

Introduction to Muscle

Why is muscle important to humans?

- Movement
- Posture (stabilize joints)
- Heat Production (shivering)

❖ break up of ATP releases energy!

How muscles are named

Action of the muscle

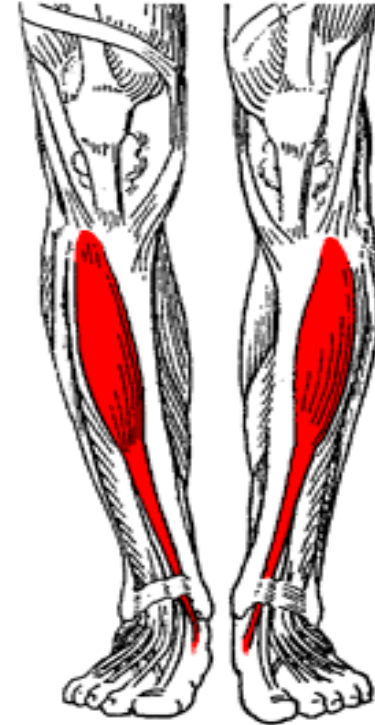
- Flexor carpi ulnaris



How muscles are named

Location of Muscles

- Tibialis anterior

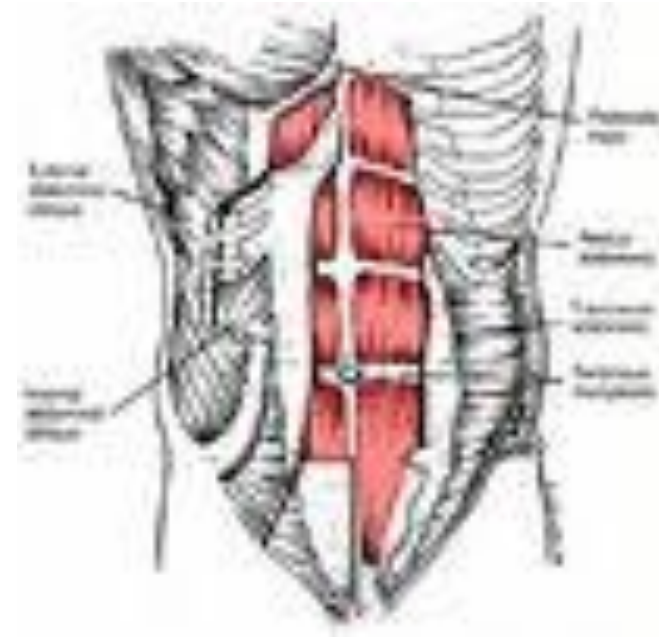


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How muscles are named

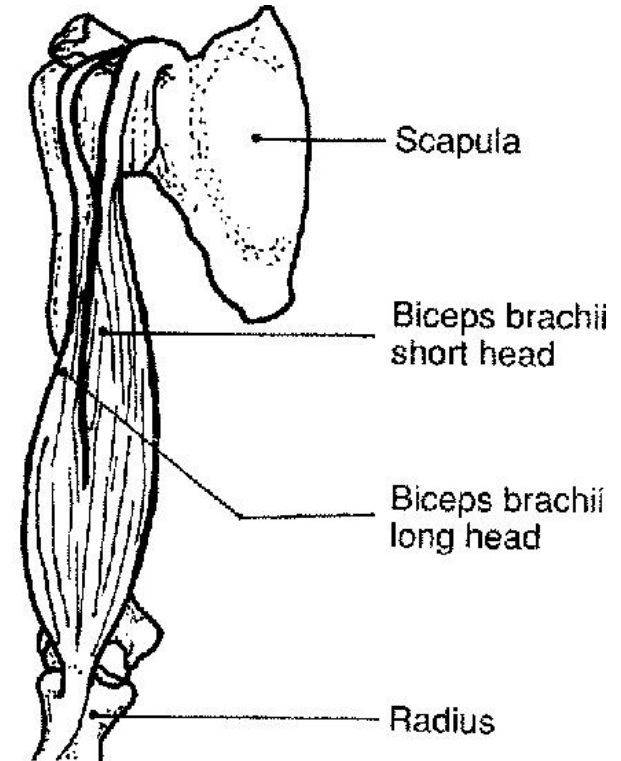
Direction of Muscle fibres

- Rectus abdominus



How muscles are named

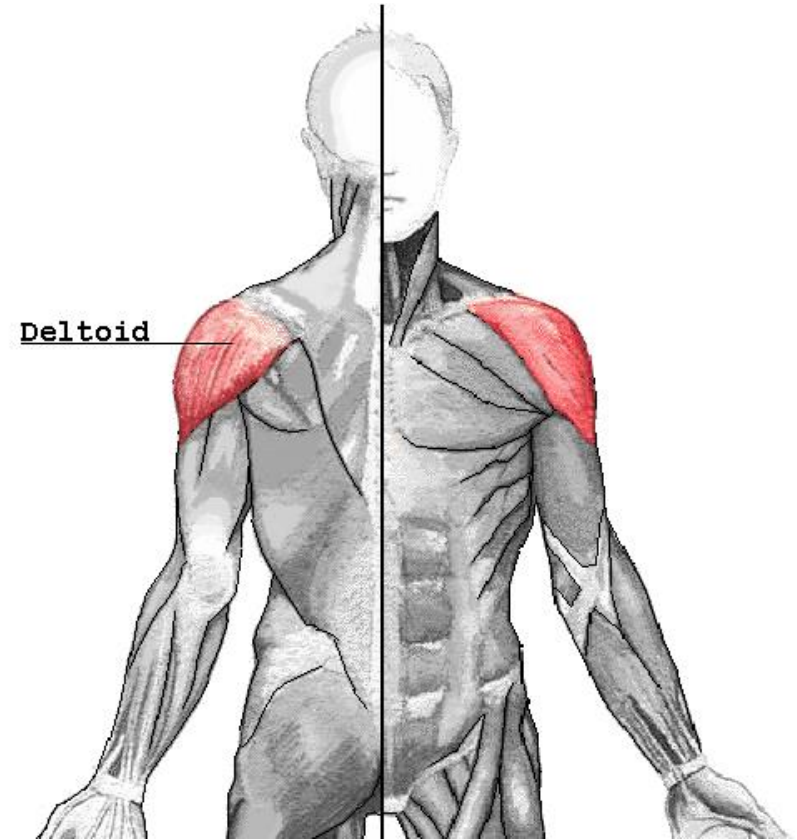
Number of Divisions/heads
(biceps brachii)



