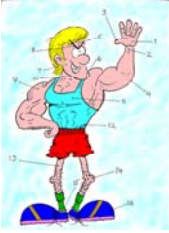


Slide 1

Muscular System

- Introduction
 - First in mind: weight lifters
 - Don't forget: heart muscles and muscles surrounding organs!!!!



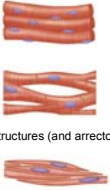
Slide 2

- Basic Functions of the Muscular system
 - Movement
 - Maintenance of Posture
 - Joint Stabilization
 - Heat Generation

Slide 3

Types of Muscle Tissue

- **Skeletal muscle tissue**
 - moves bones (and, in some cases, skin and other soft tissues)
 - striated
 - voluntary
- **Cardiac muscle tissue**
 - forms most of the wall of the heart
 - striated
 - involuntary
 - some cells have autorhythmicity
- **Smooth muscle tissue**
 - located in the walls of hollow internal structures (and arrector pili muscles)
 - nonstriated, i.e., smooth
 - involuntary
 - some cells have autorhythmicity



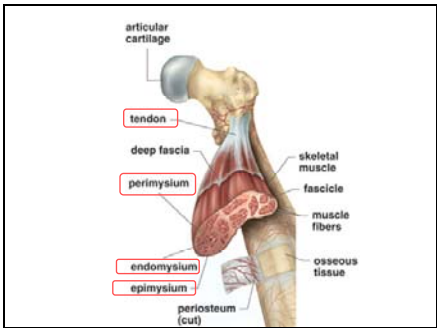
Slide 4

- Basic Functions of the Muscular system
 - Movement
 - Move body by moving bone
 - Also move visceral organs > squeezing fluid through hollow sections
 - Maintenance of Posture
 - Some skeletal muscles contract in order to maintain standing or sitting position
 - Joint Stabilization
 - Muscle tone = low level of contractile force by muscle even when not moving
 - ie keeps tension on tendons crossing over joints
 - Heat Generation
 - Contractions = heat > help maintain normal 37°C body temp
 - ATP breakdown

Slide 5

- Anatomy of Skeletal Muscle
- Connective Tissue Components
(All are components or extensions of deep fascia)
 - Epimysium (External)
 - Dense irregular connective tissue surrounding entire muscle
 - Sometimes lies between muscles
 - Connect to Tendons
 - Perimysium
 - Fibrous CT around each fascicle (bundles of MF)
 - Endomysium (Internal)

Slide 6

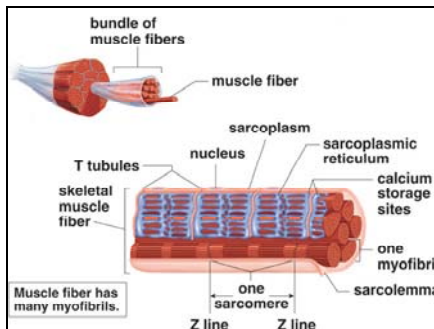


Slide 7

Anatomy of Skeletal Muscle

- Histology of SkM
 - Muscle Fibers = Muscle cells
 - Huge cells 10-100µm
 - Can reach cm in length
 - Sarcolemma= membrane
 - Sarcoplasm= cytoplasm
 - Internal area of sarcolemma (fluid and structures)
 - O-binding protein **myosin**

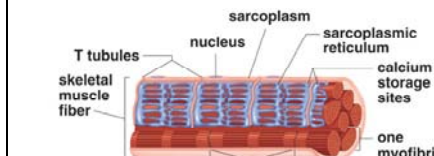
Slide 8



Slide 9

Anatomy of Skeletal Muscle

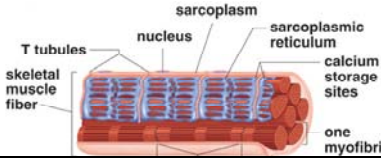
- Sarcoplasmic Reticulum
 - similar to smooth ER
 - A Tubular system (surrounds myofibrils)
 - Contains Ca⁺ ions which are essential for contraction



