

Finals Questions

1) Which of the following serves as a neurotransmitter in adrenergic neurons?

- a) Serotonin
- b) Epinephrine
- c) Dopamine
- d) Histamine

Answer: B

2) Which type of cholinergic receptor is found at synapses between preganglionic and postganglionic neurons of the sympathetic system?

- A) Muscarinic
- B) Nicotinic
- C) Alpha
- D) Beta1
- E) Beta2

Answer: B

3) Which substance activates adrenergic alpha and beta receptors equally well?

- A) Acetylcholine
- B) Norepinephrine
- C) Epinephrine
- D) Serotonin
- E) Dopamine

Answer: C

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4) Nasal, lacrimal, salivary, and gastrointestinal glands are stimulated by which of the following substances?

- A) Acetylcholine
- B) Norepinephrine
- C) Epinephrine
- D) Serotonin
- E) Dopamine

Answer: A

5) The function of which of the following organs or systems is dominated by the sympathetic nervous system?

- A) Systemic blood vessels
- B) Heart
- C) Gastrointestinal gland secretion
- D) Salivary glands
- E) Gastrointestinal motility

Answer: A

6) Which of the following is not under autonomic control?

- a. Exocrine glands
- b. Adrenal medullary glands
- c. Brown adipose tissue of mammals
- d. Skeletal muscle
- e. The pacemaker region of the heart

Answer: D

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7) The nerve that runs from the paravertebral ganglia to the heart would be termed a(n) _____ neuron.

- a. sympathetic postganglionic
- b. parasympathetic postganglionic
- c. sympathetic preganglionic
- d. parasympathetic preganglionic
- e. autonomic ganglionic

Answer: D

8) Which of the following would occur if epinephrine/norepinephrine were added to the paravertebral ganglia in the upper thoracic area (that feed the heart)?

- a. Acceleration of heart rate
- b. Deceleration of heart rate
- c. Increase in gut motility
- d. Complete stopping of the heart
- e. None of the above; there would be no effect.

Answer: E

9) A surprise phone call at 3 AM would likely cause all the following physiological reactions except

- a. inhibited salivation.
- b. pupil constriction.
- c. inhibited digestion.
- d. increased glucose production.
- e. sweating.

Answer: B

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10) The preganglionic neuron of the sympathetic system releases the neurotransmitter

- a. acetylcholine.
- b. epinephrine/norepinephrine.
- c. glutamate.
- d. GABA.
- e. calcium.

Answer: A

11) The _____ division has a long preganglionic neuron synapsed with a short postganglionic neuron.

- a. sympathetic
- B. enteric
- C. parasympathetic
- D. somatic
- E. autonomic

Answer: C

12) Application of acetylcholine all along the paravertebral ganglia will

- A. cause the heart to speed up.
- B. cause the heart to slow down.
- C. have no effect on the heart.
- D. cause the heart to speed up, then slow down.
- E. cause the heart to stop.

Answer: A

Finals Questions

13) Which of the following actions is not considered a sympathetic effect?

- a. Simulation of the secretion of epinephrine
- b. Inhibition of digestion
- c. Increased heart rate
- d. Increased blood pressure
- e. Constriction of lung passages

Answer: E

14) Application of acetylcholine directly to the heart will:

- A. cause the heart to speed up.
- B. cause the heart to slow down.
- C. have no effect on the heart.
- D. cause the heart to speed up, then slow down.
- E. cause the heart to stop.

Answer: B

15) Once acetylcholine is released into the synapse it

- A. is actively pumped back into the presynaptic neuron.
- B. crosses the postsynaptic membrane and then is broken down inside that cell.
- C. is inactivated by sodium.
- D. is inactivated by calcium.
- E. is broken down by acetyl cholinesterase.

Answer: E

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16) Which of the following statements regarding postsynaptic potentials is false?

- a. In a neuromuscular junction, the neurotransmitter is acetylcholine.
- b. In a CNS neural synapse, glycine produces an IPSP.
- c. In a CNS neural synapse, K^+ is the main ion producing the EPSP.
- d. In a CNS neural synapse, GABA produces an IPSP.
- e. In a neuromuscular synapse, both Na^+ and K^+ produce the EPSP.

Answer: C

17) _____ prevents bidirectional propagation of action potentials.

- a. The inactivation of Na^+ channels
- b. The increased permeability to K^+
- c. A decrease in membrane resistance
- d. Myelination
- e. The K^+ channel

Answer: A

18) Which of the following illustrates the principle of divergence?

- a. A single muscle spindle afferent stimulates a single spinal motor neuron.
- b. A single pain receptor afferent stimulates a single spinal interneuron.
- c. Each motor neuron receives input from thousands of synapses.
- d. A single muscle spindle afferent stimulates many motor neurons.
- e. Each motor neuron receives input that has passed through multiple synapses on its way from the CNS.

Answer: D

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19) The adrenal medulla:

- A) A modified preganglionic neuron
- B) Has nicotinic receptors
- C) Secretes more noradrenaline than adrenaline
- D) Part of parasympathetic system

Answer: B

20) In the autonomic nervous system, which of the following is false:

- A) All effector organs of the sympathetic nervous system respond well to epinephrine
- B) The medulla is considered as the cell bodies of post synaptic neurons
- C) Parasympathetic ganglia may be present within effector organs.
- D) The parasympathetic is craniosacral and the sympathetic is thoracolumbar.

