2010-2011 Undergraduate Calendar

The information published in this Undergraduate Calendar outlines the rules, regulations, curricula, programs and fees for the 2010-2011 academic year, including the Summer Semester 2010, the Fall Semester 2010 and the Winter Semester 2011.

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.

The University is a full member of:

- The Association of Universities and Colleges of Canada

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Disclaimer

University of Guelph 2010

The information published in this Undergraduate Calendar outlines the rules, regulations, curricula, programs and fees for the 2010-2011 academic year, including the Summer Semester 2010, the Fall Semester 2010 and the Winter Semester 2011.

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.

The University will not be liable for any interruption in, or cancellation of, any academic activities as set forth in this calendar and related information where such interruption is caused by fire, strike, lock-out, inability to procure materials or trades, restrictive laws or governmental regulations, actions taken by faculty, staff or students of the University or by others, civil unrest or disobedience, public health emergencies, or any other cause of any kind beyond the reasonable control of the University.

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

Collection, Use and Disclosure of Personal Information

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

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

Address for University Communication

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

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

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

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

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.

Table of Contents

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 /grade 12 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.

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 a t 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 and have achieved a minimum cumulative average of 50%.

Total Course Requirements for all Students in the General Science Program

Total of 15.00 credits as follows:

1. 4.00 credits from the first year science core - 1.00 credits beyond the 4U/ grade 12 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.
2. An additional 0.50 credits from at least 3 of the following subject areas: biological science, biochemistry/chemistry, mathematical science, physics.
3. 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*1070	[0.50]	Discovering Biodiversity *
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
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

* BIOL*1080 is a prerequisite for some courses in the biological sciences. Students are strongly recommended to also complete this course by the end of the third semester.

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

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

One of

BIOL*1070	[0.50]	Discovering Biodiversity
BIOL*1080	[0.50]	Biological Concepts of Health
BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology

0.50 Arts or Social Science electives

Students who are lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

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

One of

BIOL*1070	[0.50]	Discovering Biodiversity
BIOL*1080	[0.50]	Biological Concepts of Health
BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology

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 and Pharmaceutical Chemistry (BPCH)
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 - Earth Surface Science (ESS)*
20.00 credits - Ecology (ECOL)*
20.00 credits - Environmental Biology (ENVB)*
20.00 credits - Toxicology (TOX)
*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)
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 - Food Science (Co-op) (FOOD:C)
20.00 credits - Microbiology (Co-op) (MICR:C)
21.25 credits - Physics (Co-op) (PHYS:C)
20.00 credits - Toxicology (Co-op) (TOX: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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

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, Health 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
PATH*3610	[0.50]	Principles of Disease
POPM*3240	[0.50]	Epidemiology
POPM*4230	[0.50]	

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

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

One of

BIOL*1070	[0.50]	Discovering Biodiversity
BIOL*1080	[0.50]	Biological Concepts of Health
BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology

Students who are lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2 - Winter

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

One of

BIOL*1070 [0.50] Discovering Biodiversity
BIOL*1080 [0.50] Biological Concepts of Health
BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology

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

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

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:

Major (Honours Program)

Semester 1

BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

BIOL*1070 [0.50] Discovering Biodiversity
BIOL*1080 [0.50] Biological Concepts of Health
CHEM*1050 [0.50] General Chemistry II
MATH*1210 [0.50] Calculus II
PHYS*1010 [0.50] Introductory Electricity and Magnetism

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
0.50 Arts or Social Science electives

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 [0.75] Analytical Biochemistry
CHEM*3750 [0.50] Organic Chemistry II
MICR*2030 [0.50] Microbial Growth
STAT*2040 [0.50] Statistics I
Minimum 0.25 electives or restricted electives*

***Note**: There are a limited number of 0.25 credit courses available. Students should consult their faculty advisor or program counsellor for additional information

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

2.50 electives or restricted electives

Semester 8

BIOC*4540 [0.75] Enzymology
1.75 electives or restricted electives

Restricted Electives

Students must take as part of their program: 3.5 credits from the following list, with at least 1.00 of these credits from BIOC*4520, BIOC*4580, MCB*4050

BIOC*4520 [0.50] Metabolic Processes
BIOC*4580 [0.50] Membrane Biochemistry
MCB*4010 [0.50] Advanced Cell Biology
MCB*4050 [0.50] Protein and Nucleic Acid Structure
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
MICR*3230 [0.50] Immunology
MICR*3330 [0.50] World of Viruses
MICR*4230 [0.50] Immunology II
MICR*4330 [0.50] Molecular Virology
PBIO*3110 [0.50] Crop Physiology
PBIO*4750 [0.50] Genetic Engineering of Plants
TOX*4590 [0.50] Biochemical Toxicology
One of:
MBG*3080 [0.50] Bacterial Genetics
MBG*4080 [0.50] Molecular Genetics

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 [0.75] Analytical Biochemistry
BIOC*4540 [0.75] 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 1.50 credits must be chosen from the following courses, with at least 1.00 credits from the first three 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*4050 [0.50] Protein and Nucleic Acid Structure
MCB*4080 [0.50] Applied Microbiology and Biochemistry
MICR*3230 [0.50] Immunology
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.

This major requires the completion of 20.25 credits as indicated below.

