**UNDERGRADUATE COURSES FOR THE FALL TERM 2021**
*(courses underlined are not offered this term)*

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>Organismal Biology Laboratory</td>
<td>A. Hendry &amp; Staff</td>
</tr>
<tr>
<td>111</td>
<td>Principles: Organismal Biology</td>
<td>A. Hendry &amp; Staff</td>
</tr>
<tr>
<td>115</td>
<td>Essential Biology</td>
<td>S. Woolley/J. Vogel</td>
</tr>
<tr>
<td>200</td>
<td>Molecular Biology</td>
<td>R. Roy/K. Hastings/T. Bureau</td>
</tr>
<tr>
<td>206</td>
<td>Methods in Biology of Organisms</td>
<td>L. Pollock &amp; Staff</td>
</tr>
<tr>
<td>210</td>
<td>Perspectives of Science</td>
<td>A. Watt/M. Hendricks</td>
</tr>
<tr>
<td>215</td>
<td>Introduction to Ecology &amp; Evolution</td>
<td>N. Price/E. Abouheif/J. Sunday</td>
</tr>
<tr>
<td>219</td>
<td>Introduction to Physical Biology of the Cell</td>
<td>S. Weber/J. Vogel/A. Hendricks</td>
</tr>
<tr>
<td>300</td>
<td>Molecular Biology of the Gene</td>
<td>F. Schoeck/N. Moon</td>
</tr>
<tr>
<td>301</td>
<td>Cell and Molecular Laboratory</td>
<td>H. Zheng/A. Hayer/P. Harrison</td>
</tr>
<tr>
<td>302</td>
<td>Fundamentals of Genetics and Genomics</td>
<td>D. Schoen/P. Lasko</td>
</tr>
<tr>
<td>304</td>
<td>Evolution</td>
<td>G. Bell</td>
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<tr>
<td>306</td>
<td>Neural Basis of Behaviour</td>
<td>J. Sakata/D. Dent/A. Watt</td>
</tr>
<tr>
<td>308</td>
<td>Ecological Dynamics</td>
<td>F. Guichard</td>
</tr>
<tr>
<td>309</td>
<td>Mathematical Models in Biology</td>
<td>G. Bub</td>
</tr>
<tr>
<td>316</td>
<td>Biomembranes and Organelles</td>
<td>H. Zheng/TBA</td>
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<tr>
<td>324</td>
<td>Ecological Genetics</td>
<td>D. Schoen</td>
</tr>
<tr>
<td>331</td>
<td>Ecology/Behaviour Field Course</td>
<td>S. Reader &amp; Staff</td>
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<tr>
<td>350</td>
<td>Insect Biology and Control</td>
<td>G. Dunphy</td>
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<tr>
<td>370</td>
<td>Human Genetics Applied</td>
<td>R. Palmour &amp; Staff</td>
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<tr>
<td>377</td>
<td>Independent Reading Project</td>
<td>Staff</td>
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<tr>
<td>395</td>
<td>Quantitative Biology Seminar</td>
<td>A. Hayer &amp; Staff</td>
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<td>396</td>
<td>Undergraduate Research Project</td>
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<td>413</td>
<td>Directed Reading</td>
<td>Staff</td>
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<td>414</td>
<td>Invertebrate Brain Circuits &amp; Behaviour</td>
<td>T. Ohyama</td>
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<tr>
<td>427</td>
<td>Herpetology</td>
<td>D. Green</td>
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<tr>
<td>432</td>
<td>Limnology</td>
<td>I. Gregory-Eaves/G. Fussmann</td>
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<tr>
<td>436</td>
<td>Evolution and Society</td>
<td>E. Abouheif/S. Reader</td>
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<tr>
<td>465</td>
<td>Conservation Biology</td>
<td>L. Chapman/A. Gonzalez</td>
</tr>
<tr>
<td>466</td>
<td>Independent Research Project 1</td>
<td>Staff</td>
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<tr>
<td>467</td>
<td>Independent Research Project 2</td>
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<td>468</td>
<td>Independent Research Project 3</td>
<td>Staff</td>
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<tr>
<td>507</td>
<td>Animal Communication</td>
<td>J. Sakata/K. Onishi</td>
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<tr>
<td>510</td>
<td>Advances in Community Ecology</td>
<td>A. Gonzalez</td>
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<tr>
<td>524</td>
<td>Topics in Molecular Biology</td>
<td>H. Clarke/D. Dankort</td>
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<tr>
<td>544</td>
<td>Genetic Basis of Life Span</td>
<td>S. Hekimi</td>
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<tr>
<td>546</td>
<td>Genetics of Model Systems</td>
<td>S. Hekimi</td>
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<tr>
<td>565</td>
<td>Cell and Tissue Mechanobiology</td>
<td>A. Hayer</td>
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<tr>
<td>575</td>
<td>Human Biochemical Genetics</td>
<td>N. Braverman &amp; Staff</td>
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<tr>
<td>580</td>
<td>Genetic Approaches to Neural Systems</td>
<td>M. Hendricks/A. Watt</td>
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<tr>
<td>588</td>
<td>Molecular/Cellular Neurobiology</td>
<td>K. Hastings/Yang Xhou &amp; Staff</td>
</tr>
<tr>
<td>592</td>
<td>Integrated Bioinformatics</td>
<td>P. Harrison</td>
</tr>
<tr>
<td>594</td>
<td>Advanced Evolutionary Ecology</td>
<td>A. Hendry</td>
</tr>
</tbody>
</table>

**Note:** All classes have limited capacity.  
Register early
# Undergraduate Courses for the Winter Term 2022

(courses underlined are not offered this term)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructor(s)</th>
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<tbody>
<tr>
<td>102</td>
<td>Cell and Molecular Biology Methods</td>
<td>J. Dent/F. Schoeck &amp; Staff</td>
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<tr>
<td>112</td>
<td>Cell and Molecular Biology</td>
<td>J. Dent/F. Schoeck</td>
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<td>201</td>
<td>Cell Biology and Metabolism</td>
<td>G. Brouhard</td>
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<tr>
<td>202</td>
<td>Basic Genetics</td>
<td>N. Moon/D. Schoen/ L. Nilson/ D. Dankort/ D. Hipfner</td>
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<td>205</td>
<td>Functional Biology of Plants and Animals</td>
<td>J. Sakata/R. Barrett/F. Soper</td>
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<tr>
<td>216</td>
<td>Biology of Behaviour</td>
<td>M. Hendricks/S. Woolley/S. Reader</td>
</tr>
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<td>301</td>
<td>Cell and Molecular Laboratory</td>
<td>H. Zheng/A. Hayer/H. Larsson/D. Green/ G. Bell</td>
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<td>303</td>
<td>Developmental Biology</td>
<td>A. Gerhold/D. Dufort/Y. Rao</td>
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<td>305</td>
<td>Animal Diversity</td>
<td>R. Barrett/A. Hendry/H. Larsson/D. Green/ G. Bell</td>
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<td>307</td>
<td>Behavioural Ecology</td>
<td>S. Reader</td>
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<tr>
<td>310</td>
<td>Biodiversity and Ecosystems</td>
<td>J. Sunday/A. Gonzalez</td>
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<td>311</td>
<td>Methods in Organismal Biology</td>
<td>M. Cristescu/A. Gonzalez</td>
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<td>313</td>
<td>Eukaryotic Cell Biology</td>
<td>S. Weber</td>
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<td>314</td>
<td>Molecular Biology of Oncogenes</td>
<td>D. Dankort &amp; Staff</td>
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<td>319</td>
<td>Introduction to Biophysics</td>
<td>P. Wiseman (Physics Dept)</td>
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<td>320</td>
<td>Evolution of Brain &amp; Behaviour</td>
<td>S. Woolley/J. Sakata</td>
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<td>342</td>
<td>Contemporary Topics in Aquatic Ecology</td>
<td>I. Gregory-Eaves/N. Price</td>
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<tr>
<td>352</td>
<td>Dinosaur Biology</td>
<td>H. Larsson</td>
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<td>363</td>
<td>Mammalian Evolution</td>
<td>V. Millien</td>
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<td>377</td>
<td>Independent Reading Project</td>
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<td>389</td>
<td>Laboratory in Neurobiology</td>
<td>M. Hendricks/T. Oyama/A. Watt</td>
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<td>396</td>
<td>Undergraduate Research Project</td>
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<td>413</td>
<td>Directed Reading</td>
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<td>416</td>
<td>Genetics of Mammalian Development</td>
<td>D. Dufour/T. Taketo &amp; Staff</td>
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<td>418</td>
<td>Freshwater Invertebrate Ecology</td>
<td>A. Ricciardi</td>
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<td>428</td>
<td>Biological Diversity in Africa</td>
<td>M. Guigueno</td>
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<td>429</td>
<td>East African Ecology</td>
<td>L. Chapman</td>
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<td>441</td>
<td>Biological Oceanography</td>
<td>N. Price</td>
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<td>451</td>
<td>Research in Ecology and Development in Africa</td>
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<td>Independent Research Project 1</td>
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<td>468</td>
<td>Independent Research Project 3</td>
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<tr>
<td>515</td>
<td>Advances in Aquatic Ecology</td>
<td>I. Gregory-Eaves</td>
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<td>517</td>
<td>Cognitive Ecology</td>
<td>M. Guigueno</td>
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<td>518</td>
<td>Advanced Topics in Cell Biology</td>
<td>P. Harrison/P. Lasko</td>
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<tr>
<td>520</td>
<td>Gene Activity in Development</td>
<td>A. Gerhold</td>
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<tr>
<td>530</td>
<td>Advances in Neuroethology</td>
<td>S. Woolley/T. Oyama</td>
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<tr>
<td>532</td>
<td>Developmental Neurobiology Seminar</td>
<td>D. van Meyel &amp; Staff</td>
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<td>540</td>
<td>Ecology of Species Invasions</td>
<td>A. Ricciardi</td>
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<td>551</td>
<td>Principles of Cellular Control</td>
<td>J. Vogel</td>
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<td>553</td>
<td>Neotropical Environment</td>
<td>C. Potvin</td>
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<tr>
<td>568</td>
<td>Topics of the Human Genome</td>
<td>J. Engert &amp; Staff</td>
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<tr>
<td>569</td>
<td>Developmental Evolution</td>
<td>H. Larsson/E. Abouheif</td>
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<tr>
<td>570</td>
<td>Advanced Seminar in Evolution</td>
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<tr>
<td>598</td>
<td>Advanced Design &amp; Statistics</td>
<td>J. Sakata</td>
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</table>

**Note:** All classes have limited capacity.  
Register early.
UNDERGRADUATE COURSES SPANNING TWO SEMESTERS

<table>
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<tr>
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<th>Instructors</th>
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<tbody>
<tr>
<td>334D1/D2</td>
<td>Applied Tropical Ecology</td>
<td>F. Guichard/N. Price &amp; L. Nilson</td>
</tr>
<tr>
<td>468D1/D2</td>
<td>Independent Research Project 3</td>
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<td>469D1/D2</td>
<td>Independent Research Project 4</td>
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<td>479D1/D2</td>
<td>Honours Research Project 1 (fall and winter)</td>
<td>Staff</td>
</tr>
<tr>
<td>480D1/D2</td>
<td>Honours Research Project 2 (fall and winter)</td>
<td>Staff</td>
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<tr>
<td>499D1/D2</td>
<td>Honours Seminar in Biology (fall and winter)</td>
<td>G. Brouhard</td>
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UNDERGRADUATE COURSES GIVEN IN SUMMER 2022

See McGill Summer Studies Calendar for dates

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Instructors</th>
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<tbody>
<tr>
<td>240</td>
<td>Monteregian Flora</td>
<td>V. Millien/M. Lapointe</td>
</tr>
<tr>
<td>334D2</td>
<td>Applied Tropical Ecology</td>
<td>F. Guichard/N. Price &amp; L. Nilson</td>
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<tr>
<td>335</td>
<td>Marine Mammals</td>
<td>Huntsman Mar. Sci. Centre</td>
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<tr>
<td>377</td>
<td>Independent Reading Project</td>
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<td>413</td>
<td>Directed Reading</td>
<td>Staff</td>
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<td>466</td>
<td>Independent Research Project 1</td>
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<td>467</td>
<td>Independent Research Project 2</td>
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<td>469</td>
<td>Independent Research Project 4</td>
<td>Staff</td>
</tr>
<tr>
<td>573</td>
<td>Vertebrate Palaeontology Field Course</td>
<td>H. Larsson</td>
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</table>
INTRODUCTORY

CEGEP-EQUIVALENT COURSES

BIOL 101 (Fall)
Organismal Biology Laboratory (1 credit)

Not open to students who have passed the CEGEP Competency Code in Biology, or are taking, or have taken BIOL 111. Enrolment in this course is limited. Requires permission of the Biology Advisor

Instructor:  A. Hendry (Coordinator)  andrew.hendry@mcgill.ca
& Staff
A. L’Heureux  DUFF D-6  398-6404  annemarie.lheureux@mcgill.ca

Restrictions:  May only be taken by transfer students who have completed elsewhere the lecture component but not the laboratory of BIOL 111 and only with permission of the Biology Advisor.  *Not open to students who have taken or are taking BIOL 111.

Content:  The laboratory component of BIOL 111. Weekly, 2 hrs. Exploration of microbial, plant and animal biology through the use of dissections, demonstrations, computer simulations and a student-paired research project.
Once registered, email annemarie.lheureux@mcgill.ca to be entered on BIOL 111 myCourses

Method:  One three-hour lab per week

Evaluation:  Lab work 100% (including laboratory assignments, a lab student-paired research project and shared presentations).

Note: Attendance at first lab is mandatory to confirm registration in the course. Students who fail to attend will lose their place to others on the waiting list.
Note: One or more additional morning labs may open up if enrolment is high

BIOL 102 (Winter)
Cell and Molecular Biology Methods (1 credit)

Not open to students who have passed Biology Objective 00XU at CEGEP, or are taking, or have taken BIOL 112. Enrolment in this course is limited. Requires permission of the Biology Advisor

Instructors:  J. Dent (Coordinator)  398-3724  joseph.dent@mcgill.ca
F. Schoeck  398-6434  frieder.schoeck@mcgill.ca
A. L’Heureux (Lab Co-ord)  DUFF D-6  398-6404  annemarie.lheureux@mcgill.ca

Restrictions:  May be taken only by transfer students who have completed elsewhere the lecture component but not the laboratory of BIOL 112 and only with permission of the Biology Advisor.  Not open to students who have taken or are taking BIOL 112.

Content:  The laboratory component of BIOL 112.

Method:  One three-hour lab per week.

Evaluation:  Lab-related work 100% (including weekly pre-lab summaries and one laboratory presentation).

Note: Attendance at first lab is mandatory to confirm registration in the course. Students who fail to attend will lose their place to others on the waiting list.
BIOL 111 (Fall)
Principles: Organismal Biology

Instructors:  
A. Hendry (Coordinator)  Redpath  398-4086x 00880  andrew.hendry@mcgill.ca  
G. Bell  Redpath  398-6458  graham.bell@mcgill.ca  
M. Cristescu  N6/1  398-1053  melania.cristescu@mcgill.ca  
A. Hargreaves  N6/11  398-7401  anna.hargreaves@mcgill.ca  
A. L’Heureux (Lab Coordinator)  DUFF D-6  398-6404  annemarie.lheureux@mcgill.ca

Workload:  3 credits (2-3-4)

Prerequisite:  None.

Restrictions:  Not open to students who have passed CEGEP Biology objective 00UK (301) or equivalent, or BIOL 115. Enrolment in this course is limited.

Content:  
This course introduces the basic principles of organismal biology through the study of representative groups of unicellular organisms, plants and animals. The principles include the origins of life, major events in the history of life, adaptations of organisms to particular environments, patterns of reproduction in plants and animals, form and function, physiology, locomotion, and behavior in animals and ecology.

1) PROKARYOTES, PROTIITS, AND FUNGI  
The origin of life, photosynthesis, cellular organization, protists, algae, mosses and fungi.

2) PLANT EVOLUTION STRUCTURE AND FUNCTION  
Adaptations to terrestrial life among plants, morphology, physiology, reproduction, and life history of ferns, gymnosperms and angiosperms.

3) ANIMAL EVOLUTION, STRUCTURE AND FUNCTION  
Early multicellular animals, tissue organization, muscular and skeletal system, body plans and symmetry, cephalization and nervous systems, adaptive radiations among mollusks, arthropods and chordates, respiration and respiratory systems, hormone function, circulatory systems, vertebrate evolution.

4) ECOLOGY AND EVOLUTION  
Ecology of populations, communities and ecosystems and global change. Mechanisms of evolution and speciation.

Evaluation:  
Course work (midterm and final exams); lab work, including weekly laboratory assignments, a student-paired lab research project with shared presentation.

Laboratory:  
Weekly, 3 hrs. Exploration of microbial, plant and animal biology through the use of dissections, demonstrations, computer simulations and a student-paired research project.

BIOL 111 and 112 serve as equivalents to required CEGEP courses and as pre-requisites to several key courses in Biology programs.

Attendance at first lab is mandatory to confirm registration in the course. Students who fail to attend will lose their place to others on the waiting list. Attendance at all labs is mandatory.
BIOL 112 (Winter)
Cell and Molecular Biology

Instructors: J. Dent (Coordinator) N4/7A 398-3724 joseph.dent@mcgill.ca
F. Schoeck N8/12 398-6434 frieder.schoeck@mcgill.ca
A. L’Heureux (Lab Coordinator) DUFF D-6 398-6404 annemarie.lheureux@mcgill.ca.

Workload: 3 credits (2-3-4)

Prerequisite: None; however, a year of college general chemistry is strongly recommended. Enrolment in this course is limited.

Restrictions: AEBI 122. Not open to students who have passed Biology Objective 00XU (401) at CEGEP.

Content: The course provides an overview of cell and molecular biology for all Science students and others intending to pursue further studies in the biological sciences. For several of the topics, the emphasis in the lectures is on the scientific method and historical development of our current understanding. In a weekly one-hour conference, students will have the opportunity to discuss many of the important social issues that arise out of the discipline.

- Biomolecular Structures of Proteins, Nucleic acids, and Lipids
- Organization of the Cell
- Biomembrane Structure and Function
- Enzymes and Enzyme Catalysis
- Cell Energetics and Thermodynamics
- Respiration
- Photosynthesis
- Mitosis and Meiosis
- Mendelian Genetics
- DNA Replication
- Gene Transcription
- Protein Synthesis
- mRNA Splicing
- Control of Gene Expression
- Recombinant DNA Technology
- Genetic Disease

Method: Two one-hour lectures and one three-hour lab per week

Evaluation: Lecture: multiple-choice midterm and final examinations.
Lab: weekly in-lab discussions and pre-lab summaries, one lab presentation.

BIOL 111 and 112 serve as equivalents to required CEGEP courses and as pre-requisites to several key courses in Biology programs.

Attendance at first lab is mandatory to confirm registration in the course. Students who fail to attend will lose their place to others on the waiting list.
GENERAL AND ADVANCED COURSES IN BIOLOGY

BIOL 115 (Fall)
Essential Biology

Instructors:  
S. Woolley  
N4/8  
398-2324  
sarah.woolley@mcgill.ca  
J. Vogel  
Bellini 269  
398-5880  
jackie.vogel@mcgill.ca

Workload:  
3 credits (3-0-6)

Prerequisite:  
Not open to those who have had BIOL 111 OR BIOL 112, or equivalents.

Content:  
In this course, we will learn about living organisms at a variety of levels, from molecules to populations. Since Biology is an enormous field, it is impossible to cover it completely in a single course. As a consequence, this course will address five fundamental themes (see below). Within those themes, an effort will be made to relate the facts presented to pressing matters in our daily lives. For instance, when we discuss genetics we will talk about genetic engineering and its impact on society. This approach means that the course will tend to be topical, focusing on interesting observations and trying to explain them on the basis of biological knowledge.

