

## **SYLLABUS**

COURSE: DENF 2561 Dental Pharmacology  
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## GOALS

This course on Dental Pharmacology relates to the study of drugs commonly used in the treatment of dental disease. We will also study drugs primarily used in medicine, which fit in the same categories as dentally used drugs, when it is appropriate. The course is divided into the following sections:

- I. Fundamentals of Drug Action
  - Prior to studying the drugs used for dental disease, the basic principles of how the body responds to and reacts to administered agents will be discussed. This section is composed of three subtopics: Pharmacodynamics; Pharmacokinetics and Pharmacotherapeutics.
  - The goal of this section is to provide a foundation of principles which will be applicable to all of the specific drug groups you will study later in the course and other pharmacology related courses.
  
- II. Antibiotics
  - This section provides information regarding the principles upon which antibiotic therapy is based. This includes the mechanism of action of, factors involved in the clinical effectiveness of, bacterial resistance to, adverse effects of, and clinical use of antibiotics, antifungal and antiviral agents.
  - The goal of this section is to provide information regarding the basic and clinical pharmacology of each of these major groups. You will learn which agents are used for treating specific acute dental infections and agents that are used to provide prophylactic coverage for patients at risk for dental procedure-induced bacteremia and practice writing prescriptions for them.
  
- III. Autonomic Drugs
  - You will be treating patients who take medically-prescribed autonomic drugs and administering drugs which mimic or block autonomic function. The goal of this section is to extend your understanding of the autonomic nervous system into the realm of drugs that block or mimic actions of autonomic neurotransmitters. This knowledge will help to prevent adverse drug interactions, to manage office emergencies, and to prescribe or administer autonomic drugs.
  - This section will also provide a model for the action of other drugs acting on other neurotransmitter systems. Many of these topics will be further expanded upon in the third year where drugs for asthma, GI drugs and other CNS drugs are studied.
  
- IV. Pain and Anxiety Control
  - This part of the course is about some drugs used to treat dental procedure pain and anxiety. The goals of this section are for the student to become knowledgeable about the actions of these drugs, to select appropriate drugs for your patient, and to write safe, effective and legal prescriptions for these agents.
  
- V. Inflammation and Anti-inflammatory Drugs
  - This section provides a review of inflammation as a basis for presenting the pharmacology of those drugs used in the treatment of inflammation. The analgesic and anti-inflammatory effects of the non-steroidal anti-inflammatory drugs, glucocorticosteroids, other anti-inflammatory drugs and the histamine antagonists are discussed. This knowledge should provide the dental student and practitioner with sufficient information to select the appropriate dental treatment plan and recognize precautions which should be exercised for a patient taking these agents.

VI. Drug Abuse

- This section provides information regarding the pharmacology of alcohol, cigarettes and other drugs of abuse which may cause toxicity or drug interactions. This section will form the basis for later studies of anesthesia.

VII. Anticaries and Antiplaque and Antiperiodontitis Agents

- Various fluoride compounds have been reported to reduce or prevent dental caries but sometimes produce dental fluorosis. Therefore, the main thrust of this section will be the study of pharmacokinetics and toxicology of fluorides. A goal for this section will be for students to be able to prescribe fluoride-containing products in simulated clinical cases.
- The health of periodontium is impacted by the presence of oral microflora and the ideal properties, problems and difficulties in the use of antiplaque, antigingivitis agents will also be discussed.

Prescription Writing

The goal of the dental pharmacology course is to instruct the student when and how to prescribe medications for your adult patients. For drugs obtained by prescription only, it is implied that special therapeutic knowledge is required for safe and effective use of the medication. Principles and applications of prescription writing are integrated throughout the above sections.

## OBJECTIVES

### I. FUNDAMENTALS OF DRUG ACTION

#### A. Introduction to pharmacology

1. Define the terms pharmacology, pharmacy, and therapeutics.
2. Be familiar with the components of the Blackboard course that are discussed in class.
3. State the sources you could use to determine the drug name, pharmacology, dose (two meanings: e.g. a. amount patient needs or amount that comes in a single dose form), dosage form (e.g. tablet, capsule, suspension, etc.) and duration of treatment for the drugs you will prescribe. State the type of drug information, the agency responsible for publication, and any unique features.
4. Be able to access and begin using the Clinical Pharmacology Drug database.

#### B. Pharmacodynamics: mechanism of drug action and dose response

1. State the definition of receptors, the different types of receptors and the mechanisms they transduce.
2. Be able to relate the law of mass action to drug-receptor interactions (dose response curves).
3. Describe the relationship between drug-receptor affinity (KD) and potency and between intrinsic activity of a drug and efficacy.
4. Describe the relationship between occupancy of a receptor and pharmacological response (linear and non-linear relationships). Relate these to the phenomenon of "spare receptors."
5. Describe the definition and properties of partial and full agonists and their effects on dose response curves.
6. Describe the definition and properties of competitive and non-competitive antagonists and their effect of dose response curves induced by agonists.
7. Describe the different types of receptor systems.
8. For the lipid soluble receptor system, describe the mechanism and the working of glucocorticoid receptor as a model.
9. For the ligand regulated transmembrane enzymes describe the mechanism and the working of tyrosine kinase as a model.
10. List the different families in ligand gated ion channels.
11. Describe the basic structure, subtypes, and examples of function and role in diseases for nicotinic acetylcholine receptor and glutamate receptor.

12. For G-protein coupled receptors describe the diversity in terms of receptors and G-proteins and the effect on second messengers.
13. Describe the basic structure, subtypes, and examples of function and role in diseases for the muscarinic receptors.
14. For the adrenergic receptors describe the classification based on agonist profile and give examples for the role of each subtype in function and disease.
15. Describe the relationships between therapeutic and toxic effects.

