

Ch. 9: Muscles & Muscular Tissue
Ch. 10: Muscular System

TEST: Nov 18&19

Muscular System TEST Topics:

- **Bio Concepts**
- **3 types of muscle tissue**
- **4 Muscular Performance Tasks**
- **Muscle vs Osseous Tissue comparison**
- **Direct vs Indirect Attachment**
- **Muscle Metabolism**
- **Glucose vs Glycogen**
- **Aerobic Endurance**
- **Anaerobic Threshold**
- **Muscle Arrangement**
- **Smooth Muscle**
- **Peristalsis**
- **Muscular Dystrophy**
- **Muscle Classification**

Review Key Concepts in Bio material will be on test!

- ★ Cellular Respiration
- ★ Anaerobic Respiration
 - Lactic acid fermentation
 - Glycolysis
- ★ The role of Mitochondria
- ★ Active Transport
- ★ Facilitated Diffusion



3 Types of Muscle Tissue, p. 276

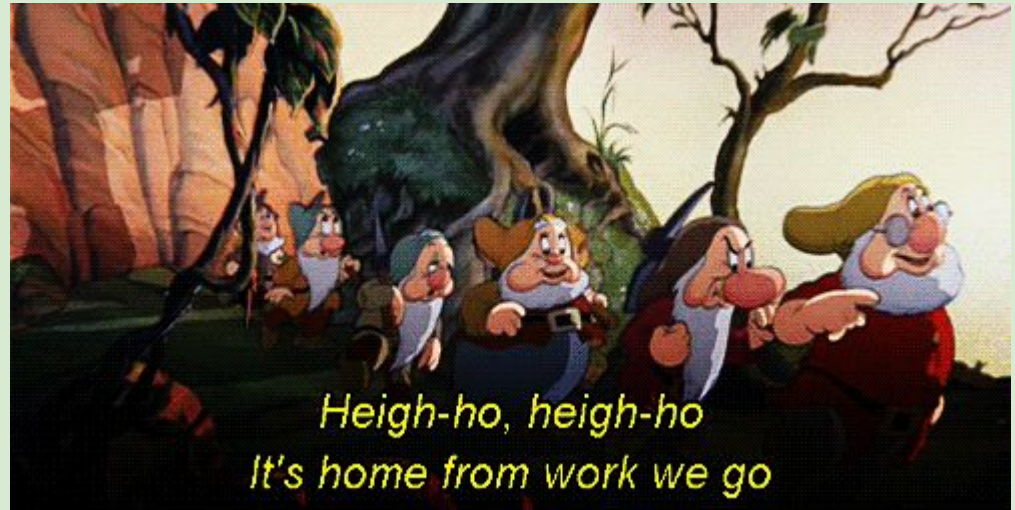
- **Skeletal** attach to & cover the bony skeleton
 - Skeletal, striated, voluntary
- **Cardiac** only in the heart
 - Cardiac, striated, involuntary
- **Smooth** walls of visceral organs moving fluids/substances
 - Visceral, nonstriated, involuntary

Project TIME!



Muscles perform these 4 tasks:

- 1. Responsiveness- excitability,
irritability**
- 2. Contractility**
- 3. Extensibility**
- 4. Elasticity**



Skeletal Muscle

vs.

