# DEPARTMENT OF SCIENCE

## COURSE OUTLINE – Fall 2017

## BC 2000 – INTRODUCTORY BIOCHEMISTRY

**3 (3-0-0)** 45 HOURS FOR 15 WEEKS


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| **INSTRUCTOR:** | Philip Johnson | **PHONE:** | 780-539-2863 |
| **OFFICE:** | J224 | **E-MAIL:** | PJohnson@gprc.ab.ca |


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| **OFFICE HOURS:** | Tuesdays | 1000-1120 hrs & 1300-1420 hrs |
| | Thursdays | 1000-1120 hrs |
| | Fridays | 1120-1250 hrs |

**PREREQUISITE(S)/COREQUISITE:** CH 1010 and CH 1610 or CH 2610

**REQUIRED TEXT/RESOURCE MATERIALS:**

"Essential Biochemistry" (4th Edition, 2018 **or** 3rd Edition, 2014)
Charlotte W. Pratt and Kathleen Cornely
John Wiley & Sons Inc. Publishers

**SUPPLEMENTS:**

Practice quizzes will be made available on Moodle to aid preparation for exams. These can be completed at any time by students.
A link to the textbook website is also available on Moodle. This site provides access to a number of useful resources.

**CALENDAR 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.

**CREDIT/CONTACT HOURS:** 3 credits (3-0-0)

**DELIVERY MODE(S):** Classes Monday 1130-1250 (J201)
Friday 1000-1120 (J201)

**COURSE OBJECTIVES:**
1. To gain an understanding of biochemical reactions and pathways.
2. To develop critical thinking skills with respect to biochemistry.

**LEARNING OUTCOMES:**
1. Students should know the reactions of common metabolic pathways.
2. Students should understand how metabolic pathways are integrated.
3. Students should understand the relationship between metabolism and disease.

**TRANSFERABILITY:**

University of Alberta (Biochemistry 200)
University of Calgary (Biochemistry 341)

**EVALUATIONS:**

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| Mid-term Exam I | 30% |
| Mid-term Exam II | 30% |
| Final Exam | 40% |

**GRADING CRITERIA:**

| **GRANDE PRAIRIE REGIONAL COLLEGE** | | | |
|---|---|---|---|
| **GRADING CONVERSION CHART** | | | |
| **Alpha Grade** | **4-point** | **Percentage** | **Designation** |
| **$A^+$** | **4.0** | **90 – 100** | **EXCELLENT** |
| **A** | **4.0** | **85 – 89** | |
| **$A^-$** | **3.7** | **80 – 84** | **FIRST CLASS STANDING** |
| **$B^+$** | **3.3** | **77 – 79** | |
| **B** | **3.0** | **73 – 76** | **GOOD** |
| **$B^-$** | **2.7** | **70 – 72** | |
| **$C^+$** | **2.3** | **67 – 69** | **SATISFACTORY** |
| **C** | **2.0** | **63 – 66** | |
| **$C^-$** | **1.7** | **60 – 62** | |
| **$D^+$** | **1.3** | **55 – 59** | **MINIMAL PASS** |
| **D** | **1.0** | **50 – 54** | |
| **F** | **0.0** | **0 – 49** | **FAIL** |
| **WF** | **0.0** | **0** | **FAIL, withdrawal after the deadline** |

**** Grade of D or D+ may not be acceptable for transfer to other post-secondary institutions. Students are cautioned that it is their responsibility to contact the receiving institutions to ensure transferability**

# BC2000 Fall 2017-18 – Topic Outline &Text Readings

| Topic | | 3rd Edition pages | 4th Edition pages |
|---|---|---|---|
| **Biological Molecules** | | | |
| | Types of biomolecules | 3-6 | 3-6 |
| | Biopolymers | 6-10 | 6-9 |
| | Nucleosides and nucleotides | 52-55 | 52-55 |
| | Basic structure of DNA and RNA | 56-61 | 56-61 |
| | Functions of Nucleic acids (Central Dogma) | 61-65 | 61-64 |
| | | | |
| **Protein Structure and Function** | | | |
| | Overview | 87-88 | 85 |
| | Amino acids | 89-91 | 86-90 |
| | Peptide bonds and primary structure | 91-96 | 90-94 |
| | Secondary structures | 96-99 | 94-97 |
| | Tertiary structure and stabilization | 99-104 | 97-101 |
| | Protein folding & Quarternary structure | 104-108 | 101-106 |
| | Oxygen binding to myoglobin and haemoglobin | 122-133 | 120-129 |
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| **Lipids and Biological Membranes** | | | |
| | Fatty acids, triacylglycerols and membrane lipids | 220-227 | 215-222 |
| | Lipid bilayers and membrane fluidity | 227-230 | 222-225 |
| | Membrane proteins | 230-233 | 225-228 |
| | Fluid Mosaic Model | 233-234 | 228-229 |
| | Passive & Active membrane transport | 246-255 | 240-248 |
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| **Enzymes** | | | |
| | What is an enzyme? | 158-161 | 154-157 |
| | Classifying enzymes | 161-162 | 157-158 |
| | Co-enzymes and dietary vitamins | 54-55; 320-322 | 54-55; 312-314 |
| | Catalytic mechanisms | 162-171 | 158-166 |
| | Substrate binding | 171-174 | 166-171 |
| | Enzyme kinetics | 188-198 | 183-192 |
| | Enzyme inhibition | 200-209 | 194-200 |
| | Allosteric enzymes | 209-211 | 200-203 |

