MICROBIOLOGY, B.SC. HONOURS

Microbiology Honours Entrance, Continuation, and Graduation Requirements

To enter the Honours program in Microbiology, a student must have completed at least 24 credit hours with a minimum DGPA of 3.00, and also obtained a minimum grade of "B" in MBIO 1010, and a minimum grade of "C+" in CHEM 1110. CHEM 1120, BIOL 1020, BIOL 1030, STAT 1150 (or STAT 1000), and the 3 credit hours of specified Mathematics or Physics are program requirements and students are strongly encouraged to complete these courses in first year.

To continue in the Microbiology Honours program, students must maintain a minimum DGPA of 3.00, and complete a minimum of 9 credit hours during each Fall and Winter Term.

To graduate from the Microbiology Honours program students must achieve a minimum DGPA of 3.00 and obtain a minimum grade of "C" on the courses that make up the 120 credit hours of the degree.

Honours Co-operative Option

A co-operative education option is available for Honours students. Students should refer to the Co-operative Education (p. 3) section for further information on the Co-op programs.

The course, grade requirements and minimum DGPA requirement for entry and continuation in the Co-operative Option are the same as that for regular Honours program.

Before beginning their first co-op work term, students are required to complete the first and second year requirements of the program, in addition to MBIO 2710 (CHEM 2710) and CHEM 2720, MBIO 3010 and MBIO 3410.

Degree Requirements

Honours

Note[1]

Course	Title	Hours
Year 1		
MBIO 1010	Microbiology I (B) [2]	3
BIOL 1020	Biology 1: Principles and Themes	3
BIOL 1030	Biology 2: Biological Diversity, Function and Interactions	3
CHEM 1100	Introductory Chemistry 1: Atomic and Molecular Structure and Energetics	3
CHEM 1110	Introductory Chemistry 2: Interaction, Reactivity, and Chemical Properties (C+)	3
CHEM 1120	Introduction to Chemistry Techniques [3]	3
	Hours	**18**
Years 1-2		
In Year 1 or Year 2 the following must be completed:		
3 credit hours of Mathematics or Physics chosen from:		3
MATH 1240	Elementary Discrete Mathematics [4]	
MATH 1300	Vector Geometry and Linear Algebra [4]	
MATH 1500	Introduction to Calculus [4]	
PHYS 1020 or PHYS 1050	General Physics 1 or Physics 1: Mechanics	
One of:		3
STAT 1150	Introduction to Statistics and Computing [5]	
STAT 1000	Basic Statistical Analysis 1 [5]	
6 credit hours from the Faculty of Arts, which should include the required "W" course		6
6 credit hours of electives [6]		6
3 credit hours from Microbiology courses or from the Option List (see below) [6]		3
	Hours	**21**
Year 2		
MBIO 2020	Microbiology II	3
MBIO/CHEM 2700	Biochemistry 1: Biomolecules and an Introduction to Metabolic Energy [7]	3
MBIO/CHEM 2710	Biochemistry 2: Catabolism, Synthesis, and Information Pathways [7]	3
CHEM 2720	Principles and Practices of the Modern Biochemistry Laboratory [7]	3
BIOL 2500	Genetics 1	3
BIOL 2520	Cell Biology	3
CHEM 2100	Organic Chemistry 1: Foundations of Organic Chemistry [7]	3
	Hours	**21**
Year 3		
MBIO 3010	Mechanisms of Microbial Disease	3
MBIO 3032	Microbiology III: Physiology and Metabolism	3
MBIO 3410	Molecular Biology	3
MBIO 3600	Molecular Microbiology Techniques	3
MBIO 3700	Experimental Microbiology Laboratory	3
	Hours	**15**
Years 3-4		
24 credit hours of Microbiology courses including (a single course may meet more than one of these requirements): [6]		24
- One course from each of Lists A, B, C, D, and E (see below); [8]		
- 12 credit hours at the 4000-level;		
- 3 credit hour course with a laboratory or tutorial (List F) [8]		
12 credit hours from the Option List (see below) [6]		12
3 credit hours of electives [6]		3
	Hours	**39**
Year 4		
MBIO 4530	Project in Microbiology	6
	Hours	**6**
	Total Hours	**120**

1. MBIO 1220 and MBIO 1410 cannot be used to satisfy course requirements in a Major or Honours program.
2. MBIO 1010 may be completed in either year 1 or year 2. It is recommended that it be completed in first year.