Compact Bone

Myofibril

Muscle fiber

Endomysium

Fascicle

Perimysium

Epimysium



Vessels/Nerves

Lamella

Lacunae

Osteon

Circumferential Lamellae

Periosteum

Skeletal Muscle- Gross Anatomy

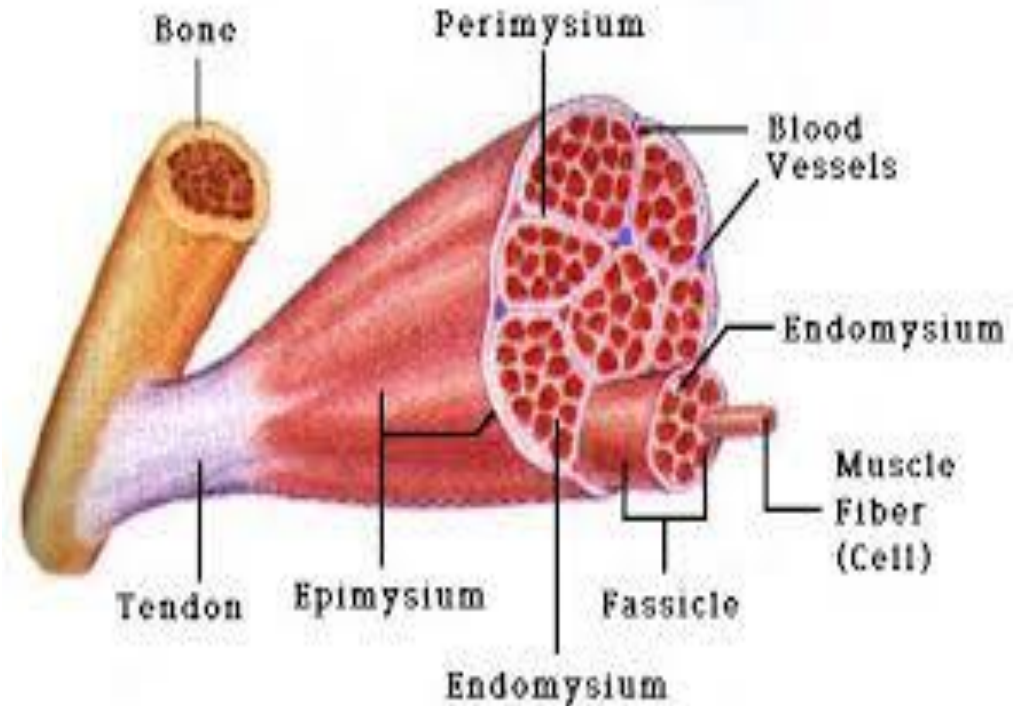
- ★ **Muscle fibers**
- ★ **Voluntary control**
 - 1 nerve
- ★ **Rich blood supply**
 - One artery
 - >1 veins
- ★ **Connective tissue**
 - Epimysium, perimysium, endomysium



Connective tissue of the skeletal muscle, **pg. 278, fig. 9.1**

Deep → Superficial

- a.
- b.
- c.
- d.
- e.
- f.



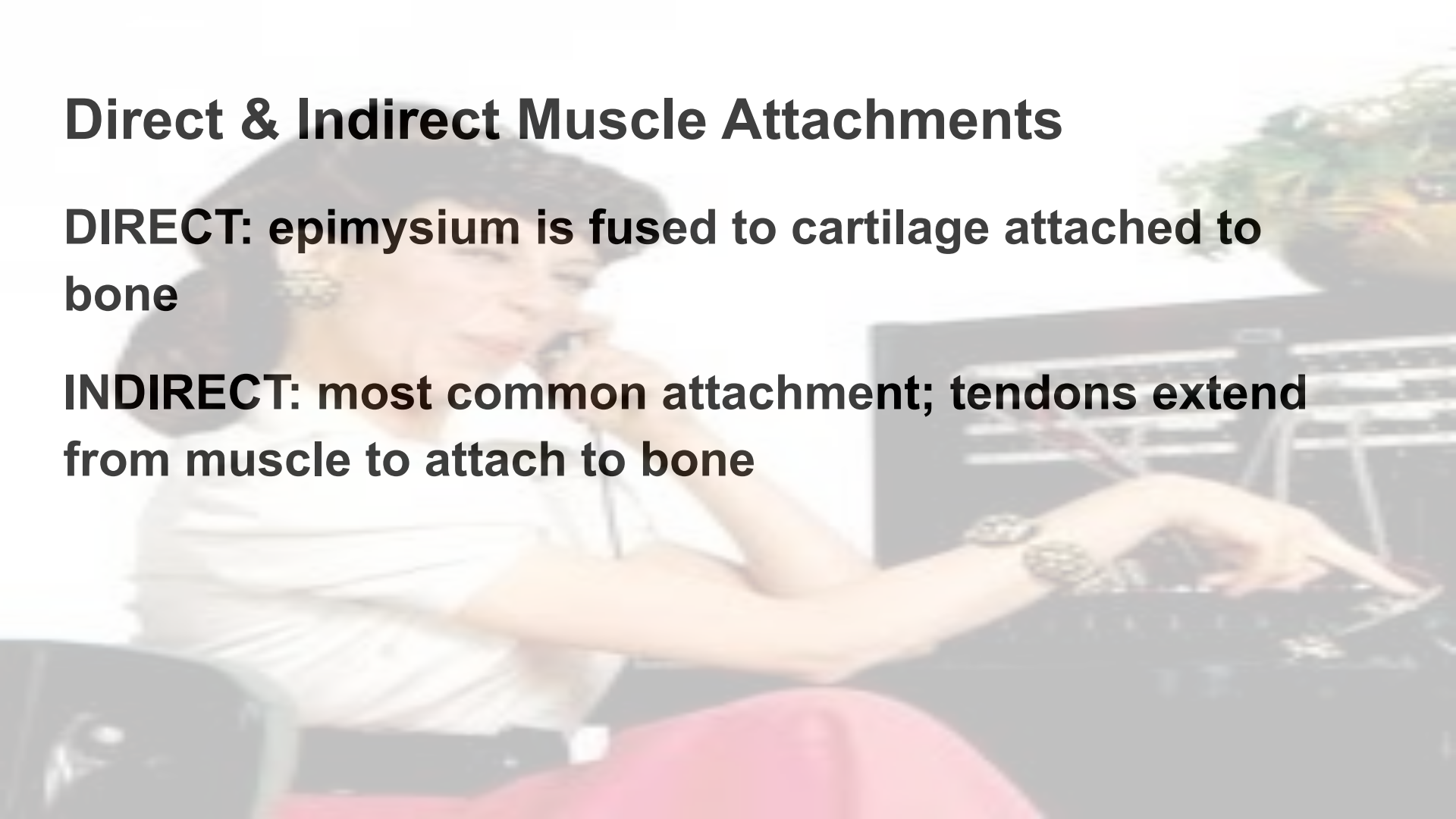
Skeletal Muscle Connective Tissue **SHEATHS**, pg 279

