

# Pharma-CNS 1

1. Commonalities of the sympathetic, parasympathetic, and somatic nervous systems involve which of the following neuroeffector transmitters?

- a) Acetylcholine
- b) Dopamine
- c) Epinephrine
- d) Norepinephrine
- e) Serotonin

2. There are major differences in the anatomical arrangement of neurons, which lead to variations of the functions in each division of the nervous system. Which of the following features describes the parasympathetic nervous system?

- a) Diffuse response
- b) Extensive preganglionic fiber branching
- c) Ganglia close to the spinal cord
- d) Short postganglionic fibers
- e) Wide distribution

3. A 47-year-old man is given atropine to decrease dental secretions during a root canal procedure. This agent is most likely to have an effect on which of the following target organs/glands?

- a) Adrenal medulla
- b) Kidney
- c) Pilomotor muscles
- d) Salivary glands
- e) Sweat glands

4. A 42-year-old woman is sunbathing on a very warm day. She falls asleep on the beach and then awakens with chills and sweats. She has no pertinent past medical or surgical history. Paramedics on the scene record a blood pressure of 80/40 mm Hg. Reflex responses of the autonomic nervous system would include which of the following?

- a) Decreased blood pressure
- b) Decreased cardiac output
- c) Decreased cardiac contractility
- d) Increased peripheral resistance
- e) Stimulation of the parasympathetic nervous system

5. A researcher who is interested in creating an anticholinergic agent that would be useful in patients with irritative bladder symptoms would be interested in targeting which of the following receptors?

- a) M1
- b) M2
- c) M3
- d) M4
- e) M5

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6. A 38-year-old woman presents to the ophthalmologist for a routine eye examination. She is given intraocular pilocarpine. She was supposed to be administered two drops in each to dilate the eyes for the examination. Unfortunately, the eyedrops were administered by a new technician who inadvertently administered 10 drops of pilocarpine in each eye. Which of the following agents should be immediately given to the patient?

- a) Atropine
- b) Carbachol
- c) Donepezil
- d) Galantamine
- e) Rivastigmine

7. A 58-year-old woman with a history of myasthenia gravis presents to the emergency department complaining of generalized abdominal pain. Her current medications include nifedipine and neostigmine. Her caretaker reports that her bottle of neostigmine is empty but was full earlier in the day. Which of the following findings is likely in this patient?

- a) Bronchodilation
- b) Constipation
- c) Dizziness
- d) Hypotension
- e) Xerostomia

8. A 79-year-old man with Alzheimer's disease is found to have significant elevation of liver function tests on routine follow-up examination. Which of the following medications should be maintained at current doses in this patient?

- a) Donepezil
- b) Galantamine
- c) Rivastigmine
- d) Tacrine
- e) Tacrolimus

9. A medical student is performing a summer research project evaluating the pharmacologic effects of atropine at varying doses. Doses are extrapolated from normal human doses of this agent. Slow infusion of this agent to a steady state dose of 0.5 mg would be expected to produce which of the following effects?

- a) Bradykinesia
- b) Coma
- c) Dilation of the pupils
- d) Dry mouth
- e) Tachycardia

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10. A 61-year-old woman is going on a cruise and is afraid that she will develop motion sickness during the trip. She is given a prescription for scopolamine patch. She has no other medical problems and has never had surgery. On the first day of the trip, the boat is rocking heavily, and the patient is nauseous and she applies the patch. Instead of being sedated, she actually became very excited and agitated. What is the most likely explanation for these findings?

- a) Patient also drank four beers in addition to using the scopolamine patch
- b) Patient did not follow proper medication directions**
- c) Underlying hepatic insufficiency
- d) Underlying renal insufficiency
- e) Underlying urinary tract abnormality

11. A 79-year-old man undergoes a hip replacement procedure under general anesthesia and is unable to be weaned from the ventilator postoperatively. Review of the anesthesia records indicated that he received the following agents: succinylcholine, diazepam, rocuronium, and fentanyl. He spends the next 5 days on a ventilator in the intensive care unit. Which of the following is the most likely explanation for this situation?

- a) Diaphragm paralysis**
- b) Hypokalemia
- c) Hyponatremia
- d) Hypocalcemia
- e) Underlying digitalis toxicity

12. An 8-month-old girl is brought to the emergency department by her parents because she has been "acting funny." They say she has been weaker than normal. She is afebrile but appears lethargic. While talking with the parents, you discover that they sometimes give her honey to calm her down and gave her a spoonful yesterday. What is the mechanism of the toxin likely causing her symptoms?

- a) Preventing acetylcholine release**
- b) Preventing acetylcholine synthesis
- c) Preventing glycine release
- d) Preventing norepinephrine release
- e) Preventing norepinephrine synthesis

13. A medical student is involved in a summer research project evaluating the potencies of the  $\alpha$ -adrenergic agonists at different receptor sites. Which of the following  $\alpha$ -adrenergic agonists would be expected to have the strongest potency at the  $\alpha_1$ -receptor?

- a) Acetylcholine
- b) Epinephrine**
- c) Isoproterenol
- d) Metanephrine
- e) Norepinephrine

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14. A 73-year-old man presents to his primary care physician complaining of a weak stream and nocturia four times at night. He is very sensitive to the medication side effects and is reluctant to take medications for this reason. Physical examination reveals a mildly enlarged prostate. Treatment of this condition may involve the use of which of the following agents to minimize side effects?

- a) Alfuzosin
- b) Doxazosin
- c) Prazosin
- d) Tamsulosin
- e) Terazosin

15. A group of teenage boys comes to the emergency department after ingesting a plant they heard would make them high. One member of the group still had some plant parts in his pocket, which you use to identify deadly nightshade that contains compounds metabolized to atropine. Which of the following is an effect of atropine?

- a) Bronchospasm
- b) Lacrimation
- c) Mydriasis
- d) Salivation
- e) Urination

16. A 62-year-old retired small business owner has had slowly increasing intraocular pressure bilaterally. You start him on drug used to treat his open-angle glaucoma, which also happens to cross the blood–brain barrier better than other drugs in its class. Which of the following drugs is this?

