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UNIVERSITY OF TEXAS AT ARLINGTON  
DEPARTMENT OF BIOLOGY  
HUMAN PHYSIOLOGY  
(Biol 3345)

Dr. David G. Bernard

SECOND INTRASESSIONAL EXAMINATION

March 22, 2007

First Name Cuong Last Name: Le UTA ID # 1000462-979

There are 55 items in this booklet; 50 are multiple choice questions and the remainder are either short essay questions or diagrams to be labeled. Be careful not to overlook any pages in the examination booklet. You have 80 minutes to complete these questions.

During the course of the examination students will remain in their assigned seats. If assistance is needed, the student should raise his/her hand and a proctor will attend the individual needs of that student.

Upon completion of the exam, each student is to remain seated, raise her/his hand, and the exam materials will be collected by a proctor. At no time is the student to leave his/her seat and carry the exam materials to the proctors or other areas of the room.

After collection of exam materials, the student is to immediately, quietly, and promptly leave the Examination Room.

**NO EXTRA TIME WILL BE ALLOWED AT THE END OF THE EXAMINING PERIOD FOR ANSWERS TO BE TRANSFERRED.**

**\* GOOD LUCK! \***



**DIRECTIONS:** Each of the numbered items or incomplete statements in this section is followed by answers or completions of the statement. Select the ONE lettered answer or completion that is BEST in each case and write your selection in the left margin beside the question. Each multiple choice question is worth 2 points. YOU DO NOT HAVE TO ATTEMPT ALL THE QUESTIONS TO EARN 100 POINTS.

1. Membrane potential:
  - A. refers to a separation of charges across the membrane or to a difference in the relative number of + and - charges in the ECF and ICF.
  - B. is measured in units of millivolts with the sign always designating the charge on the outside
  - C. is less at the equilibrium potential for  $K^+$  than at resting membrane potential
  - D. cannot be measured easily
  - E. All of these answers
  
2. If the ventral root of a spinal nerve were cut, what would be the result in the tissue or region that nerve supplies?
  - A. complete loss of sensation
  - B. a complete loss of voluntary movement
  - C. loss of neither sensation nor movement but only autonomic control
  - D. a complete loss of sensation and movement
  - E. only loss of sympathetic information
  
3. In a condition known as hypocalcemia, the level of calcium ions in the blood and interstitial fluid is lower than normal. How would this condition affect the function of the nervous system?
  - A. Cholinergic synapses would be more active.
  - B. Neurons would generate action potentials spontaneously.
  - C. Less neurotransmitter would be released in response to an action potential.
  - D. Depolarizing events would occur more frequently at the postsynaptic membrane.
  - E. Potassium channels would fail to open.
  
4. The motor end plate is:
  - A. a folded area of muscle cell membrane with ACh receptors clustered at the top of each fold
  - B. the same as the neuromuscular junction
  - C. the same as the synaptic cleft
  - D. formed by the membrane of enlarged axon terminals, or boutons, that lie on the surface of skeletal muscle cells
  - E. a special fibrous matrix whose collagen fibers hold the axon terminal in proper position
  
5. At resting membrane potential:
  - A. the membrane is more permeable to  $K^+$  than to  $Na^+$
  - B. the membrane is more permeable to  $Na^+$  than to  $K^+$
  - C.  $Cl^-$  is at its equilibrium potential
  - D. both A and C above
  - E. Both B and C above
  
6. The brainstem consists of the:
  - A. cerebrum, pons, midbrain, and medulla
  - B. midbrain, medulla, and pons
  - C. pons, medulla, cerebellum, and midbrain
  - D. midbrain only
  - E. diencephalon, midbrain and medulla
  
7. An alien retrieved alive from a crashed UFO has had a thorough medical examination. A hormone with a distinct but similar structure to epinephrine has been isolated, and named ufo-epi. Which of the following responses in humans administered a physiological dose of ufo-epi would indicate it is indeed an epinephrine agonist?
  - A. constriction of respiratory tubes
  - B. hyperglycemia (high blood glucose)
  - C. increase in fatty acids in the blood
  - D. localized sweating
  - E. decreased heart rate

