MSP graduate program at Emory

Coursework in Pharmacology and Physiology

National Meeting of Directors of
Graduate Studies in Pharmacology
Nashville 2005

Historical perspective

- Pre-1988
  - Departmental-based program
    - Introductory graduate pharmacology (2 hrs)
    - Medical Physiology (2 x 8 hrs)
    - Medical Pharmacology
- 1988
  - Interdepartmental Program in Physiological and Pharmacological Sciences
    - Introductory graduate pharmacology (expanded:3 hrs)
    - Medical Physiology
    - Medical Pharmacology (elective)

Historical perspective

- 1995
  - Molecular Therapeutics and Toxicology
    - Expand Intro Pharm course to 4 hrs
    - Integrate necessary physiology
- 2000
  - Molecular and Systems Pharmacology
    - Split out Drug Metabolism and Toxicology to separate course
    - Expand scope of Intro Pharm, especially physiology
- 2004
  - New core course in Principles of Basic Biological and Biomedical Sciences includes sections on Pharmacology
    - Frees up space in Intro Pharmacology for more systems/ disease/drug class-based topics

IBS 555/556 Principles of Basic Biomedical and Biological Sciences

Summary of modules

- Fall - 555
  - Introduction
  - Macromolecules and methods to study them
  - The nucleus: chromatin organization replication, and repair
  - The nucleus and gene expression: Transcription through translation
  - Proteins and Enzymes
  - Membranes, organelles and trafficking
- Spring - 556
  - Signaling
  - The cell cycle
  - The cytoskeleton
  - Genetics
  - Cell-cell interactions
  - Development
  - Immunology
  - Disease
    - Cancer
    - Neurodegenerative

Former Introductory Pharmacology lectures covered in IBS 555/556

Electrical properties of membranes I
Electrical properties of membranes II
Ion channels: structure/function I
Ion channels: structure/function II
The neuron: structure and biology
How to make a brain; cell type and organization
The synapse I: organization and pharm. tools
The synapse II: neuromuscular junction as model
The synapse III: presynaptic mechanisms
The synapse IV: postsynaptic mechanisms

GPCRs
GPCRs - regulation of number, location, and activity
G proteins as molecular switches
G protein effectors & RGS proteins
G protein regulated second messengers
Lipid Signaling
Ras & the Superfamily I
Ras & the Superfamily II
Receptor tyrosine kinases I
Receptor Tyrosine Kinases II
Protein kinases and phosphates I
Protein kinases and phosphates II

IBS 531 Principles of Pharmacology Syllabus

Quantitative Aspects of Drug Action
Molecular basis of specificity: Principles of drug action
Classification of receptors, molecular basis of subtypes
The law of mass action, concentration-response relationships
Agonists: The link between recognition and effect
Antagonists

Drug Disposition
Drug absorption
Drug distribution
Drug excretion and metabolism
Pharmacokinetics

Peripheral Nervous System
Neuroeffector junction drugs I: Introduction
Neuroeffector junction drugs II: Parasympathetic
Neuroeffector junction drugs III: Ganglion and neuromuscular blocking drugs
Neuroeffector junction drugs IV: Sympathomimetics
Neuroeffector junction drugs V: Sympathetic antagonists

Neuropharmacology
Organization of the central nervous system
Mechanisms and therapy of seizure disorders
Control of Arousal I: Gen. anesth., sedative/hypnotics, alcohol
Control of Arousal II: Stimulants and hallucinogens
Strategies of pain therapy
Altered responsiveness to drugs: Tolerance, physical dependence
Stimulus properties of drugs and drug abuse
Drug treatment of degenerative disorders: Parkinson's and Alzheimer's Diseases
Therapeutic Approaches to Psychiatric Disorders I: Psychoses
Therapeutic Approaches to Psychiatric Disorders II: Affective

IBS 531 Principles of Pharmacology Syllabus

Cardiovascular and Renal Pharmacology
Muscle Physiology I
Muscle Physiology II
Overview of the circulation
Neural and humoral control of the circulation
Cardiac Function
Cardiac Conduction and Rhythm
Myocardial Ischemia
Myocardial Failure
Anticoagulant,thrombolytic and stroke drugs
Overview of renal physiology
Renal drugs
Anti-hypertensive drugs
Anti-hyperlipidemic drugs

