BIOLOGY

Courses

All courses (except BIOL 899 and BIOL 999) are half courses (3.0 credit units) which are offered either in the fall or winter term if there is sufficient student interest. Detailed outlines of course content are available during the summer of each year. Most courses are offered in alternate years.

BIOM 800  Introduction to Mathematical Modeling in Ecology and Evolution
Modeling will be presented in the context of biological examples drawn from ecology and evolution, including life history evolution, sexual selection, evolutionary epidemiology and medicine, and ecological interactions. Techniques will be drawn from dynamical systems, probability, optimization, and game theory with emphasis put on how to formulate and analyze models. Three term hours. Not offered 2022-23.

BIOL 801  Evolutionary Medicine
A survey of the ways in which concepts from evolutionary biology can be used to better address and understand issues related to human health. Topics might include the evolutionary biology of infectious diseases, the utility of phylogenetics in infectious diseases, the evolution of drug (e.g., vaccines) and antibiotic resistance, the evolutionary biology of human genetic disorders, aging and senescence. Three term hours. Not offered 2022-23.

BIOL 806  Plant Molecular Biology
Model systems for plant molecular genetics; gene identification and cloning; gene transfer techniques including vector construction; transposons; genetic regulation and expression. Not offered 2022-23.

BIOL 811  Plant Metabolism
This course explores contemporary research ideas and techniques used to elucidate plant metabolism and its control. Topics include plant signal transduction, plant metabolic adaptations to abiotic and biotic stress, as well as the application of proteomics, genomics, and molecular biology for comprehending plant metabolism and the production of 'improved' transgenic crops via metabolic engineering. Not offered 2022-23.

BIOL 812  Introduction to computational analysis in biology
This course will be a hands-on introduction to essential bioinformatics skills. The goal is to build a foundation of computational skills that enable analysis of large biological data. We will learn command line Unix/Linux, shell scripting, and installation/testing/usage of popular public bioinformatics packages. We will spend significant time learning Perl and/or Python and Matlab. The course will rely heavily on problem based learning and in class discussion. Assignments will involve analyses that use primary literature data, particularly next gen sequencing data. 50% of the final grade is based on a research project conceived and carried out independently. No prior programming experience is necessary. Three term hours. Winter. R. Colautti.

BIOL 813 Statistical and Machine Learning in Biology
A course in advanced techniques for analyzing biological data. Possible topics include statistical and machine learning (e.g. likelihood models, Monte Carlo methods, approximate Bayesian computation), and neural networks (e.g. deep, recursive, convolutional). Topics covered will depend upon student and faculty interests. Lectures & Tutorials (3hrs). Course weight: 3.0 credit units. Three term hours. Not offered 2022-23.

PREREQUISITE: BIOL 860 & BIOL 812 or equivalent

BIOL 817  Contemporary Issues in Biology
The focus will be on biological issues of current importance to provide a broad exposure within a range of specific disciplines. Topics will include critical analysis of biological issues that have been featured as news items either in the popular press or in science news journals within the previous 12 months. Three term hours. Not offered 2022-23.

BIOL 818  Stress Biology
Environmental stress is addressed with respect to water, nutrition, temperature, toxins, and competition between organisms. Topics include adaptations to cope with stress; biological responses at the organismal, cellular, biochemical, physiological and molecular genetic levels. No specialized molecular biology background is required. Three term hours. Not offered 2022-23.

BIOL 819  Selected Topics in Molecular Genetics
Topics will range from population genetics to transcriptional regulation in both plants and animals. Application of the tools of molecular genetics to biological problems will be emphasized. No previous specialization in molecular biology is required, although some background in this area is highly recommended. Three term hours. Not offered 2022-23.

BIOL 820  Commercialization of Biological Research
Current issues relating to the biotechnology industry will be dealt with in detail. Topics covered include: grant writing; patenting; circumventing patents; funding sources; business plans; venture capital investments; public awareness; public perspective; and layperson presentations. Three term hours. Fall. K. Ko.
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primary literature. Hands on analytical experience will be
lectures, student seminars, and readings from the current
thorough theoretical grounding of pertinent topics via
macroevolution, and phylogenetics. Students gain a
parentage and mating systems, speciation, hybridization,
Topics may span natural selection and phenotypic plasticity,
year to year depending on the expertise of the instructor.
is an exploration of these with emphases varying from
address evolutionary and ecological questions. This course
advances in analytical techniques for using molecular data to
Each year brings new molecular tools and significant

BIOL 830  Ecological and Evolutionary Genetics
Each year brings new molecular tools and significant
advances in analytical techniques for using molecular data to
address evolutionary and ecological questions. This course
is an exploration of these with emphases varying from
year to year depending on the expertise of the instructor.
Topics may span natural selection and phenotypic plasticity,
parentage and mating systems, speciation, hybridization,
macroevolution, and phylogenetics. Students gain a
thorough theoretical grounding of pertinent topics via
lectures, student seminars, and readings from the current
primary literature. Hands on analytical experience will be
provided through student exercises using the latest software
applications. Three term hours. Fall. A. Chippindale.