Stream A

Semester 1 - Fall

BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2 - Winter

BIOL*1070	[0.50]	Discovering Biodiversity
BIOL*1080	[0.50]	Biological Concepts of Health
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

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	[0.75]	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

Summer Semester

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

Semester 6 - Fall

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

1.75 electives or restricted electives

Semester 7 - Winter

BIOC*4540	[0.75]	Enzymology
PHYS*2030	[0.50]	Biophysics of Excitable Cells

1.25 electives or restricted electives

Summer Semester

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

Semester 8 - Fall

2.50 electives or restricted electives

Restricted Electives

Students must take as part of their program: 3.5 credits from the following list, with at least 1.00 of these credits from BIOC*4520, BIOC*4580, MCB*4050

BIOC*4520	[0.50]	Metabolic Processes
BIOC*4580	[0.50]	Membrane Biochemistry
MCB*4010	[0.50]	Advanced Cell Biology
MCB*4050	[0.50]	Protein and Nucleic Acid Structure
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
MICR*3230	[0.50]	Immunology
MICR*3330	[0.50]	World of Viruses
MICR*4230	[0.50]	Immunology II
MICR*4330	[0.50]	Molecular Virology
PBIO*3110	[0.50]	Crop Physiology
PBIO*4750	[0.50]	Genetic Engineering of Plants
TOX*4590	[0.50]	Biochemical Toxicology

One of:

MBG*3080	[0.50]	Bacterial Genetics
MBG*4080	[0.50]	Molecular Genetics

Stream B

Semester 1 - Fall

BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2 - Winter

BIOL*1070	[0.50]	Discovering Biodiversity
BIOL*1080	[0.50]	Biological Concepts of Health
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

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	[0.75]	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

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

Semester 6 - Fall

CHEM*3750	[0.50]	Organic Chemistry II

2.00 electives or restricted electives

Semester 7 - Winter

BIOC*4540	[0.75]	Enzymology
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

Semester 8 - Fall

2.50 electives or restricted electives

Restricted Electives

Students must take as part of their program: 3.5 credits from the following list, with at least 1.00 of these credits from BIOC*4520, BIOC*4580, MCB*4050

BIOC*4520	[0.50]	Metabolic Processes

BIOC*4580	[0.50]	Membrane Biochemistry
MCB*4010	[0.50]	Advanced Cell Biology
MCB*4050	[0.50]	Protein and Nucleic Acid Structure
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
MICR*3230	[0.50]	Immunology
MICR*3330	[0.50]	World of Viruses
MICR*4230	[0.50]	Immunology II
MICR*4330	[0.50]	Molecular Virology
PBIO*3110	[0.50]	Crop Physiology
PBIO*4750	[0.50]	Genetic Engineering of Plants
TOX*4590	[0.50]	Biochemical Toxicology

One of:

MBG*3080	[0.50]	Bacterial Genetics
MBG*4080	[0.50]	Molecular Genetics

Biological and Pharmaceutical Chemistry (BPCH)

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 Chemistry Faculty Advisor. This major will require the completion of 20.00 credits as indicated below:

Semester 1

BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

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

One of

BIOL*1070	[0.50]	Discovering Biodiversity
BIOL*1080	[0.50]	Biological Concepts of Health

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
CHEM*2880	[0.50]	Physical Chemistry

0.25 electives or restricted electives *

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
STAT*2040	[0.50]	Statistics I

0.50 electives or restricted electives *

Semester 5

BIOC*3570	[0.75]	Analytical Biochemistry
CHEM*3750	[0.50]	Organic Chemistry II

One of:

CHEM*3640	[0.50]	Chemistry of the Elements I **

0.50 electives or restricted electives *

0.75 electives or restricted electives *

** CHEM*3640 is a prerequisite for CHEM*3650

Semester 6

Select either Option A or Option B

Option A (at Guelph)

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

1.00 electives or restricted electives *

Option B (at Seneca)

2.50 credits from:

XSEN*3020	[0.50]	Pharmaceutical Analysis
XSEN*3030	[0.50]	Pharmacology and Applied Toxicology
XSEN*3040	[0.50]	Occupational Health and Chemistry
XSEN*3060	[0.50]	Pharmaceutical Analysis - Advanced
XSEN*3070	[0.50]	Pharmaceutical Product Formulations
XSEN*3080	[0.50]	Pharmaceutical Manufacturing
XSEN*3090	[0.50]	Biopharmaceuticals

Note: All XSEN courses are taught at the Seneca@York campus of Seneca College in Toronto. (For more information, go to: http://www.chemistry.uoguelph.ca/bpch/

Semester 7

One of:

CHEM*4730	[0.50]	Synthetic Organic Chemistry
CHEM*4740	[0.50]	Topics in Bio-Organic Chemistry

2.00 electives or restricted electives *

Semester 8

2.50 electives or restricted electives *

*** Restricted Electives**

**Students are advised to pay particular attention to pre-requisite requirements when choosing individual courses, and seek advice as needed.

1. MICR*2020 [0.50] Microbial Interactions and Associations
2. 1.00 credits from the following:

MBG*2000	[0.50]	Introductory Genetics
MBG*2020	[0.50]	Introductory Molecular Biology
MCB*2210	[0.50]	Introductory Cell Biology
TOX*2000	[0.50]	Principles of Toxicology