Answer: A

21) The difference between the somatic and the autonomic nervous is all except:

- A) The autonomic nervous system is a two-neuron system
- B. the effector for the autonomic system is smooth muscle and glands
- C. somatic nervous system release norepinephrine
- D. autonomic nervous system release both acetylcholine and norepinephrine

Answer: C

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22) Preganglionic neurons release acetylcholine at the synapse with postganglionic neurons in:

- A) Both the sympathetic and parasympathetic division of the autonomic nervous system
- B) The parasympathetic division of the autonomic nervous system only
- C) Neither the sympathetic nor parasympathetic divisions of the autonomic nervous system
- D) The sympathetic division of the autonomic nervous system only

Answer: A

23) Impulses from the:

- 1) Parasympathetic division of the autonomic nervous system slowdown heart rate
- 2) Parasympathetic division of the autonomic nervous system increase heart rate
- 3) Sympathetic division of the autonomic nervous system slow down heart rate
- 4) Sympathetic division of the autonomic nervous system increase heart rate

- A) 2,3
- B) 1,4
- C) 2,4
- D) 1, 3

Answer: B

24) The cell bodies of the preganglionic neurons are located in the brain or sacral region of spinal cord in:

- A) neither the sympathetic nor parasympathetic divisions of the autonomic nervous system
- B) The sympathetic division of the autonomic nervous system
- C) Both the sympathetic and parasympathetic divisions of the autonomic nervous system
- D) The parasympathetic division of the autonomic nervous system only.

Answer: D

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25) The CNS includes the _____, whereas the PNS includes the _____.

- A. brain and autonomic nervous system; spinal cord and somatic nervous system
- B. somatic nervous system and brain; spinal cord and autonomic nervous system
- C. spinal cord and brain; autonomic nervous system and somatic nervous system
- D. none of these are correct

Answer: C

26) The pre and postganglionic neurons synapse in terminal either within or close to the organ being innervated in:

- A) The sympathetic division of the autonomic nervous system only
- B) Neither the sympathetic nor parasympathetic divisions of the autonomic nervous SYS.
- C) Both the sympathetic and parasympathetic divisions of the autonomic nervous system
- D) The parasympathetic division of the autonomic nervous system only

Answer: D

27) Which of the following is true?

- A) The adrenal medulla can respond to epinephrine
- B) Many Target Tissues Are Dually Innervated by Both Divisions of The Autonomic Nervous System.
- C) Parasympathetic and sympathetic innervation has antagonistic effects in all organs of the body.
- D) Autonomic nerves only originate in the spinal cord

Answer: B

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28) Bronchodilation may be induced by all of the following mechanisms except:

- A. stimulating the sympathetic branch of the autonomic nervous system.
- B. stimulating the parasympathetic branch of the autonomic nervous system.
- C. inhibiting the enzyme phosphodiesterase.
- D. inhibiting the parasympathetic branch of the autonomic nervous system.

Answer: B

29) Curare is a drug that inhibits acetylcholine esterase. Which of the following effects will not be produced by poisoning with curare:

- A) Pupil constrict
- B) Increased heart rate
- C) Muscle spasm
- D) Profuse sweating

Answer: B

30) The statement "its neural pathways include a peripheral synapse in a ganglion" is...

- A. true only for the sympathetic division of the autonomic nervous system (ANS).
- B. true only for the parasympathetic division of the autonomic nervous system (ANS).
- C. true for both the sympathetic and parasympathetic divisions of the autonomic nervous system
- D. not true for either the sympathetic or parasympathetic division of the autonomic nervous system
- E. true only for the somatic nervous system (SNS).

Answer: C

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31) Contains motor nerves that work in pairs to regulate involuntary activities.

- a. Afferent System
- b. Autonomic Nervous System
- c. Central Nervous System
- d. Efferent System
- e. Peripheral Nervous System
- f. Somatic Nervous System

Answer: B

32) Select the INCORRECT statement concerning saltatory conduction:

- A) Saltatory conduction occurs in myelinated fibers only
- B) Saltatory conduction speeds the conduction of an action potential along the axon
- C) Saltatory conduction increases the total ion movement needed to carry the action potential down the axon
- D) Saltatory conduction is more efficient than conduction of an action potential along an unmyelinated axon

Answer: C

33) Sympathetic:

- A. Ganglionic transmission is mediated by acetylcholine.
- B. Neuromuscular transmission at the heart is mediated by adrenaline.
- C. Neuromuscular transmission in hand skin arterioles is mediated by acetylcholine.
- D. Neuroglandular transmission at sweat glands is mediated by noradrenaline.
- E. The main source of epinephrine is post-ganglionic neurons

Answer: A

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34) Parasympathetic nerves

- A. Have opposite effects to sympathetic nerves on intestinal smooth muscle.
- B. Release norepinephrine in some places
- C. Ganglia is located near vertebral column
- D. Cause sweat secretion in skin when body temperature rises.
- E. Have longer postganglionic than preganglionic fibers.

Answer: A

35) A (alpha) adrenoceptors:

- A. Are located on myofilaments in smooth muscle cells.
- B. are Gq coupled proteins
- C. Can be stimulated by both adrenaline and noradrenaline.
- D. Are present in ganglia
- E. Are involved in the heart rate responses to noradrenaline.

Answer: C

36) _____ results from the rapid summation of _____ over time, bringing the postsynaptic neuron to its threshold. _____ occurs at the postsynaptic neuron when multiple action potentials from several presynaptic neurons result in a large depolarization by the postsynaptic neuron.

- A) Spatial summation; IPSPs; Synaptic inhibition
- B) Temporal summation; IPSPs; Spatial summation
- C) Spatial summation; EPSPs; Temporal summation
- D) Temporal summation; EPSPs; Spatial summation

Answer: D

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37) Which one of the following is not possible?

- A. temporal summation of 1 EPSP and 1 IPSP
- B. spatial summation of an EPSP and an IPSP
- C. spatial summation of 2 EPSPs
- D. temporal summation of 2 IPSPs

Answer: A

38) The concept of “autonomic tone” is quite advantageous because it allows the nervous system to have much finer control over the function of an organ or organ system than would otherwise be possible. This ability is exemplified in the control of systemic arterioles. Which action would lead to vasodilation of systemic arterioles?

