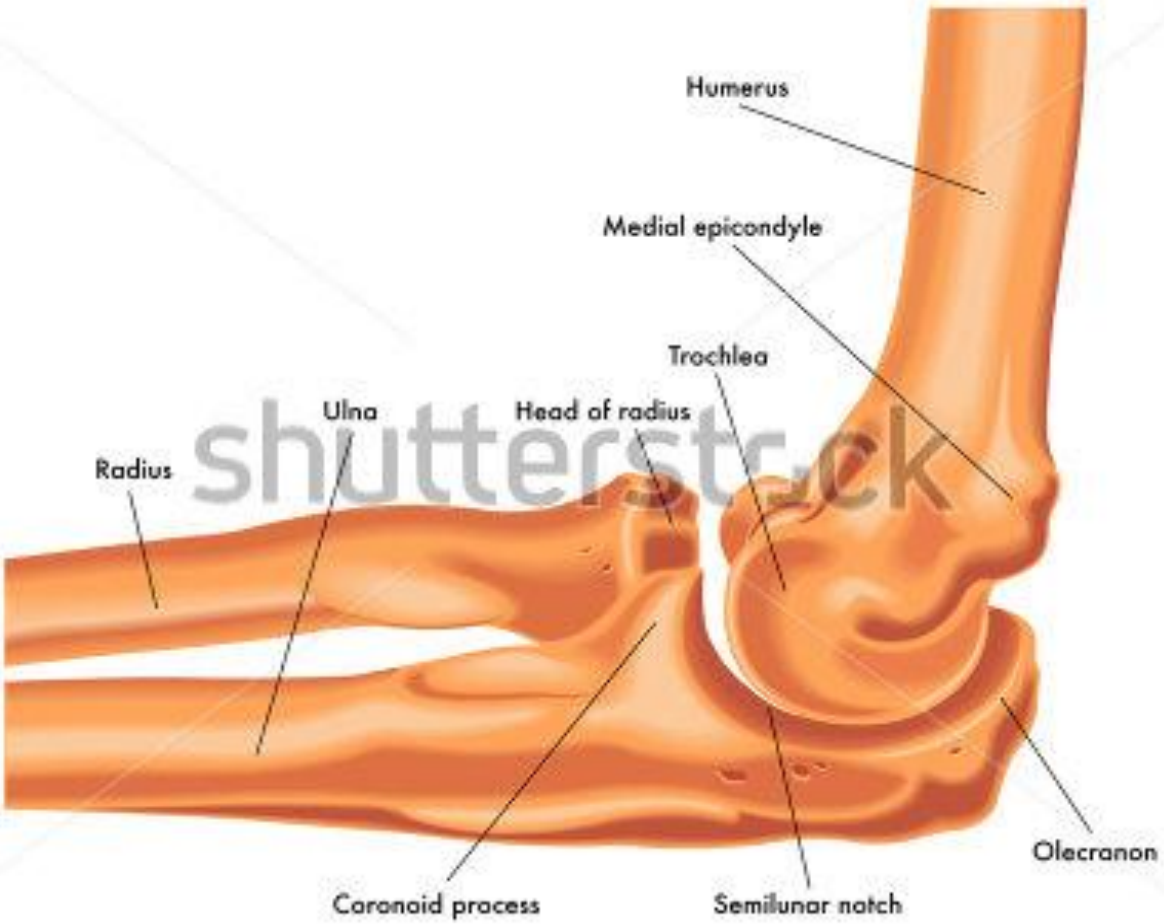
In plane joints, the apposed articular surfaces are flat or almost flat, and this permits the bones to slide on one another. Examples of these joints are the sternoclavicular and acromioclavicular joints.





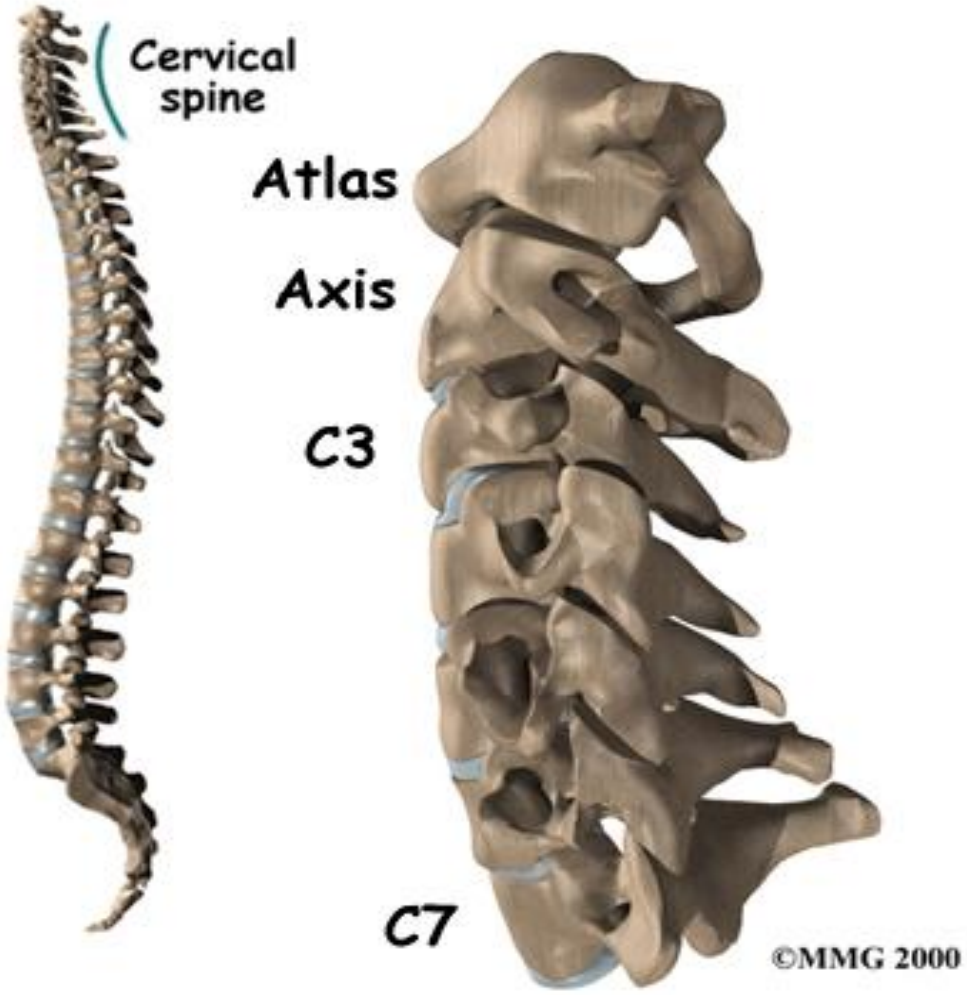
Hinge joints

- Hinge joints resemble the hinge on a door, so that flexion and extension movements are possible. Examples of these joints are the elbow, knee, and ankle joints



