BIO 350 EXAM 1 SEC 3 Sp 2018-Cooper LAST Name_____ 1st NAME _____

General science questions:

1. (2 points) What is science?

2. (2 points) What are the goals of scientific inquiry?

3. (2 points) How is scientific knowledge gained?

4. (2 points) How are new scientific discoveries integrated into existing knowledge?

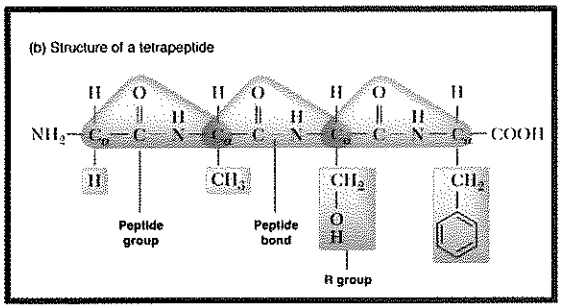
5. (2 points) Why is saying something is "just a theory" not correct in the context of what you understand about the scientific process?

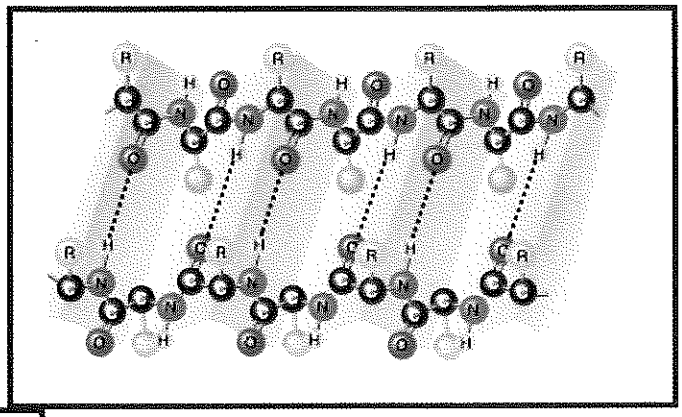
6. (5 points) Myasthenia gravis (MG) is an autoimmune disease which results from antibodies that block or destroy nicotinic acetylcholine receptors at the junction between the nerve and skeletal muscle in mammals. Rarely, an inherited genetic defect in the neuromuscular junction results in a similar condition known as congenital myasthenia. Babies of mothers with myasthenia may have symptoms during their first few months of life, known as neonatal myasthenia. Diagnosis can be supported by blood tests for specific antibodies, the edrophonium test, or a nerve conduction study. The surgical removal of the thymus gland may improve symptoms in certain cases. Plasmapheresis and high dose intravenous immunoglobulin may be used during sudden flares of the condition. MG affects 50 to 200 per million people. It is newly diagnosed in three to 30 per million people each year. Diagnosis is becoming more common due to increased awareness. It most commonly occurs in women under the age of 40 and in men over the age of 60. It is uncommon in children. With treatment, most of those affected lead relatively normal lives and have a normal life expectancy.

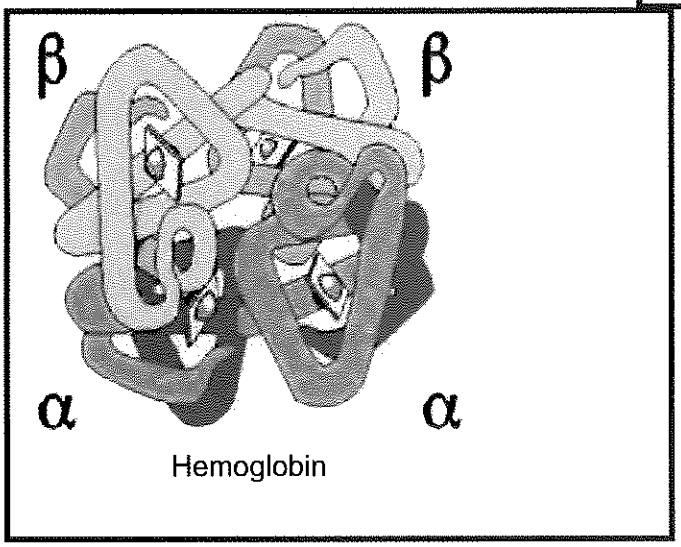
How might this affect a person initially and over long-term ?

