

BIOTECHNOLOGY, B.SC. MAJOR

Biotechnology Major Entrance, Continuation and Graduation Requirements

Note: As of Fall 2018, admission to the Biotechnology programs has been temporarily suspended. For further information, see the Faculty of Science office.

To enter the Biotechnology Joint Major program a student must have completed at least 24 credit hours with a minimum DGPA of 2.00 and also obtained a minimum grade of "C+" in CHEM 1110 and a minimum grade of "C" in CHEM 1120 and BIOL 1020. BIOL 1030, CHEM 1100, MATH 1500, PHYS 1020 or PHYS 1050, and STAT 1000 are required courses in the program and students are strongly urged to complete these courses in first year. Six credit hours of Arts electives, including the written English course should also be taken in Year 1.

Students will select one stream (Analytical or Molecular Biotechnology). All students must complete a common core of required courses plus required stream specific courses. The remaining courses can be selected from the list of recommended electives. This list is meant to give students some idea of appropriate electives; however, students have the option to choose courses not on the list in consultation with the Program Advisors.

To continue in the Major program a student must maintain a minimum DGPA of 2.00. No more than 18 credit hours of F grades can be accumulated regardless of whether any course has been repeated and a higher grade achieved.

To graduate from the Biotechnology Joint Major degree, students must maintain a minimum DGPA of 2.00. Students must also obtain a minimum grade of "C" on all common core and stream specific courses outlined below. There is no term registration load requirement in the Major degree.

Students who do not meet these minimum requirements will be required to withdraw from the program and will normally be eligible to enter the 3-Year B.Sc. General degree program.

Major Co-operative Option

A co-operative education option is available for Major students. Students should refer to the Co-operative Education (p. 2) for further information on the Co-op programs.

The course and minimum grade requirements for entry and continuation in the Co-operative Option are the same as those required for the regular Major program. However, the entry and continuation DGPA requirement is set at a minimum of 2.5.

Students are required to complete the first and second year requirements of the program and MBIO 3410 before beginning their first co-op work term.

Degree Requirements

Joint Four Year Major (Including Co-operative Option if Selected)

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Offered Jointly by the Departments of Chemistry and Microbiology

Course	Title	Hours
Year 1		
BIOL 1020	Biology 1: Principles and Themes (C)	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 Chemical Techniques (C)	3
PHYS 1020 or PHYS 1050	General Physics 1 or Physics 1: Mechanics	3
MATH 1500	Introduction to Calculus ¹	3
STAT 1000	Basic Statistical Analysis 1	3
Hours		24
Years 1-2		
6 credit hours from the Faculty of Arts including the required "W" course		6
Hours		6
Year 2		
CHEM 2100	Organic Chemistry 1: Foundations of Organic Chemistry	3
CHEM 2110	Organic Chemistry 2: Foundations of Organic Synthesis	3
CHEM 2122	Experimental Organic Chemistry	3
CHEM/MBIO 2700	Biochemistry 1: Biomolecules and an Introduction to Metabolic Energy	3
CHEM/MBIO 2710	Biochemistry 2: Catabolism, Synthesis, and Information Pathways	3
CHEM 2720	Principles and Practices of the Modern Biochemistry Laboratory	3
CHEM 2510	Introduction to Analytical Chemistry	3
MBIO 1010	Microbiology I	3
MBIO 2020	Microbiology II	3
BIOL 2520	Cell Biology	3
Hours		30
Year 3		
CHEM 2520	Introduction to Analytical Chemistry Techniques	2
CHEM 3500	Instrumental Analysis	3
MBIO 3000	Applied Biological Safety	3
MBIO 3032	Microbiology III: Physiology and Metabolism	3
MBIO 3410	Molecular Biology	3
MBIO 3700	Experimental Microbiology Laboratory	3

Work Terms (if Co-op Selected):

SCI 3980	Co-operative Education Work Term 1	0
SCI 3990	Co-operative Education Work Term 2	0
Hours		17
Years 3-4		
CHEM 3760	Advanced Methods for the Biochemistry Laboratory	4
9 credit hours of Optional Courses ²		9
15 credit hours of Required Program Stream Courses ²		15
9 credit hours of electives ³		9
Hours		37
Year 4		
CHEM 4630	Biochemistry of Proteins	3
MBIO 4520	Industrial Bioprocesses	3
Work Terms (if Co-op Selected):		
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		6
Total Hours		120

¹ MATH 1230, MATH 1510 or MATH 1520 may be used in place of MATH 1500.

