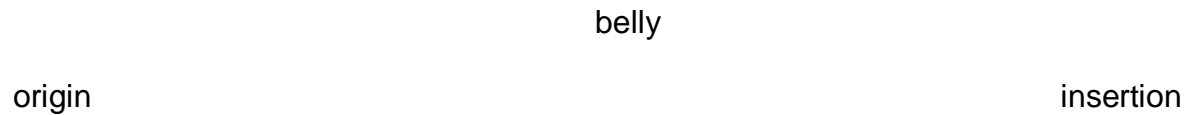


A. gross structure of skeletal muscle

- skeletal muscle cells/fibers run length of muscle
- c.t. holds fibers together and attach them to bones
- nerves and blood vessels travel through c.t. layers



1. c.t. components in muscle

a. endomysium = surrounds each cell

- reticular fibers

b. perimysium = surrounds a group of cells (fascicle)

- fibrous c.t.

c. epimysium = surround entire muscle

- dense irregular c.t.
- may be continuous with fascia

2. attachments

a. direct - fascicles appear to attach directly to bone

b. indirect - tendon attaches muscle to bones

tendon - cord of dense fibrous regular c.t.

aponeurosis - sheet of dense fibrous irregular c.t.

B. histological structure

1. sarcolemma - plasma membrane

a. motor end plate - part of neuromuscular junction

highly folded

contains receptors for the neurotransmitter acetylcholine

b. t-tubules - invaginations of the sarcolemma

adjacent to terminal cisternae of sarcoplasmic reticulum

carry depolarization to interior of cell

t-tubule membrane contains voltage-sensitive proteins called DHP

receptors

cause release of Ca from sarcoplasmic reticulum

2. sarcoplasmic reticulum (SR) - modified smooth endoplasmic reticulum
 - interconnecting tubules surround myofibrils
 - store Ca^{2+}
 - terminal cisternae line up near ends of sarcomeres
 - SR membrane contains Ca channels attached to and controlled by the DHP receptors

3. myofibril - cylindrical bundle of myofilaments (proteins) arranged in a specific pattern

sarcomere - segment of myofibril

myofilament = small bundle made of contractile and regulatory proteins

thick - myosin

thin - actin + troponin complex + tropomyosin

NOTE: the sarcolemma surrounds (is outside of) the sarcoplasmic reticulum (SR), and the SR surrounds the myofibrils

C. sarcomere structure

1. components

- a. thin filaments
- b. thick filaments
- c. titin

2. alignment and striations

Z disc - ends of sarcomere

I zone - thin filaments only at both ends of A zone

A zone - thick and thin filaments

H zone - region in center of A zone containing thick filaments only

M line - middle of H zone

D. types of skeletal muscle cell

most muscles contain all three types
proportions differ among muscles

1. red slow twitch

- high myoglobin content
- many mitochondria and capillaries
- contract slowly
- aerobic metabolism
- fatigue resistant
- found in postural muscles

2. white fast twitch

- little myoglobin
- few mitochondria or capillaries
- contract rapidly
- anaerobic metabolism
- abundant glycogen stores
- fatigue quickly
- powerful - larger diameter

3. intermediate fast twitch

- myoglobin and mitochondria
- contract quickly
- aerobic metabolism
- fatigue resistant

E. skeletal muscle contraction and relaxation

calcium ions bind to troponin

troponin changes shape

tropomyosin moves

binding sites on actin are exposed

myosin heads bind to sites

myosin heads swivel towards center of sarcomere (power stroke)

myosin head releases actin
myosin heads reposition themselves - powered by ATP
sarcolemma and t-tubules repolarize
DHP receptors close Ca release channels
pump in membrane of SR uses ATP to move Ca back into SR

F. changes in skeletal muscle

1. atrophy - decrease in cell diameter
2. hypertrophy - increase in cell diameter
3. new muscle cells may be formed from satellite cells

G. cardiac muscle

located in wall of heart
function is to create pressure that pushes blood through the blood vessels
cells branch and interconnect
one or two nuclei; central
use aerobic metabolism to make ATP
fatigue resistant
fibers joined end to end at intercalated discs
 gap junctions
 desmosomes
 fascia adherens
control
 intrinsic - autorhythmic cells generate impulses
 extrinsic - ANS controls rate

H. smooth muscle

located in organs of the respiratory, digestive, urinary and reproductive systems;
the skin; the eye; the walls of blood vessels
function is to move material through an organ, to control the diameter of an
organ, or to move another body part
short, spindle-shaped cells

one central nucleus
myofilaments not lined up - no striations
no t-tubules
organized into sheets: longitudinal, circular, or oblique

generate alternate waves of contraction and relaxation called peristalsis
control:

- no innervation
- single-unit innervation
- multiunit innervation