

Medicine school
The format of the semester lesson plan

Lesson title: Biochemistry of Discipline
Audiences: Iraqi Student of General Medicine
Share of each teacher: 0.5 Unit
Time to answer the questions: Up to one hour after the lesson sessions
Course Outline: (Day, Hours and Semesters): Monday 8-10
Teachers: Dr Soheila Asadi and Dr Hadi Mozafari
Lesson & Prerequisites: Biochemistry of Discipline

Overall Objective:

Overall aims of sessions: (one goal per session)

- 1- Glycolysis and the oxidation of pyruvate, other pathways of hexose metabolism, the citric acid cycle
- 2- Gluconeogenesis, the pentose phosphate pathway, metabolism of glycogen
- 3- Biosynthesis and oxidation of fatty acids, metabolism of unsaturated fatty acids & eicosanoids.
- 4- Metabolism of acylglycerols and sphingolipids, cholesterol synthesis, lipid transport and storage.
- 5- Catabolism of proteins and of amino acid nitrogen
- 6- Biosynthesis of the nutritionally nonessential amino acids
- 7- Catabolism of the carbon skeletons of amino acids, conversion of amino acids to specialized products
- 8- Metabolism of purine and pyrimidine nucleotides

Specific aims of each session;

The overall aim of first session: Glycolysis and the oxidation of pyruvate, the citric acid cycle

Specific aims of first session:

- 1- Definition the carbohydrate digestion pathway
- 2- Definition the most important pathways of glucose metabolism
- 3- Definition the importance of glycolysis pathway and its enzymes
- 4- Definition the important reactions of glycolysis pathway, end products of glycolysis pathway
- 5- Definition the Regulation of glycolysis pathway
- 6- Definition of alternative pathways of pyruvate metabolism
- 7- Definition of clinical aspects of glycolysis pathway
- 8- Definition the other pathways of hexose metabolism
- 9- Definition the clinical aspects of other monosaccharides
- 10- Definition the importance of citric acid cycle, its enzymes and reactions
- 11- Definition the regulation of citric acid cycle
- 12- Definition the clinical aspects of citric acid cycle

The overall aim of second session: Gluconeogenesis, the pentose phosphate pathway and metabolism of glycogen

Specific aims of second session:

- 1- Definition the importance of gluconeogenesis pathway, its enzymes and its reactions
- 2- Definition the regulation of gluconeogenesis reactions and coordination between glycolysis and gluconeogenesis during fasting and feeding states
- 3- Definition the pentose phosphate pathway, its enzymes and its reactions
- 4- Definition the importance of pentose phosphate pathway in producing NADPH and Ribose 5 phosphate
- 5- Definition the clinical aspect of pentose phosphate pathway
- 6- Definition the Glucuronic pathway and its important
- 7- Definition the Glycogen synthesis reactions and its enzymes
- 8- Definition the Glycogenolysis reactions and its enzymes
- 9- Definition the hormonal regulation of glycogen synthesis and glycogenolysis during fasting and feeding states

The overall aim of third session: Biosynthesis and oxidation of fatty acids, metabolism of unsaturated fatty acids & eicosanoids

Specific aims of first session:

- 1- Definition the lipid digestion
- 2- Definition the entering the fatty acids into mitochondria
- 3- Definition the β -oxidation pathway, its enzymes and clinical aspect of this pathway
- 4- Definition the β -oxidation of very long fatty acids in peroxisomes and its differences with mitochondrial β -oxidation
- 5- Definition the omega oxidation, its difference with mitochondrial β -oxidation and its clinical aspect
- 6- Definition the α -oxidation, its difference with mitochondrial β -oxidation and its clinical aspect
- 7- Definition the ketone bodies and the biochemical reaction which produced the ketone bodies
- 8- Definition the clinical aspect of ketone bodies in different conditions (fasting, feeding and starvation)
- 9- Definition the fatty acid biosynthesis pathway and its enzymes
- 10- Definition the regulation of fatty acids biosynthesis in fasting and feeding states and the role of hormones.
- 11- Definition the coordination between fatty acids oxidation and biosynthesis
- 12- Definition the importance of eicosanoids, prostaglandins, thromboxanes and leukotrienes biosynthesis and their clinical importance

The overall aim of fourth session: Metabolism of acylglycerols and sphingolipids, cholesterol synthesis, lipid transport and storage

Specific aims of fourth session:

- 1- Definition the triacylglycerol and phosphoglycerol biosynthesis
- 2- Definition of biosynthesis of different classes of sphingolipids, their digestion and sphingolipidoses
- 3- Definition the cholesterol biosynthesis and important enzymes in this pathway

- 4- Regulation of cholesterol biosynthesis, the clinical importance of cholesterol-lowering drugs and their mechanisms
- 5- Definition the lipid transport and storage
- 6- Definition the different classes of lipoproteins and clinical importance of them
- 7- Definition the metabolism and the role of bile salts

The overall aim of fifth session: Catabolism of proteins and of amino acid nitrogen

Specific aims of fifth session:

- 1- Definition of various enzymes and hormones which participated in protein digestion
- 2- Definition the intestinal absorption of amino acids and the genetic disorders in intestinal absorption of amino acids
- 3- Definition the Glucose-alanine cycle and the form of ammonia transportation in blood circulation
- 4- Definition of the deamination and decarboxylation reactions of amino acids and their cofactors
- 5- Definition of urea cycle and its important enzyme
- 6- Definition the metabolic disorders which associated with urea cycle
- 7- Definition the importance of transaminase enzymes in clinical diagnosis

