

SCBM 452 Pharmacology 1 Academic Year 2564 (2021)

Course description

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SCBM 452 Pharmacology 1

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Principles and mechanisms of dysfunction and diseases of cardiovascular and urinary system, general sensation, pain, analgesics, anesthetics, motor disorders and treatment, neurological disorders and treatment, psychiatric disorders and treatment, sleep, drugs for sleep disorders, epilepsy and treatment, learning memory and dementia, drug abuse and dependence

Course objectives

At the end of this course, the students will be able to

1. Describe the etiology and basic mechanism underlying the common dysfunctions and diseases of cardiovascular, urinary and neurological systems.
2. List and describe the targets and mechanisms of action, clinical indication and adverse effects of drugs acting on cardiovascular, urinary and neurological systems.
3. Apply and integrate knowledge of disease etiology and pharmacology for discussion of prospective drug research.

Course coordinator

Assoc. Prof. Dr. Nattinee Jantaratnotai, Ph.D., MD. nattinee.jan@mahidol.ac.th

Instructors

1. Assoc. Prof. Dr. Nattinee Jantaratnotai, Ph.D., MD. NJ
2. Assoc. Prof. Dr. Supachoke Mangmool, B.Pharm, Ph.D. SM
3. Assoc. Prof. Dr. Noppawan Phumala Morales, Ph.D. NM
4. Assoc. Prof. Dr. Ruedee Hemstapat, B.Sc. (Pharm), Ph.D. RH
5. Asst. Prof. Dr. Pimtip Sanvarinda, M.D., Ph.D. PM
6. Dr. Pansakorn Tanratana, MD., Ph.D. PT
7. Dr. Somchai Yanrojana, M.D., Ph.D. SY

References

1. Goodman and Gilman's The Pharmacological Basis of Therapeutics, 13th ed (2017)
Editors: Laurence Brunton, Bjorn Knollmann, Randa Hilal-Dandan. McGraw-Hill
Education (<https://accessmedicine.mhmedical.com/book.aspx?bookid=2189>)
2. Basic and Clinical Pharmacology, 14th ed (2017) Editor: Katzung B & Trevor A.
McGraw-Hill Education
(<https://accessmedicine.mhmedical.com/book.aspx?bookid=2249>)
3. Rang & Dale's Pharmacology, 9th ed (2019) Editors: James M. Ritter, Rod J. Flower,
Graeme Henderson. Elsevier
Additional research papers may be distributed to students for reading before class.

Assessment

1. Written examination (70%)
2. Performance evaluation (30%)
 - Conference 1 – 7.5%
 - Conference 4 – 7.5%
 - Quiz I, II, III – 15%

Rubric score for conference participation (total = 15 points for each conference)

	Inadequate (1 point)	Need development (3 points)	Satisfactory (5 points)
Punctuality	Arrival after 15 min	Late less than 15 min	On time/Late less than 5 min
Listening	Lack of interest or disrespect for others	Sometimes displays lack of interest	Actively and respectfully listens to peers and instructor
Frequency of participation	Not participate	1-2 times	≥ 3 times
Content	No reference, incorrect information	Reference provided but not reliable	References provided, reliable Correct information
Presentation skill	Difficult to follow, No eye contact	Some organizational of presentation, Speak quite clearly Some eye contact	Good organizational presentation, Speak clearly, good eye contact

Score and grade

The contents of lectures are accounted for 70% (written examination), and student's learning performance in the class is 30%. The final grade will be ranked from F to A, basically based on standard criterion and the rubric score.

Grading will be done using percent points.

Grade

A	≥ 80%
B+	75 - 79%
B	70 - 74%
C+	65 - 69%
C	60 - 64%
D+	55 - 59%
D	50 - 54%
F	below 50%

Schedule SCBM 452

Date: 14 September 2021 – 26 October 2021

Time: Tuesday 09.00-16.00, Thursday 09.00-12.00

Venue: online (Google classroom code: dct7whn)

Week	Date	Time	Topic	Lecturer
1	Tue 14 Sep	8.45-12.00	Orientation L1: Pharmacology of vascular tone L2: Pharmacology of volume regulation L3: Pharmacology of cardiac contraction	NJ SM
		13.00-16.00	L4: Pharmacology of lipid metabolism L5: Pharmacology of cardiac rhythm I L6: Pharmacology of cardiac rhythm II	NM PT
	Thu 16 Sep	9.00-12.00	L7: Pharmacology of hemostasis I L8: Pharmacology of hemostasis II L9: Pharmacology of hematopoiesis	PT
2	Tue 21 Sep	9.00-12.00	Conference 1: Integrated cardiovascular pharmacology: HT and CHF	SM
		13.00-16.00	Conference 2: Formative evaluation & Quiz I: CVS, hemato	NM, PT, SM
	Thu 23 Sep	10.00-12.00	Examination I (L1-9)	TA
3	Tue 28 Sep	9.00-12.00	L10-L12: Drugs used in treatment of GI diseases	SY
		13.00-16.00	L13-14: Drugs for respiratory disorders Self-study	PM
	Thu 30 Sep	9.00-12.00	L15: Introduction to CNS pharmacology L16-17: Antidepressants	NJ
4	Tue 5 Oct	9.00-12.00	L18: Anxiolytic drugs L19: Sedative-hypnotic drugs L20: Antiepileptic drugs	NJ
		13.00-16.00	Conference 3: Formative evaluation & Quiz II: GI, respi, CNS	PM, SY, RH, NJ
	Thu 7 Oct	10.00-12.00	Examination II (L10-20)	TA
5	Tue 12 Oct	9.00-12.00	L21: NSAIDs L22: Opioids L23: CNS stimulants	RH NJ
		13.00-16.00	Conference 4: Drug abuse	NJ
	Thu 14 Oct	9.00-12.00	L24: Local anesthetics L25: General anesthetics L26: Drugs for movement disorders	RH PM
6	Tue 19 Oct	9.00-12.00	L27-28: Antipsychotic drugs and mood stabilizers L29: Drugs for dementia	NJ
		13.00-16.00	Conference 5: Formative evaluation & Quiz III: CNS	NJ, PM, RH
7	Tue 26 Oct	10.00-12.00	Examination III (L21-29)	TA

L1: Pharmacology of vascular tone

Lecturer: Supachoke Mangmool, Pharmacology, Faculty of Science

Date/Time: 14 September 2021, 9:00-10:00

Learning Objectives:

Students should be able to:

1. Explain the mechanism of regulation of vascular tone.
2. Describe the mechanisms of vasodilators.
3. Distinguish the classification of vasodilators.
4. Describe the clinical uses of vasodilators.

