

**FACULTY OF HEALTH SCIENCES**

**DEPARTMENT OF PHARMACY**

***COURSE: PHA 2409 – GENERAL PHARMACOLOGY II***

**SUPPLEMENTARY EXAMINATION**

**AUGUST 2023**

**MARKS: 100**

**TIME: 3 HOURS**

**INSTRUCTIONS:**

- **ANSWER ALL QUESTIONS**

**SECTION A: MCQs****[20 MARKS]**

1. Which of the following is a body site where autonomic receptors are primarily  $\alpha_1$  adrenergic?
  - A. Bronchial muscle
  - B. Atrioventricular node
  - C. Skin vessels
  - D. Sphincter muscle of the iris
2. Which of the following effects of norepinephrine are mostly likely mediated by the activation of peripheral postsynaptic  $\beta_1$  receptors?
  - A. Increased renin secretion
  - B. Uterine relaxation
  - C. Bronchodilation
  - D. Increased liver gluconeogenesis
3. Which of the following are cholinergic neurons?
  - A. All sympathetic neurons
  - B. All sympathetic postganglionic neurons
  - C. Parasympathetic postganglionic neurons
  - D. All neurons in the autonomic nervous system
4. Which of the following is the reason why the effects of sympathetic stimulation are longer lasting and more widespread than those of parasympathetic stimulation?
  - A. There is lesser divergence of sympathetic postganglionic fibres.
  - B. Acetylcholinesterase quickly inactivates acetylcholine, but norepinephrine lingers in the synaptic cleft for a longer time.
  - C. Sympathetic output is discrete and their postganglionic neurons are not branched.
  - D. Acetylcholine remains in the synaptic cleft until norepinephrine is produced.
5. Which of the following is a drug that acts at prejunctional  $\alpha_2$ -adrenoceptors and is/are used to treat hypertension?
  - A. Midodrine
  - B. Dobutamine
  - C. Methyldopa
  - D. Dopamine
6. Which of the following is not correct about nondepolarizing neuromuscular blockers?
  - A. Initial activation of Ach receptor and depolarization of the motor end plate
  - B. Effects are reversed by acetylcholinesterase inhibitors
  - C. Bind but do not activate Ach receptors
  - D. Most of these agents have minimal cardiovascular effects
7. Which of the following drugs is used to diagnose myasthenia gravis?
  - A. Neostigmine
  - B. Atropine
  - C. Edrophonium
  - D. Bethanechol

8. Neostigmine would be expected to reverse which of the following conditions?
- A. Paralysis of skeletal muscle induced by a competitive, nondepolarizing muscle relaxant
  - B. Paralysis of skeletal muscle induced by depolarizing muscle induced by depolarizing muscle relaxant
  - C. Cardiac slowing induced by stimulation of the vagus nerve
  - D. Miosis induced by bright light
9. Which of the following drugs would be most appropriate in treating a patient with occasional bronchospasms?
- A. Nicotine
  - B. Oxygen
  - C. Ipratropium aerosol
  - D. Scopolamine patches
10. Which of the following may precipitate an attack of open-angle glaucoma if instilled into the eye?
- A. Physostigmine
  - B. Atropine
  - C. Pilocarpine
  - D. Tropicamide
11. A patient who has mild persistent allergic asthma started a treatment that included an inhaled bronchodilator. A drug with which of the following mechanism of action would be most appropriate for this patient's inhaler?
- A. Blockade of M<sub>2</sub> cholinergic receptors
  - B. Activation of  $\beta_2$  adrenoceptors
  - C. Blockade of  $\alpha_1$  adrenoceptors
  - D. Activation of H<sub>1</sub> Histamine receptors
12. A 16-year-old male snorted cocaine for the first time at a party. A few minutes later he felt euphoria and friends noted that his pupils were dilated. Which of the following molecular actions most likely mediated the mydriasis?
- A. Inhibition of norepinephrine reuptake into sympathetic terminals
  - B. Inhibition of monoamine oxidase A
  - C. Stimulation of epinephrine release from adrenal medulla
  - D. Blockade of  $\alpha_2$  receptors in sympathetic terminals.
13. A new-born was revealed to have a genetic dopamine- $\beta$ -hydroxylase deficiency. Lab tests would have also shown which of the following results?
- A. Very low plasma levels of dopamine
  - B. Very low plasma levels of norepinephrine
  - C. High plasma levels of epinephrine
  - D. High urinary levels of normetanephrine