How muscles are named

Shape of muscle

(Deltoid resembles the Greek letter delta)



How muscles are named

Point of attachment

Sternocleidomastoid is attached at the sternum, the clavicle, and mastoid bone



Basic Physiological Properties of Muscle

Contractility

- Ability to shorten (always pull, never push)

Excitability

- ability to receive and respond to a stimulus

Extensibility

- ability to be stretched

Elasticity

- -ability to return to its original shape after being stretched

Conductivity –Ability to transmit nerve impulses

Types of Muscle Contractions

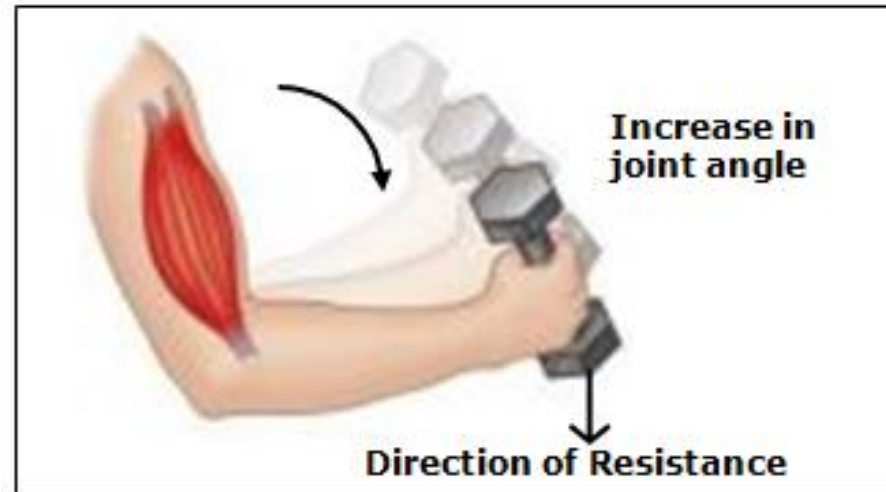
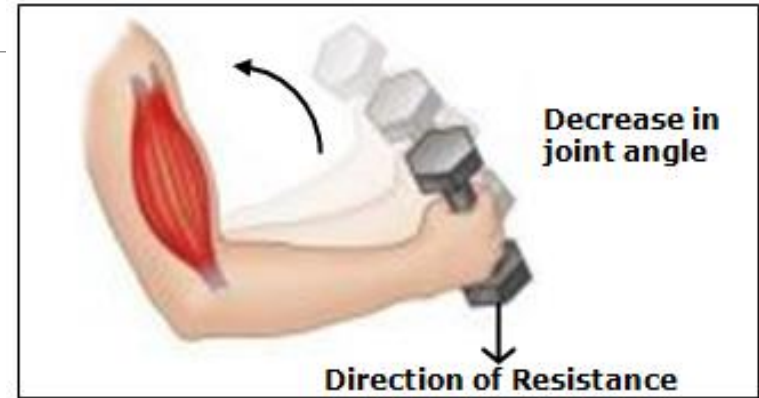
Isometric contraction - Produces force yet muscle remains at a constant length

-No joint movement

Concentric Contraction - Muscle produces force with visible shortening

-(positive movement, against gravity)

Eccentric Contraction - External Force is greater than the force within the muscle. Active lengthening of the muscle



