

Biology

Program Requirements

Course Categories for Biology Programs

The program descriptions below make use of the following course categories that are defined in the Bachelor of Science Regulations in this Calendar.

- Science Faculty Electives
- Advanced Science Faculty Electives
- Science Continuation
- Science Geography
- Science Psychology
- Approved Courses Outside the Faculties of Science and Engineering and Design
- Free Electives
- Restricted Courses: Biology General, Major, and Honours students (except students in the B.A. General, B.A. Honours and Combined Honours programs) may use Technology, Society, Environment courses TSES 3001, TSES 3002, TSES 3500, TSES 4001, TSES 4002, TSES 4003, TSES 4005, TSES 4006, TSES 4007 to fulfill degree requirements, but only as free electives.

Bioinformatics

B.Sc. Honours (20.0 credits)

A. Credits included in the Major CGPA (12.5 credits)

1. 4.0 credits in:	4.0
BIOL 1103 [0.5] Foundations of Biology I	
BIOL 1104 [0.5] Foundations of Biology II	
BIOL 2104 [0.5] Introductory Genetics	
BIOL 2200 [0.5] Cellular Biochemistry	
BIOL 3104 [0.5] Molecular Genetics	
BIOL 4106 [0.5] Advances in Molecular Biology	
BIOL 4905 [1.0] Honours Workshop	
or BIOC 4906 [1.0] Interdisciplinary Research Project	
or BIOL 4907 [1.0] Honours Essay and Research Proposal	
or BIOL 4908 [1.0] Honours Research Thesis	
2. 0.5 credit from:	0.5
BIOL 2001 [0.5] Animals: Form and Function	
BIOL 2002 [0.5] Plants: Form and Function	
BIOL 2303 [0.5] Microbiology	
BIOL 3102 [0.5] Mycology	
BIOL 3305 [0.5] Human and Comparative Physiology	
BIOL 3306 [0.5] Human Anatomy and Physiology	
3. 3.5 credits from:	3.5
BIOC 2300 [0.5] Physical Biochemistry	
BIOC 3008 [0.5] Bioinformatics	
BIOC 3101 [0.5] General Biochemistry I	
BIOC 3102 [0.5] General Biochemistry II	
BIOC 3202 [0.5] Biophysical Techniques and Applications	
BIOC 4008 [0.5] Computational Systems Biology	
BIOL 4104 [0.5] Evolutionary Genetics	
BIOC 4202 [0.5] Mutagenesis and DNA Repair	

4. 1.0 credit in BIOL or BIOC or COMP or MATH or STAT at the 3000-level or higher **1.0**

5. 0.5 credit from: **0.5**

BIOL 3901 [0.5] Research Proposal	
BIOL 4901 [0.5] Directed Special Studies	
or 4000-level BIOL	

6. 3.0 credits in **3.0**

COMP 1005 [0.5] Introduction to Computer Science I	
COMP 1006 [0.5] Introduction to Computer Science II	
COMP 2401 [0.5] Introduction to Systems Programming	
COMP 2402 [0.5] Abstract Data Types and Algorithms	
COMP 2404 [0.5] Introduction to Software Engineering	
COMP 2406 [0.5] Fundamentals of Web Applications	

B. Credits not included in the Major CGPA (7.5)

7. 2.0 credits in: **2.0**

CHEM 1001 [0.5] General Chemistry I	
& CHEM 1002 [0.5] General Chemistry II	
CHEM 2203 [0.5] Organic Chemistry I	
& CHEM 2204 [0.5] Organic Chemistry II	
See Note: below	

8. 1.0 credit from: **1.0**

PHYS 1007 [0.5] Elementary University Physics I	
& PHYS 1008 [0.5] Elementary University Physics II	
PHYS 1003 [0.5] Introductory Mechanics and	
& PHYS 1004 [0.5] Thermodynamics	
Introductory Electromagnetism and	
Wave Motion	

9. 2.0 credits in: **2.0**

MATH 1007 [0.5] Elementary Calculus I	
MATH 1107 [0.5] Linear Algebra I	
STAT 2507 [0.5] Introduction to Statistical Modeling I	
STAT 2509 [0.5] Introduction to Statistical Modeling II	

10. 2.0 credits in Approved Courses Outside the Faculties of Science and Engineering and Design (may include NSCI 1000) **2.0**

11. 0.5 credit in free electives. **0.5**

Total Credits **20.0**

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

Biology

B.Sc. Honours (20.0 credits)

A. Credits included in the Major CGPA (11.0 credits)

1. 2.0 credits in: **2.0**

BIOL 1103 [0.5] Foundations of Biology I	
BIOL 1104 [0.5] Foundations of Biology II	
BIOL 4905 [1.0] Honours Workshop	
or BIOL 4907 [1.0] Honours Essay and Research Proposal	

	or BIOL 4908 [1.0] Honours Research Thesis	
2. 2.5 credits from:		2.5
	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 2600 [0.5] Introduction to Ecology	
3. 0.5 credit from:		0.5
	BIOL 3201 [0.5] Cell Biology	
	BIOL 3205 [0.5] Plant Biochemistry and Physiology	
	BIOL 3303 [0.5] Experimental Microbiology	
	BIOL 3305 [0.5] Human and Comparative Physiology	
4. 1.0 credit in BIOL at the 2000-level or higher		1.0
5. 3.5 credits in BIOL or BIOC at the 3000-level or higher		3.5
6. 0.5 credit from		0.5
	BIOL 3901 [0.5] Research Proposal	
	BIOL 4901 [0.5] Directed Special Studies	
	or 4000-level BIOL	
7. 1.0 credit in Advanced Science Faculty Electives		1.0
B. Credits not included in the Major CGPA (9.0 credits)		
8. 1.0 credit in		1.0
	CHEM 1001 [0.5] General Chemistry I & CHEM 1002 [0.5] General Chemistry II (See Note 2, below)	
9. 1.0 credit in:		1.0
	BIOL 1105 [0.5] Biological Methods, Analysis and Interpretation	
	MATH 1007 [0.5] Elementary Calculus I	
10. 1.0 credit from:		1.0
	COMP 1005 [0.5] Introduction to Computer Science I	
	COMP 1006 [0.5] Introduction to Computer Science II	
	MATH 1107 [0.5] Linear Algebra I	
	PHYS 1007 [0.5] Elementary University Physics I or PHYS 1003 [0.5] Introductory Mechanics and Thermodynamics	
	PHYS 1008 [0.5] Elementary University Physics II or PHYS 1004 [0.5] Introductory Electromagnetism and Wave Motion	
	STAT 2507 [0.5] Introduction to Statistical Modeling I	
11. 1.0 credit in Science Faculty Electives		1.0
12. 2.0 credits in Science Continuation (not in BIOL)		2.0
13. 2.0 credits in Approved Courses Outside the Faculties of Science and Engineering and Design (may include NSCI 1000)		2.0
14. 1.0 credit in free electives.		1.0
Total Credits		20.0

Notes:

- Students should choose their second year courses carefully to ensure that they have the necessary prerequisites for upper year courses in Biology.
- For **Item 8** above, CHEM 1001 and CHEM 1002 are strongly recommended for this program. Students may substitute CHEM 1001 and CHEM 1002 with CHEM 1005 and CHEM 1006, respectively. Students choosing CHEM 1005 and CHEM 1006 will be required to obtain a grade of B- or higher in CHEM 1006 to

take BIOL 2200 and more advanced courses in BIOC and CHEM. Students completing CHEM 1005 with a grade of B- or higher are encouraged to register for CHEM 1002.

- Students in the B.Sc. Honours Biology program may elect to focus their studies in one of the following concentrations: 1) Ecology, Evolution and Behaviour, 2) Health Science, 3) Molecular and Cellular Biology, or 4) Physiology.

Biology with Concentration in Ecology, Evolution and Behaviour

B.Sc. Honours (20.0 credits)

A. Credits Included in the Major CGPA (11.0 credits)

1. 2.0 credits in:		2.0
	BIOL 1103 [0.5] Foundations of Biology I	
	BIOL 1104 [0.5] Foundations of Biology II	
	BIOL 4905 [1.0] Honours Workshop or BIOL 4907 [1.0] Honours Essay and Research Proposal or BIOL 4908 [1.0] Honours Research Thesis	
2. 2.5 credits in:		2.5
	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 2600 [0.5] Introduction to Ecology	
3. 0.5 credit from:		0.5
	BIOL 3201 [0.5] Cell Biology	
	BIOL 3205 [0.5] Plant Biochemistry and Physiology	
	BIOL 3303 [0.5] Experimental Microbiology	
	BIOL 3305 [0.5] Human and Comparative Physiology	
4. 1.0 credit from:		1.0
	BIOL 3609 [0.5] Evolutionary Concepts	
	BIOL 3611 [0.5] Evolutionary Ecology	
	BIOL 3802 [0.5] Animal Behaviour	
5. 2.0 credits from:		2.0
	BIOL 3104 [0.5] Molecular Genetics	
	BIOL 3601 [0.5] Ecosystems and Environmental Change	
	BIOL 3602 [0.5] Conservation Biology	
	BIOL 3604 [0.5] Analysis of Ecological Relationships	
	BIOL 3605 [0.5] Field Course I	
	BIOL 3609 [0.5] Evolutionary Concepts	
	BIOL 3608 [0.5] Principles of Biogeography	
	BIOL 3611 [0.5] Evolutionary Ecology	
	BIOL 3612 [0.5] Computational Methods in Ecology and Evolution	
	BIOL 3801 [0.5] Plants and Herbivores	
	BIOL 3802 [0.5] Animal Behaviour	
	BIOL 3804 [0.5] Social Evolution	
6. 2.0 credits from:		2.0
	BIOL 4102 [0.5] Molecular Ecology	
	BIOL 4103 [0.5] Population Genetics	
	BIOL 4104 [0.5] Evolutionary Genetics	
	BIOL 4203 [0.5] Evolution of Sex	

