Department of Science
Grande Prairie Regional College

BC 3200
Structure & Catalysis

Course Outline
Winter 2008-2009

Instructor
Philip Johnson B.Sc., M.Sc., Ph.D., M.S.P.H.
Office: J224
Phone: 539-2863
E-mail: *johnson@gprc.ab.ca*

Course Description:	Designed to illustrate, in detail, the relationships between structure and function in biological molecules. It covers the structure of proteins; techniques used to study proteins; contractile proteins and immunoglobulins as examples of protein function; enzyme catalysis kinetics and regulation; structural carbohydrates and glycobiology; the structure of lipids; biological membranes and mechanisms of transport; molecular mechanisms of biosignalling.
Pre-requisites:	BC 2000, CH 1020 and CH 2630
Notes:	1. Students with grades of less than B- in pre-requisite courses require consent of the instructor to enroll in BC 3200. 2. BC 3200 may not be taken for credit if credit has already been obtained in BC 2030 or BC 2050.
Transferability:	Biochemistry 320 (University of Alberta)
Textbook:	Chapters 3-7, 10-12 Lehninger Principles of Biochemistry (5^{th} Edition) David Nelson & Michael Cox W.H. Freeman and Company 2008 The 4^{th} Edition (2005) of this text is also acceptable
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:	Mid-term Exam I 30% Mid-term Exam II 30% Final Exam 40% Mid-term Exam I will test knowledge of material covered in the first third of the course. Mid-term II will test knowledge of material covered since the first mid-term. The Final Exam will be cumulative and test knowledge of the entire course with approximately 40-50% of marks assigned to questions from the first two-thirds of the course, and approximately 50-60% of marks assigned to questions from the last third 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

hours	topic	Text readings 4th edition	Text readings 5th edition
5	Amino acids, peptides and proteins		
	Amino acids		
	Common structural features	76-77	72-74
	Classification by R-group	78-80	74-77
	Uncommon amino acids	80-81	77-78
	Functions as acids and bases	81-85	78-81
	Peptides and proteins		
	Composition of peptides	85-86	82
	Sizes of active peptides and polypeptides	86-87	83-84
	Composition and additional chemical groups	87-88	84
	Levels of protein structure	88	92
	Working with proteins		
	Separation, purification and column chromatography	7-8, 89-92	7-8, 85-88
	Electrophoresis	92-95	88-91
	Activity and Specific Activity	94-95	91-92
	Covalent Structure of proteins		
	Primary structure determines function	96-97	93
	Sequence determination	97-104	93-100
	Chemical synthesis of peptides	104-106	100-102
	Biochemical information from primary sequence	106	} 102-106
	Primary sequence and evolution	106-110	
5	Three-dimensional structure of proteins		
	Overview		
	Stabilization of protein conformation	116-118	113-115
	Peptide bonds and Ramachandran Plots	118-120	115-117
	Protein Secondary structure		
	Structure and stability of the α-helix	120-122	117-120
	β-sheets and β-turns	123-124	120-121
	Bond angles and amino acid content	124	121-123
	Tertiary and Quarternary structure		
	Fibrous proteins (inc. Boxes 4-2 & 4-3)	125-129	123-129
	Globular proteins	129-135	129-131
	Determination of 3-D structure	Box 4-4	Box 4-5
	Structural patterns in globular proteins	138-141	131-136

	Structural classification	141-144	136-138
	Quarternary structure	144-146	138-140
	Denaturation and folding		
	Denaturation and renaturation	147-148	140-142
	Polypeptide folding	148-151	142-143
	Chaperones and assisted folding	151-153	143-145
2	Protein functions, interactions, molecular motors		
	Ligands and binding	157-158	153-154
	Myosin and actin	182-184	175-176
	Thin and thick filaments	184-185	176-177
	Sliding filaments and muscle contraction	185-186	178-179
6	Enzymes		
	Introduction		
	Importance of enzymes	190-191	183
	Enzymes, cofactors and classification	191-193	183-185
	How enzymes work		
	Active sites, reaction coordinate diagrams	193-195	186-188
	Definitions – reaction equilibria and rates	195-196	188
	Catalytic power and enzyme specificity	196-200	188-192
	Types of catalysis	200-202	192-194
	Enzyme kinetics and mechanisms		
	Substrate concentration and reaction rates	202-205, Box 6-1	194-197, Box 6-1
	Kinetic parameters for comparing activity	205-207	197-200
	Bisubstrate enzyme-catalyzed reactions	207-208	200
	Enzyme inhibitors	208-212, Box 6.2	201-204, Box 6-2
	Activity and pH	212	204
	Examples		
	Chymotrypsin	213-218	205-211
	Hexokinase	218-219	212
	Enolase	219 & 222	213
	Regulatory enzymes		
	Allosteric enzymes and pathway regulation	225-227	220-222
	Kinetic properties of allosteric enzymes	227-228	222
	Regulation by covalent modification	228-232	223-227
4	Carbohydrates and glycobiology		
	Monosaccharides and disaccharides		