

## PHARMACOLOGY & THERAPEUTICS COURSE INTRODUCTION

### I. INTRODUCTION

#### Overview

- (i) The word Pharmacology is originally derived from the Greek: *pharmakon* –meaning drug and *logos*-meaning knowledge.
- (ii) **Pharmacology can be defined as “the study of the effects of drugs on the function of living organisms”.** In a broader sense, Pharmacology deals with the actions, mechanism of action, clinical uses, adverse effects and the fate of drugs in the body.
- (iii) Drugs are defined as chemical substances, other than nutrients or essential dietary ingredients, that when administered to a living organism result in a distinct biological outcome.
- (iv) Drugs maybe purified chemicals, synthetic organic chemicals, substances purified from either plant or animal products or recombinant proteins generated by genetic engineering.
- (v) In order for a drug to be effective it has to be administered by an appropriate route (i.e. oral, intravenous or intramuscular etc) capable of achieving a sufficiently high enough concentration within its target tissue(s) in a chemical form that allows it to interact with its biological target to achieve its desired effect.
- (vi) The factors that determine the ability of a drug to reach its target tissue and achieve its desired therapeutic effect are determined by its inherent Pharmacokinetic and Pharmacodynamic properties.
- (vii) While drugs are intended to have a selective beneficial action, there is always the risk that a drug may have unanticipated, undesirable, and in some cases, harmful, side effects.
- (viii) The effective use of drugs in the clinical practice of medicine requires a thorough understanding of both the basic concepts of pharmacology and the specific pharmacology of any specific prescribed drug.

The central goal of the Pharmacology and Therapeutics course is two-fold. First, to provide students with a solid grounding in the basic concepts and scientific underpinnings of Pharmacology, including the following areas: pharmacokinetics, pharmacodynamics, drug metabolism and drug-drug interactions. Second, to provide students with a comprehensive

introduction to the fundamental Pharmacology and uses of the major classes of clinically important drugs currently used in medical practice.

## II. ORGANIZATION OF THE COURSE.

### A. Syllabus

The Pharmacology & Therapeutics course is year-long and is divided into two semesters.

**Semester III (Part 1); August 3<sup>rd</sup> – December 18<sup>th</sup>, 2009**

**Semester IV (Part 2); January 4<sup>th</sup> – May 7<sup>th</sup>, 2010**

You will receive an individual grade for each semester.

#### Semester III:

There are four major areas of emphasis in Semester III:

**(i) Basic Principles** –in this series of lectures you will be introduced to the fundamental concepts of Pharmacology including pharmacokinetics, pharmacodynamics, pharmacogenomics, drug metabolism, and drug interactions.

**(ii) Autonomic Pharmacology/Anesthesia/Pain medications-** this section of the course will introduce you to the pharmacology of the autonomic nervous system.

You will also be introduced to the pharmacology of anesthetics and analgesics.

**(iii) Cardiovascular Pharmacology** – in this series of lectures you will be introduced to the major drug classes that are used to treat diseases of the cardiovascular system. These drug classes include those involved in the regulation of blood coagulation, as well as drugs used to control hyperlipidemia, hypertension, angina, cardiac arrhythmias and congestive heart failure.

**(iv) Antimicrobial agents** –this final section of the semester will provide an introduction to the pharmacology and clinical use of antibiotic drugs used in the treatment of infectious diseases. Additional lectures will also cover drugs used in the treatment of asthma.

There will be a total of **FOUR** exams in Semester III on the following dates:

**August 31<sup>st</sup>; October 2<sup>nd</sup>; November 23<sup>rd</sup>; December 16<sup>th</sup>.**

### **Semester IV**

There are three major areas of emphasis in Semester IV:

**(i) *Psychopharmacology*** – the first series of lectures in the semester will provide an introduction to the pharmacology of drugs used in the treatment of common psychiatric illnesses, including the antidepressants, mood stabilizers, anxiolytics, and anti-psychotics. Other lecture topics include drugs to treat parasitic and fungal infections, drugs to treat Rheumatoid Arthritis and drugs used in the management of GI disorders.

