Pharmacology & Therapeutics

COURSE DIRECTOR

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**Overall Course Goals**

1. Provide a solid grounding in the basic concepts and scientific underpinnings of Pharmacology

2. Provide a comprehensive introduction into the Pharmacology of the major classes of clinically important drugs and their use in clinical practice

See the Course Handout and web page for a detailed list of the Pharmacology & Therapeutics Course Learning Outcomes

- Medical Knowledge
- Interpersonal and Communication Skills
- Practice-based learning and improvement
- Professionalism

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**Syllabus**

Semester III: August 5th 2019 - December 13th 2019

Semester IV: January 9th 2020 – April 27th 2020

You will receive an individual grade for each semester and will need to obtain a satisfactory pass in each Semester to pass the course
### Course Schedule-Semester III

<table>
<thead>
<tr>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pharmacology and Therapeutics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic principles</td>
<td>Autonomic Pharmacology</td>
<td>Antibiotics</td>
<td>Cardiovascular Pharmacology</td>
<td>Pulmonary</td>
</tr>
<tr>
<td>Pharmacodynamics</td>
<td>Pharmacokinetics</td>
<td>Pharmacodynamics</td>
<td>Therapy</td>
<td>Pulmonary</td>
</tr>
<tr>
<td>Drug Discovery &amp; Clinical Trials</td>
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<tr>
<td>Mechanisms of Human Disease</td>
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<tr>
<td>PCM-2</td>
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</table>

### Course Schedule-Semester IV

<table>
<thead>
<tr>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
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</thead>
<tbody>
<tr>
<td><strong>Pharmacology and Therapeutics</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GI</td>
<td>Neuro-pharmacology</td>
<td>Psycho-pharmacology</td>
<td>Endocrine Pharmacology</td>
<td>Chemotherapy</td>
</tr>
<tr>
<td>H2 blockers/PPR</td>
<td>GI (drugs)</td>
<td>Anti-parasitic agents</td>
<td>Hypothalamic &amp; Pituitary hormones</td>
<td>Chemotherapy drugs</td>
</tr>
<tr>
<td>Anti-parasitic agents</td>
<td>Clinical toxicology</td>
<td>Antidepressants</td>
<td>Pituitary hormones</td>
<td>Alternative cancer therapies</td>
</tr>
<tr>
<td>Neurotransmitter</td>
<td>Anesthesia</td>
<td>Mood stabilizers</td>
<td>Adrenal corticosteroids</td>
<td>Ant-HIV drugs</td>
</tr>
<tr>
<td>Antagonists</td>
<td>Opoid analgesics</td>
<td>Antipsychotics</td>
<td>Thyroid hormones</td>
<td>Anti-viral drugs</td>
</tr>
<tr>
<td>Drugs to treat ADHD</td>
<td>Anti-hypertensives</td>
<td>Antihypertensives</td>
<td>Drugs to treat osteoporosis</td>
<td>Herbal medications &amp; Dietary supplements</td>
</tr>
<tr>
<td>Drugs to treat Heart Failure</td>
<td>Antidiabetics</td>
<td>Anticonvulsants</td>
<td>Drugs to treat diabetes</td>
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</tbody>
</table>

### Lectures

**Pharmacology lectures**
- will last 50 mins and will be presented in SSOM 390
- will follow shortly after corresponding MHD lecture to allow for integration of closely related material

**Handouts**
- A list of key concepts and learning objectives
- A list of the important drug classes/individual drugs that will be covered in the lecture
- Summary Charts illustrating key Pharmacological features of drugs and/or a brief review of key points

**PDFs/PPS of powerpoint lecture presentation**

**Online Video/Audio files of lecture presentations**
**Small Group Case Studies**

Pharmacokinetics and Pharmacodynamics: - August
4 case studies on pharmacological basic concepts
- pharmacokinetics
- drug metabolism and drug interactions
- pharmacodynamics

Autonomic Pharmacology Demonstration: - August
Case-based discussion presented in SSOM 390 with use of clinical simulators and standardized patients
- Autonomic drug pharmacology

Clinical Applications of Antibiotics: - September
- Antibiotics clinical case studies and review questions

**Note:** Other Pharm content will be integrated into MHD small groups

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**Other Course Small Group Activities**

**Bench-to-Bedside Projects**
Project 1: Basic research and Drug Discovery
Project 2: Drug Development and Clinical Trials

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**Bench-to-Bedside Project**
Small Group Discussion and Presentations
- review and discuss a biomedical research paper of pharmacological significance focused on drug discovery and/or pathophysiology
- research primary biomedical research papers describing the development and clinical trial testing of a current drug
- prepare and present a group presentation summarizing the groups findings
- write a brief report (>400 words) aimed at explaining the major findings of the research/drug to a typical patient

**Goals:**
- gain an understanding of the ways in which basic and clinical research are performed and evaluated
- develop and hone lifelong learning skills
- develop and hone critical communication and presentation skills, including communicating complex biomedical and clinical concepts to patients

For more details – see the handout
The combined projects will be worth a total of **4%** of your final Course grade for semester III.