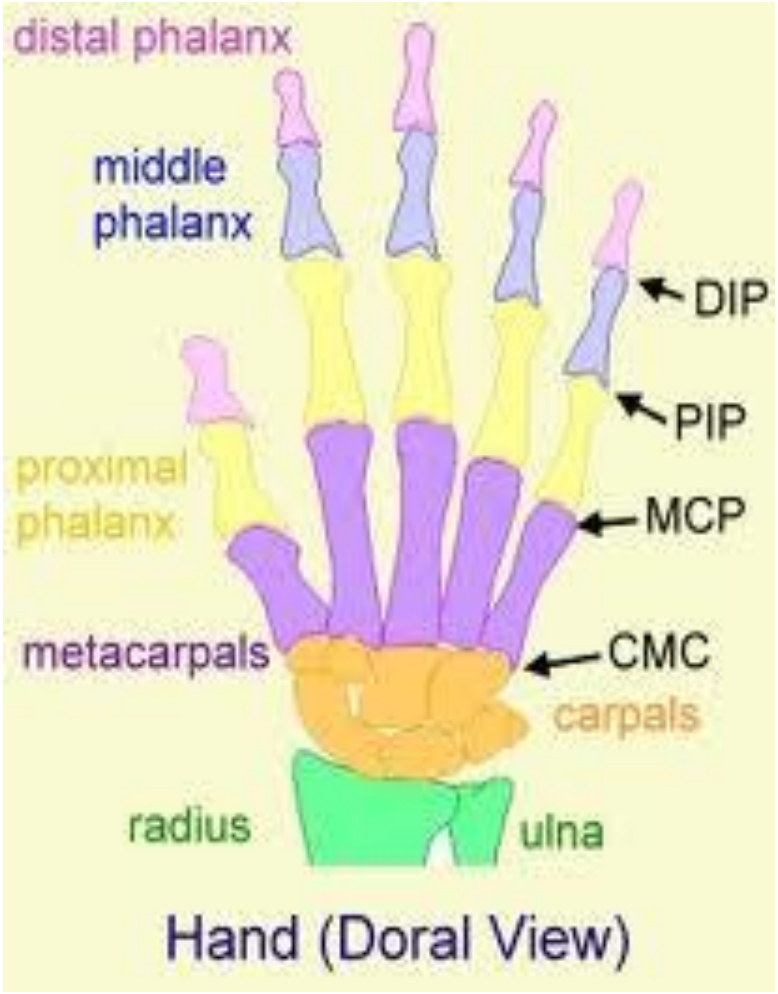
Pivot joints

In pivot joints, a central bony pivot is surrounded by a bony “ligamentous ring , and rotation is the only movement possible. The atlantoaxial and superior radioulnar joints are good examples.


Cervical spine
Atlas
Axis
C3
C7
©MMG 2000

Condyloid joints

- Condyloid joints have two distinct convex surfaces that articulate with two concave surfaces.
- The movements of flexion, extension, abduction, and adduction are possible together with a small amount of rotation. The metacarpophalangeal joints or knuckle joints are good examples .


distal phalanx
middle phalanx
DIP
PIP
proximal phalanx
MCP
metacarpals
CMC
carpals
radius
ulna
Hand (Doral View)


MCP Joints
Phalanges
Metacarpo-phalangeal joints
Metacarpals
©MMG 2003

Ellipsoid joints

In ellipsoid joints, an elliptical convex articular surface fits into an elliptical concave articular surface. The movements of flexion, extension, abduction, and adduction can take place, but rotation is impossible. The wrist joint is a good example.


Phalanges
Metacarpals
Carpals
Radius
Ulna

Saddle joints

In saddle joints, the articular surfaces are reciprocally concavoconvex and resemble a saddle on a horse's back. These joints permit flexion, extension, abduction, adduction, and rotation. The best example of this type of joint is the carpometacarpal joint of the thumb.

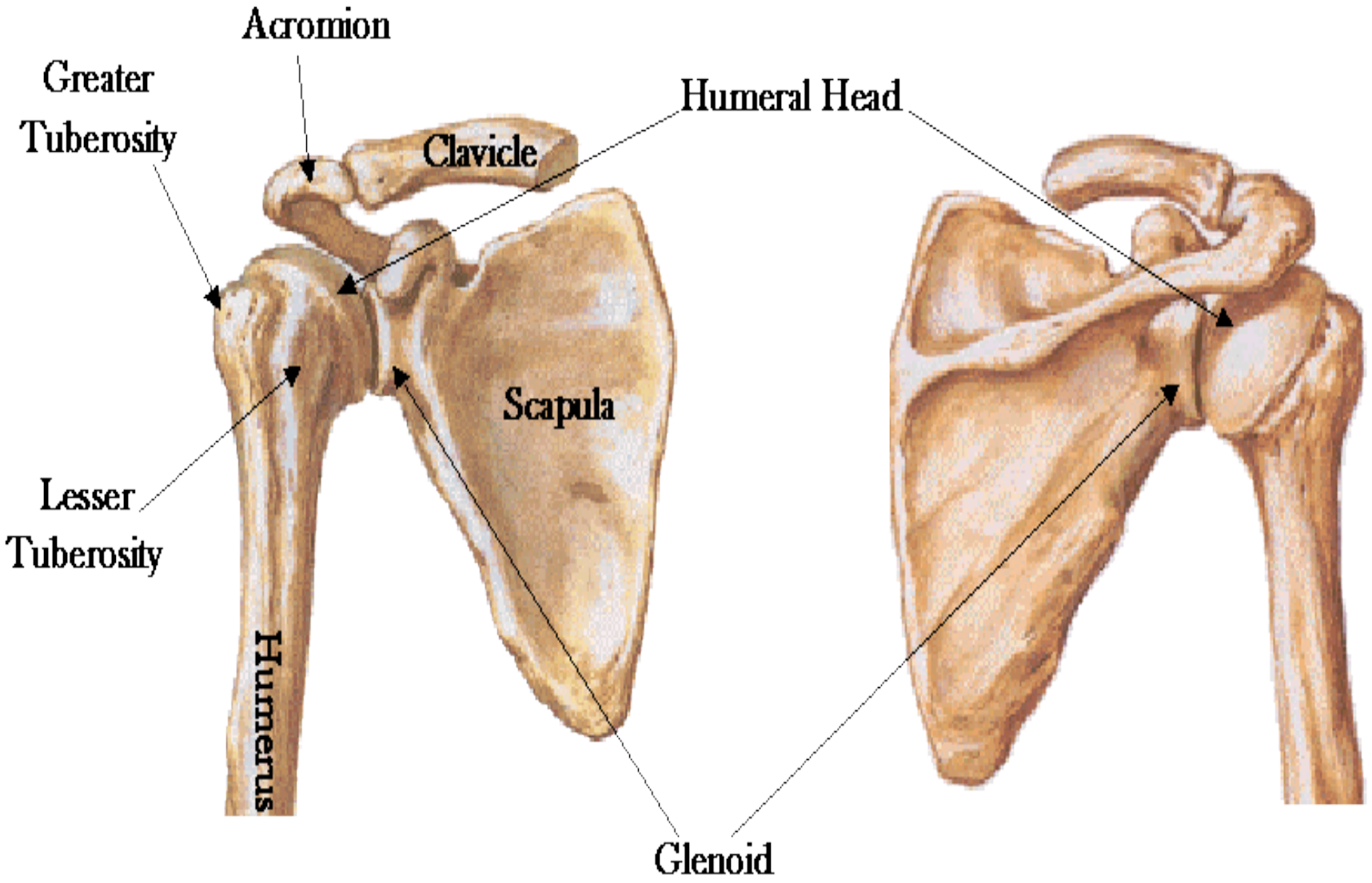

Thumb metacarpal
Metacarpo-phalangeal joint
Carpo-metacarpal joint
Trapezium
©MMG 2001