**(ii) *The endocrine system*** – this section of the course will discuss the pharmacology of drugs used to treat disorders of the endocrine system. Topics included are hypothalamic and pituitary hormones ; estrogens, progesterones and androgens ; Adrenocorticosteroids, drugs to treat osteoporosis, thyroid hormones and drugs to treat diabetes.

**(iii) *Chemotherapy*** – the final section of the semester will focus on the pharmacology of drugs used in chemotherapy and the treatment of cancer. Other topics will include drugs to treat HIV and other viral infections, the principles of clinical toxicology, and the pharmacology of common botanical medications and alternative medicine supplements.

There will be **FOUR** exams in Semester IV on the following dates:

***February 1<sup>st</sup>; February 26<sup>th</sup>; March 29<sup>th</sup>; May 5<sup>th</sup>.***

### **B. Integration with other courses**

The Pharmacology and Therapeutics course will run concurrently with other second year medical school courses including Neurosciences, Behavioral Medicine and Mechanisms of Human Disease. You will find that the lecture topics in these three courses have been integrated so that related topics in the different courses are coordinated and will be taught in a contemporaneous fashion. This will ensure that you will first hear about the underlying scientific basis of a disease process, its associated pathologies, and symptoms, prior to being introduced to the Pharmacology of the drugs used to treat that specific disease process. The topic areas are further integrated in small group sessions within both the Mechanisms and Pharmacology courses that aim to dovetail knowledge gained from both courses into addressing specific clinical scenarios. It is hoped that by integrating the course material in this way, it will aid the overall educational experience and will greatly facilitate the learning process.

**C. Lectures**

All Pharmacology lectures will be 50 min in duration and will be presented in SSOM Rm. 390. In most cases, a PDF printout of the powerpoint presentation of each lecture will be made available for download shortly before each lecture. In addition, in most cases, a video/audio recording of each lecture will be available for download shortly after the lecture. However, in some rare instances individual lecturers may not consent to having the audiovisual recording of their lectures released. In these instances we will attempt to make the class aware of this possibility prior to the lecture. As always, appropriate and professional behavior in the lecture hall is expected. Distracting classmates and/or faculty with conversation is unprofessional and is not acceptable.

**D. Learning objectives and Handouts**

A handout that can be used as a study guide for each lecture topic will accompany each lecture and will be posted on the web, where it can be accessed through the calendar for each specific date.

These handouts will include:

- a) A list of suggested reading assignments.
- b) A list of key concepts and learning objectives for each lecture topic.
- c) A list of the important drugs that will be covered during the lecture.
- d) A detailed overview of the material that will be covered in the lecture.

Charts illustrating key Pharmacological features of each drug covered in the lecture, and/or a brief review of key points made in the lecture.

**E. SELF STUDY ASSIGNMENT**

As indicated above, most of the Pharmacology material throughout the course will be delivered in the form of lectures. However, the material relevant to Dietary supplements and herbal medications will be delivered in the form of a SELF STUDY ASSIGNMENT. This means that it will be your responsibility to independently research the topic and accumulate the necessary information. For this exercise you will be provided with a list of the relevant supplements and botanical medications that need to be covered, as well as a complete list of the key learning objectives. To further assist you, you will be directed to several excellent online sources where all of the necessary information can be obtained. Questions relevant to this material will appear on the final exam at the end of Semester IV- there will be three questions relating to Dietary supplements and three questions relating to Herbal medications on the final exam. Although this material will only be tested on the final examination, the

assignment can be completed at anytime throughout the course and it is strongly recommended that you do not leave it until the very last minute.

**F. Small Group Case Studies**

Small group case analyses will last 90 min (usually) and will take place in assigned locations. The small group cases in Psychopharmacology will each last 45 mins. There will be small group case studies on basic pharmacological concepts, drug dosing, drug metabolism, and drug interactions, as well as autonomic pharmacology, and the use of drugs in the treatment of psychiatric illnesses. These small groups will use various clinical case vignettes to illustrate important Pharmacological concepts and will attempt to facilitate learning of critical Pharmacological information covered in the related lectures.

