BIOL 445 Assignment

Total: 50 marks.

Due date: March 1, 2010.

1. (40 marks). Listed below are the titles of recently published papers from the neuroethological literature. For any 4 of your choice, imagine that you are one of the authors of the article. During dinner at your next family occasion, a relative asks “So what is your research all about, anyway?”. Explain the main findings described in each of these journal articles in a way that would be of general interest. In your explanation, consider the following: What are the general questions being addressed? What is the rationale for using the particular animal model, and not another animal? What are the key experiments you conducted with a focus on how they relate to the purpose of your study? What has been learned about the neural basis of behaviour?


2. (5 marks). Match up the technique best used to find out the following:

(a) kinetics of Na⁺ channel inactivation
(b) synaptic connectivity between two neurons
(c) anatomical organization of neuropil
(d) timing of rhythmical patterns of muscle activity
(e) brain regions involved in face recognition

(i) intracellular recording
(ii) electromyograph recording
(iii) fMRI
(iv) patch clamp recording
(v) Golgi silver staining

3. A model neuron has [K⁺]_{inside} = 400 mM and [K⁺]_{outside} = 20 mM at a temperature of 20°C. Remember:

\[ E = \frac{RT}{zF} \ln \frac{[\text{ion outside cell}]}{[\text{ion inside cell}]} \]

Where: the universal gas constant (R) = 8.314 J K⁻¹ mol⁻¹; T = absolute temperature; z = 1; and the Faraday constant (F) = 9.648 x 10⁴ C mol⁻¹

(a) What is the value of the potassium equilibrium potential (E_{K⁺}) of this model neuron? Show your calculations, and state the answer in mV. (3 marks)
(b) Why does the movement of K⁺ result in a negative membrane potential? (1 mark)
(c) If K⁺ ion channels are open and V_m = -90 mV, which net direction would K⁺ flow (in or out of the cell)? (1 mark)