Ball-and-socket joints

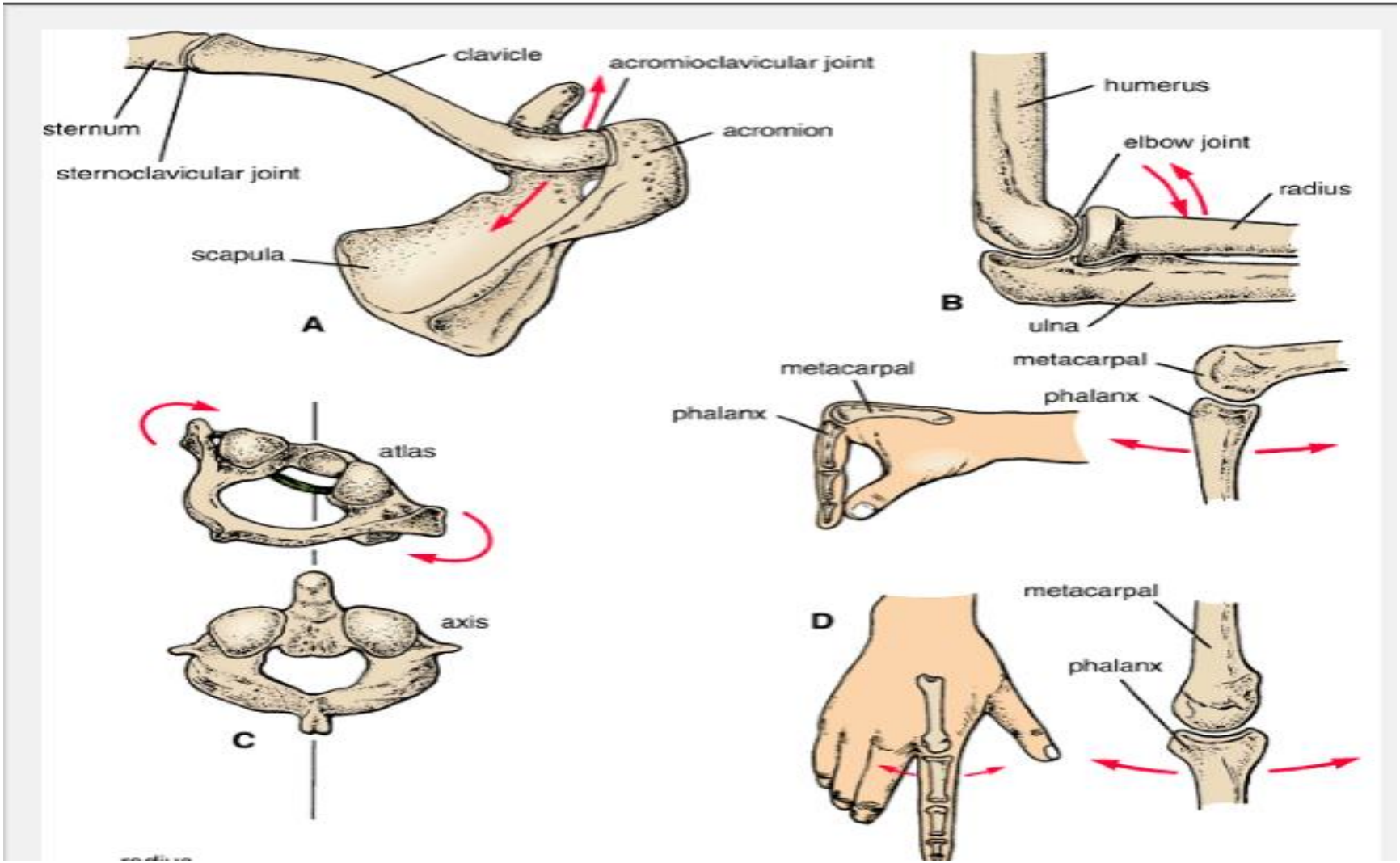
In ball-and-socket joints, a ball-shaped head of one bone fits into a socket like concavity of another.

This arrangement permits free movements, including flexion, extension, abduction, adduction, medial rotation, lateral rotation, and circumduction.

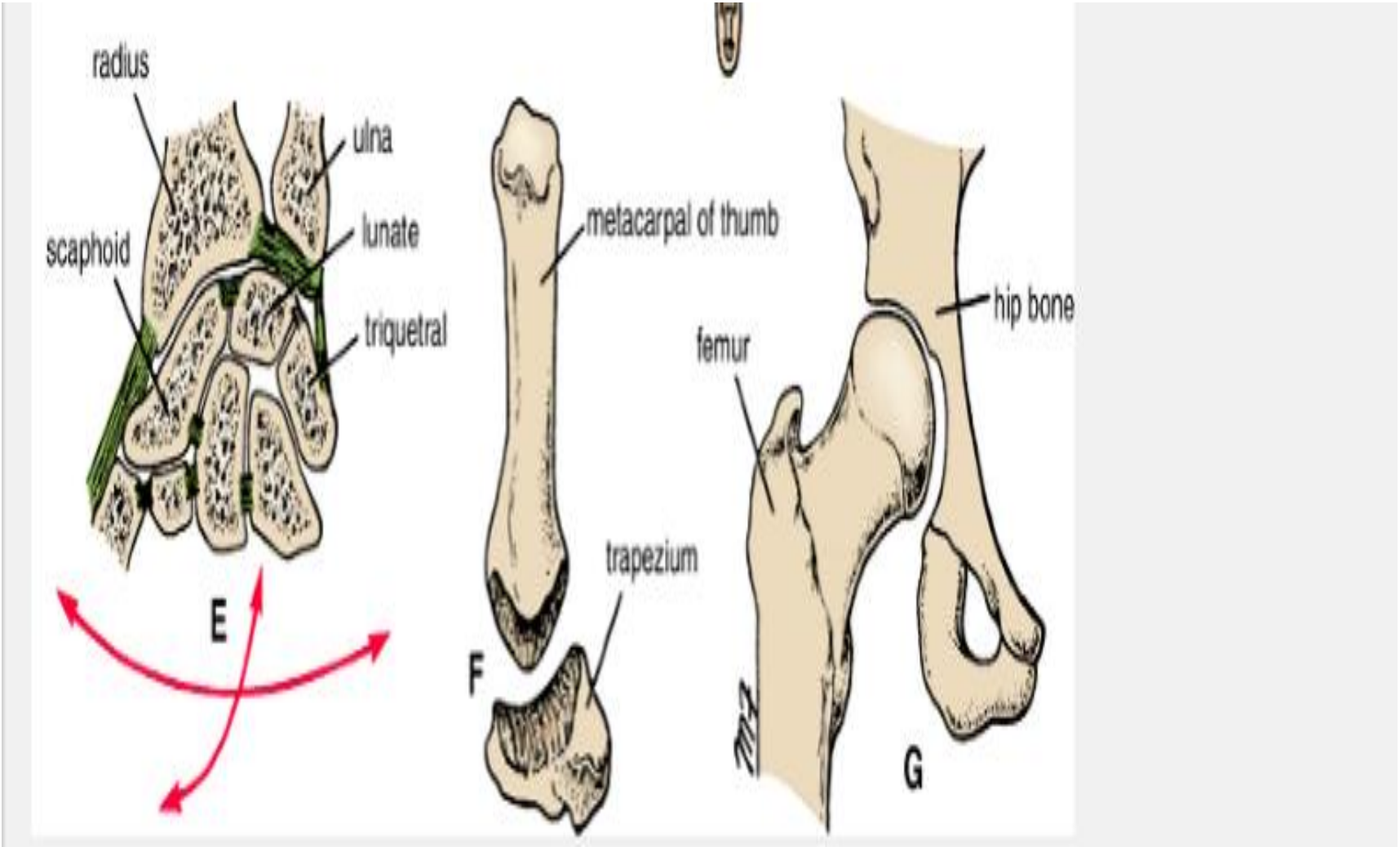
- The shoulder and hip joints are good examples of this type of joint


Acromion
Greater Tuberosity
Humeral Head
Clavicle
Scapula
Lesser Tuberosity
Humerus
Glenoid
FRONT VIEW
BACK VIEW

A. Plane joints (sternoclavicular and acromioclavicular joints). B. Hinge joint (elbow joint). C. Pivot joint (atlantoaxial joint). D. Condyloid joint (metacarpophalangeal joint).