The case vignettes and associated study questions will be made available online. After reviewing the materials presented in the lectures and completing the reading assignments, you should be able to develop responses to the study questions. You should come to the sessions prepared to discuss your answers with the rest of the group. During the small group session, the facilitators will not only solicit your input regarding a given case based on the study questions, but will also pose additional questions that stem directly from the discussion. Individual small group assignments, room numbers, and the names of the group facilitators will be posted, both on the web and outside Rm. 320. Note that in many cases, Pharmacological topics and the use of drugs in the treatment of specific diseases will be discussed in small group cases delivered within the Mechanisms of Human Disease course. Attendance at Small Groups is strongly encouraged.

**G. Tips on learning/understanding the Pharmacology of specific drugs**

As indicated above, the first section of semester III will introduce you to the basic scientific principles of Pharmacology. By its very nature this section of the course is very conceptual and deals with very basic fundamental aspects of Pharmacology. However, the remainder of the course will quickly become very specific and is organized in a stepwise fashion to introduce you to the different classes of currently available drugs that are used to treat specific diseases and clinical conditions. This will expose you to a very large amount of information. In order to facilitate your learning and understanding of this material it is helpful to consider the following specific pieces of information for each drug or class of drugs that is covered.

For each drug/drug class you should know the following:

- |                               |   |
|-------------------------------|---|
| <b>a) INDICATIONS</b>         | - under what circumstances is the drug used.  |
| <b>b) DRUG ACTION</b>         | - what clinical effect does the drug have.  |
| <b>c) MECHANISM OF ACTION</b> | - how does the drug work.   |
| <b>d) PHARMACOKINETICS</b>    | - are there any factors such as absorption, metabolism, excretion or half-life that might affect the drug action.   |
| <b>e) ADVERSE EFFECTS</b>     | - are there clinically relevant side effects of the drug.   |
| <b>f) CONTRAINDICATIONS</b>   | - are there circumstances in which the drug should not be administered to certain patient populations e.g. the elderly, those with renal insufficiency, pregnant women etc. |
| <b>g) DRUG INTERACTIONS</b>   | - are there any interactions with other potentially concomitantly administered drugs that might affect the clinical efficacy, bioavailability or toxicity of either drug.   |

This information will be discussed for each drug and/or drug class discussed throughout the course. In many cases, the information will be summarized in the charts that will accompany your lecture handouts. By learning this information for each drug/drug class, you will gain a greater appreciation for both the uses and limitations of these drugs in the effective treatment of specific patient populations. Knowing, understanding and being able to apply this information will also be critical for performing well in examinations both in the Pharmacology course and in the USLME-step 1 exam.

### **III. EXAM FORMAT & GRADING POLICY.**

- A. There will be a total of **EIGHT** exams throughout the year that contain Pharmacology and Therapeutics questions. All exams will be computerized and will be administered in the Sit-Down Labs.

- B. The dates of the exams are:  
Semester III- **August 31<sup>st</sup>; October 2<sup>nd</sup>; November 23<sup>rd</sup>; December 16<sup>th</sup>.**  
Semester IV- **February 1<sup>st</sup>; February 26<sup>th</sup>; March 29<sup>th</sup>; May 5<sup>th</sup>.**
  - C. The total number of questions containing Pharmacology material will vary from exam to exam and will depend on the total number of Pharmacology lectures given during that period of the course.
  - D. Each exam will consist of **three questions per lecture and one questions per small group session that were delivered during the corresponding section of the course.** All questions will all be multi choice format in the style of the United States Medical Licensing Exam (USMLE-Step 1). Total time allowed for each exam will vary depending on the number of exam question- the average time allotted to answer each question will be 1 min 20 sec.
  - E. After each exam you will be given a copy of your grade sheet, which will indicate the percentage of questions that you answered correctly, along with a list of key phrases that will identify those questions that you answered incorrectly.
  - F. Your **final** semester grade will be based on the **total percent correct** of your answers from all of the questions answered in each exam throughout the entire semester.
- The final grade for each semester will be compiled as follows:
- Honors:** a score greater than 1 S.D. above the class mean.  
**High Pass:** a score greater than the class mean and up to 1 S.D. above the mean.  
**Pass:** a score greater than **70%** up to the class mean.  
**Fail:** a score less than **70%**.
- G. In order to pass the entire course you will need to score AT LEAST a PASS or better in BOTH Semester III AND Semester IV.