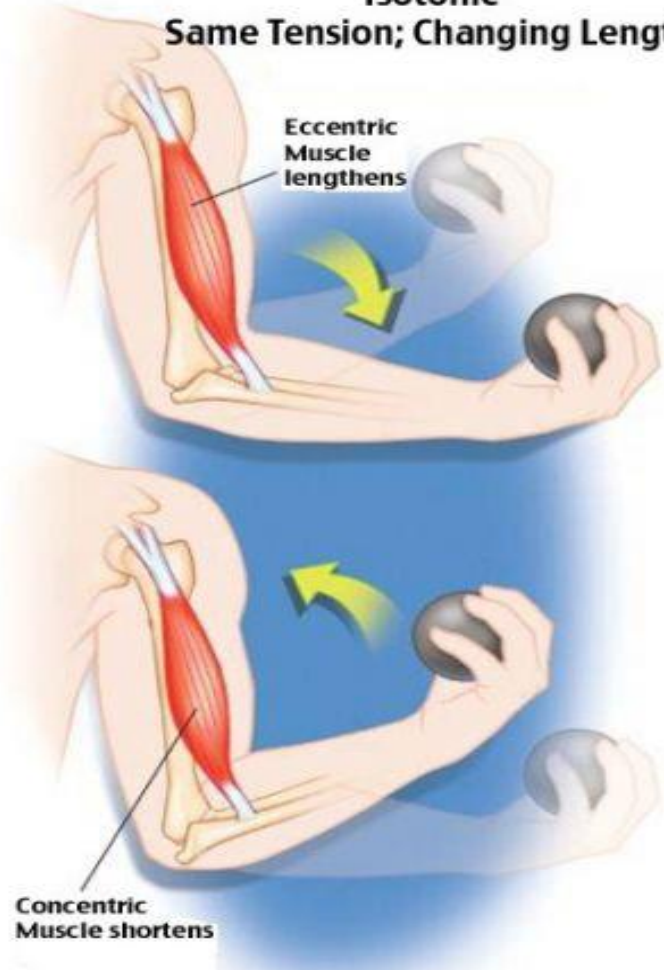
Types of Muscle Exercise

Isometric - Same length in muscle during the entire movement (thus no movement)

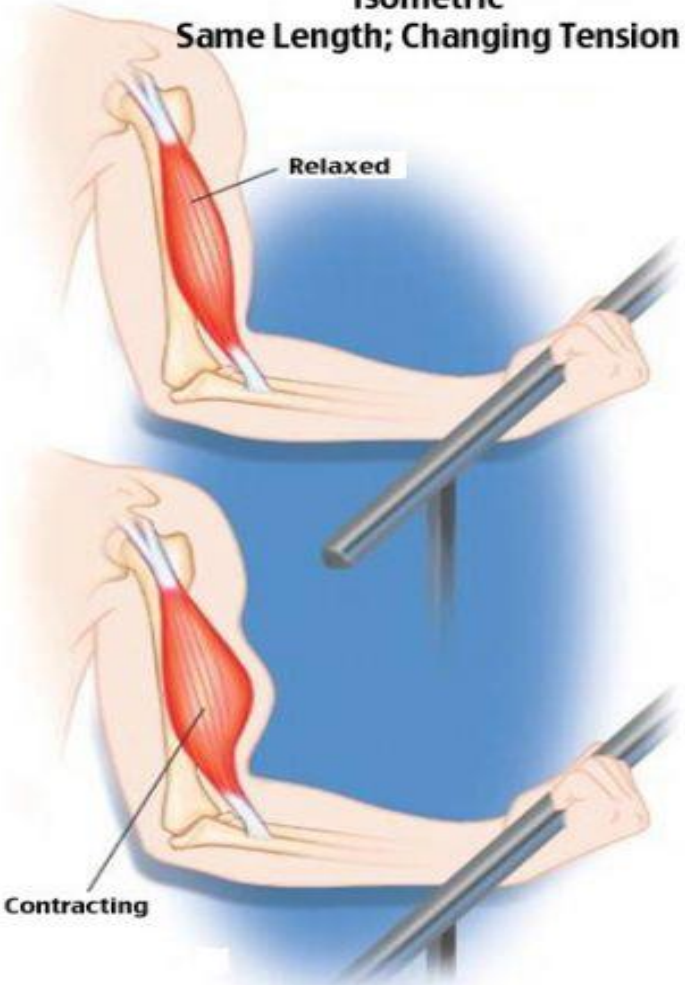
Isotonic - Same tone in muscle during entire movement (resistance is the same during movement thus speed changes at different points.)
ex. Biceps curl

Isokinetic - Same speed of movement throughout the entire movement (the speed is the same throughout thus the resistance changes) ex. nautilus machine