Slide 10

Anatomy of Skeletal Muscle

- T tubules = Transverse Tubules
 - Invaginations of sarcolemma
 - Pass all the way through a fiber at right angles
 - Allow nerve impulses to reach inner part of a fiber
 - Action potentials which cause the release of Ca^{+2} from the SR

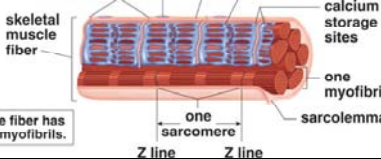


The diagram shows a cross-section of a skeletal muscle fiber. It is a long, cylindrical cell with multiple nuclei located at the periphery. The interior is filled with sarcoplasm. Transverse tubules (T tubules) are shown as invaginations of the sarcolemma that run perpendicular to the length of the fiber. Sarcoplasmic reticulum is located near the T tubules and contains calcium storage sites. A single myofibril is visible within the fiber.

Slide 11

Anatomy of Skeletal Muscle

- Sarcomere
 - Basic contractile unit of muscle fiber
 - Myofilaments do NOT extend length of fiber
 - Each extends between 2 Z lines or discs
 - Repeating myofibrils

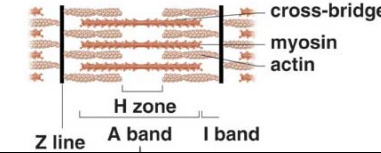


The diagram shows a skeletal muscle fiber with several sarcomeres. A sarcomere is defined as the repeating unit between two Z lines. Labels include: skeletal muscle fiber, calcium storage sites, one myofibril, sarcolemma, one sarcomere, Z line, and Z line. A note states: "Muscle fiber has many myofibrils."

Slide 12

Anatomy of Skeletal Muscle

- Myofilaments
 - Fine filaments making up myofibrils
 - Thick Myofilaments = Myosin
 - » Contains myosin and ATPase enzymes
 - » Center of sarcomere and overlaps Actin

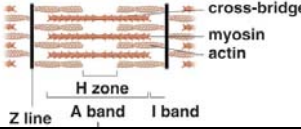


The diagram shows the molecular structure of myofilaments. Thick myosin filaments are shown with myosin heads (cross-bridges) extending from them. Thin actin filaments are shown overlapping the myosin filaments. Labels include: cross-bridge, myosin, actin, H zone, Z line, A band, and I band.

Slide 13

Anatomy of Skeletal Muscle

- Myofilaments
 - Fine filaments making up myofibrils
 - Thin Myofilaments = Actin
 - » Contains actin protein mostly
 - » Attaches Z line
 - » 2 regulatory proteins
troponin & tropomyosin.



The diagram illustrates a sarcomere, the basic contractile unit of skeletal muscle. It shows two vertical Z lines (labeled 'Z line') representing the boundaries. Between the Z lines, there are thick filaments (myosin) and thin filaments (actin). The thick filaments are labeled 'myosin' and have 'cross-bridge' structures extending from them. The thin filaments are labeled 'actin'. The central region where only thick filaments are present is labeled 'H zone'. The region containing thick filaments is labeled 'A band', and the region containing only thin filaments is labeled 'I band'.

Slide 14

Anatomy of Skeletal Muscle

- Z-Lines
 - Narrow zone of dense material
 - Boundary between adjacent sarcomeres
- *Striations***
- A-Band
 - Dark, dense area
 - Represents length of myosin filaments (& some overlap actin)
- I-Band
 - Light, less dense area
 - Contains actin filaments ONLY

Slide 15

Contraction

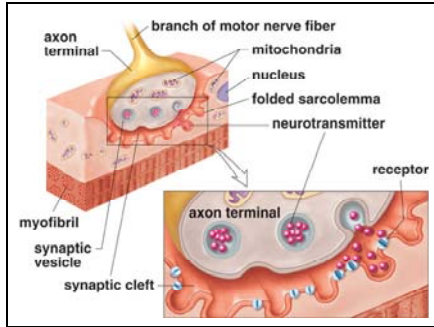
- **Muscle contraction**
 - a muscle action potential is propagated along the
 - sarcolemma through the T tubule system
 - into the sarcoplasmic reticulum
 - Then causes the release of calcium ions into the cytosol
- Muscle contraction = **sliding filament mechanism:**
 - in the presence of ATP & calcium ions
 - myosin cross bridges pull thin filaments toward the center of the sarcomere
 - resulting in a shortening of the sarcomere

