

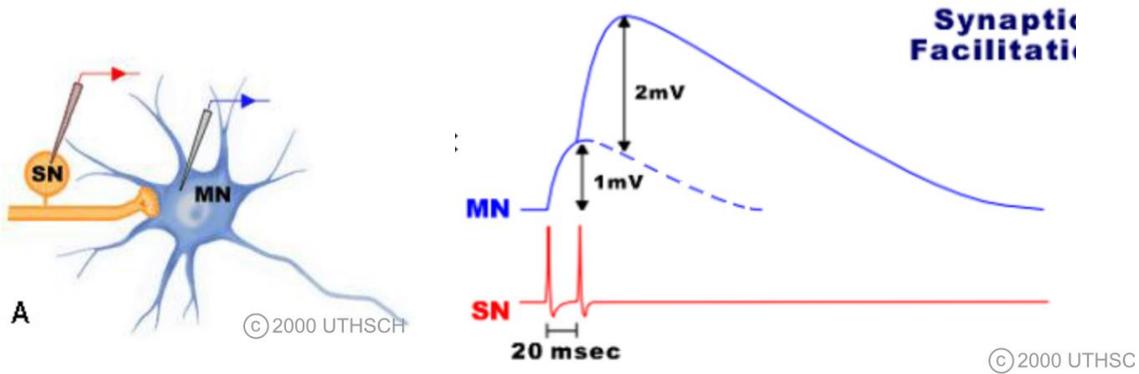
Physiology questions:

6. (5 points) A neuronal voltage-gated potassium channel (VGKC) autoantibody has been associated with Creutzfeldt-Jakob disease (CJD) autoantibody-associated encephalopathy. The diagnosis is supported by characteristic abnormalities on electroencephalography (EEG) or brain magnetic resonance imaging (MRI) and possibly by elevation of neuronal injury markers in cerebrospinal fluid (CSF). Creutzfeldt-Jakob disease is mimicked clinically by several other conditions, particularly rapid presentations of other neurodegenerative diseases and autoimmune neurologic conditions

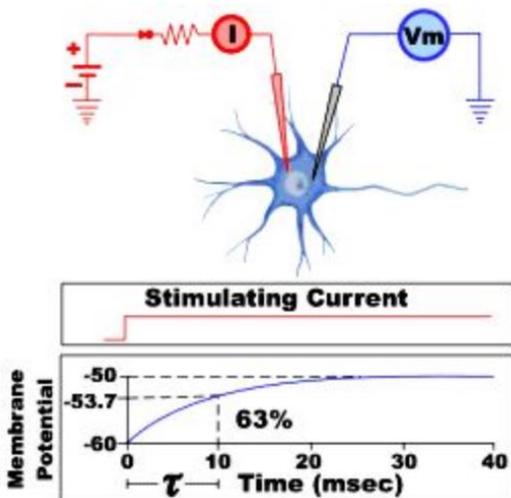
How might this affect a person initially and over long-term ?

What do you think would happen over time to the individual and what type of body position, behavioral state might this person be in if the disease is showing signs and symptoms? (WHY and LOGIC to your answers are needed)

7. (4 points) In the figure below the sensory neuron (SN) is stimulated and the motor neuron (Mn) is being recorded with an intracellular electrode. Explain the possible (logical) reasons why in such a short time the 2nd stimulus produced the response it does.



8. (4 points) In seeing the **rise tau** below and thinking of the biophysical properties of the membrane, why might a **decay tau** of a current pulse be different than the rise tau ?



9. (2 points) If a nerve membrane suddenly became equally permeable to both Na^+ and K^+ , the membrane potential would:

- A. Not change
- B. Approach the new K^+ equilibrium potential
- C. Approach the new Na^+ equilibrium potential
- D. Approach a value of about 0 mV
- E. Approach a constant value of about +55 mV

10. (6 points) Write out the Goldman-Hodgkin-Katz equation for K^+ and Na^+ . State how it can be reduced to the Nernst equation. Then list the resulting Nernst equation.

What does the Nernst equation represent? What use is it for physiologist?

If your kidneys quit functioning correctly for K^+ balance and K^+ started to increase in your extracellular fluid what would the Nernst equation predict would happen to resting membrane potential?

11. (5 points) What are some of the physiological functions of membranes? What makes up a bilipid membrane? List various means by which the fluidity of the membrane is altered for animals acclimatizing to new temperature environments.

12. (4 points) Explain homeostasis and give 2 physiological examples as well as how homeostasis is maintained in your examples.