Isotonic
Same Tension; Changing Length

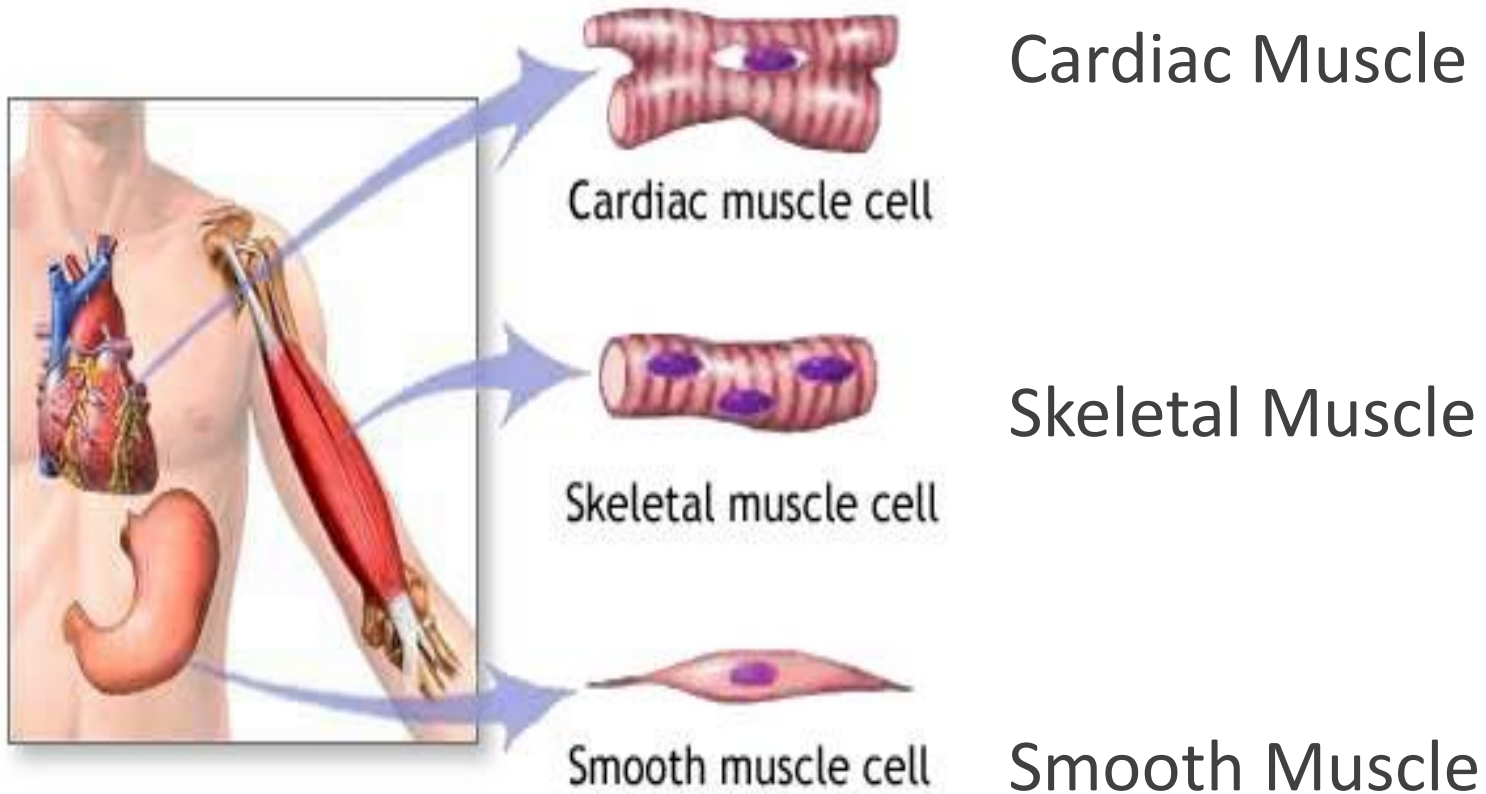


Isometric
Same Length; Changing Tension



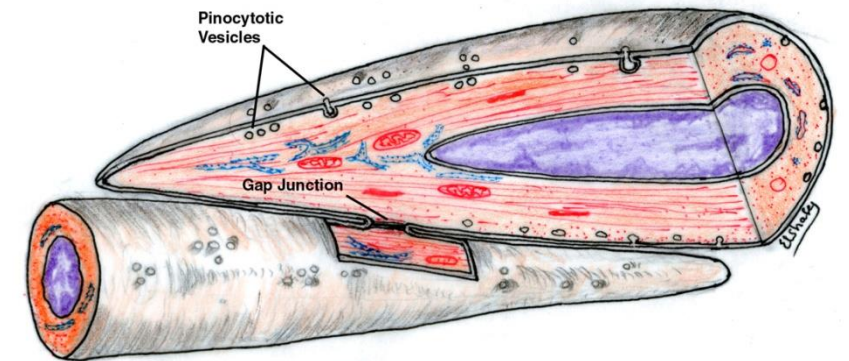
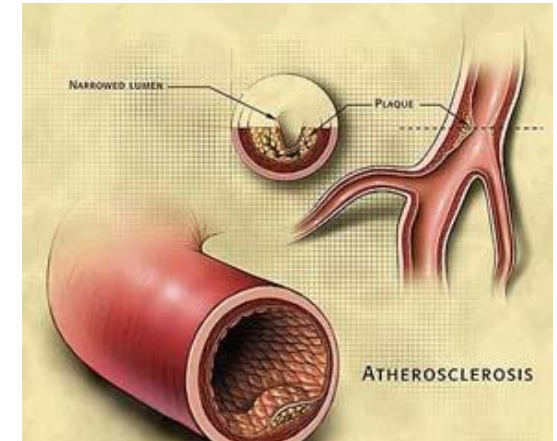


Types of Muscle Tissue



Smooth Muscle

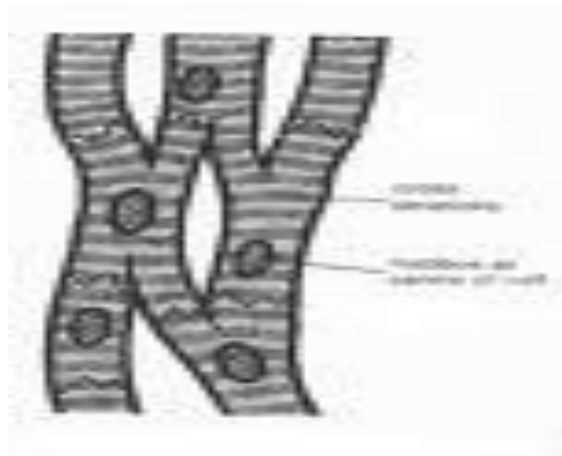
- Appearance-long tapered cells with centrally placed nuclei (one)
- Smooth looking (non striated)
- Located in the walls of organs (visceral organs)
- Rhythmic Contractions (stomach, arteries)
- Respond to hormones and autonomic nerves
-(e.g. menstrual cramps)



