Definitions

acetylcholine- neurotransmitter released from the synaptic vesicles that initiate action in the muscle fiber.
actin- a cellular protein that contains two other proteins
antagonist- counteracts with agonist
aponeuroses- a broad flat tendon
Adenosine triphosphate (ATP)* is the biochemical way to store and use energy. For your muscles -- in fact, for every cell in your body -- the source of energy that keeps everything going is called ATP.
axon-the long threadlike part of a nerve cell along which impulses are conducted from the cell body to other cells.
contraction- shortening of the muscles
cross bridges- the
head of a myosin molecule that projects from a myosin filament in muscle and in the sliding filament of muscle contraction is held to attach temporarily to an adjacent actin filament and draw it into the A band of a sarcomere between the myosin filaments.
elasticity- ability of a muscle tissue to elongate or stretch
fascia- layers of dense. fibrous, connective tissue which compartmentalize muscle adding to structure.
hypertrophy- to increase in bullk
insertion- : the part of a muscle by which it is attached to the part to be moved, usually distally located, and has a small surface area.
muscle- body tissue made of long cells that contract when stimulated and produce motion
myofibril- contractile unit composed of myosin and actin

Definitions (cont)

myosin- fibrous protein that forms (together with actin) the contractile filaments of muscle cells and is also involved in motion in other types of cells.
origin* body segment with the most mass, usually proximally located, large surface area of attachment
spasm an involuntary and abnormal contraction of muscle or muscle fibers or of a hollow organ that consists largely of involuntary muscle fibers

Cellular Structure& Function

A membrane is **permeable** when materials can pass through it.
Diffusion is the movement form an area of high concentration to an area of low concentration.
Molecules, gas ions, nutrients, and waste are able to pass through the **cell membrane**
Muscle cells provide movement
Nerve cell provide communication
Red blood cells provide oxygen transport
Movement can occur up or down a cell membrane
A **cell membrane** is a boundary wall surrounding cytoplasm of a cell
Muscle tissue has the property of contractility.
collagen is a protein which comprises bundles of flexible but strong white fibers.
Adipose is known as fat tissue (**protection, energy storage, and insulation**
Fibrous connective tissue is found in the ligaments and tendons

Basics

- **Skeletal Muscle** is an organ of the muscular system
-Skeletal Muscle is composed of skeletal muscle tissue, nervous tissue, blood, and connective tissue**
- **Tendons** Connect a muscle to bone it consist of dense connective tissue.

Basics (cont)

-Deep Fascia is fascia that surrounds or penetrates the muscle
-Subcutaneous fascia is fascia beneath the skin
-Subserous fascia is a connective tissue layer of the serous membranes covering organs in various body cavities.
-Myofibrilsare threadlike structures and are located in the sarcoplasm.
-Thick Myofilaments are composed of myosin
-Thins Myofilaments are composed of actin
-Troponin and tropomyosin associate with actin filaments
-Transverse tubules are membranous channels that extend into the sarcoplasm as invaginations continuous with the sarcolemma and contains extracellular fluid

Skeletal Muscle Structure

EPEN- (EP)imysium- a strong connective tissue that covers all muscle fibers to form a bundle called fasciculi.
(PE)rimysium- connective tissue that binds groups of muscle fibers together
(EN)domysium- connective tissue that covers the muscle fiber.
Muscle Belly to hold all muscle fibers together also to shorten when contracted.
Skeletal Muscles are named in relation to their attachment
A **sarcolemma** is a membrane that lays beneath the (**EN**)domysium
Sacroplasmic reticulm surrounds the myofibrils
TTS (Transverse Tubule System)- storage for calcium

Muscle Contraction

Tension within the muscle but no change in length **isotonic**
Tension and the muscle changes in length **isometric**
concentric is when the muscle shortens



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Muscle Contraction (cont)

Eccentric is when the muscle lengthens
Motor neuron- a nerve that carries impulses from the brain and stimulates muscle contraction
neuromuscular junction- the end of the axon terminal where it attaches to the muscle fiber
motor end plate- the location on the muscle fiber at the end of the axon terminal
motor unit- a motor neuron and the muscle fibers it innervates

Muscle Tissue

A **single twitch** is a simple muscle **contraction**
A **kymograph** is a machine used to record muscle activity
A **myogram** is a machine that traces the muscle twitch
Latent period before contraction starts
contraction phase during muscle shortening
relaxation phase after the contraction phase
Recovery Period is a short interval where the muscles are supplied with **oxygen**. It last about **60 sec.**
all or none principle- the principle that under given conditions the response of a nerve or muscle fiber to a stimulus at any strength above the threshold is the same: the muscle or nerve responds completely or not at all.
Principle source of heat in the body is **muscle contraction** example: **shivering**

