

2. (22 pts) Tetanus, or extreme muscle rigidity, refers to both a normal and a pathological condition. Normally, a skeletal muscle fiber may be kept in a fully contracted state for a brief period of time, by the rapid "firing" of the nerve enervating that fiber: thus, during tetanic stimulation, a high frequency of action potentials (AP's) travel down the nerve to its synapse with the muscle fiber and result in constant contraction. Widespread, unregulated tetanus can also be produced in many muscles within an individual by the toxic secretion of the bacterium, *Clostridium tetani*, growing anaerobically in a sealed wound.
- A. (6 pts) How might the high frequency of nerve AP's continually stimulate fiber contraction? Briefly describe our present knowledge of the intervening steps, using diagrams as appropriate.
- B. (10 pts) Clinical studies indicate tetanus is produced by very low concentrations of *C. tetani* toxin, a large hydrophilic protein. How might the toxin work in such small concentrations? Propose **two different** mechanisms based on your knowledge of muscle contraction and its neural regulation and other aspects of cell signaling.
- C. (6 pts) Describe briefly and concretely a test of **one** of your hypotheses and indicate clearly what the results would show.