13. (2 points) **A single quantum of response measured in a postsynaptic cell refers to a...**

- A) summated electrical response due to many vesicles being released from the presynaptic neuron.
- B) a measure of current needed to elicit an action potential.
- C) The amount of electrical response to hyperpolarize a cell below its resting membrane potential
- D) The response measured in a postsynaptic cell due to the release of a single vesicle from a presynaptic cell.
- E) none of the above

14. (4 points) Describe at least **3 examples** of physiological processes that have been learned from "simpler" systems that have directly benefited research and/or medical aspects related to Humans. Mention how they have benefited Human's for understanding physiological processes in humans.

15. (2 points) What is the August Krogh principle ?

16. (6 points total 2 each) What are the definitions of :

ADAPTATION-

ACCLIMATIZATION-

ACCLIMATION-

17. (2 points) Passive diffusion of a gas through a biological membrane will require ATP.

A) True

B) False

18. (2 points) Where does the process of glycolysis take place.

- A) cell cytoplasm
- B) inside the mitochondria cytoplasm
- C) on the mitochondria inner membrane

19. (2 points) How many net ATP are produced in glycolysis from the break down of 1 glucose molecule ?

- a) 36
- b) 24
- c) 2
- d) 38
- e) 3

20. (2 points) **If a cell membrane has a longer time constant and a graded depolarizing potential was traveling along the dendrites towards the cell body and on to the base of a axon (where a high density of voltage gated sodium channels are located) would be it more likely to reach a threshold for generating an action potential than say a cell with a shorter time constant ?**

- A. YES
- B. NO

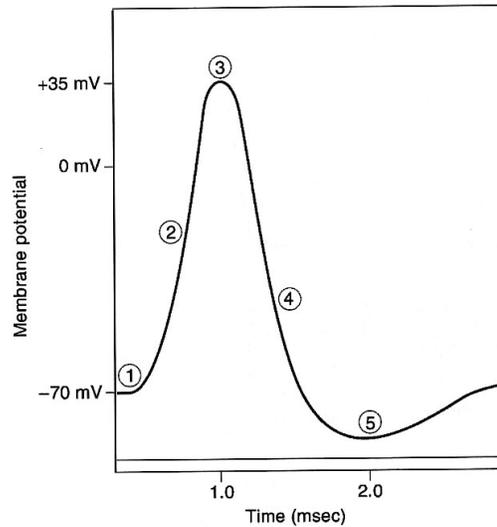
21. (4 points) **Why does the resting membrane potential increase (become less negative) when the bath around the crayfish muscle was exchanged with saline containing higher K^+ ?**

22. (2 points) A transmembrane channel lined with predominantly positively charged amino acids will

- a) allow both K^+ and Cl^- to pass
- b) repel Cl^- and allow K^+ to pass
- c) repel K^+ and allow Cl^- to pass
- d) repel both K^+ and Cl^-

23. (2 points) In the figure below, at which labeled point on the action potential is the K^+ closest to its electrochemical equilibrium?

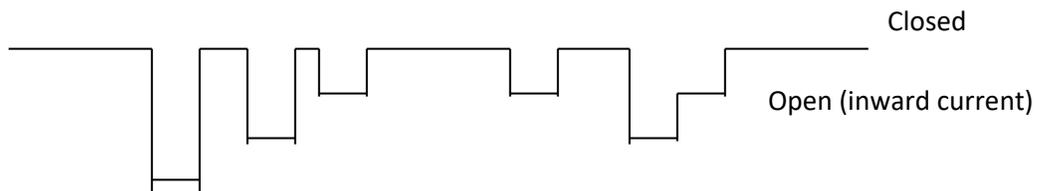
- A. 1
- B. 2
- C. 3
- D. 4
- E. 5



24. (2 points) If a red blood cell is placed in a hyposmotic solution compared to the cell's cytoplasm what will happen to the cell?

- A. The cell will shrink
- B. The cell will expand
- C. The cell will not change in shape

25. (2 points) If you saw a tight patch electrode recording for voltage gated calcium channels like the following (below) how many channels at most would be a good assumption to make are in the patch of membrane being recorded from when the membrane potential is being held above the threshold to activate the calcium channels ? (given: calcium channels show no inactivation like voltage gated sodium channels). Show your work and you logic to your answer.



26. (2 points) What is the water called that is produced from the end result of the Electron transport chain?

27. (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?**

28. (4 points) The rate of glycolysis and the Krebs (TCA) cycle is regulated as not to break down all the glucose stores at once in cell by which general means?

29. (8 points- 2 points each) **What factors define each level of protein structure for primary, secondary, tertiary, and quaternary ?**

30. (5 points, 2.5 pts each) **List 2 parameters by which an ion channel across a membrane discriminates between ion of the same charge.**

31. (5 points) In relation to the three graphs below explain the physiological properties occurring for the animals based on the data presented. What do the results mean in terms of physiological consequences for the animal? Interpretation of the data is needed.