#### IV. PREPARATION FOR EXAMINATIONS.

- A. As part of the handouts for each lecture you should also receive a chart(s) illustrating the major features of the drugs discussed during that lecture (i.e. indications, mechanism of action, adverse effects, contraindications, drug interactions). Alternatively, some lectures may supply you with a list of key review points for the lecture. In either case, these materials should be invaluable resources in your preparations for each exam.

- B. USMLE type questions with explanations can be found at the end of each chapter in Katzung and Trevor's *Examination and Board Review (8<sup>th</sup> Edition)*.
- C. An online student Resource Center accompanies the 11<sup>th</sup> edition of Katzung "*Basic & Clinical Pharmacology*". This includes chapter questions and answers with detailed rationales.
- D. An online resource of Pharmacology-related exam questions is available at:  
URL <http://www.pharmacology2000.com/learning2.htm>

## V. MISSED EXAM POLICY.

If circumstances arise that may prevent you from taking a scheduled examination (e.g. serious illness) you should immediately contact **BOTH** the course directors **AND** the Associate Dean of Student Affairs, so that a timely adjudication can be made. Students who are forced to miss exams for **legitimate** reasons, as ascertained by the Associate Dean of Student Affairs, will be given the opportunity to take a make-up exam on an individual basis.

## VI. REMEDIATION POLICY

Students who receive a failing grade for either Semester III or Semester IV will be required to take a **Remediation exam**. The course director will notify those students that failed a semester after the last exam of that semester. Remediation Exams are administered with the assistance of the Associate Dean of Student Affairs in **May/June at the end of the entire course**. The remediation exam consists of one broad-based/conceptual-type question from each lecture and small group session that were given during the semester. **Students must earn at least a 70% score to pass the remediation exam**. The course director will notify the student of the remediation exam grade.

## VII. PROFESSIONALISM.

Personal responsibility and professionalism are two key areas in the development of a physician. Professionalism is actually a separate category on the required evaluations for the American College of Graduate Medical Education. It is expected that professionalism will be extended in all aspects of your conduct in this course. This includes appropriate and professional interactions with the course directors, lecturers, educational specialists and other students. Any serious lack in professional conduct will be reported to the Dean.



It is further expected that all students will maintain personal integrity and honesty during the examination process. Once an exam has started there should be no verbal or non-verbal communication with other students. If a problem arises this should be brought to the attention of the examination proctor. Lecture handouts, textbooks, telephones, personal computer devices and any written material should not be taken into the exam room. Neither should these materials be accessed during authorized bathroom breaks. Any student that attempts to gain an unfair advantage over other students in an examination by attempting to gain access to pharmacology resource material by any of these latter unauthorized means will be guilty of academic misconduct and will be promptly reported to the Dean.

## VIII. TEXTBOOKS

### **Recommended:**

#### **EITHER**

Katzung, B.G. and Trevor, A.J. Pharmacology: Examination and Board Review 8<sup>th</sup> Edition. McGraw Hill: Norwalk, CT., 2008.

*This Board Review book has previously been recommended by past students of the course. It offers a user-friendly brief synopsis of most pharmacological topics with plenty of diagrams, figures and tables. It also includes a list of practice exam questions complete with annotated answers at the end of each section. However, you should be aware that this book provides only a brief review of each topic, not a comprehensive in-depth coverage.*

#### **OR**

Katzung, B. G., Masters, S.B. and Trevor, A.J. Basic and Clinical Pharmacology 11<sup>th</sup> Edition. McGraw Hill: Norwalk, CT. 2009.