3. A minimum of 1.50 credits at the 4000 level and 2.50 credits at the 3000/4000 level from the following list:

BIOC*3560	[0.50]	Structure and Function in Biochemistry
BIOC*4520	[0.50]	Metabolic Processes
BIOC*4540	[0.75]	Enzymology **
BIOC*4580	[0.50]	Membrane Biochemistry
BIOM*3090	[0.50]	Principles of Pharmacology **
BIOM*3200	[1.00]	Mammalian Physiology
BIOM*4090	[0.50]	Pharmacology **
CHEM*3360	[0.50]	Environmental Chemistry and Toxicology
CHEM*3440	[0.50]	Analytical Chemistry III: Analytical Instrumentation
CHEM*3640	[0.50]	Chemistry of the Elements I
CHEM*3650	[0.50]	Chemistry of the Elements II **
CHEM*3760	[0.50]	Organic Chemistry III
CHEM*4010	[0.50]	Chemistry and Industry
CHEM*4400	[0.50]	Advanced Topics in Analytical Chemistry
CHEM*4630	[0.50]	Bioinorganic Chemistry **
CHEM*4720	[0.50]	Organic Reactivity **
CHEM*4730	[0.50]	Synthetic Organic Chemistry **
CHEM*4740	[0.50]	Topics in Bio-Organic Chemistry
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
MICR*3230	[0.50]	Immunology
NUTR*3210	[0.50]	Fundamentals of Nutrition
PATH*3610	[0.50]	Principles of Disease
TOX*4590	[0.50]	Biochemical Toxicology **

Biological and Pharmaceutical Chemistry (Co-op) (BPCH:C)

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 Chemistry Faculty Advisor. This major will require the completion of 20.00 credits as indicated below:

Semester 1 - Fall

BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2 - Winter

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

BIOL*1070	[0.50]	Discovering Biodiversity

BIOL*1080 [0.50] Biological Concepts of Health
0.50 Arts or Social Science electives

Semester 3 - Fall

BIOC*2580 [0.50] Introductory Biochemistry
CHEM*2060 [0.50] Structure and Bonding
CHEM*2400 [0.75] Analytical Chemistry I
CHEM*2880 [0.50] Physical Chemistry
0.25 electives or restricted 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
STAT*2040 [0.50] Statistics I
0.50 electives or restricted electives *

Semester 5 - Fall

BIOC*3570 [0.75] Analytical Biochemistry
CHEM*3750 [0.50] Organic Chemistry II
One of:
CHEM*3640 [0.50] Chemistry of the Elements I **
0.50 electives or restricted electives *
0.75 electives or restricted electives *
** CHEM*3640 is a prerequisite for CHEM*3650

Semester 6 - Winter

Select either Option A or Option B

Option A (at Guelph)

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
1.00 electives or restricted electives *

Option B (at Seneca)

2.50 credits from:

XSEN*3020 [0.50] Pharmaceutical Analysis
XSEN*3030 [0.50] Pharmacology and Applied Toxicology
XSEN*3040 [0.50] Occupational Health and Chemistry
XSEN*3060 [0.50] Pharmaceutical Analysis - Advanced
XSEN*3070 [0.50] Pharmaceutical Product Formulations
XSEN*3080 [0.50] Pharmaceutical Manufacturing
XSEN*3090 [0.50] Biopharmaceuticals
Note: All XSEN courses are taught at the Seneca@York campus of Seneca College in Toronto. (For more information, go to: http://www.chemistry.uoguelph.ca/bpch/

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

One of:
CHEM*4730 [0.50] Synthetic Organic Chemistry
CHEM*4740 [0.50] Topics in Bio-Organic Chemistry
2.00 electives or restricted electives *

*** Restricted Electives**

**Students are advised to pay particular attention to pre-requisite requirements when choosing individual courses, and seek advice as needed.

1. MICR*2020 [0.50] Microbial Interactions and Associations
2. 1.00 credits from the following:
   MBG*2000 [0.50] Introductory Genetics
   MBG*2020 [0.50] Introductory Molecular Biology
   MCB*2210 [0.50] Introductory Cell Biology
   TOX*2000 [0.50] Principles of Toxicology
3. A minimum of 1.50 credits at the 4000 level and 2.50 credits at the 3000/4000 level from the following list:
   BIOC*3560 [0.50] Structure and Function in Biochemistry
   BIOC*4520 [0.50] Metabolic Processes
   BIOC*4540 [0.75] Enzymology **
   BIOC*4580 [0.50] Membrane Biochemistry
   BIOM*3090 [0.50] Principles of Pharmacology **
   BIOM*3200 [1.00] Mammalian Physiology
   BIOM*4090 [0.50] Pharmacology **
   CHEM*3360 [0.50] Environmental Chemistry and Toxicology
   CHEM*3440 [0.50] Analytical Chemistry III: Analytical Instrumentation
   CHEM*3640 [0.50] Chemistry of the Elements I
   CHEM*3650 [0.50] Chemistry of the Elements II **
   CHEM*3760 [0.50] Organic Chemistry III
   CHEM*4010 [0.50] Chemistry and Industry
   CHEM*4400 [0.50] Advanced Topics in Analytical Chemistry
   CHEM*4630 [0.50] Bioinorganic Chemistry **
   CHEM*4720 [0.50] Organic Reactivity **
   CHEM*4730 [0.50] Synthetic Organic Chemistry **
   CHEM*4740 [0.50] Topics in Bio-Organic Chemistry
   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
   MICR*3230 [0.50] Immunology
   NUTR*3210 [0.50] Fundamentals of Nutrition
   PATH*3610 [0.50] Principles of Disease
   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*1070 [0.50] Discovering Biodiversity
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

BIOL*1080 [0.50] Biological Concepts of Health
BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology
CHEM*1050 [0.50] General Chemistry II
PHYS*1080 [0.50] Physics for Life Sciences
0.50 Arts or Social Science 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*3200	[1.00]	Mammalian Physiology
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. 5.50 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

3.50 - Required science courses semesters 3 - 8

5.50 - 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*1070	[0.50]	Discovering Biodiversity
BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
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 Sciences , Integrative Biology and Molecular and Cellular Biology. BIOL*1080 is a prerequisite for some CBS courses. 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 Bio-Medical 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 eight 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 Bio-Medical 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*1080	[0.50]	Biological Concepts of Health
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