C. Pharmacokinetics-absorption

1. Describe the plasma membrane as a prototype barrier to drug transport. Describe and differentiate between the process of passive diffusion and the other specialized transport processes.
2. Describe how the properties of a chemical (drug), including some degree of water solubility, influences its transport across membranes.
3. Define "absorption."
4. Describe the advantages/disadvantages and factors which influence the oral administration of drugs.
5. Compare the effects of gastric pH and intestinal pH on the absorption of a weak acid (e.g., aspirin) and a weak base (e.g., codeine).
6. Explain ion trapping.
7. Explain the significance of the intraluminal surface area of the small intestine in the absorption of an acidic drug, such as aspirin.
8. Describe the influence of gastric emptying on absorption.
9. Explain why most drugs should not be taken after meals.
10. Define "latency."
11. Explain the influence of dosage form on drug absorption in terms of rate of dissolution, pH stability, and prolonged availability of drug.
12. Define "bioavailability."
13. Cite examples and explain how some orally administered drugs are inactivated before they reach the systemic circulation.
14. Describe the advantages/disadvantages of other enteral routes of drug administration; of inhalation, of intravenous, intramuscular, subcutaneous injections; of topical application to skin and mucous membranes.
15. State how the following solid dosage forms differ with respect to absorption:
  - a. tablets
  - b. capsules
  - c. enteric coated forms

- d. suspensions; emulsions
- e. extended-release dose

16. Describe iontophoresis and illustrate its use in dental therapeutics.

D. Pharmacokinetics: distribution

1. Identify the factors upon which the distribution of a drug depends.
2. Explain or define the term "volume of distribution".
3. Explain how redistribution of thiopental terminates its action.
4. Compare the renal excretion of polar compounds with lipophilic compounds.

E. Pharmacokinetics-drug metabolism and elimination

1. Identify the routes of elimination of drugs and their metabolites.
2. Describe biliary excretion and enterohepatic recycling of drugs.
3. Define the terms used to describe the relationships between drugs and metabolic enzyme systems.
4. Define oxidative metabolism and the microsomal oxidation system in the liver, including the P450 isoforms that metabolize the drugs used in dentistry.
5. State what conjugation (synthetic) metabolic reactions are and describe their role in the metabolism of the drugs used in dentistry.
6. Illustrate or recognize nonmicrosomal oxidation, reduction, hydrolysis, or conjugation reaction.
7. Recognize the multiple excretory processes that can be simultaneously altered by some metabolism inducers which act through receptor systems like the pregnane xenobiotic receptor (PXR) or the Arylhydrocarbon receptors (ARH).
8. Discuss the effect of ethanol on acetaminophen metabolism and what would be appropriate cautions for patients with regard to taking ethanol and acetaminophen together.

F. Pharmacokinetics –time course of drug action

1. Define drug clearance and state how it is determined.
2. Define first order elimination and the half-life for a first order process.
3. Write an equation for calculating a half-life from volume of distribution and clearance and using a half-life to calculate the plasma level of a drug at various times after the drug is administered.
4. Define multicompartment elimination and recognize how to use the concepts of redistribution half-life and terminal or elimination half-life.
5. Give examples of situations where drug effect and plasma drug pharmacokinetics can be out of time synchrony.

6. Describe in words and equation capacity limited elimination. Relate this to 0 and 1st order elimination and give examples of drugs that might demonstrate this kind of elimination.
7. Describe in words and equations the calculation of a loading dose.
8. Describe in words the effect of repeated dosing on plasma levels of a drug for one and two compartment drugs and define what is meant by steady state blood levels.
9. Recognize variation in styles for stating frequency of dosing in the literature.

G. Pharmacotherapeutics

1. Give examples that demonstrate how the patient factors discussed in class can effect drug elimination and time course.
2. Describe the different forms of drug toxicity and give examples.
3. Describe the types of testing that must be carried out to evaluate drug safety.
4. To the level stated in the textbook state how interactions can influence drug action.
5. Classify drug interactions and explain their mechanisms.

H. Prescription fundamentals

1. Define the terms used to describe marketing and legal classes of drugs.
2. Write a prescription with the appropriate information essential for the prescription to be filled by a pharmacist.
3. State the verbal information that should be presented to the patient regarding a drug at the time you prescribe the drug.
4. State the Texas State and Federal laws regarding the prescribing of "Rx only" and "scheduled drugs", including the laws concerning prescribing Schedule II-V drugs.
5. Demonstrate the ability to use the Clinical Pharmacology Drug Database Program to
  - a. Search for a particular drug and find its monograph.
  - b. Determine drug interactions.
  - c. Obtain patient drug information.
  - d. Make a drug comparison table.
6. State the limitation of the clinical pharmacology drug information database for dental prescribing.
7. Calculate the total number of dose forms required from the dose, frequency of administration and duration of therapy.
8. State the kinds of mistakes that are most likely to result in a dangerous or illegal prescription and procedures that will prevent such occurrences.

## II. ANTIBIOTICS

### A. Principles and mechanisms of antibiotic therapy

1. Describe "selective toxicity" as the most fundamental concept involved in antibiotic therapy.
2. List four ways by which antibiotics exert their effects on microorganisms and give examples for each.
3. Define the terms and give examples of bacteriostatic and bactericidal antibiotics.
4. Describe cellular actions of antibiotics and antibacterial spectrum.
5. Describe general laboratory and empiric method of selection of antibiotics.
6. Describe factors (Pharmacokinetics) that affect the effectiveness of antibiotics.
7. Describe drug-resistant mechanisms and its clinical significance.
8. List three major therapeutic uses of antibiotics in dentistry.
9. Define chromosomal resistance and acquired resistance.
10. Describe major categories of adverse effects associated with the use of antibiotic drugs.

