BIOCHEMISTRY

Program Notes

Subject Code for Biochemistry: BCHM
Associate Dean, Life Sciences and Biochemistry: Louise Winn (lifesci@queensu.ca)
Program Chairs: John Allingham
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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

Normally, 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 Molecular Biology, BCHM 313 Physical Biochemistry, BCHM 315 Proteins and Enzymes, BCHM 316 Metabolism, and BCHM 317 Introductory Biochemistry Laboratory) to access those fourth-year courses required to complete the Plan. However, due to the COVID-19 situation, the requirement for 2020/2021 has been modified so that the cumulative GPA (which would remain as a minimum of 2.5 for acceptance) is calculated from 12 Units in those core courses, rather than 18.

See Academic Regulations 2.4 and 2.6. (https://queensu-ca-public.courseleaf.com/arts-science/academic-regulations/)

Students wishing to continue in Biochemistry Specialization Plan (BCHM-P-BSH) (https://queensu-ca-public.courseleaf.com/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 enroll in BCHM 421 Advanced Biochemistry Laboratory I and BCHM 422 Advanced Biochem Lab II 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 counseling from the staff in the Associate Dean's office or from the counselor listed below.

<table>
<thead>
<tr>
<th>Course Prefix</th>
<th>Counsellor</th>
<th>Contact Information</th>
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<tbody>
<tr>
<td>BCHM</td>
<td>John Allingham</td>
<td><a href="mailto:allinghj@queensu.ca">allinghj@queensu.ca</a></td>
</tr>
<tr>
<td>BCHM and LISC</td>
<td>Louise Winn</td>
<td><a href="mailto:lifesci@queensu.ca">lifesci@queensu.ca</a></td>
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Biochemistry Plans

The flagship program is the Biochemistry Specialization Plan (BSCH-P-BSH) (https://queensu-ca-public.courseleaf.com/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 (BSCH-M-BSH) (https://queensu-ca-public.courseleaf.com/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 enroll in this Plan.

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. Arts and Science students require permission of the Department.
LEARNING HOURS 118 (24L;16T;6G;36O;36P)
RECOMMENDATION 4U Chemistry.
Requirements: BCHM102 Exclusion
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 may vary 126 (66O;60P)

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 313 Physical 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 enroll.

LEARNING HOURS 120 (36L;84P)

Requirements: Prerequisite Level 3 or above and BCHM315

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

LEARNING HOURS 120 (36L;12O;72P)

Requirements: CHEM280 OR (CHEM281 AND CHEM282) OR (CHEM223 AND CHEM222) OR (CHEM223 AND MBIO218) OR (CHEM223 AND CHEM222) OR (CHEM223 AND MBIO318) OR (CHEM211 AND CHEM212) OR (CHEM211 AND CHEM245)

Offering Faculty: Faculty of Health Sciences

BCHM 316 Metabolism Units: 3.00

LEARNING HOURS 122 (36L;8O;78P)

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 (96Lb;264P)

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 (48Lb;132P)
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(48O;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 Plan and (a GPA of 2.9 in 12 units of BCHM 218; 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 (36L;84P)
Requirements: Prerequisite Level 4 and registration in a BCHM Specialization or Major Plan and (a GPA of 2.50 in 12 units from 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 12 units of BCHM 218/3.0; BCHM313/3.0; BCHM315/3.0; 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 12 units of 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 431 Biochem Regulatory Mechanisms Units: 3.00
Requirements: BCHM310 OR (BCHM315 AND BCHM316) OR (BCHM315 AND BCHM317)
Offering Faculty: Faculty of Arts and Science
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 (30L;6G;84P)
Requirements:
Prerequisite Level 4 and registration in a BCHM Specialization or Major Plan) and (a GPA of 2.50 in 12 units from BCHM218; BCHM313; BCHM315; BCHM316, BCHM317).
Offering Faculty: Faculty of Health Sciences

BCHM 433 Biochemistry Of The Cell Units: 3.00
Requirements: BCHM310 OR (BCHM315 AND BCHM316) OR (BCHM315 AND BCHM317)
Offering Faculty: Faculty of Arts and Science