BIOL 4317 [0.5]	Neuroethology: The Neural Basis of Animal Behaviour	
BIOL 4318 [0.5]	Adaptations to Extreme Environments	
BIOL 4500 [0.5]	Ornithology I	
BIOL 4501 [0.5]	Ornithology II	
BIOL 4503 [0.5]	Fish Ecology, Conservation and Management	
BIOL 4604 [0.5]	Landscape Ecology	
BIOL 4802 [0.5]	Advanced Animal Behaviour	
7. 0.5 credit in	BIOL at the 2000-level or higher	0.5
8. 0.5 credit from		0.5
	BIOL 3901 [0.5] Research Proposal or BIOL 4901 [0.5] Directed Special Studies or 4000-level BIOL	
B. Credits Not Included in the Major CGPA (9.0 credits)		
9. 1.0 credit in:		1.0
	CHEM 1001 [0.5] General Chemistry I & CHEM 1002 [0.5] General Chemistry II (See Note 2, below)	
10. 1.0 credit in:		1.0
	BIOL 1105 [0.5] Biological Methods, Analysis and Interpretation	
	MATH 1007 [0.5] Elementary Calculus I	
11. 1.0 credit from:		1.0
	COMP 1005 [0.5] Introduction to Computer Science I	
	COMP 1006 [0.5] Introduction to Computer Science II	
	MATH 1107 [0.5] Linear Algebra I	
	PHYS 1007 [0.5] Elementary University Physics I or PHYS 1003 [0.5] Introductory Mechanics and Thermodynamics	
	PHYS 1008 [0.5] Elementary University Physics II or PHYS 1004 [0.5] Introductory Electromagnetism and Wave Motion	
	STAT 2507 [0.5] Introduction to Statistical Modeling I	
12. 1.0 credit in	Science Faculty Electives	1.0
13. 2.0 credits in	Science Continuation courses (not in BIOL)	2.0
14. 2.0 credits in	Approved Courses Outside the Faculties of Science and Engineering and Design (may include NSCI 1000)	2.0
15. 1.0 credit in	free electives.	1.0
Total Credits		20.0

Notes:

- Students should choose their second year courses carefully to ensure that they have the necessary prerequisites for upper year courses in Biology.
- For **Item 9** above, CHEM 1001 and CHEM 1002 are strongly recommended for this program. Students may substitute CHEM 1001 and CHEM 1002 with CHEM 1005 and CHEM 1006, respectively. Students choosing CHEM 1005 and CHEM 1006 will be required to obtain a grade of B- or higher in CHEM 1006 to take BIOL 2200 and more advanced courses in BIOC and CHEM. Students completing CHEM 1005 with a grade of B- or higher are encouraged to register for CHEM 1002.

**Biology with Concentration in Health Science
B.Sc. Honours (20.0 credits)**

A. Credits included in the Major CGPA (11.0 credits)

1. 2.0 credits in:		2.0
	BIOL 1103 [0.5] Foundations of Biology I	
	BIOL 1104 [0.5] Foundations of Biology II	
	BIOL 4905 [1.0] Honours Workshop or BIOL 4907 [1.0] Honours Essay and Research Proposal or BIOL 4908 [1.0] Honours Research Thesis	
2. 2.0 credits in:		2.0
	BIOL 2001 [0.5] Animals: Form and Function	
	BIOL 2104 [0.5] Introductory Genetics	
	BIOL 2200 [0.5] Cellular Biochemistry	
	BIOL 2303 [0.5] Microbiology	
3. 1.0 credit in:		1.0
	BIOL 3305 [0.5] Human and Comparative Physiology	
	BIOL 3307 [0.5] Advanced Human Anatomy and Physiology	
4. 1.0 credit in:		1.0
	BIOC 3101 [0.5] General Biochemistry I	
	BIOC 3102 [0.5] General Biochemistry II	
5. 1.0 credit from:		1.0
	BIOL 3104 [0.5] Molecular Genetics	
	BIOL 3201 [0.5] Cell Biology	
	BIOL 3202 [0.5] Principles of Developmental Biology	
	BIOL 3303 [0.5] Experimental Microbiology	
	BIOL 3501 [0.5] Biomechanics	
	BIOL 4318 [0.5] Adaptations to Extreme Environments	
	BIOL 4201 [0.5] Advanced Cell Culture and Tissue Engineering	
6. 1.0 credit from:		1.0
	BIOC 4009 [0.5] Biochemistry of Disease	
	BIOL 4106 [0.5] Advances in Molecular Biology	
	BIOC 4708 [0.5] Principles of Toxicology	
	BIOL 4200 [0.5] Immunology	
	BIOL 4202 [0.5] Mutagenesis and DNA Repair	
	BIOL 4306 [0.5] Animal Neurophysiology	
7. 1.0 credit from	BIOL or BIOC at the 3000-level or higher	1.0
8. 0.5 credit from:		0.5
	BIOL 3901 [0.5] Research Proposal BIOL 4901 [0.5] Directed Special Studies or 4000-level BIOL	
9. 1.0 credit from:		1.0
	NEUR 2201 [0.5] Cellular and Molecular Neuroscience	
	NEUR 2202 [0.5] Neurodevelopment and Plasticity	
	NEUR 3204 [0.5] Neuropharmacology	
	PSYC 2301 [0.5] Introduction to Health Psychology	
10. 0.5 credit from:		0.5
	PHIL 2408 [0.5] Bioethics	
	GEOG 3206 [0.5] Health, Environment, and Society	
	ANTH 3310 [0.5] Studies in Medical Anthropology	
	SOCI 3050 [0.5] Studies in the Sociology of Health	

SOCI 3056 [0.5] Women and Health

B. Credits not included in the Major CGPA (9.0 credits)

11. 2.0 credits from:	2.0
CHEM 1001 [0.5] General Chemistry I & CHEM 1002 [0.5] General Chemistry II	
CHEM 2203 [0.5] Organic Chemistry I & CHEM 2204 [0.5] Organic Chemistry II	
CHEM 2207 [0.5] Introduction to Organic Chemistry I & CHEM 2208 [0.5] Introduction to Organic Chemistry II	
See Note 2, below	
12. 1.0 credit in:	1.0
BIOL 1105 [0.5] Biological Methods, Analysis and Interpretation	
MATH 1007 [0.5] Elementary Calculus I	
13. 1.0 credit from:	1.0
COMP 1006 [0.5] Introduction to Computer Science II	
COMP 1005 [0.5] Introduction to Computer Science I	
MATH 1107 [0.5] Linear Algebra I	
PHYS 1007 [0.5] Elementary University Physics I or PHYS 1003 [0.5] Introductory Mechanics and Thermodynamics	
PHYS 1008 [0.5] Elementary University Physics II or PHYS 1004 [0.5] Introductory Electromagnetism and Wave Motion	
STAT 2507 [0.5] Introduction to Statistical Modeling I	
14. 1.0 credit in:	1.0
PSYC 1001 [0.5] Introduction to Psychology I	
PSYC 1002 [0.5] Introduction to Psychology II	
15. 1.0 credit in Science Faculty Electives	1.0
16. 1.0 credit in Science Continuation courses (not in BIOL)	1.0
17. 1.0 credit in Approved Courses Outside the Faculties of Science and Engineering and Design (may include NSCI 1000)	1.0
18. 1.0 credit in free electives.	1.0
Total Credits	20.0

Notes:

1. Students should choose their second year courses carefully to ensure that they have the necessary prerequisites for upper year courses in Biology.
2. For **Item 11** above, CHEM 1001 and CHEM 1002 are strongly recommended for this program. Students may substitute CHEM 1001 and CHEM 1002 with CHEM 1005 and CHEM 1006, respectively. Students choosing CHEM 1005 and CHEM 1006 will be required to obtain a grade of B- or higher in CHEM 1006 to take BIOL 2200 and more advanced courses in BIOC and CHEM. Students completing CHEM 1005 with a grade of B- or higher are encouraged to register for CHEM 1002.
3. In order to meet the prerequisite requirements for courses in Items 9 and 10, students should ensure that they have chosen appropriate courses in Items 15, 16, 17, 18 and 19.
4. Students intending to apply to medical schools should be aware of the requirements of different medical schools for chemistry courses with laboratories, and for English courses. This may influence the choice of

courses chosen to meet the requirements in Items 11, 17, 18, and 19.

**Biology with Concentration in Molecular and Cellular Biology
B.Sc. Honours (20.0 credits)**

A. Credits included in the Major CGPA (11.0 credits)

1. 2.0 credits in:	2.0
BIOL 1103 [0.5] Foundations of Biology I	
BIOL 1104 [0.5] Foundations of Biology II	
BIOL 4905 [1.0] Honours Workshop or BIOL 4907 [1.0] Honours Essay and Research Proposal or BIOL 4908 [1.0] Honours Research Thesis	
2. 2.5 credits in:	2.5
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	
3. 0.5 credit from:	0.5
BIOL 3205 [0.5] Plant Biochemistry and Physiology	
BIOL 3303 [0.5] Experimental Microbiology	
BIOL 3305 [0.5] Human and Comparative Physiology	
4. 1.0 credit in:	1.0
BIOC 3101 [0.5] General Biochemistry I	
BIOC 3102 [0.5] General Biochemistry II	
5. 1.0 credit in:	1.0
BIOL 3104 [0.5] Molecular Genetics	
BIOL 3201 [0.5] Cell Biology	
6. 2.0 credits from:	2.0
BIOL 4106 [0.5] Advances in Molecular Biology	
BIOL 4109 [0.5] Laboratory Techniques in Molecular Genetics	
BIOL 4200 [0.5] Immunology	
BIOL 4202 [0.5] Mutagenesis and DNA Repair	
BIOL 4201 [0.5] Advanced Cell Culture and Tissue Engineering	
BIOL 4400 [0.5] Nuclear Dynamics and The Cell Cycle	
7. 0.5 credit in BIOL or BIOC at the 2000-level or higher	0.5
8. 1.0 credit in BIOL or BIOC at the 3000-level or higher	1.0
9. 0.5 credit from:	0.5
BIOL 3901 [0.5] Research Proposal	
BIOL 4901 [0.5] Directed Special Studies or 4000-level BIOL	
B. Credits Not Included in the Major CGPA (9.0 credits)	
10. 2.0 credits in:	2.0
CHEM 1001 [0.5] General Chemistry I & CHEM 1002 [0.5] General Chemistry II	
CHEM 2203 [0.5] Organic Chemistry I & CHEM 2204 [0.5] Organic Chemistry II	
See Note 2, below	
11. 1.0 credit in:	1.0
BIOL 1105 [0.5] Biological Methods, Analysis and Interpretation	
MATH 1007 [0.5] Elementary Calculus I	
12. 1.0 credit from:	1.0

COMP 1005 [0.5]	Introduction to Computer Science I	
COMP 1006 [0.5]	Introduction to Computer Science II	
MATH 1107 [0.5]	Linear Algebra I	
PHYS 1007 [0.5]	Elementary University Physics I	
or PHYS 1003 [0.5]	Introductory Mechanics and Thermodynamics	
PHYS 1008 [0.5]	Elementary University Physics II	
or PHYS 1004 [0.5]	Introductory Electromagnetism and Wave Motion	
STAT 2507 [0.5]	Introduction to Statistical Modeling I	
13. 1.0 credit in	Science Faculty Electives	1.0
14. 1.0 credit in	Science Continuation courses (not in BIOL)	1.0
15. 2.0 credits in	Approved Courses Outside the Faculties of Science and Engineering and Design (may include NSCI 1000)	2.0
16. 1.0 credit in	free electives.	1.0
Total Credits		20.0

Notes:

- Students should choose their second year courses carefully to ensure that they have the necessary prerequisites for upper year courses in Biology.
- For Item 10 above, CHEM 1001 and CHEM 1002 are strongly recommended for this program. Students may substitute CHEM 1001 and CHEM 1002 with CHEM 1005 and CHEM 1006, respectively. Students choosing CHEM 1005 and CHEM 1006 will be required to obtain a grade of B- or higher in CHEM 1006 to take BIOL 2200 and more advanced courses in BIOC and CHEM. Students completing CHEM 1005 with a grade of B- or higher are encouraged to register for CHEM 1002.

