

BIOCHEMISTRY

Program Notes

Subject Code for Biochemistry: **BCHM**

World Wide Web Address: <http://healthsci.queensu.ca/liscbchm/biochemistry> (<http://healthsci.queensu.ca/liscbchm/biochemistry/>)

Associate Dean, Life Sciences and Biochemistry: Louise Winn (lifesci@queensu.ca)

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Overview

Biochemistry is the branch of science that explores the structures and chemical processes of molecules in living organisms that interact to form cells, tissues, and whole organisms. The Biochemistry program at Queen's provides students with in-depth training in a wide range of important topics that are related to these processes, including the mechanisms of cancer progression, cellular communication, and the molecular and chemical basis of infection, inheritance, and disease. The program also offers opportunities for students to explore rapidly expanding fields in molecular genetics, metabolism of biomolecules, bioengineering, and regenerative medicine through hands-on training with professors in research labs.

The first two years of the program provides vital background preparation in Biology, Chemistry (organic, analytical, and physical), Molecular Biology, Math, and Statistical Analysis, to understand the molecules that make up all living things. In the upper years of the program, students receive in-depth exposure to all areas of Biochemistry and Molecular Biology, Cell Biology, including extensive hands-on laboratory experiences. The Biochemistry program has enough flexibility for students to take elective courses offered in other programs within the Faculty of Arts and Science, including the Life Sciences program, for which they are eligible.

The **Department of Biomedical and Molecular Sciences** is responsible for *Biochemistry* Plans (General/Minor (Science), Major, Specialization) and plays a primary role in the *Life Sciences* Plans (General/Minor (Science), Major, Specialization). For specific information related to the Biochemistry and Life Sciences Programs, please consult the Biochemistry Program and Life Sciences Program entries in the *Calendar*.

Program Policies

Students pursuing entry into the fourth-year of the *Biochemistry* Major Plan require a minimum GPA of 2.5 in the core BCHM courses (BCHM 218, BCHM 313, BCHM 315, BCHM 316, and BCHM 317) to access those fourth-year courses required to complete the Plan. See Academic Regulations (<https://queensu-ca-public.courseleaf.com/archive/2022-2023/arts-science/academic-regulations/>) **2.4** and **2.6**.

Students wishing to continue in *Biochemistry* Specialization Plan (BCHM-P-BSH) (<https://queensu-ca-public.courseleaf.com/archive/2022-2023/arts-science/schools-departments-programs/biochemistry/biochemistry-specialization-science-bs-honours/>) in their fourth-year must:

1. achieve a minimum GPA in the core BCHM courses (see above) of 2.9 and
2. acceptance into the Plan.

Students who secure a research project but do not attain the minimum GPA of 2.9 will not be allowed to enrol in BCHM 421 and BCHM 422 but will be allowed to complete the *Biochemistry* Major Plan.

Laboratory Safety

Departmental Safety Rules are strictly enforced. A standard white laboratory coat is required for all laboratory courses. Shoes must be closed at both heel and toe. Additional safety requirements will be described at the first laboratory in each laboratory-based course.

Advice to Students

Students should seek **academic counselling** from the staff in the Associate Dean's office or from the counsellor listed below.

Course Prefix	Counsellor	Contact Information
BCHM	Robert Campbell	robert.campbell@queensu.ca
BCHM and LISC	Louise Winn	lifesci@queensu.ca
BCHM and LISC	Beatriz Sugarman	biochem@queensu.ca
BCHM and LISC	Katherine Rudder	lifesci@queensu.ca

Biochemistry Plans

The flagship program is the Biochemistry Specialization Plan (BCHM-P-BSH) (<https://queensu-ca-public.courseleaf.com/archive/2022-2023/arts-science/schools-departments-programs/biochemistry/biochemistry-specialization-science-bs-honours/>), which is recommended for students who



wish to gain in-depth training in modern experimental Biochemistry and Biochemical processes involved in human health and disease. This program culminates in an intensive fourth-year thesis research project. It equips students with a solid foundation for entry into a variety of science-based graduate programs. Students may access this Plan at the start of their fourth year, on securing a research project.

