GENETICS, B.SC. HONOURS

Genetics Honours Entry, Continuation, and Graduation Requirements

To enter the Honours program in Genetics, 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 BIOL 1030, and a minimum grade of "C+" in CHEM 1110. CHEM 1120, STAT 1150 or STAT 1000, MATH 1500 and the additional 3 credit hours of specified Mathematics courses are program requirements and students are strongly encouraged to complete these courses in first year.

To continue in the Genetics 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 with the B.Sc. Honours degree, a student must maintain a minimum 3.00 DGPA and achieve a minimum grade of "C" on all 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.

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

Honours

Course	Title	Hours
Year 1		
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 [1]	3
BIOL 1020	Biology 1: Principles and Themes	3
BIOL 1030	Biology 2: Biological Diversity, Function and Interactions (B)	3
One of:		3
STAT 1150	Introduction to Statistics and Computing [2]	
STAT 1000	Basic Statistical Analysis 1 [2]	
MATH 1500	Introduction to Calculus [3]	3
One of:		3
MATH 1240	Elementary Discrete Mathematics [3]	
MATH 1300	Vector Geometry and Linear Algebra [3]	
MATH 1700	Calculus 2 [3]	
	Hours	**24**
Years 1-2		
3 credit hours from the Faculty of Arts		3
3 credit hour "W" course		3
3 credit hours of electives		3
	Hours	**9**
Year 2		
BIOL 2500	Genetics 1	3
BIOL 2520	Cell Biology	3
CHEM 2100	Organic Chemistry 1: Foundations of 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
MBIO 1010	Microbiology I	3
MBIO 2020	Microbiology II	3
One of:		3
STAT 2150	Statistics and Computing [2]	
STAT 2000	Basic Statistical Analysis 2 [2]	
	Hours	**27**
Years 3-4		
BIOL 3500	Genetics 2	3
MBIO 3410	Molecular Biology	3
PLNT 3140	Introductory Cytogenetics	3
BGEN 3022	Introduction to Human Genetics A	3
BGEN 3024	Introduction to Human Genetics B	3
One of:		6
BGEN 4010	Project Course in Human Genetics [4]	
MBIO 4530	Project in Microbiology [4]	
One of:		3
ANTH 2240	Plagues and People	
ANTH 2560	Anthropology of Illness	
ANTH 2860	Evolution and Human Diversity	
ANTH 2890	Human Population Biology	
33 credit hours from list of optional courses (a minimum of 12 of these credit hours must be 4000 level)		33
3 credit hours of electives		3
	Hours	**60**
	Total Hours	**120**

1. CHEM 1122 and CHEM 1126 may be used in lieu of CHEM 1120. Note: CHEM 1122 and CHEM 1126 are restricted to Price Faculty of Engineering Students.
2. STAT 1150 is recommended over STAT 1000; STAT 2150 is recommended over STAT 2000.
3.
   - 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 1232 or MATH 1710 may be taken in place of MATH 1700;
   - MATH 1200 may be taken in place of MATH 1240.
4. BGEN 4010 or MBIO 4530 are required courses for students in the Genetics Honours, but are not available to students in the Co-operative

Option, and require department consent for students in the Genetics Major.

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

Honours Co-operative Option

Course	Title	Hours
Year 1		
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 [1]	3
BIOL 1020	Biology 1: Principles and Themes	3
BIOL 1030	Biology 2: Biological Diversity, Function and Interactions (B)	3
One of:		3
STAT 1150	Introduction to Statistics and Computing [2]	
STAT 1000	Basic Statistical Analysis 1 [2]	
MATH 1500	Introduction to Calculus [3]	3
One of:		3
MATH 1240	Elementary Discrete Mathematics [3]	
MATH 1300	Vector Geometry and Linear Algebra [3]	
MATH 1700	Calculus 2 [3]	
	Hours	**24**
Years 1-2		
3 credit hours from the Faculty of Arts		3
3 credit hour "W" course		3
3 credit hours of electives		3
	Hours	**9**
Year 2		
BIOL 2500	Genetics 1	3
BIOL 2520	Cell Biology	3
CHEM 2100	Organic Chemistry 1: Foundations of 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
MBIO 1010	Microbiology I	3
MBIO 2020	Microbiology II	3
One of:		3
STAT 2150	Statistics and Computing [2]	
STAT 2000	Basic Statistical Analysis 2 [2]	
	Hours	**27**
Years 3-4		
BIOL 3500	Genetics 2	3
MBIO 3410	Molecular Biology	3
PLNT 3140	Introductory Cytogenetics	3
BGEN 3022	Introduction to Human Genetics A	3
BGEN 3024	Introduction to Human Genetics B	3
One of:		3
ANTH 2240	Plagues and People	
ANTH 2560	Anthropology of Illness	
ANTH 2860	Evolution and Human Diversity	
ANTH 2890	Human Population Biology	
39 credit hours from list of optional courses (a minimum of 18 of these credit hours must be 4000 level)		39
3 credit hours of electives		3
Co-op Requirements: [4]		
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	**60**
	Total Hours	**120**

1 CHEM 1122 and CHEM 1126 may be used in lieu of CHEM 1120. Note: CHEM 1122 and CHEM 1126 are restricted to Price Faculty of Engineering Students.