- **Epimysium**: outermost covering of dense irregular surrounds the 1 muscle
- **Perimysium**: outlines each of the **MANY** fascicles
- **Endomysium**: outlines ea. Of the **MANY** myofibrils

Direct & Indirect Muscle Attachments

DIRECT: epimysium is fused to cartilage attached to bone

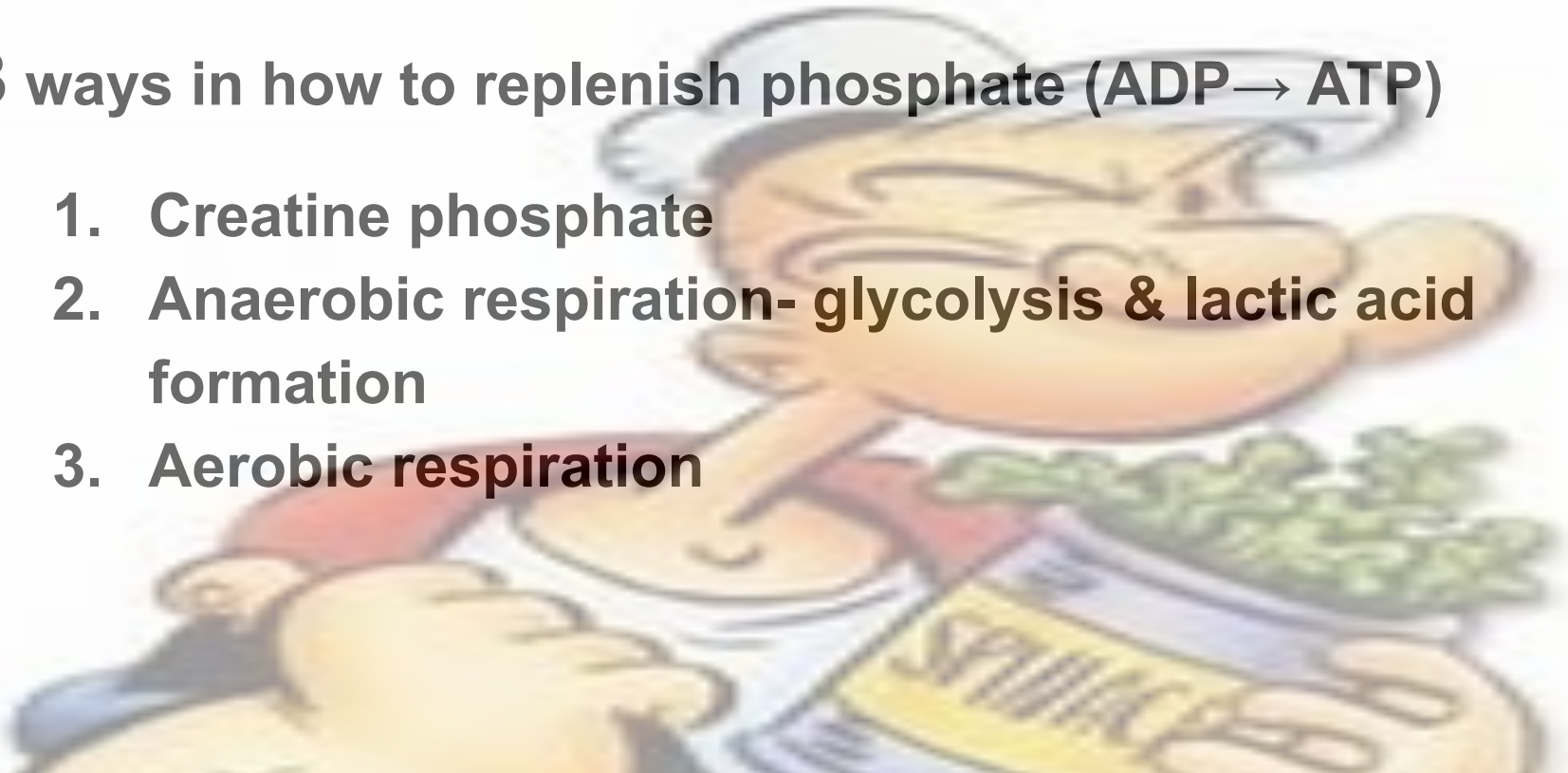
INDIRECT: most common attachment; tendons extend from muscle to attach to bone



