

BIOCHEMISTRY

Program Notes

Subject Code for Biochemistry: **BCHM**

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

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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/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/arts-science/schools-departments-programs/biochemistry/biochemistry-specialization-science-bs-honours/>)) (<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 enrol in BCHM 421 and BCHM 422 but will be allowed to complete the Biochemistry Major Plan. (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/biochemistry/biochemistry-major-science-bs-honours/>)

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	TBD	
BCHM and LISC	TBD	
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/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/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

For more information, please visit: <https://dbms.queensu.ca/faculty>

- Sheela Abraham
- John Allingham
- Robert L. Campbell
- Chantelle Cappicotti
- Edmond Chan
- Andrew Craig
- Peter L. Davies
- Zongchao Jia
- Glenville Jones
- Mark Ormiston
- Donald H. Maurice
- Christopher R. Mueller
- P. Martin Petkovich
- Steven P. Smith

Specialization

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

[programs/biochemistry/biochemistry-specialization-science-bs-honours/](https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/biochemistry/biochemistry-major-science-bs-honours/))

Major

- Biochemistry – Major (Science) – Bachelor of Science (Honours) (<https://queensu-ca-public.courseleaf.com/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/arts-science/schools-departments-programs/biochemistry/biochemistry-general-science-bs/>)
- Biochemistry – Minor (Science) (<https://queensu-ca-public.courseleaf.com/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. Exclusion BCHM 270/3.0. One-Way Exclusion May not be taken with or after BCHM 310/9.0; BCHM 315/3.0; BCHM 316/3.0.

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

Course Learning Outcomes:

1. Explain how biomolecules (DNA, RNA, protein) function and interact to support life; (PLO 1, Assessment 1-5)
2. Apply research-based theories to solve problems related to biochemistry and molecular biology; (PLO 1, Assessment 1-5)
3. Note: PLO refers to the program learning outcome that each course learning outcome matches to.
4. Use computer-based multimedia to model and mimic the behaviour of biomolecules when conditions can be controlled in an in vitro-type experimental situation, and within the context of simulated cells; (PLO 2, LaunchPad simulations)

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: Prerequisite Level 2 or above 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 310/9.0; BCHM 315/3.0.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Identify and describe the structures and functions of the major classes of biochemical molecules in the body and explain how they are synthesized and broken down in metabolism.
2. Explain the concepts of regulation by inhibition and activation at the enzyme level and extend these concepts to describe biochemical pathway regulation in the processes of metabolism at the level of the cell, organ, and body in health and disease.
3. Collaborate and communicate an understanding of the biochemical basis of an error in metabolism, including current and future diagnosis and treatments.
4. Integrate the roles of biochemical molecules and their associated processes to explain the consequences of a change in a particular biochemical process in health and disease.

**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 311 General Biochemistry Laboratory Units: 3.00

The BCHM 311 Laboratory experiments introduce the experimental nature of Biochemistry. Fundamental techniques of biochemical research are illustrated through a variety of experiments demonstrating various aspects of biochemical theory and practice.

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

Requirements: Prerequisite Registration in a LISC Specialization Plan. Corequisite BCHM 315/3.0. Exclusion BCHM 310/9.0; BCHM 317/6.0; BCHM 318/3.0; BCHM 319/3.0.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Use and understand the limitations of a variety of equipment used in biochemical studies.
2. Work with samples on a microliter and microgram scale.
3. Appropriately present, analyze and interpret a variety of experimental biochemical data.
4. Demonstrate the presentation of experimental results in the form of written laboratory reports.
5. Use sequence viewing and molecular graphics software to perform multiple sequence alignments, examine the structures of proteins and identify intermolecular interactions.
6. Apply molecular biology knowledge to the design of molecular cloning experiments.
7. Identify and use various techniques for purification of proteins.

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 218/3.0 and ([CHEM 222/3.0 and CHEM 223/3.0] or CHEM 282/3.0). Exclusion BCHM 310/9.0.

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 315/3.0. Exclusion BCHM 310/9.0.

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 Registration in a BCHM Plan. Corequisite BCHM 315/3.0 and BCHM 316/3.0. Exclusion BCHM 311/3.0; BCHM 318/3.0; BCHM 319/3.0.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. After completing the course, students will be proficient in using a variety of equipment used in biochemical studies
2. After completing the course, students will gain proficiency in working with samples on a microliter and microgram scale
3. After completing the course, students will be able to present, analyze and interpret a variety of experimental biochemical data in an appropriate manner
4. After completing the course, students will be able to present experimental results in the form of written laboratory reports

BCHM 318 Introductory Biochemistry Laboratory I Units: 3.00

The BCHM 318 Laboratory experiments introduce the experimental nature of Biochemistry. Fundamental techniques of biochemical research are illustrated through a variety of experiments demonstrating various aspects of biochemical theory and practice.

