97 points total

Your Name:_____

I. (18 points) Matching. Use each item in right hand column only once

1. statocyst	____	A. compound eye
2. neuropile	____	B. response varies directly with control signal
3. Porifera	____	C. detects prey with electroreceptors
4. ctenophore	____	D. balance organ used in flight
5. electric ray	____	E. visual process that improves contrast at edges
6. GABA	____	F. uses comb plates for locomotion
7. rhodopsin	____	G. gravity sensor
8. haltere	____	H. synaptic region in arthropod ganglion
9. praying mantis	____	I. nematode sensory organ
10. positive feedback	____	J. excitatory neurotransmitter
11. lateral inhibition	____	K. inhibitory neurotransmitter
12. paddlefish	____	L. shocks prey with summed neuromuscular potential
13. optic cartridge	____	M. part of cockroach escape system
14. hover fly	____	N. mechanoreceptor hairs measure head position
15. ommatidium	____	O. light receptor molecule
16. glutamate	____	P. computes course to intercept female in flight

17. amphid ____ Q. receives axons from retinula cells viewing same point in space.

18. cercus ____ R. choanocyte

II. (24 points) True/False

1. ____ Invertebrates are good models for understanding the neural basis of behavior because they are cold blooded, making neural processes slow enough to observe.

2. ____ *Caenorhabditis* makes a pheromone that induces a dormant stage.

3. ____ The anterior median eyes of jumping spiders focus by moving the retina.

4. ____ In the fly, cutting the nerve from the crop to the brain causes it to feed continuously because it then can no longer taste its food.

5. ____ Muscle first arose in the coelenterates.

6. ____ Asynchronous insect flight muscle contracts more frequently than it receives nerve impulses.

7. ____ During evolution the arthropod brain arose by fusion of several anterior segmental ganglia.

8. ____ Most of the delay before a cockroach begins moving after a “startling” stimulus is involved in accumulating sufficient sensory input to fire the giant axons.

9. ____ To conserve neurons in the crab the same motor neuron supplies more than one muscle.

10. ____ Since there is no genetic similarity among them, it is thought that the eyes of vertebrates, insects and molluscs evolved independently.

11. ____ There are two Mauthner’s neurons in fish to provide a safety factor should one of them fail.

12. ____ The vertebrate striated muscle fiber is caused to contract by calcium release from stores within the muscle cell.

III. (20 points) Multiple choice More than one alternative might be right.

1. If a synapse transmits chemically it:
   (a) needs Mg^{+2} to transmit
   (b) has nearly zero transmission delay
   (c) will have synaptic vesicles
   (d) will transmit current to the post-synaptic cell through gap junctions

2. Which of the following groups of organisms have ciliary photoreceptors:
   (a) annelids
   (b) arthropods
   (c) vertebrates
   (d) molluscs

3. A motor program is a
   (a) packaged set of neurons that produce a specific action
   (b) all the reflexes that an animal uses in motor activity
   (c) packaged set of neurons that can be put into action by a single neural input
   (d) the mechanism by which muscles are caused to contract

4. In a typical nerve cell the action potential arises in the:
   (a) most strongly stimulated dendrite
   (b) cell body
   (c) axon–nearest the cell body
   (d) sodium channels of the dendrites

5. Reaction time in the squid startle response is reduced by:
   (a) the large diameter of the giant axons
   (b) fast acting sodium channels in the giant axons
   (c) placement of all nerve-muscle synapses near the brain
   (d) the ability of the large eye to detect predators at a great distance

6. The ctenophores:
   (a) have stinging cells called nematocysts
   (b) are mostly all bioluminescent
   (c) possess a gravity receptor
   (d) capture small plankton prey and conduct them to the mouth with the comb plates

7. The arthropod ommatidium adapts to light by
   (a) moving pigment cells to shade the rhabdome
   (b) focussing the incoming light away from the rhabdome
   (c) moving the rhabdome away from the lens
   (d) dehydrating the lens to reduce its transparency

8. Which of the following organisms use <u>true</u> giant fibers to trigger escape responses?
   (a) cockroaches
   (b) jellyfish
   (c) fish
   (d) humans
   (e) squid

9. Arthropod muscles:
   (a) have APs to stimulate all-or-none contraction.
   (b) have polyterminal innervation from one neuron along the length of one muscle cell.
   (c) have multineuronal innervation including excitatory and inhibitory neurons.
   (d) have contractions that do not involve Ca^{++}.