BIOL*1070	[0.50]	Discovering Biodiversity
BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
CHEM*1050	[0.50]	General Chemistry II
PHYS*1080	[0.50]	Physics for Life Sciences

0.50 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

One of:

BIOM*3200	[1.00]	Mammalian Physiology
HK*3940	[1.25]	Human Physiology

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

Semester 6

BIOM*3040	[0.75]	Medical Embryology
BIOM*3090	[0.50]	Principles of Pharmacology

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

Semester 7

2.50 electives or restricted electives

Semester 8

PATH*3610	[0.50]	Principles of Disease

2.00 electives or restricted electives*

Restricted Electives

1. One anatomy course from BIOM*3010, HK*3401/2, ZOO*2090 must be completed.
2. One histology course from BIOM*4070 or ZOO*3000 must be completed.
3. One immunology course from ANSC*4650 or MICR*3230 must be completed.
4. A minimum of 2.00 credits from the following: BIOM*4030, BIOM*4050, BIOM*4090, BIOM*4110, BIOM*4150, BIOM*4180, BIOM*4210, BIOM*4220, BIOM*4420, BIOM*4500, BIOM*4510, BIOM*4521/2, HK*4070, HK*4230, HK*4360, HK*4371/2, HK*4410, HK*4460, NUTR*4320, NUTR*4350, NUTR*4360, NUTR*4510.
5. A total of 2.00 credits in Arts and Social Science courses must be completed including 1.00 credits from: PHIL*2030, PHIL*2070, PHIL*2100, PHIL*2120, PHIL*2180, psychology (PSYC*XXXX) or sociology (SOC*XXXX).

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*1090 [0.50] Introduction to Molecular and Cellular Biology
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

CHEM*1050 [0.50] General Chemistry II
One of (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:
- BIOL*1070 [0.50] Discovering Biodiversity
- BIOL*1080 [0.50] Biological Concepts of Health

One of (MATH*1210 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

BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2 - Winter

CHEM*1050 [0.50] General Chemistry II
COOP*1100 [0.00] Introduction to Co-operative Education
One of (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:
- BIOL*1070 [0.50] Discovering Biodiversity
- BIOL*1080 [0.50] Biological Concepts of Health

One of:
- CIS*2500 [0.50] Intermediate Programming
- 0.50 Arts or Social Science electives

One of (MATH*1210 recommended):
- 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

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

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

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

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
- 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:
- BUS*2090 [0.50] Individuals and Groups in Organizations
- FARE*3310 [0.50] Operations Management

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

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
One of
- BIOL*1070 [0.50] Discovering Biodiversity
- BIOL*1080 [0.50] Biological Concepts of Health
- BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology

Students who are lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

CHEM*1050 [0.50] General Chemistry II
MATH*1210 [0.50] Calculus II
PHYS*1010 [0.50] Introductory Electricity and Magnetism
One of
- BIOL*1070 [0.50] Discovering Biodiversity
- BIOL*1080 [0.50] Biological Concepts of Health
- BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology

0.50 Arts or Social Science electives

Semester 3

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

Semester 4

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

Semester 5

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

Semester 6

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

Semester 7

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

Semester 8

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

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
One of
- BIOL*1070 [0.50] Discovering Biodiversity
- BIOL*1080 [0.50] Biological Concepts of Health
- BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology

Students who are lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2 - Winter

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
- BIOL*1070 [0.50] Discovering Biodiversity
- BIOL*1080 [0.50] Biological Concepts of Health
- BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology

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

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

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

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
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

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*1090 [0.50] Introduction to Molecular and Cellular Biology
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

CHEM*1050 [0.50] General Chemistry II
MATH*1210 [0.50] Calculus II
PHYS*1010 [0.50] Introductory Electricity and Magnetism
One of
- BIOL*1070 [0.50] Discovering Biodiversity
- BIOL*1080 [0.50] Biological Concepts of Health

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
CHEM*2700 [0.50] Organic Chemistry I
CHEM*3430 [0.50] Analytical Chemistry II: Instrumental Analysis
MATH*2170 [0.50] Differential Equations I
PHYS*2260 [0.50] Quantum Physics

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
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. Approval of the Faculty Advisor must be obtained for the selection of courses not listed as restrictive electives.
3. 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*1090	[0.50]	Introduction to Molecular and Cellular Biology
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2 - Winter

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

BIOL*1070	[0.50]	Discovering Biodiversity
BIOL*1080	[0.50]	Biological Concepts of Health

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
PHYS*2260	[0.50]	Quantum Physics

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

Semester 6 - Summer

CHEM*3750	[0.50]	Organic Chemistry II

0.50 electives*

1.50 electives* or restricted electives**

Fall Semester

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

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

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. Approval of the Faculty Advisor must be obtained for the selection of courses not listed as restrictive electives.
3. 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*1090	[0.50]	Introduction to Molecular and Cellular Biology
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2 - Winter

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

BIOL*1070	[0.50]	Discovering Biodiversity
BIOL*1080	[0.50]	Biological Concepts of Health

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
PHYS*2260	[0.50]	Quantum Physics

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

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. Approval of the Faculty Advisor must be obtained for the selection of courses not listed as restrictive electives.
3. 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

School of Environmental Sciences, 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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

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*1070 [0.50] Discovering Biodiversity
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

BIOL*1080	[0.50]	Biological Concepts of Health
BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
CHEM*1050	[0.50]	General Chemistry II
PHYS*1080	[0.50]	Physics for Life Sciences

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

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

2.00 electives

Semester 7

BIOL*4110	[0.75]	Ecological Methods

1.75 electives

Semester 8

BIOL*4120	[0.50]	Evolutionary Ecology

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)