The overall aim of sixth and seventh session: Biosynthesis of the nutritionally nonessential amino acids, Catabolism of the carbon skeletons of amino acids, conversion of Acids to specialized products

Specific aims of sixth session:

- 1- Introducing nutritionally nonessential amino acids
- 2- Definition of biochemical pathways which participated in biosynthesis of nutritionally nonessential amino acids
- 3- Introducing glucogenic and ketogenic amino acids
- 4- Definition the catabolic pathways of carbon skeleton of amino acids
- 5- Definition of inborn error of metabolism in metabolism of amino acids such as Albinism, phenylketonuria, Alcaptonuria, maple urine syrup disease
- 6- Definition of importance of sulfur containing amino acid and their role in various disease
- 7- Definition of the conversion of Glycine, β -Alanine, Methionine, Ornithine & Arginine, Tryptophan, Tyrosine, Glutamate and Histidine to specialized products

The overall aim of eighth session: Metabolism of purine and pyrimidine nucleotides

Specific aims of eighth session:

- 1- Definition of de novo and salvage reaction for nucleotides biosynthesis
- 2- Definition of de novo precursors for purine biosynthesis and important

- enzymes in these pathways
- 3- Regulation and coordination of de novo and salvage pathways in purine nucleotides
 - 4- Definition the clinical importance of purine biosynthesis pathways
 - 5- Definition of the clinical importance of drug inhibition of purine nucleotide biosynthesis
 - 6- Definition of de novo precursors for pyrimidine biosynthesis and important enzymes in these pathways
 - 7- Regulation and coordination of de novo and salvage pathways in purine nucleotides
 - 8- Definition the clinical importance of pyrimidine biosynthesis pathways
 - 9- Definition the importance of acid folic in pyrimidine nucleotides biosynthesis
 - 10- Definition the catabolism of purine nucleotides , acid uric production and important enzymes which participated in purine nucleotides catabolism
 - 11- Definition the causes of increasing acid uric
 - 12- Definition the catabolism of pyrimidine nucleotides

Finally, the students should be able to:

- 1-1. Learn about the importance of glycolysis pathway, its roles and the amount of energy which yielded from it, the metabolism of various type of monosaccharide, the importance of citric acid cycle, the amount of ATP which yielded from citric acid cycle and clinical aspect of them
- 1-2. Learn about the importance of gluconeogenesis, importance of the key role of fructose 2, 6 biphosphatse and phosphofructokinase 2 in regulation of glycolysis and gluconeogenesis and regulation of blood sugar, metabolism of glycogen and the role of hormones in glycogen metabolism
- 1-3. Learn about the metabolism of fatty acids and the amount of energy which produced in fatty acid oxidation, learn about ketogenesis and its clinical importance. They should learn about fatty acid biosynthesis and eicosanoids biosynthesis and their clinical importance.
- 1-4. Learn about cholesterol biosynthesis, the role of statin drugs in decreasing of cholesterol. Learn about lipid transport and storage and the role of different classes of lipoproteins in lipid transportation.
- 1-5. Learn about the urea cycle, its clinical importance, the importance of aminotransferase enzyme in clinical diagnosis
- 1-6. Learn about biosynthesis of nutritionally nonessential amino acid, catabolism of carbon skeleton of amino acids, the important the genetic disorders which associated with amino acids metabolism and conversion of amino acids into special products.
- 1-7. Learn about the metabolism of purine and pyrimidine nucleotides, the clinical disorders which related to their metabolism, the clinical importance of folic acid in purine nucleotides biosynthesis.

Sources: Textbook of Biochemistry with Clinical Correlations 7th edition by Thomas M Devlin

Teaching Method: lecture

Training Tools: Video projector and Power Point software

Evaluation of students

Time	Date	Portion of total score(%)	method	Exam
۱۱:۳۰	۹۸/۷/۱۶	۵	descriptive question	Quiz
-	-	5 (extra)	New topic is selected by student	Short seminar (optional up to 3 seminars)
Subsequently it will be clear	Subsequently it will clear	۹۰	Multi-choice exam	Final exam
Continuously	Continuously	۵	Verbal questioning	Active presence in class

Class rules and expectations from the students:

Students should have a regular presence in the classroom. At all class sessions, they should read the content of the previous session participate in class assessment.

The name and signature of teachers: Dr soheila asadi and Dr Hadi mozafari

The name and signature of department head: Professor Zohreh Rahimi

The name and signature of the EDO Faculty Officer: Sahel Ahmadi

Delivery Date:

Postage Date:

Biochemistry course schedule (medical student)

Date and time of each session: Monday, 8-10 am

Teacher	Topic of each session	date	Session
Dr Soheila Asadi	Glycolysis and citric acid cycle	24/6/98 Monday	۱
Dr Soheila Asadi	Gluconeogenesis and glycogen metabolism, pentose phosphate pathway	1/۷/98 Monday	۲
Dr Soheila Asadi	Fatty acid oxidation and biosynthesis	8/۷/98 Monday	۳
Dr Soheila Asadi	Cholesterol and lipoprotein metabolism	15/۷/98 Monday	۴
Dr Hadi Mozafari	Urea cycle	22/۷/98 Monday	۵
Dr Hadi Mozafari	Biosynthesis of nutritionally nonessential amino acids	29/۷/98 Monday	۶
Dr Hadi Mozafari	Amino acids catabolism and conversion of them into special products	13/8/98 Monday	۷
Dr Hadi Mozafari	Metabolism of purine and pyrimidine nucleotides	20/8/98 Monday	۸