

LIFE SCIENCES

Program Notes

Subject Code for Anatomy: **ANAT**

Subject Code for Biochemistry: **BCHM**

Subject Code for Cancer Research: **CANC**

Subject Code for Cardiorespiratory Science: **CRSS**

Subject Code for Drug Discovery and Human Toxicology: **DDHT**

Subject Code for Life Sciences: **LISC**

Subject Code for Microbiology and Immunology: **MICR**

Subject Code for Neuroscience: **NSCI**

Subject Code for Pathology and Molecular Medicine: **PATH**

Subject Code for Pharmacology and Toxicology: **PHAR**

Subject Code for Physiology: **PHGY**

Subject Code for Community Health and Epidemiology: **EPID**

Subject Code for Reproduction and Development: **REPD**

World Wide Web Address: www.healthsci.queensu.ca/lisbchm/life_sciences (https://www.healthsci.queensu.ca/lisbchm/life_sciences/)

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Director of Life Sciences: Robert Campbell (robert.campbell@queensu.ca)

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Undergraduate Office E-mail Address: lifesci@queensu.ca

Overview

The hallmark of the Life Sciences program is a unique blend of disciplines represented by basic and clinical biomedical science departments in the Faculty of Health Sciences. These departments include Biomedical and Molecular Sciences, Public Health Sciences, and Pathology and Molecular Medicine, in collaboration with the Cancer Research Institute, the Centre for Neuroscience Studies, the Cardiac, Circulation and Respiratory Group, and the Research Group in Reproduction and Development.

The subjects that fall under the umbrella of the Life Sciences program include traditional biomedical disciplines devoted to the anatomical, biochemical, epidemiological, immunological, microbiological, pathological, pharmacological, and physiological sciences. In addition, there are Sub-plans dedicated to contemporary trans-disciplinary themes in the cardiovascular and respiratory sciences, drug development and human toxicology, cancer biology and genetics, and neuroscience.

The Department of Biomedical and Molecular Sciences is responsible for *Biochemistry Plans* (General (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments->

<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/biochemistry/biochemistry-general-science-bs/>)/Minor (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/biochemistry/biochemistry-minor-science/>) (Science), Major (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/biochemistry/biochemistry-major-science-bs-honours/>), Specialization (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/biochemistry/biochemistry-specialization-science-bs-honours/>)) and plays a primary role in the *Life Sciences Plans* (General (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/life-sciences/life-sciences-general-science-bs/>)/Minor (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/life-sciences/life-sciences-minor-science/>) (Science), Major (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/life-sciences/life-sciences-major-science-bs-honours/>), Specialization (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/life-sciences/life-sciences-specialization-science-bs-honours/>)). The Department is a unique amalgam of scientists and teachers who share a common goal: to ameliorate the consequences of disease and trauma by training the next generation of health care scientists and professionals. To meet this goal, the Department draws on the depth and breadth of the scientific expertise of its members. Contemporary courses are offered in the anatomical, biochemical, microbiological, immunological, pharmacological, and physiological sciences and in a wide range of cross-disciplinary studies (e.g. cardiovascular and respiratory sciences, drug development, cancer biology and genetics, and neuroscience). These courses are integral to the various Biochemistry and Life Sciences Plans.

Program Policies

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.

Access to Third and Fourth Year Courses

Students in the Life Sciences Specialization Plan (LISC-P-BSH) (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/life-sciences/life-sciences-specialization-science-bs-honours/>) will be given priority enrolment to those courses that are required to meet third- and fourth-year core and option requirements. Students in



both the Life Sciences Specialization (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/life-sciences/life-sciences-specialization-science-bs-honours/>) and the Life Sciences Major Plans (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/life-sciences/life-sciences-major-science-bs-honours/>) (LISC-P-BSH and LISC-M-BSH) should further note that a minimum cumulative GPA of 2.50 is a required prerequisite to access those fourth-year courses to complete these Plans. See Academic Regulations (<https://queensu-ca-public.courseleaf.com/arts-science/academic-regulations/#text>) **2.4** and **2.6**.

Advice to Students

Students should seek **academic counselling** from staff in the Associate Dean's office:

Course Prefix	Counsellor	Contact Information
BCHM and LISC	Katherine Rudder	lifesci@queensu.ca
BCHM and LISC	Beatriz Sugarman	biochem@queensu.ca

Students may also seek **academic counselling** from one of the counselors listed below.

Course Prefix	Counsellor	Contact Information
ANAT	Leslie MacKenzie	mackenzl@queensu.ca
BCHM	Laura van Staaldin	lmd2@queensu.ca
CANC and PATH	Christopher Nicol	nicolc@queensu.ca
CRSS	Shetuan Zhang	shetuan.zhang@queensu.ca
EPID	Ana Johnson	ana.johnson@queensu.ca
DDHT and PHAR	Nikki Philbrook	nikki.philbrook@queensu.ca
MICR	Christopher Lohans	christopher.lohans@queensu.ca
NSCI	Fernanda de Felice	fernanda.defelice@queensu.ca
PHGY	Alan Lomax	lomaxa@queensu.ca

- The Biomedical Discovery Sub-plan (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/life-sciences/life-sciences-specialization-science-bs-honours/#Biomedical-Discovery-SubPlan>) is recommended to students who wish to gain advanced laboratory experience or experiential learning in Anatomy or Epidemiology/Public Health or Immunology or Microbiology or Pathology or Pharmacology or Physiology, or Reproduction and Development.
- The Biomedical Sciences Sub-plan (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/life-sciences/life-sciences-specialization-science-bs-honours/#Biomedical-Sciences-SubPlan>) provides more

flexibility in choice of options and electives than other sub-plans, and is recommended to students who wish to obtain a wide-ranging foundation in the life sciences with opportunities for advanced study in selected topics.

The remaining four sub-plans are devoted to contemporary trans-disciplinary streams and place a high premium on laboratory-based research and seminar-based learning.

- The Cancer Sub-plan (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/life-sciences/life-sciences-specialization-science-bs-honours/#Cancer-Research>) is recommended to students who wish to proceed to graduate studies and research in Cancer Biology and Genetics. Students intending to take this sub-plan should consult the list of option courses required for completion of the program, and consider appropriate courses in Year 3.
- The Cardiorespiratory Sub-plan (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/life-sciences/life-sciences-specialization-science-bs-honours/#Cardiorespiratory-Science>) is recommended to students who wish to proceed to graduate studies and research in the cardiovascular and respiratory sciences. Students intending to take this sub-plan should complete PHGY 355 Biomedical Respiratory Physiology/3.0 in Year 3.
- The Drug Discovery and Human Toxicology Sub-plan (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/life-sciences/life-sciences-specialization-science-bs-honours/#Drug-Discovery&Human-Toxicology>) is recommended to students who are interested in enriched study in the fields of drug discovery and development as well as in mechanisms of drug and toxicant action. Students will gain advanced knowledge which will make them competitive for graduate studies and marketable in particular employment areas (e.g. government regulatory agencies and pharmaceutical companies).
- The Neuroscience Sub-plan (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/life-sciences/life-sciences-specialization-science-bs-honours/#Neuroscience>) is recommended to students who wish to proceed to graduate studies and research in the neurosciences. Students intending to take this option should complete either NSCI 323 Foundational Neuroscience/3.0 or NSCI 324 Systems Neuroscience/3.0 in Year 3. It is strongly recommended that students in this sub-plan complete both courses.

Life Sciences Major Plan (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/life-sciences/life-sciences-major-science-bs-honours/>) is recommended to students who wish to pursue

a wider range of study than is possible with the Life Sciences Specialization Plan. Access to specialized courses at the 400 level may be limited, with priority given to students in the Life Sciences Specialization Plan program.

Preparation for a Teaching Career

Students wishing to enter teaching as a career are advised to consult the Faculty of Education concerning the prerequisites for the B.Ed. program options.

Note Students enrolled in this program will be required to work with animals and tissues obtained from animals.

Faculty

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

- Sheela Abraham
- Michael A. Adams
- John Allingham
- R. David Andrew
- Bruce W. Banfield
- Sam Basta
- Gunnar Blohm
- Susan Boehnke
- Faith Brennan
- Chantelle Capicciotti
- Cheryl Cline
- Che Colpitts
- Andrew Craig
- Peter L. Davies
- Fernanda De Felice
- Sarah Dick
- Nicole Domnik
- Qingling Duan
- Eric C. Dumont
- Kimberly Dunham-Snary
- Alastair V. Ferguson
- Jason Gallivan
- Katrina Gee
- Nader Ghasemlou
- Charles H. Graham
- Charles Hindmarch
- Zongchao Jia
- Glenville Jones
- Eva Kaufman
- Michael D. Kawaja
- Madhuri Koti

- Paul Kubes
- Alan Lomax
- Leslie W. MacKenzie
- Neil S. Magoski
- Donald H. Maurice
- Christopher R. Mueller
- Jeanne Mulder
- Douglas P. Munoz
- Emily Oby
- Mark Ormiston
- Terence Ozolins
- Stephen C. Pang
- Martin Paré
- P. Martin Petkovich
- Lynne-Marie Postovit
- James N. Reynolds
- Stephen H. Scott
- Amber Simpson
- Steven P. Smith
- Patrick Stroman
- Myron R. Szewczuk
- Sebastian Talbot
- Chandrakant Tayade
- Christopher A. Ward
- Louise M. Winn
- Shetuan Zhang

Specializations

- Environmental Life Sciences – Specialization (Science) – Bachelor of Science (Honours) (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/life-sciences/environmental-life-science-specialization-science-bs-honours/>)
- Life Sciences – Specialization (Science) – Bachelor of Science (Honours) (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/life-sciences/life-sciences-specialization-science-bs-honours/>)

Major

- Life Sciences – Major (Science) – Bachelor of Science (Honours) (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/life-sciences/life-sciences-major-science-bs-honours/>)

General/Minor

- Life Sciences – General (Science) – Bachelor of Science (<https://queensu-ca-public.courseleaf.com/arts-science/>)



[schools-departments-programs/life-sciences/life-sciences-general-science-bs/](https://queensu.ca/public/courseleaf.com/arts-science/schools-departments-programs/life-sciences/life-sciences-general-science-bs/))

- Life Sciences – Minor (Science) ([https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/life-sciences/life-sciences-minor-science/](https://queensu.ca/public/courseleaf.com/arts-science/schools-departments-programs/life-sciences/life-sciences-minor-science/))

Courses

Anatomy and Cell Biology (ANAT)

ANAT 100 Anatomy of the Human Body Units: 3.00

This anatomy course is designed to introduce students to the basic structure and functional relationship of the human body. Through a series of weekly learning modules, students will learn about the basic language of Gross Anatomy and Histology in order to understand the working of various body systems. This course is also suitable for individuals who have a general interest in human anatomy.

Requirements: Exclusion ANAT 101/3.0; IDIS 150/6.0 One-Way Exclusion May not be taken with or after: ANAT 215/3.0; ANAT 216/3.0; ANAT 312/3.0; ANAT 315/3.0; ANAT 316/3.0

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Analyze the gross (macroscopic) and histology (microscopic) anatomy of the tissues and organs that constitute the human body
2. Apply appropriate anatomical terms and concepts for the purpose of identification, effective communication, and critical reading of relevant literature
3. Demonstrate the ability to collaborate and work effectively and respectfully with diverse teams
4. Describe the integrated relationship between histology and gross anatomy with respect to structure and function, and be able to extend that knowledge to various aspects of development and function
5. Employ a systematic logical thinking process to help you recognize anatomical structures and predict the physiological functions of body systems

ANAT 101 Introductory Human Anatomy Units: 3.00

A basic anatomy course with an emphasis on clinical relevance of structure and function of human body systems. RECOMMENDATION 4U Biology.

Requirements: Exclusion ANAT 101/3.0; IDIS 150/6.0 One-Way Exclusion May not be taken with or after: ANAT 215/3.0; ANAT 216/3.0; ANAT 312/3.0; ANAT 315/3.0; ANAT 316/3.0

Offering Faculty: Faculty of Health Sciences

ANAT 215 Principles of Human Morphology I Units: 3.00

The general principles of human structure and function as appreciated through a survey of the morphological sciences, including: history of anatomy; embryology; neuroanatomy; developmental, microscopic and gross anatomy of the locomotor system.