Content Outline:

1. Physiology of blood vessel and mechanism of contraction and relaxation of blood vessel
2. Classification of vasodilators
3. Site of action and mechanism of action of vasodilators
4. Pharmacological effects, pharmacokinetics, adverse drug reactions, drug interaction, contraindication of vasodilators
5. Clinical uses of vasodilators (hydralazine, minoxidil, sodium nitroprusside, organic nitrates, renin inhibitors, angiotensin-converting enzyme inhibitors, angiotensin receptor antagonists, calcium channel blockers, α_1 -blockers, endothelin receptor antagonists, neprilysin inhibitors)
6. Selection of vasodilators for treatment of hypertension

Learning Organization:

1. Studying materials provided in advance.
2. Lecture 50 minutes.
3. Question and answers 10 minutes.

Learning Materials:

PowerPoint lecture presentation

References:

1. Westfall TC, Westfall DP. Adrenergic agonists and antagonists. In: Brunton LL, editor. Goodman and Gilman's: The Pharmacological Basis of Therapeutics. 12th Ed. New York: McGraw-Hill; 2011. p. 277-334.
2. Hilal-Dandan R. Renin and angiotensin. In: Brunton LL, editor. Goodman and Gilman's: The Pharmacological Basis of Therapeutics. 12th Ed. New York: McGraw-Hill; 2011. p. 721-744.
3. Chong DY, Michel T. Pharmacology of vascular tone. In: Golan DE, editor. Principle of Pharmacology: The Pathophysiologic Basis of Drug Therapy. 3rd Ed. Philadelphia: Lippincott Williams & Wilkins; 2012. p. 353-371.
4. Katzung BG, Chatterjee K. Vasodilators & the treatment of angina pectoris. In: Katzung BG, Masters SB, Trevor AJ, editors. Basic & Clinical Pharmacology, 12th Ed. New York: McGraw-Hill ; 2012, p 193-210.
5. Rang HP, Ritter JM, Flower RJ, Henderson G. The vascular system. RANG and DALE's Pharmacology. 8th Ed. Philadelphia: Churchill Livingstone; 2016. p. 265-284.
6. Vardeny O, Miller R, and Solomon SD. Combined Neprilysin and renin-angiotensin system inhibition for the treatment of heart failure. JACC: Heart Failure. 2014;2:663-70.

Student Assessment:

MCQ exam

L2: Pharmacology of volume regulation

Lecturer: Supachoke Mangmool, Pharmacology, Faculty of Science

Date/Time: 14 September 2021, 10:00-11:00

Learning Objectives: Students should be able to

1. Explain the function of kidney and urine formation process
2. Distinguish classification of diuretics
3. Know mechanism of action, pharmacological effects, pharmacokinetics, adverse drug reactions, precaution & warning, drug interaction, contraindication of diuretics
4. Describe the clinical uses of diuretics

Content Outlines:

1. Classification of diuretic agents based on chemistry, site, and mechanism of action.
2. Effect of diuretics on renal physiology
3. Pharmacological effects, pharmacokinetics, adverse drug reactions, precaution & warning, drug interaction, contraindication of diuretics
4. Use of diuretics in clinical practice

Learning Organization:

1. Studying materials in advance
2. 50-minute lecture
3. Question-and-answer session for 10 minutes

Learning Material Provided:

PowerPoint lecture presentation

References:

1. Reilly RF, Jackson EK. Regulation of renal function and vascular tone. In: Brunton LL, editor. Goodman and Gilman's: The Pharmacological Basis of Therapeutics. 12th Ed. New York: McGraw-Hill; 2011. p. 671-720.
2. Bhattacharya M, Alper SL. Pharmacology of volume regulation. In: Golan DE, editor. Principle of Pharmacology: The Pathophysiologic Basis of Drug Therapy. 3rd Ed. Philadelphia: Lippincott Williams & Wilkins; 2012. p. 332-352.
3. Katzung BG, Chatterjee K. Vasodilators & the treatment of angina pectoris. In: Katzung BG, Masters SB, Trevor AJ, editors. Basic & Clinical Pharmacology, 12th Ed. New York: McGraw-Hill ; 2012, p 193-210.
4. Rang HP, Ritter JM, Flower RJ, Henderson G. The kidney and urinary system. RANG and DALE's Pharmacology. 8th Ed. Philadelphia: Churchill Livingstone; 2016. p. 355-366.
5. Ernst ME and Moser M. Use of diuretics in patients with hypertension. *N Engl J Med*. 2009;361:2153-64.