MODULE 1: SCIENCE & LIFE (Vogel)
Biology - Life & Diversity
Intro to the Scientific Method
Chemistry & Molecules of Life

MODULE 2: CELL BIOLOGY (Vogel)
Cell Function & Structure
Enzymes & Metabolism
Cellular Respiration
Carbon Flow & Photosynthesis

MODULE 3: GENETICS, CANCER & BIOTECHNOLOGY (Vogel)
DNA Structure, Replication & Forensics
Genes, Proteins & Gene Regulation
Cell Cycle, Mitosis, Cell Division
Checkpoints, Mutations & Cancer
Meiosis, Sex & Chromosomal Abnormalities
Mendelian Genetics
Complex Inheritance & Human Genetics
Stem Cells, Cell Differentiation & Development

MODULE 4: NEUROSCIENCE & BEHAVIOUR (Woolley)
How does the brain work?
Brain in action: the fiction of memory

MODULE 5: EVOLUTION (Woolley)
Fundamentals of Evolution: Natural Selection, Sexual Selection, Drift & Speciation
Evolution and You: Bacteria and Viruses, Global Change, Human Evolution and Language

Method:  
Two 1.5- hour lectures per week.

Evaluation:  
Midterm exams. Written assignments. Three-hour final exam.
BIOL 200 (Fall)
Molecular Biology

Instructors:  
R. Roy (Co-ordinator)  S3/22.  398-5137  richard.roy@mcgill.ca  
T. Bureau  N4/1  398-6472  thomas.bureau@mcgill.ca  
K. Hastings  MNI  398-1852  ken.hastings@mcgill.ca  
T. Bernhardt (Administrator)  N8/10  398-6416  torsten.bernhardt@mcgill.ca

Workload:  3 credits (3-0-6)

Prerequisite:  BIOL 112 or equivalent

Corequisite:  CHEM 212 or CHEM 204 or equivalents

Content:  The aim of this course is to understand the molecular basis of biological phenomena with emphasis on the fundamental processes common to all organisms (enzymatic catalysis, DNA, RNA and protein synthesis; genome structure; mechanisms of gene expression; mechanisms of regulating gene activity).

Method:  Three lectures per week, with occasional online quizzes during class time for the evaluation of student progress

Evaluation:  Mid-term exam, on-line quizzes, final examination
BIOL 201 (Winter)
Cell Biology and Metabolism

Instructors:  G. Brouhard  Bellini 267  398-2984  gary.brouhard@mcgill.ca
             T. Bernhardt (Administrator)  N8/10  398-6416  torsten.bernhardt@mcgill.ca

Workload:  3 credits (3-0-6)

Prerequisites:  BIOL 200; not open to students who have taken ANAT 212/BIOC 212 or who have taken BIOL 219.

Content:  The cell is the basic unit of life, but each cell contain thousands of different enzymes and proteins. These proteins can be viewed as tiny, intricate, molecular machines. Our goal will be to understand how these machines work. More precisely, we will study how proteins and enzymes (1) harness energy from the environment, (2) use this energy to change their structure/conformation, and (3) use these conformational changes to do the work of staying alive. We will learn how malfunctions in protein machines are the basis of many diseases. No protein works alone, of course. Therefore we will study how groups of proteins interact, either working together in teams or competing against one another. The balance of these interactions is what defines cell physiology.

The lectures will focus on key experiments that established what we know now, paying attention to the individual scientists who drove progress. In addition, we will look at experiments being performed at world-class research institutions today. Students will learn how to analyze the data produced by these experiments and to predict results. The exams will emphasize the concepts behind cell biology rather than rote memorization. Topics will be selected from the following:

How Cells Harness Energy
  Thermodynamics and the basic design of metabolism
  Glycolysis, gluconeogenesis, citric acid cycle, fatty acid oxidation, Photosynthesis
  Redox reactions, the respiratory chain, Chemiosmotic coupling

Building the Cell
  Bringing in nutrients: movement across biomembranes, endocytosis
  Making proteins: protein synthesis and the endoplasmic reticulum
  Putting proteins in place: protein targeting, secretion, exocytosis

How Cells Move
  Giving cells their shape: the cytoskeleton, microtubules, actin filaments
  Moving things around: motor proteins, intracellular transport

Cells and their Environment
  Receiving signals: hormones and their receptors, signalling cascades
  Attachment into tissues: the extracellular matrix and adhesion
  Nerve cells and communication by ion fluxes

The Life Cycle of Cells
  Growing up: regulation of cell size
  Making new cells: mitosis and the cell cycle
  Death: apoptosis

Method:  Three lectures per week.

Evaluation:  Mid-term, quizzes and final examination
BIOL 202 (Winter)
Basic Genetics

Instructors:  
N. Moon (Coordinator)  Bellini 266  398-2982  nam.moon@mcgill.ca  
D. Schoen  N3/8A  398-6461  daniel.schoen@mcgill.ca  
L. Nilson  N5/8  398-6448  laura.nilson@mcgill.ca  
D. Hipfner  IRCM  987-5508  david.hipfner@ircm.qc.ca  
T. Bernhardt (Administrator)  N8/10  398-6416  torsten.bernhardt@mcgill.ca

Workload:  3 credits (3-0-6)

Restriction:  Not open to students who have taken or are taking LSCI 204

Prerequisite:  BIOL 200 or BIOL 219.

Content:  The course is designed to convey basic information on the principles of heredity in the light of modern advances in molecular biology, problems, and applications deemed relevant for the various major programs in the biological sciences. The topics covered (not necessarily in this order) include:

1) CHROMOSOMAL BASIS OF INHERITANCE  
2) CLASSICAL DIPLOID GENETICS  
3) EXTRACHROMOSOMAL GENETICS  
4) MOLECULAR ASPECTS OF GENETICS AND GENETIC ANALYSIS  
5) MOLECULAR ASPECTS OF MUTAGENESIS, MUTATIONS AND REPAIR OF MUTATIONS  
6) MOLECULAR MARKERS, GENE CLONING; OTHER MOLECULAR TOOLS.  
7) GENOMICS AND BIOINFORMATICS  
8) GENETIC ANALYSIS OF DEVELOPMENT  
9) EUKARYOTIC CHROMOSOME MAPPING IN DIPLOIDS: MAPPING GENES IN MODEL SYSTEMS AND HUMAN  
10) HUMAN GENETICS, CANCER GENETICS, PROSPECTS FOR GENE THERAPY, GENETIC COUNSELING  
11) POPULATION GENETICS, QUANTITATIVE INHERITANCE

Method:  Three one-hour lectures and one (optional) problem-based conference per week.

Evaluation:  Mid-term and final multiple-choice exams.
BIOL 205 (Winter)
Functional Biology of Plants and Animals

Instructors: J. Sakata (Coordinator)  N4/8  398-3636  jon.sakata@mcgill.ca
R. Barrett  Redpath Muse4um  398-4086 x00856  rowan.barrett@mcgill.ca
F. Soper  N3/11A  .fiona.soper@mcgill.ca

Workload:  3 credits (3-0-6)

Prerequisites:  BIOL 200 or BIOL 219, PHYS 101 or PHYS 131 or equivalent

Corequisite:  BIOL 201 or BIOL 219 or ANAT 212/BIOC 212

Content:  This course is designed to provide a unified view of the form and function of living organisms. Rooted in comparative physiology and functional morphology, it relates the laws of physics and chemistry to the fundamental processes of living organisms. These processes include the acquisition, distribution, storage, and allocation of energy and materials, and the mechanisms involved in growth, development, reproduction, and communication. The focus is on the integrated functioning of the whole organism and its component organ systems. Implications for population, community and ecosystem processes are discussed. Examples are drawn from a wide range of organisms, but the emphasis is on higher plants and vertebrate animals. The course assumes a background in basic biology, chemistry and physics.

1. INTRODUCTION
   Introduction to the course & organisms

2. ENERGY
   Energy, light and life
   Carbon assimilation (photosynthesis carbon reactions)
   Whole plant and whole crop photosynthesis
   Acquisition of food and digestion in animals
   Aerobic and anaerobic energy production
   Uptake of water & cell water relations
   Uptake & assimilation of nutrients, especially Nitrogen in plants
   (In-class Quiz)

3. MATERIALS, GROWTH & DEVELOPMENT
   Blood circulation & material transport in animals
   Heat exchange and thermoregulation in animals
   Body size & structural support plants & animals
   Growth and development: plants & animals
   Lifespan & senescence
   Transpiration in plants
   Distribution of photosynthetic materials

4. REPRODUCTION, SENSES, BEHAVIOUR, HORMONES PLANTS
   Plant reproduction: flowers
   Plant reproduction: seeds
   Plant senses
   Poisons, medicines, drugs: plant secondary metabolites
   Plant competition
   Hormones in plants

5. REPRODUCTION & HORMONES ANIMALS
   Hormones in animals
   Reproduction in animals

6. IMMUNE SYSTEMS & STRESS
   Immune system function: plants
   Immune system function: animals
   Coping with stressful environments – plants

7. LOCOMOTION, SENSES & BEHAVIOUR ANIMALS
   Locomotion on land
   Locomotion in air & water
   Introduction to the nervous system
Nervous system function: sensory systems
Nervous system function: Neural control of behaviour
Nervous system function: Neural control of behaviour

Readings: Only the Course Pack is required.

Method: Three lectures per week, and optional conference sessions for review and clarification of course material.

Evaluation: Four open-book quizzes consisting of conceptual (applying knowledge to novel scenarios) multiple choice questions. Two of the quizzes are in-class promoting discussion and peer-to-peer learning.
Two midterm examinations and a final exam of multiple choice and short answer questions.
BIOL 206 (Fall)
Methods in Biology of Organisms

Instructors: L. Pollock (Coordinator) & Staff
            398-6460 laura.pollock@mcgill.ca

Prerequisites: BIOL 111 or equivalent.

Content: This course provides training in the methods and statistics important in organismal biology and is normally taken in U1. It is organized into a set of 3 modules. Each module consists of a data collection activity followed by statistical analysis using the R program.

Module 1: Forest sampling: Introduction to ecological sampling and descriptive statistics. Forest data is collected on Mount Royal and differences in forest types are visualized in graphical format and analysed with a t-test.

Module 2: Form and Function: Introduction to how morphological attributes correlated to the functioning of organisms. Data are collected from museum specimens. Analyses include ANOVA and simple linear regression.

Model 3: Citizen Science: Introduction to citizen science and spatial analyses in biology. Data from citizen science collection efforts are used to address student-designed hypotheses and analyses include simple and multiple regression.

Method: One-hour lecture, 3-hr lab per week

Evaluation: Each module will be graded based on a written report, oral presentation or test appropriate to the module. In some modules there is also assessment of technical skills learned. The final grade for the course will be based on the accumulated grades for 6 modules. Modules are weighted for grading. There will be no final examination.

Readings: There is no textbook. The course manual, available online, summarizes both the theoretical base and the technical instructions needed for each module.
BIOL 210 (Fall)
Perspectives of Science
(also open to Biology students as an elective)

Instructor: A. Watt (Co-ordinator)  Bellini 265  398-6457  alanna.watt@mcgill.ca
M. Hendricks  N5/11  398-6581  michael.hendricks@mcgill.ca

Content: The goal of this course is to allow you to read through a series of papers in various sciences, listen to a series of conferences, take a series of science courses (for most of you, in the Minor in Science for Arts or the Science for Teachers majors) and obtain and transmit the maximum amount of information concerning them: what is going on in terms of content, purpose, process, form and human activity; how is consensus about a particular scientific issue built or destroyed? You will be required to attend and summarize a series of public lectures in the Faculty of Science, as well as read a series of papers taken mostly from the journals Science and Nature.

1. Introduction: myths, community and consensus in science.
2. How scientists communicate with the general public.
3. How scientists communicate with other scientists.
4. The scientific method.
5. How scientists gather the facts required to test their questions.
6. Traditions, institutions and biases in science.
7. What if something goes wrong? Checks and balances in the system.
8. Conclusions

Method: Two lectures per week, plus 4 conferences in different science departments.

Evaluation: Mid-term, final examination, conference reports

Not open to U0 students
BIOL 215 (Fall)
Introduction to Ecology & Evolution

Instructors:
N. Price (Coordinator) N6/12 398-6468 neil.price@mcgill.ca
E. Abouheif N3/6 398-4087 ehab.abouheif@mcgill.ca
J. Sunday N8/3 398-8885 jennifer.sunday@mcgill.ca

Workload: 3 credits (3-0-6)

Prerequisites: BIOL 111 (or equivalent). Not open to students who have taken ENVR 202

Content:
A core-level introduction to evolutionary and ecological processes. The general topics are those dealing with processes acting in all populations at all times, especially including those that bear on the assembly of communities and ecosystems. These include population dynamics, selection, competition, cladogenesis and trophic interactions.


Method: Two 1.5-hour lectures per week; tutorial conferences for discussion and clarification of material

Evaluation Assignments, midterm exam and final examination
BIOL 216 (Winter)  
Biology of Behaviour

Instructors:  
M. Hendricks (Co-ordinator)  514-398-8925  michael.hendricks@mcgill.ca  
S. Reader  514-398-6421  simon.reader@mcgill.ca  
S. Woolley  514-398-2324  sarah.woolley@mcgill.ca

Prerequisites:  
BIOL 111 and BIOL 112 or equivalents

Content:  
Introduction to the study of animal behaviour at the population, organismal, cellular, and molecular levels. Historical and contemporary methods and experiments will be presented and discussed to provide an overall appreciation of the biology of behaviour, with a focus on the application of multiple levels of analysis to biological phenomena and the formulation of hypotheses about evolution, development, function, and mechanisms of behavioural traits. Topics will range from how animals communicate with one another to the cellular mechanisms that allow information to be processed by nervous systems.

Method:  
3 hours lecture; 1 one-hour conference per week.

Evaluation:  
Midterm exams, assignments and final exam
BIOL 219 (Fall)
Physical Biology of the Cell

Instructors:  
S. Weber (Co-ordinator)  
J. Vogel  
A. Hendricks  
A. Watt
N5/16  
Bellini 269  
McConnell 356  
Bellini 265
398-2042  
398-5880  
398-8925  
398-2806
steph.weber@mcgill.ca  
jackie.vogel@mcgill.ca  
adam.hendricks@mcgill.ca  
alanna.watt@mcgill.ca

Workload:  
4 credits (3-1-5)

Prerequisites:  
1 year of college calculus, chemistry and physics or equivalents, BIOL 112 or equivalent

Corequisites:  
MATH 222 or equivalent

Restrictions:  
Not open to students who have taken ANAT 212, BIOC 212, BIOL 200 and/or BIOL 201.
Open only to students in the following interdisciplinary programs: Major and Honors Quantitative Biology; Joint Major and Honors Computer Science and Biology; Joint Major Math and Biology; Joint Major Physiology and Math; Joint Major Physiology and Physics; Major and Honors Biophysical Chemistry; and Major and Honors Biological Physics.

Content:  
BIOL 219 is an introduction to molecular and cell biology using physical biology perspectives, and equally prepares interdisciplinary students for more advanced courses in the biological and physical sciences. Technologies and methodologies, both experimental and computational, are included in the presentation of each thematic module.

Module 1: Overview of physical biology
1.1. Overview of molecules and cells
1.2. Length and time scales relevant to molecular and cellular biology
1.3. Energy
1.4 Mechanical forces
1.5 Membranes

Module 2: Protein structure and function
2.1. Protein Structure
2.2. Protein folding
2.3. Binding and Enzyme Catalysis
2.4. Protein Regulation
2.5 Allostery

Module 3: Information storage and flow
3.1. Nucleic acid structure
3.2. Genomes
3.3. Prokaryotic transcription
3.4. Regulation of transcription
3.5. Eukaryotic transcription
3.6 mRNA processing
3.7. Translation

Module 4: Molecular self-assembly and transport
4.1. Physical properties of the cytoplasm
4.2. Phase separation
4.3. Polymerization
4.4. Diffusion
4.5. Molecular motors

Module 5: Cell cycle control
5.1. CDK oscillator
5.2. G1 phase
5.3. S phase
5.4. Mitosis
5.5 Checkpoints

**Module 6: Cell signaling and polarity**
6.1. Cell morphology
6.2. Intracellular signaling
6.3. Asymmetric cell division
6.4. Cell fate
6.5. Intercellular signaling

**Module 7: Neuroscience**
7.1. Neurons and electrical potential
7.2. Neurotransmitters
7.3. Circuits
7.4. Optogenetics

**Method:** 3 Lectures plus 1 compulsory tutorial per week
BIOL 240
Monteregian Flora (3 Credits)

Instructors:  V. Millien (Co-ordinator)  Redpath 202  514-398-4848  virginie.millien@mcgill.ca
M. Lapointe  melanie.lapointe@mcgill.ca

Prerequisites:  BIOL 111 or permission of the instructor. The course has been taken successfully by students in Arts, Architecture, Education and Management as well as Science.

Restrictions:  Students who have already taken PLNT 358 (Plant Science) cannot take this course, but PLNT 358 can be taken after taking BIOL 240.

Content:  This course is an introduction to the diversity of plants in the area surrounding Montreal, Quebec, concentrating specifically in the Saint Lawrence River Valley and on one of the Montréal Hills, Mont Saint Hilaire. Plant groups studied include fern allies, ferns, conifers and flowering plants. Studies will be conducted at McGill’s Gault Nature Reserve field station where there are dormitories, a laboratory and a wide variety of habitats and different plant communities. Emphasis will be on field and laboratory work but some lectures will be included for background material. The course will focus mainly on plant identification, including sight recognition and use of taxonomic keys. You will learn over 200 species in the context of their habitats. For each plant group, lectures will present key characteristics for field identification of family and genera. Fieldwork will include exercises in field recognition and keying. We will take advantage of the diversity of habitat found on and around Mont Saint Hilaire to study a variety of hardwood and conifer forests, rock outcrops, marshes, bogs, floodplains and lakes. Fieldwork will also include habitat analysis with the goal of explaining and predicting species occurrence.

