BIOCHEMISTRY (BIOC)

Department of Molecular and Cellular Biology, College of Biological Science

A B.Sc. in Biochemistry offers a multidisciplinary curriculum that gives students broad exposure to the life sciences with specific attention paid to the physical and chemical nature of biomolecular systems. The lab-intensive experience in this program prepares students to pursue post-graduate research opportunities in many different life science related fields. Graduates are also positioned to be successful in obtaining entrance to a number of professional programs, as well as employment in industry and government.

Major Requirements (Honours)

This is a major within the degree: Bachelor of Science.

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

Students lacking Grade 12 or 4U Biology, Chemistry or Physics should follow the revised schedule of study for this major found at https://www.uoguelph.ca/bsc/revised_SS/.

Code	Title	Credits
Semester 1		
BIOL*1090	Introduction to Molecular and Cellular Biology	0.50
CHEM*1040	General Chemistry I	0.50
MATH*1080	Elements of Calculus I	0.50
PHYS*1080	Physics for Life Sciences	0.50
0.50 Liberal Education electives		0.50
Semester 2		
BIOL*1070	Discovering Biodiversity	0.50
BIOL*1080	Biological Concepts of Health	0.50
CHEM*1050	General Chemistry II	0.50
MATH*1090	Elements of Calculus II	0.50
PHYS*1070	Physics for Life Sciences II	0.50
Semester 3		
BIOC*2580	Introduction to Biochemistry	0.50
MBG*2040	Foundations in Molecular Biology and Genetics	0.50
MICR*2420	Introduction to Microbiology	0.50
STAT*2040	Statistics I	0.50
0.50 Liberal Education electives		0.50
Semester 4		
BIOC*3560	Structure and Function in Biochemistry	0.50
CHEM*2480	Analytical Chemistry I: Chemical Analysis	0.50
CHEM*2700	Organic Chemistry I: Fundamentals	0.50
MCB*2050	Molecular Biology of the Cell	0.50
MICR*2430	Methods in Microbial Culture and Physiology	0.50
Semester 5		
BIOC*3570	Analytical Biochemistry	0.75
CHEM*2880	Physical Chemistry	0.50
CHEM*3750	Organic Chemistry II: Structure and Synthesis	0.50
Electives or restricted electives to a maximum of 2.75 total credits		1.00
Semester 6		
MBG*3350	Laboratory Methods in Molecular Biology	0.75
Electives or restricted electives to a maximum of 2.75 total credits		2.00
Semester 7		
2.50 electives or restricted electives		2.50
Semester 8		
BIOC*4540	Enzymology	0.75
Electives or restricted electives to a maximum of 2.75 total credits		2.00

Restricted Electives

Code	Title	Credits
Students must take as part of their program: 4.00 credits from the following: [1]		
BIOC*4050	Protein and Nucleic Acid Structure	0.50
BIOC*4520	Metabolic Processes	0.50
BIOC*4580	Membrane Biochemistry	0.50
BIOL*3300	Applied Bioinformatics	0.50
BIOM*3200	Biomedical Physiology	1.00
MBG*3040	Molecular Biology of the Gene	0.50
MCB*3010	Dynamics of Cell Function and Signaling	0.50
MCB*4010	Advanced Cell Biology [2]	0.50
MCB*4020	Communication in Molecular and Cellular Biology	0.50
MCB*4500	Research Project in Molecular and Cellular Biology I	1.00
MCB*4510	Research Project in Molecular and Cellular Biology	1.00
MCB*4600	Topics in Molecular and Cellular Biology	0.50
MICR*3230	Immunology	0.50
MICR*3240	Microbial Physiology and Genetics	0.50
MICR*3330	World of Viruses	0.50
MICR*4250	Microbiome and Immunity [2]	0.50
MICR*4330	Molecular Virology [2]	0.50
PBIO*3110	Crop Physiology	0.50
PBIO*4750	Genetic Engineering of Plants	0.50
STAT*2050	Statistics II	0.50
TOX*4590	Biochemical Toxicology	0.50

[1] At least 1.00 of these credits from BIOC*4050 Protein and Nucleic Acid Structure, BIOC*4520 Metabolic Processes, BIOC*4580 Membrane Biochemistry

[2] These restricted electives require other restricted electives as prerequisites. Students should consult the most recent undergraduate calendar for specific requirements.

