Pharmacology 2/9/06

Student Test Report On Exam 1 A

Course #: 243
Course Title: Pharm
Day/Time:

Instructor: Dr. M. Maguire
Description: Pharmacology
Term/Year: Spr 2006

Student Name: [redacted]
Student ID: [redacted] **Code:**

	Possible Pts.	Raw	Objective	Exam#/Essay	Percent	Grade
EXAM 1:	50.00	36.00	36.00	0	72.00%	C

Response Description:
<dash> correct response
<alphabet> student's incorrect response
<#> multiple marks
<*> bonus test item
<space> no response

Test Items:	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50
Test Key:	D,B,D,D,D	D,E,D,C,E	E,C,C,C,B	A,E,C,D,D	E,E,B,D,C	A,C,E,C,E	C,C,C,E,A	A,B,E,E,B	D,C,A,E,E	A,D,C,A,E
Answers	-,D,B,A,E	B,B,-,E,C	-,-,-,-,-	-,-,-,-,-	-,-,-,-,B	E,-,-,A,-	-,-,-,-,-	-,D,-,-,-	B,-,-,-,-	E,-,-,-,-

Test Items:	51-54									
Test Key:	B,A,A,B									
Answers	, , ,									

Remarks:

Student's Answer to Multiple Mark Question:

No multiple mark answers or answer keys found on this test.

$\frac{D}{T} = C_{ss} \cdot C_L$ $\quad C = \frac{D \cdot F}{V_D}$

$T_{1/2} = \frac{0.693 \, V_D}{CL}$

Dental Pharmacology 2006
EXAM 1
February 9, 2006
M.E. Maguire

INSTRUCTIONS

1. There are 50 questions on this exam. Please use pencil on the answer sheet.
2. Keep the exam. Turn in the answer sheet (Duh!).
3. There are **BONUS** questions at the end of the exam. You are NOT required to answer these. These are questions I consider to be somewhat harder than the regular exam questions. If you answer them, *nothing* will be deducted for a wrong answer. However, if you answer correctly, I will use that question to replace a question on the regular exam that you answered incorrectly. That is, if you get 40 of the 50 questions correct and answer 3 bonus questions correctly, then your score would be 43/50 or 86%.

I. METABOLISM

1. Phase I drug metabolic reactions include all of the following EXCEPT
   A. drug reduction reactions.
   B. drug hydrolysis reactions.
   C. cytochrome P450-catalyzed oxidations.
   D. acetylation reactions.
   E. non cytochrome P450-catalyzed oxidations.

2. The following are all true about Cytochrome P450 reactions EXCEPT that they
   A. are inducible.
   B. utilize ATP as a substrate.
   C. may expose a hydroxyl group.
   D. can be used to convert prodrugs into active drugs.
   E. can be inhibited by isoniazid

3. Formation of acetaminophen glucuronide is described by each of the following EXCEPT
   A. phase II conjugation reaction.
   B. glucose and UTP are precursors.
   C. catalyzed by a transferase enzyme.
   D. glutathione adduct.
   E. water soluble metabolite.

4. Which of the following may act as inducers of cytochromes P450?
   A. Ethanol
   B. Cigarette smoke
   C. Phenytoin
   D. All of the above
   E. None of the above

5. Phase II (Type II) metabolic reactions conjugate drugs with all the following EXCEPT
   A. acetate
   B. glycine
   C. glucuronide
   D. nitrate
   E. sulfate

6. The following activities are associated with hepatic drug metabolism EXCEPT
   A. drug detoxification
   B. prodrug activation
   C. formation of toxic drug metabolites
   D. decreased V_D

7. 40. Drug Y is completely absorbed, F_{oral} = 1.0, and hepatic clearance = 2 ml hr^{-1} kg^{-1}. It is being administered chronically. Drug Z, a known inhibitor of the liver metabolism of Drug Y, is added. At steady state, which of the following observations would be consistent with this drug interaction?
   A. Decreased F_{oral} of Drug Y
   B. Decreased pharmacodynamic effect of Drug Y
   C. Decreased V_D of Drug Y
   D. Increased Cl of Drug Y
   E. Increased $T_{1/2}$ of Drug Y

8. Induction of drug metabolism may result in all of the following EXCEPT
   A. decreased half-life of elimination.
   B. decreased oral bioavailability.
   C. increased toxicity.
   D. change in conformation of the receptor that a drug binds to.