E. Ellipsoid joint (wrist joint). F. Saddle joint (carpometacarpal joint of the thumb). G. Ball-and-socket joint (hip joint).



Nerve Supply of Joints

- The capsule and ligaments receive an abundant sensory nerve supply. A sensory nerve supplying a joint also supplies the muscles moving the joint and the skin overlying the insertions of these muscles, a fact that has been codified as Hilton's law.

Applied anatomy of the joints

- Arthrology
- Arthritis
- Arthroplasty
- Arthralgia
- Arthroscopy
- Ankylosis

From the name of ALLAH, The Most Merciful and The Mighty

رَبِّ اشْرَحْ لِیْ صَدْرِیْ o وَ یَسِّرْلِیْٓ اَمْرِیْ o وَاحْلُلْ عُقْدَةً مِّنْ لِّسَانِیْ o یَفْقَهُوْا قَوْلِیْ o (طٰہٰ:25-28)

اے میرے رب! میرا سینہ کھول دے اور میرے لیے میرا کام آسان کر دے اور میری زبان کی گرہ کھول دے تاکہ لوگ میری بات سمجھ سکیں۔

O my Lord! Open for me my chest (grant me self-confidence, contentment, and boldness). And make my task easy for me. And loose the knot (the defect) from my tongue. That they may understand my speech. (TAHA: 25-28)

Muscles

Anatomy of the Muscles

- The word muscle is derived from Latin word *mus* means a mouse.
- Most of the vertebrates muscles resemble to a mouse in their external appearance and their tendon resemble to tail of the mouse.
- Muscles consist predominantly of contractile cells and produces the movement s of various part of the body by contraction.

Types of Muscles

The muscles are of three types

1. Skeletal muscles (Striped , striated, somatic or voluntary muscles)

2. Smooth Muscles (Plain, unstriped, Non striated, Visceral or involuntary

3. Cardiac Muscles

Characteristic of Skeletal muscles

- Most abundant (muscles of the limbs and body wall) and Found attached to skeleton.
- Exhibit cross striation under microscope.
- Supplied by somatic nerves, therefore they are under voluntary control with certain exception.
- Respond quick to stimuli, capable of rapid contraction therefore fatigue easily.

Continue

- Help to adjust individual with external environment
- Under highest nervous control of cerebral cortex
- Each muscles fiber is multinucleated cylindrical cell containing group of myofibrils.
- Myofibril made up of myofilaments which are actin, myosin and tropomyosin. (actual contractile elements)

Characteristic of Smooth Muscles

- These muscles often encircle or surround the viscera.
- Do not exhibit cross striation under the microscope
- Are supplied by autonomic nervous system therefore not under voluntary control
- Respond slowly to stimuli, capable of slow contraction and therefore do not fatigue easily

Continue

- Provide motor power for regulating the internal environment related to digestion, circulation, excretion and secretion.
- Less dependent on nervous control being capable of contracting automatically, spontaneously and rhythmically.
- Each muscles fiber is elongated spindle shaped cell with a single centrally located nucleus, myofibril show longitunal striation. Muscles of the blood vessels and arector pili muscles of the skin.

Cardiac Muscles

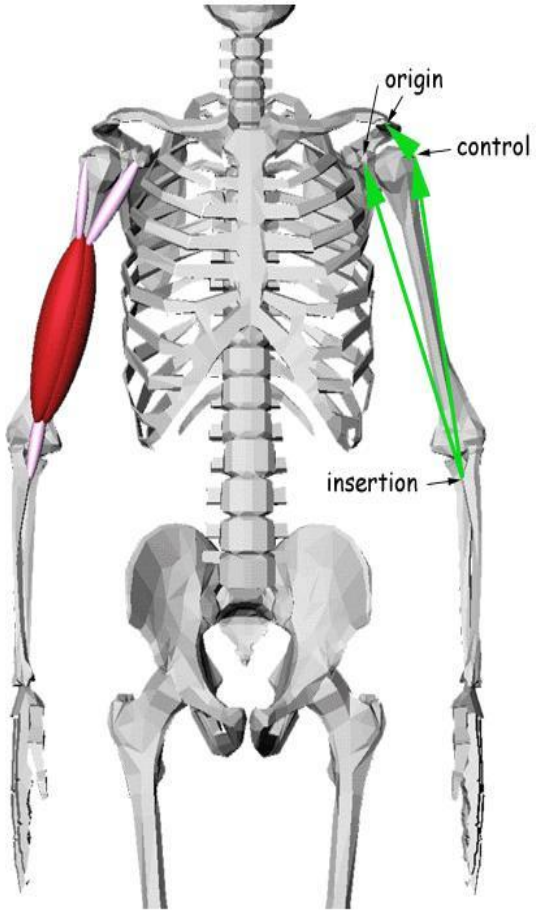
- Form the myocardium of the heart
- Striated and involuntary
- Automatic and rhythmic contraction

