

Muscle II

1. The Rules
 1. muscles cross at least one joint
 2. the bulk is usually proximal to the joint
 3. at least 2 attachments (origin & insertion)
 4. muscles pull (never push), therefore must be in pairs
 5. insertion moves towards origin during contraction
 2. Types
 1. prime movers
 2. antagonists
 3. synergists
 4. fixators
 3. Muscle Shape
 1. parallel
 1. straplike
 2. fusiform
 2. pennate
 3. convergent
 4. Naming
 1. direction of muscle fibers
 2. relative size
 3. location
 4. number of origins
 5. location of origins & insertions
 6. shape
 7. action
 5. Sliding Filament Theory
 1. cross bridge attachment
 1. following Ca^{++} release
 2. following tropomyosin moving into groove
 3. opening of myosin binding sites
 2. working stroke
 1. myosin pivots from high energy state to low energy state
 2. release of ADP and Pi from previous stroke
 3. cross bridge detachment
 1. new ATP binds
 4. cocking of myosin head
 1. ATP hydrolysis returns myosin to high energy state
 5. rigormortis
 1. cell death allows Ca^{++} influx
 2. myosin binds
 3. ATP synthesis stops- detachment impossible
 6. Anatomy of Contraction Regulation
 1. neuromuscular junction
 1. synaptic cleft
 2. synaptic vesicles
 3. Acetylcholine = Ach
 4. motor end plate
 2. figs.
 3. triad
 1. terminal cisternae of SR (on each side of)
 2. T-tubules
 4. Physiology of Contraction Regulation
 1. action potential (AP) from nerve releases synaptic vesicles
 2. vesicles release Ach
 3. Ach binds to channels and releases Na^+
 4. AP propagated along sarcolemma & down into T - tubules
 5. AP releases Ca^{++} from terminal cisternae
 6. Ca^{++} ions bind to troponin
 1. troponin changes shape
 2. moves tropomyosin away from binding site
 3. active actin sites exposed
 7. contraction
 1. myosin cross bridges attach & detach
 2. release of ATP energy
 8. removal of Ca^{++} by active transport
 9. tropomyosin blockage restored
 1. contraction ends
 2. muscle relaxes
 7. Skeletal Muscle Activity
1. Energy
 1. direct phosphorylation
 1. creatine phosphate
 2. transfer of phosphate from creatine to ADP
 3. rapid
 4. depleted in 20 seconds
 2. aerobic
 1. ATP regeneration with oxygen
 2. 36 ATP/glucose!
 3. slow
 4. requires continuous delivery of O_2
 3. anerobic glycolysis
 1. ATP regeneration without oxygen
 2. 2 ATP/glucose
 3. inefficient
 4. 2.5 times faster than aerobic respiration
 5. 30 - 40 seconds possible
 6. lactic acid formation
 1. fatigue
 2. soreness
 7. oxygen debt
 1. 6 liters of O_2 to run 100 m dash in 12 s
 2. cardiovascular system can deliver just 1.2 liters
 3. debt = 4.8 liters
 2. Contractile Force
 1. number of fibers
 2. size of fibers
 3. stretching
 4. velocity vs. duration
 1. fast twitch
 2. slow twitch
 5. graded responses
 1. rate of stimulation
 2. number of cells being stimulated
 3. Contraction types
 1. isotonic - shortening or sliding
 2. isometric - no shortening
 8. Levers (figures)
 9. Levers (summary)
 1. define: a bar that moves on a fulcrum
 2. if effort farther from fulcrum than load, then mechanical advantage (slow & strong)
 3. if effort closer to fulcrum than load, then mechanical disadvantage (fast w/ large degree of motion)
 4. 1st class operate at a mechanical advantage or disadvantage
 5. 2nd class always operate at an advantage
 6. 3rd class always operate at disadvantage