Method:  Course is taught at the Gault Nature Reserve field station where students and staff are in residence during the week. Mornings will be devoted to lectures and observations in the field and afternoons to laboratory sessions. Fieldwork will consist of hiking (possibly in rain) to make plant collections, sight identification of plants, and habitat analyses. There is a course fee for lodging, meals, the textbook and course supplies. Students MUST contact Susan Gabe (susan.gabe@mcgill.ca) to secure permission to register for the course on Minerva and contact the course coordinator (virginie.millien@mcgill.ca) for more details on course and appropriate preparations for field work. The course runs two weeks in mid-July, exact dates varying slightly year to year. Contact the course coordinator well in advance to discuss the course schedule and logistics. For more information on the course, consult the web site: http://biology.mcgill.ca/undergrad/c240t/c240add.htm

Evaluation:  Grades will be based on field sight identification, plant keying and class contribution. The quiz and exam format includes a mix of field and laboratory identifications.
BIOL 300 (Fall)
Molecular Biology of the Gene

**Instructors:**
F. Schoeck (Coordinator) 398-6434 frieder.schoeck@mcgill.ca
N. Moon 398-2982 nam.moon@mcgill.ca

**Prerequisites:**
BIOL 200, BIOL 201 or ANAT 212/BIOC 212; or BIOL 219

**Part 1: Nam-Sung Moon**

I. **Regulation of gene expression**
   A. Introduction and overview (1 lecture)
      1. Nucleic acids and gene structure
      2. Basic transcriptional mechanisms (initiation, elongation, termination)
      3. Gene structure in prokaryotes and eukaryotes
   B. Gene expression in prokaryotes (1 lecture)
      1. Transcription initiation (RNA polymerase, sigma factors)
      2. Regulation of transcription by activators and repressors
      3. Transcription termination (Rho dependent and independent, attenuation)
   C. Transcription initiation in eukaryotes (8 lectures)
      1. RNA polymerase II (holoenzyme, core promoter elements)
      2. General transcription factors and preinitiation complex assembly
      3. Mediator complexes
      4. Enhancesomes and gene expression (example: Interferon β)
      5. Insulators (example: gypsy and su(Hw))
      6. Chromatin, nucleosomes and the histone code
      7. Chromatin remodeling complexes
      8. Non-coding RNA and transcriptional control.
   D. Transcription elongation (1 lecture)
   E. Review (1 lecture)

II. **Post-transcriptional control of gene expression**
   A. Processing of eukaryotic pre-mRNA (1 lecture)
      1. Capping, polyadenylation, splicing
      2. Coupling of transcription and processing events
   B. Regulation of pre-mRNA processing (3 lectures)
      1. Splice site recognition
      2. Alternative splicing/splice site selection
      3. RNA editing
      4. Molecular consequences of RNA processing
   C. Genome editing (1 lecture)

**Part 2: Frieder Schöck**

III. **Signal transduction and Post-transcriptional cytoplasmic control of gene expression**
   A. Macromolecular transport across the nuclear envelope (2 lectures)
      1. Nuclear import and export
      2. Regulated transport of transcription factors
      3. Nuclear export of mRNP’s
      4. Transport of unspliced transcripts
   B. Cytoplasmic mechanisms of post-transcriptional control (5 lectures)
      1. mRNA degradation: decapping, deadenylation, nonsense-mediated decay
      2. mRNA localization
      3. Cytoplasmic polyadenylation
      4. Translational repression
      5. Regulation of translation initiation
      6. Translational Regulation and Unfolded Protein Response
      7. Feedback regulation of protein folding
      8. Micro RNAs and regulation of mRNA translation and stability
   C. Biochemical and genetic principles of signal transduction (3 lectures)
1. Biochemical isolation of ligands and receptors
2. Ligand binding to receptors
3. Kinases and their analysis
4. Genetic analysis of signal transduction cascades

D. G protein-linked receptors (2 lectures)
   1. Signaling through cAMP (example: fight-or-flight response)
   2. Signaling through ion channels (example: vision)
   3. Signaling through inositol phospholipids (example: CamKII-mediated short-term memory)

E. Enzyme-linked receptors and intracellular receptors (4 lectures)
   1. Receptor tyrosine kinases (example: eye development)
   2. Integrins (example: upregulation of RTK signaling in cancer)
   3. Cytokine receptors
   4. Receptor serine/threonine kinases
   5. Intracellular receptors

F. Principles of developmental signaling (1 lecture)
   1. Signal memory
   2. Lateral inhibition (example: Notch signaling)

G. Review session (1 lecture)

**Method:** Three lectures per week

**Evaluation:** Mid-term exam; Final exam
BIOL 301 (Fall or Winter)
Cell and Molecular Laboratory

Instructors:  
H. Zheng (Coordinator)  398-1328  hugo.zheng@mcgill.ca  
A. Hayer  398-8574  arnold.hayer@mcgill.ca  
P. Harrison  398-6420  paul.harrison@mcgill.ca  
TBD (Lab Coordinator)  398-4917

Prerequisites:  PHYS 102 or PHYS 142, BIOL 200, BIOL 201 or ANAT 212/BIOC 212; or BIOL 219; BIOL 202; BIOL 206 recommended.

Restriction:  BIOC 300

Content:  One 1-hr lecture and one 6-hr laboratory period per week. This course focuses on modern tools for molecular and cell biological analyses of cellular systems. Lectures will introduce students to the range of possibilities of techniques as well as their application to solve biological problems. Students will then have the opportunity to perform selected techniques in the weekly laboratories. In addition, an introduction will be provided to bioinformatics methods and their role in analysis. In-lab reports will focus on experimental design, theory and data analysis.

Evaluation:  The grade for the course is based on two assignments, laboratory quizzes, reports and on a comprehensive final essay examination. Lab reports are required when each experiment is completed; these are evaluated by the lab demonstrators. The final examination stresses the theoretical and analytical aspects of the course material.

Enrolment in this course is limited. Departmental approval for both sessions of BIOL 301 must be obtained from the Biology Department prior to registering in Minerva. Be sure to include in that email your student I.D. number, the semester and two choices of lab day.
BIOL 302 (Fall)
Fundamentals of Genetics and Genomics

Instructors:  
D. Schoen  
N3/8A  
398-6461  
daniel.schoen@mcgill.ca  
P. Lasko  
Bellini 277  
398-6721  
paul.lasko@mcgill.ca

Prerequisites:  
BIOL 200 or BIOL 219; BIOL 215 or permission of the instructor

Restriction:  
BIOL 202

Content:  
Trait variation within and across populations and species, and how this reflects variation within genomes. Case studies and problem-solving approaches will be used to illustrate the tools of genomics, molecular genetics and classical genetics, and how they are employed to understand the mechanisms of phenotypic variation. Topics will include evolutionary, developmental and human genetics. Application of multiple levels of genetic analysis, formulation, and testing of hypotheses on critical topics ranging from evolution to developmental biology to human genetics.

Method:  
3 hrs. lecture plus one conference per week

Evaluation:  
Final and midterm exams, oral presentations
Instructors: A. Gerhold (Coordinator)  N3/11B  398-6423  abigail.gerhold@mcgill.ca  
D. Dufort  RVH  934-1934x34743  daniel.dufort@mcgill.ca  
Y. Rao  MGH  934-1934x42520  yong.rao@mcgill.ca  

Prerequisites: BIOL 200, BIOL 201 or ANAT 212/BIOC 212; or BIOL 219; BIOL 300 strongly recommended.  

Corequisite: BIOL 202  

Content: This introductory course in developmental biology is designed to acquaint the student with the fundamental processes operating during embryonic development and cellular differentiation, with a focus on animal development. Development will be considered at the organismal, cellular, and molecular levels to provide a total appreciation of developmental phenomena. The emphasis will be on the interpretation of important experiments that have led to an understanding of the basic principles of development.  

1) Introduction, history, principles of experimental embryology (2 lectures)  
2) The germ line, gametogenesis, and fertilization (2 lectures)  
3) Early invertebrate development (3 lectures)  
4) Principles of cellular differentiation and morphogenesis (3 lectures)  
5) Reading a research paper and writing a scientific review (1 lecture)  
6) Axis specification in vertebrates (4 lectures)  
7) Sex determination (1 lecture)  
8) Development of the nervous system (2 lectures)  
9) Organogenesis and limb development (3 lectures)  
10) Growth, metamorphosis, regeneration, and aging (2 lecture)  
11) Plant development (2 lectures)  
12) Evolution and development (1 lecture)  

Method: There are two 90-minute lectures and optional tutorials every week.  

Evaluation: Students evaluation is based on two examinations and a term paper. Examinations will stress the ability to design and interpret simple experiments on developing organisms. The term paper will be a summary and critique of a research article from a relevant scientific journal.
BIOL 304 (Fall)
Evolution

Instructors:  G. Bell (Coordinator)    Redpath Mus.    398-6458    graham.bell@mcgill.ca

Prerequisite:  BIOL 205, BIOL 215 or ENVR 202

Content:  This course provides a comprehensive introduction to evolutionary biology. It covers both short-term and long-term evolutionary processes. The material is presented in six major sections:


The laboratory classes will entail the estimation of variation and selection in natural populations and museum collections.

The course as a whole will provide a set of principles based on the observed patterns and established processes of evolution that enable biologists to account for the diversity of all life and explain how the modern biota came to be.

Method:  Two one-hour lectures and one three-hour laboratory weekly.

Evaluation:  Laboratory reports, midterm lecture exam and final lecture exam
BIOL 305 (Winter)
Animal Diversity

Instructors:  R. Barrett  Redpath Mus.  398-4086 x 00856  rowan.barrett@mcgill.ca
H. Larsson  Redpath Mus.  398-4086 x 089457  hans.ce.larsson@mcgill.ca
D. Green  Redpath Mus.  398-4088  david.m.green@mcgill.ca
A. Hendry  Redpath Mus  398-4086 x 00880  andrew.hendry@mcgill.ca
G. Bell  Redpath Mus  398-6458  graham.bell@mcgill.ca

Prerequisite:  BIOL 215 or both ENVR 200 and ENVR 202

Content: This course will provide a systematic survey of the major animal groups, emphasizing their
evolution and phylogeny. It will use the collections and exhibits of the Redpath Museum to
provide first-hand experience of the groups described in the lectures.

Method: One one-hour lecture and 1 three-hour laboratory each week. The lectures are intended to provide
a systematic treatment of the major groups of animals. Lab sessions are intended to provide first-
hand experience of the animal groups described in the lectures. Each lab will feature comparative
material from the Museum collections, giving examples of the principal types within major groups
of animals. Labs may also make use of material from the permanent exhibits of the Museum and
audio-visual presentations.

Evaluation: Final exam; weekly lab assignments and quizzes;
BIOL 306 (Fall)
Neural Basis of Behaviour

Instructors:  J. Sakata (Coordinator)  N48  398-3636  jon.sakata@mcgill.ca
J. Dent  N4/7A  398-3724  joseph.dent@mcgill.ca
A. Watt  Bellini 265  398-2806  alanna.watt@mcgill.ca

Prerequisites:  PHYS 102 or PHYS 142 and BIOL 201 or ANAT 212/BIOC 212 or BIOL 219 or NSCI 200

Content:  This course examines the structure and function of neurons and neural circuits, with emphasis on the role of the nervous system in animal behaviour. A variety of animal models is considered. Highlights from the history of the field are integrated with the most recent experimental findings.

Basic Neurophysiology (6 lectures)
We will explore the mathematical biophysics of excitable cells and how they use membrane potential to store and transmit information. Topics include the ionic mechanisms underlying the electrical activity of nerve cells, the cellular mechanisms of synaptic transmission, and the impact of these basic mechanisms on the operation of neural circuits.

Sensory and motor systems (23 lectures)
This section explores concepts of neural information processing using a variety of vertebrate and invertebrate model systems. The focus is on peripheral and central processes underlying well-defined behaviours. The fruitfulness of multidisciplinary approaches is stressed, ranging from physics and behavioural experimentation to electrophysiology and computational neuroscience.

Neurogenetics (8 lectures)
We will survey examples of behaviours whose genetic basis has been elucidated. The emphasis is on integration of genes, neurophysiology, circuits and behaviour to generate a deep understanding of how nervous systems evolve and how they can be manipulated on the genetic level. Topics will include: sleep, circadian rhythms, aggression and sexual behaviour.

A detailed listing of lecture topics from the most recent offering of the course is available on Minerva

Method:  Three lectures weekly.

Evaluation:  Midterm examinations, final examination
BIOL 307 (Winter)
Behavioural Ecology

Instructor: S. Reader  N7/12  398-6421  simon.reader@mcgill.ca

Prerequisites: BIOL 205, BIOL 215 or permission of instructor.

Content: This course is designed as an introduction to animal behaviour and to ecology at the level of the individual organism. It takes an evolutionary perspective on the relationships between the behaviour of individual animals and their physical environment, their predators and prey, and the activities of members of their own and other species. Emphasis will be on general principles emerging in this rapidly developing field. Application of these principles to the biology of humans will be briefly discussed. An important secondary theme of the course is the process of critical and creative reading of primary research articles in the field. The conferences will involve discussions of research articles to enrich understanding of the lecture material and to illustrate the process of critical reading. The written critiques require evaluation of the strengths and weaknesses of a particular research article and its significance for the major themes of the course.

Lecture 1. Introduction: Why study behavioural ecology?
Lecture 2. History of the field
Lecture 3/4. The analysis of behaviour: Observing and quantifying behaviour
Lecture 5. Testing hypotheses and interpreting results
Lecture 6. Levels of analysis, evolution, and development
Lecture 7. Adaptive explanations of behaviour
Lecture 8. Optimal foraging
Lecture 9. Predator avoidance
Lecture 10. Game theory and resource competition
Lecture 11. Living in groups
Lecture 12. Social foraging
Lecture 13. Learning and cognition
Lecture 14. Midterm review
Lecture 15. Social learning and social cognition 1
Lecture 16. Social learning and social cognition 2
Lecture 17. Sexual selection and mate choice
Lecture 18. Parental care
Lecture 19. Mating systems
Lecture 20. Communication
Lecture 21-23. Evolution of social behaviour 1-3: Kin selection and eusociality
Lecture 22-23. Evolutionary approaches to human behaviour
Lecture 24. Mechanisms of behaviour
Lecture 25. New topics and controversies in behavioural ecology
Lecture 26. Summing up

Method: Two lectures a week plus seminar.

Evaluation: Take-home exam consisting of critiques of research papers during term, conference attendance and participation, oral presentation and a midterm and final examination.
BIOL 308 (Fall)
Ecological Dynamics

Instructor: F. Guichard    N8/14    398-6464    frederic.guichard@mcgill.ca

Workload: 3 credits (3-1-5)

Prerequisites: BIOL 215 or both ENVR 200 and ENVR 202.

Content: Population dynamics
- Population growth
- Regulation of population growth
- Time delays and stochastic processes
- Metapopulation dynamics

Species interactions
- Competition
- Predator-prey
- Epidemics
- Mutualism

Community dynamics
- Multispecies communities and niche theory
- Island biogeography
- Successions
- Food chains and trophic interactions
- Food webs

Method: Two 1.5-hour lectures per week; four 2-hour tutorials over the semester.

Evaluation: Midterm exam and final examination. The exams will consist of multiple-choice questions, short answer questions and problems.
Instructor: G. Bub (Physiology) McIntyre, Room 1128 398-8148 gil.bub@mcgill.ca

Prerequisites: 1 year of calculus; an additional course in Calculus is also recommended; or permission of instructor.

Content: The main objective is to give the student basic skills necessary to understand the ways mathematics can be applied to study biological systems.

1) FINITE DIFFERENCE EQUATIONS IN BIOLOGY (12 lectures) dynamics in 1-dimensional finite difference equations modeling ecosystems including concepts of steady states, cycles and chaos. Boolean switching networks as applied to genetic regulation. Cellular automata and fractals.

2) DIFFERENTIAL EQUATIONS (14 lectures)


Method: 2 one and a half hour lectures per week.

Evaluation: Critical review of a scientific article, homework, class test, final.
BIOL 310 (Winter)
Biodiversity and Ecosystems

Instructor: J. Sunday (Coordinator) N8/3 (514)-398-8885 jennifer.sunday@mcgill.ca
A. Gonzalez N3/2 (514) 398-6444 andrew.gonzalez@mcgill.ca

Prerequisite: BIOL 215 or both ENVR 200 and ENVR 202, MATH 112 or equivalent; or permission of the instructor

Content: This course provides undergraduate students with a strong ecological and evolutionary basis to understand the natural causes and consequences of current global environmental changes. It explores the origin and distribution of biodiversity, how biodiversity is defined and measured, how it varies in space and time, and how its loss impacts human societies. BIOL 304, BIOL 308 and BIOL 310 will be highly complementary. BIOL 310, however, does not require BIOL 308 or BIOL 304 as prerequisites. Students with an environmental interest will find much relevant material in this course.

  Topics covered include:
  □ Biodiversity: concepts & measurement
  □ The spatial distribution of biodiversity
  □ Evolutionary origins of diversity
  □ Ecological determinants of species richness, from local to global scales
  □ Ecosystems: productivity, regulation, stability, regime shifts
  □ Biodiversity and ecosystem services
  □ Global change: biogeochemical cycles, climate, biodiversity
  □ Species extinction and the biodiversity crisis
  □ Global conservation priorities

Method: Two 1.5-hour lectures per week. Two assignments with problem sets to be analyzed on a computer during the semester. One field trip to Mont St-Hilaire followed by a tutorial to analyze data from the field trip, and a written report

Evaluation: Final exam, problem sets, field trip report, in-class presentation
BIOL 311 (Winter)
Laboratory for Organismal Biology

Instructors:  M. Cristescu  N6/1  398-1053  melania.cristescu@mcgill.ca
             A. Gonzalez  N3/2  398-6444  andrew.gonzalez@mcgill.ca

Prerequisites:  BIOL 200 or 219; BIOL 206, COMP 204 and BIOL 202 or BIOL 302

Content:  Application of methods and techniques used by organismal biologists, paired with the design of sampling programs to test hypotheses using observational or experimental data, and the analysis of data. Topics include DNA barcoding/metabarcoding and experimental evolution.

Method:  2 hours lecture and 3 hours lab per week

Evaluation:  Lab assignments, lab report, presentation and participation
BIOL 313 (Winter)
Eukaryotic Cell Biology

Instructors: S. Weber (Coordinator) N5/16 398-2042 steph.weber@mcgill.ca

Prerequisites: BIOL 200, BIOL 201 or ANAT 212/BIOC 212; or BIOL 219; BIOL 202

Content: This course offers an in-depth examination of the structure and function of eukaryotic cells, with an emphasis on experimental design and interpretation. Lectures will explore the molecular mechanisms of various cellular processes, including protein homeostasis, intracellular transport, cytoskeletal dynamics, multicellular organization and cell cycle control. Through assignments and class discussions, students will learn how to read and critically evaluate the primary literature.

Cell Biology
- Cell theory
- Light microscopy, including super-resolution techniques
- Electron microscopy and tomography

Protein homeostasis
- Protein folding
- Protein degradation

Intracellular transport
- Protein sorting
- Nucleocytoplasmic transport
- Vesicle trafficking

Cytoskeletal structure and dynamics
- Polymerization
- Regulation
- Molecular motors
- Cell motility

Multicellular organization
- Epithelial polarity
- Intercellular junctions
- Extracellular matrix

Cell cycle control
- Cell growth and size control
- S phase, DNA replication
- Mitosis and meiosis
- Mechanics of cytokinesis
- Apoptosis
- Cancer

Method: Three hours of lectures each week.

Evaluation: Assignments based on readings from the primary literature; a mid-term exam and a cumulative final exam
BIOL 314 (Winter)
Molecular Biology of Cancer

Instructors: D. Dankort (Coordinator) Bellini 264
david.dankor@mcgill.ca
K. Christensen Glen Campus karen.christensen@mail.mcgill.ca

Prerequisites: BIOL 200, BIOL 201 or ANAT 212/BIOC 212; or BIOL 219 (or permission of instructor)

Content: Successive accumulation of mutations of normal genes in a single cell results in the alteration of several physiological pathways/events/molecules, which collectively contribute to the genesis of cancer. Genetic damage found in cancer cells is of two types: 1. One is dominant and in this process the genes are termed proto-oncogenes. A proto-oncogene is a normal gene whose protein product has the capacity to induce cellular transformation given it sustains some genetic insult. An oncogene is the gene that has sustained some genetic damage and, therefore, produces an abnormal protein capable of cellular transformation and cancer. 2. The other is recessive and the genes involved in this process are variously termed as tumor suppressors, growth suppressors, recessive oncogenes or anti-oncogenes. Events known to promote the formation of oncogenes, the biochemical properties of the proteins encoded by these mutated genes, and their functions will be analyzed in an attempt to understand the molecular basis of human cancers. We will also examine current molecular targets for cancer therapy and the concepts and consequences of inheriting mutations in genes that predispose to cancer.

The Aim of this course is to:
Evaluate the relationship between oncogenes and cancer;
Analyze the key physiological changes in cancer cells and oncogenes involved in the induction of such changes
Compare the major requirements for cancer
Analyze these requirements during normal development
Critically analyze research papers in cancer
Propose hypothetical new molecular targets for cancer therapy

I. Evaluate the relationship between oncogenes and cancer
1- Identify and define cellular structure and components from gene to proteins
2- Define cellular homeostasis and apply the concept to a concrete example
3- Provide a comprehensive classification of proto-oncogenes
4- Identify some common facts about cancer
5- Compare and identify the common activation mechanisms of normal genes to activate oncogenes
6- Define concepts of cancer predisposition in the context of heritable mutations in cancer associated genes

II. Characterize the role of growth factor receptors and major signal transduction pathways in cancer
1- Growth factor receptors as oncoproteins and the role of tyrosine phosphorylation in cancer. (Provide example of GFR and means of abnormal activation)
2- Intra-cellular signaling: describe major oncogenes and signaling pathways involved in cancer including src, ras and Akt; integrate molecular events from the cell surface to the nucleus.
3- The contribution of aberrant signal transduction to cancer cell using specific examples for cell surface, intracellular and nuclear events. Provide specific examples of known cancers that thrive on aberrant signaling events and how different oncogenic signals can be integrated in the same cell.

