

# 2009-2010 Undergraduate Calendar

The information published in this Undergraduate Calendar outlines the rules, regulations, curricula, programs and fees for the 2009-2010 academic year, including the Summer Semester 2009, the Fall Semester 2009 and the Winter Semester 2010.

For your convenience the Undergraduate Calendar is available in PDF format.

If you wish to link to the Undergraduate Calendar please refer to the Linking Guidelines.

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- The Association of Universities and Colleges of Canada

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The logo for the University of Guelph, featuring the text "UNIVERSITY of GUELPH" in a stylized font.The tagline "CHANGING LIVES IMPROVING LIFE" in a bold, sans-serif font, set against a yellow background.

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# Disclaimer

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## University of Guelph 2009

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The information published in this Undergraduate Calendar outlines the rules, regulations, curricula, programs and fees for the 2009-2010 academic year, including the Summer Semester 2009, the Fall Semester 2009 and the Winter Semester 2010.

The University reserves the right to change without notice any information contained in this calendar, including fees, any rule or regulation pertaining to the standards for admission to, the requirements for the continuation of study in, and the requirements for the granting of degrees or diplomas in any or all of its programs. The publication of information in this calendar does not bind the University to the provision of courses, programs, schedules of studies, or facilities as listed herein.

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In the event of a discrepancy between a print version (downloaded) and the Web version, the Web version will apply.

Published by: Undergraduate Program Services

## **Introduction**

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### **Collection, Use and Disclosure of Personal Information**

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Personal information is collected under the authority of the University of Guelph Act (1964), and in accordance with Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) <http://www.e-laws.gov.on.ca/index.html>. This information is used by University officials in order to carry out their authorized academic and administrative responsibilities and also to establish a relationship for alumni and development purposes. Certain personal information is disclosed to external agencies, including the Ontario Universities Application Centre, the Ministry of Training, Colleges and Universities, and Statistics Canada, for statistical and planning purposes, and is disclosed to other individuals or organizations in accordance with the Office of Registrarial Services Departmental Policy on the Release of Student Information. For details on the use and disclosure of this information call the Office of Registrarial Services at the University at (519) 824-4120 or see <http://www.uoguelph.ca/registrar/registrar/index.cfm?index>.

### **Statistics Canada - Notification of Disclosure**

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For further information, please see Statistics Canada's web site at <http://www.statcan.ca> and Section XIV Statistics Canada.

### **Address for University Communication**

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Depending on the nature and timing of the communication, the University may use one of these addresses to communicate with students. Students are, therefore, responsible for checking all of the following on a regular basis:

#### **Email Address**

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The University issued email address is considered an official means of communication with the student and will be used for correspondence from the University. Students are responsible for monitoring their University-issued email account regularly. See Section I--Statement of Students' Academic Responsibilities for more information.

#### **Home Address**

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Students are responsible for maintaining a current mailing address with the University. Address changes can be made, in writing, through Undergraduate Program Services.

#### **Name Changes**

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The University of Guelph is committed to the integrity of its student records, therefore, each student is required to provide either on application for admission or on personal data forms required for registration, his/her complete, legal name. Any requests to change a name, by means of alteration, deletion, substitution or addition, must be accompanied by appropriate supporting documentation.

### **Student Confidentiality and Release of Student Information Policy Excerpt**

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The University undertakes to protect the privacy of each student and the confidentiality of his or her record. To this end the University shall refuse to disclose personal information to any person other than the individual to whom the information relates where disclosure would constitute an unjustified invasion of the personal privacy of that person or of any other individual. All members of the University community must respect the confidential nature of the student information which they acquire in the course of their work.

Complete policy at <http://www.uoguelph.ca/policies/pdf/ORSInfoReleasePolicy060610.pdf>.



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## Bachelor of Science (B.Sc.)

The University of Guelph offers general and honours programs leading to the B.Sc. degree. The general program consists of a minimum of 15.00 credits (usually 30 semester courses) involving normally 6 semesters of study. The requirements for the honours program is a minimum of 20.00 credits (usually 40 semester courses) which may be obtained over 8 semesters of study. Some majors may require more than 20.00 credits.

### The Three Semester System

Most of the B.Sc. programs operate on the three semester system. In this system each of the Fall, Winter and Summer semesters is of 12 weeks duration. Two semesters are equivalent to 1 academic year at a university on the traditional system. In the three semester system, students may vary their rate of progress towards graduation. However, since many science courses must be taken in a certain sequence and not all courses are offered each semester, most science students are required to proceed from semester to semester in restricted patterns. Furthermore, the advanced courses of the honours programs are offered only in the regular fall and winter semesters.

Additional information may be obtained from Admissions Services, Office of Registrarial Services. The three-semester system and the pass-by-course method of advancement allow considerable flexibility of program arrangement. In addition, a variety of program contents is available which the student may modify to meet individual requirements.

### Transfer from One B.Sc. Program to Another

On entrance to the B.Sc. program, the student may elect to follow an intended area of specialization or to postpone this decision until a later semester. The choice of a particular program of study may be most effectively made at the end of Semester 3 or 4. Judicious selection of courses in each and every semester will allow the easiest transfer between programs without incurring the need for additional semesters of study. The program counsellor of the particular college from which it is anticipated that the majority of science courses will be taken should be consulted for advice.

## Program Information

### General Program Requirements

The general B.Sc. degree requires the successful completion of 15.00 required credits. Normally 2.50 credits (usually 5 courses) are taken in each semester so that the degree may be completed in 6 semesters. The general science program is designed to give a broad general training in biological science, chemistry, physics and mathematical science. This is achieved by requiring each student to take a minimum of 1.00 credits in each of the above areas and an additional 0.50 credits in three of the four above areas. The courses to be taken in semesters 4 to 6 may be selected to allow a broad study of the sciences from the list of approved electives for B.Sc. students.

### Honours Program Requirements

In order to graduate in the honours program, students must fulfill all program requirements for the program and have achieved a 60%, or higher, cumulative average over all course attempts. Normally 2.50 credits (usually 5 courses) are taken in each semester so that the degree may be completed in generally 8 semesters. The following types of honours programs are offered:

#### Honours Major Programs

Major in a subject

Major in a subject with a minor or a second major

#### Honours Major

These programs permit a student to study science in greater depth than is permitted by the general program. The student is required to take a minimum of 1.00 credits (usually 2 courses) in each of biological science, chemistry, physics and mathematical science. In each of semesters 3 to 8, students select science credits so that the total program provides a broad science training with concentration in an area of physical science or biological science.

A major normally consists of certain prescribed courses (minimum of 8.00 credits) and a number of elective courses to complete the requirements for the degree. The composition of science courses selected must contain a sufficient number (minimum of 6.00 credits) of 3000 and 4000 level courses including a grouping (minimum of 2.00 credits) particularly at the 4000 level. A major program may be studied in conjunction with a minor in an area of science, humanities or social science.

#### Honours Minor

A minor is a group of courses which provides for exposure to and mastery of the fundamental principles of a subject. A minor consists of a minimum of 5.00 credits (normally 10 courses). It may also require certain other courses from other areas to be taken along with the specified courses of the minor. A minor is taken in conjunction with a major.

Students should seek advice from the program counsellor of either the College of Biological Science or the College of Physical and Engineering Science dependent upon their primary area(s) of interest. Refer to B.Sc. Program Requirements: Regulation 6. Double-Counting of Credits.

## B.Sc. Program Requirements

Regulations 1, 2, 3 and 4 apply to all B.Sc. students.

### 1. Entry Credits

In general, the 4U or OAC credit or its equivalent is required in a subject area to allow entrance to the initial university course. Students who lack this requirement can remedy the deficiency by successful completion of:

BIOL\*1020 for students lacking biology  
CHEM\*1060 for students lacking chemistry  
PHYS\*1020 for students lacking physics

If more than one of the above courses is taken, students are required to complete additional credits beyond the minimum total required for the degree.

### 2. Basic Science Core

In each of the first 2 semesters B.Sc. students must take one (1) of the specified courses in each of biology, chemistry, physics and mathematical science, and 1 other course which is normally an Arts or Social Science elective.

### 3. 1000 Level Credits

If more than 7.00 credits at the 1000 level are completed, students are required to complete additional credits beyond the minimum total required for the degree.

### 4. 3000 and 4000 Level Credits

There is a requirement for a minimum of 6.00 science credits at the 3000- and 4000-levels with a minimum of 2.00 credits at the 4000 level.

### 5. Science Credits

A minimum of 16.00 science credits (usually 32 courses) is required for the honours major program. The inclusion of a minor in a non-science area involves the reduction to 14.00 science credits (usually 28 courses) with the approval of the program counsellors. Acceptable science courses in the following programs means "acceptable to the B.Sc. Program Committee". Lists of acceptable courses are available in the offices of the faculty advisors and the program counsellors and on the world wide web at the following address: [http://www.bsc.uoguelph.ca/Approved\\_electives.shtml](http://www.bsc.uoguelph.ca/Approved_electives.shtml).

### 6. Double-Counting of Credits

A maximum of 2.00 credits required in a major program may be applied to meet the requirements of a minor or an additional major.

For a completed minor in a non B.Sc. area, students can apply up to 1.00 credits, from their minor, at the 3000/4000 level towards the 6.00 credits at the 3000/4000 level required for the degree.

### 7. Continuation of Study

Students are advised to consult the regulations for continuation of study outlined in detail in Section VIII--Undergraduate Degree Regulations & Procedures.

## Doctor of Veterinary Medicine

Students in the B.Sc. program who intend to apply for admission to the Doctor of Veterinary Medicine program should register for the Major Biological Science or Major Physical Science program, or the major of their choice. Prospective candidates for the D.V.M. program should consult the admission requirements for the program. Students may obtain assistance in selecting a program that will meet the requirements for the Doctor of Veterinary Program and for continuation in biological or physical science programs by consulting the appropriate Program Counsellor.

## General Program (BSCG)

### Continuation of Study

Students are advised to consult the regulations for continuation of study within the program which are outlined in detail in Section VIII--Undergraduate Degree Regulations & Procedures.

### Conditions for Graduation

In order to qualify for graduation from the general program the student is required to attain a passing grade in a minimum of 15.00 required credits as outlined in the Total Course Requirements for all students in the General Science Program.

## Total Course Requirements for all Students in the General Science Program

Total of 15.00 credits as follows:

- 4.00 credits from the first year science core - 1.00 credits beyond the 4U or OAC level in each of biological science, chemistry, mathematical science, physics. Note: A maximum of 7.00 credits at the 1000 level may be used towards the degree requirements.
- An additional 0.50 credits from at least 3 of the following subject areas: biological science, biochemistry/chemistry, mathematical science, physics.
- 6.50 additional credits selected from the list of approved sciences electives for the B.Sc. degree program of which 2.50 credits must be at the 3000 or 4000 level. Note: One of: BIOL\*1020, CHEM\*1060, PHYS\*1020 may be counted towards the degree requirements, counting as 0.50 credits in science.

4. 2.00 credits - arts and/or social science electives approved for the B.Sc. degree program.

5. 1.00 credits in electives.

### Recommended Schedule for Students in Biological Science Areas

#### Semester 1

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1080	[0.50]	Elements of Calculus I
PHYS*1070	[0.50]	Introductory Physics for Life Sciences

0.50 Arts or Social Science electives

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

#### Semester 2

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
PHYS*1080	[0.50]	Physics for Life Sciences

One of:

CIS*1000	[0.50]	Introduction to Computer Applications
CIS*1200	[0.50]	Introduction to Computing
CIS*1500	[0.50]	Introduction to Programming
STAT*2040	[0.50]	Statistics I
MATH*2080	[0.50]	Elements of Calculus II

0.50 Arts or Social Science electives

#### Semester 3 to 6

A minimum of 2.50 credits in each semester, including at least 2.00 acceptable science credits per semester. For details consult 'Total Course Requirements'.

### Recommended Schedule for Students in Physical Science Areas

#### Semester 1

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1200	[0.50]	Calculus I
PHYS*1000	[0.50]	An Introduction to Mechanics

0.50 Arts or Social Science electives

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

#### Semester 2

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
MATH*1210	[0.50]	Calculus II
PHYS*1010	[0.50]	Introductory Electricity and Magnetism

0.50 Arts or Social Science electives

#### Semester 3 to 6

A minimum of 2.50 credits in each semester, including 2.00 acceptable science courses per semester. For details consult 'Total Course Requirements'.

### Honours Programs (BSCH)

#### Honours Program Majors

The following honours majors are available:

##### Biological Sciences:

- 20.00 credits - Animal Biology (ABIO)
- 20.25 credits - Biochemistry (BIOC)
- 20.00 credits - Biological Science (BIOS)
- 20.00 credits - Bio-Medical Science (BIOM)
- 20.00 credits - Human Kinetics (HK)
- 20.00 credits - Marine and Freshwater Biology (MFB)
- 20.00 credits - Microbiology (MICR)
- 20.00 credits - Molecular Biology and Genetics (MBG)
- 20.00 credits - Nutritional and Nutraceutical Sciences (NANS)
- 20.00 credits - Plant Science (PLSC)
- 20.00 credits - Wild Life Biology (WLB)
- 20.00 credits - Zoology (ZOO)

##### Physical Sciences:

- 20.00 credits - Biological Chemistry (BCHM)
- 21.25 credits - Biophysics (BIOP)
- 21.75 credits - Chemical Physics (CHPY)
- 20.25 credits - Chemistry (CHEM)
- 20.00 credits - Nanoscience (NANO)
- 20.00 credits - Physical Science (PSCI)
- 21.25 credits - Physics (PHYS)
- 21.25 credits - Theoretical Physics (THPY)

##### Environmental Sciences:

- 20.00 credits - Biomedical Toxicology (BTOX)
- 20.00 credits - Earth Surface Science (ESS)\*
- 20.00 credits - Ecology (ECOL)\*
- 20.00 credits - Environmental Biology (ENVB)\*
- 20.00 credits - Environmental Toxicology (ETOX)

\*also see B.SC.(ENV.)

##### Computing Science, Mathematics, Statistics

- 20.00 credits - Mathematics (MATH)
- 20.00 credits - Statistics (STAT)

##### Additional Disciplines:

- 20.00 credits - Food Science (FOOD)
- 20.00 credits - Psychology: Brain & Cognition (PBC)

##### Co-operative Educational Programs:

- 20.00 credits - Applied Mathematics and Statistics (Co-op) (APMS:C)
- 20.25 credits - Biochemistry (Co-op) (BIOC:C)
- 20.25 credits - Biomedical Toxicology (Co-op) (BTOX:C)
- 21.25 credits - Biophysics (Co-op) (BIOP:C)
- 21.25 credits - Chemical Physics (Co-op) (CHPY:C)
- 20.25 credits - Chemistry (Co-op) (CHEM:C)
- 20.00 credits - Environmental Toxicology (Co-op) (ETOX:C)
- 20.00 credits - Food Science (Co-op) (FOOD:C)
- 20.00 credits - Microbiology (Co-op) (MICR:C)
- 21.25 credits - Physics (Co-op) (PHYS:C)

##### Honours Program Minors

Minors are available in the following science areas with the particular credit requirements being given (additional minors are available from the College of Arts and the College of Social and Applied Human Sciences). A minor may include additional prerequisites - consult with the appropriate faculty advisor.

##### Biological Sciences:

- 5.00 credits - Biology (BIOL)
- 5.00 credits - Biochemistry (BIOC)
- 5.00 credits - Biotechnology (BIOT)
- 5.00 credits - Functional Foods and Nutraceuticals (FFAN)
- 5.25 credits - Microbiology (MICR)
- 5.00 credits - Molecular Biology and Genetics (MBG)
- 5.00 credits - Neuroscience (NEUR)
- 5.00 credits - Nutritional and Nutraceutical Sciences (NANS)
- 5.00 credits - Plant Science (PLSC)
- 5.00 credits - Zoology (ZOO)

##### Physical Sciences:

- 5.00 credits - Chemistry (CHEM)
- 5.00 credits - Physics (PHYS)

##### Environmental Sciences:

- 5.00 credits - Ecology (ECOL)
- 5.00 credits - Forest Systems (FSYS)
- 5.00 credits - Geographic Information Systems (GIS) and Environmental Analysis
- 5.00 credits - Geology (GEOL)

##### Mathematical Sciences:

- 5.25 credits - Computing and Information Science (CIS)
- 5.00 credits - Mathematical Science (MSCI)
- 5.00 credits - Mathematics (MATH)
- 5.00 credits - Statistics (STAT)

##### Additional Disciplines:

- 5.00 credits - Business Administration (BADM)
- 5.00 credits - Food Science (FOOD)
- 5.00 credits - Psychology: Brain & Cognition (PBC)

##### Continuation of Study

Students are advised to consult the regulations for continuation of study within the program which are outlined in detail in Section VII--Undergraduate Degree Regulations & Procedures.

##### Conditions for Graduation

###### Schedules 1 and 2

In order to qualify for graduation from the honours program, the student must fulfill all program requirements and have achieved 60%, or higher, cumulative average in all course attempts.

**Note:** A student registered in an honours program who has successfully completed all required courses and the specified total number of credits for the program but does not have a cumulative average of 60%, or higher, may apply to graduate from the general program.

## Co-operative Education Program

Admission to the Co-operative Education program may be granted on entry to the University or by application normally before the conclusion of Semester 2. Application forms can be obtained from the appropriate faculty co-op advisor. In-course students will need to complete successfully an interview in the appropriate department. Students must be either a Canadian Citizen or Permanent Resident. A cumulative average of 70% is required in courses taken in Semesters 1 and 2 to permit continuation in the program.

### Conditions for Graduation from the B.Sc. Co-operative Education Program

Conditions for graduation are the same as the corresponding regular B.Sc. program. In addition, all work reports and work performance evaluations must have a grade of satisfactory or better.

## Animal Biology (ABIO)

### Department of Animal and Poultry Science, Ontario Agricultural College

#### Major (Honours Program)

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor.

##### Semester 1

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1080	[0.50]	Elements of Calculus I
PHYS*1070	[0.50]	Introductory Physics for Life Sciences

0.50 Arts or Social Science electives

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

##### Semester 2

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
PHYS*1080	[0.50]	Physics for Life Sciences

One of:

CIS*1000	[0.50]	Introduction to Computer Applications
CIS*1200	[0.50]	Introduction to Computing
CIS*1500	[0.50]	Introduction to Programming

0.50 Arts or Social Science electives

##### Semester 3

AGR*2350	[0.50]	Animal Production Systems and Industry
BIOC*2580	[0.50]	Introductory Biochemistry
MBG*2000	[0.50]	Introductory Genetics
MCB*2210	[0.50]	Introductory Cell Biology

0.50 Arts or Social Science electives

##### Semester 4

ANSC*2340	[0.50]	Structure of Farm Animals
MBG*2020	[0.50]	Introductory Molecular Biology
NUTR*3210	[0.50]	Fundamentals of Nutrition
STAT*2040	[0.50]	Statistics I

0.50 electives or restricted electives

##### Semester 5

ANSC*3080	[0.50]	Agricultural Animal Physiology
ANSC*3120	[0.50]	Introduction to Animal Nutrition

1.50 electives or restricted electives

##### Semester 6

ANSC*3210	[0.50]	Principles of Animal Care and Welfare
ANSC*3300	[0.50]	Animal Reproduction
MBG*3060	[0.50]	Quantitative Genetics

1.00 electives or restricted electives

##### Semester 7

2.50 electives or restricted electives

##### Semester 8

2.50 electives or restricted electives

#### Restricted Electives

Students must complete 2.00 credits from Arts or Social Science courses. ANSC\*3210 is an Arts and Social Science 0.50 credit. 1.50 additional credits from Arts or Social Science are required.

0.50 credits is required from each of the following: Animal Nutrition, Animal Breeding & Genetics, and Animal Physiology & Behaviour. Students are encouraged to consult with the Faculty Advisor for help in tailoring their selection to meet personal and career interests.

**Note:** Students are required to complete 16.00 credits in science of which a minimum of 6.00 credits must be at the 3000, 4000 level and at least 2.00 credits of these must be 4000 level.

Animal Breeding & Genetics [0.50] Required

ANSC*4020	[0.50]	Genetics of Companion Animals
ANSC*4050	[0.50]	Biotechnology in Animal Science
MBG*3090	[0.50]	Applied Animal Genetics
MBG*4030	[0.50]	Animal Breeding Methods
Animal Nutrition [0.50]	Required	
ANSC*3170	[0.50]	Nutrition of Fish and Crustacea
ANSC*3180	[0.50]	Wildlife Nutrition
ANSC*4260	[0.50]	Beef Cattle Nutrition
ANSC*4270	[0.50]	Dairy Cattle Nutrition
ANSC*4280	[0.50]	Poultry Nutrition
ANSC*4290	[0.50]	Swine Nutrition
ANSC*4550	[0.50]	Horse Nutrition
ANSC*4560	[0.50]	Pet Nutrition
Animal Physiology & Behaviour [0.50]	Required	
ANSC*4090	[0.50]	Applied Animal Behaviour
ANSC*4100	[0.50]	Applied Environmental Physiology and Animal Housing
ANSC*4130	[0.50]	Reproductive Management and Technology
ANSC*4350	[0.50]	Experiments in Animal Biology
ANSC*4470	[0.50]	Animal Metabolism
ANSC*4490	[0.50]	Applied Endocrinology
An additional 3.00 credits must be obtained by selecting courses from the above lists and from the following:		
ANSC*3050	[0.50]	Aquaculture: Advanced Issues
ANSC*4610	[0.50]	Critical Analysis in Animal Science
ANSC*4650	[0.50]	Immune Mechanisms of Animals
ANSC*4700	[0.50]	Research in Animal Biology I
ANSC*4710	[0.50]	Research in Animal Biology II
BIOC*3560	[0.50]	Structure and Function in Biochemistry
MICR*3230	[0.50]	Immunology I
PATH*3610	[0.50]	Principles of Disease
POPM*3240	[0.50]	Epidemiology
POPM*4230	[0.50]	Animal Health

## Applied Mathematics and Statistics (Co-op) (APMS:C)

### Department of Mathematics and Statistics, College of Physical and Engineering Science

#### Major (Honours Program)

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. A minimum of 20.00 credits is required to complete this program which includes 5.00 credits in Mathematics, 2.50 credits in Statistics, an additional 2.00 credits in Mathematics or Statistics at the 3000 level, and an additional 2.00 credits in Mathematics or Statistics at the 4000 level, 1.00 credits in Computing and Information Science, and 1.00 credits in Arts or Social Sciences courses.

##### Semester 1 - Fall

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
CIS*1500	[0.50]	Introduction to Programming
MATH*1200	[0.50]	Calculus I
PHYS*1000	[0.50]	An Introduction to Mechanics

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

##### Semester 2 - Winter

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
CIS*2500	[0.50]	Intermediate Programming
COOP*1100	[0.00]	Introduction to Co-operative Education
MATH*1210	[0.50]	Calculus II
PHYS*1010	[0.50]	Introductory Electricity and Magnetism

##### Summer Semester

No study semester or work term.

##### Semester 3 - Fall

MATH*2000	[0.50]	Set Theory
MATH*2160	[0.50]	Linear Algebra I
MATH*2200	[0.50]	Advanced Calculus I
STAT*2040	[0.50]	Statistics I

0.50 Arts or Social Science electives

##### Winter Semester

COOP*1000	[0.00]	Co-op Work Term I
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Note: Suggested course sequences are available in the departmental brochure. Please consult with the departmental advisor.

