

muscles

- muscle is a contractile tissue ,designed for movements.
- fundamental property is contractility which is developed in highly specialized form .
- called as muscle fibers or myocytes because they are long and narrow when relaxed .
- they give form to the body and provide heat.

# Types

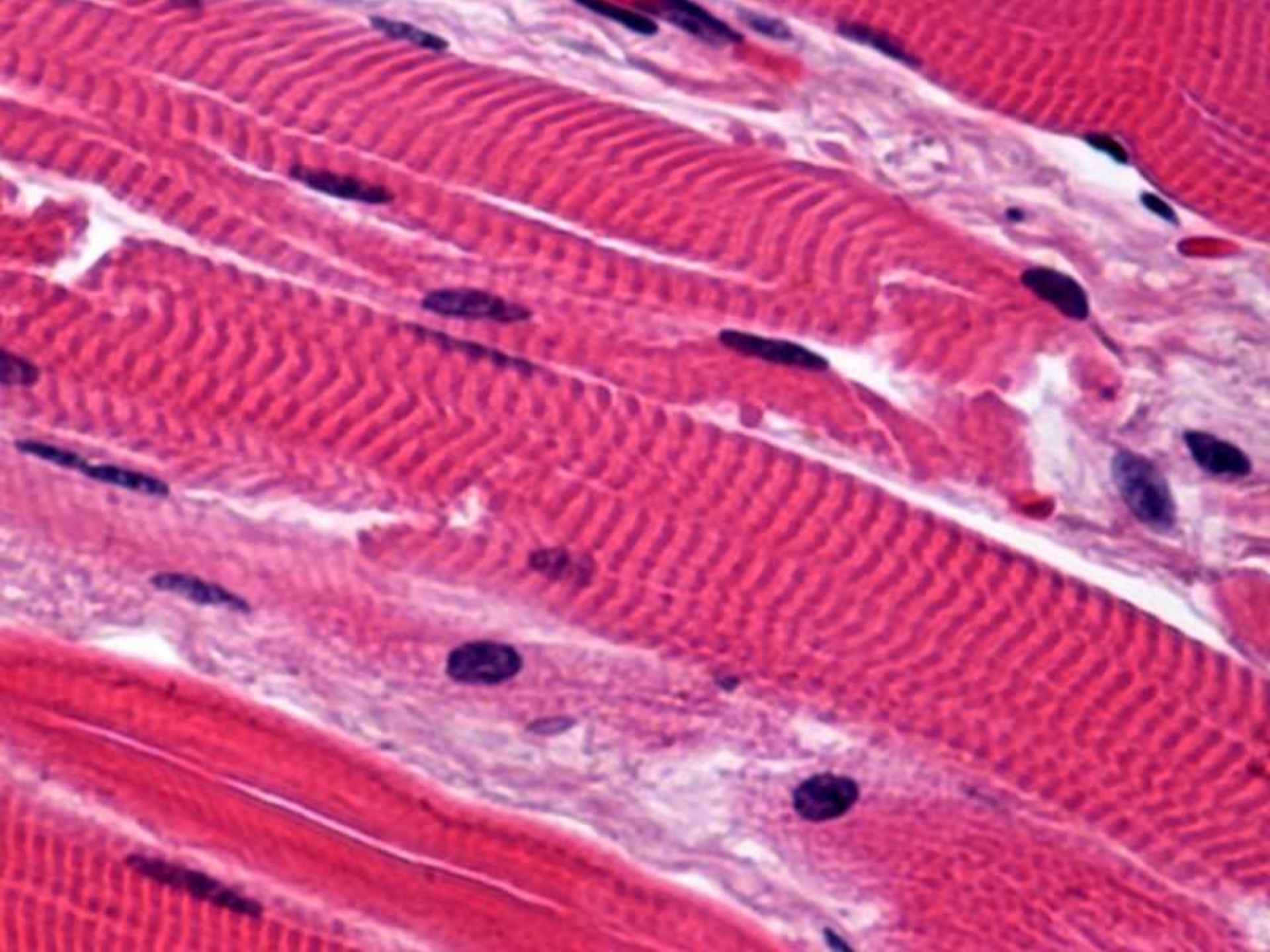
- skeletal
- cardiac
- smooth

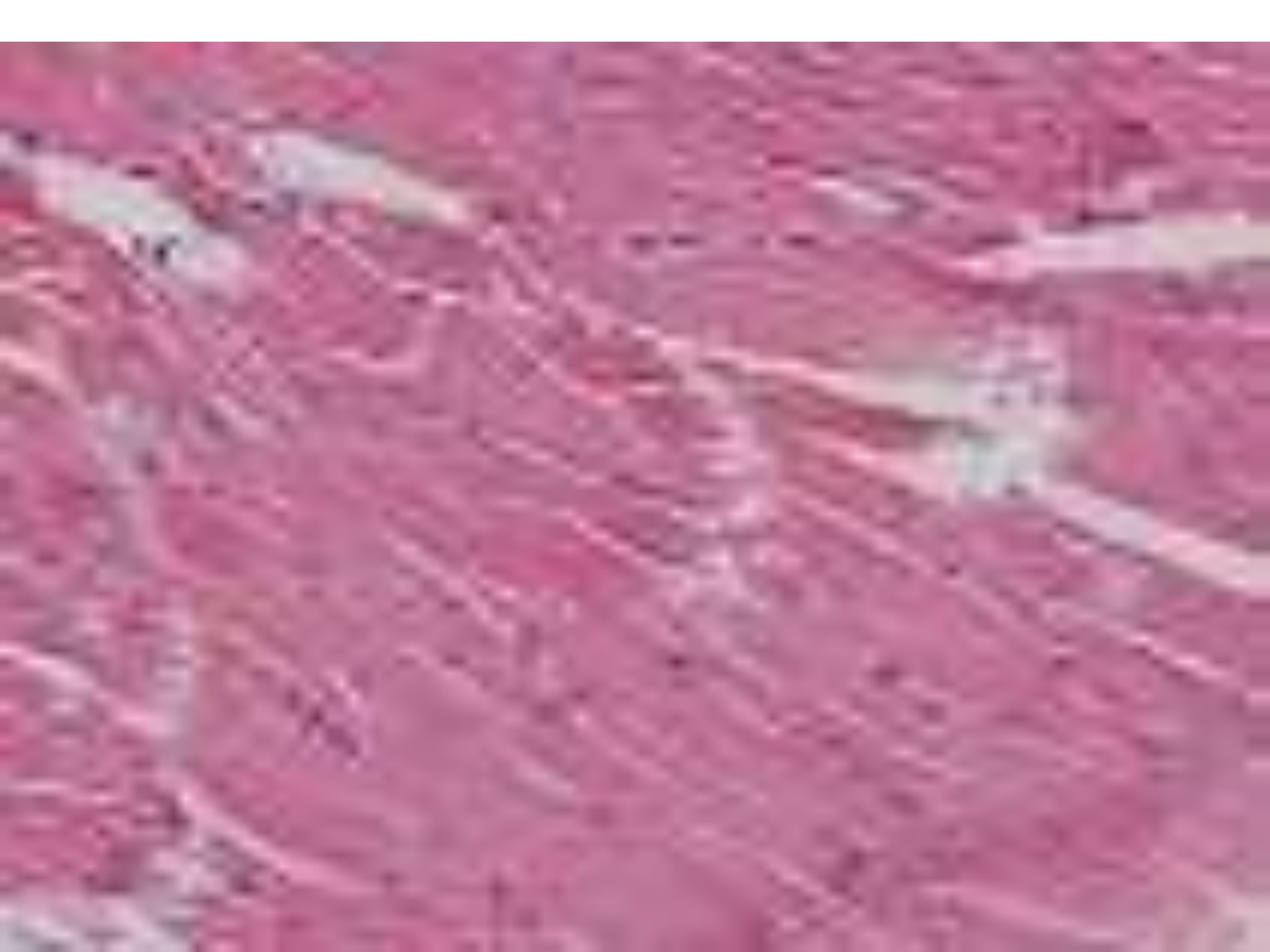
Structurally on the basis of presence of striations can be subdivided into ---

- striated -----skeletal , cardiac
- non- striated.----- smooth.

# Skeletal muscle

- forms bulk of muscular tissue of body.
- supplied by somatic motor nerves.
- Consist of **parallel bundles** of long **multinucleated fibers** which inturn is made of myofilaments , actin , myosin and tropomyosin.
- exhibits **cross striations** under microscope.
- also **called voluntry** muscle because movements in which it participates are often initiated under conscious control. But this is misleading as it is involved in various activities like---breathing, blinking, swallowing.





# Cardiac muscle

- muscle found in heart,
- supplied by autonomic nerves, thus involuntary
- consist of branching network of individual cells that are linked electrically and mechanically to function as a single unit.
- each muscle has a single nucleus placed centrally.
- cross striations are less prominent.
- cardiac muscle is less powerful than skeletal muscle but more resistant to fatigue.
- it is capable of rhythmic and automatic contractions.



