

**Dept. of Science  
Grande Prairie Regional College**

**BC 2000  
INTRODUCTORY BIOCHEMISTRY  
(3-0-0) (3 credits)**

**Course Outline  
2011 – 2012  
Fall Semester**

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. This course is designed both for students who require a single term course in the fundamental principles of biochemistry, **AND** for students who intend to take further courses in biochemistry.

**Hours:** 3-0-0

**Lectures:** Tuesdays & Thursdays, 1300-1420 hrs, J202

**Pre-requisites:** Chemistry 1010  
Chemistry 1610 or Chemistry 2610

**Transferability:** University of Alberta (Biochemistry 200)  
University of Calgary (Biochemistry 341)

**Text-book:** "Essential Biochemistry" (2<sup>nd</sup> Edition, 2011)  
Charlotte W. Pratt and Kathleen Cornely  
John Wiley & Sons Inc. Publishers

**Student Responsibilities:** Students are expected to be on time and to attend all classes. It is also expected that students will ask questions during classes when the need arises. Should students choose not to attend classes, they must assume whatever risks are involved. In this regard your attention is directed to the Academic Regulations and Student Responsibilities of Grand Prairie Regional College as described in the G.P.R.C. Calendar. It is especially important that students are familiar with the sections on plagiarism, cheating and the resultant penalties, since these are serious issues and will be dealt with severely.

To succeed in this course it is essential that students read and become familiar with the relevant material in the textbook as detailed in the following Topic Outline.

**Assignments:** To aid preparation for exams, questions and problem sets may be assigned to students throughout the course. These must be completed and handed in at the time specified. Late assignments will not be accepted.

Practice quizzes will be made available on Moodle to aid preparation for exams. These can be completed at any time by students.

<b>Evaluation:</b>	Mid-term Exam I	30%
	Mid-term Exam II	30%
	Final Exam	40%

**Grading:** Final Grades will be awarded using the following approximate overall marks:

A+	>90%
A	87-90%
A-	83-86%
B+	79-82%
B	74-78%
B-	70-73%
C+	69-74%
C	65-68%
C-	61-64%
D+	55-60%
D	50-55%
F	<50%

Each student will be assigned a grade based on their overall final mark – a bell-curve will not be used.

## BC 2000 – Topic Outline

Topic	Textbook Readings (pages)	
	1 <sup>st</sup> Edition	2 <sup>nd</sup> Edition
<b>Biological Molecules</b>		
Types of biomolecules	6-7	4-6
Biopolymers	8-10	6-10
Nucleosides and nucleotides	54-55	52-54
Basic structure of DNA and RNA	56-60	56-59
Functions of Nucleic acids (Central Dogma)	62-65	61-65
<b>Protein Structure and Function</b>		
Overview	90-93	87-89
Amino acids	93-97	89-92
Peptide bonds and primary structure	97-98	92-93
Secondary structures	103-108	95-99
Tertiary structure and stabilization	110-114	99-104
Quarternary structure	118-119	108-109
Oxygen binding to myoglobin and haemoglobin	116-126	121-131
<b>Enzymes</b>		
What is an enzyme?	167-169	154-157
Classifying enzymes	170-171	157-158
How do enzymes work?	171-173	158-160
Catalytic mechanisms	173-175	160-164
Substrate binding	181-184	167-170
Co-enzymes and dietary vitamins	288	54-56, 308-311
Competitive inhibition	214-215	197-199
Allosteric enzymes	219, 222-224	205-207
Other <i>in vivo</i> regulatory mechanisms	224	207
Co-enzymes and roles as electron carriers	284-286	304-306
<b>Lipids and Biological Membranes</b>		
Fatty acids, triacylglycerols and membrane lipids	234-238	216-222
Lipid bilayers and membrane fluidity	238-242	222-226
Membrane proteins	242-243	226
Fluid Mosaic Model	245-246	229-230

Passive and active membrane transport	251	239
Porins, ion channels and gated channels	252-256	240-245
The Na <sup>+</sup> -K <sup>+</sup> ATPase and Na <sup>+</sup> -glucose transporters	256-258	245-248
Introduction to hormones and receptors	503	258
Hormone-signaling mechanisms	503-504, 509-512	262-266

### **Introduction to Metabolism**

Energy and metabolism	11-14	10-14
Food and Fuel	277-278	297-299
Storage of fuels	279-280	299-300
Mobilization of fuels	280-282	300-302
Organ specialization	Class notes	Class notes
Metabolic pathway and common intermediates	283-283	302-303
Oxidation and reduction	284-286	304-306
Overview of metabolism	286-287	306-307
Free energy changes in metabolic reactions	289-290	311-313
Energy currency, ATP, coupled reactions	291-297	313-317, fig 3-4a

### **Glucose Metabolism**

Glucose and glycogenolysis	303-307	325-326
Glycolysis	308-313, 315-320	326-327
Fates of Pyruvate	320, 322-324	337-341
Anaerobic exercise and the Cori Cycle	502	503-504
Gluconeogenesis and Glycogen synthesis	324-330	341-347
Summary of glucose metabolism	335-336	352-353
Regulation by insulin and glucagon	504-510	505-509

### **Citric Acid Cycle and Oxidative Phosphorylation**

Introduction	342-344	359-360
Conversion of pyruvate to acetyl-CoA	344-347	360-364
Reactions of the Citric Acid Cycle	348-357	364-372
Regulation of the Citric Acid Cycle	357-358	372-373
Catabolism, anabolism and anapleurotic reactions	360-362	374-379
Overview of oxidative phosphorylation	371-372	384-385
Mitochondrial anatomy	375-377	389-390
Components of the electron transport chain	378-385	391-397

Chemiosmosis	385-386	398-399
ATP synthase	388-389	400-402
Stoichiometry of ATP synthesis	391-392	402
Regulation and coupling	392	402-404
ATP yield from aerobic catabolism of glucose	357	372

### **Metabolism of Fats, Fatty Acids and Cholesterol**

Overview of fat metabolism	Fig. 14-4	Fig. 17-4
Triacylglycerides (TAGs) and Cholesterol	235-237	218-219
Transport of lipids	425-426	434
TAG synthesis	446-447	454-455
Lipases and TAG breakdown	427-428	436
Degradation of fatty acids (activation and transport)	428-429	436-437
Degradation of fatty acids ( $\beta$ -oxidation)	429-432	437-440
Odd-chain length and unsaturated fatty acids	432-433, 436-437	440-444
Glyoxylate cycle	363	376-377
Fatty acid synthesis	437-441	445-449
Regulation of fatty acid metabolism	443	450
Fat metabolism and diabetes	517-519	512-513
Ketone bodies and ketogenesis	444-445	452-453
Cholesterol synthesis and regulation	450-454	457
Fates of cholesterol	454-455	457-460
“Good” and “Bad” cholesterol	425-426, Box 14A	434-435, Box 17A

### **Nitrogen Metabolism**

Nitrogen fixation and assimilation	463-466	466-469
Transamination and amino acid synthesis	466-467, 469-471	469-473
Essential amino acids	469	471
Catabolism of amino acids	483-486	486-489
The Urea Cycle and nitrogen disposal	487-493	490-494