



Course Detailed Description – Procedures of the Course Plan Committee /Faculty of Pharmacy

QF02/0408–2.1E

Department	Pharmacy
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Course Name	Medicinal Chemistry I	Course No.	201411
Prerequisite	201313, 201211, 201335	Credit Hours	2
Number & date of course plan approval		Brief Description	See form QF02/0409

Course Objective	<p>This course will explore the role of organic chemistry in the design and action of drugs. It will address principles of drug discovery, drug development, and drug/receptor interactions, types of chemical bonds involved in drug-receptor interactions, drug mechanism of action, and drug metabolism. Aspects of biochemistry and physical organic chemistry will be covered as necessary to understand the chemistry of drug action and metabolism in the body. This course is designed to introduce the knowledge of the relationship between different classes of pharmaceutical compounds and their physicochemical properties (relation to absorption, distribution, and elimination). It will emphasize on the stereochemical background necessary to understand the drugs activity: optical isomerism, geometric, and conformational. Students will earn basic knowledge of prodrugs concept and their actions.</p>
Intended Learning Outcomes	<p>At the end of this course students will be able to:</p> <ul style="list-style-type: none"> - recognize the physicochemical properties that affect drug bioavailability. - classify the functional groups into acidic, basic, and neutral moieties. - understand the significance of prodrug and its aim. - perceive isosterism and bioisosterism concept in drug modification. - address the metabolic pathways and distinguish between the metabolic phases and their corresponding enzymes. - predict and draw the chemical structures of drug metabolites. - understand drug/receptor complex formation and differentiate between the bonding forces mediating complex formation. - differentiate between enzyme and protein as drug targets. - Understand the mechanism of ligand as agonist, antagonist, partial agonist, activator, (reversible and irreversible) inhibitor, suicide inhibitor, transition-state analogue. - suggest chemical modification for metabolic susceptible moieties. - optimize lead structure to enhance access to the target.

Course Topics	<ol style="list-style-type: none"> 1. Physicochemical Properties in Relation to Biological Action <ul style="list-style-type: none"> - Solubility in water. - Partition coefficient. - Acid/ base partition. - Bonding forces. - Isosterism & Bioisosterism. - Geometric isomers. - Conformational Isomerism. - Optical isomerism. 2. Prodrugs 3. Drug Metabolism (Phase I and Phase II) 4. Making Drugs More Resistant to Enzymatic and Chemical Hydrolysis 5. Making Drugs Less Resistant to Enzymatic and Chemical Hydrolysis 6. Optimizing Hydrophilic/Hydrophobic Properties 7. Receptors as drug targets 8. Enzymes as drug targets 				
Text Books	<ol style="list-style-type: none"> 1- An Introduction of Medicinal Chemistry, 4th edition, Graham Patrick, Oxford University Press, 2008. 2- Foye's Principles of Medicinal Chemistry, 6th edition, Thomas L. Lemke and David A. Williams, Lippincott Williams & Wilkins, 2008. 3- Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, 11th edition, J. N. Delgado and W. A. Remers, Lippincott-Raven, 2005. 				
References	<ol style="list-style-type: none"> 1- Silverman, Elsevier, 2004. 2- Burger's Medicinal Chemistry and Drug Discovery, 6th edition, M. E. Wolff, 2003. 3- The Organic Chemistry of Drug Synthesis, Vol. 1-6, D. Lednicer and L. A. Mitscher, John Wiley and Sons. 				
Grade Determination	1 st Exam = 25% 2 nd Exam = 25% Final Exam = 50%	Practical Course Grade Determination	Course Work = 50% (Reports, Term Papers, Quizes) Final Exam = 50%		
Course Outline					
Week	Hours	Subjects		Chapters in Textbook	Notes

1	1 1	Introduction - Drug discovery from natural products.	Textbook 1-3/	
2	1 1	Physicochemical Properties in Relation to Biological Action - Solubility in water. - Partition coefficient. - Acid/ base partition.	Textbook 1-3/	
3	1 1	Physicochemical Properties in Relation to Biological Action - Bonding forces. - Isosterism & Bioisosterism. - Geometric isomers. - Conformational Isomerism. - Optical isomerism.	Textbook 1-3/	
4	1 1	Prodrugs - Basic concepts. - Prodrugs of functional groups. - Chemical delivery systems.	Textbook 1-3/	
5	1 1	Metabolic Changes of Drugs and Related Organic Compounds - General pathways of drug metabolism. - Sites of drug biotransformation. - Factors affecting drug metabolism.	Textbook 1-3/	
6	1 1	Metabolic Changes of Drugs and Related Organic Compounds - Phase I metabolic pathways.	Textbook 1-3/	
7	1 1	Metabolic Changes of Drugs and Related Organic Compounds - Phase II metabolic pathways	Textbook 1-3/	
8	1 1	Making Drugs More Resistant to Enzymatic and Chemical Hydrolysis - Steric Shield - Electronic Effects of Bioisostere - Stereoelectronic Modification	Textbook 1-3/	
9	1 1	Making Drugs More or Less Resistant to Enzymatic and Chemical Hydrolysis - Metabolic Blockers - Removal or Replacement of Susceptible Groups	Textbook 1-3/	

		- Self- destructive Drugs		
10	1 1	Optimizing Hydrophilic/Hydrophobic Properties <ul style="list-style-type: none"> - Variation of Alkyl or Acyl Substituents to vary polarity - Variation of Polar Substituents to vary polarity - Variation of <i>N</i>-alkyl to vary pKa 	Textbook 1-3/	
Week	Hours	Subjects	Chapters in Textbook	Notes
11	1 1	Optimizing Hydrophilic/Hydrophobic Properties <ul style="list-style-type: none"> - Variation of aromatic to vary pKa - Bioisosteres of Polar Groups 	Textbook 1-3/	
12	1 1	Receptors as Drug Targets <ul style="list-style-type: none"> - Design of Agonists: - Binding Groups - Position of the Binding Groups - Size and Shape - Allosteric Modulators 	Textbook 1-3/	
13	1 1	Receptors as Drug Targets <ul style="list-style-type: none"> - Design of Antagonists: - Antagonists acting at the binding site - Antagonists acting out with the binding site - Antagonists as Molecular Labels - Partial Agonist - Inverse Agonist 	Textbook 1-3/	
14	1 1	Enzyme as Drug Targets <ul style="list-style-type: none"> - Inhibitors acting at the active site of an enzyme - Reversible Inhibitors - Irreversible Inhibitors - Inhibitors acting at the allosteric binding site - Competitive and Non-competitive Inhibitors 	Textbook 1-3/	
15	1 1 1	Enzyme as Drug Targets <ul style="list-style-type: none"> - Transition-state Analogues - Suicide Substrates - Isozyme selectivity of inhibitors - Medical Uses of Enzyme Inhibitors 	Textbook 1-3/	



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Approved by Dept. Chair		Date of Approval	
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Extra Information: (Updated every semester and filled by course instructor)

Course Instructor	Dima A. Sabbah, Ph.D.
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Office hours	10 -11 am (Sun, Mon, Tues, Wed, Thurs.)