9. Each of the following statements is consistent with mutual competitive inhibition of drug metabolism by two drugs EXCEPT
   A. both drugs are being metabolized near their V_{max} rates.
   B. both drugs are metabolized by the same enzyme.
   C. the concentrations of both drugs are below their K_m values.
   D. the two drugs are being administered simultaneously.
   E. the two drugs have dissimilar structures.

10. Which of the following properties of the anticonvulsant drug carbamazepine make it a potential inducer of the metabolic enzymes of the liver endoplasmic reticulum?
   A. Binding to serum albumin.
   B. Low lipid solubility of non-ionized form.
   C. Tendency to accumulate in fat.
   D. Tendency to accumulate in the kidney.
   E. Use for therapy of a chronic disease.

11. Hepatic blood flow and intrinsic hepatic clearance are important factors in the clearance of drugs with which of the following characteristics?
    A. Very water soluble
    B. Polypeptide structure
    C. Multiple charges
    D. Volatile gas
    E. Minimal renal excretion

12. Both N-acetyltransferase and cytochrome P-450 enzymes display genetic polymorphism with respect to drug metabolism. Which of the following applies to people that are affected by one of these polymorphisms?
    A. Rapid metabolizers are more prone to drug interactions involving the parent drug.
    B. Rapid metabolizers are not prone to drug interactions involving the metabolite of the drug.
    C. Slow metabolizers are more prone to adverse reactions involving the parent drug.
    D. Slow metabolizers are more prone to drug interactions involving the metabolite of the drug.
    E. Slow metabolizers have a shorter duration of action with a single dose of drug.

13. The two-step reaction pictured below is best characterized by which of the following?

    Codeine ⇒ Morphine ⇒ Morphine-O-sulfate

    A. Formation of a water soluble metabolite.
    B. Metabolic drug activation.
    C. Both A and B
    D. Neither A nor B

II. PHARMACODYNAMICS

14. Two drugs, A and B, have the same mechanism of action. Drug A in a dose of 5 mg produces the same magnitude of response as Drug B in a dose of 500 mg. Which of the following statements is CORRECT?
    A. Drug A is less toxic.
    B. Drug A is more efficacious.
    C. Drug A is more potent.
    D. Drug A has a shorter duration of action.
    E. Drug A is a better drug to use when a maximal response is desired.

15. Each of the following statements regarding drug action and/or drug toxicity is correct EXCEPT
    A. for some drugs, even very minimal concentrations can be toxic.
    B. most drugs exert a single action.
    C. toxicity is both time- and dose dependent.
    D. toxicity can be due to over-dosage of a drug.
    E. symptoms of toxicity can be anything ranging from nausea to death.

16. A pharmacologic agonist is a chemical substance that
   A. binds to a specific receptor and initiates a response.
   B. typically elicits a pharmacologic response without binding to a specific receptor.
   C. exhibits no activity except to oppose the effect of an antagonist.
   D. binds to a specific receptor but does not initiate a response.

17. Which of the following statements best describes the toxicity of most drugs?
   A. Toxicity is unrelated to dose.
   B. Toxicity is unpredictable and random.
   C. Toxicity and therapeutic effects always arise from different mechanisms.
   D. Toxicity is not produced at the recommended dose listed in the *ADA Guide to Dental Therapeutics*
   E. Toxicity is often an extension of the desired drug effect.