### B. Penicillins and carbapenem

1. Describe the basic chemical structure of the penicillin (beta-lactam ring) and explain how the different penicillin derivatives differ structurally.
2. Describe the mechanism of action of the penicillins.
3. Describe in general, the effectiveness, pharmacokinetics and adverse effects, of the following penicillins: a) natural penicillins, b) anti-staphylococcal penicillins, c) extended spectrum penicillins, and d) anti-pseudomonal penicillins.
4. Compare penicillins regarding; route(s) of administration; acid stability; route of excretion and half-lives.
5. Describe the dental therapeutic use of penicillin V, amoxicillin and amoxicillin with clavulanate (Augmentin®).
6. Describe antibacterial spectrum and general therapeutic uses of ticarcillin and related agents.
7. Describe the antibacterial spectrum and general therapeutic uses of carbapenem antibiotics (imipenem).

### C. Cephalosporins

1. Describe the chemical structure, mechanism and antibacterial spectrum of cephalosporin.

2. Compare the different generations of cephalosporins in regards to antibacterial spectrum, drug-resistance, and therapeutic uses.
  3. Provide a list of the generations of cephalosporin recommended for dental uses and why they are recommended.
  4. Describe pharmacokinetics and adverse effects of cephalosporin.
  5. Describe the therapeutic uses of cephalosporin antibiotic particularly in patients allergic to penicillin.
- D. Macrolide (erythromycin, clarithromycin, azithromycin) and clindamycin
1. Describe macrolide regarding its mechanism of action; antibacterial spectrum; drug formulation; pharmacokinetics (absorption, fate and excretion); and list drugs that have interactions with erythromycin.
  2. Compare dental therapeutic advantages or disadvantages of using erythromycin, clarithromycin and azithromycin.
  3. Describe clindamycin regarding its antibacterial spectrum and dental uses, including pharmacokinetics and adverse effects.
  4. Describe the major adverse effects of clindamycin antibiotic associated colitis (AAC or pseudo membranous colitis) regarding its etiology; types of antibiotics implicated; symptoms and treatments.
- E. Vancomycin, linezolid, and tetracycline
1. Describe vancomycin including the following topics: mechanism of action and antibacterial spectrum, therapeutic and dental uses including (a) AAC and (b) MRSA; pharmacokinetics and major adverse effects.
  2. Describe linezolid: mechanism of action, antibacterial spectrum, special use (MRSA), and pharmacokinetics and adverse effects.
  3. Describe tetracycline antibiotics: mechanism of action, spectrum of antimicrobial activity; pharmacokinetics: route of administration, effect of divalent cation in food on absorption; distribution to bone tissue, plasma level and excretion, major adverse effects and contraindication, and therapeutic use in dentistry.
- F. Aminoglycosides, quinolones, sulfonamides and metronidazole. Review and selection of antibiotics.
1. Describe the aminoglycosides (gentamicin) regarding chemistry, mechanism of action, antibacterial spectrum, and pharmacokinetics: route of administration, absorption, distribution, metabolism, excretion, use in dentistry, in combination with other agents, and adverse effects.
  2. Describe the following with regard to the fluoroquinolone antibiotics (ciprofloxacin): chemistry and mechanism of action, antibacterial spectrum, effectiveness against *Pseudomonas*, and pharmacokinetics: absorption, distribution, metabolism, excretion, therapeutic uses, side effects, and contraindications.

3. Describe the mechanism of action of the sulfonamides. Give an example of synergism and the therapeutic usefulness of trimethoprim-sulfonamide combinations.
  4. Describe the following points regarding metronidazol: mechanism of action, antimicrobial spectrum, absorption, distribution, metabolism, excretion, therapeutic uses in dentistry (ANUG), side effects, and contraindications.
  5. Discuss the steps in a flow chart for dealing with the failure of antibiotic treatment.
- G. Therapeutic uses of antibiotics in dentistry
1. List three major therapeutic uses of antibiotics in dentistry.
  2. Give the current American Heart Association's recommendation (dosage regimens) for prophylactic use of antibiotics for dental procedures for both children and adults.
  3. List patient categories which require prophylactic antibiotic coverage prior to dental procedures.
  4. Discuss the steps in a flow chart for dealing with the failure of antibiotic treatment.
- H. Antifungal and antiviral agents
1. Describe the following points regarding nystatin (MYCOSTATIN®): antifungal spectrum, mechanism of action, route of administration, adverse effects when administered orally, therapeutic use in dentistry, dosage, dosage formulations, method of administration, and usual duration of therapy.
  2. Describe the following points regarding ketoconazole (NIZORAL®): mechanism of action, antifungal spectrum, dosage, absorption, distribution, metabolism, excretion, therapeutic use, toxicity/side effects, and drug interaction.
  3. Describe the following regarding fluconazole (DIFLUCAN®): mechanism of action, antifungal spectrum, dosage, absorption, distribution, metabolism, excretion, therapeutic use, toxicity/side effects, drug interactions, and use in the treatment of candidiasis in HIV patients.
  4. Describe the following points regarding clotrimazole (LOTRIMIN®; MYCELEX®), mechanism of action, antifungal spectrum, dosage, absorption, distribution, metabolism, excretion, therapeutic use, method of application, standard dosage regimen for treatment of oral candidiasis, available dosage formulations, and toxicity or side effects
  5. Describe the mechanism of action and therapeutic use of acyclovir, amantadine and zidovudine.
  6. Describe the drug-drug interactions, mechanism(s) and effects occurring with each of the anti-infective drugs.

### III. AUTONOMIC DRUGS

#### A. Autonomic nervous system fundamentals

1. Describe the anatomical organization of the autonomic nervous system.
2. List the major neurotransmitters used in different parts of the autonomic nervous system.
3. Describe functional properties of the sympathetic nervous system.
4. Describe functional properties of the parasympathetic nervous system.
5. Describe functional properties of the enteric nervous system.
6. Use a) the baroreceptor reflex and b) pupillary responses to illustrate how the autonomic nervous system can maintain homeostasis or respond to emergencies.
7. Learn the physiological actions of autonomic receptors in different effector systems in the body.