8. The spinal cord has grey matter on the:
- A. outside, white matter on the inside, and a dorsal motor root
  - B. inside, white matter on the outside, and a ventral motor root
  - C. inside, white matter on the outside, and a dorsal motor root
  - D. outside, white matter on the inside, and a ventral motor root
9. Astrocytes:
- A. induce formation of the blood-brain barrier ✓
  - B. are important in the repair of brain injuries and in neural scar formation ✓
  - C. take up excess  $K^+$  from the brain ECF ✓
  - D. physically support neurons ✓
  - E. All of these answers are correct. ✓
10. An IPSP is associated with:
- A. a change in sodium ion permeability
  - B. hyperpolarization
  - C. opening of voltage-gated channels
  - D. lowering the threshold for an action potential to occur
  - E. All of these are correct answers.
11. A second nerve impulse cannot be generated until:
- A. the membrane potential has been reestablished
  - B. the Na ions have been pumped back into the cell
  - C. the K ions have been pumped back out of the cell
  - D. All of the above are correct. ✓
12. Nicotinic receptors
- A. bind ACh and open monovalent cation channels. ✓
  - B. are found on skeletal muscles at the neuromuscular junction. ✓
  - C. are identical throughout the nervous system. ✓
  - D. A and B
  - E. A, B, and C
13. The difference between electronic and saltatory conduction is that:
- A. saltatory conduction requires the presence of myelin
  - B. during electronic conduction only subthreshold depolarizations are conducted
  - C. saltatory conduction is a graded event
  - D. in electronic conduction the amplitude of the signal gets smaller
  - E. saltatory conduction only occurs near the cell body
14. The outermost connective tissue covering of spinal nerves is the:
- A. endoneurium
  - B. endomysium
  - C. perineurium
  - D. epineurium
  - E. epimysium
15. Graded potentials:
- A. are local changes in membrane potential that occur in varying degrees of magnitude ✓
  - B. serve as short-distance signals ✓
  - C. serve as long-distance signals ✓
  - D. both A and B
  - E. both A and C
16. The role of acetylcholinesterase is to:
- A. act as a transmitting agent ✓
  - B. amplify or enhance the effect of ACh ✓
  - C. destroy ACh a brief period after its release by the axonal endings ✓
  - D. stimulate the production of acetylcholine ✓
  - E. inhibit the release of acetylcholine ✓
17. In which of the following would the rate of impulse conduction be the greatest?
- A. a myelinated fiber 20 microns in diameter
  - B. a nonmyelinated fiber 20 microns in diameter
  - C. a myelinated fiber 2 microns in diameter
  - D. a nonmyelinated fiber 2 microns in diameter
  - E. a nonmyelinated fiber 25 cm long

18. Which of these has a higher concentration in cerebrospinal fluid than in the blood?

- A. ~~K<sup>+</sup>~~ B. ~~H<sup>+</sup>~~ C. ~~Ca<sup>2+</sup>~~  
D. ~~HCO<sub>3</sub><sup>-</sup>~~ E. Na<sup>+</sup>

19. The dorsal root ganglia contain:

- A. ~~axons of motor neurons~~  
B. ~~axons of sensory neurons~~  
C. ~~cell bodies of motor neurons~~  
D. cell bodies of sensory neurons  
E. C and D

20. During the rising phase of the action potential:

- A. ~~K<sup>+</sup> permeability is much greater than Na<sup>+</sup> permeability~~  
B. Na<sup>+</sup> permeability is much greater than K<sup>+</sup> permeability  
C. ~~K<sup>+</sup> permeability is the same as Na<sup>+</sup> permeability~~  
D. ~~Na<sup>+</sup> efflux occurs~~  
E. ~~Two of these answers are correct.~~