##### Semester 4 - Summer

MATH*2170	[0.50]	Differential Equations I
STAT*2050	[0.50]	Statistics II



0.50 Arts or Social Science electives

1.00 electives

**Fall Semester**

COOP\*2000 [0.00] Co-op Work Term II

**Semester 5 - Winter**

MATH\*2130 [0.50] Numerical Methods

MATH\*2210 [0.50] Advanced Calculus II

0.50 credits in Mathematics or Statistics at the 3000 level or above

1.00 electives

**Summer Semester**

COOP\*3000 [0.00] Co-op Work Term III

**Semester 6 - Fall**

STAT\*3100 [0.50] Introductory Mathematical Statistics I

STAT\*3240 [0.50] Applied Regression Analysis

At least 1.00 credits from:

MATH\*3100 [0.50] Differential Equations II

MATH\*3200 [0.50] Real Analysis

MATH\*3240 [0.50] Operations Research

0.50 electives

**Semester 7 - Winter**

STAT\*3110 [0.50] Introductory Mathematical Statistics II

1.50 credits in Mathematics or Statistics at the 3000 level or above

0.50 electives

**Summer Semester**

COOP\*4000 [0.00] Co-op Work Term IV

**Semester 8 - Fall**

2.00 credits in Mathematics or Statistics at the 4000 level

0.50 electives

**Electives must include:**

1.00 credits in Arts and Social Science courses

2.00 credits in Mathematics or Statistics at the 3000 level

2.00 credits in Mathematics or Statistics at the 4000 level

**Biochemistry (BIOC)****Department of Molecular and Cellular Biology, College of Biological Science****Major (Honours Program)**

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. The major will require the completion of at least 20.25 credits as indicated below:

**Semester 1**

BIOL\*1030 [0.50] Biology I

CHEM\*1040 [0.50] General Chemistry I

CIS\*1500 [0.50] Introduction to Programming

MATH\*1200 [0.50] Calculus I

PHYS\*1000 [0.50] An Introduction to Mechanics

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

**Semester 2**

BIOL\*1040 [0.50] Biology II

CHEM\*1050 [0.50] General Chemistry II

MATH\*1210 [0.50] Calculus II

PHYS\*1010 [0.50] Introductory Electricity and Magnetism

0.50 Arts or Social Science electives

**Semester 3**

BIOC\*2580 [0.50] Introductory Biochemistry

CHEM\*2060 [0.50] Structure and Bonding

CHEM\*2880 [0.50] Physical Chemistry

MBG\*2000 [0.50] Introductory Genetics

MICR\*2030 [0.50] Microbial Growth

**Semester 4**

BIOC\*3560 [0.50] Structure and Function in Biochemistry

CHEM\*2480 [0.50] Analytical Chemistry I

CHEM\*2700 [0.50] Organic Chemistry I

MBG\*2020 [0.50] Introductory Molecular Biology

MCB\*2210 [0.50] Introductory Cell Biology

**Semester 5**

BIOC\*3570 [0.50] Analytical Biochemistry

CHEM\*3750 [0.50] Organic Chemistry II

STAT\*2040 [0.50] Statistics I

1.00 electives or restricted electives\*

**Semester 6**

MBG\*3350 [0.75] Laboratory Methods in Molecular Biology I

PHYS\*2030 [0.50] Biophysics of Excitable Cells

1.50 electives or restricted electives\*

**Semester 7**

BIOC\*4520 [0.50] Metabolic Processes

MCB\*4080 [0.50] Applied Microbiology and Biochemistry

MICR\*3230 [0.50] Immunology I

1.00 electives or restricted electives\*

**Semester 8**

BIOC\*4540 [0.50] Enzymology

BIOC\*4580 [0.50] Membrane Biochemistry

1.50 electives or restricted electives\*

**\* Restricted Electives**

1. One of: MCB\*4050, TOX\*4590.

2. One of: BIOM\*3100, MICR\*3330, MICR\*4230, PBIO\*3110, PBIO\*4750.

3. One of: MBG\*3080, MBG\*4080, MICR\*4330. For MICR\*4330 the prerequisite MICR\*3330 should be completed in a previous fall semester.

**Minor (Honours Program)**

A minor in Biochemistry consists of at least 5.00 course credits. The following courses are required:

BIOC\*3560 [0.50] Structure and Function in Biochemistry

BIOC\*3570 [0.50] Analytical Biochemistry

BIOC\*4540 [0.50] Enzymology

CHEM\*2480 [0.50] Analytical Chemistry I

CHEM\*2700 [0.50] Organic Chemistry I

One of:

MBG\*2020 [0.50] Introductory Molecular Biology

MICR\*2030 [0.50] Microbial Growth

In addition, at least 2.00 credits must be chosen from the following courses, with at least 1.00 credits from the first four courses listed:

BIOC\*4520 [0.50] Metabolic Processes

BIOC\*4580 [0.50] Membrane Biochemistry

MBG\*3350 [0.75] Laboratory Methods in Molecular Biology I

MCB\*4080 [0.50] Applied Microbiology and Biochemistry

MICR\*3230 [0.50] Immunology I

TOX\*4590 [0.50] Biochemical Toxicology

**Biochemistry (Co-op) (BIOC:C)****Department of Molecular and Cellular Biology, College of Biological Science**

Two Streams are available. Stream A is different from Stream B in that Stream A has a double work term following academic semester 5. The course content of semesters 1-4 is the same as that listed above for the regular Honours Program Major. Students in the Co-op program must also take COOP\*1100 in the second academic semester. The total program requirements, including the selection of electives are also the same.

Students will be expected to undertake their work terms after semester 3 and completion of course CHEM\*2480. Since certain courses must be taken in a different semester from usual, consult your Faculty Co-op Advisor for assistance with course selection.

To graduate from the Co-op program a minimum of 4 successfully completed work terms is normally required.

**Stream A****Semester 1 - Fall**

BIOL\*1030 [0.50] Biology I

CHEM\*1040 [0.50] General Chemistry I

CIS\*1500 [0.50] Introduction to Programming

MATH\*1200 [0.50] Calculus I

PHYS\*1000 [0.50] An Introduction to Mechanics

**Semester 2 - Winter**

BIOL\*1040 [0.50] Biology II

CHEM\*1050 [0.50] General Chemistry II

COOP\*1100 [0.00] Introduction to Co-operative Education

MATH\*1210 [0.50] Calculus II

PHYS\*1010 [0.50] Introductory Electricity and Magnetism

0.50 Arts or Social Science electives

**Summer Semester**

No academic semester or work term

**Semester 3 - Fall**

BIOC\*2580 [0.50] Introductory Biochemistry

CHEM\*2060 [0.50] Structure and Bonding

CHEM\*2480 [0.50] Analytical Chemistry I

CHEM\*2880 [0.50] Physical Chemistry

MBG\*2000 [0.50] Introductory Genetics

**Winter Semester**

COOP\*1000 [0.00] Co-op Work Term I

**Semester 4 - Summer**

BIOC*3570	[0.50]	Analytical Biochemistry
CHEM*2700	[0.50]	Organic Chemistry I
MBG*2020	[0.50]	Introductory Molecular Biology
STAT*2040	[0.50]	Statistics I

0.50 Arts or Social Science electives

**Semester 5 - Fall**

BIOC*3560	[0.50]	Structure and Function in Biochemistry
CHEM*3750	[0.50]	Organic Chemistry II
MICR*2030	[0.50]	Microbial Growth
MCB*2210	[0.50]	Introductory Cell Biology

0.50 electives or restricted electives\*

**Winter Semester**

COOP*2000	[0.00]	Co-op Work Term II
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**Summer Semester**

COOP*3000	[0.00]	Co-op Work Term III
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**Semester 6 - Fall**

MICR*3230	[0.50]	Immunology I
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2.00 electives or restricted electives\*

**Semester 7 - Winter**

BIOC*4540	[0.50]	Enzymology
BIOC*4580	[0.50]	Membrane Biochemistry
MBG*3350	[0.75]	Laboratory Methods in Molecular Biology I
PHYS*2030	[0.50]	Biophysics of Excitable Cells

0.50 electives or restricted electives\*

**Summer Semester**

COOP*4000	[0.00]	Co-op Work Term IV
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**Semester 8 - Fall**

BIOC*4520	[0.50]	Metabolic Processes
MCB*4080	[0.50]	Applied Microbiology and Biochemistry

1.50 electives or restricted electives\*

**\* Restricted Electives**

1. One of: MCB\*4050, TOX\*4590.
2. One of: BIOM\*3100, MICR\*3330, MICR\*4230, PBIO\*3110, PBIO\*4750.
3. One of: MBG\*3080, MBG\*4080, MICR\*4330. For MICR\*4330 the prerequisite MICR\*3330 should be completed in a previous fall semester.

**Stream B****Semester 1 - Fall**

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
CIS*1500	[0.50]	Introduction to Programming
MATH*1200	[0.50]	Calculus I
PHYS*1000	[0.50]	An Introduction to Mechanics

**Semester 2 - Winter**

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
COOP*1100	[0.00]	Introduction to Co-operative Education
MATH*1210	[0.50]	Calculus II
PHYS*1010	[0.50]	Introductory Electricity and Magnetism

0.50 Arts or Social Science electives

**Summer Semester**

No academic semester or work term

**Semester 3 - Fall**

BIOC*2580	[0.50]	Introductory Biochemistry
CHEM*2060	[0.50]	Structure and Bonding
CHEM*2480	[0.50]	Analytical Chemistry I
CHEM*2880	[0.50]	Physical Chemistry
MBG*2000	[0.50]	Introductory Genetics

**Winter Semester**

COOP*1000	[0.00]	Co-op Work Term I
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**Semester 4 - Summer**

BIOC*3570	[0.50]	Analytical Biochemistry
CHEM*2700	[0.50]	Organic Chemistry I
MBG*2020	[0.50]	Introductory Molecular Biology
STAT*2040	[0.50]	Statistics I

0.50 Arts or Social Science electives

**Fall Semester**

COOP*2000	[0.00]	Co-op Work Term II
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**Semester 5 - Winter**

BIOC*3560	[0.50]	Structure and Function in Biochemistry
MCB*2210	[0.50]	Introductory Cell Biology

MICR*2030	[0.50]	Microbial Growth
PHYS*2030	[0.50]	Biophysics of Excitable Cells

0.50 electives or restricted electives\*

**Summer Semester**

COOP*3000	[0.00]	Co-op Work Term III
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**Semester 6 - Fall**

CHEM*3750	[0.50]	Organic Chemistry II
MICR*3230	[0.50]	Immunology I

1.50 electives or restricted electives\*

**Semester 7 - Winter**

BIOC*4540	[0.50]	Enzymology
BIOC*4580	[0.50]	Membrane Biochemistry
MBG*3350	[0.75]	Laboratory Methods in Molecular Biology I

1.00 electives or restricted electives\*

**Summer Semester**

COOP*4000	[0.00]	Co-op Work Term IV
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**Semester 8 - Fall**

BIOC*4520	[0.50]	Metabolic Processes
MCB*4080	[0.50]	Applied Microbiology and Biochemistry

1.50 electives or restricted electives\*

**\* Restricted Electives**

1. One of: MCB\*4050, TOX\*4590.
2. One of: BIOM\*3100, MICR\*3330, MICR\*4230, PBIO\*3110, PBIO\*4750.
3. One of: MBG\*3080, MBG\*4080, MICR\*4330. For MICR\*4330 the prerequisite MICR\*3330 should be completed in a previous fall semester.

**Biological Chemistry (BCHM)****Department of Chemistry, College of Physical and Engineering Science****Major (Honours Program)**

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. This major will require the completion of 20.00 credits as indicated below:

**Semester 1**

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1200	[0.50]	Calculus I
PHYS*1000	[0.50]	An Introduction to Mechanics

0.50 Arts or Social Science electives

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

**Semester 2**

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
MATH*1210	[0.50]	Calculus II
PHYS*1010	[0.50]	Introductory Electricity and Magnetism

0.50 Arts or Social Science electives

**Semester 3**

BIOC*2580	[0.50]	Introductory Biochemistry
CHEM*2060	[0.50]	Structure and Bonding
CHEM*2400	[0.75]	Analytical Chemistry I
MBG*2000	[0.50]	Introductory Genetics
STAT*2040	[0.50]	Statistics I

**Semester 4**

CHEM*2070	[0.50]	Structure and Spectroscopy
CHEM*2700	[0.50]	Organic Chemistry I
CHEM*3430	[0.50]	Analytical Chemistry II: Instrumental Analysis
MBG*2020	[0.50]	Introductory Molecular Biology

0.50 electives or restricted electives \*

**Semester 5**

BIOC*3570	[0.50]	Analytical Biochemistry
CHEM*2880	[0.50]	Physical Chemistry
CHEM*3640	[0.50]	Chemistry of the Elements I
CHEM*3750	[0.50]	Organic Chemistry II

0.50 electives or restricted electives \*

**Semester 6**

BIOC*3560	[0.50]	Structure and Function in Biochemistry
CHEM*3650	[0.50]	Chemistry of the Elements II
CHEM*3760	[0.50]	Organic Chemistry III

One of: \*\*

CHEM*4630	[0.50]	Bioinorganic Chemistry
CHEM*4720	[0.50]	Organic Reactivity

0.50 electives or restricted electives \*

**Semester 7**

CHEM\*4730 [0.50] Synthetic Organic Chemistry

CHEM\*4740 [0.50] Topics in Bio-Organic Chemistry

0.50 Chemistry, Biochemistry or Molecular Biology and Genetics courses at the 3000 or 4000 level \*\*\*

0.75 electives or restricted electives \*

**Semester 8**

One of:

CHEM\*4630 [0.50] Bioinorganic Chemistry

CHEM\*4720 [0.50] Organic Reactivity

1.00 Chemistry, Biochemistry or Molecular Biology and Genetics course at the 3000 or 4000 level \*\*\*

1.00 electives or restricted electives \*

**Selection of restricted electives are subject to the following:**

1. \*MCB\*2210 must be taken.
2. \* MICR\*2020 or MICR\*2030 must be taken.
3. \*\* Note: CHEM\*4630 and CHEM\*4720 are offered in alternating winter semesters and both courses are required.
4. \*\*\* 1.50 credits are to be selected from the following list of allowable courses at the 3000 and 4000 level:

BIOC*4520	[0.50]	Metabolic Processes
BIOC*4540	[0.50]	Enzymology
BIOC*4580	[0.50]	Membrane Biochemistry
CHEM*3440	[0.50]	Analytical Chemistry III: Analytical Instrumentation
CHEM*4900	[0.75]	Chemistry Research Project I
CHEM*4910	[0.75]	Chemistry Research Project II
MBG*3350	[0.75]	Laboratory Methods in Molecular Biology I
MBG*4080	[0.50]	Molecular Genetics
MCB*4050	[0.50]	Protein and Nucleic Acid Structure
MCB*4080	[0.50]	Applied Microbiology and Biochemistry
TOX*4590	[0.50]	Biochemical Toxicology

**Biological Science (BIOS)****College of Biological Science****Major (Honours Program)**

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. This major will require the completion of 20.00 credits as indicated below:

**Schedule of Studies****Semester 1**

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1080	[0.50]	Elements of Calculus I
PHYS*1070	[0.50]	Introductory Physics for Life Sciences

0.50 Arts or Social Science electives

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by the end of Semester 3.

**Semester 2**

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
PHYS*1080	[0.50]	Physics for Life Sciences

0.50 Arts or Social Science electives

0.50 electives or restricted electives

**Semester 3**

MBG\*2000 [0.50] Introductory Genetics

One of:

BIOC\*2580 [0.50] Introductory Biochemistry

MCB\*2210 [0.50] Introductory Cell Biology

1.00 electives\*

0.50 Arts or Social Science elective

**Semester 4**

STAT\*2040 [0.50] Statistics I

One of:

BIOC\*2580 [0.50] Introductory Biochemistry

MCB\*2210 [0.50] Introductory Cell Biology

1.00 electives\*

0.50 Arts or Social Science elective

**Semester 5 to 8**

2.50 in each semester\*

**\* Required Biological Science electives**

1. At least one of:

BIOL*2060	[0.50]	Ecology
BIOL*3110	[0.50]	Population Ecology
BOT*3050	[0.50]	Plant Functional Ecology

2. At least one of:

BIOL*2250	[0.50]	Biostatistics and the Life Sciences
CIS*1000	[0.50]	Introduction to Computer Applications
CIS*1200	[0.50]	Introduction to Computing
MATH*2080	[0.50]	Elements of Calculus II
STAT*2050	[0.50]	Statistics II
STAT*2250	[0.50]	Biostatistics and the Life Sciences

3. At least one of:

BIOM*3100	[0.50]	Mammalian Physiology I
BOT*2100	[0.50]	Life Strategies of Plants
ENVB*4290	[0.50]	Applied Insect Physiology **
HK*3940	[1.25]	Human Physiology
ZOO*3200	[0.50]	Comparative Animal Physiology I

\*\* additional prerequisite required, not specified in semesters 1 to 4.

4. 6.00 additional Biological Science credits of which 4.00 must be at the 3000 or 4000 level. The list of approved science electives is posted at <http://www.bsc.uoguelph.ca/>.

**Credit Summary (20.00 credits)**

4.00 - First year science core

3.00 - Required science courses semesters 3 - 8

6.00 - Approved Biological Science electives of which 4.00 must be 3000/4000 level

3.00 - Approved science electives of which 2.00 must be 3000/4000 level\* May include 1 of BIOL\*1020, CHEM\*1060, PHYS\*1020

2.00 - Approved Arts or Social Science electives

2.00 - Electives

\*2.00 science credits must be at the 4000 level.

**Biology (BIOL)****College of Biological Science****Minor (Honours Program)**

A minor in Biology consists of a minimum of 5.00 credits including the following courses:

BIOL*1030	[0.50]	Biology I
BIOL*1040	[0.50]	Biology II
MBG*2000	[0.50]	Introductory Genetics
MCB*2210	[0.50]	Introductory Cell Biology

One of:

BIOL*2060	[0.50]	Ecology
BIOL*3110	[0.50]	Population Ecology

Of the additional 2.50 credits, students must complete a minimum of 1.50 credits at the 3000 or 4000 level, from courses offered by the following departments: Human Health and Nutritional Science, Integrative Biology and Molecular and Cellular Biology. This minor is restricted to students registered in B.Sc. majors in the Physical Sciences, B.A.S., and the B.A. degree programs.

**Bio-Medical Science (BIOM)****Department of Biomedical Sciences and Department of Human Health and Nutritional Sciences**

This joint program of the Department of Human Health and Nutritional Sciences and the Department of Biomedical Sciences focuses on the maintenance and promotion of human and animal health through the study of function (biochemistry and physiology), structure (anatomy and histology), and the basic medical sciences (epidemiology and pharmacology). It will permit graduates to contribute to society in the area of health maintenance. The program is a good preparation for students intending to develop professional or research careers in the medical and biological sciences. Through the use of electives, students may structure a program emphasizing either nutritional sciences or principles of health and disease prevention. For more information on recommended electives contact the Faculty Advisor of the major.

This program is designed to partially meet the current requirements for an entry into medical schools in Ontario (a student interested in meeting these requirements should check the present admission requirements for the medical schools); as well as entry into the DVM program of the Ontario Veterinary College.

Live animals and/or animal tissues are used for teaching purposes in some courses in the Bio-Medical Science Major. This must be accepted by students admitted to the program. All animals are protected under the Animals for Research Act of Ontario (1980), the Guidelines for the Care and Use of Experimental Animals (Canadian Council on Animal Care), and the Animal Care Policies of the University of Guelph.

Students who are admitted into the Biomedical Science major from high school must meet additional requirements to continue in the major. Continuation after first year is based on the cumulative average in the first two full-time semesters (5.00 credits), including the seven core courses as prescribed by the Schedule of Studies (see below). Students with a minimum average of 75% average will be guaranteed continuation in this major. For students with a 70-74.9% average, continuation will be competitive based on available

spaces. Students with an average below 70% will be changed to the Biological Science major. Students may subsequently change to another B.Sc. major of their choice.

B.Sc. students who were not admitted into the Biomedical Science major from high school and wish to declare the specialization at the end of first year must apply directly to the Department of Biomedical Sciences by the last day of classes in the winter semester and meet the additional requirements specified above.

B.Sc. students beyond first year who wish to declare the specialization must apply directly to the Department of Biomedical Sciences by the last day of classes in the winter semester. Admission to the major will be based on the cumulative average in the previous two full-time semesters (5.00 credits). Acceptance will be competitive based on available spaces. Students with an average below 70% will not be considered for admission to the major.

All decisions will be made at the end of June.

### Major (Honours Program)

A minimum of 20.00 credits is required.

Note: Students are required to complete 16.00 credits in science of which a minimum of 2.00 credits must be at the 4000 level.

#### Semester 1

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1080	[0.50]	Elements of Calculus I
PHYS*1070	[0.50]	Introductory Physics for Life Sciences

0.50 electives or restricted electives

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

#### Semester 2

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
PHYS*1080	[0.50]	Physics for Life Sciences

1.00 electives or restricted electives

#### Semester 3 (see admission statement above)

BIOC*2580	[0.50]	Introductory Biochemistry
MBG*2000	[0.50]	Introductory Genetics
MCB*2210	[0.50]	Introductory Cell Biology
STAT*2040	[0.50]	Statistics I

0.50 electives or restricted electives

#### Semester 4

BIOC*3560	[0.50]	Structure and Function in Biochemistry
MBG*2020	[0.50]	Introductory Molecular Biology
NUTR*3210	[0.50]	Fundamentals of Nutrition

1.00 electives or restricted electives

#### Semester 5

POPM*3240	[0.50]	Epidemiology
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One of:

BIOM*3100	[0.50]	Mammalian Physiology I
HK*3940	[1.25]	Human Physiology

If BIOM\*3100 is selected, then BIOM\*3110 and BIOM\*3120 must be taken in Semester 6.

Electives or restricted electives to a maximum of 2.75 total credits in this semester.

#### Semester 6

BIOM*3040	[0.50]	Medical Embryology
BIOM*3090	[0.50]	Principles of Pharmacology

Electives or restricted electives to a maximum of 2.75 total credits in this semester.

Note: As part of the electives or restricted electives students must select BIOM\*3110 and BIOM\*3120 in Semester 6 if BIOM\*3100 was selected in Semester 5.

#### Semester 7

MICR*3230	[0.50]	Immunology I
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One of:

BIOM*3030	[0.75]	Biomedical Histology
ZOO*3000	[0.50]	Comparative Histology

Electives or restricted electives to a maximum of 2.75 total credits.

#### Semester 8

PATH*3610	[0.50]	Principles of Disease
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2.00 electives or restricted electives\*

#### Restricted Electives

1. One anatomy course from BIOM\*3010, HK\*3401/2, ZOO\*2090 must be completed.
2. A minimum of 1.00 credits in research experience must be met by completing one of the following:
  - i. (HK\*4410 or BIOM\*4210) and (1 of BIOM\*4220, BIOM\*4500, HK\*4230)
  - ii. 1 of BIOM\*4510, BIOM\*4521/2, HK\*4360, HK\*4371/2

iii. an equivalent course from another department with the permission of the Faculty Advisor

3. A total of 2.00 credits in Arts and Social Science courses must be completed including:

- i. 0.50 credits in philosophy and ethics from PHIL\*2030, PHIL\*2070, PHIL\*2100, PHIL\*2120, PHIL\*2180
- ii. 0.50 credits in either psychology (PSYC\*XXXX) or sociology (SOC\*XXXX)

### Biomedical Toxicology (BTOX)

**Interdisciplinary Program, Department of Biomedical Sciences, Ontario Veterinary College**

#### Major (Honours Program)

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor.

#### Semester 1

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1080	[0.50]	Elements of Calculus I
PHYS*1070	[0.50]	Introductory Physics for Life Sciences

0.50 Arts or Social Science electives

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

#### Semester 2

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
PHYS*1080	[0.50]	Physics for Life Sciences
STAT*2040	[0.50]	Statistics I

0.50 Arts or Social Science electives

#### Semester 3

BIOC*2580	[0.50]	Introductory Biochemistry
CHEM*2480	[0.50]	Analytical Chemistry I
MBG*2000	[0.50]	Introductory Genetics
TOX*2000	[0.50]	Principles of Toxicology

0.50 Arts or Social Science electives

#### Semester 4

CHEM*2700	[0.50]	Organic Chemistry I
MBG*2020	[0.50]	Introductory Molecular Biology
MCB*2210	[0.50]	Introductory Cell Biology
NUTR*3210	[0.50]	Fundamentals of Nutrition
STAT*2050	[0.50]	Statistics II

#### Semester 5

BIOC*3560	[0.50]	Structure and Function in Biochemistry
BIOM*3100	[0.50]	Mammalian Physiology I
MBG*3350	[0.75]	Laboratory Methods in Molecular Biology I
TOX*3300	[0.50]	Analytical Toxicology

0.25 electives

#### Semester 6

BIOM*3090	[0.50]	Principles of Pharmacology
BIOM*3110	[0.50]	Mammalian Physiology II
BIOM*3120	[0.25]	Laboratory Exercises in Mammalian Physiology
PATH*3610	[0.50]	Principles of Disease

0.75 electives

#### Semester 7

BIOM*3030	[0.75]	Biomedical Histology
BIOM*4090	[0.50]	Pharmacology
NUTR*4510	[0.50]	Toxicology, Nutrition and Food
TOX*4000	[0.50]	Medical Toxicology
TOX*4590	[0.50]	Biochemical Toxicology

#### Semester 8

STAT*3510	[0.50]	Environmental Risk Assessment
TOX*4100	[0.50]	Toxicological Pathology
TOX*4200	[0.50]	Topics in Toxicology

0.75 electives

### Biomedical Toxicology (Co-op) (BTOX:C)

**Interdisciplinary Program, Department of Biomedical Sciences, Ontario Veterinary College**

#### Major (Honours Program)

A 70% average in courses completed in semesters 1 and 2 is normally required for admission to semester 3 of this program. An optional fourth co-op work term is available.