What do you think would happen over time to the individual and what type of physiological problems would be of most concern ? (WHY and LOGIC to your answers are needed)

7. (2 points) Which structures below belong to which of these following groups (primary, secondary, tertiary, quaternary) ?







Hemoglobin

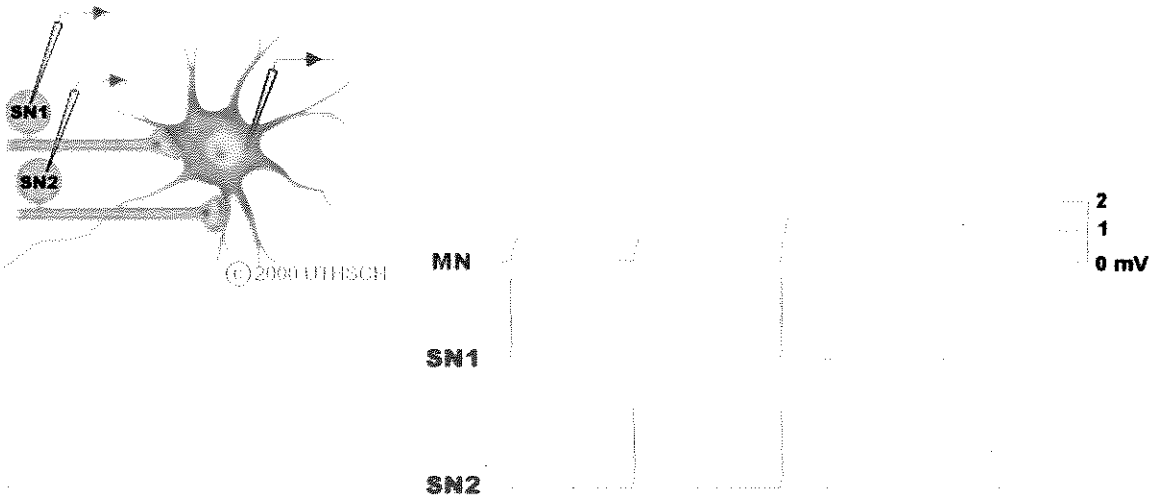
8. (2 points) Given the following information what is the equilibrium potential for Li+ under these experimental conditions?

The concentration of Li+ outside the cell is 200 mM and the Li+ concentration inside the cell is 20 mM. The cell is not permeable to other ions but only Li+
Givens:
log ([1]/[10]) = -1
log ([10]/[1]) = 1
log (100) = 2
log (10) = 1
RT/F = 0.058 Volts

A) + 116 mV
B) + 58 mV
C) – 58 mV
D) + 29 mV
E) 0 mV

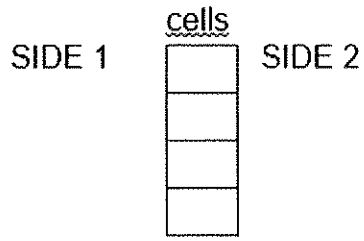
9. (5 points) In the figure below two sensory neurons (SN1 and SN2) are being stimulated and the responses are being recorded in the motor neuron (MN) cell body. Explain why the shapes of the responses recorded are the way they are details about why the one is so much larger than the others.

↑and provide



10. (4 points) How to determine the time constant (tau) for a cell? Diagram how this would be determined from a theoretical voltage trace. (You draw the trace and **label** and explain how to determine tau from the trace).

11. (4 points) Given the following facts for the membrane shown



(i) the pump is blocked only on side 1 and this has no effect on the flux of Na+ ions.
(ii) Raising the [Na+] on side 2 has no effect on the net flux of Na+ ions across the membrane.
(iii) Raising the [Na+] on side 1 to very high levels produces a saturation on the net flux of Na+ ions across the membrane.
(iv) The net flux of water is from side 1 to side 2
(v) Cells are connected by a tight junctions and will not allow water to flow paracellular.
(vi) There is an Na/K ATPase pump on one side of this membrane.

Given these facts explain why the following statements is correct or not correct.