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

Requirements: Prerequisite Registration in a BCHM Plan. Corequisite BCHM 315/3.0. Exclusion BCHM 310/9.0; BCHM 311/3.0; BCHM 317/6.0.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Use and understand the limitations of a variety of equipment used in biochemical studies.
2. Work with samples on a microliter and microgram scale.
3. Appropriately present, analyze and interpret a variety of experimental biochemical data.
4. Demonstrate the presentation of experimental results in the form of written laboratory reports.
5. Identify and use various techniques for purification of proteins.

BCHM 319 Introductory Biochemistry Laboratory II Units: 3.00

The BCHM 319 Laboratory continues the training in experimental biochemistry that was begun in BCHM 318 with a focus on molecular biology methods. Fundamental techniques of biochemical research are illustrated through a variety of experiments demonstrating various aspects of biochemical theory and practice.

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

Requirements: Prerequisite Registration in a BCHM Plan and BCHM 318/3.0. Corequisite BCHM 316/3.0. Exclusion BCHM 310/9.0; BCHM 311/3.0; BCHM 317/6.0.

Offering Faculty: Faculty of Health Sciences

BCHM 320 Applications of Synthetic Biology Units: 3.00

Applications of Synthetic Biology provides students with a comprehensive overview of designing and developing biological 'parts' (genes) to use for applications including but not limited to medical, artistry, and agricultural - with special emphasis regarding ethical use. Students will learn and can expand their entrepreneurial skills through website design and grant writing assessments. Moreover, students will be taught concepts such as DNA cloning methods, computational modelling of biological parts, and developing biological assays to assess function of a synthetic part. Successful completion of this course will prepare students to use components of synthetic biology/genetic engineering in their future endeavours.

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

Learning Hours: 120 (24 Lecture, 48 Online Activity, 48 Private Study)

Requirements: Prerequisite Level 3 or above and (BCHM 102/3.0 or BCHM 218/3.0 or BCHM 270/3.0 or BIOL 205/3.0).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Compose a synthetic biological part to solve a real-world problem (including but not limited to medicine, artistry, and agricultural applications).
2. Design a methodology to clone, express, purify, and functionally assess a protein, starting with a gene.
3. Predict the properties of a biological part using computational modelling and computer aided visual tools.
4. Debate the usage and ethical considerations of synthetic biology in everyday life.
5. Integrate synthetic biology methodologies with the central dogma of molecular biology.
6. Communicate the necessity and requirements of a research project by scientific writing.

**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.

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

Learning Hours: 120 (48 Online Activity, 72 Private Study)

Requirements: Prerequisite (Level 3 or above and [BCHM 102/3.0 or BCHM 218/3.0 or BCHM 270/3.0 or BIOL 205/3.0]) or permission of the instructor. Exclusion BIOL 331/3.0.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Assimilate the evolution and advancements in the field of genetics and genomics to understand how they permitted the mapping of genes contributing to human diseases, traits, and drug response outcomes.
2. Apply the basic principles of research methodology to develop biological hypotheses pertaining to the role or contribution of genetic factors in human traits and identify methodologies for testing such hypotheses.
3. Reconcile the impact of genetic and genomics studies on the field to discuss the strengths and limitations of genetics studies and how this can affect progress in clinical outcome.

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.

Learning Hours: 114 (30 Lecture, 6 Seminar, 6 Laboratory, 6 Practicum, 12 Group Learning, 6 Individual Instruction, 6 Online Activity, 42 Private Study)

Requirements: Prerequisite ([Level 4 or above and registration in the BCHM Specialization or Major Plan] and [a minimum GPA of 2.50 in BCHM 218/3.0; BCHM 313/3.0; BCHM 315/3.0; BCHM 316/3.0; BCHM 317/6.0]) or ([Level 4 or above and registration in the LISC Specialization or Major Plan] and [a minimum GPA of 2.50 in BCHM 218/3.0 and [BCHM 310/9.0 or [BCHM 315/3.0 and BCHM 316/3.0]).

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.

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

Requirements: Prerequisite ([Level 4 or above and registration in the BCHM Specialization or Major Plan] and [a minimum GPA of 2.50 in BCHM 218/3.0; BCHM 313/3.0; BCHM 315/3.0; BCHM 316/3.0; BCHM 317/6.0]) or ([Level 4 or above and registration in the LISC Specialization or Major Plan] and [a minimum GPA of 2.50 in BCHM 218/3.0 and [BCHM 310/9.0 or [BCHM 315/3.0 and BCHM 316/3.0]).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Understand the physical and functional properties of the human genome
2. Use Bioinformatic tools to identify human variation and assess their significance
3. Understand how genome variation is assessed and contributes to human disease and therapies
4. Interpret the significance of SNPs and cancer mutations
5. Understand how microRNA's control gene expression
6. Understand the applications of genome editing tools to research and therapy
7. Understand how epigenetics can control gene expression
8. Know the role of stem cells in development and disease
9. Analyse and interpret contrivertical scientific literature and present findings from advanced molecular biology-related research articles to your peers

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.

