

**Macao Polytechnic Institute**  
**School of Health Sciences and Sports**  
**Bachelor of Science in Biomedical Technology**  
**(Pharmacy Technology)**

**Module Outline**

Academic Year 2021 / 2022 Semester 1

<b>Learning Module</b>	Pharmacology I			<b>Class Code</b>	BSPY2101
<b>Pre-requisite(s)</b>	Nil				
<b>Medium of Instruction</b>	Chinese / English			<b>Credit</b>	6
<b>Lecture Hours</b>	90 hrs	<b>Lab/Practice Hours</b>	0 hrs	<b>Total Hours</b>	90 hrs
<b>Instructor</b>	Dr. Tao Yi, Aaron		<b>E-mail</b>	yitao@ipm.edu.mo	
<b>Office</b>	Room M707, 7/F, Meng Tak Building, Main Campus		<b>Telephone</b>	8599-3471	

**Description**

This 90-hour learning module is the first in a series of courses that equip students with pharmacological knowledge. The learning module systemically introduces mechanisms of action, pharmacological effects, clinical indications, drug interactions and adverse effects of various drug classes.

**Learning Outcomes**

After completing the learning module, students will be able to:

1. Describe the basic concepts of pharmacology.
2. Discuss the relationship among mechanisms of action, therapeutic effects and adverse effects of different drugs.
3. Describe the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs.

## **Content**

1. Introduction to pharmacology (3 hours)
  - 1.1 General principles
  - 1.2 Pharmacodynamics
  - 1.3 Pharmacokinetics
  - 1.4 The roles of Pharmacology
  - 1.5 Sources of drugs
  - 1.6 How to learn Pharmacology

*(UNDERSTAND: describe the basic concepts of pharmacology)*
  
2. Pharmacokinetics (7 hours)
  - 2.1 Routes of drug administration
  - 2.2 Drug permeation across membranes
  - 2.3 Absorption
  - 2.4 Distribution
  - 2.5 Biotransformation
  - 2.6 Excretion
  - 2.7 Elimination
  - 2.8 Design and optimization of dosage regimen

*(UNDERSTAND: describe the basic concepts of Pharmacokinetics)*
  
3. Drug-receptor interactions and pharmacodynamics (3 hours)
  - 3.1 Mechanism of action of drugs
  - 3.2 Drug receptor
  - 3.3 Dose-response relationship
  - 3.4 Classification of drugs binding to receptor

*(UNDERSTAND: describe the basic concepts of Pharmacodynamics)*
  
4. The autonomic nervous system (2 hours)
  - 4.1 Overview
  - 4.2 Introduction to the nervous system
  - 4.3 Chemical signaling between cells
  - 4.4 Signal transduction in the effector cell

*(UNDERSTAND: describe the functions of the autonomic nervous system)*
  
5. Cholinergic agonists (4 hours)
  - 5.1 Classification of ANS Drugs
  - 5.2 The cholinergic neuron
  - 5.3 Cholinergic receptors (cholinoceptors)

- 5.4 Direct-acting cholinergic agonists
- 5.5 Indirect-acting cholinergic agonists: anticholinesterase agents (reversible)
- 5.6 Indirect-acting cholinergic agonists: anticholinesterase agents (irreversible)
- 5.7 Toxicology of anticholinesterase agents

*(MASTER: discover the relationship among mechanisms of action, therapeutic effects and adverse effects of drugs, memorize the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs)*

6. Cholinergic antagonists (3 hours)

- 6.1 Overview
- 6.2 Antimuscarinic agents
- 6.3 Ganglionic blockers
- 6.4 Neuromuscular-blocking agents

*(MASTER: discover the relationship among mechanisms of action, therapeutic effects and adverse effects of drugs, memorize the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs)*

7. Adrenergic agonists (3 hours)

- 7.1 Overview
- 7.2 The adrenergic neuron
- 7.3 Characteristics of adrenergic agonists
- 7.4 Direct-acting adrenergic agonists
- 7.5 Indirect-acting adrenergic agonists
- 7.6 Mixed-action adrenergic agonists

*(MASTER: discover the relationship among mechanisms of action, therapeutic effects and adverse effects of drugs, memorize the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs)*

8. Adrenergic antagonists (3 hours)

- 8.1 Overview
- 8.2  $\alpha$ -adrenergic blocking agents
- 8.3  $\beta$ -adrenergic blocking agents
- 8.4 Drugs affecting neurotransmitter release or uptake

