



<p><b>1.0 Degree Title</b> Specify the two degrees for concurrent degree programs</p> <p>1.1 <input style="width: 100%;" type="text" value="B.Sc."/></p> <p>1.2 Concentration (Legacy = Concentration/Option) If applicable (30 char. max.) <input style="width: 100%;" type="text" value="JOINT MAJOR IN BIOLOGY AND MATHEMATICS"/></p> <p>1.3 Minor (with Concentration, if applicable) (30 char. max.)</p> <p>1.4 Category</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">Faculty Program (FP)</td> <td style="width: 50%; border: none;">Honours (HON)</td> </tr> <tr> <td style="border: none;">Major</td> <td style="border: none;">Joint Honours</td> </tr> <tr> <td style="border: none;">Joint Major X</td> <td style="border: none;">Component (HC)</td> </tr> <tr> <td style="border: none;">Major Concentration (CON)</td> <td style="border: none;">Internship/Co-op</td> </tr> <tr> <td style="border: none;">Minor</td> <td style="border: none;">Thesis (T)</td> </tr> <tr> <td style="border: none;">Minor Concentration (CON)</td> <td style="border: none;">Non-Thesis (N)</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none;">Other</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none;">Please specify</td> </tr> </table> <p>1.5 <input style="width: 100%;" type="text" value="B.Sc.; Joint Major in Biology and Mathematics"/></p>	Faculty Program (FP)	Honours (HON)	Major	Joint Honours	Joint Major X	Component (HC)	Major Concentration (CON)	Internship/Co-op	Minor	Thesis (T)	Minor Concentration (CON)	Non-Thesis (N)		Other		Please specify	<p><b>2.0 Administering Faculty/Unit</b> <input style="width: 100%;" type="text" value="Science /Biology"/></p> <p><b>Offering Faculty/Department</b> <input style="width: 100%;" type="text" value="Science/Biology/Mathematics &amp; Statistics"/></p> <p><b>3.0 Effective Term of revision or retirement</b> Please give reasons in 5.0 "Rationale" in the case of retirement (Ex. Sept. 2004 = 200409)      Retirement</p> <p>Term: <input style="width: 100%;" type="text" value="201109"/></p> <p><b>4.0 Existing Credit Weight</b>      <b>Proposed Credit Weight</b></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: 1px solid black; text-align: center;">76</td> <td style="width: 50%; border: 1px solid black; text-align: center;">76</td> </tr> </table> <p><b>5.0 Rationale for revised program</b></p> <p><b>change program prerequisites</b> to selection with an advisor to increase flexibility depending on student's preferences. <b>one less required course and more weight to streams; rationale:</b> BIOL 308 is a required course, but is only of interest to students in the ecology and evolution stream. Move to the list of courses to be taken in the ecology and evolutionary ecology stream. Required stream credits are not increased, students get 3 more credits of electives. <b>courses added to streams; rationale:</b> give more options and choices to the students: <b>BIOL 435</b> (ecology and evolutionary ecology stream) &amp; <b>BIOL 435</b> (molecular evolution stream), and additional credits from a <b>biology research courses</b> (all 3 streams): 3 credits are included in the required courses, additional credits can count towards the stream credits. Give credits to advanced courses prerequisites: add <b>BIOL 304</b>, prerequisite for BIOL 569 (molecular evolution stream) <b>highlight course conflict</b> between BIN□511 and BIOL 592</p>	76	76
Faculty Program (FP)	Honours (HON)																		
Major	Joint Honours																		
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Minor Concentration (CON)	Non-Thesis (N)																		
	Other																		
	Please specify																		
76	76																		

**6.0 Revised Program Description (Maximum 150 words)**

This program is built on a selection of mathematics and biology courses that recognizes mathematical biology as a field of research, with 3 streams within biology: Ecology and Evolutionary Ecology, Molecular Evolution, and Neurosciences.

