



Department of Chemistry

College of Education

University of Salahaddin

Subject: Metabolism

Course Book – (Year 4)-Second Semester

Lecturer's name: Dr. Parween Abdulsamad Ismail

Academic Year: 2023/2024

Course Book

1. Course name	Hormones
2. Lecturer in charge	Parween Abdulsamad Ismail
3. Department/ College	Chemistry/ Education
4. Contact	e-mail: parween7abdulsamad@yahoo.com Tel:07504567405
5. Time (in hours) per week	Theory: 2 Practical:
6. Office hours	Sunday: 9am-12 pm Thursday: 10am-12pm
7. Course code	
8. Teacher's academic profile	<p>I graduated from Salahaddin University in 1995 with a BSc in chemistry .After that, I accessed to work at the University of Salahaddin as Assistant Chemist till 1995-1997 in Education College /Chemistry Dept. Then I completed the MSc in Clinical Biochemistry at Salahaddin University in(1998_ 2000). Following this, I worked as an assistance lecturer and then upgrading to lecturer in 2007 in Chemistry department,college of Education, Salahaddin University-Erbil.</p> <p>The teaching experience is both theoretical and practical in theClinical Biochemistry .</p> <p>In 2008 I began my doctorate research at the Hawler Medical University, Biochemistry Dept., College of Medicine. I completed my PhD-Clinical Biochemistry in 2011and since then I have had the opportunity to work as academic staff at Salahaddin university-Erbil,college of education, department of Chemistry.</p> <p>Following this, I got upgrading to assistance professor in 2014 .Above and beyond of teaching both undergraduate and graduate students I am currently working as a researcher ,My academic and research program interest focus on Clinical Biochemistry .</p> <p>I have more than 24 published articles and supervised a PhD student in Clinical Biochemistry and going to publish some other articles, oversee MSc and PhD students in the mentioned fields</p>

9. Keywords	
<p>10. Course overview:</p> <p>We all understand that the carbohydrates, proteins, and fats we consume provide our bodies with energy, but there are biologically-active nutritional chemicals that do not provide energy. What roles do these molecules serve in our body? By what mechanisms do they impact our health? These are the questions that we will address throughout this course.</p> <p>Topics covered include, amino acid metabolism, lipid synthesis, and the metabolic functions of vitamins and minerals. The course will also explore the functions of biologically-active non-nutrients</p> <p>This course will provide a survey of metabolic processes in domestic farm animals as it relates to digestion, absorption, and cellular metabolism of macronutrients including carbohydrates, fats, and proteins. Integration of metabolic pathways for nutrient utilization by various body tissues will be discussed.</p> <p>An introduction to the thermodynamic aspects of energy metabolism and the principles of anabolic and catabolic metabolic pathways. Emphasis will be placed on the overall purpose of the major pathways, the precursor molecules leading into these pathways, the important pathway products and the basic types of control that regulate metabolic flux. Examples in prokaryotic systems will be provided where possible.</p>	
<p>11. Course objective</p> <ul style="list-style-type: none"> • Describe the steps of digestion and absorption of the macro- and micro-nutrients. • Explain the metabolic steps of catabolism and anabolism for the macronutrients and calculate energy production. • Analyze diets and outline lifestyle changes for the promotion of health in healthy individuals and those with nutrition-related diseases. • <p>Educational Goals</p> <ol style="list-style-type: none"> 1. Define the terms metabolism, metabolic pathway, catabolism, and anabolism. 2. Understand how ATP is formed from ADP and inorganic phosphate (Pi), and vice versa. 3. Understand how Coenzyme-A is used to transfer acyl groups. 4. Understand the roles of the NAD⁺/NADH and FAD/FADH₂ coenzymes in the transfer of electrons. <p>Identify the oxidized and reduced form of each of these pairs.</p> <ol style="list-style-type: none"> 5. Understand the differences between linear, circular, and spiral metabolic pathways and give an example of each. 	

6. Name the products formed during the digestion of polysaccharides, triglycerides, and proteins, and know the part(s) of the digestive track where each occurs.
7. Identify the initial reactant and final products of glycolysis, and understand how this pathway is controlled.
8. Understand and compare glycolysis and gluconeogenesis pathways.
9. Know the fate of pyruvate under aerobic and anaerobic conditions.
10. Define the terms hyperglycemic and hypoglycemic.
11. Understand how the body controls blood glucose concentration by the release of insulin or glucagon into the bloodstream.
12. Understand and compare glycogenesis and glycogenolysis. Understand how these processes are involved in maintaining normal blood glucose concentration.
13. Understand and compare type I, type II, and gestational diabetes.
14. Identify the initial reactant and final products of the citric acid cycle; understand how this pathway is controlled.
15. Understand how the oxidation of coenzymes during oxidative phosphorylation is used to produce ATP.
16. Compare the malate-aspartate shuttle and the glycerol 3-phosphate shuttle and understand their significance in affecting the amount of ATP that can be produced from glucose.
17. Predict how many ATP are formed when acetyl-CoA undergoes stages 3 and 4 of catabolism.
18. Describe the catabolism of triglycerides, the β -oxidation spiral, and how β -oxidation differs from fatty acid anabolism (biosynthesis).
19. Given the structure of a fatty acid, predict how many ATP are formed when it undergoes the β -oxidation spiral.
20. Understand and compare lipolysis and fatty acid synthesis.
21. Explain the biological origins of ketosis and ketoacidosis.
22. Understand how transamination and oxidative deamination are involved in the catabolism of amino acids.
23. Given the structure of an amino acid and α -ketoglutarate, predict the products of a transamination reaction.
24. Explain how quaternary ammonium groups ($-\text{NH}_3^+$) are removed from amino acids and eliminated from the body.