10. Mechanoreceptors are heavily concentrated in the mammalian ear. They function to:
   (a) detect gravity within a statocyst (or more accurately via an otolith)
   (b) detect sound via hair cells connected to the flexible basilar membrane which vibrates due to the sound waves
   (c) provide spatial orientation in three planes via sensing sound waves in the semi-circular canals
   (d) detect movements of the ear drum via a direct connection with mechano-sensitive cells

IV. (15 points) Short answer CHOOSE 3 OUT OF THE 5 TO ANSWER.

Write answer clearly in the space provided (approximately 3-4 sentences each).

1. Describe how the space constant of a nerve cell affects its function.

2. Explain why a myelinated axon has to have Nodes of Ranvier for the cell to transmit nerve impulses.

3. Explain how the *Caenorhabditis* mutant "bent" contributes to understanding how that organism orients up a concentration gradient of an attractant chemical.

DO NOT WRITE BELOW THIS LINE

IV. Short Answer (cont.)
Write answer clearly in the space provided (approximately 3-4 sentences each).

4. How does sexual cannibalism benefit the male Australian Red Back spider?

5. Explain why *Ascaris* and *Caenorhabditis* are considered a "team" in the investigation of the genetic basis of neural structure and function.

DO NOT WRITE BELOW THIS LINE

V. (20 points) Answer the questions relating to the following diagrams:
Fit your answer in the space provided. As in section IV, your answers should be approximately 3-4 sentences each.

1. (5 pts)

a)What does curve 1 represent?

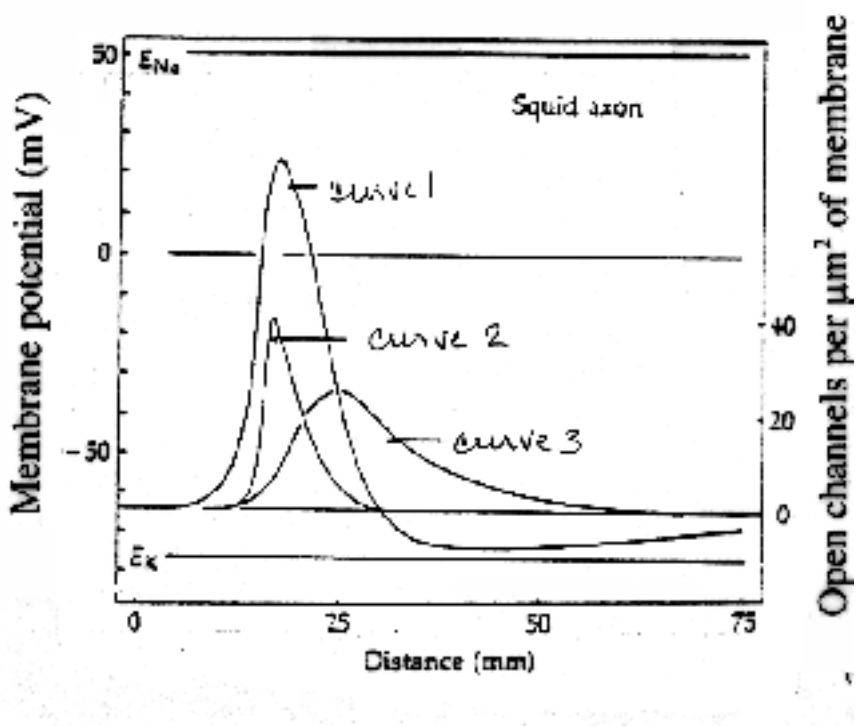
_____

b) What do curves 2 & 3 represent?

curve 2:_____

curve 3:_____

c) How do curves 2 & 3 explain curve 1?



