74/100 SEL +5

1. (15 pts) A physiology student is interested in determining the difference between changing preload and afterload on the heart. She obtains the data below shown in Figures 1 and 2. (Note x-axis is ventricle volume and y–axis is ventricle pressure.)

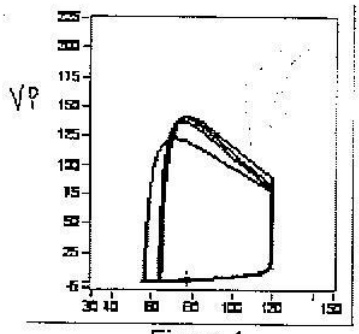


Figure 1

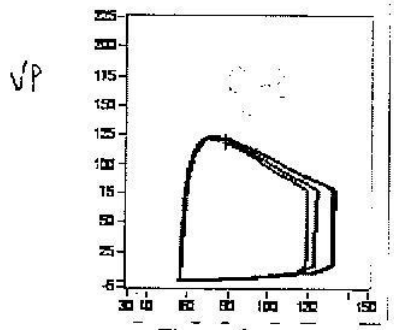


Figure 2

Which figure represents data from changes in afterload and which from changes in preload? Explain how you made your choice. Define End Systolic Volume (ESV) and End Diastolic Volume (EDV). Which volume is changed when heart strength is increased and is this volume increased or decreased? What effect does this have on stroke volume?

Figure 2 displays a change in preload because as preload increases, EDV increases since the heart is stretching more. Figure 1 displays a change in Afterload because the pressure pumping blood out of the heart, is changing. ESV is the volume of blood left in the heart after systole (pumping blood out). EDV is the volume of blood in the heart after dyastole (filling). ESV is decreased when heart strength is increased because the heart is pumping blood out with more strength. This increases SV because SV = EDV - ESV

2. (20 pts) Define sensory receptive fields, and discuss the roles of receptive field size and density in stimulus localization and acuity (e.g., two pins). Describe the mechanism of lateral inhibition, and discuss how lateral inhibition affects stimulus localization and acuity.

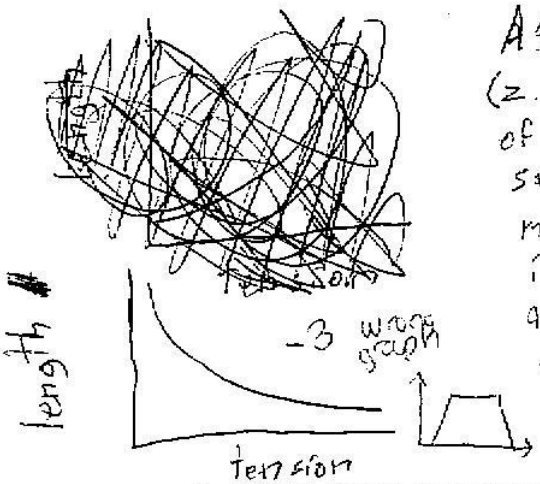
+20

+5 A sensory receptive field is the area in which a sensory neuron can recieve a signal. If receptive field size is large and the density of neurons is low (case A), localization of a stimulus is poor. if the fields are small and +5 the neurons are densely packed (case B), localization is more exact. In other words, in case A: if 2 pins are pricking someone in a small localized area, the person might not be able to feel that there are 2 pins since they may both be affecting the same neuron. In case B, the pins would each fire seperate neurons since there are more →

neurons to affect in that area and thus better differentiation between the sensation caused by each pin is possible. Lateral inhibition +5 is a mechanism in which neurons around the primary stimulated neuron are inhibited by the signals from the primary neuron. This causes the signals recieved by the surrounding neurons to be lessened, thus increasing the acuity and localization of the original stimulus.

