澳門理工大學
Universidade Politécnica de Macau
Macao Polytechnic University

FACULTY OF HEALTH SCIENCES AND SPORTS

BACHELOR OF SCIENCE IN BIOMEDICAL TECHNOLOGY (PHARMACY TECHNOLOGY)

LEARNING MODULE OUTLINE

Academic Year	2023-2024	Semester	1
Module Code	BSMC2101		
Learning Module	Medicinal Chemistry		
Pre-requisite(s)	BSOC1102 - Organic Chemistry		
Medium of Instruction	Chinese & English		
Credits	4	Contact Hours	60
Instructor	Dr. Pedro Fong Dr. Tao Yi, Aaron	Email	pedrofong@mpu.edu.mo yitao@mpu.edu.mo
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MODULE DESCRIPTION

This course provides an introduction to the fundamental principles of medicinal chemistry. It covers key concepts in drug discovery, the identification and development of lead compounds, combinatorial chemistry, chiral drugs, structure-activity relationships (SAR), quantitative structure-activity relationships (QSAR), and computer-aided drug design. The teaching format incorporates lectures, tutorials, case studies, laboratory practical, and computer modelling sessions.

MODULE INTENDED LEARNING OUTCOMES (ILOS)

On completion of this learning module, students will be able to:

M1.	Demonstrate an understanding of the basic principles and concepts of medicinal chemistry, including drug discovery and lead compound identification.
M2.	Apply knowledge of combinatorial chemistry in the design and synthesis of potential drug candidates.
M3.	Analyse and interpret structure-activity relationships to evaluate the potency and selectivity of drug molecules.
M4.	Apply computer-aided drug design tools and techniques to assist in the rational design of novel therapeutics.
M5.	Demonstrate proficiency in laboratory practical techniques used in medicinal chemistry research, including synthesis and characterization of drug molecules.
M6.	Communicate scientific concepts effectively through written reports and oral presentations, demonstrating comprehension of medicinal chemistry principles.

These ILOs aims to enable students to attain the following Programme Intended Learning Outcomes (PILOs):

PILOs	M1	M2	M3	M4	M5	M6
P1. To demonstrate understanding of a range of subjects, fields, principles and approaches relevant to pharmacy technology	✓	✓	✓	✓	✓	✓
P2. To demonstrate understanding of theories, analytical approaches and practices that underpin pharmacy operations and management	✓	✓		✓	✓	✓
P3. To demonstrate understanding of major trends and issues related to pharmacy technology	✓				✓	✓
P4. To apply professional knowledge and skills to analyse, interpret and solve problems, challenges and risks in pharmacy practice	✓				✓	
P5. To critically appraise and interpret scientific and clinical literature and apply evidence-based practice	✓	✓			✓	✓
P6. To acquire and apply research skills in pharmacy technology	✓	✓	✓	✓	✓	✓
P7. To demonstrate effective communication and teamwork skills						✓
P8. To maintain professional and ethical standards in pharmacy practice and research	✓	✓	✓	✓	✓	✓

MODULE SCHEDULE, COVERAGE AND STUDY LOAD

Week	Content Coverage	Contact Hours
2	Introduction (Aaron) • Students will be able to describe the key concepts of medicinal chemistry, including lead compound, analogue, SAR, QSAR, pharmacophore, drug-likeness, Lipinski's rules and high-throughput screening.	3
3	Drug structure and solubility (Aaron) • Students will be able to infer solubility from the structure of drugs and illustrate general methods of changing drug solubility.	3
4	Drug targets (Aaron) • Students will be able to describe structures and functions of receptors and enzymes, distinguish between different types of receptors and enzymes, analyze the relationship between drug structure and target affinity, and illustrate general methods of design of agonists and antagonists.	4
5	Practice 1 (Aaron) • Preparation & characterization of aspirin by chemical synthesis in laboratory scale.	4
6	Practice 2 (Aaron) • Accelerated stability test, content determination by UV spectrophotometry	4
8	Stability of drugs and Kinetics of drug stability (Aaron) • Students will be able to describe degradation pathways of pharmaceuticals and accelerated stability test methods, measure	3

	influences of pH and temperature on degradation, and calculate shelf-life by Arrhenius law.	
8	Drug discovery (Pedro) - Students will be able to understand and perform some basic drug discovery processes based on the following topics: • Choosing a disease • Choosing a drug target • Identifying a bioassay • Finding a lead compound • Isolation and purification • Structure determination	2
8/9	Drug design (Pedro) - Students will be able to understand and perform some basic drug design processes based on the following topics: • Optimizing target interactions • Structure-activity relationships • Identification of a pharmacophore • Strategies in drug optimization • Optimizing access to the target • Resistant to chemical and enzymatic degradation • Resistant to drug metabolism • Reducing toxicity • Prodrugs	4
9	Group discussion (Aaron)	3
9	Getting the drug to market (Pedro) - Students will be able to understand the fundamental processes of getting a new drug to market: • Preclinical and clinical trials • Patenting and regulatory affairs • Chemical and process development • Case studies: The design of ACE inhibitors, artemisinin and related antimalarial drugs and the design of oxamniquine	2
9/10	Computers in medicinal chemistry (Pedro) - Students will be able to describe and perform basic techniques on computational chemistry: • Molecular and quantum mechanics • Molecular dimensions and properties • Energy minimization • Docking procedures – manual, automatic, rigid and flexible docking • Automated screening of database for lead compounds • Quantitative structure-activity relationship	5
10	Group discussion (Aaron)	3
11	Review and in-class exercises (Aaron)	3
12	Practical 3 (Pedro) • Ligand Preparation for Molecular Modelling	3
12	Practical 4 (Pedro) • ADMET and CYP Screening	2
13	Practical 5 (Pedro) • Selection of Protein Structures for Molecular Modelling	3
13	Practical 6 (Pedro) • Multiple Target Predictions	2

