

Compound Action Potentials from the Frog Sciatic Nerve

Name: _____

Introduction

Write a couple of paragraphs describing and/or defining a compound action potential (CAP). You can briefly describe the technique you used to measure CAPs, especially if it helps you describe them. Also, what do you expect to learn from this experiment? In other words what is the purpose of the experiment?

Results

Attach a copy of your completed Data Notebooks from the experiment protocol at the end of this report.

Figure 1: Determination of threshold stimulus voltage, maximal stimulus voltage, and demonstration of recruitment

In the space below, draw a scatter plot of CAP amplitude versus stimulus voltage. Use your data from Table 1 of your Data Notebook.

Threshold stimulus voltage

What is the minimal CAP amplitude? What is the lowest stimulus voltage needed to elicit a threshold response? (answer below)

Minimum CAP amplitude: _____ mV.

Lowest voltage required for minimum CAP: _____ mV.

The maximum CAP amplitude

What is the maximal CAP amplitude? What is the lowest stimulus voltage needed to elicit a maximal response? (answer below)

Maximum CAP amplitude: _____ mV.

Lowest voltage required for maximal CAP: _____ mV.

Figure 2: Determination of the refractory periods of a bullfrog sciatic nerve

In the space below, draw a scatter plot of CAP amplitude vs. stimulus interval. Use your data from Table 2 in your Data Notebook. Indicate on your graph the relative and absolute refractory periods.

Table 1: Calculation of conduction velocity of a bullfrog sciatic nerve

Indicate the conduction velocity that you calculated for the sciatic nerve in the space below. Use your data from Table 3 in your Data Notebook.

Conduction velocity: _____ m/sec.

Figure 3: Biphasic vs. monophasic CAP recordings in bullfrog sciatic nerve

- a. Produce a sample tracing of nerve stimulation that results in a biphasic waveform
- b. Produce a sample tracing or nerve stimulation that results in a monophasic waveform.

Figure 4: Strength-duration curve of a bullfrog sciatic nerve

Make a scatter plot of stimulus intensity (mV) vs. duration (msec) – use data from Table 5, Data Notebook. Fit a line to your data and determine the rheobase and chronaxie.

Rheobase: _____

Chronaxie: _____

Discussion

Answer the following questions in complete sentences – always make a point of using your data to help you answer the question.

1. What is threshold in context of nerve function (as opposed to axon)? Explain recruitment – in other words, why does CAP intensity increase within a certain range as you increase stimulus intensity? How does this fit in the context of the all-or-none law? Does it agree with it? Is it a violation of all-or-none? What is a maximal stimulus? Use data from Figure 1 to help you with this discussion.

2. Using data from Figure 2, explain what the absolute refractory period (ARP) and the relative refractory period (RRP) mean in the context of a peripheral nerve. How does this experiment relate to the ARP and RRP in a single neuron?

In other words, what is the cause of the ARP and RRP in a single neuron? How does this relate to your data examining the ARP and RRP in a mixed nerve?

3. a. What is the conduction velocity for your nerve? How does it compare to values in the literature?
- b. Your conduction velocity measurement represents an “average” velocity for all fibers making up the nerve. What types of fibers make up the sciatic nerve? Why do different fibers have different conduction velocities? What are structural/functional differences between various fiber types?
- c. Is there evidence of different fiber types from your recordings, explain why/why not?

4. When recording a CAP you usually observe a biphasic waveform. Why? How does damaging the nerve result in a monophasic waveform? Refer to Figure 3 in Results.

5. Refer to the strength duration curve you plotted in Figure 4. Briefly describe the relationship between stimulus strength and duration as far as eliciting a threshold response. Define rheobase and chronaxie, and list your values for these parameters. What are some applications of these parameters and of strength duration curves in studying properties of excitable tissues?

Bibliography

List literature and book sources used throughout your discussion – you can pick a format, just be consistent. As an example look at the formats used by *Journal of Biological Chemistry*, *Journal of Applied Physiology*, or another journal you are familiar with. You can go to the web site of a given journal and look up their editorial policies (instructions for authors) – you'll find a bibliography guideline.