BCHM 441 Current Topics in Biochemistry Units: 3.00
Tutorials, assignments and demonstrations focused on 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 421/6.0 and BCHM 422/6.0 will not be allowed to register in BCHM 441/3.0; Students in the LISC Specialization Plan registered in one of ANAT 499/9.0, CANC 499/9.0, EPID 499/9.0, LISC 499/9.0, MICR 455/6.0, MICR 499/9.0, NSCI 499/9.0, PATH 499/9.0, PHAR 499/9.0 or PHGY 499/9.0 will not be allowed to register in BCHM 441/3.0.
Requirements: Prerequisite Level 4 and registration in a BCHM Specialization or Major Plan) and (a GPA of 2.50 in 12 units from BCHM218; BCHM313; BCHM315; BCHM316, BCHM317).
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 (18S;18G;84P)
Requirements:
Prerequisites Level 4 and registration in a BCHM Specialization Plan and (a GPA of 2.7 in 12 units of 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 may vary: 114 (360;78P)
Requirements: Minimum 4th year (Level 4) standing and one of {(BCHM 310 or (BCHM 315 BCHM 316)); [(BCHM 218, BCHM 270, and BCHM 370)]; [(BCHM 310 or (BCHM 315 BCHM 316)), a GPA of 2.5 (registration in a LISC MA) 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

BCHM 799 Introduction To Animal Care Units: 0.00
Offering Faculty: Faculty of Health Sciences

BCHM 800 Introd. To Recomb. Dna Method. Units: 3.00
Offering Faculty: Faculty of Health Sciences
BCHM 820  **Adv. Topics In Molecular Biol. Units: 3.00**
Discussions and presentations on current topics in molecular biology. The emphasis will be on mammalian systems and will cover a wide range of topics relating to recent advances in molecular biology. Typical topics include gene regulation, replication, DNA repair, forensic analysis, human genomics and genetics. Marks are based on student presentations and essays typically in “News and Views” or Mini-Review formats. Three hours per week, presentations and discussions of original papers. Fall; C. Mueller.

**Offering Faculty:** Faculty of Health Sciences

BCHM 822  **Mechanisms Of Metabolic Cont. Units: 3.00**
Lectures and discussions on mechanisms of metabolic control. Recent research on a wide range of specific metabolic systems is examined critically. Emphasis is placed on biochemical factors and principles which play a role in the integration and control of metabolism. Lectures and seminars, three hours per week; Winter; Alternate years.

**Offering Faculty:** Faculty of Health Sciences

BCHM 823  **Advances in Protein Structure & Function Units: 3.00**
This course consists of weekly presentations and discussions of recent advances towards the understanding of protein structure and function. Topics of discussion include novel approaches, techniques and concepts in the discovery of protein functions. Students will develop skills in literature research, critical evaluation of published work, effective presentation and discussion of papers. A specific theme, such as cell motility, may be used to illustrate research approaches employed to study biological systems in general. Three lecture hours per week; Winter; Alternate years; A. Mak.

**Offering Faculty:** Faculty of Health Sciences

BCHM 828  **Biochemistry Research Project Units: 3.00**
This course is intended to provide the student with the opportunity to gain familiarity with their research field. Students will review the literature related to their proposed graduate research thesis project and write a series of essays on topics selected in consultation with their supervisor; these will be evaluated by a supervisory committee consisting of their supervisor and two other faculty members. They will also develop a written draft research proposal that will be presented to their supervisory committee and defended in a final oral examination. This course is not mandatory but is highly recommended to be taken by students in the first full term of the graduate program. G.P. Côté (course coordinator).

**Offering Faculty:** Faculty of Health Sciences

BCHM 830  **Biochemistry Sem. Pgm-M.Sc. Units: 6.00**
**Offering Faculty:** Faculty of Health Sciences

BCHM 841  **Current Topics In Biochem I Units: 3.00**
This course will focus on protein structure and function with special emphasis on membrane proteins and selected soluble protein systems. The course will consist of lectures and presentations that will be organized around specific readings from the recent literature. A portion of the course will be devoted to membrane protein structure and function. Selected examples of structural and functional studies of soluble proteins will include enzymes and inhibitors; protein-protein interactions; protein engineering; high-throughput identification of enzyme substrates. Some instruction will be given in homology modeling and database analysis of gene products. Three hours per week, half course lectures and seminars.

**Offering Faculty:** Faculty of Health Sciences

BCHM 928  **Biochemistry Research Project Units: 3.00**
**Offering Faculty:** Faculty of Health Sciences

BCHM 930  **Biochemistry Seminar Pgm.-Ph.D Units: 6.00**
**Course Equivalencies:** BCHM 930; BCHM930B

**Offering Faculty:** Faculty of Health Sciences

BCHM 999  **Ph.D. Thesis Research Units: 6.00**
All courses are half-courses which are offered either in the fall or winter term if there is sufficient student interest. Detailed outlines of course content are available during the summer of each year. Most courses are offered in alternate years.

**Offering Faculty:** Faculty of Health Sciences

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