

BIOLOGY

Departmental Notes

Subject Code: **BIOL**

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Overview

Queen's Biology students have the opportunity to explore the full breadth of biology: the inner workings of cells; the integrative biology of organisms; the interactions between organisms in ecological communities; and the central roles of genetics and evolution in shaping the diversity of life. Hands-on laboratory exercises, field courses offered locally at our renowned Queen's University Biological Station (<https://qubs.ca/home/>) and around the world, and independent research opportunities in professors' laboratories on selected topics are hallmarks of a Degree Plan in Biology. The mission of Queen's Biology is to prepare graduating students to be engaged, independent, and critically thinking citizens, well-prepared for further study and with a variety of career options.

Departmental Policies

Academic policies of the Department of Biology are outlined on the Department's website (<https://biology.queensu.ca/>) and course syllabi. Some Biology courses may require students to cover costs such as laboratory manuals and

field trips. Laboratory manuals may contain important information on issues specific to the course of study such as laboratory safety, the ethical use of animals, and academic integrity. All students are expected to read and follow these departmental policies, which complement the Code of Conduct and Academic Regulations (<https://queensu-ca-public.courseleaf.com/arts-science/academic-regulations/>) described elsewhere in this *Calendar* and on the Biology website.

Advice to Students

Students have some flexibility in selecting courses that can be credited toward biology concentrations. However, judicious planning is required in order to avoid conflicts. For example, physics is optional for B.Sc. degree plans but is recommended in specific areas of biology. To avoid course conflicts in upper years, students are advised to plan their course of study in consultation with an Academic Adviser in the Department of Biology upon admission, and again at the beginning of second year. Academic Advisers are available for consultation and program approval.

To assist students in designing a Biology degree Plan, planners for four different course streams are described on the departmental website. These streams are

1. Genetics and Molecular Biology,
2. Plant Biology,
3. Integrative Animal Biology, and
4. Ecology and Evolutionary Biology,

each representing a sub-discipline within biology corresponding to teaching and research specializations of faculty within the Department of Biology. Students who wish to cater their degree Plan and specialize in one of these areas are encouraged to use the appropriate planner to help in mapping out course selections. Suggestions are given for courses to select from Biology as well as supporting courses that are offered by other departments. Course streams are not formal degree Plan options in Biology, and some students may prefer to sample broadly from across all four areas.

Students wishing to take a single elective course in Biology are advised to take BIOL 110 Human Genetics and Evolution/3.0, BIOL 111 Ecology and the Environment/3.0, or BIOL 350 Evolution and Human Affairs/3.0. Those wishing to take more elective courses in Biology are advised to consider that most courses have prerequisites, which include the core courses described in the following Plans.



Special Study Opportunities

Admission to 400- and 500-level Biology Courses

Admission to 400- and 500-level Biology courses requires a minimum cumulative GPA of 2.0 in any previously taken courses from the **Biological Foundations List (BIOL_FNDS)** regardless of Degree Plan. Requests for special consideration must be submitted to the Chair of Undergraduate Studies (kok@queensu.ca).

BIOL_FNDS

Code	Title	Units
BIOL 102	Fundamentals of Biology: Molecular and Cell Biology	3.00
BIOL 103	Fundamentals of Biology: Organisms to Ecosystems	3.00
BIOL 200	Diversity Of Life	3.00
BIOL 205	Mendelian and Molecular Genetics	3.00
BIOL 206	Evolutionary Genetics	3.00
BIOL 212	Scientific Methods in Biology	3.00
BIOL 300	Ecology	3.00
BIOL 330	Cell Biology	3.00
BIOL 334	Comparative Biochemistry	3.00
BIOL 339	Animal Physiology	3.00
BIOL 341	Plant Physiology	3.00

Advanced Honours Seminars

BIOL 501 – BIOL 535

Biology offers a series of advanced 3.0 unit seminars with emphases on reading primary literature, writing, presentation skills, and experimental enquiry. Small class sizes and extensive interaction with faculty help promote an independent, discovery-based learning experience. Topics and course numberings for seminar offerings vary from year to year and are listed each spring for third-year students to consider. Normally, due to enrolment restrictions, students taking BIOL 537 Research in Biology will be permitted to take only one of these seminar courses and all other fourth-year students will be permitted to take a maximum of two. Preferred access will be given to students at Level 4 and registered in a B.Sc.(Hons.) program with a BIOL Plan.

Honours Thesis

BIOL 537 Research in Biology

The thesis course in Biology is a 12.0-unit, two-semester immersion in research that provides ideal preparation for graduate studies and research. Students follow the main steps of a graduate degree on a compressed schedule, from conception and proposal of a project to its execution, presentation in the form of a poster and public talk, a written thesis and a formal defense. Third-year students should

consult the Biology website for further information on the faculty members offering BIOL 537 Research in Biology placements, the specific projects available, and details on the application process.