Slide 16

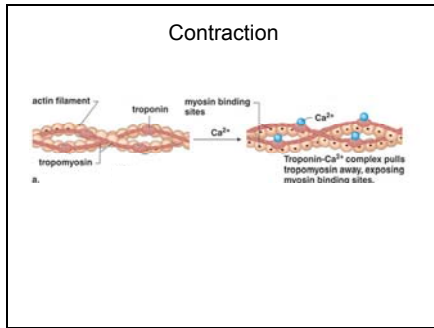
Anatomy of Skeletal Muscle

- Neuromuscular junction
 - Junction between MN and muscle fiber membrane
 - synapse
 - Consists of:
 - Axon terminals of the motor neuron
 - Synaptic cleft
 - Sarcolemma
 - Function
 - chemically transmit electrical nerve impulses from axon of neuron to sarcolemma of muscle fiber

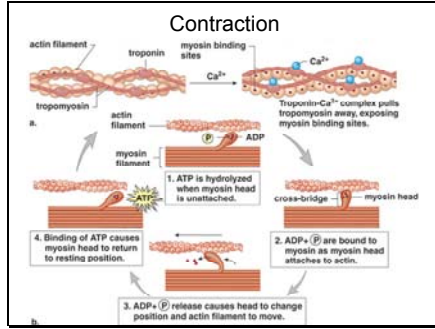
Slide 17



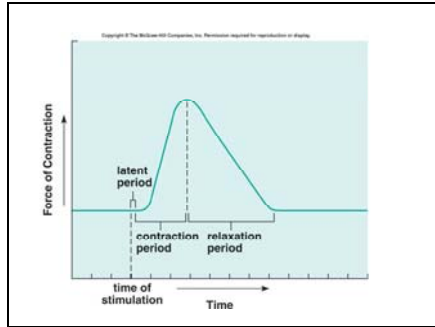
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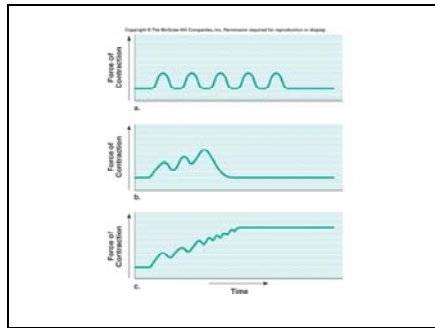
Slide 19



Slide 20




Slide 21



Slide 22

Skeletal Muscles

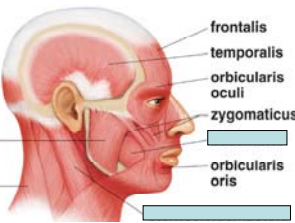
- Naming Muscles
 - Size
 - Shape
 - Direction of fibers
 - Location
 - Attachment
 - # of attachments
 - Action



Slide 23

Skeletal Muscles

- Head & Neck Muscles

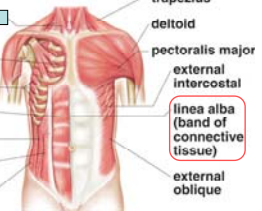


Labels: frontalis, temporalis, orbicularis oculi, zygomaticus, orbicularis oris, masseter, trapezius