#### Semester 1 - Fall

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I

MATH\*1080 [0.50] Elements of Calculus I  
 PHYS\*1070 [0.50] Introductory Physics for Life Sciences  
 0.50 Arts or Social Science electives  
 Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

**Semester 2 - Winter**

BIOL\*1040 [0.50] Biology II  
 CHEM\*1050 [0.50] General Chemistry II  
 COOP\*1100 [0.00] Introduction to Co-operative Education  
 PHYS\*1080 [0.50] Physics for Life Sciences  
 STAT\*2040 [0.50] Statistics I

0.50 Arts or Social Science electives

**Semester 3 - Fall**

BIOC\*2580 [0.50] Introductory Biochemistry  
 CHEM\*2480 [0.50] Analytical Chemistry I  
 MBG\*2000 [0.50] Introductory Genetics  
 TOX\*2000 [0.50] Principles of Toxicology

0.50 Arts or Social Science electives

**Winter**

COOP\*1000 [0.00] Co-op Work Term I

**Semester 4 - Summer**

CHEM\*2700 [0.50] Organic Chemistry I  
 MCB\*2210 [0.50] Introductory Cell Biology  
 PATH\*3610 [0.50] Principles of Disease  
 STAT\*2050 [0.50] Statistics II

0.50 electives

**Fall**

COOP\*2000 [0.00] Co-op Work Term II

**Semester 5 - Winter**

BIOC\*3560 [0.50] Structure and Function in Biochemistry  
 MBG\*2020 [0.50] Introductory Molecular Biology  
 NUTR\*3210 [0.50] Fundamentals of Nutrition  
 STAT\*3510 [0.50] Environmental Risk Assessment

0.50 electives

**Summer**

COOP\*3000 [0.00] Co-op Work Term III

**Semester 6 - Fall**

BIOM\*3100 [0.50] Mammalian Physiology I  
 MBG\*3350 [0.75] Laboratory Methods in Molecular Biology I  
 NUTR\*4510 [0.50] Toxicology, Nutrition and Food  
 TOX\*3300 [0.50] Analytical Toxicology

0.25 electives

**Semester 7 - Winter**

BIOM\*3090 [0.50] Principles of Pharmacology  
 BIOM\*3110 [0.50] Mammalian Physiology II  
 BIOM\*3120 [0.25] Laboratory Exercises in Mammalian Physiology  
 TOX\*4100 [0.50] Toxicological Pathology  
 TOX\*4200 [0.50] Topics in Toxicology

0.25 electives

**Semester 8 - Fall**

BIOM\*3030 [0.75] Biomedical Histology  
 BIOM\*4090 [0.50] Pharmacology  
 TOX\*4000 [0.50] Medical Toxicology  
 TOX\*4590 [0.50] Biochemical Toxicology

0.25 electives

**Biophysics (BIOP)****Department of Physics, College of Physical and Engineering Science****Major (Honours Program)**

The program emphasizes the physics of biological systems. It provides an excellent background for careers in the expanding interdisciplinary research laboratories of Government and Industry. Completion of the program at an appropriate level will qualify a student to pursue post-graduate studies in biophysics and certain areas of physics.

Since some of the required courses are not offered every semester, students entering the Major in Biophysics should plan their program in consultation with the Department of Physics Departmental Advisor.

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. This major requires the completion of 21.25 credits as indicated below. At least 1.00 credits must be from Arts and/or Social Science courses.

**Semester 1**

BIOL\*1030 [0.50] Biology I

CHEM\*1040 [0.50] General Chemistry I  
 CIS\*1500 [0.50] Introduction to Programming

One of (MATH\*1200 recommended):

MATH\*1080 [0.50] Elements of Calculus I  
 MATH\*1200 [0.50] Calculus I

One of (PHYS\*1000 recommended):

PHYS\*1000 [0.50] An Introduction to Mechanics  
 PHYS\*1070 [0.50] Introductory Physics for Life Sciences  
 PHYS\*1080 [0.50] Physics for Life Sciences

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

**Semester 2**

BIOL\*1040 [0.50] Biology II  
 CHEM\*1050 [0.50] General Chemistry II

1 physics course from the following list (PHYS\*1010 recommended):

PHYS\*1010 [0.50] Introductory Electricity and Magnetism  
 PHYS\*1080 [0.50] Physics for Life Sciences  
 PHYS\*1130 [0.50] Physics with Applications

One of (recommended):

MATH\*1210 [0.50] Calculus II  
 MATH\*2080 [0.50] Elements of Calculus II

0.50 Arts or Social Science electives

**Semester 3**

MATH\*2160 [0.50] Linear Algebra I  
 MATH\*2200 [0.50] Advanced Calculus I  
 PHYS\*2440 [0.75] Mechanics I  
 PHYS\*2460 [0.75] Electricity and Magnetism I

One of:

MBG\*2000 [0.50] Introductory Genetics  
 MCB\*2210 [0.50] Introductory Cell Biology

**Semester 4**

MATH\*2170 [0.50] Differential Equations I  
 PHYS\*2030 [0.50] Biophysics of Excitable Cells  
 PHYS\*2260 [0.50] Quantum Physics  
 PHYS\*2450 [0.75] Mechanics II  
 PHYS\*2470 [0.75] Electricity and Magnetism II

**Semester 5**

BIOC\*2580 [0.50] Introductory Biochemistry  
 MATH\*3100 [0.50] Differential Equations II  
 PHYS\*3100 [0.75] Electronics  
 PHYS\*3230 [0.50] Quantum Mechanics I  
 PHYS\*3240 [0.50] Statistical Physics I

**Semester 6**

BIOC\*3560 [0.50] Structure and Function in Biochemistry  
 PHYS\*3220 [0.50] Waves and Optics  
 PHYS\*3510 [0.50] Intermediate Laboratory  
 PHYS\*4040 [0.50] Quantum Mechanics II  
 PHYS\*4540 [0.50] Molecular Biophysics

**Semester 7**

MCB\*4050 [0.50] Protein and Nucleic Acid Structure  
 PHYS\*4240 [0.50] Statistical Physics II  
 PHYS\*4560 [0.50] Biophysical Methods

Two of:

PHYS\*4001 [0.50] Research in Physics  
 PHYS\*4120 [0.50] Atomic and Molecular Physics  
 PHYS\*4500 [0.50] Advanced Physics Laboratory

0.50 electives

0.50 electives

Note: At least one of PHYS\*4120 in semester 7 or PHYS\*4150 in semester 8 must be taken. Either PHYS\*4001/2 in semesters 7 and 8 or PHYS\*4300 in semester 8 must be taken.

**Semester 8**

BIOC\*4580 [0.50] Membrane Biochemistry

One of:

PHYS\*4002 [0.50] Research in Physics  
 PHYS\*4300 [0.50] Inquiry in Physics

One of:

PHYS\*4150 [0.50] Solid State Physics

0.50 electives

0.50 Arts or Social Science electives

0.50 electives

Note: At least one of PHYS\*4120 in semester 7 or PHYS\*4150 in semester 8 must be taken. Either PHYS\*4001/2 in semesters 7 and 8 or PHYS\*4300 in semester 8 must be taken.

Note: PHYS\*4001/2 will be projects in biophysics, some of which may be in biological areas outside the Department of Physics.

### Biophysics (Co-op) (BIOP:C)

Department of Physics, College of Physical and Engineering Science

#### Major (Honours Program)

Since some of the required courses are not offered every semester, students entering the Major in Biophysics (Co-op) should plan their program in consultation with the Department of Physics Faculty Advisor.

To graduate from the Co-op program a minimum of 4 successfully completed work terms is normally required.

This major requires the completion of 21.25 credits as indicated below:

#### Semester 1 - Fall

The program for the first semester is the same as the Major in Biophysics (regular) program.

#### Semester 2 - Winter

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
COOP*1100	[0.00]	Introduction to Co-operative Education
1 physics course from the following list (PHYS*1010 recommended):		
PHYS*1010	[0.50]	Introductory Electricity and Magnetism
PHYS*1080	[0.50]	Physics for Life Sciences
PHYS*1130	[0.50]	Physics with Applications

One of:

CIS*2500	[0.50]	Intermediate Programming
0.50 Arts or Social Science electives		

One of:

MATH*1210	[0.50]	Calculus II
MATH*2080	[0.50]	Elements of Calculus II

#### Semester 3 - Fall

MATH*2160	[0.50]	Linear Algebra I
MATH*2200	[0.50]	Advanced Calculus I
PHYS*2440	[0.75]	Mechanics I
PHYS*2460	[0.75]	Electricity and Magnetism I

One of:

MBG*2000	[0.50]	Introductory Genetics
MCB*2210	[0.50]	Introductory Cell Biology

#### Winter Semester

COOP*1000	[0.00]	Co-op Work Term I
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#### Semester 4 - Summer

BIOC*2580	[0.50]	Introductory Biochemistry
MATH*2170	[0.50]	Differential Equations I
PHYS*2260	[0.50]	Quantum Physics
PHYS*3240	[0.50]	Statistical Physics I

0.50 Arts or Social Science electives\*

\*1.00 must be taken as Arts or Social Science electives in this Major

#### Fall Semester

COOP*2000	[0.00]	Co-op Work Term II
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#### Semester 5 - Winter

BIOC*3560	[0.50]	Structure and Function in Biochemistry
PHYS*2030	[0.50]	Biophysics of Excitable Cells
PHYS*2450	[0.75]	Mechanics II
PHYS*2470	[0.75]	Electricity and Magnetism II
PHYS*3220	[0.50]	Waves and Optics

#### Summer Semester

COOP*3000	[0.00]	Co-op Work Term III
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#### Semester 6 - Fall

MATH*3100	[0.50]	Differential Equations II
PHYS*3100	[0.75]	Electronics
PHYS*3230	[0.50]	Quantum Mechanics I

1.00 electives

#### Semester 7 - Winter

BIOC*4580	[0.50]	Membrane Biochemistry
PHYS*3510	[0.50]	Intermediate Laboratory
PHYS*4040	[0.50]	Quantum Mechanics II
PHYS*4540	[0.50]	Molecular Biophysics

0.50 electives

#### Summer Semester

COOP*4000	[0.00]	Co-op Work Term IV
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#### Semester 8 - Fall

MCB*4050	[0.50]	Protein and Nucleic Acid Structure
PHYS*4120	[0.50]	Atomic and Molecular Physics
PHYS*4240	[0.50]	Statistical Physics II
PHYS*4560	[0.50]	Biophysical Methods

One of:

PHYS*4500	[0.50]	Advanced Physics Laboratory
0.50 electives		

### Biotechnology (BIOT)

Department of Molecular and Cellular Biology, College of Biological Science

#### Minor (Honours Program)

A minimum of 5.00 credits is required.

BIOC*3560	[0.50]	Structure and Function in Biochemistry
MBG*2020	[0.50]	Introductory Molecular Biology
MICR*2020	[0.50]	Microbial Interactions and Associations
MICR*2030	[0.50]	Microbial Growth

One of:

ENGG*2660	[0.50]	Biological Engineering Systems I
ENGG*3830	[0.50]	Bio-Process Engineering
FOOD*2620	[0.50]	Food Engineering Principles

Two of:

ECON*1050	[0.50]	Introductory Microeconomics
ECON*1100	[0.50]	Introductory Macroeconomics
ECON*2100	[0.50]	Economic Growth and Environmental Quality
ECON*2310	[0.50]	Intermediate Microeconomics
ECON*2410	[0.50]	Intermediate Macroeconomics
MCS*1000	[0.50]	Introductory Marketing

Three of:

ANSC*4050	[0.50]	Biotechnology in Animal Science
FOOD*3260	[0.50]	Industrial Microbiology
MBG*4240	[0.50]	Applied Molecular Genetics
MCB*4080	[0.50]	Applied Microbiology and Biochemistry
MICR*3230	[0.50]	Immunology I
MICR*4180	[0.50]	Microbial Processes in Environmental Management
PBIO*3750	[0.50]	Plant Tissue Culture

### Business Administration (BADM)

Department of Economics, College of Management and Economics

#### Minor (Honours Program)

A minimum of 5.00 credits is required.

BUS*2220	[0.50]	Financial Accounting
BUS*2230	[0.50]	Management Accounting
ECON*1050	[0.50]	Introductory Microeconomics
ECON*1100	[0.50]	Introductory Macroeconomics
ECON*2310	[0.50]	Intermediate Microeconomics
ECON*2410	[0.50]	Intermediate Macroeconomics
ECON*3560	[0.50]	Theory of Finance
MCS*1000	[0.50]	Introductory Marketing
MCS*3040	[0.50]	Business and Consumer Law

One of:

AGEC*3310	[0.50]	Operations Management
BUS*2090	[0.50]	Individuals and Groups in Organizations

Students wishing to acquire further depth in Business Administration should consider taking electives from the schedules of study listed under Economics in the B.A. degree, Economics and Mathematical Economics in the B.A.H. degree and Management Economics Industry and Finance in the B.Comm. degree.

### Chemical Physics (CHPY)

Administered by the Office of the Dean, College of Physical and Engineering Science on behalf of the Department of Chemistry and the Department of Physics

#### Major (Honours Program)

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. A minimum of 21.75 credits is required. At least 1.00 credits must be from Arts and/or Social Science courses.

#### Semester 1

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1200	[0.50]	Calculus I
PHYS*1000	[0.50]	An Introduction to Mechanics
CIS*1500	[0.50]	Introduction to Programming

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

#### Semester 2

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
MATH*1210	[0.50]	Calculus II
PHYS*1010	[0.50]	Introductory Electricity and Magnetism
0.50 Arts or Social Science electives		

<b>Semester 3</b>			CHEM*2700 [0.50] Organic Chemistry I 0.50 Arts or Social Science electives
CHEM*2060 [0.50]	Structure and Bonding		
MATH*2160 [0.50]	Linear Algebra I		
MATH*2200 [0.50]	Advanced Calculus I		
PHYS*2440 [0.75]	Mechanics I		
PHYS*2460 [0.75]	Electricity and Magnetism I		
<b>Semester 4</b>			
CHEM*2070 [0.50]	Structure and Spectroscopy		
CHEM*2480 [0.50]	Analytical Chemistry I		
MATH*2170 [0.50]	Differential Equations I		
PHYS*2450 [0.75]	Mechanics II		
PHYS*2470 [0.75]	Electricity and Magnetism II		
<b>Semester 5</b>			
CHEM*2820 [0.50]	Thermodynamics and Kinetics		
CHEM*3860 [0.50]	Quantum Chemistry		
PHYS*3100 [0.75]	Electronics		
PHYS*3230 [0.50]	Quantum Mechanics I		
PHYS*3240 [0.50]	Statistical Physics I		
<b>Semester 6</b>			
CHEM*3430 [0.50]	Analytical Chemistry II: Instrumental Analysis		
PHYS*3220 [0.50]	Waves and Optics		
PHYS*4040 [0.50]	Quantum Mechanics II		
One of:			
CHEM*2700 [0.50]	Organic Chemistry I		
	0.50 Arts or Social Science electives		
One of:			
CHEM*3870 [0.50]	Molecular Spectroscopy		
CHEM*4880 [0.50]	Topics in Advanced Physical Chemistry		
<b>Semester 7</b>			
CHEM*3440 [0.50]	Analytical Chemistry III: Analytical Instrumentation		
IPS*4001 [0.75]	Chemical Physics Research Project		
MATH*3100 [0.50]	Differential Equations II		
PHYS*4120 [0.50]	Atomic and Molecular Physics		
PHYS*4240 [0.50]	Statistical Physics II		
<b>Semester 8</b>			
IPS*4002 [0.75]	Chemical Physics Research Project		
One of:			
CHEM*3870 [0.50]	Molecular Spectroscopy		
CHEM*4880 [0.50]	Topics in Advanced Physical Chemistry		
1.50 electives			

### Chemical Physics (Co-op) (CHPY:C)

Administered by the Office of the Dean, College of Physical and Engineering Science on behalf of the Department of Chemistry and the Department of Physics

#### Major (Honours Program)

A minimum of 21.25 credits is required. At least 1.00 credits must be from Arts and/or Social Science courses.

##### Semester 1 - Fall

The program for the first semester is the same as for the Major in Chemical Physics (regular) program.

##### Semester 2 - Winter

BIOL*1040 [0.50]	Biology II	
CHEM*1050 [0.50]	General Chemistry II	
COOP*1100 [0.00]	Introduction to Co-operative Education	
MATH*1210 [0.50]	Calculus II	
PHYS*1010 [0.50]	Introductory Electricity and Magnetism	

One of:

CIS*2500 [0.50]	Intermediate Programming	
	0.50 Arts or Social Science electives	

##### Semester 3 - Fall

CHEM*2060 [0.50]	Structure and Bonding	
MATH*2160 [0.50]	Linear Algebra I	
MATH*2200 [0.50]	Advanced Calculus I	
PHYS*2440 [0.75]	Mechanics I	
PHYS*2460 [0.75]	Electricity and Magnetism I	

##### Winter Semester

COOP*1000 [0.00]	Co-op Work Term I	
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##### Semester 4 - Summer

CHEM*2070 [0.50]	Structure and Spectroscopy	
CHEM*2480 [0.50]	Analytical Chemistry I	
MATH*2170 [0.50]	Differential Equations I	
PHYS*3240 [0.50]	Statistical Physics I	

One of:

CHEM*2700 [0.50]	Organic Chemistry I	
	0.50 Arts or Social Science electives	

##### Fall Semester

COOP*2000 [0.00]	Co-op Work Term II	
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##### Semester 5 - Winter

CHEM*3430 [0.50]	Analytical Chemistry II: Instrumental Analysis	
PHYS*2450 [0.75]	Mechanics II	
PHYS*2470 [0.75]	Electricity and Magnetism II	
PHYS*3220 [0.50]	Waves and Optics	

One of:

CHEM*3870 [0.50]	Molecular Spectroscopy	
	0.50 electives	

##### Summer Semester

COOP*3000 [0.00]	Co-op Work Term III	
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##### Semester 6 - Fall

CHEM*2820 [0.50]	Thermodynamics and Kinetics	
CHEM*3440 [0.50]	Analytical Chemistry III: Analytical Instrumentation	
CHEM*3860 [0.50]	Quantum Chemistry	
PHYS*3230 [0.50]	Quantum Mechanics I	

One of:

CHEM*3640 [0.50]	Chemistry of the Elements I	
CHEM*3750 [0.50]	Organic Chemistry II	
	0.50 electives	

##### Semester 7\*\* - Winter

PHYS*4040 [0.50]	Quantum Mechanics II	
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One of:

CHEM*3760 [0.50]	Organic Chemistry III	
	0.50 electives	

One of:

CHEM*3870 [0.50]	Molecular Spectroscopy	
CHEM*4880 [0.50]	Topics in Advanced Physical Chemistry	

0.50 Arts or Social Science electives

0.50 electives

##### Summer Semester

COOP*4000 [0.00]	Co-op Work Term IV	
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##### Semester 8\*\* - Fall

MATH*3100 [0.50]	Differential Equations II	
PHYS*3100 [0.75]	Electronics	
PHYS*4120 [0.50]	Atomic and Molecular Physics	
PHYS*4240 [0.50]	Statistical Physics II	

0.50 electives

\*\* A minimum of 2.00 credits in science courses at the 4000 level is required for graduation.

### Chemistry (CHEM)

Department of Chemistry, College of Physical and Engineering Science

#### Major (Honours Program)

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. The major will require the completion of 20.25 credits as indicated below:

##### Semester 1

BIOL*1030 [0.50]	Biology I	
CHEM*1040 [0.50]	General Chemistry I	
MATH*1200 [0.50]	Calculus I	
PHYS*1000 [0.50]	An Introduction to Mechanics	

0.50 Arts or Social Science electives

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

##### Semester 2

BIOL*1040 [0.50]	Biology II	
CHEM*1050 [0.50]	General Chemistry II	
MATH*1210 [0.50]	Calculus II	
PHYS*1010 [0.50]	Introductory Electricity and Magnetism	

0.50 electives

##### Semester 3

BIOC*2580 [0.50]	Introductory Biochemistry	
CHEM*2060 [0.50]	Structure and Bonding	
CHEM*2400 [0.75]	Analytical Chemistry I	
MATH*2150 [0.50]	Applied Matrix Algebra	

0.50 electives\*

##### Semester 4

CHEM*2070 [0.50]	Structure and Spectroscopy	
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CHEM*2700	[0.50]	Organic Chemistry I
CHEM*3430	[0.50]	Analytical Chemistry II: Instrumental Analysis
MATH*2170	[0.50]	Differential Equations I

0.50 electives\*

**Semester 5**

CHEM*2820	[0.50]	Thermodynamics and Kinetics
CHEM*3640	[0.50]	Chemistry of the Elements I
CHEM*3750	[0.50]	Organic Chemistry II
CHEM*3860	[0.50]	Quantum Chemistry

0.50 electives\*

**Semester 6**

CHEM*3650	[0.50]	Chemistry of the Elements II
CHEM*3760	[0.50]	Organic Chemistry III

1.50 electives\* or restricted electives\*\*

**Semester 7 and 8**

CHEM*3440	[0.50]	Analytical Chemistry III: Analytical Instrumentation
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3.00 Chemistry or Biochemistry\*\*

1.50 electives\*

\*selection of electives is subject to the following:

1. At least 1.00 credits must be in the Arts & Social Sciences.
2. PHYS\*2040 or PHYS\*2260
3. Approval of the Faculty Advisor must be obtained for the selection of courses not listed as restrictive electives.
4. Options for an "Area of Focus" or a minor are available. Subject areas include Biochemistry, Computing and Information Science, Earth Sciences, Environmental Sciences, Mathematical Sciences, and Physics. Please consult with your Faculty Advisor for more detail.

\*\*3.00 credits from the 3000/4000 level as follows:

1. 1.50 comprising of (CHEM\*3870 or CHEM\*4880), (CHEM\*4620 or CHEM\*4630), (CHEM\*4720 or CHEM\*4730)
2. 1.50 chosen from CHEM\*3870, CHEM\*4010, CHEM\*4400, BIOC\*4520, BIOC\*4540, BIOC\*4580, CHEM\*4620, CHEM\*4630, CHEM\*4720, CHEM\*4730, CHEM\*4740, CHEM\*4880, CHEM\*4900, CHEM\*4910, MCB\*4050, MCB\*4080, TOX\*4590

**Note:**

1. Some of these courses may have to be taken in Semester 6.
2. Some of these courses are offered only in alternate years, and some have additional prerequisites for which the student must plan ahead, with the assistance of the faculty advisor.

**Minor (Honours Program)**

A minor in Chemistry consists of at least 5.00 credits in Chemistry courses (CHEM) at the 2000 level or above including a minimum of 2.50 credits at the 3000 or 4000 level. Exclusions: CHEM\*2300 and CHEM\*3360 cannot be counted toward this specialization

**Chemistry (Co-op) (CHEM:C)****Department of Chemistry, College of Physical and Engineering Science****Major (Honours Program)**

The major will require the completion of 20.25 credits as indicated below.

The course content of semesters 1 to 3 is the same as listed in the regular Honours Program Major.

To graduate from the Co-op program a minimum of 4 successfully completed work terms is normally required. These can be taken as four single work terms (Stream A), or as a double work term between two single work terms (Stream B).

**Stream A:** single work term option**Semester 1 - Fall**

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1200	[0.50]	Calculus I
PHYS*1000	[0.50]	An Introduction to Mechanics

0.50 Arts or Social Science electives

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

**Semester 2 - Winter**

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
COOP*1100	[0.00]	Introduction to Co-operative Education
MATH*1210	[0.50]	Calculus II
PHYS*1010	[0.50]	Introductory Electricity and Magnetism

0.50 electives

**Semester 3 - Fall**

BIOC*2580	[0.50]	Introductory Biochemistry
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CHEM*2060	[0.50]	Structure and Bonding
CHEM*2400	[0.75]	Analytical Chemistry I
MATH*2150	[0.50]	Applied Matrix Algebra

0.50 electives\*

**Winter Semester**

COOP*1000	[0.00]	Co-op Work Term I
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**Semester 4 - Summer**

CHEM*2070	[0.50]	Structure and Spectroscopy
CHEM*2700	[0.50]	Organic Chemistry I
CHEM*3430	[0.50]	Analytical Chemistry II: Instrumental Analysis
MATH*2170	[0.50]	Differential Equations I

0.50 electives\*

**Semester 5 - Fall**

CHEM*2820	[0.50]	Thermodynamics and Kinetics
CHEM*3440	[0.50]	Analytical Chemistry III: Analytical Instrumentation
CHEM*3640	[0.50]	Chemistry of the Elements I
CHEM*3860	[0.50]	Quantum Chemistry

0.50 electives\*

**Winter Semester**

COOP*2000	[0.00]	Co-op Work Term II
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**Semester 6 - Summer**

CHEM*3750	[0.50]	Organic Chemistry II
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One of:

PHYS*2260	[0.50]	Quantum Physics
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0.50 electives\*

1.50 electives\* or restricted electives\*\*

**Fall Semester**

COOP*3000	[0.00]	Co-op Work Term III
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**Semester 7 - Winter**

CHEM*3650	[0.50]	Chemistry of the Elements II
CHEM*3760	[0.50]	Organic Chemistry III

1.50 electives\* or restricted electives\*\*

**Summer Semester**

COOP*4000	[0.00]	Co-op Work Term IV
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**Semester 8 - Fall**

2.50 electives\* or restricted electives\*\*

\* selection of electives is subject to the following:

1. At least 1.00 credits must be in the Arts & Social Sciences.
2. PHYS\*2040 or PHYS\*2260
3. Approval of the Faculty Advisor must be obtained for the selection of courses not listed as restrictive electives.
4. Options for an "Area of Focus" or a minor are available. Subject areas include Biochemistry, Computing and Information Science, Earth Sciences, Environmental Sciences, Mathematical Sciences, and Physics. Please consult with your Faculty Advisor for more detail.