NOTE Priority will be given to students registered in a LISC Specialization Plan.

Requirements: Prerequisite (BIOL 102 and BIOL 103) or (BIOL 201 and BIOL 202) or permission of the Department of Biomedical Molecular Sciences. Exclusion ANAT 315.

Offering Faculty: Faculty of Health Sciences

ANAT 216 Principles of Human Morphology II Units: 3.00

The general principles of human structure and function as appreciated through a survey of the development, microscopic and gross anatomy of the body systems: cardiovascular, respiratory, immune/lymphatic, endocrine, digestive and genitourinary.

NOTE Priority will be given to students registered in a LISC Specialization Plan.

Requirements: Prerequisite ANAT 215. Exclusion ANAT 316.

Offering Faculty: Faculty of Health Sciences

ANAT 270 Human Anatomy and Morphology Units: 3.00

This course is designed to introduce the foundations of human structure and function to students at all levels of post-secondary education. Through a series of learning modules, students will develop an understanding of the architecture of the human body through interactive study using a virtual cadaver. This course will survey the gross and microscopic anatomy of the body organ systems including the skeletal, muscular, nervous, endocrine, cardiovascular, lymphatic/immune, respiratory, digestive, urinary and reproductive systems.

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

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

Learning Hours: 120 (60 Online Activity, 60 Private Study)
Requirements: Prerequisite Level 2 and one of (ANAT 100; BIOL 102; PHGY 170) One-Way Exclusion May not be taken with or after ANAT215; ANAT216; ANAT315; ANAT316.

Offering Faculty: Faculty of Health Sciences

ANAT 309 Functional Histology Units: 3.00

Introduction to mammalian histology, or microscopic anatomy, a branch of anatomical sciences focusing on structures and functions of tissues and cells at the light and electron microscope level. Structure-function relationships within many tissues and organs at the cell and tissue level will be a focus.

NOTE Priority will be given to students registered in a LISC Specialization Plan or Health Sciences plan.

Learning Hours: 120 (36 Lecture, 24 Laboratory, 60 Private Study)

Requirements: Prerequisite Level 3 or above and (PHGY 170 or BIOL 102 or BIOL 103 or BIOL 202).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Compare, contrast and discuss the differences in the organization and structure of the four basic tissue types and their association into organs and systems
2. Describe normal structure-function relationships within cells and tissues as well as recognize abnormal histology, such that a prediction of the consequences of this disruption can be made for a disease state
3. Recognize and describe the organization of the mammalian cell and the function of the major cell organelles
4. Using histological sections, identify the four basic tissue types and various tissues, organs and cell types

ANAT 312 Functional Neuroanatomy Units: 3.00

Study of the structure and function of the nervous system by lectures, hands-on laboratories, brain dissection, and readings. Topics include, but are not limited to, sensory and motor systems, brain imaging, and clinical examples.

Requirements: Prerequisite (ANAT 215 and ANAT 216) or (ANAT 315 and ANAT 316) or (PHGY 215 and PHGY 216).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Understand and apply appropriate anatomical terms and concepts for the purpose of identification, effective communication and critical reading of relevant literature.
2. Analyze the gross (macroscopic) and histological (microscopic) anatomy of the tissues and organs that constitute the human nervous system.
3. Employ a systematic logical thinking process to help you recognize anatomical structures and predict the physiological functions of the nervous system.
4. Describe the integrated relationship between gross and histological neuroanatomy with respect to structure and function, and be able to extend that knowledge to various aspects of development and function.
5. Demonstrate an ability to collaborate and work effectively and respectfully with diverse teams.

ANAT 315 The Human Musculoskeletal System Units: 3.00

Gross and functional anatomy of the back, body wall, upper and lower limbs, including blood supply and neural controls.

Requirements: Prerequisite (BIOL 102 and BIOL 103) or (BIOL 201/3.0 and BIOL 202/3.0) or KNPE 153. Exclusion ANAT 215.

Offering Faculty: Faculty of Health Sciences

ANAT 316 The Human Visceral Systems Units: 3.00

Gross and functional anatomy of the thorax, abdomen and pelvis, head and neck.

Requirements: Prerequisite ([BIOL 102 and BIOL 103] or [BIOL 201/3.0 and BIOL 202/3.0] or KNPE 153) or permission of the Department of Biomedical and Molecular Sciences. Exclusion ANAT 216.

Offering Faculty: Faculty of Health Sciences



ANAT 380 Clinically Relevant Human Anatomy Units: 3.00

ANAT 380 will explore regional anatomy of the human body focusing on the major organ systems, their components, and the relationships between them. In this course, students will apply anatomical knowledge to collaboratively solve case-based clinical scenarios, and develop a realistic clinical case based on an underlying anatomical issue.

Note: Also offered online.

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

Requirements: Minimum 3rd year standing one of:

ANAT 100 OR ANAT 101 OR ANAT 215/216 OR ANAT 315/316

AND one of: PHGY 215/216 OR KNPE 125/225

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Analyze the gross anatomy of the organs that constitute the different regions of the human body to predict the physiological functional relationship. (PLO 2, 3, 6, 8; Assessment 1-4)
2. Integrate module content, medical terminology, and external medical literature to collaboratively solve case-based problems related to anatomical issues. (PLO 2, 8; Assessment 1, 2, 4)
3. Apply knowledge gained from course content to develop an anatomically accurate clinical scenario and clearly communicate orally both anatomical and medical terminology. (PLO 2, 8; Assessment 2)

ANAT 391 Introduction to Cadaveric Dissection Units: 3.00

Students work individually and collaboratively to develop macro and microdissection skills using human cadaveric specimens. Students learn how cadaveric dissection for teaching purposes (prosection) influences communication and teaching of anatomy.

Learning Hours: 120 (36 Laboratory, 48 Online Activity, 36 Private Study)

Requirements: Prerequisite Minimum 3rd year (level 3) standing, registration in a LISC/BCHM/BHSc Major or Specialization Plan, and a minimum standing of B+ in one of ([ANAT 100/3.0 or ANAT 101/3.0; and ANAT 380/3.0]; [ANAT 215/3.0 and ANAT 216/3.0]; [ANAT 315/3.0 and ANAT 316/3.0]).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Dissect and display gross and microscopic anatomical features on a human cadaveric specimen using conventional and novel dissection techniques, producing a high-quality museum worthy specimen.
2. Critically develop and appraise questions and concepts related to gaps in contemporary anatomical pedagogy to create a feasible research question.
3. Clearly communicate the process of dissection and major findings from completed student work to contextualize dissection as a tool for teaching anatomy and in a research setting.

ANAT 409 Selected Topics in Histology Units: 3.00

A focused histological and cell biological study of three selected mammalian tissues, organs and/or systems.

Requirements: Prerequisite Minimum 4th year (Level 4) standing, registration in a LISC/BHSc Major or SSP, a GPA of 2.5, and one of ([ANAT 215/3.0 and ANAT 216/3.0]; (ANAT 315/3.0 and ANAT 316/3.0); ANAT 309/3.0).

Offering Faculty: Faculty of Health Sciences

ANAT 417 Mammalian Embryonic Development Units: 3.00

Comprehensive overview of cellular and molecular mechanisms that direct embryogenesis including gastrulation, neurulation, establishment of body axes, differentiation, sex determination, limb development, organogenesis, and teratology. Participation in seminar presentations and group discussions is required.

Learning Hours: 114 (24 Lecture, 12 Seminar, 1 Individual Instruction, 77 Private Study)

Requirements: Prerequisite Level 4 and a GPA of 2.5 and (registration in a LISC Major or Specialization Plan) and (ANAT 309 or [ANAT 215 and ANAT 216] or [ANAT 315 and ANAT 316]).

Course Equivalencies: ANAT 417, ANAT 471

Offering Faculty: Faculty of Health Sciences

ANAT 471 Human Embryology Units: 3.00

In ANAT 471, students work individually/collaboratively to explore stages of normal human embryonic and fetal development and how changes in underlying mechanisms link to common congenital or developmental abnormalities. Various assessments include quizzes, a journal club, a PBL investigating a developmental abnormality, a midterm and final exam.

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

Requirements: Prerequisite Level 3 or above and one of ([ANAT 100 and ANAT 380] or [ANAT 101 and ANAT 380] or [ANAT 215 and ANAT 216] or [ANAT 315 and ANAT 316]).

Course Equivalencies: ANAT 417, ANAT 471

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Apply knowledge from course content and external peer-reviewed literature to predict the functional sequelae of abnormal physiological development as well as linking the condition to medical interventions.
2. Critically develop and appraise questions and concepts related to gaps in contemporary embryological knowledge to create a cogent research proposal
3. Identify and describe the embryological development of tissues, organs and systems as well as how changes in the process can be linked to abnormal physiological development.

ANAT 499 Research Project in Anatomy and Cell Biology Units: 12.00

An examination of the development and present state of knowledge in selected research areas of Anatomy and Cell Biology. Research project involves experimental design, data collection and analysis, written report, poster presentation and oral presentation. Students will be required to attend seminars and tutorials on topics related to research. Limited enrolment; restricted to fourth year honours, permission of the department required.

NOTE Acceptance by a supervisor required prior to registration.

NOTE Students whose research requires the care and/or handling of animals must also complete the Introductory Animal Care Course and if required the appropriate Animal Use workshops through the Office of the University Veterinarian.

Learning Hours: 480 (288 Laboratory, 24 Group Learning, 24 Individual Instruction, 144 Private Study)

Requirements: Prerequisite Level 4 and registration in a LISC Specialization Plan and a cumulative GPA of 2.50 or higher and ([ANAT 215/3.0 and ANAT 216/3.0] or ANAT 309/3.0 or [ANAT 315/3.0 and ANAT 316/3.0]). 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



ANAT 599 Research Inquiry in Anatomy Units: 6.00

ANAT 599 is a course on collaborative research in the Anatomical Sciences. Students will use a team-based approach to devise a research question that addresses a gap in knowledge in the Anatomical Sciences. Research questions may include basic science queries based in human anatomy, and questions related to teaching and learning in the Anatomical Sciences. In small groups, students will develop and carry out comprehensive research objectives, and draft a complete manuscript of the summative work intended for publication in a peer-reviewed academic journal. Using the skills previously gained in ANAT 391, students will also produce a high-quality prosected human anatomical specimen. The goal of prosection is to dissect a specimen in a stepwise manner aimed at teaching the dissected structures. To develop proficiencies in online anatomical education and communicating complex anatomical concepts, students will be expected to use audio and visual elements to create a presentation highlighting the key features of their respective specimens. Students will participate in self-reflection and peer feedback to think critically about their skills in anatomical research and pedagogy. The advancement of the relevant competences will facilitate professional development. The course has various types of assessments including a practical dissected specimen and accompanying presentation video, thoughtful reflection and peer feedback, and a summative research manuscript. Students will have the opportunity to develop a research question with their teams and complete research objectives in a comprehensive and thoughtful manner, mentored by the course instructors.

Learning Hours: 120 (36 Laboratory, 36 Group Learning, 48 Private Study)

Requirements: Prerequisite Level 4 or above and registration in a LISC Major or Specialization, or BHSc Program, and a minimum grade of A- in ANAT 391/3.0. 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

Course Learning Outcomes:

1. Create a detailed prosected specimen with clearly evident anatomical features and generate a video teaching peers about the key anatomical structures.
2. Critically develop a thoughtful research question and investigate discrete objectives, communicating the research results in a written summative manuscript

Biochemistry (BCHM)

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 MBI0 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; MBI0218; MBI0318

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 controversial 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

Cancer Research (CANC)**CANC 380 Evolutionary Biology of Cancer Units: 3.00**

This online course is designed to introduce students to cancer as an evolutionary problem. The material is unique in that it emphasizes the impact of the immune system in fighting cancer while at the same time shaping tumour cell evolution. Students will need to synthesize the impact of factors present in the tumour microenvironment.

NOTE Also offered online.