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

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)

School of Environmental Sciences, 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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

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 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*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]	Toxicological 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	[0.50]	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*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 **
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 **

List D - Supporting Courses

ENVB*4420	[0.50]	Problems in Environmental 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

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*1080	[0.50]	Biological Concepts of Health
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2 - Winter

BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
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

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:

1. ENGL*1200 is recommended for those students needing to improve their English grammar.
2. FOOD*2150 could be replaced by FOOD*2010 with permission of department advisor.
3. 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*4220	[0.25]	Topics in Food Science
FOOD*4230	[0.25]	Research in Food Science
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
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*1080	[0.50]	Biological Concepts of Health
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2 - Winter

BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
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

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

Winter Semester

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

Semester 7 - Fall

FOOD*4120	[0.75]	Food Analysis

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)

School of Environmental Sciences, 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*3330	[0.50]	Ecosystem Processes and Applications
ENVB*4420	[0.50]	Problems in Environmental Biology
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

Four of:

BIOL*3130	[0.50]	Conservation Biology
BIOL*4040	[0.50]	Natural Resources Policy
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*4420 is preferred, but may be substituted by BIOL*4410 or NRS*4110 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]	The Earth From Space
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
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)

School of Environmental Sciences, Ontario Agricultural College

Minor (Honours Program)

A minor will consist of at least 5.00 credits in Geology. The following 6 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*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, of which 16.00 must be from the list of acceptable science courses, are required

Semester 1

BIOL*1080	[0.50]	Biological Concepts of Health
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

BIOL*1070	[0.50]	Discovering Biodiversity
BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
CHEM*1050	[0.50]	General Chemistry II
PHYS*1080	[0.50]	Physics for Life Sciences

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

0.50 electives

0.50 Arts or Social Science 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 Arts or Social Science 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

2.50 electives or restricted electives

Semester 8

2.50 electives or restricted electives

Restricted Electives

A minimum of 2.00 credits of restricted electives are required which must be selected from HK*3100, HK*4XXX, NUTR*4XXX (must be an approved B.Sc. Science Elective).

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*1070	[0.50]	Discovering Biodiversity
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

BIOL*1080 [0.50] Biological Concepts of Health
BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology
CHEM*1050 [0.50] General Chemistry II
PHYS*1080 [0.50] Physics for Life Sciences
0.50 Arts or Social Science electives*

Semester 3

STAT*2040 [0.50] Statistics I
ZOO*2090 [0.50] Vertebrate Structure and Function
ZOO*2100 [0.50] Developmental Biology
1.00 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*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

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
One of
- BIOL*1070 [0.50] Discovering Biodiversity
- BIOL*1080 [0.50] Biological Concepts of Health
- BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology

Students who are lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

CHEM*1050 [0.50] General Chemistry II
MATH*1210 [0.50] Calculus II
PHYS*1010 [0.50] Introductory Electricity and Magnetism
One of
- BIOL*1070 [0.50] Discovering Biodiversity
- BIOL*1080 [0.50] Biological Concepts of Health
- BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology

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
- 0.50 electives

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
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 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 from the restricted elective credits).

Semester 1

BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

BIOL*1070 [0.50] Discovering Biodiversity
BIOL*1080 [0.50] Biological Concepts of Health
CHEM*1050 [0.50] General Chemistry II
PHYS*1080 [0.50] Physics for Life Sciences
0.50 Arts or Social Science 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 Arts or Social Science electives

Semester 4

MBG*2020 [0.50] Introductory Molecular Biology
MCB*2210 [0.50] Introductory Cell Biology
MICR*2030 [0.50] Microbial Growth
0.50 electives
0.50 Arts or Social Science electives

Semester 5

BIOC*3560 [0.50] Structure and Function in Biochemistry
MBG*3080 [0.50] Bacterial Genetics
MICR*3120 [0.50] Systematic Bacteriology
1.00 electives or restricted electives

Semester 6

MBG*3350 [0.75] Laboratory Methods in Molecular Biology I
MICR*3260 [0.50] Microbial Adaptation and Development
1.25 electives or restricted 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

Restricted Elective Credits

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

BIOC*4540 [0.75] Enzymology
BIOC*4580 [0.50] Membrane Biochemistry
BIOL*3050 [0.50] Mycology
ENVB*3280 [0.50] Waterborne Disease Ecology
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*3230 [0.50] Immunology
MICR*3270 [0.50] Microbial Cell Biology
MICR*3330 [0.50] World of Viruses
MICR*4010 [0.50] Pathogenic Bacteriology
MICR*4140 [0.50] Soil Microbiology and Biotechnology *
MICR*4180 [0.50] Microbial Processes in Environmental Management *
MICR*4230 [0.50] Immunology II
MICR*4280 [0.50] Microbial Ecology
MICR*4330 [0.50] Molecular Virology
MICR*4430 [0.50] Medical Virology
PATH*3040 [0.50] Principles of Parasitology
*Only 1 of MICR*4140 and MICR*4180 can be used to meet the restricted elective requirements.

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
- 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*1070, BIOL*1080, BIOL*1090 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 generally require an additional semester to meet all the program requirements. Students should plan their programs in consultation with the faculty advisor. A total of 20.00 credits are required to complete the major. 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 from the restricted elective credits).

