A. Muscle Physiology

1. Factors Affecting Contraction

   a) All or None Principle – a muscle fiber contracts 100% or not at all

   ❖ Explain how the intensity of a muscle contraction is controlled when muscle cells follow the “are all or none” principle.

Motor Units

(1) A group of muscle fibers all controlled by one nerve.

(2) Motor Unit size determines muscle precision. (Think gears)

   (a) Many small M.U. = fine control

   (b) Few big M.U. = coarse control

(3) Purpose – simplified control (bank of lights on 1 switch), saves on # of brain cells needed

❖ What explains the shakiness of the line as it increases?

b) Nerve Stimulation (Threshold Stimulus – minimum frequency of impulses that a nerve will react to.)

   (1) Subliminal – a nerve message too weak to cause contraction (background noise) constantly generated
(2) Liminal - the weakest stimulus able to cause 1 MU to contract (Greater or = threshold)

(3) Maximal - Nerve stimuli to all MU in a muscle. Difficult and Painful. (100% of cells contracting) - almost never done.

(4) Summation of Stimuli - several subliminal stimuli in rapid succession. Cause a twitch. (result of fatigue - lack of sleep, mental exhaustion, stress)

c) Temperature

(1) Increased temperature = more efficient contractions

d) Coordinated Muscular Activity

(1) Prime Mover - does most of the motion (biceps brachii)

(2) Synergist - assists prime mover. Smaller. (brachialis, brachioradialis)

(3) Antagonist - Opposite of Prime mover. (triceps brachii)

2. Types of contractions

a) Twitch - single, isolated contraction of a MU

b) Isometric - Contraction w/ no change in muscle length (against stationary object) "holding still"

c) Isotonic (Isokinetic)

(1) Concentric - muscle shortens (against gravity/force)

(2) Eccentric - Muscle Lengthens (with gravity or against current motion)

d) Muscle Tone - Slight contraction of a resting muscle. Motor Units work in relays.

For Joint Protection

- Explain what type of contraction this is likely to produce and how you can tell.