

## **New Pharmacology Course!!!**

### **Pharmacology 3620: Human Pharmacology and Therapeutic Principles**

The Department of Physiology and Pharmacology is excited to introduce a new 3<sup>rd</sup> year course in Pharmacology – Pharm 3620: *Human Pharmacology and Therapeutic Principles*. This will be a full year systems-based pharmacology course that will examine drugs used to treat diseases that affect various organs of the body (e.g. cardiovascular disease, neurological diseases, etc.) and some fundamental principles. There will be emphasis on how the drugs target the organ, the mechanisms of the drug action, and adverse effects of the drugs on the system.

The topics in Pharmacology 3620 will be aligned closely with the topics in Physiology 3120 (Human Physiology – a course strongly recommended as a co-requisite). As a result, you will learn how a particular organ system works in physiology and then, in Pharm 3620, you will learn about the diseases that affect that system and how the drugs work to target and treat the diseases.

Some of the drugs that will be examined include:

- Drugs for neurological diseases including seizures, anxiety, Parkinson's disease, depression, psychosis, treatment of pain, local and general anesthetics, and drugs that target the autonomic nervous system.
- Drugs that act on bacteria, viruses (including AIDS) and ones used to treat cancer (chemotherapy)
- Drugs for cardiovascular diseases including heart failure, angina, arrhythmias and hypertension
- Drugs for endocrine diseases that affect the thyroid gland, diabetes (type 1 and 2), fertility problems, cholesterol problems, obesity, osteoporosis
- Drugs for gastrointestinal diseases such as peptic ulcers and inflammatory diseases
- Over the counter drugs. The types of over the counter drugs, their effectiveness and concerns with their use.

This course will replace the existing Pharmacology 3550b and 3560a.

Both Pharmacology 3620 and Physiology 3120 will be required in the Honors Specialization and Specialization modules in Physiology and Pharmacology, as well as in the Honors Specialization, Specialization, Major and Minor modules in Pharmacology.

Antirequisite(s): the former Pharmacology 3550A/B, 3560A/B; the former Pharmacology and Toxicology 357

Prerequisite(s): Biochemistry 2280A; Biology 2382B

Pre- or corequisite(s): Physiology 3120 is **strongly** recommended  
2 lecture hours per week, 1.0 course

Assessment methods: 2 online or in-class quizzes (worth roughly 15%), midterm (roughly 30-40%) and final exam (roughly 50-60%) – all multiple choice exams

### **Tentative Schedule and Contents:**

- Week 1      Introduction 1 – objectives and theme, resources, definitions, evaluations etc.
- Introduction 2 – What is a drug, chemical nature of drugs , drug targets, kinetic and dynamic concepts, ADME, sources of drugs, routes of administration, drug discovery, regulatory oversight
- Week 2      Pharmacokinetics 1 – Absorption, effect of pH, transport, non-specific binding, plasma levels
- Pharmacokinetics 2 – One compartment kinetics, Vd, Ct, C0, clearance,  $t_{1/2}$  , first/zero order, multiple dosing, IV infusion, importance in drug discovery
- Week 3      Drug Metabolism 1 – Kinetics of metabolism, phase 1&2 reactions, cytochrome P450 enzyme system
- Drug Metabolism 2 – Induction, inhibition, polarity, elimination, implications for drug interactions, personalized medicine
- Week 4      Pharmacogenetics 1 – Genomic determinants of drug ADME, receptors and other targets, drug interactions
- Pharmacogenetics 2 – Implications for therapy, personalized medicine, isoniazid, dibucaine etc.
- Week 5      Pharmacodynamics 1 – Pharmacological analysis, graded/quantal D/R relationships agonists (partial and full) , antagonists competitive, non-competitive, potency, efficacy, spareness.
- Pharmacodynamics 2 – Drug targets; G protein-coupled receptors, trans-membrane enzymes, signaling
- Week 6      Pharmacodynamics 3 – Drug targets; Ligand-gated ion channels, nuclear targets
- Week 7      Routes of administration – Properties, advantages/disadvantages, kinetics, metabolism, toxicological considerations
- Quiz
- Introduction to Neuropharmacology 1 – Brief CNS anatomy, neurotransmitters, drug targets
- Week 8      Introduction to Neuropharmacology 2 – Overview of CNS diseases, neurodegenerative, seizure, anxiety, traumatic, etc.

