81/81

# Support and movement

Dr. Safi

**Skeleton** → Stores 97% of calcium + Phosphorus
- axial 80
- appendicular 126 bones

**Skull** 29 bones

| Paired 2 | 4 Unpaired | Facial Paired 8 | Unpaired 2 bones |
|---|---|---|---|
| Parietal | Sphenoid | Maxilla | mandible |
| Temporal | occipital | Lacrimal | Vomer |
| | frontal | Nasal | |
| | Ethmoid | nasal conch | |
| | | zygomatic | |
| | | Palatine | |

SOFE PT — a song Read like PML NNZ

Hyoid → Not attached to any bone

Total 33 Vertebrae → fused to form 26

Vertebral coloum → 4 curvatures

False ribs vs Floating ribs

| False ribs | Floating ribs |
|---|---|
| 8, 9, 10th by common costal cartilage → attached indirectly | 11, 12 th Not attached |

Pelvic vertebra have 5 sacrum + 4 coccyx

Pelvic girdle = ileum, ischium, pubis

Tarsals → 7, capels → 8

Fibula → calf bone

**Joints** 360 Joints

Bone – Bone by ligament

Bone – muscle by tendon

Fibrous → Fixed
- Sutures → skull
- Syndesmosis → Tibia – Fibula
- Gomposis → Teeth – Jaws

Cartilagenous joints
- Sympysis → pubic discs
- Sycondroses → Intervertebral + costal cartilage

Synovial → Ball and socket (weakest joint)
- Elipsoid
- B/w skull and 1st Vertebrae

Hormonal + Heridatery + nutritional disorder
- Osteoporosis
- Arthritis
- Rickets + osteomalacia

Cervical Spondolysis → most common

| Osteoarthritis | Rheumatid | Gouty → uric acid |
|---|---|---|
| most common knee, hip | immune system attack on hands + wrist | Big toe deposit |
| Intervertebral Joints | •Synovial Joint | Sodium-urate crystals |

# Nervous coordination

→ absent in plants

Nissi's granules → E.R + Golgi body + Ribosomes

Neurofibrils = dendrite + axon

Neuroglial cell → 50% nervous system

Nerve impulse 20 times faster in myelinated than unmyelinated → depends on Thickness, length + mylein sheath

| Nerve tract | ganglion | nucleus |
|---|---|---|
| PNS, CNS | PNS, CNS | |
| axon | cell body | |

Unipolar

Sensory Neuron → axon like dendrite → dendron

Inter neurons → Unipolar in invertebrates but Bipolar in human (retina + ear)

Interneuron → non myelinated, multipolar, involument.

Motor neuron → multipolar + single axon but many dendrites

Reflex action → no brain
- receptor → CNS (spinal cord) → effector

| Compact Bone | vs | spongy bone |
|---|---|---|
| Yellow bonemarrow | | Red bone marrow |
| Unit → osteon or Haversian system | | canellous or trabecular bone |
| Volkman canal from perio to endosteum. | | |

Osteoblast → Secret collagen
- Bone forming cells

Osteoclast → do bone resorption + called bone macrophages

unmineralized ground matrix

Osteocytes = osteoblast + matrix
- maintains enzyme + mineral secretion

**Muscles**

| Smooth | Cardiac | Skeletal |
|---|---|---|
| Earliest form | most modern ✓ | moderen ✗ |
| Intercalated discs ✗ | mono | multinucleated |
| mononucleated | ✓ irregular striations | ✓ regular striated |
| Striations ✗ | | |
| Slow speed | Intermediate ✓ | Slow to rapid |
| | | Not fatigue resistant ✗ |

**Sarcomere** → B/w 2 Z-lines

Epimysium → Perimysium → endomysium

sarcolemma make T-tubules called triads

myofibrils 1-2 μm

myofilaments → 100 μm

Z-line (I band) — M line (H zone) — Z line

when Sarcomere contracts → H-Zone disappears, I-band Shortens, A-band remain constant

Myosin — actin → 8nm diammeter
- Fibrous actin by G-actin formed

16nm in diammeter + 6 Polypeptide chains

300 myosin molecules = 1 thick filament

Each myosin covered by 6 actin filaments

Myosin → globular head → enzymatic
- fibrous tails → mecanoenzyme

Twisting of troponin by $Ca^+$ attachment → Exposes binding sites of actin

In relaxed state → thick + thin band overlap only at the end → H-Zone

**Membrane Potential:** $Na^+$ ions outside 10 times, $K^+$ inside → 30 times ↑

2 $K^+$ inward 3 $Na^+$ outward pumped

Refractory period → 4 milliseconds + neuron conducts 250 impulses / second

Saltatory conduction 50 times faster than unmyelinated · myelinated → 120 ms-1
- 1-3 m/sec

Hyperpolarization → more $K^+$ outside than $Na^+$ inside

Absolute refractory period
- No response to any stimulus

Relaxed state → $K^+$ more permable

But depolarize state → $Na^+$ more permable ↑ occurs due to delayed $K^+$ gate closing

−50 → 0 → +30 → −90
- threshold, depolarize, hyperpolarize

Cartilage → No bone marrow, nerves, lymphatics, blood supply ✗

calcifies to form bone. located in lacunae

| Hyaline | Fibro | elastic cartilage |
|---|---|---|
| Most abundant at the end of long bones, nose, larynx, Trachea | B/w discs of vertebrae | In epiglottis and external pinna |

Type-1 collagen → bone

Type-2 → cartilage

Hardest working muscle → cardiac

Pump 2500 gallon / per day

muscle contraction-relaxation → 1 ATP uses

Break cross-bridge

All myofibrils → will participate in muscle contraction

Quadracips → straight the joint when contract

Hamstrings → bend the joint

**Disease:** when contract Tetany

Cramp → Tetanic contraction → hypoglycemia ↓ low $Ca^+$ level

Common in thigh + hip · continous contraction

Tetanus → lack of $O_2$ + By bacteria

when sarcomere contracts → Not increase in length

**Past Papers**

Bone inorganic matrix → 65%

Breakdown of bone → osteoclasts

Strongest vs longest muscle
- massester, gluteus maximus

Creatine – Pay as an energy source

lactic acid → Converted by liver to glucose by using 20% energy

Hinge joint → B/w humerus and radio-ulna

Fluid containing joint → Synovial

Nerve inflammation → not related to arthritis.

Factin by 2 G-actin

Mature bone cell formed · cartilage more difficult to heal bcz less vascular supply.
- osteocytes

Muscle fatigue
- glucose ↓
- Lactic acid ↑

· When muscle relaxes $Ca^+$ pumped back to S. reticulum

Hamstrings insertion on tibia (shin bone)

Hip + shoulder ball socket joint.

**End**

**Synapse:** Presynaptic → $Ca^+$ releases but Postsynaptic → $Na^+$ releases inside

Electrical 0-2 nm cleft · Each vesicle have 10000 neurotransmitters

Chemical 20 nm cleft

Breakdown of adrenaline by monoamine oxidases

Neurotransmitters made by nissi's granules

| Excitatory | vs | Inhibitory |
|---|---|---|
| decreases threshold | | Increases ↑ |
| $Na^+$ permability ↑ | | ↓ decreases |
| acetylcholine → PNS | | endorphins → both hormones + neurotransmitters |
| dopamine → CNS | | as a |
| epinepine + nor → Both hormones and transmitters | | GABA + Glycine |

Sarin a nerve gas binds irreversibly to acetylcholine – estrase → muscles remains contracted

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