<p><b>32.13.5.9 Bachelor of Science (B.Sc.) - Major Biology and Mathematics (76 credits)</b>  This program is built on a selection of mathematics and biology courses that recognizes mathematical biology as a field of research, with 3 streams within biology: Ecology and Evolutionary Ecology, Molecular Evolution, and Neurosciences.</p>	<p><b>32.13.5.9 Bachelor of Science (B.Sc.) - Major Biology and Mathematics (76 credits)</b>  This program is built on a selection of mathematics and biology courses that recognizes mathematical biology as a field of research, with 3 streams within biology: Ecology and Evolutionary Ecology, Molecular Evolution, and Neurosciences.</p>
<p><b>Program Prerequisites:</b>  Before selecting this program, students should have completed the following 28 - 32 credits of science courses or their equivalents.  <b>BIOL 111 (3) Principles: Organismal Biology</b>  BIOL 112 (3) Cell and Molecular Biology  CHEM 110 (4) General Chemistry 1  CHEM 120 (4) General Chemistry 2  MATH 133 (3) Linear Algebra and Geometry  MATH 140 (3) Calculus 1  MATH 141 (4) Calculus 2  <b>PHYS 101 (4) Introductory Physics - Mechanics</b>  <b>PHYS 102* (4) Introductory Physics – Electromagnetism</b>  * <b>PHYS 102 is required only for students following the Molecular Evolution Stream or Neurosciences Stream of this program. It need not necessarily be taken in U0.</b></p>	<p><b>Advising notes for U0 students</b></p> <p>It is highly recommended that freshman BIOL, CHEM, MATH, and PHYS courses be selected with an advisor to ensure they meet the core requirements of the program.</p> <p>This program is recommended for U1 students achieving a CGPA of 3.2 or better; and entering CEGEP students with a Math/Science R-score of 28.0 or better.</p>
<p><b>Required Courses (37 credits)</b>  * If a student has <i>already taken</i> CHEM 212 or its equivalent, the credits can be made up with a complementary course in consultation with the program coordinator.  ** Students who have sufficient knowledge in a programming language should take COMP 250 (3) Introduction to Computer Science rather than COMP 202.  *** Students may take either MATH 223 or MATH 247.  BIOL 200 (3) Molecular Biology  BIOL 201 (3) Cell Biology and Metabolism  BIOL 215 (3) Introduction to Ecology and Evolution  <b>BIOL 308 (3) Ecological Dynamics</b></p>	<p><b>Required Courses (34 credits)</b>  * If a student has already taken CHEM 212 or its equivalent, the credits can be made up with a complementary course in consultation with the program coordinator.  ** Students who have sufficient knowledge in a programming language should take COMP 250 (3) Introduction to Computer Science rather than COMP 202.  *** Students may take either MATH 223 or MATH 247.  BIOL 200 (3) Molecular Biology  BIOL 201 (3) Cell Biology and Metabolism  BIOL 215 (3) Introduction to Ecology and Evolution  CHEM 212* (4) Introductory Organic</p>