Credit Summary

(20.00 Total Credits)

Code	Title	Credits
First year science credits		4.50
Required science courses semesters 3 - 8		7.75
Restricted electives		4.00
Liberal Education electives		1.00
Free electives – any approved electives for B.Sc. students		2.75
Total Credits		**20**

Of the total credits required, students are required to complete 16.00 credits in science of which a minimum of 2.00 credits must be at the 4000 level and an additional 4.00 credits must be at the 3000 or 4000 level.

Co-op Requirements (Honours)

This is a major within the degree: Bachelor of Science.

The Co-op program in Biochemistry is a four and a half year program, including four work terms. Students must complete a Fall (Sequence B only), Winter and Summer work term, and must follow the academic work schedule as outlined below (also found on the Co-operative Education website: https://www.recruitguelph.ca/cecs/).

Academic and Co-op Work Term Schedule – Sequence A

Year	Fall	Winter	Summer
1	Academic Semester 1	Academic Semester 2 COOP*1100	Off
2	Academic Semester 3	COOP*1000 Work Term I	Academic Semester 4
3	Academic Semester 5	COOP*2000 Work Term II	COOP*3000 Work Term III
4	Academic Semester 6	Academic Semester 7	COOP*4000 Work Term IV
5	Academic Semester 8	N/A	N/A

Academic and Co-op Work Term Schedule – Sequence B

Year	Fall	Winter	Summer
1	Academic Semester 1	Academic Semester 2 COOP*1100	Off
2	Academic Semester 3	COOP*1000 Work Term I	Academic Semester 4
3	COOP*2000 Work Term II	Academic Semester 5	COOP*3000 Work Term III
4	Academic Semester 6	Academic Semester 7	COOP*4000 Work Term IV
5	Academic Semester 8	N/A	N/A

Please refer to the Co-operative Education program policy with respect to work term performance grading, work term report grading and program completion requirements.

For additional program information students should consult with their Co-op Co-ordinator and Co-op Faculty Advisor, listed on the Co-operative Education web site.

Credit Summary

(22.00 Total Credits)

Code	Title	Credits
First year science credits		4.50
Required science courses semesters 3 - 8		7.75
Restricted electives		4.00
Liberal Education electives		1.00
Free electives – any approved electives for B.Sc. students		2.75
Co-op Work Terms		2.00
Total Credits		**22**

Of the total credits required, students are required to complete 16.00 credits in science of which a minimum of 2.00 credits must be at the 4000 level and an additional 4.00 credits must be at the 3000 or 4000 level.

Recommended Program Sequence

Sequence A

Students lacking Grade 12 or 4U Biology, Chemistry or Physics should follow the revised schedule of study for this major found at https://www.uoguelph.ca/bsc/revised_SS/.

Code	Title	Credits
Semester 1 - Fall		
BIOL*1090	Introduction to Molecular and Cellular Biology	0.50
CHEM*1040	General Chemistry I	0.50
MATH*1080	Elements of Calculus I	0.50
PHYS*1080	Physics for Life Sciences	0.50
0.50 Liberal education electives		0.50
Semester 2 - Winter		
BIOL*1070	Discovering Biodiversity	0.50
BIOL*1080	Biological Concepts of Health	0.50
CHEM*1050	General Chemistry II	0.50
COOP*1100	Introduction to Co-operative Education	0.00
MATH*1090	Elements of Calculus II	0.50
PHYS*1070	Physics for Life Sciences II	0.50
Summer Semester		
No academic semester or work term		
Semester 3 - Fall		
BIOC*2580	Introduction to Biochemistry	0.50
CHEM*2480	Analytical Chemistry I: Chemical Analysis	0.50
CHEM*2880	Physical Chemistry	0.50
MBG*2040	Foundations in Molecular Biology and Genetics	0.50
0.50 Liberal education electives		0.50
Winter Semester		
COOP*1000	Co-op Work Term I	0.50
Semester 4 - Summer		
BIOC*3560	Structure and Function in Biochemistry	0.50
CHEM*2700	Organic Chemistry I: Fundamentals	0.50
MICR*2420	Introduction to Microbiology	0.50
STAT*2040	Statistics I	0.50
0.50 Electives or restricted electives		0.50

