The background of the slide is a photograph of a beach scene. On the right side, there is a prominent sign that reads "The Original Location of MUSCLE BEACH". The sign is white with a blue border and is mounted on a metal post. In the background, there are palm trees, a sandy beach, and a clear blue sky. The overall scene is bright and sunny.

Ch. 9: Muscles & Muscular Tissue

Ch. 10: Muscular System

QUIZ: Dec 6&7

SKELETAL MUSCLE- the voluntary muscle

- Composed of muscle fibers, veins, arteries, nerve fibers and connective tissue
 - Vessels provide rich blood supply as it takes energy
 - Gives off metabolic waste removed through veins
 - Connective tissue: epimysium, perimysium, endomysium
 - 1 muscle fiber = many myofibrils



\$115 MILLION

2014 ALS Ice Bucket Challenge

67%

20%

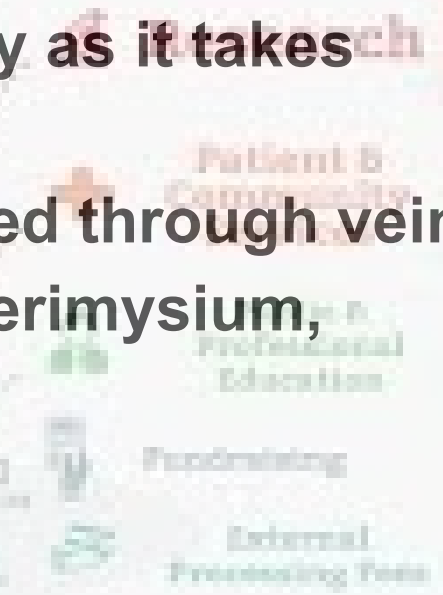
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We are forever grateful for the generous support we received from the ALS Ice Bucket Challenge.

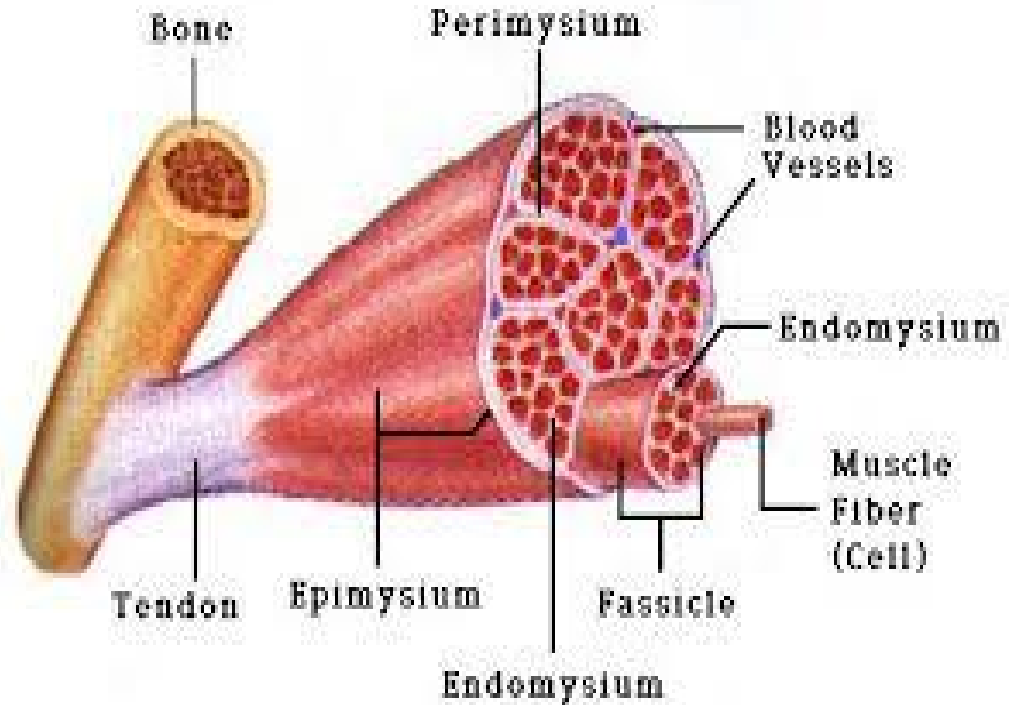
The ALS Association is leading the fight to find treatments and a cure for ALS through research, care services, and public policy programs.



