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 (calendar.uoguelph.ca/undergraduate-calendar/degree-programs/bachelor-science-bsc/)**.**

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	0.50
CHEM*2700	Organic Chemistry I	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	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
1. Students must take as part of their program: 4.00 credits fom 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	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*4330	Molecular Virology	0.50
MICR*4530	Immunology II	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
2. Students must take as part of their program: 0.50 credits from the following:		
PHYS*2030	Biophysics of Excitable Cells	0.50
PHYS*2240	Thermal Physics	0.50
PHYS*2330	Electricity and Magnetism I	0.50
PHYS*2600	General Astronomy	0.50
PHYS*3080	Energy	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

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 (# 1 and # 2 in restricted elective list)		4.50
Liberal Education electives		1.00
Free electives – any approved electives for B.Sc. students		2.25
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 (calendar.uoguelph.ca/undergraduate-calendar/degree-programs/bachelor-science-bsc/**).**

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 elective (# 1 and #2 in restricted elective list)		4.50
Liberal Education electives		1.00
Free electives – any approved electives for B.Sc. students		2.25
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	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	0.50
MICR*2420	Introduction to Microbiology	0.50
STAT*2040	Statistics I	0.50
Electives or Restricted Electives to a maximum of 2.75 total credits		0.75
Semester 5 - Fall		
CHEM*3750	Organic Chemistry II	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
0.50 electives or restricted electives		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
1. Students must take as part of their program: 4.00 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
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	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*4330	Molecular Virology	0.50
MICR*4530	Immunology II	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
2. Students must take as part of their program: 0.50 credits from the following:		
PHYS*2030	Biophysics of Excitable Cells	0.50
PHYS*2240	Thermal Physics	0.50
PHYS*2330	Electricity and Magnetism I	0.50
PHYS*2600	General Astronomy	0.50
PHYS*3080	Energy	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.

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	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	0.50
BIOC*3560	Structure and Function in Biochemistry	0.50

MICR*2420	Introduction to Microbiology	0.50
STAT*2040	Statistics I	0.50
Electives or Restricted Electives to a maximum of 2.75 total credits		0.75
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	0.50
BIOC*3570	Analytical Biochemistry	0.75
2.00 electives or restricted electives		2.00
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
1. Students must take as part of their program: 4.00 credits from the following: [3]		
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	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*4330	Molecular Virology	0.50
MICR*4530	Immunology II	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
2. Students must take as part of their program: 0.50 credits from the following:		
PHYS*2030	Biophysics of Excitable Cells	0.50
PHYS*2240	Thermal Physics	0.50
PHYS*2330	Electricity and Magnetism I	0.50
PHYS*2600	General Astronomy	0.50
PHYS*3080	Energy	0.50

3

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

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	0.50
CHEM*2700	Organic Chemistry I	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