Semester 5 - Fall		
CHEM*3750	Organic Chemistry II: Structure and Synthesis	0.50
BIOC*3570	Analytical Biochemistry	0.75
MCB*2050	Molecular Biology of the Cell	0.50
MICR*2430	Methods in Microbial Culture and Physiology	0.50
Electives or restricted electives to a maximum of 2.75 total credits		0.50
Winter Semester		
COOP*2000	Co-op Work Term II	0.50
Summer Semester		
COOP*3000	Co-op Work Term III	0.50
Semester 6 - Fall		
MBG*3350	Laboratory Methods in Molecular Biology	0.75
Electives or restricted electives to a maximum of 2.75 total credits		2.00
Semester 7 - Winter		
BIOC*4540	Enzymology	0.75
Electives or restricted electives to a maximum of 2.75 total credits		2.00
Summer Semester		
COOP*4000	Co-op Work Term IV	0.50
Semester 8 - Fall		
2.50 Electives or restricted electives		2.50

Restricted Electives

Code	Title	Credits
Students must take as part of their program 4.00 credits from the following: [1]		
BIOC*4050	Protein and Nucleic Acid Structure	0.50
BIOC*4520	Metabolic Processes	0.50
BIOC*4580	Membrane Biochemistry	0.50
BIOL*3300	Applied Bioinformatics	0.50
BIOM*3200	Biomedical Physiology	1.00
MBG*3040	Molecular Biology of the Gene	0.50
MCB*3010	Dynamics of Cell Function and Signaling	0.50
MCB*4010	Advanced Cell Biology [2]	0.50
MCB*4020	Communication in Molecular and Cellular Biology	0.50
MCB*4500	Research Project in Molecular and Cellular Biology I	1.00
MCB*4510	Research Project in Molecular and Cellular Biology	1.00
MCB*4600	Topics in Molecular and Cellular Biology	0.50
MICR*3230	Immunology	0.50
MICR*3240	Microbial Physiology and Genetics	0.50
MICR*3330	World of Viruses	0.50
MICR*4250	Microbiome and Immunity [2]	0.50
MICR*4330	Molecular Virology [2]	0.50
PBIO*3110	Crop Physiology	0.50
PBIO*4750	Genetic Engineering of Plants	0.50
STAT*2050	Statistics II	0.50
TOX*4590	Biochemical Toxicology	0.50

1. At least 1.00 of these credits from BIOC*4050 Protein and Nucleic Acid Structure, BIOC*4520 Metabolic Processes, BIOC*4580 Membrane Biochemistry.
2. These restricted electives require other restricted electives as prerequisites. Students should consult the most recent undergraduate calendar for specific requirements.

Sequence B

Students lacking Grade 12 or 4U Biology, Chemistry or Physics should follow the revised schedule of study for this major found at https://www.uoguelph.ca/bsc/revised_SS/.

Code	Title	Credits
Semester 1 - Fall		
BIOL*1090	Introduction to Molecular and Cellular Biology	0.50
CHEM*1040	General Chemistry I	0.50
MATH*1080	Elements of Calculus I	0.50
PHYS*1080	Physics for Life Sciences	0.50
0.50 Liberal education electives		0.50
Semester 2 - Winter		
BIOL*1070	Discovering Biodiversity	0.50
BIOL*1080	Biological Concepts of Health	0.50
CHEM*1050	General Chemistry II	0.50
COOP*1100	Introduction to Co-operative Education	0.00
MATH*1090	Elements of Calculus II	0.50
PHYS*1070	Physics for Life Sciences II	0.50
Summer Semester		
No academic semester or work term		
Semester 3 - Fall		
BIOC*2580	Introduction to Biochemistry	0.50
CHEM*2480	Analytical Chemistry I: Chemical Analysis	0.50
CHEM*2880	Physical Chemistry	0.50
MBG*2040	Foundations in Molecular Biology and Genetics	0.50
0.50 Liberal education electives		0.50
Winter Semester		
COOP*1000	Co-op Work Term I	0.50
Semester 4 - Summer		
CHEM*2700	Organic Chemistry I: Fundamentals	0.50
BIOC*3560	Structure and Function in Biochemistry	0.50
MICR*2420	Introduction to Microbiology	0.50
STAT*2040	Statistics I	0.50
0.50 Electives or restricted electives		0.50
Fall Semester		
COOP*2000	Co-op Work Term II	0.50
Semester 5 - Winter		
MCB*2050	Molecular Biology of the Cell	0.50
MICR*2430	Methods in Microbial Culture and Physiology	0.50
1.50 Electives or restricted electives		1.50
Summer Semester		
COOP*3000	Co-op Work Term III	0.50
Semester 6 - Fall		