\*\* 3.00 credits from the 3000/4000 level as follows:

1. 1.50 comprising of (CHEM\*3870 or CHEM\*4880), (CHEM\*4620 or CHEM\*4630), (CHEM\*4720 or CHEM\*4730)
2. 1.50 chosen from CHEM\*3870, CHEM\*4010, CHEM\*4400, BIOC\*4520, BIOC\*4540, BIOC\*4580, CHEM\*4620, CHEM\*4630, CHEM\*4720, CHEM\*4730, CHEM\*4740, CHEM\*4880, CHEM\*4900, CHEM\*4910, MCB\*4050, MCB\*4080, TOX\*4590

**Note:**

Some of these courses are offered only in alternate years, and some have additional prerequisites for which the student must plan ahead, with the assistance of the faculty advisor.

**Stream B:** double work term option**Semester 1 - Fall**

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1200	[0.50]	Calculus I
PHYS*1000	[0.50]	An Introduction to Mechanics

0.50 Arts or Social Science electives

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

**Semester 2 - Winter**

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
COOP*1100	[0.00]	Introduction to Co-operative Education
MATH*1210	[0.50]	Calculus II



PHYS\*1010 [0.50] Introductory Electricity and Magnetism  
0.50 electives

**Semester 3 - Fall**

BIOC\*2580 [0.50] Introductory Biochemistry  
CHEM\*2060 [0.50] Structure and Bonding  
CHEM\*2400 [0.75] Analytical Chemistry I  
MATH\*2150 [0.50] Applied Matrix Algebra  
0.50 electives\*

**Winter Semester**

COOP\*1000 [0.00] Co-op Work Term I

**Semester 4 - Summer**

CHEM\*2070 [0.50] Structure and Spectroscopy  
CHEM\*2700 [0.50] Organic Chemistry I  
CHEM\*3430 [0.50] Analytical Chemistry II: Instrumental Analysis  
MATH\*2170 [0.50] Differential Equations I  
0.50 electives\*

**Semester 5 - Fall**

CHEM\*2820 [0.50] Thermodynamics and Kinetics  
CHEM\*3640 [0.50] Chemistry of the Elements I  
CHEM\*3750 [0.50] Organic Chemistry II  
CHEM\*3860 [0.50] Quantum Chemistry  
0.50 electives\*

**Semester 6 - Winter**

CHEM\*3650 [0.50] Chemistry of the Elements II  
CHEM\*3760 [0.50] Organic Chemistry III

One of:

PHYS\*2260 [0.50] Quantum Physics

0.50 electives\*

1.00 electives\* or restricted electives\*

**Summer Semester**

COOP\*2000 [0.00] Co-op Work Term II

**Fall Semester**

COOP\*3000 [0.00] Co-op Work Term III

**Semester 7 - Winter**

2.50 electives\* or restricted electives\*\*

**Summer Semester**

COOP\*4000 [0.00] Co-op Work Term IV

**Semester 8 - Fall**

CHEM\*3440 [0.50] Analytical Chemistry III: Analytical Instrumentation  
2.00 electives\* or restricted electives\*\*

\* selection of electives is subject to the following:

1. At least 1.00 credits must be in the Arts & Social Sciences.
2. PHYS\*2040 or PHYS\*2260
3. Approval of the Faculty Advisor must be obtained for the selection of courses not listed as restrictive electives.
4. Options for an "Area of Focus" or a minor are available. Subject areas include Biochemistry, Computing and Information Science, Earth Sciences, Environmental Sciences, Mathematical Sciences, and Physics. Please consult with your Faculty Advisor for more detail.

\*\* 3.00 credits from the 3000/4000 level as follows:

1. 1.50 comprising of (CHEM\*3870 or CHEM\*4880), (CHEM\*4620 or CHEM\*4630), (CHEM\*4720 or CHEM\*4730)
2. 1.50 chosen from CHEM\*3870, CHEM\*4010, CHEM\*4400, BIOC\*4520, BIOC\*4540, BIOC\*4580, CHEM\*4620, CHEM\*4630, CHEM\*4720, CHEM\*4730, CHEM\*4740, CHEM\*4880, CHEM\*4900, CHEM\*4910, MCB\*4050, MCB\*4080, TOX\*4590

**Note:**

Some of these courses are offered only in alternate years, and some have additional prerequisites for which the student must plan ahead, with the assistance of the faculty advisor.

**Computing and Information Science (CIS)****Department of Computing and Information Science, College of Physical and Engineering Science**

A knowledge of Computing is a complement to most areas of study. The Minor in Computing and Information Science is directed towards students who wish to supplement their studies in another area with some experience in Computing. Students interested in pursuing a Major in Computing can do so through the Bachelor of Computing Degree Program.

**Minor (Honours Program)**

CIS\*1500 [0.50] Introduction to Programming  
CIS\*1910 [0.50] Discrete Structures in Computing I

CIS\*2430 [0.50] Object Oriented Programming  
CIS\*2500 [0.50] Intermediate Programming  
CIS\*2520 [0.50] Data Structures  
CIS\*2750 [0.75] Software Systems Development and Integration  
CIS\*2910 [0.50] Discrete Structures in Computing II  
CIS\*3530 [0.50] Data Base Systems and Concepts  
1.00 additional credits from CIS or STAT courses at the 2000 level or above

**Earth Surface Science (ESS)****Department of Geography, College of Social and Applied Human Sciences****Department of Land Resource Science, Ontario Agricultural College**

This program combines elements of Geomorphology, Geology and Meteorology and focuses on the study of processes and properties of the abiotic component of the environment.

Graduates of the program should meet the knowledge requirements for eligibility to apply for membership as Environmental Geoscientists in the Association of Professional Geoscientists of Ontario (APGO), allowing for use of the designation P. Geo.

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. Students planning to enter the program are advised to consult advisors in either of the two departments. Students needing program approval should contact the B.Sc. Advisors in the Department of Geography.

**Major (Honours Program)****Semester 1**

BIOL\*1030 [0.50] Biology I  
CHEM\*1040 [0.50] General Chemistry I  
GEOL\*1050 [0.50] Geology and the Environment  
PHYS\*1080 [0.50] Physics for Life Sciences

0.50 Mathematics course from:

MATH\*1080 [0.50] Elements of Calculus I  
MATH\*1200 [0.50] Calculus I

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

**Semester 2**

BIOL\*1040 [0.50] Biology II  
CHEM\*1050 [0.50] General Chemistry II  
PHYS\*1130 [0.50] Physics with Applications  
GEOG\*1300 [0.50] Introduction to the Biophysical Environment

0.50 Arts or Social Science electives

**Semester 3 and 4**

GEOG\*2000 [0.50] Geomorphology  
GEOG\*2110 [0.50] Climate and the Biophysical Environment  
GEOL\*2020 [0.50] Stratigraphy  
GEOL\*2200 [0.50] Glacial Geology  
MET\*2030 [0.50] Meteorology and Climatology  
SOIL\*2010 [0.50] Soil Science

0.50 Mathematics/Computer Science from:

CIS\*1200 [0.50] Introduction to Computing  
CIS\*1500 [0.50] Introduction to Programming  
MATH\*1210 [0.50] Calculus II  
MATH\*2080 [0.50] Elements of Calculus II

One of:

GEOG\*2460 [0.50] Analysis in Geography  
STAT\*2040 [0.50] Statistics I

0.50 Arts or Social Science electives

0.50 electives

**Semester 5 and 6**

GEOG\*3000 [0.50] Fluvial Processes  
GEOG\*3610 [0.50] Environmental Hydrology  
GEOL\*2110 [0.50] Earth Material Science  
GEOL\*3190 [0.50] Environmental Water Chemistry

1.50 from List A

1.50 electives

**Semester 7 and 8**

GEOG\*4150 [0.50] Sedimentary Processes

1.50 from List A

3.00 electives

**List A**

GEOG\*3620 [0.50] Desert Environments  
GEOG\*4250 [0.50] Coastal Processes  
GEOG\*4690 [1.00] Geography Field Research  
GEOL\*3060 [0.50] Groundwater  
GEOL\*3090 [0.50] Applied Structural Geology  
GEOL\*3250 [0.50] Field Methods in Geosciences

GEOL*4090	[0.50]	Sedimentology
GEOL*4130	[0.50]	Clay and Humic Chemistry
MET*3050	[0.50]	Microclimatology

**Other Requirements**

1. At least 1.50 credits from List A must be at the 4000 level.
2. At least 2.50 electives must be acceptable science courses.
3. At least 6.00 of all science credits must be 3000 or 4000 level, of which at least 2.00 must be at the 4000 level.

**Ecology (ECOL)****Department of Integrative Biology, College of Biological Science**

The program provides a solid foundation in the principles of ecology, and further training in both pure and applied aspects of ecology. After the fourth semester, the student may choose to enter one (1) of three (3) areas of emphasis, or to design a course package that meets his/her own specific ecological interests (General Ecology). The program offers preparation for careers in conservation, resource management, ecological consulting, or nature interpretation; or for graduate training and research in fundamental ecology and evolutionary biology. This major qualifies students for post-graduate work in the environmental sciences, and provides a sound science background for students wishing to pursue careers in teaching, government service or the private sector.

**Major (Honours Program)**

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. A minimum total of 20.00 credits is required to complete the major.

**Semester 1**

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1080	[0.50]	Elements of Calculus I
PHYS*1070	[0.50]	Introductory Physics for Life Sciences

0.50 Arts or Social Science electives

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by the end of Semester 3.

**Semester 2**

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
PHYS*1080	[0.50]	Physics for Life Sciences

One of:

CIS*1200	[0.50]	Introduction to Computing
CIS*1500	[0.50]	Introduction to Programming

0.50 Arts or Social Science electives

**Semester 3**

MCB*2210	[0.50]	Introductory Cell Biology
STAT*2040	[0.50]	Statistics I

One of:

GEOG*1300	[0.50]	Introduction to the Biophysical Environment
GEOL*1050	[0.50]	Geology and the Environment

1.00 electives\*

**Semester 4**

BIOC*2580	[0.50]	Introductory Biochemistry
BIOL*3110	[0.50]	Population Ecology
MBG*2000	[0.50]	Introductory Genetics

One of:

BIOL*2250	[0.50]	Biostatistics and the Life Sciences
STAT*2050	[0.50]	Statistics II

0.50 electives\*

**Semester 5**

BIOL*3010	[0.50]	Laboratory and Field Work in Ecology
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One of:

BOT*2100	[0.50]	Life Strategies of Plants
ZOO*3200	[0.50]	Comparative Animal Physiology I

One of:

BIOL*3020	[0.50]	Population Genetics
BIOL*3400	[0.50]	Evolution

1.00 electives

**Semester 6**

BIOL*3120	[0.50]	Community Ecology
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2.00 electives

**Semester 7**

BIOL*4110	[0.75]	Ecological Methods
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1.75 electives

**Semester 8**

BIOL*4120	[0.50]	Evolutionary Ecology
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2.00 electives

\* Restricted Electives

One of:

ZOO*2090	[0.50]	Vertebrate Structure and Function
ZOO*2700	[0.50]	Invertebrate Morphology & Evolution

**Areas of Emphasis****General Ecology (GECO)**

A minimum of 3.00 credits from the area-of-emphasis-specific credits, plus 1.50 additional science credits. Of the 4.50 credits, at least 3.50 must be at the 3000 or 4000 level.

**Experimental Ecology (EECO)**

ZOO*4070	[0.50]	Animal Behaviour
ZOO*4170	[0.50]	Experimental Comparative Animal Physiology

0.75 credits from:

BIOL*4410	[0.75]	Field Ecology
BIOL*4600	[0.75]	Tropical Ecology
BIOL*4610	[0.75]	Arctic Ecology
BIOL*4700	[0.50]	Field Biology
BIOL*4710	[0.25]	Field Biology
BIOL*4800	[0.50]	Field Biology
BIOL*4810	[0.25]	Field Biology
IBIO*4500	[0.75]	Research in Integrative Biology I

One of the following not already successfully completed in Semester 6:

BIOL*3020	[0.50]	Population Genetics
BIOL*3400	[0.50]	Evolution

1.75 additional science credits, at least 1.50 of which are at the 3000 or 4000 level

**Interpretive Ecology (IE)**

ENVB*3000	[0.50]	Nature Interpretation
ZOO*4070	[0.50]	Animal Behaviour
ZOO*4910	[0.50]	Integrative Vertebrate Biology

0.75 credits from:

BIOL*4410	[0.75]	Field Ecology
BIOL*4600	[0.75]	Tropical Ecology
BIOL*4610	[0.75]	Arctic Ecology
BIOL*4700	[0.50]	Field Biology
BIOL*4710	[0.25]	Field Biology
BIOL*4800	[0.50]	Field Biology
BIOL*4810	[0.25]	Field Biology

At least 0.75 additional science credits at the 3000 or 4000 level

One of:

BIOL*3050	[0.50]	Mycology
BOT*3710	[0.50]	Plant Diversity and Evolution

One of:

ZOO*4920	[0.25]	Lab Studies in Ornithology
ZOO*4930	[0.25]	Lab Studies in Ichthyology
ZOO*4940	[0.25]	Lab Studies in Herpetology
ZOO*4950	[0.25]	Lab Studies in Mammalogy

One of:

BIOL*3450	[0.50]	Introduction to Aquatic Environments
ENVB*3090	[0.50]	Insect Diversity and Biology

Recommended:

CHEM*3360	[0.50]	Environmental Chemistry and Toxicology
ENVB*3040	[0.50]	Natural Chemicals in the Environment
ENVB*4040	[0.50]	Behaviour of Insects
MICR*4140	[0.50]	Soil Microbiology and Biotechnology

**Resource Conservation (RC)**

AGEC*2700	[0.50]	Survey of Natural Resource Economics
BIOL*3130	[0.50]	Conservation Biology
BIOL*4040	[0.50]	Natural Resources Policy
ECON*1050	[0.50]	Introductory Microeconomics

2.50 additional science credits, at least 1.50 of which are at the 3000 or 4000 level

Recommended:

BIOL*4060	[0.50]	Restoration Ecology
BIOL*4150	[0.50]	Wildlife Conservation and Management
ECON*2100	[0.50]	Economic Growth and Environmental Quality
ENVB*2030	[0.50]	Current Issues in Forest Science
ENVB*4780	[0.50]	Forest Ecology
ENVS*3320	[0.50]	Principles of Landscape Ecology

**Minor (Honours Program)**

A minimum of 5.00 credits is required to completed the minor, which must include:

BIOL*3010	[0.50]	Laboratory and Field Work in Ecology
BIOL*3110	[0.50]	Population Ecology
BIOL*3120	[0.50]	Community Ecology
BIOL*4110	[0.75]	Ecological Methods
BIOL*4120	[0.50]	Evolutionary Ecology

One of:

BIOL*3020	[0.50]	Population Genetics
BIOL*3400	[0.50]	Evolution

One of:

BOT*2100	[0.50]	Life Strategies of Plants
ZOO*2090	[0.50]	Vertebrate Structure and Function

One of:

GEOG*1220	[0.50]	Human Impact on the Environment
GEOG*1300	[0.50]	Introduction to the Biophysical Environment
GEOL*1050	[0.50]	Geology and the Environment

0.75 credits chosen in consultation with the faculty advisor

## Environmental Biology (ENVB)

### Department of Environmental Biology, Ontario Agricultural College

The honours B.Sc. program in Environmental Biology combines a broad education in the life sciences with a more specialized understanding of the biological consequences of interactions between humans and the environment. This major prepares students for post-graduate work in environmental biology and related life sciences and provides a strong foundation for students wishing to pursue careers in teaching, government service or the private sector.

### Major (Honours Program)

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. This major requires the completion of 20.00 credits. A minimum of 16.00 of these 20.00 must be science credits. Of these 16.00 science credits, a minimum of 6.00 must be at the 3000 - and 4000-levels with a minimum of 2.00 credits at the 4000-level.

#### Semester 1

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1080	[0.50]	Elements of Calculus I
PHYS*1070	[0.50]	Introductory Physics for Life Sciences

0.50 Arts or Social Science elective

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

#### Semester 2

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
PHYS*1080	[0.50]	Physics for Life Sciences

One of:

CIS*1200	[0.50]	Introduction to Computing
CIS*1500	[0.50]	Introduction to Programming
MATH*2080	[0.50]	Elements of Calculus II
STAT*2040	[0.50]	Statistics I

0.50 Arts or Social Science elective

#### Semester 3

BIOC*2580	[0.50]	Introductory Biochemistry
STAT*2040	[0.50]	Statistics I (if not taken in semester 2)
TOX*2000	[0.50]	Principles of Toxicology

1.00 electives or restricted electives chosen from lists A, B, C and/or D (or 1.50 if STAT\*2040 was taken in semester 2)

#### Semester 4

BIOL*3110	[0.50]	Population Ecology
ENVB*2100	[0.50]	Problem-Solving in Environmental Biology
MBG*2000	[0.50]	Introductory Genetics

1.00 electives or restricted electives chosen from lists A, B, C and/or D

#### Semester 5

2.50 electives or restricted electives chosen from lists A, B, C and/or D (at least 1.00 restricted electives must be selected, including at least one ENVB course)

#### Semester 6

BIOL*3400	[0.50]	Evolution
ENVB*3330	[0.50]	Ecosystem Processes and Applications

1.50 electives or restricted electives chosen from lists A, B, C and/or D

#### Semester 7

Students contemplating graduate studies are encouraged to take ENVB\*4420 and/or ENVB\*4800 in semesters 7 or 8.

2.50 electives or restricted electives chosen from lists A, B, C and/or D

#### Semester 8

2.50 electives or restricted electives chosen from lists A, B, C and/or D

### Restricted Electives

Select 4.50 credits from the following lists of restricted electives during Semesters 3-8. At least 1.00 of these credits must be from ENVB courses.

Students should note that some restricted electives (marked by asterisks \*\*) require other restricted electives as prerequisites. Students should consult the most recent undergraduate calendar for specific requirements.

### List A - Environment & Agriculture

Minimum of 1.00 credits from the following list:

CROP*2110	[0.50]	Crop Ecology
CROP*2280	[0.50]	Crops in Land Reclamation
ENVB*2010	[0.50]	Food Production and the Environment
ENVB*2040	[0.50]	Plant Health and the Environment
ENVB*3040	[0.50]	Natural Chemicals in the Environment
ENVB*3210	[0.50]	Plant Pathology
ENVB*4040	[0.50]	Behaviour of Insects **
ENVB*4100	[0.50]	Integrated Management of Invasive Insect Pests **
ENVB*4130	[0.50]	Chemical Ecology: Principles & Practice **
MICR*3220	[0.50]	Plant Microbiology
MICR*4140	[0.50]	Soil Microbiology and Biotechnology
NRS*3000	[0.50]	Environmental Issues in Agriculture and Landscape Management

PBIO\*4750 [0.50] Genetic Engineering of Plants \*\*

### List B - Impacts of Pollution on Living Organisms

Minimum of 1.00 credits from the following list:

BIOL*3450	[0.50]	Introduction to Aquatic Environments
BIOL*4350	[0.50]	Biology of Polluted Waters **
BIOL*4610	[0.75]	Arctic Ecology
ENVB*3010	[0.50]	Climate Change Biology
ENVB*3030	[0.50]	Pesticides and the Environment
ENVB*3280	[0.50]	Waterborne Disease Ecology
ENVB*4240	[0.50]	Biological Activity of Pesticides
ENVB*4550	[0.50]	Ecotoxicological Risk Characterization **
GEOG*3020	[0.50]	Global Environmental Change
MBG*4270	[0.50]	DNA Replication, Recombination and Repair **
MICR*4180	[0.50]	Microbial Processes in Environmental Management
PBIO*4530	[0.50]	Environmental Pollution Stresses on Plants **
TOX*3360	[0.50]	Environmental Chemistry and Toxicology

### List C - Conservation of Biodiversity & Natural Resources

Minimum of 1.00 credits from the following list:

BIOL*3130	[0.50]	Conservation Biology
BIOL*4040	[0.50]	Natural Resources Policy
BIOL*4150	[0.50]	Wildlife Conservation and Management
BIOL*4600	[0.75]	Tropical Ecology
ENVB*2030	[0.50]	Current Issues in Forest Science
ENVB*3090	[0.50]	Insect Diversity and Biology
ENVB*3230	[0.50]	Agroforestry Systems **
ENVB*3250	[0.50]	Forest Health and Disease
ENVB*3270	[0.50]	Forest Biodiversity **
ENVB*3300	[0.50]	Applied Ecology and Environment **
ENVB*4020	[0.50]	Water Quality and Environmental Management **
ENVB*4220	[0.50]	Biology of Aquatic Insects **
ENVB*4260	[0.50]	Field Entomology **
ENVB*4270	[0.50]	Insect Biosystematics **
ENVB*4780	[0.50]	Forest Ecology **
ENVS*4220	[0.50]	Environmental Impact Assessment**
NRS*2120	[0.50]	Introduction to Environmental Stewardship
NRS*3100	[0.50]	Resource Planning Techniques
SOIL*3050	[0.50]	Land Utilization **
SOIL*3080	[0.50]	Soil and Water Conservation **
ZOO*4110	[0.50]	Principles of Fish and Wild Life Management

### List D - Supporting Courses

ENVB*4420	[0.50]	Problems in Environmental Biology
ENVB*4800	[0.50]	Topics in Applied Biology

The following restricted elective courses are required as prerequisites for some courses in lists A, B and C:

BIOL*3120	[0.50]	Community Ecology
BOT*2100	[0.50]	Life Strategies of Plants
MBG*2020	[0.50]	Introductory Molecular Biology
SOIL*2010	[0.50]	Soil Science

### Environmental Toxicology (ETOX)

**Interdisciplinary Program, Department of Environmental Biology, Ontario Agricultural College**

### Major (Honours Program)

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor.

<b>Semester 1</b>			STAT*2040 [0.50] Statistics I
BIOL*1030 [0.50] Biology I			0.50 electives*
CHEM*1040 [0.50] General Chemistry I			<b>Semester 3 - Fall</b>
MATH*1080 [0.50] Elements of Calculus I			BIOC*2580 [0.50] Introductory Biochemistry
PHYS*1070 [0.50] Introductory Physics for Life Sciences			CHEM*2480 [0.50] Analytical Chemistry I
0.50 electives*			MBG*2000 [0.50] Introductory Genetics
Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.			TOX*2000 [0.50] Principles of Toxicology
			0.50 electives*
<b>Semester 2</b>			<b>Winter Semester</b>
BIOL*1040 [0.50] Biology II			COOP*1000 [0.00] Co-op Work Term I
CHEM*1050 [0.50] General Chemistry II			<b>Semester 4 - Summer</b>
PHYS*1080 [0.50] Physics for Life Sciences			CHEM*2700 [0.50] Organic Chemistry I
STAT*2040 [0.50] Statistics I			SOIL*2010 [0.50] Soil Science
0.50 electives*			STAT*2050 [0.50] Statistics II
<b>Semester 3</b>			TOX*3360 [0.50] Environmental Chemistry and Toxicology
BIOC*2580 [0.50] Introductory Biochemistry			0.50 electives*
CHEM*2480 [0.50] Analytical Chemistry I			<b>Semester 5 - Fall</b>
MBG*2000 [0.50] Introductory Genetics			BIOL*2060 [0.50] Ecology
TOX*2000 [0.50] Principles of Toxicology			BIOL*3450 [0.50] Introduction to Aquatic Environments
0.50 electives*			TOX*3300 [0.50] Analytical Toxicology
<b>Semester 4</b>			ZOO*3200 [0.50] Comparative Animal Physiology I
BIOL*2060 [0.50] Ecology			0.50 electives*
CHEM*2700 [0.50] Organic Chemistry I			<b>Semester 6 - Winter</b>
MBG*2020 [0.50] Introductory Molecular Biology			BIOC*3560 [0.50] Structure and Function in Biochemistry
STAT*2050 [0.50] Statistics II			BOT*2100 [0.50] Life Strategies of Plants
0.50 electives*			ENVB*3030 [0.50] Pesticides and the Environment
<b>Semester 5</b>			MBG*2020 [0.50] Introductory Molecular Biology
BOT*2100 [0.50] Life Strategies of Plants			ZOO*4170 [0.50] Experimental Comparative Animal Physiology
BIOC*3560 [0.50] Structure and Function in Biochemistry			0.50 electives*
TOX*3300 [0.50] Analytical Toxicology			<b>Semester 7</b>
ZOO*3200 [0.50] Comparative Animal Physiology I			BIOL*3450 [0.50] Introduction to Aquatic Environments
0.50 electives*			BIOL*4350 [0.50] Biology of Polluted Waters
<b>Semester 6</b>			MBG*3350 [0.75] Laboratory Methods in Molecular Biology I
ENVB*3030 [0.50] Pesticides and the Environment			MICR*4180 [0.50] Microbial Processes in Environmental Management
SOIL*2010 [0.50] Soil Science			0.25 electives*
TOX*3360 [0.50] Environmental Chemistry and Toxicology			<b>Semester 8</b>
ZOO*4170 [0.50] Experimental Comparative Animal Physiology			PBIO*4530 [0.50] Environmental Pollution Stresses on Plants
0.50 electives*			STAT*3510 [0.50] Environmental Risk Assessment
<b>Semester 7</b>			TOX*4200 [0.50] Topics in Toxicology
BIOL*3450 [0.50] Introduction to Aquatic Environments			TOX*4550 [0.50] Ecotoxicological Risk Characterization
BIOL*4350 [0.50] Biology of Polluted Waters			0.50 electives*
MBG*3350 [0.75] Laboratory Methods in Molecular Biology I			<b>Semester 8 - Fall</b>
MICR*4180 [0.50] Microbial Processes in Environmental Management			BIOL*4350 [0.50] Biology of Polluted Waters
0.25 electives*			MBG*3350 [0.75] Laboratory Methods in Molecular Biology I
<b>Semester 8</b>			MICR*4180 [0.50] Microbial Processes in Environmental Management
PBIO*4530 [0.50] Environmental Pollution Stresses on Plants			0.75 electives*
STAT*3510 [0.50] Environmental Risk Assessment			* a minimum of 1.50 credits must be from the College of Arts and/or the College of Social and Applied Human Sciences
TOX*4200 [0.50] Topics in Toxicology			<b>Food Science (FOOD)</b>
TOX*4550 [0.50] Ecotoxicological Risk Characterization			<b>Department of Food Science, Ontario Agricultural College</b>
0.50 electives*			<b>Major (Honours Program)</b>
* a minimum of 1.50 credits must be from the College of Arts and/or the College of Social and Applied Human Sciences			Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor.