Muscle Metabolism- glucose & glycogen

3 ways in how to replenish phosphate ($ADP \rightarrow ATP$)

1. Creatine phosphate
2. Anaerobic respiration- glycolysis & lactic acid formation
3. Aerobic respiration



1. Creatine Phosphate

- Found in muscles- 2x more CP than ATP
- During intense exercise
- Creatine kinase (enzyme) allows for efficient work
- $CP + ADP = ATP$
- Maximum muscle power of 14-16 sec, enough energy for a 100-meter dash
- Rest &/or inactivity $>CP$

2. a. Lactic Acid Formation- 5% ATP production

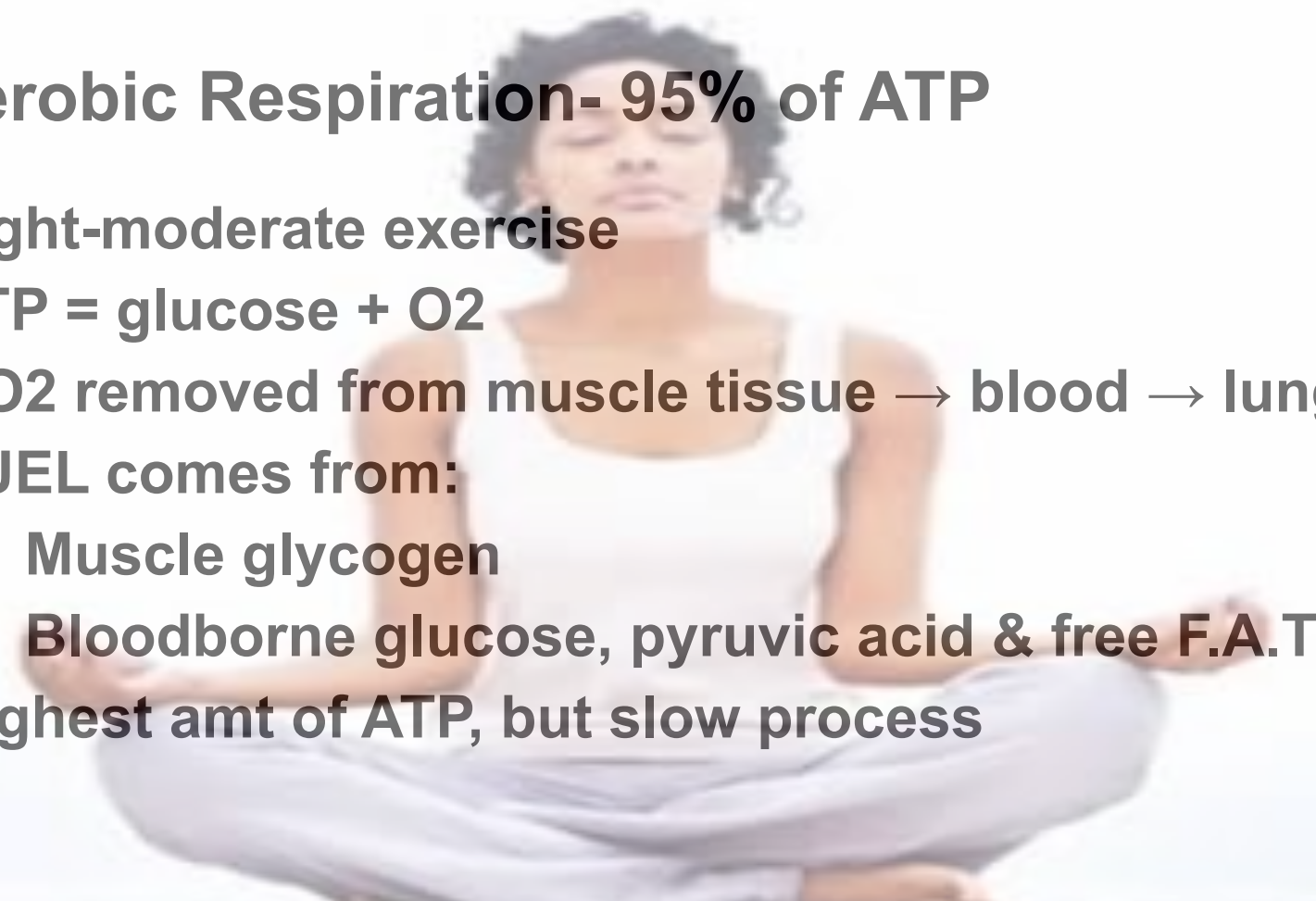
- ATP & CP are exhausted
- ATP generated by breakdown of glucose from blood or glycogen stored in muscle
- When muscle contraction $>$ ATP supply, lactic acid is made
- Helps during spurts of vigorous activity
- $>$ lactic acid = sore muscles during intense exercise
- Fastest method of ATP production