- a) Echothiophate
- b) Edrophonium
- c) Neostigmine
- d) Physostigmine
- e) Pyridostigmine

17. A 28-year-old man is hospitalized on the trauma service with multiple organ system failure after sustaining multiple fractures and internal injuries. His most recent CT scan of the abdomen does not reveal any visceral organ injury. He is currently on an intravenous epinephrine drip to maintain his blood pressure and heart rate. His most recent laboratory studies reveal a blood glucose level of 425 mg/dL. What is the most likely explanation of this finding?

- a) Hepatic glycogenolysis
- b) Hepatic gluconeogenesis
- c) Pancreatic failure
- d) Pancreatic infarct from trauma
- e) Splenic rupture

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18. A 68-year-old man presents to the emergency department with worsening chest pain. He has a history of congestive heart failure and currently takes digoxin. Physical examination reveals an acutely ill man who is tachypneic. His room air pulse oximetry is 90%. Pulmonary auscultation reveals bilateral wheezing. Neck examination reveals jugular venous distension. Which one of the following is the most appropriate treatment for this patient?

- a) Albuterol via nebulizer
- b) Dobutamine
- c) Epinephrine via nebulizer
- d) Norepinephrine
- e) Phenylephrine

19. A 32-year-old man presents to his primary care physician because of a 2-week history of nasal stuffiness, cough, and sinus pain. He is prescribed with phenylephrine. He must be aware of which of the following potential adverse effects?

- a) Constipation
- b) Diarrhea
- c) Epistaxis
- d) Hypertension
- e) Tinnitus

20. A 49-year-old man who smokes three packs of cigarettes per day for the last 20 years (60 pack years) is currently taking an oral nicotine agent to stop smoking as well as clonidine. Approximately 3 days ago, he stopped taking his clonidine and now complains of a pounding headache. What is the most likely explanation for this finding?

- a) Development of portal hypotension
- b) Development of subclinical diabetes
- c) Development of rebound hypertension
- d) Receptor hypersensitivity

21. A 70-year-old man with hypertension and decreased urinary flow presents to his primary care physician for treatment of his urinary symptoms. His current medications include a calcium channel blocker. Physical examination reveals a 20-g prostate without nodules. Which of the following is the most efficacious treatment for this patient with minimal potential for adverse events?

- a) Alfuzosin
- b) Doxazosin
- c) Phenoxybenzamine
- d) Phentolamine
- e) Tamsulosin

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22. In patients with Parkinson's disease, histologic studies suggest an imbalance in brain neurotransmitters. In contrast to normal individuals, the patients with Parkinson's disease have an abundance of which of the following neurons and associated neurotransmitters?

- a) Acetylcholine
- b) Dopamine
- c) Epinephrine
- d) Norepinephrine
- e) Serotonin

23. Five patients are seen by their primary care physician because of chronic anxiety. Benzodiazepines are being considered for each of the patients. Which of the following patients would be best suited for this medication?

- a) A 31-year-old woman who is 16 weeks pregnant
- b) A 32-year-old woman with alcoholic liver disease and HIV disease
- c) A 36-year-old man with gastroesophageal reflux disorder
- d) A 39-year-old man with alcoholic liver disease
- e) A 62-year-old man with narrow-angle glaucoma

24. A 27-year-old hospital worker has access to the pharmacy when no other workers are around. He is able to find morphine and inject himself with supratherapeutic dose of morphine. He then collapses and is found dead by coworkers 24 h later. What is the most likely explanation for his death?

- a) Cardiac arrest
- b) Cardiac ischemia
- c) Cardiomyopathy
- d) Respiratory depression and arrest
- e) Transient cerebral ischemic attack and subsequent stroke

25. A 72-year-old man is brought to his physician by his son. The son complains that this patient has been becoming forgetful, confused, moody, and aggressive over the past few months. Which of the following neurotransmitter changes is characteristic of Alzheimer's disease?

- a) Decreased acetylcholine
- b) Decreased dopamine
- c) Decreased norepinephrine
- d) Increased acetylcholine
- e) Increased dopamine

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26. A 59-year-old man presents to his primary care physician with an extremely sore shoulder following an accident at work. He is not found to have any fractures or tears and is treated with an injection of prednisolone for bursitis. He smokes and is currently taking levothyroxine because of a thyroidectomy, a b-blocker for mild heart failure, and prazosin for benign prostatic hyperplasia. His medications and the nicotine in his cigarettes each act on a different receptor. Activation of which of the following receptors produces the fastest cellular response?

- a)  $\alpha_1$ -Adrenergic receptor
- b)  $\beta_1$ -Adrenergic receptor
- c) Glucocorticoid hormone receptor
- d) Nicotinic cholinergic receptor
- e) Thyroid hormone receptor

27. A 31-year-old female is brought to the emergency department by friends who said she has been "taking drugs." They did not know specifically what she had taken. She presents with respiratory depression and dysphoria. Stimulation of which receptor is likely causing her dysphoria?

- a) Cannabinoid receptor
- b) GABA receptor
- c)  $\kappa$ -Opioid receptor
- d)  $\mu$ -Opioid receptor
- e) Serotonin receptor

28. A 47-year-old woman is recovering from a hysterectomy. Her physician prescribes an opioid analgesic as needed for postoperative pain. Opioids can cause many effects in addition to analgesia including constipation, respiratory depression, euphoria, miosis, and drowsiness. With prolonged use, tolerance develops to most of these effects. Which of the following effects persists in spite of tolerance leading to a decrease in the other effects?

- a) Analgesia
- b) Constipation
- c) Drowsiness
- d) Euphoria
- e) Nausea and vomiting

29. An 83-year-old man is brought to the clinic by his family with complaints stating he can no longer perform his daily activities or be trusted to live on his own. During his neurological exam, he presents with moderate memory loss, apraxia, and anomia. Also, he displays aggressive behaviors throughout the physical exam. He was diagnosed to be in an early stage of Alzheimer's disease. What class of drugs would be most helpful in treating the patient?