### Environmental Toxicology (Co-op) (ETOX:C)

Interdisciplinary Program, Department of Environmental Biology, Ontario Agricultural College

#### Major (Honours Program)

A 70% average in the science courses of semesters 1 and 2 is normally required for admission to semester 3 of this program. An optional fourth co-op work term is available.

#### Semester 1

BIOL*1030 [0.50] Biology I		
CHEM*1040 [0.50] General Chemistry I		
MATH*1080 [0.50] Elements of Calculus I		
PHYS*1070 [0.50] Introductory Physics for Life Sciences		
0.50 electives*		

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

#### Semester 2

BIOL*1040 [0.50] Biology II		
CHEM*1050 [0.50] General Chemistry II		
COOP*1100 [0.00] Introduction to Co-operative Education		
PHYS*1080 [0.50] Physics for Life Sciences		

STAT*2040 [0.50] Statistics I		
0.50 electives*		

#### Semester 3 - Fall

BIOC*2580 [0.50] Introductory Biochemistry		
CHEM*2480 [0.50] Analytical Chemistry I		
MBG*2000 [0.50] Introductory Genetics		
TOX*2000 [0.50] Principles of Toxicology		
0.50 electives*		

#### Winter Semester

COOP*1000 [0.00] Co-op Work Term I		
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#### Semester 4 - Summer

CHEM*2700 [0.50] Organic Chemistry I		
SOIL*2010 [0.50] Soil Science		
STAT*2050 [0.50] Statistics II		
TOX*3360 [0.50] Environmental Chemistry and Toxicology		
0.50 electives*		

#### Semester 5 - Fall

BIOL*2060 [0.50] Ecology		
BIOL*3450 [0.50] Introduction to Aquatic Environments		
TOX*3300 [0.50] Analytical Toxicology		
ZOO*3200 [0.50] Comparative Animal Physiology I		
0.50 electives*		

#### Semester 6 - Winter

BIOC*3560 [0.50] Structure and Function in Biochemistry		
BOT*2100 [0.50] Life Strategies of Plants		
ENVB*3030 [0.50] Pesticides and the Environment		
MBG*2020 [0.50] Introductory Molecular Biology		
ZOO*4170 [0.50] Experimental Comparative Animal Physiology		

#### Summer Semester

COOP*2000 [0.00] Co-op Work Term II		
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#### Fall Semester

COOP*3000 [0.00] Co-op Work Term III		
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#### Semester 7 - Winter

PBIO*4530 [0.50] Environmental Pollution Stresses on Plants		
STAT*3510 [0.50] Environmental Risk Assessment		
TOX*4200 [0.50] Topics in Toxicology		
TOX*4550 [0.50] Ecotoxicological Risk Characterization		
0.50 electives*		

#### Semester 8 - Fall

BIOL*4350 [0.50] Biology of Polluted Waters		
MBG*3350 [0.75] Laboratory Methods in Molecular Biology I		
MICR*4180 [0.50] Microbial Processes in Environmental Management		
0.75 electives*		

\* a minimum of 1.50 credits must be from the College of Arts and/or the College of Social and Applied Human Sciences

### Food Science (FOOD)

Department of Food Science, Ontario Agricultural College

#### Major (Honours Program)

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor.

#### Semester 1 - Fall

BIOL*1030 [0.50] Biology I		
CHEM*1040 [0.50] General Chemistry I		
MATH*1080 [0.50] Elements of Calculus I		
PHYS*1070 [0.50] Introductory Physics for Life Sciences		
0.50 Arts or Social Science electives		

Note: CIS\*1200, rather than an Arts or Social Science credit is recommended for those needing to improve their computer skills.

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

#### Semester 2 - Winter

BIOL*1040 [0.50] Biology II		
CHEM*1050 [0.50] General Chemistry II		
MATH*2080 [0.50] Elements of Calculus II		
PHYS*1080 [0.50] Physics for Life Sciences		
0.50 Arts or Social Science electives		

#### Semester 3 - Fall

BIOC*2580 [0.50] Introductory Biochemistry		
CHEM*2880 [0.50] Physical Chemistry		
FOOD*2150 [0.50] Introduction to Nutritional and Food Science		
STAT*2040 [0.50] Statistics I		

0.50 electives

**Semester 4 - Winter**

FOOD*2100	[0.50]	Communication in Food Science I
FOOD*2620	[0.50]	Food Engineering Principles
MICR*2030	[0.50]	Microbial Growth
NUTR*3210	[0.50]	Fundamentals of Nutrition

0.50 electives

**Semester 5 - Fall**

FOOD*3030	[0.50]	Food Chemistry I
FOOD*3160	[0.75]	Food Processing I
FOOD*3230	[0.75]	Food Microbiology

0.50 electives

**Semester 6 - Winter**

FOOD*3040	[0.50]	Food Chemistry II
FOOD*3170	[0.50]	Food Processing II
FOOD*3260	[0.50]	Industrial Microbiology
FOOD*3700	[0.50]	Sensory Evaluation of Foods

0.50 electives

**Semester 7 - Fall**

FOOD*4120	[0.75]	Food Analysis
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1.75 electives

**Semester 8 - Winter**

FOOD*4100	[0.25]	Communication in Food Science II
FOOD*4700	[0.50]	Food Product Development

1.75 electives

**Notes:**

- ENGL\*1200 is recommended for those students needing to improve their English grammar.
- FOOD\*2150 could be replaced by FOOD\*2010 with permission of department advisor.
- Of the 6.50 electives credits:
  - At least 2.00 must be Arts or Social Sciences.
  - At least 2.00 must be from list of Restricted Electives.
  - At least 0.5 must be from additional science electives.

**Restricted Electives:**

FOOD*4070	[0.50]	Food Packaging
FOOD*4090	[0.50]	Functional Foods and Nutraceuticals
FOOD*4110	[0.50]	Meat and Poultry Processing
FOOD*4140	[0.25]	Communication in Food Science III
FOOD*4220	[0.25]	Topics in Food Science
FOOD*4230	[0.25]	Research in Food Science I
FOOD*4240	[0.25]	Research in Food Science II
FOOD*4310	[0.50]	Food Safety Management Systems
FOOD*4400	[0.50]	Dairy Processing
FOOD*4520	[0.50]	Utilization of Cereal Grains for Human Food
MCS*3010	[0.50]	Quality Management
POPM*4040	[0.50]	Epidemiology of Food-borne Diseases

**Credit Summary (20.00 total credits)**

4.00 - 1st year science required

9.50 - Required in semesters 3-8

2.00 - Restricted electives

2.00 - Arts or Social Science electives

0.50 - Additional Science electives

2.00 - Free electives

**Minor (Honours Program)**

The Minor in Food Science consists of 5.00 credits as follows:

BIOC*2580	[0.50]	Introductory Biochemistry
FOOD*3030	[0.50]	Food Chemistry I
FOOD*3230	[0.75]	Food Microbiology
MICR*2030	[0.50]	Microbial Growth

One of:

FOOD*2010	[0.50]	Principles of Food Science
FOOD*2150	[0.50]	Introduction to Nutritional and Food Science
NUTR*2150	[0.50]	Introduction to Nutritional and Food Sciences

One of:

FOOD*2410	[0.50]	Introduction to Food Processing
FOOD*3160	[0.75]	Food Processing I

**Restricted Electives**

Choose from the following list to bring the total to a minimum of 5.00 credits for the Minor:

FOOD*2620	[0.50]	Food Engineering Principles
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FOOD*3040	[0.50]	Food Chemistry II
FOOD*3170	[0.50]	Food Processing II
FOOD*3260	[0.50]	Industrial Microbiology
FOOD*3700	[0.50]	Sensory Evaluation of Foods
FOOD*4070	[0.50]	Food Packaging
FOOD*4090	[0.50]	Functional Foods and Nutraceuticals
FOOD*4110	[0.50]	Meat and Poultry Processing
FOOD*4120	[0.75]	Food Analysis
FOOD*4310	[0.50]	Food Safety Management Systems
FOOD*4400	[0.50]	Dairy Processing
FOOD*4520	[0.50]	Utilization of Cereal Grains for Human Food
FOOD*4700	[0.50]	Food Product Development
NUTR*3210	[0.50]	Fundamentals of Nutrition
POPM*4040	[0.50]	Epidemiology of Food-borne Diseases

**Food Science (Co-op) (FOOD:C)****Department of Food Science, Ontario Agricultural College****Major (Honours Program)****Semester 1 - Fall**

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1080	[0.50]	Elements of Calculus I
PHYS*1070	[0.50]	Introductory Physics for Life Sciences

0.50 Arts or Social Science electives

Note: CIS\*1200, rather than an Arts or Social Science credit is recommended for those needing to improve their computer skills.

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

**Semester 2 - Winter**

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
MATH*2080	[0.50]	Elements of Calculus II
PHYS*1080	[0.50]	Physics for Life Sciences

0.50 Arts or Social Science electives

**Summer Semester**

Off

**Semester 3 - Fall**

BIOC*2580	[0.50]	Introductory Biochemistry
CHEM*2880	[0.50]	Physical Chemistry
COOP*1100	[0.00]	Introduction to Co-operative Education
FOOD*2150	[0.50]	Introduction to Nutritional and Food Science
STAT*2040	[0.50]	Statistics I

0.50 electives

**Semester 4 - Winter**

FOOD*2100	[0.50]	Communication in Food Science I
FOOD*2620	[0.50]	Food Engineering Principles
MICR*2030	[0.50]	Microbial Growth
NUTR*3210	[0.50]	Fundamentals of Nutrition

0.50 electives

**Summer Semester**

COOP*1000	[0.00]	Co-op Work Term I
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**Semester 5 - Fall**

FOOD*3030	[0.50]	Food Chemistry I
FOOD*3160	[0.75]	Food Processing I
FOOD*3230	[0.75]	Food Microbiology

0.50 electives

**Semester 6 - Winter**

FOOD*3040	[0.50]	Food Chemistry II
FOOD*3170	[0.50]	Food Processing II
FOOD*3260	[0.50]	Industrial Microbiology
FOOD*3700	[0.50]	Sensory Evaluation of Foods

0.50 electives

**Summer Semester**

Optional

**Fall Semester**

COOP*2000	[0.00]	Co-op Work Term II
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**Winter Semester**

COOP*3000	[0.00]	Co-op Work Term III
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**Semester 7 - Fall**

FOOD*4120	[0.75]	Food Analysis
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1.75 electives

**Semester 8 - Winter**

FOOD*4100	[0.25]	Communication in Food Science II
FOOD*4700	[0.50]	Food Product Development
1.75 electives		

**Notes:**

See Notes and Credit Summary in Food Science Major.

**Forest Systems (FSYS)****Department of Environmental Biology, Ontario Agricultural College****Minor (Honours Program)**

A minor in Forest Systems consists of 5.00 credits from the following courses:

ENVB*2030	[0.50]	Current Issues in Forest Science
ENVB*4400	[0.50]	Forest Systems Field Camp
ENVB*4780	[0.50]	Forest Ecology

Two of:

ENVB*3230	[0.50]	Agroforestry Systems
ENVB*3250	[0.50]	Forest Health and Disease
ENVB*3270	[0.50]	Forest Biodiversity

One of:

ENVB*3300	[0.50]	Applied Ecology and Environment
ENVB*3330	[0.50]	Ecosystem Processes and Applications

Four of:

BIOL*2150	[0.50]	Natural History of Ontario
BIOL*3130	[0.50]	Conservation Biology
BIOL*4040	[0.50]	Natural Resources Policy
BOT*2030	[0.50]	Plants in the Ontario Landscape
ENVB*3010	[0.50]	Climate Change Biology
GEOG*3110	[0.50]	Biotic and Natural Resources
GEOG*3610	[0.50]	Environmental Hydrology
GEOG*4110	[0.50]	Environmental Systems Analysis
HORT*3350	[0.50]	Woody Plant Production and Culture
SOIL*2010	[0.50]	Soil Science

\* ENVB\*4400 is preferred, but may be substituted by ENVB\*4420, NRS\*4110 or ZOO\*4410 with the approval of the faculty advisor.

**Functional Foods and Nutraceuticals (FFAN)****Department of Human Health and Nutritional Sciences, College of Biological Science****Department of Food Science, Ontario Agricultural College.****Minor (Honours Program)**

A minor in Functional Foods and Nutraceuticals consists of 5.00 credits.

BIOC*2580	[0.50]	Introductory Biochemistry
ECON*1050	[0.50]	Introductory Microeconomics
NUTR*3210	[0.50]	Fundamentals of Nutrition
TOX*2000	[0.50]	Principles of Toxicology

One of:

FOOD*2010	[0.50]	Principles of Food Science
FOOD*2150	[0.50]	Introduction to Nutritional and Food Science
NUTR*2150	[0.50]	Introduction to Nutritional and Food Sciences

One of:

FOOD*4090	[0.50]	Functional Foods and Nutraceuticals
NUTR*4090	[0.50]	Functional Foods and Nutraceuticals

2.00 Restricted Electives\*

\*restricted electives should be chosen in consultation with the Nutritional and Nutraceutical Sciences faculty advisor. Any 3000 and 4000 level courses from the following subject areas are eligible as restricted electives: Nutrition\*\*, Food Science\*\*, Biomedical Sciences\*\*, Toxicology, Population Medicine, Animal Science, Plant Biology, Human Kinetics\*\*, and Pathology.

\*\*students in these majors must select restricted electives outside of the major

**Geographic Information Systems (GIS) and Environmental Analysis****Department of Geography, College of Social and Applied Human Sciences****Minor (Honours Program)**

A minimum of 5.00 credits is required from:

GEOG*1300	[0.50]	Introduction to the Biophysical Environment
GEOG*2420	[0.50]	Aerial-photo Interpretation
GEOG*2480	[0.50]	Mapping and GIS
GEOG*3210	[0.50]	Management of the Biophysical Environment
GEOG*3420	[0.50]	Remote Sensing of the Environment
GEOG*3480	[0.50]	GIS and Spatial Analysis
GEOG*4480	[0.50]	Applied Geographic Information Systems

One of:

GEOG*2000	[0.50]	Geomorphology
GEOG*2110	[0.50]	Climate and the Biophysical Environment

One of:

GEOG*3110	[0.50]	Biotic and Natural Resources
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GEOG*3610	[0.50]	Environmental Hydrology
GEOG*3620	[0.50]	Desert Environments

And one of:

GEOG*4110	[0.50]	Environmental Systems Analysis
GEOG*4210	[0.50]	Environmental Governance

[Note: GEOG\*3110 or GEOG\*3610 is required as prerequisite for GEOG\*4110]

**Geology (GEOL)****Department of Land Resource Science, Ontario Agricultural College****Minor (Honours Program)**

A minor will consist of at least 5.00 credits in Geology. The following 7 courses are mandatory:

GEOL*1050	[0.50]	Geology and the Environment
GEOL*2020	[0.50]	Stratigraphy
GEOL*2110	[0.50]	Earth Material Science
GEOL*2200	[0.50]	Glacial Geology
GEOL*3090	[0.50]	Applied Structural Geology
GEOL*3120	[0.50]	Paleontology
GEOL*4090	[0.50]	Sedimentology

The remaining credits can be chosen from Geology or the Geomorphology offerings in Geography in the calendar and must be 2000 level or above.

**Human Kinetics (HK)****Department of Human Health and Nutritional Sciences, College of Biological Science**

Human Kinetics is concerned with understanding capacities for, and limits of, human movement at different ages and with the role of physical activity in human health. Through the use of electives, students may structure a program emphasizing biomechanics and ergonomics, human population biology or nutrition, exercise and metabolism.

If lacking the fundamentals of word processing, spread sheet use and data management, the student should select CIS\*1200 as early in the program as possible.

**Major (Honours Program)**

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. A minimum of 20.00 credits is required.

**Semester 1**

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1080	[0.50]	Elements of Calculus I
PHYS*1070	[0.50]	Introductory Physics for Life Sciences

0.50 electives or restricted electives

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

**Semester 2**

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
PHYS*1080	[0.50]	Physics for Life Sciences

1.00 electives or restricted electives

**Semester 3**

BIOC*2580	[0.50]	Introductory Biochemistry
MBG*2000	[0.50]	Introductory Genetics
MCB*2210	[0.50]	Introductory Cell Biology

1.00 electives or restricted electives

**Semester 4**

HK*2270	[0.50]	Principles of Human Biomechanics
MBG*2020	[0.50]	Introductory Molecular Biology
NUTR*3210	[0.50]	Fundamentals of Nutrition
ZOO*2100	[0.50]	Developmental Biology

0.50 electives or restricted electives

**Semester 5**

HK*3401	[0.75]	Human Anatomy
HK*3600	[0.75]	Applied Human Biology
HK*3940	[1.25]	Human Physiology

**Semester 6**

BIOC*3560	[0.50]	Structure and Function in Biochemistry
HK*3402	[0.75]	Human Anatomy
STAT*2040	[0.50]	Statistics I

0.50 electives or restricted electives

**Semester 7**

If desired, electives or restricted electives up to a maximum of 2.75 total credits.

**Semester 8**

If desired, electives or restricted electives up to a maximum of 2.75 total credits.

**Note:** Students are required to complete 16.00 credits in acceptable science courses.

**Restricted Electives**

Students must complete 2.00 credits from Arts or Social Science courses with the recommendation that 0.50 of the 2.00 credits be in philosophy. A minimum of 2.00 credits of restricted electives is required. They are to be selected from HK\*3100, HK\*4XXX, NUTR\*4090, NUTR\*4210.

**Marine and Freshwater Biology (MFB)****Department of Integrative Biology, College of Biological Science**

The Major in Marine and Freshwater Biology provides a broad ecological perspective on aquatic environments based on the physical as well as the biological sciences. This major prepares students for post-graduate work in the aquatic sciences, and provides a sound science background for students wishing to pursue careers in teaching, government service or the private sector.

**Major (Honours Program)**

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. A minimum total of 20.00 credits is required to complete the major.

**Semester 1**

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1080	[0.50]	Elements of Calculus I
PHYS*1070	[0.50]	Introductory Physics for Life Sciences

0.50 Arts or Social Science electives\*

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by the end of Semester 3.

**Semester 2**

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
PHYS*1080	[0.50]	Physics for Life Sciences
STAT*2040	[0.50]	Statistics I

0.50 Arts or Social Science electives\*

**Semester 3**

ZOO*2090	[0.50]	Vertebrate Structure and Function
ZOO*2100	[0.50]	Developmental Biology

1.50 electives\*\*

**Semester 4**

BIOC*2580	[0.50]	Introductory Biochemistry
MBG*2000	[0.50]	Introductory Genetics
MCB*2210	[0.50]	Introductory Cell Biology
ZOO*2700	[0.50]	Invertebrate Morphology & Evolution

0.50 electives\*\*

**Semester 5**

BIOL*3110	[0.50]	Population Ecology
BIOL*3400	[0.50]	Evolution
BIOL*3450	[0.50]	Introduction to Aquatic Environments
ZOO*3200	[0.50]	Comparative Animal Physiology I
ZOO*3700	[0.50]	Integrative Biology of Invertebrates

**Semester 6**

BIOL*3120	[0.50]	Community Ecology
ZOO*3210	[0.50]	Comparative Animal Physiology II

1.50 electives\*\*, \*\*\*

**Semester 7**

BIOL*4350	[0.50]	Biology of Polluted Waters
ZOO*4570	[0.50]	Marine Ecological Processes
ZOO*4910	[0.50]	Integrative Vertebrate Biology
ZOO*4930	[0.25]	Lab Studies in Ichthyology

0.75 electives\*\*

**Semester 8**

BIOL*4010	[0.50]	Adaptational Physiology
ZOO*4330	[0.50]	Biology of Fishes

1.50 electives\*\*

\* CIS\*1200 is recommended for those needing to improve their computer skills

\*\* suggested electives list available from the faculty advisors

\*\*\* BIOL\*2250 is strongly recommended if independent research project courses are anticipated in semesters 7 and/or 8

**Electives - must include:**

1. A minimum of 0.75 credits from:

BIOL*4110	[0.75]	Ecological Methods
BIOL*4410	[0.75]	Field Ecology
BIOL*4600	[0.75]	Tropical Ecology
BIOL*4610	[0.75]	Arctic Ecology
BIOL*4700	[0.50]	Field Biology

BIOL*4710	[0.25]	Field Biology
BIOL*4800	[0.50]	Field Biology
BIOL*4810	[0.25]	Field Biology
IBIO*4500	[0.75]	Research in Integrative Biology I
IBIO*4510	[0.75]	Research in Integrative Biology II
IBIO*4521/2	[2.00]	Thesis in Integrative Biology
ZOO*4300	[0.75]	Marine Biology and Oceanography
ZOO*4540	[0.50]	Marine and Freshwater Research

2. Other field or research courses with approval of faculty advisor.

3. At least 1.00 Arts and/or Social Science electives.

**Mathematical Science (MSCI)****Department of Mathematics & Statistics, College of Physical and Engineering Science****Minor (Honours Program)**

This requires 1.00 calculus credits and 4.00 other credits chosen from mathematics, statistics, and computing and information science. For these 4.00 credits students will choose at least 0.50 from each discipline. At least 1.00 credits must be at the 3000 level or above. This minor cannot be combined with a major in Mathematics, Statistics, or Computing and Information Science.

**Mathematics (MATH)****Department of Mathematics and Statistics, College of Physical and Engineering Science****Major (Honours Program)**

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. A total of 20.00 credits is required to complete the Major which includes at least 10.00 credits in Mathematics & Statistics. This major must include at least 6.00 credits at the 3000 or 4000 level from the approved list of science electives of which at least 2.00 credits must be at the 4000 level (and may include STAT\*4340). At least 1.00 credits in Arts and Social Science must be completed.

**Semester 1**

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
CIS*1500	[0.50]	Introduction to Programming
MATH*1200	[0.50]	Calculus I
PHYS*1000	[0.50]	An Introduction to Mechanics

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

**Semester 2**

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
MATH*1210	[0.50]	Calculus II
PHYS*1010	[0.50]	Introductory Electricity and Magnetism

0.50 electives (CIS\*2500 recommended)

**Semester 3**

MATH*2000	[0.50]	Set Theory
MATH*2160	[0.50]	Linear Algebra I
MATH*2200	[0.50]	Advanced Calculus I
STAT*2040	[0.50]	Statistics I

0.50 Arts or Social Science electives

**Semester 4**

MATH*2130	[0.50]	Numerical Methods
MATH*2170	[0.50]	Differential Equations I
MATH*2210	[0.50]	Advanced Calculus II

One of:

MATH*3160	[0.50]	Linear Algebra II
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0.50 electives

**Semester 5**

MATH*3100	[0.50]	Differential Equations II
MATH*3200	[0.50]	Real Analysis

One of:

MATH*3130	[0.50]	Abstract Algebra
MATH*3240	[0.50]	Operations Research

One of:\*

STAT*3100	[0.50]	Introductory Mathematical Statistics I
STAT*3240	[0.50]	Applied Regression Analysis

0.50 electives

**Note:** Students who wish to take STAT\*4340 in semester 8 should take STAT\*3100 in semester 5, STAT\*3110 in semester 6 and STAT\*3240 in semester 5 or 7.