2. b. Glycolysis

- Occurs after digesting glucose
- Glucose 'prepares' to be converted into pyruvic acid
- Anaerobic process
- Mitochondrion
- It can proceed in 2 directions
 - Fermentation
 - Cellular respiration



3. Aerobic Respiration- 95% of ATP

- Light-moderate exercise
 - $\text{ATP} = \text{glucose} + \text{O}_2$
 - CO_2 removed from muscle tissue \rightarrow blood \rightarrow lungs
 - FUEL comes from:
 - Muscle glycogen
 - Bloodborne glucose, pyruvic acid & free F.A.T
 - Highest amt of ATP, but slow process
- 
- A woman with dark curly hair, wearing a white tank top and light purple pants, is sitting in a lotus position on a light-colored floor. Her eyes are closed, and her hands are resting on her knees in a meditative pose. The background is a plain, light-colored wall.

AEROBIC ENDURANCE, pg 299

***ATP supply = ATP demand**

- **Must have oxygen for Aerobic respiration**
- **Light exercise: up to 2 hours**
- **Short & Powerful activities**
 - **Lifting weights**
 - **Diving**
 - **Sprinting**



anAEROBIC THRESHOLD, pg 299

***ATP Demand > ATP Supply**

- **Exercise exceeds ATP for Glycolysis**
- **Intermediate activities**
 - **Tennis**
 - **Soccer**
 - **100 m swim**



Muscle Fatigue, pg 300

- Inability to contract
- ATP declines during contraction
- Imbalance of Na^+ and K^+ in membrane potential
- Aerobic Endurance recovers faster than anaerobic threshold



Fascicle arrangements in muscles, fig.10.1,pg322

- 1 Fascicle = many MYOFIBRILS
- 7 patterns

1. Circular

2. Convergent

3. Parallel

4. Unipennate

5. Bipennate

6. Fusiform

7. Multipennate

(a) Circular
(orbicularis oris)

(b) Convergent
(pectoralis major)

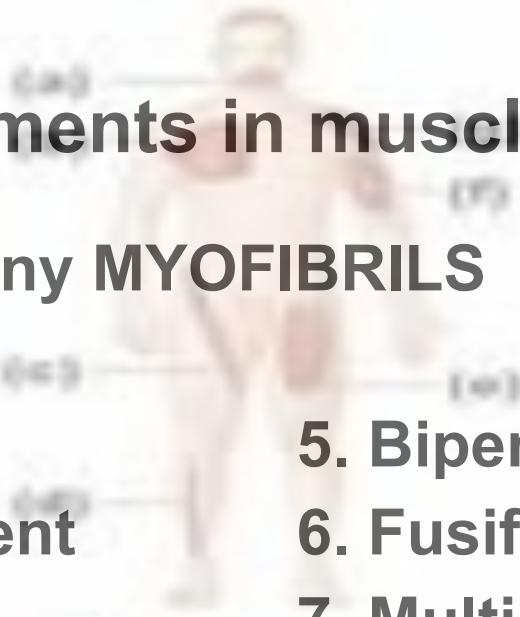
(c) Parallel
(sartorius)

