# Muscle lab introduction

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- •We have over 600 major muscles.
- •We have 240 muscles that have specific jobs
- Sartorius muscle: It is the longest muscle in the body.



## Naming Skeletal Muscles

- Location of muscle bone or body region associated with the muscle
- Shape of muscle e.g., the deltoid muscle (deltoid = triangle)
- Relative size e.g., maximus (largest), minimus (smallest), longus (long)
- Direction of fibers e.g., rectus (fibers run straight), transversus, and oblique (fibers run at angles to an imaginary defined axis)
- Number of origins e.g., biceps (two origins) and triceps (three origins)
- Location of attachments named according to point of origin or insertion
- Origin and insertion: sternocleidomastoideus( origin on the sternum and clavicle, insertion on the mastoid process); b rachioradialis(origin on the brachium or arm, insertion on the radius).
- Action e.g., flexor or extensor, as in the names of muscles that flex or extend, respectively

## Arrangement of Fascicles

- Parallel fascicles run parallel to the long axis of the muscle (e.g., sartorius)
- Fusiform spindle-shaped muscles (e.g., biceps brachii)
- Pennate short fascicles that attach obliquely to a central tendon running the length of the muscle (e.g., rectus femoris)
- Convergent fascicles converge from a broad origin to a single tendon insertion (e.g., pectoralis major)
- Circular fascicles are arranged in concentric rings (e.g., orbicularis oris)



# **Skeletal Muscle Shapes**



## NAMING OF MUSCLES

1.	Shape	Trapezius Serratus anterior
2.	Location	න්තාගත්ම පෙන්නි. මේ.රෝගාගේ පෙනත්ව
3.	Attachment	Sternocleidomastoid Supraspinatus
4.	Size	Guteus maximus
5.	Orientation of fibers	Rectus abdominus External oblique
6.	Relative position	Vastus medialis Vastus lateralis
7.	Function or Action	Pronator teres Supinator
8.	Other camelet@l	Sartenius

## **Muscle fiber types are classified by**

#### **Anatomical appearance:**

• red versus white

#### **Muscle function:**

- Fast/ slow
- Slow or fatigable versus Fatigue / resistant Biochemical properties:
- such as high or low
- aerobic capacity

### **Histochemical** properties:

- such as enzyme
- profile

#### <u>As many as eight types</u> <u>Red (type I)</u>

- long term
- slow contractions

### White (type IIa)

- short term
- fast contractions

## White (type IIb)

No change from one type to another

• change within fast types

	I	IIA	IIB
MUSCLE FIDER TYPE	(contains type I myosin)	(contains type IIa myosin)	(contains type IIx myosin)
MUSCLE FIBER SIZE	small	large	medium
CONTRACTION SPEED	slowest	intermediate	fastest
MAXIMUM FORCE	low	high	medium
OXIDATIVE CAPACITY	high	medium	low
GLYCOLYTIC CAPACITY	low	medium	high
POWER	low	intermediate	high

Characteristic	Туре І	Type IIA	Type IIX / IIB
Contraction time	Slow	Fast	Very fast
Size of motor neuron	Small	Large	Very large
Resistance to fatigue	High	Intermediate	Low
Activity used for	Aerobic	Long term anaerobic	Short term anaerobio
Force production	Low	High	Very high
Mitochondrial density	High	High	Low
Capillary density	High	Intermediate	Low
Oxidative capacity	High	High	Low
Glycolytic capacity	Low	High	High
Major storage fuel	Triglycerides	CP, Glycogen	CP, Glycogen

# Four major muscle groups of the body include:

- •Muscles of the head and neck
- •Muscles of the trunk
- •Muscles of the upper extremity
- •Muscles of the lower extremity.



## TERMINOLOGY

#### **Myofibers**

In order of decreasing size... Myofiber = entire cell. Myofibrils : bundles of myofilaments inside myofiber. Myofilaments :actin and myosin proteins

#### **SARCOTERMS**

Sarcolemma : plasma membrane of myofiber Sarcoplasm: cytoplasm of myofiber Sarcoplasmic reticulum (SR):ER of myofiber Sarcomere: contractile unit inside myofiber Agonist muscle: Prime mover.