**Biology with Concentration in Physiology
B.Sc. Honours (20.0 credits)**

A. Credits Included in the Major CGPA (11.0 credits)

1. 2.0 credits in:		2.0
BIOL 1103 [0.5]	Foundations of Biology I	
BIOL 1104 [0.5]	Foundations of Biology II	
BIOL 4905 [1.0]	Honours Workshop	
or BIOL 4907 [1.0]	Honours Essay and Research Proposal	
or BIOL 4908 [1.0]	Honours Research Thesis	
2. 2.0 credits in:		2.0
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	
3. 1.5 credits in:		1.5
BIOL 3205 [0.5]	Plant Biochemistry and Physiology	
BIOL 3305 [0.5]	Human and Comparative Physiology	
BIOL 3307 [0.5]	Advanced Human Anatomy and Physiology	
4. 1.5 credits in:		1.5
BIOC 2300 [0.5]	Physical Biochemistry	
BIOC 3101 [0.5]	General Biochemistry I	
BIOC 3102 [0.5]	General Biochemistry II	
5. 2.0 credits from:		2.0

BIOL 3201 [0.5]	Cell Biology	
BIOL 3202 [0.5]	Principles of Developmental Biology	
BIOL 3501 [0.5]	Biomechanics	
BIOL 3802 [0.5]	Animal Behaviour	
BIOL 4317 [0.5]	Neuroethology: The Neural Basis of Animal Behaviour	
BIOL 4318 [0.5]	Adaptations to Extreme Environments	
BIOL 4201 [0.5]	Advanced Cell Culture and Tissue Engineering	
BIOL 4008 [0.5]	Molecular Plant Development	
BIOC 4203 [0.5]	Advanced Metabolism	
BIOL 4209 [0.5]	Advanced Plant Physiology	
BIOL 4306 [0.5]	Animal Neurophysiology	
6. 1.0 credit in	BIOL at the 2000-level or higher	1.0
7. 0.5 credit in	BIOL or BIOC at the 3000-level or higher	0.5
8. 0.5 credit from:		0.5

BIOL 3901 [0.5]	Research Proposal	
BIOL 4901 [0.5]	Directed Special Studies	
4000-level BIOL		

B. Credits not included in the Major CGPA (9.0 credits)

9. 2.0 credits from:		2.0
CHEM 1001 [0.5]	General Chemistry I	
& CHEM 1002 [0.5]	General Chemistry II	
CHEM 2203 [0.5]	Organic Chemistry I	
& CHEM 2204 [0.5]	Organic Chemistry II (or)	
CHEM 2207 [0.5]	Introduction to Organic Chemistry I	
& CHEM 2208 [0.5]	Introduction to Organic Chemistry II	
See Note 2, below		
10. 1.0 credit in:		1.0
BIOL 1105 [0.5]	Biological Methods, Analysis and Interpretation	
MATH 1007 [0.5]	Elementary Calculus I	
11. 1.0 credit from:		1.0
PHYS 1007 [0.5]	Elementary University Physics I	
or PHYS 1003 [0.5]	Introductory Mechanics and Thermodynamics	
PHYS 1008 [0.5]	Elementary University Physics II	
or PHYS 1004 [0.5]	Introductory Electromagnetism and Wave Motion	
COMP 1005 [0.5]	Introduction to Computer Science I	
COMP 1006 [0.5]	Introduction to Computer Science II	
MATH 1107 [0.5]	Linear Algebra I	
STAT 2507 [0.5]	Introduction to Statistical Modeling I	
12. 1.0 credit in	Science Faculty electives	1.0
13. 1.0 credit in	Science Continuation courses (not in BIOL)	1.0
14. 2.0 credits in	Approved Courses Outside the Faculties of Science and Engineering and Design (may include NSCI 1000)	2.0
16. 1.0 credit in	free electives.	1.0
Total Credits		20.0

Notes:

- Students should choose their second year courses carefully to ensure that they have the necessary prerequisites for upper year courses in Biology.

2. For Item 9 above, CHEM 1001 and CHEM 1002 are strongly recommended for this program. Students may substitute CHEM 1001 and CHEM 1002 with CHEM 1005 and CHEM 1006, respectively. Students choosing CHEM 1005 and CHEM 1006 will be required to obtain a grade of B- or higher in CHEM 1006 to take BIOL 2200 and more advanced courses in BIOC and CHEM. Students completing CHEM 1005 with a grade of B- or higher are encouraged to register for CHEM 1002.

Biology

B.Sc. Major (20.0 credits)

A. Credits included in the Major CGPA (9.0 credits)

1. 1.0 credit in:	1.0
BIOL 1103 [0.5] Foundations of Biology I	
BIOL 1104 [0.5] Foundations of Biology II	
2. 2.5 credits from:	2.5
BIOL 2001 [0.5] Animals: Form and Function	
BIOL 2002 [0.5] Plants: Form and Function	
BIOL 2104 [0.5] Introductory Genetics or BIOL 2107 [0.5] Fundamentals of Genetics	
BIOL 2200 [0.5] Cellular Biochemistry or BIOL 2201 [0.5] Cell Biology and Biochemistry	
BIOL 2303 [0.5] Microbiology	
BIOL 2600 [0.5] Introduction to Ecology	
3. 0.5 credit from:	0.5
BIOL 3205 [0.5] Plant Biochemistry and Physiology	
BIOL 3306 [0.5] Human Anatomy and Physiology	
4. 3.0 credits in BIOL at the 3000-level or higher	3.0
5. 2.0 credits in Advanced Science Faculty electives	2.0
B. Credits Not Included in the Major CGPA (11.0 credits)	
6. 1.0 credit from:	1.0
CHEM 1001 [0.5] General Chemistry I & CHEM 1002 [0.5] General Chemistry II	
CHEM 1005 [0.5] Elementary Chemistry I & CHEM 1006 [0.5] Elementary Chemistry II (See Note 2, below)	
7. 1.0 credit in:	1.0
BIOL 1105 [0.5] Biological Methods, Analysis and Interpretation	
MATH 1007 [0.5] Elementary Calculus I	
8. 1.0 credit from:	1.0
MATH 1107 [0.5] Linear Algebra I	
COMP 1005 [0.5] Introduction to Computer Science I	
COMP 1006 [0.5] Introduction to Computer Science II	
PHYS 1007 [0.5] Elementary University Physics I or PHYS 1003 [0.5] Introductory Mechanics and Thermodynamics	
PHYS 1008 [0.5] Elementary University Physics II or PHYS 1004 [0.5] Introductory Electromagnetism and Wave Motion	
STAT 2507 [0.5] Introduction to Statistical Modeling I	
9. 1.0 credit in Science Faculty Electives	1.0
10. 2.0 credits in Advanced Science Faculty Electives	2.0
11. 2.0 credits in Science Continuation courses (not in BIOL)	2.0

12. 2.0 credits in Approved Courses Outside the Faculties of Science and Engineering and Design (may include NSCI 1000)	2.0
13. 1.0 credit in free electives.	1.0
Total Credits	20.0

Notes:

1. Students should choose their second year courses carefully to ensure that they have the necessary prerequisites for upper year courses in Biology.
2. For item 6 above, students choosing CHEM 1005 and CHEM 1006 will be required to obtain a grade of B- or higher in CHEM 1006 to take BIOL 2200 and more advanced courses in BIOC and CHEM.

Biology

B.Sc. General (15.0 credits)

Note: some advanced Biology courses with laboratory components will not be available to students enrolling in the B.Sc. General program.

A. Credits included in the Major CGPA (6.0 credits)

1. 1.0 credit in:	1.0
BIOL 1103 [0.5] Foundations of Biology I	
BIOL 1104 [0.5] Foundations of Biology II	
2. 2.0 credits from:	2.0
BIOL 2001 [0.5] Animals: Form and Function	
BIOL 2002 [0.5] Plants: Form and Function	
BIOL 2107 [0.5] Fundamentals of Genetics	
BIOL 2201 [0.5] Cell Biology and Biochemistry	
BIOL 2303 [0.5] Microbiology	
BIOL 2600 [0.5] Introduction to Ecology	
3. 0.5 credit in:	0.5
BIOL 3306 [0.5] Human Anatomy and Physiology	
4. 2.5 credits from BIOL at the 2000-level and 3000-level or higher	2.5
B. Credits Not Included in the Major CGPA (9.0 credits)	
5. 1.0 credit from:	1.0
CHEM 1001 [0.5] General Chemistry I & CHEM 1002 [0.5] General Chemistry II	
CHEM 1005 [0.5] Elementary Chemistry I & CHEM 1006 [0.5] Elementary Chemistry II (See Note 2, below)	
6. 1.0 credit in:	1.0
BIOL 1105 [0.5] Biological Methods, Analysis and Interpretation	
MATH 1007 [0.5] Elementary Calculus I	
7. 1.0 credit from:	1.0
COMP 1005 [0.5] Introduction to Computer Science I	
COMP 1006 [0.5] Introduction to Computer Science II	
MATH 1107 [0.5] Linear Algebra I	
PHYS 1007 [0.5] Elementary University Physics I or PHYS 1003 [0.5] Introductory Mechanics and Thermodynamics	
PHYS 1008 [0.5] Elementary University Physics II or PHYS 1004 [0.5] Introductory Electromagnetism and Wave Motion	
STAT 2507 [0.5] Introduction to Statistical Modeling I	
8. 2.0 credits in Science Continuation (not in BIOL)	2.0
9. 1.0 credit in Science Faculty Electives	1.0

10. 2.0 credits in Approved Courses Outside the Faculties of Science and Engineering and Design (may include NSCI 1000)	2.0
11. 1.0 credit free electives.	1.0
Total Credits	15.0

Notes:

1. Students should choose their second year courses carefully to ensure that they have the necessary prerequisites for upper year courses in Biology.
2. Students choosing CHEM 1005 and CHEM 1006 will be required to obtain a grade of B- or higher in CHEM 1006 to take advanced courses in BIOC and CHEM.