21. The interior of the cell becomes less negative due to an influx of sodium ions.

- A. ~~Action potential~~ B. ~~Repolarization~~  
C. ~~Absolute refractory period~~ D. Depolarization  
E. ~~Relative refractory period~~

22. The subdural space

- A. ~~separates the arachnoid mater from the pia mater~~  
B. ~~separates the pia mater from the dura mater~~  
C. ~~separates the dura mater from the brain~~  
D. contains cerebrospinal fluid  
E. ~~is between the vertebrae and the dura mater~~

23. The third and fourth ventricles are linked by the:

- A. ~~central canal~~ B. ~~lateral ventricles~~ C. mesencephalic aqueduct  
D. ~~interventricular foramina~~ E. ~~medulla oblongata~~

24. Select the statement that is most correct.

- A. ~~Ganglia are collections of neuron cell bodies in the CNS that are associated with efferent fibers.~~  
B. ~~Efferent ganglia are not associated with the autonomic system.~~  
C. ~~The dorsal root ganglion is a motor only structure.~~  
D. ~~The cell bodies of afferent ganglia are located in the spinal cord.~~  
E. Ganglia exist outside the spinal cord.

25. Excess cerebrospinal fluid is drained into the:

- A. ~~jugular veins~~ B. ~~dural sinus~~ C. superior sagittal sinus  
D. ~~falx cerebri~~ E. ~~cranial vein~~

26. Myelinated axons conduct impulses much faster because:

- A. ~~the myelin insulates the axon~~  
B. ~~channels only have to open at the nodes~~  
C. voltage is not lost through and along myelinated areas  
D. ~~of saltatory conduction~~  
E. ~~All of these answers are correct~~

27. The all-or-none principle states that:

- A. ~~all stimuli will produce identical action potentials~~  
B. all stimuli great enough to bring the membrane to threshold will produce identical action potentials  
C. ~~the greater the magnitude of the stimuli, the greater the intensity of the action potential~~  
D. ~~only sensory stimuli can activate action potentials~~  
E. ~~only motor stimuli can activate action potentials~~

28. Which of the following nerve fibers will have the highest conduction velocity?

- A. ~~an unmyelinated nerve fiber with conduction velocity = 0.35 m/sec~~  
B. ~~an unmyelinated nerve fiber smaller than the nerve fiber in A~~  
C. ~~a myelinated nerve fiber the same size as the nerve fiber in A~~  
D. a myelinated fiber larger than the nerve fiber in A  
E. ~~it is impossible to determine with the information provided~~

29. Because of the presence of both activation and inactivation gates, voltage-gated  $\text{Na}^+$  channels can:
- A. be closed but capable of opening
  - B. Be activated
  - C. be closed and not capable of opening
  - D. All of the above answers are correct. ✓
  - E. None of these answers.
30. If a somatic motor neuron fires an action potential, then
- A. acetylcholine is released from the axon terminal ✓
  - B. a skeletal muscle is triggered to contract ✓
  - C. the response is always excitatory ✓
  - D. A and B
  - E. A, B and C
31. Which statement regarding CSF production and flow is correct?
- A. CSF is produced along the spinal cord
  - B. CSF is produced by meningeal cells
  - C. CSF enters the meningeal layer through the cerebral aqueduct ?
  - D. CSF flows inferiorly along the dorsal subarachnoid space of the spinal cord ✓
  - E. CSF does not flow through the meningeal layers
32. Motor innervation of the voluntary swallowing muscles and intrinsic laryngeal muscles is by way of the \_\_\_\_\_ nerve.
- A. abducens
  - B. vestibulocochlea
  - C. spinal accessory
  - D. hypoglossal
  - E. vagus
33. Postganglionic fibers of autonomic neurons are usually:
- A. myelinated
  - B. larger than preganglionic fibers
  - C. located in the brain
  - D. located in the spinal cord
  - E. unmyelinated ✓
34. Preganglionic fibers of parasympathetic neurons can be found in all of the following cranial nerves, **EXCEPT** C.N.:
- A. III ✓
  - B. VII ✓
  - C. IX ✓
  - D. X ✓
  - E. XII ✓
35. Each of the following is a function of the nervous system, **EXCEPT**:
- A. providing sensation of the internal and external environments ✓
  - B. integrating sensory information ✓
  - C. coordinating voluntary and involuntary activities ✓
  - D. directing activities that continue for extended periods such as growth and pregnancy X
  - E. regulating or controlling peripheral structures and systems X
36. Parasympathetic blocking agents would be useful in treating:
- A. heart failure ✓
  - B. high blood pressure ✓
  - C. diarrhea ✓
  - D. A and C
  - E. All of the above X
37. Interneurons:
- A. are found only in the central nervous system ✓
  - B. carry only sensory impulses X
  - C. carry only motor impulses X
  - D. only connect motor neurons to other motor neurons X
  - E. are found between neurons and their effectors X
38. How does blocking the ability for retrograde flow in an axon affect the activity of a neuron?
- A. The neuron is unable to produce neurotransmitters.
  - B. The neuron is unable to produce action potentials.
  - C. The soma is unable to export products to the synaptic knobs.
  - D. The soma is unable to respond to changes in the distal end of the neuron. ✓
  - E. The neuron is unable to depolarize when stimulated.