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

Requirements: Minimum 3rd year (Level 3) standing and one of (MICR 270/3.0; MICR 360/3.0; MICR 386/3.0) and one of (BCHM 270/3.0; BCHM 218/3.0).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Acquire a basic understanding of the evolutionary nature of cancer to recognize and evaluate the contribution of tumour heterogeneity and plasticity to cancer progression.
2. Analyze the tumour microenvironment to define its role in tumour invasion and its link to metastasis.
3. Characterize the role of immunity and inflammation in cancer and to define their contributions to cancer control or progression.
4. Recognize the impact of cancer on society and major milestones in cancer research to appreciate the successes of therapies and to assess the need for further development.
5. To apply an understanding of therapeutic selectivity to identify and evaluate the potential benefits and adverse effects of different therapeutic interventions in cancer.

**CANC 440 Cancer Biology and Therapeutics Units: 3.00**

A consideration of current knowledge and theories about the biology and treatment of cancer. The course will be presented in a small group format, with active student participation required.

NOTE Priority to students in the LISC Specialization Plan, CANC Sub-Plan.

Requirements: Prerequisite (Level 4 or above and registration in a BCHM/LISC Major or Specialization, or BHSc program and a minimum GPA of 3.0 in [BCHM 218/3.0 or BCHM 370/3.0]).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Understand the current state of knowledge of the biology, pathology and clinical outcomes of multiple forms of cancer, and relate how these factors determine established and experimental diagnostic and therapeutic approaches.
2. Discuss major issues related to the biology, pathology, diagnostics and therapeutics of each disease, in a small group student presentation format.
3. Synthesize knowledge you have acquired through the course to propose and justify your own novel approach to cancer diagnosis or treatment.

CANC 499 Research Project in Cancer Biology and Genetics Units: 12.00

A research project involving the study of cancer biology or genetics. The project will be supervised by a faculty member associated with the Cancer Research Institute, and will provide opportunities for experimental design, data analysis and both written and oral presentation of results. Students must contact a potential faculty supervisor in the Spring preceding registration in fourth year. Enrolment is limited; acceptance by a supervisor required prior to registration. NOTE Acceptance by a supervisor required prior to registration.

NOTE Students whose research requires the care and/or handling of animals must also complete the Introductory Animal Care Course and if required the appropriate Animal Use workshops through the Office of the University Veterinarian.

Learning Hours: 480 (288 Laboratory, 24 Group Learning, 24 Individual Instruction, 144 Private Study)

Requirements: Prerequisite Level 4 and registration in the LISC Specialization Plan (CANC Sub-Plan) and a cumulative GPA of 2.50 or higher. 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

Cardiorespiratory Science (CRSS)

CRSS 453 Principles in Cardiorespiratory Science I Units: 3.00

An advanced organ systems approach to the physiological principles underlying cardiac function and oxygen delivery using lectures, seminars, and selected readings. Topics include mechanics and regulation of heart function as well as perturbations in cardiac function. Oxygen delivery and utilization will be examined at the levels of the lung, blood, and tissue. The responses to alterations in oxygen demand and/or supply will also be addressed. Obstructive sleep apnea will be used as a model of a pathological cardiorespiratory system interactions.

NOTE Priority given to students in the CRSS Sub-Plan.

Requirements: Prerequisite Minimum 4th year (Level 4) standing, registration in a LISC/BHSc Major or SSP, a GPA of 2.5, and one of [(PHGY 215 and PHGY 216); PHGY 214/6.0; PHGY 212/6.0].

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Gain advanced understanding of cardiorespiratory systems by scrutinizing diseased states and major discoveries.
2. Build skills in presentation of complex topics and scientific writing.

CRSS 454 Cardiovascular Sciences Units: 3.00

A study of the physiology, pharmacology and anatomy of the cardiovascular system. Topics include integrative mechanisms of control and pharmacotherapy involved in short-term and long-term control of the circulation in health and disease. NOTE Also offered online. Consult the Bachelor of Health Sciences program office.

Learning Hours: 138 (18 Lecture, 10 Seminar, 10 Group Learning, 100 Private Study)

Requirements: Minimum 4th year (Level 4) standing and (registration in a LISC or BCHM MAJ or SSP Plan or BHSc program) and a GPA of 2.50. Exclusion LISC 454.

Course Equivalencies: CRSS454; LISC454

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Critically evaluate a scientific study to present the key findings and how they apply to the mechanisms of short term and long term control of the circulation.
2. Describe the time course of changes in the components that make up the baroreceptor reflex as a consequence of short term changes in blood pressure.
3. Explain the mechanistic basis and the time-course of alterations within the cardiovascular system (e.g. BP, heart rate, etc.) produced during and after a therapeutic intervention.
4. Identify a gap in knowledge regarding a lifestyle intervention that could potentially impact on blood pressure chronically in order to design a novel study to test a hypothesis.

CRSS 456 Molecular and Cellular Basis of Cardiovascular Disease Units: 3.00

An intensive course surveying the molecular and cellular mechanisms underlying the pathophysiology of the major cardiovascular diseases, and the current and emerging tolls used in their diagnosis and treatment. Alterations in signalling, metabolism, and structure and function will be discussed to present an integrative view of how cardiovascular diseases develop and progress.

NOTE Priority given to students in the CRSS Sub-Plan.

Requirements: Prerequisite (Level 4 and registration in a LISC Specialization or Major, or BHSc program and a minimum GPA of 2.5 and [PHGY 215/3.0 and PHGY 216/3.0]).

Offering Faculty: Faculty of Health Sciences



CRSS 498 Cardiorespiratory Rounds Units: 3.00

An advanced course in which students attend cardiology and respirology rounds in the Department of Medicine and prepare written and oral reports based on the material presented. The course will provide students with an in-depth exposure to topics in clinical cardiorespiratory science. The course will be offered in alternate years.

NOTE Priority given to students in the CRSS Sub-Plan.

Requirements: Prerequisite Level 4 and registration in a LISC Major or Specialization Plan and a GPA of 2.5 and ([PHGY 215 and PHGY 216] or PHGY 214 or PHGY 212 or PHGY 210).

Offering Faculty: Faculty of Health Sciences

Community Health and Epidemiology (EPID)

EPID 301 Principles of Epidemiology Units: 3.00

Basic methods involved in researching the distribution and determinants of health/disease in populations. Core principles of epidemiology are examined, as are the various epidemiological approaches to study design. The latter include descriptive (cross-sectional and ecological), observational (case-control and cohort), and experimental (randomized controlled trials) approaches.

Learning Hours: 117 (13.5L, 13.5T, 6 Group Learning, 12 Online Activity, 72 Private Study)

Requirements: Prerequisite BIOL 243 or CHEE 209 or COMM 162 or ECON 250 or GPHY 247 or KNPE 251 or NURS 323 or POLS 285 (formerly POLS 385/3.0) or PSYC 202 or SOCY 211 or STAM 200 or STAT 263 or STAT 267 or STAT 269 or STAT 367. Exclusion HSCI 270 (formerly BMED 270/3.0); HLTH 323.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Define and explain the main terms used in epidemiology (concepts, measures).
2. Recognize and distinguish the main study designs (cross-sectional and correlational, case control, cohort, randomized controlled trial and systematic reviews) used to identify causes of disease and to evaluate the effectiveness of clinical and public health interventions.
3. Calculate and interpret the main measures used in descriptive and analytic studies (rates, estimates of association).
4. Identify and evaluate the main sources of error related to interpreting the epidemiological findings (chance, bias, confounding).
5. Recognize and explain the practical applications of epidemiology (outbreaks, surveillance, prevention, screening).

EPID 401 Biostatistical Data Analysis Units: 3.00

An applied statistics course covering practical topics in tests and confidence intervals for single and multiple samples, ANOVA, linear regression, correlations, methods for categorical data, and nonparametric methods. The lab uses statistical software. The course emphasizes analyzing data arising in life sciences using practical statistical methods.

Requirements: Prerequisite Level 4 or above and registration in the LISC/BCHM Specialization or Major Plan, or BHSc program, and a cumulative GPA of 2.50 or higher, and one of (BIOL 243/3.0; COMM 162/3.0; ECON 250/3.0; HSCI 190/3.0; PSYC 202/3.0; SOCY 211/3.0; STAM 200/3.0; STAT 263/3.0).

Offering Faculty: Faculty of Health Sciences

EPID 499 Research Project in Epidemiology Units: 12.00

An examination of an epidemiological research question chosen by the student with guidance from the supervisor. Project will involve review of the literature, development of a proposal, data collection and/or processing, data analysis, a written report and oral presentation. Students will be required to attend and report on seminars of their choosing from a number of venues across campus. Limited enrolment. **NOTE** Acceptance by a supervisor required prior to registration.

NOTE Students whose research requires the care and/or handling of animals must also complete the Introductory Animal Care Course and if required the appropriate Animal Use workshops through the Office of the University Veterinarian.

Learning Hours: 480 (288 Laboratory, 24 Group Learning, 24 Individual Instruction, 144 Private Study)

Requirements: Prerequisite Level 4 and registration in the LISC Specialization Plan and a cumulative GPA of 2.50 or higher and (HSCI 270/3.0 or EPID 301/3.0 or HLTH 323/3.0). Corequisite EPID 401/3.0. 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

EPID 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

Drug Development and Human Toxicology (DDHT)**DDHT 459 Principles of Drug Discovery Units: 3.00**

Advanced study of the early stage components involved in the complex process of drug development including target identification, design and synthesis, structure activity relationships, in vitro and in vivo efficacy determination, biochemical and biological optimization.

NOTE Priority given to students in the LISC Specialization Plan, DDHT Sub-Plan.

Learning Hours: 120 (12 Lecture, 24 Group Learning, 84 Private Study)

Requirements: Prerequisite PHAR 270/3.0 or PHAR 340 or PHAR 370. Recommended PHAR 416. Exclusion PHAR 480.

Offering Faculty: Faculty of Health Sciences

DDHT 460 Principles of Drug Development Units: 3.00

Advanced study of the component parts of the complex process of drug discovery and development and the assessment of human toxicology including drug delivery and formulation, directed toxicology studies, drug disposition, clinical trials, legal issues and regulatory approval.

NOTE Priority given to students in the LISC Specialization Plan, DDHT Sub-Plan.

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

Requirements: Prerequisite PHAR 270/3.0 or PHAR 340 or PHAR 370. Recommended DDHT 459 and PHAR 416. Exclusion PHAR 480.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Develop solutions to drug discovery/development problems to discuss either orally or in writing solutions to these problems.
2. Critically analyze the social and economic implications of legislative decisions pertaining to the pharmaceutical industry to argue a particular side of these decisions.
3. Develop and refine professional interpersonal communication skills.
4. Develop an understanding of the biologic, social, and economic constraints that influence drug development.



Life Sciences (LISC)

LISC 300 The Process of Discovery in the Biomedical Sciences Units: 3.00

Teams of students will identify the critical questions that must be answered to resolve major controversies or gaps of knowledge that impede the application of fundamental principles in the Life Sciences to health care. The end product will be a written report and public presentation that is accessible to a wide audience.

NOTE Restricted to students registered in Level 3 or above in a (LISC Specialization or Major Plan or BCHM Specialization or Major Plan or BIOL Plan or PSYC Plan).

NOTE Limited enrollment available to BIOL and PSYC students.

Learning Hours: 126 (6 Lecture, 6 Seminar, 33 Group Learning, 33 Online Activity, 48 Private Study)

Requirements: Prerequisite Minimum 3rd year (Level 3) standing and registration in one of (LISC Honours Plan; BCHM Honours Plan; BHSc Program; BIOL Plan; PSYC Plan).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Search for, identify, and critically assess sound scientific manuscripts and sources.
2. Work effectively in groups to integrate and present data from various scientific sources.
3. Produce written works that synthesize information they have gathered.
4. Present their findings in both lay and scientific language in either a scientific poster or oral presentation format.

LISC 387 Sex Differences in Health and Disease Units: 3.00

This course will focus on the role of sex/gender related differences in etiology, pathogenesis and immune responses of human diseases. Conventional and advanced tools in diagnosis and treatment of diseases affecting men and women.

Learning Hours: 120 (24 Lecture, 12 Seminar, 36 Group Learning, 48 Private Study)

Requirements: Prerequisite (Level 3 and registration in a LISC/BCHM Major or Specialization Plan or BHSC program) and (a GPA of 2.5) and one of (MICR 270/3.0; MICR 360/3.0; MICR 386/3.0) and BCHM 218/3.0. Exclusion REPD 387/3.0*.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Students will have the basic understanding of immunological and hormonal mechanisms that integrate and impart sex differences in diseases with an emphasis on those that associate with the urogenital tract.
2. Students will gain a basic knowledge of recent advances in diagnosis and treatment of diseases exhibiting sex differences.
3. Students will be able to apply the concepts acquired in critical assessment and identification of knowledge gaps in immunologically driven sex differences in disease pathology and outcomes.