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

A. Credits Included in the Major CGPA (12.5 credits)

1. 6.0 credits in:	6.0
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 2301 [0.5] Biotechnology I	
BIOL 2303 [0.5] Microbiology	
BIOL 3104 [0.5] Molecular Genetics	
BIOL 3201 [0.5] Cell Biology	
BIOL 3301 [0.5] Biotechnology II	
BIOL 4301 [0.5] Current Topics in Biotechnology	
2. 1.0 credit in:	1.0
BIOC 3101 [0.5] General Biochemistry I	
BIOC 3102 [0.5] General Biochemistry II	
3. 4.5 credits from:	4.5
BIOC 2300 [0.5] Physical Biochemistry or CHEM 2103 [0.5] Physical Chemistry I	
BIOC 3008 [0.5] Bioinformatics	
BIOC 3103 [0.5] Practical Biochemistry I	
BIOC 3104 [0.5] Practical Biochemistry II	
BIOC 3202 [0.5] Biophysical Techniques and Applications	
BIOL 3004 [0.5] Insect Diversity	
BIOL 3102 [0.5] Mycology	
BIOL 3205 [0.5] Plant Biochemistry and Physiology	
BIOL 3303 [0.5] Experimental Microbiology	
BIOL 3305 [0.5] Human and Comparative Physiology	
BIOL 3501 [0.5] Biomechanics	
BIOL 3901 [0.5] Research Proposal	
BUSI 2800 [0.5] Entrepreneurship	
CHEM 3700 [0.5] Industrial Applications of Chemistry	
CHEM 3800 [0.5] The Chemistry of Environmental Pollutants	
FOOD 3005 [0.5] Food Microbiology	
BIOC 4001 [0.5] Methods in Biochemistry	
BIOC 4004 [0.5] Industrial 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 4203 [0.5] Advanced Metabolism	
BIOC 4204 [0.5] Protein Biotechnology	
BIOC 4708 [0.5] Principles of Toxicology	
BIOL 4106 [0.5] Advances in Molecular Biology	
BIOL 4109 [0.5] Laboratory Techniques in Molecular Genetics	
BIOL 4200 [0.5] Immunology	
BIOL 4201 [0.5] Advanced Cell Culture and Tissue Engineering	
BIOL 4202 [0.5] Mutagenesis and DNA Repair	
BIOL 4206 [0.5] Human Genetics	
BIOL 4901 [0.5] Directed Special Studies	
TSES 4001 [0.5] Technology and Society: Risk	
TSES 4002 [0.5] Technology and Society: Forecasting	
4. 1.0 credit in:	1.0
BIOL 4905 [1.0] Honours Workshop or 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)	
5. 2.0 credits in:	2.0
CHEM 1001 [0.5] General Chemistry I & CHEM 1002 [0.5] General Chemistry II	
CHEM 2203 [0.5] Organic Chemistry I & CHEM 2204 [0.5] Organic Chemistry II (See Note, below)	
6. 1.0 credit in:	1.0
BIOL 1105 [0.5] Biological Methods, Analysis and Interpretation	
MATH 1007 [0.5] Elementary Calculus I	
7. 1.5 credits from:	1.5
COMP 1005 [0.5] Introduction to Computer Science I	
COMP 1006 [0.5] Introduction to Computer Science II	
MATH 1107 [0.5] Linear Algebra I	
PHYS 1007 [0.5] Elementary University Physics I or PHYS 1003 [0.5] Introductory Mechanics and Thermodynamics	
PHYS 1008 [0.5] Elementary University Physics II or PHYS 1004 [0.5] Introductory Electromagnetism and Wave Motion	
STAT 2507 [0.5] Introduction to Statistical Modeling I	
8. 2.0 credits in Approved Courses Outside the Faculties of Science and Engineering and Design (may include NSCI 1000)	2.0
19. 1.0 credit free elective.	1.0
Total Credits	20.0

Note: For **Item 5** 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.

Biology and Earth Sciences

B.Sc. Combined Honours (20.0 credits)

A. Credits Included in the Major CGPA (12.0 credits)

1. 1.5 credits in:	1.5
BIOL 1103 [0.5]	Foundations of Biology I
BIOL 1104 [0.5]	Foundations of Biology II
BIOL 2001 [0.5]	Animals: Form and Function
2. 1.0 credit in:	1.0
ERTH 1006 [0.5]	Exploring Planet Earth
ERTH 1009 [0.5]	The Earth System Through Time
3. 0.5 credit from:	0.5
BIOL 2600 [0.5]	Introduction to Ecology
BIOL 3605 [0.5]	Field Course I
4. 3.5 credits in BIOL or BIOC, with at least 1.0 credit at the 3000-level and 1.0 credit at the 4000-level	3.5
5. 3.0 credits in:	3.0
ERTH 2102 [0.5]	Mineralogy to Petrology
ERTH 2312 [0.5]	Paleontology
ERTH 2314 [0.5]	Sedimentation and Stratigraphy
ERTH 3111 [0.5]	Vertebrate Evolution II
ERTH 3112 [0.5]	Vertebrate Evolution I
ERTH 3113 [0.5]	Geology of Human Origins
6. 0.5 credit from:	0.5
ERTH 3203 [0.5]	Applied Sedimentology
ERTH 3206 [0.5]	Oceanography: Its Modern and Geologic Records
7. 1.0 credit in EARTH at the 4000-level	1.0
8. 1.0 credit from:	1.0
BIOL 4905 [1.0]	Honours Workshop
BIOL 4907 [1.0]	Honours Essay and Research Proposal
BIOL 4908 [1.0]	Honours Research Thesis
ERTH 4908 [1.0]	Honours Thesis
ERTH 4909 [0.5]	Research in Earth Sciences (and 0.5 credit in EARTH at the 4000-level)

B. Credits Not Included in the Major CGPA (8.0 credits)

9. 1.0 credit in:	1.0
MATH 1007 [0.5]	Elementary Calculus I
MATH 1107 [0.5]	Linear Algebra I
10. 1.0 credit from:	1.0
CHEM 1001 [0.5]	General Chemistry I
& CHEM 1002 [0.5]	General Chemistry II
CHEM 1005 [0.5]	Elementary Chemistry I
& CHEM 1006 [0.5]	Elementary Chemistry II
11. 1.0 credit in:	1.0
PHYS 1007 [0.5]	Elementary University Physics I
& PHYS 1008 [0.5]	Elementary University Physics II
12. 0.5 credit in:	0.5
STAT 2507 [0.5]	Introduction to Statistical Modeling I
13. 0.5 credit in:	0.5
COMP 1005 [0.5]	Introduction to Computer Science I
14. 1.0 credit in Science Continuation courses	1.0

15. 2.0 credits in Approved Courses Outside the Faculties of Science and Engineering and Design (may include NSCI 1000)	2.0
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16. 1.0 credit in free electives	1.0
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Total Credits	20.0
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Note: Students choosing CHEM 1005 and CHEM 1006 will be required to obtain a grade of B- or higher in CHEM 1006 to take BIOL 2200 and more advanced courses in BIOC and CHEM.

Biology and Physics

B.Sc. Combined Honours (20.0 credits)

A. Credits Included in the Major CGPA (12.0 credits)

1. 1.0 credit from:	1.0
PHYS 1001 [0.5]	Foundations of Physics I
& PHYS 1002 [0.5]	Foundations of Physics II (recommended)
PHYS 1003 [0.5]	Introductory Mechanics and Thermodynamics
& PHYS 1004 [0.5]	Introductory Electromagnetism and Wave Motion
PHYS 1007 [0.5]	Elementary University Physics I
& PHYS 1008 [0.5]	Elementary University Physics II (with an average grade of B- or higher)

2. 2.0 credits in:	2.0
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PHYS 2604 [0.5]	Modern Physics I
PHYS 2202 [0.5]	Wave Motion and Optics
PHYS 2305 [0.5]	Electricity and Magnetism
PHYS 2401 [0.5]	Thermal Physics

3. 2.0 credits in:	2.0
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PHYS 3007 [0.5]	Third Year Physics Laboratory: Selected Experiments and Seminars
PHYS 3207 [0.5]	Topics in Biophysics
PHYS 3606 [0.5]	Modern Physics II
PHYS 3701 [0.5]	Elements of Quantum Mechanics

4. 1.0 credit from:	1.0
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PHYS 3308 [0.5]	Electromagnetism
PHYS 3802 [0.5]	Advanced Dynamics
PHYS 3807 [0.5]	Mathematical Physics I
PHYS 4008 [0.5]	Fourth-Year Physics Laboratory: Selected Experiments and Workshop
PHYS 4203 [0.5]	Physical Applications of Fourier Analysis
PHYS 4409 [0.5]	Thermodynamics and Statistical Physics
PHYS 4608 [0.5]	Nuclear Physics
PHYS 4707 [0.5]	Introduction to Quantum Mechanics I

5. 4.0 credits in:	4.0
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BIOL 1103 [0.5]	Foundations of Biology I
BIOL 1104 [0.5]	Foundations of Biology II
BIOL 2200 [0.5]	Cellular Biochemistry
BIOL 2104 [0.5]	Introductory Genetics
BIOL 2001 [0.5]	Animals: Form and Function
BIOL 3201 [0.5]	Cell Biology
BIOL 3104 [0.5]	Molecular Genetics

BIOL 3305 [0.5]	Human and Comparative Physiology	
6. 1.0 credit from:		1.0
BIOL 4106 [0.5]	Advances in Molecular Biology	
BIOL 4109 [0.5]	Laboratory Techniques in Molecular Genetics	
BIOL 4202 [0.5]	Mutagenesis and DNA Repair	
BIOL 4301 [0.5]	Current Topics in Biotechnology	
BIOL 4306 [0.5]	Animal Neurophysiology	
7. 1.0 credit from:		1.0
BIOL 4905 [1.0]	Honours Workshop	
BIOL 4907 [1.0]	Honours Essay and Research Proposal	
BIOL 4908 [1.0]	Honours Research Thesis	
PHYS 4909 [1.0]	Fourth-Year Project	
PHYS 4907 plus 0.5 credit 4000-level PHYS		
PHYS 4908 plus 0.5 credit 4000-level PHYS		
B. Credits Not Included in the Major CGPA (8.0 credits)		
8. 1.0 credit in:		1.0
CHEM 1001 [0.5]	General Chemistry I	
& CHEM 1002 [0.5]	General Chemistry II (See Note, below)	
9. 1.5 credits in:		1.5
MATH 1004 [0.5]	Calculus for Engineering or Physics	
MATH 1005 [0.5]	Differential Equations and Infinite Series for Engineering or Physics	
MATH 1104 [0.5]	Linear Algebra for Engineering or Science	
10. 2.0 credits in:		2.0
STAT 2507 [0.5]	Introduction to Statistical Modeling I	
MATH 2004 [0.5]	Multivariable Calculus for Engineering or Physics	
MATH 3705 [0.5]	Mathematical Methods I	
MATH 3806 [0.5]	Numerical Analysis (Honours)	
11. 0.5 credit in:		0.5
COMP 1005 [0.5]	Introduction to Computer Science I	
12. 2.0 credits in	approved courses outside the faculties of Science and Engineering and Design (may include NSCI 1000)	2.0
13. 1.0 credit in	free electives	1.0
Total Credits		20.0

Note: For **Item 8** above, CHEM 1001 and CHEM 1002 are strongly recommended for this program. Students may substitute CHEM 1001 and CHEM 1002 with CHEM 1005 and CHEM 1006, respectively. Students choosing CHEM 1005 and CHEM 1006 will be required to obtain a grade of B- or higher in CHEM 1006 to take BIOL 2200 and more advanced courses in BIOC and CHEM. Students completing CHEM 1005 with a grade of B- or higher are encouraged to register for CHEM 1002.

