

EXAM II: Zoology 121, Human Physiology

110 Points Total; Please read each question carefully! Exam is double-sided (7 pages).

Name Shirley Green Lab Section (circle): T 8:30 T 11:30 T2:30 Th 11:30 Th 2:30

Part I. Multiple Choice. 2 Points Each (34 Points Total). Only one choice is correct.

- 1 _____ signals travel through the blood.
- A autocrine
 - B paracrine
 - C endocrine
 - D nuclear
- 2 Which of the following statements best compares graded potentials to action potentials?
- A Action potentials are long distance signals and graded potentials are short-distance signals
 - B Graded potentials are all-or-none, while action potentials depend on the intensity of the stimulus
- 3 Which of the following statements best describes spatial summation?
- A Adding up EPSPs and/or IPSPs that are close together in time
 - B Adding up EPSPs and/or IPSPs that converge on the neuron from multiple synapses
- 4 A receptor protein that also functions as an ion channel is called a/an _____ receptor.
- A Metabotropic
 - B Ionotropic
 - C Adrenergic
 - D Nuclear
- 5 Neuropeptides are synthesized
- A In the synaptic knob, then pumped into synaptic vesicles
 - B In the endoplasmic reticulum, then transported in vesicles down the 'microtubule highway' of the axon

- 6 Which one of the following is NOT a mechanism for removing neurotransmitter from the synapse?
- A Diffusion
 - B Reuptake into synaptic knob by specific transporters
 - C Phagocytosis by macrophages
 - D Inactivation by specific enzymes
- 7 Which one of the following brain regions is important for homeostatic regulation of thirst and hunger and temperature?
- A Ventral tegmental area
 - B Hypothalamus
 - C Amygdala
 - D Brainstem
- 8 Which of the following is the major function of astrocytes?
- A Regulate ionic composition of extracellular fluid in the brain
 - B Immune cells of the brain
 - C Formation of myelin in the CNS
 - D Formation of myelin in the PNS
- 9 In long-term potentiation (mechanism for learning and memory), this retrograde messenger can deliver information from postsynaptic to presynaptic neurons.
- A Carbon dioxide
 - B Nitrous oxide
 - C Nitric oxide
 - D Carbon monoxide
- 10 Mechanoreceptors are sensory cells specialized to sense
- A Damage/pain
 - B Pressure
 - C Chemicals
 - D Osmolarity

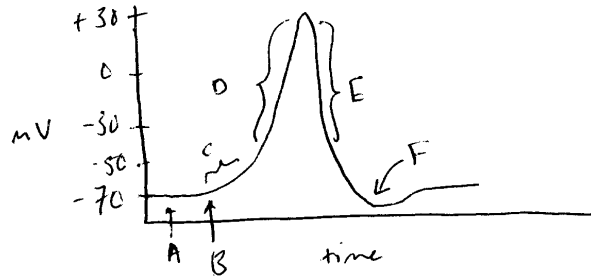
- 11 Capsaicin, the 'hot' component of hot peppers, stimulates
- A Taste receptor cells
 - B Olfactory receptor cells
 - C Polymodal nociceptors
 - D Thermal nociceptors
- 12 In the dark, photoreceptors are:
- A Hyperpolarized
 - B Depolarized
 - C Repolarized
 - D Unhappy
- 13 Which of the following BEST describes the function of the autonomic nervous system?
- A Control of skeletal muscles
 - B Input to central nervous system regarding external environment
 - C Controls fight, flight, feeding, mating
 - D Mediates emotional responses
- 14 Which of the following reflexes is monosynaptic?
- A Withdrawal reflex
 - B Pupillary reflex
 - C Gag reflex
 - D Stretch reflex
- 15 Which of the following hormones is transported in the blood by being bound to plasma proteins?
- A Melatonin
 - B Thyroid hormone
 - C Insulin (a peptide hormone)
 - D Epinephrine
- 16 This hormone has a function in regulating circadian rhythms
- A Melatonin
 - B Cortisol
 - C Growth hormone
 - D GABA

17 This neurotransmitter is thought to be involved in drug addiction.

- A Norepinephrine
- B Melatonin
- C Dopamine
- D Serotonin

Part II. Short Answer. 3 Points Each (48 Points Total).