**Semester 6**

MATH*3260	[0.50]	Complex Analysis
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One of:

MATH\*3160 [0.50] Linear Algebra II (if not taken in Sem. 4)

0.50 electives

1.50 electives

### Semester 7

0.50 credits from a 4000 level mathematics

1.50 electives\*\*

One of:

MATH\*3130 [0.50] Abstract Algebra

MATH\*3240 [0.50] Operations Research

### Semester 8

1.00 credits from a 4000 level mathematics \*\*

1.50 electives

\*A student selecting STAT\*3100 should take STAT\*3110 in semester 6.

\*\*Students are reminded that the major requires 2.00 credits (four courses) at the 4000 level in Mathematics.

### Minor (Honours Program)

A total of 5.00 credits is required to complete the Minor, including:

2.50 credits from:

(MATH\*1080 or MATH\*1200)

(MATH\*1210 or MATH\*2080)

MATH\*2000 [0.50] Set Theory

(MATH\*2150 or MATH\*2160)

MATH\*2200 [0.50] Advanced Calculus I

0.50 Statistics (STAT\*) credits at the 2000 level or above.

2.00 additional Mathematics credits at the 2000 level or above, including 1.50 credits at the 3000 or 4000 level.

### Microbiology (MICR)

#### Department of Molecular and Cellular Biology, College of Biological Science

Microbiology programs are designed to give students a good understanding of microorganisms, including diversity, ecology, physiology, molecular genetics, current approaches in bacterial genomics/proteomics, and microbial associations with animal hosts and the environments. Such knowledge will provide the basis for further work with microbes in medicine, agricultural industries (including biotechnology, pharmaceuticals, food and beverage) and the environment (surveillance and bioremediation).

Students can take the B.Sc. program with a Major or a Minor in Microbiology, or combine the minor with another major. Students should plan their programs in consultation with the microbiology faculty advisor. As course offerings may change during the program, students are strongly encouraged to review their plans at least once a year with their advisors, and to check the departmental website for program news.

### Major (Honours Program)

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. A total of 20.00 credits is required to complete the major.

#### Semester 1

BIOL\*1030 [0.50] Biology I

CHEM\*1040 [0.50] General Chemistry I

MATH\*1080 [0.50] Elements of Calculus I

PHYS\*1070 [0.50] Introductory Physics for Life Sciences

0.50 electives

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

#### Semester 2

BIOL\*1040 [0.50] Biology II

CHEM\*1050 [0.50] General Chemistry II

PHYS\*1080 [0.50] Physics for Life Sciences

One mathematics/computer course from:

CIS\*1200 [0.50] Introduction to Computing

CIS\*1500 [0.50] Introduction to Programming

MATH\*2080 [0.50] Elements of Calculus II

0.50 electives

#### Semester 3

BIOC\*2580 [0.50] Introductory Biochemistry

MBG\*2000 [0.50] Introductory Genetics

MICR\*2020 [0.50] Microbial Interactions and Associations

STAT\*2040 [0.50] Statistics I

0.50 electives

#### Semester 4

MBG\*2020 [0.50] Introductory Molecular Biology

MCB\*2210 [0.50] Introductory Cell Biology

MICR\*2030 [0.50] Microbial Growth

1.00 electives

#### Semester 5

BIOC\*3560 [0.50] Structure and Function in Biochemistry

MBG\*3080 [0.50] Bacterial Genetics

MICR\*3120 [0.50] Systematic Bacteriology

MICR\*3230 [0.50] Immunology I

MICR\*3330 [0.50] World of Viruses

#### Semester 6

BIOL\*3050 [0.50] Mycology

MBG\*3350 [0.75] Laboratory Methods in Molecular Biology I

MICR\*3260 [0.50] Microbial Adaptation and Development

0.75 electives

#### Semester 7

2.50 electives or restricted electives which can include MCB\*4500

#### Semester 8

2.50 electives or restricted electives which can include MCB\*4510

#### Elective and Restricted Elective Credits

2.00 elective credits must be from the Arts and Social Sciences.

2.50 restricted elective credits of which 1.00 credit must be at the 4000 level.

A minimum of 6.00 science credits must be at the 3000/4000 level of which at least 2.00 credits must be at the 4000 level (including the 1.00 restricted elective credit).

#### Restricted Electives

BIOC\*4540 [0.50] Enzymology

BIOC\*4580 [0.50] Membrane Biochemistry

FOOD\*3230 [0.75] Food Microbiology

FOOD\*3260 [0.50] Industrial Microbiology

FOOD\*4400 [0.50] Dairy Processing

MCB\*4060 [0.50] Molecular & Cell Biology of Yeast

MCB\*4080 [0.50] Applied Microbiology and Biochemistry

MCB\*4500 [1.00] Research Project in Molecular & Cellular Biology I

MCB\*4510 [1.00] Research Project in Molecular & Cellular Biology 2

MCB\*4600 [0.50] Topics in Molecular and Cellular Biology

MICR\*3220 [0.50] Plant Microbiology

MICR\*3270 [0.50] Microbial Cell Biology

MICR\*4010 [0.50] Pathogenic Bacteriology

MICR\*4230 [0.50] Immunology II

MICR\*4280 [0.50] Microbial Ecology

MICR\*4330 [0.50] Molecular Virology

MICR\*4430 [0.50] Medical Virology

One of:

MICR\*4140 [0.50] Soil Microbiology and Biotechnology

MICR\*4180 [0.50] Microbial Processes in Environmental Management

### Minor (Honours Program)

The minor in Microbiology consists of the following 5.25 credits:

2.25 credits including:

BIOC\*3560 [0.50] Structure and Function in Biochemistry

MBG\*3350 [0.75] Laboratory Methods in Molecular Biology I

MICR\*2020 [0.50] Microbial Interactions and Associations

MICR\*2030 [0.50] Microbial Growth

2.00 credits from:

BIOL\*3050 [0.50] Mycology

FOOD\*3230 [0.75] Food Microbiology

FOOD\*3260 [0.50] Industrial Microbiology

MBG\*2020 [0.50] Introductory Molecular Biology

MBG\*3080 [0.50] Bacterial Genetics

MICR\*3120 [0.50] Systematic Bacteriology

MICR\*3220 [0.50] Plant Microbiology

MICR\*3230 [0.50] Immunology I

MICR\*3260 [0.50] Microbial Adaptation and Development

MICR\*3270 [0.50] Microbial Cell Biology

MICR\*3330 [0.50] World of Viruses

MICR\*4140 [0.50] Soil Microbiology and Biotechnology

MICR\*4180 [0.50] Microbial Processes in Environmental Management

1.00 credits from:

MCB\*4060 [0.50] Molecular & Cell Biology of Yeast

MCB\*4080 [0.50] Applied Microbiology and Biochemistry

MICR\*4010 [0.50] Pathogenic Bacteriology

MICR\*4230 [0.50] Immunology II

MICR\*4280 [0.50] Microbial Ecology

MICR\*4330 [0.50] Molecular Virology

MICR\*4430 [0.50] Medical Virology

### Microbiology (Co-op) (MICR:C)

#### Department of Molecular and Cellular Biology, College of Biological Science



Students in the Major in Microbiology program may take the Co-op option. Students do not begin their first work term until they have completed semester 3 and courses BIOL\*1030, BIOL\*1040 and MICR\*2030. Students in the co-op program must also complete COOP\*1100 in the second academic semester. At least 3 work terms (COOP\*1000, COOP\*2000, COOP\*3000) are required in the co-op program, and the course requirements are the same as shown for the major program. Some courses must be taken during a different semester than usual, and Co-op students may require an additional semester to meet all the program requirements. Students should plan their programs in consultation with the faculty advisor.

### Stream A

#### Semester 1 - Fall

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1080	[0.50]	Elements of Calculus I
PHYS*1070	[0.50]	Introductory Physics for Life Sciences

0.50 electives

Students who are admitted to the Co-op Program but deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

#### Semester 2 - Winter

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
COOP*1100	[0.00]	Introduction to Co-operative Education
PHYS*1080	[0.50]	Physics for Life Sciences

One mathematics/computer course from:

CIS*1200	[0.50]	Introduction to Computing
CIS*1500	[0.50]	Introduction to Programming
MATH*2080	[0.50]	Elements of Calculus II

0.50 electives

#### Summer Semester

No academic semester or work term

#### Semester 3 - Fall

BIOC*2580	[0.50]	Introductory Biochemistry
MBG*2000	[0.50]	Introductory Genetics
MICR*2020	[0.50]	Microbial Interactions and Associations
MICR*2030	[0.50]	Microbial Growth

0.50 electives

#### Winter Semester

COOP*1000	[0.00]	Co-op Work Term I
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#### Semester 4 - Summer

MBG*2020	[0.50]	Introductory Molecular Biology
MCB*2210	[0.50]	Introductory Cell Biology
STAT*2040	[0.50]	Statistics I

1.00 electives

#### Semester 5 - Fall

BIOC*3560	[0.50]	Structure and Function in Biochemistry
MBG*3080	[0.50]	Bacterial Genetics
MICR*3120	[0.50]	Systematic Bacteriology
MICR*3230	[0.50]	Immunology I
MICR*3330	[0.50]	World of Viruses

#### Semester 6 - Winter

BIOL*3050	[0.50]	Mycology
MBG*3350	[0.75]	Laboratory Methods in Molecular Biology I
MICR*3260	[0.50]	Microbial Adaptation and Development

0.75 electives

#### Summer - Semester

COOP*2000	[0.00]	Co-op Work Term II
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#### Fall Semester

COOP*3000	[0.00]	Co-op Work Term III
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#### Semester 7 - Winter

2.50 electives or restricted electives which can include MCB\*4500

#### Summer Semester

COOP*4000	[0.00]	Co-op Work Term IV (optional)
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#### Semester 8 - Fall

2.50 electives or restricted electives which can include MCB\*4510

### Stream B

#### Semester 1 - Fall

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1080	[0.50]	Elements of Calculus I
PHYS*1070	[0.50]	Introductory Physics for Life Sciences

0.50 electives

Students who are admitted to the Co-op Program but deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

#### Semester 2 - Winter

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
COOP*1100	[0.00]	Introduction to Co-operative Education
PHYS*1080	[0.50]	Physics for Life Sciences

One mathematics/computer course from:

CIS*1200	[0.50]	Introduction to Computing
CIS*1500	[0.50]	Introduction to Programming
MATH*2080	[0.50]	Elements of Calculus II

0.50 electives

#### Summer Semester

No academic semester or work term

#### Semester 3 - Fall

BIOC*2580	[0.50]	Introductory Biochemistry
MBG*2000	[0.50]	Introductory Genetics
MICR*2020	[0.50]	Microbial Interactions and Associations
MICR*2030	[0.50]	Microbial Growth

0.50 electives

#### Winter Semester

COOP*1000	[0.00]	Co-op Work Term I
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#### Semester 4 - Summer

MBG*2020	[0.50]	Introductory Molecular Biology
MCB*2210	[0.50]	Introductory Cell Biology
STAT*2040	[0.50]	Statistics I

1.00 electives

#### Fall Semester

COOP*2000	[0.00]	Co-op Work Term II
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#### Semester 5 - Winter

BIOC*3560	[0.50]	Structure and Function in Biochemistry
BIOL*3050	[0.50]	Mycology
MBG*3350	[0.75]	Laboratory Methods in Molecular Biology I
MICR*3330	[0.50]	World of Viruses

0.25 electives

#### Summer Semester

COOP*3000	[0.00]	Co-op Work Term III
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#### Semester 6 - Fall

MICR*3120	[0.50]	Systematic Bacteriology
MICR*3230	[0.50]	Immunology I
MBG*3080	[0.50]	Bacterial Genetics

1.00 electives

#### Semester 7 - Winter

MICR*3260	[0.50]	Microbial Adaptation and Development
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2.00 electives or restricted electives which can include MCB\*4500

#### Summer Semester

COOP*4000	[0.00]	Co-op Work Term IV (optional)
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#### Semester 8 - Fall

2.50 electives or restricted electives which can include MCB\*4510

### Elective and Restricted Elective Credits

2.00 elective credits must be from the Arts and Social Sciences.

2.50 restricted elective credits of which 1.00 credit must be at the 4000 level.

A minimum of 6.00 science credits must be at the 3000/4000 level of which at least 2.00 credits must be at the 4000 level (including the 1.00 restricted elective credit).

#### Restricted Electives

BIOC*4540	[0.50]	Enzymology
BIOC*4580	[0.50]	Membrane Biochemistry
FOOD*3230	[0.75]	Food Microbiology
FOOD*3260	[0.50]	Industrial Microbiology
FOOD*4400	[0.50]	Dairy Processing
MCB*4060	[0.50]	Molecular & Cell Biology of Yeast
MCB*4080	[0.50]	Applied Microbiology and Biochemistry
MCB*4500	[1.00]	Research Project in Molecular & Cellular Biology I
MCB*4510	[1.00]	Research Project in Molecular & Cellular Biology 2
MCB*4600	[0.50]	Topics in Molecular and Cellular Biology
MICR*3220	[0.50]	Plant Microbiology
MICR*3270	[0.50]	Microbial Cell Biology
MICR*4010	[0.50]	Pathogenic Bacteriology
MICR*4230	[0.50]	Immunology II
MICR*4280	[0.50]	Microbial Ecology
MICR*4330	[0.50]	Molecular Virology

MICR*4430	[0.50]	Medical Virology
One of:		
MICR*4140	[0.50]	Soil Microbiology and Biotechnology
MICR*4180	[0.50]	Microbial Processes in Environmental Management

## Molecular Biology and Genetics (MBG)

### Department of Molecular and Cellular Biology, College of Biological Science

The B.Sc. program with a Major in Molecular Biology and Genetics is a broadly based program in genetics including related areas of cell and molecular biology. In consultation with the Faculty Advisor, students can choose a general program or can focus their courses in areas such as molecular biology, cell biology, developmental biology, genetics, or agricultural genetics. The program qualifies students for postgraduate training in cell or molecular biology and genetics including clinical genetics and genetic counselling, and provides an excellent background for careers in biotechnology, toxicology, agriculture and medical research. Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor.

### Major (Honours Program)

A total of 20.00 credits is required to complete the major.

#### Semester 1

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1080	[0.50]	Elements of Calculus I
PHYS*1070	[0.50]	Introductory Physics for Life Sciences

0.50 Arts or Social Science electives

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

#### Semester 2

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
PHYS*1080	[0.50]	Physics for Life Sciences

One of:

CIS*1200	[0.50]	Introduction to Computing
CIS*1500	[0.50]	Introduction to Programming

0.50 Arts or Social Science electives

#### Semester 3

BIOC*2580	[0.50]	Introductory Biochemistry
MBG*2000	[0.50]	Introductory Genetics
MCB*2210	[0.50]	Introductory Cell Biology
STAT*2040	[0.50]	Statistics I

0.50 electives or restricted electives

#### Semester 4

MBG*2020	[0.50]	Introductory Molecular Biology
MICR*2030	[0.50]	Microbial Growth
STAT*2050	[0.50]	Statistics II

1.00 electives or restricted electives

#### Semester 5

MBG*3350	[0.75]	Laboratory Methods in Molecular Biology I
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1.75 electives or restricted electives

#### Semester 6

2.50 electives or restricted electives

#### Semester 7\*

MCB*4500	[1.00]	Research Project in Molecular & Cellular Biology I
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1.50 electives or restricted electives

#### Semester 8\*

MCB*4510	[1.00]	Research Project in Molecular & Cellular Biology 2
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1.50 electives or restricted electives

\*instead of the 2 semester sequence of MCB\*4500 / MCB\*4510 students may choose to take MCB\*4600 and 1.50 subject area electives

**Note:** Students are reminded that AT LEAST 2.00 credits must be at the 4000 level in order to complete the major.

Arts and Social Science Electives - 2.00 credits

### Restricted Electives

1. Ecology Elective - 0.50 credits

BIOL*2060	[0.50]	Ecology
BIOL*3110	[0.50]	Population Ecology
BOT*3050	[0.50]	Plant Functional Ecology
MICR*4280	[0.50]	Microbial Ecology

2. Arts and Social Science Electives - 2.00 credits

3. Physiology Elective - 0.50 credits

BIOM*3100	[0.50]	Mammalian Physiology I
BOT*3310	[0.50]	Plant Growth and Development
HK*3940	[1.25]	Human Physiology

ZOO*3200	[0.50]	Comparative Animal Physiology I
4. Subject Area Electives - 3.00 credits (4.50 if MCB*4600 is taken instead of MCB*4500 and MCB*4510)		
BIOC*3560	[0.50]	Structure and Function in Biochemistry
BIOL*3020	[0.50]	Population Genetics
BIOL*3300	[0.50]	Applied Bioinformatics
MBG*3050	[0.50]	Human Genetics
MBG*3060	[0.50]	Quantitative Genetics
MBG*3080	[0.50]	Bacterial Genetics
MBG*3100	[0.50]	Plant Genetics
MBG*3360	[0.75]	Laboratory Methods in Molecular Biology II
MBG*3600	[0.25]	Introduction to Genomics
MBG*4030	[0.50]	Animal Breeding Methods
MBG*4080	[0.50]	Molecular Genetics
MBG*4110	[0.50]	Advanced Concepts in Genetics
MBG*4160	[0.50]	Plant Breeding
MBG*4240	[0.50]	Applied Molecular Genetics
MBG*4270	[0.50]	DNA Replication, Recombination and Repair
MBG*4300	[0.50]	Plant Molecular Genetics
MCB*4010	[0.50]	Advanced Cell Biology
MCB*4050	[0.50]	Protein and Nucleic Acid Structure
MICR*3330	[0.50]	World of Viruses
MICR*4330	[0.50]	Molecular Virology

One of:

MBG*4040	[0.50]	Genetics and Molecular Biology of Development
MBG*4070	[0.50]	Genetics and Molecular Biology of Development

### Minor (Honours Program)

A minor in Molecular Biology and Genetics requires 5.00 credits in Molecular Biology and Genetics chosen in consultation with the faculty advisor, and will include:

MBG*2000	[0.50]	Introductory Genetics
MBG*2020	[0.50]	Introductory Molecular Biology

4.00 credits from:

BIOC*3560	[0.50]	Structure and Function in Biochemistry
BIOL*3020	[0.50]	Population Genetics
BIOL*3300	[0.50]	Applied Bioinformatics
MBG*3050	[0.50]	Human Genetics
MBG*3060	[0.50]	Quantitative Genetics
MBG*3080	[0.50]	Bacterial Genetics
MBG*3100	[0.50]	Plant Genetics
MBG*3600	[0.25]	Introduction to Genomics
MBG*4030	[0.50]	Animal Breeding Methods
MBG*4080	[0.50]	Molecular Genetics
MBG*4110	[0.50]	Advanced Concepts in Genetics
MBG*4160	[0.50]	Plant Breeding
MBG*4240	[0.50]	Applied Molecular Genetics
MBG*4270	[0.50]	DNA Replication, Recombination and Repair
MBG*4300	[0.50]	Plant Molecular Genetics
MCB*4010	[0.50]	Advanced Cell Biology
MCB*4050	[0.50]	Protein and Nucleic Acid Structure
MICR*3330	[0.50]	World of Viruses
MICR*4330	[0.50]	Molecular Virology

One of:

MBG*4040	[0.50]	Genetics and Molecular Biology of Development
MBG*4070	[0.50]	Genetics and Molecular Biology of Development

### Nanoscience (NANO)

Administered jointly by the Department of Chemistry and the Department of Physics, College of Physical and Engineering Science.

### Major (Honours Program)

The major will require the completion of 20.00 credits as indicated below.

#### Semester 1

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1200	[0.50]	Calculus I
NANO*1000	[0.50]	Introduction to Nanoscience
PHYS*1000	[0.50]	An Introduction to Mechanics

Students who are admitted deficient in one 4U course in Chemistry or Physics must take the equivalent introductory course in first semester. It is in the students best interest if the first-year science core in that subject is completed by the end of Semester 3.

#### Semester 2

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
MATH*1210	[0.50]	Calculus II
PHYS*1010	[0.50]	Introductory Electricity and Magnetism

0.50 electives

**Semester 3**

CHEM*2060	[0.50]	Structure and Bonding
MATH*2160	[0.50]	Linear Algebra I
NANO*2000	[0.50]	Synthesis of Nanomaterials
PHYS*2310	[0.50]	Mechanics I
PHYS*2330	[0.50]	Electricity and Magnetism I

**Semester 4**

CHEM*2070	[0.50]	Structure and Spectroscopy
MATH*2170	[0.50]	Differential Equations I
NANO*2100	[0.50]	Analysis of Nanomaterials

1.00 electives\*

**Semester 5**

One of:

CHEM*3860	[0.50]	Quantum Chemistry
PHYS*3230	[0.50]	Quantum Mechanics I
NANO*3500	[0.50]	Thin Film Science
NANO*3600	[0.50]	Computational Methods in Materials Science

1.00 electives

**Semester 6**

NANO*3200	[0.50]	Nanolithographic Techniques
NANO*3300	[0.50]	Spectroscopy of Nanomaterials
NANO*3700	[0.50]	Introduction to Quantum Computing

1.00 electives

**Semester 7**

NANO*4100	[0.50]	Biological Nanomaterials
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2.00 electives

**Semester 8**

NANO*4200	[0.50]	Topics in Nanomaterials
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2.00 electives

\* If a student wants to take PHYS\*3230 in semester 5, then they must select PHYS\*2320 and PHYS\*2340 as electives in semester 4.

**Selection of electives is subject to the following rules:**

1. The student must select at least 1.00 credits in Arts or Social Science.
2. The program must include at least 6.00 science credits at the 3000 and 4000 level of which at least 2.00 must be at the 4000 level.
3. In semesters 7 and 8, the student must select to do either NANO\*4900 or NANO\*4910.

In completing the science requirements for the degree, some suggested complementary areas of focus are:

**Chemistry: Inorganic**

Semester 4:	CHEM*2480
Semester 5:	CHEM*3640
Semester 6:	CHEM*3650
Semester 7:	CHEM*2820, CHEM*4620
Semester 8:	CHEM*2700

**Chemistry: Organic**

Semester 4:	CHEM*2700
Semester 5:	CHEM*3750
Semester 6:	CHEM*3760
Semester 7:	CHEM*2820, CHEM*4730
Semester 8:	CHEM*2480, CHEM*4720

**Chemistry: Physical/Analytical**

Semester 4:	CHEM*2480
Semester 5:	CHEM*2820
Semester 6:	CHEM*3430 or CHEM*3870
Semester 7:	CHEM*3440, CHEM*3860
Semester 8:	CHEM*3870, CHEM*3430

**Engineering**

Semester 2:	CIS*1500
Semester 4:	ENGG*2450*
Semester 5:	ENGG*2410*, ENGG*3450*
Semester 6:	ENGG*4550*
Semester 7:	ENGG*4080*

**Mathematics and Statistics**

Semester 4:	STAT*2040
Semester 5:	STAT*3100
Semester 6:	MATH*2130
Semester 7:	NANO*4500, MATH*3240
Semester 8:	NANO*4510, MATH*3160

**Physics**

Semester 4:	PHYS*2320, PHYS*2340
Semester 5:	PHYS*3240, MATH*2200

Semester 6: PHYS\*3220

Semester 7: PHYS\*4240, PHYS\*4180

Semester 8: PHYS\*4040

\***Note:** Courses marked with an asterisk may require additional prerequisites. Students should consult the relevant course descriptions for further information.

**Neuroscience (NEUR)****Office of the Associate Dean, B.Sc. Program****Minor (Honours Program)**

A minor in Neuroscience shall include a minimum of 5.00 credits including:

NEUR*4000	[0.50]	Current Issues in Neuroscience
PSYC*2410	[0.50]	Behavioural Neuroscience I

1 of:

PSYC*2010	[0.50]	Quantification in Psychology
STAT*2040	[0.50]	Statistics I

and at least 0.50 credits from:

BIOM*2000	[0.50]	Concepts in Human Physiology for B.A. students only
BIOM*3100	[0.50]	Mammalian Physiology I
HK*3940	[1.25]	Human Physiology
ZOO*3200	[0.50]	Comparative Animal Physiology I

1.00 credits from an independent research project in the neurosciences, approved by the faculty advisor, selected from a combination of:

BIOM*4420	[0.50]	Research Modules
HK*4230	[0.50]	Advanced Study in Human Biology and Nutritional Sciences
HK*4360	[1.00]	Research in Human Biology and Nutritional Sciences
HK*4371/2	[1.00]	Research in Human Biology and Nutritional Sciences II
IBIO*4500	[0.75]	Research in Integrative Biology I
IBIO*4510	[0.75]	Research in Integrative Biology II
NEUR*4401/2	[1.00]	Research in Neurosciences
NEUR*4450	[1.00]	Research in Neurosciences
PSYC*4500	[0.50]	Current Theoretical Issues in Psychology
PSYC*4510	[0.50]	Current Issues in Psychology
PSYC*4870	[0.50]	Honours Thesis I
PSYC*4880	[1.00]	Honours Thesis II

and 2.00 from the following:

BIOM*3000	[0.50]	Functional Mammalian Neuroanatomy
BIOM*3090	[0.50]	Principles of Pharmacology
BIOM*4030	[0.50]	Endocrine Physiology
HK*3100	[0.50]	Neuromuscular Physiology
PHYS*2030	[0.50]	Biophysics of Excitable Cells
PSYC*2390	[0.50]	Principles of Sensation and Perception
PSYC*3030	[0.50]	Neurochemical Basis of Behaviour
PSYC*3040	[0.50]	Current Issues in Neuropsychology
PSYC*3410	[0.50]	Behavioural Neuroscience II
PSYC*4050	[0.50]	Seminar in Animal Learning
PSYC*4470	[0.50]	Behavioural Neuroscience Seminar
PSYC*4600	[0.50]	Cognitive Neuroscience
ZOO*4470	[0.50]	Comparative Endocrinology

In fulfillment of the 2.00 additional credits, students may take 1 of:

BIOM*3040	[0.50]	Medical Embryology
ZOO*2100	[0.50]	Developmental Biology

and non-B.Sc. students may also select:

MBG*2020	[0.50]	Introductory Molecular Biology
MCB*2210	[0.50]	Introductory Cell Biology

Please note that some of the restricted electives require prerequisites that are not included in the minor.