- a) Cholinesterase stimulants
- b) Cholinesterase inhibitors
- c) Dopamine agonists
- d) Muscarinic receptor inhibitors
- e) NMDA glutamate receptor agonists

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30. A 53-year-old woman is on a cruise to the Caribbean. The waters are somewhat choppy, and she fears that she will have motion sickness. She presents to the ship physician who gives her scopolamine to take to prevent motion sickness. This agent works in which of the following pathways?

- a) Blockade of  $\beta_1$ -receptors
- b) Blockade of  $\beta_2$ -receptors
- c) Blockade of  $H_2$  receptors
- d) Blockade of M receptors
- e) Stimulation of the CTZ receptors

31. Regarding differences between the sympathetic and parasympathetic nervous systems in a healthy 29-year-old graduate student athlete, which of the following is a feature of the sympathetic nervous system?

- a) Discrete response
- b) Ganglia located near target organs
- c) Limited distribution
- d) Short preganglionic fibers
- e) Thoracolumbar region of the spinal cord

32. A novel medication to treat gastric motility disorders will act at the terminal step in the synthesis/breakdown of acetylcholine. Which of the following is the terminal step in the synthesis and release of acetylcholine?

- a) Degradation
- b) Release of neurotransmitter
- c) Recycling of choline
- d) Synthesis
- e) Uptake into storage vesicles

33. Which of the following statements is correct about the normal functioning of the nicotinic receptors in a 19-year-old male college student athlete from the college baseball team?

- a) Nicotine at high doses stimulates the receptor
- b) Nicotinic receptors are located in the adrenal cortex
- c) Nicotinic receptors are located in the autonomic ganglia
- d) Nicotinic receptors located at the neuromuscular junction are known as NN receptors

34. A 15-year-old boy attempts suicide and is brought to the emergency department by the local rescue squad. He was found in the garage with an opened spray bottle of insecticide nearby. He has lost consciousness. His heart rate is 45 beats/minute, and his blood pressure is 80/40 mm Hg. He is sweating and salivating profusely. What is the most appropriate treatment for this patient?

- a) Atropine
- b) Edrophonium
- c) Norepinephrine
- d) Physostigmine
- e) Trimethaphan

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35. An individual lacks the ability to synthesize dopamine in the axoplasm of the adrenergic neuron. Should the problem occur at the rate-limiting step of this conversion, which of the following substances will accumulate?

- a) Dopamine
- b) L-dopa
- c) Norepinephrine
- d) Testosterone
- e) Tyrosine

36. A 54-year-old man with multiple medical problems and anxiety is placed on diazepam. He has been taking the medication for 6 months. He is concerned that he is having changes in his memory as a result of being on this medication. Which of the following memory effects are likely?

- a) Anterograde amnesia
- b) Long-term memory loss
- c) Loss of ability to taste
- d) Loss of prior negative memories
- e) Short-term memory loss

37. A 19-year-old man is brought to the emergency department after being found by his roommate to have snorted cocaine several times in the past few days, the last time being 10 h previously. He was given a drug that sedated him, and he fell asleep. The drug that was used to counter this patient's apparent cocaine withdrawal was very likely which of the following?

- a) Cocaine
- b) Fluoxetine
- c) Hydroxyzine
- d) Lorazepam
- e) Phenobarbital

38. A 60-year-old man presents to his primary care physician for a new patient appointment. He is taking several drugs for his medical conditions. One of his medical conditions is hypertension, for which he takes a drug that acts on  $\alpha_2$ -receptors to lower blood pressure. Which of the following drugs is this?

- a) Clonidine
- b) Metoprolol
- c) Reserpine
- d) Scopolamine
- e) Tyramine

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39. A 3-year-old girl was found by her mother chewing on some weeds in their flower garden. The mother rushed her to the hospital along with a portion of the weed. The emergency department physician identifies the weed as deadly nightshade, which contains atropine. Which of the following drugs might a physician give as an antidote to atropine?

- a) Dopamine
- b) Epinephrine
- c) Physostigmine
- d) Pralidoxime
- e) Scopolamine

40. A 28-year-old woman is hospitalized (hospital day 3) on the maternity floor after cesarean section delivery of her first child. The child was born at term by C-section because of failure of labor to progress. The patient has been unable to void normally since the procedure. Which of the following is the most appropriate treatment for this patient?

- a) Bethanechol
- b) Carbachol
- c) Physostigmine
- d) Pilocarpine
- e) Tacrine

41. A first-year anesthesiology resident reaches for isoflurane as the induction agent for a patient who is about to receive general anesthesia. When the attending faculty sees this, he quickly takes the syringe away from the resident because this agent can cause which of the following effects when used for induction?

- a) Coughing
- b) Dry mouth
- c) Hypertension
- d) Laryngeal relaxation
- e) Muscle relaxation

42. A 37-year-old man who is morbidly obese (weight is 375 lb) is referred for weight-reducing surgery via gastric bypass. After hearing the risks of the surgery, the patient decides on a medical approach to treatment. He begins therapy with phentermine. Which of the following is the most important for both the patient and the family to know about this medication?

- a) Abuse potential
- b) Cardiovascular toxicities
- c) Hypertension
- d) Risk of stroke
- e) Seizures

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43. A 55-year-old man with multidrug-resistant methicillin resistant *Staphylococcus aureus* is treated with intravenous linezolid for 40 days. He is currently hospitalized in the intensive care unit. Which of the following consultations should be ordered in this patient at this time?

- a) Gastroenterology
- b) Ophthalmology
- c) Podiatry
- d) Pulmonary medicine
- e) Urology

44. A 21-year-old woman presents to her primary care physician with worsening alogia as well as harboring the delusion that an ex-boyfriend (who now lives in a different state) is spying on her through her computer. Her physician prescribes chlorpromazine, a low-potency antipsychotic. The physician warns her of possible anticholinergic side effects. Which of the following is an anticholinergic effect?