III. Cell cycle, inflammation and apoptosis in cancer
1- Review the cell cycle and describe the two major cell cycle pathways p53 and Rb.
2- Describe the mechanisms of cell death and inflammation
3- Explain how evasion of apoptosis can lead to cancer (Oncogenes bcl/bax; p53)
4- Define the limitless replicative potential (immortalization)-Telomere, telomerase and immortalization (oncogene hEST2/hTERT/hTRT)
5- Describe the one carbon metabolism pathway and its relationship to cancer.
6- Justify the need for genomic instability - Loss of genes involved in sensing and repairing DNA damage or chromosomal segregation during mitosis (example: MSH2 family of genes, hSecurin gene)

IV. Angiogenesis, epithelial mesenchymal transition and cancer models
1- Define Sustained angiogenesis and explain its role in cancer- Production of angiogenesis
2- Analyze the need for cancer cells to invade tissues and to metastasize - Functional elimination of genes that suppress the cell’s ability to invade tissues and to metastasize (example: E-cadherin gene, CDH1 gene)
3- Compare the role of EMT in development with cancer – does E-cadherin and stromal genes play similar roles?
4- Compare in vivo versus in vitro models of cancer

V. Translating molecular events to cancer therapy: How a precise molecular understanding of cancer can directly affect cancer therapy.
1- An overview of molecules designed or selected to target major oncogenes and are currently used in cancer therapy:
2- What cancers can be molecularly targeted? Example of Chronic Myelogenous Leukemia, Gastro-intestinal stromal tumours, breast, lung, melanoma and brain cancers.
3- The role of gene therapy in cancer. Other perspectives currently under investigation in cancer therapy.
4- Immunotherapy and cancer (hairy cell leukemia, BCG inoculations, stem cell transplantation).
5- Through the example of one highly aggressive cancer the review of major oncogenes, oncogenic pathways and available molecular targets for adjuvant treatments will be performed.

Method: Three hours of lectures per week.

Evaluation: Mid-term(s), written assignments, final examination. Exams will be based on materials presented and discussed in class and on assigned readings
BIOL 316 (Fall)
Biomembranes and Organelles
(Not offered in 2021-22)

Instructor: H. Zheng  N5/10  398-1328  hugo.zheng@mcgill.ca

Prerequisite: BIOL 201 or ANAT 212/BIOC 212 or BIOL 219

Contents: “Long ago it became evident that the key to every biological problem must finally be sought in the cell, for every living organism is, or at some time has been, a cell.” The central importance of Cell Biology in biological sciences was well summarized by E.B. Wilson (1856-1939), a pioneering American zoologist and geneticist. The emphasis of this course is on the molecular basis of the structure, generation and function of eukaryotic cell membranes and organelles and their medical impacts. The lectures will discuss some advanced topics, such as membrane structure, ion transport, cell energetics in different organelles, endomembrane system, vesicle trafficking, cell-cell contact and communications. As a subject of experimental science, the rapid advance in cell biology is largely dependent on and driven by results from laboratory research. Therefore, some classical and modern experimental methods to study cells will also be discussed.

The lectures will discuss the following advanced cell biology topics:

1) Membrane structure: membrane lipid and proteins; membrane transport; ion channels in nerve cells
2) Cellular energetics: function and biogenesis of mitochondria and chloroplasts, the role of mitochondria in aging
3) Endomembrane system: The dynamics and function of ER, Golgi and post-Golgi organelles; protein trafficking and human diseases
4) Social interaction of cells: extra-cellular matrix and plant cell walls

Method: Three hours of lectures per week

Evaluation: Two assignments and a final exam
**BIOL 319 (Winter)**

**Introduction to Biophysics**

**Instructor:** P. Wiseman
Otto Maass Chem/Rutherford Buildings 398-5354 paul.wiseman@mcgill.ca

**Prerequisites:** BIOL 200 or BIOL 219, MATH 222, PHYS 230, PHYS 232 or PHYS 253 or permission of the instructor

**Restrictions:** Not open to students who have taken or are taking PHYS 319.

**Content:** Emerging physical approaches and quantitative measurement techniques are providing new insights into longstanding biological questions. This undergraduate course will present underlying physical theory, quantitative measurement techniques, and significant findings in molecular and cellular biophysics. Principles covered include Brownian motion, low Reynolds-number environments, forces relevant to cells and molecules, chemical potentials and free energies, models of biopolymer folding and kinetics in a biological context. Those principles are applied to study proteins, DNA, RNA, lipids and membranes in a biophysical context at the cellular level. U2 and U3 students with training in physics and quantitative biology will be well-suited to the course.

**Topics covered (not necessarily in order):**
- Introduction to physical biology and quantitative modeling.
- Brownian motion and diffusion.
- Stokes-Einstein relation and applications.
- Gibbs free energy and Entropy.
- Random walks for modeling biopolymer folding.
- Mechanical and chemical equilibrium in the living cell.
- Chemical binding kinetics, membrane receptors.
- Intermolecular forces.
- Electrostatics in salty solutions.
- Cellular membranes and membrane potential.
- Cytoskeleton and dynamics.
- Biophysics applications of fluorescence and super-resolution optical microscopy.

**Method:** 3 hours lecture

**Evaluation:** Assignments, two in-class midterms and final exam
BIOL 320 (Winter)
Evolution of Brain and Behaviour

Instructors:  
S. Woolley (Coordinator)  
N4/8  
398-2324  
sarah.woolley@mcgill.ca  
Jon Sakata  
N4/8  
398-3636  
jon.sakata@mcgill.ca

Prerequisites:  
NSCI 201 or BIOL 306

Content:  
The diversity of behaviour that exists across vertebrate taxa is rooted in variation in the organization and structure of specific neuroanatomical circuits. We will examine how particular brain systems differ across species and how these species differences in neuroanatomy contribute to species differences in behaviour. This course will build upon rudimentary principles of neuroscience, behavioural control, and evolution.

Method:  
2 hours lecture and 1 hour mandatory seminar per week

Evaluation:  
Midterm and final exams, short written assignments, class participation
Instructors: D. Schoen (Coordinator) N3/8A 398-6461 daniel.schoen@mcgill.ca

Prerequisites: BIOL 202

Content: The aim of this course is to present evolutionary genetics within an ecological context. The course will cover theoretical and applied topics together with relevant data from natural populations of plant and animals. As part of this course we also aim to provide students with experience in reading and presenting the primary scientific literature and in gaining experience with some of the principle methodological tools in the field (e.g., use of molecular ecological tools for identification of organisms, phylogenetic analysis of molecular data, estimation of genetic diversity).

1) THE ECOLOGICAL CONTEXT OF EVOLUTIONARY CHANGE
2) TYPES OF GENETIC VARIATION: DNA, PROTEINS, QUANTITATIVE VARIATION
3) ORGANIZATION OF GENETIC VARIATION
   A) Population, races, ecotypes, species
   B) Hardy-Weinberg equilibrium
   C) Two loci. Linkage equilibrium
4) POPULATION STRUCTURE
   A) Inbreeding theory and mating systems
   B) Population subdivision
   C) Effective population size and genetic drift
   D) Shifting balance theory
5) EFFECTS OF NATURAL SELECTION ON GENE FREQUENCIES IN POPULATIONS
   A) Differential survival, reproduction, and fitness variation
   B) Basic modes of selection
   C) Frequency- and density-dependent selection
   D) Selection in heterogeneous environments
   E) Selection and gene flow
   F) Selection and mutation
   G) Selection and genetic drift
   H) Fisher's fundamental theorem
6) POLYGENIC TRAITS AND EVOLUTION
   A) Polygenic inheritance and the analysis of phenotypic variation
   B) Phenotypic description of selection
   C) Heritability, genetic correlation, and selection
7) EVOLUTION AT THE MOLECULAR LEVEL
   A) Rate and patterns of sequence evolution
   B) Neutral theory
   C) Gene duplication, unequal crossing over, transposition, and concerted evolution
   D) Mobile genetic elements and selfish DNA

Method: Two lectures per week; one group discussion or lab per week.

Evaluation: Mid term, final exam, participation in discussions and short assignments
## BIOL 331 (Fall)
### Ecology/Behaviour Field Course (3 credits)
(given last two weeks of August)

**Instructors:**
- S. Reader (Coordinator)  
  N7/12  
  398-6421  
  simon.reader@mcgill.ca
- A. Hargreaves  
  N6/11  
  398-7401  
  anna.hargreaves@mcgill.ca
- L. Pollock  
  N7/4  
  398-8005  
  laura.pollock@mcgill.ca

The professors teaching the course vary from year to year, as do the specific dates of the course but in general the course is taught the last two weeks before classes begin. Check the course website in late winter for specific teachers and course dates for the coming fall.

**Prerequisites:**  
BIOL 206, BIOL 215

**Content:**  
The aim of this course is to provide training in basic methods for the quantitative study of plant and animal systems and the testing of hypotheses in nature. The course is held at McGill's Gault Nature Reserve on Mont St. Hilaire. During the first part of the course students participate in 3-4 modules structured to provide experience in the study of both aquatic and terrestrial environments. Each module is organized around a research problem and includes elements of experimental design, data collection, analysis and interpretation. Two-and-a-half days are devoted to independent research projects designed and executed by students working singly or in small teams. This independent study project forms the basis of a written report which is completed in September after the conclusion of the field component. This is an excellent introduction to field studies in the environmental sciences that provides an affordable and stimulating experience under the guidance of 3-4 professors representing a variety of perspectives on ecology and animal behaviour.

**Method:**  
Although this is technically a fall course, it is in fact completed by October. The course begins with a 12-day field course during the last two weeks of August just before fall classes (specific dates vary year to year), followed by completion of an independent project in early fall. You can count on spending the equivalent of one full week during the first three weeks of the fall term in analysis of results, literature review and report writing.

**Evaluation:**  
On basis of field work and written report.

**Registration:**  
Students should contact Susan Gabe (Stewart Building, N7/9A before May 1 to sign up for the course (20 slots, first come first served) and pay a deposit of $150 toward room and board costs. The required application form and additional information can be found on the BIOL 331 website (http://www.biology.mcgill.ca/undergrad/C331A/index.htm). Be aware that your deposit will be refundable up to June 30, but not after that. We will maintain a waiting list once 16 people have signed up on MINERVA; if someone drops the course than students on the waiting list will be allowed to register in the order in which their applications were received. A minimum of 12 students is required for the course to be offered. Deposits will be returned to students if the course is not given.
BIOL 334D1/D2 (Winter/Summer)
Applied Tropical Ecology (3 credits)
(Winter meetings; 2 weeks in May)

Instructors:  
F. Guichard (Co-ordinator)  N8/14  398-6464  frederic.guichard@mcgill.ca  
N. Price  N6/12  398-6468  neil.price@mcgill.ca  
L. Nilson  N5/8  398-6448  laura.nilson@mcgill.ca

Prerequisites:  
BIOL 206, BIOL 215 OR both ENVR 200 and 202, and permission of instructor.

Content:  
This course focuses on aspects of marine and terrestrial tropical ecology relevant to conservation of natural resources and other applied problems. It is taught at McGill's Bellairs Research Institute in Barbados, for two weeks in May. The course is organized as a series of small-group field exercises and projects. Limited enrolment. Students interested in taking the course should fill out an application form and attend the information session in October or November. The course fee (approx. $1600) covers all expenses in Barbados but not tuition and airfare. See the web site for more details: http://www.biology.mcgill.ca/undergrad/c334b/  
N.B. This course is completed in the summer term. Students in their last year will only graduate in Summer (Oct/Nov convocation) at the earliest.

Readings:  
Course Pack and articles available through myCourses

Method:  
12-day field course. Students should expect to work all day, every day, of the course. Field work often involves both aquatic and terrestrial studies, but topics change from year to year.

Evaluation:  
Based on participation in field work, evaluation of a project carried out during the course and results of an examination before the start of the course which tests understanding of preliminary readings.

BIOL 335 (Summer)
Marine Mammals (3 credits)
Huntsman Marine Science Centre (HMSC), New Brunswick  
(2 weeks in August)

Instructor:  
A. Babin  Huntsman Marine Science Centre  amanda@babin-labs.com

Prerequisite:  
BIOL 205 or equivalent

Content:  
The course is taught at the Huntsman Marine Science Centre, St. Andrews, N.B. during the middle two weeks of August. It is an introduction to the biology of marine mammals with special emphasis on the whales and seals of the Bay of Fundy and Northwest Atlantic waters, though the diversity of marine mammals throughout the globe will be discussed. There will be frequent field trips to observe marine mammals in their natural habitat. Lectures and laboratory sessions will cover such topics as: species identification, evolution, adaptations and current research techniques. For more information see the Undergraduate Coordinator in N7/9A - Stewart Biology Building, or visit the web site at: http://www.huntsmanmarine.ca/education-outreach/courses/university/

Method:  
The minimum of 130 contact hours over the two-week period combines lectures, laboratory exercises, field trips, and individual research projects.

Evaluation:  
Individual and group presentations and reports, class debate, final exam

Note: Students must APPLY EARLY TO HUNTSMAN, well before registering with McGill
BIOL 342 (Winter)
Contemporary Topics in Aquatic Ecology (3 credits)

Instructor:  I. Gregory Eaves (coordinator)  N4/8  398-6425  irene.gregory-eaves@mcgill.ca
            N. Price  N6/12  398-6468  neil.price@mcgill.ca

Prerequisites:  BIOL 205, and BIOL 215 or both ENVR 200 and ENVR 202

Restrictions:  Not open to students who have taken or are taking BIOL 432

Content:  The course teaches fundamental concepts in aquatic ecology by addressing topics that represent some of the most pressing issues environmental issues of the day. Seminars provide baseline knowledge about the structure and function of aquatic ecosystems and how these are altered by processes including climate change, ocean acidification, habitat loss and eutrophication.

Method:  3 hours of seminar per week

Evaluation:  Short written assignments, oral presentations, final term paper and class participation:

BIOL 350 (Fall)
Insect Biology and Control

Instructor:  G.B. Dunphy  Nat. Res. Sci, Mac Campus  398-7903  gary.dunphy@mcgill.ca

Prerequisites:  BIOL 205 or permission of the instructor. Students without the necessary prerequisite are strongly encouraged to contact the professor for permission

Restrictions:  Not open to students who are taking or who have taken ENTO 330 or ENTO 350.

Content:  A lecture course designed to introduce insect structure, physiology, behaviour, biochemistry, development, systematics, evolution, ecology and control. The course stresses interrelationships and integrated pest control. (Minimum enrolment 12 students).

1) Introduction
2) External anatomy
3) Internal anatomy
4) Physiology
5) Test of material from lectures to date
6) Sensory systems
7) Insects and their environments
8) Pest insects in agriculture, forestry and medicine
9) Pest control by chemical, cultural and physical methods
10) Test of material covered since previous test
11) Predators and parasitoids in biological control
12) Virus control of pest insects
13) Bacterial control of pest insects
14) Insect immunity

Method:  Lectures, modules and term papers.

Evaluation:  Final exam, midterm tests, and term paper
BIOL 352 (Winter)
Dinosaur Biology

Instructor:  H. Larsson  Redpath Museum  398-4087  hans.ce.larsson@mcgill.ca

Prerequisite:  BIOL 215 or ENVR 202 or EPSC 233 or permission of the instructor.

Content:  Using dinosaurs as exemplars, this course teaches aspects of comparative, functional, and developmental morphology, macroevolution, macroecology, and phylogenetic systematics. Lab dissections will explore vertebrate anatomy. Extensive collections and exhibits of the Redpath Museum will be used. The material is presented in seven major sections.

Part 2: Organs | Comparative and functional anatomy.
Part 4: Dinosaur diversity | A survey of all taxonomic groups of non-avian dinosaurs.
Part 6: Bird diversity | A survey of all taxonomic groups of birds.
Part 7: Conclusions | Future directions in dinosaur research.

Method:  Two one-hour lectures and one three-hour laboratory per week.

Evaluation:  Mid-term exam, lab quizzes, presentations and a written project and final exam

BIOL 363
Mammalian Evolution (Winter)
(Not offered 2021-2022)

Instructor:  V. Millien  Redpath 202  398-4849  virginie.millien@mcgill.ca

Prerequisite:  BIOL 305 or WILD 350 or permission of the instructor.

Content:  This course will provide the students with detailed knowledge of the origin, evolutionary history, diversity and adaptation of mammal species to their environment. Beside a systematic review of fossil and living orders of mammals, aspects of mammalian paleoecology, functional morphology and adaptation will also be explored. The course will use the extensive collections and exhibits of the Redpath Museum as a resource for weekly laboratories.

Method:  2 hours of lecture and a 3-hour lab each week.

Evaluation:  Final exam, weekly lab quizzes, team assignment with oral presentation.
BIOL 370 (Fall)
Human Genetics Applied

Instructors: R. Palmour (Coordinator)  Irving Ludmer Bldg  398-7303  roberta.palmour@mcgill.ca
& Staff
Administrative office W-315 Strathcona  398-4198  ross.mackay@mcgill.ca

Prerequisites: BIOL 200, BIOL 201 or ANAT 212/BIOC 212; or BIOL 219; and BIOL 202

Content: The extraordinary expansion in the applicability of human genetics to human welfare has created not only exciting possibilities for reducing disease and improving health, but also real and potential problems -- ethical, moral and practical. This course will summarize the factual basis of the issues at a level intelligible to second- and third-year undergraduates, using the following topics, and drawing upon examples from the experience of the lecturers.

1. GENETIC VARIATION (2 lectures)
   Phenotype, protein, DNA

2. THE HUMAN GENOME (2 lectures)
   Sequencing and mapping the human genome
   The genetics of gene expression

3. MENDELIAN AND NON-MENDELIAN TRAITS (7 lectures)
   Linkage analysis; genotype-phenotype relationships;
   Defining and mapping complex traits; whole genome association

4. EPIGENETICS (1 lecture)
   Post-natal modifications of the somatic genome and its effects on gene expression

5. BEHAVIOUR (2 lectures)
   Behavioral traits; major psychiatric disorders

6. POPULATION GENETICS (2 lectures)
   Basic concepts; mutation and selection; founder effect and genetic drift

7. DEVELOPMENTAL AND REPRODUCTIVE GENETICS (3 lectures)
   Basic concepts; dysmorphologies; preimplantation diagnosis

8. DIAGNOSIS SCREENING AND THERAPY OF GENETIC DISEASE (2 lectures)
   Theory (sensitivity; specificity; cost-benefit); practice
   Phenotherapy, genotherapy, ethics/eugenics

9. CANCER GENETICS (1 lecture)
   From families to genes; clinical applications

10. GENE THERAPY AND GENE EDITING (1 lecture)
    Approaches and methodologies; promises and risks

11. GENETIC COUNSELLING (1 lecture)
    Risks (empirical, Bayesian, chromosomal); prenatal diagnosis; ethical and social issues

Method: Two 1.5-hour lectures per week.
Evaluation: Mid-term, take-home paper, final exam;
BIOL 377 (Fall, Winter, Summer)  
Independent Reading Project (3 credits)

Instructor: Any staff member of the Biology Department.

Coordinator: N. Nelson N7/9B 398-4109 nancy.nelson@mcgill.ca

Prerequisite: BIOL 200 and BIOL 201 (or ANAT/BIOC 212); or BIOL 219; or BIOL 215; or permission

Restriction: Open to U2 or U3 students in Biology only


Cannot be taken under the S/U option

BIOL 389 (Winter)  
Laboratory in Neurobiology

Instructors: M. Hendricks (Co-ordinator) N5/11 398-6591 michael.hendricks@mcgill.ca  
T. Oyama N5/25 398-2124 tomoko.oyama@mcgill.ca  
A. Watt Bellini 265 398-2806 alanna.watt@mcgill.ca

Prerequisites: BIOL 306 or NEUR 310 or NSCI 200 or PHGY 311 or permission of instructor. Enrolment is limited to 32 students (16 per section)

Content: The main objective of the course is to allow students to experience firsthand how neurobiological questions are asked and answered. In each of the following three course sections, you will first be introduced to the relevant experimental techniques and then conduct a small independent research project.

