

THE UNIVERSITY OF AUCKLAND

MEDSCI 204 - INTRODUCTION TO PHARMACOLOGY & TOXICOLOGY

MID-SEMESTER TEST 2008

16th September, 2008

Time allowed: 45 min.

Answer all 40 questions (each question is worth equal marks)
This exam is worth 10% of your final grade.

Instructions

Complete your name and ID information (as per your ID card) and version code (i.e. 00000001) on the SCANTRON MCQ form as instructed **using a pencil** (no entry is required for the STREAM box).

Answer all questions; you have 45 minutes to complete the paper of 40 questions.

There is only one correct answer per question, worth one point.

No points are taken away for an incorrect answer. However, if more than one answer is chosen or it is not clear which answer has been chosen then no points will be awarded.

If you want to change your selection make sure you erase your first answer completely.

- 1) One of the following drugs is NOT derived from a naturally occurring plant material. Which one?
 - a) Paclitaxel
 - b) Digitalis (digoxin)
 - c) Morphine
 - d) Penicillin
 - e) None of the above – they all come from plants

- 2) Which of the following drug names is NOT a generic drug name?
 - a) Dispirin
 - b) Paracetamol
 - c) Celecoxib
 - d) Sildenafil
 - e) Cimetidine

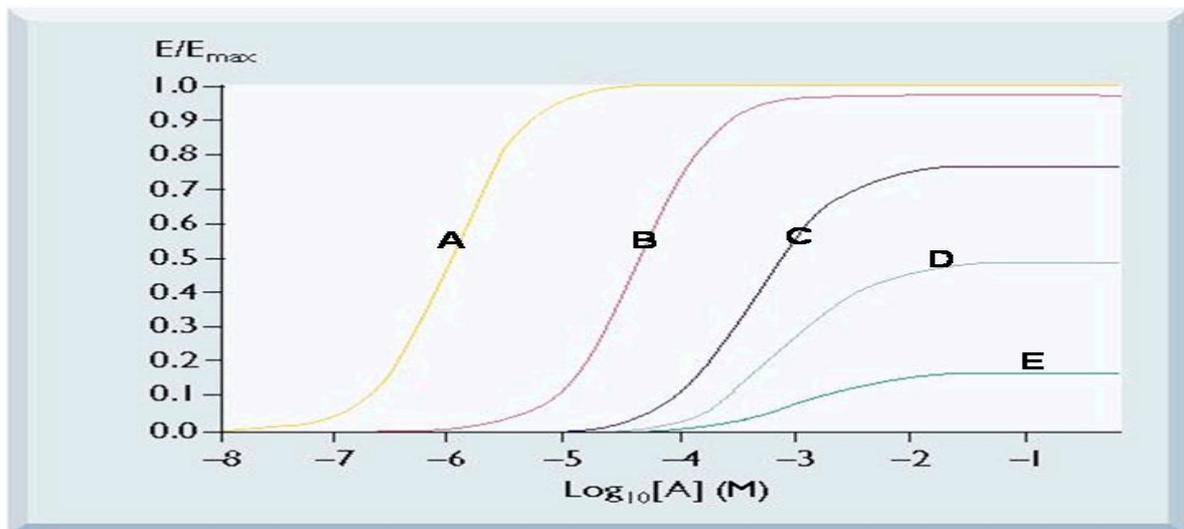
- 3) For a drug such as human growth hormone, what would be the most likely mechanism for absorption into the body?
- Passive diffusion
 - Endocytosis
 - Active transport
 - Facilitated diffusion
 - Filtration
- 4) Which of the following processes requires the use of energy, often in the form of ATP?
- Active transport
 - Filtration
 - Passive diffusion
 - Facilitated diffusion
 - All of the above
- 5) What is the meaning of the “first pass effect” following oral drug administration?
- A drug can be eliminated in the urine or faeces before it can be metabolised
 - A drug must first pass through the liver before it will exert any biological activity
 - A drug is metabolized before it reaches the systemic circulation
 - Some drugs are not effective on their first pass through the circulation but are increasingly more effective through subsequent passes
 - A drug must bind to its target initially before it can subsequently exert a biological effect
- 6) Which statement is FALSE:
- Oral administration of drugs is the safest and most convenient route
 - All drugs taken orally have a low bioavailability due to liver metabolism
 - The rate of stomach emptying is a major factor in the rate of drug absorption
 - Food may increase the bioavailability of some drugs
 - Diarrhoea may decrease the bioavailability of some drugs
- 7) With regard to drug distribution to tissues, which statement is FALSE:
- Tissue uptake of the drug is dependent on its solubility in that tissue
 - Drugs may be reversibly bound to albumin in the tissues
 - Distribution of drugs to tissues is independent of blood flow to the tissue
 - Drugs are distributed to the heart, lungs, liver and kidney very rapidly
 - Drug binding to tissues may have adverse effects