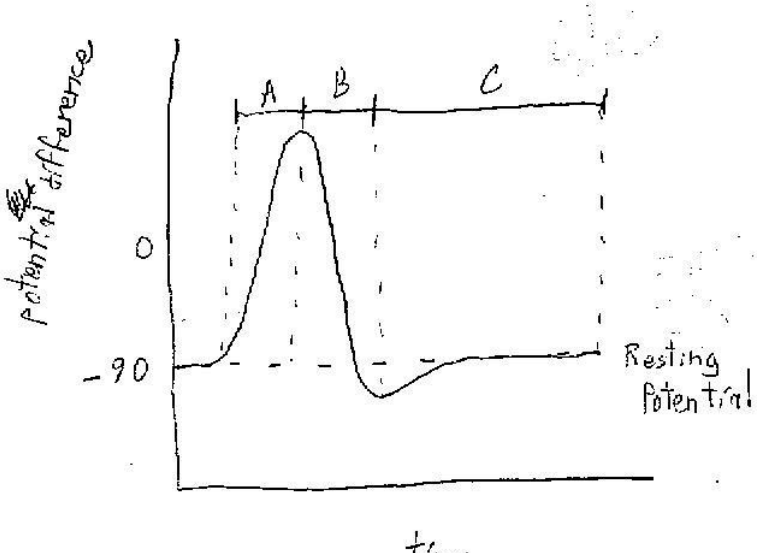
max tension = resting length, all myosin heads form crossbridges
1/2 max = 1/2 cross bridges form,

3. (15 pts) In a lab experiment, a skeletal muscle is stimulated for an isometric contraction. Draw the length-tension curve for this, and describe the correlation between tension development and sarcomere structure. Under what conditions is the tension at its maximum? Half-maximum (describe one of the two possibilities)?



As the sarcomere contracts (z lines move closer together due to attachment of motor proteins on thick filaments to thin filaments in sarcomere) more tension is developed since more strain is being put on the muscle. Tension is at max when the ends of the thin filaments are touching. Tension is at half max when the ends of the thin filaments are half their original distance from each other. -5

4. (20 pts) Diagram the changes in potential difference with time during an action potential in a neuron. Correlate action potential shape with the changes in potassium and sodium permeability.
What would happen to the magnitude of the action potential if the external Na+ concentration was significantly increased from the normal ? Explain.



A) increased Na^+ permeability

B) increased K^+ permeability, Na^+ channels close

C) permeabilities of K^+ & Na^+ return to normal

If Na^+ concentration was significantly increased, AP would also increase. This is because the magnitude of the AP is determined by the influx of Na^+ and the influx would increase if concentration outside the cell was increased.

5. (15pts) Identify the three sources of ATP used to supply energy for skeletal muscle contraction. 1) Oxidative phosphorylation
2) ~~Fermentation~~
3) Glycolytic phosphorylation

What is the major energy source in a fast oxidative fiber? Would this fiber have myoglobin, a large number of capillaries and a large number of mitochondria? Explain.

Oxidative phosphorylation. The ~~fiber~~ fiber would have myoglobin, ~~a~~ a large ~~number~~ number of capillaries, and a large number of mitochondria. The large number of mitochondria ~~is~~ is needed for the production of large amounts of ATP in oxidative phosphorylation which are needed for the fast reaction of fast oxidative fiber, the large number of capillaries are needed in order to provide enough oxygen for oxidative phosphorylation. Myoglobin is needed for the quick responsiveness of Fast oxidative fiber

+5

6. (15 pts) LASIK and LASEK are two of the several procedures used to correct refractive error in the human eye by altering corneal shape, and therefore corneal refractive power. Briefly define emmetropia and myopia, and describe how corneal shape needs to be altered to go from myopia to emmetropia.

Myopia is when the cornea is ~~thick~~ more curved and emmetropia is when the cornea is less curved. To go from Myopia to emmetropia, the curvature of the cornea must be lessened.

-5

-5

+5

myopia = long globe, nearsighted

emmetropia = normal vision