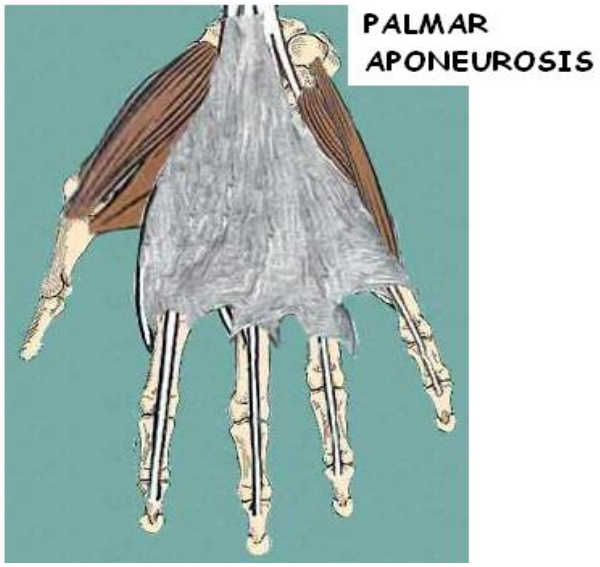
Parts of a skeletal muscle

- Origin
- Insertion
- Fleshy Part
- Fibrous part

1. Tendon (cord Like)
2. Aponeurosis (flattened)

Part of the Muscles





Structure of skeletal Muscle

- Contractile Tissue
- Supporting tissues

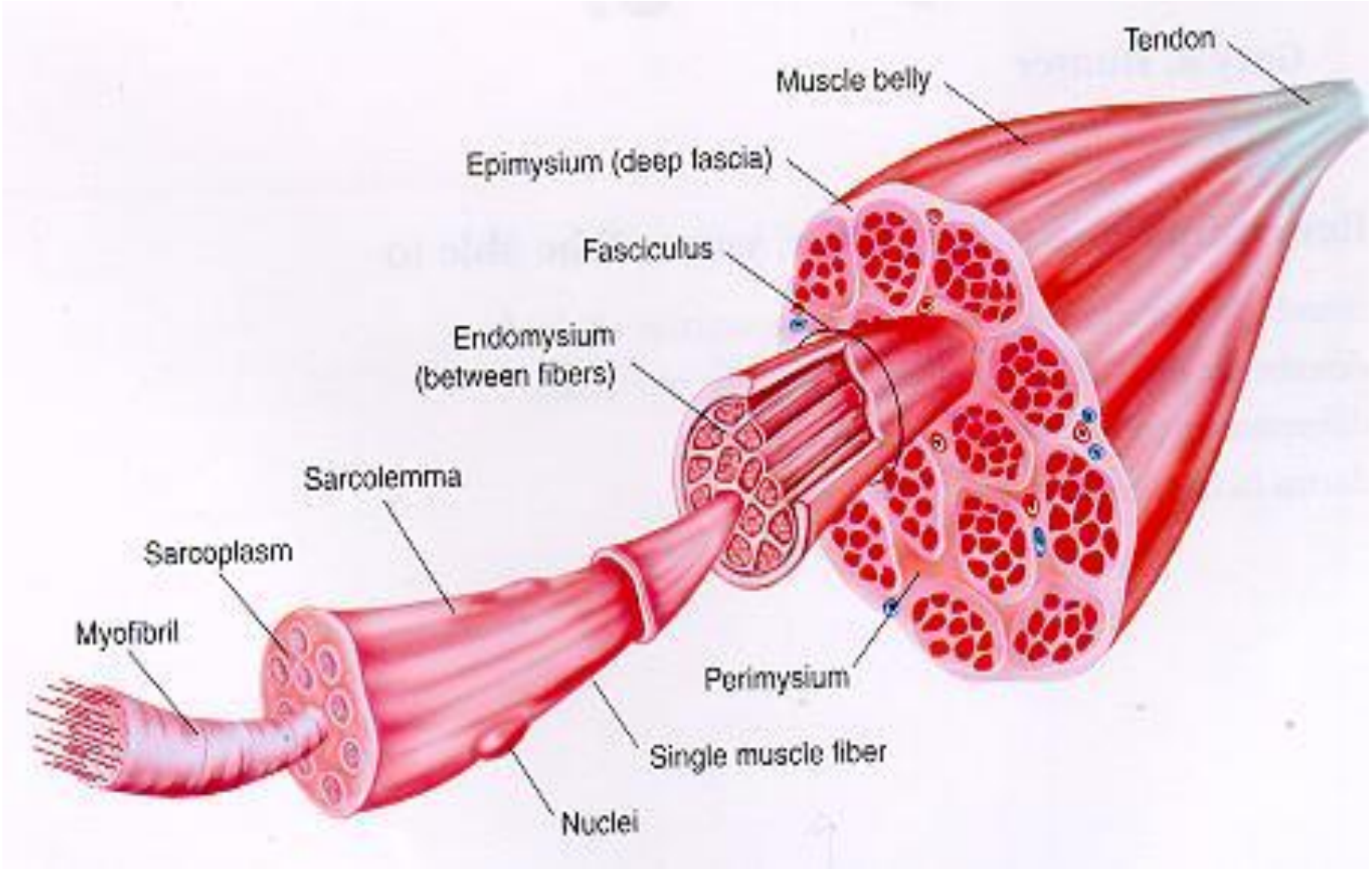
Contractile Tissues

- Muscle is made up of fasciculi
- Fasciculus is made up of muscle fibers
- Muscle fiber is made up of myofibrils & is covered by sarcolemma
- Myofibril is made up of Actin & Myosin filaments & each myofibril is covered by sarcoplasm on which motor nerve endings are making contact
- Sarcoplasm contains calcium ions & sends transverse channels between myofibrils

