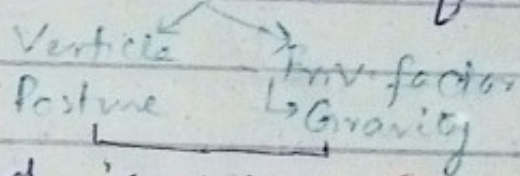


# Support & Movement

## Need:

↳ Aquatic life —————> Terrestrial life



## Endo skeleton

↳ mesodermal origin.

Skeleton

↳ framework

- ↳ support
- ↳ shape
- ↳ movement
- ↳ protect organs
- ↳ storage
- ↳ Blood site

### Bone Cartilage

→ soft connective tissue

→ Collagen type II

→ chondrocytes

→ Perichondrium

→ Same consistency.

→ No bone marrow

→ Avascular

→ Diffusion

→ Slow healing process

→ Bluish white

→ Flexible

3 types:

→ Hyaline:

↳ Primitive & Abundant

↳ End of long bones

↳ respiratory tract.

→ Elastic:

↳ elastic nature

↳ ear & epiglottis

→ Fibro:

↳ collagen fiber

↳ Pubic + Inter vertebral

### Bone Cartilage

→ Hard connective tissue.

→ Collagen type I

→ osteocytes

→ Periosteum

→ 2 parts

↳ Outer → Compact

↳ Inner → Spongy

↳ Bone marrow

→ Vasculization.

Blood

→ Capillaries → diffusion

→ Fast healing

→ Brown

→ Rigid.

3 types

→ Osteoblast: → bone forming cells

↳ mineral uptake

↳ mineralization

↳ secrete collagen.

→ Osteocyte: → highly mineralized cells

↳ mature bone cell

→ Osteon: → unit of bone → haversian canal

→ Osteoclast: → bone dissolving cells

↳ demineralization

↳ Reabsorption

↳ phagocytic activity

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# Joints: → Bone connections (articulation)

**Fibrous**  
→ Covered by dense fibrous collagen.

→ No Cavity

→ Support & protection

→ Sutures:

Cranial joint

→ Gomphosis:

Teeth socket

→ Syndesmosis

Parallel bones.

↳ b/w radius and ulna

**Cartilagenous**

→ Covered by cartilagenous structure

→ No cavity

→ Shock absorb

→ Immovable

→ Pubic symphysis  
b/w 2 Coxal bones

In pelvis → no role in male  
↳ help female parturition.

→ slightly

→ vertebral joints

**Synovial**

→ covered by ligaments

→ Cavity

→ movement

→ Pivot

→ Condyloid

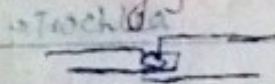
→ Planar

→ Saddle

→ Hing

→ Ball and socket

Hing joint:

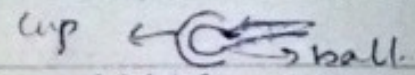


→ 180°

→ single plane

→ Weight lift

Ball and socket joint:



→ 360°

→ multiple plane

→ free movement

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## Disorders:

**Rheuma Arthritis**

→ Inflammation of synovial membrane

→ Progressive

→ Auto immune. ♂

**Gouty Arthritis**

→ Uric acid crystal

→ metabolic

→ Genetic

**Osteo arthritis**

→ Bones → Thinning.

→ hormonal. ♀  
↳ In female estrogen

causes thinning of bone and skin softness

# Muscles → Contractile structures.

- ↳ movement
- ↳ ~~mechanical~~ Chemical E into mechanical E
- ↳ storage
- ↳ Heat production
- ↳ Structural organs.
- ↳ Protection.

## Smooth

## Cardiac

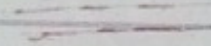
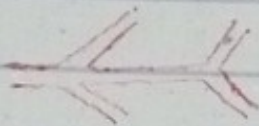
## Skeletal.

→ Primitive &

→ little advance

→ highly advance.

Abundant



spindle

highly branched

cylindrical.

→ Non striated

→ Irregular striation

→ Regular striation.