- a) Bradycardia
- b) Diarrhea
- c) Lacrimation
- d) Miosis
- e) Urinary retention

45. A 37-year-old woman presents to the plastic surgery group for the second round of treatment to address her wrinkles. She complains that her right eyelid and forehead are “too droopy” and has a persistent headache since her first Botox treatment 5 days ago. What is the mechanism of action for this treatment?

- a) Binds  $\alpha$ -receptors preventing activation
- b) Binds muscarinic receptors preventing activation
- c) Blocks uptake of choline into nerve terminals
- d) Prevents release of cholinergic vesicles
- e) Prevents storage of cholinergic vesicles

46. A 24-year-old Caucasian woman with dysplastic nevus syndrome presents to her annual checkup with a suspicious-looking mole. The physician decides to remove it. To prepare the site, she injects a lidocaine preparation. The surrounding tissue blanches. What is most likely present with the lidocaine that causes the blanching?

- a) Epinephrine
- b) Levothyroxine
- c) Nifedipine
- d) Nothing—lidocaine is thick and white itself and only appears to cause blanching
- e) Sodium bicarbonate

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47. A researcher is creating a novel medication to act at M 1 receptors. This agent will likely have which of the following augmentative effects on target organs?

- a) Cardiac muscle contractility
- b) Constipation
- c) Diarrhea
- d) Gastric acid secretion
- e) Stroke volume

48. A 34-year-old man with a sacral spinal cord injury has neurogenic bowel. He is on a bowel regimen that involves periodic bowel cleansing with soapsuds enemas. He is given a trial of bethanechol for this condition. Which of the following adverse events must his treating physician be aware of?

- a) Bronchodilation
- b) Diarrhea
- c) Dry mouth
- d) Dry skin
- e) Sigmoid colonic stasis

49. A 69-year-old man with a history of squamous cell carcinoma of the larynx underwent treatment with surgical resection and postoperative radiation therapy. He currently has significant xerostomia. Which of the following would be the best course of treatment for this patient?

- a) Bethanechol
- b) Carbachol
- c) Oral liquid intake
- d) Resection of the parotid gland
- e) Pilocarpine

50. The use of atropine drops to the eye of a 37-year-old man who is a stockbroker would produce which of the following effects?

- a) Cycloplegia
- b) Decreased intraocular pressure
- c) Miosis
- d) Responsiveness to light

51. A 53-year-old man with a history of cataracts and retinal disease is going to undergo a 6- to 10-h procedure that will require mydriasis to complete the procedure. Which of the following ophthalmic agents would be most useful for this situation?

- a) Atropine
- b) Cyclopentolate
- c) Nicotine
- d) Tropicamide

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52. A 75-year-old man with a 40-pack-year history of smoking and known chronic obstructive pulmonary disease complains of intermittent cough. Physical examination reveals wheezing, which is suggestive of bronchospasm. Which of the following is the most appropriate treatment for this patient?

- a) Ipratropium aerosol
- b) Mecamylamine
- c) Nicotine
- d) Oxygen
- e) Scopolamine

53. A researcher is developing a medication that selectively stimulates  $\beta_2$ -receptors without affecting any other receptors. As a result of such stimulation, which of the following effects is possible?

- a) Bronchoconstriction
- b) Glucagon release
- c) Renin release
- d) Uterine smooth muscle contraction
- e) Vasoconstriction

54. A 19-year-old man cuts his hand while slicing a bagel. He sustains a 4-cm laceration of the palmar aspect of his hand. The wound will be sutured with absorbable sutures. Prior to beginning the procedure, the wound is injected with lidocaine containing 1:100,000 parts epinephrine. The rationale behind the use of epinephrine is which of the following?

- a) Augment pain sensation
- b) Increase bleeding to improve toxin release from the wound
- c) Slow anesthetic metabolism from tissue
- d) Vasodilation at the site of administration

55. A 23-year-old man with erectile dysfunction refuses to see a physician for his problem. Instead, he purchases an over-the-counter product that contains yohimbine. He claims that he now has improved sexual function with improved quality of his erections. What is the most likely explanation for this finding?

- a) Cavernosal artery stimulation
- b) Cavernosal nerve stimulation
- c) Development of hypertension
- d) Development of priapism
- e) Improved sympathetic outflow to the periphery

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56. A group of teenage boys present to the emergency department after ingesting a plant they heard would make them high. One member of the group still had some plant parts in his pocket, which you use to identify deadly nightshade. They present with xerostomia, dry eyes, flushed skin, blurry vision, and tachycardia. Which substance is likely causing their symptoms?

- a) Atropine
- b) Bethanechol
- c) Physostigmine
- d) Strychnine
- e) Tyramine

57. A 37-year-old man with a history of inguinal hernia undergoes elective surgical repair. The anesthesiologist is concerned about potential adverse effects of the inhalational agent chosen—halothane. The initial symptom of halothane's adverse reaction is which of the following?

- a) Anorexia
- b) Fever
- c) Hepatitis
- d) Nausea
- e) Vomiting

58. Isoflurane is used as the induction agent in a 9-year-old girl who is undergoing tonsillectomy and adenoidectomy. She has a history of obstructive sleep apnea and has developmental delay. Which of the following characteristics of this agent is correct?

- a) Can induce cardiac arrhythmia
- b) Causes peripheral vasoconstriction
- c) Fruity smelling gaseous agent
- d) Produces dose-dependent hypotension
- e) Undergoes significant metabolism

59. A 5-year-old boy is brought to the clinic by his parents who say that he often has trouble catching his breath when he has been playing hard outside. He is allergic to peanuts. At the moment, he is breathing fine. Which of the following drugs would dilate his bronchioles in an acute asthma attack?

- a) Albuterol
- b) Methacholine
- c) Neostigmine
- d) Nicotine
- e) Pilocarpine

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60. A 26-year-old man presents to an urgent care clinic with a dry cough for the past week. The cough was associated with a fever and chills for 2 days, but he has since been afebrile. He has no other symptoms. What opioid is most appropriate to treat this patients' cough?