BIOL 831  Bioremediation
Bioremediation is the use of organisms to alleviate
environmental problems. Topics will include the biology of
the organisms involved and their bioremediation processes.
Plants act to absorb and concentrate heavy metals from
soils whereas micro organisms, invertebrates and plants
degrade organic toxins and remove excess nutrients from
soils, substrates and water. The processes include extraction,
absorption, concentration, and degradation of contaminants.
Three term hours. Not offered 2022-23.

BIOL 839  Plant Ecology and Evolution
Mechanisms of natural selection involving adaptive strategies
for growth, survival and reproduction in plants and the
consequences of this selection on the characteristics of plant
populations and communities. Recent research topics and
theoretical developments are stressed. Three term hours. Not
offered 2022-23.

BIOL 843  Advanced Data Management and
Experimental Design
This course provides an introduction to advanced statistical
methods (multivariate analysis, randomization methods,
phylogenetic analysis) and experimental design for biologists.
The emphasis is on problem solving and the use of
microcomputers for data acquisition, management, analysis
and publication. Three term hours. Not offered 2022-23.
PREREQUISITE OR COREQUISITE: BIOL 343 or equivalent.

BIOL 847  Data Analysis in Community and Paleoecology
A variety of quantitative techniques are now being used
increasingly in the fields of community ecology, paleoecology
and paleolimnology (e.g. linear and unimodal regression
and calibration, direct and indirect multivariate ordination,
quantitative reconstruction models, rate of change analysis
and analysis of spatial and temporal data). This course will
investigate these computational techniques and explore
their applications in the above mentioned fields. This course
assumes a working knowledge of classical statistics. Three
term hours. Winter. B.F. Cumming. PREREQUISITE: BIOL 343 or permission by instructor.

BIOL 848  Field Course in Population Biology
This is a two week field course designed to introduce
graduate students to field research problems and methods
in behavioural ecology, ethology, population and community
ecology, and ecological genetics. The course consists of
lectures, field research projects and data analysis. Fall/Winter/

BIOL 849  Environmental Issues

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Consideration will be given to environmental, legal, economic, political, sociological and biological aspects of current issues in the management of the Great Lakes. Models for managing nutrients, toxics and fisheries will be compared from a multidisciplinary viewpoint. Three term hours. Not offered 2022-23.

**BIOL 850  Darwinism and cultural evolution**
Contributions of Darwinian evolutionary theory to the understanding of contemporary culture. Through seminars, essays, and group discussions, students explore ideas, research objectives, and recent discoveries in applying Darwinism to the interpretation of cultural products like art and literature, social cultural institutions like religion and marketing, societal problems like war and environmental conservation, and emerging designs for new models of sustainable civilization in the 21st century. Three term hours.  
Winter.  L.W. Aarssen  
EXCLUSION: BIOL 535

**BIOL 855  Conservation Biology**
Key issues in conservation biology will be explored in seminars and discussions. Topics will include: minimum viable populations, habitat configuration and sustainable populations, biodiversity, habitat fragmentation, edge effects, keystone species, meta populations, restoration ecology, endangered species, inbreeding, heterozygosity and fitness, genetics of captive breeding, population genetics and conservation. Three term hours. Not offered 2022-23.

**BIOL 860 Introduction to Management and Statistical Analysis of Biological Data**
This course is for students at early stages of planning research and collecting data. Topics include experimental design, matching hypotheses with statistical analyses, parameter estimation and graphing. Analyses will be based on a normal error distribution implemented in the R statistical language. Lectures. (3 hrs) & tutorials (3 hrs); First 6 weeks of fall term. Enrolment may be limited. Course weight: 3.0 credit units. Three term hours. Not offered 2022-23.

**BIOL 862 Application of Generalized Linear Models to Biological Data**
Data analysis in Biology often involves counts, densities or proportions that require non Normal analysis. This course introduce generalized linear models (GLMs) implemented using the R statistical language, including logistic regression, overdispersion and Poisson, quasi likelihood, negative binomial and mamma models. Lectures (3 hrs) & tutorials (3 hrs). Second 6 weeks of fall term. Enrolment may be limited. Course weight: 3.0 credit units. Not offered 2022-23.