Student Assessment:

MCQ exam

L3: Pharmacology of cardiac contraction

Lecturer: Supachoke Mangmool, Pharmacology, Faculty of Science

Date/Time: 14 September 2021, 11:00-12:00

Learning Objectives:

Students should be able to:

1. Explain the mechanism of contraction and relaxation of the heart
2. Explain cellular pathophysiology of contractile dysfunction
3. Distinguish classification of inotropic drugs

4. Explain mechanisms of action, pharmacologic effects, pharmacokinetics, adverse drug reaction (ADR), drug interaction, contraindication and indication of inotropic drugs
5. Discuss the uses of inotropic drugs for treatment of contractile dysfunction

Content Outline:

1. Physiology of the heart and mechanism of contraction/relaxation of the heart
2. Pathophysiology of contractile dysfunction
3. Classification of inotropic drugs
 - 3.1 Digitalis: digoxin, digitoxin
 - 3.2 Other positive inotropic drugs: catecholamine beta adrenoceptor agonists, phosphodiesterase inhibitors, calcium-sensitizing agents
4. Pharmacological effects, pharmacokinetics, adverse drug reactions, precaution & warning, drug interaction, contraindication of inotropic drugs
5. Use of inotropic drugs in clinical practice

Learning Organization:

1. Studying materials provided in advance.
2. Lecture 50 minutes.
3. Question and answers 10 minutes.

Learning Materials:

PowerPoint lecture presentation

References:

1. Maron BA, Rocco TP. Pharmacotherapy of congestive heart failure. In: Brunton LL, editor. Goodman and Gilman's: The Pharmacological Basis of Therapeutics. 12th Ed. New York: McGraw-Hill; 2011. p. 789-814.
2. Chong DY, Michel T. Pharmacology of cardiac contractility. In: Golan DE, editor. Principle of Pharmacology: The Pathophysiologic Basis of Drug Therapy. 3rd Ed. Philadelphia: Lippincott Williams & Wilkins; 2012. p. 422-436.
3. Katzung BG. Drugs used in heart failure. In: Katzung BG, Masters SB, Trevor AJ, editors. Basic & Clinical Pharmacology, 12th Ed. New York: McGraw-Hill ; 2012, p 211-226.
4. Rang HP, Ritter JM, Flower RJ, Henderson G. The heart. RANG and DALE's Pharmacology. 8th Ed. Philadelphia: Churchill Livingstone; 2016. p. 247-264.
5. Hasenfuss G, Teerlink J. Cardiac inotropes: current agents and future directions. *Eur Heart J.* 2011;32:1838-45

Student Assessment:

MCQ exam

L4: Pharmacology of lipid metabolism

Lecturer: Noppawan Phumala Morales, Pharmacology, Faculty of Science

Date/Time: 14 September 2021, 13:00-14:00

Learning Objectives:

Students should be able to:

1. Describe pathways of lipoprotein metabolism.
2. Explain the pathogenesis of atherosclerosis and the consequences.
3. Discuss mechanisms, clinical uses, and adverse effects of drugs used to treat dyslipidemia.

Content Outline:

1. Classification and functions of lipoproteins
2. Lipoprotein metabolism
3. Pathophysiology and classification of dyslipidemia
4. Etiology and consequences of atherosclerosis

5. Pharmacological treatment of dyslipidemia
 - a. Inhibitors of cholesterol synthesis
 - b. Inhibitors of bile acid absorption
 - c. Inhibitors of cholesterol absorption
 - d. Fibrates
 - e. Niacin
 - f. Omega-3 fatty acids

Learning Organization:

1. Studying materials provided in advance.
2. Lecture 50 minutes.
3. Question and answers 10 minutes.

Learning Materials:

PowerPoint lecture presentation

References:

1. Malloy MJ, Kane JP. Agents used in dyslipidemia. In: B G. Katzung, S B. Masters, A J. Trevor, editors. Basic & Clinical Pharmacology, 12th Ed.: New York: McGraw-Hill; 2012, p 619-34.
2. Cohen DE, Armstrong EJ. Pharmacology of cholesterol and lipoprotein metabolism. In: D E. Golan, A H Tashjian Jr, E J Armstrong, A W Armstrong, editors. Principles of pharmacology: the pathophysiologic basis of drug thereapy. 3rd ed. Baltimore: Lippincott Williams & Wilkins; 2012. p. 311-31.

L5-6: Pharmacology of cardiac rhythm I-II

Lecturer: Pansakorn Tanratana, M.D., Ph.D., Pharmacology, Faculty of Science

Date/Time: 14 September 2021, 14:00-16:00

Learning Objectives:

Students are able to

1. Describe simple pathogenesis of common cardiac arrhythmias
2. Classify antiarrhythmic agents according to their mechanisms of action.
3. Explain the toxicity of the prototype antiarrhythmic agents.
4. Discuss principle in the clinical use of antiarrhythmic drugs

Content Outline:

1. Mechanisms of arrhythmias
2. Basic pharmacology of the antiarrhythmic drugs
3. Classification of the antiarrhythmic drugs
4. Mechanisms of action, side effects of antiarrhythmic drugs
5. Principles in the clinical use of antiarrhythmic drugs

Learning Organization:

1. Studying the learning materials provided in advanced
2. Lecture 100 minutes
3. Question and answers 10 minutes

Learning material provided:

1. Transcripts of the lecture outline
2. Slide from power-point presentation

References:

1. Hume J.R. and Grant A.O.: Agents Used in Cardiac Arrhythmias. Katzung: Basic and Clinical Pharmacology, 11th Ed (2009) p 225-249. Editors: Katzung B.G. Lange-Medical McGraw-Hill Companies.
2. Roden D.M: Antiarrhythmic Drugs; Goodman & Gilman's. The Pharmacological Basis of Therapeutics, 11th Ed. (2006) p 899-932. Editors: Bruton L.L., Lazo J.S. and Parker K.L. McGraw-Hill Companies.