[3] CHEM 1122 and CHEM 1126 may be used in place of CHEM 1120. Note: CHEM 1122 and CHEM 1126 are only available to Price Faculty of Engineering students.

[4]
- MATH 1210, MATH 1220, or MATH 1310 may be taken in place of MATH 1300;
- MATH 1230, MATH 1510, the former MATH 1520, or MATH 1524 may be taken in place of MATH 1500;
- MATH 1200 may be used in place of MATH 1240.

[5] STAT 1150 is recommended over STAT 1000.

[6] By careful choice of course options and electives, programs may be selected giving emphasis to various areas of Microbiology, e.g., Biochemistry and Molecular Biology or Environmental and Ecological Microbiology. Students must be aware of course and grade prerequisites when selecting 3000 and 4000 level Microbiology courses as well as specific options courses from other departments.

[7] CHEM 2100 must be taken before MBIO 2710 (CHEM 2710). Courses (MBIO 2700 and CHEM 2700) and (MBIO 2710 and CHEM 2710) are the same and credit cannot be held for both. It is strongly recommended that MBIO 2710 (or CHEM 2710) and CHEM 2720 be completed prior to Year 3 as they are prerequisite to many upper level MBIO courses.

[8]
- **List A**: MBIO 2230, MBIO 3282, MBIO 3472, MBIO 4480, MBIO 4520;
- **List B**: MBIO 2420, MBIO 3000, MBIO 4020, MBIO 4300, MBIO 4410, MBIO 4520;
- **List C**: MBIO 3430, MBIO 4442, MBIO 4700;
- **List D**: MBIO 4602, MBIO 4612, MBIO 4672;
- **List E**: MBIO 3450, MBIO 3460, MBIO 4540;
- **List F**: MBIO 3460, MBIO 4442, MBIO 4480, MBIO 4520.

(Letters in brackets indicate minimum prerequisite standing for further study.)

Honours Co-operative Option

Note[1,2]

Course	Title	Hours
Year 1		
MBIO 1010	Microbiology I (B) [3]	3
BIOL 1020	Biology 1: Principles and Themes	3
BIOL 1030	Biology 2: Biological Diversity, Function and Interactions	3
CHEM 1100	Introductory Chemistry 1: Atomic and Molecular Structure and Energetics	3
CHEM 1110	Introductory Chemistry 2: Interaction, Reactivity, and Chemical Properties (C+)	3
CHEM 1120	Introduction to Chemistry Techniques [4]	3
	Hours	**18**
Years 1-2		
In Year 1 or Year 2 the following must be completed:		
3 credit hours of Mathematics or Physics chosen from:		3
MATH 1240	Elementary Discrete Mathematics [5]	
MATH 1300	Vector Geometry and Linear Algebra [5]	
MATH 1500	Introduction to Calculus [5]	
PHYS 1020 or PHYS 1050	General Physics 1 or Physics 1: Mechanics	
One of:		3
STAT 1150	Introduction to Statistics and Computing [6]	
STAT 1000	Basic Statistical Analysis 1 [6]	
6 credit hours from the Faculty of Arts, which should include the required "W" course		6
6 credit hours of electives [7]		6
3 credit hours from Microbiology courses or from the Option List (see below) [7]		3
	Hours	**21**
Year 2		
MBIO 2020	Microbiology II	3
MBIO/CHEM 2700	Biochemistry 1: Biomolecules and an Introduction to Metabolic Energy [8]	3
MBIO/CHEM 2710	Biochemistry 2: Catabolism, Synthesis, and Information Pathways [2,8]	3
CHEM 2720	Principles and Practices of the Modern Biochemistry Laboratory [2,8]	3
BIOL 2500	Genetics 1	3
BIOL 2520	Cell Biology	3
CHEM 2100	Organic Chemistry 1: Foundations of Organic Chemistry [8]	3
	Hours	**21**
Year 3		
MBIO 3010	Mechanisms of Microbial Disease [2]	3
MBIO 3032	Microbiology III: Physiology and Metabolism	3
MBIO 3410	Molecular Biology [2]	3
MBIO 3600	Molecular Microbiology Techniques	3
MBIO 3700	Experimental Microbiology Laboratory	3
	Hours	**15**
Years 3-4		
27 credit hours of Microbiology courses including (a single course may meet more than one of these requirements): [7]		27
- One course from each of Lists A, B, C, D, and E (see below); [9]		
- 15 credit hours at the 4000-level;		
- 3 credit hour course with a laboratory or tutorial (List F). [9]		
15 credit hours from the Option List (see below) [7]		15
3 credit hours of electives [7]		3
Co-op Requirements: [2]		
SCI 3980	Co-operative Education Work Term 1	0
SCI 3990	Co-operative Education Work Term 2	0
SCI 4980	Co-operative Education Work Term 3	0
SCI 4990	Co-operative Education Work Term 4 (if a 4th work term is selected)	0
	Hours	**45**
	Total Hours	**120**

[1] MBIO 1220 and MBIO 1410 cannot be used to satisfy course requirements in a Major or Honours program.