Fig.7a Cardiac muscle fiber, ls

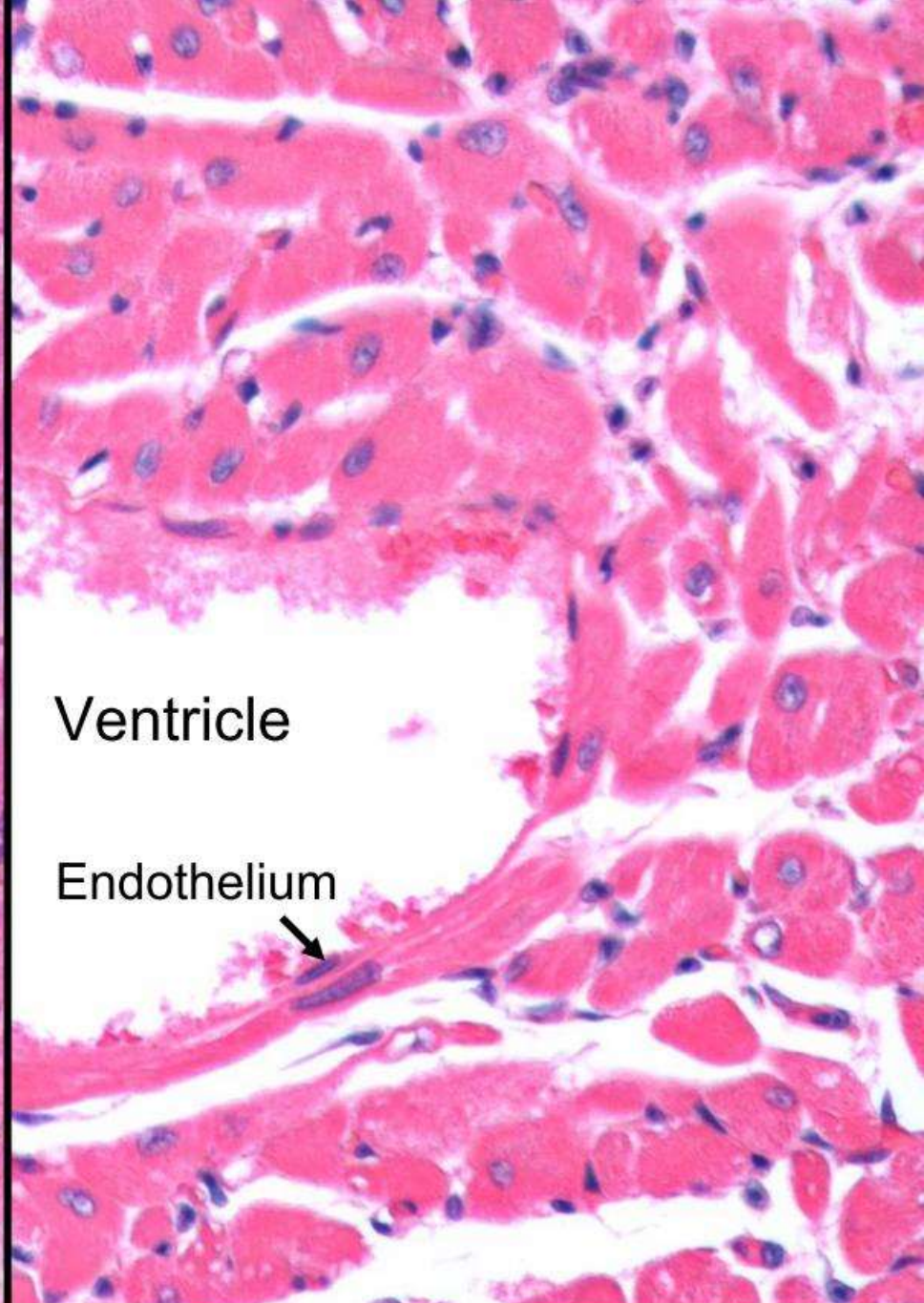
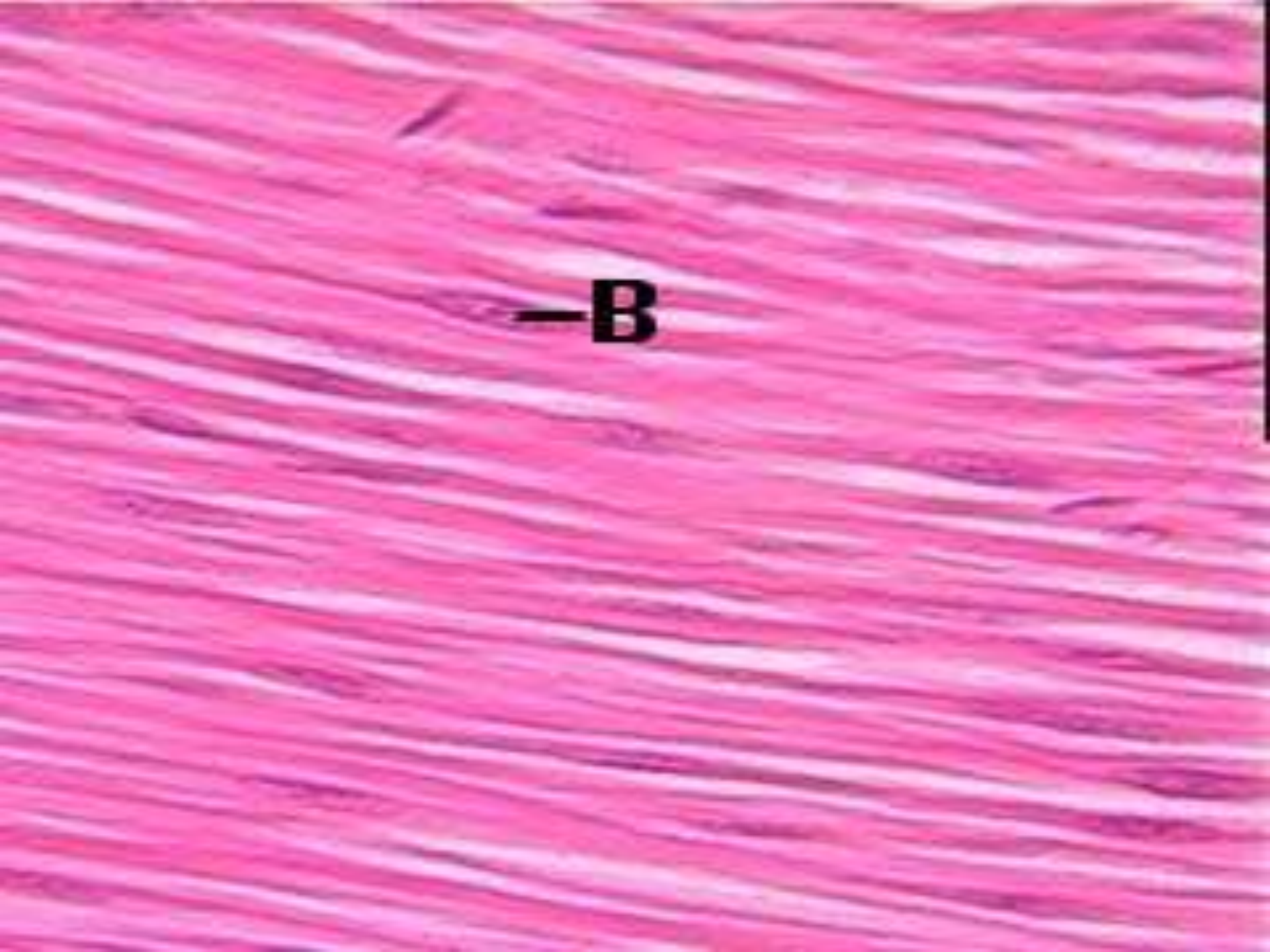