Cardiac Muscle

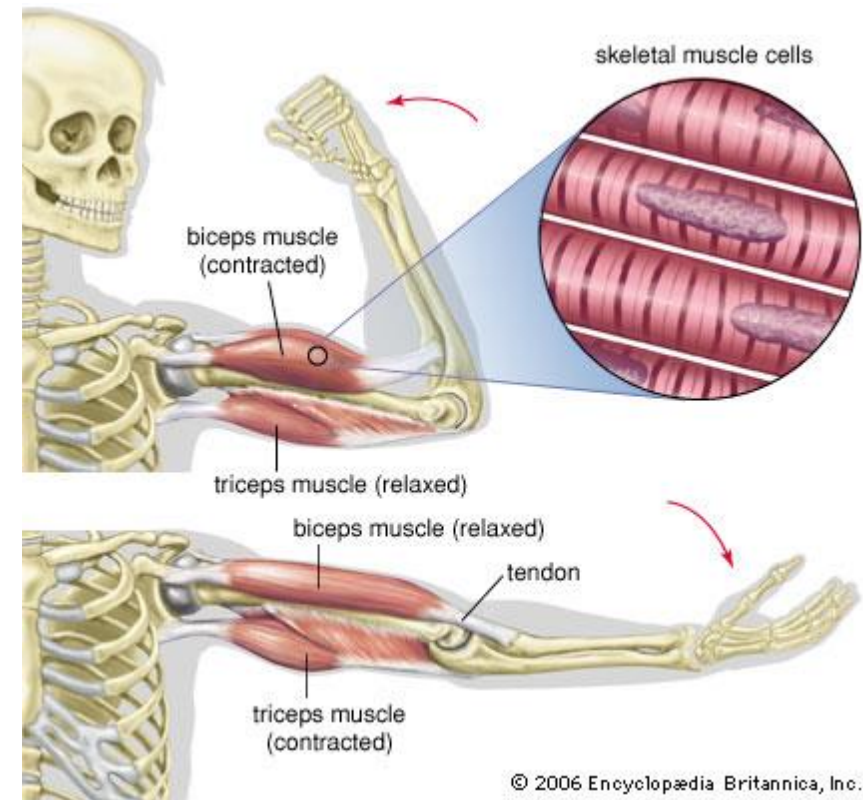


- Make up the Heart Muscle
- Branched appearance
- 1 or 2 centrally placed nuclei
- Highly Vascularized



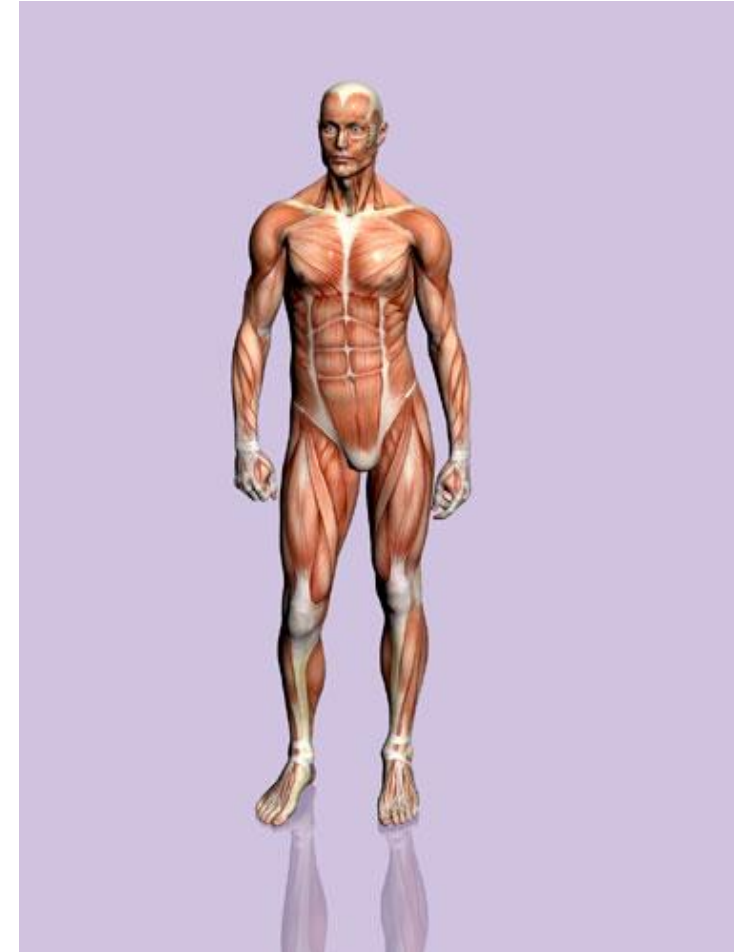
Skeletal Muscle

- Also known as; Striated Muscle, or Voluntary muscle
- Is skeletal muscle always voluntary?
 - Posture, muscle tone
- Individual Muscle cells are called Muscle Fibers



Skeletal Muscle Cont...