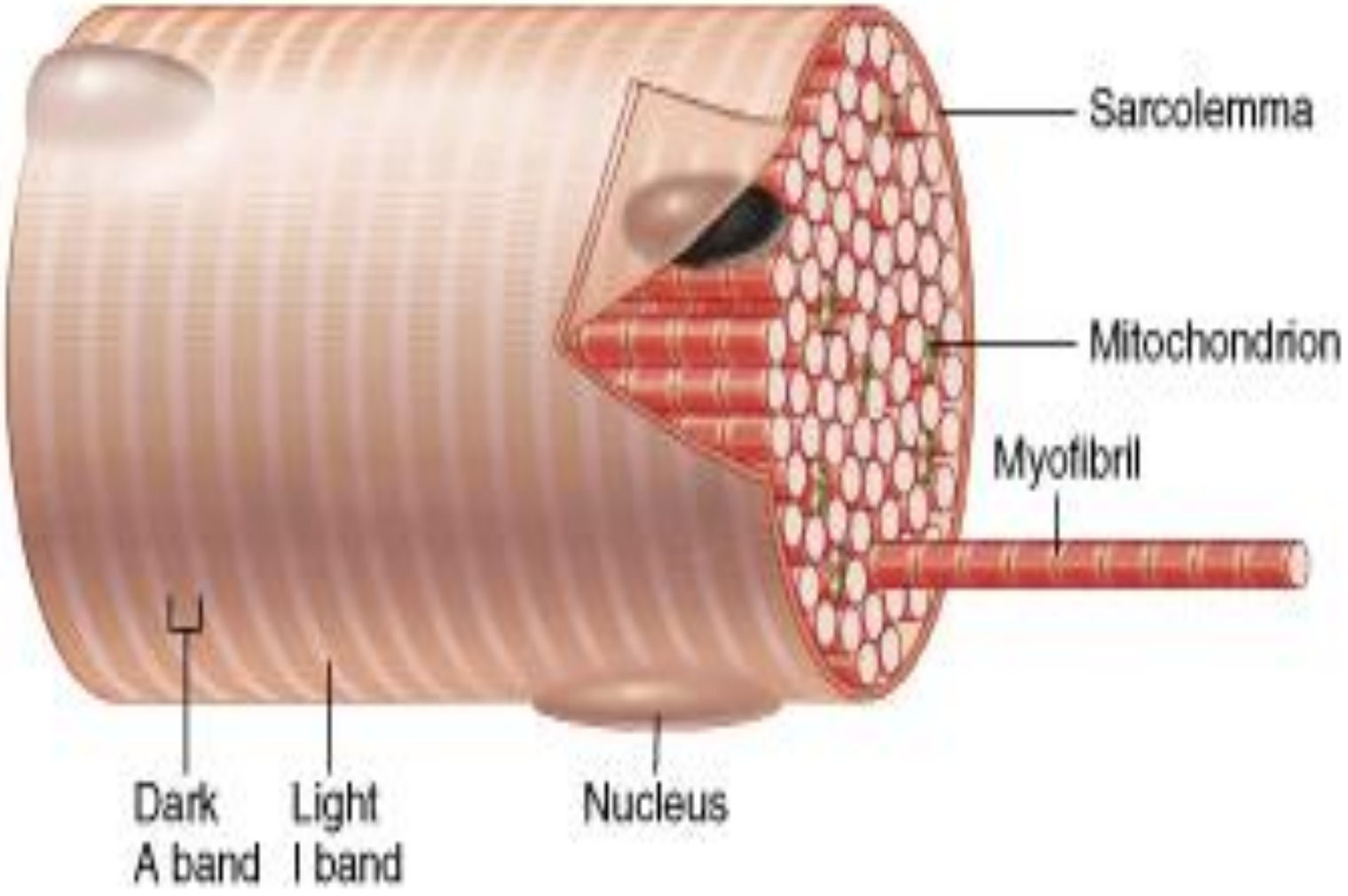
Supporting Tissues

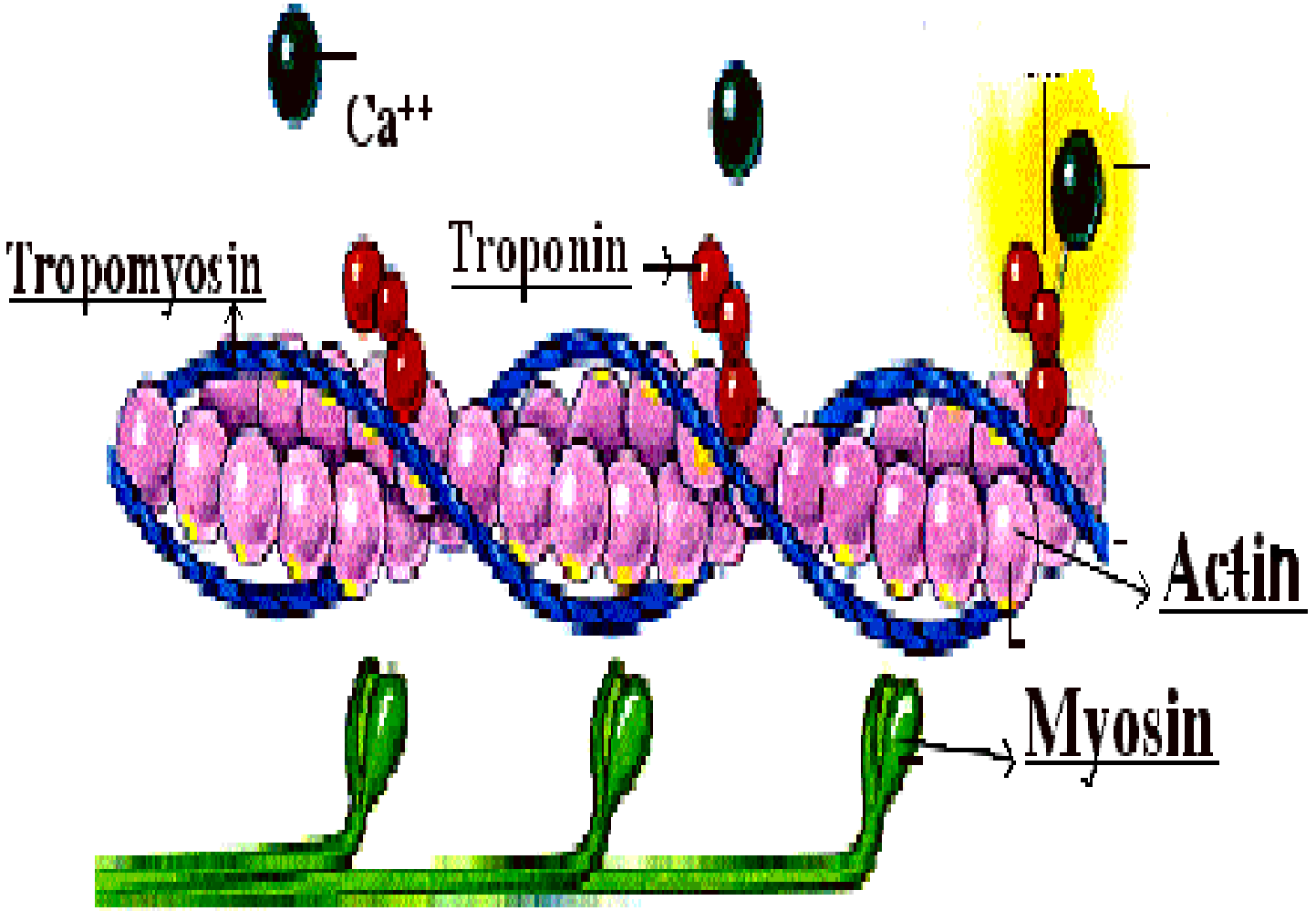
- Endomysium (surround the muscle fiber)
- Perimycium (surround the muscle fibers)
- Epimysium (Surround the entire muscle)

