**Problem 2e**

Zero-order ultrasensitivity means zero-order in the protein substrate, which saturates the enzyme surface, and ultrasensitive because it is more sensitive than a Michaelis-Menten response to stimulus. The importance of zero-order ultrasensitivity is described in Goldbeter and Koshland (1981). Zero-order ultrasensitivity can used in bicyclic cascade. Additional cycles in a cascade provide the potentiality for increasing the sensitivity of an individual cycle. Mathematical equations can be derived to show that Zero-order ultrasensitivity cannot occur when the converter enzymes operate entirely in the domain of the first-order kinetics. Zero-order ultrasensitivity occurs even when a single effector acts in a noncooperative manner on one of the converter enzymes. With higher turnover numbers for the converter enzymes, lower concentrations of the target proteins, or both, a millisecond time course could be achieved. zero-order ultrasensitivity," in which converter enzymes operating under saturating conditions amplify the response to a signal. A given pathway or cascade can use any one of these mechanisms or all three to enhance its sensitivity.