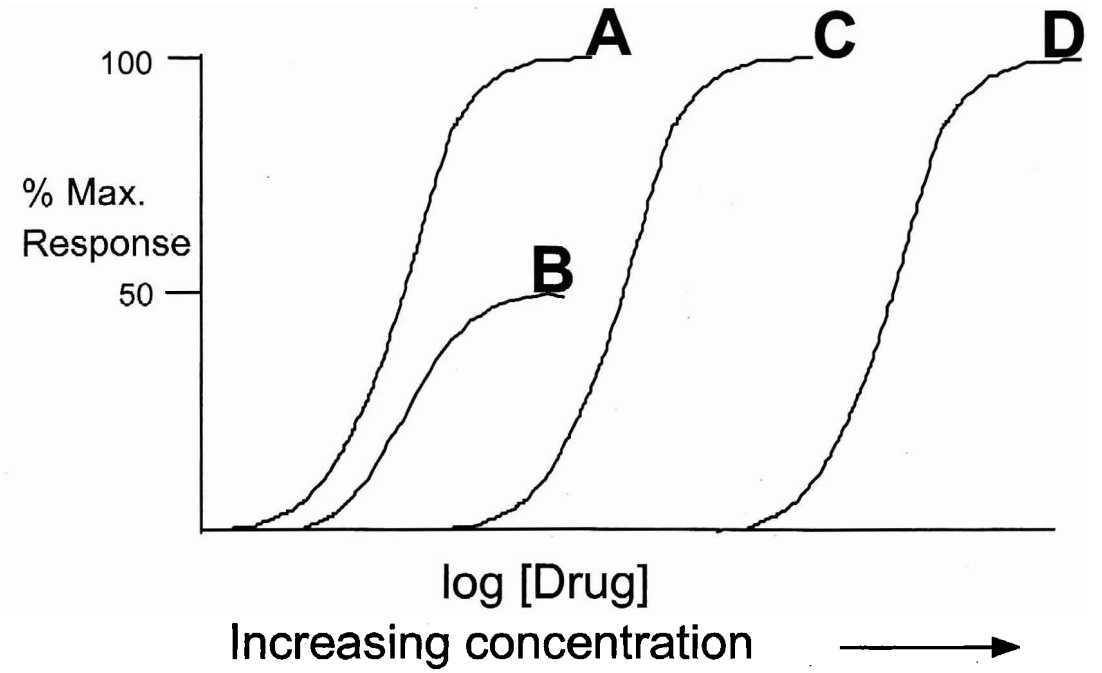
18. Compared to its density (number per cell) at the resting state, the density of an α-adrenergic receptor on vascular smooth muscle will likely be increased during chronic administration of a/an .
   A. partial antagonist.
   B. agonist.
   C. antagonist.
   D. partial agonist.

19. Which of the following statements concerning a drug's properties is CORRECT?
   A. An antagonist can block the action of a partial agonist but not the action of a full agonist.
   B. A partial agonist has greater potency than an antagonist.
   C. An antagonist has less potency than an agonist.
   D. The effects of a competitive antagonist are reversible.
   E. The effects of a non-competitive antagonist are reversible.

20. Which of the following is the *LEAST* important property of a drug?
   A. Bioavailability
   B. Clearance
   C. Half-life
   D. Potency
   E. Volume of distribution

21. The therapeutic index of a drug
   A. determines the V_D of the drug.
   B. determines the $T_{1/2}$ of the drug.
   C. measures the ratio of the clearances of the drug's primary metabolite *versus* the parent drug.
   D. measures the drug dose necessary to achieve the minimal therapeutic concentration.
   E. measures the ratio of the drug dose causing toxicity *versus* that giving a therapeutic effect.

THE NEXT TWO (2) QUESTIONS REFER TO THE FOLLOWING GRAPH.



22. All of the following statements regarding Drugs A/B/C/D could be correct EXCEPT
    - A. response B is caused by a different drug than Responses A/C/D.
    - B. response B is caused by a partial antagonist.
    - C. response C is caused by a different drug than Response A.
    - D. assume Drug X gives Response A. Response C shows the effect elicited by Drug X after the addition of a competitive antagonist.
    - E. assume Drug X gives Response A. Response D shows the effect elicited by Drug X after the addition of a non-competitive antagonist.

23. Assuming *each curve* represents the response to a *different* drug, which of the drugs is LEAST efficacious?
    - A. Drug A
    - B. Drug B
    - C. Drug C
    - D. Drug D

END OF QUESTIONS CONCERNING THE ABOVE FIGURE

24. The "Log Dose-Response Curve" for drug action obeys the Law of Mass Action. The following statements about this relationship are all correct EXCEPT
    - A. drug concentration is varied.
    - B. **total receptor concentration** remains constant.
    - C. "effect" is proportional to the concentration of the 'drug-receptor' complex.
    - D. "effect" may refer to the range of a physiological response within a group of individuals to a given dose of drug.
    - E. "effect" may refer to either a toxic or a therapeutic action of the drug.