Stream A

Semester 1 - Fall

BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2 - Winter

BIOL*1070	[0.50]	Discovering Biodiversity
BIOL*1080	[0.50]	Biological Concepts of Health
CHEM*1050	[0.50]	General Chemistry II
COOP*1100	[0.00]	Introduction to Co-operative Education
PHYS*1080	[0.50]	Physics for Life Sciences

0.50 Arts or Social Science 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 Arts or Social Science electives

Winter Semester

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

Semester 4 - Summer

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

0.50 electives

0.50 Arts or Social Science 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

1.00 electives or restricted electives

Semester 6 - Winter

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

1.25 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 which can include MCB*4500

Summer Semester

COOP*4000	[0.00]	Co-op Work Term IV (optional)

Semester 8 - Fall

2.50 electives or restricted electives which can include MCB*4510

Stream B

Semester 1 - Fall

BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2 - Winter

BIOL*1070	[0.50]	Discovering Biodiversity
BIOL*1080	[0.50]	Biological Concepts of Health
CHEM*1050	[0.50]	General Chemistry II
COOP*1100	[0.00]	Introduction to Co-operative Education
PHYS*1080	[0.50]	Physics for Life Sciences

0.50 Arts or Social Science 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 Arts or Social Science electives

Winter Semester

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

Semester 4 - Summer

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

0.50 electives

0.50 Arts or Social Science electives

Fall Semester

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

Semester 5 - Winter

BIOC*3560	[0.50]	Structure and Function in Biochemistry
MBG*3350	[0.75]	Laboratory Methods in Molecular Biology I

1.25 electives or restricted electives

Summer Semester

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

Semester 6 - Fall

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

1.50 electives or restricted electives

Semester 7 - Winter

MICR*3260	[0.50]	Microbial Adaptation and Development

2.00 electives or restricted electives which can include MCB*4500

Summer Semester

COOP*4000	[0.00]	Co-op Work Term IV (optional)

Semester 8 - Fall

2.50 electives or restricted electives which can include MCB*4510

Restricted Elective Credits

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

BIOC*4540	[0.75]	Enzymology
BIOC*4580	[0.50]	Membrane Biochemistry
BIOL*3050	[0.50]	Mycology
ENVB*3280	[0.50]	Waterborne Disease Ecology
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*3230	[0.50]	Immunology
MICR*3270	[0.50]	Microbial Cell Biology
MICR*3330	[0.50]	World of Viruses
MICR*4010	[0.50]	Pathogenic Bacteriology
MICR*4140	[0.50]	Soil Microbiology and Biotechnology *
MICR*4180	[0.50]	Microbial Processes in Environmental Management *
MICR*4230	[0.50]	Immunology II
MICR*4280	[0.50]	Microbial Ecology
MICR*4330	[0.50]	Molecular Virology
MICR*4430	[0.50]	Medical Virology
PATH*3040	[0.50]	Principles of Parasitology

*Only 1 of MICR*4140 and MICR*4180 can be used to meet the restricted elective requirements.

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*1090	[0.50]	Introduction to Molecular and Cellular Biology
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

BIOL*1070	[0.50]	Discovering Biodiversity
BIOL*1080	[0.50]	Biological Concepts of Health
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

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

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

1.50 electives or restricted electives

Semester 8*

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

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*3200	[1.00]	Mammalian Physiology
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*1090	[0.50]	Introduction to Molecular and Cellular Biology
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

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

One of

BIOL*1070	[0.50]	Discovering Biodiversity
BIOL*1080	[0.50]	Biological Concepts of Health

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
2.00 electives

Semester 8

NANO*4200 [0.50] Topics in Nanomaterials
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*3200 [1.00] Mammalian Physiology
- 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*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

In fulfillment of the 2.00 additional credits, students may take 1 of:
- BIOM*3040 [0.75] 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*1080 [0.50] Biological Concepts of Health
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

BIOL*1070 [0.50] Discovering Biodiversity
BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology
CHEM*1050 [0.50] General Chemistry II

PHYS*1080 [0.50] Physics for Life Sciences
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
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*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*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*1070, BIOL*1080, BIOL*1090)

   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

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

One of
- BIOL*1070 [0.50] Discovering Biodiversity
- BIOL*1080 [0.50] Biological Concepts of Health
- BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology

0.50 Arts or Social Science electives
Students who are lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

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

One of
- BIOL*1070 [0.50] Discovering Biodiversity
- BIOL*1080 [0.50] Biological Concepts of Health
- BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology

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

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
(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

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*

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
One of
BIOL*1070 [0.50] Discovering Biodiversity
BIOL*1080 [0.50] Biological Concepts of Health
BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology

Students who are lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2*

CHEM*1050 [0.50] General Chemistry II
MATH*1210 [0.50] Calculus II
PHYS*1010 [0.50] Introductory Electricity and Magnetism
One of
BIOL*1070 [0.50] Discovering Biodiversity
BIOL*1080 [0.50] Biological Concepts of Health
BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology
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
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
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
0.50 electives
One of:
PHYS*4001 [0.50] Research in Physics
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

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
One of
BIOL*1070 [0.50] Discovering Biodiversity
BIOL*1080 [0.50] Biological Concepts of Health
BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology
Students who are lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2 - Winter

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
BIOL*1070 [0.50] Discovering Biodiversity
BIOL*1080 [0.50] Biological Concepts of Health
BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology
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

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
0.50 electives*
0.50 electives*

Fall Semester

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

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

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
0.50 electives**
0.50 electives**

Summer Semester

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

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

School of Environmental Sciences, 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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

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
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
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:

AGR*4450 [1.00] Research Project I
AGR*4460 [1.00] Research 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
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] 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
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*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*1090 [0.50] Introduction to Molecular and Cellular Biology
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

CHEM*1050 [0.50] General Chemistry II
PHYS*1080 [0.50] Physics for Life Sciences
One of:
- BIOL*1070 [0.50] Discovering Biodiversity
- BIOL*1080 [0.50] Biological Concepts of Health

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

Semester 3

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 *

Semester 4

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

Semester 5

PSYC*3370 [0.50] Experimental Design and Analysis
2.00 electives *

Semester 6

PSYC*3250 [0.50] Psychological Measurement
PSYC*3380 [0.50] Non-experimental Research Methods
1.50 electives *

Semester 7**

2.50 electives **

Semester 8**

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.