Fig.7b Cardiac muscle fiber, cs



# Smooth muscle

- these ms often encircle or surround the viscera.
- autonomic nerves supply them ,thus involuntary.
- Elongated cells are small and larger and taper at ends.
- cross striations are not prominent because the actin and myosin filaments are not organized into repeating units .Thus appear non-striated.
- nucleus is centrally placed
- capable of slow and sustained contractions.
- smooth muscle is also called involuntary muscle.



**B**

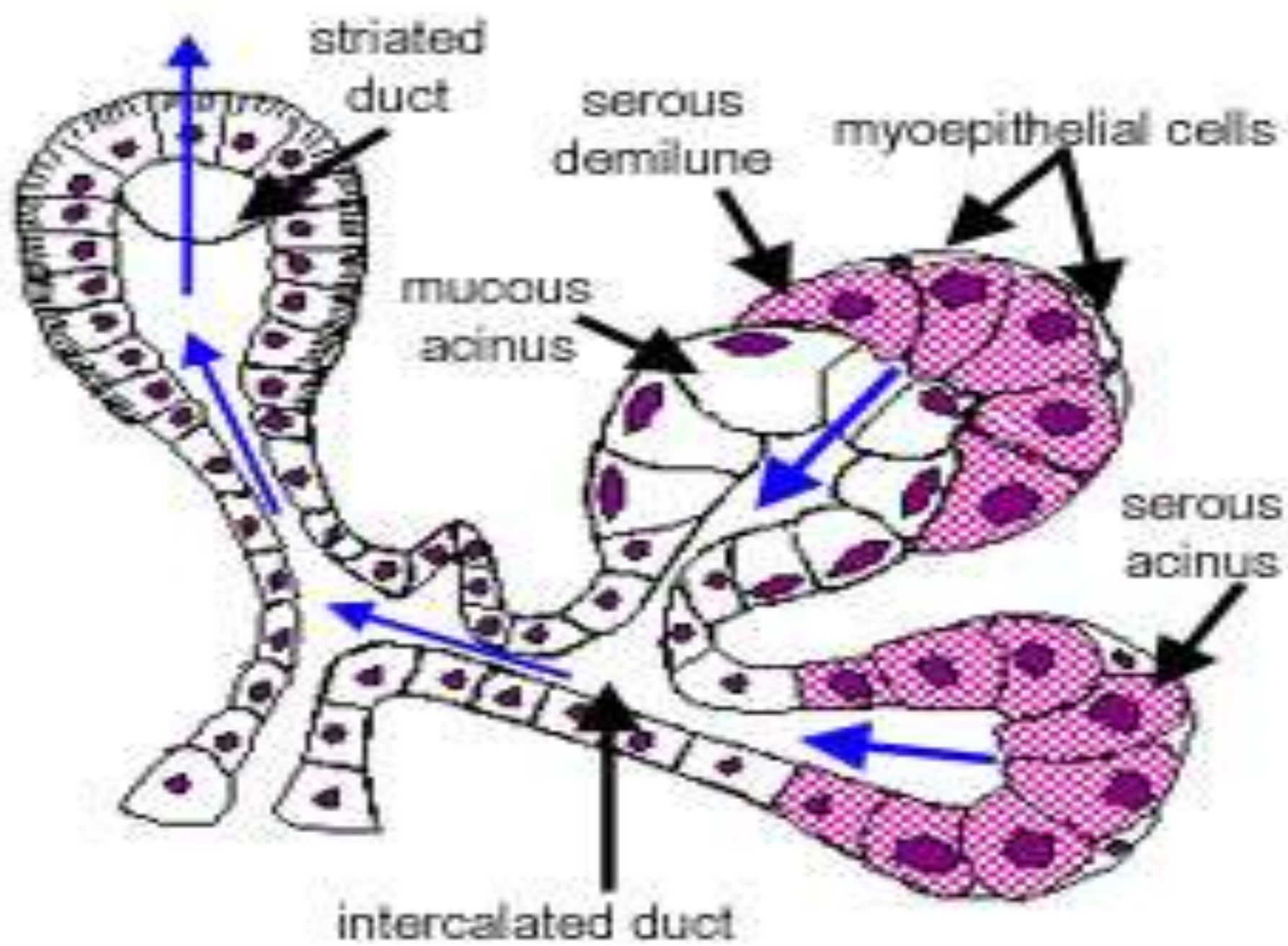
- **e.g---**
- all systems of body,
- walls of viscera, GIT etc.,
- tunica media of vessels
- arrector pilorum muscle of skin
- Intrinsic muscle of eye
- Dartos muscle of scrotum,

In some places it is **associated with skeletal** muscle---

- sphincters of anus,
- urinary bladder
- transitional zone of oesophagus.