- 8) The liver is the primary organ of drug metabolism. In liver cells (hepatocytes) metabolism mainly occurs:
- In the nucleus
 - In the nucleus, plasma membrane, and golgi
 - In the plasma membrane and mitochondria
 - In the mitochondria and golgi
 - In the endoplasmic reticulum
- 9) Which of the following statements about Phase 1 metabolism is FALSE?
- It converts a parent compound into a more chemically reactive molecule
 - It always makes a molecule more water soluble
 - It often creates substrates for Phase 2 metabolism
 - CYP450 enzymes often play a key role in Phase 1 metabolism
 - None of the above - all the statements are true
- 10) Which of the following is a well known and potent inhibitor of the metabolism of some important and commonly used drugs?
- Cruciferous vegetables
 - B-B-Q meat
 - Green tea
 - Grapefruit juice
 - Beer
- 11) Which of the following statements about the induction and inhibition of metabolism is CORRECT?
- Enzyme inhibition decreases the number of enzymes present, while induction has no effect on enzyme number
 - CYP450 enzymes can be induced, but not inhibited
 - Both inhibition and induction are always readily and rapidly reversible
 - Maximal induction takes 3-5 days, while inhibition occurs almost immediately
 - All of the above
- 12) Which of the following statements is FALSE with regard to excretion of drugs by the kidney?
- All drugs must be metabolised before excretion by the kidney
 - Both polar and non-polar drugs are filtered in the glomerulus
 - Active transport of ionized drugs occurs in the proximal tubule
 - The excretion of weak acids can be increased by alkalization of the urine with sodium bicarbonate
 - Passive reabsorption of most drugs is pH dependent

- 13) Which factor does NOT influence renal drug excretion:
- Ageing
 - Urine flow rate
 - Pregnancy
 - Heart failure
 - None of the above – they all influence renal drug excretion
- 14) Which of the following situations is likely to result in increased drug excretion in the urine?
- Alkalinisation (raised pH) for a weakly basic drug
 - Alkalinisation (raised pH) for a weakly acidic drug
 - Acidification (decreased pH) for a weakly acidic drug
 - Heart failure
 - Treatment with probenecid
- 15) With regard to the termination of drug action, which of the following is CORRECT:
- Drugs must be excreted from the body to terminate their activity
 - Metabolism of drugs always abolishes their pharmacological activity
 - Distribution of a drug out of the bloodstream terminates its activity
 - Binding to plasma proteins terminates a drug's activity
 - Metabolism and excretion are the major mechanisms involved in termination of drug activity
- 16) The volume of distribution of a drug is:
- The total volume of the body minus the blood volume
 - Equal to the volume of total body water
 - The constant relating the rate of drug elimination to the plasma drug concentration
 - The constant relating amount of drug in the body to the plasma drug concentration
 - The volume of the extracellular fluid
- 17) If the area under the curve of an oral dose is one-quarter that for the same iv dose, what can one assume the bioavailability of the oral dose is?
- 0.25%
 - 400%
 - 4%
 - 25%
 - None of the above

- 18) After a single i.v. drug dose which has a half-life of 8h, what percentage of the dose is still in the body after 1 day?
- a) 87.50%
 - b) 75%
 - c) 50%
 - d) 25%
 - e) 12.50%
- 19) The volume of distribution for the drug farnicidin is 50 L. What is the loading dose required to achieve a target concentration of 5 mg/L?
- a) This cannot be calculated without knowing the clearance rate of the drug
 - b) 10,000 mg
 - c) 2500 mg
 - d) 250 mg
 - e) 100 mg
- 20) Which of the following descriptions best describes the subdivision of pharmacology called pharmacodynamics?
- a) The study of chemical agents of therapeutic value or potential toxicity on biological systems
 - b) The study of the effects of drugs on cellular / body systems and their mechanism of action
 - c) The study of clinical applications of pharmacology, e.g. neuropharmacology, cardiovascular pharmacology, endocrine pharmacology etc
 - d) The study of drug absorption, distribution and metabolism/excretion
 - e) The study of the effects of the recipient's body on a drug
- 21) Which of the following is NOT a protein drug target?
- a) Ionotropic receptor
 - b) Angiotensin converting enzyme
 - c) Serotonin transporter
 - d) A calcium channel
 - e) None of the above - they are all protein drug targets
- 22) With respect to receptors, the term "selectivity" means:
- a) The drug will only act upon one receptor family
 - b) The drug never shows maximum efficacy
 - c) The drug will bind to all subtypes of the receptor for a particular agonist
 - d) The drug will preferentially bind (with higher affinity) to one subtype of a receptor family
 - e) The drug has affinity but no efficacy for all receptors within a receptor family