12. Student's obligation

- 1-The student attention in all theoretical lectures in academic year.
- 2-Completion of all classes
- 3-Attendance in exams.
- 4-Write or prepare reports.

13. Forms of teaching

Our lecture is depending directly on showing the strong point in the lecture via data show depending on the power point program and explain some figures on the white board with the students.

14. Assessment scheme

Final exam: 50 marks

Midterm-exams: 20 marks for Midterm-exam1 and 20 marks for Midterm-exam 2

And 10 marks for activity

15. Student learning outcome:

The teaching should provide knowledge of the body uptake of nutrients and these storing and renewal in different physiological conditions. The student should be able to integrate the received knowledge so that she/he within this field can explain the background of relevant diseases

Upon successful completion of this course, students will be able to:

- ✓ Identify key steps in the digestion and absorption of carbohydrates as well as their metabolism at the cellular level.
- ✓ Identify the key steps in the digestion and absorption of fat as well as the metabolism of fatty acids at the cellular level.
- ✓ Identify key steps in the digestion and absorption of protein as well as the fate of key amino acids in metabolic pathways at the cellular and interorgan level.
- ✓ Discuss and/or diagram how the above macronutrients are metabolized differently depending on the nutritional state of the animal (energy abundance or energy deficiency).
- ✓ Describe the major metabolic pathways (glycolysis, citric acid cycle, pentose phosphate pathway, b-oxidation, fatty acid synthesis, and oxidative phosphorylation) as well as their integration into metabolism as a whole
- ✓ Describe the pathways and intermediates that are involved in both the build-up and breakdown of key biomolecules (carbohydrates, amino acids, fatty acids and nucleotides).
- ✓ Demonstrate an understanding of the central principles and themes of metabolism including an appreciation of metabolism from the perspective of free energy.

16. Course Reading List and References:

Bender DA: Introduction to Nutrition and Metabolism, 5th ed. CRC Press, 2014.

Comparative Animal Nutrition and Metabolism (1st Edition) by P. Cheeke and E. Dierenfeld. 2010. ISBN-13: 978-1845936310

Frayn KN: Metabolic Regulation: A Human Perspective, 3rd ed. Wiley-Blackwell, 2010.

▪ **Key references:**

Nicholls DG, Ferguson SJ: Bioenergetics, 4th ed. Elsevier, 2013.

“Lands B: Consequences of essential fatty acids. *Nutrients* 2012;4:1338.

Goss V, Hunt AN, Postle AD: Regulation of lung surfactant phospholipid synthesis and metabolism. *Biochim Biophys Acta* 2013;1831:448.

The useful links:

<https://products.office.com/en-us/student/office-in-education>

<https://www.byui.edu/online/online-support-center>

17. The Topics:	Lecturer's name
<p>Week 1 Introduction to metabolism Introductory concepts Pathway regulation Redox reactions</p> <p>Week 2: Energy metabolism I: The TCA cycle The tricarboxylic acid (TCA) cycle 3. Energy metabolism II: ATP generation ATP generation Substrate-level phosphorylation Oxidative phosphorylation .</p> <p>. Week 3 Carbohydrate structure, digestion, and absorption</p> <p>Carbohydrate metabolism . Carbohydrates: A definition Glycolysis The pyruvate ! acetyl CoA reaction</p> <p>Week 4: Gluconeogenesis Glycogen metabolism The pentose phosphate pathway (PPP) Fructose, Galactose, Sorbitol and Ethanol</p> <p>Week 5</p>	<p>Dr. Parween (2 hrs)</p>

<p>Fat metabolism: structure, terms, digestion, and absorption</p> <p>Week 6: Lipid transport and metabolism. Lipids: An introduction Fatty acid biosynthesis Lipid catabolism</p> <p>Week 7,8: Fat metabolism: Cholesterol metabolism. Lipid transport Ketones and ketogenesis β-oxidation</p> <p>Week9 Protein Digestion and Absorption</p> <p>Week10,11 Protein structure Amino acids Key reactions in amino acid metabolism . . Amino acid synthesis . .</p> <p>Week12,13: Biological derivatives of amino acids Nitrogen balance Amino acid catabolism The urea cycle Protein synthesis and degradation</p> <p>Week 14: Purines, pyrimidines and haem One-carbon pool. Purine metabolism Pyrimidine metabolism Haem metabolism</p> <p>Week 15 Glucose homeostasis The states of glucose homeostasis Hormonal control of glucose homeostasis Glucose homeostasis in exercise Diabetes mellitus .</p>	
<p>18. Practical Topics ()</p>	

19. Examinations:

Question Styles

Q1. Mention the-----

Q2. Write short note on-----

Q3. Answer the following-----

Q4. Which of the following-----

20. Extra notes:

21. Peer review