# Myoepithelial cells

- found in **association with** number of **secretary** glands,
- they **contain contractile** elements similar to smooth muscle
- **ectodermal** in origin.
- they are **stellate** and **basket** like in form, with **long dendritic extensions** clasping on adjacent **glandular acini** e.g salivary and mammary glands.
- the cells are located b/w **glandular epithelial cells and basement membrane.**



# SKELETAL MUSCLE(ORGANIZATION)

- each ms fiber form a unit structure of the muscle.
- it is long multinucleated cylindrical surrounded by thin c.t sheath known as endomycium.
- several fibers are organized into small bundles called as **fasciculi**.
- each fasciculus is surrounded by c.t called as **perimycium**.,c.t which surrounds the entire muscle is called **epimycium**.

# Muscle fiber

- a skeletal muscle consist of muscle fasciculi.
  - each fasciculus consist of group of muscle fibers.
  - Each muscle fiber consist of a group of myofibrils.
  - each myofibril is composed of group of myofilaments.
  - two types of myofilaments—actin,myosin I.e thin actin &thick myosin filament.

# Skeletal Muscle - Muscle Spindle

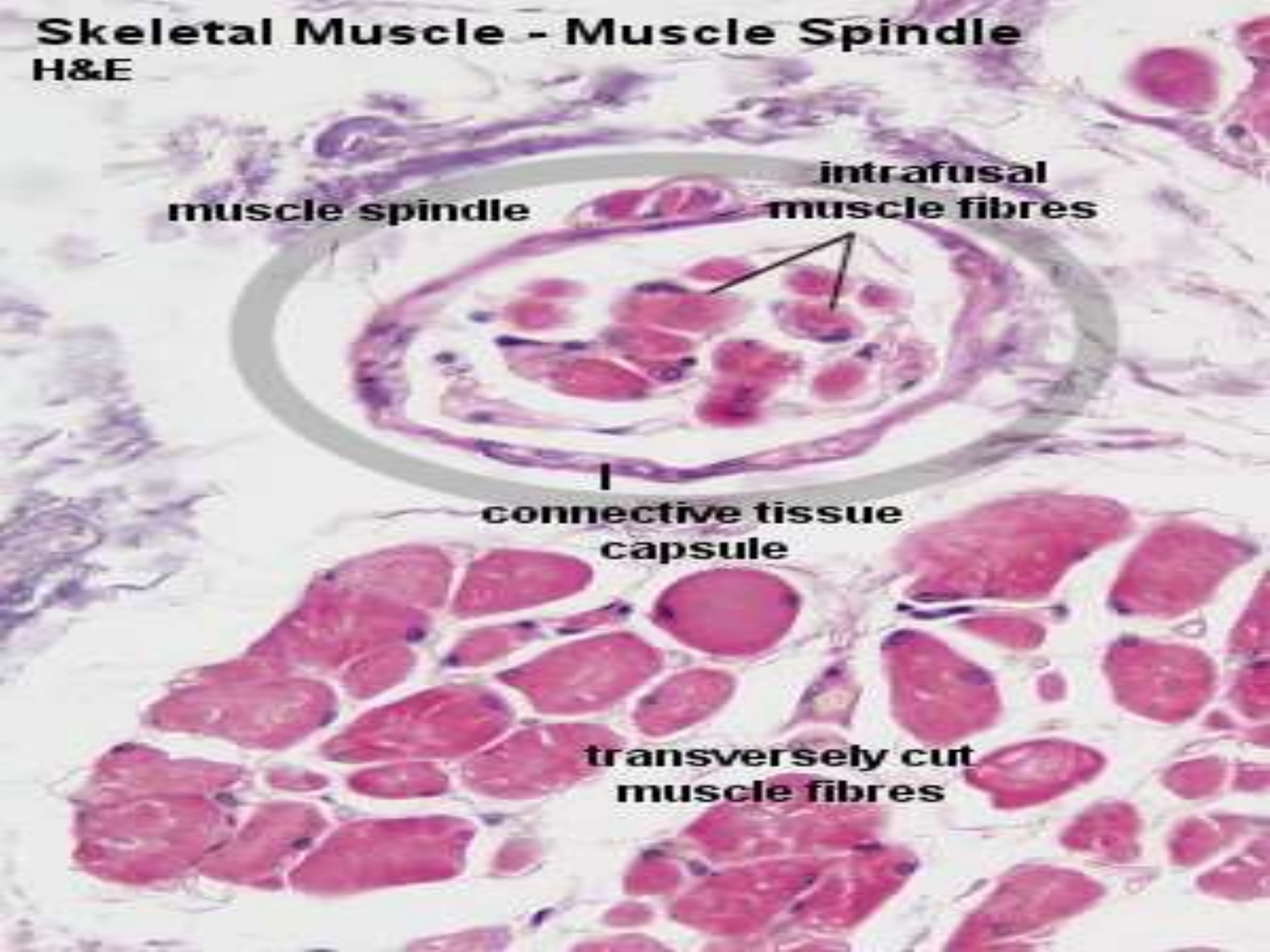
H&E

muscle spindle

intrafusal muscle fibres

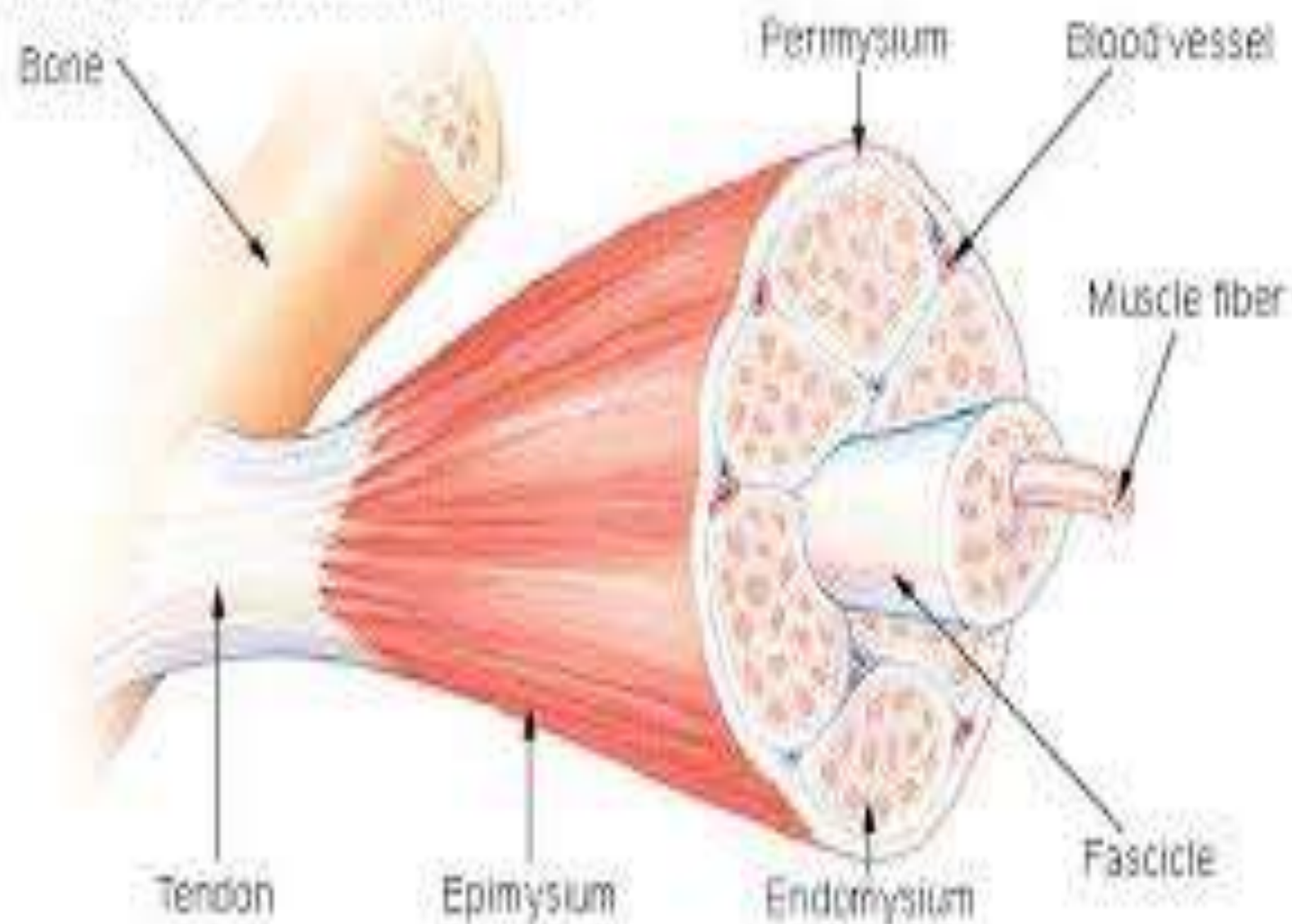
connective tissue capsule

transversely cut muscle fibres





## Structure of a Skeletal Muscle



- during muscle contraction actin filaments slide b/w the myosin filaments towards the centre of sarcomere.
- thus z line comes closer with shortening of contractile unit.

# Types of skeletal ms

- Slow twitch or red fibers or type 1 fibers
- fast twitch or white fibers or type 2 fibers.

## **Slow /red fibers**

- they are red in colour, due to presence of myohaemoglobin.
- thin fibers rich in mitochondria ,oxidative enzymes., poor in phosphorylases and glycogen.
- these fibers contract slowly, contractions remain more sustained,suitable for maintaining posture e.g **brachialis,soleus.**

## **White/fast fibers**

- they are paler , thicker than slow fibers.
- have few mitochondria, less oxidative enzymes,
- rich in glycogen and phosphorylases.
- they contract quickly, but contractions are less sustained, e.g biceps **brachii,gastronemius.**

# Parts of a skeletal muscle

- has fleshy and fibrous part both.
- fleshy belly stretches b/w two points across a joint.
- attachment proximal to joint is called **origin**, and distal to joint **is insertion**.
- Fibers of insertion are usually tendinous , condensed to form a chord like structure known as **tendon**.
- when flattened and membranous insertion it is known as **aponeurosis**.