14. A 43-year-old man recently diagnosed with pheochromocytoma (an adrenal gland tumor) started a treatment with a drug that can cause a pronounced decrease in norepinephrine and epinephrine by blocking the first rate-limiting step in catecholamine biosynthesis. Which of the following enzymes was most likely inhibited by the drug?
- A. Aromatic 1-amino acid decarboxylase
  - B. Dopamine  $\beta$ -hydroxylase
  - C. Tyrosine hydroxylase
  - D. Monoamine oxidase
15. A patient presented with symptoms of palpitations, inward trembling, sweating, hunger, weakness and nervousness. These symptoms likely resulted from increased firing of which of the following neurons?
- A. Somatic motor neurons
  - B. Preganglionic parasympathetic neurons
  - C. Preganglionic sympathetic neurons
  - D. Postganglionic parasympathetic neurons
16. Which of the following is released and causes the vasodilation associated with muscarinic cholinergic agonists?
- A. Histamine
  - B. Norepinephrine
  - C. Nitric oxide
  - D. Acetylcholine
17. Which of the following expected effects of norepinephrine would be most likely mediated by the activation of peripheral postsynaptic  $\beta_1$  receptors?
- A. Bronchodilation
  - B. Uterine relaxation
  - C. Increased renin secretion
  - D. Decreased insulin secretion
18. A 62-year-old man suffering from postural hypotension started therapy with a drug that selectively activates  $\alpha_1$  receptors. Which of the following post receptor mechanisms most likely mediated the therapeutic effects of the drug in this patient?
- A. Increased activation of phospholipase C
  - B. Decreased synthesis of inositol triphosphate (IP<sub>3</sub>) and diacylglycerol (DAG)
  - C. Increased synthesis of cyclic guanosine monophosphate (cGMP)
  - D. Opening of ligand-gated K<sup>+</sup> channel
19. Which of the following statements is inaccurate about nonsteroidal anti-inflammatory drugs (NSAIDs).
- A. Gastrointestinal complications are the most common unwanted effects of these drugs.
  - B. These drugs inhibit COX-1 and COX-2 isoenzymes with equal potency.
  - C. Paracetamol is analgesic and antipyretic but has only weak anti-inflammatory effect.
  - D. NSAIDs reduce gastric blood flow.

20. Which of the following is the most accurate statement about neurotransmission?

- A. Neurotransmitters are synthesized in the presynaptic nerve terminal.
- B. Fusion of vesicles with the presynaptic membrane is facilitated by  $K^+$  influx triggered by the action potential.
- C. Neurotransmitters are taken up into the presynaptic neuron by passive diffusion.
- D. Acetylcholine release is modified by receptors on the presynaptic membrane.

**SECTION B: MATCHING****[20 MARKS]**

1. Match the following drugs with their therapeutic indications, and for each match describe the receptors involved to effect therapy. (10)

<b>Drug</b>	<b>Indication</b>
a) Bethanechol	i) Hypertension
b) Atenolol	ii) Myasthenia gravis
c) Salbutamol	iii) Urinary retention
d) Pilocarpine	iv) Glaucoma
e) Pyridostigmine	v) Asthma

