Biotechnology

Co-operative Education Option is available. See the Co-operative Education section of this Calendar for details. (http://www.carleton.ca/calendars/2012-13/undergrad/regulations/co-operativeeducation)

Graduation Requirements

In addition to the requirements listed below, students must satisfy:

1. the University regulations (see the *Academic Regulations of the University* section of this Calendar),
2. the Faculty regulations applying to all B.Sc. students including those relating to Science Continuation and Breadth requirements (see the *Academic Regulations for the Bachelor of Science* section of this Calendar).

Students should consult with the Department or Institute responsible for their program when planning their program and selecting courses.

Program Requirements

General Note on Programs

Students in the Biochemistry and Biotechnology program must complete BIOC 4907 [1.0] or BIOC 4908 [1.0]. Students in the Biology and Biotechnology program must complete BIOL 4907 [1.0] or BIOL 4908 [1.0]. BIOC 4908 [1.0] and BIOL 4908 [1.0] are subject to limited enrollment and requires that students secure a supervisor in the year prior to their Honours thesis.

Biochemistry and Biotechnology B.Sc. Honours (20.0 credits)

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A. Credits Included in the Major CGPA (14.5 credits)		
1. 2.5 credits in:		2.5
BIOL 1103 [0.5]	Foundations of Biology I	
BIOL 1104 [0.5]	Foundations of Biology II	
BIOL 2104 [0.5]	Introductory Genetics	
BIOL 2303 [0.5]	Microbiology	
BIOL 3104 [0.5]	Molecular Genetics	
2. 0.5 credit from:		0.5
BIOL 2001 [0.5]	Animals: Form and Function	
BIOL 2002 [0.5]	Plants: Form and Function	
3. 0.5 credit from:		0.5
BIOL 3205 [0.5]	Plant Biochemistry and Physiology	
BIOL 3305 [0.5]	Human and Comparative Physiology	
BIOL 3306 [0.5]	Human Anatomy and Physiology	
4. 1.0 credit from:		1.0
BIOL 3201 [0.5]	Cell Biology	
BIOL 3303 [0.5]	Experimental Microbiology	
BIOL 3307 [0.5]	Advanced Human Anatomy and Physiology	
BIOL 4106 [0.5]	Methods in Molecular Genetics	
BIOL 4109 [0.5]	Laboratory Techniques in Molecular Genetics	
BIOL 4201 [0.5]	Animal Cell Culture: Methods and Applications	
BIOL 4300 [0.5]	Applied and Environmental Microbiology	
BIOL 4301 [0.5]	Current Topics in Biotechnology	
5. 3.0 credits in:		3.0
BIOC 2200 [0.5]	Cellular Biochemistry	
BIOC 3006 [1.0]	Practical Biochemistry	
BIOC 3101 [0.5]	General Biochemistry I	
BIOC 3102 [0.5]	General Biochemistry II	
BIOC 3202 [0.5]	Biophysical Techniques and Applications	
6. 1.0 credit from:		1.0
BIOC 4907 [1.0]	Honours Essay and Research Proposal	
BIOC 4908 [1.0]	Research Project	
7. 1.0 credit from:		1.0
BIOC 4004 [0.5]	Industrial Biochemistry	
BIOC 4005 [0.5]	Biochemical Regulation	
BIOC 4007 [0.5]	Membrane Biochemistry	
BIOC 4009 [0.5]	Biochemistry of Disease	
BIOC 4200 [0.5]	Immunology	
BIOC 4201 [0.5]	Animal Cell Culture: Methods and Applications	
BIOC 4202 [0.5]	Mutagenesis and DNA Repair	
BIOC 4203 [0.5]	Advanced Metabolism	
BIOC 4204 [0.5]	Protein Biotechnology	
BIOC 4400 [0.5]	Nuclear Dynamics and the Cell Cycle	
8. 4.0 credits in:		4.0
CHEM 1001 [0.5]	General Chemistry I	
CHEM 1002 [0.5]	General Chemistry II	
CHEM 2103 [0.5]	Physical Chemistry I	
or BIOC 2300 [0.5]	Physical Biochemistry	
CHEM 2203 [0.5]	Organic Chemistry I	
CHEM 2204 [0.5]	Organic Chemistry II	
CHEM 2303 [0.5]	Analytical Chemistry	
CHEM 2501 [0.5]	Introduction to Inorganic and Bioinorganic Chemistry	
CHEM 3201 [0.5]	Advanced Organic Chemistry I	
9. 0.5 credit from:		0.5
CHEM 3202 [0.5]	Advanced Organic Chemistry II	
CHEM 3205 [0.5]	Experimental Organic Chemistry	
10. 0.5 credit in BIOC chosen from Item 7 above, or:		0.5
BIOC 2400 [0.5]	Independent Research I	
BIOC 3400 [0.5]	Independent Research II	
BIOC 3008 [0.5]	Bioinformatics	
BIOC 4001 [0.5]	Methods in Biochemistry	
BIOC 4008 [0.5]	Computational Systems Biology	
BIOC 4708 [0.5]	Principles of Toxicology	
BIOC 4901 [0.5]	Selected Topics in Biochemistry	
BIOL 2001 [0.5]	Animals: Form and Function	
BIOL 2002 [0.5]	Plants: Form and Function	
BIOL 3102 [0.5]	Mycology	
BIOL 3201 [0.5]	Cell Biology	
BIOL 3202 [0.5]	Principles of Developmental Biology	
BIOL 3205 [0.5]	Plant Biochemistry and Physiology	