**BIOL 863 Introduction to Mixed Effects Models for Biological Data**
The course will focus on linear models that include random effects implemented using the R statistical language. Topics will include partitioning of random variance, nested, partially nested and repeated measures experimental designs, and modern approaches to evaluating competing models. Lectures (3 hrs) & tutorials (3 hrs). First 6 weeks of winter term. Enrolment may be limited. Course weight: 3.0 credit units. Not offered 2022-23.

**BIOL 865 Advanced Statistical Analysis of Biological Data**
A course in advanced statistical techniques for biological data. Possible topics include comparative methods, phylogenetic analysis, general additive models, nonlinear regression, network analysis, time series analysis, resampling, path analysis. Topics covered will depend upon student and faculty interests. Lectures & Tutorials (3hrs). Course weight: 3.0 credit units. Not offered 2022-23. PREREQUISITE: BIOL 860 & BIOL 812 or equivalent.

**BIOL 870 Classical Studies in Molecular Biology**
In this course we will explore advances in molecular biology and genetics with a historical perspective. We will read classical papers outlining major discoveries such as the molecular structure of nucleic acids, the genetic code, the genetic basis of inheritance, and others. Classical studies will be paired with modern studies that build upon these earlier findings. Modern studies will change each year depending on the interests of the students. A major goal of the course is to gain an appreciation for how creativity and carefully designed experiments drive innovation. Students should have foundational knowledge of molecular biology and genetics, as evidenced by a BSc degree that included courses in these subjects. Three term hours. Winter. Not offered 2022-23.

**BIOL 889 Mentoring Experience in Biology**
Students will advise and train other students in biological investigations, normally over a two term period. Open to full time students having completed two terms of study in Biology M.Sc. or Ph.D. programs. Activities include guidance
on research proposals, research procedures, student presentations, and drafts of student work. This is a non-credit course, graded on a Pass/Fail basis.

**PREREQUISITE:** Permission of Coordinator of Graduate Studies

**BIOL 897 Seminar Course**
Attending a diverse array of seminars is an essential component in the development of a student, especially in a department as diverse as biology. The aim of this course is to develop skills in listening, synthesizing and critical thinking, as well as fostering the development of important oral and written communication skills. Students will be required to attend at least 30 department or specialized research seminars, as well as present a seminar based upon their graduate thesis research. Enrolment is extended over six terms and is limited to new graduate students in Biology. Fall/Winter/Summer. L. Seroude.

**BIOL 899 Master's Thesis Research**

**BIOL 951 Advanced Studies in Ecology, Evolution and Behaviour I**
Selected topics in ecology, evolution and behaviour. An advanced course on current research in ecology, evolution and behaviour, based on recent research literature. For detailed information, consult the course coordinator. Three term hours. Not offered 2022-23.

**BIOL 952 Advanced Studies in Ecology, Evolution and Behaviour II**
Selected topics in ecology, evolution and behaviour. An advanced course on current research in ecology, evolution and behaviour, based on recent research literature. For detailed information, consult the course coordinator. Three term hours. Not offered 2022-23.

**BIOL 953 Advanced Studies in Plant Sciences I**
Selected topics in plant sciences. An advanced course on current research in plant science, based on recent research literature. For detailed information, consult the course coordinator.

**BIOL 954 Advanced Studies in Plant Sciences II**
Selected topics in plant sciences. An advanced course on current research in plant science, based on recent research literature. For detailed information, consult the course coordinator.

**BIOL 955 Advanced Studies in Molecular and Cellular Biology I**
Selected topics in molecular biology. An advanced course on current research in molecular biology, based on recent research literature. For detailed information, consult the course coordinator. Three term hours. Fall. G. diCenzo and S. Regan.

**BIOL 956 Advanced Studies in Molecular and Cellular Biology II**
Selected topics in molecular biology. An advanced course on current research in molecular biology, based on recent research literature. For detailed information, consult the course coordinator. Three term hours. Fall. G. diCenzo and S. Regan.

**BIOL 957 Advanced Studies in Animal Physiology I**
Selected topics in animal physiology. An advanced course on current research in animal physiology, based on recent research literature. For detailed information, consult the course coordinator.

**BIOL 958 Advanced Studies in Animal Physiology II**
Selected topics in animal physiology. An advanced course on current research in animal physiology, based on recent research literature. For detailed information, consult the course coordinator.

**BIOL 959 Advanced Studies in Environmental Sciences I**
Selected topics in environmental sciences. An advanced course on current research in environmental sciences. For detailed information, consult the course coordinator.

**BIOL 960 Advanced Studies in Environmental Sciences II**
Selected topics in environmental sciences. An advanced course on current research in environmental sciences. For detailed information, consult the course coordinator.

**BIOL 999 Ph.D. Thesis Research**

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