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

Deep → Superficial

- a. Myofibril**
- b. Muscle fiber**
- c. Endomysium**
- d. Fascicle**
- e. Perimysium**
- f. Epimysium**



Bone vs Skeletal Muscle



Lamella

myofibril

Osteon

muscle fiber

Compact bone

fascicle

Lacunae

endomysium

Endosteum

perimysium

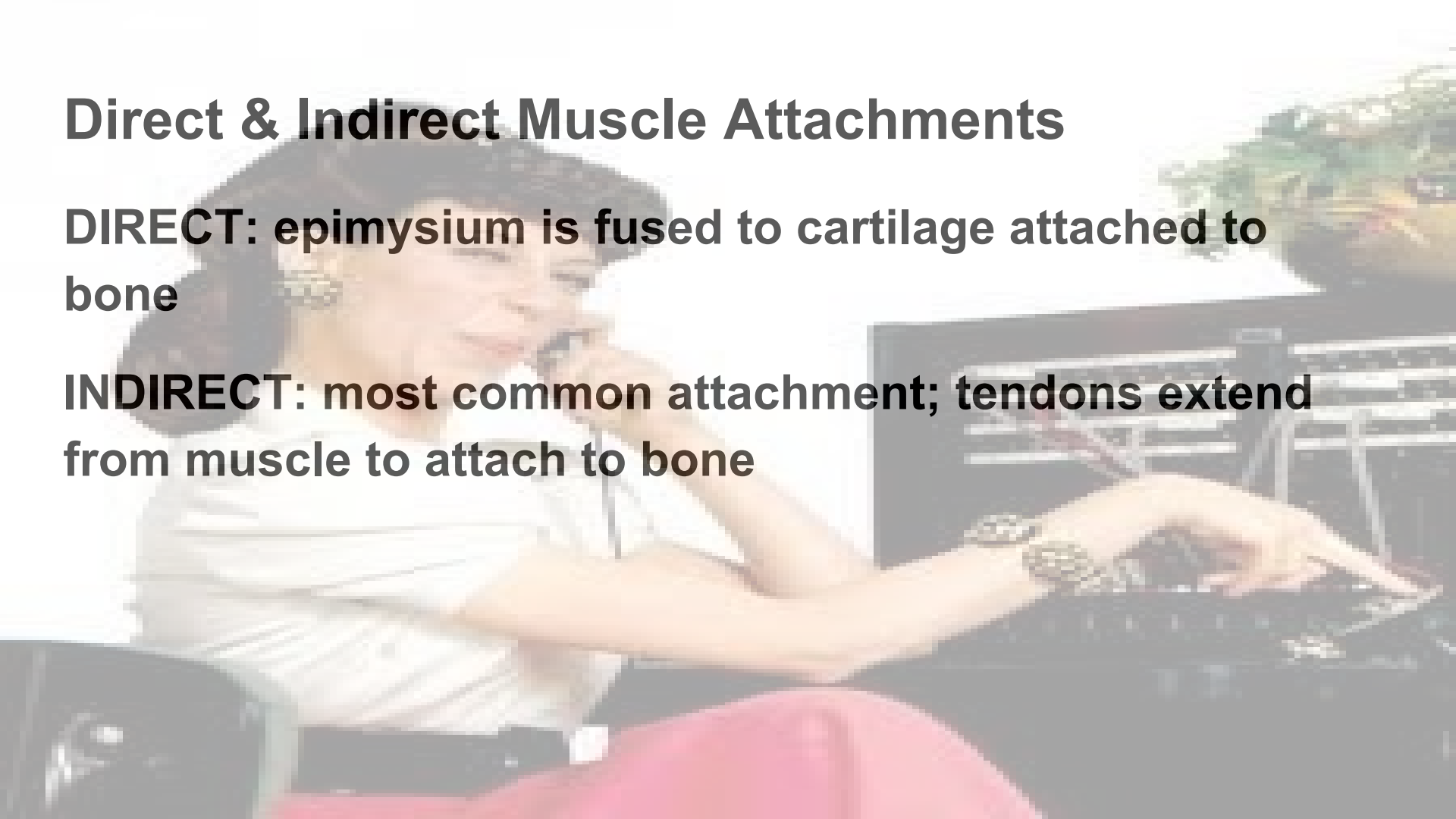