- A) Increased activity of preganglionic parasympathetic neurons
- B) Decreased activity of postganglionic parasympathetic neurons
- C) Increased activity of postganglionic sympathetic neurons
- D) Decreased activity of postganglionic sympathetic neurons
- E) Increased activity of preganglionic sympathetic neurons

Answer: D

Midterm Questions

1) An inhibitory postsynaptic potential:

- (A) Depolarizes the postsynaptic membrane by opening Na⁺ channels
- (B) Depolarizes the postsynaptic membrane by opening K⁺ channels
- (C) Hyperpolarizes the postsynaptic membrane by opening Ca²⁺ channels
- (D) Hyperpolarizes the postsynaptic membrane by opening Cl⁻ channels

Answer: D

2) Which of the following is an inhibitory neurotransmitter in the central nervous system (CNS)?"

- (A) Norepinephrine
- (B) Glutamate
- (C) γ -Aminobutyric acid (GABA)
- (D) Serotonin
- (E) Histamine

Answer: C

3) If a single type of neurotransmitter, released simultaneously by many different neurons onto the same downstream neuron, causes far more Na⁺ channels than K⁺ channels to open, in this downstream neurons, then which of the following should occur as a result?

- A) EPSPs
- B) Spatial summation
- C) Temporal summation
- D) Spatial summation and EPSPs

Answer: D

Midterm Questions

4) Which ion has the greatest electrochemical driving force in a typical neuron with a resting membrane potential of -65 millivolts?

- A) Chloride
- B) Potassium
- C) Sodium

Answer: C

5) A transmitter substance released from a presynaptic neuron activates a second messenger G-protein system in the postsynaptic neuron. Which one of the following postsynaptic responses to the transmitter substance is NOT a possible outcome?

- A) Activation of cyclic adenosine monophosphate (cAMP)
- B) Activation of cyclic guanosine monophosphate (cGMP)
- C) Activation of gene transcription
- D) Closing a ligand gated ion channel
- E) Opening an ion channel

Answer: D

6) The release of neurotransmitter at a chemical synapse in the central nervous system is dependent upon which of the following?

- A) Synthesis of acetylcholinesterase
- B) Hyperpolarization of the synaptic terminal
- C) Opening of ligand-gated ion calcium channels
- D) Influx of calcium into the presynaptic terminal

Answer: D

Midterm Questions

7) Which of the following is characteristic of the events occurring at an excitatory synapse?

- A) There is a massive efflux of calcium from the presynaptic terminal
- B) Synaptic vesicles bind to the postsynaptic membrane
- C) Voltage-gated potassium channels are closed
- D) Ligand-gated channels are opened to allow sodium entry into the postsynaptic neuron

Answer: D

8) Which statement concerning the generation of an action potential is correct?

- A) When the membrane potential in the soma/axon hillock dips below "threshold," an action potential is initiated
- B) The action potential is initiated in synaptic boutons
- C) The least number of voltage-gated sodium channels in an axon is found near the node of Ranvier
- D) Once an action potential is initiated, it will always run its course to completion

Answer: D

9) Which statement concerning intercellular signalling is correct?

- A) A neuromuscular synapse is a form of autocrine signalling
- B) Steroid hormones are lipophobic, so they pass the cell membrane and attach to certain receptors that alter gene expression inside the cell
- C) Autocrine and paracrine transmission include releasing the hormone in the close vicinity of the cell
- D) Amine hormones are tyrosine derivatives that always induce their effect by attachment to ligand-gated channels.

Answer: C

Midterm Questions

10) Which of the following electrical events is characteristic of inhibitory synaptic interactions?

- A) A neurotransmitter agent that selectively opens ligand-gated chloride channels is the basis for an inhibitory postsynaptic potential
- B) Because the Nernst potential for chloride is about -70 mV, chloride ions tend to move out of the cell along its electrochemical gradient
- C) A neurotransmitter that selectively opens potassium channels will allow potassium to move into the cell
- D) An increase in the extracellular sodium concentration usually leads directly to an inhibitory postsynaptic potential

Answer: A

11) An excitatory post-synaptic potential

- A. Is the depolarization of a post-synaptic nerve cell membrane that occurs when a presynaptic neuron is stimulated.
- B. Involves reversal of polarity across the post-synaptic nerve cell membrane.
- C. May be recorded from a posterior root ganglion cell.
- D. Is propagated at the same rate as an action potential.
- E. Is caused by the electrical field induced by activity in the pre-synaptic nerve terminals.

Answer: A

12) Nerve impulses

- A. Can travel in one direction only in a nerve fiber.
- B. Can travel in one direction only across an electrical synapse.
- C. Travel at the speed of an electric current.
- D. Correspond in duration to that of the nerve refractory period.
- E. Can be transmitted at higher frequencies in autonomic than in somatic nerves.

Answer: D

Midterm Questions

13) Saltatory conduction, which of the following is false:

- A. Occurs only in myelinated fibers.
- B. Does not depend on depolarization of the nerve membrane.
- C. Has a slower velocity in cold than in warm conditions.
- D. Transmits impulses with a velocity proportional to fiber diameter.

Answer: B

14) Saltatory conduction:

- A. Myelination of fibers is not essential
- B. Does not depend on depolarization of the nerve membrane.
- C. Occurs across gap points between nerves
- D. Is faster than non-saltatory conduction in nerve fibers with diameters around 10 μm .
- E. Requires release of acetylcholine to start conduction.

Answer: D

15) What is the main difference between voltage gated and ligand-gated ion channels?

- a) Voltage-gated ion channels are located in cardiac cell membranes, whereas ligand-gated ion channels are located in neuronal cell membranes.
- b) Only voltage-gated ion channels can be studied by patch-clamp techniques
- c) Voltage-gated ion channels are activated by changes in membrane potential, whereas ligand-gated ion channels are activated by the binding of a chemical messenger.
- d) Only ligand-gated ion channels are found in the resting conformational state
- e) Only ligand-gated ion channels contain an α -subunit protein

Answer: C

Midterm Questions

16) Which of the following statements is true regarding the propagation of an action potential along a nerve axon?