- Drugs for Anxiety – GABA receptors, BZ activity, kinetics, barbiturates
- Week 9      Drugs for Seizures – Underlying pathophysiology, drug targets, metabolism esp. phenytoin, zero order kinetics
- Drugs for Parkinson’s disease – Nature of neurodegenerative disorder, dopaminergic system, agonists, enzyme inhibitors, MAO
- Week 10     Drugs for Depression – Underlying pathophysiology, mechanisms, SSRIs, C3s, MAO inhibitors, drug-food interactions
- Drugs for Psychoses – Underlying pathophysiology, dopaminergic transmission, history (CPZ), typical/atypical drugs, EP effects, other receptors
- Week 11     Introduction to Sensory Neuropharmacology – Brief neuroanatomy, brief review of nerve function (ap), pain pathways
- Drugs for Treatment of Pain – Opioid receptors and drugs, endogenous opioids, NSAIDs, COX-selective drugs, other drugs
- Week 12     Local Anesthetics - Microanatomy, Na<sup>+</sup> channel function, pH/pK, ester and amide drugs
- General Anesthetics - History, membrane expansion theories, GABA receptors and presumed mechanism, stages of anesthesia, MAC, volatile drugs, second gas, IV drugs
- Week 13     Introduction to Autonomic Neuropharmacology – Neuroanatomy, neurotransmitters, synthesis, uptake, transport, drug targets
- Drugs acting at the Cholinergic Nervous System – Agonists, antagonists, AChE inhibitors, drugs acting at other targets, GI and respiratory effects
- [Midterm Exam]
- [Xmas]
- Week 14     Drugs acting at the Adrenergic Nervous System 1 – Adrenergic receptors, Agonists, antagonists
- Drugs acting at the Adrenergic Nervous System 2 – Cardiovascular effects of adrenergic drugs, renal and respiratory effects, indirect agonists
- Week 15     Introduction to Chemotherapy – Concepts, molecular targets, principles of therapy, mechanisms underlying selectivity

Drugs used in Bacterial Infection 1 – Brief review of bacterial phylogeny, bacterial spectrum, Gram staining, bacteriostatic/bacteriocidal drugs, cell wall synthesis inhibitors, lactamases

Week 16 Drugs used to treat Bacterial Infection 2 – Protein synthesis inhibitors, targets, mechanisms, concept of synergism

Drugs used to treat Bacterial/Viral Infection – Additional antibacterial drugs, viral targets and drugs, resistance, MRSA, VRE, TB, AIDS

Week 17 Drugs used to treat Cancer 1 – Concepts underlying cancer chemotherapy, cell cycle, targets, alkylating drugs, antimetabolites

Drugs used to treat Cancer 2 – Microtubule inhibitors, relevant antibiotics, monoclonal antibodies (Herceptin)

Week 18 Introduction to Cardiovascular Pharmacology – Concepts, underlying pathophysiology, drug targets

Drugs used to treat Cardiovascular Disease 1 – Drugs used in treatment of heart failure

Week 19 Drugs used to treat Cardiovascular Disease 2 – Drugs used to treat angina

Drugs used to treat Cardiovascular Disease 3 – Drugs used to treat arrhythmias

Week 20 Drugs used to treat Cardiovascular Disease 4 – Drugs used to treat hypertension 1, importance, scope of problem, drug targets, mechanisms

Drugs used to treat Cardiovascular Disease 5 – Drugs used to treat hypertension 2, additional drugs, targets, mechanisms, diuretic drugs, targets, mechanisms

### Quiz

Week 21 Introduction to Endocrine Pharmacology – Brief review of anatomy, concepts, insufficiency, replacement therapy, antagonism, targets

Drugs used to treat Thyroid Disease – Hypothyroidism, T3/T4 replacement, hyperthyroidism, antithyroid drugs, targets, mechanisms

Week 22 Drugs used to treat Type 1 Diabetes – Underlying pathophysiology, history of insulin, dynamics and kinetics of insulin replacement

Drugs used to treat Type 2 Diabetes – orally active drugs, targets, mechanisms, sulfonamides, meglitinides, biguanides, thiazolidenediones, gliptins, DPP4 inhibition

- Week 23      Drugs used to treat Inflammatory Diseases – Underlying pathophysiology, adrenocorticosteroids, glucocorticoids, mineralocorticoids, mechanism, targets, adverse effects
- Drugs used to Manipulate Fertility – Reproductive steroids, mechanisms, targets, OCPs environmental estrogens, androgens
- Week 24      Drugs used to treat Hyperlipidemia – Underlying pathophysiology and biochemistry, lipoproteins, hypercholesterolemia, statins, fibrates, mechanisms
- Drugs used to treat Obesity– underlying pathophysiology, targets, mechanisms
- Week 25      Drugs used to treat Osteoporosis – underlying pathophysiology, targets, mechanisms
- Drugs used in Gastrointestinal Diseases – Drugs in peptic ulcer disease (PUD), proton pump inhibitors, GERD, drugs used in IBD
- Week 26      What’s Different about Toxicology? – Concepts and definitions, similarities. Differences, importance of routes of administration
- Toxicology 1 – Specific examples of mechanisms of toxicity, airborne, waterborne, exposure
- Week 27      Toxicology 2 – Additional examples of mechanisms of toxicity, elementary risk assessment
- Over-the-Counter drugs – Major groups, presumptive targets, effectiveness, concerns

[Final Exam]