2. Match the following drugs with their pharmacological descriptions.

<b>DRUG</b>	<b>DESCRIPTION</b>
<b>1. Ephedrine</b>	a) A selective $\beta_2$ agonist
<b>2. Amphetamine</b>	b) A selective competitive blocker of the $\alpha_1$ receptor
<b>3. Isoproterenol</b>	c) A nonselective $\beta$ adrenoceptor blocker
<b>4. Oxymetazoline</b>	d) A cardioselective $\beta$ blocker that antagonises $\beta_1$ receptors at doses 50- to 100- fold less than those required to block $\beta_2$ receptors.
<b>5. Terbutaline</b>	e) A selective $\beta_1$ agonist
<b>6. Dobutamine</b>	f) A plant alkaloid that causes depletion of biogenic amines; norepinephrine, dopamine and serotonin.
<b>7. Tamsulosin</b>	g) A cardiac stimulant which is an agonist at $\beta_1$ and $\beta_2$ adrenergic receptors
<b>8. Atenolol</b>	h) An indirect-acting adrenergic drug that acts as a central nervous system (CNS) stimulant
<b>9. Reserpine</b>	i) An $\alpha_1$ agonist that acts as a nasal decongestant
<b>10. Propranolol</b>	j) An $\alpha$ , $\beta$ adrenergic agonist, that has CNS activity and also acts as a nasal decongestant

**SECTION C: TRUE OR FALSE****[20 MARKS]****State whether the following statements are TRUE or FALSE:**

1. The sympathetic division of the ANS utilises adrenaline as its primary transmitter substance.
2. The parasympathetic and sympathetic nervous systems have opposite effects in every organ.
3. Sympathetic nervous stimulation to the gut inhibits gut motility and sphincter tone.
4. Acetylcholine is metabolised by plasma cholinesterase in the synaptic cleft.
5. Dopamine and noradrenaline are synthesised from levodopa.
6. Dopamine is a transmitter in the peripheral autonomic nervous system.
7. Tyramine is metabolised by both isoenzymes of monoamine oxidase (MAO-A and MAO-B).
8. Both  $\alpha_1$  and  $\alpha_2$ -adrenoceptor antagonists can be used to lower blood pressure.
9. Botulism is caused by poisoning with a bacterial toxin.
10. Botulinum toxin enhances acetylcholine release from all cholinergic neurons.
11. There are two subtypes of  $\beta$ -adrenoceptor.
12. Blockade of presynaptic adrenoceptors by propranolol increases noradrenaline release.
13. The actions of synaptic serotonin and noradrenaline are curtailed mainly by metabolism by MAO and COMT.
14. The synaptic uptake of noradrenaline and serotonin can be inhibited selectively.
15. The vagal cranial nerve to the eye decreases pupil size.
16. Blockade of  $H_1$  histamine receptors reduces gastric acid secretion.
17. Glutamate and glycine are inhibitory amino acid transmitters.
18. Acetylcholine release is modified by receptors on the presynaptic membrane.
19. Neurotransmitters are synthesized in the presynaptic nerve terminals.
20. Neurotransmitters are taken up into the presynaptic neuron by passive diffusion.

**SECTION D: LONG/SHORT ANSWER QUESTIONS****[40 MARKS]**

1. In the following list; drugs are paired with therapeutic indications. For each pair, describe the mechanism underlying the indication. **(20)**
  - a. Atenolol: hypertension
  - b. Salbutamol: asthma
  - c. Timolol: glaucoma
  - d. Methyldopa: pregnancy induced hypertension
  - e. Adrenaline: respiratory distress
  - f. Bethanechol: postpartum nonobstructive urinary retention
  - g. Baclofen: skeletal muscle spasm
  - h. Atracurium: an adjunct to general anaesthesia
  - i. Pilocarpine: ocular hypertension
  - j. Scopolamine: motion sickness.
  
2. Distinguish between the following: **(10)**
  - a. Sympathetic and histaminergic effects on bronchial smooth muscles
  - b. Nicotinic and muscarinic receptors
  - c. Myasthenia crisis and cholinergic crisis
  - d. Direct acting and indirect acting adrenergic drugs
  - e. Parasympathomimetic drugs and 2<sup>nd</sup> generation H<sub>1</sub> antihistamine effects
  
3. Discuss histamine synthesis, storage, release and removal of its activity. **(10)**