25. Classification of hormone and neurotransmitter receptors is predominately by measurement of the
   A. intracellular second messenger generated by receptor activation.
   B. maximal effect of a series of agonists and antagonists.
   C. rank order of potency of a series of agonists and antagonists.
   D. therapeutic index for a series of agonists and antagonists.
   E. tissue distribution of the receptor in question.

26. If **R** is the resting, inactive state of a receptor and **R*** is the activated state of that same receptor, which of the following is a correct statement concerning the properties of drugs that bind at that receptor?
   A. An agonist always has greater affinity for **R*** than for **R.**
   B. An antagonist always has greater affinity for **R*** than for **R.**
   C. A noncompetitive antagonist always has equal affinity for **R*** and **R.**
   D. An partial antagonist always has equal affinity for **R*** than for **R.**
   E. A partial agonist always has equal affinity for **R*** and **R.**

III. PHARMACOKINETICS

THE NEXT FOUR (4) QUESTIONS REFER TO THE FOLLOWING CASE.

CASE. A 70 kg woman is receiving drug X. This drug is completely absorbed and is metabolized by a single enzyme present exclusively in the liver. The patient's pharmacokinetic parameters for this drug have been determined and are:

F_{oral} = 0.75
V_D = 75 liters
Cl = 750 ml/min
% bound to plasma protein = 80
K_m for cytochrome P450 = 8 μg/ml

27. The *oral* loading dose required to produce an initial concentration of 9.0 μg/ml is
   A. 300 mg
   B. 600 mg
   C. 900 mg
   D. 1200 mg
   E. 1500 mg

$C = \frac{D \cdot F}{V_D}$ $\quad \frac{9\,mg}{mL} = \frac{D \cdot 0.75}{7500\,mL}$ $\quad 67500 = 9\,D$

28. The *intravenous* maintenance dose required to sustain a concentration of 8.0 μg/ml is
   A. 0.60 mg/min
   B. 1.2 mg/min
   C. 2.4 mg/min
   D. 3.6 mg/min
   E. 6.0 mg/min

$\frac{D}{T} = C_{ss} \cdot Cl$ $\quad DR = 8\,mg/mL \cdot 750\,mL/min = 6{,}000\,mg/min$

29. The half-life of X is
   A. 6.93 min
   B. 50 min
   C. 69.3 min
   D. 500 min
   E. 693 min

$T_{1/2} = \frac{0.693 \cdot V_D}{Cl} = \frac{0.693 \cdot 75\,mL}{750\,mL/min} =$

30. If an infusion of X is begun and *no loading dose is given*, at 5.0 hours the plasma concentration will be
    A. less than 25% of the steady state concentration.
    B. between 25 and 50% of the steady state concentration.
    C. 50% of the steady state concentration.
    D. between 50 and 75% of the steady state concentration.
    E. greater than 75% of the steady state concentration.

END OF QUESTIONS CONCERNING THE ABOVE CASE AND DRUG.

THE NEXT THREE (3) QUESTIONS REFER TO THE FOLLOWING SCENARIO:

A patient is receiving drug X. This drug is completely absorbed and is metabolized by a single cytochrome P450 in the liver. The patient's pharmacokinetic parameters for this drug have been determined and are:

$F_{oral} = 0.8$
$V_D = 500$ L
Cl = 385 ml/min
percent of Drug X in blood bound to plasma protein = 80%
therapeutic concentration range = 1-6 μg/ml
K_m for cytochrome P450 = 10 μg/ml

31. The oral loading dose required to produce an initial concentration of 3 μg/ml is *approximately*
    A. 1.1
    B. 1.5 gm
    C. 1.9 gm
    D. 2.3 gm
    E. 4.5 gm

32. What is the *approximate* $T_{1/2}$ of X?
    A. 6.9 hr
    B. 7.5 hr
    C. 15 hr
    D. 21.6 hr
    E. 30

33. If X were infused intravenously at a rate of 1.9 mg/min, the *steady state* plasma concentration, *calculated assuming first order kinetics,* would be *approximately*
    A. 1 μg/ml
    B. 3 μg/ml
    C. 5 μg/ml
    D. 7 μg/ml
    E. 10 μg/ml

END OF QUESTIONS CONCERNING THE ABOVE SCENARIO.