# Classification acc. To fascicular arrangement of muscles.

- a) parallel muscles-e.g, quadratus lumborum,thyrohyoid.
- b) strap ms—e.g sartorius
- C) strap like with tendinous insertion- e.g rectus abdominis
- D) fusiform muscle-e.g biceps brachii.

# Pennate muscle

## **unipennate –**

- All fleshy fibers slope into one side of tendon
- e.g-flexor pollicis longus,
- extensor digitorum longus,
- peroneus tertius.

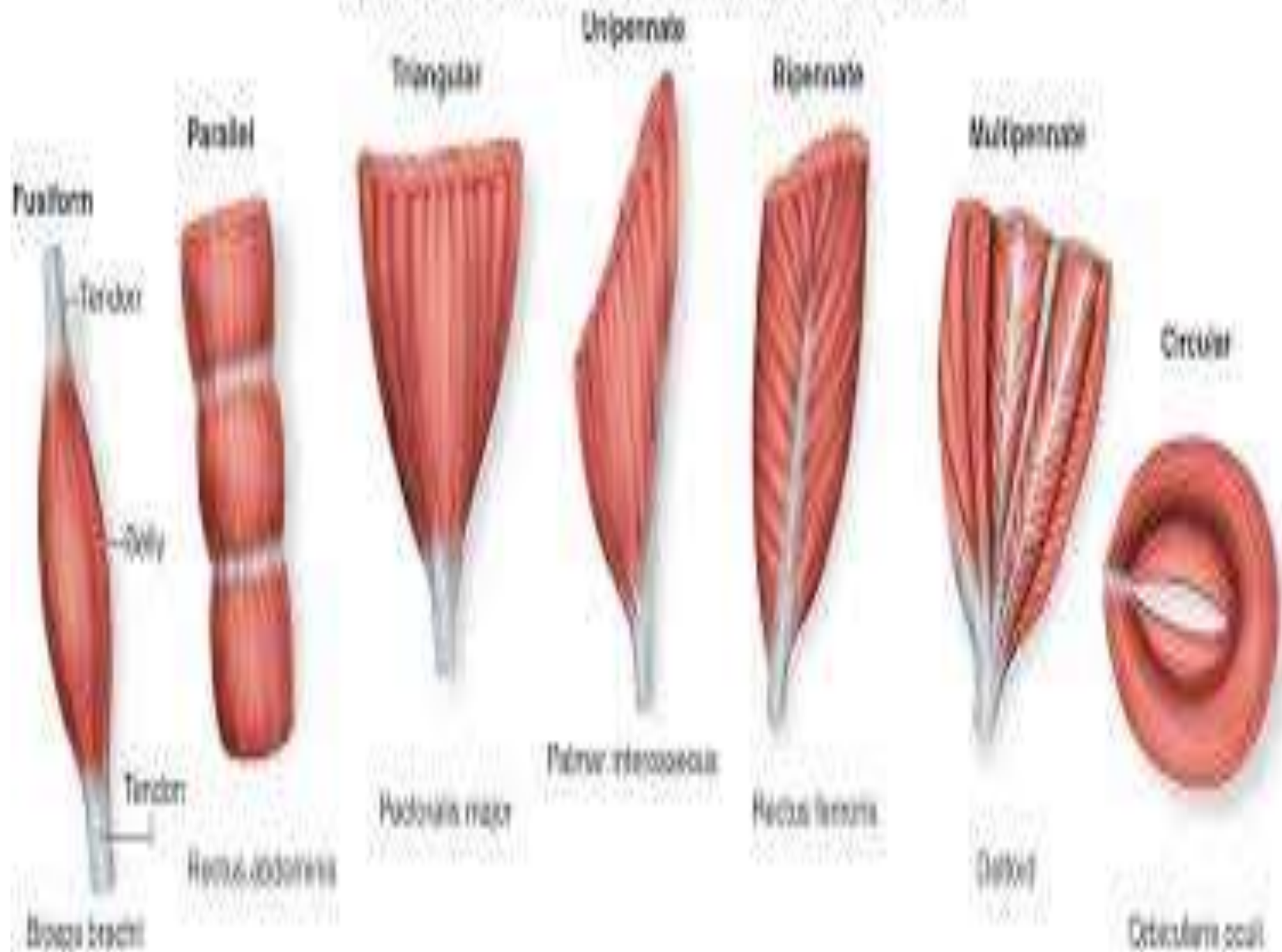
## **bipennate-**

- Tendon formed in central axis of muscle,
- fibers slope on the two sides of central tendon.
- **E.g** –tibialis posterior, rectus femoris.

## **Multipennate**

- series of tendinous bands within a muscle with tendinous intersections.
- muscular fasciculi are arranged b/w these tendinous intersections,
- **E.g** acromial fibers of deltoid.





## **Circumpennate-**

- muscle is cylindrical with central tendon within it,
- oblique ms fibers converge into central tendon from all sides,
- **E.g** tibialis anterior.

## **spiral ms-**

- ms is twisted in arrangement close to its insertion,
- e.g supinator ms.

## **Cruciate ms—**

- Fibers are arranged in superficial and deep planes, e.g. masseter, sternocleidomastoid muscle.

## **Bursa**

- it's a closed sac filled with lubricating synovial fluid.
- it reduces friction, allow free movement b/w two mobile but tightly apposed surfaces.