1). The Na+ ions inside the cell would tend to be pumped from side 2 into the cell

2). K+ ions would be pumped from side 2 into the cell of the membrane.

3). K+ ions would be pumped directly from inside the cell to side 1.

4). The Na/K pump is on side 2 of this membrane.

MATCH 12-13 with the following (you can use an answer more than once):

a) . .typically occurs in gradual manner over many generations.
b)....changes that occur within an individual's life time in natural conditions
c) ....maintaining a consistent internal environment
d) ....changes that occur within an individual's life time in laboratory conditions
e)..... No changes over the animal's life time

12. (2 points) ADAPTATION-

13. (2 points) ACCLIMATIZATION-

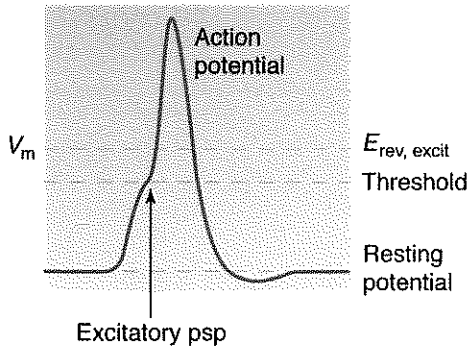
14. (4 points) How can ion channels be selective for different types of ions with different charges and sizes ? Why a K+ ion does not travel through a Na+ channel or a Cl- channel ? (Explain your answers).

15. (4 points) Explain and discuss the differences between the Nernst equation and the Goldman-Hodgkin-Katz equation. What information is gained from each of these equations?

16. (4 points) How can a cell get energy, in the form of ATP, from fat and lipids as compared to glucose? What metabolic paths are used for fat and proteins as compared to glucose.

17. (5 points) In order to function properly, membranes must remain fluid. A key mechanism by which temperature conformers, like fish or invertebrates, cope with changing temperatures is to vary the relative proportion of saturated and unsaturated fatty acids in their lipid membranes. To acclimatize to cold temperatures, animals alter their membranes in various ways. Name at least 3 ways in which membranes might change and state how it effects the membrane in increasing or decreasing fluidity.

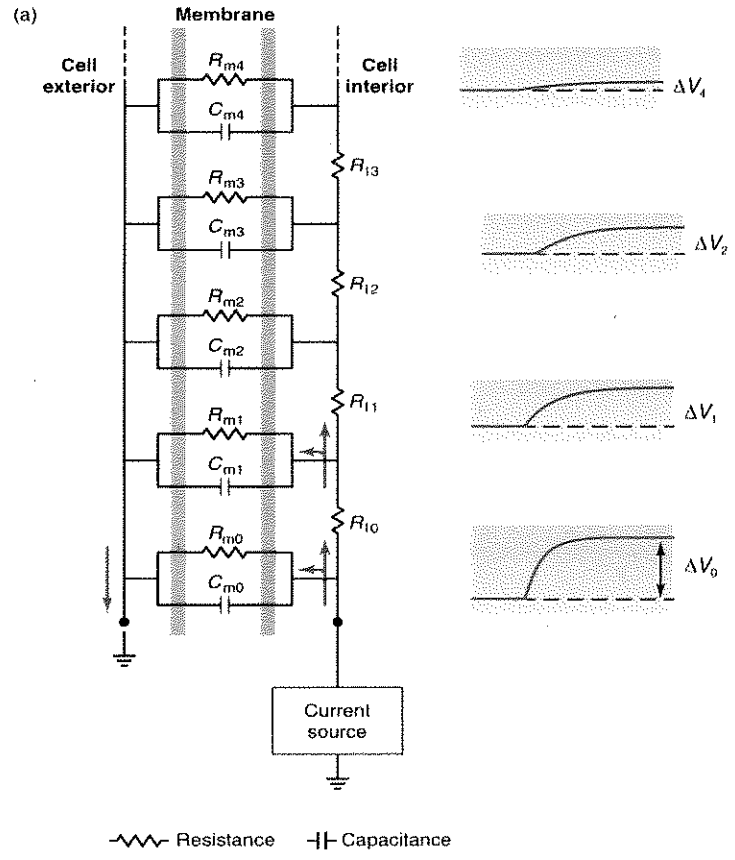
18. (4 points) Explain what is happening at threshold to result in the action potential and why is it that the peak of the action potential does not reach the E_{Na} for the cell (2 reasons).