#### B. Cholinergic drugs

1. List the organs on which muscarine and nicotine exert selective effects.
2. Describe the signal transduction pathways for muscarinic and nicotinic receptors and the differences in receptor subtypes.
3. List or recognize the names of cholinomimetic drugs.
4. Describe the muscarinic and nictotinic effects of anticholinesterase drugs.
5. List or recognize the general therapeutic uses of anticholinesterases and describe the rationale for their use in glaucoma, xerostomia, myasthenia gravis, atropine poisoning, and abdominal surgery.
6. List or recognize the toxic reactions and side effects of anticholinesterase drugs.

#### C. Cholinergic blocking drugs

1. List or recognize classes of cholinceptor blocking drugs.
2. Describe the mechanism of action of anticholinergic drugs.
3. List or recognize the general therapeutic uses of antimuscarinic drugs.
4. List the contraindications to the use of antimuscarinic drugs.
5. Describe the uses of adrenergic and cholinergic drugs for use in treating glaucoma.

#### D. Sympathetic autonomic pharmacology-agonists & antagonists

1. Describe the synthetic pathway for dopamine, norepinephrine (NE) and epinephrine (EPI).

2. Discuss the structure of catecholamines and reason for rapid oxidation.
3. Describe storage and release of catecholamines; blockade of release by prejunctional  $\alpha_2$ -adrenergic receptors.
4. Describe termination of catecholamine actions; mechanisms of plasma membrane and vesicle reuptake (reuptake I and II), diffusion and metabolism by MAO and COMT; know inhibitors of reuptake and metabolism.
5. Describe indirect acting adrenergic drugs (tyramine) and mixed indirect (amphetamines).
6. Describe subtypes of  $\alpha$  and  $\beta$ -adrenergic receptors. Understand the general potency/selectivity of NE, EPI, and Isoproterenol on  $\alpha$  versus  $\beta_1$  and  $\beta_2$ -adrenergic receptors.
7. Describe "fight or flight" and the major role of  $\alpha_1$ ,  $\alpha_2$ ,  $\beta_1$ , and  $\beta_2$ -adrenergic receptors on kidneys, lungs, liver, muscle, heart, vasculature (arteries vs veinules), eyes, and digestive tract.
8. Discuss major uses and side effects of  $\alpha$ - and  $\beta$ -adrenergic drugs. The prototypical agonists and antagonists for the  $\alpha_1$ ,  $\alpha_2$ ,  $\beta_1$ , and  $\beta_2$ -adrenergic receptors.
9. Discuss drugs for the treatment of asthma, importance of drug stability, partial agonism, and potency.
10. Describe CNS action of clonidine that reduces blood pressure.
11. Discuss  $\beta$ -blockers and role in blood pressure and congestive heart failure.

#### IV. PAIN AND ANXIETY CONTROL

##### A. Introduction to CNS pharmacology

1. State the composition of the blood brain barrier and what effect it has on penetration of drugs into the brain.
2. Define the terms: action potentials, threshold, EPSP and IPSP and passive potential ("standing potentials" on non-electrogenic membranes).
3. State the sites of drug action at the synapse.
4. Discuss the coupling of neurotransmitter mediated neuronal activity to long term changes in neuronal function; mediated through change in second messengers, kinases and cell nuclear activity and translation into long term biochemical or structural changes within neurons.
5. Describe how endogenous chemicals regulate sleeping and waking states.

##### B. CNS stimulants

1. Define physiological antagonism.

2. Differentiate between sympathomimetic stimulant agents with respect to pharmacology, adverse reactions, and abuse.
3. Describe attention deficit-hyperactivity disorder (AD/HD) and the agents used to treat it.
4. Describe cocaine pharmacology, adverse reactions, drug interactions and reactive hypertension and cocaine-induced changes in blood pressure.
5. Compare the pharmacokinetics, pharmacologic actions, indications, and side effects of caffeine and theophylline.
6. Describe how stimulants like amphetamine (and its dextro rotatory isomer, dextroamphetamine), methylphenidate, caffeine and theophylline may alter the effectiveness of CNS antianxiety agents, sedatives, and depressants (and anesthetic agents) used in dentistry.
7. List agents that may contribute to dry mouth and bruxism.

C. Antianxiety agents

1. Describe the principal neurochemical systems involved in the mediation of anxiety.
2. Define the common terms used to describe anxiety and the actions of antianxiety agents.
3. Explain the currently accepted mechanism of action for benzodiazepines acting in the benzodiazepine-GABA-chloride-ion channel complex.
4. State how metabolism and pharmacokinetics can influence the choice, use, and safety of an anti-anxiety agents (be able to compare triazolam, lorazepam, midazolam, and diazepam), considering factors that alter their normal time course of action.
5. Describe the pharmacology of diazepam (as a prototype benzodiazepine) actions on the CNS, cardiovascular system, and respiratory system both alone and when used in combination with other drugs.
6. Describe the principal dental uses for the benzodiazepines.
7. Compare and contrast diazepam's use with that of midazolam, triazolam, and alprazolam.
8. Select which benzodiazepine drugs are marketed as hypnotics.
9. List the precautions for use, adverse reactions, and contraindications and drug interactions for the benzodiazepine drugs.
10. State appropriate behavioral instruction for patients who receive pre-appointment sedation.
11. Write appropriate warnings to add to your prescription for antianxiety agents.
12. Recognize the benzodiazepine antagonist flumazenil (Romazicon®) and state when it is used and the precautions for its use.

13. Compare and contrast the actions of diazepam (Valium®) and buspirone (Buspar®).
14. Compare and contrast diazepam and zolpidem (Ambien®) and zaleplon (Sonata®) and eszopiclone (Lunestra®).
15. Identify which anti-anxiety agents are preferred in young, pregnant, and elderly patients.
16. State the alterations of sedative hypnotic actions with repeated dosing and the principles of drug withdrawal stated in your textbook.