*This is the companion textbook to the above Board Review book. It is used by many Pharmacology courses at other Medical Schools around the country. It offers an in-depth detailed discussion of each topic and can be used as a primary resource textbook. It contains excellent summary charts of points at the end of each chapter.*

## IX. ADDITIONAL TEXTBOOKS AND E-RESOURCES

### **A. Textbooks.**

1. Goodman & Gilman's The Pharmacological Basis of Therapeutics 11<sup>th</sup> Edition. McGraw Hill: NY 2006.

*This voluminous textbook provides a very comprehensive and in depth discussion of all areas of modern clinical pharmacology. It is considered as the “gold standard” of Pharmacology textbooks. However, it would probably be overkill for the course for all but the most interested students.*

2. Goodman & Gilman's Manual of Pharmacology and Therapeutics 1<sup>st</sup> Edition. McGraw Hill Professional NY 2007.

*This is a condensed readily portable paperback version of the main Goodman & Gilman Reference textbook highlighted above. Highly recommended for those students that want a comprehensive user-friendly Pharmacology resource that can easily be carried in either a pocket or backpack.*

3. Howland & Mycek. Lippincott's Illustrated Reviews, Pharmacology 4th Edition., Lippincott Williams &Wilkins, 2008.

*A “user friendly” review book that provides a basic outline of each topic. Provides just about the right amount of detail for easy review of any given topic. Includes many excellent tables, charts and illustrations for easy review of the material.*

4. Katzung, B.G. and Trevor, A.J. USMLE Road Map; Pharmacology, McGraw Hill, 2003.

*Provides a very brief outline of the most important areas of Pharmacology. Each chapter includes a list of bullet points that cover the major topics. At the end of each chapter there are a number of clinical problems along with USMLE-style questions and annotated answers. Could work as a study aid, although is not recommended as a primary resource textbook.*

## **B. E-Resources**

### **1. Up-to-Date**

URL <http://www.utdol.com/application/search.asp>

*This website is available through computers on campus and provides access to an extensive searchable data base of excellent articles on specific medications and their treatment. Provides excellent discussion on all aspects of specific medications including indications, mechanism of action, side effects and drug interactions. An excellent resource of current up-to-date information.*

## **2. ACPMedicine (Scientific American Medicine)**

*This Online Textbook is available through the library e-books collection. It contains a series of excellent up-to-date chapters on a variety of disease process, detailing the underlying biology and pathology of each disease. Most importantly, each chapter ends with a discussion of the available therapeutic approaches to treat each disease, as well as a succinct review of the most important pharmacological aspects of each of the highlighted medications.*

## **3. Medical Letter®**

URL <http://www.medicalletter.org/html/archives2007.htm>

*Provides access to an archive of articles on specific medications. Provides essential information on the use of each drug, mechanism of action, pharmacokinetics, side effects and important drug interactions.*

## **4. Treatment Guidelines**

URL <http://www.medicalletter.org/html/archivesTG.htm>

*Provides access to an extensive series of articles on specific diseases and/or conditions and the specific classes of medications that are used in their treatment.*

## **5. Medical Pharmacology- Online Pharmacology content & Practice questions**

URL <http://www.pharmacology2000.com/learning2.htm>

*This is a privately run web site that provides concise review notes on a comprehensive list of Pharmacological topics and specific medications. In addition, it offers the chance to take a number of different online practice exams for each topic. Although I cannot attest to the complete accuracy of the material, it seems that this site would be a good resource for exam preparation.*

## **6. The Knowledge Objectives in Medical Pharmacology.**

URL

[http://www.aspet.org/AMSPC/Knowledge\\_Objectives/default.asp](http://www.aspet.org/AMSPC/Knowledge_Objectives/default.asp)

*This is the official list of important medications that every US medical student should be familiar with as defined by the Association for Medical School Pharmacology.*

## **X. KEY CONTACTS**

### **COURSE DIRECTOR**

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**REMEMBER TO CHECK YOUR E-MAIL ON A REGULAR BASIS. UPDATES AND CHANGES WILL BE ONLY POSTED THROUGH E-MAIL. ALSO CHECK THE WEEKLY COURSE SCHEDULE FOR ANY CHANGES.**

**PHARMACOLOGY & THERAPEUTICS FACULTY**  
**SEMESTER III & IV 2007-2008**

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