The Biochemistry Major Plan (BCHM-M-BSH) (<https://queensu-ca-public.courseleaf.com/archive/2022-2023/arts-science/schools-departments-programs/biochemistry/biochemistry-major-science-bs-honours/>) is designed for those students who want comprehensive training in Biochemistry but may wish to pursue interests outside of experimental Biochemistry. This option provides flexibility for students to take a minor in another subject. To accommodate these interests there are opportunities for more elective credits in the final year of the program. Typically, students interested in pursuing alternate plans than graduate studies in experimental Biochemistry should enrol in this Plan.

Faculty

- Sheela Abraham (<https://dbms.queensu.ca/faculty/sheela-abraham/>)
- John Allingham (<https://dbms.queensu.ca/faculty/john-allingham/>)
- Robert L. Campbell (<https://dbms.queensu.ca/faculty/robert-l-campbell/>)
- Chantelle Cappicotti (<https://dbms.queensu.ca/faculty/chantelle-capicciotti/>)
- Edmond Chan (<https://dbms.queensu.ca/faculty/edmond-chan/>)
- Graham P. Côté (<https://dbms.queensu.ca/faculty/graham-p-cote/>)
- Andrew Craig (<https://dbms.queensu.ca/faculty/andrew-craig/>)
- Peter L. Davies (<https://dbms.queensu.ca/faculty/peter-l-davies/>)
- Zongchao Jia (<https://dbms.queensu.ca/faculty/zongchao-jia/>)
- Glenville Jones (<https://dbms.queensu.ca/faculty/glenville-jones/>)
- Mark Ormiston (<https://dbms.queensu.ca/faculty/mark-ormiston/>)
- Christopher R. Mueller (<https://dbms.queensu.ca/faculty/christopher-r-mueller/>)
- P. Martin Petkovich (<https://dbms.queensu.ca/faculty/p-martin-petkovich/>)
- Steven P. Smith (<https://dbms.queensu.ca/faculty/steven-p-smith/>)

Specialization

- Biochemistry – Specialization (Science) – Bachelor of Science (Honours) (<https://queensu-ca-public.courseleaf.com/archive/2022-2023/arts-science/schools-departments-programs/biochemistry/biochemistry-specialization-science-bs-honours/>)

Major

- Biochemistry – Major (Science) – Bachelor of Science (Honours) (<https://queensu-ca-public.courseleaf.com/archive/2022-2023/arts-science/schools-departments-programs/biochemistry/biochemistry-major-science-bs-honours/>)

General/Minor

- Biochemistry – General (Science) – Bachelor of Science (<https://queensu-ca-public.courseleaf.com/archive/2022-2023/arts-science/schools-departments-programs/biochemistry/biochemistry-general-science-bs/>)
- Biochemistry – Minor (Science) (<https://queensu-ca-public.courseleaf.com/archive/2022-2023/arts-science/schools-departments-programs/biochemistry/biochemistry-minor-science/>)

Courses

BCHM 102 Introduction to Biochemistry Units: 3.00

Chemical principles as applied to biochemistry, human and clinical biochemistry.

NOTE Primarily intended for students in Nursing, Life Sciences, or Biochemistry programs. Other Arts and Science students require permission of the Department to enrol.

Learning Hours: 118 (24 Lecture, 16 Tutorial, 6 Group Learning, 36 Online Activity, 36 Private Study)

Requirements: Prerequisite None. Recommended 4U Chemistry. One-Way Exclusion May not be taken with or after BCHM 270; BCHM 310; BCHM 315; BCHM 316.

Offering Faculty: Faculty of Health Sciences

BCHM 218 Molecular Biology Units: 3.00

Molecules and macromolecules that participate in the replication and expression of genes. Current methods for exploring the structure, function, and manipulation of genetic material.

NOTE Also offered online. Consult the Bachelor of Health Sciences program office.

LEARNING HOURS may vary. 120 (36L;12T;72P)
EQUIVALENCY MBIO 218/3.0.