- 23) Which of the following best describes the difference between an agonist and an antagonist?
- Agonists = affinity and efficacy, antagonists = no affinity and no efficacy
 - Agonists = affinity and no efficacy, antagonists = no affinity and no efficacy
 - Agonists = affinity and no efficacy, antagonists = no affinity and efficacy
 - Agonists = affinity and efficacy, antagonists = affinity and no efficacy
 - Agonists = affinity and no efficacy, antagonists = affinity and efficacy
- 24) Which of the following compounds could be described as having negative efficacy?
- Inverse agonist
 - Antagonist
 - Agonist
 - Partial agonist
 - Ligand
- 25) The diagram below shows concentration response curves of a ligand (A), in the presence of increasing concentrations of an interacting drug (X). Curve A is ligand alone, curves B – E are in the presence of increasing concentrations of drug X. From the data it can be deduced that:



- Drug X is acting as a physiological antagonist of drug A
- Drug X has a higher affinity for its receptor than drug A
- Drug X acts as a competitive irreversible antagonist of drug A
- At the highest concentration tested (curve E) drug X acts as an inverse agonist
- Drug X may either be a non-competitive or uncompetitive antagonist of drug A

- 26) What percentage of receptors on a cell need to be bound by agonist to elicit a maximal response?
- a) 30%
 - b) 60%
 - c) 80%
 - d) 100%
 - e) It could be any of the above
- 27) Which of the following options best describes the Receptor Occupancy Theory?
- a) The rate at which a ligand occupies receptors will be proportional to its effect
 - b) Receptors can exist in either an active state or an inactive state depending on whether it is occupied by a ligand or not
 - c) The size of a drug effect will be proportional to the number of receptors occupied
 - d) When a receptor is occupied by a ligand it can interact with a variety of signal transduction pathways
 - e) A ligand needs to occupy all the available receptors to cause a maximum effect
- 28) Which of the following statements about G-protein-coupled receptors is FALSE?
- a) They typically contain 7 trans-membrane helices
 - b) They can bind ligands via an extracellular ligand binding domain
 - c) Upon binding to ligand they are translocated to the nucleus
 - d) They have an intracellular signal transduction domain
 - e) Upon activation they typically induce changes in intracellular levels of 2nd messengers such as cAMP
- 29) Long-term treatment with an agonist drug might lead to:
- a) Receptor down-regulation leading to tolerance to the agonist
 - b) Receptor up-regulation leading to tolerance to the agonist
 - c) Receptor up-regulation leading to supersensitivity to the agonist
 - d) Receptor down-regulation leading to supersensitivity to the agonist
 - e) None of the above
- 30) Which of the following mechanisms of drug action is CORRECT?
- a) Fluoxetine – inhibits a carrier molecule
 - b) Propranolol – inhibits an ion channel
 - c) NSAIDs – antagonise a receptor
 - d) Local anaesthetics – inhibit an enzyme
 - e) None of the above