Research Mentorship

BIOL 538 Research Mentorship in Biology I, BIOL 539 Research Mentorship in Biology II, BIOL 540 Research Mentorship in Biology

This family of courses offers students the opportunity to arrange, with a Biology faculty member and permission of the Department, a placement in a laboratory and literature-based research project of either 3.0 or 6.0 units. Students undertaking a Research Mentorship gain the hands-on experience of contributing to an active research laboratory and interacting with the researchers, as well as undertaking a customized independent study that compliments the laboratory's research program.

Field Studies in Biology

BIOL 307 Field Biology I, BIOL 317 Field Biology II, BIOL 327 Field Biology III

The Department of Biology is an active participant in the Ontario Universities' Program in Field Biology (OUPFB) and a leader among Canadian universities in providing unique learning experiences via one- and two-week modules locally and around the globe. Superb resources are available close to Kingston at our Queen's University Biological Station and the Elbow Lake Environmental Education Centre, and recent courses have touched every continent except for Antarctica.

Faculty

Lonnie W. Aarssen (<https://biology.queensu.ca/people/department/professors/lonnie-aarssen/>), Maria Aristizabal (<https://biology.queensu.ca/people/department/professors/maria-aristizabal/>), Shelley E. Arnott (<https://biology.queensu.ca/people/department/professors/arnott/>), F. Bonier (<https://biology.queensu.ca/people/department/professors/f-bonier/>), William Bendena (<https://biology.queensu.ca/people/department/professors/w-g-bendena/>), Peter Boag (<https://www.queensu.ca/gazette/media/expert/boag-peter/>), Ian D. Chin-Sang (<https://biology.queensu.ca/people/department/professors/chin-sang/>), Adam K. Chippindale (<https://biology.queensu.ca/people/department/professors/a-chippindale/>), Robert Colautti (<https://biology.queensu.ca/people/department/professors/r-i-colautti/>), Brian F. Cumming (<https://biology.queensu.ca/people/department/professors/cumming/>), Andrew J. Daugulis (<https://chemeng.queensu.ca/people/Faculty/AndrewDaugulis/>), Peter L. Davies (<https://biology.queensu.ca/people/department/cross-appointed-faculty/peter-l-davies/>), Troy Day (<https://biology.queensu.ca/people/department/cross-appointed-faculty/day1/>),

George C. diCenzo (<https://biology.queensu.ca/people/department/professors/george-dicenzo/>), Eric Dumont (<https://biology.queensu.ca/people/department/cross-appointed-faculty/eric-dumont/>), Christopher G. Eckert (<https://biology.queensu.ca/people/department/professors/eckert/>), Janice Friedman (<https://biology.queensu.ca/people/department/professors/jannice-friedman/>), Vicki Friesen (<https://biology.queensu.ca/people/department/professors/vicki-friesen/>), Paul Grogan (<https://biology.queensu.ca/people/department/professors/grogan/>), Peter V. Hodson (<https://www.queensu.ca/ensc/peter-hodson/>), Kenton Ko (<https://biology.queensu.ca/people/department/professors/ko/>), Daniel D. Lefebvre (<https://biology.queensu.ca/people/department/professors/lefebvre/>), William C. Leggett (<https://biology.queensu.ca/people/department/emeritus-faculty/>), Alexander Little (<https://biology.queensu.ca/people/department/professors/alexander-little/>), Stephen C. Lougheed (<https://biology.queensu.ca/people/department/professors/lougheed/>), Paul R. Martin (<https://biology.queensu.ca/people/department/professors/martin/>), Jacqueline Monaghan (<https://biology.queensu.ca/people/department/professors/jacqueline-monaghan/>), Robert D. Montgomerie (<https://biology.queensu.ca/people/department/professors/emeritus-professor-researchers/robert-montgomerie/>), Christopher D. Moyes (<https://biology.queensu.ca/people/department/professors/moyes/>), William A. Nelson (<https://biology.queensu.ca/people/department/professors/nelson/>), Diane Orihel (<https://biology.queensu.ca/people/department/professors/diane-orihel/>), W. Paterson (<https://biology.queensu.ca/people/department/adjunct-faculty/>), William C. Plaxton (<https://biology.queensu.ca/research/facilities/queen-s-university-phytotron/staff-and-associated-research-groups/plaxton/>), Laurene M. Ratcliffe (<https://www.queensu.ca/gazette/media/expert/ratcliffe-laurene/>), Sharon M. Regan (<https://biology.queensu.ca/people/department/professors/regan/>), Mel Robertson (<https://biology.queensu.ca/people/department/professors/emeritus-professor-researchers/mel-robertson/>), Laurent Seroude (<https://biology.queensu.ca/people/department/professors/seroude/>), John P. Smol (<https://biology.queensu.ca/people/department/professors/smol/>), Wayne Snedden (<https://biology.queensu.ca/people/department/professors/snedden/>), Peter Taylor (<https://biology.queensu.ca/people/department/cross-appointed-faculty/taylor/>), Bruce Tufts (<https://biology.queensu.ca/people/department/professors/tufts/>), Stephen Vanner (<https://biology.queensu.ca/people/department/cross-appointed-faculty/stephen-vanner/>), Virginia Walker (<https://biology.queensu.ca/people/department/professors/emeritus-professor-researchers/vwalker/>), Yuxiang Wang (<https://biology.queensu.ca/people/department/professors/wang/>), Sarah Yakimowski (<https://biology.queensu.ca/people/department/professors/sarah-yakimowski/>), Paul Young