*(MASTER: discover the relationship among mechanisms of action, therapeutic effects and adverse effects of drugs, memorize the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs)*

**9. Test I (2 hours)**

10. Drugs for neurodegenerative diseases (3 hours)

- 10.1 Overview
- 10.2 Neurotransmission in the CNS
- 10.3 Synaptic potentials
- 10.4 Overview of Parkinson's disease
- 10.5 Drugs used in Parkinson's disease
- 10.6 Drugs used in Alzheimer disease
- 10.7 Drugs used in multiple sclerosis
- 10.8 Drugs used in amyotrophic lateral sclerosis

*(MASTER: discover the relationship among mechanisms of action, therapeutic effects and adverse effects of drugs, memorize the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs)*

## 11. Anxiolytic and hypnotic drugs (2 hours)

- 11.1 Overview
- 11.2 Benzodiazepines
- 11.3 Benzodiazepine antagonist
- 11.4 Other anxiolytic agents
- 11.5 Barbiturates
- 11.6 Other hypnotic agents

*(MASTER: discover the relationship among mechanisms of action, therapeutic effects and adverse effects of drugs, memorize the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs)*

## 12. Antidepressants (3 hours)

- 12.1 Overview
- 12.2 Mechanism of antidepressant drugs
- 12.3 Selective serotonin reuptake inhibitors
- 12.4 Serotonin/norepinephrine reuptake inhibitors
- 12.5 Atypical antidepressants
- 12.6 Tricyclic antidepressants
- 12.7 Monoamine oxidase inhibitors
- 12.8 Treatment of mania and bipolar disorder

*(MASTER: discover the relationship among mechanisms of action, therapeutic effects and adverse effects of drugs, memorize the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs)*

## 13. Antipsychotic drugs (3 hours)

- 13.1 Overview
- 13.2 Schizophrenia
- 13.3 Antipsychotic drugs

*(MASTER: discover the relationship among mechanisms of action, therapeutic effects and adverse effects of drugs, memorize the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs)*

14. Drugs for Epilepsy (3 hours)

14.1 Overview

14.2 Etiology of seizures

14.3 Classification of seizures

14.4 Drug selection

14.5 Antiepilepsy medications

14.6 Status epilepticus

14.7 Women's health and epilepsy

*(MASTER: discover the relationship among mechanisms of action, therapeutic effects and adverse effects of drugs, memorize the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs)*

15. Anesthetics (3 hours)

15.1 Overview

15.2 Patient factors in selection of anesthesia

15.3 Stages and depth of anesthesia

15.4 Inhalation anesthetics

15.5 Intravenous anesthetics

15.6 Neuromuscular blockers

15.7 Local anesthetics

*(MASTER: discover the relationship among mechanisms of action, therapeutic effects and adverse effects of drugs, memorize the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs)*

16. Opioids (3 hours)

16.1 Overview

16.2 Opioid receptors

16.3 Opioid agonists

16.4 Partial agonists and mixed agonist–antagonists

16.5 Other analgesics

16.6 Antagonists

*(MASTER: discover the relationship among mechanisms of action, therapeutic effects and adverse effects of drugs, memorize the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs)*

17. CNS Stimulants (2 hours)

17.1 Overview

17.2 Psychomotor stimulants

17.3 Hallucinogens

*(MASTER: discover the relationship among mechanisms of action, therapeutic effects and adverse effects of drugs, memorize the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs)*

**18. Test II (2 hours)**

19. Antihypertensives (4 hours)

19.1 Overview

19.2 Etiology of hypertension

19.3 Mechanisms for controlling blood pressure

19.4 Treatment strategies

19.5 Diuretics

19.6  $\beta$ -adrenoceptor-blocking agents

19.7 Ace inhibitors

19.8 Angiotensin ii receptor blockers

19.9 Renin inhibitor

19.10 Calcium channel blockers

19.11  $\alpha$ -adrenoceptor-blocking agents

19.12  $\alpha$ -/ $\beta$ -adrenoceptor-blocking agents

19.13 Centrally acting adrenergic drugs

19.14 Vasodilators

19.15 Hypertensive emergency

19.16 Resistant hypertension

19.17 Combination therapy

*(MASTER: discover the relationship among mechanisms of action, therapeutic effects and adverse effects of drugs, memorize the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs)*

