

Spring 2024: Medicinal Chemistry (CHM-3209-1)

Course description

This course is an undergraduate elective and a course for PhD program. This course covers the branch of chemistry which deals primarily with the linking of diseases, its mechanisms, development and how they can be modulated or reversed using the chemistry of compounds. The curriculum is designed with an objective to familiarize students with the fundamental concepts of medicinal chemistry in drug discovery, development, uses, and mechanism of drug action. The course is intended for students who have a background in chemistry, biochemistry, biology, biotechnology, pharmacy and interested in the process of medicinal chemistry. Students can gain knowledge of synthetic chemistry, process chemistry, pharmaceutical chemistry, computational chemistry, and basics of chemical understanding in biological mechanism throughout this special course.

Special features This course is aimed at students with a strong interest in the biological aspects of chemistry in drug development in major disease areas. Students will have the opportunity to develop a comprehensive knowledge of chemistry alongside subject-specific and generic skills to develop a strong understanding of application of chemistry in contexts relevant to society and industry. This course also imparts building a strong base for all those who wish to pursue higher education in related fields.

Course outcome

Upon completion of this course, students will have the opportunity to develop a comprehensive subject-specific knowledge and understanding of medicinal chemistry alongside and how chemistry is extensively applied in the field of drug discovery. The intended outcome is to train students on various aspects of new drug discovery/development, target identification, lead discovery, optimization and the molecular basis of drug design and drug action, drug formulation, drug toxicity and bioavailability.

Books and references

1. An Introduction to Medicinal Chemistry, Graham L. Patrick
2. The Organic Chemistry of Drug Design and Drug Action, Richard B. Silverman
3. Fundamentals of Medicinal Chemistry, Gareth Thomas
4. Lehninger's Principles of Biochemistry, Cox and Nelson
5. Burger's Medicinal Chemistry and Drug Discovery, Donald J. Abraham
6. The Handbook of Medicinal Chemistry, Andrew Davis
7. Innovative Drug Synthesis, Jie J. Li and Douglas S. Johnson
8. Fluorine in Medicinal Chemistry and Chemical Biology, Iwao Ojima
9. Heterocyclic Chemistry in Drug Discovery, Jie J. Li
10. Textbook of Medicinal Chemistry, V. Alagarsamy

Course content of Medicinal Chemistry (CHM-3209-1)

1. *Introduction to drug discovery and development*
 - How are the new drugs discovered?
 - How to design a drug molecule?
 - From discovery to human trials: Different phases of investigating a drug molecule
 - How does testing continue after a new drug is approved?
2. *Principles of drug action*
 - Functional group review
 - Stereochemistry
 - Acid-base chemistry
 - Biologically significant heterocyclic compounds
 - Physicochemical properties and drug action
 - Bioisosteric replacement
 - Drug-receptor bonding
3. *Drug metabolism and prodrugs*
 - Drug metabolism
 - Prodrugs
 - Drug formulation
4. *Drug bioavailability and pharmacokinetics*
 - Definition of bioavailability and pharmacokinetics
 - Objectives of bioavailability
 - Methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.
 - Intravenous Injection (Bolus), Intravenous infusion and Extra vascular administrations
5. *Antipsychotic agents*
 - Classical antipsychotic agents: synthesis, mechanism of action, and SAR
 - Non-classical antipsychotic agents
 - Newer drugs
6. *Antidepressants*
 - Classification
 - Mechanism of action
 - Side-effects of antidepressants
 - Monoamino oxidase (MAO) inhibitors
 - Tricyclic antidepressants
 - Atypical antidepressants
 - Miscellaneous drugs
 - Newer drugs

7. *Antibiotics and antiviral agents*

- Available antibiotics for gram-positive and gram-negative bacteria
- Antibiotics resistance
- Anti-HIV agents
- Anti-Herpes Simplex Virus (HSV) Agents
- Sars-Cov-2: Discovery, diagnostics, and drug development

8. *Insulin and oral hypoglycaemic agents*

- Discovery of insulin
- Type-1 and Type-2 diabetes
- Hyperglycaemia and hypoglycaemia
- Oral hypoglycaemic agents
- Strategies for controlling hyperglycaemia.
- Available drugs and their mechanism of action

9. *CNS agents*

- The Blood-Brain Barrier, gatekeeper of the brain
- How to get drugs into the brain? What makes a compound brain-penetrant? The transporter problem.
- Anti-parkinsonism agents
- Muscle relaxants
- Drugs for Alzheimer's disease treatment
- CNS stimulants