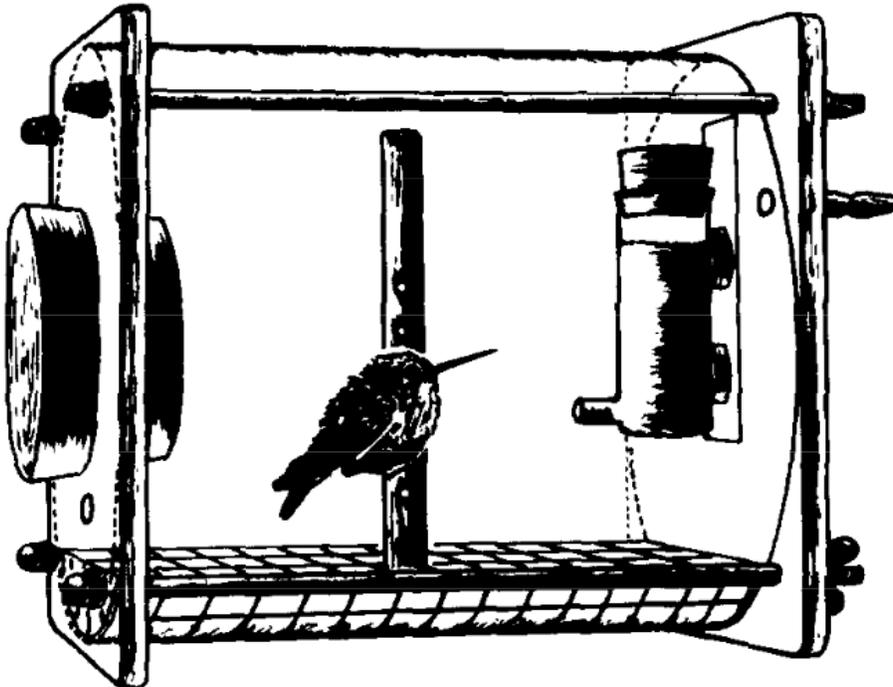


Fig. 1. Schematic view of the plexiglas respirometer chamber used in this study. Shown is a very small hummingbird species (*Clorostilbon mellisugus*, 2.9 g).

Table 1. Mean energy metabolism (J g·hr) at different ambient temperatures during day (1st number), during night (2nd number) and during torpor (3rd number)

Species, sex, mean body mass (g)	Mean metabolism (J g·hr) at							Temperature(x) metabolism(y)	
	2 C	5 C	10 C	12 C	15 C	20 C	25 C	regression (coefficient r)	
<i>Ocreatus underwoodii</i> ♂(2.7)			715	-	604	507	493	$y = -15.3 \times + 847$	(-0.96)
			378	-	291	234	203	$y = -11.6 \times + 480$	(-0.90)
			60	-	36	44	*	$y = -1.6 \times + 71$	(-0.65)
<i>Chlorostilbon mellisugus</i> ♂(2.9)		689	636	-	419	479	428	$y = -13.6 \times + 734$	(-0.86)
		262	311	-	228	203	180	$y = -5.4 \times + 318$	(-0.84)
		101	76	-	25	26	26	$y = -4.0 \times + 111$	(-0.90)
<i>Orthorhyncus cristatus</i> 1 ♂(2.9)		475	450	-	416	477	375	$y = -3.5 \times + 491$	(-0.64)
		217	243	-	205	231	144	$y = -3.2 \times + 255$	(-0.65)
		85	75	-	51	26	63	$y = -1.9 \times + 88$	(-0.64)
<i>Orthorhyncus cristatus</i> 2 ♂(2.9)			456	-	520	313	300	$y = -13.5 \times + 634$	(-0.81)
			308	-	228	165	140	$y = -11.3 \times + 408$	(-0.98)
			98	-	*	25	68	$y = -2.1 \times + 99$	(-0.50)
<i>Archilochus alexandri</i> 1 ♂(2.9)		532	598	-	626	—	477	$y = -3.3 \times + 605$	(-0.44)
		249	390	-	297	—	235	$y = -2.9 \times + 332$	(-0.35)
		*	61	-	*	*	*	*	
<i>Archilochus alexandri</i> 2 ♂(3.2)			615	-	533	535	478	$y = -8.2 \times + 638$	(-0.94)
			349	-	228	228	170	$y = -10.7 \times + 431$	(-0.92)
			52	-	*	*	*	*	

32. (5 points) What were some of the main general findings we went over about Dr. Katz and how he determined the quantal hypothesis in synaptic transmission. Basically what were some of his key findings and how did he do these experiments to obtain these findings?