Neuroscience

B.Sc. Combined Honours (20.0 credits)

A. Credits Included in the Major CGPA (14.5 credits)

1. 5.5 credits in:		5.5
NEUR 1202 [0.5]	Neuroscience of Mental Health and Psychiatric Disease	
NEUR 1203 [0.5]	Neuroscience of Mental Health and Neurological Disease	

NEUR 2001 [0.5]	Introduction to Research Methods in Neuroscience	
NEUR 2002 [0.5]	Introduction to Statistics in Neuroscience	
NEUR 2201 [0.5]	Cellular and Molecular Neuroscience	
NEUR 2202 [0.5]	Neurodevelopment and Plasticity	
NEUR 3001 [0.5]	Data Analysis in Neuroscience I	
NEUR 3002 [0.5]	Data Analysis in Neuroscience II	
NEUR 3204 [0.5]	Neuropharmacology	
NEUR 3206 [0.5]	Sensory and Motor Neuroscience	
NEUR 3207 [0.5]	Integrative Neuroscience	
2. 3.0 credits in:		3.0
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 2104 [0.5]	Introductory Genetics	
BIOL 2200 [0.5]	Cellular Biochemistry	
BIOL 3305 [0.5]	Human and Comparative Physiology	
3. 2.5 credits in	BIOL or BIOC in 3000-level or above	2.5
4. 1.0 credit from:		1.0
NEUR 3301 [0.5]	Genetics of Mental Health	
NEUR 3303 [0.5]	The Neuroscience of Consciousness	
NEUR 3304 [0.5]	Hormones and Behaviour	
NEUR 3401 [0.5]	Environmental Toxins and Mental Health	
NEUR 3402 [0.5]	Impact of Lifestyle and Social Interactions on Mental Health	
NEUR 3403 [0.5]	Stress and Mental Health	
NEUR 3501 [0.5]	Neurodegeneration and Aging	
NEUR 3502 [0.5]	Neurodevelopmental Determinants of Mental Health	
NEUR 4301 [0.5]	Neurobiology of Energy Homeostasis	
NEUR 4302 [0.5]	Sex and the Brain	
NEUR 4303 [0.5]	Indigenous Health & Mental Health	
NEUR 4305 [0.5]	Immune-Brain Interactions	
NEUR 4306 [0.5]	The Neural Basis of Addiction	
NEUR 4600 [0.5]	Advanced Lab in Neuroanatomy	
5. 1.0 credit from:		1.0
BIOC 4007 [0.5]	Membrane Biochemistry	
BIOL 2600 [0.5]	Introduction to Ecology	
BIOL 3307 [0.5]	Advanced Human Anatomy and Physiology	
BIOL 3605 [0.5]	Field Course I	
BIOL 3609 [0.5]	Evolutionary Concepts	
BIOL 3802 [0.5]	Animal Behaviour	
BIOL 3804 [0.5]	Social Evolution	
BIOL 4306 [0.5]	Animal Neurophysiology	
BIOL 4317 [0.5]	Neuroethology: The Neural Basis of Animal Behaviour	
BIOL 4802 [0.5]	Advanced Animal Behaviour	
CHEM 2204 [0.5]	Organic Chemistry II	
6. 0.5 credit from:		0.5
NEUR 4200 [0.5]	Seminar on Current Advances in Neuroscience	

NEUR 4202 [0.5]	Seminar on Current Research in Neuroscience and Psychiatric Disease	
NEUR 4203 [0.5]	Seminar on Current Research in Neuroscience and Clinical Neurology	
7. 1.0 credit in	neurophysiology, animal behaviour, neuropsychology or a related topic from:	1.0
NEUR 4905 [1.0]	Honours Workshop	
NEUR 4907 [1.0]	Honours Essay and Research Proposal	
NEUR 4908 [1.0]	Honours Research Thesis	
BIOL 4905 [1.0]	Honours Workshop	
BIOL 4907 [1.0]	Honours Essay and Research Proposal	
BIOL 4908 [1.0]	Honours Research Thesis	
B. Credits not included in the Major CGPA (5.5 credits)		
8. 1.0 credit in:		1.0
MATH 1007 [0.5]	Elementary Calculus I	
MATH 1107 [0.5]	Linear Algebra I	
9. 1.5 credits in:		1.5
CHEM 1001 [0.5]	General Chemistry I	
& CHEM 1002 [0.5]	General Chemistry II	
CHEM 2203 [0.5]	Organic Chemistry I (See Note 2 below)	
10. 1.0 credit in:		1.0
PHYS 1007 [0.5]	Elementary University Physics I	
& PHYS 1008 [0.5]	Elementary University Physics II	
11. 2.0 credits in	approved courses outside of the faculties of Science and Engineering and Design (may include NSCI 1000)	2.0
Total Credits		20.0

Biology

B.A. Honours (20.0 credits)

A. Credits included in the Major CGPA (8.0 credits)

1. 1.0 credit in:		1.0
BIOL 1103 [0.5]	Foundations of Biology I	
BIOL 1104 [0.5]	Foundations of Biology II	
2. 2.5 credits from:		2.5
BIOL 2001 [0.5]	Animals: Form and Function	
BIOL 2002 [0.5]	Plants: Form and Function	
BIOL 2104 [0.5]	Introductory Genetics	
or BIOL 2107 [0.5]	Fundamentals of Genetics	
BIOL 2200 [0.5]	Cellular Biochemistry	
or BIOL 2201 [0.5]	Cell Biology and Biochemistry	
BIOL 2303 [0.5]	Microbiology	
BIOL 2600 [0.5]	Introduction to Ecology	
3. 0.5 credit from:		0.5
BIOL 3205 [0.5]	Plant Biochemistry and Physiology	
BIOL 3303 [0.5]	Experimental Microbiology	
BIOL 3305 [0.5]	Human and Comparative Physiology	
BIOL 3306 [0.5]	Human Anatomy and Physiology	
4. 1.0 credit in	BIOL at the 3000-level or higher	1.0
5. 2.0 credits in	BIOL	2.0
6. 1.0 credit from:		1.0
BIOL 4905 [1.0]	Honours Workshop	
or 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 (12.0 credits)

7. 1.0 credit from:		1.0
CHEM 1001 [0.5]	General Chemistry I	
& CHEM 1002 [0.5]	General Chemistry II	
CHEM 1005 [0.5]	Elementary Chemistry I	
& CHEM 1006 [0.5]	Elementary Chemistry II	
(see Note 2 below)		
8. 1.0 credit in	Science Faculty Electives at the 2000-level or higher, not in BIOL	1.0
9. 1.0 credit in	Science Faculty Electives not in BIOL	1.0
10. 2.0 credits in	approved courses at the 2000 level outside of the faculties of Science and Engineering and Design	2.0
11. 4.0 credits in	approved courses outside of the faculties of Science and Engineering and Design (may include NSCI 1000)	4.0
12. 1.0 credit at	the 3000- or 4000-level	1.0
13. 2.0 credits in	free electives.	2.0
Total Credits		20.0

Notes:

- Students should choose their second year courses carefully to ensure that they have the necessary prerequisites for upper year courses in Biology
- For Item 7 above, students choosing CHEM 1005 and CHEM 1006 will be required to obtain a grade of B- or higher in CHEM 1006 to take BIOL 2200 and more advanced courses in BIOC and CHEM.

Biology

B.A. General (15.0 credits)

Note: some advanced Biology courses with laboratory components will not be available to students enrolling in the B.A. General program.

A. Credits included in the Major CGPA (6.0 credits)

1. 1.0 credit in:		1.0
BIOL 1103 [0.5]	Foundations of Biology I	
BIOL 1104 [0.5]	Foundations of Biology II	
2. 2.0 credits from:		2.0
BIOL 2001 [0.5]	Animals: Form and Function	
BIOL 2002 [0.5]	Plants: Form and Function	
BIOL 2107 [0.5]	Fundamentals of Genetics	
BIOL 2201 [0.5]	Cell Biology and Biochemistry	
BIOL 2303 [0.5]	Microbiology	
BIOL 2600 [0.5]	Introduction to Ecology	
3. 3.0 credits in	BIOL	3.0
B. Credits not included in the Major CGPA (9.0 credits)		
4. 1.0 credit from:		1.0
CHEM 1001 [0.5]	General Chemistry I	
& CHEM 1002 [0.5]	General Chemistry II	
CHEM 1005 [0.5]	Elementary Chemistry I	
& CHEM 1006 [0.5]	Elementary Chemistry II (see Note 2, below)	
5. 1.0 credit in	Science Faculty Electives, not in BIOL	1.0
6. 4.0 credits in	approved courses outside of the faculties of Science and Engineering and Design (but may include NSCI 1000)	4.0

7. 1.0 credit at the 2000-level or higher	1.0
8. 2.0 credits in free electives.	2.0
Total Credits	15.0

Notes:

1. Students should choose their second year courses carefully to ensure that they have the necessary prerequisites for upper year courses in Biology.
2. For Item 4 above, students choosing CHEM 1005 and CHEM 1006 will be required to obtain a grade of B- or higher in CHEM 1006 to take more advanced courses in BIOC and CHEM.

Biology

B.A. Combined Honours (20.0 credits)

A. Credits included in the Biology Major CGPA (6.0 credits)

1. 1.0 credit in:	1.0
BIOL 1103 [0.5] Foundations of Biology I	
BIOL 1104 [0.5] Foundations of Biology II	
2. 2.5 credits from:	2.5
BIOL 2001 [0.5] Animals: Form and Function	
BIOL 2002 [0.5] Plants: Form and Function	
BIOL 2104 [0.5] Introductory Genetics or BIOL 2107 [0.5] Fundamentals of Genetics	
BIOL 2200 [0.5] Cellular Biochemistry or BIOL 2201 [0.5] Cell Biology and Biochemistry	
BIOL 2303 [0.5] Microbiology	
BIOL 2600 [0.5] Introduction to Ecology	
3. 1.0 credit in BIOL at the 3000-level or higher	1.0
4. 1.5 credits from BIOL	1.5
B. Additional Requirements (14.0 credits)	
5. 1.0 credit from:	1.0
CHEM 1001 [0.5] General Chemistry I & CHEM 1002 [0.5] General Chemistry II	
CHEM 1005 [0.5] Elementary Chemistry I & CHEM 1006 [0.5] Elementary Chemistry II (see Note 2, below)	
6. 1.0 credit from:	1.0
BIOL 4905 [1.0] Honours Workshop or BIOL 4907 [1.0] Honours Essay and Research Proposal or BIOL 4908 [1.0] Honours Research Thesis or equivalent from the other Honours department	
7. 1.0 credit in Science Faculty Electives, not in BIOL, at the 2000-level or higher	1.0
8. 1.0 credit in Science Faculty Electives, not in BIOL	1.0
9. 7.0 credits in approved courses outside of the faculties of Science and Engineering and Design (may include NSCI 1000), to include the requirements for the other discipline	7.0
10. 3.0 credits in free electives.	3.0
Total Credits	20.0

Notes:

1. Students should choose their second year courses carefully to ensure that they have the necessary prerequisites for upper year courses in Biology.
2. For item 5 above, students choosing CHEM 1005 and CHEM 1006 will be required to obtain a grade of B-

or higher in CHEM 1006 to take BIOL 2200 and more advanced courses in BIOC and CHEM.