→ Involuntary

→ Involuntary

→ Voluntary

→ Autonomic

→ Autonomic & myogenic

→ Somatic

X

→ Interrelated discs

X

→ Uni nucleated

→ Uni nucleated

→ Multinucleated

→ slow

→ Intermediate

→ slow to rapid

→ Not adaptive

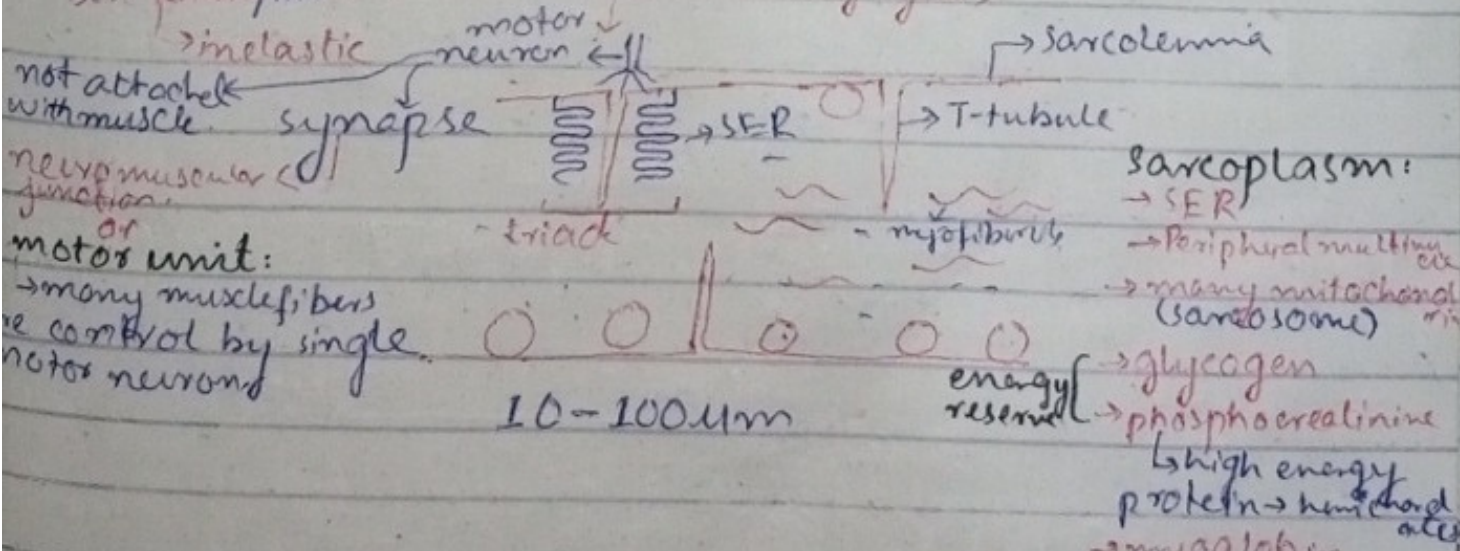
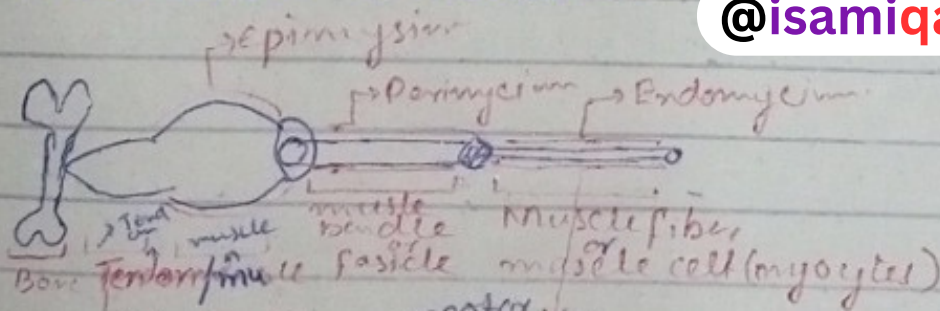
→ Not adaptive