1) Introduction to electrophysiology and neurogenetics (4 labs). Recordings of the electrical activity of neurons has formed the foundation of our understanding of the neural basis of behavior. You will learn to use the electrophysiology equipment and a simple extracellular recording technique which you will use to explore mutations affecting neurotransmission in the nematode Caenorhabditis elegans. You will design experiment to test the effect of mutants and/or neuroactive drugs on neurotransmission.

2) Intrinsic and network properties of identified neurons (4 labs). In many invertebrate animals, such as the leech, which will be used here, neurons are individually identifiable based on their morphology and physiology. You will learn to perform intracellular recordings from specific neurons in the leech nervous system and how to determine the electrical properties of nerve cells in a quantitative manner using basic biophysical experiments. Finally, in an experiment designed by yourself, you will have the opportunity to study the role of specific ion channels and synaptic input for the electrical activity of individual neurons.

3) Synaptic plasticity (4 labs). Using a mammalian in vitro preparation, you will use extracellular stimulation combined with field recordings to study long-term potentiation (LTP) and/or long-term depression (LTD) at synapses; mechanisms believed to be the cellular basis of learning and memory. With input from the instructor and colleagues, you will then design and conduct experiments to delve more deeply into the mechanistic underpinnings of synaptic plasticity.

Method: 1 hour lecture, 5 hours laboratory; students work in pairs.
Evaluation: The grade will be based on three written laboratory reports, each of which follows the format of published journal articles.

BIOL 395 (Fall)
Quantitative Biology Seminar 1

Instructors: A. Hayer Bellini 268 398-8574 arnold.hayer@mcgill.ca & Staff

Prerequisites: BIOL 200 or BIOL 219, CHEM 212, COMP 250 and MATH 222

Restrictions: Registration is restricted to U2 students in the following programs: Major and Honors Quantitative Biology; Joint Major and Honors Computer Science and Biology; Joint Major Math and Biology; Joint Major Physiology and Math; Joint Major Physiology and Physics; Major and Honors Biophysical Chemistry; and Major and Honors Biological Physics.

Content: This course provides an overview of concepts and current research in quantitative biology: theoretical ecology and evolution, computational biology, and physical biology.

Each week a faculty member will present on their research in a lecture. Readings from the literature or a publication from the lecturer’s research group may be assigned for each lecture to enhance understanding of the material. Readings are available through on-line journal access provided through McGill University.

Method: One hour seminar a week

Evaluation: Mid-term and final exam, consisting of short-answer questions. Exams will cover only material discussed in class. Midterm and final exam. No make-up or extra credit assignments are permitted.

BIOL 396 (3 credits)
(Fall, Winter or Summer)
Undergraduate Research Project

Instructor: Any staff member of the Biology Department

Coordinator: N. Nelson N7/9B 398-4109 nancy.nelson@mcgill.ca

Restrictions: This course cannot be taken under the S/U option, and must be elective credits. Students cannot be supervised by the instructor for two 396 Science courses. Open to students in programs offered by the Faculty of Science only. Not open to Biology students.

Content and Procedures: Independent research project with a final written report worth at least 50% of the total grade. See http://www.mcgill.ca/science/ours for more information about available projects and application forms and procedures.

Cannot be taken under the S/U option

BIOL 413 (Fall, Winter, Summer)
Directed Reading (1 credit)

Instructor: Any staff member of the Biology Department.

Coordinator: N. Nelson N7/9B 398-4109 nancy.nelson@mcgill.ca

Prerequisites: BIOL 200, 201 or ANAT 212/BIOC 212; or BIOL 219; BIOL 202, 205, 215. Registration form is required as for the Independent Study courses.
Content: Special topics paper under the guidance of a staff member of the Biology Department. The course presents the opportunity to improve scientific writing skills and to ease compliance with the number of credits required for graduation. See http://biology.mcgill.ca/undergrad/res_opps.html. Application forms and Suggested Criteria.

Method: Review written in scientific format.

Cannot be taken under the S/U option

BIOL 414 (Fall)
Invertebrate Brain Circuits & Behaviour

Instructor: T. Ohyama  Bellini 279  514-398-2124  tomoko.oyama@mcgill.ca

Prerequisites: Basic of neurobiology (as provided by prerequisite courses BIOL 306, NSCI 200, NSCI 201, PHGY 311, or NEUR 310) and basic computer skills (such as those offered by COMP 201 or its equivalent) are essential.

Content: BIOL 414 is a lecture course that covers the neural and molecular underpinnings of animal behavior, elucidating how such mechanisms work together in the context of neural circuits to drive specific behaviors. Topics will include odor-guided navigation and pheromone communication, visual processing of color and shape, the neuroscience of circadian rhythms, and the molecular and genetic basis of learning and memory. We will touch upon the emerging field of bio-robotics, where principles of insect sensory integration and locomotion are incorporated into robot design. We will also conduct a group programming project.

Method: 2 hours lecture, in-depth small group discussion of primary literature and 1 hour mandatory seminar per week/

Evaluation: Midterm and final exams, short written assignments and presentation

BIOL 416 (Winter)
Genetics of Mammalian Development

Instructors: D. Dufort (Co-ord)  MUHC-RI GLEN 3220  934-1934x34743  daniel.dufort@mcgill.ca
T. Taketo  MUHC-RI GLEN 3220  934-1934x34197  teruko.taketo@mcgill.ca
& Staff

Prerequisites: BIOL 202, 300, 303 or permission.

Content: This course aims to examine problems, theories, and experimental evidence on several concepts of mammalian developmental processes at molecular to organogenesis levels. Emphasis will be put on recent developments in the field and novel approaches to address various developmental issues.

Topics covered in class (selected from the following)
Gametogenesis
Preimplantation development
Stem cells
Implantation
Placental development
Body axis establishment
Kidney development
Muscle regeneration
Epigenetics

Readings: Selected research articles.

Method: 5 topics will be covered during the semester. Each topic will have an introductory overview given by the Instructor (or invited lecturer), followed by presentations of recent articles by students followed by a research seminar given by the Instructor responsible for each section. Students are expected to present 2 articles and write 2 critique from the articles presented in class. Emphasis will be put on identifying the strengths and weaknesses of each paper presented in order to develop critical thinking abilities.

Evaluation: Students will be evaluated on the basis of participation and discussion, presentations, and critiques

BIOL 418 (Winter)
Freshwater Invertebrate Ecology
(not offered in 2021-2022)

Instructor: A. Ricciardi Redpath Museum 398-4089 tony.ricciardi@mcgill.ca

Prerequisites: BIOL 205; BIOL 215 or both ENVR 200 and ENVR 202; or permission of the instructor. Enrolment is limited to 25 students.

Content: This course explores the life history and ecology of freshwater invertebrates in lakes, rivers and wetlands. It will focus on their habitat requirements, functional ecology and food web interactions. We will also examine how invertebrates affect the functioning of aquatic ecosystems, and how their diversity is threatened by human activities.

Lectures – The course will begin by exploring the special features of freshwater habitats, the major distinctions between freshwater and marine invertebrates, the constraints of living in a freshwater environment, and general patterns of freshwater biodiversity and zoogeography. The next series of lectures will examine invertebrate life cycles, food web interactions, and the faunal groups that characterize various types of freshwater habitats. Emphasis will be placed on the adaptations and functional ecology of invertebrates in different habitats, while introducing concepts such as functional feeding guilds and the river continuum. The final series of lectures will examine the role of anthropogenic stressors as threats to freshwater invertebrate diversity, and the value of invertebrates as sentinel of environmental change.

Labs – The labs will demonstrate techniques of identification of major invertebrate groups, using both preserved and living specimens. The final lab will familiarize students with the use of invertebrate data in biomonitoring and environmental assessment. A field sampling trip may be scheduled for the second or third week.

Readings: Selected journal articles will be posted on the course web site.

Method: Two 1hr lectures per week and one 3hr lab session per week.

Evaluation: Midterm exam, Lab exam, Final exam
BIOL 427 (Fall)
Herpetology
(Given in alternate years; Not offered in 2021-2022)

Instructor: D. M. Green Redpath Museum 398-4086x4088 david.m.green@mcgill.ca

Workload: 3 credits (2-3-4)

Prerequisite: BIOL 205 and BIOL 305 or permission of instructor

Content: This course considers the evolution and diversity of amphibians and reptiles, emphasizing detailed discussions of aspects that illustrate general principles of organismal and evolutionary biology. As such, the course explores the evolution and diversity of amphibians and reptiles (origins and phylogeny; diversity and systematics of extinct and modern forms), reproduction (development, metamorphosis, neoteny; phenotypic plasticity), communication and social behaviour (Vocalizations, acoustic communication, sensory systems, reproductive behaviour, social behaviour and parental care). physiology (hibernation and cold tolerance; venoms and toxicology, defensive strategies), biomechanics (jaw mechanics; Locomotion, limblessness, arboreality, fossorial life, swimming), genetics (sex determination; Parthenogenesis and hybridization) and ecology (predator/prey relations, population ecology, conservation and endangered species. The laboratories emphasize structure and identification of representative forms, especially local and North American species.

Method: Two lectures, one laboratory per week. One field trip.

Evaluation: One final examination and quizzes on lecture material; one final laboratory examination. Students will also be graded on an essay which will include its presentation as a seminar.

BIOL 428 (Winter)
Biological Diversity in Africa
(Part of the Africa Field Semester)

Instructor: TBA

Prerequisites: BIOL 305 or equivalent, or permission of instructor

Co-requisites: BIOL/NRSC 451 and ANTH/GEOG 451

Restriction: Not open to those students who have taken BIOL 328

Content: This course deals in depth with biological diversity as exemplified by one or more taxonomic groups of organisms in Africa that are the specialties of particular instructors. As such, it will be a course in field herpetology, ornithology, mammalogy, ichthyology, entomology, invertebrate zoology and/or botany. It is taught at a series of locations in Uganda, Kenya and/or Tanzania taking advantage of a variety of physical locations and ecosystems to impart practical training in species identification and field research. Biological principles embodied in the organisms concerned will also be discussed. Specific lecture topics may include, as appropriate, evolution, diversity, systematics, reproduction, communication, social behaviour, physiology, biomechanics, genetics, and/or conservation biology. Numerous field exercises will introduce students to the
indigenous biota, local habitats and field research methods. Students must register for the Africa Field Study Semester.

**Method:**
Daily lectures and field exercises, together totaling at least 60 hours, over a three-week period in East Africa.

**Evaluation:**
Depending upon the instructor(s), may include a field project report, participation in field work, seminar and/or one mid-term and one final examination on lecture material.

**BIOL 429 (Winter)**
**East African Ecology**
*(Part of the Africa Field Semester)*

**Instructor:**
TBD

**Prerequisites:**
BIOL 215 or equivalents

**Co-requisites:**
BIOL/NRSC 451 and ANTH/GEOG 451

**Restrictions:**
Not open to those students who have taken BIOL 329

**Content:**
This course deals in detail with aspects of ecology particularly pertinent to East Africa and conservation of biological diversity in the region at the discretion of the instructor. The course uses field settings to impart training in ecological principles critical to tropical conservation with an emphasis on research design and field research exercises. It is taught at a series of locations in Uganda and/or Kenya taking advantage of the variety of physical locations and ecosystems in the region to facilitate practical experience using real-world examples. Specific lecture topics may include, as appropriate, ecological diversity, community composition, ecosystem structure and maintenance, trophic dynamics, and conservation biology with an emphasis on ecosystems of East Africa. Numerous field exercises will introduce students to local ecosystems, local biodiversity, and field research methods. Students must register for the Africa Field Study Semester.

**Method:**
Daily lectures and field exercises, together totaling at least 60 hours, over a three to four week period in Uganda and/or Kenya.

**Evaluation:**
Depending upon the instructor, may include a field project report, participation in field work, seminar and/or one mid-term and one final examination based on lecture material.
**BIOL 432 (Fall)**  
**Limnology**  
**Day Field Trips**

**Instructor:**  
Gregory-Eaves (co-ordinator)  
N4/8  
398-6425  
irene.gregory-eaves@mcgill.ca  
G. Fussmann  
N8/15  
398-1370  
gregor.fussmann@mcgill.ca

**Prerequisite:**  
BIOL 206 and BIOL 215 or permission of instructor.

**Restriction:**  
ENVB 432

**Content:**  
Limnology is the study of inland waters: lakes, rivers and wetlands. Wetzel (2001) defines limnology as “the study of structural and functional interrelationships of organisms of inland waters as they are affected by their dynamic physical, chemical and biotic environment”. For this class, we will provide students with an introduction to lake communities and the physical and chemical properties of their environment. Rivers and wetlands will be covered only briefly, but students may choose to do their independent projects on these systems. Topics covered during the class will include the watershed and its hydrology; fluxes of nutrients and materials to and within lakes; the pelagial and littoral zones and their dynamics; sediments and paleolimnology, and the structure and dynamics of major plant and animal communities. Interwoven will be lectures on nutrient and heavy metal pollution.

**Method:**  
3 lectures and 2 weekend field trips per week; day field trips, if conditions allow

**Evaluation:**  
Midterm, final exam, (possibly field project proposal, field project oral report and field participation)

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**Biology 436 (Fall)**  
**Evolution and Society**

**Instructors:**  
E. Abouheif (Co-coordinator)  
N3/6  
398-7190  
ehab.abouheif@mcgill.ca  
S. Reader (Co-coordinator)  
N7/12  
398-6421  
simon.reader@mcgill.ca

**Prerequisites:**  
BIOL 304 or permission of the instructor

**Content:**  
Explores the impact that biological evolution and evolutionary thinking has on society. Topics covered include intelligence, language, race, sex, medicine, politics, and creationism. We will introduce each topic and lead discussion, while an invited lecturer will focus on a particular aspect of that topic.

**Introduction:**  
Lecture 1: Approaches to studying evolution and culture I  
Lecture 2: Approaches to studying evolution and culture II

**Evolution and Sex:**  
Lecture 3: Introduction  
Lecture 4: Presentation by guest lecturer (TBA)  
Lecture 5: Discussion and debate

**Evolution of Intelligence and the Brain:**  
Lecture 6: Introduction  
Lecture 7: Presentation by guest lecturer (TBA)  
Lecture 8: Discussion and debate

**Evolution, Human Health, Disease & Medicine:**  
Lecture 9: Introduction  
Lecture 10: Presentation by guest lecturer (TBA)
Method: Each topic will be considered over three class periods. During the first period the professor will present a lecture introducing the material. The next meeting will host an expert from the McGill or wider community who will present an in depth analysis of one aspect of the topic. Experts will come from a range of fields, allowing students to compare evolutionary and other approaches to the topics. Finally, the third period will be devoted to a guided discussion of the material presented in the first two periods.

Evaluation: Summary presentation (10%) – will be based on role-playing presentations of the problems discussed in the previous two lectures. Role-playing presentations are meant to both summarize key aspects of the content of the two previous lectures, as well as raise several “controversial points of discussion” in order to spark debate and discussion among the group. The criteria for how these role-playing presentations will be graded will be given to the students at the beginning of the course, and the students will receive feedback on their performance shortly after the discussion.

Participation in Discussions (20%): We expect that students will be prepared for the discussion periods by the take home assignments (see below), and that the summary presentations at the beginning of these periods will serve as a catalyst to ignite the discussions. Marks will be accorded for evidence that the students are using lecture material to inform and advance their arguments. Students will be given feedback on their performance once half-way during the term. This feedback will include advice on improving performance where necessary. Attendance will also be taken at lectures and discussions, and will form part of the participation grade.

Take home assignments (35%): these will be given after each guest lecturer has spoken. Thus, there will be seven assignments over the term. The students will be asked to summarize the previous two lectures on a particular topic, highlighting those elements of the presentations that they think are cardinal in understanding the topic. In addition, they will be given a list of questions related to the topic, of which they will choose one to answer in a short essay. The students are encouraged to discuss their questions with each other. The assignments will be due on the day of the discussion period for the topic, before the discussion period commences. Note that the lowest-graded assignment will be excluded from the mean grade.

Term Paper (35%): topics for the term paper will be chosen from a list provided by the professors.
**BIOL 41 (Winter)**  
**Biological Oceanography**

**Instructor:** N. Price  
N6/12  
398-6468  
neil.price@mcgill.ca

**Prerequisites:** BIOL 206, BIOL 215 or both ENVR 200 and ENVR 202. Enrolment limited.

**Content:** The course examines aspects of plankton biology and ecology, emphasizing small-scale (physiological/biochemical) and large-scale (ocean basin/global) processes. The unifying theme of the lectures and lab exercises is the control and fate of production in the sea. The course will provide the student with an understanding of the structure and function of pelagic marine ecosystems.

**Method:** Lectures and laboratories.

**Evaluation:** Final exam, labs and term paper.

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**BIOL 451 (Winter)**  
**Research in Ecology and Development in Africa**  
*(Part of the African Field Studies Semester, AFSS)*

**Instructors:** TBD  
& Staff

**Co-requisite:** ANTH 451 or GEOG 451

**Restriction:** Not open to students who are taking or have taken NRSC 451

**Content:** This course contributes to the core curriculum for students participating in the African Field Studies Semester. The course focuses on development of observation and independent inquiry skills in the areas of ecology and development in Africa through: participation in short-term project modules in collaboration with existing researchers; participation in interdisciplinary team research on topics selected to allow comparative analysis of field sites; active and systematic observation, documentation, and integration of field experience in ecology and development issues. Students must register for the African Field Studies Semester.

**Methods:** Lectures at field sites, interdisciplinary research (group projects), field exercises, field observation records.

**Evaluations:** Research project, module assignments, and field observation records and participation.

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**BIOL 465 (Fall)**  
**Conservation Biology**

**Instructor:** L. Chapman (Coordinator)  
N3/12A  
398-6431  
lauren.chapman@mcgill.ca

A. Gonzalez  
N3/2  
398-6444  
andrew.gonzalez@mcgill.ca

**Prerequisite:** BIOL 215 or both ENVR 200 and ENVR 202
Content: Conservation biology deals with the impoverishment of biodiversity through human related activities. As such, students in this course will be exposed to the pattern of biological processes involved in changes in biodiversity, and current examples of biodiversity loss. The course will focus on the key biological concepts that relate to conservation biology. The course will define diversity, review how diversity is lost and consider important genetic and demographic attributes of populations that make them more or less susceptible to extinctions. The structure and stability of multi-species communities, including the effects of the removal or introduction of species, and other perturbations upon community dynamics will be taught. Specific issues as population viability analysis, fragmented habitats, the effect of introduced or exotic species, and restoration ecology will be presented. Each of these biological topics will be discussed to the extent that they relate to conservation and help in formulating solutions towards reducing the loss of biodiversity. The course will also examine the importance of non-biological disciplines such as ethics, anthropology and history on conservation action. Guest speakers will cover complementary issues.

Method: Two 1.5 hour lectures per week

Evaluation: 2-3 Individual assignments; one group project, final exam
BIOL 466 and BIOL 467 (3 credits each)  
(Fall, Winter or Summer)  
Independent Research Project 1 and Independent Research Project 2

Instructors: Any staff member of the Biology Department
Coordinator: N. Nelson  N7/9B  398-4109  nancy.nelson@mcgill.ca
Workload: 3 credits (0-0-9)
Prerequisites: BIOL 206 or 301, or other suitable -300-level laboratory course. Open to U3 Biology students. All projects have to be arranged with individual instructors of the Biology Department. Honours Biology students may include a maximum of 6 credits of independent research as complementary credits. Liberal and Major Biology students may include a maximum of 9 credits of independent research as complementary courses. A form, available online at http://biology.mcgill.ca/undergrad/res_opps.html, must be completed and returned to Nancy Nelson at the beginning of the term in order to register for these courses on Minerva.