Minor in Biology (4.0 credits)

The Minor in Biology is available to students registered in degree programs other than those offered by the Department of Biology.

Requirements (4.0 credits)

1. 1.0 credit in:	1.0
BIOL 1103 [0.5] Foundations of Biology I	
BIOL 1104 [0.5] Foundations of Biology II	
2. 1.0 credit from:	1.0
BIOL 1105 [0.5] Biological Methods, Analysis and Interpretation	
BIOL 1010 [0.5] Biotechnology and Society	
BIOL 1902 [0.5] Natural History	
BIOL 2001 [0.5] Animals: Form and Function	
BIOL 2002 [0.5] Plants: Form and Function	
BIOL 2005 [0.5] Human Physiology	
BIOL 2107 [0.5] Fundamentals of Genetics	
BIOL 2201 [0.5] Cell Biology and Biochemistry	
BIOL 2303 [0.5] Microbiology	
BIOL 2903 [0.5] Natural History and Ecology of Ontario	
3. 1.0 credit in BIOL at the 2000-level or higher	1.0
4. 1.0 credit in BIOL at the 3000-level or higher	1.0
Total Credits	4.0

Note: At least 2.0 of these credits must be taken at Carleton University.

Biology (BIOL) Courses

BIOL 1010 [0.5 credit]

Biotechnology and Society

A course for students interested in the science behind recent advances in biotechnology. The different ways in which biotechnology is being applied in agriculture, health care, and the environment will be examined. Preclusion: credit will not be given if taken concurrently with, or after BIOL 2200 or BIOC 2200 or BIOL 2201. Students in Biology and Biochemistry programs may only take this course as a free elective. Lectures three hours a week.

BIOL 1103 [0.5 credit]

Foundations of Biology I

A research-oriented course focusing on the scientific process of biological exploration at the cellular level. Topics include cell organization, metabolism, genetics, and reproduction. Precludes additional credit for BIOL 1003 (no longer offered). Prerequisite(s): Ontario 4U/M in Biology (or equivalent), or Ontario 4U/M in Chemistry (or equivalent). Lectures three hours a week, laboratory or tutorial three hours a week.

BIOL 1104 [0.5 credit]**Foundations of Biology II**

A research-oriented course focusing on the scientific process of biological exploration at the macroscale. Topics include evolution, diversity of life, and ecological relationships.

Precludes additional credit for BIOL 1004 (no longer offered).

Prerequisite(s): Ontario 4U/M in Biology (or equivalent) or BIOL 1103.

Lectures three hours a week, laboratory or tutorial three hours a week.

BIOL 1105 [0.5 credit]**Biological Methods, Analysis and Interpretation**

Formulation of biological research questions, development of hypotheses and predictions, design of experiments, collection and analysis of data, interpretation and presentation of results.

Lectures three hours a week.

BIOL 1902 [0.5 credit]**Natural History**

A course designed primarily for students in non-biology programs to investigate the natural history of plants and animals, and the communities in which they occur. Particular attention is paid to the Ottawa region, but appropriate examples from other locales are also included. Lectures three hours a week.

BIOL 2001 [0.5 credit]**Animals: Form and Function**

An introduction to the diverse structures of animals (both invertebrates and vertebrates) in relationship to their functions, discussed within an evolutionary framework.

Prerequisite(s): (BIOL 1003 and BIOL 1004) or (BIOL 1103 and BIOL 1104) or permission of the Department.

Lectures three hours a week, laboratory or tutorial three hours a week.

BIOL 2002 [0.5 credit]**Plants: Form and Function**

An introduction to the structure and development of higher plants (at cellular, morphological and organism levels) discussed in relation to their function.

Prerequisite(s): (BIOL 1003 and BIOL 1004) or (BIOL 1103 and BIOL 1104) or permission of the Department.

Lectures three hours a week, laboratory or tutorial three hours a week.

BIOL 2005 [0.5 credit]**Human Physiology**

Topics may include: neurophysiology, sensory reception, the skeletal system, muscular contraction, the cardiovascular system, the respiratory system, and the gastrointestinal system. Preclusion: credit will not be given if taken concurrently with, or after BIOL 3305 or BIOL 3306. Students in Biology and Biochemistry programs may only take this course as a free elective. Prerequisite(s): BIOL 1003 or BIOL 1103 and (CHEM 1001 and CHEM 1002) or (CHEM 1005 and CHEM 1006) or permission of the Department.

Lectures three hours a week.

BIOL 2104 [0.5 credit]**Introductory Genetics**

A lecture and laboratory course on the mechanisms of inheritance and the nature of gene structure, composition and function, introducing both classical Mendelian genetics and modern molecular genetics. It is strongly recommended that this course be taken by Biology majors in their second year of study.

Precludes additional credit for BIOL 2106 (no longer offered) and BIOL 2107. Credit for BIOL 2106 will only be given if taken before BIOL 2104.

Prerequisite(s): (BIOL 1003 and BIOL 1004) or (BIOL 1103 and BIOL 1104) or permission of the Department.

Lectures three hours a week, laboratory or tutorial three hours a week.

BIOL 2107 [0.5 credit]**Fundamentals of Genetics**

Mechanisms of inheritance and the nature of gene structure, composition and function, introducing both classical Mendelian genetics and modern molecular genetics.

Precludes additional credit for BIOL 2104 and BIOL 2106 (no longer offered).

Prerequisite(s): (BIOL 1003 and BIOL 1004) or (BIOL 1103 and BIOL 1104) or permission of the Department.

Lectures three hours a week.

BIOL 2200 [0.5 credit]**Cellular Biochemistry**

Cellular functions and their interrelationships. Introduction to thermodynamics, membrane structure and function, transport mechanisms, basic metabolic pathways, energy production and utilization, communications between cells. It is strongly recommended that Biology Majors and Honours students take this course in their second year of study.

Also listed as BIOC 2200.

Precludes additional credit for BIOL 2201.

Prerequisite(s): (BIOL 1003 and BIOL 1004) or (BIOL 1103 and BIOL 1104), (CHEM 1001 and CHEM 1002) or (CHEM 1005 and CHEM 1006), or permission of the Department.

Lectures three hours a week, laboratory or tutorial four hours a week.

BIOL 2201 [0.5 credit]**Cell Biology and Biochemistry**

A study of the molecular, metabolic and structural organization of cells in relation to function. This course is recommended for students not taking upper year Biology laboratory courses for which BIOL/BIOC laboratories are prerequisites.

Precludes additional credit for BIOL 2200, BIOC 2200.

Prerequisite(s): (BIOL 1003 or BIOL 1103) and (CHEM 1002 or CHEM 1006), or permission of the Department.

Lectures three hours a week.

BIOL 2301 [0.5 credit]**Biotechnology I**

An introductory course on the science, technology, entrepreneurial skills and business considerations related to biotechnology. The course will survey broadly across the disciplines of Biology, including applications in agriculture, health, environment and industry.

Prerequisite(s): (BIOL 1003 and BIOL 1004) or (BIOL 1103 and BIOL 1104) or permission of the department.

Lectures and workshops three hours a week

BIOL 2303 [0.5 credit]**Microbiology**

The biology of the bacteria, Archaea, Viruses and Protozoans, from the fundamentals of cell chemistry, molecular biology, structure and function, to their involvement in ecological and industrial processes and human disease.

Prerequisite(s): BIOL 1003 or BIOL 1103.

Lectures three hours a week.

BIOL 2600 [0.5 credit]**Introduction to Ecology**

The scientific study of interactions of living organisms and their environment, and how these affect the distribution and abundance of life. Topics include energy transformation and flow, nutrient cycling, population and community dynamics, human impacts on ecosystems, conservation issues. Laboratory includes field and computer exercises.

Prerequisite(s): (BIOL 1003 and BIOL 1004), or (BIOL 1103 and BIOL 1104) or permission of the Department.

Lectures three hours a week, laboratory or tutorial four hours a week.

BIOL 2903 [0.5 credit]**Natural History and Ecology of Ontario**

Introduction to the remarkable diversity and ecological relationships of Ontario's flora and fauna, which are explored in a habitat context.

Precludes additional credit for BIOL 1903 (no longer offered).

Prerequisite(s): BIOL 1004 or BIOL 1104 or BIOL 1902.

Lectures three hours a week.

BIOL 3004 [0.5 credit]**Insect Diversity**

Introductory course dealing with the taxonomic diversity, anatomy, behavior and physiology of insects, as well as their impacts on ecosystems, agriculture and animal and human health.

Precludes additional credit for BIOL 4601.

Prerequisite(s): BIOL 2001.

Lectures three hours a week.

BIOL 3008 [0.5 credit]**Bioinformatics**

A practical exploration in the application of information technology to biochemistry and molecular biology. Insight into biological knowledge discovery via molecular structure and function prediction, comparative genomics and biological information management.

Also listed as BIOC 3008, COMP 3308.

Prerequisite(s): BIOC 2200 or BIOL 2200, or permission of the Department.

Lectures two hours a week, computer workshop three hours a week.

BIOL 3102 [0.5 credit]**Mycology**

This introductory course will cover the morphology, physiology, life cycles, evolution, ecology and biotechnology of the fungi.

Prerequisite(s): BIOL 2104 or BIOL 2107.

Lectures three hours a week.

BIOL 3104 [0.5 credit]**Molecular Genetics**

A lecture course dealing with modern advances in molecular genetics.

Prerequisite(s): BIOL 2104 or BIOL 2107 or permission of the Department.

Lectures three hours a week.

BIOL 3201 [0.5 credit]**Cell Biology**

A lecture and laboratory course on the structure, composition, and function of eukaryotic cells.

Prerequisite(s): BIOL 2104 and BIOL 2200/BIOC 2200, or permission of the Department.

Lectures three hours a week, laboratory four hours a week.