Periosteum

epimysium

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



Rigor Mortis

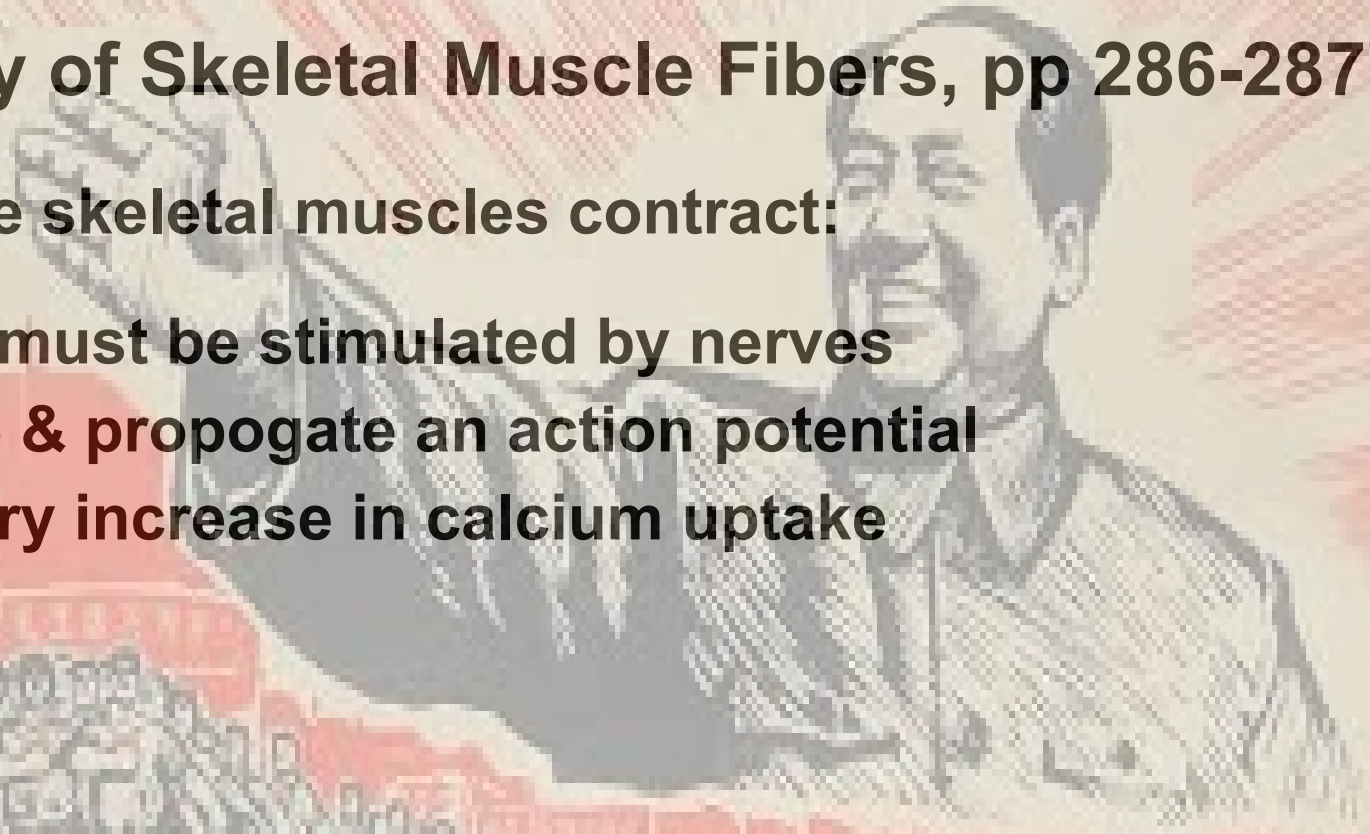
- **After death, ATP is still at work causing for muscles stiffen 3-4 hours after death**
- **Dying cells are unable to exclude calcium**
- **When breathing stops, ATP synthesis stops**