39. Which statement is **TRUE** about sleep?
- A. It is an easily reversible state of inactivity.
  - B. It is characterized by lack of interaction with the external environment.
  - C. Sleep is now considered an active state, requiring neuronal activity.
  - D. During a sleep cycle a person alternates between REM sleep and deep wave sleep.
  - E. All of these statements are true.

40. The two divisions of the efferent side of the peripheral nervous system are:
- A. somatic motor neurons and voluntary neurons
  - B. somatic motor neurons and autonomic neurons
  - C. the sympathetic and parasympathetic divisions
  - D. voluntary nervous system and somatic motor neurons
  - E. visceral nervous system and the involuntary nervous system

41. Target receptor for preganglionic neurons:
- A. acetylcholine
  - B. norpinephrine
  - C. cholinergic nicotinic receptor
  - D. adrenergic receptor
  - E. cholinergic muscarinic receptor

Match each with its function (Questions 42 to 43):

- |               |                       |
|---------------|-----------------------|
| A. Dura mater | B. Pia mater          |
| C. Arachnoid  | D. Subarachnoid space |
| E. Ventricles |                       |

42. The innermost layer of the meninges, delicate, contains many blood vessels.
43. The weblike, spidery middle meningeal layer.

44. Major centers concerned with autonomic control of breathing, blood pressure, heart rate, and digestive activities are located in the
- |                      |               |                  |
|----------------------|---------------|------------------|
| A. medulla oblongata | B. pons       | C. mesencephalon |
| D. diencephalon      | E. cerebellum |                  |

45. The cranial nerves that are involved in controlling eye movements are:
- |                   |                    |                    |
|-------------------|--------------------|--------------------|
| A. I, II, and III | B. III, IV, and VI | C. II, III, and IV |
| D. II and VI      | E. III and V       |                    |

46. Branches that sometimes occur along the length of an axon are called:
- |                |                   |                |
|----------------|-------------------|----------------|
| A. telodendria | B. synaptic knobs | C. collaterals |
| D. hillock     | E. synapse        |                |

47. Which term below best describes an excitable tissue when a resting membrane potential is present?
- |                |                 |                   |
|----------------|-----------------|-------------------|
| A. polarized   | B. depolarized  | C. hyperpolarized |
| D. repolarized | E. nonpolarized |                   |

48. The ion needed to initiate the release of acetylcholine into the synaptic cleft is:
- |             |                     |            |
|-------------|---------------------|------------|
| A. sodium   | B. potassium        | C. calcium |
| D. chloride | E. $\text{HCO}_3^-$ |            |