14	Practical 7 (Pedro) • Docking using online platform	2
14	Practical 8 (Pedro) • Bioisosteric replacement	3
15	Presentation (Pedro)	2

TEACHING AND LEARNING ACTIVITIES

In this learning module, students will work towards attaining the ILOs through the following teaching and learning activities:

Teaching and Learning Activities	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**
T1. Lectures with case studies and real-life examples	✓	✓	✓	✓		
T2. Hands-on laboratory sessions	✓	✓			✓	
T3. Computer modelling exercises	✓	✓	✓	✓		
T4. Literature review and critical analysis	✓	✓	✓	✓		✓
T5. Group discussion and projects	✓	✓	✓	✓	✓	✓
T6. Online resources and virtual tools tutorials	✓			✓		

ATTENDANCE

Attendance requirements are governed by the Academic Regulations Governing Bachelor's Degree Programmes of the Macao Polytechnic University. Students who do not meet the attendance requirements for the learning module shall be awarded an 'F' grade.

ASSESSMENT

In this learning module, students are required to complete the following assessment activities:

Assessment Activities	**Weighting (%)**	**ILOs to be Assessed**
A1. Practice 1 (Aaron)	7.5	M1, M2, M5, M6
A2. Practice 2 (Aaron)	7.5	M1, M2, M5, M6
A3. Group discussion (Aaron)	5	M1, M2, M3, M5, M6
A4. In-class exercises (Aaron)	30	M1, M2, M3, M5, M6
A5. Presentation (Pedro)	15	M1, M2, M3, M4, M6
A6. Small scale research report (Pedro)	35	M1, M2, M3, M4, M6

This learning module is graded on a 100-point scale, with 100 being the highest possible score and 50 being the passing score.

This module does not include a final examination or re-sit examination. Any student attaining less than 90% in practical sessions will be given an "F' grade, regardless of the score achieved in the course works and assignment.

The assessment will be conducted following the University's Assessment Strategy (see www.mpu.edu.mo/teaching_learning/en/assessment_strategy.php). Passing this learning module indicates that students will have attained the ILOs of this learning module and thus acquired its credits.

MARKING SCHEME

High grades will be awarded to work that demonstrates exceptional understanding and mastery of the subject matter and consistently exceeding expectations. The followings are the general assessment criteria for the assessment activities.

Assessment Activities	Assessment Criteria	Mark Ranges				
		88-100	73-87	58-72	50-57	<50
A1. Practice 1 (Aaron)	Demonstrate the understanding of the key concepts and principles covered in the practical session.	Excellent	Good/ Very Good	Satisfactory	Marginal Pass	Fail; not reaching marginal levels
A2. Practice 2 (Aaron)	Demonstrate the ability to interpret and analyse experimental data to draw valid conclusions.	Excellent	Good/ Very Good	Satisfactory	Marginal Pass	Fail; not reaching marginal levels
A3. Group discussion (Aaron)	Active participation and contribution to group discussions, demonstrating effective communication and teamwork skills.	Excellent	Good/ Very Good	Satisfactory	Marginal Pass	Fail; not reaching marginal levels
A4. In-class exercises (Aaron)	Accurate completion of in-class exercises, demonstrating a solid grasp of the underlying concepts and their practical applications.	Excellent	Good/ Very Good	Satisfactory	Marginal Pass	Fail; not reaching marginal levels
A5. Presentation (Pedro)	Demonstration of in-depth research and understanding of the medicinal chemistry aspects covered in the presentation.	Excellent	Good/ Very Good	Satisfactory	Marginal Pass	Fail; not reaching marginal levels
A6. Small scale research report (Pedro)	Comprehensive and well-structured report, presenting a clear research question, methodology, and analysis of findings.	Excellent	Good/ Very Good	Satisfactory	Marginal Pass	Fail; not reaching marginal levels

REQUIRED READINGS

Graham Patrick. (2024) An Introduction to Medicinal Chemistry (7th Edition). Oxford University Press, UK.

Reading materials, such as lecture notes and journal articles, will be provided to the students by the instructors of this module.

REFERENCES

M. E. Aulton. (2013) Aulton's Pharmaceutics: The Design and Manufacture of Medicines (4th edition). Churchill Livingstone, Edinburgh, U.K.

A. Zaihra. (2012) Anticancer tyrosine kinase inhibitors - QSAR and molecular modelling. Lap Lambert Academic Publishing.

G. Thomas. (2007) Medicinal Chemistry. John Wiley & Sons Ltd, England.

STUDENT FEEDBACK

At the end of every semester, students are invited to provide feedback on the learning module and the teaching arrangement through questionnaires. Your feedback is valuable for instructors to enhance the module and its delivery for future students. The instructor and programme coordinators will consider all feedback and respond with actions formally in the annual programme review.

ACADEMIC INTEGRITY

The Macao Polytechnic University requires students to have full commitment to academic integrity when engaging in research and academic activities. Violations of academic integrity, which include but are not limited to plagiarism, collusion, fabrication or falsification, repeated use of assignments and cheating in examinations, are considered as serious academic offenses and may lead to disciplinary actions. Students should read the relevant regulations and guidelines in the Student Handbook which is distributed upon the admission into the University, a copy of which can also be found at www.mpu.edu.mo/student_handbook/.