BIOL 3202 [0.5 credit]**Principles of Developmental Biology**

Introduction to the underlying principles and mechanisms governing development in multicellular animals and plants. Differentiation, growth, morphogenesis, and patterning will be examined at the organismal, cellular, and molecular levels to provide a balanced view of developmental phenomena in key model organisms.

Prerequisite(s): BIOL 2104 or BIOL 2107 and one of BIOL 2001 or BIOL 2002, or permission of the Department.

Lectures three hours a week.

BIOL 3205 [0.5 credit]**Plant Biochemistry and Physiology**

A lecture and laboratory course consisting of selected topics in metabolism and physiology of plants, including photosynthesis, nutrient uptake and transport, intermediary and secondary metabolism, germination, growth and development.

Prerequisite(s): BIOL 2002 and BIOL 2200/BIOC 2200, or permission of the Department.

Lectures three hours a week, laboratory four hours a week.

BIOL 3301 [0.5 credit]**Biotechnology II**

An interdisciplinary course on interactions between science, invention and innovation in biotechnology. Case studies related to regional biotechnology opportunities; social and ethical issues impacting biotechnology.

Prerequisite(s): BIOL 2301 or (BIOL 2104 and BIOL 2200/BIOC 2200) or permission of the department.

Lectures and laboratory/workshops three hours a week

BIOL 3303 [0.5 credit]**Experimental Microbiology**

Intensive training in laboratory techniques in microbiology, using bacteria and other microorganisms to demonstrate processes of cell growth, metabolism, gene expression, rapid evolution, gene transfer, microbial community dynamics and interactions with other organisms.

Prerequisite(s): BIOL 2104, BIOL 2200/BIOC 2200 and BIOL 2303, or permission of the Department.

Lecture/tutorial one and a half hours a week, laboratory four hours a week.

BIOL 3305 [0.5 credit]**Human and Comparative Physiology**

The properties of physiological systems and components of humans and other animals with an emphasis on physical and chemical bases.

Precludes additional credit for BIOL 3306.

Prerequisite(s): BIOL 2200/BIOC 2200 and BIOL 2001. A credit in PHYS at the 1000-level is strongly recommended.

Lectures three hours a week, laboratory four hours a week.

BIOL 3306 [0.5 credit]**Human Anatomy and Physiology**

The anatomy and physiology of the neuromuscular, cardiovascular, respiratory, and excretory systems of humans with comparison to other animals.

Precludes additional credit for BIOL 3305.

Prerequisite(s): (BIOL 1003 and BIOL 1004) or (BIOL 1103 and BIOL 1104), and (CHEM 1001 and CHEM 1002) or (CHEM 1005 and CHEM 1006).

Lectures three hours per week.

BIOL 3307 [0.5 credit]**Advanced Human Anatomy and Physiology**

The anatomy and physiology of the endocrine, skeletal, digestive, immunological, and reproductive systems, with additional emphasis on the embryological origins of the major physiological systems.

Prerequisite(s): BIOL 3305 or BIOL 3306.

Lectures three hours per week, workshop or laboratory four hours per week.

BIOL 3501 [0.5 credit]**Biomechanics**

Properties of muscles, tendons, bones, joints and the co-ordinated use of these structures. Human and other animal locomotion and fitness, bird flight, especially the soaring of the vulture and the albatross, and animal migration are covered in detail.

Prerequisite(s): (BIOL 1003 and BIOL 1004) or (BIOL 1103 and BIOL 1104).

Lectures three hours a week, workshop two hours a week.

BIOL 3601 [0.5 credit]**Ecosystems and Environmental Change**

Exploration of the unique contribution of the ecosystem approach to ecology, and of early key literature in ecosystem ecology through to current work on global environmental change.

Prerequisite(s): BIOL 2600.

Lectures three hours a week, laboratory four hours a week in six sessions.

BIOL 3602 [0.5 credit]**Conservation Biology**

The science of biology as applied to the problem of maintaining species diversity. Topics include: history of conservation biology, valuation of species, indices of biodiversity, extinction, conservation genetics, conservation planning in parks and reserves, landscape ecology and case studies of conservation problems.

Prerequisite(s): BIOL 2600 or permission of the Department.

Lectures three hours a week and laboratory/workshop three hours a week.

BIOL 3604 [0.5 credit]**Analysis of Ecological Relationships**

Introduction to the analysis of ecological data. Students analyze real ecological data sets in weekly laboratory sessions. Methods introduced include simple linear, polynomial, and multiple regression analysis, analysis of variance, nonparametric tests, tests of independence and logistic regression analysis.

Prerequisite(s): BIOL 2600 and STAT 2507.

Lectures one and one-half hours and laboratory two and one-half hours a week.

BIOL 3605 [0.5 credit]**Field Course I**

An intensive study of living organisms under natural conditions. Credit is based on two weeks of full-time fieldwork with attendant assignments. A wide range of modules is available. Transportation and room and board costs are borne by the student. Students may take both BIOL 3605 and BIOL 3606 for credit, but neither may be used to repeat a particular module.

Also listed as NEUR 3203, for animal behaviour modules only.

Prerequisite(s): at least one course in BIOL beyond the 1000-level and written permission of the Department.

All day, approximately six days a week.

BIOL 3606 [0.5 credit]**Field Course II**

An intensive study of living organisms under natural conditions. Credit is based on two weeks of full-time fieldwork with attendant assignments. A wide range of modules is available. Transportation and room and board costs are borne by the student. Students may take both BIOL 3605 and BIOL 3606 for credit, but neither can be used to repeat a particular module.

Prerequisite(s): at least one course in BIOL beyond the 1000-level and written permission of the Department.

All day, approximately six days a week.

BIOL 3608 [0.5 credit]**Principles of Biogeography**

Contemporary and past controls on distribution of plants and animals at global, regional and local scales; significance of these distributions.

Also listed as GEOG 3104.

Prerequisite(s): BIOL 2600 or GEOG 1010 or permission of the Department.

Lectures, laboratory, and fieldwork five hours a week.

BIOL 3609 [0.5 credit]**Evolutionary Concepts**

Evolution is the change in population properties across generations. Genetic variation, mutation, selection, drift, gene flow, genome evolution, speciation, development, biodiversity, fossils, and macro-evolution.

Prerequisite(s): BIOL 2104 or BIOL 2107 or permission of the instructor.

Lectures three hours a week.

BIOL 3611 [0.5 credit]**Evolutionary Ecology**

The term "adaptation" is meaningful only with respect to an ecological context. Ecological contexts lead to evolutionary outcomes such as diverse mating systems, ageing, sexual reproduction, sexual dimorphism, geographic variation, phenotypic plasticity, and diverse life histories.

Precludes additional credit for BIOL 4608.

Prerequisite(s): BIOL 2600.

Lectures three hours a week; one field trip.

BIOL 3612 [0.5 credit]**Computational Methods in Ecology and Evolution**

Introduction to the development and use of computer programs to address biological problems. Topics include the development of programs to analyse ecological data, models of population dynamics, deterministic chaos, cellular automata, simulations of foraging behaviour and evolutionary computation.

Prerequisite(s): BIOL 2600 or permission of the Department.

Lectures two hours per week, workshop three hours per week.

BIOL 3801 [0.5 credit]**Plants and Herbivores**

Exploration of the chemical, physiological, ecological and evolutionary interactions that underlie the relationship between plants and their insect herbivores.

Prerequisite(s): BIOL 2001 and BIOL 2002.

Lectures/seminars three hours a week.

BIOL 3802 [0.5 credit]**Animal Behaviour**

Advanced study of animal behaviour including the environmental, genetic, and neural influences on behaviour. Topics such as predator-prey interactions, mating behaviour, migration, parental care and social interactions are interpreted in an evolutionary context.

Prerequisite(s): BIOL 2001 or BIOL 2600 or permission of the Department.

Lectures and workshop/tutorials three hours a week.

BIOL 3804 [0.5 credit]**Social Evolution**

Diversity in social behaviour from evolutionary and ecological perspectives. Topics include ecological determinants of social living, social networks, social foraging, inclusive fitness, kin selection, altruism, cooperation, and mating systems and strategies.

Prerequisite(s): BIOL 2001 and BIOL 2600, or permission of the Department.

Lectures three hours a week.

BIOL 3901 [0.5 credit]**Research Proposal**

The development of a competitive research proposal in consultation with an advisor.

Prerequisite(s): third year standing in an Honours Biology program and permission of the Department.

BIOL 3902 [0.5 credit]**Topics in Biology I**

Specific topics of current interest. Topics may vary from year to year.

Prerequisite(s): third-year standing in a Biology program or permission of the Department.

Lecture, seminars, or workshops three hours per week.

BIOL 3999 [0.0 credit]**Co-operative Work Term Report**

Practical experience for students enrolled in the Co-operative Option. Students must receive satisfactory evaluations from their work term employer. Written reports describing the work term project will be required. Graded Sat or Uns.

Prerequisite(s): registration in the Biology Co-operative Option and permission of the Department.

BIOL 4008 [0.5 credit]**Molecular Plant Development**

Recent advances in plant development including molecular, biochemical, genomics, and proteomics studies.

Prerequisite(s): BIOL 2002 or permission of the Department.

Lectures three hours a week.

BIOL 4102 [0.5 credit]**Molecular Ecology**

The interface of molecular biology, ecology and population biology. Topics include experimental design and a survey and critique of molecular genetic methods to study ecology.

Prerequisite(s): BIOL 2104 or BIOL 2107 and BIOL 2600; BIOL 3104 or one of BIOL 3601, BIOL 3602 (may be taken concurrently), or permission of the Department.

Lectures three hours a week.

BIOL 4103 [0.5 credit]**Population Genetics**

Evolution of gene frequencies, including selection, mutation, genetic drift, inbreeding, gene flow, and population structure.

Prerequisite(s): BIOL 2104 or BIOL 2107 or permission of the Department. A course in statistics is highly recommended.

Lectures and seminars three hours a week.

BIOL 4104 [0.5 credit]**Evolutionary Genetics**

An overview of the molecular evidence of evolution, speciation as well as the phylogenetic analysis of biological sequence data and biometrical traits.

Prerequisite(s): (BIOL 2001 or BIOL 2002) and (BIOL 2104 or BIOL 2107) or permission of the Department. A course in statistics is recommended.

Lectures and computer lab three hours a week.

BIOL 4106 [0.5 credit]**Advances in Molecular Biology**

Review of the application of high throughput approaches to research in molecular and cellular biology and biochemistry with an emphasis on gene function and human disease progression.

Prerequisite(s): BIOL 2303 and (BIOL 3104 or BIOL 3201).

Lectures and seminars three hours a week.

BIOL 4109 [0.5 credit]**Laboratory Techniques in Molecular Genetics**

This laboratory course provides practical familiarity with commonly used techniques in molecular genetics. The laboratory is suitable for students with a developing interest in problems of molecular and cellular biology and biochemistry.

