MALE REPRODUCTIVE SYSTEM → Mesoderm

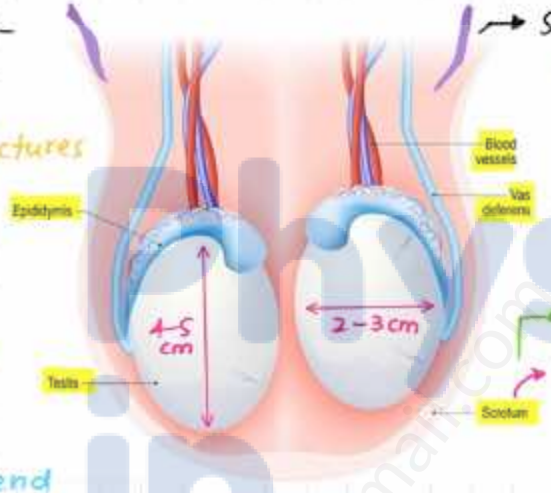
GENITALIA → Reproductive structure
EXTERNAL → Exposed (Testes, Copulatory Organ)
INTERNAL → Not Exposed

- FUNCTIONS
  - → Semen
  - → Sexual Activity
  - → Male Sex Hormones

TESTES → Male Gonads, Paired structures

↓
collection of seminiferous tubules
- Solid bodies
- Small, ovoid structures

- **MONARCHIDISM**
  → Single testis
- **CRYPTORCHIDISM**
  → Testes remain abdomen
  → Failure to descend



→ Suspensory Ligaments (Hold the testis)

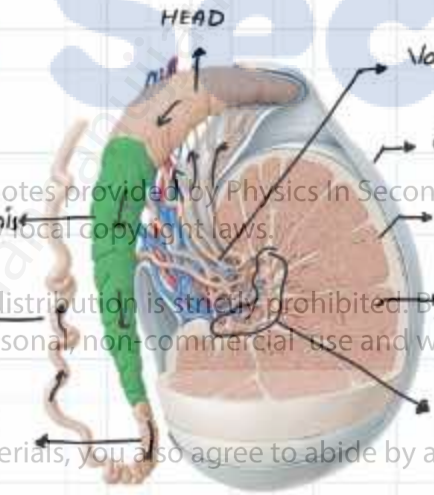
- Testes are as large as olive seed.

→ Lower Temperature (35°C)
Smooth Muscles
Winter → Move to abdomen
Summer
↳ Move away from abdomen

STRUCTURE OF A TESTIS

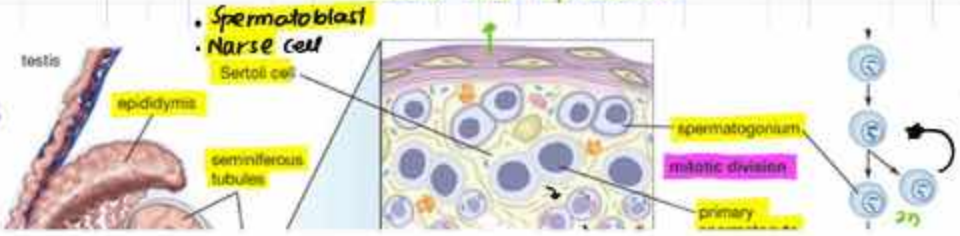
URINIFEROUS TUBULES → Nephron

EPIDIDYMIS
→ Sperm maturation
→ Sperm Storage



SPERMATOGENESIS

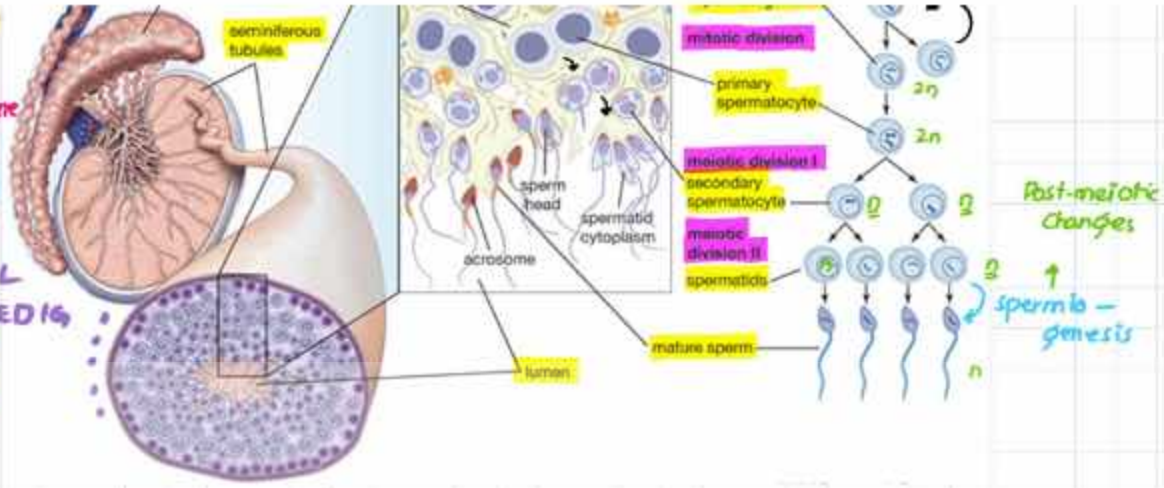
→ Mitosis + Meiosis
→ Duration (65 – 72 days), 10 weeks
Germ line Epithelium



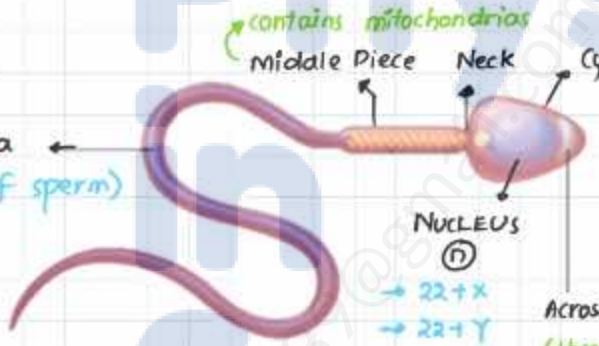
SERTOLI CELLS
- Nourishment of sperm

- Nourishment of sperms
- Inhibin hormone (Chect the spermatogenesis)

INTERSTITIAL CELLS / LYEDIG
- To secrete Testosterone



STRUCTURE OF A SPERM



HEALTHY MALE :
→ 400 million sperms / day

INSEMINATION :
→ Entrance of Semen

→ 2-5 ml / ejeculation

SEMEN
- Sperms (10%.) → 20-150 millions of sperms
- Secretions (90%.)

DUCT SYSTEM OF TESTIS

SEMINIDEROUS TUBULES → Structural and functional unit of testis.