L7-8: Pharmacology of hemostasis I-II**Lecturer:** Pansakorn Tanratana, M.D., Ph.D., Pharmacology, Faculty of Science**Date/time:** 16 September 2021, 9:00-11:00**Learning Objectives:**

Students should be able to:

1. Explain the fundamental concept of hemostasis
2. Describe platelet functions and mechanism of platelet activation induced by various agonists.
3. Classify and discuss the clinical uses of different classes of antiplatelet drugs.
4. Discuss the pharmacological basis of the anticoagulants
5. Discuss the pharmacological basis of fibrinolytic drugs
6. Discuss the clinical applications of all drugs involved in coagulation

Content Outline:

1. Physiology of hemostasis
2. Pathogenesis of thrombosis
3. Agonists and mechanisms of platelet activation
4. Antiplatelet drugs: mechanisms, clinical uses, and adverse effects
 - 4.1 Cyclooxygenase inhibitors
 - 4.2 Phosphodiesterase inhibitors
 - 4.3 ADP receptor pathway inhibitors
 - 4.4 GPIIb/IIIa antagonists
5. Blood coagulation cascade
6. Basic pharmacology of anticoagulants.
 - 6.1 Indirect thrombin inhibitors
 - 6.2 Direct thrombin inhibitors
7. Basic pharmacology of the fibrinolytic drugs
8. Clinical pharmacology of drugs used to prevent clotting used in bleeding disorders

Learning Organization:

1. Studying materials provided in advance.
2. Lecture 100 minutes.
3. Question and answers 10 minutes.

Learning Materials:

PowerPoint lecture presentation

References:

1. Armstrong AW, Golan DE. Pharmacology of hemostasis and thrombosis. In: D E. Golan, A H Tashjian Jr, E J Armstrong, A W Armstrong, editors. Principles of pharmacology: the pathophysiologic basis of drug therapy. 2nd ed. Baltimore: Lippincott Williams & Wilkins; 2008. p. 387-409.
2. Hilal-Dandan R. Renin and angiotensin. In: L L. Brunton, editor. Goodman & Gilman's The Pharmacological Basis of Therapeutics, 12th ed. New York: McGraw-Hill ;2011.
3. Katzung BG, Chatterjee K. Vasodilators & the treatment of angina pectoris. In: B G. Katzung, S B. Masters, A J. Trevor, editors. Basic & Clinical Pharmacology, 12th Ed.: New York: McGraw-Hill ; 2012.

L9: Pharmacology of hematopoiesis**Lecturer:** Pansakorn Tanratana, M.D., Ph.D., Pharmacology, Faculty of Science**Date/time:** 16 September 2021, 11:00-12:00**Learning Objectives:**

Student are able to

1. Describe the etiology of anemia
2. Explain the mechanism, pharmacokinetics, clinical used and toxicities of agents used in anemia.
3. Discuss the uses of hematopoietic growth factors
4. Discuss the uses of iron chelators in hemochromatosis

Content Outline:

1. Classification and etiology of anemia
2. Agents used in anemia
 - 2.1 Iron
 - 2.2 Vitamin B12
 - 2.3 Folic acid
3. Hematopoietic growth factors
 - 3.1 Erythropoietin
 - 3.2 Myeloid growth factor
 - 3.3 Megakaryocyte growth factor
4. Iron chelators

Learning Organization:

1. Study the learning material provide in advanced
2. Lecture 45 minutes
3. Question and answer 10 minutes

Learning Material Provided

1. Transcripts of the lecture outline
2. Slides from PowerPoint presentation

References:

1. Zehnder JL. Agents used in cytopenias; Hematopoietic growth factors. In: Katzung BG, Trevor AJ. eds. Basic and Clinical Pharmacology, 13e New York, NY: McGraw-Hill; 2015.

Conference 1: Integrated cardiovascular pharmacology: hypertension and congestive heart failure

Lecturer: Supachoke Mangmool, Pharmacology, Faculty of Science

Date/Time: 21 September 2021, 9.00-12.00

Learning objectives:

Students are able to

1. Explain the mechanism of blood pressure control and sites of drug action.
2. Describe the mechanisms of antihypertensive drugs and compensatory response to the drugs.
3. Understand the guideline and pharmacotherapy for treatment of hypertension.
4. Explain the pathophysiology, causes, risk factor, signs & symptoms of heart failure.
5. Describe the principles of pharmacological management of heart failure.
6. Discuss the mechanisms and effects of drugs that influence the compensatory mechanisms of heart failure
7. Understand the guideline and pharmacotherapy for treatment of HF

Content outline:

1. Definition, epidemiology, classification of hypertension
2. Pathophysiology of hypertension
3. Antihypertensive classes: mechanisms, clinical uses, adverse effects
4. Guideline and clinical management of hypertension

5. Definition and classification of heart failure
6. Pathophysiology, causes, risk factor, signs & symptoms of heart failure
7. Management and pharmacological treatment of heart failure
8. Guidelines for treatment of heart failure

Learning organization:

1. Studying materials provided in advance.
2. Lecture 120 minutes.
3. Discussion, Question and answers 20 minutes.
4. Quiz 20 min

References:

1. Whelton PK CR, Aronow WS, Casey DE Jr, Collins KJ, Dennison Himmelfarb C, DePalma SM, Gidding S, Jamerson KA, Jones DW, MacLaughlin EJ, Muntner P, Ovbigele B, Smith SC Jr, Spencer CC, Stafford RS, Taler SJ, Thomas RJ, Williams KA Sr, Williamson JD, Wright JT Jr. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *J Am Coll Cardiol* 2018;71(19):e127-e248.
2. James P, Oparil S, Carter B, Cushman W, Dennison-Himmelfarb C, Handler J, et al. 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). *JAMA*. 2014;311(5):507-20.
3. Benowitz N. Antihypertensive agents. In: Katzung B, editor. *Basic & Clinical Pharmacology*. 14th Ed. New York: McGraw-Hill Education; 2018. p. 173-93.
4. Eschenhagen T. Treatment of hypertension. In: Brunton L, Hilal-Dandan R, Knollmann B, editors. *Goodman and Gilman's: The Pharmacological Basis of Therapeutics*. 13th Ed. New York: McGraw-Hill; 2018.
5. สมาคมความดันโลหิตสูงแห่งประเทศไทย. แนวทางการรักษาโรคความดันโลหิตสูง ในเวชปฏิบัติทั่วไป พ.ศ. 2562. พ.ศ. 2562.
6. Armstrong E. Pharmacology of cardiac contractility. In: Golan D, Armstrong E, Armstrong A, editors. *Principles of pharmacology: The pathophysiologic basis of drug therapy*. 4th Ed. Philadelphia Wolters Kluwer Health; 2017. p. 454-68.
7. Ariyachaipanich A KR, Kunjara Na Ayudhya R, Yingchoncharoen T, Buakhamsri A, Suvachittanont N. Heart Failure Council of Thailand (HFCT) 2019 Heart Failure Guideline: Introduction and Diagnosis. *J Med Assoc Thai*. 2019;102(2):231-9.
8. Ponikowski P, Voors A, Anker S, Bueno H, Cleland J, Coats A, et al. 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure: The Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC) Developed with the special contribution of the Heart Failure Association (HFA) of the ESC. *Eur Heart J*. 2016;37(27):2129-2200.
9. Rossignol P, Hernandez A, Solomon S, Zannad F. Heart failure drug treatment. *Lancet*. 2019;393:1034-44.