Content: Projects to be carried out independently by students under the guidance of individual staff members. The projects will include experimental work with exposure to published data and theories. Emphasis is on acquisition of skills in technique, analysis, and communication in the process of generating a scientific report. Students interested in Independent Studies should consult "Guidelines for Independent Studies", available at http://biology.mcgill.ca/undergrad/res_opps.html. Students are expected to work a minimum of 9 hours per week for 13 weeks on the project.

Evaluation: The full-time or affiliated staff member of the Biology Department supervising the project evaluates the overall performance in the various stages of the project, including the final written report. Work performed and the report will receive separate marks summarized in a final mark with weighting (70/30, 60/40, 50/50) at the discretion of the supervisor. One copy of the marked report must be submitted electronically to nancy.nelson@mcgill.ca.

Cannot be taken under the S/U option

BIOL 468 (Fall, Winter or Summer)  
Independent Research Project 3 (6 credits)

Instructor(s): Any staff member of the Biology Department.
Coordinator: N. Nelson  N7/9B  398-4109  nancy.nelson@mcgill.ca

For course details see Biology BIOL 466.
Cannot be taken under the S/U option

BIOL 469 D1/D2 (Fall and Winter)  
Independent Research Project 4 (9 credits)

Instructor(s): Any staff member of the Biology Department.
Coordinator: N. Nelson  N7/9B  398-4109  nancy.nelson@mcgill.ca

For course details see Biology BIOL 466
Cannot be taken under the S/U option
BIOL 479 D1/D2 (Fall and Winter) Honours Research Project 1 (9 credits)

and BIOL 480 D1/D2 (Fall and Winter) Honours Research Project 2 (12 credits)

Instructors:  
G. Brouhard (Director)  
Bellini 267  
398-2984  
gary.brouhard@mcgill.ca  
& Staff  
N. Nelson (Advisor)  
N7/9B  
398-4109  
nancy.nelson@mcgill.ca

Procedures & Prerequisites:  
Restricted to U3 students in the Biology Honours Program. Projects must be arranged individually with and accepted by a staff member of the Biology Department. Students must email the Honours Advisor their intent by June 1 of the year prior to the final year. The proposed supervisor must also email acceptance of the student. A completed application form available on the web (http://biology.mcgill.ca/undergrad/honours/index.htm) and an Abstract must be submitted to the Honours Director and Advisor by the first week of September. Applications should, therefore, be considered as competitive. A research proposal must be submitted by October 15. The proposal will be reviewed by the student’s Honours Committee member(s), an instructor in the student's field of study. The major objective of the course is to provide an introduction to the design, execution and reporting of research. The number of projects that can be handled is limited and their quality will be examined carefully.

Content:  
These courses are intended to allow students to obtain in-depth training in their major field of interest. Programs of independent study pursued under these course numbers will usually consist of a project and include preparatory reading and a comprehensive written report and an oral presentation.

Evaluation:  
On overall performance in the various parts of the program. Evaluation will be the responsibility of the supervisor in consultation with the member(s) of the supervisory committee.
BIOL 499 D1/D2 (Fall and Winter)
Honours Seminar in Biology (4 credits)

Instructors: G. Brouhard (Director) Bellini 267 398-2984 gary.brouhard@mcgill.ca & Staff

Prerequisites: Acceptance to U3 Honours Program.

Content: The aim of this course is two-fold: on the one hand it is intended to further interest in a wide range of biological topics, and on the other to promote acquaintance with recent advances and research techniques in a chosen area of concentration.

Method: All students will attend 6 guest speaker seminars designated "honours seminars" by the Honours Director. For each seminar the students will read research articles in advance, participate in discussion with the speaker and prepare a written summary of the talk. In April the students will organize a symposium and present their own research data.

Evaluation: Participation in discussion and written summaries (3 credits) and quality of presentation in the conference (1 credit).

BIOL 506 (Fall)
Neurobiology of Learning

Instructor: Aparna Suvrathan 514-934-1934 x47140 aparna.suvrathan@mcgill.ca

Prerequisites: Advanced neuroscience course for undergraduate students in their final year and graduate students. Prerequisites BIOL 306 or NEUR 310 or NSCI 200 and NSCI 201 or PHGY 311 or PHGY 314 or permission of instructor. Limited to 16 students, including both undergraduate and graduate students.

Content: This course explores the neurobiological basis of learning. The focus will be on the synaptic, cellular and circuit-level processes that support learning, in the context of different brain regions and forms of learning. There will be three sections in the course. The first section will be lecture based, providing a framework of the current state of knowledge in the field. The second section will involve critical analysis and presentation of recent literature by students. In the third section, students will identify gaps in current knowledge and propose research to address them.

Method: Faculty lectures (first module), in-depth discussion of primary literature (second module), and work on a research proposal (third module). Two 1.5h sessions per week.

Evaluation: Written exam, participation in discussions, research paper presentation, research proposal, participation.
BIOL 507 (Fall)
Animal Communication

Instructors: Jon Sakata (Coordinator)  N4/8  398-3636  jon.sakata@mcgill.ca
K. Onishi  398-1725  kris.onishi@mcgill.ca

Prerequisites/Co-requisites: Students should have taken or be currently enrolled in a course in introductory neurobiology (e.g. BIOL 306 or NEUR 310 or NSCI 200 or NSCI 201 or PHGY 311) and a course in Behavioural Ecology (e.g. BIOL 307). Since all co-requisites may not be offered in the same term, students are advised that they may have to plan their schedules so that they register in these courses in the term prior to BIOL 507. Or students may enroll with the permission of instructor. Enrolment is limited.

Content: This course provides an introduction to communication between animals. We will discuss the basic setup of communication systems, but also take a close look at the physical and historical constraints shaping the production and reception of communication signals. The course will cover the relevant physics of communication as well as sensory physiology and the physiology of signal production. Examples will be drawn from all major communication channels. Specifically, we will study acoustic, vibrational, visual, chemical, and electrical communication in a variety of animals (including humans) and contexts (courtship, aggression, predator evasion). Emphasis will be laid on the evolution of communication systems. Discussion will include the neural systems underlying human language and the relationship between human language and communication systems of other animals.

Method: A set of lectures will introduce basic aspects of animal communication and its evolution. Each student will present an original research article from the recent literature and will write a review paper on a current topic in animal communication research.

Evaluation: Discussion contributions, assignments on myCourses related to articles covered in student presentations, presentation of original research article, term paper

BIOL 510 (Fall)
Advances in Community Ecology
(Given in alternate years; Offered in 2021-2022)

Instructor: A. Gonzalez  N3/2  398-6444  andrew.gonzalez@mcgill.ca

Prerequisites: BIOL 308 or GEOG 350 or permission of instructor

Content: “Ecology is the science of communities. A study of the relation of a single species to the environment conceived without reference to communities and, in the end, unrelated to the natural phenomena of its habitat and community associations is not properly included in the field of ecology” (Shelford 1929).

We will cover the central concepts in community ecology organized around three major themes:
1. Maintenance of biodiversity at local and regional scales
2. Historical and phylogenetic perspectives
3. Ecological networks: food webs, mutualisms and metacommunities
4. The links between biodiversity and ecosystem functioning.
Particular emphasis will be placed on the principal theories, their historical development, and the observational and experimental support for them. By the end of the course the student will have a broad appreciation of current knowledge in community ecology.

**Method:** Weekly, 1.5-hour lecture and discussion and 1.5-hour seminar for paper discussion.

**Evaluation:** Class participation, 3 short essay assignments, 1 oral presentation

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**BIOL 515 (Winter)**

**Advances in Aquatic Ecology**

(Not offered in 2021-2022)

**Instructor:** I. Gregory-Eaves  
N4/8 398-6425 irene.gregory-eaves@mcgill.ca

**Prerequisites:** BIOL 432 or BIOL 441 or permission of the instructor. Enrolment in this course is limited.

**Content:** This course is designed to allow senior undergraduate and graduate students to become intimately acquainted with the key primary literature in aquatic ecology and the major issues challenging the field, while also stimulating them to develop their own ideas on how to overcome these and expand the discipline. There are four main exercises in the course: 1) a student-led discussion of primary literature; 2) a critical review; 3) a meta-analysis, and 4) a grant proposal. These exercises are designed to encourage independent thinking, to give students an appreciation of how different types of investigations are initiated, how innovative approaches emerge, and how novel theoretical concepts are synthesized in the area of aquatic ecology.

1) **Student-led paper discussions.**  
The students will discuss a pair of papers, one of which will be among the most highly cited papers on this topic and the second of which will be of approximately the same vintage and contain interesting approaches or findings but will have had more modest citations.

2) **A critical review** (oral presentation and abstract).  
Students should critically analyze a paper by addressing its strengths and weaknesses, asking what questions remain unanswered and how additional questions might be addressed. Students should also take a historical view to the critique by developing an appreciation of the studies which formed the foundations of the paper in question. A 250-word abstract should also be prepared summarizing the above points. Class members are expected to read the focal paper and abstract such that they can participate actively in the class discussion.

3) **Meta-analysis** (oral presentation and extended abstract)  
The literature regarding many basic questions in aquatic ecology is full of similar studies that have reported small – moderate effects, but often there is no quantitative synthesis (aka meta-analysis) to identify a general pattern. Students will be given a background in meta-analyses in the form of a lecture and background readings. For the meta-analyses assignment, each student will be responsible for identifying a topic, conducting an appropriate meta-analysis of the available literature and presenting this analysis to the class orally. Students are also expected to develop a two-page extended abstract, which will allow fellow class members to prepare to participate in the discussion.

4) **Grant proposal** (oral presentation and abstract)  
Identifying exciting new avenues for research and building on existing literature is a major activity of any research scientist. The goal of this exercise is to build on our earlier discussions identifying emerging areas of research and understanding what makes for a successful project. This grant proposal project will be conducted in two steps. During week 6 of the course, each student will submit a one page letter of intent that clearly outlines their question, set in the context of existing literature, and provides some details regarding their approach (e.g. lab experiment, field experiment, and/or field survey). A week later, the students will receive feedback from the class grant panel such that they might further develop their ideas. In the last three weeks of the course, each student will give a presentation summarizing their grant proposals.
Method: Two 1.5 hr seminars per week

Evaluation: Based on: 1. student-led paper discussion; 2. tracking an idea - oral presentation (could be with partner) and abstract (individual); 3. meta-analysis - oral presentation (individual or group) and extended abstract (individual); 4. grant proposal - oral presentation (individual), letter of intent (individual), and written proposal (individual); 5. general class participation

BIOL 517 (Winter)
Cognitive Ecology
(Not offered in 2021-2022)

Instructors: M. Guigueno N7/3 398-2688 melanie.guigueno@mcgill.ca

Prerequisites: BIOL 307 or permission of the instructor

Content: This course is designed to introduce upper-level undergraduate students and graduate students to the ecology and evolution of cognition and its underlying neural mechanisms, and examine links between cognition, behaviour in the wild, and the brain. This course will build upon the principles of behavioural ecology and neuroscience. As a second theme of the course, students will further develop writing and presentation skills from BIOL 307. Students will learn how to write for general and scientific audiences, and to give full lectures on topics within cognitive ecology (also known as neuroecology).

Module 1: Introduction to cognitive ecology
Module 2: Learning – Mechanisms, Ecology, and Evolution
Module 3: Neural representation and the evolution of signal form
Module 4: Cognitive ecology of bird song
Module 5: Cognitive ecology of spatial memory and navigation
Module 6: Cognitive ecology of mating systems
Module 7: Structural plasticity in invertebrate brains
Module 8: Evolution of large brains
Module 9: Cognition and sociality

Method: Two 1.5 hour lectures a week.

Evaluation: Assignments consisting of writing a Wikipedia article and a research proposal, an oral presentation (lecture), and participation, including evaluating peers on their oral presentation.

BIOL 518 (Winter)
Advanced Topics in Cell Biology

Instructors: P. Harrison 398-6420 paul.harrison@mcgill.ca
P. Lasko Bellini 277 398-6721 paul.lasko@mcgill.ca

Prerequisites: BIOL 313 or permission

Content: This course is for advanced undergraduate and graduate students. Readings are recent and classic journal articles and reviews. Specific topics vary but typically include the evolution of cells, cell
biology of bacteria, chromosome biology, cell biology in development, mitosis and cell division. The course emphasizes the development of important ideas in the field. By the end of this class, students should (1) be able to read, interpret and critique works from the primary literature, (2) be familiar with modern techniques and approaches in cell biology, (3) be able to formulate and articulate their ideas both in writing and orally, and (4) be able to provide constructive criticism to their peers.

Method: The course grade is based on an oral presentations, participation, assignments and a term paper. Since participation is a major part of the grade, missed classes will decrease your final grade.

Evaluation: The course grade is based on an oral presentation, a research paper, participation and assignments. Since participation is a major part of the grade, missed classes will decrease your final grade.

BIOL 520 (Winter)
Gene Activity in Development
(Not offered in 2021-2022)

Instructor: A. Gerhold  Stewart N5/7  398-6423  abigail.gerhold@mcgill.ca

Prerequisites: BIOL 300, 303, or permission of instructor.

Content: A critical examination of recent literature on the role and regulation of gene activity during development. The emphasis will be on molecular and genetic analyses. Topics will vary from year to year but are likely to include: transcriptional and post-transcriptional regulation of gene expression during cellular differentiation; analyses of factors and pathways involved in cell fate determination and patterning. These topics will be presented with emphasis on a few currently important developmental systems chosen from: insects (Drosophila), nematodes (C. elegans), non-mammalian vertebrates (Xenopus/zebrafish), mammals (mice), and plants (Arabidopsis).

Method: Discussions will be initially led by professor, but each student will lead one class as well during the term. Recent research papers will be discussed in class.

Evaluation: Students will be evaluated on the basis of their oral and written presentations and on course participation.

BIOL 524 (Fall)
Topics in Molecular Biology

Instructors: H. Clarke  MUHC Research Inst.  934-1934x34748  hugh.clarke@mcgill.ca
D. Dankort  Bellini 264  398-2307  david.dankort@mcgill.ca

Prerequisites: BIOL 300 and 303 or equivalents or permission of the instructor. Enrolment is limited to 12 students.

Content: This seminar course will consider the most recent literature in the fields of molecular biology of development and cancer. Topics will be drawn from the genetics of model organisms and humans, cell biology, cell differentiation and development, and genetic diseases.

Method: Each student will present a seminar and lead the subsequent discussions. of recent publications, present a one-hour seminar and lead the subsequent discussion. Students also submit written questions pertaining to the research papers being discussed at each seminar presentation and are expected to participate in the discussion of those papers. Each student also submits an end-of-
term paper providing a critical evaluation of two papers that he or she has chosen from the literature and which are relevant to one of the topics presented in class.

**Evaluation:** The students will be graded on the quality of their presentations, the submitted questions for other presentations, their participation in group discussions and the end-of-term paper.

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**BIOL 530 (Winter)**  
**Advances in Neuroethology**

**Instructors:**  
S. Woolley (Coordinator)  
T. Ohyama

**Prerequisites:**  
BIOL 306 or NSCI 200 or NSCI 201 or PHGY 311 or permission of instructor.

**Content:**  
The course will consider the neural mechanisms underlying behaviour, focusing on specializations of neural circuits for particular behavioural functions. Specific topics will vary according to the current literature, but may include communication, navigation, social behaviour, visually guided behaviour, escape behaviour, orientation, neurogenetics of behaviour and locomotion.

**Method:**  
Each new topic will be introduced by a lecture, supplemented by assigned reading. The following classes will be devoted to student seminars and critical discussions of recent research articles.

**Evaluation:**  
Participation in discussions, presentation of an original research article, assignments on myCourses related to articles covered in student presentations, term paper

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**BIOL 532 (Winter)**  
**Developmental Neurobiology Seminar**

**Instructors:**  
D. Van Meyel (Co-ord.)  
A. Kania  
J-F. Cloutier  
E. Ruthazer  
A. Fournier

**Prerequisites:**  
BIOL 303 or 306, or permission of instructor.

**Content:**  
The development of the nervous system is examined with particular emphasis on the processes which underlie the appearance of complex but highly ordered neural circuits during embryonic development. Among the specific topics to be discussed are: neural induction and patterning, birthdays and migrations, the specification and diversification of neurons; axon guidance, target selection and topographic mapping; the influence of neuronal activity on CNS development, neurotrophic factors and neuronal cell death, synapse formation, stem cells, and CNS repair and regeneration. The course emphasizes the application of modern cellular and molecular approaches used to investigate these problems.

**Method:**  
The course is organized into modules that cover specific topics in developmental neurobiology. Each module starts with an introductory lecture by the professor followed by student presentations of related research papers that have been selected from the recent literature.

**Evaluation:**  
Based on two seminar presentations, short written assignments, a written term paper, and participation in class discussions.
BIOL 540 (Winter)
Ecology of Species Invasions
(cross-listed with ENVR 540)

Instructor: A. Ricciardi, Redpath Museum, 398-4089 tony.ricciardi@mcgill.ca

Prerequisites: BIOL 215 (or ENVR 200 plus 202), and at least one 300- or 400-level course in ecology, evolution, or conservation biology. (new prerequisite, awaiting approval)

Restrictions: Not open to students who have taken ENVR 540

Content: Invasions by alien species are increasing in frequency around the world. They are leading threats to biodiversity, and they can alter ecosystem processes, and damage economic resources and human health. This course will explore the causes and consequences of invasion. Using concepts from population biology, community ecology and evolution, we will examine the reasons why some species are highly invasive and why some ecosystems are more vulnerable to invasion than others. We will also look at methods of risk assessment and management strategies for dealing with this global environmental problem.

Method: Three 1-hour lectures per week

Evaluation: Students will be evaluated based on two midterm exams, a research paper and a seminar

BIOL 544 (Fall)
Genetic Basis of Life Span
(Given in alternate years; Not offered in 2021-2022)

Instructor: S. Hekimi Bellini 268 398-6440 siegfried.hekimi@mcgill.ca

Prerequisites: BIOL 202 or 219, 300 or permission; BIOL 303 recommended

Content: The course will consider how gene action is determining the duration of life in various organisms, focusing on the strengths and limitations of the genetic approach. The course will focus particularly on model organisms such as yeast, Caenorhabditis, Drosophila and mouse, as well as on the characterization of long-lived people.

Method: Each new topic will be introduced by the instructor. Classes will be devoted to student seminars and critical discussions of recent research articles.

Evaluation: One long oral presentation and participation in discussions.

Enrolment limited to 12 students
BIOL 546 (Fall)
Genetics of Model Systems
(Given in alternate years; Offered in 2021-2022)

Instructor: S. Hekimi
Bellini 268 398-6440 siegfried.hekimi@mcgill.ca

Prerequisites: BIOL 202, 300 or permission; BIOL 303 recommended

Content: The course will provide an introduction to the genetics and molecular genetics of unicellular, plant, invertebrate and vertebrate model systems, including, among others, E. coli, yeast, Arabidopsis, Caenorhabditis, Drosophila, Zebra fish, and mice. We will examine the characteristics of each system, how the systems have been most successfully used (their advantages and disadvantages) and, using chosen topics, how findings with these systems are shaping our understanding of basic principles in the life sciences.

Method: Each new topic will be introduced by the instructor and sometimes by an invited lecturer specialized in the use of a particular model system. Classes will be devoted to student seminars and critical discussions of recent research articles.

Evaluation: One long oral presentation and participation in discussions, and 3-5 simple answer quizzes.