34. The half-life for a drug might be altered by all of the following EXCEPT
A. Increasing the volume of distribution
B. Changing the renal clearance
C. Changing the total clearance
D. Decreasing the volume of distribution
E. Increasing the maintenance dose

35. The clearance and volumes of distribution are given for 5 drugs below. Which has the longest $T_{1/2}$?

	Clearance ($ml\ min^{-1}\ kg^{-1}$)	V_D (L/kg)
A.	4	10
B.	4	1.0
C.	10	3.0
D.	10	1.3
E.	30	50

36. Which of the following statements concerning pharmacokinetics is CORRECT?
A. Elimination of most drugs follows first order kinetics.
B. Steady state drug concentration is dependent on V_D.
C. Loading dose is dependent primarily on Cl.
D. The rate of absorption of a drug is dependent on its Cl.
E. The $T_{1/2}$ for elimination of a drug is directly dependent on Cl.

37. The steady-state plasma concentration of lidocaine being administered continuously as a intravenous infusion is increased by congestive heart failure due to which of the following changes?
A. Decreased distribution to fat
B. Decreased hepatic blood flow
C. Increased plasma protein binding
D. Decreased renal blood flow
E. Increased binding to tissues

38. Which of the following properties of a drug is NOT dose/concentration-dependent.
A. Toxicity
B. Binding to plasma protein
C. Metabolism
D. Receptor binding
E. $T_{1/2}$

39. Given equivalent doses of drugs A and B: upon distribution, A is confined essentially to the plasma whereas B is highly sequestered in muscle. Both are cleared primarily *via* glomerular filtration. Which of the following relationships apply to A *versus* B (in that order)?
A. Long *versus* short $T_{1/2}$.
B. Low *versus* high lipid solubility.
C. Low *versus* high plasma concentration.
D. Short *versus* long duration of action.
E. Small *versus* large volume of distribution.

A - plasma
B - muscle

IV. ABSORPTION/DISTRIBUTION/ELIMINATION

40. A drug with a V_D of 500 L most likely
    - A. distributes primarily into the extracellular fluid space.
    - B. distributes primarily into muscle and/or fat.
    - C. is distributed primarily in the blood.
    - D. probably undergoes extensive first pass metabolism.

41. Drugs R and S are being administered simultaneously. Both depend on CYP2D6 for their elimination. Drug R has a plasma concentration equal to 0.1X its K_m for CYP2D6. Drug S has a plasma concentration equal to 10X its K_m for CYP2D6. Which of the following best describes the consequence of this situation?
    - A. The metabolism of Drug R is nearly normal
    - B. The metabolism of Drug S is about 90% inhibited.
    - The metabolism of Drug S is enhanced.
    - D. The metabolism of Drug R is about 90% inhibited.
    - E. The metabolism of Drug R and Drug S is inhibited to the same extent.

42. A drug with a V_D of 40 L most likely
    - A. distributes primarily into the central nervous system.
    - distributes primarily into the plasma.
    - C. is probably evenly distributed throughout total body water.
    - D. is probably eliminated very rapidly.
    - E. probably undergoes extensive first pass metabolism.

43. A drug has a very short $T_{1/2}$. Which of the following is most compatible with this short $T_{1/2}$?
    - A. A small V_D
    - B. Minimal first pass metabolism
    - C. Extensive reabsorption by the kidney
    - D. Extensive induction of metabolic degradative enzymes.
    - E. Poor bioavailability

44. Which of the following is the most important factor in determining the absorption of a drug?
    - A. Concentration of drug in intestine
    - B. Diffusion coefficient
    - C. pH of the small intestine
    - D. pK_a
    - E. Oil:water partition coefficient

45. The rate of gastrointestinal absorption of a drug is generally dependent on all of the following factors EXCEPT
    - A. intestinal surface area.
    - B. the oil:water partition coefficient of the drug.
    - C. the pK_a of the drug.
    - D. the rate of stomach emptying.
    - E. stomach surface area.