Graduate Studies Advisory Note

** 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

Note: 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.

List A

PSYC*3030 [0.50] Neurochemical Basis of Behaviour
PSYC*3100 [0.50] Evolutionary Psychology
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] Seminar in Motivation and Emotion
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.

Major (Honours Program)

Semester 1

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
One of
- BIOL*1070 [0.50] Discovering Biodiversity
- BIOL*1080 [0.50] Biological Concepts of Health
- BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology

Students who are lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

CHEM*1050 [0.50] General Chemistry II
MATH*1210 [0.50] Calculus II
PHYS*1010 [0.50] Introductory Electricity and Magnetism
One of
- BIOL*1070 [0.50] Discovering Biodiversity
- BIOL*1080 [0.50] Biological Concepts of Health
- BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology

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:

One of:
- MATH*1080 [0.50] Elements of Calculus I
- MATH*1200 [0.50] Calculus I

One of:
- MATH*1210 [0.50] Calculus II
- MATH*2080 [0.50] Elements of Calculus II

One of:
- MATH*2150 [0.50] Applied Matrix Algebra
- MATH*2160 [0.50] Linear Algebra I

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
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

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
One of
- BIOL*1070 [0.50] Discovering Biodiversity
- BIOL*1080 [0.50] Biological Concepts of Health
- BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology

Students who are lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

CHEM*1050 [0.50] General Chemistry II
MATH*1210 [0.50] Calculus II
PHYS*1010 [0.50] Introductory Electricity and Magnetism
One of
- BIOL*1070 [0.50] Discovering Biodiversity
- BIOL*1080 [0.50] Biological Concepts of Health
- BIOL*1090 [0.50] Introduction to Molecular and Cellular Biology

0.50 Arts or Social Science electives

Note: 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
- 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:*
- 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

Toxicology (TOX)

Interdisciplinary Program, Departments of Biomedical Sciences, Chemistry, School of Environmental Sciences, Molecular and Cellular Biology

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*1090	[0.50]	Introduction to Molecular and Cellular Biology
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

BIOL*1080	[0.50]	Biological Concepts of Health
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
STAT*2050	[0.50]	Statistics II
TOX*3360	[0.50]	Environmental Chemistry and Toxicology

0.50 electives or restricted electives*

Semester 5

BIOC*3560	[0.50]	Structure and Function in Biochemistry
CHEM*3750	[0.50]	Organic Chemistry II
TOX*3300	[0.50]	Analytical Toxicology

One of:

BIOM*3200	[1.00]	Mammalian Physiology
ZOO*3200	[0.50]	Comparative Animal Physiology I

0.50 electives or restricted electives*

Semester 6

BIOM*3090	[0.50]	Principles of Pharmacology
ENVB*3030	[0.50]	Pesticides and the Environment
PATH*3610	[0.50]	Principles of Disease

One of:

ZOO*3200	[0.50]	Comparative Animal Physiology I
ZOO*3210	[0.50]	Comparative Animal Physiology II

0.50 electives or restricted electives*

OR

1.00 electives (if BIOM*3200 taken in Sem. 5)

Semester 7

MBG*3350	[0.75]	Laboratory Methods in Molecular Biology I
TOX*4000	[0.50]	Medical Toxicology
TOX*4590	[0.50]	Biochemical Toxicology

0.75 electives or restricted electives*

Semester 8

TOX*4100	[0.50]	Toxicological Pathology
TOX*4200	[0.50]	Topics in Toxicology
TOX*4550	[0.50]	Toxicological Risk Characterization

1.00 electives or restricted electives*

*** Restricted Electives**

At least 1.50 credits must be completed from the following list of allowable courses.

**Students are advised to pay particular attention to pre-requisite requirements when choosing individual courses, and seek advice as needed.

List A - Research

TOX*4900	[1.00]	Toxicology Research Project I
TOX*4910	[1.00]	Toxicology Research Project II

List B - Biomedical

BIOM*4070	[0.75]	Biomedical Histology
BIOM*4090	[0.50]	Pharmacology
MBG*4270	[0.50]	DNA Replication, Recombination and Repair
MICR*3230	[0.50]	Immunology
NUTR*3210	[0.50]	Fundamentals of Nutrition
NUTR*4510	[0.50]	Toxicology, Nutrition and Food

List C - Environmental

BIOL*2060	[0.50]	Ecology
BIOL*3450	[0.50]	Introduction to Aquatic Environments
BIOL*4350	[0.50]	Biology of Polluted Waters
BOT*2100	[0.50]	Life Strategies of Plants
ENVB*4240	[0.50]	Biological Activity of Pesticides
MICR*4180	[0.50]	Microbial Processes in Environmental Management
PBIO*4530	[0.50]	Environmental Pollution Stresses on Plants
SOIL*2010	[0.50]	Soil Science
STAT*3510	[0.50]	Environmental Risk Assessment

A minimum of 20.00 credits are required for graduation.