Enrolment limited to 12 students

BIOL 551 (Winter)
Principles of Cellular Control
(Given in alternate years; Offered in 2021-2022)

Instructor: J. Vogel
Bellini 269 398-5880 jackie.vogel@mcgill.ca
P. Francois
Rutherford Physics 398-1635 paul.francois2@mcgill.ca
Instructors to be announced

Prerequisites: CHEM 115 or 120; MATH 133 and 141; PHYS 142; or equivalents; BIOL 201 or BIOL 219 or ANAT/BIOC 212. COMP 204, PHYS 230 and BIOL/PHYS 319 are recommended

Content: This course attempts to overview fundamental principles of cellular control. Cell cycle control is a major theme. Biological and physical concepts will be brought to bear on control systems in healthy cells, largely based in studies using model organisms. Concepts are related to human cells with relevance to disease (cancer), but disease and cancer are not a focus of this course. It should be remembered that understanding what constitutes a healthy system, and how that state is maintained, is just as critical as understanding the basis of disease. This course is designed with the understanding that students come from both the biological/biomedical sciences and physical sciences and thus the material covered must be accessible to all regardless of their background.

Topics include:
- Cell cycle control
- Switches, thresholds in biological systems
- Oscillators
- Symmetry and symmetry breaking
- Organization of cellular systems
- Biological machines
- Methods of analysis

Method: Faculty lectures and student presentations. Two 1.5 hr sessions per week

Evaluation: Presentation, written assignment, team project and participation.
BIOL 553 (Winter)
Neotropical Environment (3 credits)
Winter Term in Panama

Instructor: C. Potvin S3/27 398-3730 catherine.potvin@mcgill.ca

Prerequisite: Spanish Language Elementary HISP 218 or equivalent, Principles of Statistics MATH 203 or equivalent, BIOL 215 or both ENVR 200 and ENVR 202, and permission of Panama program coordinator.

Co-requisite: ENVR 451 (Research in Panama), AGRI 550 (Sustained Tropical Agriculture) and GEOG 498 (Humans in Tropical Environments)

Restriction: This course is limited to those students taking the full Field Study Semester in Panama. (See page 132)

Content: This course is taught over three weeks in January at the Smithsonian Tropical Research Institute (STRI) in Panama. Students study tropical ecology and species richness through field trips. These excursions develop an understanding of the challenges of sampling and measuring biodiversity in species rich areas. Ecological theory and methodology is revisited in view of tropical conditions. The course also documents the conservation status of ecosystems, communities and species in Panama. It ends with a workshop on indigenous knowledge.

Methods: The course is intensive and involves two continuous weeks of field work. Field-trips bring students in contact with forest canopy, semi-dry, cloud and mangrove forests.

Evaluation: Based on participation in field work, practical exercises and a diary.
BIOL 565 (Fall)
Cell and Tissue Mechanobiology
Not offered in 2022-22

Instructor: Arnold Hayer  Bellini 275  514-398-8574  arnold.hayer@mcgill.ca

Prerequisites: One 300-level cell biology course or equivalent and/or instructor’s approval.

Restrictions: Restricted to senior undergraduate and graduate students of the Faculty of Science, Faculty of Medicine, and the Department of Bioengineering, who fulfill the prerequisites or those approved by the instructor. Enrolment restricted to 25 students.

Content: During tissue development and homeostasis, cells interact mechanically with other cells and with their environment. In three modules, this course explores the emerging field of mechanobiology and mechanotransduction, and their relevance in the context of multicellular physiology in health and disease. In the first module, the molecular and cellular foundations of mechanobiology are covered. During the second module, current literature on the topic will be presented and discussed by students. In the third module, students will identify gaps in current knowledge and propose research to address them.

Method: Faculty lectures (first module), in-depth discussion of primary literature (second module), and work on a research proposal (third module). Two 1.5h sessions per week.

Evaluation: Based on quizzes, oral research paper presentation/discussion, research proposal and participation.
BIOL 568 (Winter)
Topics on the Human Genome

Instructors:  J. Engert (Coordinator)  MUHC  934-1934x35325  jamie.engert@mcgill.ca
& Staff
R. Mackay (Administrator)  SADB  398-4198  ross.mackay@mcgill.ca

Prerequisites:  BIOL 202, 300, 370 or permission of instructor.

Content:  The course covers recent advances in next generation sequencing and their applications to various fields in biology. The course also covers various examples of inherited and acquired human diseases, approaches to study and modeling them, and ethical implications related to the use of data derived from human subjects.

1.  Genome wide association studies: design, linkage disequilibrium, genetic risk scores (3 hours).
2.  Next generation sequencing methods: Applications to RNA, genomic DNA and cDNA including a workshop and work with your own real data (9 hours).
3.  Transcriptional regulation, chromatin structure and methods to study them including a workshop and hands-on CHIP-seq data analysis (6 hours).
4.  DNA Methylation and human diseases (3 hours)
5.  Genetic mosaicism and de novo mutations in human diseases (3 hours).
6.  Genetics of cancer ontogeny (4.5 hours)
7.  General developmental genetics and use of pluripotent stem cells (3 hours).
8.  Ethical, Legal, and Social Aspects of Human Genomics Research (4.5 hours).

Method:  Two 1.5 hour lectures per week.

Evaluation:  Mid-term, participation and final exam

BIOL 569 (Winter)
Developmental Evolution
(Given in alternate years; Not offered in 2021-2022)

Instructors:  H. Larsson (Coordinator)  Redpath Mus.  398-4086 x089457  hans.ce.larsson@mcgill.ca
E. Abouheif  N3/6  398-7190  ehab.abouheif@mcgill.ca

Prerequisites:  BIOL 303 and BIOL 304, or permission

Content:  This course is intended for advanced undergraduate and graduate students. Developmental Evolution (DE) examines the influence of developmental mechanisms on evolution. This course will focus on the emerging principles of DE, and will draw on data and examples from plants and invertebrate and vertebrate animals. The course will cover topics such as: homology, modularity, dissociation, co-option, evolutionary novelty, evolution of genetic cis-regulation, developmental constraint and evolvability, heterochrony, phenotypic and genotypic plasticity, and canalization to understand how development influences evolution.

Method:  The course will follow a seminar style format, in which the instructors present key lectures throughout the course, followed by student group presentations and discussions of topics chosen by groups of students from a list of suggested topics. Each student will also write a scientific-format paper on a topic approved by the instructors. The paper may be a review of current issues or a presentation of a novel approach to issues in developmental evolution.

Evaluation:  Student presentations, scientific paper and class participation
BIOL 573 (Summer)
Vertebrate Palaeontology Field Course (3 credits)

Instructors:  H. Larsson         Redpath Museum      398-4086 ext. 089457      hans.ce.larsson@mcgill.ca

Prerequisites:  BIOL 304, BIOL 352, or permission of instructor.

Content:  This course is intended for advanced undergraduate and graduate students. The primary objective for the course is to train students in collecting and analysis methods in vertebrate palaeontology. The course will be given at a selected Late Cretaceous (~70 million years old) locality in Alberta and/or Saskatchewan. Fieldwork will be conducted for approximately 18 days. During that time, students will have practical training with stratigraphic mapping, fossil prospection, identification and collecting. An emphasis will be placed on terrestrial vertebrate fossils (i.e. dinosaurs, crocodiles, and other reptiles) and palaeocommunity analysis.

Method:  Two-week field course in August.

Evaluation:  Based on results of an examination at the start of the course that tests understanding of preliminary readings, participation in field work, field book logs and discussions in the field.

Registration:  Students should contact Prof. Larsson no later than April 1 to sign up for the course (15 slots first come first served) and receive an instruction sheet. The course fee is approximately $1000 but will vary slightly from year to year. It covers all personal expenses such as equipment, camping and museum fees, food, vehicle rentals and fuel, but not tuition or transportation to a designated Alberta/Saskatchewan meeting place. A minimum of 6 students is required for the course to be offered. Further information appears on notices in the Redpath Museum in February/March and on the course web site that can be accessed from Prof. Larsson’s home page. The latter can be reached via the Biology home page Faculty link.

BIOL 575 (Fall)
Human Biochemical Genetics

Instructors:  N. Braverman (Coordinator)  MUHC  934-1934x23404  nancy.braverman@mcgill.ca
R. Mackay (Administrator)  SADB  398-4198  ross.mackay@mcgill.ca

Prerequisites:  BIOL 202, 300 or permission.

Content:  The science of genetics has allowed major advances into our understanding of the basis of human disease. This course touches on how the study of human systems has led to advances in basic biology. Topics to be covered include disorders of folate and cobalamin transport and metabolism, lysosomal storage disease, peroxisome disorders, genetics of lipoproteins and human disease, genetics of steroid receptors, genetics of collagen and mitochondrial disease.

Method:  Two 1.5 hour lectures per week. In addition, 3-4 student groups will be established from the class and each will be responsible for giving presentations in areas related to the topics covered. Each presentation will be done during an allotted lecture time.

Evaluation:  1.5-hour mid-term; group presentations, 3 hour final
BIOL 580 (Fall)
Genetic Approaches to Neural Systems

Instructor: M. Hendricks (co-ordinator) 5/11 398-6581 michael.hendricks@mcgill.ca
A. Watt Bellini 265 398-2806 alanna.watt@mcgill.ca

Prerequisites: BIOL 306 or NSCI 200 or NSCI 201 or PHGY 311 or permission of instructor.

Content: This course is an examination of recent research employing cutting-edge genetic tools to examine the functional and structural properties of the nervous system. The focus will be on genetic methods for studying neural circuits and behavior, in a range of model organisms. Topics will include recent technological advances, such as optogenetics for modifying and controlling neuronal activity, and animal models of neurological diseases. Students will critically analyze the application of these methods to current research through in-class discussion of primary literature, student presentations, and written assignments, as well as peer evaluation of the work of other students.

Method: Background lectures will be given on specific topics. The focus of the class will be on student presentations, discussion and critical evaluation of primary research articles.

Evaluation: Participation in discussions, presentation, term paper, assignments, peer evaluation

BIOL 588 (Fall)
Advances in Molecular/Cellular Neurobiology

Instructors: K. Hastings MNI 398-1852 ken.hastings@.mcgill.ca
Y. Zhou MNI yang.zhou7@mcgill.ca
& Staff

Prerequisite: BIOL 300 and 306, or permission of instructor.

Content: The main objectives of the course are to expose final year neurobiology undergraduates and graduate students in neuroscience disciplines to:

1) Recently published studies in which molecular biological research methods have provided new insight into the role of specific genes and proteins in the nervous system.
2) The critical analysis of scientific research papers in an organized round table discussion setting. The lecture topics vary somewhat from year to year but the following are almost certain to be covered in one form or another in each year: gene expression in the nervous system, gene and protein isoform families and alternative RNA splicing, membrane protein synthesis, neuronal growth factors, synaptogenesis, cell adhesion molecules/extracellular matrix, cytoskeleton, ion channels, signal transduction systems and molecular genetics of neurological mutants in man and experimental animals. Students develop skills in understanding and communicating scientific information.

Method: Following a short series of introductory lectures, the course consists of an alternating series of topic-focused lectures (Thursdays) and corresponding discussion sessions (Tuesdays). Each lecture will cover the basic principles of some aspect of cell/molecular neurobiology. A recently published research article related to the lecture topic will be assigned, and the paper will be discussed in detail in the next discussion session. During discussion sessions students are asked to interpret specific Figures and Tables in the research articles in terms of experimental technique, conclusions drawn, and relevance to the overall point of the paper. Towards the end of the term
the class has an informal meeting with a guest scientist who is an invited seminar speaker at the university and whose recent work they have already discussed as a group. Besides providing the investigator’s own viewpoint of specific neurobiology issues, this meeting is an opportunity to consider broader research issues including career development and the behind-the-scenes thinking and work that underlies published scientific papers.

**Evaluation:** Participation in discussion sessions counts for three-quarters of the grade. A class test will count for the remainder.

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**BIOL 592 (Fall)**

**Integrated Bioinformatics**

**Instructors:** P. Harrison  N7/16  398-6420  paul.harrison@mcgill.ca

**Prerequisites:** BIOL 301 (or equivalent); or permission

**Restriction:** Not open to students who are taking or have taken, BINF 511; may not be used as a program course for students in Computer Science programs

**Content:** This course is an integrated overview of bioinformatics, primarily for biology students. We will cover a range of bioinformatics methods that are useful for the experimental biologist to aid in interpretation of data and experimental design. We will work through some specific examples, primarily using internet-based tools. The course is also useful as an introduction for students wishing to progress to further study in bioinformatics.

**Topics will be as follows:**
- Introduction to databases
  - Basic tips for use of bioinformatics tools and manipulation of bioinformatics data on the computer.
- Sequence alignment and database searching for homologs.
- Gene annotations and how to interpret them; ‘next-generation’ sequencing data.
- Annotation of non-coding DNA: transposable elements, pseudogenes and RNAs.
- Comparing genomes
- Networks and pathways of proteins and genes
- Classifications of protein function and their use for analyzing data sets of genes/proteins.
- Annotating and examining features in proteins (protein domains, motifs, disordered regions)

**Method:** There are two 1.5 hour lecture, demonstration or discussion sessions per week. The demonstration sessions are for bioinformatics tools on the internet, or which can be installed on a computer. There are six short take-home assignments, based on the lecture material. Students are asked to make a 15-minute presentation on a bioinformatics paper that they can choose from a list provided, or which they can pick for themselves.

**Evaluation:** Assignments, presentation and class participation
BIOL 594 (Fall)
Advanced Evolutionary Ecology
(Not offered in 2021-2022)

Instructor: A. Hendry  
Redpath Museum  
398-4086 x00880  
andrew.hendry@mcgill.ca

Workload: 3 credits (3-0-6)

Prerequisites: BIOL 304, BIOL 308 or permission

Content: Interactions between ecology and evolution, particularly as they play out on contemporary time scales. The class is based on 12 chapters of an in-press book by the instructor on *Eco-Evolutionary Dynamics*. Chapters (and therefore lecture/discussion topics) include natural selection, adaptation, adaptive divergence, gene flow, ecological speciation, population dynamics, community structure, ecosystem function, plasticity, and genetics.

Method: You must read assigned chapters/papers, attend classes, and regularly contribute to class discussions. In addition, each student will design and complete a scientific paper in a style suitable for submission to a peer-reviewed journal. Actual submission to journal is not necessary but every effort will be made to facilitate submission of suitable papers. Papers can include new theoretical models or literature reviews that test the predictions of existing models. Many previous papers from the class have been published in peer-reviewed journals and some have garnered many citations.

Evaluation: Class participation and scientific paper

BIOL 596 (Winter, 1 credit)
Advanced Experimental Design
(Not offered in 2021-2022)

Instructors: Jon Sakata  
N4/8  
514-398-3636  
jon.sakata@mcgill.ca

Prerequisite: BIOL 373 or equivalent and permission of instructor

Content: This course is aimed at graduate students in the Department of Biology and at upper-level undergraduates planning for data collection. As the course title indicates, the focus is on experimental design as a key step in experimentation with, and observation of, biological systems. The course will be oriented to help the students with the specific challenges that they are facing (or will be facing) in their own research. It will consist of three blocks: (i) formal lectures, (ii) discussions of scientific papers and of model experiments, and (iii) students presentation of their own experiments including hypothesis, design and challenges.

Evaluation: Based on discussions, presentation and written reports
BIOL 597 (Winter, 2 credits)
Advanced Biostatistics
Not offered in 2021-2022

Instructors: Jon Sakata  N4/8  514-398-3636  jon.sakata@mcgill.ca

Prerequisites: BIOL 373 or equivalent, and permission of instructor; BIOL 596 recommended

Content: This course will be oriented to help graduates and upper division undergraduates with data analysis challenges they are facing in their own research. It is designed to be an extension of BIOL 596, Advanced Experimental Design. ANOVA, regression, mixed models, information theory, etc.

Readings: Selected readings from textbooks, journal articles

Method: It will consist of formal lectures, discussions of scientific papers and model experiments, student discussions of analytical techniques, and student presentations of the application of statistical approaches to their own data.

Evaluation: Based on written assignments, class presentations and participation.

BIOL 598 (Winter, 3 credits)
Advanced Design and Statistics116
Not Offered in 2021-2022

Instructor: Jon Sakata  N4/8  514-398-3636  jon.sakata@mcgill.ca

Prerequisite: BIOL 373 or equivalent and permission of instructor

Restrictions: Not open to students who have taken BIOL 596 and/or BIOL 597

Content: The first part of the course focuses on experimental design as a key step in experimentation with and observation of biological systems. The second part of the course will help graduate and upper division undergraduate students with data analysis challenges they are facing in their own research. ANOVA, regression, mixed models, ordination, information theory, etc.

Method: It will consist of formal lectures, discussions of scientific papers and model experiments, student discussions of analytical techniques, and student presentations of the application of statistical approaches to their own data.

Readings: Selected readings from textbooks, journal articles

Evaluation: Based on written assignments, class presentations and participation.
ABOUHEIF, Ehab  Professor  N3/6  (514) 398-7190
EHAB.ABOUHEIF@MCGILL.CA
Evolutionary developmental biology: comparative and functional gene expression studies in ants and other insects are used to study the evolution of developmental regulatory genes and gene networks; the importance of ecological influences on development and evolution; and the relationship between molecular and morphological evolution.

BARTRETT, Rowan  Associate Member  Redpath Museum Rm 207  (514) 398-4086
X00856  ROWAN.BARRETT@MCGILL.CA
My work is motivated by a desire to understand the genetic basis of adaptation to changing environments. My research bridges theoretical and empirical approaches in population genetics, evolutionary ecology, and molecular biology to ask questions about the reciprocal interactions between ecological and evolutionary processes. I pursue this research program with a variety of key study systems, including stickleback fish, deer mice, and microbes.

BELL, Graham  Professor and Chairman  (514) 398-6458
GRAHAM.BELL@MCGILL.CA
Experimental studies of adaptation using yeast, Chlamydomonas and bacteria as model systems. The rate and effect of mutations and the dynamics of selection. Genetic variation and species diversity in environments that vary in space and time, and the evolution of specialists and generalists. Field experiments using genetically well known model organisms.

BELLINI, Francesco  Adjunct Professor  BELLUS Health Inc
FBELLINI@PICCHIO-INTL.COM  FBELLUS@PICCHIO-INTL.COM
Fields of research include microtubule dynamics in cells, the molecular basis of cell shape and the biophysical mechanisms by which cells engineer these large-scale structures, the role of microtubule motors and other microtubule-associated proteins in cellular processes, and the biophysical mechanisms by which cells engineer these large-scale structures.

BROUHARD, Gary  Associate Professor  (514) 398-2984
GARY.BROUHARD@MCGILL.CA
Cells adopt a range of shapes and can build an amazing variety of structures from proteins. We are interested in the biophysical mechanisms by which cells engineer these large-scale structures—in other words, the molecular basis of morphology. The subject of our current research is the microtubule cytoskeleton. We investigate the proteins that control the microtubule cytoskeleton, namely microtubule polymerases, motor proteins, and other microtubule-associated proteins. The lab uses the techniques of single-molecule biophysics, which shed light on the fundamental workings of these important enzymes.

BROWN, Gregory G.  Emeritus and Post-Professor  GREG.BROWN@MCGILL.CA
Yeast genomics. Molecular biology of protein secretion and cell surface assembly in yeast.

BUREAU, Thomas E.  Associate Professor  N4/1  (514) 398-6472
THOMAS.BUREAU@MCGILL.CA
Molecular evolution of genes and genomes, with an emphasis on the involvement of mobile elements in the evolution of developmentally important genes. Determination of the transposition mechanisms of novel mobile elements, including MITEs (miniature inverted-repeat transposable elements). Development of genomics-based approaches to study genome evolution. Examination of the role of retroelement-mediated cellular gene transduction in the evolution of retroviruses.
CHAPMAN, Lauren  Professor  N3/12A  (514) 398-6431
    LAUREN.CHAPMAN@MCGILL.CA
    Aquatic ecology and conservation, evolutionary and ecological consequences of respiratory strategies in fishes, Ecophysiology, ecomorphology, adaptive divergence, tropical inland waters, Africa. Recent work focuses on divergent selection across oxygen gradients in fishes, the interaction of hypoxia with other environmental stressors (e.g., introduced species) and value of tropical wetlands in the maintenance of fish faunal structure and diversity.