Student Assessment: rubric and quiz

L10-12: Drugs used in the treatment of GI diseases

Lecturer: Somchai Yanrojana, M.D., Ph.D., Pharmacology, Faculty of Science

Date/time: 28 September 2021, 9:00-12:00

Learning Objectives: Students should be able to

1. Describe mechanism of action of drugs for peptic ulcer disease and gastroesophageal reflux
2. Discuss the major adverse effects and limitation of current treatment for peptic ulcer disease and gastroesophageal reflux
3. Explain the mechanism of action of anti-emetic and prokinetic drugs
4. Discuss the difference between anti-emetic and prokinetic drugs
5. Select the proper anti-emetic drugs to alleviate chemotherapy induced vomiting, post-operative vomiting, motion sickness and hyperemesis of pregnancy
6. Compare adverse effects of anti-emetic and prokinetic drugs
7. Explain the mechanism of action of anti-diarrheal drugs and laxatives
8. List adverse effects of anti-diarrheal drugs and laxatives

Content Outline:

1. Regulation of gastric acid secretion
2. Acid-reducing drugs
 - Antacid
 - H₂ antagonist
 - Proton pump inhibitor
3. Protection of gastric mucosa
 - Sucralfate
 - Misoprostol
4. Eradication of *Helicobacter pylori*
5. Prokinetic drugs
 - D₂ antagonist
 - 5-HT₄ agonist
6. Pathophysiology of nausea and vomiting
 - Neurotransmitters
 - Pathways
7. Antiemetic drugs
 - D₂ antagonist
 - 5-HT₃ antagonist
 - NK₁ antagonist
 - Cannabinoid agonist
8. Laxatives
 - Bulk forming laxatives
 - Surfactant laxatives
 - Osmotic laxatives
 - Non-specific stimulant laxatives
9. Anti-diarrheal drugs
 - Oral rehydration solution
 - Adsorbents
 - Opioid agonist

Learning Organization:

1. Studying the learning materials provided in advance
2. Lecture part 1 – 50 min
3. Break 10 min
4. Lecture part 2 – 50 min
5. Questions and answers 10 min
6. Lecture part 3 – 50 min
7. Questions and answers 10 min

Learning Materials Provided:

1. Slides from PowerPoint lecture presentation

References:

1. Goodman and Gilman's Pharmacological Basis of Therapeutics. 13th ed, Editors: Hardman J.G, Limberd L.E. and Gilman A.G., McGraw Hill, 2017.
2. Katzung Basic and Clinical Pharmacology. 14th ed. Lange Medical Books/the McGraw-Hill Companies, Inc. 2017.

Student Assessment: MCQ**L13-14:** Drugs for respiratory diseases**Lecturer:** Pimtip Sanvarinda, Pharmacology, Faculty of Science**Date/time:** 28 September 2021, 13:00-15:00**Learning Objectives:** students should be able to

1. Describe the principle and mechanism of action of drugs used in respiratory system
2. Give examples of drugs combination in treatment of asthma and COPD
3. Describe the side effects of drugs used in respiratory system

Content Outlines:

- antitussive
- mucoactive agents (expectorant, mucolytics)
- drugs used in asthma and COPD
 - bronchodilators
 - leukotriene antagonists
 - mast cell stabilizers
 - corticosteroids
 - anti-IgE antibody

Learning Organization: Lectures**References:**

1. Tripathi, KD. Essentials of Medical Pharmacology. 7th ed. New Delhi: Jaypee Brothers, 2013.
2. Katzung, Bertram G, Susan B. Masters, and Anthony J. Trevor. Basic & Clinical Pharmacology. New York: McGraw-Hill Medical, 2012.

L15: Introduction to CNS pharmacology**Lecturer:** Nattinee Jantaratnotai, Pharmacology, Faculty of Science**Date/Time:** 30 September 2021, 9.00-11.00**Learning Objectives:**

Students should be able to

1. Classify sites of CNS drug action
2. Identify neurotransmitters and neuropeptides that play a role in neurological disorders and neuropsychiatric diseases
3. Explain the key step in the synthesis, storage, release and inactivation of the major neurotransmitters: glutamate, GABA, acetylcholine, dopamine, norepinephrine, serotonin

Content Outline:

1. Sites of CNS drug action
2. Neurotransmission process of the major neurotransmitters: glutamate, GABA, acetylcholine, dopamine, norepinephrine, serotonin
 - 2.1 Function
 - 2.2 Synthesis

2.3 Receptor

2.4 Degradation

Learning Organization:

1. Studying the learning materials provided in advance
2. Lecture 50 min
3. Questions and answers 10 min

Learning Materials Provided:

1. Slides from PowerPoint lecture presentation

References:

1. Goodman and Gilman's Pharmacological Basis of Therapeutics. 13th ed, Editors: Hardman J.G, Limberd L.E. and Gilman A.G., McGraw Hill, 2017.
2. Katzung Basic and Clinical Pharmacology. 14th ed. Lange Medical Books/the McGraw-Hill Companies, Inc. 2017.