<p>CHEM 212* (4) Introductory Organic Chemistry 1          COMP 202** (3) Introduction to Computing 1          MATH 222 (3) Calculus 3          MATH 223*** (3) Linear Algebra          MATH 242 (3) Analysis 1          MATH 243 (3) Analysis 2          MATH 247*** (3) Honours Applied Linear Algebra          MATH 315 (3) Ordinary Differential Equations          MATH 323 (3) Probability</p>	<p>Chemistry 1          COMP 202** (3) Introduction to Computing 1          MATH 222 (3) Calculus 3          MATH 223*** (3) Linear Algebra          MATH 242 (3) Analysis 1          MATH 243 (3) Analysis 2          MATH 247*** (3) Honours Applied Linear Algebra          MATH 315 (3) Ordinary Differential Equations          MATH 323 (3) Probability</p>
<p><b>Complementary Courses (39 credits)</b>          For the 39 credits, students complete 21 credits of BINF, BIOL, NEUR, PHGY, PSYC courses including one of three Streams (Ecology and Evolutionary Ecology, Molecular Evolution, Neurosciences) and 18 credits of MATH courses.</p>	<p><b>Complementary Courses (42 credits)</b>          For the 42 credits, students complete <u>24</u> credits of BINF, BIOL, NEUR, PHGY, PSYC courses including one of three Streams (Ecology and Evolutionary Ecology, Molecular Evolution, Neurosciences) and 18 credits of MATH courses.</p>
<p><b>Math or Biology Research Course</b>          Note: Students selecting a BIOL course count this toward their 21 credits of BINF, BIOL, NEUR, PHGY, PSYC courses while students selecting a MATH course count this toward their 18 credits of MATH courses.          3 credits from the following Math or Biology Research courses:          BIOL 466 (3) Independent Research Project 1          BIOL 467 (3) Independent Research Project 2          MATH 410 (3) Majors Project</p>	<p><b>Math or Biology Research Course</b>          Note: Students selecting a BIOL course count this toward their 21 credits of BINF, BIOL, NEUR, PHGY, PSYC courses while students selecting a MATH course count this toward their 18 credits of MATH courses.          3 credits from the following Math or Biology Research courses:          BIOL 466 (3) Independent Research Project 1          BIOL 467 (3) Independent Research Project 2          MATH 410 (3) Majors Project</p>
<p><b>Math Courses</b>          15 - 18 credits of MATH courses chosen from Sequence 1 or 2 and from "Remaining Math Courses" as follows:</p>	<p><b>Math Courses</b>          15 - 18 credits of MATH courses chosen from Sequence 1 or 2 and from "Remaining Math Courses" as follows:</p>
<p><b>Sequence 1</b>          12 credits from the following courses:          * Students may take either MATH 317 or MATH 327          ** Students may take either MATH 326 or MATH 437          MATH 314 (3) Advanced Calculus</p>	<p><b>Sequence 1</b>          12 credits from the following courses:          * Students may take either MATH 317 or MATH 327          ** Students may take either MATH 326 or MATH 437          MATH 314 (3) Advanced Calculus</p>

<p>MATH 317* (3) Numerical Analysis  MATH 319 (3) Introduction to Partial Differential Equations  MATH 326** (3) Nonlinear Dynamics and Chaos  MATH 327* (3) Matrix Numerical Analysis  MATH 437** (3) Mathematical Methods in Biology</p>	<p>MATH 317* (3) Numerical Analysis  MATH 319 (3) Introduction to Partial Differential Equations  MATH 326** (3) Nonlinear Dynamics and Chaos  MATH 327* (3) Matrix Numerical Analysis  MATH 437** (3) Mathematical Methods in Biology</p>
<p><b>Sequence 2</b>  9 credits from the following:  MATH 324 (3) Statistics  MATH 423 (3) Regression and Analysis of Variance  MATH 447 (3) Stochastic Processes</p>	<p><b>Sequence 2</b>  9 credits from the following:  MATH 324 (3) Statistics  MATH 423 (3) Regression and Analysis of Variance  MATH 447 (3) Stochastic Processes</p>
<p><b>Remaining Math Courses</b>  Remaining 3 to 9 credits of MATH courses may be chosen from any of the two preceding sequences and/or from the following list:  MATH 204 (3) Principles of Statistics 2  MATH 340 (3) Discrete Structures 2  MATH 523 (4) Generalized Linear Models  MATH 524 (4) Nonparametric Statistics  MATH 525 (4) Sampling Theory and Applications</p>	<p><b>Remaining Math Courses</b>  Remaining 3 to 9 credits of MATH courses may be chosen from any of the two preceding sequences and/or from the following list:  MATH 204 (3) Principles of Statistics 2  MATH 340 (3) Discrete Structures 2  MATH 523 (4) Generalized Linear Models  MATH 524 (4) Nonparametric Statistics  MATH 525 (4) Sampling Theory and Applications</p>
<p><b>BIOL, NEUR, PHGY, PHYS, PSYC courses</b>  18 to 21 credits of BIOL, NEUR, PHGY, PHYS, PSYC courses including one of three Streams.</p>	<p><b>BIOL, NEUR, PHGY, PHYS, PSYC courses</b>  <u>21 to 24</u> credits of BIOL, NEUR, PHGY, PHYS, PSYC courses including one of three Streams.  Note: Some courses in the Streams may have prerequisites.</p>
<p><b>Ecology and Evolutionary Ecology Stream</b>  At least 15 credits selected as follows:  <b>Stream Required Course</b>  BIOL 206 (3) Methods in Biology of Organisms  <b>Stream Complementary Courses</b>  3 credits from the following field courses or any other field course with permission:  BIOL 240 (3) Montereyan Flora  BIOL 331 (3) Ecology/Behaviour Field Course  BIOL 334D1 (1.5) Applied Tropical Ecology  BIOL 334D2 (1.5) Applied Tropical Ecology</p>	<p><b>Ecology and Evolutionary Ecology Stream</b>  At least 15 credits selected as follows:  <b>Stream Required Course</b>  BIOL 206 (3) Methods in Biology of Organisms  <b>Stream Complementary Courses</b>  3 credits from the following field courses or any other field course with permission:  BIOL 240 (3) Montereyan Flora  BIOL 331 (3) Ecology/Behaviour Field Course  BIOL 334D1 (1.5) Applied Tropical Ecology  BIOL 334D2 (1.5) Applied Tropical Ecology</p>

