MED1103: Biomolecules & Metabolism Module - 2019/20 Batch

Year 1 Semester 1

Module Coordinator: Dr. S. P. R. P. Prematilake

Topic	Time	Objectives	Dept.	Resp. Person	T/L activity	Comments
Cell MED1103/1						
Introduction to water and biomolecules MED1103/1.1	1hr	1. state the properties of water which enables it to be the major constituent of cell and its environment 2. state what is meant by "hydrophilic", "hydrophobic" and "amphipathic", and provide examples for each 3. define "macromolecules" and "monomers" 4. name the macromolecules found in the human body 5. state the significance of interactions that occur within biomolecules, between biomolecules, and between biomolecules and water	Biochemistry	Head, Biochemistry	Lecture (1hr)	
Biochemical role of the cell MED1103/1.2	1hr	1. describe the biochemical functions of the fundamental unit of life (cell) 2. describe the biochemical role of cell organelles 3. state that the proper functioning of cell organelles is important to smooth cell functional	Biochemistry	Head, Biochemistry	Lecture (1hr)	
Membrane MED1103/1.3	1hr	describe the basic structure & functions of the cell membrane	Biochemistry	Head, Biochemistry	Lecture (1hr)	PD 1 on membrane

Biomolecules MED1103/1.4	11hrs	describe the role (with respect to structure and function) of biomolecules a. Carbohydrates b. Amino acids c. Proteins d. Lipids e. Mucopolysaccharides	Biochemistry	Head, Biochemistry	Lecture (1hr) Lecture (1hr) Lecture (1hr) Lecture (1hr) Lecture (1hr) PD (2 x 3hrs)	and lipids. PD 2 on carbohydrates, amino acids and proteins.
Enzymes & their activity MED1103/2						
Enzymes MED1103/2.1	11hrs	1. describe what an enzyme is and the functions of enzymes in the body 2. recall how the structure of protein contribute to function of an enzyme 3. explain the mode of action of enzymes in terms of an active site, enzyme/substrate complex, lowering of activation energy and enzyme specificity 4. explain and investigate the effects of pH, temperature, enzyme concentration and substrate concentration on enzyme action 5. follow the time course of an enzyme-catalysed reaction, by measuring rates of formation of products or rate of disappearance of substrate (example amylase) 6. briefly describe the terms V_{max} and K_m 7. explain the effects of competitive and non-competitive inhibitors on the rate of enzyme activity 8. define the term allosteric enzymes and isozymes	Biochemistry	Head, Biochemistry	Lectures (2hrs) PD (2 x 3hrs)	State the application of knowledge on enzymes in Medicine (deficiency, disease diagnosis and as target of drugs). SGD is on both topics.
Regulation of enzyme activity MED1103/2.2		describe the regulation of enzyme activity in terms of • Induction/ repression • Allosteric modification	Biochemistry	Head, Biochemistry	Lecture (1hr) SGD (2hrs)	

		• Covalent modification				
Energy for the cell MED1103/3						
Introduction to the Energy for the cell MED1103/3.1	11hrs	1. state the need of energy for cellular activity 2. state the molecules and the mechanisms involved in the energy production	Biochemistry	Head, Biochemistry	Lecture (1hr)	PD and SGD are on all topics.
Glycolysis MED1103/3.2		1. state the biomedical importance of glycolysis 2. outline the glycolytic pathway and its rate limiting steps 3. define the term substrate level phosphorylation 4. describe the difference between aerobic and anaerobic glycolysis 5. outline the regulation of glycolysis	Biochemistry	Head, Biochemistry	Lecture (1hr)	
TCA Cycle MED1103/3.3		1. explain the amphibolic role of the pathway (plays a role in both oxidative and synthetic pathways) 2. describe the TCA Cycle as an integrated pathway in metabolism 3. list the enzymes and co enzymes of the TCA cycle 4. describe the entry of fatty acids, pyruvate and amino acids into the TCA cycle 5. explain how the pathway is regulated	Biochemistry	Head, Biochemistry	Lecture (1hr)	
Oxidation of Amino acids MED1103/3.4		1. describe how amino acids are oxidized to produce energy (including transamination and oxidative deamination) 2. state the difference between glucogenic and ketogenic amino acids	Biochemistry	Head, Biochemistry	Lecture (1hr)	
Oxidation of fatty acids MED1103/3.5		1. outline the main events taking place during oxidation of fatty acids 2. describe how the oxidation of fatty acids is regulated	Biochemistry	Head, Biochemistry	Lecture (1hr)	

		3. explain the difference in the energy yield based on different biomolecules				
Electron transport chain MED1103/3.6		1. state the function of the electron transport chain 2. describe the components of the electron transport chain 3. describe how ATP is generated during electron transport 4. state the final electron acceptor and the end product formed at the end of aerobic respiration 5. state the site specific inhibitors (CN, CO, H_2S, NaN_3, Antimycin A) of electron transport chain	Biochemistry	Head, Biochemistry	Lecture (1hr) PD (3hrs) SGD (2hrs)	
Energy for the muscle MED1103/3.7	2hrs	1. name different types of muscle and state the adaptations available for their function 2. state the major fuels used by skeletal muscle and describe the environment present to promote energy production (pH, temperature, electrolytes) 3. describe the status of ATP/ADP ratio in a skeletal muscle fiber when it is resting and active, explaining how the ratio affects energy production under aerobic and anaerobic (hypoxic) conditions	Biochemistry	Head, Biochemistry	Lectures (2hrs)	This lecture needs to be timed after corresponding lectures by the department of physiology.
Other hexose metabolic pathways MED1103/4						
HMP Shunt MED1103/4.1	1hr	1. outline the pathway and its rate limiting step 2. explain the role of the HMP shunt in different cells/ tissues 3. explain the metabolic consequences of G6PD deficiency	Biochemistry	Head, Biochemistry	Lecture (1hr)	
Metabolism of other carbohydrates	1hr	outline the processes involved in the synthesis of fructose, galactose and lactose	Biochemistry	Head, Biochemistry	Lecture (1hr)	

