Douglas College

EFFECTIVE: SEPTEMBER 2003
CURRICULUM GUIDELINES

A. Division: Science and Technology

Effective Date: September 2003

B. Department / Program
Area: Biology

Revision [X] New Course [ ]

If Revision, Section(s)
Revised: A,B,F,G,M,N,O,P,Q,R

Date of Previous Revision: September 1984

Date of Current Revision: May 2002

C: Biology 421 **D**: Cell Biochemistry **E:** 3

Subject & Course No.	Descriptive Title	Semester Credits

F: Calendar Description:

An introduction to the biochemistry of a cell, including the structural and functional aspects of the micro and macro molecules. Protein structure, enzyme kinetics, and energy pathways will be considered. Some metabolic sequences in the cell will be examined in relation to control mechanisms.

G: Allocation of Contact Hours to Type of Instruction / Learning Settings

Primary Methods of Instructional Delivery and/or Learning Settings:

Lecture/Tutorial/Lab

Number of Contact Hours: (per week / semester for each descriptor)

Lecture: 3 hours/week

Tutorial: 1 hour/week

Number of Weeks per Semester: 14

H: Course Prerequisites:

Biology 321 and Chemistry 320, or permission of the instructor.

I: Course Corequisites:

Chemistry 420

J: Course for which this Course is a Prerequisite

None

K: Maximum Class Size:

35

L: PLEASE INDICATE:

[ ] Non-Credit

[ ] College Credit Non-Transfer

[X] College Credit Transfer:

SEE BC TRANSFER GUIDE FOR TRANSFER DETAILS (www.bccat.bc.ca)

M: Course Objectives / Learning Outcomes

Upon completion of Biology 421, the student will be able to:

- Describe the chemistry of water, acid-base properties, and buffers.
- Describe the chemistry of amino acids.
- Explain how protein sequence is determined, and describe the structure of peptides.
- Describe the structure of proteins, especially in terms of how this structure relates to function.
- Describe what allosteric proteins are, and their importance.
- Describe the structure, function, and behaviour of hemoglobin and myoglobin.
- Describe enzyme kinetics
- Explain basic bioenergetic principles as they relate to catabolism in the cell – free energy, coupled reactions, nucleotides.
- Describe the chemistry of carbohydrates – structure and function.
- Explain in detail the process of cellular respiration – glycolysis, Krebs cycle, electron transport and ATP synthesis.
- Describe anabolism in the cell in terms of gluconeogenesis.
- Describe the biosynthesis of macromolecules (specifically polysaccharides) in terms of glycogen synthesis, and describe the degradation of macromolecules in terms of glycogenolysis.
- Describe metabolic control in the cell and energy charge.
- Describe regulation in the cell in terms of hormone action.
- Provide brief descriptions of alternative oxidative pathways – i.e. lipid and fatty acid oxidation, amino acid oxidation, the phosphogluconate pathway.
- Provide a brief overview of human metabolism in terms of interrelationships between the catabolic and anabolic pathways discussed during the course of the semester.

N: Course Content:

The major topics in the course include the following:

An Introduction – What is Biochemistry?

Proteins:

Water and Acid-Base concepts
Amino acids, peptides, and proteins
The Henderson-Hasselbalch Equation
PH, pK, and pI.
Electrophoresis
Peptide sequencing
Protein structure
Titration curves of amino acids and peptides

Globular proteins

Myoglobin (Mb) – structure, function, and behaviour
Hemoglobin (Hb) – structure, function, and behaviour
- Major differences between myoglobin and hemoglobin

Adult hemoglobin versus fetal hemoglobin
The effect of certain metabolites (i.e. H+ ions, CO, and BPG) on hemoglobin
Sickle cell anemia and its effect on hemoglobin structure and function

Enzyme Kinetics

Enzymes as biological catalysts
Reaction rates
The specificity of enzymes for their substrates
Specific catalytic groups and their contribution to catalysis
Substrate concentrations
The Michaelis-Menten Equation
Lineweaver-Burk plots

The meaning of Vmax and Km as they relate to enzymes
Reversible and irreversible inhibition
The affect of pH on enzyme activity
Allosteric enzymes, and how their kinetics differ from those of non-allosteric enzymes

Bioenergetics

The Laws of Thermodynamics – a short review
Entropy
Standard and Actual Free-Energy Change
The Equilibrium Constant
Coupled reactions
Phosphate group transfers and ATP

Catabolism

Glycolysis
The Tricarboxylic Acid Cycle or Krebs Cycle
The electron Transport System
The Glycerol-Phosphate and Malate-Aspartate Shuttle Mechanisms
Gluconeogenesis
Glycogen metabolism – Glycogen synthesis and Glycogenolysis
Other alternative oxidative pathways
The effects of hormones on metabolism
Integration of metabolism

O: Methods of Instruction

This course involves three hours a week of classroom instruction and one hour a week of tutorials in which selected problems from the textbook are solved.

P: Textbooks and Materials to be Purchased by Student

Nelson and Cox, 2000. *Lehninger – Principles of Biochemistry* (3rd edition). New York: Worth Publishers.

Q: Means of Assessment

TYPE OF EVALUATION	**POINTS**
Class tests	10-25
Two term examinations	30-50
One final examination	30-40
TOTAL	**100**

Grades: A+ 95-100, A 90-94, A- 85-89, B+ 80-84, B 75-79, B- 70-74, C+ 65-69, C 60-64, C- 55-59, P 50-54, F 0-49.

R: Prior Learning Assessment and Recognition: specify whether course is open for PLAR

There is no provision of PLAR, other than that normally done by examining transcripts and comparing course outlines of Biochemistry courses taken within the last five years elsewhere to the Douglas College Biology 421 course content.

Course Designer(s)

Education Council / Curriculum Committee Representative

Dean / Director

Registrar