Requirements: Minimum 2nd year (Level 2) standing and one of (BIOL 102/3.0; PHGY 170/3.0) and one of (CHEM 112/6.0; CHEM 114/3.0).

Course Equivalencies: BCHM218; MBIO218; MBIO318
Offering Faculty: Faculty of Health Sciences

BCHM 270 Biochemical Basis of Health and Disease Units: 3.00

This course will introduce general biochemical concepts that will allow for an understanding of the biological and chemical principles underlying human physiology, health and disease. The course will provide self-paced learning and utilize evidence-based teaching principles, small group learning, peer-learning and guided-independent learning methodologies to provide an inclusive learning environment. Students will gain an enhanced appreciation of general applications of biochemistry as applied in day to day healthy life and during the disease states, diagnosis and clinical management of metabolic disorders.

NOTE Also offered online. Consult the Bachelor of Health Sciences program office.

NOTE This introductory biochemistry online course is intended for prospective students in Nursing, Environmental Sciences, Engineering, Commerce, and general science programs.

NOTE May not be taken for credit towards the Plan requirements of the BCHM or LISC Specialization or Major Plans.

Learning Hours: 126 (66 Online Activity, 60 Private Study)

Requirements: Minimum 2nd year (Level 2) standing and [(PHGY 170/3.0) or (BIOL 102/3.0 and BIOL 103/3.0)], or permission of the instructor. Exclusion BCHM 102/3.0 One-Way exclusion May not be taken with or after BCHM 310/6.0; BCHM 315/3.0.

Offering Faculty: Faculty of Health Sciences

BCHM 310 General Biochemistry Units: 9.00

Principles of protein biochemistry, enzymology, and protein engineering. Metabolism of carbohydrates, amino acids and lipids. Role of coenzymes. Generation and storage of metabolic energy. Principles of regulatory mechanisms, membrane structure and function, hormone action, and cellular signalling.

NOTE Students lacking the prerequisites CHEM 222/3.0 or CHEM 282/3.0 may take these courses as a corequisite with permission of the Department.

Learning Hours: 348 (72 Lecture, 36 Laboratory, 240 Private Study)

Requirements: Prerequisite Level 3 or above and BCHM 218 and [(CHEM 222 and CHEM 223] or CHEM 282). Exclusion BCHM 102/3.0; BCHM 315/3.0; BCHM 316/3.0.

Offering Faculty: Faculty of Health Sciences

BCHM 313 Molecular Biochemistry Units: 3.00

This course will provide an in depth view of the molecular mechanisms controlling how genes are organized, regulated and expressed in mammalian cells. Once you understand how proteins are made, you will learn a variety of approaches to visualize and measure proteins and enzymatic activities in mammalian cells.

NOTE If you have taken or are currently registered in BCHM 310/9.0 you may contact the department for permission to enrol.

Learning Hours: 120 (36 Lecture, 84 Private Study)

Requirements: Prerequisite Level 3 or above and BCHM 315.

Offering Faculty: Faculty of Health Sciences

BCHM 315 Proteins and Enzymes Units: 3.00

Principles of protein biochemistry, enzymology, and protein engineering.

NOTE Students lacking the prerequisites CHEM 222 or CHEM 282 may take these courses as a corequisite with permission of the Department.

Learning Hours: 120 (36 Lecture, 12 Online Activity, 72 Private Study)

Requirements: Prerequisite Level 3 or above and BCHM 218 and [(CHEM 222 and CHEM 223] or CHEM 282). Exclusion BCHM 102; BCHM 310.

Offering Faculty: Faculty of Health Sciences

BCHM 316 Metabolism Units: 3.00

Metabolism of carbohydrates, amino acids and lipids. Role of coenzymes. Generation and storage of metabolic energy. Principles of regulatory mechanisms, membrane structure and function, hormone action, and cellular signalling.