Learning Hours: 222 (6 Seminar, 144 Laboratory, 24 Individual Instruction, 6 Online Activity, 42 Private Study)

Requirements: Prerequisite Level 4 or above and registration in a BCHM Specialization 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). Exclusion Maximum 12.0 units from: ANAT 499/12.0; ANAT 599/6.0; BCHM 421/6.0; BCHM 422/6.0; BCHM 594/3.0; BCHM 595/6.0; BCHM 596/12.0; CANC 499/12.0; DISC 591/3.0; DISC 592/3.0; DISC 593/3.0; DISC 594/3.0; DISC 598/6.0; DISC 599/6.0; EPID 499/12.0; EPID 595/6.0; HSCI 591/3.0; HSCI 592/3.0; HSCI 593/3.0; HSCI 594/3.0; HSCI 595/3.0; HSCI 598/6.0; HSCI 599/6.0; LISC 499/12.0*; LISC 594/3.0; LISC 595/6.0; LISC 596/12.0; LISC 598/9.0; MICR 499/12.0; NSCI 499/12.0; PATH 499/12.0; PATH 595/6.0; PHAR 499/12.0; PHGY 499/12.0; REPD 499/12.0.

Offering Faculty: Faculty of Health Sciences

BCHM 422 Advanced Biochemistry Laboratory 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.

Learning Hours: 222 (6 Seminar, 144 Laboratory, 24 Individual Instruction, 6 Online Activity, 42 Private Study)

Requirements: Prerequisite Level 4 or above and registration in a BCHM Specialization 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). Exclusion Maximum 12.0 units from: ANAT 499/12.0; ANAT 599/6.0; BCHM 421/6.0; BCHM 422/6.0; BCHM 594/3.0; BCHM 595/6.0; BCHM 596/12.0; CANC 499/12.0; DISC 591/3.0; DISC 592/3.0; DISC 593/3.0; DISC 594/3.0; DISC 598/6.0; DISC 599/6.0; EPID 499/12.0; EPID 595/6.0; HSCI 591/3.0; HSCI 592/3.0; HSCI 593/3.0; HSCI 594/3.0; HSCI 595/3.0; HSCI 598/6.0; HSCI 599/6.0; LISC 499/12.0*; LISC 594/3.0; LISC 595/6.0; LISC 596/12.0; LISC 598/9.0; MICR 499/12.0; NSCI 499/12.0; PATH 499/12.0; PATH 595/6.0; PHAR 499/12.0; PHGY 499/12.0; REPD 499/12.0.

Course Equivalencies: BCHM 422, BCHM 422B

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.

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

Requirements: Prerequisite ([Level 4 or above and registration in the BCHM Specialization or Major Plan] and [a minimum GPA of 2.50 in BCHM 218/3.0; BCHM 313/3.0; BCHM 315/3.0; BCHM 316/3.0; BCHM 317/6.0]) or ([Level 4 or above and registration in the LISC Specialization or Major Plan] and [a minimum GPA of 2.50 in BCHM 218/3.0 and [BCHM 310/9.0 or [BCHM 315/3.0 and BCHM 316/3.0]]).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. The primary objective of this course is to provide students with a basic understanding of the major signaling pathways that regulate important cell functions such as growth, proliferation, survival and motility.
2. Emphasis will be placed on the biochemical properties, including structure and enzymatic activity, of key signaling enzymes such as protein kinases, ubiquitin ligases, G protein coupled receptors and the enzymes that synthesize leukotrienes and prostaglandins.

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: Prerequisite Level 4 or above and registration in a BCHM/LISC Major or Specialization, or BHSc program and a cumulative GPA of 2.5 or higher and ([BCHM 218/3.0 and BCHM 270/3.0 and BCHM 370/3.0] or BCHM 310/9.0 or [BCHM 315/3.0 and BCHM 316/3.0]).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Describe what proteomics and metabolomics are, including how they differ from other emerging 'omics fields, to identify the significance they carry in scientific research. (PLO 8; Assessment 1–5)
2. Understand the basis of proteomic and metabolomic techniques and their limitations to be able to create scientific arguments as to whether or not they can be applied to a specific problem. (PLO 8; Assessment 1, 3–4)
3. Identify the types of information that proteomic and metabolomic techniques provide, and how these techniques can become more powerful when combined with complementary methods. (PLO 8; Assessment 1, 3–5)
4. Develop an appreciation of how online databases can be used as tools in the comprehensive analysis of the results gained from metabolomic and proteomic methods discussed. (PLO 8; Assessment 1, 3)
5. Gain a comprehensive understanding of how the proteomic and metabolomic methods can be used in both the study and diagnosis of disease states in order to apply them to their own research endeavors. (PLO 8; Assessment 1, 3–5)

BCHM 594 Independent Study Units: 3.00

Exceptionally qualified students entering their fourth-year may take an independent study provided it has been approved by the Program Office(s) principally involved. The Program Office may approve an independent study without permitting it to be counted toward a concentration in that Program Office. It is, consequently, the responsibility of a student taking an independent study to ensure that the concentration requirements for their degree will be met. NOTE Requests for an independent study must be received one month before the start of the first term in which the student intends to undertake the independent study.