46. An uncharged drug that is neither a weak organic acid nor a weak organic base and is soluble in both aqueous and lipid environments is likely to be characterized by
A. a V_D similar to total body water.
B. accumulation in the CNS.
C. high affinity binding to plasma albumin.
D. limited oral bioavailability.
E. very high reabsorption from the renal tubules.

47. The rate of absorption of a drug will determine
A. steady-state plasma concentration.
B. systemic clearance.
C. bioavailability.
D. peak plasma concentration.
E. intrinsic clearance.

48. Which of the following properties of a drug is most closely associated with its ability to cross the "blood brain barrier"?
A. Binding to plasma protein
B. Capillary permeability
C. Lipid solubility
D. Positive charge
E. Small size

49. Which of the following is a correct statement concerning pharmacokinetic or pharmacodynamic parameters?
A. Cl is the constant fraction of drug cleared per unit time.
B. F_{oral} is the fractional rate of drug absorption from the small intestine.
C. The "slope" of a dose response curve is a measure of the rate of that drug's onset of action.
D. Steady state concentration of a chronically administered drug is dependent on V_D.
E. V_D is the physical fluid volume in the body into which a drug is distributed.

50. A drug that is highly charged and water soluble is likely to display which of the following characteristics?
A. A large volume of distribution (V_D)
B. A low clearance (Cl)
C. Easy access to the central nervous system
D. Extensive hepatic metabolism
E. Limited oral bioavailability (F_{oral})

BONUS QUESTIONS

51. A patient is taking phenytoin, a drug used in the treatment of seizure disorders, and has not had a seizure in 2 months and had a serum phenytoin concentration of 10 mg/liter last week. We know that phenytoin is 90% bound to plasma albumin, has an apparent volume of distribution of 0.7 liters/kg and is eliminated by hepatic metabolism. Because of an infection you prescribe Drug X. Drug X is known to increase hepatic microsomal P450 mediated hydroxylation activity Four days after beginning Drug X the patient has a seizure and is brought to the emergency room where you see him. When you compare phenytoin now to before starting Drug X you expect which of the following?
    A. **The apparent volume of distribution will be increased.**
    B. The plasma concentration of total phenytoin will be lower.
    C. The protein-binding of phenytoin will be decreased.
    D. The renal clearance of phenytoin will be increased.
    E. The systemic clearance of phenytoin will be decreased.

52. All of the following statements about proximal renal tubular secretion of organic cations like TEA^+ (tetraethylammonium) are correct EXCEPT
    A. the brush basolateral membrane is more permeable to TEA^+ than the brush border (lumenal) membrane.
    B. the Na^+/H^+ antiporter plays a role in TEA^+ transport across the brush border membrane.
    C. the pH gradient favors uptake by passive non-ionic diffusion at basolateral membrane.
    D. uptake at the basolateral membrane is carrier-mediated.
    E. uptake at the basolateral membrane is coupled to intracellular energy.

53. Which drug is most likely to undergo competition for intestinal absorption after oral intake?
    A. A glucose analog
    B. **A lipophilic weak organic base, pK_a 11**
    C. A hydrophilic weak organic acid, pK_a 4
    D. A quaternary nitrogen compound
    E. A lipophilic weak organic acid, pK_a 1.5

54. Dog A is injected intramuscularly with a large dose of morphine. The dog is then placed into a cage with Dog B. Upon returning some hours later to check on Dog A, you observe that Dog B is clearly morphine intoxicated. Which of the following statements concerning morphine would help explain why Dog B is morphine intoxicated?
    A. **Morphine is a weak organic acid that causes constipation.**
    B. Morphine is a weak organic base that causes emesis.
    C. Morphine is a weak organic acid that is well absorbed in the stomach.
    D. Morphine causes sedation and euphoria.
    E. Morphine is volatile, and its primary route of elimination is via the lungs.