- a) Butorphanol
- b) Dextromethorphan
- c) Diphenoxylate
- d) Guaifenesin
- e) Loperamide

61. A 34-year-old man with a seizure disorder presents to the emergency department with severe left-sided flank pain. The pain began suddenly this morning and has not improved. His urinalysis shows microscopic hematuria, and a KUB confirms a kidney stone. Which pain medication should be avoided in this patient?

- a) Acetaminophen
- b) Butorphanol
- c) Fentanyl
- d) Morphine
- e) Tramadol

62. A 33-year-old woman patient needs to be anesthetized before a dilation and curettage for abnormal uterine bleeding. Her anesthesia is induced initially with an inhaled, nonflammable anesthetic that contains no halogenated carbons. Of the following, which agent best fits this description?

- a) Enflurane
- b) Diethyl ether
- c) Halothane
- d) Nitrous oxide
- e) Propofol

63. The potency of inhaled anesthetics is defined as the minimum alveolar concentration. Five anesthetic gases are infused into 2-kg rats denoted as gas A through gas E with the MACs noted. Which of the following gases would likely be nitrous oxide?

- a) Gas A MAC 0.75%
- b) Gas B MAC 1.2%
- c) Gas C MAC 2%
- d) Gas D MAC 6%
- e) Gas E MAC 105%

64. Which is correct regarding the sympathetic nervous system?

- a) It generally mediates body functions in "rest and digest" mode.
- b) The neurotransmitter at the sympathetic ganglion is norepinephrine (NE).
- c) The neurotransmitter at the sympathetic ganglion is acetylcholine (ACh).
- d) Sympathetic neurons release ACh in the effector organs.

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65. Why does the somatic nervous system enable a faster response compared to the ANS?

- a) Somatic motor neurons have ganglia where neurotransmission is mediated by ACh.
- b) Somatic motor neurons have ganglia where neurotransmission is mediated by NE.
- c) Somatic motor neurons are not myelinated.
- d) Somatic motor neurons are myelinated and do not have ganglia.

66. Which physiological change occurs when the parasympathetic system is activated?

- a) Increase in heart rate
- b) Inhibition of lacrimation (tears)
- c) Dilation of the pupil (mydriasis)
- d) Increase in gastric motility

67. Which physiological change is expected when the sympathetic system is inhibited using a pharmacological agent?

- a) Reduction in heart rate
- b) Increase in blood pressure
- c) Decrease in fluid secretions
- d) Constriction of blood vessels

68. Which is correct regarding activation of receptors on the effector organs in the ANS?

- a) Acetylcholine activates muscarinic receptors.
- b) Acetylcholine activates adrenergic receptors.
- c) Epinephrine activates nicotinic receptors.
- d) Norepinephrine activates muscarinic receptors.

69. Which statement concerning the parasympathetic nervous system is correct?

- a) The parasympathetic system often discharges as a single, functional system.
- b) The parasympathetic division is involved in near vision, movement of food, and urination.
- c) The postganglionic fibers of the parasympathetic division are long, compared to those of the sympathetic nervous system.
- d) The parasympathetic system controls the secretion of the adrenal medulla.

70. Which is correct regarding neurotransmitters and neurotransmission?

- a) Neurotransmitters are released from the presynaptic nerve terminals.
- b) Arrival of an action potential in the postsynaptic cell triggers release of neurotransmitter.
- c) Intracellular calcium levels drop in the neuron before the release of neurotransmitter.
- d) Serotonin and dopamine are the primary neurotransmitters in the ANS.

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71. An elderly man is brought to the emergency room after ingesting a large quantity of prazosin tablets, a drug that blocks  $\alpha_1$  adrenergic receptors, which mediate effects of epinephrine and norepinephrine on the blood vessels and urinary bladder. Which symptom is most likely to be seen in this patient?

- a) Reduced heart rate (bradycardia)
- b) Dilation of blood vessels (vasorelaxation)
- c) Increased blood pressure
- d) Reduction in urinary frequency

72. Which statement is correct regarding the autonomic nervous system?

- a) Afferent neurons carry impulses from the central nervous system (CNS) to the effector organs.
- b) Preganglionic neurons of the sympathetic system arise from the cranial nerves, as well as from the sacral region.
- c) When there is a sudden drop in blood pressure, the baroreceptors send signals to the brain to activate the parasympathetic system.
- d) The heart receives both sympathetic and parasympathetic innervation.

73. Which is correct regarding membrane receptors and signal transduction?

- a) ANS neurotransmitters bind to membrane receptors on the effector cells, which leads to intracellular events.
- b) Cholinergic muscarinic receptors are ionotropic receptors.
- c) Cholinergic nicotinic receptors are metabotropic receptors.
- d) Metabotropic receptors activate ion channels directly.

74. Botulinum toxin blocks the release of acetylcholine from cholinergic nerve terminals. Which is a possible effect of botulinum toxin?

- a) Skeletal muscle paralysis
- b) Improvement of myasthenia gravis symptoms
- c) Increased salivation
- d) Reduced heart rate

75. A patient develops urinary retention after an abdominal surgery. Urinary obstruction was ruled out in this patient. Which strategy would be helpful in promoting urination?

- a) Activating nicotinic receptors
- b) Inhibiting the release of acetylcholine
- c) Inhibiting cholinesterase enzyme
- d) Blocking muscarinic receptors

76. Which of the following drugs could theoretically improve asthma symptoms?

- a) Bethanechol
- b) Pilocarpine
- c) Pyridostigmine
- d) Atropine

# Pharma-CNS 1

77. If an ophthalmologist wants to dilate the pupils for an eye examination, which drug/class of drugs is theoretically useful?

- a) Muscarinic receptor activator (agonist)
- b) Muscarinic receptor inhibitor (antagonist)
- c) Pilocarpine
- d) Neostigmine

78. In Alzheimer disease, there is a deficiency of cholinergic neuronal function in the brain. Theoretically, which strategy is useful in treating symptoms of Alzheimer disease?