Physiology of Skeletal Muscle Fibers, pp 286-287

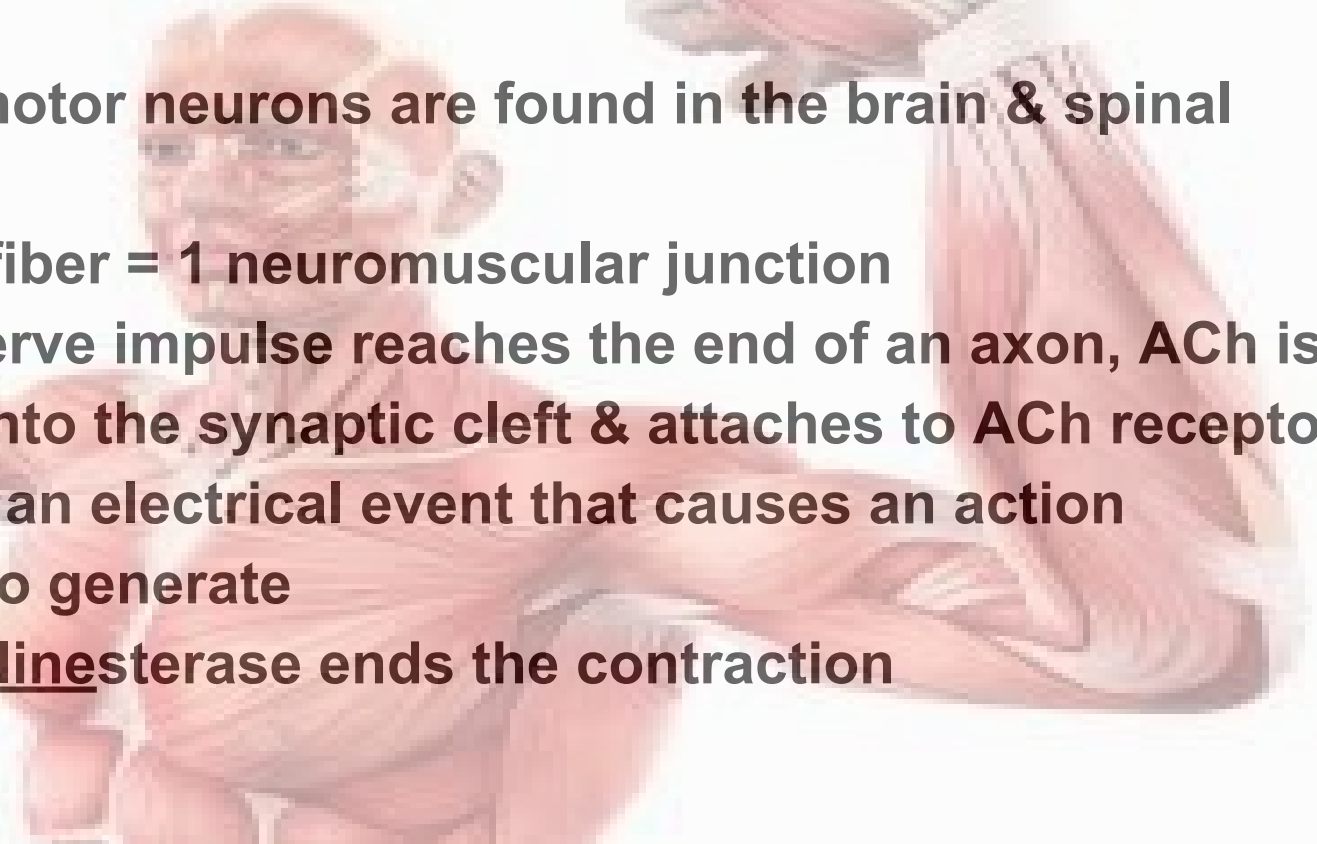
How to make skeletal muscles contract:

1. Muscles must be stimulated by nerves
2. Generate & propagate an action potential
3. Temporary increase in calcium uptake



Steps 1&2, How muscles contract: fig. 9.8, pp 286-287

- **Somatic motor neurons are found in the brain & spinal cord**
- **1 muscle fiber = 1 neuromuscular junction**
- **When a nerve impulse reaches the end of an axon, ACh is released into the synaptic cleft & attaches to ACh receptor, triggering an electrical event that causes an action potential to generate**
- **Acetylcholinesterase ends the contraction**



E-C Coupling = 3rd step of calcium uptake

- **Excitation-Contraction Coupling**
- **Fig. 9.11, pp 290-291 summarize how myosin connects with actin on the cellular level**
- **Results in a CROSS BRIDGE CYCLE**
 - **How $ADP + p = ATP$**