Structure of a muscle

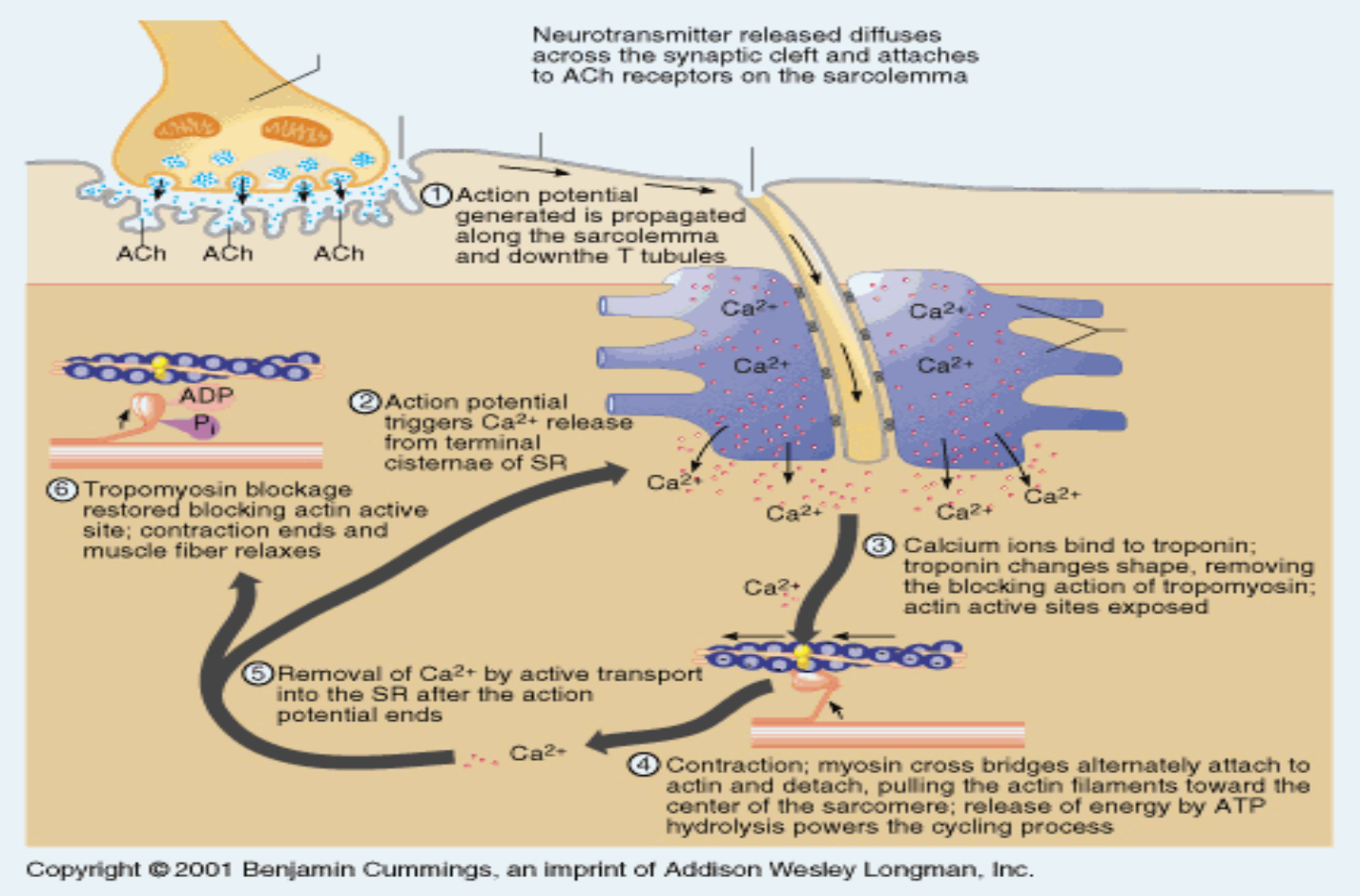


Contractile element of a muscle




Ca++
Tropomyosin
Troponin
Actin
Myosin

Contraction of a Muscles (striated)



Slow and Fast Muscles Fibers

A: Type 1 (Slow) fiber:

- Slow tonic contraction (postural Muscles)
- Red due to myoglobin
- Fiber are rich in mitochondria and oxidative enzyme
- poor phosphorylases
- Highly resistant to fatigue

Type II fast fibers

- Show fast phasic contraction
- White in color , low amount of myoglobin
- Rich in glycogen & phosphorylases
- Poor mitochondria and oxidative enzymes
- Easily Fatigue

Intermediate fibers

- Represent a variant of type II
- Relatively resistant to fatigue but less than type 1

Fascicular Architecture of Muscles

- The arrangement of muscle fiber varies according to direction, force and range of habitual movement at particular joint.
- Force of movt directly Proportional to number and size of muscle fiber
- Range of motion is proportional to length of the fiber

Parallel Fasciculi

Fasciculi are Parallel to the line of pull

1. Quadrilateral (thyrohyoid)
2. Strap like (sternohyoid & Sartorius)
3. Strap like with tendinous insertion
   (Rectus Abdominus)
4. Fusiform (Bicep, Diagastric)

range of motion in such muscles is maximum

Oblique Fasciculi

Fasciculi are oblique to the line of pull

- Muscle may be triangular or pinnate
- range of movt reduced
- muscle is more powerful

Cont.

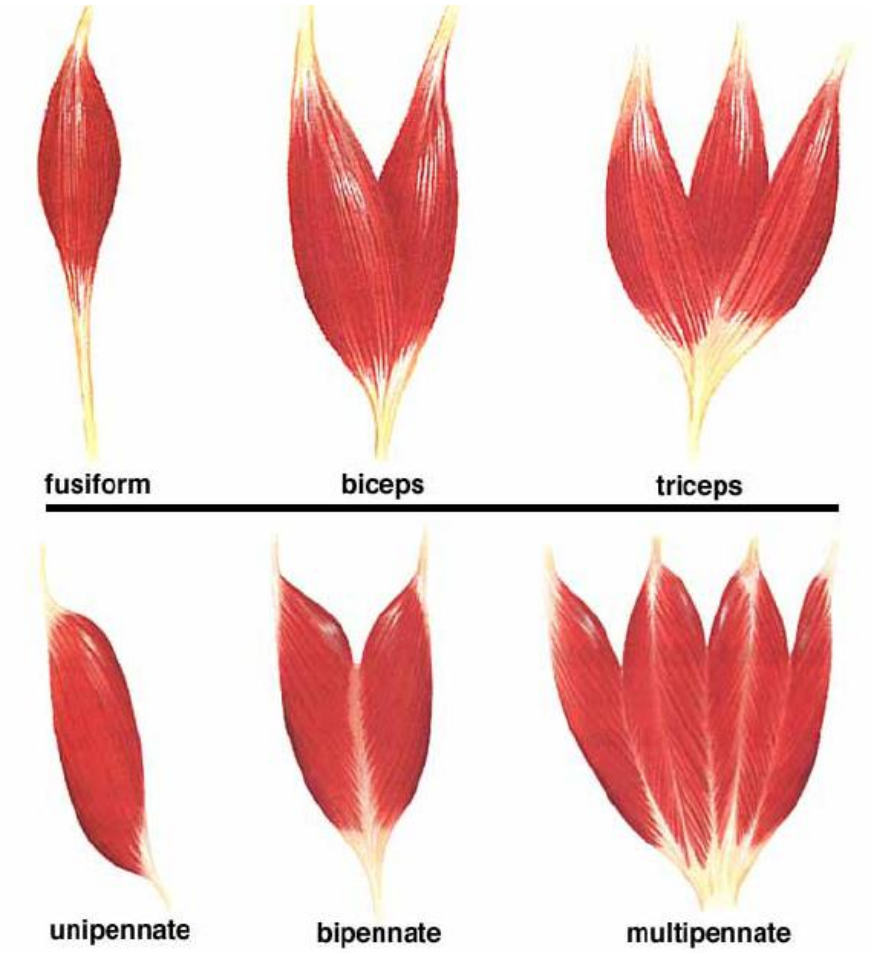
- Triangular (temporalis, addutor longus)
- Unipennate (Flexor Pollicis longus)
- Bipennate (rectus femoris)
- Multipennate (Deltoid, subscapularis)
- Circumpennate (tibialis anterior)