² Optional courses and program stream courses requirements can be found in course lists below.

³ Refer to list of recommended elective courses below prior to registration in your electives.

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

Common Core Courses:

BIOL 2520, CHEM 2100, CHEM 2110, CHEM 2122, CHEM 2700/MBIO 2700, CHEM 2710/MBIO 2710, CHEM 2720, CHEM 2510, CHEM 2520, CHEM 3500, CHEM 3760, CHEM 4630, MBIO 1010, MBIO 2020, MBIO 3000, MBIO 3032, MBIO 3410, MBIO 3700, MBIO 4520

Optional Courses:

Appropriate prerequisites must be taken for all Optional courses.

CHEM 3520, CHEM 3700, CHEM 4360, CHEM 4670, MBIO 3430, MBIO 4020, MBIO 4410, MBIO 4440, BIOL 3300, BIOL 4554/BIOL 4556, BIOL 4540, BIOL 4560, PLNT 2530, PLNT 4610, COMP 3820

Program Stream Courses:

Analytical Biotechnology:

MATH 1700¹, CHEM 4370, CHEM 4590, CHEM 4670, CHEM 4700

¹ MATH 1232 or MATH 1710 may be used in place of MATH 1700.

Molecular Biotechnology:

BIOL 4544 or BIOL 4556, MBIO 3600, MBIO 4602, MBIO 4612, MBIO 4672

Note: In some instances prerequisites will be waived upon approval by the appropriate department.

Recommended General Electives if not required in Program stream:

Appropriate prerequisites must also be taken for all Electives.

BIOE 3200, BIOE 3530, BIOE 4510; BIOL 1300 (BOTN 1010), BIOL 2242 (BOTN 2010), BIOL 2380 (BOTN 2180/ZOOL 2180), BIOL 2260 (BOTN

2210), BIOL 2300 (BOTN 2370/ZOOL 2370), BIOL 3550 (BOTN 3190), BIOL 3290 (BOTN 3280), BIOL 3500 (BOTN 3460), BIOL 4500 (BOTN 4180), BIOL 3542 (BIOL 2540), BIOL 4540 (ZOOL 4150), BIOL 4544 (BIOL 3540); CHEM 4360, CHEM 4370, CHEM 4590, CHEM 4620, CHEM 4670, CHEM 4700; COMP 1010, COMP 1020, COMP 1260, COMP 1270; ENG 1420; ENTR 2020; MATH 1700¹; MBIO 3282, MBIO 3010, MBIO 3430, MBIO 4440 (MBIO 3440), MBIO 3450, MBIO 3460, MBIO 3472, MBIO 4480 (MBIO 3480), MBIO 4010, MBIO 4410, MBIO 4470, MBIO 4602, MBIO 4612, MBIO 4672; PHAC 4030, PHAC 4040; PHIL 2740, PHIL 2830; PLNT 3140, PLNT 3500, PLNT 3520, PLNT 3570, PLNT 4310, PLNT 4330, PLNT 4550, PLNT 4560, PLNT 4570, PLNT 4580, PLNT 4590, PLNT 4600; STAT 2000

¹ MATH 1232 or MATH 1710 may be used in place of MATH 1700.

Other suitable courses may be selected through consultation with the department heads

Co-operative Education

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
- Biotechnology (As of Fall 2018, admission to the Biotechnology programs has been temporarily suspended. For further information, see the Faculty of Science office.)
- 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
- Biotechnology (As of Fall 2018, admission to the Biotechnology programs has been temporarily suspended. For further information, see the Faculty of Science office.)
- 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, Biotechnology, 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.