- a) Inhibiting cholinergic receptors in the brain
- b) Inhibiting the release of acetylcholine in the brain
- c) Inhibiting the acetylcholinesterase enzyme in the brain
- d) Activating the acetylcholinesterase enzyme in the brain

79. An elderly female who lives in a farmhouse was brought to the emergency room in serious condition after ingesting a liquid from an unlabeled bottle found near her bed, apparently in a suicide attempt. She presented with diarrhea, frequent urination, convulsions, breathing difficulties, constricted pupils (miosis), and excessive salivation. Which of the following is correct regarding this patient?

- a) She most likely consumed an organophosphate pesticide.
- b) The symptoms are consistent with sympathetic activation.
- c) Her symptoms can be treated using an anticholinesterase agent.
- d) Her symptoms can be treated using a cholinergic agonist.

80. A patient who received a nondepolarizing neuromuscular blocker (NMB) for skeletal muscle relaxation during surgery is experiencing mild skeletal muscle paralysis after the surgery. Which drug could reverse this effect of NMBs?

- a) Pilocarpine
- b) Bethanechol
- c) Neostigmine
- d) Atropine

81. A 60-year-old female who had a cancerous growth in the neck region underwent radiation therapy. Her salivary secretion was reduced due to radiation and she suffers from dry mouth (xerostomia). Which drug would be most useful in treating xerostomia in this patient?

- a) Acetylcholine
- b) Pilocarpine
- c) Echothiophate
- d) Atropine

# Pharma-CNS 1

82. A 40-year-old male presents to his family physician with drooping eyelids, difficulty chewing and swallowing, and muscle fatigue even on mild exertion. Which agent could be used to diagnose myasthenia gravis in this patient?

- a) Atropine
- b) Edrophonium
- c) Pralidoxime
- d) Echothiophate

83. *Atropa belladonna* is a plant that contains atropine (a muscarinic antagonist). Which of the following drugs or classes of drugs will be most useful in treating poisoning with belladonna?

- a) Malathion
- b) Physostigmine
- c) Muscarinic antagonists
- d) Nicotinic antagonists

84. During an ophthalmic surgical procedure, the surgeon wanted to constrict the pupil using a miotic drug. However, he accidentally used another drug that caused dilation of the pupil (mydriasis). Which drug was most likely used?

- a) Acetylcholine
- b) Pilocarpine
- c) Tropicamide
- d) Bethanechol

85. Sarin is a nerve gas that is an organophosphate cholinesterase inhibitor. Which agent could be used as an antidote to sarin poisoning?

- a) Pilocarpine
- b) Carbachol
- c) Atropine
- d) Physostigmine

86. A patient with Alzheimer disease needs treatment for overactive bladder (OAB). Which drug is the best choice for this patient?

- a) Darifenacin
- b) Solifenacin
- c) Tolterodine
- d) Trospium

87. A patient with asthma was prescribed  $\beta_2$  agonist for acute relief of bronchospasm, but did not respond to treatment. Which drug is the most likely next option for this patient?

- a) Benztropine
- b) Ipratropium
- c) Oxybutynin
- d) Physostigmine

# Pharma-CNS 1

88. A 50-year-old male who is noncompliant with medications was recently diagnosed with chronic obstructive pulmonary disease (COPD). His physician would like to prescribe an inhaled anticholinergic that is dosed once or twice daily. Which drug is most appropriate for this patient?

- a) Atropine
- b) Ipratropium
- c) Tiotropium
- d) Trosipium

89. Which is the most effective drug for motion sickness for a person planning to go on a cruise?

- a) Atropine
- b) Fesoterodine
- c) Scopolamine
- d) Tropicamide

90. Which is correct regarding ganglion-blocking drugs?

- a) Blockade of sympathetic ganglia could result in reduced blood pressure.
- b) Blockade of parasympathetic ganglia could result in reduced heart rate.
- c) Nicotine is a nondepolarizing ganglion blocker.
- d) Atropine is a nondepolarizing ganglion blocker.

91. Which drug is useful in treating sinus bradycardia?

- a) Atropine
- b) Cisatracurium
- c) Neostigmine
- d) Succinylcholine

92. An ICU patient with severe lung injury requires a neuromuscular blocking agent to assist in his ventilator management. He has liver disease and is currently in renal failure. Which neuromuscular blocker is the best choice for this patient?

- a) Cisatracurium
- b) Pancuronium
- c) Vecuronium
- d) Rocuronium

93. Where would you expect to see the first return of function in skeletal muscles following discontinuation of a nondepolarizing neuromuscular blocking agent?

- a) Arms
- b) Diaphragm
- c) Fingers
- d) Pupils

# Pharma-CNS 1

94. Which of the following is correct regarding adrenergic neurotransmission?

- a) Norepinephrine is the major neurotransmitter released from sympathetic nerve terminals.
- b) Norepinephrine is mainly released from the adrenal glands.
- c) Tricyclic antidepressants and cocaine prevent the release of norepinephrine from the nerve terminals.
- d) Monoamine oxidase (MAO) converts dopamine to norepinephrine in the nerve terminal.

95. Which of the following adrenergic drugs is used in the treatment of overactive bladder?

- a) Epinephrine
- b) Dobutamine
- c) Phenylephrine
- d) Mirabegron

96. Which of the following classes of adrenergic agents has utility in the management of hypertension?

- a)  $\alpha$  1 Agonist
- b)  $\alpha$ 2 Agonist
- c)  $\beta$ 1 Agonist
- d)  $\beta$ 3 Agonist

97. Which of the following is correct regarding responses mediated by adrenergic receptors?

- a) Stimulation of  $\alpha$ 1 receptors increases blood pressure.
- b) Stimulation of sympathetic presynaptic  $\alpha$ 2 receptors increases norepinephrine release.
- c) Stimulation of  $\beta$ 2 receptors increases heart rate (tachycardia).
- d) Stimulation of  $\beta$ 2 receptors causes bronchoconstriction.