Points awarded will be based upon the following:

(A) Faculty assessment of the group presentations (20%)
- score applied to each member of the group

(B) Grading of the two written reports (60%)

(C) Peer-to-Peer assessment (20%)
- each member of the group will have 100 points to distribute amongst the group based upon the quality of participation of each group member

**Competencies Addressed**
- Practice-based learning and improvement
- Interpersonal and communication skills
- Professionalism

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**Small Group Attendance**

- In keeping with school policy attendance at all small group activities is required.
- Excused absences will require prior permission from the Office of Student Affairs.
- Failure to attend and participate in small activities will result in a report to ARIC and an evaluation of NOT MEETING EXPECTATIONS in your Professionalism competency.

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**Exams**

There will be 10 Pharmacology exams in total throughout the year.

<table>
<thead>
<tr>
<th>Semester III</th>
<th>Semester IV</th>
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<tbody>
<tr>
<td>August 19th</td>
<td>January 24th</td>
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<tr>
<td>August 30th</td>
<td>February 17th</td>
</tr>
<tr>
<td>September 23rd</td>
<td>March 6th</td>
</tr>
<tr>
<td>October 28th</td>
<td>April 6th</td>
</tr>
<tr>
<td>December 13th</td>
<td>April 27th</td>
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</tbody>
</table>

**Exam Questions**
- 3 questions per lecture hour
- +1 question per small group
- All questions will be in USLME-best answer format
- Time allotted per question = 1 min 30 sec

All exams will be integrated with MHD and PCM2.
Exam Grading Policy

- Grades will be given for each semester
- Final semester grade determined by total percent correct on ALL exams throughout semester
- You will need to pass both semesters

Grades will be determined as follows:

- Pass: a score greater than or equal to 70%
- Fail: a score < 70%

Remediation Policy: Failing Grades

1. Students who fail either semester will be required to take a remediation exam for that semester.
   Note: Only those students that post a mean score of >60% have an automatic right to take the remediation exam. Students scoring < 60% will be forwarded to the Student Progress committee who will determine whether they should allowed to remediate or need to retake the course.

2. Remediation exams for both Semester III and Semester IV will be given after the completion of the entire course at the end of Semester IV in May/June.

3. Exams are comprised of representatives questions related to course content given during the semester
   - purpose is for remediating student to demonstrate competency in course content

4. To pass the remediation exam you must score >75% correct

5. It is school policy that remediation exams must be successfully passed prior to sitting the USMLE step 1 board exams.

Tips on studying Pharmacology I

<table>
<thead>
<tr>
<th>For each drug/drug class you should know:</th>
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<tbody>
<tr>
<td>INDICATIONS</td>
<td>- under what circumstances is the drug used</td>
</tr>
<tr>
<td>DRUG ACTION</td>
<td>- what clinical effect does the drug have</td>
</tr>
<tr>
<td>MECHANISM OF ACTION</td>
<td>- how does the drug work</td>
</tr>
<tr>
<td>ADVERSE EFFECTS</td>
<td>- are there any clinically relevant side effects</td>
</tr>
<tr>
<td>CONTRAINDICATIONS</td>
<td>- are there patient groups that should not be administered the drug</td>
</tr>
<tr>
<td>PHARMACOKINETICS</td>
<td>- are there any factors such as absorption, distribution, metabolism, excretion or half-life that might affect the drug action</td>
</tr>
<tr>
<td>DRUG INTERACTIONS</td>
<td>- are there any potential interactions with other drugs that might affect toxicity and/or bioavailability of either drug</td>
</tr>
</tbody>
</table>
**EXAMPLE OF A DRUG CHART**

