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.

II. Pharmacology and Therapeutics: Course Goals and Objectives

Overview.
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. 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.

Specific key concepts and learning objectives will be provided for each individual lecture topic. However, the general course goals are as follows:

(A) To learn basic scientific concepts and principles that will serve as the foundation for understanding the pharmacology of specific drugs.

Specifically:

- To understand the fundamental scientific principles of drug action and the various mechanisms by which drugs can mediate their pharmacological effect
- To understand the fundamental principles of pharmacokinetics that underly the absorption, distribution, metabolism and elimination of drugs in the body and thereby affect drug effectiveness
- To understand the biochemical reactions that result in the metabolism of drugs within the body
- To understand the rationale behind designing different dosing regimens of particular drugs in specific patient populations
- To understand how specific patient characteristics and genetics can affect the clinical response to a particular class of drugs
- To understand the scientific basis underlying how two different drugs can interact within the body and can have undesirable effects either on drug concentrations or drug clinical effects
- To understand the process by which new drugs are discovered and approved for use in the clinic
- To understand the basic principles of toxicology; the mechanisms by which excess exposure of certain drugs, toxins, chemicals, heavy metals and poisons can lead to adverse toxicological effects; and the basic principles of clinically managing the poisoned patient.

(B) To understand the Pharmacology and clinical use of the major class of clinically important drugs.

These include drugs affecting the autonomic nervous system; anesthetics and analgesics; drugs to treat the heart and diseases of the cardiovascular system; drugs affecting the pulmonary system; antibiotics; drugs used to treat psychiatric disorders; drugs of abuse and drugs use to treat addiction; drugs that affect the immune system; drugs that affect the endocrine system; dietary supplements and herbal medications; antiviral drugs and chemotherapeutic drugs used in the treatment of cancer

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

a) INDICATIONS	- under what circumstances is the drug used.
b) DRUG ACTION	- what clinical effect does the drug have.
c) MECHANISM OF ACTION	- what is the scientific basis for how the drug works.
d) ADVERSE EFFECTS	- are there clinically relevant side effects of the drug that may adversely affect the health of the patient
e) CONTRAINDICATIONS	- are there circumstances in which the drug should not be administered to certain patient populations due to significantly increased risk of adverse effects e.g. the elderly, those with renal insufficiency, pregnant women etc.
f) PHARMACOKINETICS	- are there any factors such as absorption, distribution, metabolism or elimination that might affect the clinical effectiveness of the drug in a given patient population e.g. renal excretion of a drug with a narrow therapeutic window in patients suffering from renal insufficiency.
g) DRUG INTERACTIONS	- are there any possible interactions with other concomitantly administered drugs that might affect the clinical efficacy, bioavailability or toxicity of either drug.

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 6th – December 16th, 2013
Semester IV (Part 2); January 6th – April 29th, 2014

You will receive an **individual** grade for **each** semester.

Semester III:
There are five 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) Antimicrobial agents –this section of the semester will provide an introduction to the pharmacology and clinical use of antibiotic drugs used in the treatment of infectious diseases.

(iv) 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.

(***v) Miscellaneous Pharmacology Topics***- this final section will deal with a number of topics including, pharmacotherapy of anemia, immunomodulation therapy, treatment of allergies and pharmacotherapy of mycobacterial and fungal infections

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

August 19th; September 3rd; September 20th; October 28th; December 16th.
Note: The Pharm course will not have questions on the MHD exam scheduled for November 18th

Semester IV

There are four 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. There will also be lectures on sedative hypnotic drugs and drugs used to treat drug abuse.

(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 used to treat thyroid disorders ; drugs to treat osteoporosis, 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.

(iv) Other topics- Other lecture topics that will be introduced throughout the semester include drugs to treat Parkinsonism and dementia, drugs to treat parasitic infections ; drugs to treat Rheumatoid Arthritis ; drugs used in the management of GI disorders ; and Herbal Medications and Drug Supplements.

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

February 1st; March 7th; April 7th; April 29th.

B. Integration with other courses

The Pharmacology and Therapeutics course will run concurrently with Mechanisms of Human Disease. You will find that the lecture topics in these have been integrated so that related topics 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. A PDF printout of the powerpoint presentation of each lecture will be made available for download shortly before each 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.
e) 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. Small Group Case Studies

In addition to lectures the course also includes a variety of small group case studies. These small group case analyses will typically last 90 min and will take place in assigned locations within the sit-down-labs of SSOM. They 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. In the first semester the small group cases will be focused on basic pharmacological concepts such as pharmacokinetics, pharmacodynamics drug dosing, drug metabolism, and drug interactions. In the second semester there will be four small group cases that will each focus on the pathophysiology and drug management of an individual psychiatric condition (e.g. bipolar disorder, schizophrenia, depression and drug abuse). The case vignettes and associated study questions will be made available online. 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.