RETE TESTIS → Network of tubules

VASA EFFERENTIA (10-20 ducts) → Distal part of Rete testis

EPIDIDYMIS (6 meter / 20 feet)
- → Long coiled tube
- → Sperm maturation
- → Storage and transport of sperms

① VAS DEFERENCE → Distal part of Epididymis
(Sperm duct) ② Seminal vesicle

EJECULATORY DUCT → Two Ejeculatory Duct (1 from Each Testis)

URETHERA → Urino-genital duct

ACCESSORY GLANDS

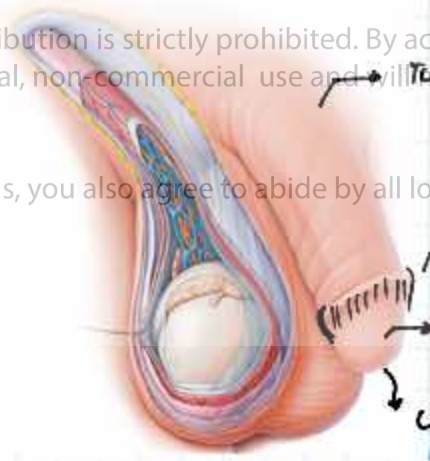
SEMINAL VESICLE
- 1st Secretion
- Paired Structure
→ Sac-like pouches
→ Attached to vas deference near bladder
- Sugar Rich Fluid (Fructose)
- Provide Energy to Sperms

PROSTATE GLAND
- 2nd Secretion
- Un-paired / Golf ball
→ Below urinary bladder on both sides of urethera.
- Additional Fluid
- Nourishment and Protection
→ Acidic Secretion
→ Citrate ↑↑
→ Hyaluronidase

BULBO-URETHERAL
Pea-Size
- 3rd Secretion
- Paired structure
→ Cowper's gland
→ On side of urethra, Just below prostate.
- Clear, Slippery
- Mucus
- Neutralize tract
→ Alkaline Secretion

COPULATORY ORGAN → PENIS (To launch sperms in Female Reproductive tract)

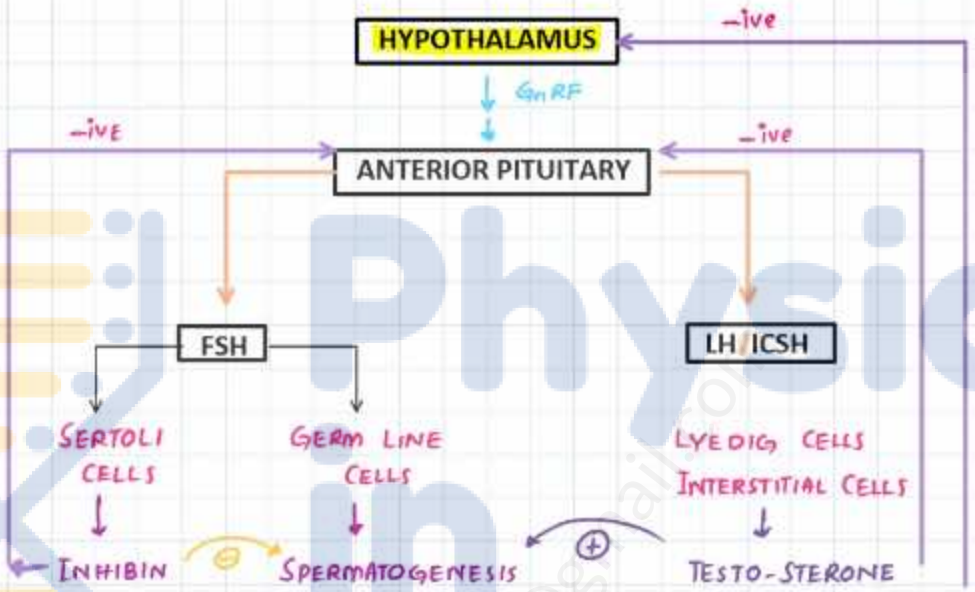
HUMAN BODY
INTERNAL FERTILIZATION
Sperm + Ova
↓
ZYGOTE
↓
EMBRYO



→ Never Pass Sperm
→ Erectile Fibres → Urination
Tube
Erect Form → Sex derive
Never Pass urine

→ Foreskin → Removed in some religion
→ Glans Penis (Sensitive Part)
Urethral Orifice (Semen + Urine)

HORMONAL CONTROL SYSTEM OF MALE REPRODUCTIVE SYSTEM



Complex System as that of male → **FEMALE REPRODUCTIVE SYSTEM**

PARTS

- → OVARIES (Female Gonads) (Oval, Solid structures) → Oogenesis (Production of ova)
- → DUCTS (Fallopian, Ovarian, Oviducts) → Release of ova, Fertilization
- → EXTERNAL GENITALIA → Intercourse, Birth

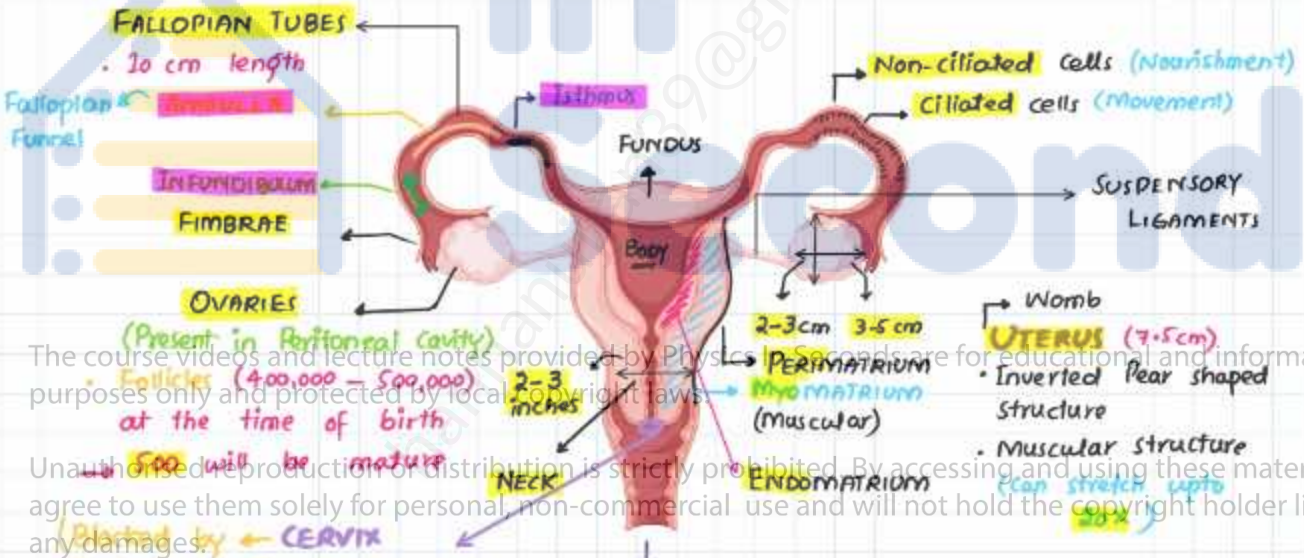
CLITORIS (Sensory part) → Labia Majora

Urethral Opening

Labia Minora

Vaginal Opening (Vulva)