Student Assessment:

MCQ

L16-17: Antidepressants

Lecturer: Nattinee Jantaratnotai, Pharmacology, Faculty of Science

Date/Time: 30 September 2021, 10.00-12.00

Learning Objectives:

Students should be able to

1. Define and classify mood disorders
2. Discuss pathogenesis of depression
3. Classify antidepressants according to mechanism of action
4. Discuss the pharmacological properties, mechanism of action and adverse effects of various antidepressants
5. List the major side effects of antidepressants
6. List the uses of antidepressants

Content Outline:

1. Classification and symptoms of mood disorders
2. The pathogenesis of depression
3. Classification of antidepressants
4. Pharmacological properties, mechanism of action and adverse effects of antidepressants
5. Clinical uses of antidepressants

Learning Organization:

1. Studying the learning materials provided in advance
2. Lecture 100 min
3. Questions and answers 10 min

Learning Materials Provided:

1. Slides from PowerPoint lecture presentation

References:

1. Goodman and Gilman's Pharmacological Basis of Therapeutics. 13th ed, Editors: Hardman J.G, Limberd L.E. and Gilman A.G., McGraw Hill, 2017.
2. Katzung Basic and Clinical Pharmacology. 14th ed. Lange Medical Books/the McGraw-Hill Companies, Inc. 2017.

L18: Anxiolytic drugs

Lecturer: Nattinee Jantaratnotai, Pharmacology, Faculty of Science

Date/Time: 5 October 2021, 9:00-10:00

Learning Objectives:

Students should be able to

1. Describe and classify anxiety disorders
2. Describe the role of neurotransmitters in the development of anxiety disorders
3. Consider the benefits and risks of types of medication used to treat anxiety disorders

Content Outline:

1. Classification of anxiety disorders
2. The role of neurotransmitters in the development of anxiety disorders
3. Mechanism of action, pharmacological effects and side effects of anxiolytic drugs

Learning Organization:

1. Studying the learning materials provided in advance
2. Lecture 50 min
3. Questions and answers 10 min

Learning Materials Provided:

1. Slides from PowerPoint lecture presentation

References:

1. Goodman and Gilman's Pharmacological Basis of Therapeutics. 13th ed, Editors: Hardman J.G, Limberd L.E. and Gilman A.G., McGraw Hill, 2017.
2. Katzung Basic and Clinical Pharmacology. 14th ed. Lange Medical Books/the McGraw-Hill Companies, Inc. 2017.

L19: Sedative-hypnotic drugs

Lecturer: Nattinee Jantaratnotai, Pharmacology, Faculty of Science

Date/Time: 5 October 2021, 10:00-11:00

Learning Objectives:

Students should be able to

1. Discuss the mechanisms of action of sedative-hypnotic drugs
2. Compare the pharmacological properties and side effects of sedative-hypnotic drugs
3. Identify potential targets and/or preferable characteristic for novel sedative-hypnotic drugs

Content Outline:

1. Classification of insomnia
2. Drugs that activate GABA-A receptors
 - 2.1 Benzodiazepines
 - 2.2 Z compounds
3. Novel targets of sedative hypnotic drugs
 - 3.1 Melatonin receptor agonists
 - 3.2 Orexin receptor antagonists
4. Miscellaneous mechanism
 - 4.1 First generation antihistamines
 - 4.2 Antidepressants

Learning Organization:

1. Studying the learning materials provided in advance
2. Lecture 50 min
3. Questions and answers 10 min

Learning Materials Provided:

1. Slides from PowerPoint lecture presentation

References:

1. Goodman and Gilman's Pharmacological Basis of Therapeutics. 13th ed, Editors: Hardman J.G, Limberd L.E. and Gilman A.G., McGraw Hill, 2017.

2. Katzung Basic and Clinical Pharmacology. 14th ed. Lange Medical Books/the McGraw-Hill Companies, Inc. 2017.

Student Assessment:

MCQ

L20: Antiepileptic drugs

Lecturer: Nattinee Jantaratnotai, Pharmacology, Faculty of Science

Date/Time: 5 October 2021, 11:00-12:00

Learning Objectives:

Students should be able to

1. Describe the mechanisms of seizures
2. Explain the pharmacological properties and mechanisms of action of antiepileptic drugs
3. Compare major side effects and limitation of antiepileptic drugs
4. Identify potential targets and/or preferable characteristic for novel antiepileptic drugs

Content Outline:

1. Pathophysiology of epilepsy
2. Drugs that decrease excitation
 - 2.1 Sodium channel blockers: Phenytoin, carbamazepine, valproate, lamotrigine, topiramate
 - 2.2 Calcium channel blockers: Ethosuximide, valproate
 - 2.3 Potassium channel openers: Retigabine
 - 2.4 Glutamate receptor antagonists: Felbamate, topiramate, perampanel
 - 2.5 Glutamate release inhibitors: Gabapentin
3. Drugs that increase inhibition
 - 3.1 GABA-A agonists: Benzodiazepines
 - 3.2 GABA uptake inhibitor: Tiagabine
 - 3.3 GABA transaminase inhibitor: Vigabatrin, valproate
4. Miscellaneous mechanism: Levetiracetam

Learning Organization:

1. Studying the learning materials provided in advance
2. Lecture 50 min
3. Questions and answers 10 min

Learning Materials Provided:

1. Slides from PowerPoint lecture presentation

References:

1. Goodman and Gilman's Pharmacological Basis of Therapeutics. 13th ed, Editors: Hardman J.G, Limberd L.E. and Gilman A.G., McGraw Hill, 2017.
2. Katzung Basic and Clinical Pharmacology. 14th ed. Lange Medical Books/the McGraw-Hill Companies, Inc. 2017.
3. Hill DS, Wlodarczyk BJ, Palacios AM, Finnell RH. Teratogenic effects of antiepileptic drugs. *Expert Rev Neurother.* 2010;10(6):943-59.
4. Hernández-Díaz S, Smith CR, Shen A, Mittendorf R, Hauser WA, Yerby M, Holmes LB; North American AED Pregnancy Registry; North American AED Pregnancy Registry. Comparative safety of antiepileptic drugs during pregnancy. *Neurology.* 2012;78(21):1692-9.