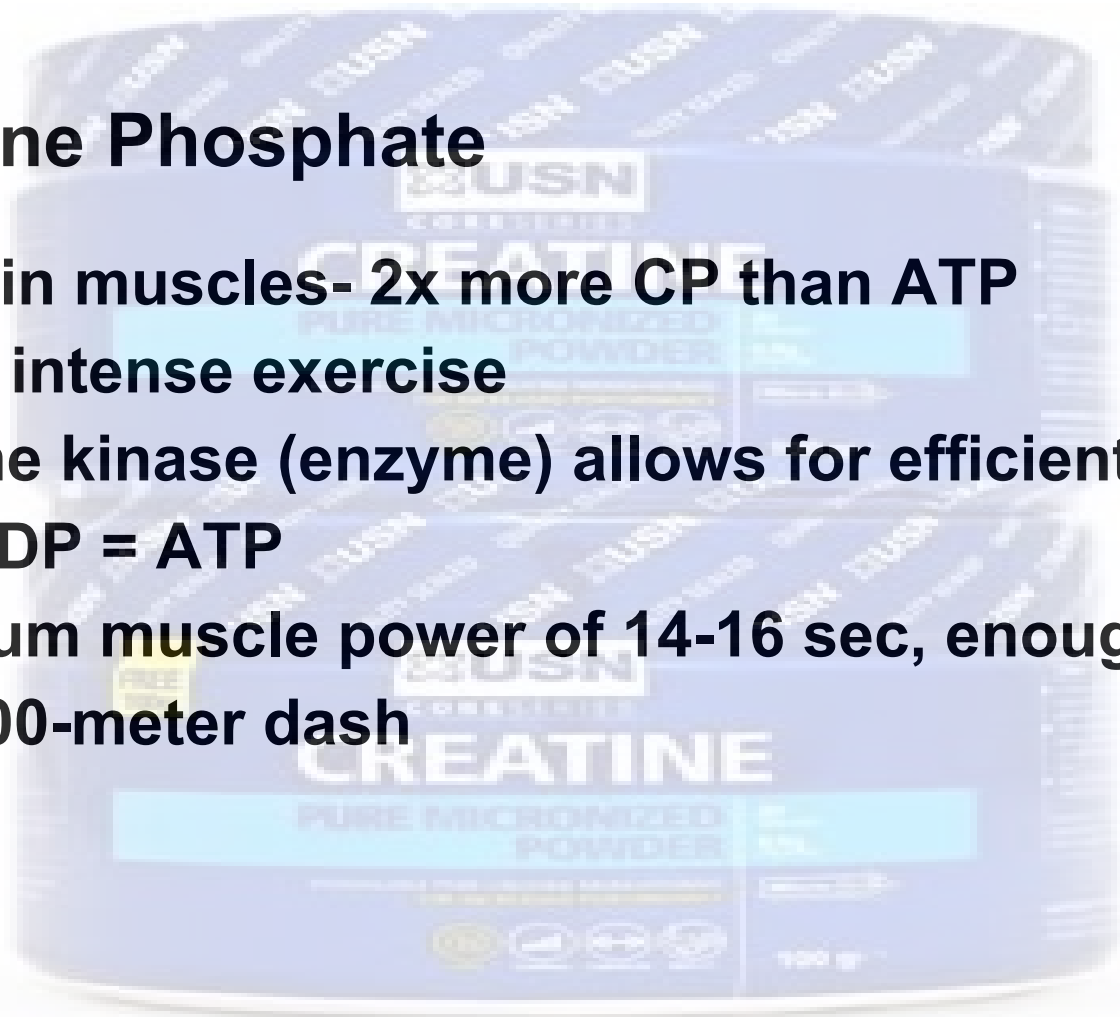
Muscle Metabolism



- **ATP storage in muscle is in small amts**
- **Must have a continual source of ATP for contractile activities**
- **3 ways in how to +p**
 1. **Creatine phosphate**
 2. **Anaerobic respiration**
 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



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 pyruvate
- 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

Fascicle arrangements in muscles, fig.10.1,pg322

- 1 Fascicle = many muscle fibers
- 7 patterns

1. Circular

2. Convergent

3. Parallel

4. Unipennate

5. Bipennate

6. Fusiform

7. Multipennate

(a) Circular
(orbicular oris)

(b) Convergent
(pectoralis major)

(c) Parallel
(sartorius)

(d) Unipennate
(deltoid)

(e) Unipennate
(extensor digitorum longus)

(f) Bipennate
(pectus femoralis)

(g) Fusiform
(biceps brachii)

(h) Multipennate
(deltoid)

Source: © 2012 McGraw-Hill Education

Circular Fascicles

- Forms a concentric ring
- Found in external body openings
- 'squeezers'
- **SPHINCTERS**



Convergent

- Fan or triangular shape
- 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: how muscles attach to the tendon**
- **Unipennate: half- feather**
 - **Extensor digitorum longus (shin)**
- **Bipennate: 'feather' structure**
 - **Rectus femoris /fem-err-iss/ (quads)**
- **Multipennate: many feathers**
 - **Deltoid (shoulders)**