LISC 390 Integrated Life Science Laboratory I Units: 3.00

Students will learn a number of different laboratory techniques, developing skills in scientific methodology, data acquisition, and interpretation. Students will also attain skills in critical thinking and hypothesis development, as well as gain experience in writing a laboratory report, and participating in research presentations.

NOTE Priority will be given to students registered in a LISC Specialization Plan.

Requirements: Prerequisite (PHGY 210/6.0 or PHGY 214/6.0 or [PHGY 215 and PHGY 216]) and (LISC 391 or PHAR 230 or PHAR 340 or PHAR 370 [formerly PHAR 270/3.0]). Exclusion BMED 384.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Apply qualitative and quantitative research methodologies to test hypotheses, generate data, and interpret results spanning the fields of biochemistry, anatomy, physiology, immunology, pharmacology, and microbiology.
2. Conduct, analyze, and interpret their own research, and discuss the significance of the findings within the context of respective fields.
3. Justify and support an experimental plan by searching through and scrutinizing the available scientific literature of the topic in question.
4. Navigate human anatomical specimens, identifying different tissues, organs and systems, while discussing links between their structure and function.
5. Perform laboratory experiments using appropriate technique, with emphasis on efficiency and multitasking.

LISC 391 Integrated Life Sciences Laboratory Units: 3.00

An intermediate laboratory course on the Physiology and Pharmacology of Cardiorespiratory Sciences and Neuroscience. Students develop skills to acquire and evaluate data and methods. Critical thinking skills are used for the development of arguments, assumptions, and information required to evaluate concepts and hypotheses.

NOTE Priority will be given to students registered in a LISC Specialization Plan.

Learning Hours: 108 (36 Laboratory, 36 Online Activity, 36 Private Study)

Requirements: Prerequisite PHGY 210/6.0 or PHGY 214/6.0 or (PHGY 215 and PHGY 216). Exclusion BMED 384.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Apply understanding of physiology and pharmacology principles to an experimental laboratory setting of neuroscience and cardiorespiratory physiology.
2. Develop qualitative and quantitative research methodologies including data acquisition and analysis to effectively test a hypothesis, generate data, and interpret results using appropriate statistics, and data analysis including graphing and curve fitting.
3. Work collaboratively in a group to effectively design, execute, analyze, and present experimental data.
4. Discuss the significance of their findings in the form of informal reports, formal laboratory report in a defined format, scientific poster, and oral presentation.



LISC 400 Neuro-Immune Interactions in Health and Disease Units: 3.00

This course is designed to advance critical thinking skills, as well as oral and written communication skills, via an inquiry-based approach in neuroimmunology. Teams of students identify the critical cellular and molecular processes regulating neuro-immune interactions in health and disease.

Learning Hours: 120 (24 Group Learning, 36 Individual Instruction, 36 Online Activity, 24 Private Study)

Requirements: Prerequisite Minimum 3rd year (Level 3) standing, registration in a LISC/BCHM/BHSc Major or SSP, a GPA of 2.5, and one of ([PHGY 290/3.0 and MICR 270/3.0]; LISC 300/3.0; NSCI 323/3.0; NSCI 324/3.0; MICR 360/3.0; MICR 386/3.0).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Accumulate relevant scientific evidence through scholarly review of the neuroimmunology literature and critically evaluate the content as it relates to the proposed topic.
2. Identify gaps in knowledge and/or paradoxes and/or obstacles in the collected neuroimmunology literature with regard to limitations in resolving fundamental questions in the specific area under study.
3. Communicate (verbal and written) their knowledge, insights and a conceptual framework to their peers and a lay audience; providing justification/rationale that investigation of the critical issues they have identified provide a constructive strategy to advance the field of neuroimmunology.
4. Capitalize on the power of group dynamics, to support and advocate for team members, and manage diverse opinions and personalities.
5. Provide thoughtful, logical and innovative questions to the projects proposed by other groups.

LISC 426 Current Concepts in Sensorimotor Neuroscience Units: 3.00

A multi-disciplinary course exploring advanced concepts of sensorimotor integration from a systems neuroscience perspective. Topics include the neural basis of perception, action selection, reinforcement learning, and motor control. Students will learn to critically evaluate scientific literature and present these concepts to classmates.

Requirements: Prerequisite Level 4 or above and registration in the LISC Major or Specialization Plan, or BHSc Program, and a cumulative GPA of 2.50 or higher and (NSCI 323/3.0 or NSCI 324/3.0).

Offering Faculty: Faculty of Health Sciences

LISC 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.

NOTE Also offered at Bader College, UK.

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

LISC 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

LISC 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

LISC 598 Independent Study Units: 9.00

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

Microbiology and Immunology (MICR)**MICR 121 Microbiology for Nursing Students Units: 3.00**

This course provides the student with a foundation in the subdisciplines of bacteriology, virology, parasitology, and immunology. The course is designed to examine common infectious diseases through a body-systems approach. Laboratory and tutorial sessions emphasize diagnostic microbiology.

Requirements: BCHM010 OR BCHM102

Offering Faculty: Faculty of Health Sciences

**MICR 221 Fundamental Microbiology Units: 3.00**

A fundamental study of the structure, genetics, and growth of microorganisms, focusing on bacteria and viruses. The roles of microbes in the environments in which they exist will be considered.

Learning Hours: 120 (36 Lecture, 18 Laboratory, 66 Private Study)

Requirements: PREREQUISITE (A GPA of 1.90 (obtained in any term) or a `Pass` (obtained in Winter 2020) in BIOL 102/3.0 and BIOL 103/3.0) and CHEM 112/6.0.
EXCLUSIONS MICR 271/3.0

Course Equivalencies: MICR221, MICR229

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. understand the main ways bacteria exchange DNA
2. understand the major structures of bacterial cells, their functions and assembly;
3. recognize roles microbes play in the environment as well as in disease
4. appreciate the diversity of microbes
5. identify the growth phases of bacteria and how growth can be measured
6. understand the many ways microbes acquire nutrients from their environment
7. understand how bacteria communicate
8. understand the many ways bacteria regulate expression of their genes;
9. integrate lecture material with the lab component
10. identify major virus families and understand their structure, replication strategies and diversity
11. understand how viruses disseminate within the infected host organism and how they cause disease
12. understand how the host organism responds to virus infection and develops immunity to future infection by the same virus
13. understand the mechanisms by which some viruses evade host immune defenses
14. understand the challenges faced in the global delivery of vaccines to eradicate select viral pathogens.

MICR 270 Infection, Immunity and Inflammation Units: 3.00

This course focuses on 1) the overall organization of the immune system, 2) the role of the immune system in combating diseases caused by common pathogens as well as adverse reactions of the immune system and 3) application of the basic knowledge of immunology to the field of infectious disease prevention and control by vaccines and treatment of cancer. The unique features of this course lie in its overall structure and delivery that will prepare the student for further in-depth learning in the field of immunology.

NOTE This online course in infection and immunity is designed for students from various biological sciences and allied health backgrounds at all levels of post-secondary education and is recommended as a foundation course for students pursuing a life sciences career.

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

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

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

Requirements: Minimum 2nd year (Level 2) standing and one of (BIOL 102/3.0; MICR 121/3.0; PHGY 170/3.0). One-way Exclusion May not be taken with or after MICR 360/3.0; MICR 386/3.0; BMED 386.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Describe the beneficial and detrimental interactions of the innate and adaptive branches of the human immune system.
2. Describe the organization of the immune system and how it functions.
3. Describe the unique features of human defense mechanisms against microbial agents.
4. Understand how the basic knowledge of immunology can be applied and translated to the development of immunological techniques, vaccines, and cancer immunotherapies.

MICR 271 Introduction to Microbiology Units: 3.00

An introduction to the biology of microbes, including both pathogenic & beneficial bacteria, viruses, fungi, & protozoa. This overview of the biological features of these microorganisms will highlight these organisms' roles in the environment & in human health contributing to infectious diseases vs. maintaining healthy microbiomes.

NOTE Only offered online. Consult the Bachelor of Health Sciences Program office.

Learning Hours: 120 (60 Online Activity, 60 Private Study)

Requirements: Minimum 2nd year (Level 2) standing and one of (PHGY 170/3.0; BIOL 102/3.0). Exclusion MICR 221/3.0

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Analyze information pertaining to a specific organism to evaluate the impact of microbial replication, gene expression and antibiotic resistance of the microorganism in health, disease or the environment.
2. Collaboratively demonstrate a working knowledge of microbe characteristics that relate to their survival by working effectively with peers.
3. Employ a basic understanding of the biological features of bacteria, viruses, and eukaryotic microbes to transition to higher level microbiology courses.
4. Employ effective peer review in a small group setting in order to collaboratively formulate predictions of the success or failure of designed superbugs.

MICR 290 Antibiotic Resistance Lab Units: 3.00

This immersive laboratory course is designed to give students the opportunity to apply important microbiological and biochemical research techniques to the study of antibiotic resistance. Students work in small groups on a semester-long project, developing valuable lab skills that will support them with future research opportunities.

Learning Hours: 120 (36 Laboratory, 48 Online Activity, 36 Private Study)

Requirements: Prerequisite Level 2 or above and registration in a BCHM or LISC Plan, or BHSc Program, and (BIOL 102/3.0 or PHGY 170/3.0).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Recognize hazards in a research environment in order to employ safe laboratory practices.
2. Summarize observations and research data in a lab notebook in order to communicate their results in a written format.
3. Explain how common biochemical and microbiological research techniques work, and evaluate when a particular technique should be applied.
4. Apply basic research techniques to answer scientific questions.
5. Interpret and evaluate experimental results to present their findings as a written report.
6. Evaluate the literature on antibiotic resistance to explain topics in this area to a scientific audience.

**MICR 320 Microbes in Health and Disease Units: 3.00**

This course will focus on the roles of microbes in health (human microbiome) and disease (pathogens). The molecular mechanisms of bacterial/viral virulence and the host response will be examined in order to develop an in depth understanding of the etiology of infectious diseases and the benefits derived from the human microbiome. Consult the Bachelor of Health Sciences program office

NOTE Also offered online. Learning Hours may vary.

Requirements: Minimum 3rd year (Level 3) standing and one of (MICR 221/3.0; MICR 271/3.0; MICR 229/3.0) and one of (MICR 360/3.0; MICR 386/3.0; BMED 386/3.0). Exclusion MICR 382/3.0

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Describe and apply knowledge of how microbes interact with the human host in relation to health (human microbiome) and disease (microbial pathogens). Organize & assess information from various sources to critically and appropriately problem solve.
2. Integrate the information taught in the course to provide a broad-based understanding of the global impact of microbes on health and disease. Reflect upon and track how accumulated knowledge is influencing perception of human health and infectious disease.
3. Reflect upon and document learning styles and strategies best suited to optimize depth and breadth of learning.
4. Work collaboratively in a small group setting to apply accumulated knowledge in critical evaluation of the factors that contribute to the etiology of infectious diseases.

MICR 360 Immunology Units: 3.00

The general principles and mechanism of immune reaction. Immunochemical and immunobiological aspects of antibody formation and cell-mediated immunity in health and disease will be considered.

Learning Hours: 144 (36 Lecture, 36 Online Activity, 72 Private Study)

Requirements: Prerequisite MICR 221 or MICR 271. Exclusion MICR 386.

Offering Faculty: Faculty of Health Sciences

MICR 386 Fundamentals of Immunology in Health and Disease Units: 3.00

Integrates the key principles of immunology to facilitate learning of immunology as it relates to human health and disease. This course offers real-life case studies, problems encountered and solutions applied, immunology virtual laboratory simulation, and extensive coverage of the basic science underlying each topic in the module.