Student Assessment:

MCQ

L21: NSAIDs

Lecturer: Ruedee Hemstapat, Department of Pharmacology, Faculty of Science

Date/time: 12 October 2021, 9:00-10:00

Learning Objectives: After completion of this lecture, the students should be able to:

1. Describe the classification of analgesics and NSAIDs
2. Discuss the differences between selective and non-selective COX-2 inhibitors
3. Describe the mechanism of actions for NSAIDs
4. Describe the general therapeutic uses of NSAIDs
5. Describe the common adverse effects of NSAIDs
6. Describe the mechanisms of action, therapeutic uses, and common adverse effects of NSAIDs and drugs used in gout

Content Outline:

1. Overview of analgesics and NSAIDs
2. Overview of arachidonic acid pathway
3. Selective and non-selective COX-2 inhibitors
4. Mechanisms of actions, therapeutic uses and common adverse effects of NSAIDs
5. Drugs used in gout

Learning Organization:

1. Lecture 50 min
2. Questions and answers 10 min

Learning Materials Provided:

1. Slides from PowerPoint lecture presentation

References:

1. Goodman and Gilman's Pharmacological Basis of Therapeutics. 12th ed, Editors: Hardman J.G, Limberd L.E. and Gilman A.G., McGraw Hill, 2011.
2. Katzung Basic and Clinical Pharmacology. 14th ed. Lange Medical Books/the McGraw-Hill Companies, Inc., 2017.

Student Assessment: MCQ

L22: Opioids

Lecturer: Ruedee Hemstapat, Pharmacology, Faculty of Science

Date/Time: 12 October 2021, 10:00-11:00

Learning objectives:

Students are able to

1. Explain the mechanisms of action and how opioids produce analgesia.
2. Describe the pharmacological effects of opioid drugs.
3. Describe the adverse effects and precautions associated with the use of opioid drugs

Content outline:

- Pain pathways
- Mechanism of action of opioids
- Pharmacological effects of opioids
- Opioid agonists and opioid antagonists
- Adverse effects and precautions associated with the use of opioid drugs

Learning organization:

- 50-min lecture
- 10-min discussion (question and answer)

References

1. Katzung, B.C. (2015) Basis and Clinical Pharmacology, 13rd ed. Lange Medical Books. The McGraw-Hill Companies, Inc.
2. Rang, HP and Dale M.M. Rang and Dale's Pharmacology, 8th ed. 2016.

3. Brenner GM and Stevens CW. Pharmacology (student consult), 4th ed. 2013.
4. Hitner H and Nagle B. Pharmacology: an introduction, 6th ed. 2012

Student Assessment:

MCQ

L23: CNS stimulants

Lecturer: Nattinee Jantaratnotai, Pharmacology, Faculty of Science

Date/Time: 12 October 2021, 11:00-12:00

Learning Objectives:

Students are able to

1. Describe symptoms of ADHD (Attention-deficit hyperactivity disorder)
2. Describe pathophysiology of ADHD
3. Describe management of ADHD
4. Describe pharmacological properties, mechanism of action and major side effects of CNS stimulants

Content Outline:

1. Symptoms of ADHD
2. Pathophysiology of ADHD
3. Management of ADHD
4. Pharmacological properties, mechanisms of action and major side effects of CNS stimulants

Learning Organization:

1. Studying the learning materials provided in advance
2. Lecture 50 min
3. Questions and answers 10 min

Learning Materials Provided:

1. Slides from PowerPoint lecture presentation

References:

1. Feldman, M.D., Christensen, J.F. (2014) Behavioral Medicine: A Guide for Clinical Practice. 4th ed. The McGraw-Hill Companies, Inc.
2. Ropper, A.H., Samuels, M.A., Klein, J.P. (2014) Adams and Victor's Principles of Neurology. 10th. The McGraw-Hill Companies, Inc.

Student Assessment:

MCQ exam

Conference 4: Drug abuse

Lecturer: Nattinee Jantaratnotai, Pharmacology, Faculty of Science

Date/Time: 12 October 2021, 13:00-16:00

Learning Objectives:

Students should be able to

1. Explain the definitions of these terms: dependence, addiction, tolerance, withdrawal
2. Explain reward pathway and the dopamine hypothesis of addiction
3. Explain brain changes in addiction
4. Explain the basic pharmacology of these substances: cocaine, amphetamine, nicotine, marijuana
5. Explain the metabolism of ethanol
6. Explain the acute and chronic effects of ethanol on the body
7. Explain the principles of managing dependence and addiction

Content Outline:

1. Definition of terms involved in drug abuse
2. Reward pathway and dopamine hypothesis of addiction
3. Brain changes in addiction
4. Basic pharmacology of drug addiction
5. The effects of ethanol on the body
6. The principles of managing drug addiction

Learning Organization:

1. Studying the learning materials provided in advance
2. Presentation and discussion 120 min
3. Lecture 50 min
4. Questions and answers 10 min

References:

1. Basic & Clinical Pharmacology, 14e, Chapter 23: The Alcohols and Chapter 32: Drugs of Abuse <https://accessmedicine.mhmedical.com/book.aspx?bookID=2249#175215347>

Student Assessment: rubric and quiz

L24: Local anesthetics

Lecturer: Ruedee Hemstapat, Department of Pharmacology, Faculty of Science

Date/Time: 14 October 2021, 9:00-10:00

Learning objectives:

Students are able to

1. Describe how a local anesthetic works (mechanism of action)
2. Explain how local anesthetics block the response to pain.
3. Explain the difference between the two classes of local anesthetic
4. Describe the adverse effects and precautions associated with the use of local anesthetics