- skeletal Muscle is a tissue that contains muscle tissue, connective tissue, nerves and blood vessels
- Muscle Fibers are Long Cylindrical In shape and contain many nuclei
- Skeletal Muscle fibers can be specialized (Red, White, Intermediate)

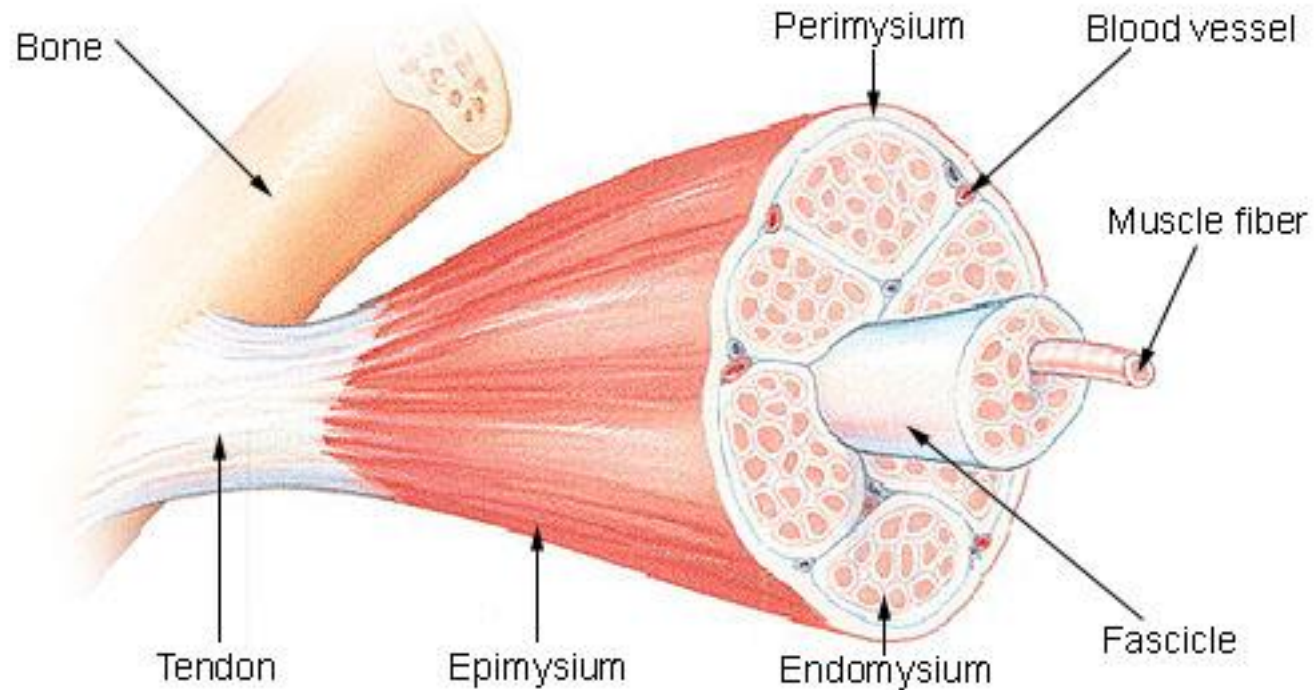


Muscle Structure

- The Epimysium (CT) covers the body's 430 or more skeletal muscles.
- The tendons are attached to the connective tissue on the bone known as the Periosteum (CT)
- Under the Epimysium the muscle fibers are grouped together in bundles called (Fasciculi) Fascicle
- A Fascicle may contain up to 150 muscle fibers
- Muscle Fascicle is surrounded by Perimysium(CT)
- The individual Muscle Fibers inside the Fascicle are surrounded by Endomysium (CT)

Structure of Muscle

Structure of a Skeletal Muscle



Structure of muscle cont...