20. Diuretics (2 hours)

20.1 Overview

20.2 Normal regulation of fluid and electrolytes by the kidneys

20.3 Thiazides and related agents

20.4 Loop or high-ceiling diuretics

20.5 Potassium-sparing diuretics

20.6 Carbonic anhydrase inhibitor

20.7 Osmotic diuretics

*(MASTER: discover the relationship among mechanisms of action, therapeutic effects and adverse effects of drugs, memorize the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs)*

21. Drugs for heart failure (3 hours)

21.1 Overview

21.2 Physiology of muscle contraction

21.3 Inhibitors of the renin–angiotensin–aldosterone system

21.4  $\beta$ -blockers

21.5 Diuretics

21.6 Vaso- and venodilators

21.7 Inotropic drugs

21.8 Order of therapy

*(MASTER: discover the relationship among mechanisms of action, therapeutic effects and adverse effects of drugs, memorize the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs)*

22. Antiarrhythmics (3 hours)

22.1 Overview

22.2 Introduction to the arrhythmias

22.3 Class I antiarrhythmic drugs

22.4 Class II antiarrhythmic drugs

22.5 Class III antiarrhythmic drugs

22.6 Class IV antiarrhythmic drugs

22.7 Other antiarrhythmic drugs

*(MASTER: discover the relationship among mechanisms of action, therapeutic effects and adverse effects of drugs, memorize the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs)*

23. Antianginal drugs (2 hours)

23.1 Overview

23.2 Types of angina

23.3 Treatment strategies

23.4  $\beta$ -adrenergic blockers

23.5 Calcium channel blockers

23.6 Organic nitrates

23.7 Sodium channel blocker

*(MASTER: discover the relationship among mechanisms of action, therapeutic effects and adverse effects of drugs, memorize the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs)*

24. Anticoagulants and Antiplatelet agents (5 hours)

24.1 Overview

24.2 Thrombus versus embolus

24.3 Platelet response to vascular injury

24.4 Platelet aggregation inhibitors

24.5 Blood coagulation

24.6 Anticoagulants

24.7 Thrombolytic drugs

24.8 Drugs used to treat bleeding

*(MASTER: discover the relationship among mechanisms of action, therapeutic effects and adverse effects of drugs, memorize the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs)*

25. Drugs for hyperlipidemia (3 hours)

25.1 Overview

25.2 Treatment goals

25.3 Drugs for hyperlipidemia

*(MASTER: discover the relationship among mechanisms of action, therapeutic effects and adverse effects of drugs, memorize the classification, clinical indications, mechanism of actions, and significant adverse effects of commonly used drugs)*

**26. Active learning and presentation (10 hours)**

26.1 Neurodegenerative disorders: Parkinson's disease, Alzheimer's disease, multiple sclerosis (MS), and amyotrophic lateral sclerosis (ALS)

26.2 Depression and mania

26.3 Schizophrenia

26.4 Epilepsy

26.5 Hypertension

26.6 Heart failure

26.7 Arrhythmias

26.8 Angina pectoris

26.9 Thrombotic disorders: acute myocardial infarction (MI), deep vein thrombosis (DVT), pulmonary embolism (PE), and acute ischemic stroke