In addition to the small group cases there will also be two pharmacology demonstrations that will use clinical simulators and standardized patients to illustrate important aspects in the use of autonomic and cardiovascular drugs. These demonstrations will take place at the assigned times in SSOM Rm. 390. You will be expected to have reviewed the cases prior to the class and to come to these sessions ready to fully participate in the discussions.

In line with current school policy attendance at Small Groups is Mandatory- there will be sign up sheets for each separate small group session. Failure to attend and participate in small groups will result in an evaluation of NOT MEETING EXPECTATIONS in your Professional competency component of the course. If, for whatever reason you find that you have a legitimate reason for being unable to attend a particular small group session you should seek advance permission from the Course Director.

F. 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:

a) INDICATIONS***** - under what circumstances is the drug used.

b) DRUG ACTION***** - what clinical effect does the drug have.

c) MECHANISM OF ACTION* ** - how does the drug work at the biochemical level.

d) ADVERSE EFFECTS* ** - are there clinically relevant side effects of the drug.

e) CONTRAINDICATIONS* ** - 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.

f) PHARMACOKINETICS - are there any factors such as absorption, metabolism, excretion or half-life that might affect the drug action.

g) DRUG INTERACTIONS - are there any interactions with other potentially concomitantly administered drugs that might affect the clinical efficacy, bioavailability or toxicity of either drug.

***- indicates most relevant HIGH YIELD information that is essential to master in order to perform well on the USMLE Step 1 exam.

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.

IV. EXAM FORMAT & GRADING POLICY.

A. There will be a total of **NINE** 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 19th; September 3rd; September 20th; October 28th; December 16th***.

Note: The Pharm course will not have questions on the MHD exam scheduled for November 18th

Semester IV***- February 1st; March 7th; April 7th; April 29th.***

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. The exams are **NOT** cumulative. 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. 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 **92%**.
High Pass: a score greater than **85%** and less than **92%**.
Pass: a score greater than **70%** and less than **85%**.
Fail: a score less than **70%**.

Note: Scores within 0.5 percentage points of a grade cut off will be rounded up to the higher grade

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.

V. 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.

~~A.~~B. USMLE type questions with explanations can be found at the end of each chapter in Katzung and Trevor's *Examination and Board Review (9th Edition)*.

C. An online student Resource Center accompanies the 12th edition of Katzung "*Basic & Clinical Pharmacology*". This includes chapter questions and answers with detailed rationales.

D. The following represent Pharmacology-related exam questions that are available online:
URL http://www.pharmacology2000.com/learning2.htm
URL http://www.medtrng.com/pharmacology_quizzes.htm

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VI. 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.

VII. 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 purpose of the remediation exam is for the student to demonstrate competence of the material presented in the course. The composition of the exam will be decided by the course director and will consist of representative questions reflecting material that was presented throughout 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.

VIII. 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 unauthorized means will be guilty of academic misconduct and will be promptly reported to the Dean.

IX. TEXTBOOKS

Recommended:
EITHER

Katzung, B. G., Masters, S.B. and Trevor, A.J. Basic and Clinical Pharmacology 12th Edition. McGraw Hill: Norwalk, CT. 2011.

- Available in the Inkling Format for iPad
- Also available through Access Medicine

This is a textbook that is used by many Pharmacology courses at other Medical Schools around the country- it is the companion textbook to the Board Review book listed below. 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.

OR

Katzung, B.G. and Trevor, A.J. Pharmacology: Examination and Board Review 9th Edition. McGraw Hill: Norwalk, CT., 2010.

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.

X. ADDITIONAL TEXTBOOKS AND E-RESOURCES

A. Textbooks.

~~1.~~1. Goodman & Gilman's The Pharmacological Basis of Therapeutics 12th Edition. McGraw Hill: NY 2010.

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.

- available in the Inkling format for iPad
- also available through Access Medicine

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

Note: The 2nd Edition will be released December 2013

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.

~~2.~~3. Howland & Mycek. Lippincott's Illustrated Reviews, Pharmacology 5th Edition., Lippincott Williams &Wilkins, 2011.

A "user friendly" textbook 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.

B. Review Books

~~3.~~4. Pazdernik & Kerecsen Rapid Review: Pharmacology, 3rd Edition Elsevier, 2010.

An excellent review book that provides essential facts and information for each of the major drug classes in a succinct user-friendly format- includes many excellent charts and figures. Highly recommended as a board review study aid to complement the lecture handouts provided in the course.

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5. Gleason, DejaReview Pharamacology, 2nd Edition, McGraw Hill, 2010.
An excellent resource for exam preparation. Essentially Pharm flash cards in a book format. Provides numerous active recall questions on each of the key topics that allows the student to gauge their study progress.