CHEM*3750	Organic Chemistry II: Structure and Synthesis	0.50
BIOC*3570	Analytical Biochemistry	0.75
Electives or restricted electives to a maximum of 2.75 total credits		1.50
Semester 7 - Winter		
BIOC*4540	Enzymology	0.75
MBG*3350	Laboratory Methods in Molecular Biology	0.75
1.00 Electives or restricted electives		1.00
Summer Semester		
COOP*4000	Co-op Work Term IV	0.50
Semester 8 - Fall		
2.50 Electives or restricted electives		2.50

Restricted Electives

Code	Title	Credits
Students must take as part of their program: 4.00 credits from the following: [1]		
BIOC*4050	Protein and Nucleic Acid Structure	0.50
BIOC*4520	Metabolic Processes	0.50
BIOC*4580	Membrane Biochemistry	0.50
BIOL*3300	Applied Bioinformatics	0.50
BIOM*3200	Biomedical Physiology	1.00
MBG*3040	Molecular Biology of the Gene	0.50
MCB*3010	Dynamics of Cell Function and Signaling	0.50
MCB*4010	Advanced Cell Biology [2]	0.50
MCB*4020	Communication in Molecular and Cellular Biology	0.50
MCB*4500	Research Project in Molecular and Cellular Biology I	1.00
MCB*4510	Research Project in Molecular and Cellular Biology	1.00
MCB*4600	Topics in Molecular and Cellular Biology	0.50
MICR*3230	Immunology	0.50
MICR*3240	Microbial Physiology and Genetics	0.50
MICR*3330	World of Viruses	0.50
MICR*4250	Microbiome and Immunity [2]	0.50
MICR*4330	Molecular Virology [2]	0.50
PBIO*3110	Crop Physiology	0.50
PBIO*4750	Genetic Engineering of Plants	0.50
STAT*2050	Statistics II	0.50
TOX*4590	Biochemical Toxicology	0.50

[1] At least 1.00 of these credits from BIOC*4050 Protein and Nucleic Acid Structure, BIOC*4520 Metabolic Processes, BIOC*4580 Membrane Biochemistry.

[2] These restricted electives require other restricted electives as prerequisites. Students should consult the most recent undergraduate calendar for specific requirements.

Minor Requirements (Honours)

This minor cannot be combined with a major in Biochemistry.

A minor in Biochemistry consists of at least 5.00 course credits.

Code	Title	Credits
Required Courses		
BIOC*3560	Structure and Function in Biochemistry	0.50
BIOC*3570	Analytical Biochemistry	0.75
BIOC*4540	Enzymology	0.75
CHEM*2480	Analytical Chemistry I: Chemical Analysis	0.50
CHEM*2700	Organic Chemistry I: Fundamentals	0.50
MBG*2040	Foundations in Molecular Biology and Genetics	0.50
or MICR*2420	Introduction to Microbiology	
Other Courses		
Select 1.50 credits from the following: [2]		
BIOC*4050	Protein and Nucleic Acid Structure	0.50
BIOC*4520	Metabolic Processes	0.50
BIOC*4580	Membrane Biochemistry	0.50
MBG*3350	Laboratory Methods in Molecular Biology	0.75
MICR*3230	Immunology	0.50
MICR*3330	World of Viruses	0.50
TOX*4590	Biochemical Toxicology	0.50

[2] At least 1.00 of these credits from BIOC*4050 Protein and Nucleic Acid Structure, BIOC*4520 Metabolic Processes, BIOC*4580 Membrane Biochemistry