- a) Saltatory conduction is associated with a slowing of action potential propagation.
- b) Propagation is always unidirectional
- c) Multiple sclerosis (destruction of myelin) is associated with increased conduction velocity
- d) Large myelinated nerve fibers conduct faster than small unmyelinated nerve fibers
- e) The propagation of action potentials requires a direct source of ATP

Answer: D

17) The concentration of neurotransmitter in the synaptic cleft is determined by:

- a) The rate of active uptake of the transmitter by the surrounding neurons
- b) The amount of transmitter released by the presynaptic nerve terminal
- c) The rate of enzymatic breakdown of the transmitter in the synaptic cleft
- d) The diffusion rate of the transmitter from the presynaptic nerve terminal to the synaptic cleft.
- e) All of the above.

Answer: E

18) A key goal of intra-neuronal communication is to:

- A) Release neurotransmitter from the presynaptic terminal
- B) Generate an EPSP at presynaptic dendrites
- C) Generate an IPSP at presynaptic, dendrites
- D) re-uptake neurotransmitter from the synaptic cleft
- E) Generate spatial and temporal summation in the presynaptic dendrites

Answer: A

Midterm Questions

19) Which of the following is NOT a property associated with electrical synapse?

- A) Presence of gap junctions
- B) Direct inter-neuron ion movement
- C) Synchronous activation of group of cells
- D) Binding neurotransmitter to postsynaptic receptors
- E) Very rapid signaling between neurons

Answer: D

20) During inter-neuronal communication, which step below immediately follows intracellular calcium signaling to synaptic vesicles?

- A) Action potentials arrive at the axon terminal
- B) Vesicles move to the presynaptic membrane
- C) Voltage-gated calcium ion channels open
- D) Neurotransmitter diffuses across the synapse

Answer: B

21) Which of the following is a type of long distance or reflex control in the maintenance of homeostasis?

- A) Autocrine agent regulation
- B) Endocrine gland integration
- C) Both paracrine and autocrine regulation
- D) Paracrine agent regulation

Answer: B

Midterm Questions

22) Cell that secretes product is also the target.

- A. paracrine
- B. autocrine
- C. endocrine

Answer: B

23) Neurotransmitters are:

- A. paracrine
- B. autocrine
- C. endocrine
- D. Exocrine

Answer: A

24) Which of the following neurotransmitters is associated exclusively with inhibition and leads to influx (movement into a neuron) of chloride ions?

- A) GABA
- B) acetylcholine
- C) Glutamate
- D) epinephrine

Answer: A

Midterm Questions

25) What does a ligand-gated channel require in order to open?

- A) Increase in concentration of Na⁺ ions
- B) Binding of a neurotransmitter
- C) Increase in concentration of K⁺ ions
- D) Depolarization

Answer: B

26) _____ allow the direct passage of ions and signaling molecules from the intracellular compartment of one cell to the intracellular compartments of another cell

- A) Dendrites
- B) Metabotropic receptors
- C) Synaptic vesicles
- D) Gap junctions

Answer: D

27) When an action potential reaches the axon terminal and depolarizes the presynaptic membrane, calcium enters the axon terminal and binds with _____receptor to cause synaptic vesicles to_____

- A) G-protein; migrate and fuse with presynaptic membrane
- B) Synaptotagmin; migrate and fuse with presynaptic membrane
- C) Axon membrane; release neurotransmitter
- D) Protein kinase; release neurotransmitter

Answer: B

Midterm Questions

28) Neurotransmitters are synthesized in the _____

- A) Axon terminal
- B) Synaptic vesicles
- C) Neuronal soma (cell body)
- D) Axon
- E) Synapse

Answer: C

29) A channel or pore in a postsynaptic receptor is referred to as a (n) _____ receptor.

- A) Postsynaptic
- B) Metabotropic
- C) voltage-dependent
- D) Presynaptic
- E) Ionotropic

Answer: E

30) _____ refers to a rapid clearing of neurotransmitter from the synaptic cleft by special proteins and transporters.

- A) Pinocytosis
- B) Reuptake
- C) Degradation
- D) Phagocytosis
- E) Endocytosis

Answer: B

Midterm Questions

31) Which of the following are inhibitory neurotransmitters:

- A) Glycine
- B) Glutamate
- C) GABA
- D) A+B
- E) A+C

Answer: E

32) _____ is in a neurotransmitter class or category called "catecholamines".

- A) Glutamate
- B) GABA
- C) Enkephalin
- D) Epinephrine
- E) Glycine

Answer: D

33) _____ is the major inhibitory neurotransmitter that balances and offsets excitatory signals in the nervous system

- A) GABA
- B) Dopamine
- C) Glutamate
- D) Acetylcholine
- E) Norepinephrine

Answer: A

Midterm Questions

34) _____ is a neurotransmitter that is released onto glands and postganglionic neurons in the autonomic nervous system.

- A) Dopamine
- B) Serotonin
- C) Acetylcholine
- D) Glycine
- E) GABA

Answer: C

35: intracellular G-protein second messenger signaling?

- A) Ion channel protein
- B) Histamine
- C) Lipids
- D) GTP

Answer: D

36) _____ is the major excitatory neurotransmitter

- A) Serotonin
- B) Leu-enkephaline
- C) Glutamate
- D) Glycine

Answer: C

Midterm Questions

37) Which of the following increases neuronal excitability:

- A) K⁺ efflux
- B) Alkalosis
- C) Gamma amino butyric acid
- D) Repetitive neuronal stimulation

Answer: B

38) Forced rapid breathing results in alkalization of the blood which would lead to which of the following changes in neuronal activity?

- A) Decrease in neuronal activity
- B) Increase in neuronal activity
- C) Initial decrease followed by an increase
- D) No change in neuronal activity

Answer: B

39) The release of neurotransmitter at a chemical synapse in the central nervous system is dependent upon which of the following?

- A) Synthesis of acetylcholinesterase
- B) Hyperpolarization of the synaptic terminal
- C) Opening of ligand-gated ion calcium channels
- D) Influx of calcium into the presynaptic terminal

Answer: D

Midterm Questions

40) Hypoventilation has which of the following effects on neuronal activity?

