Discussion Week 8

If you haven't already done so please watch the Muscle EMG podcast. Reading assignment: Eckert Ch. 10 (on website) is a little longer (more thorough so skim looking for these things below) but flows better, or Withers pp. 415-442 (Muscle). Neural control of muscle is in Eckert 410-11.

Structure of Muscle

Discuss:

1. When we look at histological sections of muscle, we see I, H, Z, and A bands. Where is the actin and myosin in these sections? How are they assembled to make up the sarcomeres and the crossbridges? Now imagine the muscle fiber shortening and apply the sliding filament model. Why does force produced change as muscle length changes? Is there a mechanistic explanation for the relationship between force produced and muscle fiber length?

2. Look at the molecular interactions involved in muscle contraction. When are ATP consumed? Why is Ca^{2+} needed? What is involved in the excitation-contraction-coupling and how is the contraction of an entire muscle (a large number of fibers) coordinated? Why are twitches transitory?

3. Two classic results in muscle physiology are the force-velocity and force-load curves from experiments on muscle contraction. What is the relationship between force and velocity? Force and load? What are general relationships we can learn from studying isometric vs. isotonic contraction? Under what situation is force maximized for a muscle? Velocity? Power?

Fiber Types, Neural Control of Muscle

4. What are the three main fiber types of vertebrate striated muscle? How do their properties contrast? How might a particular muscle be designed for fast movement versus slow, constant activity? Where (which muscles, animals) might you see differences in fiber composition?

5. Compare and contrast how vertebrate and invertebrate muscles are controlled (activated) by neurons. What is the difference in how graded responses are controlled (explain in terms of innervation, action potentials, and what form the inhibitory and excitatory signals take). What is the relationship between a vertebrate twitch and tetanus?

6. It is hypothesized that elderly people lose stability because as they age, they have fewer motor neurons. When the motor neurons degenerate, it leads to loss of those motor units. How can you explain this phenomenon of higher fall incidence among elderly knowing what you know (also think about the role of antagonistic muscles across joints).