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), and one of (MICR 270/3.0; MICR 271/3.0; MICR 221/3.0). Exclusion MICR 360/BMED 877

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Advocate for ethical issues in the immunological approach to health and life sciences by effectively researching major issues at the forefront of the discipline
2. Assess immunology resources critically (e.g. videos, virtual lab, and clinical images) and use precise written responses to present the work to both a science literate and general audience
3. Dissect a problem into its key features by thinking in an integrated manner and interpret immunological data from a virtual lab to identify consistent and inconsistent components
4. Explain the fundamentals of immunology and describe key principles of the immune system, mechanisms of immune reactions, aspects of antibody formation, and cell-mediated immunity in health and disease

MICR 435 Advanced Prokaryotic Structure and Function Units: 3.00

An in-depth analysis of the genetics, biochemistry, assembly and function of the major structures of the prokaryotic cell. Emphasis on the experimental approaches in the current literature.

Requirements: PREREQUISITES BIOL 205/3.0 and (MICR 221/3.0 or MICR271 or MICR 229/3.0 with a minimum grade of B-) and reg in the LISC Major or Spec. Plan) and (a GPA of 2.5). COREQUISITE BCHM 310/6.0 or BCHM 315/3.0 or BIOL 334/3.0.

Offering Faculty: Faculty of Health Sciences

MICR 436 Microbial Genetics Units: 3.00

A detailed description of the processes of heredity in bacteria including a discussion of gene structure and evolution, gene expression and its control, the exchange of genetic material in the microbial world and genetic engineering and its applications. The laboratory component will emphasize modern approaches to genetic engineering.

NOTE Offered in alternate years to MICR 435/3.0.

Requirements: PREREQUISITES BIOL 205/3.0 and (MICR 221/3.0 or MICR227 or MICR 229/3.0 with a minimum grade of B) and (reg in the LISC Major or Spec. Plan) and (a GPA of 2.5). COREQUISITE BCHM 310/3.0 or BCHM 315/3.0 or BIOL 334/3.0.

Offering Faculty: Faculty of Health Sciences

MICR 450 Principles of Molecular Virology Units: 3.00

Further study of contemporary virology, using the textbook as a guide to particles, genomes, replication, expression, infection and pathogenesis. Emphasizing reading and writing to develop skills in observation and critical thinking, important attributes in understanding the scientific method.

NOTE Offered in alternate years to MICR 451/3.0.

Requirements: PREREQUISITES BIOL 205/3.0 and (MICR 221/3.0 or MICR271 with a minimum grade of B-) and (Level 4 and registration in the LISC Major or Spec. Plan) and (a GPA of 2.5). COREQUISITE BCHM 310/6.0 or BCHM 315/3.0.

Offering Faculty: Faculty of Health Sciences

MICR 451 Viral Pathogenesis Units: 3.00

This molecular virology course covers viral replication strategies and virus-host interactions, with an emphasis on mechanisms of viral pathogenesis, focusing on human pathogenic viruses such as coronaviruses, hepatitis viruses, HIV, and herpesviruses. Tutorials will be in journal club format with group discussion and analysis of recent literature.

Learning Hours: 120 (24 Lecture, 12 Tutorial, 84 Private Study)

Requirements: Prerequisite Level 3 or above and registration in the LISC Major or Specialization Plan, or BHSc program and a minimum CGPA of 2.50 and (MICR 221/3.0 or MICR 271/3.0) and (BCHM 218/3.0 or BIOL 330/3.0).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Appreciate how viruses impact health and society
2. Develop ability to interpret and evaluate primary scientific literature
3. Understand virological assays and how to interpret them
4. Learn strategies for viral entry, genome organization, protein expression and replication
5. Acquire basic understanding of virus-host interactions
6. Compare mechanisms of viral pathogenesis

MICR 452 Viral Infection and Immunity Units: 3.00

Course material will focus on the molecular basis for virus pathogenesis including host immune responses to virus infection, and viral countermeasures. Emphasis will be on viral infections that result in gastrointestinal, haematological, neurological, and respiratory diseases. Tutorials will focus on discussion of current and seminal literature.

Requirements: Prerequisite Minimum 4th year (Level 4) standing, registration in a LISC/BHSc Major or SSP, a GPA of 2.5, and one of (MICR 221; MICR 271), and one of (MICR 360; MICR 386).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Demonstrate understanding of advanced virology topics.
2. Development of literature-based research skills in order to evaluate and critique how current research articles advance the field of virology.
3. Development of writing skills in order to critique current scientific literature and use this to support a personal opinion.
4. Participate in a collaborative group presentation to convey current topics in virology.

MICR 461 Advanced Immunology Units: 3.00

Advanced immunology course focused on current topics in immunology and immunology-related scientific research.

Requirements: Prerequisite Minimum 4th year (Level 4) standing, registration in a LISC/BHSc Major or SSP, a GPA of 2.5, and a minimum grade of A- in one of (MICR 360; MICR 386).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Participate in a collaborative group presentation to convey current immunology topics.
2. Create an individual presentation in order to explain specific aspects of your topic.
3. Development of research skills in order to evaluate and critique how current research articles advance the field.
4. Development of writing skills in order to critique current scientific literature and use this to support a personal opinion.



MICR 483 Advanced Topics in Infectious Diseases Units: 3.00

This course will examine basic principles of infectious diseases such as Pathophysiology, Epidemiology and Transmission, and Control of Infectious Agents including an emphasis on Antimicrobial Therapy and Resistance. Selected Infectious Disease syndromes will be examined to explore unique host microbe interactions. Students will work through the topics online using interactive multimedia modules. Student assessment will include weekly online quizzes, group, and individual assignments. Active participation will also form part of student assessment. At the completion of the course, students will have an understanding of the key concepts of emerging topics in infectious diseases.

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

Requirements: Prerequisite Minimum 4th year (Level 4) standing and one of (MICR 320/3.0; MICR 270/3.0; MICR 221/3.0; MICR 271/3.0), or permission from the instructor. Equivalency BMED 483/3.0*.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Integrate epidemiological and transmission principles of infectious diseases to independently or collaboratively explain, discuss, and appreciate the global impact of infectious diseases.
2. Use the principles learned during the study of selected infectious disease syndromes and apply those principles to advocate for effective control of infectious diseases.
3. Integrate information found in course modules and primary literature to explain the pathophysiology of selected infectious diseases and the role it plays in disease progression and treatment.

MICR 484 Infectious Diseases and Zoonoses Units: 3.00

This course provides the opportunity for students to apply foundational to advanced knowledge of medical microbiology and infectious disease, particularly with respect to how different vectors contribute to the overflow of pathogens into humans.

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

Learning Hours: 120 (24 Lecture, 36 Group Learning, 36 Online Activity, 24 Private Study)

Requirements: Prerequisite Level 3 or above and (MICR 221/3.0 or MICR 270/3.0 or MICR 271/3.0).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Gain a broad understanding of medically relevant pathogens, including bacteria, viruses, fungi, and parasites, to enable the development of an overarching concept of the key components involved.
2. Apply foundational practices of infection prevention and control to predict how those processes mitigate the spread of pathogens from animals to humans.
3. Apply knowledge and concepts of microbiology to demonstrate how pathogens impact their animal host and then predict the interplay between infection control interventions, local environments and human populations.
4. Identify, describe, and predict the outcome of a change in pathogenesis in their non-animal hosts (i.e. humans or other intermediates) and how this might impact human health.

MICR 499 Research Project in Microbiology and Immunology Units: 12.00

A research project supervised by and closely related to the research program of a faculty member. The research project involves experimental design, data collection and analysis, written report and oral presentation. Students will be required to attend seminars and tutorials on topics related to research. Limited enrolment.

NOTE Acceptance by a supervisor required prior to registration.

NOTE Students whose research requires the care and/or handling of animals must also complete the Introductory Animal Care Course and if required the appropriate Animal Use workshops through the Office of the University Veterinarian.

Learning Hours: 480 (288 Laboratory, 24 Group Learning, 24 Individual Instruction, 144 Private Study)

Requirements: Prerequisite Level 4 and registration in a LISC or ELSC Specialization Plan and cumulative GPA of 2.50 or higher and (MICR 221/3.0 or MICR 271/3.0). 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

Neuroscience (NSCI)**NSCI 323 Foundational Neuroscience Units: 3.00**

Fundamental properties of the nervous system. Emphasis placed on the properties of neurons that are fundamental to neuron-to-neuron communication, the formation of neural circuits, and the repair of the nervous system following injury. Tutorials introduce techniques and neurological problems that illustrate principles of neural function.

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

Learning Hours: 120 (24 Lecture, 24 Group Learning, 36 Online Activity, 24 Off-Campus Activity, 12 Private Study)

Requirements: Prerequisite BIOL 339/3.0 or KNPE 125/3.0 or KNPE 225/3.0 or (PHGY 215/3.0 and PHGY 216/3.0) or PSYC 271/3.0.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Recognize and describe essential knowledge required to navigate the field of neuroscience and further apply this knowledge into advanced molecular, cellular, systems, and behavioral neuroscience.
2. Identify, describe, and critique the most current ruling principles in neuroscience related to: How neurons develop, grow, migrate, and connect to form neuronal circuits and a functional mature nervous system.
3. Identify, describe, and critique the most current ruling principles in neuroscience related to: How neurons and neuronal circuits acquire, transmit, store, and retrieve information.
4. Identify, describe, and critique the most current ruling principles in neuroscience related to: How dysfunctional neuronal function results in developmental and functional diseases of the nervous system.

NSCI 324 Systems Neuroscience Units: 3.00

Fundamental properties of the nervous system. Emphasis placed on the properties of neurons and neural circuits that underlie behaviour and cognitive functions within selected neural systems, such as sensory, motor, reward, and autonomic systems. Tutorials introduce techniques and neurological problems that illustrate principles of neural function.

Requirements: Prerequisite (PHGY 215/3.0 and PHGY 216/3.0) or PSYC 271/3.0 or NSCI 323/3.0 or PHGY 210/6.0 or PHGY 212/6.0 or PHGY 214/6.0.

Offering Faculty: Faculty of Health Sciences



NSCI 325 The Science of Psychedelics Units: 3.00

An active learning-based course aimed at providing a thorough scientific perspective on psychedelics. Students will learn about the historical and cultural relevance of psychedelics, their mechanisms of action, and their current and predicted therapeutic use. Emphasis will be placed on rigorously verified knowledge surrounding psychedelic therapy. Course format encourages students to acquire and/or perfect essential learning competencies such as critical thinking, independent learning, problem-solving, communication and teamwork.

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

Learning Hours: 120 (24 Lecture, 24 Group Learning, 36 Online Activity, 24 Off-Campus Activity, 12 Private Study)

Requirements: Prerequisite Level 3 or above.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Appraise the demonstrated and proposed psychedelics therapy.
2. Assess the ratio risk and benefits of psychedelic therapy.
3. Compare the pharmacodynamic and pharmacokinetic properties of various psychedelics.
4. Contrast and compare the mechanisms of action of psychedelics and psychedelic-like drugs.
5. Recognize and appraise the historical and cultural uses/significance of psychedelics.

NSCI 401 Introduction to Theoretical Neuroscience Units: 3.00

This course will provide an introduction to the main modelling approaches and theoretical concepts in Neuroscience. The computational anatomy of the brain and how it implements perception, learning, memory, decision making and motor control, among other topics, will be discussed.

RECOMMENDATION NSCI 323/3.0, NSCI 324/3.0, ANAT 312/3.0, PSYC 271/3.0.

Requirements: Prerequisite Minimum 4th year (Level 4) standing, registration in a LISC/BHSc Major or SSP, a GPA of 2.5, and one of (BIOL 243; CHEE 209; COMM 162; ECON 250; GPHY 247; HSCI 190; KNPE 251; NURS 323; POLS 285; PSYC 202; SOCY 211; STAM 200; STAT 263; STAT 267; STAT 367).

Offering Faculty: Faculty of Health Sciences

NSCI 403 Introduction to Neuroimaging Units: 3.00

This course covers the theory and practice of modern neuroimaging methods. Topics include data acquisition, research study design, and analysis methods. Functional MRI is presented in the most depth, but computed tomography (CT), positron emission tomography (PET), and single photon emission computed tomography (SPECT), are also covered.

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

Requirements: Prerequisite Minimum 4th year (Level 4) standing, registration in a LISC/BHSc Major or SSP, a GPA of 2.5, and one of (NSCI 323; NSCI 324; ANAT 312; PSYC 271; PSYC 370).