18 - 21 Refer to the labeled diagram, and fill in the missing steps describing the events in an action potential.

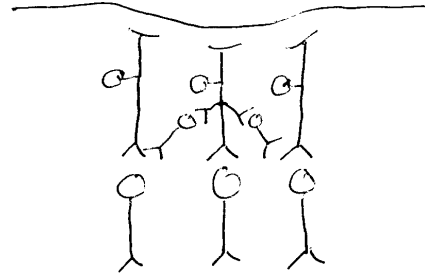


- A Most K⁺ channels open, most Na⁺ channels closed
- B _____
- C Na⁺ enters with its electrochemical gradient, this further depolarizes membrane, opens more voltage-gated Na⁺ channels; positive feedback loop established.
- D _____
- E _____
- F _____

22 The action potential has a refractory period, during which additional action potentials are either difficult or impossible. What are the consequences of this refractory period (i.e. what is the function of the refractory period?)

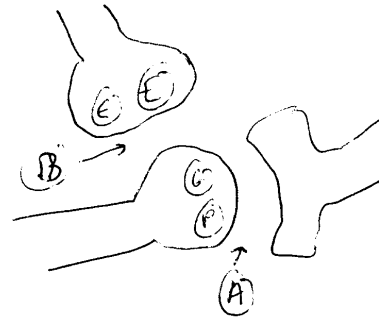
23 Name a second messenger molecule. _____

24 On the diagram of lateral inhibition, please indicate which synapses are inhibitory and which are excitatory (draw a (-) or a (+)).



25 What does lateral inhibition accomplish?

26 The neuropeptide, enkephalin, can result in analgesia (less pain being perceived), as shown in the diagram. The synapse where enkephalin functions (synapse B) is _____ (axo-dendritic/axo-somatic/axo-axonic).



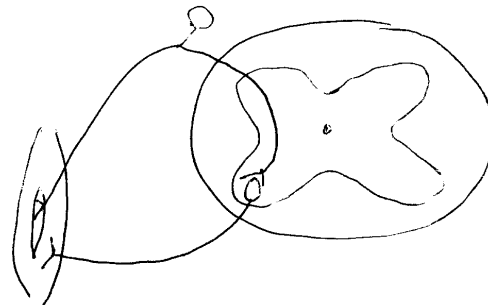
27 How does enkephalin act to reduce synaptic transmission at the synapse labeled 'A'?

28 The sense of balance/position in space is conveyed by three senses. They are: Proprioception, _____ and _____

29 Which sensory system has the most direct neuronal pathway to the limbic system?

30 In the entire effective branch of the peripheral nervous system, only two neurotransmitters are used. What are they? _____ and _____

31 In the diagram of a stretch reflex, draw a gamma motor neuron (show where cell body is and where synaptic knob is).



32 Briefly describe the function of the gamma motor neuron. _____

- 33 The hormone Prolactin Releasing Hormone (PRH) is released from the hypothalamus and regulates production of the hormone prolactin in the anterior pituitary. PRH is a _____ (tropic/non-tropic) hormone. PRH is a peptide and is water-soluble (hydrophilic), therefore PRH must act on _____ (cell surface/nuclear) receptors.

Part III. Describe/Illustrate. Points as indicated (28 Points Total).

- 34 10 Points. No choices.
Describe the steps involved in synaptic transmission; begin with an action potential in the presynaptic neuron. Include a diagram in your answer.

- 35 8 Points. Choose one of the following neurotransmitters (circle your choice): Glutamate, GABA, Dopamine, Acetylcholine, Norepinephrine. List the following features.

Is this a neurotransmitter or neuropeptide? _____

How is it synthesized and packaged into vesicles? _____

Does it act on metabotropic or ionotropic receptors? _____

Discuss one major role of this neurotransmitter that was discussed in class :

- 36 10 Points. Choose one of the following sensory cells, and describe how it functions: **photoreceptor, hair cell, or one of the taste receptor cells**. Begin with how the sensory cell is initially affected by the stimulus (light, sound wave, or chemical) and end with how this affects neurotransmitter release. Include an illustration.

Extra Credit (4 pts): A question was raised in class as to why mint 'tastes' cool. Suggest a possible reason – include the sensory cell that may be involved, and a mechanism for how mint can activate this cell.