49. On which lobe would one expect to find the primary sensory cortex?
- |            |             |              |              |
|------------|-------------|--------------|--------------|
| A. Frontal | B. Parietal | C. Occipital | D. Temporal. |
|------------|-------------|--------------|--------------|

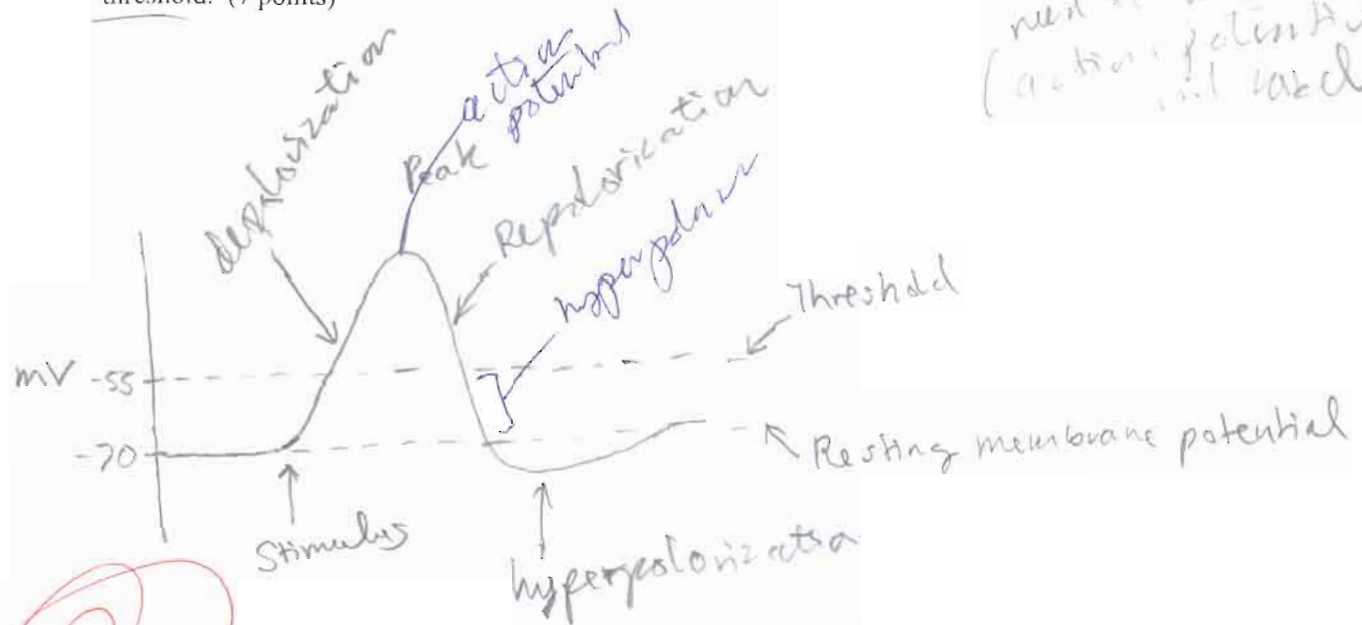
50. Each peripheral nerve provides \_\_\_\_\_ innervation to specific structures
- |                |                |            |
|----------------|----------------|------------|
| A. motor       | B. sensory     | C. tactile |
| D. A and/or B. | E. B and/or C. |            |

Short Answer Questions

Please answer these questions briefly. Label diagrams correctly, with lines pointing to the proper structures. Partial credit will be given where appropriate. Write legibly!!

You can use the back of the last page to continue any question. Number them, please!!

51. Draw and completely label a graph showing what would happen to the resting membrane potential if the sodium/potassium pumps were made non-functional and immediately after the nerve was stimulated to threshold. (7 points)



3

52. You are walking to class, pondering the intricacies of physiology, when you trip over an uneven place in the sidewalk, and fall. Unhurt but embarrassed and angry, you jump up and glance around to see if anyone is watching. (From your knowledge of neuroanatomy and function, explain how the following areas of the brain might be involved in this scenario: (3 points)

- a. cerebrum - motor
- b. cerebellum - ~~motor~~ balance
- c. limbic system - emotion

The information received by the central nervous system (cerebrum). Then, the CNS activates the PNS to respond (limbic system).