98. An asthma patient was given a nonselective  $\beta$  agonist to relieve bronchoconstriction. Which adverse effect would you expect in this patient?

- a) Bradycardia
- b) Tachycardia
- c) Hypotension (reduction in blood pressure)
- d) Worsening bronchoconstriction

99. A 22-year-old male is brought to the emergency room with suspected cocaine overdose. Which of the following symptoms is most likely in this patient?

- a) Hypertension
- b) Bronchoconstriction
- c) Bradycardia
- d) Miosis (constriction of pupil)

# Pharma-CNS 1

100. A 12-year-old boy with a peanut allergy is brought to the emergency room after accidental consumption of peanuts. He is in anaphylactic shock. Which of the following drugs is most appropriate to treat this patient?

- a) Norepinephrine
- b) Phenylephrine
- c) Dobutamine
- d) Epinephrine

101. An elderly patient is brought to the emergency room with a blood pressure of 76/60 mm Hg, tachycardia, and low cardiac output. He is diagnosed with acute heart failure. Which of the following drugs is most appropriate to improve his cardiac function?

- a) Epinephrine
- b) Fenoldopam
- c) Dobutamine
- d) Isoproterenol

102. Which of the following adrenergic agonists is commonly present in nasal sprays available over-the-counter (OTC) to treat nasal congestion?

- a) Clonidine
- b) Albuterol
- c) Oxymetazoline
- d) Formoterol

103. A patient who has hypertension and mild asthma attacks bought a herbal remedy for asthma online. He does not take any prescription medications for asthma, but takes a  $\beta_1$  selective blocker for hypertension. The herbal remedy relieves the asthma attacks, but his blood pressure seems to increase despite the  $\beta$  blocker therapy. Which of the following drugs is most likely present in the herbal remedy?

- a) Phenylephrine
- b) Norepinephrine
- c) Ephedrine
- d) Salmeterol

104. A 60-year-old patient started a new antihypertensive medication. His blood pressure is well controlled, but he complains of fatigue, drowsiness, and fainting when he gets up from the bed (orthostatic hypotension). Which of the following drugs is he most likely taking?

- a) Metoprolol
- b) Propranolol
- c) Prazosin
- d) Alfuzosin

# Pharma-CNS 1

105. A 30-year-old male patient was brought to the ER with amphetamine overdose. He presented with high blood pressure and arrhythmias. Which drug is the most appropriate to treat the cardiovascular symptoms of amphetamine overdose in this patient?

- a) Metoprolol
- b) Prazosin
- c) Labetalol
- d) Nebivolol

106. A new antihypertensive drug was tested in an animal model of hypertension. The drug when given alone reduces blood pressure in the animal. Norepinephrine when given in the presence of this drug did not cause any significant change in blood pressure or heart rate in the animal. The mechanism of action of the new drug is similar to which of the following agents?

- a) Doxazosin
- b) Clonidine
- c) Atenolol
- d) Carvedilol

107. A  $\beta$  blocker was prescribed for hypertension in a patient with asthma. After a week of treatment, the asthma attacks got worse, and the patient was asked to stop taking the  $\beta$ -blocker. Which  $\beta$ -blocker would you suggest as an alternative that is less likely to worsen the asthma?

- a) Propranolol
- b) Metoprolol
- c) Labetalol
- d) Carvedilol

108. A 70-year-old male is treated with doxazosin for overflow incontinence due to his enlarged prostate. He complains of dizzy spells while getting up from bed at night. Which drug would you suggest as an alternative that may not cause dizziness?

- a) Propranolol
- b) Phentolamine
- c) Tamsulosin
- d) Terazosin

109. A 50-year-old male was in anaphylactic shock after being stung by a hornet. The medical team tried to reverse the bronchoconstriction and hypotension using epinephrine; however, the patient did not fully respond to the treatment. The patient's wife mentioned that he is taking a prescription medication for blood pressure. Which medication is he most likely taking that contributed to a reduced response to epinephrine?

- a) Doxazosin
- b) Propranolol
- c) Metoprolol
- d) Acebutolol

# Pharma-CNS 1

110. Which of the following is correct regarding  $\alpha$ -adrenergic blockers?

- a)  $\alpha$ -Adrenergic blockers are used in the treatment of hypotension in anaphylactic shock.
- b)  $\alpha$ -Adrenergic blockers are used in the treatment of benign prostatic hyperplasia (BPH).
- c)  $\alpha$ -Adrenergic blockers may cause bradycardia.
- d)  $\alpha$ -Adrenergic blockers reduce the frequency of urination.

111. Which of the following is correct regarding  $\beta$ -blockers?

- a) Treatment with  $\beta$  blockers should not be stopped abruptly.
- b) Propranolol is a cardio selective  $\beta$ -blocker.
- c) Cardio selective  $\beta$ -blockers worsen asthma.
- d)  $\beta$ -Blockers decrease peripheral resistance by causing vasorelaxation.

112. Which of the following drugs is commonly used topically in the treatment of glaucoma?

- a) Esmolol
- b) Timolol
- c) Silodosin
- d) Yohimbine

113. Which of the following drugs has the highest potential to worsen orthostatic hypotension when given together with prazosin?

- a) Propranolol
- b) Atenolol
- c) Nebivolol
- d) Labetalol

114. Regarding levels of sedation, which one applies to loss of perception and sensation to painful stimuli?

- a) Anxiolysis
- b) General anesthesia
- c) Moderate sedation
- d) Deep sedation

115. Which of the following decreases minimum alveolar concentration (MAC)?

- a) Hyperthermia
- b) Cocaine intoxication
- c) Pregnancy
- d) Chronic ethanol abuse

# Pharma-CNS 1

116. Which of the following determines the speed of recovery from intravenous anesthetics used for induction?

- a) Liver metabolism of the drug
- b) Protein binding of the drug
- c) Ionization of the drug
- d) Redistribution of the drug from sites in the CNS

117. Which one of the following is a potent intravenous anesthetic and analgesic?

- a) Propofol
- b) Midazolam
- c) Ketamine
- d) Fentanyl

118. Which local anesthetic is metabolized by plasma cholinesterase?

- a) Tetracaine
- b) Bupivacaine
- c) Lidocaine
- d) Ropivacaine

119. A 23-year-old patient with a history of severe postoperative nausea and vomiting is coming in for plastic surgery. Which anesthetic drug would be best to use for maintenance in this situation?

