ChatGPT

Sure, Subesh! Here's a fully updated and simplified version of your study content. Everything is explained in short and clear language, including details like myofibrils.

MUSCLE TYPES & CONTRACTIONS

1. Types of Muscles (Compare & Contrast)

Type	Appearance	Nuclei	Control	Function	Location
Skeletal	Striated lines	Multiple	Voluntary	Moves bones	Attached to bone
Cardiac	Striated lines	One	Involuntary	Pumps blood	Heart
Smooth	No lines	One	Involuntary	Moves stuff in organs	Walls of organs

2. Types of Contractions

- **Isotonic**: Muscle changes length and moves (like lifting weights).
- **Isometric**: Muscle stays the same length (like pushing a wall).

SKELETAL MUSCLE STRUCTURE

Muscles are organized like layers: - **Muscle Group** → Muscles → Fascicles (bundles) → Muscle Fibers (cells) → Myofibrils → Sarcomeres

Connective Tissue Layers (wrapping materials):

- **Fascia**: Wraps a group of muscles.
- **Epimysium**: Wraps one whole muscle.
- **Perimysium**: Wraps each fascicle (bundle of muscle fibers).
- **Endomysium**: Wraps each muscle fiber (muscle cell).

Myofibrils

- **Myofibrils** are long protein threads inside a muscle fiber.
- Each myofibril contains repeating units called **sarcomeres**.
- They are where contraction happens (they do the work!).

SARCOMERE & HOW MUSCLES CONTRACT

- **Sarcomere**: the smallest working unit in a muscle. It is the part that shortens when a muscle contracts.

- Made of:
- **Actin** (thin filament)
- **Myosin** (thick filament)
- **Z-discs** at the ends

How Contraction Works:

1. **Calcium** enters the muscle cell's cytoplasm.
2. Calcium binds to **troponin**.
3. This moves **tropomyosin** so **myosin heads** can grab onto actin.
4. Myosin uses **ATP** to pull actin → this is the **power stroke**.
5. **Z-discs** move closer together → sarcomere shortens.
6. **H-zone** and **I-band** get smaller.
7. **A-band** stays the same.

HOW NERVES START MUSCLE CONTRACTION

- Nerve signal reaches muscle → releases **acetylcholine**.
- This stimulates the **motor plate** (where nerve and muscle meet).
- Signal travels through **T-tubules** (tunnels in muscle fiber).
- Signal activates **DHP receptor** → triggers **Ryn receptor**.
- This opens the **sarcoplasmic reticulum**, releasing **calcium** into the cell.

Triad = T-tubule + 2 ends of sarcoplasmic reticulum

STRONGER CONTRACTIONS

- **More signals = more calcium = more contraction.**
- **Muscle Twitch Graph**: Shows the 3 phases
- **Latent phase**: delay after stimulation
- **Contraction phase**: muscle shortens
- **Relaxation phase**: muscle returns to normal

Hypertrophy

- Bigger muscle fibers = more myofibrils = more strength

MUSCLE FIBER TYPES

Type	Color	Fatigue	Growth	ATP Source	Speed
Fast Glycolytic	White	Fatigues fast	Grows a lot	Glycolysis (no oxygen)	Fast
Slow Oxidative	Red	Doesn't fatigue	Grows little	Aerobic (needs oxygen)	Slow

Type	Color	Fatigue	Growth	ATP Source	Speed
Fast Oxidative	Pink	Moderate fatigue	Medium growth	Mixed	Medium

- Red = more **myoglobin** (holds oxygen) & **mitochondria** (makes energy)
- White = fewer mitochondria but fast power

MOTOR UNITS

- A **motor unit** = one nerve + all the muscle fibers it connects to
- **Small motor unit** = fine control (like in eyes, hands)
- **Large motor unit** = strong movement (like in legs)

CARDIAC MUSCLE

Differences from Skeletal:

Feature	Skeletal Muscle	Cardiac Muscle
Nuclei	Many per cell	One per cell
Stimulation	From motor neuron (SNS)	From nodal/conducting cells
Moves	Bones	Blood
Calcium Source	Inside (sarc. reticulum)	Outside (from extracellular fluid)

Similarities:

- Both use **myofibrils**, **sarcomeres**, and **power stroke**.

CARDIAC CELL TYPES

1. Nodal/Conducting Cells (set the heart rhythm)

- **Do NOT contract**.
- Automatically make action potentials using **Na+ funny channels**.
- **Ca2+ channels** create the spike (not Na+ like in skeletal muscle).
- These regular spikes set your **heart rate**.

Signal Pathway: SA Node → AV Node → Bundle of His → Bundle Branches → Purkinje Fibers

2. Contractile Cells (actually pump blood)

- Work like skeletal cells but use **external calcium**.

- Have a **plateau phase** in their action potential (Ca2+ in, K+ out).
- This prevents **tetanus** (no continuous contraction).

Cardiac Action Potential vs Skeletal:

- Cardiac = long **plateau** (longer refractory period)
- Skeletal = quick spike

CARDIAC CYCLE & MONITORING

Key Terms:

- **Stroke Volume**: blood per beat
- **Heart Rate**: beats per minute

Factors that affect them: - **Ion levels**, **nervous system**, **preload** (stretch), **afterload** (resistance)

Heart Sounds:

- **Lub**: AV valves close (ventricles contract)
- **Dub**: Semilunar valves close (ventricles relax)

Monitoring:

- **Pulse**: physical beat
- **EKG**: electrical signal of heart

BLOOD FLOW

1. Heart → Arteries → Arterioles → Capillaries
2. Capillaries → Venules → Veins → Heart

Capillary Types

- **Continuous**: most tissues (tight)
- **Fenestrated**: kidneys, intestines (leaky)
- **Sinusoidal**: liver, spleen (very open)

BLOOD PRESSURE & FLOW

- Blood moves from **high to low pressure**
- Bigger container (like veins) = **lower pressure**
- Smaller container (like arterioles) = **higher pressure**
- More blood = **higher pressure**, less blood = **lower pressure**

CAPILLARY EXCHANGE

- **Diffusion**: small ions move to balance
- Some big things (like proteins) can’t move

Two Pressures:

- **Hydrostatic Pressure**: pushes fluid **out** of capillary
- **Osmotic Pressure**: pulls fluid **in** to capillary

Let me know if you'd like this broken down into: - Flashcards - A quiz - Illustrated diagrams - Or help on any specific part again!