Anal Opening



Lactobacilli → (Lactic Acid) → Acidic pH

→ Copulation / Sexual / Intercourse

→ Semen Release

→ Rough Appearance

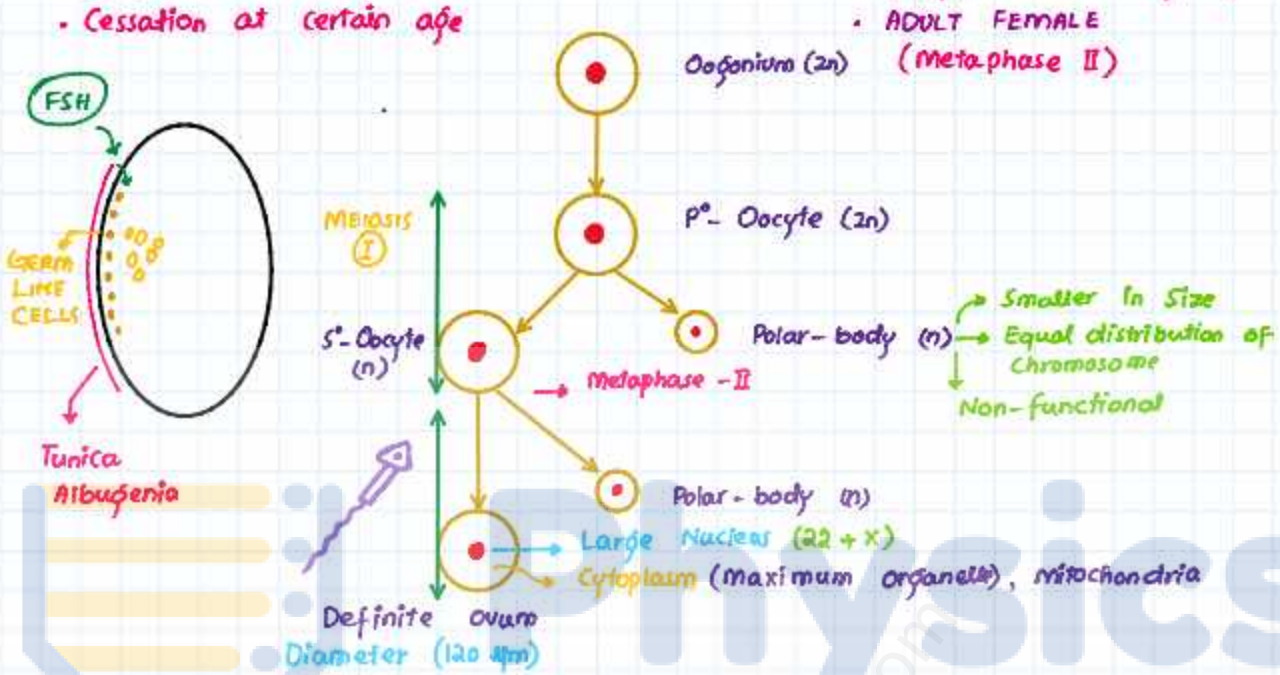
O-OGENESIS → Production of Ova

- Dis-continuous Process
- Cessation at certain age
- STARTS BEFORE BIRTH (Prophase I ↷ Pachytene)
- ADULT FEMALE (Metaphase II)

Oogonium (2n)

- Cessation at certain age

- ADULT FEMALE (Metaphase II)



FEMALE REPRODUCTIVE SYSTEM

MENSTRUAL CYCLE

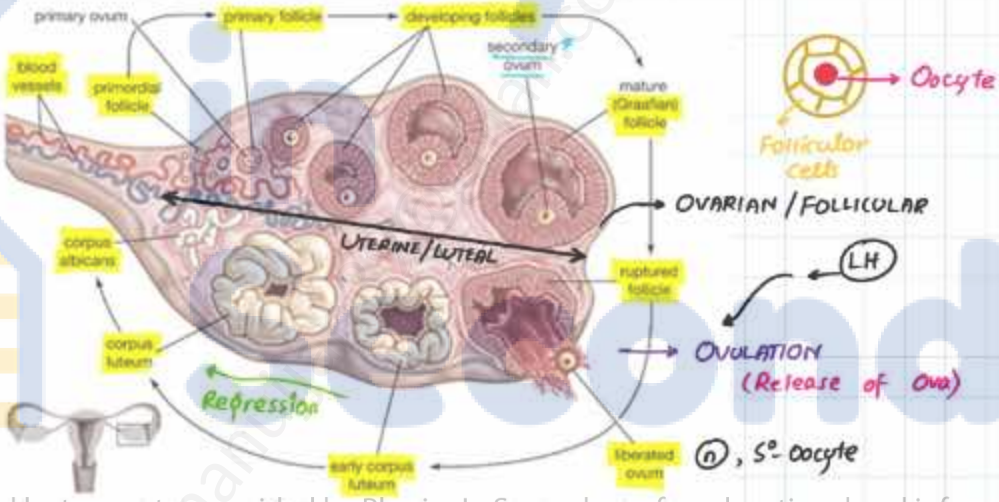
- Only in Primates
- → Menses → Month
- → MENARCHE (Adult , Teenage 13 years)
- → MENOPAUSE (45 → 50 ++)
  (Cessation of menstrual cycle)
- → NORMAL CYCLE → 28 days
  (21 — 35 days)

OESTROUS CYCLE

- Other than Primates
- → Once/year , twice /year
- → Or more frequent
  "ON HEAT" (Release of ova)
- . Maximum chances of fertilization
- → Endometrium Reabsorbed

FSH → Germ line cells
Follicles → 1 Follicle

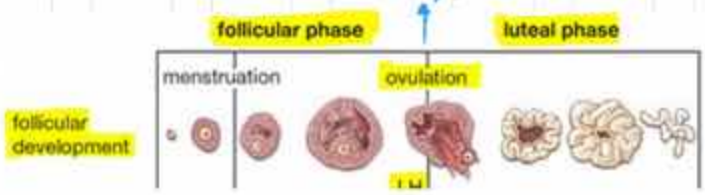
Remaining Follicles are degenerated (Follicle Atresia)



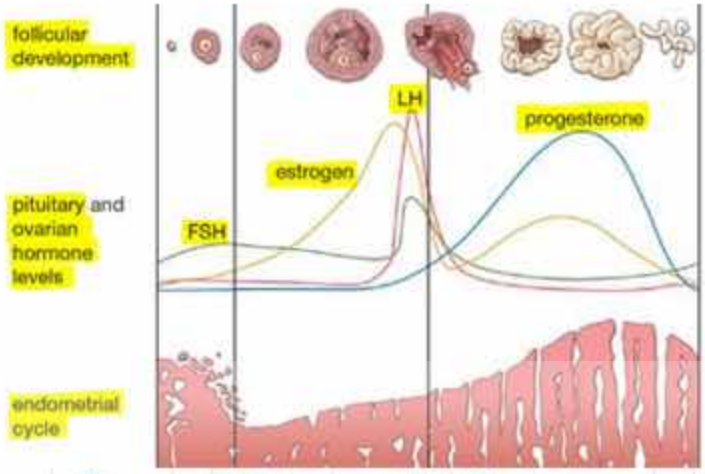
Largest cell → Egg cell

Smallest Human → Sperm cell (5 μm)

9th day — 15th day
FERTILE DURATION
13 ⟷ 15
(3 days)



MENSTRUAL



"PIB"
Menstruation
(3 → 7 days)

MENSTRUAL CYCLE → 32
Ovulation ?
32 − 14 = 18th

CYCLE → 26
26 − 14 = 12th

BLEEDING
(3 → 5th day)

1st 5th 6th 12th 16th 28th

MENSTRUATION — FOLLICULAR — SECRETORY PHASE

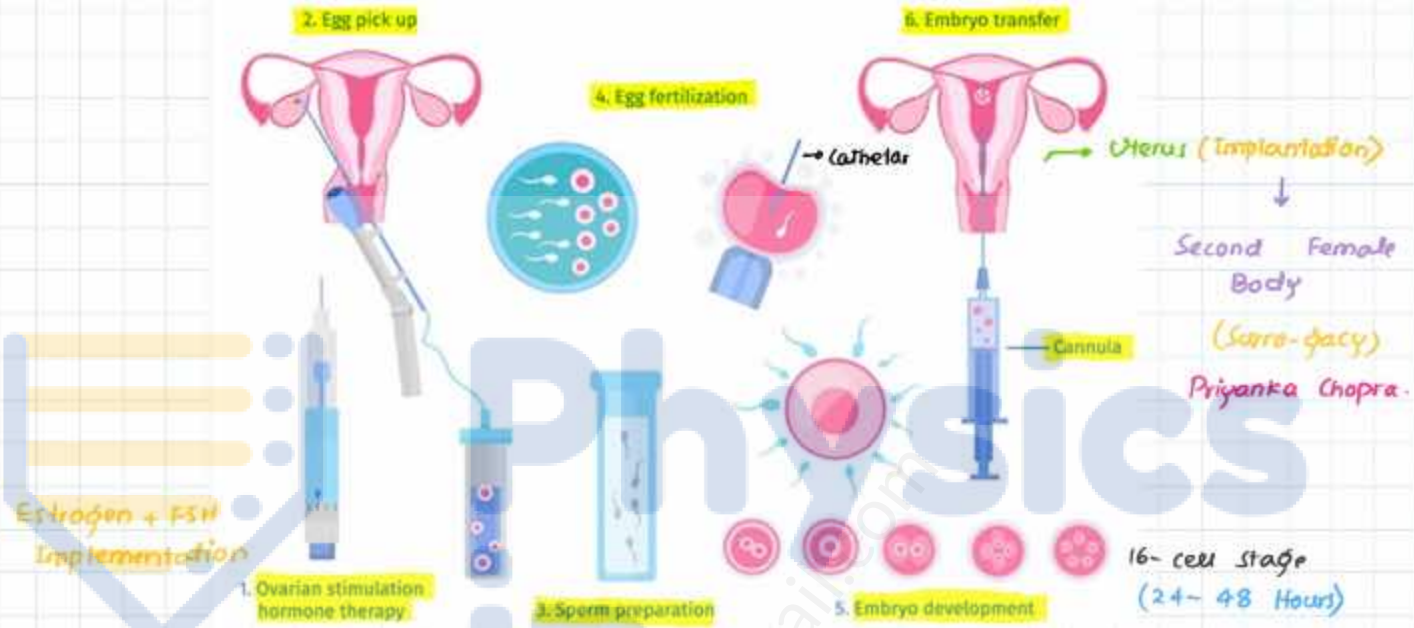
- No pregnancy has occurred
- Cessation of progesterone Hormone
- Endometrium detrioration