**Nutritional and Nutraceutical Sciences (NANS)****Department of Human Health and Nutritional Sciences, College of Biological Science**

The Nutritional and Nutraceutical Sciences major is concerned with understanding the contribution of food, beverage and nutritional supplement consumption to growth, development of optimal biological function, maintenance of health, and treatment of disease.

If lacking the fundamentals of word processing, spread sheet use and data management, the student should select CIS\*1200 as early in the program as possible.

**Major (Honours Program)**

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. A total of 20.00 credits is required, including 2.00 credits from Arts and Social Sciences courses.

**Semester 1**

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1080	[0.50]	Elements of Calculus I
PHYS*1070	[0.50]	Introductory Physics for Life Sciences

0.50 electives or restricted electives

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

### Semester 2

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
PHYS*1080	[0.50]	Physics for Life Sciences

1.00 electives or restricted electives

### Semester 3

BIOC*2580	[0.50]	Introductory Biochemistry
MBG*2000	[0.50]	Introductory Genetics
MCB*2210	[0.50]	Introductory Cell Biology

1.00 electives

### Semester 4

BIOC*3560	[0.50]	Structure and Function in Biochemistry
MBG*2020	[0.50]	Introductory Molecular Biology
NUTR*3210	[0.50]	Fundamentals of Nutrition
STAT*2040	[0.50]	Statistics I

0.50 electives or restricted electives

### Semester 5

HK*3940	[1.25]	Human Physiology
NUTR*3330	[0.50]	Micronutrients, Phytochemicals and Health
NUTR*3390	[0.50]	Applied Nutritional and Nutraceutical Sciences I

0.25 or 0.50 electives or restricted electives

### Semester 6

BIOM*3090	[0.50]	Principles of Pharmacology
NUTR*4090	[0.50]	Functional Foods and Nutraceuticals
NUTR*4330	[0.50]	Applied Nutritional and Nutraceutical Sciences II
PATH*3610	[0.50]	Principles of Disease

0.50 electives or restricted electives

### Semester 7

NUTR*4210	[0.50]	Nutrition, Exercise and Energy Metabolism
NUTR*4510	[0.50]	Toxicology, Nutrition and Food

1.50 electives or restricted electives

### Semester 8

2.50 electives or restricted electives

### Restricted Electives

Students must complete 2.00 credits from Arts and Social Sciences courses and 1.00 credits from among the following:

BIOM*4420	[0.50]	Research Modules
HK*4230	[0.50]	Advanced Study in Human Biology and Nutritional Sciences
HK*4360	[1.00]	Research in Human Biology and Nutritional Sciences
HK*4371/2	[1.00]	Research in Human Biology and Nutritional Sciences II
HK*4410	[0.50]	Research Concepts
HK*4460	[0.50]	Regulation of Human Metabolism
NUTR*4200	[0.50]	Nutrition and Immune Function
NUTR*4320	[0.50]	Nutrition and Metabolic Control of Disease
NUTR*4360	[0.50]	Current Issues in Nutrigenomics

### Minor (Honours Program)

A minor in Nutritional and Nutraceutical Sciences (NANS) requires 5.00 credits as follows:

BIOC*2580	[0.50]	Introductory Biochemistry
NUTR*3210	[0.50]	Fundamentals of Nutrition
NUTR*3330	[0.50]	Micronutrients, Phytochemicals and Health
NUTR*4090	[0.50]	Functional Foods and Nutraceuticals
STAT*2040	[0.50]	Statistics I

At least 0.50 credits from:

BIOM*3100	[0.50]	Mammalian Physiology I
HK*3940	[1.25]	Human Physiology
ZOO*3200	[0.50]	Comparative Animal Physiology I

and 2.00 credits from:

ANSC*3170	[0.50]	Nutrition of Fish and Crustacea
ANSC*3180	[0.50]	Wildlife Nutrition
ANSC*4260	[0.50]	Beef Cattle Nutrition
ANSC*4270	[0.50]	Dairy Cattle Nutrition
ANSC*4280	[0.50]	Poultry Nutrition
ANSC*4290	[0.50]	Swine Nutrition
ANSC*4550	[0.50]	Horse Nutrition
ANSC*4560	[0.50]	Pet Nutrition
FOOD*2010	[0.50]	Principles of Food Science
HK*4230	[0.50]	Advanced Study in Human Biology and Nutritional Sciences
HK*4360	[1.00]	Research in Human Biology and Nutritional Sciences

HK*4371/2	[1.00]	Research in Human Biology and Nutritional Sciences II
NUTR*2150	[0.50]	Introduction to Nutritional and Food Sciences
NUTR*3390	[0.50]	Applied Nutritional and Nutraceutical Sciences I
NUTR*4200	[0.50]	Nutrition and Immune Function
NUTR*4210	[0.50]	Nutrition, Exercise and Energy Metabolism
NUTR*4320	[0.50]	Nutrition and Metabolic Control of Disease
NUTR*4360	[0.50]	Current Issues in Nutrigenomics
NUTR*4510	[0.50]	Toxicology, Nutrition and Food

### Physical Science (PSCI)

#### College of Physical and Engineering Science

#### Major (Honours Program)

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. This major will require the completion of 20.00 credits as indicated below:

#### 1. Basic Science Core - 4.00 credits

1.00 - Biology (BIOL\*1030, BIOL\*1040)

1.00 - Chemistry (CHEM\*1040, CHEM\*1050)

1.00 - Physics [(PHYS\*1000, PHYS\*1010) or (PHYS\*1070, PHYS\*1080) or (PHYS\*1080, PHYS\*1130)]

1.00 - Mathematical Science [(MATH\*1080, MATH\*2080) or (MATH\*1200, MATH\*1210)]

#### 2. Subject Area Core - 8.00 credits

0.50 (STAT\*2040 or STAT\*2100)

0.50 (CIS\*1200 or CIS\*1500)

7.00 physical science credits, including at least 4.00 credits at the 3000 or 4000 level of which 2.00 credits must be at the 4000 level.

#### 3. Science Electives - 4.00 credits

4.00 science credits from the List of Approved Science Electives for B.Sc. Students\*

#### 4. Arts and Social Science Electives - 2.00

2.00 acceptable Arts or Social Science credits selected from the List of Approved B.Sc. Electives\*

#### 5. Free Electives - 2.00 credits

**Note:** the program must include a total of 6.00 science credits at the 3000 or 4000 level. Of these, at least 2.00 credits must be physical science at the 4000 level.

### Semester 1

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I

One of:

PHYS*1000	[0.50]	An Introduction to Mechanics
PHYS*1070	[0.50]	Introductory Physics for Life Sciences
PHYS*1080	[0.50]	Physics for Life Sciences

One of:

MATH*1080	[0.50]	Elements of Calculus I
MATH*1200	[0.50]	Calculus I

0.50 Arts or Social Science electives

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

### Semester 2

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II

One of:

PHYS*1010	[0.50]	Introductory Electricity and Magnetism
PHYS*1080	[0.50]	Physics for Life Sciences
PHYS*1130	[0.50]	Physics with Applications

One of:

MATH*1210	[0.50]	Calculus II
MATH*2080	[0.50]	Elements of Calculus II

0.50 Arts or Social Science electives

### Semester 3

1.50 science electives from the approved list of acceptable B.Sc. science electives\*

0.50 electives

One of:

CIS*1200	[0.50]	Introduction to Computing
CIS*1500	[0.50]	Introduction to Programming

OR

STAT*2040	[0.50]	Statistics I
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### Semester 4

1.50 science electives from the approved list of B.Sc. science electives\*

0.50 electives

One of:

CIS*1200	[0.50]	Introduction to Computing
CIS*1500	[0.50]	Introduction to Programming

(if a statistics course is chosen in Semester 3)

OR

STAT*2040	[0.50]	Statistics I
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(if a computing course is chosen in Semester 3)

**Semester 5 to 8**

Total of 2.50 credits per semester including at least 2.00 science electives.

Sufficient courses at the 3000 or 4000 level must be selected in Semesters 5 through 8 to total 6.00 credits in science at the 3000 or 4000 level with at least 2.00 physical science at the 4000 level.

\*approved course lists are available in the Dean's Office, College of Physical and Engineering Science and on the world wide web at [http://www.cpes.uoguelph.ca/BSc/approved\\_electives.htm](http://www.cpes.uoguelph.ca/BSc/approved_electives.htm)**Honours Physical Science (With a Minor)**

The requirements and schedules are the same as for Honours Physical Science. Available Minor subjects are listed at the beginning of the B.Sc. Program section under the heading Honours Program Minors.

**Physics (PHYS)****Department of Physics, College of Physical and Engineering Science**

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. Since some of the required courses are not offered every semester, students entering the Major in Honours Physics should plan their program in consultation with the Department of Physics Faculty Advisor.

**Major (Honours Program)**

This major requires the completion of 21.25 credits. At least 1.00 credits must be from Arts and/or Social Science courses.

**Semester 1\***

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
CIS*1500	[0.50]	Introduction to Programming
MATH*1200	[0.50]	Calculus I
PHYS*1000	[0.50]	An Introduction to Mechanics

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

**Semester 2\***

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
MATH*1210	[0.50]	Calculus II
PHYS*1010	[0.50]	Introductory Electricity and Magnetism

0.50 Arts or Social Science electives

\* students who have taken physics courses other than PHYS\*1000 in Semester 1 and PHYS\*1010 in Semester 2, may proceed to semester 3 with the permission of the Department of Physics

**Semester 3**

MATH*2160	[0.50]	Linear Algebra I
MATH*2200	[0.50]	Advanced Calculus I
PHYS*2440	[0.75]	Mechanics I
PHYS*2460	[0.75]	Electricity and Magnetism I

One of:

STAT*2040	[0.50]	Statistics I
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0.50 Arts electives

0.50 Social Science electives

**Semester 4**

MATH*2170	[0.50]	Differential Equations I
PHYS*2260	[0.50]	Quantum Physics
PHYS*2450	[0.75]	Mechanics II
PHYS*2470	[0.75]	Electricity and Magnetism II

One of:

STAT*2040	[0.50]	Statistics I
STAT*2120	[0.50]	Probability and Statistics for Engineers

0.50 electives

**Semester 5**

MATH*3100	[0.50]	Differential Equations II
PHYS*3100	[0.75]	Electronics
PHYS*3230	[0.50]	Quantum Mechanics I
PHYS*3240	[0.50]	Statistical Physics I

One of:

MATH*2000	[0.50]	Set Theory
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0.50 electives

**Semester 6**

PHYS*3220	[0.50]	Waves and Optics
PHYS*3400	[0.50]	Advanced Mechanics
PHYS*3510	[0.50]	Intermediate Laboratory
PHYS*4040	[0.50]	Quantum Mechanics II

One of:

MATH*3170	[0.50]	Partial Differential Equations and Special Functions
MATH*3260	[0.50]	Complex Analysis

0.50 electives

**Semester 7+**

PHYS*4180	[0.50]	Advanced Electromagnetic Theory
PHYS*4500	[0.50]	Advanced Physics Laboratory

One of:

PHYS*4240	[0.50]	Statistical Physics II
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0.50 electives

One of:

PHYS*4001	[0.50]	Research in Physics
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0.50 electives

0.50 electives \*\*

Note: Either PHYS\*4001/2 in semesters 7 and 8, or PHYS\*4300 in semester 8 must be taken

**Semester 8+**

One of:

PHYS*4002	[0.50]	Research in Physics
PHYS*4300	[0.50]	Inquiry in Physics

2.00 electives \*\*

+ students going on to graduate school in physics should take PHYS\*4001/2, PHYS\*4120, PHYS\*4130, PHYS\*4150, PHYS\*4240

\*\* Either PHYS\*4001/2 in semesters 7 and 8, or PHYS\*4300 in semester 8 must be taken.

In addition, at least 1.50 credits must be from lists A and B below. At least 1.00 credits must be from list A. Substitutions of courses in list B by other 3000 or 4000 level courses must be approved by the Physics Faculty Advisor.

**List A**

PHYS*4120	[0.50]	Atomic and Molecular Physics
PHYS*4130	[0.50]	Subatomic Physics
PHYS*4150	[0.50]	Solid State Physics

**List B**

EDRD*3120	[0.50]	Educational Communication
GEOL*3060	[0.50]	Groundwater
NRS*3600	[0.50]	Remote Sensing
PHYS*4540	[0.50]	Molecular Biophysics
PHYS*4560	[0.50]	Biophysical Methods
PHYS*4910	[0.50]	Advanced Topics in Physics I
PHYS*4920	[0.50]	Advanced Topics in Physics II
PHYS*4930	[0.50]	Advanced Topics in Physics III
POLS*3370	[0.50]	Environmental Politics and Governance
STAT*3240	[0.50]	Applied Regression Analysis
STAT*3510	[0.50]	Environmental Risk Assessment

**Minor (Honours Program)**

A minor in Physics requires 5.00 credits in physics courses including at least 1.00 at the 3000 or 4000 level.

The following four courses, with a weight of 0.75 each, are required:

PHYS*2440	[0.75]	Mechanics I
PHYS*2450	[0.75]	Mechanics II
PHYS*2460	[0.75]	Electricity and Magnetism I
PHYS*2470	[0.75]	Electricity and Magnetism II

The following courses are strongly recommended:

PHYS*1000	[0.50]	An Introduction to Mechanics
PHYS*1010	[0.50]	Introductory Electricity and Magnetism

**Physics (Co-op) (PHYS:C)****Department of Physics, College of Physical and Engineering Science**

Since some of the required courses are not offered every semester, students entering the Major in Physics (Co-op) should plan their program in consultation with the Department of Physics Faculty Advisor. To graduate from the Co-op program a minimum of 4 successfully completed work terms (COOP\*1000, COOP\*2000, COOP\*3000, COOP\*4000) is normally required.

**Major (Honours Program)**

This major requires the completion of 21.25 credits.

**Semester 1 - Fall**

The program for the first semester is the same as the Major in Physics (regular) program.

**Semester 2 - Winter**

BIOL*1040	[0.50]	Biology II
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CHEM*1050	[0.50]	General Chemistry II
COOP*1100	[0.00]	Introduction to Co-operative Education
MATH*1210	[0.50]	Calculus II
PHYS*1010	[0.50]	Introductory Electricity and Magnetism

One of:

CIS*2500	[0.50]	Intermediate Programming
0.50 Arts or Social Science electives*		

### Semester 3 - Fall

MATH*2160	[0.50]	Linear Algebra I
MATH*2200	[0.50]	Advanced Calculus I
PHYS*2440	[0.75]	Mechanics I
PHYS*2460	[0.75]	Electricity and Magnetism I

One of:

MATH*2000	[0.50]	Set Theory
STAT*2040	[0.50]	Statistics I

0.50 Arts or Social Science electives\*

### Winter Semester

COOP*1000	[0.00]	Co-op Work Term I
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### Semester 4 - Summer

MATH*2170	[0.50]	Differential Equations I
PHYS*2260	[0.50]	Quantum Physics
PHYS*3240	[0.50]	Statistical Physics I

One of:

CIS*2520	[0.50]	Data Structures
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0.50 electives\*

0.50 electives\*

### Fall Semester

COOP*2000	[0.00]	Co-op Work Term II
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### Semester 5 - Winter

PHYS*2450	[0.75]	Mechanics II
PHYS*2470	[0.75]	Electricity and Magnetism II
PHYS*3220	[0.50]	Waves and Optics

One of:

STAT*2040	[0.50]	Statistics I
STAT*2120	[0.50]	Probability and Statistics for Engineers
MATH*3260	[0.50]	Complex Analysis

0.50 electives

0.50 electives

### Summer Semester

COOP*3000	[0.00]	Co-op Work Term III
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### Semester 6 - Fall +

MATH*3100	[0.50]	Differential Equations II
PHYS*3100	[0.75]	Electronics
PHYS*3230	[0.50]	Quantum Mechanics I

1.00 electives \*\*

### Semester 7 - Winter +

PHYS*3400	[0.50]	Advanced Mechanics
PHYS*3510	[0.50]	Intermediate Laboratory
PHYS*4040	[0.50]	Quantum Mechanics II

One of:

MATH*3170	[0.50]	Partial Differential Equations and Special Functions
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0.50 electives\*\*

0.50 electives\*\*

### Summer Semester

COOP*4000	[0.00]	Co-op Work Term IV
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### Semester 8 - Fall +

PHYS*4180	[0.50]	Advanced Electromagnetic Theory
PHYS*4240 or 0.50 electives		
PHYS*4500	[0.50]	Advanced Physics Laboratory

1.00 electives\*\*

\* 1.00 must be taken as Arts or Social Science electives in this Major

+ and \*\* refer to the notes in the Major in Physics program

## Plant Science (PLSC)

Department of Plant Agriculture, Ontario Agricultural College

Department of Environmental Biology, Ontario Agricultural College

Department of Integrative Biology, College of Biological Science

Department of Molecular and Cellular Biology, College of Biological Science

### Major (Honours Program)

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. The major requires the completion of 20.00 credits and students must declare one of the following areas of emphasis: Applied Plant Science, Botany, Plant Biotechnology, Plant Environmental Science or Unspecialized.

### Semester 1

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1080	[0.50]	Elements of Calculus I
PHYS*1070	[0.50]	Introductory Physics for Life Sciences

0.50 Arts or Social Science electives

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

### Semester 2

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
PHYS*1080	[0.50]	Physics for Life Sciences

One of:

CIS*1200	[0.50]	Introduction to Computing
CIS*1500	[0.50]	Introduction to Programming
MATH*2080	[0.50]	Elements of Calculus II

0.50 Arts or Social Science electives

### Semester 3

AGR*2470	[0.50]	Introduction to Plant Agriculture
BIOC*2580	[0.50]	Introductory Biochemistry
BOT*2100	[0.50]	Life Strategies of Plants
MBG*2000	[0.50]	Introductory Genetics

0.50 Arts and Social Science electives

### Semester 4

MBG*2020	[0.50]	Introductory Molecular Biology
MCB*2210	[0.50]	Introductory Cell Biology
STAT*2040	[0.50]	Statistics I

1.00 electives or restricted electives

### Semester 5

BOT*3410	[0.50]	Plant Anatomy
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2.00 electives or restricted electives

### Semester 6

BOT*3310	[0.50]	Plant Growth and Development
BOT*3710	[0.50]	Plant Diversity and Evolution

1.50 electives or restricted electives

### Semester 7

2.50 electives or restricted electives

### Semester 8

BOT*4380	[0.50]	Metabolism in the Whole Life of Plants
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2.00 electives or restricted electives

### Program Requirements

1. A minimum of 6.00 credits must be at the 3000 or 4000 levels with a minimum of 2.00 credits at the 4000 level.
2. 1.50 credits of Arts and Social Science electives

### Electives and Restricted Elective (9.00 credits)

1. Students are to choose 5.00 credits for an area of emphasis: Applied Plant Science, Botany, Plant Biotechnology, Plant Environmental Science or Unspecialized.
2. Of the 9.00 credits, 6.50 must be approved science electives.
3. Restricted electives, indicated with †, are non-science electives.
4. Restricted electives, indicated with \*\*, require other restricted electives as prerequisites. Students should consult the most recent undergraduate calendar for specific requirements.
5. ‡Students interested in graduate studies are encouraged to take two semesters of research projects which will count towards restricted elective requirements in an area of emphasis:

HORT*4900	[0.50]	Plant Agriculture Special Project I
HORT*4910	[0.50]	Plant Agriculture Special Project II

or

IBIO*4500	[0.75]	Research in Integrative Biology I
IBIO*4510	[0.75]	Research in Integrative Biology II

or

MCB*4500	[1.00]	Research Project in Molecular & Cellular Biology I **
MCB*4510	[1.00]	Research Project in Molecular & Cellular Biology 2

### Area of Emphasis

#### Applied Plant Science (APSC)

CROP*2110	[0.50]	Crop Ecology
SOIL*2010	[0.50]	Soil Science

1.00 credit from:

CROP*4240	[0.50]	Weed Science
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ENVB*3210	[0.50]	Plant Pathology
ENVB*4100	[0.50]	Integrated Management of Invasive Insect Pests **
‡ 3.00 credits from:		
CROP*3300	[0.50]	Grain Crops
CROP*3310	[0.50]	Protein and Oilseed Crops
CROP*3340	[0.50]	Managed Grasslands
CROP*4220	[0.50]	Cropping Systems **
ENVB*2040	[0.50]	Plant Health and the Environment
ENVB*3030	[0.50]	Pesticides and the Environment
ENVB*3160	[0.50]	Management of Turfgrass Diseases **
HORT*2450	[0.50]	Introduction to Turfgrass Science
HORT*3010	[0.50]	Annual, Perennial and Indoor Plants - Identification and Use

HORT*3050	[0.50]	Management of Turfgrass Insect Pests and Weeds **
HORT*3230	[0.50]	Plant Propagation
HORT*3260	[0.50]	Woody Plants
HORT*3270	[0.50]	Biotechnology of Medicinal Plants
HORT*3280	[0.50]	Greenhouse Production
HORT*3350	[0.50]	Woody Plant Production and Culture
HORT*3430	[0.50]	Wine-Grape Culture
HORT*3510	[0.50]	Vegetable Production
HORT*4200	[0.50]	Turf, the Environment and Society **
HORT*4300	[0.50]	Postharvest Physiology
HORT*4420	[0.50]	Fruit Crops
HORT*4450	[0.50]	Advanced Turfgrass Science **
MBG*3100	[0.50]	Plant Genetics
MBG*4160	[0.50]	Plant Breeding
NRS*3000	[0.50]	Environmental Issues in Agriculture and Landscape Management **

OAGR*2050	[0.50]	Gateway to Organic Agriculture
OAGR*4160	[0.50]	Design of Organic Production Systems
PBIO*3110	[0.50]	Crop Physiology
PBIO*3750	[0.50]	Plant Tissue Culture
PBIO*4100	[0.50]	Soil Plant Relationships
PBIO*4750	[0.50]	Genetic Engineering of Plants
SOIL*3080	[0.50]	Soil and Water Conservation
SOIL*3200	[0.50]	Environmental Soil Biology
SOIL*4090	[0.50]	Soil Management

**Botany (BOT)**

BIOL*2060	[0.50]	Ecology
MBG*3100	[0.50]	Plant Genetics
PBIO*4000	[0.50]	Molecular and Cellular Aspects of Plant-Microbe Interactions
PBIO*4150	[0.50]	Molecular and Cellular Aspects of Plant Development

‡ 3.00 credits from:

One of:

BIOL*2250	[0.50]	Biostatistics and the Life Sciences
STAT*2250	[0.50]	Biostatistics and the Life Sciences
BIOL*3110	[0.50]	Population Ecology
BOT*3050	[0.50]	Plant Functional Ecology
MBG*4300	[0.50]	Plant Molecular Genetics
MICR*2020	[0.50]	Microbial Interactions and Associations
MICR*3220	[0.50]	Plant Microbiology
PBIO*3110	[0.50]	Crop Physiology
PBIO*3750	[0.50]	Plant Tissue Culture
PBIO*4750	[0.50]	Genetic Engineering of Plants

**Plant Biotechnology (PBTC)**

MBG*3100	[0.50]	Plant Genetics
MBG*3350	[0.75]	Laboratory Methods in Molecular Biology I
PBIO*3750	[0.50]	Plant Tissue Culture
PBIO*4750	[0.50]	Genetic Engineering of Plants

‡ minimum of 2.75 credits from:

BIOL*3300	[0.50]	Applied Bioinformatics
MBG*3600	[0.25]	Introduction to Genomics
MBG*4160	[0.50]	Plant Breeding
MBG*4300	[0.50]	Plant Molecular Genetics
MCB*4010	[0.50]	Advanced Cell Biology
MICR*2020	[0.50]	Microbial Interactions and Associations
MICR*3220	[0.50]	Plant Microbiology
MICR*3230	[0.50]	Immunology I
MICR*3330	[0.50]	World of Viruses
PBIO*3110	[0.50]	Crop Physiology
PBIO*4150	[0.50]	Molecular and Cellular Aspects of Plant Development

**Plant Environmental Science (PESC)**

BOT*3050	[0.50]	Plant Functional Ecology
ENVB*2040	[0.50]	Plant Health and the Environment
ENVB*4780	[0.50]	Forest Ecology

GEOG*2480	[0.50]	Mapping and GIS
‡ 3.00 credits from:		
BIOL*3010	[0.50]	Laboratory and Field Work in Ecology
BIOL*3110	[0.50]	Population Ecology
BIOL*3120	[0.50]	Community Ecology
BIOL*3130	[0.50]	Conservation Biology **
BIOL*4050	[0.50]	Advanced Eukaryotic Microbiology
ENVB*2030	[0.50]	Current Issues in Forest Science
ENVB*2040	[0.50]	Plant Health and the Environment
ENVB*3000	[0.50]	Nature Interpretation **
ENVB*3030	[0.50]	Pesticides and the Environment
ENVB*3040	[0.50]	Natural Chemicals in the Environment
ENVB*3090	[0.50]	Insect Diversity and Biology
ENVB*3210	[0.50]	Plant Pathology
ENVB*3250	[0.50]	Forest Health and Disease
ENVB*3300	[0.50]	Applied Ecology and Environment
ENVB*3330	[0.50]	Ecosystem Processes and Applications **
ENVB*4100	[0.50]	Integrated Management of Invasive Insect Pests **
GEOG*2210	[0.50]	Environment and Resources
GEOG*3210	[0.50]	Management of the Biophysical Environment **
GEOG*4210	[0.50]	Environmental Governance **
GEOG*4220	[0.50]	Local Environmental Management
LARC*3320	[0.50]	Principles of Landscape Ecology **
NRS*2120	[0.50]	Introduction to Environmental Stewardship **
PHIL*2070	[0.50]	Philosophy of the Environment
POLS*3370	[0.50]	Environmental Politics and Governance
SOIL*2010	[0.50]	Soil Science

**Unspecialized (UNSP)**

Choose 5.00 credits from any courses listed in the other areas of emphasis.