- 31) Which of the following statements about the autonomic nervous system (ANS) is FALSE?
- a) The sympathetic nervous system consists of post-ganglionic neurons that form two paravertebral chains on either side of the spinal cord, plus midline ganglia
 - b) The ANS uses both homotropic and heterotropic neuromodulation to control neurotransmitter release
 - c) Neurons from the ANS can store and release more than one neurotransmitter
 - d) In general, the preganglionic neurotransmitter in both branches of the ANS is the same, but is different for postganglionic neurons
 - e) ACh acts as a transmitter for the parasympathetic but not sympathetic branch
- 32) Select the INCORRECT statement about the ANS:
- a) The actions of the parasympathetic nervous system prepare the body for strenuous activity or an emergency “flight or flight” reaction
 - b) Homotropic neuromodulation means a transmitter can activate presynaptic receptors to prevent further transmitter release
 - c) ATP, nitric oxide (NO) and neuropeptide Y (NPY) are examples of NANC transmitters
 - d) All endogenous compounds released from ANS neurons are agonists
 - e) There are specific agonists and antagonists that can distinguish between pre- and post-synaptic receptors in the ANS
- 33) At cholinergic synapses, which of the following statements is CORRECT?
- a) Choline acetyltransferase (ChAT) regulates degradation of acetylcholine into choline and acetate
 - b) Acetylcholine levels are regulated by rapid reuptake into the nerve terminals
 - c) Presynaptic M2 receptors mediate an autoinhibitory feedback loop to inhibit further acetylcholine release
 - d) Ganglionic nicotinic receptors are useful drug targets due to their widespread distribution
 - e) All of the above
- 34) Which of the following statements regarding muscarinic receptors is FALSE?
- a) Muscarinic activation has widespread effects such as increased sweating, smooth muscle contraction and stimulating GI tract activity
 - b) M2 receptors in the heart, when activated, lead to an increase in the heart rate
 - c) Pirenzapine and gallamine are both potent M1 and M2 receptor antagonists
 - d) Presynaptic muscarinic receptors serve to inhibit acetylcholine release
 - e) Five muscarinic receptors have been cloned, all of which are coupled to G-proteins

- 35) Which of the following is NOT a target for pharmacological intervention in the PARASYMPATHETIC branch of the autonomic nervous system?
- Prevention of vesicular storage of neurotransmitter (e.g by vesamicol)
 - Prevention of neurotransmitter release (e.g botulinum toxin)
 - Post-synaptic receptor antagonism (e.g by atropine)
 - Inhibition of the enzyme(s) which degrade the neurotransmitter (e.g neostigmine)
 - Blockade of the pre-synaptic Uptake 1 carrier protein for the neurotransmitter (e.g tricyclic antidepressants)
- 36) Which of the following statements with respect to noradrenergic transmission is CORRECT?
- DOPA decarboxylase is the rate-limiting step in dopamine and NA synthesis
 - Termination of NA activity occurs primarily via NA reuptake rather than degradation
 - Uptake 1 and 2 pathways are high affinity (neuronal) systems, whereas Uptake 3 is a low affinity (muscle) system
 - Increased neuronal calcium concentrations trigger NA release via a process involving chromogranin A transport
 - NA binds only to post-synaptic receptors, not pre-synaptic receptors
- 37) With respect to β -adrenoreceptors, which of the following is FALSE?
- β_1 and β_2 receptors both act to increase levels of the second messenger cAMP
 - β_1 agonists cause an increase in heart rate and force of contraction
 - β_2 antagonists cause bronchodilation
 - β_3 receptors are located in adipose tissue and regulate lipolysis
 - β_2 agonists can be used to relax uterine smooth muscle during premature labour
- 38) Which of the following statements is FALSE:
- β -antagonists such as propranolol are also used for treatment of glaucoma and peripheral effects of anxiety
 - β -antagonists lower blood pressure in patients with hypertension but does not cause hypotension in normotensive people
 - Reserpine blocks the transport of NA into vesicles leading to NA accumulation and breakdown in the cytoplasm
 - Drugs can affect NA release by preventing exocytosis, evoking NA release in the absence of nerve terminal depolarisation, interacting with presynaptic α_2 -receptors or affecting available intracellular stores of NA
 - None of the above – they are all correct

- 39) Which of the following best describes the mechanism of action of drugs such as amphetamine
- a) Act by inhibiting monoamine oxidase activity
 - b) Act directly as a competitor antagonist at adrenergic receptors
 - c) Act by depleting the vesicles of noradrenaline
 - d) Act indirectly by displacing noradrenaline from its vesicles which subsequently diffuses from the neuron through a transporter into the synapse
 - e) Act by blocking noradrenaline uptake into synaptic vesicles
- 40) Which of the following pairs (drugs and mechanism of action) is NOT correct
- a) Neostigmine - non-selective, muscarinic competitive antagonist
 - b) Phenoxybenzamine - non-selective, irreversible α -adrenoreceptor antagonist
 - c) Salbutamol - β 2-adrenoreceptor selective agonist
 - d) Pirenzepine - M1-selective, competitive reversible antagonist
 - e) Dobutamine - β 1 selective agonist

END OF TEST