# Types of bursae

## **subtendinous –**

- seen where ever tendons rub against the resistant structure,
- it intervenes b/w tendon and bone
- tendon and ligament , b/w two adjacent tendons.

## **Articular bursa-**

- seen in relation with joint cavity.

## **subcutaneous bursa**

- it is present over bony and ligamentous points subjected to pressure and friction.
- it appears b/w skin and bony prominence.g **infrapatellar bursa.**
- **submuscular bursa**— lies deep to muscle
- **subfascial bursa**-lies deep to fascia
- **communicating bursa**- bursa communicating with joint cavity-**e.g** subcapsular bursa.

# Nomenclature of muscles

acc. **To shape—**

- deltoid—triangular
- quadratus---square
- rhomboid---diamond shaped
- lumbrical—worm like.

**size-**

- major, minor longus---pectoralis major, pectoralis minor, flexor pollicis longus.
- brevis- short---extensor pollicis brevis.
- longissimus –longest—longissimus cervicis.

## **No.of heads-**

- biceps—two heads( biceps brachii)
- triceps---three heads( triceps brachii)
- Quadriceps—four heads( quadriceps femoris)
- digastric – two bellies( anterior and posterior)

## **position-**

- **supraspinatus**-above spine of scapula
- **infraspinatus**—below spine of scapula
- abdominis-of the abdomen,**external oblique abdominis.**
- oris-of the mouth,**orbicularis oris.**

## **depth-**

- superficial—flexor digitorum superficialis,
- profundus—deep---flexor digitorum profundus.
- External-external oblique abdominis.
- internal-internal oblique abdominis.

## **attachments**

- sternocleidomastoid—from sternum, clavicle to mastoid
- coracobrachialis—from coracoid process to the arm.



- action
- extensor, flexor—flexor pollicis longus.
- adductor, abductor—abductor pollicis longus.
- levator , depressor—levator labii superioris,
- supinator, pronator—supinator muscle,  
pronator pteres.
- constrictor, dilator—constrictor pupillae.

# Actions of a muscle

- to produce a movement following group of ms are involved.
- A) prime movers
- B) antagonists
- C) fixation ms
- D) synergists

## **prime movers-**

- A muscle or group of muscles that directly bring about a desired movement , e.g **biceps brachii**,
- antagonists**
- these muscles oppose the desired movement.
- They help prime movers by active relaxation to perform smooth act.
- E.g **triceps brachii**.

## **Fixation muscle**

- group of ms which stabilize the proximal joints of a limb .thus allow movements at the distal joints by the prime movers,e.g biceps brachii.

## **synergists muscle**

- When combined action of group of muscles produce a particular movement. E.g flexor carpi ulnaris and flexor carpi radialis by their combined action produce flexion of wrist joint

# Hybrid muscle

- composite /hybrid muscle –develop by fusion of two different musculature.thus having different origins (more than or = 2 heads) and different innervation( >or =2 nerves supplying single ms)
- e.g adductor magnus—obturator & tibial nerve.,
- biceps femoris—tibial & common peroneal nerve
- Digastric ms—nerve to myelohyoid,digastric branch of facial nerve.
- pectineus—femoral , obturator nerve.

# applied

- **A) paralysis**
- loss of motor power ( power of movement) is called paralysis.it can occur due to---
- Damage to motor neural pathway
- inherent disease of muscle( myopathy)
- damage to upper motor neuron causes---**spastic paralysis**, with exaggerated tendon reflexes.
- damage to lower motor neuron causes **flaccid paralysis** with loss of tendon jerks.

## **B) muscular spasm-**

- quite painful , localized muscle spasm is commonly caused by a muscle pull.
- generalized muscle spasm occurs in **tetanus** and **epilepsy**.
- **C) myasthenia gravis**
- it is a neuromuscular disorder characterized by weakness and fatigue of skeletal muscle.
- occurs due to decrease in no. of available acetylcholine receptors at neuromuscular junction due to antibody mediated autoimmune attack.( flaccid paralysis)

- D) disuse atrophy and hypertrophy
- The muscles which are not used for long time become thin and weak , called **disuse atrophy**
- adequate or excessive use of particular muscle causes better development or **hypertrophy**.
- e) in **organophosphorus poisoning** due to ingestion of some insecticides containing organophosphorus bind to and inhibit action of acetylcholine, resulting in accumulation of acetylcholine leading to hyperexcitation of the muscle.skeletal muscle responsible for respiration contract continuously , but cannot relax, followed by fatigue, so death occurs due to spastic paralysis of ms of respiration.



# Mcq

- the characteristic features of smooth muscle fiber are:
- 1) prominent striations
- 2) peripheral nucleus
- 3) central nucleus
- 4) multinucleated
- slow twitch fibers are:
- 1) rich in myohemoglobin
- 2) poor in mitochondria
- 3) rich in glycogen
- 4) contract rapidly

- one is an example of bipennate muscle;
- 1) sartorius
- 2) rectus femoris
- 3) flexor pollicis longus
- 4) deltoid
- tibialis anterior is following type of muscle-
- unipennate
- bipennate
- multipennate
- circumpennate

- myoepithelial cells is:
- 1) ectodermal in origin
- 2) mesodermal in origin
- 3) endodermal in origin
- 4) partly from ectoderm and partly from endoderm.