Offering Faculty: Faculty of Health Sciences

NSCI 414 Progress in Neuroanatomy and Neuropharmacology Units: 3.00

A contemporary and comprehensive assessment of the neurochemical anatomy and neuropharmacology of the mammalian and human nervous systems as they relate to development, function and disease. Topics will include dynamics of neurotransmitter interactions, neuronal drug receptor interactions and second messengers, neurotoxicity associated transmitters and neural growth factors. NOTE BMCO students should contact the Department regarding prerequisites.

Requirements: Prerequisite A minimum grade of B- in (ANAT 312/3.0 or NSCI 323/3.0 or PHAR 340/3.0 or PHAR 370/3.0) and a minimum cumulative GPA of 2.50 or higher. Corequisite NSCI 324/3.0.

Offering Faculty: Faculty of Health Sciences

**NSCI 422 Cellular and Molecular Neuroscience Units:
3.00**

A course providing 1) the essentials in cellular and molecular neuroscience to pursue a graduate program and/or a career in neuroscience or related field, and 2) independent learning and communication skills applicable broadly. The course is divided into three segments: 1) neuronal integration, 2) synaptic plasticity, and 3) neuromodulation.

NOTE BMCO students should contact the Department regarding prerequisites.

Learning Hours: 119 (12 Lecture, 24 Seminar, 8 Group Learning, 6 Individual Instruction, 69 Private Study)

Requirements: Prerequisite Minimum 4th year (Level 4) standing, registration in a LISC/BHSc Major or SSP, a GPA of 2.5, and a minimum grade of B in NSCI 323.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. To develop student's critical thinking skills
2. To encourage student's independent learning and problem-solving skills
3. To perfect oral and written communication skills
4. To learn and discuss current knowledge on 1-neuronal integration, 2-synaptic plasticity, 3-neuromodulation.

**NSCI 424 Neurodegeneration and Brain Health Units:
3.00**

This course focuses on the molecular basis of neurodegeneration in Alzheimer's disease and related neurodegenerative diseases. The course further covers the molecular basis of the systemic communication with the brain and the ability of circulatory blood factors to foster brain resilience and health. The course is designed to cover current research developments on the field. The course intends to advance critical thinking and has a focus to improve student's oral skills. Assessments include three presentations.

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

Learning Hours: 120 (36 Lecture, 60 Group Learning, 24 Private Study)

Requirements: Prerequisite Level 4 or above and registration in a LISC Major or Specialization, or BHSc Program, and a cumulative GPA of 2.50, and (ANAT 312/3.0 or NSCI 323/3.0 or NSCI 324/3.0).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Understand and integrate the basic principles of neurodegeneration processes in Alzheimer's disease and related neurodegenerative diseases in order to communicate how they develop in the brain at a molecular, cellular, and behavioural level.
2. Understand and integrate, at the molecular level, neuroprotective processes stimulated by the systemic communication with the brain and how this communication may counteract neurodegeneration.
3. Critically analyze, and/or interpret scientific data in primary research reports and reviews in order to contextualize and communicate current knowledge in the field of neurodegeneration and brain health.
4. Learn to prepare effective slide deck presentations to use in the communication of the scientific basis of neurodegeneration and brain health.
5. Provide peer assessment, as well as thoughtful, logical questions and comments to the projects presented by peers.

**NSCI 429 Disorders of the Nervous System Units: 3.00**

A multi-disciplinary course exploring advanced concepts of clinical neuroscience. Topics include stroke, traumatic brain and cord injuries, neurodegenerative disorders, epilepsy, schizophrenia, depression, deep brain stimulation, pain and placebo effects, normal and abnormal aging, stem cells. Students will learn to critically evaluate scientific literature and present these concepts to classmates during student-led seminars. Restricted to fourth-year students. Enrollment is limited.

Requirements: Prerequisite Minimum 4th year (Level 4) standing, registration in a LISC/BHSc Major or SSP, a GPA of 2.5, and one of (NSCI 322; NSCI 323; NSCI 324; ANAT 312).

Offering Faculty: Faculty of Health Sciences

NSCI 433 Cellular Elements of the Nervous System: Responses to Injury and Disease Units: 3.00

Cellular dysfunction is a critical feature of neural injury and disease among humans. This course will examine the cellular elements of the mammalian central and peripheral nervous system, with an emphasis placed on understanding normal and abnormal cellular function in both humans and animal models.

NOTE Restricted to students registered in the 4th year.

Learning Hours: 114 (36 Lecture, 36 Laboratory, 42 Private Study)

Requirements: Prerequisite Minimum 4th year (Level 4) standing, registration in a LISC/BHSc Major or SSP, a GPA of 2.5, and one of (NSCI 323; NSCI 324), and one of (ANAT 309; ANAT 312).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Gain a greater understanding of the cellular organization of the mammalian nervous system.
2. Understand the cellular contributions to normal functioning both centrally and peripherally.
3. Understand how cells respond to injury or disease of the nervous system.

NSCI 444 Controversies in Neuroscience Units: 3.00

As insight regarding the human brain expands, so do related issues such as what constitutes personhood, what drives the criminal mind, intelligence-enhancing drugs and end-of-life issues. Lead by experts who deal daily with such concerns, we will focus weekly on a particular topic in neuroscience which impacts on society.

Learning Hours: 108 (12 Lecture, 24 Seminar, 72 Private Study)

Requirements: Prerequisite Minimum 4th year (Level 4) standing, registration in a LISC/BHSc Major or SSP, a GPA of 2.5, and one of (NSCI 322; NSCI 323; NSCI 324; ANAT 312).

Offering Faculty: Faculty of Health Sciences

NSCI 483 Neurobiology of Learning and Memory Units: 3.00

An exploration of brain systems underlying how we learn and remember, and how they become disordered. Online multimedia modules and study of cutting edge research articles reveal how modern techniques and ideas are driving neuroscience forward. Requires interviewing a person with a disorder in order to learn to advocate for them in society.

Requirements: Minimum 4th year (Level 4) standing and one of [(PHGY 215/3.0 and PHGY 216/3.0); PSYC 271/3.0; PHGY 214/6.0; PHGY 210/6.0]. For LISC and BCHM Honours students Level 4 and registration in a LISC or BCHM Major or Specialization Plan and a GPA of 2.5

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Collaborate with others in order to effectively collect, analyze, and interpret scientific data.
2. Communicate an integrated understanding of the scientific basis and societal impact of neurological disorders of learning and memory to colleagues in order to advocate for vulnerable populations.
3. Critically evaluate primary research reports and reviews in order to contextualize and communicate current knowledge in the field of learning and memory.
4. Demonstrate skill in providing and responding to feedback in a professional manner.
5. Describe the basic principles of learning and memory processes in order to communicate how they are generated by the brain at a cellular, systems, and behavioural level.

NSCI 491 Directed Special Laboratory Units: 3.00

Laboratory course in a selected area of Neuroscience to be arranged in consultation with individual members of the Centre for Neuroscience Studies. Course involves experimental design, data collection and analysis (approximately 6 hours of laboratory work per week required) as well as a brief communication of the laboratory work. NOTE Students are limited to one NSCI 491/3.0 research project in Year 4.

NOTE Students whose research project requires the care and/or handling of animals must also complete the Introductory Animal Care Course and if required the appropriate Animal Use workshops through the Office of the University Veterinarian.

Requirements: Prerequisite Availability of a supervisor and permission of the course coordinator; level 4 in the LISC Specialization Plan, NSCI Sub-Plan.

Offering Faculty: Faculty of Health Sciences

NSCI 499 Research Project in Neuroscience Units: 12.00

An investigation into a selected area of neuroscience. The research project involves experimental design, data collection, and analysis, written report and oral presentation. Students will be required to attend seminars and tutorials on topics related to research. Limited enrolment.

NOTE Acceptance by a supervisor required prior to registration.

NOTE Students whose research requires the care and/or handling of animals must also complete the Introductory Animal Care Course and if required the appropriate Animal Use workshops through the Office of the University Veterinarian.

Learning Hours: 480 (288 Laboratory, 24 Group Learning, 24 Individual Instruction, 144 Private Study)

Requirements: Prerequisite Level 4 and registration in a LISC Specialization and a cumulative GPA of 2.50 or higher. 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

Pathology and Molecular Medicine (PATH)

PATH 111 Data Science Through Visualization Units: 3.00

This blended course is designed to bring awareness and raise excitement in data science. Through different types of visualization students will learn key concepts of data science and big data investigation. The course will also explore examples of how data science is applied to solve problems in various disciplines.

Learning Hours: 120 (12 Lecture, 24 Group Learning, 36 Online Activity, 48 Private Study)

Requirements: Prerequisite None.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Perform, observe, and interpret visualization of data from variety of sources.
2. Apply skills acquired to critically evaluate and summarize data.
3. Describe appropriate data visualization for diverse types of challenges.
4. Collaborate and communicate an understanding of concepts and diverse perspectives in data science.



PATH 120 Understanding Human Disease in the 21st Century Units: 3.00

The course provides an introduction to human disease and our understanding of key conditions with major global health and societal impact, including cardiovascular, neurological and infectious diseases and cancer. The basic concepts of disease mechanisms and current management will be explored using specific diseases and clinical example cases. Also offered online.

LEARNING HOURS may vary 120(12L;36G;36O;36P)

Requirements: One-Way Exclusion PATH 310/3.0; CANC 440/3.0

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Access the individual and population impacts of human disease by effectively researching major issues affecting changes in global health
2. Apply the skills acquired to critically evaluate scientific literature on human disease
3. Collaborate and communicate an understanding of the causes and implications of human disease including current and future management and treatments.
4. Explain how different populations are differentially impacted by the same disease
5. Identify and describe mechanisms underlying human disease and be able to recognize potential origins of human disease states

PATH 310 Introduction to Pathology and Molecular Medicine Units: 3.00

An introduction to pathology and molecular medicine. The course will be organized around a specific set of diseases, designed to illustrate basic concepts in the molecular biology, biochemistry, and pathology of human disease.

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

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).

Course Equivalencies: PATH310, PATH410

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Integrate underlying genetic and biochemical factors with resultant pathologic processes and disease states.
2. Compare and contrast the contributions of genetics and environmental factors to disease.
3. Apply course concepts to a hypothetical disease to identify its molecular basis and clinical features, and rationalize testing and treatment options.
4. Clearly and concisely articulate ideas in both oral and written formats, working individually as well as in team-based learning groups.

PATH 381 Clinical Biochemistry Units: 3.00

This upper-year health sciences course covers topics relating to the integrated role of clinical biochemists within a healthcare team. Students will critique analytical techniques in the context of various diseases. Through problem-based learning, students will also explore how to identify and troubleshoot issues in laboratory testing.

Learning Hours: 120 (12 Lecture, 12 Tutorial, 36 Online Activity, 60 Private Study)

Requirements: Prerequisite Level 3 or above and (BCHM 102/3.0 or BCHM 218/3.0 or BCHM 270/3.0) and 3.0 units from (BIOL 243/3.0; GPHY 247/3.0; HSCI 190/3.0; KNPE 251/3.0; NURS 323/3.0; POLS 285/3.0; PSYC 202/3.0; STAM 200/3.0; STAT 263/3.0).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Describe the role of clinical biochemistry in healthcare by linking clinical laboratory principles to patient care.
2. Critique how specific clinical laboratory test methodologies can be used to screen for, diagnose, and/or manage a given disease.
3. Scrutinize and assess the clinical application of novel biomarkers in the context of relevant, current literature.
4. Demonstrate verbal and written proficiency in clinical laboratory instrumentation and methods by navigating troubleshooting scenarios involving issues with a clinical biochemistry test.

PATH 411 Applied Data Science in Molecular Medicine Units: 3.00

The course introduces data science tools and methods to handle, process and extract knowledge and insights from large molecular medicine datasets. The focus will be on applying statistics, machine learning and related methods for the analysis of various research datasets and digital pathology.