BIOL 3303 [0.5]	Experimental Microbiology	
BIOL 3305 [0.5]	Human and Comparative Physiology	
BIOL 4106 [0.5]	Methods in Molecular Genetics	
BIOL 4109 [0.5]	Laboratory Techniques in Molecular Genetics	
BIOL 4201 [0.5]	Animal Cell Culture: Methods and Applications	
BIOL 4209 [0.5]	Advanced Plant Physiology	
BIOL 4300 [0.5]	Applied and Environmental Microbiology	
BIOL 4301 [0.5]	Current Topics in Biotechnology	
CHEM 3100 [0.5]	Physical Chemistry II	
CHEM 3202 [0.5]	Advanced Organic Chemistry II	
CHEM 3205 [0.5]	Experimental Organic Chemistry	
CHEM 3700 [0.5]	Industrial Applications of Chemistry	
CHEM 3800 [0.5]	The Chemistry of Environmental Pollutants	
CHEM 4406 [0.5]	Pharmaceutical Drug Design	
B. Credits Not Included in the Major CGPA (5.5 credits)		
11. 1.0 credit from:		1.0
PHYS 1007 [0.5] & PHYS 1008 [0.5]	Elementary University Physics I and Elementary University Physics II	
PHYS 1003 [0.5] & PHYS 1004 [0.5]	Introductory Mechanics and Thermodynamics and Introductory Electromagnetism and Wave Motion	
12. 1.5 credits in:		1.5
MATH 1007 [0.5]	Elementary Calculus I	
MATH 1107 [0.5]	Linear Algebra I	
STAT 2507 [0.5]	Introduction to Statistical Modeling I	
13. 0.5 credit in:		0.5
NSCI 1000 [0.5]	Seminar in Science (or an Approved Arts or Social Sciences elective)	
14. 1.5 credits in Approved Arts or Social Sciences electives		1.5
15. 1.0 credit in free elective.		1.0
Total Credits		20.0

Biology and Biotechnology B.Sc. Honours (20.0 credits)