Learning Hours: 122 (36 Lecture, 8 Online Activity, 78 Private Study)

Requirements: Prerequisite BCHM 315 Exclusion BCHM 102; BCHM 310

Offering Faculty: Faculty of Health Sciences

BCHM 317 Introductory Biochemistry Laboratory Units: 6.00

Application of separation and assay techniques to the study of proteins, metabolism and molecular biology. Attendance required in both terms. Enrollment will be limited because of laboratory constraints, and selection will be based on academic standing.

Learning Hours: 360 (96 Laboratory, 264 Private Study)

Requirements: Prerequisite Reg. in a BCHM Specialization or Major Plan. Corequisite BCHM315 and BCHM316. Exclusion No more than 6.0 units from BCHM317; BCHM319.

Offering Faculty: Faculty of Health Sciences



BCHM 319 Introductory Biochemistry Laboratory Units: 3.00

Application of separation and essay techniques to the study of proteins, metabolism and molecular biology.

NOTE This course is for outgoing Biochemistry Honours exchange students who are not able to obtain the equivalent of BCHM 317/6.0 when on exchange.

Learning Hours: 180 (48 Laboratory, 132 Private Study)

Requirements: coreq BCHM315

Course Equivalencies: BCHM317B; BCHM319

Offering Faculty: Faculty of Health Sciences

BCHM 370 Genetics and Genomics Units: 3.00

An introduction to the field of applied genomics for identifying genes underlying multi-factorial traits, diseases, and drug treatment outcomes. Basic principles of gene mapping studies will be covered in the context of recent advances in the field including statistical methods, and integrative analyses of biological datasets.

Notes: Also offered online

LEARNING HOURS may vary: 120(480;72P)

Requirements: Minimum 3rd year (Level 3) standing and one of (BCHM 218/3.0; BCHM 270/3.0) or permission of the instructor. . Exclusion BIOL 331/3.0.

Offering Faculty: Faculty of Health Sciences

BCHM 410 Protein Structure and Function Units: 3.00

This course presents an integrated approach to the study of protein function. Topics include proteomic techniques, mass spectrometry, protein purification, imaging, surface plasmon resonance, calorimetry, bioinformatics and protein evolution, protein modifications and processing, interpretation and applications of 3-D structure, and structure-function relationships.

NOTE Offered jointly with BMED 810/3.0. Students in a LISC or BMCO Plan should contact the Department regarding prerequisites and permission to register.

Requirements: Prerequisite Level 4 and registration in a BCHM Specialization or Major Plan) and (a GPA of 2.50 in BCHM218; BCHM313; BCHM315; BCHM316, BCHM317).

Offering Faculty: Faculty of Health Sciences

BCHM 411 Advanced Molecular Biology Units: 3.00

This course concentrates on the molecular biology of mammalian models particularly mechanisms involved in human diseases. The human genome project, forensic analysis, DNA diagnostics of human diseases, models of transcriptional and growth regulation and cancer, DNA repair, RNA processing and translation are all discussed. Emphasis on recent findings and course materials will be drawn from current reviews.

NOTE Offered jointly with BMED 811/3.0. Students in a LISC or BMCO Plan should contact the Department regarding prerequisites and permission to register.

Learning Hours: 120 (36 Lecture, 84 Private Study)

Requirements: Prerequisite Level 4 and registration in a BCHM Specialization or Major Plan) and (a GPA of 2.50 in BCHM218; BCHM313; BCHM315; BCHM316, BCHM317).

Offering Faculty: Faculty of Health Sciences

BCHM 421 Advanced Biochemistry Laboratory I Units: 6.00

Biochemical research techniques with emphasis on nucleic acids, protein structure and function, regulation of gene expression and metabolic control processes.

NOTE 6.0-unit course offered in the Fall Term.

Requirements: PREREQUISITE Level 4 and registration in a BCHM Specialization Plan and (a GPA of 2.9 in BCHM 218/3.0; BCHM 313/3.0; BCHM 315/3.0; BCHM 316/3.0; BCHM 317/6.0)

Offering Faculty: Faculty of Health Sciences

BCHM 422 Advanced Biochem Lab II Units: 6.00

An independent research project by each student in one of the departmental research labs. Evaluation is based on oral presentation, lab performance and a thesis.