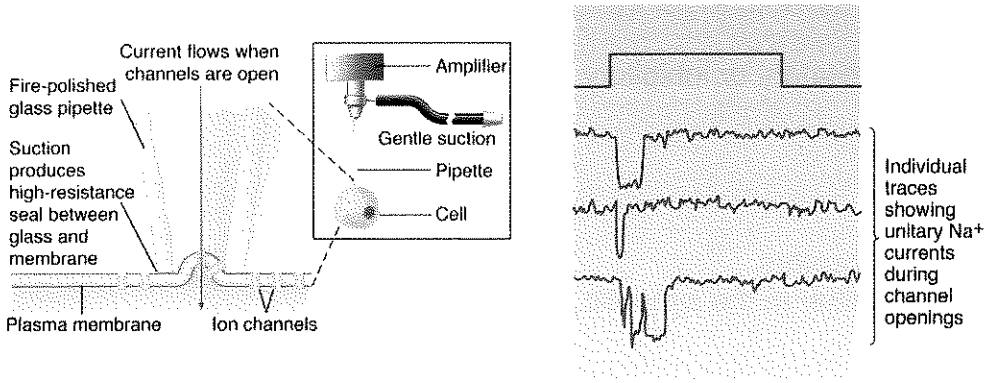
19. (2 points) whether a synapse is excitatory or inhibitory depends on the

a. type of neurotransmitter.
b. presynaptic axon terminal.
c. size of the synapse.
d. nature of the postsynaptic receptors.
e. concentration of neurotransmitter in the synaptic space.

20. (3 points) in the diagram below estimate where Lambda would be approximately from the current source and the 1st voltage reading from the current source. (also explain why you choose that location)



21. (4 points) Below are figures we used to explain the technique of patch clamping on a cell membrane. Why was this technique so important that the two people which came up with this technique awarded a Nobel Prize in Medicine and Physiology? Explain your answer.



22. (6 points) If you stimulate an axon in the middle, action potentials are conducted in both directions. Yet when an action potential is generated at the axon hillock, it goes only toward the axon terminals and does not backtrack. Explain why action potentials are bidirectional in the first example and unidirectional in the second (Provide details in answers). Propose some reasons why using devices which stimulate axons in the middle for medical applications of promoting axon growth of cut nerves might be problematic for the neuron's function?

23. (2 points) The speed of conduction of a nerve impulse can be influenced by which of the following factors?

1. temperature **2.** diameter of axon **3.** myelin sheath **4.** the amount of capacitance on the membrane

a) 1, 3 and 4 **b)** 1, 2 and 3 **c)** 3 and 1 **d)** 3 and 2 **e)** 1, 2, 3 and 4

24. (2 points) The substance acetylcholine (ACh) is released from synaptic vesicles by the process of

a) phagocytosis **b)** simple diffusion **c)** passive transport **d)** exocytosis **e)** endocytosis

25. (2 points) Sodium levels in Tim's blood began to fall. His adrenal glands released a hormone called aldosterone which decreased the sodium output in his urine and caused his blood sodium levels to rise. This is an example of a ?

a. Positive feedback mechanism
b. Negative feedback mechanism

26. (2 points) When salt is poured on a slug or a snail, it dies because

A. salt moves out of the slug, depriving it of essential minerals
B. water moves out of the slug, causing dehydration
C. salt moves into the slug, poisoning it
D. water moves into the slug, causing it to swell

27. (2 points) The potassium channels that are primarily responsible for repolarization of the plasma membrane of an axon after the initiation of an action potential are activated by

a) directly by binding of intracellular Na+
b) epinephrine
c) cAMP
d) membrane depolarization
e) membrane hyperpolarization

28. (2 points) If two excitatory synapses occur on different regions of a dendritic tree of a single neuron and they are activated at the same time, what is the term when they add together when the signals reach the cell body ?