- A) Depresses neuronal activity
- B) Increases neuronal activity
- C) Increases synaptic delay
- D) Increases neurotransmitter release

Answer: A

41) The excitatory or inhibitory action of a neurotransmitter is determined by which of the following?

- A) Function of its postsynaptic receptor
- B) Molecular composition
- C) Shape of the synaptic vesicle in which it is contained
- D) Distance between the pre- and post-synaptic membranes

Answer: A

42) Which of the following is characteristic of the events occurring at an excitatory synapse?

- A) There is a massive efflux of calcium from the presynaptic terminal
- B) Synaptic vesicles bind to the postsynaptic membrane
- C) Voltage-gated potassium channels are closed
- D) Ligand-gated channels are opened to allow sodium entry into the postsynaptic neuron

Answer: D

Midterm Questions

43) Which of the following is an important functional parameter of pain receptors?

- A) Exhibit little or no adaptation
- B) Not affected by muscle tension
- C) Signal only flexion at joint capsules
- D) Can voluntarily be inhibited

Answer: A

44) Which of the following best describes the concept of specificity in sensory nerve fibers that transmit only one modality of sensation?

- A) Frequency coding principle
- B) Concept of specific nerve energy
- C) Singularity principle
- D) Labeled line principle

Answer: D

45) Which of the following statements concerning the mechanoreceptive receptor potential is/are true?

- A) Increase in stimulus energy results in an increase in receptor potential.
- B) When receptor potential rises above a certain threshold action potentials will appear in the neuron attached the receptor.
- C) Number of action potentials generated in the neuron attached to the receptor is proportional to receptor potential.
- D) All of the above are correct.

Answer: D

Midterm Questions

46) Which of the following is a property of C fibers?

- (A) Have the slowest conduction velocity of any nerve fiber type
- (B) Have the largest diameter of any nerve fiber type
- (C) Are afferent nerves from muscle spindles
- (D) Are afferent nerves from Golgi tendon organs
- (E) Are preganglionic autonomic fibers

Answer: A

47) Sensory receptor potentials

- (A) Are action potentials
- (B) Always bring the membrane potential of a receptor cell toward threshold
- (C) Always bring the membrane potential of a receptor cell away from threshold
- (D) Are graded in size, depending on stimulus intensity
- (E) Are all or none

Answer: D

48) Which statement concerning synaptic transmission is correct?

- A) When a specific population of synaptic terminals is spread over the considerable surface of a neuron, their collective effects cannot spatially summate and lead to initiation of an action potential
- B) Even if the successive discharges of an excitatory synapse occur sufficiently close in time, they cannot temporally summate and initiate an action potential
- C) A neuron is "facilitated" when its membrane potential is moved in the less negative or depolarizing direction
- D) Even when rapidly stimulated by excitatory synaptic input for a prolonged period, neurons typically do not exhibit synaptic fatigue

Answer: C

Midterm Questions

49) In sensory receptors

- A. Stimulus energy is converted into a local depolarization.
- B. The generator potential is graded and self-propagating.
- C. A generator potential can be produced by only one form of energy.
- D. The frequency of action potentials generated doubles when the strength of the stimulus doubles.
- E. Serving touch sensation, constant suprathreshold stimulation causes action potentials to be generated at a constant rate.

Answer: A

50) Which of the following is a consequence of myelination in large nerve fibers?

- a) Decrease in the velocity of nerve impulses along the axon
- b) Increase in the nonselective diffusion of ions across the axon membrane
- c) Generation of action potentials only at the nodes of Ranvier
- d) Increase in the membrane capacitance of the axon
- e) Increase in the energy required to maintain ion gradients across the membrane

Answer: C

51) Which of the following statements regarding the processing of signals by neurons is correct?

- a) The distribution of multiple input signals from a single source onto many neurons in the pool is an example of convergence
- b) Divergence of signals can lead to amplification of the signal
- c) The combination of multiple input signals from multiple sources onto a single neuron in the pool is an example of divergence
- d) Convergence of input signals to individual neurons in the pool, each of which contributes to the same output channel, can lead to amplification of the signal
- e) In some instances, a sensory input to a neuronal pool causes a prolonged pause in the generation of output signals, called an after discharge

Answer: B

Midterm Questions

52) As a somatosensory receptor potential rises higher above a threshold, which of the following best characterizes the new frequency of action potentials?

- a) Unchanged until the receptor potential increases to twice the threshold level
- b) Increased
- c) Decreased
- d) Unchanged
- e) Increased only when the receptor potential increases to twice the threshold level

Answer: B

53) Which one of the following statements concerning sensory neurons or their functional properties is true?

- a) In spatial summation, increasing signal strength is transmitted by using progressively greater numbers of sensory fibers
- b) All sensory fibers are unmyelinated
- c) In temporal summation, increased stimulus strength is signaled by decreasing the frequency of action potentials in the sensory fibers
- d) Continuous subthreshold stimulation of a pool of sensory neurons results in disfacilitation of those neurons
- e) Increased stimulus intensity is signaled by a progressive decrease in the receptor potential

Answer: A

Midterm Questions

54) Which of the following electrical events is characteristic of inhibitory synaptic interactions?

- A) A neurotransmitter agent that selectively opens ligand-gated chloride channels is the basis for an inhibitory postsynaptic potential
- B) Because the Nernst potential for chloride is about 270 mV, chloride ions tend to move out of the cell along its electrochemical gradient
- C) A neurotransmitter that selectively opens potassium channels will allow potassium to move into the cell
- D) An increase in the extracellular sodium concentration usually leads directly to an inhibitory postsynaptic potential

Answer: A

55) Olfactory receptor cells belong to which of the following groups of cells?

- A) Bipolar neurons
- B) Fibroblasts
- C) Modified epithelial cells
- D) Multipolar neurons
- E) Pseudounipolar neurons

Answer: A

56) An excitatory post-synaptic potential

- A. Is the depolarization of a post-synaptic nerve cell membrane that occurs when a presynaptic neuron is stimulated?
- B. Involves reversal of polarity across the post-synaptic nerve cell membrane.
- C. Is propagated at the same rate as an action potential.
- D. Is caused by the electrical field induced by activity in the pre-synaptic nerve terminals.