Content outline:

- Mechanism of action of local anesthetics
- Pharmacological effects of local anesthetics
- Classification of local anesthetics
- Adverse effects and precautions associated with the use of local anesthetics

Learning organization:

- 50-min lecture
- 10-min discussion (question and answer)

References

1. Katzung, B.C. (2015) Basis and Clinical Pharmacology, 13rd ed. Lange Medical Books. The McGraw-Hill Companies, Inc.
2. Rang, HP and Dale M.M. Rang and Dale's Pharmacology, 8th ed. 2016.
3. Brenner GM and Stevens CW. Pharmacology (student consult), 4th ed. 2013.
4. Hitner H and Nagle B. Pharmacology: an introduction, 6th ed. 2012

L25: General anesthetics

Lecturer: Ruedee Hemstapat, Department of Pharmacology, Faculty of Science

Date/Time: 14 October 2021, 10:00-11:00

Learning objectives:

Students are able to

1. Explain stages of anesthesia
2. Describe types of general anesthesia
3. Explain the mechanism of action, pharmacokinetics of anesthetics
4. Discuss the pharmacological effects of general anesthetics

Content outline:

- Mechanism of action of general anesthetics
- Types of general anesthesia: Intravenous anesthetics and Inhalation anesthetics
- Pharmacokinetic and pharmacological effects of general anesthetics
- Adverse effects and precautions associated with the use of general anesthetics

Learning organization:

- 50-min lecture
- 10-min discussion (question and answer)

References

1. Katzung, B.C. (2015) Basis and Clinical Pharmacology, 13rd ed. Lange Medical Books. The McGraw-Hill Companies, Inc.
2. Rang, HP and Dale M.M. Rang and Dale's Pharmacology, 8th ed. 2016.
3. Brenner GM and Stevens CW. Pharmacology (student consult), 4th ed. 2013.
4. Hitner H and Nagle B. Pharmacology: an introduction, 6th ed. 2012

L26: Drugs for movement disorders**Lecturer:** Pimtip Sanvarinda, Pharmacology, Faculty of Science**Date/Time:** 14 October 2021, 11:00-12:00**Objectives:** students should be able to

1. Describe the pathophysiology of Parkinson's disease and other movement disorders
2. Give examples of drugs used in treatment of Parkinson's disease and other movement disorders
3. Describe the side effects of drugs used for movement disorders

Class outline:

1. The dopaminergic pathway
2. Pathophysiology of parkinsonism
 - Parkinson's disease
3. Drug-induced parkinsonism
4. Drugs for treatment of Parkinson's disease
 - levodopa
 - dopamine receptor agonists
 - Catechol-O-Methyltransferase (COMT) inhibitors
 - selective MAO-B inhibitors
 - muscarinic receptor antagonists
 - Miscellaneous: treatments for tremor, tics, Huntington's chorea

Examination: MCQ**Reference:**

1. Goodman, L., Gilman, A., Brunton, L., Lazo, J. and Parker, K. Goodman & Gilman's the pharmacological basis of therapeutics. New York: McGraw-Hill, 2015.
2. Katzung, B.G., Trevor A.J. (2017) Basic & Clinical Pharmacology 14th ed. McGraw-Hill Education.

L27-18: Antipsychotic drugs and mood stabilizers**Lecturer:** Nattinee Jantaratnotai, Pharmacology, Faculty of Science**Date/Time:** 19 October 2021, 9:00-11:00**Learning Objectives:**

Students are be able to

1. Describe dopamine pathways

2. Compare typical and atypical antipsychotics
3. List 2-3 drugs in each group
4. Describe therapeutic uses of antipsychotic drugs
5. List the major side effects of antipsychotic drugs
6. Describe symptoms of manic episode
7. List therapeutic uses and major side effects of mood stabilizers

Content Outline:

1. Major symptoms of schizophrenia: positive vs negative symptoms
2. Classification of antipsychotic drugs
 - 2.1 Typical antipsychotic drugs
 - 2.2 Atypical antipsychotic drugs
3. Pharmacological properties, mechanisms of action and major side effects of antipsychotic drugs
4. Symptoms of mania
5. Treatment of mania with mood stabilizers

Learning Organization:

1. Studying the learning materials provided in advance
2. Lecture 50 min
3. Break 10 min
4. Lecture 50 min
5. Questions and answers 10 min

References:

1. Goodman & Gilman's (2017) The Pharmacological Basis of Therapeutics 13th ed. The McGraw-Hill Companies, Inc.
2. Katzung, B.G., Trevor A.J. (2017) Basic & Clinical Pharmacology 14th ed. McGraw-Hill Education.

L29: Drugs for dementia

Lecturer: Nattinee Jantaratnotai, Pharmacology, Faculty of Science

Date/Time: 19 October 2021, 11.00-12.00

Learning Objectives:

Students are able to

1. Define the following terms: declarative memory, non-declarative memory, amnesia, dementia
2. Describe the possible mechanisms that lead to neuronal cell death
3. Describe risk factors and causes of dementia
4. Describe symptoms of Alzheimer's disease
5. Discuss pathophysiology of Alzheimer's disease
6. Describe the current therapeutic approaches for the treatment and prevention of Alzheimer's disease

Content Outline:

1. Definition and classification of learning and memory
2. Possible mechanisms that lead to neuronal cell death
3. Risk factors and causes of dementia
4. Symptoms of Alzheimer's disease
5. Pathophysiology of Alzheimer's disease
6. Current therapeutic approaches for the treatment and prevention of Alzheimer's disease

Learning Organization:

1. Studying the learning materials provided in advance
2. Lecture 50 min

3. Questions and answers 10 min

References:

1. Katzung, B.G., Trevor A.J. (2017) Basic & Clinical Pharmacology 14th ed. McGraw-Hill Education.
2. Pharmacology 7th ed. (Rang HP et al. Eds) Churchill Livingstone., 2012.