Slide 24

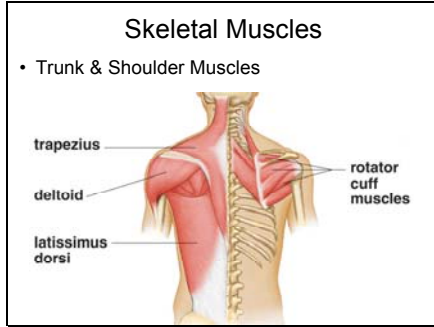
Skeletal Muscles

- Trunk & Shoulder Muscles

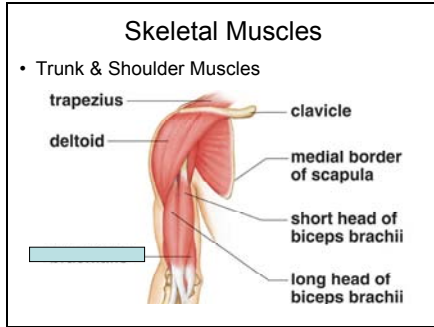


Labels: trapezius, deltoid, pectoralis major, external intercostal, linea alba (band of connective tissue), external oblique, serratus anterior, rectus abdominis, transversus abdominis, external oblique

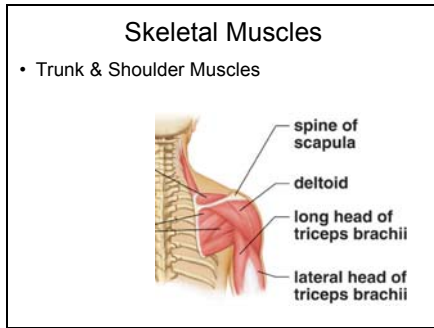
Slide 25



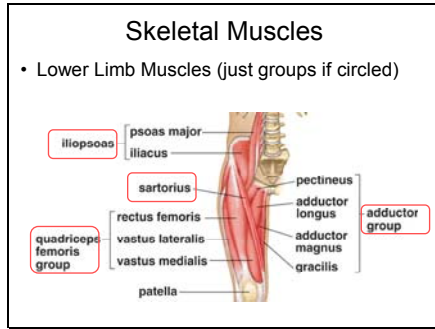
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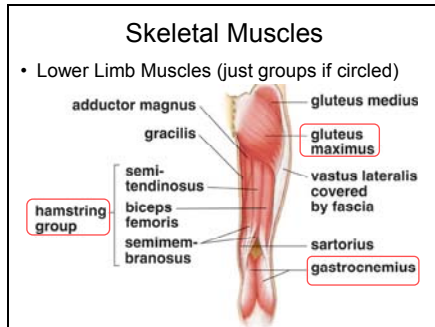
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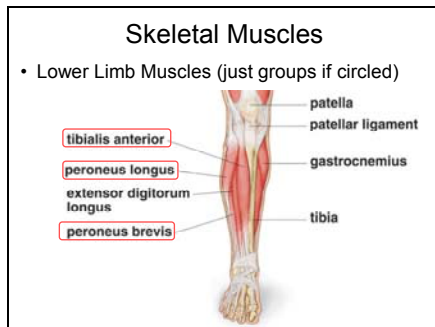
Slide 28



Slide 29



Slide 30



Slide 31

Muscles

Aging and Muscular Tissue

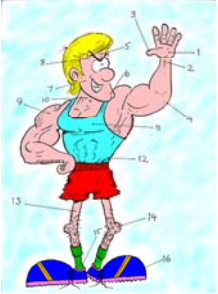
- After 30 years of age
 - progressive decrease in skeletal muscle mass
 - replaced primarily by fibrous CT & adipose tissue
- This is accompanied by a ↓ in maximal strength & a slowing of muscle reflexes
- In some muscles, there is a change in the proportions of the specific types of skeletal muscle fibers

Slide 32

Muscle Disorders

• Spasms <ul style="list-style-type: none">– involuntary contractions	• Tetanus <ul style="list-style-type: none">• Bacterial infection• Rigidly locked jaw
• Strain <ul style="list-style-type: none">– Overstretching	• Muscular dystrophy <ul style="list-style-type: none">• Broad term• Degeneration• Weakness
• Myalgia <ul style="list-style-type: none">– Inflammation of muscle	• Myasthenia gravis <ul style="list-style-type: none">• Autoimmune disease• Weakness
• Tendinitis <ul style="list-style-type: none">– Inflammation of tendons	

Slide 33



Myology