Answer: A

Midterm Questions

57) An action potential in a nerve fiber:

- A. Occurs when its membrane potential is hyperpolarized to a critical level.
- B. Is associated with a transient decrease in membrane permeability to sodium.
- C. Is associated with a transient decrease in membrane permeability to potassium.
- D. Induces local electrical currents in adjacent segments of the fiber.
- E. Has an amplitude which varies directly with the strength of stimulus.

Answer: D

58) An inhibitory post-synaptic potential, which is false:

- A. May be recorded in a post-ganglionic sympathetic neuron.
- B. May be recorded in an anterior horn motor neuron.
- C. Moves membrane potential towards the equilibrium potential for potassium.
- D. May summate in space and time with other excitatory and inhibitory potentials in the same neuron.

Answer: A

59) A volley of impulses travelling in a pre-synaptic neuron causes, which is false:

- A. An identical volley in the post-synaptic neuron.
- B. An increase in the permeability of the pre-synaptic nerve terminals to calcium.
- C. Vesicles in the nerve endings to fuse with the cell membrane and release their contents.
- D. An action potential may not be produced in the postsynaptic membrane if it does not reach the threshold.
- E. Neurotransmitter to travel down the nerve axon.

Answer: A

Midterm Questions

60) Which of the following is an important functional parameter of pain receptors?

- A) Exhibit little or no adaptation
- B) Not affected by muscle tension
- C) Signal only flexion at joint capsules
- D) Can voluntarily be inhibited

Answer: A

61) A 23-year-old gymnast lifts her right leg above her head while in the standing position. Activation of a single pyramidal cell in the motor cortex leads to stimulation of 2000 muscle fibers in her right quadriceps muscle. Which of the following best describes the type of neuronal circuitry activated in this woman when she lifts her leg?

- A) Converging
- B) Diverging
- C) Inhibitory
- D) Reverberatory

Answer: B

62) If a person's cold receptors no longer convert cold stimuli into sensory signals, that person has a problem with the process of _____.

- A. reception
- B. transmission
- C. perception
- D. transduction

Answer: D

Midterm Questions

63) What is sensory adaptation?

- A) The adaptive ability of our senses to pick up on potentially threatening stimuli
- B) The process by which our senses become less sensitive to constant stimuli
- C) Selective attention
- D) How the senses become developed during infancy

Answer: B

64) When a second EPSP arrives at a single synapse before the effects of the first have disappeared occurs?

- A) Spatial summation
- B) Temporal summation
- C) Inhibition of the impulse
- D) Hyperpolarization
- E) Decrease in speed of impulse transmission.

Answer: B

65) Which of the following catalyzes the cutting of PIP₂ into 2 moles of IP₃ and diacylglycerol in cell signaling?

- a) Phosphokinase C
- b) Phospholipase C
- c) Lipokinase
- d) Phosphodiesterase C

Answer: B

Midterm Questions

- 66) The binding of ligands to many G-protein coupled receptors leads to _____
- a) Decrease in concentration of certain intracellular signal molecules called second messengers
 - b) Increase in concentration of certain intracellular signal molecules called second messengers
 - c) Decrease in concentration of certain extracellular signal molecules called first messengers
 - d) Increase in concentration of certain extracellular signal molecules called first messengers

Answer: B

- 67) A hormone or ligand can be considered as _____
- a) First messenger
 - b) Second messenger
 - c) Third messenger
 - d) Fourth messenger

Answer: A

- 68) Which second messenger signals the release of Ca^{+2} from endoplasmic reticulum?
- a) IP3
 - b) 1, 2 diacyl glycerol
 - c) cAMP
 - d) cGMP

Answer: A

Midterm Questions

69) For a hormone to elicit a specific response from a cell, the cell must possess

- A. a synapse.
- B. integration.
- C. a cell body.
- D. dendrites specific to the hormone.
- E. receptor proteins specific to the hormone.

Answer: E

70) The _____ is/are directly responsible for the amplifying effects during a second messenger cascade.

- A. receptors
- B. substrates
- C. enzymes
- D. cell membrane
- E. orthophosphate groups

Answer: C

71) Intracellular modification of activity in response to an external signal is an example of

- A. transduction.
- B. transformation.
- C. conversion.
- D. the electrochemical gradient.
- E. covalent modulation.

Answer: A

Midterm Questions

72) Extracellular signaling molecules initiate their actions on a cell by binding with certain protein molecules of the cell called

- A. ligands.
- B. peripheral proteins.
- C. integral proteins.
- D. receptors.
- E. structural proteins.

Answer: D

73) Receptor proteins can bring about all of the following cellular actions except

- A. reinforcing the structure of the membrane.
- B. opening a protein channel on the membrane.
- C. activating an enzyme on the intracellular surface.
- D. combining with a ligand to initiate transcription.
- E. activating a G protein.

Answer: A

74) Which of the following is not considered a second messenger?

- a. Cyclic GMP
- b. Cyclic AMP
- c. Calcium ions
- d. Epinephrine
- e. 1, 2-diacylglycerol (DAG)

Answer: D

Midterm Questions

- 75) As a second messenger, calcium typically binds to
- A. calmodulin, and the complex activates protein kinases.
 - B. a G protein to activate general second messengers.
 - C. cyclic AMP to activate cAMP-dependent protein kinases.
 - D. nitric oxide to activate cytoplasmic guanylyl cyclase.
 - E. inositol triphosphate to activate the endoplasmic reticulum.