Proliferative Phase

FSH ⊖
↓ → Estrogen
Follicles ↓
(5-20) Thickening of uterine wall

- 14th days
- (12 - 14 day)

IN-VITRO FERTILIZATION / TEST TUBE BABIES



Physics in Seconds

SEXUALLY TRANSMITTED DISEASES → (30) ↑↑ micro-organisms

- Multiple Sexual Partners
- Un-ethical activities (intercourse)

BACTERIAL DISORDERS → ANTI-BIOTICS

GONORRHEAE — N. Gonorrheae (Gram +ive)

TRANSMISSION → Genital, Oro-genital contact

SYMPTOMS → Genital wounds, Sensation of Pain during Micturation + Pus
Oviducts (damage, blocked)
Newborn → Eye Infection (leads to blindness)

TREATMENT → Anti-biotics (Penicillin + Tetracycline)

SYPHILIS → Spirochaete (Treponema pallidum)

TRANSMISSION → Genital Contact

SYMPTOMS → Leisions (STAGES)
P° — Hard Chancre
S° — Rash on all body
T° — CVS, Nervous sys. Eyes, Bones, Joints
Gumma (KPK)

TREATMENT → Anti-biotics

VIRAL DISEASES

GENITAL HERPES → Herpes Simplex
I → Above belly button
II → Below belly button

- Painful blisters, ulcers on genital organs

→ Anti-viral Proteins

AIDS → HIV (Human Immuno-deficiency Virus)

- Affects Helper T-lymphocyte (Cell mediated Immunity)

→ Anti-viral Proteins

GENITAL WARTS → Human Papilloma Virus
TRICHOMONIASIS → Trichomonas (Protozoans)

SKELETAL SYSTEM → MESODERM

CONNECTIVE TISSUES
↳ CONNECTIVE PROTEIN
COLLAGEN *
(Extra-cellular Protein)

- SUPPORT & SHAPE
- PROTECTION
- MOVEMENT
- MINERAL HOMEOSTASIS
- HAEMO-POIESIS (Blood Formation)

1. BONE (Hardest Connective Tissue)
2. CARTILAGE
3. TENDON
4. LIGAMENTS
5. ADIPOSE TISSUES
6. BLOOD (Most Soft connective Tissue)

"OSTEO" ← BONE CELL AND STRUCTURE → "OSTEOLOGY"

Study of Bones.

OSTEOGENIC CELLS

OSTEOCYTE

* Mature cells

- Deposition
  - → Organic
  - → Inorganic

OSTEO-BLAST

* Forming

- Add new bone cells
- Osteoblasts ↑↑ (Bone deformities)

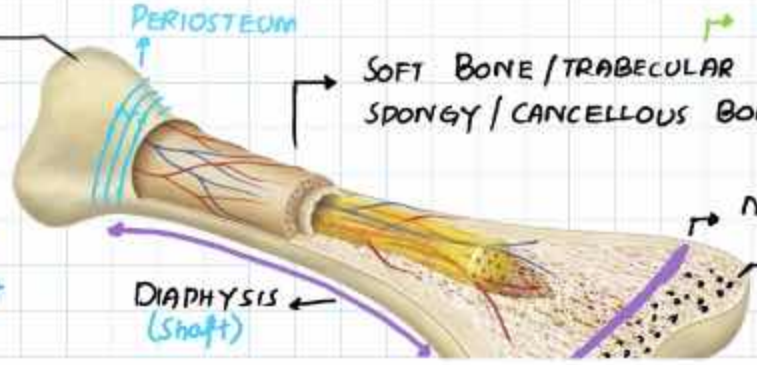
OSTEOCLAST

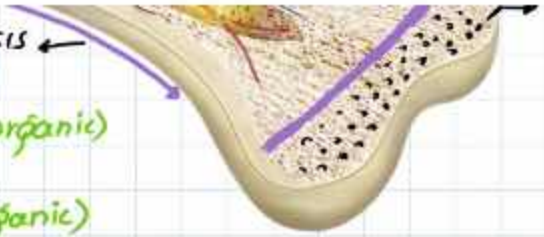
* Dissolve

- Macrophages
  - → Decomposition of worn out cells
- Osteo-clast ↑↑ (Bone resorption)

BONE → 1/3rd of Connective tissues

Connective Protein (Collagen I)





- Avascular Part

COMPOSITION

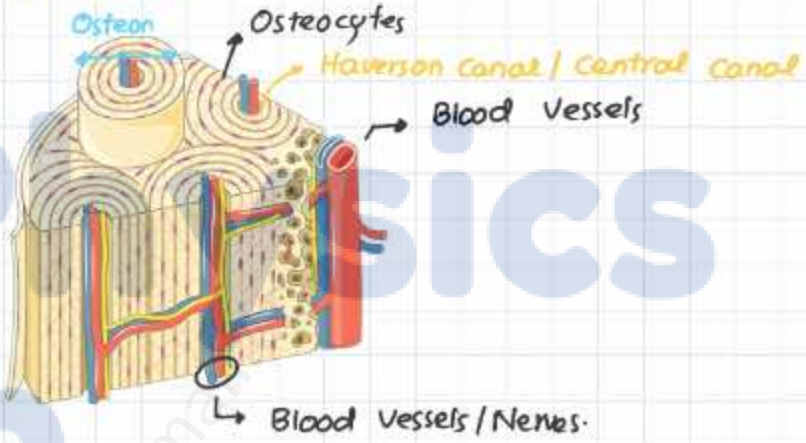
→ 65% (Ca^{++} phosphates) (Inorganic)
Carbonates)

→ 35% (Proteins, collagen) (Organic)

- PERFORATING CANAL (Volkman's Canal)

OSTEON :

- Haverison units
- Fundamental units



CHONDRO → **CARTILAGE** → Connective Protein

(Chondro-cyte)

Collagen II

→ Relatively less rigid connective tissue.
→ Loosely Packed
→ Blood Supply (Avascular)
Gets its nourishment via diffusion.
→ No mineral Deposition
→ Outer covering (Peri-chondrium)
→ Reshaping ×
→ Healing ×
→ Occurrance in Body (Joints, External Ear, Trachea etc)

OSTEO-CALCIN
(Protein Hormone)
→ Secreted by Osteoclasts
- Insulin adjustment
- Testosterone ↑↑
- Bone Strength
- Muscle Strength

HYALINE CARTILAGE:
→ most abundant
→ movable Joints
→ Nose, Larynx, Trachea

ELASTIC CARTILAGE
→ External Ear (Pinnae)
→ Epiglottis

FIBRO-CARTILAGE
→ Inter-vertebral discs
→ Annulus Fibrosis

New born Bones (300)

DIVISION OF HUMAN SKELETON

→ 18 % of body weight
→ 97 % Store (Ca^{++}, PO_4^{-2})

AXIAL SKELETON → 80 | 126 ← **APPENDICULAR SKELETON**

(206)