#### Antagonist muscle:

Flexorsand extensors that act on the same joint to produce opposite actions

<u>Synergic :</u> Helping the movement

#### **Reciprocal innervation:**

motor neurons of antagonistic muscles inhibit each other (through interneurons) so they don't both contract simultaneously.

When limb is flexed, antagonistic extensor muscles are passively stretched

## Medical Terminology

Anti-, contra- 🛛 → against		
Bi-, di-	two, twice	
Gloss/o-	tongue	
Infra-	below	
lso-	equal	
Kin/o-, -kinnin	move	
-lemma	husk, covering	
-meter	measure	
peri-	around	
sarc/o- -trophy desmo-	flesh nourish band	

grav-	heavy
labi-	lip
tens-	strength
-asthenia	weakness
ten/o, tendin/o	tendon
muscul/o-	muscle
my/o-, myos/o	o- muscle
ligament/o-	ligament
fasci/o-	fascia
dys- a-, an- faci-	painful without face, fascia

<u>Type of muscles</u>		
Cardiac muscle	Involuntary controlled by	
Smooth muscle	autonomic nervous system	
Skeletal muscle (aka striped or striated muscle)	voluntary controlled by somatic nervous system	

## Diaphragm one exception to the rules

- An interesting exception to the visceral muscles being under involuntary control is the diaphragm, which controls breathing.
- This muscle is normally under involuntary control (we don't usually have to think about breathing), but a person can exert a limited amount of voluntary control also (for example, purposely holding one's breath or br eathing quickly or deeply).







![](_page_16_Picture_0.jpeg)

![](_page_17_Picture_0.jpeg)

# **Fascicle and Perimysium**

![](_page_18_Figure_1.jpeg)

![](_page_19_Picture_0.jpeg)

![](_page_20_Picture_0.jpeg)

![](_page_21_Picture_0.jpeg)

![](_page_22_Picture_0.jpeg)

![](_page_23_Picture_0.jpeg)

## **Types of Muscle Action**

**Concentric** ==→ shortening

**Eccentric** =  $\rightarrow$  lengthening (20% greater than concentric with less energy)

**Isometric** = → no change in length

Concentric contraction - the muscle shortens

Isometric contraction -no change in muscle length

Eccentric contraction -the muscle lengthens

## **Types of Muscle Tissue**

![](_page_25_Figure_1.jpeg)

Cell characteristics Long, cylindrical, unbranched striated, multinuclear

Short, branched, striated , single nucleus, intercalated discs

![](_page_25_Picture_4.jpeg)

Short, spindle-shaped, non-striated, single nucleus

Model © WMBS taken tomos © Picture © BioEducation, 11C

Smooth

muscle

## Structure of a Skeletal Muscle

![](_page_26_Figure_1.jpeg)

![](_page_27_Figure_0.jpeg)

![](_page_28_Figure_0.jpeg)

![](_page_28_Figure_1.jpeg)

![](_page_29_Figure_0.jpeg)

![](_page_30_Figure_0.jpeg)

- M- disk (line) does not move.
- H-Zone shrinks
- A-Band does not change length
- Z-lines move toward the M-line
- All sarcomeres contract so the the muscle insertion
- will move toward the origin.
  Skeletal Muscle Fiber
  Skeletal muscle fiber

![](_page_31_Figure_6.jpeg)

![](_page_31_Figure_7.jpeg)

![](_page_32_Figure_0.jpeg)

- 2. Sarcolemma
- Motor end plate
  Synaptic end bulb

 Endomysium
 Myelin sheath 7. Nucleus of the Schwann cell

![](_page_33_Picture_0.jpeg)

- 1. nucleus
- 2. intercalated discs
- 3. striations

![](_page_34_Picture_0.jpeg)

- 1. sarcolemma

- nucleus
  artery
  connective