<p>BIOL 432 (3) Limnology At least 9 credits chosen from the following list, of which 6 credits must be at the 400-level or above: BIOL 202 (3) Basic Genetics BIOL 304 (3) Evolution BIOL 310 (3) Biodiversity and Ecosystems BIOL 324 (3) Ecological Genetics BIOL 434 (3) Theoretical Ecology BIOL 585 (3) Game Theory and Evolutionary Dynamics BIOL 590 (3) Linking Community and Ecosystem Ecology BIOL 594 (3) Advanced Evolutionary Ecology</p>	<p>BIOL 432 (3) Limnology At least 9 credits chosen from the following list, of which 6 credits must be at the 400-level or above: BIOL 202 (3) Basic Genetics BIOL 304 (3) Evolution <b><u>BIOL 308 (3) Ecological Dynamics</u></b> BIOL 310 (3) Biodiversity and Ecosystems BIOL 324 (3) Ecological Genetics BIOL 434 (3) Theoretical Ecology <b><u>BIOL 435 (3) Natural Selection</u></b> <b><u>BIOL 466 (3) Independent Research Project 1</u></b> <b><u>BIOL 467 (3) Independent Research Project 2</u></b> <b><u>BIOL 468 (6) Independent Research Project</u></b> BIOL 585 (3) Game Theory and Evolutionary Dynamics BIOL 590 (3) Linking Community and Ecosystem Ecology BIOL 594 (3) Advanced Evolutionary Ecology</p>
<p><b>Molecular Evolution Stream</b> At least 16 credits selected as follows: <b>Stream Required Courses</b> BIOL 202 (3) Basic Genetics BIOL 301 (4) Cell and Molecular Laboratory <b>Stream Complementary Courses</b> At least 9 credits selected from: <b><u>BINF 511 (3) Bioinformatics for Genomics</u></b> BIOL 518 (3) Advanced Topics in Cell Biology BIOL 569 (3) Developmental Evolution BIOL 572 (3) Molecular Evolution <b><u>BIOL 592 (3) Integrated Bioinformatics</u></b></p>	<p><b>Molecular Evolution Stream</b> At least 16 credits selected as follows: <b>Stream Required Courses</b> BIOL 202 (3) Basic Genetics BIOL 301 (4) Cell and Molecular Laboratory <b>Stream Complementary Courses</b> <b><u>* Students may take either BINF 511 or BIOL 592.</u></b> At least 9 credits selected from the following list, <u>of which 6 credits must be at the 400-level or above:</u> <b><u>BIOL 303 (3) Developmental Biology</u></b> <b><u>BIOL 304 (3) Evolution</u></b> <b><u>BIOL 435 (3) Natural Selection</u></b> <b><u>BIOL 466 (3) Independent Research Project 1</u></b> <b><u>BIOL 467 (3) Independent Research Project 2</u></b> <b><u>BIOL 468 (6) Independent Research Project</u></b> <b><u>BINF 511* (3) Bioinformatics for Genomics</u></b> BIOL 518 (3) Advanced Topics in Cell Biology BIOL 569 (3) Developmental Evolution BIOL 572 (3) Molecular Evolution</p>

