



<p>1.0 Degree Title 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%; height: 20px;" type="text"/> <input style="width: 100%; height: 20px;" type="text"/></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)  Major  <b>Joint Major X</b>  Major Concentration (CON)  Minor  Minor Concentration (CON) </td> <td style="width: 50%; border: none;"> Honours (HON)  Joint Honours  Component (HC)  Internship/Co-op  Thesis (T)  Non-Thesis (N)  Other  Please specify  <input style="width: 100%; height: 20px;" type="text"/> </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) Major <b>Joint Major X</b> Major Concentration (CON) Minor Minor Concentration (CON)	Honours (HON) Joint Honours Component (HC) Internship/Co-op Thesis (T) Non-Thesis (N) Other Please specify <input style="width: 100%; height: 20px;" type="text"/>	<p>2.0 Administering Faculty/Unit <input style="width: 100%;" type="text" value="Science / Biology"/></p> <p>Offering Faculty/Department <input style="width: 100%;" type="text" value="Science/Biology"/></p> <p>3.0 Effective Term of revision or retirement 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="201209"/></p> <p>4.0 Existing Credit Weight      Proposed Credit Weight</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>5.0 Rationale for revised program</p> <p><b>Clarify wording</b> for the number of credits required in complementary course lists, and using title names for the two Math sequences.</p> <p><b>Move MATH 437</b> from the Math Sequence 1 to the list of Remaining Math Courses.</p> <p><b>Remove</b> statement in Sequence 1, **Students may take either MATH 326 or MATH 437.</p> <p><b>Add BIOL 313, BIOL 319</b> to the Molecular Evolution Stream; two relevant and useful course for this stream.</p> <p><b>Add new course, BIOL 320</b>, to the Complementary courses in the Neurosciences Stream.</p> <p style="text-align: right;"><input type="checkbox"/></p>	76	76
Faculty Program (FP) Major <b>Joint Major X</b> Major Concentration (CON) Minor Minor Concentration (CON)	Honours (HON) Joint Honours Component (HC) Internship/Co-op Thesis (T) Non-Thesis (N) Other Please specify <input style="width: 100%; height: 20px;" type="text"/>				
76	76				

6.0 Revised Program Description (Maximum 150 words)

<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<div style="border: 1px solid black; min-height: 200px;"></div>
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<p><b>EXISTING 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>PROPOSED 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>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>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 (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 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</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 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</p>

MATH 323 (3) Probability	MATH 323 (3) Probability
<b>Complementary Courses (42 credits)</b> For the 42 credits, students complete 24 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.	<b>Complementary Courses (42 credits)</b> For the 42 credits, students complete 24 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.
<b>Math or Biology Research Course</b> Note: Students selecting a BIOL course count this toward their <b>21</b> 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	<b>Math or Biology Research Course</b> Note: Students selecting a BIOL course count this toward their <b>24</b> 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
<b>Math Courses</b> 15 - 18 credits of MATH courses chosen from Sequence 1 or 2 and from "Remaining Math Courses" as follows:	<b>Math Courses</b> 15 <b><u>credits (if MATH 410 was selected as research course) or</u></b> 18 credits of MATH courses chosen from Sequence 1 or 2 and from "Remaining Math Courses" as follows:
<b>Sequence 1</b> 12 credits from the following courses: * Students may take either MATH 317 or MATH 327 <del>** Students may take either MATH 326 or MATH 437</del> MATH 314 (3) Advanced Calculus 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 <del>MATH 437** (3) Mathematical Methods in Biology</del>	<b>Sequence 1: <u>Theory</u></b> 12 credits from the following courses: * Students may take either MATH 317 or MATH 327 MATH 314 (3) Advanced Calculus 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
<b>Sequence 2</b> 9 credits from the following:	<b>Sequence 2: <u>Statistics</u></b> 9 credits from the following:

<p>MATH 324 (3) Statistics  MATH 423 (3) Regression and Analysis of Variance  MATH 447 (3) Stochastic Processes</p>	<p>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  <u><b>MATH 437 (3) Mathematical Methods in Biology</b></u>  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>  21 to 24 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>BIOL, NEUR, PHGY, PHYS, PSYC courses</b>  21 <u><b>credits (if BIOL course was selected as research course)</b></u> or 24 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) Monteregian Flora  BIOL 331 (3) Ecology/Behaviour Field Course  BIOL 334D1 (1.5) Applied Tropical Ecology  BIOL 334D2 (1.5) Applied Tropical Ecology  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 308 (3) Ecological Dynamics  BIOL 310 (3) Biodiversity and Ecosystems</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) Monteregian Flora  BIOL 331 (3) Ecology/Behaviour Field Course  BIOL 334D1 (1.5) Applied Tropical Ecology  BIOL 334D2 (1.5) Applied Tropical Ecology  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 308 (3) Ecological Dynamics  BIOL 310 (3) Biodiversity and Ecosystems</p>

<p>BIOL 324 (3) Ecological Genetics          BIOL 434 (3) Theoretical Ecology          BIOL 435 (3) Natural Selection          BIOL 466 (3) Independent Research Project 1          BIOL 467 (3) Independent Research Project 2          BIOL 468 (6) Independent Research Project          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 324 (3) Ecological Genetics          BIOL 434 (3) Theoretical Ecology          BIOL 435 (3) Natural Selection          BIOL 466 (3) Independent Research Project 1          BIOL 467 (3) Independent Research Project 2          BIOL 468 (6) Independent Research Project          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>          * Students may take either BINF 511 or BIOL 592.          At least 9 credits selected from the following list, of which 6 credits must be at the 400-level or above:          BIOL 303 (3) Developmental Biology          BIOL 304 (3) Evolution          BIOL 435 (3) Natural Selection          BIOL 466 (3) Independent Research Project 1          BIOL 467 (3) Independent Research Project 2          BIOL 468 (6) Independent Research Project          BINF 511* (3) Bioinformatics for Genomics          BIOL 518 (3) Advanced Topics in Cell Biology          BIOL 569 (3) Developmental Evolution          BIOL 572 (3) Molecular Evolution          BIOL 592* (3) Integrated Bioinformatics</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>          * Students may take either BINF 511 or BIOL 592.          At least 9 credits selected from the following list, of which 6 credits must be at the 400-level or above:          BIOL 303 (3) Developmental Biology          BIOL 304 (3) Evolution  <u><b>BIOL 313 (3) Eukaryotic Cell Biology</b></u>  <u><b>BIOL 319 (3) Biophysics</b></u>          BIOL 435 (3) Natural Selection          BIOL 466 (3) Independent Research Project 1          BIOL 467 (3) Independent Research Project 2          BIOL 468 (6) Independent Research Project          BINF 511* (3) Bioinformatics for Genomics          BIOL 518 (3) Advanced Topics in Cell Biology          BIOL 569 (3) Developmental Evolution          BIOL 572 (3) Molecular Evolution          BIOL 592* (3) Integrated Bioinformatics</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          BIOL 466 (3) Independent Research Project 1</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:  <u><b>BIOL 320 (3) Evolution of Brain and Behaviour (New Course)</b></u></p>

<p>BIOL 467 (3) Independent Research Project 2          BIOL 468 (6) Independent Research Project          BIOL 530 (3) Advances in Neuroethology          PHGY 314 (3) Integrative Neuroscience          PHGY 425 (3) Analyzing Physiological Systems          PSYC 427 (3) Sensorimotor Behaviour</p>	<p>BIOL 389 (3) Laboratory in Neurobiology          BIOL 466 (3) Independent Research Project 1          BIOL 467 (3) Independent Research Project 2          BIOL 468 (6) Independent Research Project          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 24 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>21-24 credits</b> with any course listed in the above three streams. <b>Other relevant courses may be substituted</b> with the approval of the program coordinator.</p>