PROTECTIVE STRUCTURES

- → Skull
- → Vertebral Column
- → Sternum
- → Rib Cage

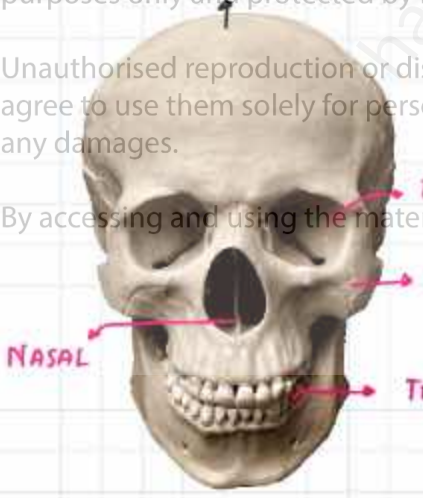
APPENDAGES

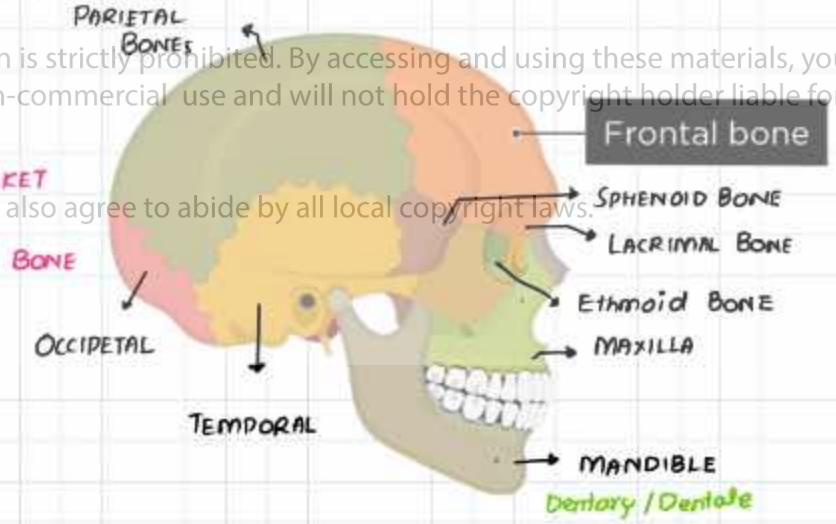
- → Pectoral Girdles + Fore Limb
- → Pelvic Girdle + Hind Limb

OSSIFICATION :

300 (New Born) → 206 (Adult)

HUMAN SKULL





FACIAL BONES 14

CRANIAL BONES 08

PAIRED (12) | (2) **UN-PAIRED**

- Palatine
- Maxilla
- Lacrimal
- Nasal Bones
- Inferior Concha
- Zygomatic Bones

- Vomer
- Mandible

PAIRED (2) | (1) **UN-PAIRED**

- Parietal Bones
- Temporal Bones

- Sphenoid
- Occipetal
- Frontal Bone
- Ethmoid Bone

. **HYOID BONE**
→ Lingual / U-shaped Bone
→ Does not articulate with any other bone

. **EAR OSSICLES** (06)
→ Malleus, Inchus, Stapese (Smallest Bone)

VERTEBRAL COLUMN

→ VERTEBRAS → 33
→ BONES → 26

4 CURVATURES

CERVICAL CURVATURE → (07)
$C_1 \rightarrow C_7$ (Neck Region)
C_1 (Atlas) → YES MOVEMENT
C_2 (Axis) → NO MOVEMENT

THORACIC CURVATURE
(12)
$T_1 \rightarrow T_{12}$
→ To attach costal Bones (Ribs)

LUMBER CURVATURE (05)
$L_1 \rightarrow L_5$

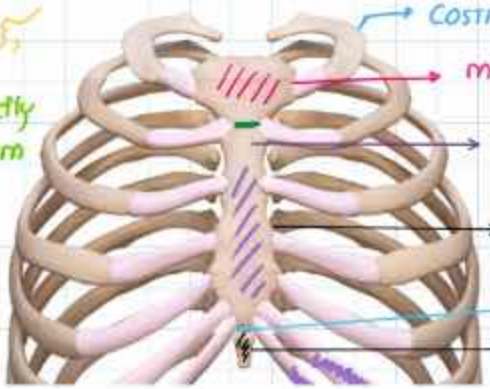
PELVIC CURVATURE
(09)
SACRUM (Anterior 5) | COCCYX (Posterior 4) ← Tail Bone

STERNUM AND RIB-CAGE

BREAST BONE (Single Bone) ← STERNUM AND RIB-CAGE → COSTAL CAGE
12 Pairs (24 Bones)

TRUE RIBS سچی پسلیاں
$1^{st} \rightarrow 7^{th}$ pair
. Because they directly attaches with Sternum

FALSE RIBS جھوٹی
$8^{th} \rightarrow 10^{th}$, 11^{th}, 12^{th}
↓ Attaches | ↓ Do not

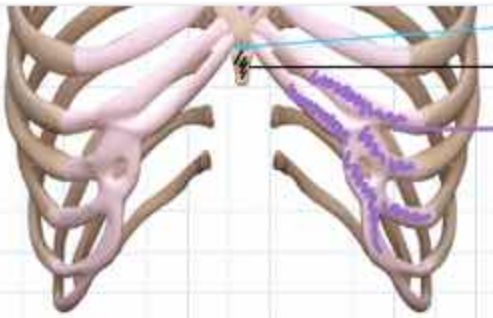


- COSTAL BONES (RIB)
- MANUBRIUM (1^{st} costal Pair)
- STERNAL ANGE
- BODY ($2^{nd} \rightarrow 7^{th}$ costal Pair)
- Xiphi-sternal Joint
- XIPHOID PROCESSES

Attaches with Sternum via cartilage

Do not attach

FLOATING RIBS
11th, 12th



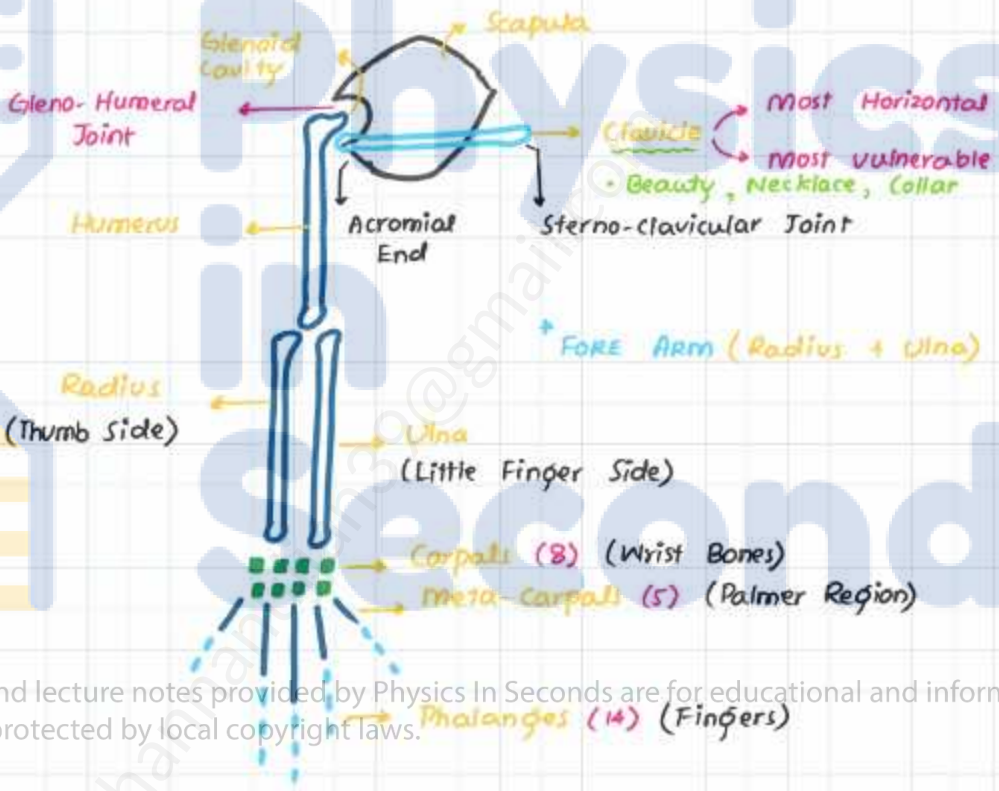
Xiphi-sternal Joint

XIPHOID PROCESSES

COSTAL ARCHES
(Cartilagenous structure)