Prerequisite(s): BIOL 2200/BIOC 2200 and BIOL 2303 and BIOL 3104 or permission of the Department.

Lecture/laboratory six hours a week in two sessions.

BIOL 4200 [0.5 credit]**Immunology**

The organization and function of the immune system, including the anatomy of the immune system, the properties and behaviour of cells of the immune system, and the molecular and genetic bases of the immune response.

Also listed as BIOC 4200.

Prerequisite(s): BIOL 3201 or permission of the Department.

Lectures three hours a week.

BIOL 4201 [0.5 credit]**Advanced Cell Culture and Tissue Engineering**

Theory and application of current techniques and developments in cell culture as applied to research questions in the field of stem cells and tissue engineering. Also listed as BIOC 4201.

Prerequisite(s): BIOL 3201 or permission of the Department.

Laboratory four hours per week, tutorial one hour a week. Labs require regular participation outside of the scheduled lab time to maintain cell cultures and set up or complete experiments.

BIOL 4202 [0.5 credit]**Mutagenesis and DNA Repair**

A mechanistic study of mutagenesis and DNA repair. Topics include DNA structure perturbations, spontaneous and induced mutagenesis, the genetics and Biochemistry of DNA repair and recombination, and the role of mutations in the development of genetic disease and cancer.

Also listed as BIOC 4202.

Prerequisite(s): BIOL 3104 and BIOL 2200/BIOC 2200 or permission of the Department.

Lectures two hours a week and workshop two hours a week.

BIOL 4203 [0.5 credit]**Evolution of Sex**

The evolution of sex, including meiosis, syngamy, sex determination, sex chromosomes, and gender from organismal, genetic, and developmental perspectives; the origin, maintenance, function, and ubiquity of sex.

Prerequisite(s): BIOL 2104 or BIOL 2107.

Lectures three hours a week.

BIOL 4206 [0.5 credit]**Human Genetics**

A survey of human genetic variation and mutation in a molecular genetics context. Topics may include molecular basis of diseases, chromosomal abnormalities, genomic imprinting, cancer genetics, genomics, gene mapping and gene therapy.

Prerequisite(s): BIOL 3104 or permission of the Department.

Lectures three hours a week.

BIOL 4207 [0.5 credit]**Advanced Embryology & Developmental Biology**

A laboratory-based exploration of techniques and recent developments in the use of model embryological systems as applied to questions of development and human health.

Prerequisite(s): BIOL 3201 or BIOL 3202 or permission of the Department.

Laboratory four hours per week, tutorial one hour a week.

Labs require regular participation outside of the scheduled lab time to set up or complete experiments.

BIOL 4209 [0.5 credit]**Advanced Plant Physiology**

An advanced course dealing with recent developments in selected topics of plant physiology.

Prerequisite(s): BIOL 3205 and CHEM 2203, CHEM 2204 or permission of the Department.

Lectures/discussion three hours a week.

BIOL 4300 [0.5 credit]**Applied Microbiology**

Studies of the application of microorganisms. Topics may include: microbial communities, and agricultural, pharmaceutical, industrial and health sciences.

Prerequisite(s): (BIOL 2200/BIOC 2200 or BIOL 2201), BIOL 2303 and (BIOL 3104 or BIOL 3303) or permission of the Department.

Lectures and tutorial three hours a week.

BIOL 4301 [0.5 credit]**Current Topics in Biotechnology**

Explorations of developing biotechnologies in areas such as microbial products, protein engineering, plant genetic engineering, environmental remediation, pharmaceuticals production and medical diagnostics and therapy.

Prerequisite(s): BIOL 3301 or (BIOL 2104 or BIOL 2107) and (BIOL 2200/BIOC 2200 or BIOL 2201,) or permission of the department.

Lectures and tutorials three hours a week.

BIOL 4303 [0.5 credit]**Advances in Microbiology**

Exploration of current microbiology including the biology of infectious agents, microbial and functional genomics and proteomics. Special attention will be paid to the "big questions" in the field. Students will be exposed to proposing research to answer a specific question in microbiology.

Prerequisite(s): BIOL 2303 and (BIOL 3104 or BIOL 3303 or BIOC 3102) or permission of the Department.

Lectures three hours per week.

BIOL 4306 [0.5 credit]**Animal Neurophysiology**

A course dealing with recent advances made in particular areas of animal neurophysiology.

Precludes additional credit for BIOL 4305.

Prerequisite(s): BIOL 3305 or BIOL 3306, or permission of the Department.

Lectures two hours a week, workshops or laboratory four hours a week.

BIOL 4317 [0.5 credit]**Neuroethology: The Neural Basis of Animal Behaviour**

The proximate mechanisms underlying animal behaviour are examined focusing on how nervous systems evolve in response to environmental selection pressures.

Topics include genetic and hormonal influences on behaviour (e.g. maternal care), unique sensory worlds (e.g. magnetic), and various levels of neural integration, from simple reflexes to complex social behaviour.

Prerequisite(s): BIOL 3305 or BIOL 3306, or permission of the Department.

Lectures three hours a week.

BIOL 4318 [0.5 credit]**Adaptations to Extreme Environments**

Lectures, discussions and student presentations will be used to examine adaptations of animals to extreme environments (e.g. desert) or lifestyles (e.g. diving), at the physiological, biochemical and molecular levels. Emphasis on becoming familiar with the current primary literature.

Prerequisite(s): BIOL 3305, or permission of the Department.

Lectures three hours a week, workshop two hours a week.

BIOL 4400 [0.5 credit]**Nuclear Dynamics and The Cell Cycle**

Molecular cell biology of nuclear functions and the eukaryotic cell cycle. Topics may include chromosome architecture and dynamics; nucleocytoplasmic exchange; pre-mRNA processing; ribosome biogenesis; mitotic and meiotic nuclear disassembly and reassembly; and regulation of cell proliferation and cell death.

Also listed as BIOC 4400.

Prerequisite(s): BIOL 3201, or BIOC 3102, or permission of the Department.

Lectures one and a half hours per week, workshop one and a half hours per week.

BIOL 4500 [0.5 credit]**Ornithology I**

Introduction to ornithology, the study of birds; the evolution of birds, migration, geographic variation, adaptations for flight, feeding, reproduction; extinction and preservation.

Prerequisite(s): BIOL 2001.

Lectures three hours per week.

BIOL 4501 [0.5 credit]**Ornithology II**

The taxonomy of birds and species identification are learned through the use of study skins in the lab. Field excursions allow first-hand study of wintering species. Participants must acquire a pair of binoculars and one of the recommended field guides.

Prerequisite(s): BIOL 4500.

Laboratory/field excursions four hours per week.

BIOL 4502 [0.5 credit]**Herpetology**

Herpetology is the study of amphibians and reptiles. The behaviours, physiological ecology, conservation and identification of amphibians and reptiles will be examined through lectures, seminars and hands-on activities.

Prerequisite(s): BIOL 2001.

Lectures or seminars three hours per week.

BIOL 4503 [0.5 credit]**Fish Ecology, Conservation and Management**

Introduction to the diversity and environmental biology of the world's fishes. Applied issues in fisheries management, conservation, and aquaculture. Workshops expose students to techniques in fisheries science through hands-on demonstrations and field excursions.

Prerequisite(s): BIOL 2600 or permission of the Department.

Lectures/seminars two hours a week, plus labs/workshops two hours a week.

BIOL 4603 [0.5 credit]**Insect Evolution and Biology**

Major questions on the origin, evolution and adaptation of structures and physiology of terrestrial arthropods, especially insects.

Prerequisite(s): BIOL 3004, or permission of the Department.

Lectures two hours a week, laboratory four hours a week.

BIOL 4604 [0.5 credit]**Landscape Ecology**

Landscape ecology is the study of how landscape structure affects the abundance and distribution of organisms. The focus of this course is on research methods and results in landscape ecology. Applications in forestry, agriculture, and species conservation.

Prerequisite(s): BIOL 2600 or equivalent, BIOL 3601 or BIOL 3602 or BIOL 3608 or equivalent, and honours standing in Biology, Geography, or Environmental Sciences.

Lecture three hours a week.

BIOL 4802 [0.5 credit]**Advanced Animal Behaviour**

Contemporary issues in behavioural ecology. Topics may include the relevance of behavioural ecology to conservation biology, to new insights into human social behaviour, and will be selected through consultation between professor and students.

Prerequisite(s): BIOL 3802 or BIOL 3804, or permission of the Department.

Lectures two hours a week, laboratory four hours a week.

BIOL 4900 [1.0 credit]**Directed Special Studies and Seminar**

Prerequisite(s): permission of the Department.

BIOL 4901 [0.5 credit]**Directed Special Studies**

Independent or group study, open to third- and fourth-year students to explore a particular topic, in consultation with a Faculty supervisor. May include directed reading, written assignments, tutorials, laboratory or field work.

Prerequisite(s): permission of the Department. Students normally may not offer more than 1.0 credit of Directed Special Studies in their program.

BIOL 4902 [0.5 credit]**Topics in Biology II**

Specific topics of current interest. Topics may vary from year to year.

Prerequisite(s): fourth-year standing in a Biology program or permission of the Department.

Lecture, seminars, or workshops three hours per week.

BIOL 4905 [1.0 credit]**Honours Workshop**

Within the context of an active learning environment, students participate in a variety of activities which may include literature reviews and critiques, media releases and response papers, oral presentations, and posters. Projects are focused on an area of biological research of interest to the student.

Precludes additional credit for BIOL 4907 and BIOL 4908.

Prerequisite(s): fourth-year standing in an Honours biology program and permission of the Department.

Workshops three hours per week.

BIOL 4907 [1.0 credit]**Honours Essay and Research Proposal**

An independent critical review and research proposal, using library resources, under the direct supervision of a Faculty advisor. Evaluation is based on a written report and a poster presentation.

Precludes additional credit for BIOL 4905 and BIOL 4908.

Prerequisite(s): fourth-year standing in an Honours Biology program and permission of the Department.

BIOL 4908 [1.0 credit]**Honours Research Thesis**

An independent research project undertaken in the field and/or the laboratory, under the direct supervision of a faculty adviser. Evaluation is based on a written thesis and a poster presentation.

Precludes additional credit for BIOL 4905 and BIOL 4907.

Prerequisite(s): fourth-year standing in an Honours biology program with a minimum CGPA of 8.0 in the major or permission of the Department.

Summer session: some of the courses listed in this Calendar are offered during the summer. Hours and scheduling for summer session courses will differ significantly from those reported in the fall/winter Calendar. To determine the scheduling and hours for summer session classes, consult the class schedule at central.carleton.ca

Not all courses listed are offered in a given year. For an up-to-date statement of course offerings for the current session and to determine the term of offering, consult the class schedule at central.carleton.ca