**Minor (Honours Program)**

A minor in Plant Science requires 5.00 credits in the Plant Science Program chosen in consultation with the Faculty Advisor. The courses include:

AGR*2470	[0.50]	Introduction to Plant Agriculture
BOT*2100	[0.50]	Life Strategies of Plants
BOT*3310	[0.50]	Plant Growth and Development
BOT*3410	[0.50]	Plant Anatomy
BOT*3710	[0.50]	Plant Diversity and Evolution
BOT*4380	[0.50]	Metabolism in the Whole Life of Plants

2.00 credits from any courses listed in the areas of emphasis.

Restricted electives, indicated with , are non-science electives. Restricted electives, indicated with \*\*, require other restricted electives as prerequisites.

**Psychology: Brain & Cognition (PBC)****Department of Psychology, College of Social and Applied Human Sciences**

The B.Sc. Major in Psychology: Brain and Cognition offers an opportunity for students to develop interests within learning, perception, cognition, and biopsychology from a sound base in physical and biological sciences. Students primarily interested in other areas within psychology should consult the schedule of studies for the Bachelor of Arts program. Psychology courses in the above focuses may also be studied via the B.A. program.

**Note on Honours Courses**Courses marked (H) are designed for students in a psychology major or minor or the Information Systems and Human Behaviour program and the Educational Psychology Minor program. Students in other programs wishing to take these courses must obtain the permission of the instructors concerned. Unless otherwise specified, all other courses may be taken by general, honours, and students from other programs, providing the prerequisites are met. **Courses designated with (H) are Honours level courses requiring for registration a cumulative average of at least 70% in all course attempts in Psychology, or registration in the ISHB Major.****Major (Honours Program)****Semester 1**

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
MATH*1080	[0.50]	Elements of Calculus I
PHYS*1070	[0.50]	Introductory Physics for Life Sciences

One of:

PSYC*1100	[0.50]	Principles of Behaviour
PSYC*1200	[0.50]	Dynamics of Behaviour

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

**Semester 2**

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
PHYS*1080	[0.50]	Physics for Life Sciences

One of:

CIS*1200	[0.50]	Introduction to Computing
CIS*1500	[0.50]	Introduction to Programming
One of:		
PSYC*1100	[0.50]	Principles of Behaviour
PSYC*1200	[0.50]	Dynamics of Behaviour
<b>Semester 3</b>		
One of:		
PSYC*2330	[0.50]	Principles of Learning
PSYC*2410	[0.50]	Behavioural Neuroscience I
One of:		
PSYC*2390	[0.50]	Principles of Sensation and Perception
PSYC*2650	[0.50]	Cognitive Psychology
One of:		
PSYC*2010	[0.50]	Quantification in Psychology
STAT*2040	[0.50]	Statistics I
1.00 electives *		
<b>Semester 4</b>		
PSYC*2040	[0.50]	Research Statistics
PSYC*2360	[0.50]	Introductory Research Methods
0.50 Psychology core (PSYC*2330, PSYC*2390, PSYC*2410, PSYC*2650)		
0.50 electives*		
One of:		
PSYC*2310	[0.50]	Introduction to Social Psychology
PSYC*2450	[0.50]	Introduction to Developmental Psychology
PSYC*2740	[0.50]	Personality
<b>Semester 5</b>		
PSYC*3370	[0.50]	Experimental Design and Analysis
2.00 electives *		
<b>Semester 6</b>		
PSYC*3250	[0.50]	Psychological Measurement
PSYC*3380	[0.50]	Non-experimental Research Methods
1.50 electives *		
<b>Semester 7**</b>		
2.50 electives **		
<b>Semester 8**</b>		
2.50 electives**		
* Electives in semester 3-8 must satisfy the following requirements:		
i. 1.00 arts and/or non-psychology social science credits		
ii. 2.50 credits at the 3000 level		
iii. 2.00 credits at the 4000 level		
iv. 3.50 credits from List A		
v. 3.50 credits from List B		
Note: of these electives, 2.50 credits must be at the 3000/4000 level and 2.00 additional credits must be at the 4000 level.		
<b>Graduate Studies Advisory Note</b>		
** students planning to enter a graduate program in Psychology are advised to complete PSYC*4870 and PSYC*4880 in Semesters 7 and 8, respectively. Note that PSYC*4370 or PSYC*4900 must be completed prior to or concurrently with either PSYC*4870 or PSYC*4880		
<b>Note:</b> The selection of electives should take into consideration the prerequisites for preferred advanced courses. With the permission of the Psychology Department PRIOR to course selection, up to 2 non-psychology credits can be used towards the psychology credits if such courses enhance the student's psychology program.		
<b>List A</b>		
PSYC*3030	[0.50]	Neurochemical Basis of Behaviour
PSYC*3040	[0.50]	Current Issues in Neuropsychology
PSYC*3100	[0.50]	Evolutionary Psychology
PSYC*3220	[0.50]	Ergonomics: the Scientific Study of People-System Relationships
PSYC*3260	[0.50]	Laboratory in Animal Learning
PSYC*3330	[0.50]	Memory
PSYC*3340	[0.50]	Psycholinguistics
PSYC*3410	[0.50]	Behavioural Neuroscience II
PSYC*3850	[0.50]	Intellectual Disabilities
PSYC*4050	[0.50]	Seminar in Animal Learning
PSYC*4370	[0.50]	History of Psychology
PSYC*4470	[0.50]	Behavioural Neuroscience Seminar
PSYC*4600	[0.50]	Cognitive Neuroscience
PSYC*4750	[0.50]	Motivation
PSYC*4870	[0.50]	Honours Thesis I
PSYC*4880	[1.00]	Honours Thesis II
PSYC*4900	[0.50]	Psychology Seminar

**List B**

All courses on the List of Approved Science Electives for B.Sc. students, excluding psychology.

**Minor (Honours Program)**

A minor in Psychology: Brain and Cognition requires 5.00 psychology credits as follows:

PSYC*1100	[0.50]	Principles of Behaviour
PSYC*1200	[0.50]	Dynamics of Behaviour
PSYC*2360	[0.50]	Introductory Research Methods

2.00 credits from 2000 level psychology core courses selected as follows:

a. 1.50 credits from:

PSYC*2330	[0.50]	Principles of Learning
PSYC*2390	[0.50]	Principles of Sensation and Perception
PSYC*2410	[0.50]	Behavioural Neuroscience I
PSYC*2650	[0.50]	Cognitive Psychology

b. 0.50 credits from:

PSYC*2310	[0.50]	Introduction to Social Psychology
PSYC*2450	[0.50]	Introduction to Developmental Psychology
PSYC*2740	[0.50]	Personality

1.00 credits from courses in List A

One of:

PSYC*2010	[0.50]	Quantification in Psychology
STAT*2040	[0.50]	Statistics I

**Statistics (STAT)****Department of Mathematics and Statistics, College of Physical and Engineering Science**

Students in this program will acquire the ability to use modern statistical methods in a variety of applications, the theoretical understanding necessary to develop statistical methods to meet new needs and a solid preparation for further study. As well, since statistical computing is a fundamental tool for the application and development of modern statistical methods, students will develop skills in computer applications programming using such high-level languages as SAS and S-PLUS.

Students may enter this major in any semester. A student wishing to declare the major must consult the Faculty Advisor. A total of 20.00 credits is required to complete the major. Required 1000 level courses are listed under Semester 1 and Semester 2 of the recommended Schedule of Studies for Major. At least 8.00 credits in Statistics and Mathematics are required at the 2000 level or above, as follows: MATH\*2130, MATH\*2150, MATH\*2160, MATH\*2200, STAT\*2040, STAT\*2050, STAT\*3100, STAT\*3110, STAT\*3210, STAT\*3240, STAT\*3320. Five other courses (2.50 credits) in Statistics at the 3000 or 4000 level, of which at least four (2.00 credits) must be at the 4000 level. One other course (0.50 credits) in Mathematics or Statistics at the 2000 level or above.

**Recommended Schedule of Studies for Major (Honours Program)****Semester 1**

BIOL*1030	[0.50]	Biology I
CHEM*1040	[0.50]	General Chemistry I
CIS*1500	[0.50]	Introduction to Programming
MATH*1200	[0.50]	Calculus I
PHYS*1000	[0.50]	An Introduction to Mechanics

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by Semester 3.

**Semester 2**

BIOL*1040	[0.50]	Biology II
CHEM*1050	[0.50]	General Chemistry II
MATH*1210	[0.50]	Calculus II
PHYS*1010	[0.50]	Introductory Electricity and Magnetism

0.50 Arts or Social Science electives\*\*

**Semester 3**

MATH*2200	[0.50]	Advanced Calculus I
STAT*2040	[0.50]	Statistics I

One of:

MATH*2150	[0.50]	Applied Matrix Algebra
MATH*2160	[0.50]	Linear Algebra I

0.50 Arts or Social Science electives

0.50 electives\*\*

**Semester 4**

MATH*2130	[0.50]	Numerical Methods
STAT*2050	[0.50]	Statistics II

1.50 electives\*\*

**Semester 5**

STAT*3100	[0.50]	Introductory Mathematical Statistics I
STAT*3240	[0.50]	Applied Regression Analysis



STAT\*3320 [0.50] Sampling Theory with Applications  
1.00 electives\*\*

**Semester 6**

STAT\*3110 [0.50] Introductory Mathematical Statistics II  
STAT\*3210 [0.50] Experimental Design  
1.50 electives\*\*

**Semester 7**

2.50 electives\*\*

**Semester 8**

2.50 electives\*\*

\*The recommended Arts or Social Science elective can be postponed to a future semester if the student wishes to take STAT\*2040 in Semester 2.

\*\* Electives must satisfy the following requirements:

1. Electives must include at least 2.50 credits in Statistics at the 3000 or 4000 level, and an additional 0.50 credits in Statistics or Mathematics at the 2000 level or above.
2. At least 2.00 credits in Statistics must be at the 4000 level.
3. Electives plus core courses must include at least 6.00 credits at the 3000 or 4000 level from the B.Sc. Program Committee approved list of science electives.
4. At least 1.00 credits in Arts or Social Science must be completed.

**Minor (Honours Program)**

A total of 5.00 credits in Statistics and Mathematics are required, including:

MATH\*1200 [0.50] Calculus I  
MATH\*1210 [0.50] Calculus II  
STAT\*2040 [0.50] Statistics I  
STAT\*2050 [0.50] Statistics II  
STAT\*3100 [0.50] Introductory Mathematical Statistics I  
STAT\*3110 [0.50] Introductory Mathematical Statistics II  
STAT\*3240 [0.50] Applied Regression Analysis

One of:

MATH\*2150 [0.50] Applied Matrix Algebra  
MATH\*2160 [0.50] Linear Algebra I

0.50 additional credits in Statistics

0.50 additional credits in Statistics or Mathematics

**Theoretical Physics (THPY)****Department of Physics, College of Physical and Engineering Science**

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. Since some of the required courses are not offered every semester, students entering the Major in Theoretical Physics should plan their program in consultation with the Faculty Advisor.

**Major (Honours Program)**

This major requires the completion of 21.25 credits. At least 1.00 of these credits must be obtained from the completion of Arts and/or Social Science courses.

**Semester 1 to 3**

The program for the first three semesters is the same as the Major in Physics program.

**Semester 4**

MATH\*2170 [0.50] Differential Equations I  
PHYS\*2260 [0.50] Quantum Physics  
PHYS\*2450 [0.75] Mechanics II  
PHYS\*2470 [0.75] Electricity and Magnetism II

One of:\*

MATH\*2210 [0.50] Advanced Calculus II  
0.50 electives

**Semester 5**

MATH\*3100 [0.50] Differential Equations II  
PHYS\*3100 [0.75] Electronics  
PHYS\*3230 [0.50] Quantum Mechanics I  
PHYS\*3240 [0.50] Statistical Physics I

One of:

MATH\*2000 [0.50] Set Theory  
0.50 electives

**Semester 6**

MATH\*3260 [0.50] Complex Analysis  
PHYS\*3220 [0.50] Waves and Optics  
PHYS\*3400 [0.50] Advanced Mechanics  
PHYS\*3510 [0.50] Intermediate Laboratory  
PHYS\*4040 [0.50] Quantum Mechanics II

**Semester 7**

PHYS\*4120 [0.50] Atomic and Molecular Physics  
PHYS\*4180 [0.50] Advanced Electromagnetic Theory  
PHYS\*4240 [0.50] Statistical Physics II

Two of:

PHYS\*4001 [0.50] Research in Physics  
PHYS\*4500 [0.50] Advanced Physics Laboratory  
One 3000 or 4000 level mathematics course  
0.50 electives  
0.50 electives

Note: Either PHYS\*4001/2 in semesters 7 and 8, or PHYS\*4300 in semester 8, must be taken.

**Semester 8**

PHYS\*4130 [0.50] Subatomic Physics  
PHYS\*4150 [0.50] Solid State Physics

One of:

PHYS\*4002 [0.50] Research in Physics  
PHYS\*4300 [0.50] Inquiry in Physics

One 3000 or 4000 level mathematics course

0.50 electives

Note: Either PHYS\*4001/2 in semesters 7 and 8, or PHYS\*4300 in semester 8, must be taken.

\*those not taking MATH\*2210 in Semester 4 must consult the Department of Physics Departmental Advisor

**Wild Life Biology (WLB)****Department of Integrative Biology, College of Biological Science**

The Major in Wild Life Biology provides exposure to the ecological principles upon which the scientific management of wild life is based. This major prepares students for post-graduate work in ecology and management of wild life and provides a sound science background for students wishing to pursue careers in teaching, government service or the private sector.

**Major (Honours Program)**

Students may enter this major in semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. A minimum total of 20.00 credits is required to complete the major.

**Semester 1**

BIOL\*1030 [0.50] Biology I  
CHEM\*1040 [0.50] General Chemistry I  
MATH\*1080 [0.50] Elements of Calculus I  
PHYS\*1070 [0.50] Introductory Physics for Life Sciences

0.50 Arts or Social Science electives

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by the end of Semester 3.

**Semester 2**

BIOL\*1040 [0.50] Biology II  
CHEM\*1050 [0.50] General Chemistry II  
PHYS\*1080 [0.50] Physics for Life Sciences  
STAT\*2040 [0.50] Statistics I

0.50 Arts or Social Science electives

**Semester 3**

BIOC\*2580 [0.50] Introductory Biochemistry  
ZOO\*2090 [0.50] Vertebrate Structure and Function  
ZOO\*2100 [0.50] Developmental Biology

1.00 electives \*\*

**Semester 4**

MBG\*2000 [0.50] Introductory Genetics  
MCB\*2210 [0.50] Introductory Cell Biology  
NUTR\*3210 [0.50] Fundamentals of Nutrition  
ZOO\*2700 [0.50] Invertebrate Morphology & Evolution

0.50 electives \*\*

**Semester 5**

BIOL\*3010 [0.50] Laboratory and Field Work in Ecology  
BIOL\*3110 [0.50] Population Ecology  
BOT\*3050 [0.50] Plant Functional Ecology  
ZOO\*3200 [0.50] Comparative Animal Physiology I  
BIOL\*3400 [0.50] Evolution

**Semester 6**

ANSC\*3180 [0.50] Wildlife Nutrition  
BIOL\*3120 [0.50] Community Ecology  
ZOO\*3210 [0.50] Comparative Animal Physiology II

1.00 electives \*\*, \*\*\*

**Semester 7 \*\*\*\***

BIOL\*4110 [0.75] Ecological Methods  
ZOO\*4070 [0.50] Animal Behaviour  
ZOO\*4910 [0.50] Integrative Vertebrate Biology

0.75 electives \*

**Semester 8**

BIOL\*4110 [0.75] Ecological Methods  
2.00 electives \*\*

\* CIS\*1200 is recommended for those needing to improve their computer skills

\*\* suggested electives list available from faculty advisors

\*\*\* BIOL\*2250 is strongly recommended if independent research project courses are anticipated in semester 7 and/or 8

\*\*\*\* a minimum of 0.75 credits from these courses may be taken as an alternative to BIOL\*4110 in semester 7:

BIOL\*4410 [0.75] Field Ecology  
BIOL\*4600 [0.75] Tropical Ecology  
BIOL\*4610 [0.75] Arctic Ecology  
BIOL\*4700 [0.50] Field Biology  
BIOL\*4710 [0.25] Field Biology  
BIOL\*4800 [0.50] Field Biology  
BIOL\*4810 [0.25] Field Biology  
IBIO\*4500 [0.75] Research in Integrative Biology I  
IBIO\*4510 [0.75] Research in Integrative Biology II  
IBIO\*4521/2 [2.00] Thesis in Integrative Biology  
ZOO\*4300 [0.75] Marine Biology and Oceanography

Other field or research courses with approval of faculty advisor.

**Electives must include:**

1. A minimum of 0.50 credits from:

ZOO\*4920 [0.25] Lab Studies in Ornithology  
ZOO\*4930 [0.25] Lab Studies in Ichthyology  
ZOO\*4940 [0.25] Lab Studies in Herpetology  
ZOO\*4950 [0.25] Lab Studies in Mammalogy

2. At least 1.00 Arts and/or Social Science electives.

**Zoology (ZOO)****Department of Integrative Biology, College of Biological Science**

The Major in Zoology offers a broad education in the life sciences while providing a more specialized understanding of the structure, function and ecology of animals. This major qualifies students for post-graduate work in zoology and other life sciences and provides a sound science background for students wishing to pursue careers in teaching, government service or the private sector.

**Major (Honours Program)**

Students may enter this major in Semester 1 or any semester thereafter. A student wishing to declare the major must consult the Faculty Advisor. A minimum total of 20.00 credits is required to complete the major.

**Semester 1**

BIOL\*1030 [0.50] Biology I  
CHEM\*1040 [0.50] General Chemistry I  
MATH\*1080 [0.50] Elements of Calculus I  
PHYS\*1070 [0.50] Introductory Physics for Life Sciences

0.50 Arts or Social Science electives \*

Students who are admitted deficient in one OAC/4U course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The first-year science core in that subject should be completed by the end of Semester 3.

**Semester 2**

BIOL\*1040 [0.50] Biology II  
CHEM\*1050 [0.50] General Chemistry II  
PHYS\*1080 [0.50] Physics for Life Sciences  
STAT\*2040 [0.50] Statistics I

0.50 Arts or Social Science electives \*

**Semester 3**

ZOO\*2090 [0.50] Vertebrate Structure and Function  
ZOO\*2100 [0.50] Developmental Biology

1.50 electives \*\*

**Semester 4**

BIOC\*2580 [0.50] Introductory Biochemistry  
MBG\*2000 [0.50] Introductory Genetics  
MCB\*2210 [0.50] Introductory Cell Biology  
ZOO\*2700 [0.50] Invertebrate Morphology & Evolution

0.50 electives \*\*

**Semester 5**

BIOL\*3110 [0.50] Population Ecology  
BIOL\*3400 [0.50] Evolution  
ZOO\*3200 [0.50] Comparative Animal Physiology I  
ZOO\*3700 [0.50] Integrative Biology of Invertebrates

0.50 electives \*\*

**Semester 6**

BIOL\*3120 [0.50] Community Ecology

ZOO\*3210 [0.50] Comparative Animal Physiology II  
1.50 electives \*\*, \*\*\*

**Semester 7**

ZOO\*3000 [0.50] Comparative Histology  
ZOO\*4070 [0.50] Animal Behaviour  
ZOO\*4910 [0.50] Integrative Vertebrate Biology

1.00 electives \*\*

**Semester 8**

2.50 electives \*\*

\* CIS\*1200 is recommended for those needing to improve their computer skills

\*\* suggested electives list available from the faculty advisors

\*\*\* BIOL\*2250 is strongly recommended if independent research project courses are anticipated in semesters 7 and/or 8

**Electives must include:**

1. A minimum of 0.25 credits from:

ZOO\*4920 [0.25] Lab Studies in Ornithology  
ZOO\*4930 [0.25] Lab Studies in Ichthyology  
ZOO\*4940 [0.25] Lab Studies in Herpetology  
ZOO\*4950 [0.25] Lab Studies in Mammalogy

2. A minimum of 0.50 credits from:

BIOL\*4410 [0.75] Field Ecology  
BIOL\*4600 [0.75] Tropical Ecology  
BIOL\*4610 [0.75] Arctic Ecology  
BIOL\*4700 [0.50] Field Biology  
BIOL\*4710 [0.25] Field Biology  
BIOL\*4800 [0.50] Field Biology  
BIOL\*4810 [0.25] Field Biology  
IBIO\*4500 [0.75] Research in Integrative Biology I  
IBIO\*4510 [0.75] Research in Integrative Biology II  
IBIO\*4521/2 [2.00] Thesis in Integrative Biology  
ZOO\*4170 [0.50] Experimental Comparative Animal Physiology  
ZOO\*4300 [0.75] Marine Biology and Oceanography

Other field or research courses with approval of faculty advisor.

3. At least 1.00 Arts or Social Science electives.

4. This major must contain at least 6.00 science credits at the 3000 or 4000 level, which must include at least 2.00 at the 4000 level. The restricted elective in point number 1 above counts as part of this 3000 or 4000 level requirement.

**Note:** The Major in Zoology is a flexible program which allows students in consultation with faculty advisors, to design a program to meet their own needs and interests. For example, students may wish to concentrate in Evolutionary Physiology, Quantitative Zoology, or Systematic Zoology for which lists of electives are available from faculty advisors.

**Minor (Honours Program)**

Students in programs other than Zoology, Wildlife Biology, Marine and Freshwater Biology and Ecology who have a strong interest in Zoology may choose to take a minor in Zoology.

A minor in Zoology requires a minimum of 5.00 credits, 4.00 of which must be from the following list:

BIOL\*3110 [0.50] Population Ecology  
BIOL\*3120 [0.50] Community Ecology  
BIOL\*3400 [0.50] Evolution  
ZOO\*2090 [0.50] Vertebrate Structure and Function  
ZOO\*2100 [0.50] Developmental Biology  
ZOO\*2700 [0.50] Invertebrate Morphology & Evolution  
ZOO\*3000 [0.50] Comparative Histology  
ZOO\*3200 [0.50] Comparative Animal Physiology I  
ZOO\*3210 [0.50] Comparative Animal Physiology II  
ZOO\*3700 [0.50] Integrative Biology of Invertebrates  
ZOO\*4070 [0.50] Animal Behaviour  
ZOO\*4330 [0.50] Biology of Fishes  
ZOO\*4910 [0.50] Integrative Vertebrate Biology  
ZOO\*4920 [0.25] Lab Studies in Ornithology  
ZOO\*4930 [0.25] Lab Studies in Ichthyology  
ZOO\*4940 [0.25] Lab Studies in Herpetology  
ZOO\*4950 [0.25] Lab Studies in Mammalogy

The remaining 1.00 credit may also come from this list or from outside this list, in consultation with a faculty advisor.