[2] Students in the Co-operative Option are required to complete MBIO 2710 (CHEM 2710) and CHEM 2720, MBIO 3010 and MBIO 3410 before their first employment term.

[3] MBIO 1010 may be completed in either year 1 or year 2. It is recommended that it be completed in first year.

[4] CHEM 1122 and CHEM 1126 may be used in place of CHEM 1120. Note: CHEM 1122 and CHEM 1126 are only available to Price Faculty of Engineering students.

5
- MATH 1210, MATH 1220, or MATH 1310 may be taken in place of MATH 1300;
- MATH 1230, MATH 1510, the former MATH 1520, or MATH 1524 may be taken in place of MATH 1500.
- MATH 1200 may be used in place of MATH 1240.

6 STAT 1150 is recommended over STAT 1000.

7 By careful choice of course options and electives, programs may be selected giving emphasis to various areas of Microbiology, e.g., Biochemistry and Molecular Biology or Environmental and Ecological Microbiology. Students must be aware of course and grade prerequisites when selecting 3000 and 4000 level Microbiology courses as well as specific options courses from other departments.

8 CHEM 2100 must be taken before MBIO 2710 (CHEM 2710). Courses (MBIO 2700 and CHEM 2700) and (MBIO 2710 and CHEM 2710) are the same and credit cannot be held for both. MBIO 2710 (or CHEM 2710) and CHEM 2720 must be completed prior to Year 3 as they are required for entry for the Co-operative Option.

9
- **List A**: MBIO 2230, MBIO 3282, MBIO 3472, MBIO 4480, MBIO 4520;
- **List B**: MBIO 2420, MBIO 3000, MBIO 4020, MBIO 4300, MBIO 4410, MBIO 4520;
- **List C**: MBIO 3430, MBIO 4442, MBIO 4700;
- **List D**: MBIO 4602, MBIO 4612, MBIO 4672;
- **List E**: MBIO 3450, MBIO 3460, MBIO 4540;
- **List F**: MBIO 3460, MBIO 4442, MBIO 4480, MBIO 4520.

(Letters in brackets indicate minimum prerequisite standing for further study.)

Option List for All Microbiology Programs

Agroecology

Course	Title	Hours
AGEC 2370	Principles of Ecology	3

Biological Sciences

Course	Title	Hours
BIOL 2242	The Flowering Plants	3
BIOL 2260	Biology of Fungi and Lichens	3
BIOL 2300	Principles of Ecology	3
BIOL 2380	Introductory Toxicology	3
BIOL 2410	Human Physiology 1	3
BIOL 2420	Human Physiology 2	3
BIOL 3290	Medicinal and Hallucinogenic Plants	3
BIOL 3370	Limnology	3
BIOL 3400	Plant Physiology	3
BIOL 3452	Environmental Plant Physiology	3
BIOL 3470	Environmental Physiology of Animals 1	3
BIOL 3472	Environmental Physiology of Animals 2	3
BIOL 3500	Genetics 2	3
BIOL 3542	Developmental Biology	3
BIOL 3560	Comparative Animal Histology	3
BIOL 4480	Comparative Endocrinology	3
BIOL 4540	Developmental Molecular Biology	3
BIOL 4542	Genes and Development	3
BIOL 4544	Advanced Developmental and Cellular Biology	3
BIOL 4554	Molecular Biology Techniques for Eukaryotes - DNA	3
BIOL 4556	Molecular Biology Techniques for Eukaryotes - RNA	3
BIOL 4560	Microtechnique	3