Energy Sources

- **ALL** energy is from the **sun**
- **Immediate energy** in humans is from **ATP**
- **ATP** is made by energy released from the breakdown of foods and other compounds of food
-ENERGY IS THE CAPACITY TO PREFORM WORK
-WORK: APPLICATION OF OFRCE THROUGH A DISTANCE

3 Processes for producing ATP

1.. Phosphagen System- During short-term, intense activities, a large amount of power needs to be produced by the muscles, creating a high demand for ATP. The phosphagen system **(ATP-CP system)** is the quickest way to resynthesize ATP). **Creatine phosphate (CP)**, which is stored in skeletal muscles, donates a phosphate to **ADP to produce ATP: ADP + CP — ATP + C**. Since this process does not need oxygen to resynthesize ATP, it is anaerobic, or oxygen-independent. As the fastest way to resynthesize ATP, the phosphagen system is the predominant energy system used for all-out exercise lasting up to about **5- 10 seconds**. However, since there is a limited amount of stored CP and ATP in skeletal muscles, fatigue occurs rapidly.. **2. Glycolysis**- Glycolysis is the predominant energy system used for all-out exercise lasting from **30 seconds to about 2 minutes** and is the **second-fastest** way to resynthesize ATP. During glycolysis, **carbohydrate**—in the form of either **blood glucose (sugar) or muscle glycogen (the stored form of glucose)**—is broken down through a series of chemical reactions to form pyruvate (glycogen is first broken down into glucose through a process called glycogenolysis). Conversion to lactate occurs when the demand for oxygen is greater than the supply (i.e., during anaerobic exercise). Conversely, when there is enough oxygen available to meet the muscles' needs (i.e., during aerobic exercise), pyruvate (via acetyl-CoA) enters the mitochondria and goes through **aerobic** metabolism.. **3.** Aerobic System- The oxidation of **carbohydrates or fats**. Unlimited source of **Energy** ATP produced by aerobic glycolysis, from Kerb's cycle and a huge source from fat metabolism

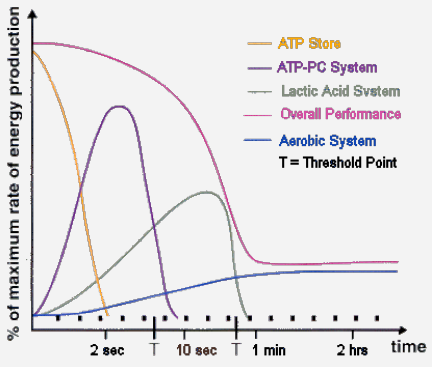
Sliding Filament Theory of Muscle Contraction

During muscle contraction, the globular heads of the myosin attach to the active site of the actin myofilament and "ratchet" or swivel pulling the actin toward the center of the sarcomere (unit of contraction). This causes the actin myofilaments to slide past one another resulting in a shortening of a sarcomere. The sarcomere shortens and the muscle contracts.

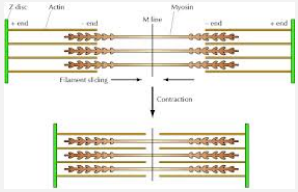
Characteristics of Fiber Types

Fast Twitch- The speed of contraction is **high**. The force**(power)** is **high**. It takes a **short time** for the fast twitch muscles to become tired. **Carbohydrates(glycogen) fuel the fast twitch fibers. Fast twitch muscles are** anaerobic **which means they don't need oxygen.** Lactic acid and heat** is the waste that fast twitch muscles produce.
Slow Twitch- The speed of contraction is **low**. The force**(power)** is **low**. It takes a **long time** for the slow twitch muscles to become tired. **Carbohydrates and fats** fuel the slow twitch fibers. Slow twitch muscles are **aerobic** which means they need oxygen. **carbon dioxide, water, and heat** is the waste that slow twitch muscles produce.

Energy Continuum- Energy Pathways Diagram



Digaram of muscle contraction



Sliding filament theory proposes that the **a-band** contain flexible cross bridges that come in contact with energy sites on more numerous **I-band** and with the availability of energy, the cross-bridges pull the active filament a short distance and release it and attach to another site, resulting in a shortening of the **H-zone** between the **I-bands**



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