MUSCLE METABOLISM

Stored ATP: 4-6 seconds worth

Direct Phosphorylation of ADP by Creatine Phosphate

Creatine phosphate + ADP = ATP + creatine (waste product)

provides an addition 10 seconds of ATP

Anaerobic: Glycolysis and Lactic Acid Formation

This form of ATP generation is over twice as fast as aerobic respiration; however it only harvests ~5% as much ATP.

Provides about ~45 seconds of ATP

Aerobic Respiration: can supply ATP for hours, depending on "aerobic endurance" of individual

Energy Systems Used During Sports Activities

Sprinting relies primarily on creatine phosphate

Soccer/basketball relies primarily on anaerobic formation of ATP

Long-distance running relies primarily on aerobic respiration

Heat Production: ~60% of energy released during muscle contraction is given off as heat.

Force of Muscle Contraction

Number of Muscle Fibers Stimulated

Size of Fibers Stimulated: muscle fibers hypertrophy with regular exercise

Frequency of Stimulation: due to summation (see above)

Degree of Muscle Stretch: If the muscle fibers are too overlapped, very little shortening can occur; if they are not overlapped enough, the myosin heads can't get enough grip and less force is generated.

Velocity and Duration of Contraction

Muscle Fiber Type—most muscles have a mixture of the following three types of fibers; but all fibers within one motor unit must be the same.

Slow oxidative fibers: Reddish due to high quantities of myoglobin (a protein closely related to hemoglobin, which stores and transports oxygen in muscle fibers). Myoglobin is red, making the muscle appear "dark"--such as the wings and legs of a chicken.

Relies on aerobic respiration and has a lot of endurance, but not a lot of power.

Fast glycolytic fibers: whitish (less myoglobin and fewer capillaries)

Relies on glycolysis (thus forming lactic acid) and has a lot of power, but not much endurance

Fast oxidative fibers: intermediate characteristics

Effect of Exercise on Muscles

Adaptations to Aerobic Exercise (which calls on slow oxidative fibers)

Increase in capillaries

Increase in # of mitochondria

Increase in myoglobin

Can convert fast glycolytic fibers into slow ones!

Adaptations to Anaerobic Exercise (such as weight-lifting)

Increase in muscle fiber size

Increase in connective tissue (to reinforce against large forces)