Requirements: Prerequisite Permission of the Program Office(s) principally involved. Exclusion Maximum 12.0 units from: ANAT 499/12.0; ANAT 599/6.0; BCHM 421/6.0; BCHM 422/6.0; BCHM 594/3.0; BCHM 595/6.0; BCHM 596/12.0; CANC 499/12.0; DISC 591/3.0; DISC 592/3.0; DISC 593/3.0; DISC 594/3.0; DISC 598/6.0; DISC 599/6.0; EPID 499/12.0; EPID 595/6.0; HSCI 591/3.0; HSCI 592/3.0; HSCI 593/3.0; HSCI 594/3.0; HSCI 595/3.0; HSCI 598/6.0; HSCI 599/6.0; LISC 499/12.0*; LISC 594/3.0; LISC 595/6.0; LISC 596/12.0; LISC 598/9.0; MICR 499/12.0; NSCI 499/12.0; PATH 499/12.0; PATH 595/6.0; PHAR 499/12.0; PHGY 499/12.0; REPD 499/12.0.

Offering Faculty: Faculty of Health Sciences

BCHM 595 Independent Study Units: 6.00

Exceptionally qualified students entering their fourth-year may take an independent study provided it has been approved by the Program Office(s) principally involved. The Program Office may approve an independent study without permitting it to be counted toward a concentration in that Program Office. It is, consequently, the responsibility of a student taking an independent study to ensure that the concentration requirements for their degree will be met. NOTE Requests for an independent study must be received one month before the start of the first term in which the student intends to undertake the independent study.

Requirements: Prerequisite Permission of the Program Office(s) principally involved. Exclusion Maximum 12.0 units from: ANAT 499/12.0; ANAT 599/6.0; BCHM 421/6.0; BCHM 422/6.0; BCHM 594/3.0; BCHM 595/6.0; BCHM 596/12.0; CANC 499/12.0; DISC 591/3.0; DISC 592/3.0; DISC 593/3.0; DISC 594/3.0; DISC 598/6.0; DISC 599/6.0; EPID 499/12.0; EPID 595/6.0; HSCI 591/3.0; HSCI 592/3.0; HSCI 593/3.0; HSCI 594/3.0; HSCI 595/3.0; HSCI 598/6.0; HSCI 599/6.0; LISC 499/12.0*; LISC 594/3.0; LISC 595/6.0; LISC 596/12.0; LISC 598/9.0; MICR 499/12.0; NSCI 499/12.0; PATH 499/12.0; PATH 595/6.0; PHAR 499/12.0; PHGY 499/12.0; REPD 499/12.0.

Offering Faculty: Faculty of Health Sciences

BCHM 596 Independent Study Units: 12.00

Exceptionally qualified students entering their fourth-year may take an independent study provided it has been approved by the Program Office(s) principally involved. The Program Office may approve an independent study without permitting it to be counted toward a concentration in that Program Office. It is, consequently, the responsibility of a student taking an independent study to ensure that the concentration requirements for their degree will be met. NOTE Requests for an independent study must be received one month before the start of the first term in which the student intends to undertake the independent study.

Requirements: Prerequisite Permission of the Program Office(s) principally involved. Exclusion Maximum 12.0 units from: ANAT 499/12.0; ANAT 599/6.0; BCHM 421/6.0; BCHM 422/6.0; BCHM 594/3.0; BCHM 595/6.0; BCHM 596/12.0; CANC 499/12.0; DISC 591/3.0; DISC 592/3.0; DISC 593/3.0; DISC 594/3.0; DISC 598/6.0; DISC 599/6.0; EPID 499/12.0; EPID 595/6.0; HSCI 591/3.0; HSCI 592/3.0; HSCI 593/3.0; HSCI 594/3.0; HSCI 595/3.0; HSCI 598/6.0; HSCI 599/6.0; LISC 499/12.0*; LISC 594/3.0; LISC 595/6.0; LISC 596/12.0; LISC 598/9.0; MICR 499/12.0; NSCI 499/12.0; PATH 499/12.0; PATH 595/6.0; PHAR 499/12.0; PHGY 499/12.0; REPD 499/12.0.

Offering Faculty: Faculty of Health Sciences