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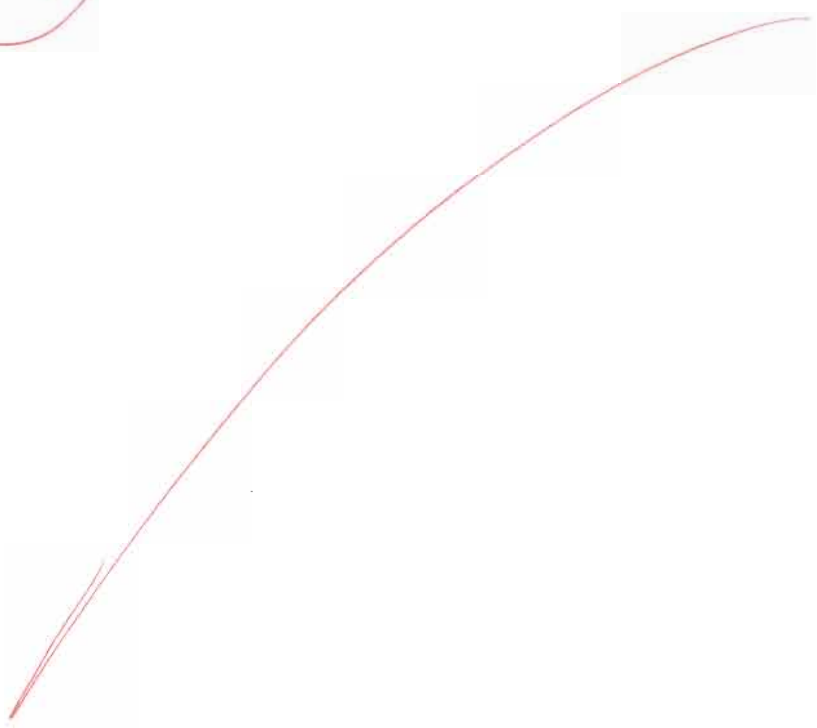
53. Please answer only ONE of the following (A OR B). Circle the one you are answering. (3 points each)

- A. Write out the Nernst equation and explain its significance. What is the equilibrium potential for an ion?
- B. In multiple sclerosis, there is progressive and intermittent damage to the myelin sheath of axons of the central nervous system. One symptom is poor motor control of the affected area. Why does destruction of the myelin sheath affect motor control?

1) Nernst equation =  $\frac{61 \text{ mV}}{z} \log \frac{[\text{ion}]_{\text{outside}}}{[\text{ion}]_{\text{inside}}}$

2) Equilibrium potential for an ion = It is the point at which the electrical force and chemical force of the ion are balanced.

A



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54. List the anatomic and functional categories of neurons. (3 points)