Chemistry

Course	Title	Hours
CHEM 2110	Organic Chemistry 2: Foundations of Organic Synthesis	3
CHEM 2122	Experimental Organic Chemistry	3
CHEM 2300	Inorganic Chemistry 1: Structure and Applications	3
CHEM 2510	Introduction to Analytical Chemistry	3
CHEM 2600	Physical Chemistry 1	3
CHEM 3100	Organic Chemistry 3: Advanced Organic Synthesis	3
CHEM 3500	Instrumental Analysis	3
CHEM 3600	Physical Chemistry 2	3
CHEM 3700	Biophysical Chemistry	3
CHEM 4590	Bioanalytical Methods	3
CHEM 4360	Signalling and Regulation of Gene Expression	3
CHEM 4370	Glycobiology and Protein Activation	3
CHEM 4620	Biochemistry of Nucleic Acids	3
CHEM 4630	Biochemistry of Proteins	3
CHEM 4670	Drug Design and Drug Discovery	3

Environmental Science

Course	Title	Hours
ENVR 2180	Introductory Toxicology	3

Food Sciences

Course	Title	Hours
FOOD 4150	Food Microbiology 1	3

General Agriculture

Course	Title	Hours
AGRI 2180	Introductory Toxicology	3

Pharmacology

Course	Title	Hours
PHAC 4030	Drugs in Human Disease I	3
PHAC 4040	Drugs in Human Disease II	3

Plant Science

Course	Title	Hours
PLNT 3400	Plant Physiology	3

Statistics

Course	Title	Hours
STAT 2000	Basic Statistical Analysis 2	3
or STAT 2150	Statistics and Computing	

Note: Other suitable options may be selected with permission of the department.

Co-operative Education Option Academic Regulations: B.Sc. (Major) & B.Sc. and B.C.Sc. (Honours)

Co-operative education is a form of experiential learning which integrates the academic education (classroom-based learning) of interested and qualified students with relevant, supervised, and paid work experience (work-based learning) with employers. Co-op students gain valuable skills

to guide them through their academic education and prepare them for future careers after graduation.

The Faculty of Science offers a Co-operative Education Option in the following Major programs:

- Biochemistry
- Biological Sciences
- Chemistry
- Computer Science
- Data Science
- Genetics
- Mathematics
- Microbiology
- Physics & Astronomy
- Psychology
- Statistics.

The Honours programs offering a Co-operative Education Option are:

- Biochemistry
- Biological Sciences
- Chemistry
- Computer Science
- Genetics
- Mathematics
- Microbiology
- Physics & Astronomy
- Statistics
- Joint Computer Science – Mathematics
- Joint Computer Science – Physics and Astronomy
- Joint Computer Science – Statistics
- Joint Mathematics – Physics and Astronomy
- Joint Statistics – Mathematics program.

Co-operative education is optional and supplementary to academic requirements of the chosen degree. All regulations governing regular Major and Honours programs apply to the Co-operative Education Option. In addition, the following variations apply:

Entrance

To enter the Co-operative Education Option a student must be eligible to enter the Major or Honours program offered by the department. At the time of application, students must have a minimum Degree Grade Point Average (DGPA) of 2.5 for the Major and 3.0 for the Honours Programs. For Psychology, students must have a minimum Degree Grade Point Average (DGPA) of 3.0 for the Major. Co-op is not available for students in the Honours Psychology Program.

The normal point of entry to the Co-operative Education Option is following the completion of second year in the Faculty of Science. Students seeking admission will submit an application during their second year and complete an intake process with the appropriate departmental Co-op Coordinator. Application deadlines are established by the Science Co-op Office.

Students are advised that satisfying the entrance requirements does not guarantee a place in the Co-operative Education Option. The Science Co-op Office reserves the right to determine and select the best-qualified applicants.

Students admitted into the Co-operative Education Option will complete pre-employment training, including workshops, prior to the start of their first co-op work term. The structure and content of this training is developed by the Science Co-op Office. Attendance and completion of this training is mandatory.

Structure and Sequencing

The Co-operative Education Option consists of both academic terms and co-op work terms.

Each academic term can be either four months in duration or eight months in duration, as designated by the Major or Honours department.

Each co-op work term can be either four months in duration or eight months in duration, as designated by the Science Co-op Office. An eight month work term would be counted as the equivalent of two 4 month terms.

Each academic term and each co-op work term will commence in January, May or September.

The sequence of academic terms and co-op work terms is variable to suit the needs of each department, and is designated by the Science Co-op Office in conjunction with each Major or Honours department. All Faculty of Science Co-operative Education Options must end on an academic term.

Students are expected to follow the academic/co-op work term sequence defined by their Major or Honours department from admission through to graduation.