26.10 Hyperlipidemias

**27. Final (2 hours)**



Date	Time	Content
27/09/2021	16:30-18:30	Introduction to pharmacology
28/09/2021	14:30-18:30	Pharmacokinetics (I)
05/10/2021	14:30-18:30	Pharmacokinetics (II)
08/10/2021	11:00-13:00	Drug-receptor interactions and pharmacodynamics
11/10/2021	11:00-13:00	The autonomic nervous system
12/10/2021	14:30-18:30	Cholinergic agonists
15/10/2021	11:00-13:00	Cholinergic antagonists (I)
18/10/2021	11:00-13:00	Cholinergic antagonists (II)
19/10/2021	14:30-18:30	Adrenergic agonists Adrenergic antagonists (I)
22/10/2021	11:00-13:00	Adrenergic antagonists (II)
<b>25/10/2021</b>	<b>11:00-13:00</b>	Review (I) <b>Presentation (I): Neurodegenerative disorders</b>
26/10/2021	14:30-18:30	Drugs for neurodegenerative diseases Anxiolytic and hypnotic drugs (I)
<b>29/10/2021</b>	<b>11:00-13:00</b>	<b>Test I</b>
<b>01/11/2021</b>	<b>14:30-18:30</b>	Anxiolytic and hypnotic drugs (II) <b>Presentation (II): Depression and mania</b>
		Antidepressants (I)
<b>05/11/2021</b>	<b>11:00-13:00</b>	Antidepressants (II) <b>Presentation (III): Schizophrenia</b>
08/11/2021	11:00-13:00	Antipsychotics (I)
<b>09/11/2021</b>	<b>14:30-18:30</b>	Antipsychotics (II) <b>Presentation (IV): Epilepsy</b>
		Drugs for Epilepsy (I)
12/11/2021	11:00-13:00	Drugs for Epilepsy (II) Anesthetics (I)
15/11/2021	14:30-18:30	Anesthetics (II) Opioids (I)
16/11/2021	14:30-18:30	Opioids (II) CNS Stimulants Review (II)
<b>19/11/2021</b>	<b>11:00-13:00</b>	<b>Presentation (V): Hypertension</b> Antihypertensives (I)
23/11/2021	14:30-18:30	Antihypertensives (II) Diuretics (I)
<b>25/11/2021</b>	<b>14:30-18:30</b>	Diuretics (II) <b>Presentation (VI): Heart failure</b>

---

		Drugs for Heart failure (I)
<b>26/11/2021</b>	<b>11:00-13:00</b>	<b>Test II</b>
<b>29/11/2021</b>	<b>14:30-18:30</b>	Drugs for Heart failure (II)
		<b>Presentation (VII): Arrhythmias</b>
		Antiarrhythmics (I)
<b>30/11/2021</b>	<b>14:30-18:30</b>	Antiarrhythmics (II)
		<b>Presentation (VIII): Angina pectoris</b>
		Antianginal drugs
<b>01/12/2021</b>	<b>11:00-13:00</b>	<b>Presentation (IX): Thrombotic disorders</b>
		Anticoagulants and Antiplatelet agents (I)
02/12/2021	14:30-18:30	Anticoagulants and Antiplatelet agents (II)
<b>03/12/2021</b>	<b>11:00-13:00</b>	<b>Presentation (X): Hyperlipidemias</b>
		Drugs for hyperlipidemia (I)
03/12/2021	14:30-16:30	Drugs for hyperlipidemia (II)
		Review (III)
<b>16/12/2021</b>	<b>11:00-13:00</b>	<b>Final exam</b>

---

### **Teaching Method**

Lectures, case studies, active learning, presentations, and class discussion. Approximately 10% of the course contents will be taught using active learning instructional strategies.

### **Attendance**

Attendance requirements are governed by the “Academic Regulations Governing Bachelor’s Degree Programmes of Macao Polytechnic Institute”. Students are not eligible to attend the final examination and re-sit examination, moreover, an “F” will be given as the final grade to students who have less than the stated attendance for the enrolled learning module.

## **Assessment**

This learning module is graded on a 100 point scale, with 100 being the highest possible score and 50 being the passing score. Any students scoring less than 35% of the total mark in the final examination will be given an “F” grade for the course even if the overall grade is 50% or higher.

	<b>Item</b>	<b>Description</b>	<b>Percentage</b>
1.	Presentation	Topic 26	10%
2.	In Class oral Tests	Question answering competitions	5%
3.	Group discussions	Case studies	5%
4.	Test I		25%
5.	Test II		25%
6.	Final exam		30%
<b>Total Percentage:</b>			100%

## **Teaching Material(s)**

### **Textbook(s)**

- Harvey RA, Clark MA, Finkel R, et al. 2018, Lippincott’s illustrated reviews: pharmacology. 7<sup>th</sup> ed. Baltimore, MD: Lippincott Williams & Wilkins.

## **Reference**

### **Reference book(s)**

- Katzung B, Masters S, Trevor A. 2015, Basic and clinical pharmacology. 13<sup>th</sup> ed. New York: McGraw-Hill Medical.
- Brunton L, Chabner B, Knollman. 2011, Goodman and Gilman’s the pharmacological basis of therapeutics. 12<sup>th</sup> ed. New York: McGraw-Hill Professional.
- Lexicomp. 2017, *Drug information handbook: a clinically relevant resource for all healthcare professionals*. 26<sup>th</sup> ed. Lexi-Comp.
- Joint Formulary Committee. 2017, *British National Formulary 73*. Pharmaceutical Press.