

# Medical Biochemistry

## CHEM 1005

### Course Outline

<b>UNIT 1: Cellular fundamentals and applications of molecular biology</b>		
Week 1: Biochemistry basics and enzymology		
<b>Course Objectives: 1,7</b>	<b>Chapters</b>	
<b>At the end of this week the learner will:</b> be able to illustrate the importance of key compounds in biological settings and the necessity of biological buffers. It will also provide an understanding of enzymes and their relevance in biological reactions.		<b>Session 1:</b>
	4	Water, Acids, Bases and Buffers
	6	Amino Acids in Proteins
	7	Structure-Function Relationships in Proteins
		<b>Session 2:</b>
	8	Enzymes as Catalysts
	9	Regulation of Enzymes
<b>Week 2: Cellular Communication</b>		
<b>Course Objectives: 1,4</b>	<b>Chapters</b>	

be able to explain how cells communicate and integrate signals resulting in a cellular or physiological change.	10	Relationship between cell biology and biochemistry
	11	Cell Signaling by Chemical Messengers
<b>Week 3: Central Dogma - DNA structure and synthesis</b>		
<b>Course Objectives: 1,2,3,5,6</b>	<b>Chapters</b>	
be able to describe the structure and synthesis of nucleotides. Students will be able to relate the phases of the cell cycle to DNA replication and repair processes.		<b>Session 1:</b>
	12	Nucleotide structure
	41	Purine and Pyrimidine Synthesis and Salvage
		<b>Session 2</b>
	13	DNA Synthesis
<b>Week 4: Central Dogma - Transcription and Translation</b>		
<b>Course Objectives: 1,5</b>	<b>Chapters</b>	
to describe the flow of genetic information from DNA to the level of protein synthesis.	14	Transcription
	15	Translation
<b>Week 5: Gene regulation and diagnostic evaluation</b>		
<b>Course Objectives: 1,3,6</b>	<b>Chapters</b>	
be able to integrate information from previous weeks and illustrate how cells sense and regulate gene expression. The learner will also be able to understand how to evaluate these changes at a molecular level using cutting edge molecular technologies.		<b>Session 1:</b>
	16	Regulation of Gene expression
		<b>Session 2:</b>
	17	Use of Recombinant DNA Techniques in Medicine

<b>Week 6: Amino acids as specialized products</b>		
<b>Course Objectives: 1,6,7</b>	<b>Chapters</b>	
be able to evaluate how defects in amino acid metabolism are inherited and how accumulation of intermediary metabolites can be used to clinically diagnose these disorders.	39	Synthesis and degradation of amino acids
	40	Tetrahydrofolate, Vitamin B12, and S-Adenosylmethionine
<b>UNIT 2: Generation of Energy and Carbohydrate Metabolism</b>		
<b>Week 7: Generation of energy</b>		
<b>Course Objectives:2,7</b>	<b>Chapters</b>	
be able to relate the free energy of a reaction with its directionality. The learner will also be able to describe the relevance and generation of ATP within the cell.	19	Cellular Bioenergetics
	21	Oxidation phosphorylation
<b>Week 8: Carbohydrate Metabolism</b>		
<b>Course Objectives: 1,2</b>	<b>Chapters</b>	
be able to summarize carbohydrate, fat and amino acid metabolism and the interrelationship of various tissues. Specifically, the learner will assess the metabolic fate of carbohydrates following digestion.		<b>Session 1:</b>
	26	Basic concepts in the regulation of Fuel metabolism by insulin, glucagon and other hormones.
		<b>Session 2:</b>
	27	Digestion, absorption and transport of carbohydrates
	22	Generation of ATP from Glucose: Glycolysis
	28	Formation and Degradation of Glycogen

<b>Week 9: TCA cycle</b>		
<b>Course Objectives: 1,2</b>	<b>Chapters</b>	
be able to describe the role and regulation of the TCA cycle in generating reducing equivalents and substrates for intermediary metabolism.	20	Tricarboxylic Acid Cycle
<b>Week 10: Alternative glucose metabolism and the RBC</b>		
<b>Course Objectives: 1,2</b>	<b>Chapters:</b>	
be able to discuss alternative pathways for glucose metabolism; specifically glucose metabolism within the red blood cell and the necessity of NADPH.		<b>Session 1:</b>
	29	Pathways of Sugar metabolism: Pentose Phosphate Pathway, Fructose
		<b>Session 2:</b>
	44	The Biochemistry of Erythrocytes and other blood cells
<b>UNIT 3: Lipid metabolism and integrated metabolism</b>		
<b>Week 11: Digestion, circulation and synthesis of lipids</b>		
<b>Course Objectives: 1,2</b>	<b>Chapters</b>	
be able to illustrate how lipids are digested, transported to the periphery and synthesized. The learner will also assess how these processes are hormonally regulated.		<b>Session 1:</b>
	32	Digestion and transport of Dietary Lipids
		<b>Session 2:</b>
	33	Synthesis of Fatty acids, Triacylglycerols and Major Membrane Lipids
<b>Week 12: Cholesterol synthesis and lipoprotein metabolism</b>		
<b>Course Objectives: 1,2</b>	<b>Chapters</b>	

be able to interpret the circulation of both dietary and endogenous cholesterol as well as determine how this impacts de novo cholesterol synthesis. The learner will also determine the interrelationship VLDL and HDL metabolism	34	Cholesterol absorption, synthesis and metabolism
<b>Week 13: Maintenance of blood glucose</b>		
<b>Course Objectives: 1,2</b>	<b>Chapters</b>	
be able to describe the necessity and hormonal regulation of gluconeogenesis and the maintenance of blood glucose.		<b>Session 1:</b>
	31	Gluconeogenesis and Maintenance of Blood Glucose
	33	Synthesis of Fatty acids, Triacylglycerols and Major Membrane Lipids
		<b>Session 2:</b>
	25	Metabolism of Ethanol
<b>UNIT 4: Hormonal control of metabolism and metabolic acidosis</b>		
<b>Week 14: Protein digestion and the urea cycle</b>		
<b>Course Objectives: 1, 2,3,6</b>	<b>Chapters</b>	
to be able to assess the amino acid pool within the body and determine the relative flux thru the urea cycle based on protein catabolism.	37	Protein Digestion and Amino Acid Absorption
	38	Fate of Amino Acid Nitrogen: Urea cycle
<b>Week 15: Fasted state and Metabolic Acidosis</b>		
<b>Course Objectives: 1, 2,3,6</b>	<b>Chapters</b>	
be able to determine metabolic adaptations that occur during the fasting state and to confidently revisit the integration of intermediary metabolism within the liver, brain, kidney, skeletal muscle and adipose.	3	Fasting
	36	Integration of carbohydrate and Lipid metabolism

	42	Interrelationships of Amino acids with other tissues
<b>Week 16: Additional hormones that impact metabolism</b>		
<b>Course Objectives: 2,3</b>	<b>Chapters</b>	
be able to integrate the actions of alternative hormones on the discussed metabolic pathways to facilitate integration of metabolism across tissues.	43	Actions of Hormones that Regulate Fuel Metabolism