Toxicology (Co-op) (TOX:C)

Interdisciplinary Program, Departments of Biomedical Sciences, Chemistry, School of Environmental Sciences, Molecular and Cellular Biology

Major (Honours Program)

Semester 1 - Fall

BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2 - Winter

BIOL*1080	[0.50]	Biological Concepts of Health
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 Semester

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

Semester 4 - Summer

CHEM*2700	[0.50]	Organic Chemistry I
PATH*3610	[0.50]	Principles of Disease
STAT*2050	[0.50]	Statistics II
TOX*3360	[0.50]	Environmental Chemistry and Toxicology

0.50 electives or restricted electives*

Semester 5 - Fall

BIOC*3560	[0.50]	Structure and Function in Biochemistry
CHEM*3750	[0.50]	Organic Chemistry II
TOX*3300	[0.50]	Analytical Toxicology

One of:

MBG*2020 and ZOO*3200		
BIOM*3200	[1.00]	Mammalian Physiology

Semester 6 - Winter

BIOM*3090	[0.50]	Principles of Pharmacology
ENVB*3030	[0.50]	Pesticides and the Environment

One of:

ZOO*3210	[0.50]	Comparative Animal Physiology II **
MBG*2020	[0.50]	Introductory Molecular Biology ***

** (if ZOO*3200 taken in Sem. 5)
*** (if BIOM*3200 taken in Sem. 5)

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

TOX*4100	[0.50]	Toxicological Pathology
TOX*4200	[0.50]	Topics in Toxicology
TOX*4550	[0.50]	Toxicological Risk Characterization

1.00 electives or restricted electives*

Semester 8- Fall

MBG*3350	[0.75]	Laboratory Methods in Molecular Biology I
TOX*4000	[0.50]	Medical Toxicology
TOX*4590	[0.50]	Biochemical Toxicology

0.75 electives or restricted electives*

*** Restricted Electives**

At least 1.50 credits must be completed from the following list of allowable courses.

**Students are advised to pay particular attention to pre-requisite requirements when choosing individual courses, and seek advice as needed.

List A - Research

TOX*4900	[1.00]	Toxicology Research Project I
TOX*4910	[1.00]	Toxicology Research Project II

List B - Biomedical

BIOM*4070	[0.75]	Biomedical Histology
BIOM*4090	[0.50]	Pharmacology
MBG*4270	[0.50]	DNA Replication, Recombination and Repair
MICR*3230	[0.50]	Immunology
NUTR*3210	[0.50]	Fundamentals of Nutrition
NUTR*4510	[0.50]	Toxicology, Nutrition and Food

List C - Environmental

BIOL*2060	[0.50]	Ecology
BIOL*3450	[0.50]	Introduction to Aquatic Environments
BIOL*4350	[0.50]	Biology of Polluted Waters
BOT*2100	[0.50]	Life Strategies of Plants
ENVB*4240	[0.50]	Biological Activity of Pesticides
MICR*4180	[0.50]	Microbial Processes in Environmental Management
PBIO*4530	[0.50]	Environmental Pollution Stresses on Plants
SOIL*2010	[0.50]	Soil Science
STAT*3510	[0.50]	Environmental Risk Assessment

A minimum of 20.00 credits are required for graduation.

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*1070	[0.50]	Discovering Biodiversity
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

BIOL*1080	[0.50]	Biological Concepts of Health
BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
CHEM*1050	[0.50]	General Chemistry II
PHYS*1080	[0.50]	Physics for Life Sciences

0.50 Arts or Social Science electives

Semester 3

BIOC*2580	[0.50]	Introductory Biochemistry
STAT*2040	[0.50]	Statistics I
ZOO*2090	[0.50]	Vertebrate Structure and Function
ZOO*2100	[0.50]	Developmental Biology

0.50 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
BIOL*3400	[0.50]	Evolution
BOT*3050	[0.50]	Plant Functional Ecology
ZOO*3200	[0.50]	Comparative Animal Physiology I

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
BIOL*4150	[0.50]	Wildlife Conservation and Management
ZOO*4070	[0.50]	Animal Behaviour
ZOO*4910	[0.50]	Integrative Vertebrate Biology

0.25 electives *

Semester 8

2.50 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*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. At least 6.00 science credits must be at the 3000 or 4000 level, 2.00 of which must be at the 4000 level.

8.50 credits are electives, including at least 1.00 Arts or Social Science electives and 0.75 credit from restricted electives. BIOL*2250 is strongly recommended if independent research project courses are anticipated in semesters 7 and/or 8 CIS*1 200 is recommended for those needing to improve their computer skills.

Semester 1

BIOL*1070	[0.50]	Discovering Biodiversity
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 lacking one 4U /grade 12 course in Biology, Chemistry or Physics must take the equivalent introductory course in first semester. The required first-year science

courses in that subject should be completed according to the revised schedule of studies available at: http://www.bsc.uoguelph.ca/revisedss

Semester 2

BIOL*1080	[0.50]	Biological Concepts of Health
BIOL*1090	[0.50]	Introduction to Molecular and Cellular Biology
CHEM*1050	[0.50]	General Chemistry II
PHYS*1080	[0.50]	Physics for Life Sciences

0.50 Arts or Social Science electives

Semester 3

STAT*2040	[0.50]	Statistics I
ZOO*2090	[0.50]	Vertebrate Structure and Function
ZOO*2100	[0.50]	Developmental Biology

1.00 electives or restricted 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 or restricted 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 or restricted electives

Semester 6

BIOL*3120	[0.50]	Community Ecology
ZOO*3000	[0.50]	Comparative Histology
ZOO*3210	[0.50]	Comparative Animal Physiology II

1.00 electives or restricted electives

Semester 7

ZOO*4070	[0.50]	Animal Behaviour
ZOO*4910	[0.50]	Integrative Vertebrate Biology

1.50 electives or restricted electives

Semester 8

2.50 electives or restricted electives

Restricted 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*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.

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 credits may also come from this list or from outside this list, in consultation with a faculty advisor.