(d) Unipennate
(extensor digitorum longus)

(e) Bipennate
(rectus femoris)

(f) Fusiform
(biceps brachii)

(g) Multipennate
(deltoid)



Circular Fascicles

- Forms a concentric ring
- Found in external body openings
- SPHINCTERS



Convergent

- Fan or triangular shape
- Converges towards a single tendon

Pectoralis major muscle



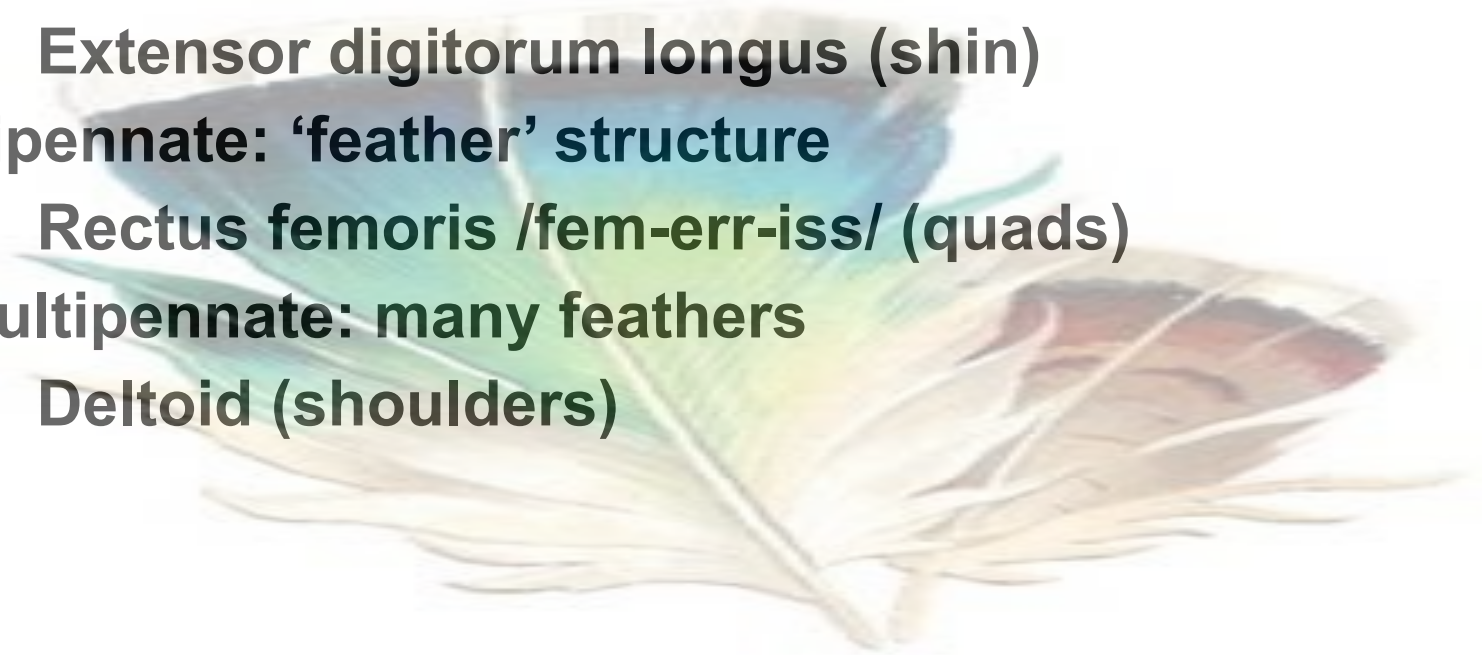
Parallel

- **Strap-like muscles**
 - Sartorius (thigh) muscle
- **Spindle shaped w/ expanded belly**
 - **Also considered a fusiform /fuze-form/ muscle category**



