

SEMESTER I & II
LSM2101 – METABOLISM AND REGULATION

Prerequisite: LSM1101 or LSM1401

Workload: 39 lecture hours + 11 tutorial hours

Overview of the biosynthesis and catabolism of carbohydrates, proteins, lipids and nucleic acids in the context of human health and disease. Emphasis on the integration and regulation of metabolic pathways in different tissues and organs. Principles of bioenergetics and mitochondrial energy metabolism, free radicals, mitochondrial DNA damage in aging and neurodegenerative diseases.

S/N	Topics	Lecture hours
1.	Introduction Overview of metabolism and general features in regulation of metabolic pathways.	1 Theresa Tan (semester 1) Sanjay Swarup (semester 2)
2.	Bioenergetics ATPases, substrate-level phosphorylation, redox potential and free energy release Electron transport Oxidative phosphorylation	1 1 2 Theresa Tan (semester 1) Sanjay Swarup (semester 2)
3.	Carbohydrate Metabolism Glycolysis and its regulation Metabolism of other hexoses HMP Glycogen: metabolism and regulation Gluconeogenesis and pentose phosphate pathway TCA cycle	2 1 1 2 1 2 Theresa Tan (semester 1) Sanjay Swarup & Ganesh Anand (semester 2)
4.	Lipid Metabolism Digestion, absorption and transport β -oxidation of fatty acids Ketogenesis Fatty acid biosynthesis Synthesis of eicosanoids and membrane phospholipids Cholesterol metabolism	2 1 1 1 1 2 Markus Weng (semester 1) Adam Yuan (semester 2)
5.	Amino Acid Metabolism Overview of amino acid metabolism Transamination and deamination Urea synthesis and the urea cycle Metabolic fates of the carbon skeletons of amino acids Metabolism of selected amino acids Other specialised products derived from amino acid decarboxylation	1 1 1 1 1 1 Yew Wen Shan (Semester 1) Ganesh Anand (semester 2)

S/N	Topics	Lecture hours
6.	Regulation and integration of metabolism Enzyme and hormonal regulation of metabolic pathways Cellular compartmentation and organ specialization Fuel metabolism in the starve-fed cycle and during exercise Integration of metabolism of carbohydrates, lipids and proteins to ATP synthesis	1 1 1 1 Theresa Tan (semester 1) Adam Yuan (semester 2)
7.	Nucleic Acid Metabolism Chemistry of nucleotides Synthesis of purine and pyrimidine ribonucleotides Formation of deoxyribonucleotides Nucleotide degradation	1 2 1 1 Yew Wen Shan (Semester 1) Ganesh Anand (semester 2)
8.	Free Radicals Reactive oxygen species formed through metabolic pathways Oxidative damage in ageing and neurodegenerative diseases Antioxidants	2 Theresa Tan (semester 1) Adam Yuan (semester 2)
		Total Lectures: 39h Tutorials: 11h
		Total hours 50h

TEXT BOOK (Reference books):

(1) Voet, D., Voet, J. and Pratt, C.: Fundamentals of Biochemistry

MODULE CO-ORDINATORS:

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