→ highly adaptive

→ Fatigue resistance X

## Skeletal Muscles:

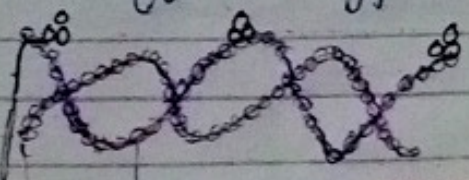
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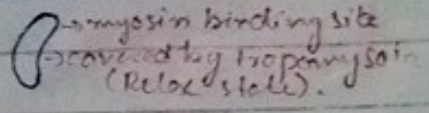
# Myofibers: (1000-2000)

myofilaments

Actin filament (7 P.P) 7-8nm  
 → 3 different types.



→ G-Actin (2 P.P)



→ Tropomyosin (2 P.P)

→ Troponin (3 P.P)

→ TnC → Ca<sup>++</sup>

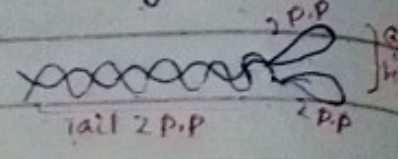
→ TnI → Actin

→ TnT → Tropomyosin.

(6 P.P) (16nm) Myosin filament.

→ 1 type

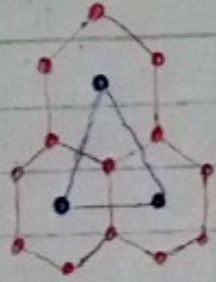
300 myosin molecules



ATP binding site (ATPase)



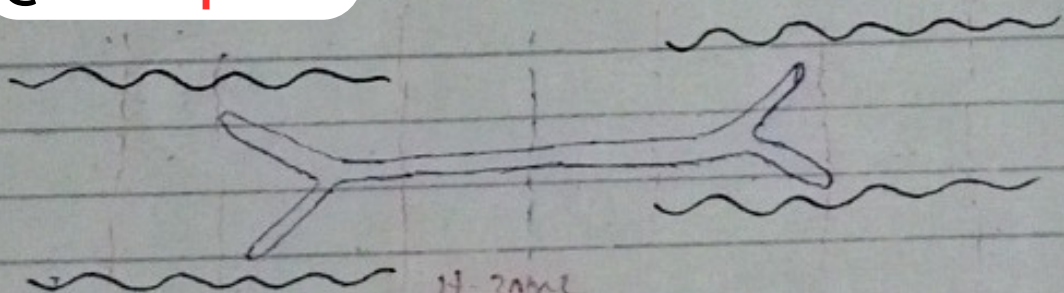
Actin binding site



→ 1 myosin filament is covered by 6 actin filaments

→ 1 actin filament is covered by 3 myosin filaments

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H-zone  
 here bright

Dark band

Light band

M-Line

Z-line

Z-line

Sarcomere

complete A band

$\frac{1}{2}$  I-band +  $\frac{1}{2}$  I-band

# Contraction:

- Action potential arrives → neuromuscular junction → Acetylcholine
- T-tubule receive.
- $Ca^{++}$  release by SER → Sarcoplasm
- $Ca^{++}$  bind → Troponin
- Tropomyosin displace → Myosin binding site → exposed.
- Myosin binding site bind → Actin binding site = cross bridge
- Myosin head → contract ~~sites~~ → ATP → release.
- Actin filament → myosin filament
- Overlapping increase & muscle contract.

## Changes:

- I band shortens
- Z line → closer
- Sarcomere → contract
- H-zone → disappear.
- muscle contraction →  $Ca^{++}$
- muscle relaxation → ATP
- for 1 cycle of contraction and relaxation 1 ATP is required.

## No change:

- Length of actin filament
- Length of myosin filament
- A-band
- M-Line
- Muscle size.
- after it anaerobic respiration start. → Lactic acid.
- per muscle contraction → death. → rigor mortis

→ one muscle performs very small work like holding pen and similar muscle perform heavy work like weight lifting. what happens? motor units will increase

→ All or non-phenomenon → each muscle cell has only one motor unit it means all myofibers are controlled by single motor unit. so when action potential will arrive either all myofibers contract or none.