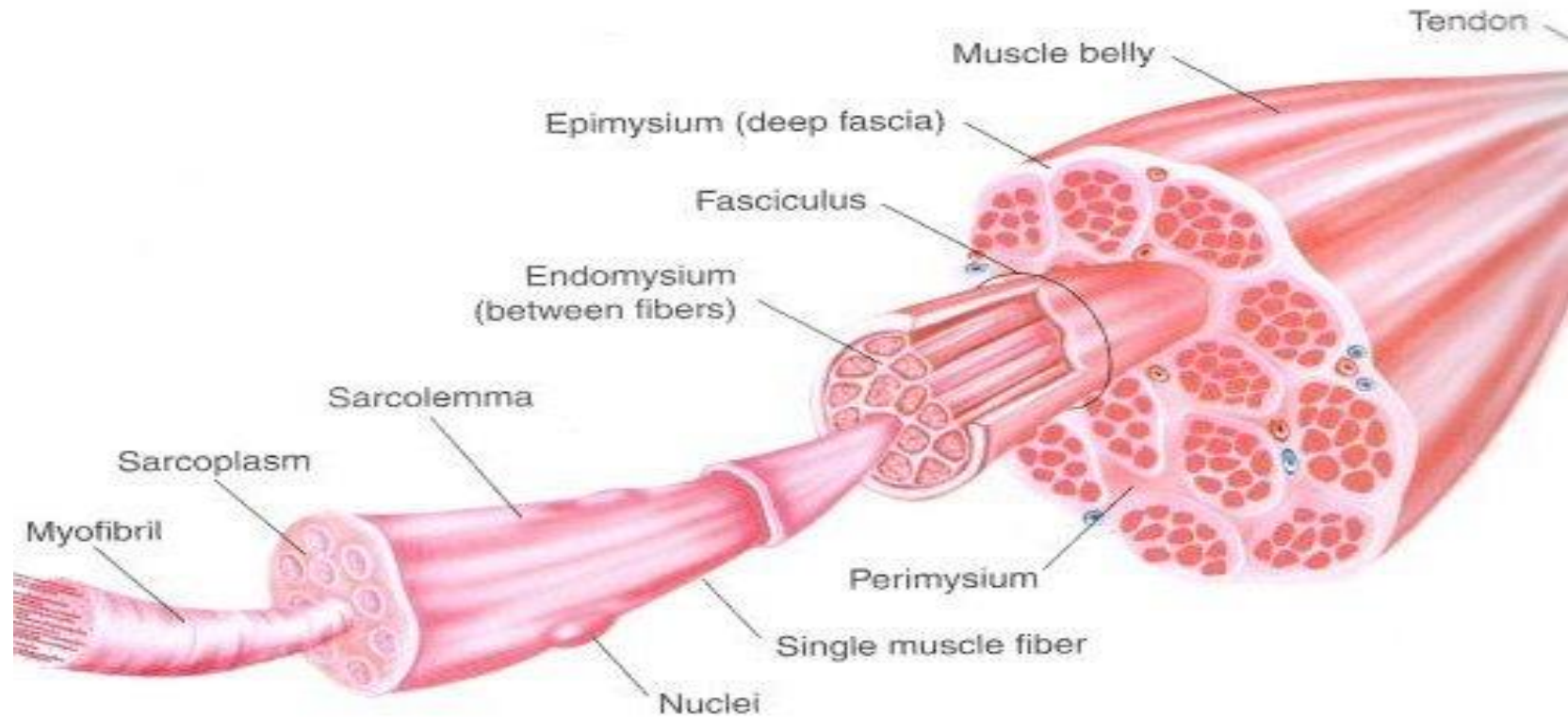
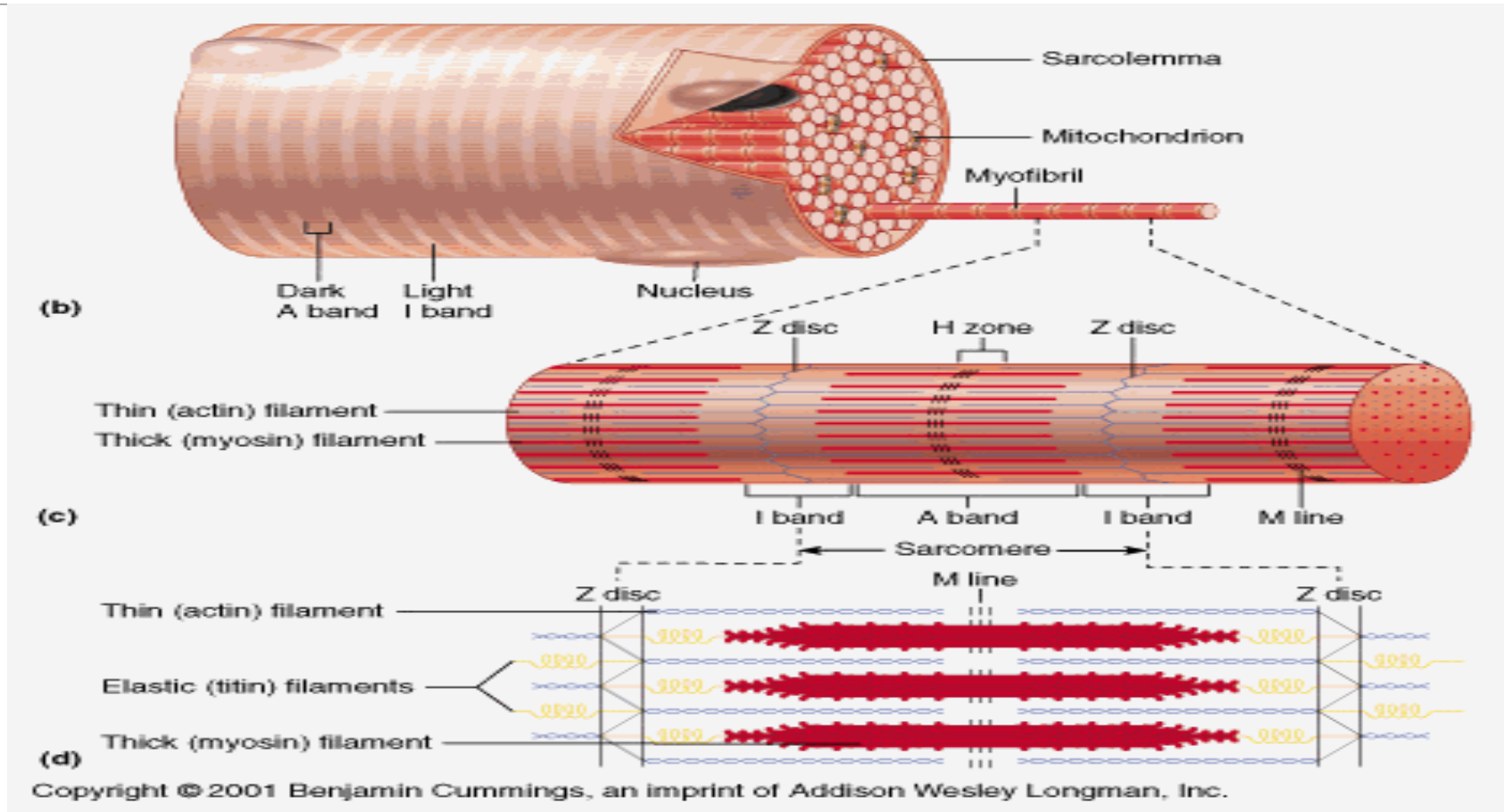
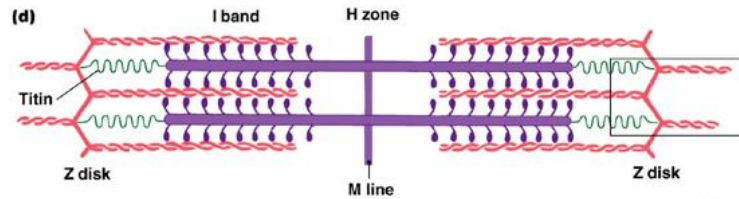
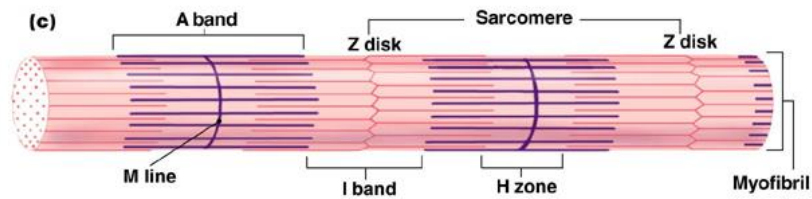