MED1103/4.2						
Synthesis of important biomolecules MED1103/5						
Gluconeogenesis MED1103/5.1	14hrs	1. define gluconeogenesis 2. explain how gluconeogenesis is regulated 3. explain how it differs from glycolysis 4. explain the biological role of gluconeogenesis	Biochemistry	Head, Biochemistry	Lecture (1hr)	SGD is on all four topics.
Glycogen metabolism MED1103/5.2		1. describe the main events of glycogenesis 2. describe the main events of glycogenolysis 3. explain how glycogen metabolism is regulated 4. state the importance of liver glucose-6-phosphatase in the maintenance of blood glucose level	Biochemistry	Head, Biochemistry	Lecture (1hr)	
Simple and complex lipids MED1103/5.3		1. outline the process of fatty acid synthesis 2. state how fatty acid synthesis is regulated 3. state the main steps of cholesterol synthesis 4. state how cholesterol synthesis is regulated 5. state the effect of statins on cholesterol synthesis	Biochemistry	Head, Biochemistry	Lecture (2hrs)	
Ketone bodies metabolism MED1103/5.4		1. name the "ketone bodies" 2. state why ketone bodies are synthesized and outline ketone body synthesis 3. state the tissues involved in metabolism of ketone bodies 4. explain the importance of ketone bodies in energy production 5. state the circumstances where ketone body formation is increased	Biochemistry	Head, Biochemistry	Lecture (1hr) SGD (2hr)	
Purines & Pyrimidines MED1103/5.5		1. state the components of nucleic acids 2. state the precursors of purines and pyrimidines 3. describe the role of PRPP in purine and pyrimidine	Biochemistry	Head, Biochemistry	Lecture (1hr)	SGD is on both topics.

		metabolism 4. explain how the purine and pyrimidine syntheses are regulated 5. state how AMP, GMP, PABA analogs, folic acid analogs, mycophenolic acids, allopurinol and nucleotide analogs affect purine and pyrimidine metabolism				
Proteins MED1103/5.6		1. state how the genetic information is conveyed to a protein 2. describe the process of transcription 3. describe the process of post-transcriptional modifications and its importance 4. state the different types of RNA 5. describe the properties of the genetic code 6. describe the process of translation 7. describe the process of post-translational modifications and its importance 8. list the differences between prokaryotic and eukaryotic protein synthesis 9. explain the effect of antibiotics (aminoglycosides, tetracyclins, chloramphenicol, macrolides, clindamycin, fusidic acid) on protein synthesis	Biochemistry	Head, Biochemistry	Lecture (3hrs) SGD (2hrs)	
Collagen MED1103/5.7		1. state the basic steps involved in collagen synthesis (including post-translational modifications) and their defects 2. state different types of collagen and their distribution 3. explain the biochemical basis of diseases related to collagen	Biochemistry	Head, Biochemistry	Lecture (1hr)	
Homeostasis MED1103/6						
Regulation of metabolism	2hrs	1. state the effect of insulin, glucagon, cortisol, epinephrine on enzymes in regulation of energy	Biochemistry	Head, Biochemistry	Lectures (2hrs)	1-hr lecture for each

MED1103/6		metabolism 2. recall the regulatory functions of the following; hexokinase, glucose 6-phosphatase, phosphofructokinase, fructose diphosphatase, pyruvate dehydrogenase, pyruvate carboxylase, citrate synthase and isocitrate dehydrogenase, acetyl CoA carboxylase, HMG CoA reductase, aspartate carbamoyl transferase and phosphoribosyl pyrophosphate amino transferase				objective
Vitamins and minerals in metabolism: Nutritional Biochemistry – I MED1103/7						
Water-soluble vitamins MED1103/7.1	8hrs	1. name the water-soluble vitamins 2. describe the biochemical functions of the vitamins 3. state the requirements, sources and availability (internal and external factors) 4. describe the effects of deficiency	Biochemistry	Head, Biochemistry	Lectures (2hrs)	(emphasis will be given with respective modules for the following: role of iron on red cell (1208) calcium and fluoride on bone (2112) iodine on
Fat-soluble vitamins MED1103/7.2		1. name the fat-soluble vitamins 2. describe the biochemical functions of the vitamins 3. state the requirements, sources and availability (internal and external factors) 4. describe the effects of deficiency and excess			Lectures (2hrs)	

Minerals MED1103/7.3		1. describe the biochemical functions of minerals. 2. state the requirements, sources and availability (internal and external factors) 3. describe the effects of deficiency and excess calcium, phosphorus, zinc, chromium, manganese, magnesium, selenium, fluoride, cobalt, copper, iron, iodine			Lectures (2hrs) SGD (2hrs)	thyroid (2112) SGD is on all objectives.