APPENDICULAR SKELETON

PECTORAL GIRDLE

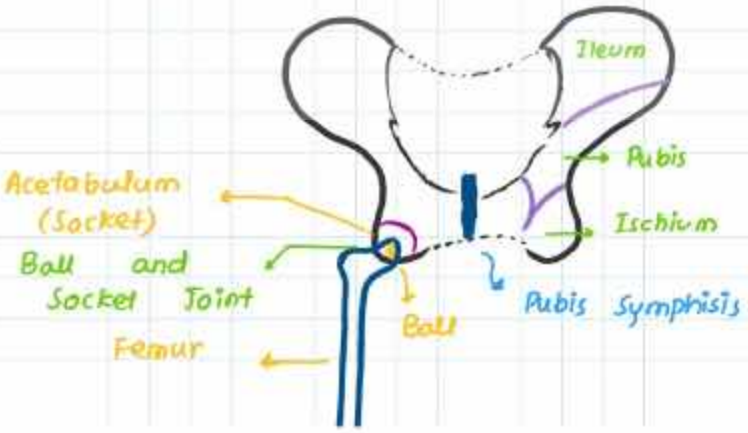


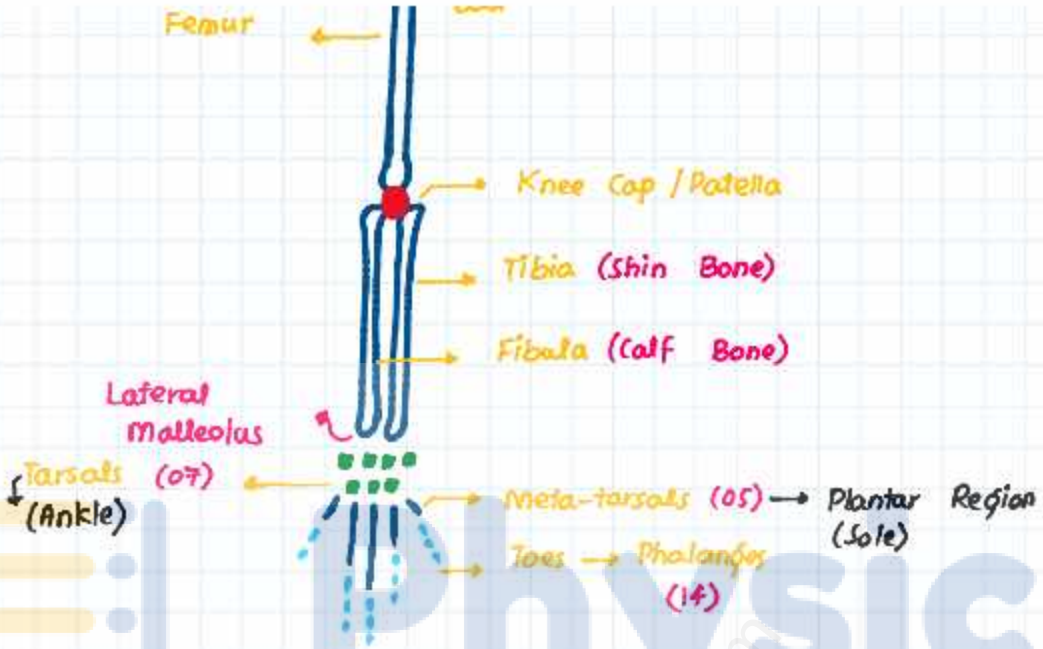
PELVIC GIRDLE AND HIND LIMB

COAXAL BONES (3)

Each coaxal Bone formed of (Ileum, Ischium, Pubis)

PELVIC PORTION
. Female (Broad)
. Male (Narrow)



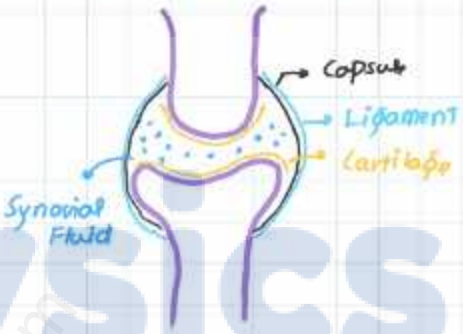


ARTHRO → **JOINTS** → Adult Body (360)
Site where bones articulate.

FIBROUS JOINTS
- → Fixed Joints
- → Skull Sutures
- → Teeth
- → Long Bones (Shaft Regions)

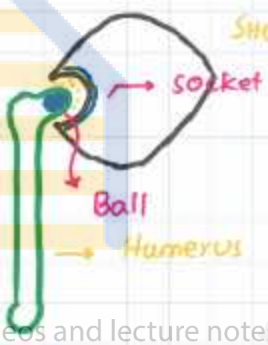
CARTILIGINOUS JOINTS
- → Slightly movable Joints
- → Ribs and vertebrae
  - Contraction (Upward)
  - Relaxation (Downward)
- → Fibrocartilage
  - Symphysis Pubis

SYNOVIAL JOINTS
- → Freely Movable Joints



FREELY MOVABLE JOINTS

BALL AND SOCKET JOINTS



HINGE JOINTS
→ Responsible for Back & Forth movement
1. Elbow Joint
2. Knee Joint

PIVOT JOINTS
→ Rotational movement
1. Skull to spine
2. Radius and Ulna
3. Tibia & Fibula
4. Atlas & Axis

SLIDING JOINTS
→ For movement in many directions
MULTI-STAGE JOINT
1. Wrist (Carpals)
2. Ankle (Tarsals)

GLIDING JOINTS → Between Vertebras

- Plane Joints
- Arthroidal Joints

ELLIPSOIDAL JOINTS

- Condyloid Joints
  1. Skull + 1st Vertebrae (Atlas)
  2. Metacarpals + Phalanges

SADDLE JOINTS

1. Carpals and metacarpals of thumb.

ARTHRITIS

"Inflammation of Joints characterized by the degeneration and damage to the Joint tissue"

SYMPTOMS

→ Pain after physical activity
→ Creaking sound from Joints
→ Stairs , Get up

① OSTEO ARTHRITIS
. Progressive disease
. Knee, Hip Joints

② RHEUMATOID ARTHRITIS (Auto-Immune disorder)
↳ Inflammed Synovial membrane.