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| | Other *in vivo* regulatory mechanisms | 211 | 203 |
| | Co-enzymes and roles as electron carriers | 316-317 | 308-309 |
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| **Introduction to Metabolism** | | | |
| | Energy and metabolism | 10-14 | 10-14 |
| | Food and Fuel | 308-311 | 301-303 |
| | Storage and use of fuels | 312-314 | 304-306 |
| | Metabolic pathways and common intermediates | 314-316 | 306-308 |
| | Oxidation and reduction | 316-317 | 308-309 |
| | Overview of metabolism | 318-320 | 310-312 |
| | Free energy changes in metabolic reactions | 323-325 | 314-316 |
| | Energy currency, ATP, coupled reactions | 325-330<br>Fig 3-3a | 316-321<br>Fig 3-2a |
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| **Glucose Metabolism** | | | |
| | Introduction | 290-294, 359 338-33 | 283-287; 349; 329 |
| | Glycolysis | 339-350 | 330-340 |
| | Fates of Pyruvate | 350-354 | 341-344 |
| | Anaerobic exercise and the Cori Cycle | 513-514 | 499-500 |
| | Gluconeogenesis and Glycogen metabolism | 354-359 | 344-349 |
| | Pentose phosphate pathway | 361-363 | 350-352 |
| | Summary of glucose metabolism | 363-364 | 352-353 |
| | Hormonal regulation | 515-518; 277-280;<br>522-523 | 501-505; 270-273;<br>509-510 |
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| **Citric Acid Cycle and Oxidative Phosphorylation** | | | |
| | Introduction | 370-371 | 362 |
| | Conversion of pyruvate to acetyl-CoA | 371-374 | 362-365 |
| | Reactions of the Citric Acid Cycle | 374-381 | 365-372 |
| | Regulation of the Citric Acid Cycle | 381-382 | 372-373 |
| | Catabolism, anabolism and anapleurotic reactions | 384-388 | 374-378 |
| | Overview of oxidative phosphorylation | 394-395 | 385 |
| | Mitochondria and Electron transport chain | 399-408 | 390-399 |
| | Chemiosmosis | 408-410 | 399-401 |
| | ATP synthase | 410-414 | 401-405 |
| | ATP yield from aerobic catabolism of glucose | 380-381 | 372 |
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| **Metabolism of Fats, Fatty Acids and Cholesterol** | | | |
| | Overview of fat metabolism | Fig. 17-4 | Fig. 17-4 |
| | Transport of lipids | 443-444 | 432-434 |
| | TAG synthesis | 463-465 | 452-454 |
| | Lipases and TAG breakdown | 445 | 435 |
| | Degradation of fatty acids (activation & transport) | 445-446 | 435-436 |
| | Degradation of fatty acids (β-oxidation) | 446-453 | 436-443 |
| | Glyoxylate cycle | 386 | 377 |
| | Fatty acid synthesis | 453-459 | 443-449 |
| | Regulation of fatty acid metabolism | 459-460 | 449-450 |
| | Fat metabolism and diabetes | 522-524 | 509-511 |
| | Ketone bodies and ketogenesis | 461-462 | 450-452 |
| | Cholesterol synthesis and regulation | 466-467 | 454-457 |
| | Fates of cholesterol | 467-467 | 454-457<br>Box 17A |
| | "Good" and "Bad" cholesterol | 458<br>Box 17A | |
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| **Nitrogen Metabolism** | | | |
| | Nitrogen fixation and assimilation | 475-478 | 464-467 |
| | Transamination and amino acid synthesis | 478-482 | 467-471 |
| | Catabolism of amino acids | 494-498 | 476-480 |
| | The Urea Cycle and nitrogen disposal | 498-502 | 480-484 |
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**STUDENT RESPONSIBILITIES:**
Students are expected to attend **all** classes, seminars and laboratory sessions. All assignments must be completed in full and handed in by the date specified. Refer to the College Policy on Student Rights and Responsibilities at https://www.gprc.ab.ca/about/administration/policies/#academic_policies

**STATEMENT ON PLAGIARISM AND CHEATING:**
Cheating and plagiarism will not be tolerated and there will be penalties. For a more precise definition of plagiarism and its consequences, refer to the Student Conduct section of the College Admission Guide at http://www.gprc.ab.ca/programs/calendar/ or the College Policy on Student Misconduct: Plagiarism and Cheating at http://www.gprc.ab.ca/about/administration/policies/

**Note: all Academic and Administrative policies are available on the same page.