	<b><u>BIOL 592* (3) Integrated Bioinformatics</u></b>
<p><b>Neurosciences Stream</b>  At least 15 credits selected as follows:  <b>Stream Required Course</b>  BIOL 306 (3) Neural Basis of Behaviour  <b>Stream Complementary Courses</b>  At least 12 credits selected from:  BIOL 389 (3) Laboratory in Neurobiology  BIOL 530 (3) Advances in Neuroethology  PHGY 314 (3) Integrative Neuroscience  PHGY 425 (3) Analyzing Physiological Systems  PSYC 427 (3) Sensorimotor Behaviour</p>	<p><b>Neurosciences Stream</b>  At least 15 credits selected as follows:  <b>Stream Required Course</b>  BIOL 306 (3) Neural Basis of Behaviour  <b>Stream Complementary Courses</b>  At least 12 credits selected from:  BIOL 389 (3) Laboratory in Neurobiology  <b><u>BIOL 466 (3) Independent Research Project 1</u></b>  <b><u>BIOL 467 (3) Independent Research Project 2</u></b>  <b><u>BIOL 468 (6) Independent Research Project</u></b>  BIOL 530 (3) Advances in Neuroethology  PHGY 314 (3) Integrative Neuroscience  PHGY 425 (3) Analyzing Physiological Systems  PSYC 427 (3) Sensorimotor Behaviour</p>
<p><b>Remaining BINF, BIOL, NEUR, PHGY, PSYC</b>  For the remaining BINF, BIOL, NEUR, PHGY, PSYC complementary course credits, if any, students top up their credits to the necessary 21 with any course listed in the above streams in Biology or any other course in Biology with the approval of the program coordinator.</p>	<p><b>Remaining BINF, BIOL, NEUR, PHGY, PSYC</b>  For the remaining BINF, BIOL, NEUR, PHGY, PSYC complementary course credits, if any, students top up their credits to the necessary <b>24</b> with any course listed in the above streams in Biology or any other course in Biology with the approval of the program coordinator.</p>

8.0 Consultation with

Related Units	Yes	No	Financial Consult	Yes	No
Attach list of consultations	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>

9. Approvals

Routing Sequence	Name	Signature	Date
Department	<input type="text"/>	<input type="text"/>	<input type="text"/>
Curric/Acad Committee	<input type="text"/>	<input type="text"/>	<input type="text"/>
Faculty 1	<input type="text"/>	<input type="text"/>	<input type="text"/>
Faculty 2	<input type="text"/>	<input type="text"/>	<input type="text"/>
Faculty 3	<input type="text"/>	<input type="text"/>	<input type="text"/>
SCTP	<input type="text"/>	<input type="text"/>	<input type="text"/>
GS	<input type="text"/>	<input type="text"/>	<input type="text"/>
APPC	<input type="text"/>	<input type="text"/>	<input type="text"/>
Senate	<input type="text"/>	<input type="text"/>	<input type="text"/>

Submitted by

Name	<input type="text"/>	To be completed by ARR:
Phone	<input type="text"/>	CIP Code
Email	<input type="text"/>	<input type="text"/>
Submission Date	<input type="text"/>	