D. Second choice sedative: hypnotics and muscle relaxants

1. State the action of barbiturates on chloride ion channel complex (not Bz site), AMPA, kainate (non-NMDA glutamate), acetylcholine nicotinic, and perhaps ion channels.
2. Describe the absorption, distribution, metabolism excretion, pharmacologic actions, dose response relations, adverse actions, and drug interactions for barbiturates.
3. Describe when barbiturates might be used in dentistry and state what kinds of patients barbiturates shouldn't be prescribed to.
4. Compare the actions of barbiturates (example: pentobarbital) to the benzodiazepines (example: diazepam) for efficacy and safety.
5. State appropriate warnings to put on a sedative-hypnotic prescription.
6. List the names of muscle relaxants discussed in class.
7. Compare the relative efficacy, safety and drug interactions, and dependence liability between muscle relaxants, benzodiazepines and barbiturates.
8. Describe the preparations of chloral hydrate (see clinical pharmacology database); describe its pharmacology, indications, adverse actions and drug interactions and state what constitutes an average hypnotic dose.

E. Opiate analgesics and antagonists

1. Describe the alkaloidal content of opium.
2. Draw the structure of morphine and be able to compare it to the structure of enkephalin.
3. Describe endogenous opiates, their receptors, second messengers and their role in the actions of opiate drugs.
4. Describe the absorption, distribution (including effect of blood brain barrier), metabolism and excretion, and dosage forms of opiates.
5. State the consequences of the very lipid soluble opiates (i.e. fentanyl) accumulating in fatty tissue after repeated dosing.

6. Describe the pharmacological actions of the opiates both analgesic and other actions.
7. Describe the types of pain for which opioid analgesics are appropriate.
8. Describe the contraindications, adverse action and drug interactions for opiate drugs.
9. Discuss the adverse reactions for opiates and which can be lethal.
10. Recognize that the combination of MAO inhibitors and meperidine produces a dangerous drug interaction.
11. State what warnings are appropriate for an opioid analgesic prescription.
12. State the symptoms of acute opioid intoxication and state the antidote for acute opioid intoxication.
13. Describe the pure opiate antagonists: their ability to antagonize opiates, indications other than opiate antagonism, compare their half-lives to each other and to clinically used opiates, and when multiple doses of antagonists may be required.
14. State what simple structural change can cause an opioid agonist to act as an antagonist.
15. Describe the effect of opiate antagonists on opioid dependent individuals.
16. Describe and state the pharmacology of the mixed agonist-antagonist analgesics, their advantages and disadvantages, compare them to "pure" opiates agonists and opiate antagonists.
17. Describe opiate tolerance and dependence.

F. Prescription writing laws

1. State the legal limits of diagnoses for which a dentist can prescribe.
2. State why drug abuse is a challenge to a dentist in his/her office.
3. State what "audit trail" means when applied to controlled substances and recognize the procedures you will employ as part of the audit trail.
4. State the laws concerning handling Schedule II-V for drugs generally prescribed in dentistry and commonly abused drugs, including prescribing, storage and disposal.

V. INFLAMMATORY AND ANTI-INFLAMMATORY DRUGS

A. Inflammatory mechanisms

1. List the four cardinal (clinical) signs of acute inflammation and relate each to its cause.

2. Describe three events that occur in the microvascular system in inflammation and compare to the biphasic vascular response that occurs to moderate injury/infection.
3. Identify the major role of the localized epithelial/mucosal cells, vascular endothelium and leucocytes at the site of acute inflammation.
4. Describe the response and role of neutrophils, eosinophils, monocytes and macrophages to acute inflammation and identify the migration sequence from plasma to the site of injury/infection.
5. Identify the major inflammatory mediators within these groups; autocoids, kinins, eicosanoids, cytokines; their source, general synthesis, target sites, receptors and general action of these mediators.
6. Identify key tissue/enzyme sites to control the action of these endogenous chemical mediators.

**B. Nonsteroidal anti-inflammatory agents**

1. Describe the pathways and enzymes involved in prostaglandin and leukotriene biosynthesis.
2. Describe the physiologic effects of prostaglandins and leukotrienes in target tissues especially the vascular system and immune cells.
3. Discuss the clinical efficacy and the potential side effects of prostaglandin agonists and agents that antagonize prostaglandins and leukotrienes.
4. Describe the effects of NSAIDs on the inflammatory and noiceptive processes.
5. List the classes of NSAIDs and the prototype drugs in each class.
6. List the pharmacological properties of NSAIDs, especially as seen in poisoning by this class of compounds.
7. Describe the pharmacokinetics and metabolism of NSAIDs.
8. Describe the differences in the mechanisms of action of the uricosuric agents and allopurinol in the treatment of gout.

**C. Histamine antagonists**

1. Compare and contrast a “physiological antagonist” with a “receptor antagonist.”
2. Explain why epinephrine instead of antihistamines is used in the treatment of immediate hypersensitivity reactions or systemic histamine toxicity.
3. Recognize that currently there are four classes of pharmacological antagonists of histamine (H1, H2, H3, and H4).
4. List the major effects of histamine antagonized by H1 and H2 histamine receptor antagonist.
5. Recognize that there are multiple chemical classes of “First-Generation” H1 receptor antagonists.

6. List four prototype "First-Generation" H1 receptor antagonists, one from each of the four chemical classes.
7. Define the mechanism of action, the absorption, distribution, and metabolism, the side effects, and the drug interactions of the "First-Generation" H1 receptor antagonists.
8. List the effects on the CNS, and how these effects are used for preoperative sedation and OTC sleep aids.
9. Compare and contrast three prototype "Second-Generation" H1 receptor antagonists to the first generation agents.
10. Define the mechanism of action, the absorption, distribution, and metabolism, the side effects, and the drug interactions of the H2 receptor antagonists.
11. List the four H2 receptor antagonists currently available for clinical use.
12. Explain, on the basis of the drug interactions with cimetidine, the dental precautions that should be exercised in the use of lidocaine or benzodiazepines such as diazepam (VALIUM®) in a patient taking cimetidine.
13. Describe the uses of antihistamines in dentistry.
14. List an antihistamine agent which is contraindicated during early pregnancy.