- a) Isoflurane
- b) Sevoflurane
- c) Nitrous oxide
- d) Propofol

120. A 61-year-old patient with an acute myocardial infarction has severely reduced cardiac output. He has to undergo emergent coronary artery bypass surgery. Which of the following would you expect in this patient?

- a) Faster induction time with IV anesthetics
- b) Need for increased dosage of IV anesthetics
- c) Faster induction time with inhaled anesthetics
- d) Enhanced removal of inhaled anesthetics to peripheral tissues

121. A 70-year-old patient in the intensive care unit needs sedation due to prolonged endotracheal intubation. Which of the following medications should be avoided for sedation in this patient?

- a) Fentanyl
- b) Etomidate
- c) Propofol
- d) Dexmedetomidine

# Pharma-CNS 1

122. A 35-year-old man presents with appendicitis and requires a surgical intervention. He has a family history of malignant hyperthermia. Which anesthetic agent is most appropriate to use in this patient?

- a) Isoflurane
- b) Propofol
- c) Succinylcholine
- d) Sevoflurane

123. A 32-year-old woman presents for a right distal radius fracture. She requests regional anesthesia to help with her pain postoperatively. She reports that as a child, she had an allergic reaction to Novocain (procaine) at the dentist's office. Which local anesthetic is appropriate for use in this patient?

- a) Chloroprocaine
- b) Benzocaine
- c) Ropivacaine
- d) Tetracaine

124. Which of the agents listed is a phenanthrene opioid that exhibits a full and immediate response to treatment with naloxone in the case of overdose?

- a) Meperidine
- b) Morphine
- c) Buprenorphine
- d) Fentanyl

125. A 76-year-old female with renal insufficiency has severe pain secondary to a compression fracture in the lumbar spine. She reports that the pain has been uncontrolled with tramadol, and it is decided to start treatment with an opioid. Which is the best opioid for this patient?

- a) Meperidine
- b) Fentanyl transdermal patch
- c) Hydrocodone/acetaminophen
- d) Morphine

126. Which statement about buprenorphine is correct?

- a) Buprenorphine has a much higher incidence of opioid-induced respiratory depression compared to other  $\mu$  agonists.
- b) Buprenorphine has many dosage formulations, and all formulations can be prescribed for the treatment of pain or opioid dependence.
- c) Buprenorphine has a lower number of drug-drug interactions compared to methadone.
- d) Buprenorphine is a full  $\mu$  agonist, an antagonist of the NMDA receptor, and a norepinephrine and serotonin reuptake inhibitor.

# Pharma-CNS 1

127. A 56-year-old patient has suffered with painful diabetic neuropathy and severe chronic back pain with radiculopathy secondary to spinal stenosis for many years. This patient has failed to receive relief from his neuropathic pain with first-line agents such as tricyclics, SNRIs, or anticonvulsants. Based on the mechanism of action, which opioid could be considered in this patient to treat both nociceptive and neuropathic pain?

- a) Meperidine
- b) Oxymorphone
- c) Morphine
- d) Tapentadol

128. Which of the following statements regarding methadone is correct?

- a) Methadone is an excellent choice for analgesia in most patients because there are limited drug-drug interactions.
- b) The equianalgesic potency of methadone is similar to that of morphine.
- c) The duration of analgesia for methadone is much shorter than the elimination half-life.
- d) The active metabolites of methadone accumulate in patients with renal dysfunction.

129. AN is a 57-year-old man who has been treated with oxycodone for chronic nonmalignant pain for over 2 years. He now reports increased pain in the afternoon while at work. Which of the following is a short-acting opioid and is the best choice for this patient's breakthrough pain?

- a) Methadone
- b) Fentanyl
- c) Hydrocodone
- d) Nalbuphine

130. A 64-year-old man is preparing for a total knee replacement. He is taking many medications that are metabolized by the CYP450 enzyme system and is worried about drug interactions with the pain medication that will be used following surgery. Which of the following opioids would have the lowest chance of drug interactions in this patient?

- a) Methadone
- b) Tapentadol
- c) Tramadol
- d) Oxycodone

131. Which of the following statements regarding adverse effects of opioid therapy is correct?

- a) The risk of respiratory depression is highest during an initial opioid initiation or following a dose increase.
- b) Opioid-induced constipation is only seen with the initiation of opioid therapy.
- c) The incidence of nausea and sedation increases with long-term use of opioid therapy.
- d) Decreased testosterone levels are commonly seen with short-term use of opioid therapy.

# Pharma-CNS 1

132. KM is a 64-year-old man who has been hospitalized following a car accident in which he sustained a broken leg and broken arm. He has been converted to oral morphine in anticipation of discharge from the hospital. Upon discharge, which medication should he receive along with the morphine?

- a) Diphenhydramine
- b) Methylphenidate
- c) Senna
- d) Docusate sodium

133. AN is a 67-year-old man who has been treated with oxycodone for chronic nonmalignant pain with no changes in the dosing regimen for over 2 years. His pain has been fairly well controlled, and he remains active, reports satisfaction with his pain regimen, and denies any side effects. He has been recently diagnosed with COPD and obstructive sleep apnea (OSA). Which of the following options is the best treatment recommendation for him at this time?

- a) Taper off all opioids due to increased risk of opioid induced respiratory depression.
- b) Prescribe naloxone nasal spray to have at home in case he experiences an opioid overdose.
- c) Prescribe oral naloxone tablets to have at home in case he experiences an opioid overdose.
- d) No action is needed at this time. His pain is well controlled, and he is reporting no side effects.