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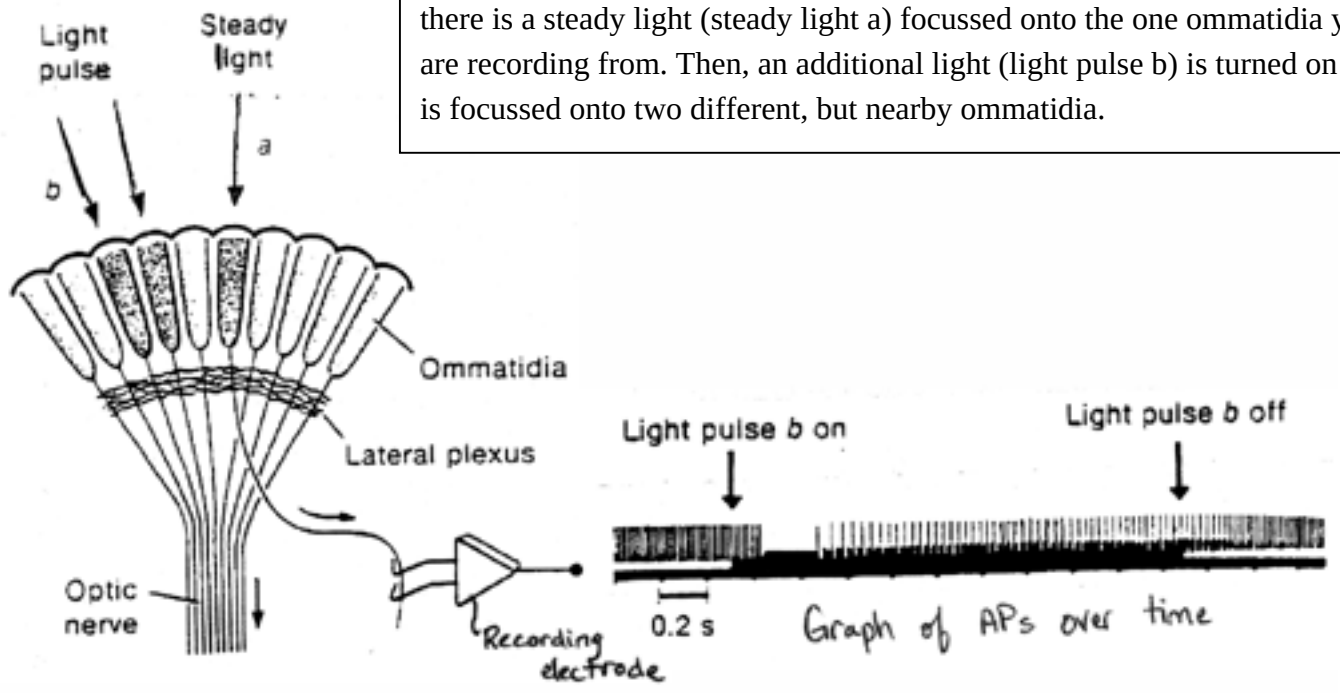
2. (5 pts)
In this experiment you are recording the APs from one ommatidia within a Limulus eye. The experiment is such that first you examine the APs when there is a steady light (steady light a) focussed onto the one ommatidia you are recording from. Then, an additional light (light pulse b) is turned on that is focussed onto two different, but nearby ommatidia.



Explain what this experiment demonstrates accounting specifically for the pattern of APs observed in the graph.