D. Combination analgesics

1. Distinguish between opiates and NSAIDs and state the mechanism of action for each type.
2. State the reasons why combination analgesics may be rational.
3. State the purpose of drugs or adjuncts added to combination analgesics.
4. State the ingredients of the drug combinations and their amounts.
5. State what the maximum dose of the drug is and which drug is limiting at this dose.
6. Compare the pharmacodynamic compatibility of the agents.

E. Adrenal glucocorticosteroids

1. Identify the major glucocorticoids used as pharmacologic agents.
2. Describe the differences between the use of glucocorticoids in replacement therapy versus use as anti-inflammatory agents.
3. State the major pharmacological uses of glucocorticoids, the basis for their usage and their undesirable side effects.
4. Discuss the pharmacological differences between the naturally occurring glucocorticoids and the synthetic glucocorticoids.

5. Describe the mechanisms controlling the endogenous levels of glucocorticoids and the significance of these control mechanisms in the pharmacological use of these steroids.
6. State the recommended dental uses of glucocorticoids.

## VI. DRUG ABUSE

### A. Drug abuse I

1. Discuss the purpose of the Comprehensive Drug Abuse and Control Act of 1970.
2. Define the terms describing drug abuse presented in class.
3. State the theories for development of substance abuse.
4. Describe the changes in transmitters and second messengers involved in the development of drug abuse for acute and chronic drug actions, and withdrawal of the agent.
5. Select six categories, and their component drugs, which constitute the major drugs of abuse.
6. List the common names or slang terms used for the drugs of abuse as presented in class.
7. Describe the dental implications of drug abuse for both the patient and dentist.

### B. Drug abuse II: alcohol and nicotine

1. Describe the chemistry and classification of aliphatic alcohols and recognize the three that are of clinical interest.
2. Define the term "denatured alcohol." Describe the general uses of these alcohols in dentistry.
3. Describe the acute and chronic pharmacological effects of ethanol on the CNS, gastrointestinal tract, cardiovascular system, liver, urinary and biliary tracts, and general metabolic activity.
4. Describe the major toxicity from excess exposure to or drinking of methanol and isopropyl alcohols.
5. Describe the problems and pathology presented to the dentist by a patient who abuses alcohol.
6. Compare the drug interactions and mechanisms involved in the interactions for a) acute and b) chronic ethanol ingestion combined with CNS depressants, vasodilators, penicillins, aspirin, acetaminophen, oral anticoagulants, and oral hypoglycemic agents.
7. Describe the basis of ethanol tolerance and cross-tolerance to anesthetic agents.
8. Describe the symptoms (in chronological order) seen with the abstinence syndrome to ethanol according to the severity of the withdrawal response.

9. State the currently accepted explanation for nicotine-pharmacology on the brain: stimulation and dependence.
10. Describe the pathology (systemic and oral) resulting from long-term tobacco use. (Compare smoking vs. smokeless tobacco).
11. State the pharmacological treatments available to the dentist to assist tobacco cessation.

VII. ANTICARIES AND ANTIPLAQUE AND ANTIPERIODONTITIS AGENTS

A. Anticaries agent – fluoride

1. Describe the chemistry, pharmacokinetics, and toxicity of fluoride.
2. Describe the therapeutic use of fluorides and preparations of fluoride products available for prescription and over-the-counter use.
3. Write prescriptions of fluorides for dental patients.

B. Antiplaque, antigingivitis, and antiperiodontitis agents

1. Define dental plaque.”
2. Explain the rationale for plaque chemotherapy.
3. State the problems in the use of these antiplaque agents.
4. Discuss the ideal properties and guidelines for acceptance.
5. Discuss the chemistry, properties, and mechanism(s) of action of anti-plaque and anti-periodontitis agents.

## RESOURCES

### I. Media Resources:

#### A. Printed Materials:

##### 1. Required Textbook

Bertram G. Katzung  
*Basic and Clinical Pharmacology*, 10th. ed.  
Appleton & Lange, 2006

##### 2. Optional Textbook

Yagiela JA, Dowd FJ, Neidle EA  
*Pharmacology and Therapeutics for Dentistry*  
Mosby, New York, 2004.

##### 3. Monograph

BlackBoardCourseInfo  
<http://bb.uth.tmc.edu>

### II. Human Resources:

#### A. Faculty

Vahn Lewis  
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### III. Electronic Resources

Note: The value of these resources is discussed in the Blackboard site under Course Information.

- A. Blackboard Course Info:  
Much of the course is available at the Blackboard site at <http://bb.uth.tmc.edu>.
- B. GSM Clinical Pharmacology Drug Database  
<http://www.clinicalpharmacology-ip.com/> From the Dental Branch, Medical School, Baylor University and the TMC JJ Library
- C. Dental Pharmacology CD

The Dental Pharmacology CD will contain the material from the Blackboard site. This will enable students with slow Internet connections or those who want to study while not at the dental school to have access to all of the material available at the beginning of the course.

- D. Dr. Lewis' Home Page  
<http://www.db.uth.tmc.edu/faculty/vlewis/default.htm>
- E. Streaming videos of each seminar will available through Blackboard shortly after the seminar is presented.

## STUDY PLAN AND REQUIREMENTS

As is true for most college level courses, the content of the course comes from both your lecture notes and from material in the textbook. In general, the lecture will provide a framework for your study, which is to be extended by the material assigned in the textbook. Most support material will be at the Blackboard site, <<http://bb.uth.tmc.edu>>. Supplemental material may be posted on the course web page: <<http://www.db.uth.tmc.edu/faculty/vlewis/Vahnspage/2561/2561.htm>>.