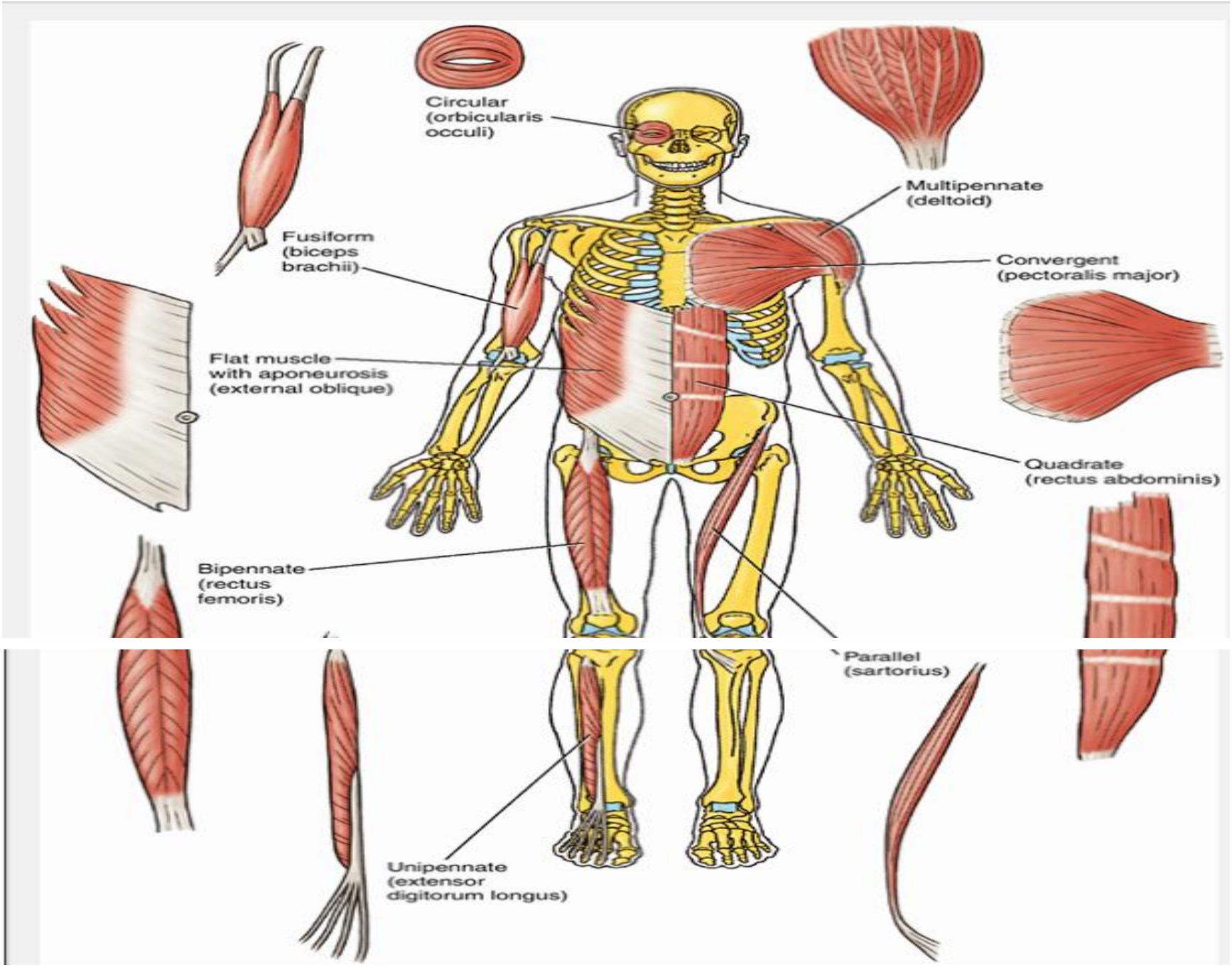
Spiral or Twisted Fasciculi

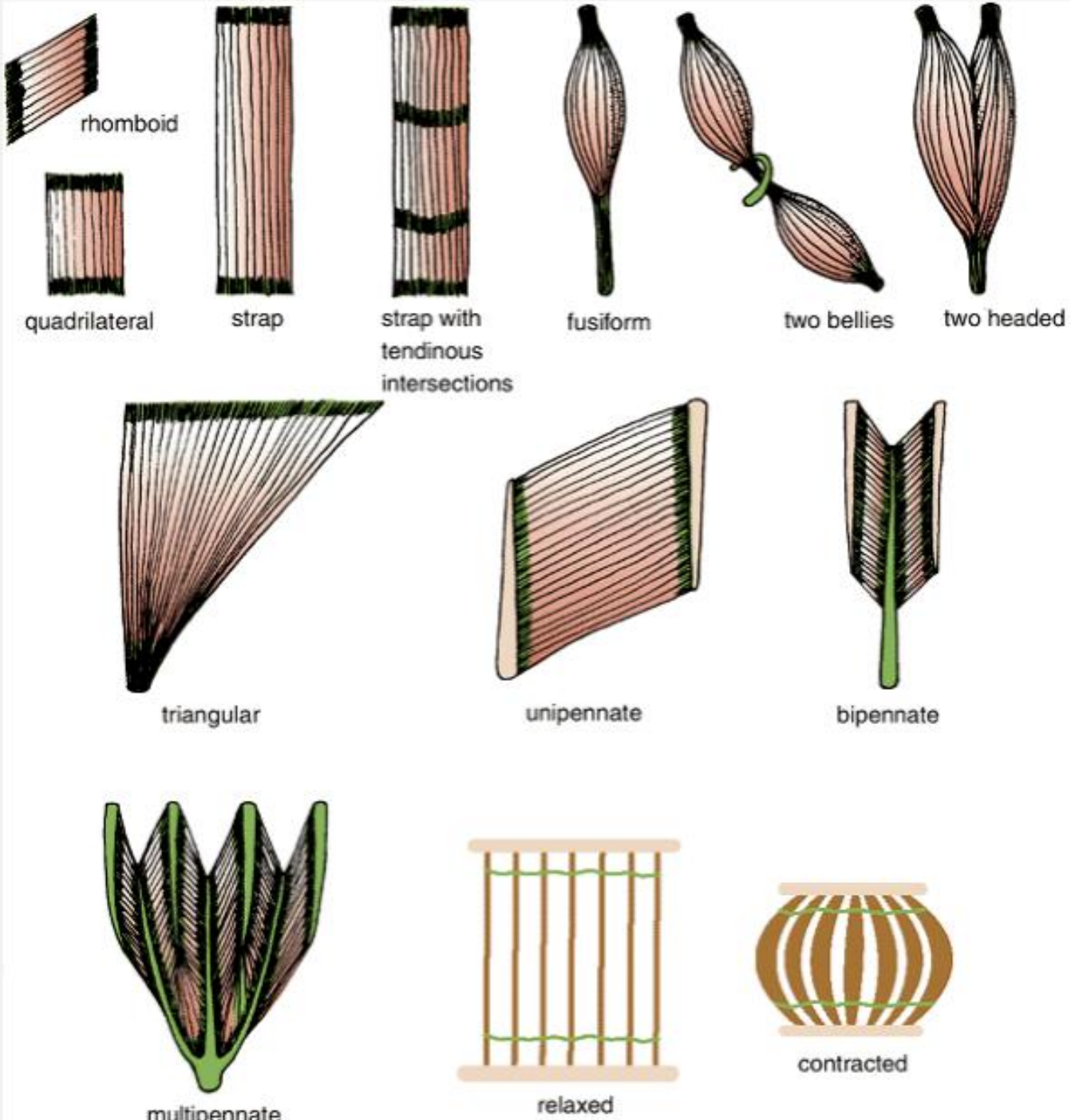
Twisted fibers are found

E.g. ,Trapezius, pectoralis major,lattisimus dorsi

Parallel and oblique fibers




Circular
(orbicularis
occuli)
Multipennate
(deltoid)
Fusiform
(biceps
brachii)
Convergent
(pectoralis major)
Flat muscle
with aponeurosis
(external oblique)
Quadrate
(rectus abdominis)
Bipennate
(rectus
femoris)
Parallel
(sartorius)
Unipennate
(extensor
digitorum longus)


rhomboid
quadrilateral
strap
strap with tendinous intersections
fusiform
two bellies
two headed
triangular
unipennate
bipennate
multipennate
relaxed
contracted

Naming of Skeletal Musclesa

Name	Shape	Size	Number of Heads or Bellies	Position	Depth	Attachments	Actions
Deltoid	Triangular						
Teres	Round						
Rectus	Straight						
Major		Large					
Latissimus		Broadest					
Longissimus		Longest					
Biceps			Two heads				
Quadriceps			Four heads				
Digastric			Two bellies				
Pectoralis				Of the chest			
Supraspinatus				Above spine of scapula			
Brachii				Of the arm			
Profundus					Deep		
Superficialis					Superficial		
Externus					External		
Sternocleidomastoid						From sternum and clavicle to mastoid process	
Coracobrachialis						From coracoid process to arm	
Extensor							Extend
Flexor							Flex
Constrictor							Constrict

[a]These names are commonly used in combination, for example, flexor pollicis longus (long flexor of the thumb).

ALLAH Bless you

THANKS