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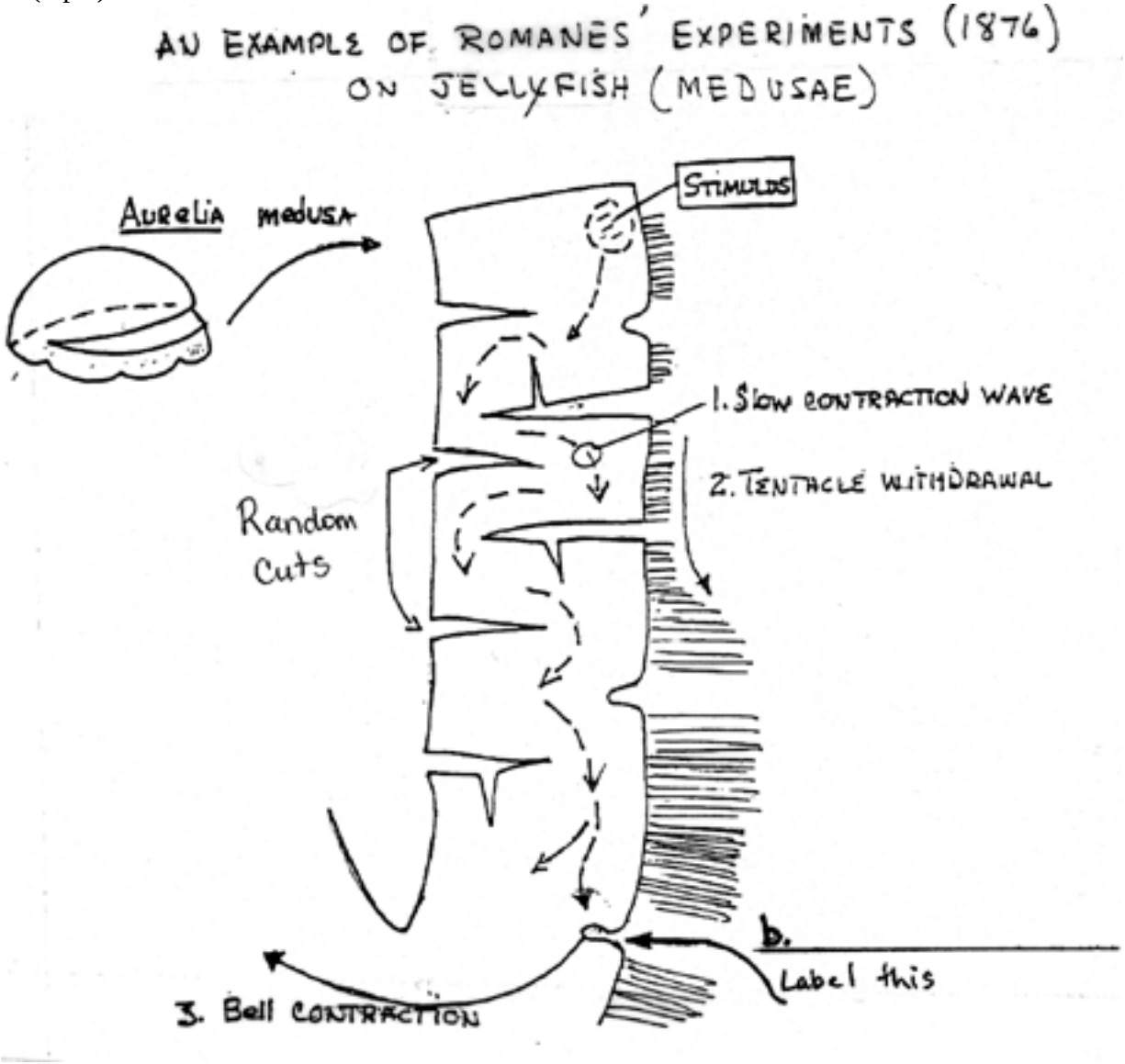
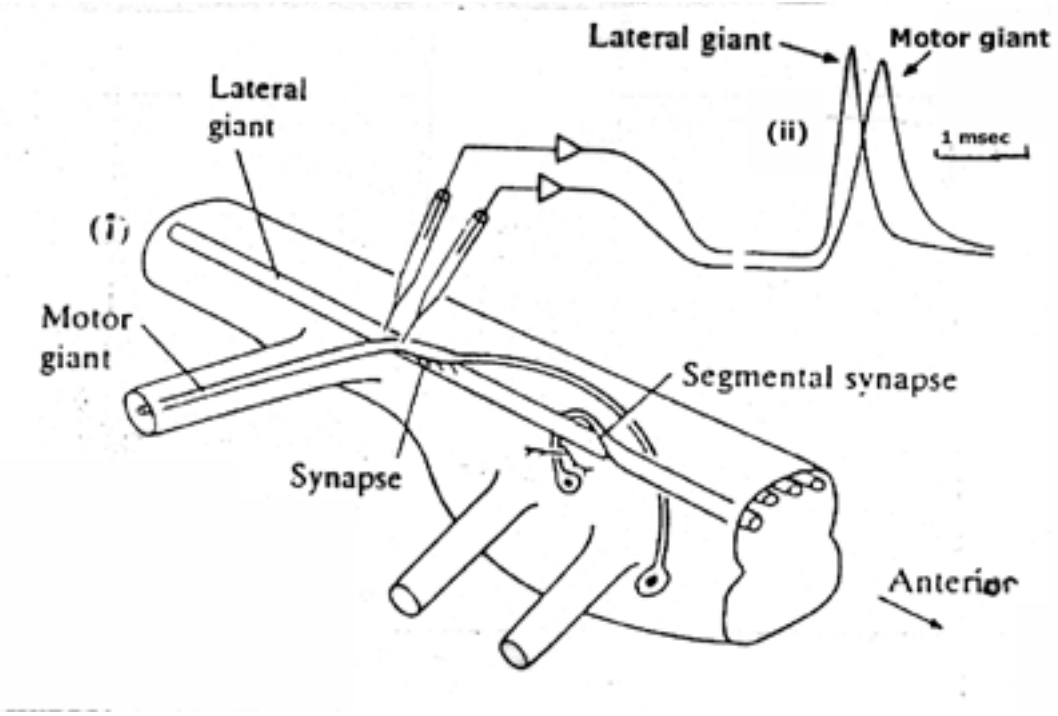
3. (5 pts)



a) What did making these cuts show about nerve transmission in cnidarians?

b) Label arrow and explain what happens at this region.

4. (5 pts) Crayfish giant fiber system



(i) Drawing of an abdominal ganglion to show the relative positions of the lateral giant and motor giant neurons, the synapse between them and the arrangement for recording from each side of this synapse.
(ii) Simultaneous, intracellular recordings from the lateral giant and motor giant neurons close to the synapse.

a) How does the lateral giant communicate with the motor giant?
b) How does the record in diagram (ii) evidence this?
c) Why do these two giant fibers communicate in this manner?