**Attending Class:** It is our policy that all students are expected to attend all classes during the entire session. We know from experience that students who attend class generally do better than those who do not. Also, the faculty spend considerable time preparing for their meetings with the class. It is a school policy that students are expected to attend class and that roll may be taken at each meeting. By UTHDB Senate policy, course grade penalties can be assessed for unexcused student absences.

**Doing Homework:** Homework is an important component of learning in this course. The material assigned in homework should be considered essential, not optional. Much of the homework will be performed in collaborative groups which will be assigned during the course.

**Attending Examinations:** Students are expected to take their examinations at the scheduled examination date and time. Remake examinations will only be permitted for verifiable extraordinary circumstances that are approved by the course director. Students should prepare themselves to be able to sit in class for the expected length of the examinations. Hats may not be worn in class. Electronic devices such as cell phones, Bluetooth headsets, tape recorders, Ipods etc. may not be brought to exams as they have the potential for compromising test security. Certain religious garb will be allowed but it may not be used to conceal electronic devices that might compromise the test security. Special needs students need to arrive at their examination appointments on time and be certain that they know where their examination is to be held.

**Distractions in Class:** Any behavior by a student that is distracting to rest of the class or that interferes with an optimal learning environment in class is unacceptable. The presenter or course director may, at their discretion, request that distracting behavior be stopped. If the distracting behavior is not stopped, the faculty may request a student (or students) leave the class. Any student asked to leave class for disruptive behavior will be considered to be absent without excuse. Examples of disruptive behavior include sleeping in class, beeping pagers or ringing cell phones. Electronic devices may be used for the promotion of the goals of the class, however reading your email or generally surfing the web during class is discouraged. Loud talking that interferes with other students hearing the faculty or discussion of subjects not related to or distracting from the subjects under study, repeated leaving and entering and consistent tardiness or leaving early so that other students are distracted by these activities are not acceptable.

In general, we have had very few problems with any of the issues cited above. If each student is courteous to their classmates and recognizes that a good environment is necessary for optimal learning we will continue to have an excellent learning environment in this course.

**DENF 2561 DENTAL PHARMACOLOGY  
2009 Fall Semester Lecture Schedule**

Monday and Wednesday, 10-10:50 am; Thursday, 2-2:50 pm,  
with exceptions on Sep 24, Oct 1, Oct 22, Oct 29, and Nov 19; see schedule below.  
Class to be held in Room 132; all exams in Room 207

Reading assignments may be found on Blackboard,  
at the top of each seminar outline in the Course Documents section.

<b>Date</b>	<b>Description</b>	<b>Faculty</b>
1 Aug 19 10-10:50 am	Introduction To Pharmacology.	Lewis
2 Aug 20 2-2:50 pm	Pharmacodynamics: Mechanism Of Drug Action	Dessauer
3 Aug 24 10-10:50 am	Pharmacodynamics: Dose response relationships	Dessauer
4 Aug 26 10-10:50 am	Pharmacokinetics: Drug absorption (dose forms)	Chan, J.
5 Aug 27 2-2:50 pm	Pharmacokinetics: Drug distribution	Chan, J.
6 Aug 31 10-10:50 am	Pharmacokinetics: Drug metabolism and elimination	Lewis
7 Sep 2 10-10:50 am	Pharmacokinetics: Time course of drug action	Lewis
8 Sep 3 2-2:50 pm	Pharmacotherapeutics: Clinical use of drugs	Lewis
Sep 7	<i>Labor Day Holiday</i>	
9 Sep 9 10-10:50 am	Prescription Fundamentals	Lewis
10 Sep 10 2-2:50 pm	Principles And Mechanisms Of Antibiotic Therapy	Chan PK
Sep 14 10-10:50 am	<b>Examination I</b> Sessions 1-10	<b>Room 207</b> Faculty
11 Sep 16 10-10:50 am	Penicillins And Carbapenem	Chan PK
12 Sep 17 2-2:50 pm	Cephalosporins, etc	Chan PK
13 Sep 21 10-10:50 am	Macrolide (Erythromycin, Clarithromycin, Azithromycin) And Clindamycin	Chan PK
14 Sep 23 10-10:50 am	Vancomycin, Linezolid, And Tetracyclin	Chan PK
15 <b>Sep 24 1-1:50 pm</b>	Aminoglycosides, Quinolones, Sulfonamides And Metronidazole, Therapeutic Uses Of Antibiotics In Dentistry and Review	Chan PK

Date	Description	Faculty
16 Sep 28 10-10:50 am	Antifungal	Chan, J
17 Sep 30 10-10:50 am	Antiviral	Chan, J
18 <b>Oct 1 1-1:50 pm</b>	Autonomic Nervous System Fundamentals	Walters
Oct 5 10-10:50 am	<b>Exam II</b> <b>Room 207</b> Sessions 11-19	Faculty
19 Oct 7 10-10:50 am	Cholinergic Drugs	Dessauer
20 Oct 8 2-2:50 pm	Cholinergic Blocking Drug	Dessauer
21 Oct 12 10-10:50 am	Sympathetic Autonomic Pharmacology: Agonists	Clark
22 Oct 14 10-10:50 am	Sympathetic Autonomic Pharmacology: Antagonists	Clark
23 Oct 15 2-2:50 pm	Introduction To CNS Pharmacology and Natural Sleeping And Waking Factors	Lewis
24 Oct 19 10-10:50 am	CNS Stimulants	Lewis
25 Oct 21 10-10:50 am	Antianxiety Agents: Benzodiazepines I	Lewis
26 <b>Oct 22 1-1:50 pm</b>	Antianxiety Agents: Benzodiazepine II & Others	Lewis
Oct 26 10-10:50 am	<b>Exam III</b> <b>Room 207</b> Sessions 20-29	Faculty
27 Oct 28 10-10:50 am	Second Choice Sedative: Hypnotics and Muscle Relaxants.	Lewis
28 <b>Oct 29 2-3:50 pm</b>	Opiate Analgesics and Antagonists	Lewis
29 Nov 2 10-10:50 am	Prescription Writing Laws	Lewis
30 Nov 4 10-10:50 am	Inflammatory Mechanism	Hutchins
31 Nov 5 2-2:50 pm	Nonsteroidal Anti-Inflammatory Agents I	Loose
32 Nov 9 10-10:50 am	Nonsteroidal Anti-Inflammatory Agents II	Loose