Treatment of Cancer and Infectious Diseases
Infection therapeutics I: Anti-viral
Infection therapeutics II: Antibiotics
Infection therapeutics III: Antibiotics
Cancer therapeutics I
Cancer therapeutics II

Anti-inflammatory and Immunosuppressant drugs
Anti-inflammatory drugs I: Prostaglandins and other eicosanoids
Anti-inflammatory drugs II: Anti-histamines and glucocorticoids
Immunosuppressants
Drugs used in the treatment of asthma

Endocrine and Gastrointestinal drugs
Contraceptives
Insulin and anti-diabetic drugs
Gastrointestinal drugs

IBS 531 Principles of Pharmacology Syllabus

Cardiovascular and Renal Pharmacology
Muscle Physiology I
Muscle Physiology II
Overview of the circulation
Neural and humoral control of the circulation
Cardiac Function
Cardiac Conduction and Rhythm
Drugs used in myocardial ischemia
Drugs used in myocardial failure
Anticoagulant, thrombolytic and stroke drugs
Overview of renal physiology
Renal drugs
Anti-hypertensive drugs
Anti-hyperlipidemic drugs

Treatment of Cancer and Infectious Diseases
Infection therapeutics I: Anti-viral
Infection therapeutics II: Antibiotics
Infection therapeutics III: Antibiotics
Cancer therapeutics I
Cancer therapeutics II

Anti-inflammatory and Immunosuppressant drugs
Anti-inflammatory drugs I: Prostaglandins and other eicosanoids
Anti-inflammatory drugs II: Anti-histamines and glucocorticoids
Immunosuppressants
Drugs used in the treatment of asthma

Endocrine and Gastrointestinal drugs
Contraceptives
Insulin and anti-diabetic drugs
Gastrointestinal drugs

Sample lecture outlines

Neuroeffector junction drugs IV: Sympathomimetics Hall

Anatomy & physiology of the sympathetic nervous system
Drug targets at sympathetic nervous system synapses
G protein-coupled receptor signaling pathways
Sympathomimetic drugs: epinephrine, albuterol, amphetamine, etc.

Contraceptives Feng

Menstrual cycle and hormonal control
Mechanisms of hormonal-based contraception: negative feedback.
Estrogens and progestins
- receptors
- synthetic and natural

Clomiphene
Mifepristone

IBS 532 Drug Metabolism and Toxicology

Biotransformation

Introduction to biotransformation: inactivation, bioactivation, reactive intermediates
Cytochrome P450 I
Cytochrome P450 II and other oxidation enzymes
Epoxide hydrolase; quinone oxidoreductase; conjugation enzymes
Metabolism of toxic compounds I
Metabolism of toxic compounds II
Induction and inhibition of metabolizing enzymes
Genetic variation in drug response and toxicity

Toxicology: general principles

Overview of Toxicology
Toxicity endpoints : Descriptive animal toxicology, in vitro toxicity tests
Risk assessment and regulatory toxicology I
Risk assessment and regulatory toxicology II
Mechanisms of Cellular Toxicity I: Bioenergetics
Mechanisms of Cellular Toxicity II: Disruption of ionic homeostasis
Mechanisms of Cellular Toxicity III: Oxidative stress
DNA damage and repair
Principles of mutagenesis and carcinogenesis
Carcinogens and anticarcinogens: Experimental models and assays
Developmental toxicology I
Developmental toxicology II
Acute poisoning and treatment

Toxicology: specific toxins

Receptor-mediated toxicity: Ah receptor
Hypersensitivity and autoimmune reactions
Alcohols I: CNS toxicity
Alcohols II: systemic toxicity
Heavy metals

Current required courses

Year 1

- 555 BBBS (6)
- 531 Pharm (4)
- 570r Graduate Seminar (2)
- 597r Rotations (2)

- 556 BBBS (6)
- 532 Drug Metab. Toxicol (2)
- 570r Graduate Seminar (2)
- 597r Rotations (2)

Year 2

- 537 Frontiers Mol. Pharm (1)
- 570r Graduate Seminar (2)
- IBS 606 Values in Science

- 538 Design and Analysis of Experiments (4)
- 570r Graduate Seminar (2)

Year 3

- 790r Advanced Graduate Seminar (1)