C. E-Resources

1. ACPMedicine (Scientific American Medicine)

~~2.~~*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.*

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~~1.~~2. Up-to-Date

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

This website is available through computers on campus and can be accessed via the library web site (under quick links). It provides access to an extensive searchable and clickable database of excellent articles and monographs on specific disease conditions and the medications used to treat them. 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 pharmacological information that is widely used on the clinical floors.

3. 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.

4. The Knowledge Objectives in Medical Pharmacology.

URL
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

Name: Neil A. Clipstone, Ph.D.
Associate Professor of Pharmacology
Location: SSOM Rm 320
Phone/Contacts: Office- x66195
Email – nclipstone@lumc.edu

ASSISTANT COURSE DIRECTOR

Name: Debra Hoppensteadt, Ph.D.
Associate Professor of Pathology and Pharmacology
Location: Bldg 102, Room 2643
Phone/Contacts: Office – x64625
Email – dhoppen@lumc.edu

EDUCATION SPECIALIST

Name: Jackie Greer
Location: Bldg 120, Room 320
Phone/Contacts: Direct – x68083
Email – jgreer@lumc.edu

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 2013-2014

Instructor	Department Address	Phone	E-mail address
Asconape, Jorge M.D.	Neurology,		jasconape@lumc.edu
Bakowska, Joanna Ph.D.	Pharmacology, Bld 102 Rm 3636	6-8427	jbakowska@lumc.edu
Battaglia, George Ph. D.	Pharmacology, Bld. 102, Rm. 3631	6-5680	gbattag@lumc.edu
Byram, Scott M.D.			sbyram@lumc.edu
Byron, Ken, Ph. D.	Pharmacology, Bld. 102, Rm. 2720	7-2819	kbyron@lumc.edu
Clipstone, Neil, Ph. D.	SSOM Rm 320	6-6195	nclipstone@lumc.edu
Cuevas, Bruce Ph.D.	Pharmacology, Bld. 102, Rm. 3657	6-6408	bcuevas@lumc.edu
Fareed, Jawed, Ph. D.	Pathology, Bld. 102, Rm. 2652	6-5581	jfareed@lumc.edu
Gallagher, Thomas, Ph.D.	Microbiology, Bld. 105, Rm. 3812	6-4850	tgallag@lumc.edu
Hoppensteadt, Debra, Ph.D.	Pathology, Bld. 102, Rm 2643	6-4625	dhoppen@lumc.edu
Gentile, Saverio, Ph.D.	Pharmacology, Bld 102	6-3263	sagentile@lumc.edu
Hecht, David M.D.			dhecht@lumc.edu
Johnson, Stuart, M.D.	Inf. Disease, Bld. 54, Rm. 149	6-3232	sjohnson@lumc.edu
Kennedy, Richard, Ph. D.	Research Svcs., Bld. 120, Rm. 411	6-8434	rkennedy@lumc.edu
Kini, Ameet, M.D.	Pathology, Bld. 110, Rm. 2220	7-2611	akini@lumc.edu
Kristopaitis, Theresa, M.D.	Medicine, Bld. 54, Rm. 109	6-8757	tkristo@lumc.edu
Marchese, Adriano, Ph. D.	Pharmacology, Bld. 102, Rm. 2720	6-3456	amarchese@lumc.edu
Majetschak, Matthias, M.D., Ph.D.	BSTI, EMS 110	7-2472	mmajetschak@lumc.edu
Micetich, Kenneth, M.D.	Hematology/Oncology, Bld. 112, Rm. 246	7-3144	kmiceti@lumc.edu
Michelfelder, Aaron			amichel@lumc.edu
O'Keefe, Paul M.D.			pokeefe@lumc.edu
Pachucki, Constance, M.D.	Infectious Disease Hines	(7) 241-6635	constance.pachucki@med.va.gov
Patel, Tarun, Ph. D.	Pharmacology, Bld. 102, Rm. 3621	6-3261	tpatel7@lumc.edu
Quinn, Andrea, Pharm. D.	Hickory Hills Primary Care Center	(7) 233-6897	aquinn@lumc.edu
Rana, Ajay Ph.D.	Pharmacology, Bld, 101 Rm 2700	6-5761	arana@lumc.edu
Rana, Basabai Ph.D.	Gastroenterology, Bld 102 Rm 6631	6-8476	brana@lumc.edu
Robinson, John, M.D.	Rheumatology, Bld. 54, Rm. 113	6-5139	jrobins@lumc.edu
Samarel, Allen, M.D.	Cardiovasc. Research Bld. 110, Rm. 5222	7-2821	asamare@lumc.edu
Schilling, David, M.D.	Psychiatry, Bld. 105, Rm. 1940	6-5073	dschil1@lumc.edu
Scrogin, Karie, Ph. D.	Pharmacology, Bld. 102, Rm. 2723A	6-5652	kscrogi@lumc.edu

Jackie Greer
Education Specialist
Bld. 120, Rm
68083
jgreer@lumc.edu