<b>Date</b>	<b>Description</b>	<b>Faculty</b>
33 Nov 11 10-10:50 am	Histamine Antagonists	Weisbrodt
34 Nov 12 2-2:50 pm	Combination Analgesics	Lewis
35 Nov 16 10-10:50 am	<b>Exam IV</b> Sessions 32-38	<b>Room 207</b> Faculty
36 Nov 18 10-10:50 am	Adrenal Glucocorticosteroids I	Knutson
37 <b>Nov 19 1-1:50 pm</b>	Synthetic Glucocorticosteroids II	Knutson
38 Nov 23 10-10:50 am	Drug Abuse I: Mechanisms <b>Course Evaluation</b>	Lewis
39 Nov 25 10-10:50 am	Drug abuse II: Ethanol and nicotine	Rosenfeld
40 Nov 26	<i>Thanksgiving Holiday</i>	
41 Nov 30 10-10:50 am	Anticaries Agent – Fluoride I	Chan, J
42 Dec 2 10-10:50 am	Anticaries Agent – Fluoride II	Chan, J
43 Dec 3 2-2:50 pm	Antiplateque, Antigingivitis, And Antiperiodontitis Agents	Chan, J
<b>Dec 7 1-3:30 pm</b>	<b>FINAL EXAM</b>	<b>Room 207</b> Faculty

## EVALUATION METHODS

Evaluation methods will include attendance, homework, short quizzes, four examinations, and a final exam with prescription writing examination.

### **Attendance**

The Dental Branch has a mandatory attendance in class policy. Attendance may affect the nature of remediation. Students that need to remediate and did not attend classes may be required to do more remediation if they don't know the material that was presented or if they are very far behind may be recommended to repeat the course.

### **Homework**

Homework will be assigned to reinforce, extend or apply the information you have received in your lectures. You will learn prescription writing in collaborative homework assignments. Homework will count for 10% of the course grade.

The homework will form the basis for the prescription part of the final examination, please try to get as much as you can out of the homework exercises. All group members are to be present during the homework exercise meeting and each should individually sign their name on the homework at the top of the first page and include the date of the group meeting and the letter designation for the group at the top of the first page. Students will not be allowed to enter their names on a homework exercise after it is turned in. If your name is not on the homework you will receive a zero for that exercise. I will not accept individual homework for group exercises. You will need to work with the other students in your group to form a consensus on the report. Purposely excluding a member from the group is unacceptable and may result in group penalties.

### **Quizzes**

Quiz grades may be attached to a variety of activities in class and web based assessments. The quizzes will count for 10% of the course grade.

The objectives are to be used as a study guide in preparation for examinations. Material not covered in the objectives will not be tested on. There may be more objectives than test items. In these cases the exam material will be a sampling from the stated objectives. Objectives may be modified by the faculty during the course. If objectives are changed during the course, these changes will be presented in writing during class and a copy of such changes will be provided to the course director and to the class president at least five (5) working days prior to the examination over the material.

Lecture material is intended to organize and emphasize the material that you need to know. When lecture is over you should have a good context for understanding the assigned text and other study material. The objectives may cover material not specifically covered in the lecture but available from the other required sources, e.g. your book!

### **Grade Posting, Test Review, and Protest Policy**

We will grade your exams at the Dental Branch and post preliminary scores on the day of the exam on Blackboard grade sheet. Exams will not be returned, but a copy of your Scantron will be made available

shortly after the exam. Students will have an opportunity to review an exam with respect to their Scantron during a brief session to be scheduled shortly after each exam. Examination grades will be posted to your Blackboard grade sheet. This provides excellent security and privacy for returned grades. Quiz grades will be posted on the Blackboard grade sheet. Homework grades will be returned on the homework and in the Blackboard grade sheet.

### **Examinations**

This course is roughly divided into five sections. The section exams are 50 minutes in length and will have about four questions per hour of material. The examinations may not exactly coincide with the end of a section if there are scheduling or test size issues that need to be considered. The final examination is weighted twice in the final grade.

### **Final Examination**

The final examination will cover the entire course. One part will consist of multiple-choice, true/false, and matching-type questions, will be graded on a Scantron form, and will count for 75% of the grade of the final. A prescription writing case will be included on the final and will count for 25% of the grade of the final. Typically, about one-half of the didactic test final examination will cover the material before the fourth test.

Students who do not pass any or all part(s) of the final examination will be required to perform appropriate remedial study and pass the examination at a time to be determined by the Evaluation & Promotion Committee.

### **Course Grade**

The course grade will be a weighted average of the scores on homework, quizzes, section examinations, and the final examination. The final examination is weighted twice in the final grade.

### **Summary of Weights of Course Components**

Quizzes	10%
Homework	10%
Final Exam	27%
Exams	53%

### **Course Evaluation**

Course evaluation will be multi-component. Student attitude will be assessed with anonymous surveys after each exam. A noon meeting between selected students and faculty will be held at the end of the course for a face-to-face discussion of issues arising during the class. (Lunches will be provided.) In addition, the Dental Branch requests that each year, toward the end of the semester, students evaluate the course for their records. Other course assessment tools will be used to assess learning. We regularly consider student input. If you can think of any way we can improve the course please suggest it on the course evaluation form.