A. temporal summation
B. interference inhibition
C. lateral inhibition
D. spatial summation
E. long-term potentiation

29. (2 points) In a cell, movement of molecules from an area of low concentration to an area of high concentration

a) uses facilitated diffusion **b)** requires cellular energy **c)** needs associated (peripheral) proteins

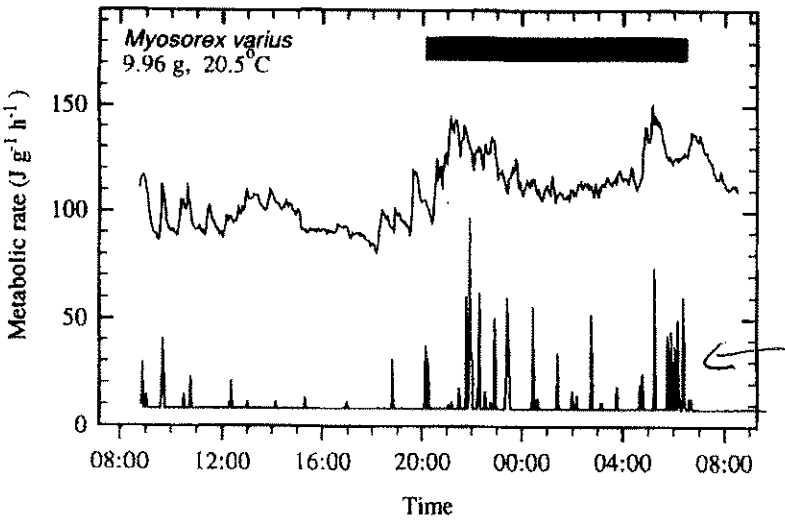
d) requires both cellular energy and facilitated diffusion **e)** uses its concentration gradient to move

30. (8 points) **Described the quantal hypothesis theory for synaptic transmission. What evidence drove Dr. Katz to come up with this concept ? How where such experiments conducted?**

31. (8 points) Design an experiment with the squid axon you might do to examine the influence of ions on the shape of the action potential using physiological logic you learned so far (details of the experimental conditions and how to conduct the experiments are needed).

32. (5 points) In relation to the two figures below explain the physiological meaning behind the data presented. Interpretation of the data from what we learned about in class.

Shrew Metabolism and Thermoregulation



Activity measures

FIG. 1. Metabolic rate (upper line) and activity levels (lower line) of *Myosorex varius* over 24 hr. There is no scale for activity, but the relative height of the line is an indication of the number of sensor trigger events in each measurement interval. Dark bar indicates hours of darkness.

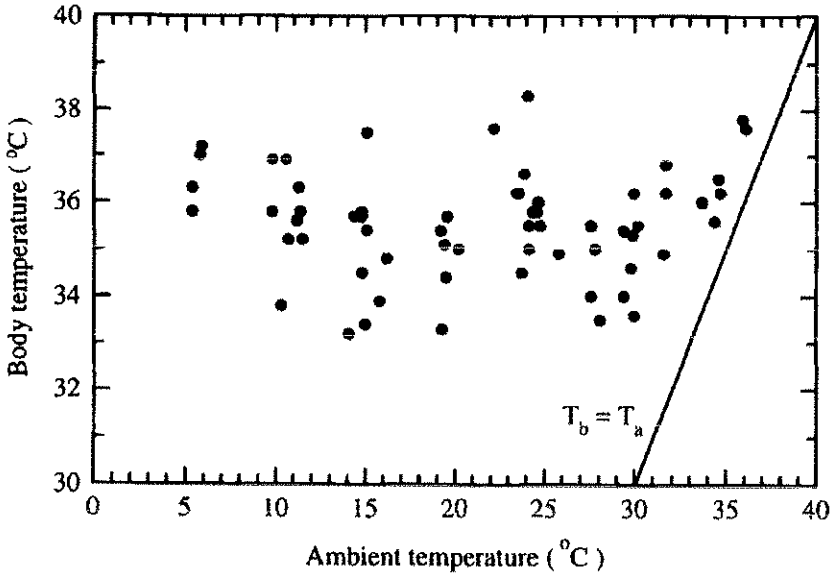


FIG. 5. Body temperatures of *Myosorex varius* in relation to temperature. The solid line represents the line of equality.