Anatomic

- Pseudounipolar
- bipolar
- multipolar

25

Functional

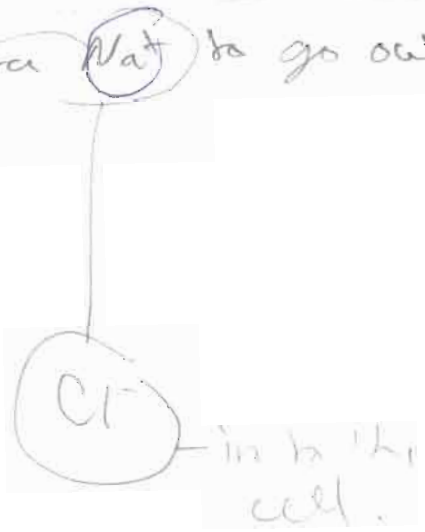
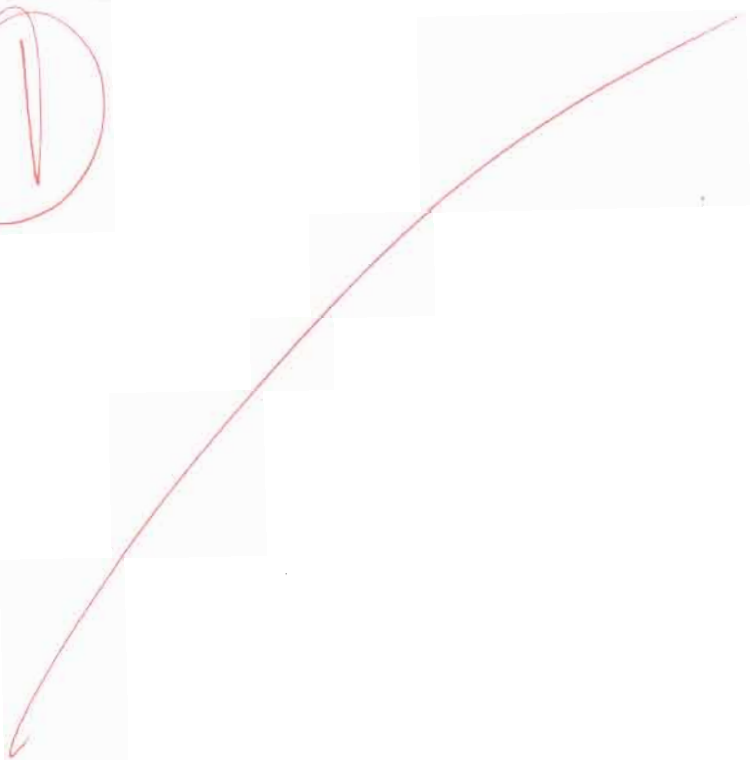
- sensory
- motor

55. Using ions, describe two ways a cell can become hyperpolarized. (2 points)

1) A cell can be become hyperpolarized by continuing opened the  $K^+$  channel so that  $K^+$  can still go out.

2) " by allowing extra  $Na^+$  to go out off the cell.

1

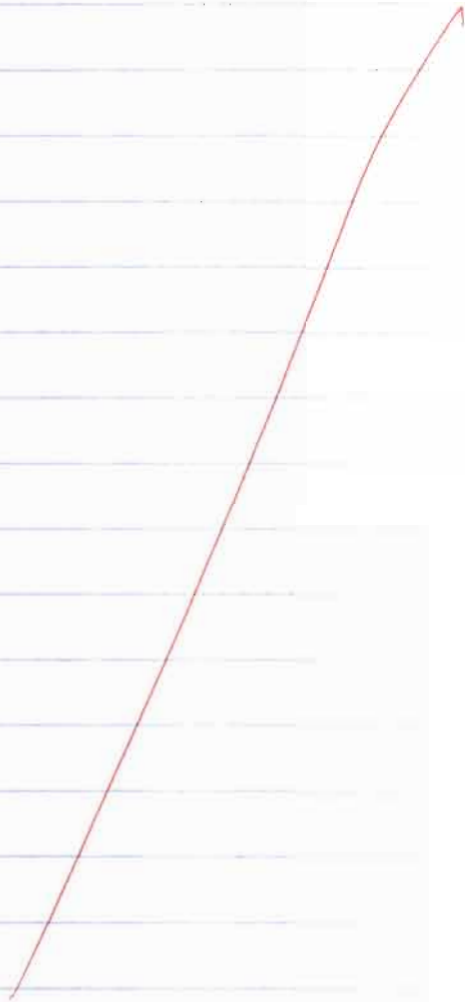




Human Physiology  
03/27/07  
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- 1) Adequate stimulus - has enough power to produce action potential
- 2) Receptive field - receive information from previous neurons.



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[Redacted]

[Redacted]

[Redacted]

[Redacted]

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Cuong H  
03/06/07  
Human Phys.



1) Cerebrospinal fluid contains more water than the blood. CSF is used to protect the brain. Also, CSF is not inside the blood

