Instructor's Response(s) to Discussion Questions(s) - Module 3

Imagine that a motor unit, with its nerve intact, is placed in a solution that is calcium-free (but has the proper ionic strength – don't worry how). Further imagine that the ends of the muscle fibers in the motor unit are held such that length is constant. If the nerve is stimulated and fires an action potential will the muscle fibers contract? Briefly explain. Please **post your response to the Discussion Board by 6 PM on day 4 of the module**.

No, the muscle fibers will NOT contract. Release of ACh (the neurotransmitter for mammalian skeletal muscle) from the presynaptic terminal bouton (at the end of the muscle nerve) requires that Ca^{2+} enter the presynaptic terminal bouton (the presynaptic side of the neuromuscular junction) in response to an AP fired on the motor nerve. Since the solution surrounding the experimental preparation is calcium-free no Ca^{2+} will enter the presynaptic bouton, therefore no ACh will be released. If no ACh is released from the nerve terminal no ACh will bind to receptors on the muscle cell membrane so sodium channels will not be opened, meaning that there will not be an AP fired on the muscle cell membrane (the sarcolemma). Absent a sarcolemmal AP there will be no release of Ca^{2+} from SR, so no Ca^{2+} will become available to bind to TnC; thus there will be no crossbridge cycling and, hence, no contraction. See video 6, slides 2, 3, and 4.

Rev 0, 8/5/16
Rev 1, 2/7/17 - change right margin
Rev 2, 8/14/17 - minor language change; no change to concept
Rev 3, 2/18/18 - cosmetics; no changes to content
Rev 4, 7/13/18 - from Spring 2018, up-date for 601; no content changes
Rev 5, 9/14/18 - added a bit of clarification at the end
Rev 6, 2/16/19 - correct typo (missing parenthesis); no content changes