③ **GOUT** → Metabolic disorder

"Accumulation of uric acids in Joints"
→ Crystals are found in joints.
Sodium urate crystals

- Myo , Mys → **MUSCLES**
  - Sarcolemma (Membrane of muscle cell)
  - Sarcoplasm (Cytoplasm of muscle cell)

→ Myo-logy
→ Sarco (Flesh)
Muscle Fiber (Skeletal, Smooth)

→ More than 600 muscles (650 muscles), 640 muscles (BTB)
→ More than Half of Body (40–50%)

SPECIAL CHARACTERS OF MUSCLE TISSUE :

- EXCITABILITY (Responsive)
- CONTRACTILITY
- EXTENSIBILITY
- ELASTICITY

LOCOMOTION → Dis-placed
MOVEMENT → (Not-Displaced)

CLASSIFICATION OF MUSCLES

SMOOTH MUSCLES

- Simplest muscles
- Primitive

- Involuntary
- Unstriped
- Uni-nucleated
- Slow Speed
- Not Fatigued
- Visceral Organs (Esophagus, Stomach Intestine)
- Spontaneous, Stretch Nervous System, Hormonal control

CARDIAC MUSCLES

- Involuntary
- Irregular striation
- Uni-nucleated
- Intermediate
- 2500 gallon / day
- Not Fatigued
- Heart
- Spontaneous

SKELETAL MUSCLES

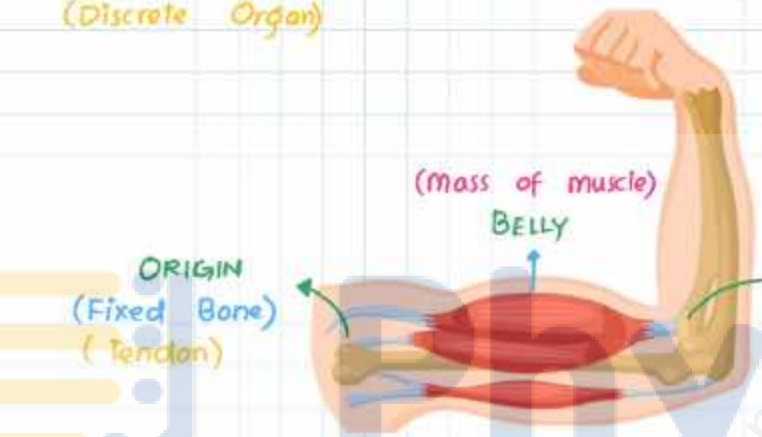
- Advanced muscles
- Modernd

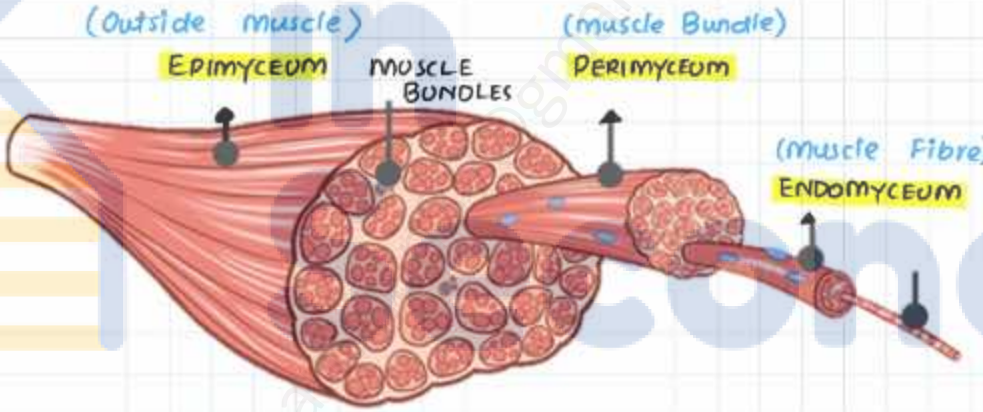
- Voluntary
- Regular striation
- Multi-nucleated
- Slow → Rapid
- Fatigued
- Attached to Bones
- Nervous System (Somatic N. System)

Structure of a Skeletal Muscle

which are attached with bones.

- SKELETAL MUSCLE (Discrete Organ)



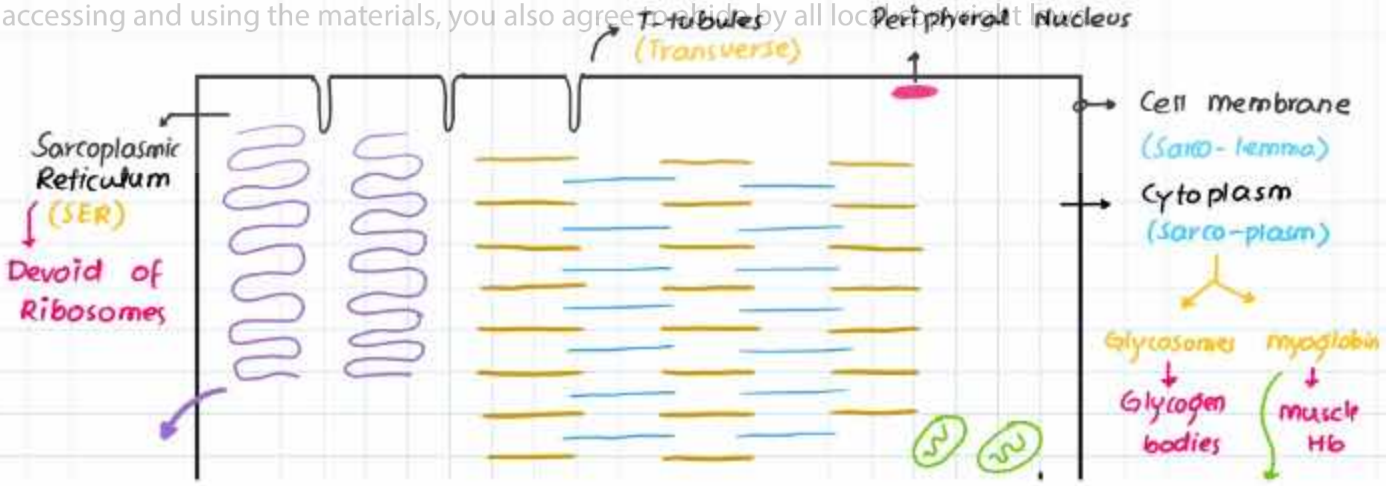


MUSCLE FIBRE → MYOFIBRILS → MYOFILAMENTS
(10 – 100 μm) (1 – 2 μm)

- 10x greater than average body cell

THICK (16 nm) THIN (7-8 nm)

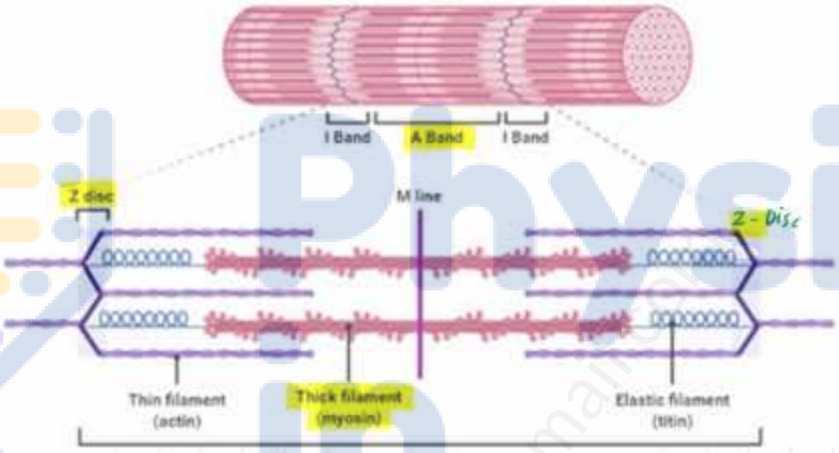
- 15 nm BTB



Pores (Passive) Pumps (Active)

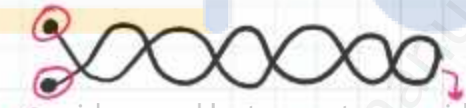
(can Polarize light)
Anisotropic
(A) - BAND
- Thick filament
- Thin filament

Isotropic (can't Polarise)
(I) - BAND
- Thin filament



SARCOMERE (Basic Contractile unit)

THICK FILAMENT (16nm)
→ Myosin Protein
→ Mechano - Enzyme

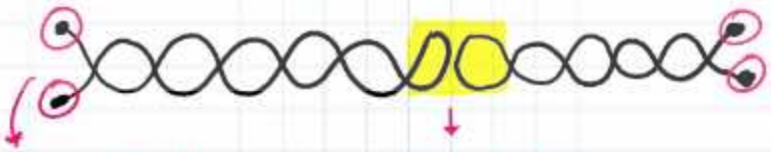


THIN FILAMENT (7-8 nm)
G-Actin (monomer) → Actin (2)
F-Actin (Polymer) → Tropomyosin (2) → Covers attach site
→ Troponin