<table>
<thead>
<tr>
<th>Indications</th>
<th>MOA</th>
<th>Adverse Effects</th>
<th>Misc</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amphotericin B</strong></td>
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<tr>
<td>Broad Spectrum - All life-threatening mycotic infections</td>
<td>Fungal plasma membrane</td>
<td>Inflammation, Nephrotoxicity, Hematotoxicity</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Infusion-related toxicity (Amphotericin B)</td>
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<tr>
<td><strong>Flucytosine</strong></td>
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<td>Narrow Spectrum - Cryptococcus neoformans</td>
<td>Fungal cytoplasm</td>
<td>GI (frequent) nausea, vomiting, diarrhea</td>
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<tr>
<td><strong>Echinocandins</strong></td>
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<tr>
<td>Candida &amp; Aspergillus</td>
<td>Inhibits β-glucan synthase</td>
<td>Well tolerated, Histamine-like effects, Poor CSF penetration</td>
<td></td>
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<tr>
<td><strong>Griseofulvin</strong></td>
<td>Fungal microtubules</td>
<td>Many adverse effects, Fetal abnormalities</td>
<td></td>
</tr>
<tr>
<td><strong>Terbinafine</strong></td>
<td>Fungal squalene epoxidase</td>
<td>Well tolerated, Adverse effects rare</td>
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**Tips on studying Pharmacology II**

You will need to know:

1. The **GENERIC** name of each drug not the trade name
   - e.g. atorvastatin and not Lipitor®
   - Acetaminophen and not Tylenol®
2. Which drugs belong to which particular Drug class
   - e.g. atorvastatin (anti-hyperlipidemics), Acetaminophen (analgesics)
3. How to distinguish one drug class from another
   - i.e. which drug class is the preferred medication for a given clinical condition (most efficacious/less serious adverse effects)
4. How to distinguish between drugs in a particular drug class
   - i.e. are there major differences between drugs that could affect the clinical outcome in a given patient
   - e.g. pharmacokinetics/adverse effects/drug interactions etc

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**Exam Question Sample**

Helen is a 32-yr old female that presents to your office complaining of recent weight gain, fatigue and proximal muscle weakness. She informs you that she has been undergoing recent alterations in her mood. Her physical examination is significant for marked central obesity, with prominent fat pads present on her shoulders and neck. She also displays facial plethora, evidence of facial hair growth and purple striae on her abdomen. She reports that she is not currently taking any medications. You suspect that these symptoms are caused by an ACTH-secreting pituitary adenoma, which is confirmed with further tests. Her oncologist recommends surgical removal of the tumor, but the patient is reluctant to undergo surgery. Which of the following treatment regimens would be most appropriate to medically manage her condition?

A) Hydrocortisone
B) Prednisolone
C) Fludrocortisone
D) Ketoconazole and Aminoglutethimide
E) Hydrocortisone and Fludrocortisone
Textbooks

Recommended
Katzung, B.G., Masters, S.B. and Trevor, A.J.
Basic and Clinical Pharmacology 14th Edition
Comprehensive coverage of all the major topics- widely used by Medical Schools across the country.
- includes many color figures and summary charts
- provides online access to flash cards and practice tests
- available on-line through the library e-resources
- available in the Inking Format for iPad

Other textbooks to consider
Goodman & Gilman
The Pharmacological Basis of Therapeutics, 12th Edition
Very comprehensive, in-depth analysis of all areas of modern pharmacology
Considered by many to be the "gold standard"
- probably overkill for all but the most interested students
- available via Inking

Goodman & Gilman’s
Manual of Pharmacology and Therapeutics, 2nd Edition
This a condensed conveniently sized paperback version of the main
Goodman and Gilman textbook
- an excellent resource

Howland & Mycek
Lippincott’s Illustrated Reviews, Pharmacology 6th Edition
User friendly review book that provides a solid outline of major points of each topic
- contains many excellent figures to aid the learning process
- available via Inking

Review books
Pazdernick and Kerecsen
Excellent review book that provides essential facts and key information for each of the major drug classes in a succinct user-friendly format
- includes many excellent charts and figures
- provides access to online USMLE-style practice tests
- highly recommended as a board review study aid to complement lecture handouts provided during the course

Gleason
Contains numerous quick recall questions on key pharmacology concepts and drug facts
- essentially Pharm Flash card in a handy book format
- good resource for exam preparation to gauge study progress

First Aid for the USMLE step 1 exam
Provides essential facts and key information for all of the basic science material covered in the first two years of medical school
- contains many excellent figures & charts to aid the learning process.
E-resources

**Up-to-Date: Medicine** - available through library
Website providing an extensive searchable database of excellent articles on specific Diseases & conditions, the pharmacology of specific medications and their uses. Constantly kept “Up-to-date” by review of >375 journals.

**Scientific American Medicine** - available through library e-resources
Contains a series of excellent up-to-date chapters on a variety of disease processes detailing the underlying biology and pathology of each disease, as well as a discussion of the most common therapeutic approaches to treat each disease, including a succinct review of the key pharmacological aspects of each medication.