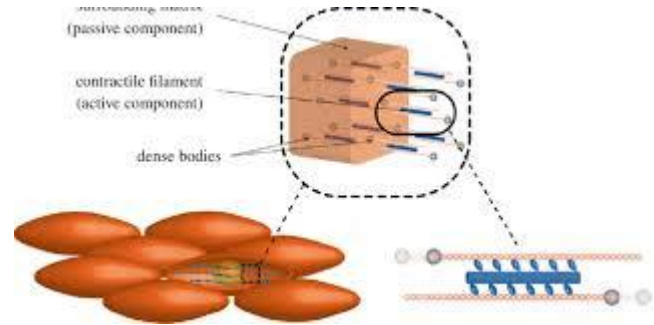
Biceps brachii

- **Pennate:** attaches to the side of the central tendon
- **Unipennate:** half- feather
 - Extensor digitorum longus (shin)
- **Bipennate:** 'feather' structure
 - Rectus femoris /fem-err-iss/ (quads)
- **Multipennate:** many feathers
 - Deltoid (shoulders)



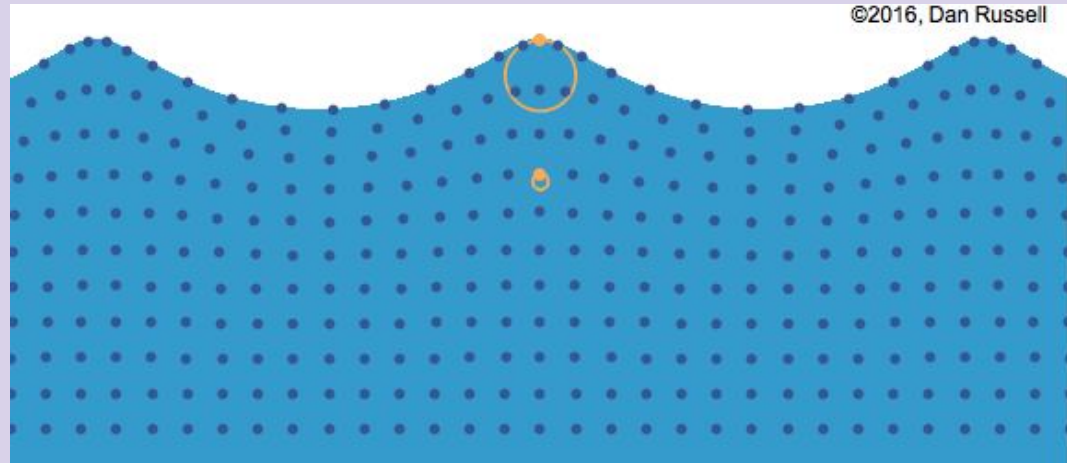
2 of 3 Muscular Tissue: **SMOOTH**, pp 305-311

- Muscle in the walls of all the body's hollow organs
- Microscopic Structure
 - Spindle shaped
 - Nucleated
 - Blended with Endomysium
 - Organized in sheets



Peristalsis, p. 306

- **Wave-like contractions of internal organ's pathway**
 - **2 Types**
 - **Expulsion**
 - **Constriction**



CONSTRICTION

- **Asthma**
- **Stomach cramps**



EXPULSION

- **Digestive tract**
- **Rectum**
- **Urinary bladder**
- **Uterus**



2 Types of Smooth Muscle, pg. 311

Single-Unit

- Fibers composed of sheets
- Responds to chemical stimuli
- Organs & pathways

Multiunit

- Customized fibers
- Responds to neural stimuli
- Arrector pili
- Pupil- contraction/dilation

H.I.- Muscular Dystrophy

- Muscle-destroying disease
- 9 types

***Myotonic**

***Duchenne**

***Becker**

***Limb-girdle**

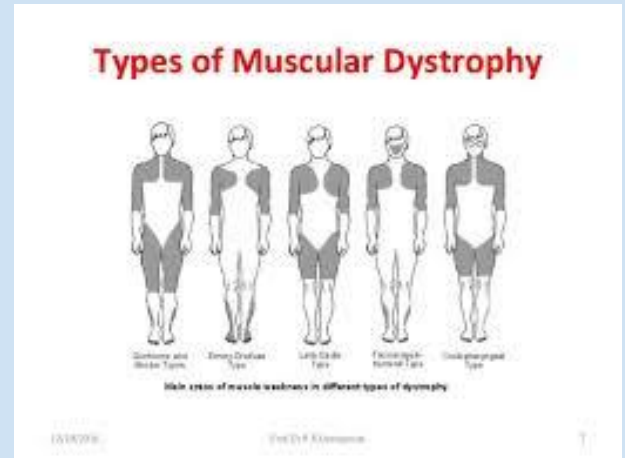
***Facioscapulohumeral**

***Emery-Dreifuss**

***Distal**

***Oculopharyngeal**

***Congenital**



Factors UNRELATED TO M.D.

- Surgery cause muscle weakness
- Toxic Exposure
- Medication- side effects
- Neuro-muscular?