2 STAT 1150 is recommended over STAT 1000; STAT 2150 is recommended over STAT 2000.

3
- 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 1232 or MATH 1710 may be taken in place of MATH 1700;
- MATH 1200 may be taken in place of MATH 1240.

4 Students in the Co-operative Option are advised to ensure that they are able to satisfy the prerequisites for all 3000 and 4000 level courses they plan to take.

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

Optional Courses for the Genetics Honours and Major Programs (Including Co-operative Options)

Biochemistry and Medical Genetics

Course	Title	Hours
BGEN 4010	Project Course in Human Genetics [1]	6

1 MBIO 4530 and BGEN 4010 are project courses. A research project is chosen in consultation with the Microbiology department (MBIO 4530) or Biochemistry and Medical Genetics (BGEN 4010) and the Genetics program committee, and is supervised by a staff member. Only one of MBIO 4530 or BGEN 4010 may be selected in this program. These are required courses for students registered in the Genetics Honours program and may be available to students registered in the Genetics Major program by departmental consent.

Biological Sciences

Course	Title	Hours
BIOL 2410	Human Physiology 1	3
BIOL 2420	Human Physiology 2	3
BIOL 2600	Introduction to Computational Biology	3
BIOL 3290	Medicinal and Hallucinogenic Plants	3

BIOL 3300	Evolutionary Biology	3
BIOL/PLNT 3400	Plant Physiology	3
BIOL 3542	Developmental Biology	3
BIOL 3560	Comparative Animal Histology	3
BIOL 4300	Evolution and Adaptation	3
BIOL 4500	Molecular Genetics of Plant Development	3
BIOL 4510	Evolutionary Genetics	3
BIOL 4540	Developmental Molecular Biology	3
BIOL 4542	Genes and Development	3
BIOL 4554	Molecular Biology Techniques for Eukaryotes - DNA	3
BIOL 4556	Molecular Biology Techniques for Eukaryotes - RNA	3
BIOL 4560	Microtechnique	3
BIOL 4650	Biology and Society	3
BIOL 4890	Special Topics in Biology	3
BIOL 4892	Special Topics in Biology with Laboratory	3

Chemistry

Course	Title	Hours
CHEM 2110	Organic Chemistry 2: Foundations of Organic Synthesis	3
CHEM 2122	Experimental Organic Chemistry	3
CHEM 2600	Physical Chemistry 1	3
CHEM 3600	Physical Chemistry 2	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

Microbiology

Course	Title	Hours
MBIO 2420	Introductory Virology	3
MBIO 3000	Applied Biological Safety	3
MBIO 3010	Mechanisms of Microbial Disease	3
MBIO 3032	Microbiology III: Physiology and Metabolism	3
MBIO 3430	Molecular Evolution	3
MBIO 3450	Regulation of Biochemical Processes	3
MBIO 3460	Membrane and Cellular Biochemistry	3
MBIO 4020	Immunology	3
MBIO 4030	Advanced Topics in Microbiology	3
MBIO 4032	Advanced Topics in Microbiology	3
MBIO 4300	Infectious Diseases Around the World	3
MBIO 4410	Virology	3
MBIO 4442	Research in Systems Microbiology	3
MBIO 4480	Microbes in our Environment	3
MBIO 4530	Project in Microbiology [1]	6
MBIO 4540	Biological Energy Transduction	3
MBIO 4602	Molecular Genetics of Prokaryotes - Lectures	3
MBIO 4612	Molecular Genetics of Eukaryotes - Lectures	3
MBIO 4672	Applied Molecular Biology	3
MBIO 4700	Computational Molecular Microbiology	3

[1] MBIO 4530 and BGEN 4010 are project courses. A research project is chosen in consultation with the Microbiology department (MBIO 4530) or Biochemistry and Medical Genetics (BGEN 4010) and the Genetics program committee, and is supervised by a staff member. Only one of MBIO 4530 or BGEN 4010 may be selected in this program. These are required courses for students registered in the Genetics Honours program and may be available to students registered in the Genetics Major program by departmental consent.

Computer Science

Course	Title	Hours
COMP 1010	Introductory Computer Science 1	3
COMP 1020	Introductory Computer Science 2	3
COMP 1500	Computing: Ideas and Innovation	3
COMP 1600	Navigating Your Digital World	3

Physics

Course	Title	Hours
PHYS 1020	General Physics 1	3
PHYS 1030	General Physics 2	3
PHYS 1050	Physics 1: Mechanics	3
PHYS 1070	Physics 2: Waves and Modern Physics	3

Animal Science

Course	Title	Hours
ANSC 3500	Principles of Animal Genetics	3
ANSC 4280	Applied Animal Genetics	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 2530	Plant Biotechnology	3
PLNT/BIOL 3400	Plant Physiology	3
PLNT 3520	Principles of Plant Improvement	3
PLNT 4330	Intermediate Plant Genetics	3
PLNT 4610	Bioinformatics	3

By an appropriate selection of courses from this list, students can obtain particular program emphasis in either plant, human or molecular genetics.

The Honours Co-op program must contain a minimum of 18 credit hours of 4000 level courses as options in Years 3 and 4.

Other suitable optional courses may be arranged through consultation with the Genetics program committee.

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.