Learning Hours: 120 (18L12pC, 84 Group Learning, 6 Online Activity, 36 Private Study)

Requirements: Prerequisite BIOL 243/3.0 or ECON 250/3.0 or GPHY 247/3.0 or HSCI 190/3.0 or NURS 323/3.0 or POLS 285/3.0 or PSYC 202/3.0 or SOCY 211/3.0 or STAT 263/3.0 or STAM 200/3.0.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Perform basic programming and scripting (Mini Assignments 1 and 2, Group Assignments 1-3)
2. Design experiment with data analysis in mind (Mini Assignment 2, Group Assignments 1-3)
3. Perform data analysis that includes sequence alignment, data preprocessing, unsupervised and supervised learning and statistics (Mini Assignments 1 - 3, Group Assignments 1 - 3)
4. Work in a team to complete assignments, report and present results (Group Assignments 1 - 3)
5. Assess and critique analytical methodology found in scientific publications (Paper critiques)

PATH 425 Current Topics in Human Genetics Units: 3.00

An advanced level course introducing current topics in human genetics. The course will focus on the significance and implications of genetic variation and its role in disease, development and normal human diversity. In particular, the course will explore the future directions and implications of human genetic research in the post genomic era. Participation in seminars and group discussions is required. Enrollment is limited.

RECOMMENDATION BCHM 218/3.0 or permission of the course coordinator.

Requirements: Prerequisite Minimum 4th year (Level 4) standing, registration in a LISC/BHSc Major or SSP, a GPA of 2.5, and a minimum grade of B in one of (BIOL 205; PATH 310). Exclusion BIOL 441.

Offering Faculty: Faculty of Health Sciences

**PATH 430 The Molecular Basis of Disease Units: 3.00**

An in-depth perspective of the pathogenesis of human disease. An integration of the genetic, biochemical, physiologic, anatomic, and general etiologic factors which play a role in the progression of several specific diseases from inception to death or recovery. The course will comprise short introductory presentations by teaching faculty followed by the presentation and discussion of relevant scientific papers by students. Given jointly with PATH 826/3.0.

Requirements: Prerequisite Minimum 4th year (Level 4) standing, registration in a LISC/BHSc Major or SSP, a GPA of 2.5, and PATH 310.

Offering Faculty: Faculty of Health Sciences

PATH 499 Research Project in Pathology Units: 12.00

A research project involving the study of human disease processes. The project will be supervised by a Faculty member in the Department and will provide opportunities for experimental design, data analysis and both written and oral presentation of results. Students must contact a potential faculty supervisor in the Spring preceding registration in fourth year.

NOTE Acceptance by a supervisor required prior to registration.

NOTE Students whose research requires the care and/or handling of animals must also complete the Introductory Animal Care Course and if required the appropriate Animal Use workshops through the Office of the University Veterinarian.

Learning Hours: 480 (288 Laboratory, 24 Group Learning, 24 Individual Instruction, 144 Private Study)

Requirements: Prerequisite Level 4 and registration in a LISC Specialization Plan and a cumulative GPA of 2.50 or higher. 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

PATH 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

Pharmacology and Toxicology (PHAR)

PHAR 100 Introductory Pharmacology Units: 3.00

Topics covered include central nervous system stimulants and depressants, narcotics, alcohol, cardiovascular agents, contraceptives, environmental toxicants, mechanism of drug action and disposition, antibiotics, drugs used in sports, over-the-counter drugs, food additives, and vitamins.

NOTE Also offered online. Consult the Bachelor of Health Sciences program office. Learning Hours may vary.

Requirements: One-Way Exclusion PHAR 230/3.0; PHAR 270/3.0; PHAR 340/3.0; PHAR 370/3.0; PHAR 450/3.0

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Apply learned knowledge of the essential elements of a phase 3 clinical trial to design a hypothetical clinical trial for a new drug to treat a specific disease or condition. (PLO 4, 8; Assessment 1)
2. Describe the mechanism of action and physiological effects of classes of drugs to be able to summarize the reason(s) for their use and abuse in society. (PLO 4, 6; Assessments 2-5)
3. Discuss the pharmacological principles of drug abuse to advocate for healthy and appropriate drug use. (PLO 4, 6; Assessment 2)
4. Effectively discuss and apply relevant pharmacological principles within a group to successfully complete collaborative assignments. (PLO 4; Assessments 1, 2)

PHAR 230 Pharmacology for the Health Sciences Units: 3.00

Lecture series on the following topics: principles of drug action, autonomic pharmacology, cardiovascular-renal pharmacology, neuropsychopharmacology, chemotherapy, drugs acting on the endocrine system, over-the-counter drugs, and therapeutic applications.

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

Requirements: Corequisite (PHGY 215 and PHGY 216) or KNPE 225 or PHGY 210/6.0 or PHGY 214/6.0. Exclusion PHAR 270/3.0; PHAR 340; PHAR 370.

Offering Faculty: Faculty of Health Sciences

PHAR 340 Principles of General Pharmacology I Units: 3.00

Topics include: fundamental principles of drug action, autonomic nervous system pharmacology, and toxicology.

Learning Hours: 120 (27 Lecture, 24 Tutorial, 69 Private Study)

Requirements: PREREQUISITE (PHGY 215 and PHGY 216) or BIOL 339 or PHGY 210 or PHGY 214 EXCLUSION No more than 3.0 units from PHAR 230; PHAR 270; PHAR 340; PHAR 370.

Offering Faculty: Faculty of Health Sciences

PHAR 370 Fundamentals of Pharmacology and Therapeutics Units: 3.00

An interdisciplinary course that introduces the basic principles and clinical applications of pharmacology. This 12-week course covers six topics. Students will work through the topics online, using a combination of online modules, readings, and short video clips. Students will participate in a variety of assessments throughout the course.

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

Also offered online.

Requirements: Corequisite One of (PHGY 215/3.0 and PHGY 216/3.0) or KNPE 225/3.0. Exclusion PHAR 230/3.0; PHAR 270/3.0; PHAR 340/3.0 One-Way Exclusion PHAR 450/3.0

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Apply the principles of drug therapy to solve basic pharmacokinetics problems
2. Describe how drugs affect the body and how the body affects drugs to predict beneficial and adverse drug effects
3. Discuss the use of therapeutics in a variety of physiology systems and processes to propose basic therapeutic plans for common diseases and ailments
4. Explain how drugs target and combat infections and cancers to evaluate the pros and cons of available treatment options and to advocate for appropriate use to decrease the emergence of resistance
5. Source and critically analyse phase 3 clinical trials to recognize a well-designed, valid study for a new drug

**PHAR 380 Toxicological Inquiry Units: 3.00**

Students in this course will learn about the human toxicology associated with both pharmaceutical and environmental exposures. General principles and mechanisms of toxicity will be introduced in order to describe how different pharmaceuticals and environmental compounds can lead to adverse effects in humans. Students will apply module content to current toxicological topics through exploration of popular media and the scientific literature. Development of a research proposal contributes to a large proportion of course work and assessment.

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

Learning Hours: 120 (60 Online Activity, 60 Private Study)

Requirements: Prerequisite Level 2 or above and (BCHM 102/3.0 or BCHM 218/3.0 or BCHM 270/3.0 or BCHM 316/3.0 or BIOL 334/3.0).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Describe principles and mechanisms of toxicity in order to explain the range of possible effects following exposure to chemicals.
2. Consolidate academic literature and module content in order to develop a research question and hypothesis for an experiment involving a potentially toxic chemical.
3. Compare and contrast popular media representations of toxicity with relevant scientific literature in order to critically evaluate how toxicology is perceived by the public.

PHAR 416 Xenobiotic Disposition and Toxicity Units: 3.00

An advanced study of chemical disposition and toxicity. Topics include toxicokinetics, biotransformation, metabolite-mediated toxicity, free radicals, the mechanism of action of toxicants, effects of toxicants on organ systems and a detailed examination of selected toxic agents. NOTE BCHM, BIOL, BMCO, ELSC, and ETOX students should contact the Department for permission to enrol in this course.

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

Requirements: Prerequisite Level 4 or above and registration in a LISC/BCHM Major or Specialization, ELSC Specialization, or BHSc program, and a CGPA of 2.5 or higher and (PHAR 370/3.0 or BCHM 310/9.0 or BCHM 316/3.0).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Describe principles and mechanisms of toxicity.
2. Explain the effects of exposure to chemicals in different situations.
3. Compare and contrast mechanisms of toxicity in different target tissues.
4. Consolidate knowledge to be able to critically analyze the attributes and shortcomings of peer reviewed manuscripts in the discipline of toxicology.
5. Present key points related to specific topics in toxicology.

PHAR 450 Principles of General Pharmacology II Units: 3.00

Topics include: neuropsychopharmacology, cardiovascular pharmacology, agents acting on the endocrine system, and chemotherapy.

NOTE This course involves team based learning sessions and a drug literature evaluation assignment.

Requirements: Prerequisite (PHAR 230 or PHAR 270 or PHAR 370 with a min grade of B) or PHAR 340.

Offering Faculty: Faculty of Health Sciences

PHAR 480 Drug Discovery and Development Units: 3.00

This survey course covers the life-cycle of pharmaceutical products including discovery, development, and the transition to a generic or over-the-counter medication. Specific themes include target identification, design and synthesis, efficacy determination, optimization, preclinical safety assessment, clinical trials, and the differences between biologics and small chemical entities. Social and economic pressures exerted upon the pharmaceutical industry are also explored.

Requirements: Minimum 4th year (Level 4) standing and one of (PHAR 230/3.0; PHAR 370/3.0; PHAR 340/3.0). LISC MAJ SSP students require a GPA of 2.5. Note this course cannot be used as credit towards the LISC DDHT SSP Plan Exclusion DDHT 459/3.0; DDHT 460/3.0

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Critically analyze the social and economic implications of legislative decisions pertaining to the pharmaceutical industry to argue a particular side of these decisions.
2. Develop solutions to drug discovery/development problems to discuss either orally or in writing solutions to these problems.
3. Develop an understanding of the biologic, social, and economic constraints that influence drug discovery and drug development.
4. Develop and refine professional interpersonal communication skills.

PHAR 499 Research Project in Pharmacology and Toxicology Units: 12.00

An examination of the development and present state of knowledge in selected research areas of pharmacology and toxicology. Research project involves experimental design, data collection and analysis, written report and oral presentation. Students will be required to attend seminars and tutorials on topics related to research.

NOTE Acceptance by a supervisor required prior to registration.

NOTE Students whose research requires the care and/or handling of animals must also complete the Introductory Animal Care Course and if required the appropriate Animal Use workshops through the Office of the University Veterinarian.

Learning Hours: 480 (288 Laboratory, 24 Group Learning, 24 Individual Instruction, 144 Private Study)

Requirements: Prerequisite Level 4 and registration in a LISC or ELSC Specialization Plan and a cumulative GPA of 2.50 or higher. 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



Physiology (PHGY)

PHGY 170 Human Cell Physiology Units: 3.00

This is an introductory level course on the structure and function of human cells for students interested in pursuing human health-related disciplines. Students will also learn the principles of energy metabolism, cell growth and proliferation, and how cells interact with their environment. There is also an overall focus to relate cellular processes to human function and disease, culminating in a group presentation focused on one specific cell process and how it affects health. Students taking this course will be well-prepared for upper year molecular biology courses.

NOTE Also offered online. Consult the Bachelor of Health Sciences program office. Learning Hours may vary.

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

Requirements: One-Way Exclusion KNPE 225/3.0

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Identify and describe basic cellular components to be able to characterize their roles in the structure and function of human cells (PLO 1,3; Assessment 1-5)
2. Integrate a basic understanding of cellular processes to articulate how human cells interact with their environment (PLO 1,3; Assessment 1-5)
3. Recognize key principles of human cell function in order to understand the cellular basis of health and disease (PLO 1,3; Assessment 1-5)
4. Understand how cells, tissues, organs and systems work together in order identify and explain the mechanisms through which the body maintains homeostasis.

PHGY 215 Principles of Mammalian Physiology I Units: 3.00

The focus of this course is on the central and peripheral nervous systems, muscle physiology, the heart, and the vascular system.

NOTE This course may be paired with PHGY 216/3.0 to achieve an introductory physiology full course (6.0 units).

NOTE Although it is recommended to take PHGY 215/3.0 first, this course can be taken before, after, or concurrently with PHGY 216/3.0.

NOTE Also offered online. Consult the Bachelor of Health Sciences program office. Learning Hours may vary.

Requirements: Minimum 2nd year (Level 2) standing.

Exclusion (KNPE 125/3.0; KNPE 225/3.0); [PHGY 210/6.0; PHGY 214/6.0; (PHGY 215/3.0 and PHGY 216/3.0)].