4 Functional Groups, p. 321 groups of muscles achieve movement

1. Agonist
2. Antagonists
3. Synergists
4. Fixators



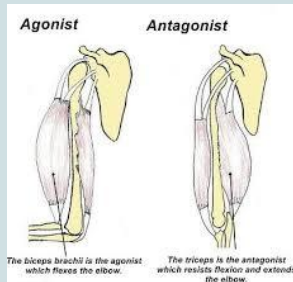
AGONIST

- Targeted muscle
- Aka Prime Mover



ANTAGONIST

- Muscles that oppose or reverse the agonist
- Stretched or Relaxed when agonist is contracted
- HELPS REGULATE PRIME MOVER
- OPPOSITE SIDE OF AGONIST

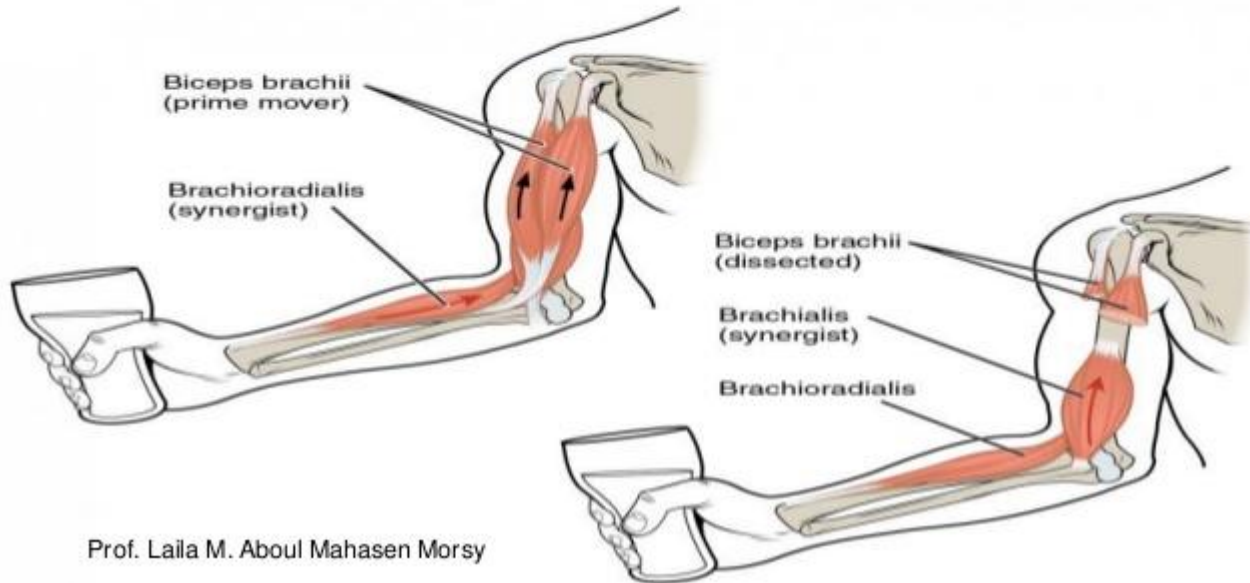


SYNERGIST

- **Group of muscles and joints work towards the objective of the movement**
 - **Adds extra force**
 - **Reduces unnecessary movements**

Synergist

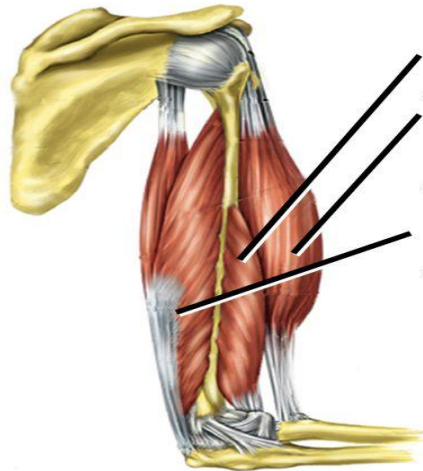
- **Synergist** are other muscles that work together with the prime mover to produce a common action .
- When the prime mover crosses 2 or more joints , synergists prevent undesired action at the intermediate joints .



FIXATOR

a stabilizer that acts to eliminate the unwanted movement of an agonist's, or prime mover's, origin.

Muscle Actions during Elbow Flexion



- Prime mover = brachialis
- Synergist = biceps brachii
- Antagonist = triceps brachii
- Fixator = muscle that holds scapula firmly in place such as rhomboids