Answer: A

- 76) Which of the following receptor proteins change(s) membrane voltage immediately when activated?
- a. Ligand-gated channel
 - b. G protein-coupled receptor
 - c. Enzyme/enzyme-linked receptor
 - d. Intracellular receptors
 - e. G protein-coupled receptor and enzyme/enzyme-linked receptor

Answer: A

- 77) Which of the following receptor proteins activate(s) enzymes on the cell membrane?
- a. Ligand-gated channel and G protein-coupled receptor
 - b. G protein-coupled receptor and enzyme/enzyme-linked receptor
 - c. Enzyme/enzyme-linked receptor and intracellular receptors
 - d. Ligand-gated channel, G protein-coupled receptor, and enzyme/enzyme-linked receptor
 - e. Ligand-gated channel and intracellular receptors

Answer: B

Midterm Questions

78) When epinephrine attaches to a(n) _____, the process of _____ results in the formation of a large amount of intracellular _____.

- a. G protein–coupled receptor; amplification; glucose
- B. ligand-gated receptor; amplification; glucose
- c. G protein–coupled receptor; metabolic pathways; glycogen
- D. enzyme-enzyme–linked receptor; amplification; glycogen
- E. intracellular receptor; protein expression; glucose

Answer: B

79) Which of the following is not involved at the cell membrane in a second messenger cascade?

- a. Adenylyl cyclase
- b. Guanylyl cyclase
- c. G protein–coupled receptor
- d. Protein kinase
- e. Phospholipase C

Answer: D

80) Which of the following differentiates chemical synapses from electrical synapses?

- A. chemical synapses involve a neurotransmitter
- B. chemical synapses involve direct physical contact between cells
- C. chemical synapses initiate action potentials quickly
- D. chemical synapses contain special links called connexons

Answer: A

Midterm Questions

81) How does the G protein activate adenylyl cyclase?

- a. The G protein trimer attaches to adenylyl cyclase to activate it.
- b. The G protein mediates the release of cAMP-dependent protein kinase, which activates adenylyl cyclase.
- c. The G protein activates various second messengers, which all activate pathways that activate adenylyl cyclase.
- d. The α subunit of the G protein, with GTP, diffuses laterally in the membrane and binds to adenylyl cyclase to activate it.
- e. The G protein causes a depolarization, which activates adenylyl cyclase.

Answer: D

82) Which of the following statements regarding metabotropic receptors is false?

- a. They can be a G protein-coupled receptor.
- b. They can directly open or close ion channels.
- c. They can activate a G protein.
- d. They usually use a second messenger.
- e. They mediate membrane voltage changes via slow postsynaptic potentials.

Answer: B

83) Which of the following is most uniquely associated with a metabotropic receptor?

- a. Neurotransmitter
- b. Second messenger
- c. Ligand-gated receptor
- d. Voltage-gated receptor
- e. Synaptic vesicle

Answer: B

Midterm Questions

84) Which of the following proteins cannot contact a G protein directly?

- a. Protein kinase C
- b. Potassium channel
- c. Phospholipase C
- d. Adenylyl cyclase
- e. Norepinephrine receptor

Answer: A

85) Sensory receptor cells can be classified in all of the following ways except

- A. location of the source of the stimulus.
- B. sensory modality.
- C. form of stimulus energy.
- D. mechanism of transduction.
- E. sense organ.

Answer: E

86) A stimulating depolarizing current that depolarizes the axon hillock just slightly negative to the threshold will

- A. not change the overall membrane potential at all.
- B. produce an action potential.
- C. produce a very small action potential.
- D. produce a temporary graded potential.
- E. produce a small action potential that increases in amplitude as it travels along the axon.

Answer: D

Midterm Questions

87) Which reflex is responsible for monosynaptic excitation of ipsilateral homonymous muscle?

- (A) Stretch reflex (myotatic)
- (B) Golgi tendon reflex (inverse myotatic)
- (C) Flexor withdrawal reflex
- (D) Subliminal occlusion reflex

Answer: A

88) Fill in the blanks according to the process of reflex action. 1. The reflex pathway comprises at least one ..a...neuron (receptor) and one ...b...(effector or excitor) neuron appropriately arranged in a series

2. Theb...neuron receives signal from a sensory organ and transmit the impulse via a ...c... nerve root into the CNS (at the level of spinal cord).

3. The ...b... neuron then carries signals from CNS to the effector.

4. The stimulus and response thus form a reflex ...d...

- A) a-afferent, b-efferent, c-dorsal, d-arc
- B) a-afferent, b-efferent, c-ventral, d-arc
- C) a-efferent, b-afferent, c-dorsal, d-pathway
- D) a-efferent, b-afferent, c-ventral, d-action

Answer: A

Midterm Questions

5) In the knee jerk reflex, the effector and receptor are:

- A. Muscle spindle and motor endplate respectively
- B. Afferent neuron and efferent neuron respectively
- C. Motor endplate and muscle spindle respectively
- D. Sensory neuron and motor neuron respectively

Answer: C

6) Which of the following is not a reflex action?

- A) Closing of eyelids against fricking
- B) moving the hand away from a hot object
- C) Resistance of the passive stretch of muscles
- D) Obeying a command

Answer: D

7) Which one does not involve the brain?

- A) Spinal reflex
- B) Cerebral reflex
- C) Cranial reflex
- D) Voluntary action

Answer: A

Midterm Questions

8) Dorsal root of the spinal nerve contains:

- A) Sensory neurons only
- B) Relay and sensory neurons
- C) Sensory and motor
- D) Motor and relay neurons

Answer: A

9) Motor neuron of reflex arc carries impulse from?

- A) Receptor to central nervous system
- B) Central nervous system to effectors
- C) Central nervous system to receptors
- D) Effectors to central nervous system

Answer: B

10) Which one control reflex action?

- A) Central nervous system
- B) Sympathetic nervous system
- C) Parasympathetic nervous system
- D) Sensory nerves

Answer: A

Midterm Questions

11) After cutting through the dorsal root of a spinal nerve of a mammal, when associated receptor in the skin were stimulated, the animal would

- A) Still be able to feel the stimulation
- B) Show no response
- C) Show a normal by slow response
- D) Respond but only

Answer: B

12) When a muscle is suddenly stretched, a signal is transmitted over IA sensory fibers from muscle spindles. Which of the following statements best describes the response elicited by these spindle afferent signals?

