

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

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

**Course Outline
2009 – 2010**

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

Pre-requisites: Chemistry 1010
Chemistry 1610 or Chemistry 2610

Transferability: University of Alberta (BIOCH 200)

Text-book: "Essential Biochemistry" (2004)
Charlotte W. Pratt and Kathleen Cornely
John Wiley & Sons Inc. Publishers

Lectures: Tuesdays & Thursdays, 1300-1420 hrs, J226

Evaluation:

Quizzes	30%
Mid-term Exam	30%
Final Exam	40%

Grading: Final Grades will be awarded using the following approximate 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%

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.

BC 2000 - Lecture Schedule

Topic	Readings
Introduction (1 hour) Biomolecules/biopolymers	Ch. 1: 6-11
Nucleotides and Nucleic acids (3 hours) Purine & pyrimidine bases Nucleosides & nucleotides High-energy molecules & phosphodiester bonds Co-enzymes and role as electron carriers Structure of DNA and RNA The Central Dogma (genes to proteins) Regulation of gene expression	Ch. 3: 54-55 Ch. 3: 55-57 Ch. 3: 56; Ch. 9: 291-294 Ch. 9: 284-285 Ch. 3: 57-60 Ch. 3: 62-65 Ch. 19: 583-588
Protein Structure and Function (6 hours) Amino acids Peptide bonds and primary structure Secondary structures Tertiary structure (myoglobin) Oxygen binding to myoglobin Quarternary structure (haemoglobin) Cooperativity and allostery Amino acid substitutions: Foetal haemoglobin Sickle-cell anaemia	Ch. 4: 93-97 Ch. 4: 97-98 Ch. 4: 103-108 Ch. 4: 108-118 Ch. 4: 116-118 Ch. 4: 118-119 Ch. 4: 121-126 Ch. 4: 126 Ch. 4: 125
Enzymes (3 hours) What is an enzyme? Classifying enzymes How do enzymes work? Catalytic mechanisms Co-enzymes and dietary vitamins Competitive inhibition Allosteric enzymes Other <i>in vivo</i> regulatory mechanisms	Ch. 6: 167-169 Ch. 6: 170-171 Ch. 6: 171-173 Ch. 6: 173-175; 181-184 Ch. 9: 288 Ch. 7: 214-215 Ch. 7: 219; 222-224 Ch. 7: 224
Lipids and Biological Membranes (4 hours) Fatty acids and triacylglycerols Membrane lipids Lipid bilayers and membrane fluidity Membrane proteins Fluid Mosaic Model Membrane transporters Active transport Introduction to hormones Hormone-signaling mechanisms	Ch. 8: 234-235 Ch. 8: 236-238 Ch. 8: 238-242 Ch. 8: 242-245 Ch. 8: 245-246 Ch. 8: 252-256 Ch. 8: 256-258 Ch. 16: 503 Ch. 16: 503-504; 509-512

Lecture Schedule (continued)

Introduction to Metabolism (2 hours)

Energy and metabolism	Ch. 1: 11-14
Food and Fuel	Ch. 9: 277-283
Oxidation and reduction	Ch. 9: 284-287
Free energy changes in metabolic reactions	Ch. 9: 289-290
Energy currency, ATP, coupled reactions	Ch. 9: 291-297

MID-TERM EXAM

Glucose Metabolism (4 hours)

Glucose and glycogenolysis	Ch. 10: 305-307
Glycolysis	Ch. 10: 308-320
Fates of Pyruvate	Ch. 10: 320-324
Glycogen breakdown and the Cori Cycle	Ch. 16: 502
Gluconeogenesis and Glycogen synthesis	Ch. 10: 324-330

Citric Acid Cycle and Oxidative Phosphorylation (4 hours)

Introduction	Ch. 11: 342-344
Conversion of pyruvate to acetyl-CoA	Ch. 11: 344-347
Reactions of the Citric Acid Cycle	Ch. 11: 348-357
Regulation of the Citric Acid Cycle	Ch. 11: 357-358
Amphibolic nature of Citric Acid Cycle	Ch. 11: 360-364
Oxidative phosphorylation	Ch. 12: 371-393
Energy yield from complete oxidation of glucose	

Metabolism of Fats, Fatty Acids and Cholesterol (7 hours)

Fats as energy stores	
Catabolism of lipids	
Lipases and hormone-sensitive lipases	Ch. 14: 427-428
Oxidation of fatty acids	Ch. 14: 428-433
Conversion of fats to carbohydrates	Ch. 11: 363
Ketone bodies	Ch. 14: 444-446
Use of fats during exercise	
Anabolism of Fatty Acids	
Fatty acid synthesis	Ch. 14: 437-442
Regulation of Fatty acid synthesis	Ch. 14: 443-444

Integration of Carbohydrate and Lipid Metabolism (2 hours)

Organ specialization	
Cori cycle and the Glucose/Alanine Cycle	Ch. 16: 501-502
Actions of Insulin	Ch. 16: 504-509
Actions of Glucagon and Adrenaline	Ch. 16: 509-510
Diabetes	Ch. 16: 517-519

Synthesis and Transport of Cholesterol (3 hours)

Cholesterol synthesis	Ch. 14: 450-455
Lipoproteins and atherosclerosis	Ch. 14: 425-426; 441; 455-456

Lecture Schedule (continued)

Nitrogen Metabolism (2 hours)

Nitrogen fixation and assimilation

Ch. 15: 463-466

Transamination reactions

Ch. 15: 466-467

Synthesis of non-essential amino acids

Ch. 15: 467-471

Catabolism of amino acids

Ch. 15: 483-486

The Urea Cycle and nitrogen disposal

Ch. 15: 487-493

FINAL EXAM