Figure 1: Muscle belly split into various component parts (from Essentials of Strength Training & Conditioning, National Strength & Conditioning Association)

Myofibril

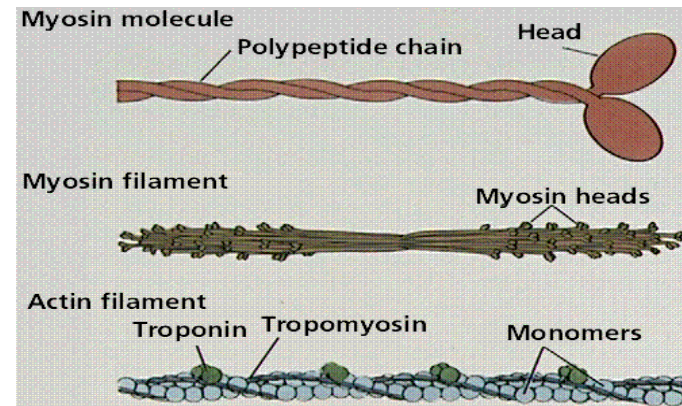
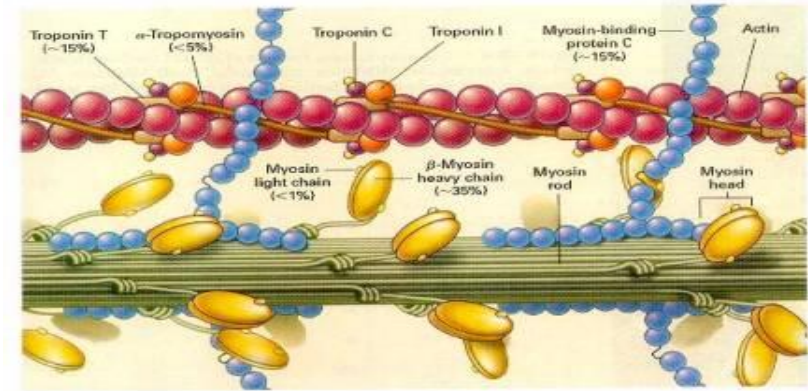


Myofibril



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Fig. 12-3



How Does Muscle Contraction Occur?

The Nervous System (brain and spinal cord) must work in conjunction with muscles in order to activate and deactivate muscles at alarming rates in order to produce movement.

Neuromuscular System

- Refers to the complex linkages between the muscular system and the brain and spinal cord.
- When kicking a soccer ball, or lifting a dumbbell, muscles contract in a smooth and efficient sequence. In order for this to occur, a message is created and sent down the brain and spinal cord to the area/muscles needed.

Neuromuscular System

- <http://www.youtube.com/watch?v=ZscXOvDgCmQ>

<http://www.youtube.com/watch?v=70DyJwwFnkU>

Muscle Contraction

Step by step muscle contraction

http://media.pearsoncmg.com/bc/bc_0media_ap/apflix/ap/ap_video_player.html?cbc

Video:

<http://www.youtube.com/watch?v=CepeYFvqmk4>

Muscle contraction Summary

- Action Potential (chemical message) is initiated in CNS and travels down to the Synaptic Cleft and causes Acetylcholine (ACH) to be released across the Neuromuscular Junction
- ACH binds to receptors on the Sarcolemma which open Sodium/Potassium channels and allow Sodium to rush into the cell/muscle fibre

Cont..

- As Sodium rushes into the cell, the action potential travels through the entire muscle including the t-tubules.
- This causes a release of Calcium (Ca^{++}) from the sarcoplasmic reticulum into the sarcoplasm (inside cell)
- Calcium then binds to troponin which pulls tropomyosin off of the myosin binding sites on the actin molecules

Cont..

- Myosin and Actin bind and ATP is dissociates into ADP and Pi and Energy which is used for one power stroke. The process is repeated as long as there are sufficient ATP and Ca^{++} is present in the cell
- To end the contraction, Ca^{++} must be transferred back to the Sarcoplasmic Reticulum via the Calcium pump. This process is again initiated via the CNS and requires ATP!

Tasers

TASER® M18L with Laser Sight

Length 6.50" (13.26 cm)
Length w/ Cartridge 8.00" (20.32 cm)
Height 6.00" (15.24 cm)
Width 1.50" (3.81 cm)
Weight 18 oz (510.28 g)



PROBES

Two barbed probes fire from the M18 up to 15 feet to deliver the charge. The charge can be delivered through two inches of clothing.

Cartridge

Probes

TAGS

Tiny identification tags are released when the weapon is fired. Each tag is marked with the serial number of the cartridge that fired for greater accountability.

Tags

<http://www.youtube.com/watch?v=95qZtwJNjxk&NR=1&feature=fvwp>