NOTE 6.0-unit course offered in the Fall Term.

Requirements: PREREQUISITE Level 4 and registration in a BCHM Specialization Plan and (a GPA of 2.9 in BCHM 218/3.0; BCHM 313/3.0; BCHM 315/3.0; BCHM 316/3.0; BCHM 317/6.0)

Offering Faculty: Faculty of Health Sciences

BCHM 432 The Molecular Basis of Cellular Function Units: 3.00

Principles of regulatory mechanisms; regulation of cellular function and growth by oncogenes, growth factors, isoprenoids and steroid hormones. Receptors, second messengers and protein phosphorylation. Correlation of cell ultrastructure with biochemical function. Description of the components, assembly, metabolism and evolution of cellular structures are described.

NOTE Offered jointly with BMED 832/3.0. Students in a LISC Plan should contact the Department regarding prerequisites and permission to register.

Learning Hours: 120 (30 Lecture, 6 Group Learning, 84 Private Study)

Requirements: Prerequisite Level 4 and registration in a BCHM Specialization or Major Plan) and (a GPA of 2.50 in BCHM218; BCHM313; BCHM315; BCHM316, BCHM317).

Offering Faculty: Faculty of Health Sciences

BCHM 441 Current Topics in Biochemistry Units: 3.00

Tutorials, assignments and demonstrations in important subjects in biochemistry emphasizing topics of broad interest. Particular emphasis will be paid to the applications of biochemical knowledge and new technologies.

NOTE Students in the BCHM Specialization Plan registered in BCHM 421 and BCHM 422 will not be allowed to register in BCHM 441; Students in the LISC Specialization Plan registered in one of ANAT 499, CANC 499, EPID 499, LISC 499, MICR 455, MICR 499, NSCI 499, PATH 499, PHAR 499 or PHGY 499 will not be allowed to register in BCHM 441.

Learning Hours: 120 (21 Lecture, 9 Seminar, 3 Group Learning, 3 Off-Campus Activity, 84 Private Study)

Requirements: Prerequisite Level 4 or above and registration in a BCHM Major Plan and (a GPA of 2.5 in BCHM 218; BCHM 313; BCHM 315; BCHM 316; BCHM 317).

Offering Faculty: Faculty of Health Sciences

BCHM 442 Seminars in Biochemistry Units: 3.00

Seminars, assignments and demonstrations focused on important subjects in biochemistry, emphasizing the scientific pipeline, from discovery to commercialization. Particular emphasis will be placed on applications of biochemical knowledge and new technologies.

NOTE Students in the BCHM Major Plan registered in BCHM 441/3.0 will not be allowed to register in BCHM 442/3.0.

Learning Hours: 120 (18 Seminar, 18 Group Learning, 84 Private Study)

Requirements: Prerequisites Level 4 and registration in a BCHM Specialization Plan and (a GPA of 2.7 in BCHM 218, BCHM313, BCHM315, BCHM316, BCHM317).

Offering Faculty: Faculty of Health Sciences

BCHM 482 Proteomics and Metabolomics Units: 3.00

This course will focus on the principles of proteomics and metabolomics and their application in the new systems biology `omics approach to scientific discovery. This course will emphasize both the methodologies used in proteomics and metabolomics, as well as their applications in both research, medical diagnostics, and disease management. NOTE: Only offered online. Consult the Bachelor of Health Sciences program office.

Learning Hours: 114 (36 Online Activity, 78 Private Study)

Requirements: - 4th year (Level 4) standing - BCHM 310 OR BCHM 315 BCHM 316 OR BCHM 218, BCHM 270, BCHM 370 - a Cumulative GPA of 2.5 - registration in a Health Sciences Program or a BCHM/LISC MAJ or SSP Plan

Offering Faculty: Faculty of Health Sciences

BCHM 594 Independent Study Units: 3.00

Offering Faculty: Faculty of Health Sciences

BCHM 595 Independent Study Units: 6.00

Offering Faculty: Faculty of Health Sciences

BCHM 596 Independent Study Units: 12.00

Offering Faculty: Faculty of Health Sciences