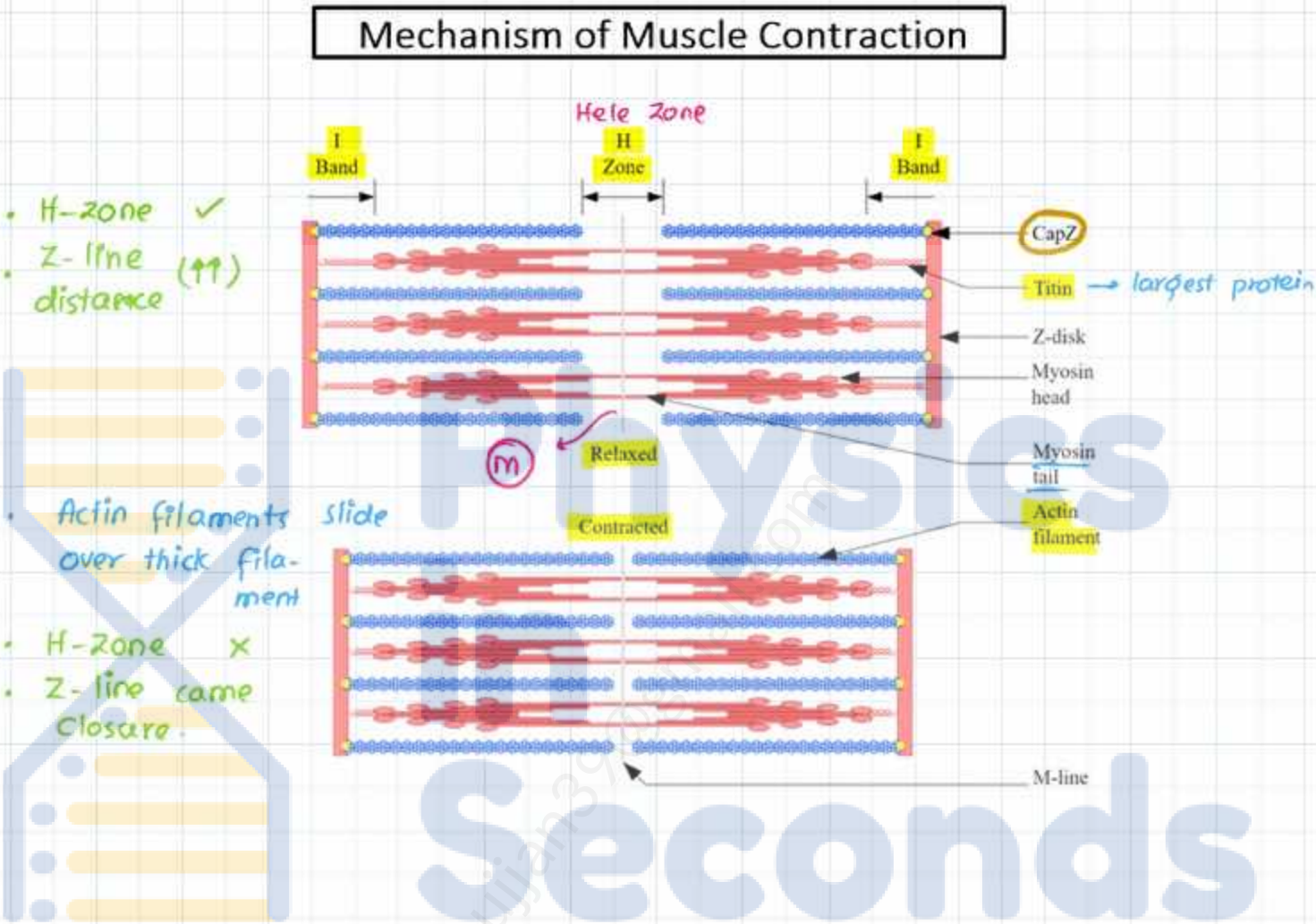
- Attaches with Actin
- Attaches with Tropomyosin

→ Inhibitory Sub-unit

- Each myosin molecule → 6 Polypeptides
- Each Thick filament → 300 molecules

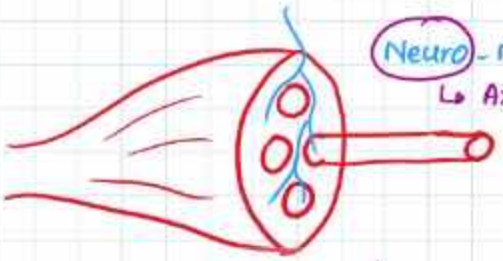


- Tropomyosin (40 - 60 molecules)



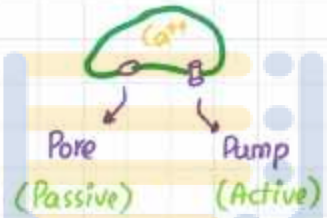
Control of Cross Bridges

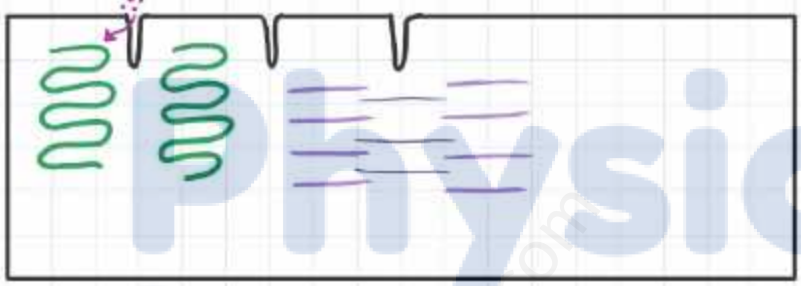
Triads → 2 Terminal Cisterna, 1 T-tubule



Neuro-muscular Junction / Plate
↳ Axon Ending releases Neurotransmitters (Acetylcholine)

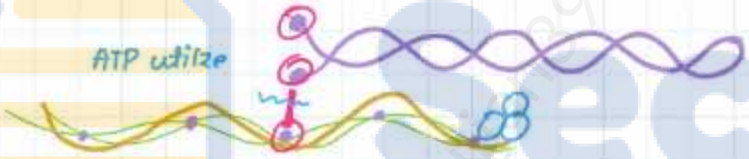
① Release of Neurotransmitter at T-tubule.
② Ca^{++} pores ↓ Ca^{++} releases in cytosol
③ Ca^{++} attaches at troponin "C"





1 motor Neuron + muscle Fibers

- Ca^{++} attachment with troponin ↷ slides tropomyosin
  ↓
  Exposure of attachment site on Actin.



④ Result in sliding of thin filament on thick filament

*

CHANGES DURING CONTRACTION		RELAXATION
• A-Band	No Effect	No Effect
• I-Band	Shortens	Elongate
• H-zone	Disappear	Re-appear
• M-Line	No effect	No-effect
• Z-line	Came closer	Get away
• Sarcomere	Shortens	Elongate

Average length ↓
2 µm

ENERGY REQUIREMENT → Carbohydrates + Fats

Glycogen → Glucose $\xrightarrow{O_2}$ $CO_2 + H_2O +$ (ATP)*
Glycogenolysis
Creatine Phosphate*

Glycogen → Glucose $\xrightarrow{O_2}$ $CO_2 + H_2O +$ (ATP)*

Glycogenolysis

Creatine Phosphate *

RIGOR MORTIS (Inability to Relax)

- Starts after 4 Hour of death
- Continue upto 40 Hours.
- After that decomposition

ANTAGONIST

→ Opposite Action

- Flexors (Flexion)
- Extensors (Extension)

Reversible → cold conditions

Irreversible → Burning Effect.

AGONIST

→ Same function

- Brachialis
- Bi ceps

→ Muscles only pull not push (BTB)

→ Human Eye Contraction 0.01 Second (STB)