Co-op Work Term Requirements

All Co-operative Education Options require participating students to complete at least three (3) 4-month co-op work terms for a total of a minimum of 12 months' work experience. Each co-op work term is completed with one employer.

Students are required to register in the appropriate co-op work term course and pay the work term fee prior to starting their co-op work term.

Co-operative Education Option students are required to submit a work term report at the end of each co-op work term. These reports are due at times designated by the Science Co-op Office. In order to remain in the Co-operative Education program, a student must obtain a grade of "Pass" for each work term report. The Science Co-op Office will provide students with instructions regarding the content and format requirements of the work term reports.

While on a co-op work term, students are not permitted to take more than six hours of academic credit, and may not take more than one course at a time.

Academic Term Requirements

Coursework requirements of the Co-operative Education Option are equivalent to the coursework requirements of the four-year Major program. For students completing an Honours program, the coursework requirements of the Co-operative Education Option are equivalent to the coursework requirements of the Honours program with the exception of the Biochemistry, Genetics and Microbiology programs.

Co-operative Education Option students are required to maintain full-time study while registered for an academic term.

To continue in a four year Major Co-operative Education Option, students must maintain a minimum DGPA of 2.50 at each point of assessment; except for students in Psychology where a minimum DGPA of 3.00 must be maintained at each point of assessment. A student's performance will be evaluated following each academic term. In addition, the student must meet all individual course prerequisites for further study and departmental continuation and graduation requirements. Please see department entries for further information. Continuation in the Major Co-operative Education Option is also contingent upon satisfactory performance during co-op work terms.

To continue in an Honours Co-operative Education Option a student must maintain a minimum DGPA of 3.00 or higher at each point of assessment. A student's performance will be evaluated following each academic term. In addition, the student must meet all individual course prerequisites for further study and departmental continuation and graduation requirements. Please see department entries for further information. Continuation in the Honours Co-operative Education Option is also contingent upon satisfactory performance during co-op work terms.

Students may be required to withdraw from the Co-operative Education Option for any of the following reasons:

- Failure to maintain the minimum academic requirements of the Faculty of Science and/or Major/Honours program.
- Failure to maintain the minimum credit hour requirements of the academic term in the co-op option.
- Unsatisfactory performance during a co-op work term.
- Failure to submit a co-op work term report or the submitted report does not achieve a "Pass" grade.
- Failure to observe the policies outlined in university governing documents related to Behavioural Policies and Academic Misconduct.
- Having consulted with the Co-op Director and/or Faculty Advisor, in the opinion of the Co-op Coordinator, the student does not possess sufficient ability, skills, aptitude, attitude, diligence or motivation to successfully complete the Co-operative Education Option.

Students who wish to voluntarily withdraw from the Co-operative Education Option must obtain the written approval from their Co-op Coordinator and the Science Co-op Director. Students must submit their withdrawal request to their Co-op Coordinator and receive approval by the withdrawal dates set by the Science Co-op Office for each co-op work term.

Students are not normally permitted to withdraw from the Co-operative Education Option once they have secured a position for their co-op work term; whether the position was obtained through the Science Co-op Office or through students' own self-directed job search. Enrollment in the applicable co-op course(s) will be maintained and students are responsible for all assessed fees for the duration of the co-op work term and for meeting all academic requirements.

Students who accumulate more than 18 credit hours of failed courses after entering the four-year Major program (regardless of the origin of the grade or if the course has been repeated) will be required to withdraw from the Major Co-op program. Students are also subject to the academic assessment policy found in the Faculty Academic Regulations (https://catalog.umanitoba.ca/undergraduate-studies/science/#facultyacademicregulationstext).

Students who accumulate more than 15 credit hours of failed courses after entering the Honours degree program (regardless of the origin of the grade or if the course has been repeated) will be required to withdraw from the Honours Co-op program. Students required to withdraw from the Honours program may be eligible to pursue the B.Sc. Major program or the B.Sc. General degree program. Students are also subject to the academic assessment policy found in the Faculty Academic Regulations (https://catalog.umanitoba.ca/undergraduate-studies/science/#facultyacademicregulationstext).

Four year Major Co-operative Education Option students who are required to withdraw, or voluntarily revert to an alternative degree program must fulfil all academic requirements of that degree.

Honours Co-operative Education Option students who are required to withdraw or voluntarily revert to an alternative degree program must fulfill all academic requirements of that degree.