CHASE, Ronald  Professor Emeritus  RONALD.CHASE@MCGILL.CA

CLARKE, Hugh  Associate Member  Royal Victoria Hospital  (514) 934-1934 x34748
    HUGH.CLARKE@MCGILL.CA
    Mammalian oogenesis and early embryogenesis. Changes in chromatin composition during oogenesis and early embryogenesis with the aim of identifying how these might control initial programming of gene expression. Intracellular signalling mechanisms that regulate oocyte growth.

Cristescu, Melania  Associate Professor  N6/1  (514) 398-1053
    MELANIA.CRISTESCU@MCGILL.CA
    Invasive species; genetic diversity and mutations of organism; aquatic ecosystems.

Dankort, David  Associate Professor  Bellini 264  (514) 398-2307
    DAVID.DANKORT@MCGILL.CA
    Cancer represents a failure of built-in protection mechanisms to quell rogue cells that have sustained oncogenic mutations. Paradoxically, many of the same mutated oncogenes that cause cancer also elicit a permanent growth arrest (senescence) or induce apoptotic cell death of primary cells: two such oncogenes are RAS and BRAF. One research goal of my laboratory is to determine mechanistically how a tumour cell subverts these growth restraints leading to unbridled proliferation and ultimately malignancy. We will use the power of mammalian genetics in ‘state-of-the-art’ genetically engineered mouse model and cell culture systems to define causative roles for RAS and BRAF-cooperating genes involved in lung cancer and melanoma developments and progression.

Davies, Jonathan  Adjunct Professor  1-604-822-5486
    J.DAVIES@UBC.CA
    Research Interests include: phylogenetic methods in ecology; phylogenetic community structure and ecosystem processes; evolutionary conservatism in plant phenology and responses to global change; and Integrating phylogenetic diversity metrics within conservation triage

Dent, Joseph A.  Associate Professor  N4/7A  (514) 398-3724
    JOSEPH.DENT@MCGILL.CA
    Molecular genetics of behaviour in C. elegans. Understanding the structure and function of ligand-gated chloride channels, how they are integrated into the synapse, and how they contribute to behavioural circuits. Evolution of channel subunit diversity. Developing new tools for the analysis of nervous systems.

Dhindsa, Rajinder S.  Professor Emeritus  RAJ.DHINDSA@MCGILL.CA

Dufort, Daniel  Associate Member  MUHC-RI, Glen EM0.3230  (514) 934-1934 x34743
    DANIEL.DUFORT@MUHC.MCGILL.CA
    My laboratory is interested in understanding the molecular mechanisms involved in the process of embryo implantation. We have demonstrated that the embryo secretes Wnt proteins which activate Wnt signalling in the uterus. We further demonstrated that inhibition of Wnt signalling impairs the implantation process illustrating the importance of this pathway in embryo implantation (in press, PNAS). This project will be aimed at characterizing the function of Wnt signalling in the uterus during the implantation process.


FRANÇOIS, Paul, Associate Member Rutherford Physics Bldg Rm 221 (514) 398-1635
PAULF@PHYSICS.MCGILL.CA
Theoretical biological physics: modelling of physical properties gene networks and their evolution, in the context of embryonic development.

FUSSMANN, Gregor Professor N7/18B (514) 398-1370
GREGOR.FUSSMANN@MCGILL.CA
Community ecology. Population and community dynamics; stability and complexity of food webs; the interplay of ecological and evolutionary dynamics; clonal structure of populations. Approach: both theoretical and empirical (laboratory and field experiments with aquatic organisms).

GERHOLD, Abigail Assistant Professor N3/11B (514) 398-6423
A.R.GERHOLD@GMAIL.COM
We are interested in how cell division occurs “in situ”, that is, how are fundamental mitotic processes adapted to the native environment in which a cell divides. We address this question using the adult germline stem cells and embryonic blastomeres of *C. elegans* as a model. We use a combination of live-cell imaging, quantitative image analysis and genetic approaches to investigate how different aspects of mitosis are modified by the adoption of cell fate during development, by physiological changes in the adult organism and by the complex architecture of mature tissues.

GONZALEZ, Andrew Associate Professor N3/2 (514) 398-6444
ANDREW.GONZALEZ@MCGILL.CA
Community ecology through a blend of experiment (both in the lab and in the field) and theory. Two major themes: 1) The causes and consequences of extinction in fragmented landscapes, and 2) Diversity and persistence in variable environments.

GREEN, David M. Associate Member Redpath Museum (514) 398-4086 x4088
DAVID.M.GREEN@MCGILL.CA
Evolution, biosystematics, and conservation biology. Geographic variation, population biology, cytogenetics, and molecular genetics of amphibians.

GREGORY-EAVES, Irene Assistant Professor (514) 398-6425
IRENE.GREGORY-EAVES@MCGILL.CA
My lab’s long term research goals are to make essential progress in our understanding of the structure and functioning of lakes and to quantify how these ecosystems have responded to the accelerated rate of change introduced by human activities over the Anthropocene. Central to this program is the ability to develop, scrutinize and integrate data from different sources: lake surveys, time series and field experiments.

GUICHARD, Frédéric Professor (514) 398-6464
FREDERIC.GUICHARD@MCGILL.CA
Theoretical ecology and complex system theory applied to inter-tidal ecosystems and to marine reserve design. Emergence of large scale patterns and dynamics from local interactions among individuals. Multi-disciplinary approach involving mathematical modelling, field experiments and remote sensing.

GUIGUENO, Mélanie Assistant Professor
MELANIE.GUIGUENO@MAIL.MCGILL.CA
We combine field and laboratory approaches to examine natural behaviour in natural settings and to examine links between behaviour, cognition, and the brain. Brain measures include fine-scale differences, such as neurogenesis. An important study system is avian brood parasitism, in which some parasitic species show female-biased sex differences in spatial behaviour in the field with associated sex differences in spatial memory and in the hippocampus (part of the brain responsible for spatial memory).

GUZMAN, Hector Adjunct Professor STRI (507) 212-8733
GUZMANH@SLEDU
Ecology and population dynamic of coral reefs; sclerochronology; conservation biology; human impacts on marine ecosystems, coastal management and marine pollution.
HARGREAVES, ANNA, Assistant Professor
ANNA.HARGREAVES@MCGILL.CA
Evolutionary ecology of species distributions and species interactions. We tackle topics of both theoretical and conservation interest, including: local adaptation and dispersal evolution at range edges; how these affect range stability and responses to global change; geographic patterns in biotic interactions (e.g. pollination, herbivory, competition) and biodiversity. Research emphasizes field experiments (usually with plants because they're the best), complimented by data synthesis, simulation models, and lab or greenhouse experiments.

HARRISON, Paul   Associate Professor
PAUL.HARRISON@MCGILL.CA
Bioinformatics and computational biology. Genome evolution and annotation; analysis and annotation of pseudogenes and their implications; protein folding, amyloidogenesis and the prion phenomenon; methods for protein structure prediction.

HASTINGS, Kenneth  Associate Member   Montreal Neurological Institute
KEN.HASTINGS@MCGILL.CA
Muscle gene regulation, evolution of muscle gene families and muscle cell subtypes, evolution and function of SL trans-splicing in the chordates.

HAYER, ARNOLD  Assistant Professor
ARNOLD.HAYER@MCGILL.CA
Our research is focused on three main areas: (1) Cytoskeletal dynamics during autonomous and collective mammalian cell migration, (2) polarity signaling within and between collectively migrating cells, and (3) coordination of cell motility between cells during vascular morphogenesis. We follow an interdisciplinary approach, using live-cell microscopy, fluorescence-based biosensors, microfabrication, and computational image analysis. By studying mechanisms that control autonomous and collective cell behavior, we aim to understand the fundamental principles of how cells are organized into tissue.

HEKIMI, Siegfried  Professor
SIEGFRIED.HEKIMI@MCGILL.CA
Molecular genetics of aging. To understand the mechanisms that govern the life span of animals, we use the nematode Caenorhabditis elegans as well as mice and human cells in culture to identify and characterize genes that affect physiological rates, including the rate of aging.

HENDRICKS, Adam  Associate Member   McConnell Engineering Bldg
ADAM.HENDRICKS@MCGILL.CA
HENDRICKS, Michael  Associate Professor
MICHAEL.HENDRICKS@MCGILL.CA

HENDRY, Andrew  Professor
ANDREW.HENDRY@MCGILL.CA
The evolution of biological diversity: adaptive radiation, ecological speciation, "rapid" evolution, natural selection and gene flow. Empirical systems currently include salmon, sticklebacks, and guppies. Methods include surveys of biological diversity, field and laboratory experiments, molecular genetics, quantitative genetics, and theoretical modelling.

HIPFNER, David  Adjunct Professor
DAVID.HIPFNER@IRCM.QC.CA
Dr. Hipfner has continued to study how epithelial tissue size and shape are controlled in the developing fly. In particular, his group has focused on a class of proteins, called kinases, that are key transducers of the signals inside cells that control these processes. By focusing on kinases that have clearly identifiable counterparts in more complex animals, this research will provide basic insights into how tissue growth and organization are regulated in humans, and how perturbation of this regulation may contribute to the establishment and progression of tumours.
KALFF, Jacob  Professor Emeritus  
JACOB.KALFF@MCGILL.CA

KRAMER, Donald  Professor Emeritus  
DONALD.KRAMER@MCGILL.CA

LARSSON, Hans  Associate Member  
HANS.E.LARSSON@MCGILL.CA  
Vertebrate palaeontology and developmental evolution. Palaeontological work focuses on terrestrial Mesozoic vertebrates in the Canadian arctic and explores signatures of ancient climate shifts in palaeo-faunas. Developmental evolution work addresses what developmental mechanisms (morphological and molecular) are responsible for changes in the evolution of vertebrate morphology.

LASKO, Paul F.  Professor  
PAUL.LASKO@MCGILL.CA  

LECHOWICZ, Martin J.  Professor Emeritus  
MARTIN.LECHOWICZ@MCGILL.CA  

LEFEBVRE, Louis  Professor Emeritus  
LOUIS.LEFEBVRE@MCGILL.CA  
Animal behaviour, feeding strategies of flock-feeding birds, social learning.

LEUNG, Brian  Associate Professor  
BRIAN.LEUNG2@MCGILL.CA  
Biological invasions, ecology of diseases, anthropogenic stressors. Addressing environmental issues through the synthesis of models (mathematical, computational, and statistical) with empirical data (literature, field or lab studies). Creating models for ecological forecasting, given uncertainty and sparse data. Developing decision theory, using risk analysis.

MCMILLAN, Owen  Adjunct Member  
MCMILLANO@SLEDU  
Origins of adaptive variation, the genetic basis of mating behaviour, and the ecological and evolutionary processes that shape genetic variation in natural populations.

MILLIEN, Virginie  Associate Member  
VIRGINIE.MILLIEN@MCGILL.CA  
The evolution of body size and morphological diversity in relation to environmental change: Ecotypic variation and climate change; The evolution of species on islands; The effects of climate change and isolation on morphological evolution; Functional morphology in fossil rodents and other mammals; Competition and community size structure among coexisting species; Species range shift under climate change and the emergence of Lyme disease in Southern Quebec.

MOON, Nam-Sung  Associate Professor  
NAM.MOON@MCGILL.CA  
Molecular genetics of cancer genes in Drosophila melanogaster. Multiple genetic changes are responsible for the development of human cancer. Often, genes that are altered in cancers are evolutionarily conserved and their functions can be studied in a model organism such as the fruit fly (Drosophila melanogaster). My research is focused on studying cancer related genes using Drosophila as a model organism. In particular, I am interested in understanding the in vivo function of RBF1, the Drosophila homologue of the RB (Retinoblastoma) gene, which is functionally inactivated in most types of cancer.
NILSON, Laura  Professor  N5/8  (514) 398-6448
LAURA.NILSON@MCGILL.CA
Developmental genetics in Drosophila melanogaster. Identification and analysis of genes required in the somatic follicle cells of the ovary for patterning of the future embryo. Genetic and molecular analysis of organization and morphogenesis of the ovarian follicular epithelium.

OHYAMA, Tomoko  Assistant Professor  Bellini 279  514-398-2124
TOMOKO.OYAMA@MCGILL.CA
How is sensory information processed to generate specific behaviour? Studies neuronal circuits and mechanisms in sensory-integration of behaviour using Drosophila larvae as a model system.

PAGE, Rachel  Adjunct Professor  STRI  507-212-8509
PAGER@S1.EDU
Vertebrate behavior, in particular predator-prey interactions, the sensory and cognitive ecology of foraging, and the effect of eavesdroppers on signal evolution.

POLLOCK, Laura  Assistant Professor  N7/4  514-398-8005
LAURA.POLLOCK@MCGILL.CA
My research addresses various topics in ecology, biogeography, and conservation, but I’m increasingly drawn to the pursuit of making sense of large-scale biodiversity patterns via statistical models.

POTVIN, Catherine  Professor  514-398-3730
CATHERINE.POTVIN@MCGILL.CA
Physiological ecology; global change; photosynthesis and productivity; experimental design and biostatistics; conservation biology; tropical ecology.

PRICE, Neil M.  Professor  N6/12  (514) 398-6468
NEIL.PRICE@MCGILL.CA

READER, Simon  Associate Professor  514-398-6421
SIMON.READER@MCGILL.CA
Animal behaviour, behavioural ecology, behavioural neuroscience, cognitive evolution. Research focuses on social behaviour and social learning in the laboratory and the field.

REYES LAMOTHE, Rodrigo  Associate Professor  Bellini 271  (514) 398-5137
RODRIGO.REYESLAMOTHE@MCGILL.CA
Dynamics of replication; chromosome organization, segregation and cell division.

RICCIARDI, Anthony  Associate Member  Redpath Museum  514-398-4089
TONY.RICCIARDI@MCGILL.CA

ROFF, Derek  Professor Emeritus  Univ. California

ROSENBLATT, David  Associate Member  Human Genetics N5/13  (514) 398-3600
DAVID.ROSENBLATT@MCGILL.CA
Inborn errors of cobalamin (Vitamin B12) and folate metabolism. Gene discovery and studies of gene product function in the cobalamin pathway. Gene discovery for autosomal recessive Mendelian disorders.
The normal development of an organism depends on the precise orchestration of cell division, differentiation and morphogenesis. Although much is understood about how developmental regulatory genes affect cell differentiation, little is understood about how they control cell proliferation. Using both genetic analysis and molecular approaches, the Roy Laboratory is engaged in the identification and characterization of genes that affect cell division throughout the course of development in *C. elegans*.

SAKATA, Jon  Associate Professor  N4/8  (514) 398-3636
JON.SAKATA@MCGILL.CA
I integrate behavioural, neurophysiological and molecular approaches to investigate the neural circuitry underlying social influences on vocal learning and control.

SCHOECK, Frieder  Associate Professor  N/12  (514) 398-6434
FRIEDER.SCHOECK@MCGILL.CA
We study cell-matrix adhesion and the actin cytoskeleton, in particular, how integrin-associated proteins regulate adhesion during muscle attachment and myofibril assembly in the fruit fly *Drosophila*. Our research will shed light on the regulation of integrin adhesion and its coordination with the actin cytoskeleton, and will lead to a better understanding of muscle disorders.

SCHOEN, Daniel J.  Professor  N3/8A  (514) 398-6461
DANIEL.SCHOEN@MCGILL.CA

SOPER, Fiona  Assistant Professor  N3/11A
FIONA.SOPER@MCGILL.CA
My research explores the interface between plant physiology and ecosystem nutrient cycling. What physiological and chemical traits shape plant nutrient uptake? And how do these plant traits drive ecosystem processes such as soil nutrient availability, productivity and trace gas emissions? I work across a range of biomes (with a current focus on tropical forests and am especially fascinated by drivers and responses to global change.

SUNDAY, Jennifer  Assistant Professor  N8/3  (514) 398-8885
JENNIFER.SUNDAY@MCGILL.CA
We are interested in understanding how species distributions respond to environmental change, through direct effects, adaptive capacities, and biotic interactions. We use macroecology, natural experiments, and controlled experiments - informed by theory - to build a predictive understanding of how population and communities will respond further to climate change. We focus mainly on marine, but also terrestrial ecosystems, to understand global and general processes.

TAKETO, Teruko  Associate Member  MUHC-RI, Glen EM0.3220l  (514) 934-1934 x34197
TERUKO.TAKETO@MCGILL.CA
Genetic mechanism of gonadal sex determination and differentiation in mouse models for sex reversal. Cause of infertility in the XY sex-reversed female mouse. Analysis of meiotic chromosomes

TORCHIN, Mark  Adjunct Professor  STRI  (703) 487-3770
TORCHINM@SLEDU
Marine population and community ecology, host-parasite interactions, invasion ecology, conservation biology.

VALLES, Henri  Adjunct Professor  Univ. of the West Indies  246-417-7101
HENRI.VALLES@CAVEHILL.UWI.EDU
Settlement and post-settlement processes of reef organisms; Coral disease and bleaching; Reef fisheries; Ecological indicators; Lionfish invasion; Queen conch management; Quantitative methods in ecology.
The overall objective of research in our laboratory is to understand molecular and organizational principles that underlie the assembly of functional neural circuits during development. Our research program is divided into two primary themes that focus on 1) the importance of neuron-glial interactions during development, and 2) the patterned growth and guidance of axons and dendrites. We are also interested in how perturbations of these processes contribute to neurological diseases, and how improved understanding of the underlying mechanisms can be used to promote repair in the injured or diseased CNS.

VOGEL, Jaclyn Associate Professor

The mitotic spindle plays an essential role in the transmission of genetic information during cell division in all eukaryotic cells. Our research focuses on spindle dynamics and cell cycle control mechanisms. We use budding yeast as a model for the detailed analysis of these evolutionarily conserved processes, using high-resolution microscopy, biochemistry, molecular genetics, and the analysis of relevant genetic networks and protein structure-function relationships using genomic and bioinformatics methods.

WATT, Alanna Associate Professor

We are interested in the development of neuronal circuits, and the early patterned network activity that is thought to play a role in this process. Using electrophysiology combined with two-photon and confocal imaging, my lab studies how network activity and other early events play a role in sculpting the developing cerebellum.

WEBER, Stephanie Assistant Professor

Cells are crowded with macromolecules that form highly organized yet dynamic structures. While advances in fluorescence microscopy enable us to visualize this spatiotemporal heterogeneity, the mechanisms underlying intracellular organization remain largely unknown. The Weber lab uses quantitative live-cell imaging and physical modeling to understand how biological systems establish and dynamically regulate spatial order in the cell and ultimately how these processes affect the growth and size of the whole organism.

WESTERN, Tamara Associate Professor

Correct growth and development in plants is inextricably linked with the characteristics of their cell walls. My research focuses on the mechanisms of cell wall production and modification using a combination of genetics and cell biology. We also address the ramifications of changes in cell wall properties on plant development through morphological and biomechanical studies.

WOOLLEY, Sarah Assistant Professor

Neuroethology. Neural mechanisms underlying the production and perception of social communication behaviors in songbirds using electrophysiology, behavioral analysis, molecular biology and computational methods.

ZETKA, Monique Associate Professor

Proper chromosome morphogenesis is required for the faithful segregation of chromosomes during meiosis and can be readily studied in the nematode Caenorhabditis elegans. The research goals of my laboratory are to investigate the function and regulation of meiotic chromosome organization using a combination of genetics, molecular biology and high-resolution cytogenetics.

ZHENG, Hugo Associate Professor

The overall goal of my research is to understand how plant intracellular membrane trafficking is regulated as cell morphology changes during plant development and in response to environmental stresses. We are using a GFP-based living cell imaging technology combined with genetic approaches to study how plant genes control these important processes. Another research we are interested is to use reverse genetic and
chemical genomic approaches to study the molecular regulation and function of very-long-chain fatty acid (VLCFA) biosynthesis and secretion in the production of waxes, seed oils, and sphingolipids.