Department of Science
Grande Prairie Regional College

BC 2000
Introductory Biochemistry

Self-study Course Outline
Winter 2008-2009

Instructor
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Course Description:	An introduction to the fundamental principles of biochemistry. Protein structure and function; lipids and the structure of biological membranes; nucleotides and the structure of nucleic acids; bioenergetics and the metabolism of carbohydrates, lipids and nitrogen; the integration and regulation of cellular metabolism.
Hours:	3-0-0
Pre-requisites:	CH 1010, and CH 1610 or CH 2610
Transferability:	Biochemistry 200 (University of Alberta) Biochemistry 341 (University of Calgary)
Textbook:	'Essential Biochemistry' (2004) Charlotte W. Pratt and Kathleen Cornely John Wiley & Sons Inc., Publishers
Requirements:	Since participation in lectures and completion of assignments are essential to achieving success in this course, regular attendance at classes is highly recommended. Students who chose not to attend classes must assume whatever risks are involved. In this regard, your attention is directed to the Academic Regulations and Student Responsibilities of Grande Prairie Regional College as described on pages 39-51 of the 2008-2009 G.P.R.C. Calendar. Students are expected to read and become familiar with the material covered in the assigned readings from the text as detailed on the following Topic Outline. since not all of the readings content will be covered in classes.

Evaluation:		
	Quizzes	30%
	Mid-term Exam I	30%
	Final Exam	40%

There will be approximately 7or 8 quizzes assigned on a regular basis throughout the course. Each quiz will concentrate on a particular aspect of the material. To calculate final quiz mark, the five quizzes with the highest marks will be used.
The Mid-term exam will test knowledge of material covered during the first half of the course.
The Final Exam will be cumulative and test knowledge of the entire course with approximately 30-40% of marks assigned to questions from the first half of the course, and approximately 60-70% of marks assigned to questions from the second half of the course.

Final grades will be assigned according to each students overall mark in the course. A bell-curve WILL NOT be used to assign grades.

BC 3200 – Topic Outline

	Text pages
Biological Molecules	
Four major types of biological molecules	6-7
Three major types of biopolymers	8-10
Nucleotides and Nucleic acids	
Purine and Pyrimidine nucleotides	} 54-55
Basic composition of nucleosides and nucleotides	
Basic strucutre of DNA	56-60
Basic structure of RNA	60
Functions of DNA and RNA (Central Dogma)	62-65
Protein Structure and Function	
The amino acids and the properties of their side-chains	93-97
Peptide bonds and protein primary structure	97-98
Secondary structures (α-helix, β-sheet, loops)	103-108
Stabilizing the teertiary strucutre of proteins	110-114
Quarternary strucutre	118-119
The structure of heme	116
The strucutre of myoglobin and binding of oxygen	108-118
The structure of haemoglobin	120
Co-operativity in oxygen binding to haemoglobin	121-122
Structural basis of co-operativity	122-123
The Bohr Effect	124
The role of BPG in oxygen binding to haemoglobin	126
The effect of amino acid substitutions on protein function:	
sickle-cell anaemia	125
foetal haemoglobin	126
Enzymes	
What is an enzyme?	167-169
Classification of enzymes	170-171
How do enzymes work?	171-173
Catalytic mechanisms	173-175
Substrate binding and stabilization of transition state	181-184
Coenzymes and dietary vitamins	288
Competitive binding of enzyme activity	214-215
Allosteric enzymes	219, 222-224
Other means of regulating enzyme activity *in vivo*	224
Co-enzymes and their role as electron carriers	284-286

	Text pages
Biological Membranes	
Structure and properties of fatty acids, triacylglycerols and membrane lipids	234-238
Lipid bilayers and membrane fluidity	238-242
Membrane proteins	242-243
Fluid mosaic model of membrane structure	245-246
Passive and active membrane transport	251
Porins, ion channels and gated channels	252-255
The Na-K ATPase and Na-Glucose transporter	256-258
Introducing hormones and receptors	503
Hormone-signaling mechanisms (eg. cAMP)	503-504, 509-512
Introduction to Metabolism	
Energy and metabolism	11-14
Digestion of fuels	277-278
Storage of fuels (adipose cells, glycogen, polypeptides)	279-280
Mobilization of fuels	280-282
Organ specialization	see slides
The metabolic pathway and common intermediates	282-283
Oxidation and reduction (NAD, FAD, Q)	284-286
Overview of metabolism	286-287
Free energy changes in metabolic reactions	289-290
Energy currency, ATP, and coupled reactions	291-297
Glucose Metabolism	
Glucose and glycogenolysis	303-307
Glycolysis	308-313, 315-320
Fates of pyruvate	320, 322-324
Anaerobic exercise and the Cori Cycle	502
Gluconeogenesis and Glycogen synthesis	324-330
A summary of glucose metabolism	335-336
Regulation of glucose metabolism by insulin and glucagon	handout
Citric Acid Cycle and Oxidative Phosphorylation	
Introduction to the Citric Acid (Kreb's) Cycle	342-344
Conversion of pyruvate to Acetyl-CoA	344, 347
Reactions of the Citric Acid Cycle	348-357
Regulation of the Citric Acid Cycle	357-358
Catabolism, anabolism and anapleurotic reactions	360, 362
Overview of Oxidative phosphorylation	371-372
Mitochondrial anatomy	375-377

	Text pages
Components of the Electron Transport Chain	378-385
Chemiosmosis	385-386
ATP synthase	388-389
Stoichiometry of ATP synthesis	391-392
Regulation of oxidative phosphorylation (coupling)	392
ATP yield from complete aerobic catabolism of glucose	357
Metabolism of Fats, Fatty acids and Cholesterol	
Overview of fat metyabolism	Figure 14-4
Structure of Triacylglycerides (TAGS) and Cholesterol	235, 237
Transport of lipids in Lipoproteins	425-426
TAG synthesis	446-447
Lipases and TAG breakdown	427-428
Degradation of fatty acids: activation and transport	428-429
Degradation of fatty acids: oxidation	429-431
Energy yield from fatty acid oxidation	431-432
Oxidation of odd-chain length and unsaturated fatty acids	432-433, 436-437
Why mammals convert fat to carbohydrate	363
Fatty acid synthesis	437-441
Reciprocal regulation of fatty acid synthesis and fatty acid oxidation	443
Hormonal regulation of fat metabolism and diabetes	517-519
Ketone bodies and ketogenesis	444-445
Cholesterol synthesis and regulation by HMG-CoA reductase	450-454
Fates of cholesterol	454-455
LDL and HDL in cholesterol metabolism	455
Atherosclerosis – good and bad cholesterol	425-426, Box 14A
Nitrogen Metabolism	
The Nitrogen Cycle	463-464
Assimilation of ammonia	465-466
Transamination and synthesis of amino acids	466-467, 469-470
Essential amino acids	469
Catabolism of amino acids	483
Amino acids are glucogenic, ketogenic or both	483-486
The Urea Cycle	487-491
Other mechanisms for nitrogen disposal	492