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A. Credits Included in the Major CGPA (12.5 credits)		
1. 5.0 credits in:		5.0
BIOL 1103 [0.5]	Foundations of Biology I	
BIOL 1104 [0.5]	Foundations of Biology II	
BIOL 2001 [0.5]	Animals: Form and Function	
BIOL 2002 [0.5]	Plants: Form and Function	
BIOL 2104 [0.5]	Introductory Genetics	
BIOL 2200 [0.5]	Cellular Biochemistry	
BIOL 2303 [0.5]	Microbiology	
BIOL 3104 [0.5]	Molecular Genetics	
BIOL 3201 [0.5]	Cell Biology	
BIOL 4301 [0.5]	Current Topics in Biotechnology	
2. 0.5 credit from:		0.5
BIOL 3205 [0.5]	Plant Biochemistry and Physiology	
BIOL 3305 [0.5]	Human and Comparative Physiology	
3. 1.5 credits in:		1.5
BIOC 3101 [0.5]	General Biochemistry I	
BIOC 3102 [0.5]	General Biochemistry II	
BIOC 4004 [0.5]	Industrial Biochemistry	
4. 1.0 credit from:		1.0
BIOL 4106 [0.5]	Methods in Molecular Genetics	
BIOL 4109 [0.5]	Laboratory Techniques in Molecular Genetics	
BIOL 4200 [0.5]	Immunology	
BIOL 4201 [0.5]	Animal Cell Culture: Methods and Applications	
5. 3.5 credits from:		3.5
BIOL 3102 [0.5]	Mycology	
BIOC 3202 [0.5]	Biophysical Techniques and Applications	
BIOL 3303 [0.5]	Experimental Microbiology	
BIOL 3901 [0.5]	Research Proposal	
BIOL 4106 [0.5]	Methods in Molecular Genetics	
BIOL 4109 [0.5]	Laboratory Techniques in Molecular Genetics	
BIOL 4200 [0.5]	Immunology	
BIOL 4201 [0.5]	Animal Cell Culture: Methods and Applications	
BIOL 4202 [0.5]	Mutagenesis and DNA Repair	
BIOC 2300 [0.5]	Physical Biochemistry	
or CHEM 2103 [0.5]	Physical Chemistry I	
BIOL 4901 [0.5]	Directed Special Studies	
BIOC 3006 [1.0]	Practical Biochemistry	
BIOC 3008 [0.5]	Bioinformatics	
BIOC 4001 [0.5]	Methods in Biochemistry	
BIOC 4005 [0.5]	Biochemical Regulation	
BIOC 4007 [0.5]	Membrane Biochemistry	
BIOC 4008 [0.5]	Computational Systems Biology	
BIOC 4009 [0.5]	Biochemistry of Disease	
BIOC 4204 [0.5]	Protein Biotechnology	
BIOC 4708 [0.5]	Principles of Toxicology	
CHEM 3700 [0.5]	Industrial Applications of Chemistry	
CHEM 3800 [0.5]	The Chemistry of Environmental Pollutants	
TSES 4001 [0.5]	Technology and Society: Risk	
TSES 4002 [0.5]	Technology and Society: Forecasting	
6. 1.0 credit in:		1.0
BIOL 4907 [1.0]	Honours Essay and Research Proposal	
or BIOL 4908 [1.0]	Honours Research Thesis	
B. Credits Not Included in the Major CGPA (7.5 credits)		
7. 2.0 credits in:		2.0
CHEM 1001 [0.5] & CHEM 1002 [0.5]	General Chemistry I and General Chemistry II	
CHEM 2203 [0.5] & CHEM 2204 [0.5]	Organic Chemistry I and Organic Chemistry II (See Note, below)	
8. 1.0 credit from:		1.0

PHYS 1007 [0.5] & PHYS 1008 [0.5]	Elementary University Physics I and Elementary University Physics II	
PHYS 1003 [0.5] & PHYS 1004 [0.5]	Introductory Mechanics and Thermodynamics and Introductory Electromagnetism and Wave Motion	
9. 1.5 credits in:		1.5
MATH 1007 [0.5]	Elementary Calculus I	
MATH 1107 [0.5]	Linear Algebra I	
STAT 2507 [0.5]	Introduction to Statistical Modeling I	
10. 0.5 credit in:		0.5
NSCI 1000 [0.5]	Seminar in Science (or Approved Arts or Social Sciences)	
11. 1.5 credits in Approved Arts or Social Sciences		1.5
12. 1.0 credit free elective.		1.0
Total Credits		20.0

Note: For **Item 7** above, CHEM 1001 General Chemistry I and CHEM 1002 General Chemistry II are strongly recommended for this program. Students may substitute CHEM 1001 General Chemistry I and CHEM 1002 General Chemistry II with CHEM 1005 Elementary Chemistry I and CHEM 1006 Elementary Chemistry II, respectively. Students choosing CHEM 1005 Elementary Chemistry I and CHEM 1006 Elementary Chemistry II will be required to obtain a grade of B- or higher in CHEM 1006 Elementary Chemistry II to take BIOL 2200 Cellular Biochemistry and more advanced courses in BIOC and CHEM. Students completing CHEM 1005 Elementary Chemistry I with a grade of B- or higher are encouraged to register for CHEM 1002 General Chemistry II.