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Apply analytical skills to further your knowledge of physiological systems. (PLO8; Assessment 1,2)
2. Define homeostasis and apply feedback loops to predict and understand the control of physiological systems in the face of a variable and changing environment. (PLO1; Assessments 1,3,4)
3. Describe the physiology of the nervous system, muscles, and the cardiovascular system to identify and explain pathophysiological states. (PLO2; Assessments 1-4)
4. Note: PLO refers to the program learning outcomes to which each course learning outcome matches to.
5. Understand physiology at the molecular, cellular, and system levels in order to explain their combined role in integrative physiology. (PLO1,2; Assessments 1-4)

PHGY 216 Principles of Mammalian Physiology II Units: 3.00

The focus of this course is the physiology of the respiratory, renal, gastrointestinal, endocrine, and reproductive system.

NOTE This course may be paired with PHGY 215/3.0 to achieve an introductory physiology full course (6.0 units).

NOTE Although it is recommended to take PHGY 215/3.0 first, PHGY 216/3.0 can also be taken before or concurrently with PHGY 215/3.0.

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

Learning hour may vary.

Requirements: Minimum 2nd year (Level 2) standing.

Exclusion (KNPE 125/3.0;KNPE 225/3.0); [PHGY 210/6.0;PHGY 214/6.0;(PHGY 215/3.0 PHGY 216/3.0)]. Note it is recommended to take PHGY 215/3.0 first, PHGY 216/3.0 can be taken before or concurrently with PHGY 215/3.0.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Apply research skills to further your knowledge of physiological systems. (PLO8; Assessment 2)
2. Describe the physiology of the respiratory, renal, gastrointestinal, endocrine, and reproductive systems to define normal and abnormal function. (PLO2; Assessments 1-4)
3. Note: PLO refers to the program learning outcomes to which each course learning outcome matches to.
4. Understand physiology at the molecular, cellular, and system levels in order to explain how their roles and functions are combined in integrative physiology. (PLO1,2; Assessments 1-4)

PHGY 290 Investigation of Human Physiological Responses Units: 3.00

This course is designed to advance critical thinking and practical lab skills through collaborative experimentation on human physiological responses to various stimuli. Upon completion, students should be able to (i) plan and perform experimental protocols, (ii) collect, analyze and interpret data and (iii) produce quality presentations of findings.

Learning Hours: 120 (36 Laboratory, 48 Online Activity, 36 Private Study)

Requirements: Corequisite Minimum 2nd year (Level 2) standing, registration in a BHSc, LISC, or BCHM program, and co-req PHGY 215/3.0 Note: We recommend that students should have already completed a statistics course (e.g. HSCI 190/3.0 or equivalent)

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Collaborate with group members to develop a testable hypothesis and experimental design, using an iterative process that incorporates feedback from group members.
2. Demonstrate the ability to defend an experimental design with respect to the methods and approaches used to collect experimental data (i.e. heart rate, blood pressure, hand-eye coordination and cognitive ability).
3. Evaluate and interpret experimental results to present a study with its limitations in a visual poster, oral presentation or written report.
4. Evaluate and report on peer reviewed literature with respect to appropriate ways of measuring physiological responses (heart rate, blood pressure, hand-eye coordination and cognitive ability) to a stimulus.



PHGY 350 Pathophysiology Units: 3.00

An introductory course in Pathophysiology in which the underlying functional changes of cell and cell systems will be discussed in association with a variety of disease processes.

Learning Hours: 114 (36 Lecture, 6 Online Activity, 72 Private Study)

Requirements: Prerequisite (PHGY 215 and PHGY 216) or (KNPE 125 and KNPE 225) or PHGY 210 or PHGY 212 or PHGY 214

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. identify the mechanisms (cellular and systemic) by which selected diseases occur in the major physiologic systems of the body
2. recognize and identify the major signs/symptoms of selected diseases, and understand how they are produced by the diseases processes implicated
3. differentiate between similar-but-different diseases based on their signs/symptoms and pathogenesis (basic principles of differential diagnosis)
4. briefly describe selected diagnostic methods and key treatment approaches for the diseases studied, based on your understanding of the underlying disruptions to normal physiologic function occurring within each disease
5. effectively use appropriate terminology to describe disease etiology, pathogenesis, treatment and outcome(s)
6. work effectively with a diverse group of peers to plan and execute a concise research investigation
7. present your findings on a specific disease, as obtained through investigation of primary sources, in a clear, balanced, and engaging presentation communicated at a level appropriate to your audience.

PHGY 355 Biomedical Respiratory Physiology Units: 3.00

An intermediate course focusing on biomedical applications of lung biology. Topics include lung mechanics, gas exchange, acid-base balance and control of breathing.

Requirements: PREREQUISITE (PHGY 215/3.0 and PHGY 216/3.0) or PHGY 210/6.0 or PHGY 212/6.0 or PHGY 214/6.0.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Understanding human lung function in various paradigms, including: social determinants of lung health; normal and pathologic lung function (mechanical, chemical, neural, and integrative) at rest, in exercise and in sleep; differences between human lung function and that of other species adapted to different environments (structure:function)
2. Developing competency in and appreciation for diverse approaches to pulmonary function testing (lab component)
3. Laying a foundation of scientific writing skills, including effective literature searching, abstract-writing, and report-writing.

PHGY 424 Ion Channels of Excitable Cells Units: 3.00

The electrophysiology and biophysics of neuronal and cardiac membranes; molecular biology, structure, and function of ion channels. Students will learn to critically evaluate scientific literature. Instructional format is primarily student-led seminars.

Requirements: Prerequisite Minimum 4th year (Level 4) standing, registration in a LISC/BHSc Major or SSP, a GPA of 2.5, and a minimum grade of C in one of ([PHGY 215 and PHGY 216]; PHGY 210/6.0; PHGY 214/6.0; PHGY 212/6.0).

Offering Faculty: Faculty of Health Sciences

PHGY 444 Gastrointestinal Physiology Units: 3.00

Cellular and molecular approaches to human intestinal function are described and synthesized into an understanding of intestinal physiology at the organ level. Taught by GI researchers and clinician-scientists; students prepare and present critical appraisals of current primary research papers.

Requirements: PREREQUISITE Level 4 and registration in a LISC Major or Specialization Plan and a GPA of 2.5 and [a minimum grade of C in (PHGY 215/3.0 and PHGY 216/3.0) or PHGY 210/6.0 or PHGY 212/6.0 or PHGY 214/6.0].

Offering Faculty: Faculty of Health Sciences

PHGY 494 Neuroendocrinology Units: 3.00

Students are exposed to an in depth study of selected topics in neuroendocrinology and neuroendocrine techniques. Neuroendocrinology refers to the neural control of endocrine and autonomic function. Areas of focus will include central nervous system control of cardiovascular function, reproduction, and appetite. In addition, students will learn to critically evaluate scientific literature. Instructional format is primarily student led seminars.

Learning Hours: 114 (36 Seminar, 12 Online Activity, 96 Private Study)

Requirements: PREREQUISITE A minimum grade of B in: PHGY 210 or PHGY 212 or PHGY 214 or (PHGY 215 and PHGY 216) and Level 4 in a LISC Major or Specialization Plan and (a GPA of 2.5).

Offering Faculty: Faculty of Health Sciences

PHGY 499 Research Project in Physiology Units: 12.00

An investigation in a selected area of physiology. The project involves experimental design, data collection and analysis, submission of written reports, and oral presentations. Students attend seminars/tutorials on related topics.

NOTE Acceptance by a supervisor required prior to registration.

NOTE Students whose research requires the care and/or handling of animals must also complete the Introductory Animal Care Course and if required the appropriate Animal Use workshops through the Office of the University Veterinarian.

Learning Hours: 480 (288 Laboratory, 24 Group Learning, 24 Individual Instruction, 144 Private Study)

Requirements: Prerequisite Level 4 and registration in a LISC Specialization Plan and a cumulative GPA of 2.50 or higher. 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

Reproduction and Development (REPD)**REPD 372 Reproduction and Development Units: 3.00**

Students will obtain a general background on various aspects of human reproduction, ranging from male and female gamete development to pregnancy and birth. The course will serve as a gateway to more advanced courses in human reproduction and development.

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

Learning Hours: 120 (60 Online Activity, 60 Private Study)

Requirements: Minimum 3rd year (Level 3) standing, one of (ANAT 100/3.0; ANAT 101/3.0; [ANAT 215/3.0 and ANAT 216/3.0]; [ANAT 315/3.0 and ANAT 316/3.0]) and one of (PHGY 210/6.0; PHGY 214/6.0; [KNPE 125/2.0 and KNPE 225/3.0]; [PHGY 215/3.0 and PHGY 216/3.0]).

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Critically assess scientific literature and media reports in human reproductive biology to support arguments in oral and written work.
2. Describe key fundamental concepts in male and female reproductive biology to create a framework that can be applied to more complex topics in human reproduction.
3. Explain the scientific basis of diseases of pregnancy to determine their implications on health in later life.
4. Integrate course content through active discussion with peers to solve case-based problems related to pregnancy, parturition, and other topics in human reproduction.

**REPD 416 Biology of Reproduction Units: 3.00**

Comprehensive overview of cellular and molecular biology of mammalian

reproduction including gametogenesis, fertilization, early embryo development and placentation; selected topics of clinical aspects of reproduction. Participation in seminars and group discussion is required.

Learning Hours: 120 (36 Lecture, 36 Seminar, 48 Private Study)

Requirements: PREREQUISITE Level 4 and (registration in a LISC Major or Specialization plan) and (a GPA of 2.7) and either [(ANAT 215 and ANAT 216) or ANAT 309].

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Describe how the different specialized components of the sperm and oocyte are involved in fertilization and in relation to male and female fertility and infertility
2. Become familiarized with and describe the assisted reproductive techniques currently used in fertility clinics and reproductive centers
3. Describe current technology and experimental techniques supporting research in reproduction
4. Describe events in normal pregnancy, including cell lineage commitment, implantation, placentation, and development
5. Describe key fundamental concepts in male and female reproductive biology and apply this knowledge in human reproduction
6. Identify and describe current trends in reproductive research
7. To be aware of ethical arguments related to reproductive technologies and the hypothesis that health of adults is determined in part by experiences during fetal development

REPD 473 Developmental Origins of Health And Disease Units: 3.00

REPD 473, Development Origins of Health and Disease, will cover how the early-life environment contributes to later-life health. Four major topics will be covered: maternal exposures, maternal nutrition, infection, and pregnancy complications. Students will learn about how alterations in the embryonic and fetal environment due to these four parameters can and do contribute to the development of non-communicable diseases that persist throughout life. Students will have the opportunity to explore and consolidate the academic literature pertaining to DOHaD, as well as investigating the resources available to these populations of patients.

Requirements: Minimum 4th year (Level 4) standing and one of (PHAR 230/3.0; PHAR 370/3.0; PHAR 340/3.0; PHAR 380/3.0) and REPD 372/3.0.

Offering Faculty: Faculty of Health Sciences

Course Learning Outcomes:

1. Align principles of the developmental origins of health and disease hypothesis with primary literature in the field in order to present, connect, and extend concepts within the research article(s)
2. Consolidate information pertaining to an untoward embryonic/fetal environment in order to describe how that environment contributes to the individual's long-term health and disease
3. Define the hypothesis and mechanisms of the Developmental Origins of Health and Disease (DOHAD) to explain the connection between the in utero environment and different adult diseases.
4. Explain the consequences of developmental exposures in order to teach the public about a specified condition and advocate for support and resources for the patient population.

REPD 499 Research Project in Reproduction and Development Units: 12.00

An examination of the development and present state of knowledge in selected research areas of Reproduction and Development. Research project involves experimental design, data collection and analysis, written report, poster presentation and oral presentation. Students will be required to attend seminars and tutorials on topics related to research.

NOTE Limited enrolment; restricted to 4th year honours; permission of the Department required. Acceptance by a supervisor required prior to registration.

NOTE Students whose research requires the care and/or handling of animals must also complete the Introductory Animal Care Course and if required the appropriate Animal Use workshops through the Office of the University Veterinarian.

Learning Hours: 480 (24 Lecture, 48 Seminar, 192 Laboratory, 168 Private Study)

Requirements: Prerequisite Level 4 and registration in a LISC Specialization Plan and a cumulative GPA of 2.50 or higher. 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