- A) Contraction of the muscle in which the active spindles are located
- B) Relaxation of the muscle in which the active spindles are located
- C) Contraction of muscles antagonistic to those in which the active spindles are located
- D) Relaxation of intrafusal fibers in the active spindles
- E) Direct synaptic activation of gamma motor neurons

Answer: A

13) Which of the following cells receives direct synaptic input from Golgi tendon organs?

- A) Cranial nerves
- B) Dynamic gamma motor neurons
- C) Alpha motor neurons
- D) Inhibitory interneurons
- E) Type II excitatory interneurons

Answer: D

Midterm Questions

14) Which statement best describes a characteristic functional difference between a Golgi tendon organ and a muscle spindle?

- A) The output signals of a Golgi tendon organ lead to inactivation of the muscle associated with the active tendon organ
- B) Golgi tendon organs do not function in the course of voluntary movements that require a normal level of tension development in the associated muscle
- C) Signals arising from Golgi tendon organs do not contribute to conscious proprioception
- D) Signals arising from Golgi tendon organs are synaptically linked directly to an alpha motor neuron
- E) The signals from a Golgi tendon organ are conducted along sensory fibers that conduct more rapidly than those of the muscle spindle

Answer: A

17) Which of the following reflexes is correctly paired with the sensory structure that mediates the reflex?

- A) Autogenic inhibition—muscle spindle
- B) Reciprocal inhibition—Golgi tendon organ
- C) Reciprocal inhibition—Pacinian corpuscle
- D) Stretch reflex—muscle spindle
- E) Golgi tendon reflex—Meissner corpuscle

Answer: D

18) Which of the following reflexes best describes incoming pain signals that elicit movements performed by antagonistic muscle groups on either side of the body?

- A) Crossed extensor reflex
- B) Withdrawal reflex
- C) Reciprocal inhibition
- D) Autogenic inhibition

Answer: B

Midterm Questions

19) Fast IPSPs result mainly from a (n) _____ in permeability to _____.

- A. decrease; Na⁺
- B. increase; Cl⁻
- C. increase; K⁺
- D. decrease; Ca²⁺
- E. increase; Na⁺

Answer: B

20) Which of the following statements about the features of a nervous system is false?

- a. The transmission rate is relatively fast.
- b. Neurotransmitter release takes place throughout the body via the blood.
- c. Neurons form highly discrete lines of communication.
- d. Action potential signals do not degrade over distance.
- e. In the PNS, a nerve consists of the axons of multiple neurons bundled together.

Answer: B

21) Most tissues in the body are under _____ control.

- A. neural
- B. endocrine
- C. both neural and endocrine
- D. neurohormonal
- E. neither neural nor endocrine

Answer: C

Midterm Questions

22) The main ion responsible for the EPSP is

- a. Na⁺.
- b. K⁺.
- c. Cl⁻.
- d. Ca²⁺.
- e. Cl⁻ or K⁺.

Answer: A

23) Calmodulin binds to _____ and becomes activated.

- a. Na⁺
- b. G protein
- c. Ca²⁺
- D. protein kinase C
- E. adenylyl cyclase

Answer: C

24) Which of the following is not a reflex action?

- A) Swallowing food
- B) Shivering
- C) Salivation
- D) Closure of eyelids by flashing light

Answer: A

Midterm Questions

25) Route of reflex arc is

- A. Effectors, grey matter, motor fibers, sensory fibers and receptors
- B. Receptors, sensory fibers, grey matter and motor fibers
- C. Receptors sensory fibers, grey matter, motor fibers and effectors
- D. Sensory fibers, grey matter, motor fibers, receptors and effectors

Answer: C

27) When your family physician taps your left patellar tendon with a mallet, motor neurons innervating the flexors of the left knee are inhibited by _____ in the _____.

- A. interneurons; muscle
- B. interneurons; tendon
- C. interneurons; brain
- D. interneurons; spinal cord
- E. sensory neurons; muscle

Answer: D

28) In the stretch reflex, a signal from a sensory neuron that detects stretch in a muscle reaches a motor neuron innervating the stretched muscle via

- A. excitatory interneurons in the brain.
- B. inhibitory interneurons in the brain.
- C. a single excitatory synapse.
- D. inhibitory interneurons in the spinal cord.

Answer: C

Midterm Questions

29) When you step on a tack, excitation of sensory afferents leads to excitation of motor neurons innervating one set of muscles and inhibition of motor neurons innervating another set of muscles. The stimulus produces opposite responses in different motor neurons because

- A. the afferent neuron releases different neurotransmitters at different synapses.
- B. motor neurons innervating different muscles have different receptors.
- C. motor neurons innervating different muscles release different neurotransmitters at the neuromuscular junction.
- D. the signals reach some motor neurons via excitatory interneurons but they reach other motor neurons via inhibitory interneurons.
- E. the sensory afferents transmit both excitatory and inhibitory action potentials that are sent to different motor neurons.

Answer: D

30) When you are walking barefoot and your left foot lands on a marble,

- A. the extensors of your left leg contract.
- B. the flexors of your left leg relax.
- C. the extensors of your right leg contract.
- D. the flexors of your right leg contract.
- E. both the extensors and flexors of your left leg contract.

Answer: C

31) Neuron C receives a 10 mV EPSP from neuron A and a 6 mV IPSP from neuron B, what type of summation is this and will neuron C fire an action potential?

- A) Spatial summation, yes
- B) Temporal summation, yes
- C) Spatial summation, No
- D) Temporal summation, No

Answer: C

Midterm Questions

32) Neuron D receives three 10 mV EPSPs in very quick succession from neuron E. What type of summation does this represent and will neuron E fire an action potential?

- A) Spatial summation, yes
- B) Temporal summation, yes
- C) Spatial summation, No
- D) Temporal summation, No

Answer: B

3) Which of the following is true about chemical synapse?

- A) Chemical synapses are the least numerous types in the human body
- B) Chemical synapses are found mainly in smooth muscles
- C) Chemical synapse is unidirectional
- D) Chemical synapse allow two-way signalling

Answer: C