(<https://biology.queensu.ca/people/department/professors/young/>)

Programs

- Biology and Mathematics – Specialization (Science) – Bachelor of Science (Honours) (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/biology/biology-mathematics-specialization-science-bs-honours/>)
- Biology and Psychology – Specialization (Science) – Bachelor of Science (Honours) (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/biology/biology-psychology-specialization-science-bs-honours/>)
- Biotechnology – Specialization (Science) – Bachelor of Science (Honours) (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/biology/biotechnology-specialization-science-bs-honours/>)
- Environmental Biology – Specialization (Science) – Bachelor of Science (Honours) (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/biology/environmental-biology-specialization-science-bs-honours/>)
- Biology – Major (Science) – Bachelor of Science (Honours) (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/biology/biology-major-science-bs-honours/>)
- Biology – General (Arts) – Bachelor of Arts (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/biology/biology-general-arts-ba/>)
- Biology – General (Science) – Bachelor of Science (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/biology/biology-general-science-bs/>)
- Biology – Minor (Arts) (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/biology/biology-minor-arts/>)
- Biology – Minor (Science) (<https://queensu-ca-public.courseleaf.com/arts-science/schools-departments-programs/biology/biology-minor-science/>)

Courses

BIOL 1LEC Unspecified Lecture-100 Level Units: 6.00

Offering Faculty: Faculty of Arts and Science



BIOL 102 Fundamentals of Biology: Molecular and Cell Biology Units: 3.00

The essential biochemistry, genetics, cell biology, and metabolic pathways underlying the survival and success of all living organisms. Themes and case studies could range from the application of genetic engineering in biotechnology to the role of cellular dysregulation in inheritable diseases.

NOTE Also offered online. Consult Arts and Science Online. Learning Hours may vary.

NOTE Also offered at the Bader International Study Centre, Herstmonceux. Learning Hours may vary.

LEARNING HOURS 111 (24L;6Lb;9G;12O;60P).

Requirements: Prerequisite None. Recommended 4U Biology and Chemistry, or equivalent high school background.

Offering Faculty: Faculty of Arts and Science

BIOL 103 Fundamentals of Biology: Organisms to Ecosystems Units: 3.00

The origins and diversification of multicellular organisms, their form, function and adaptation to stress and a changing world. Themes and case studies include energy flow from molecules to ecosystems, organismal interactions including parasitism and disease dynamics, and the impacts of human activity.

NOTE Also offered online. Consult Arts and Science Online. Learning Hours may vary.

NOTE Also offered at the Bader International Study Centre, Herstmonceux. Learning Hours may vary.

LEARNING HOURS 123 (36L;24Lb;24O;39P).

Requirements: Prerequisite None. Recommended BIOL 102.

Offering Faculty: Faculty of Arts and Science

BIOL 110 Human Genetics and Evolution Units: 3.00

Introductory genetics and evolutionary processes as they relate to the human condition - genetic diseases, medical techniques, inheritance and ethical issues such as cloning and genetically modified foods.

NOTE Also offered online. Consult Arts and Science Online. Learning Hours may vary.

LEARNING HOURS 118 (26L;10T;10G;36O;36P)

Requirements: Prerequisite None. One-Way Exclusion May not be taken with or after BIOL 102; BIOL 103.

Offering Faculty: Faculty of Arts and Science

BIOL 111 Ecology and the Environment Units: 3.00

Introduces the basic concepts of ecology and shows how they relate to environmental issues such as population growth, resource management, biodiversity, agriculture, air and water pollution, energy, and climate change, and to solutions leading to a sustainable environment.

NOTE Also offered online. Consult Arts and Science Online. Learning Hours may vary.

LEARNING HOURS 108 (36L;72P)

Requirements: Prerequisite None. One-Way Exclusion May not be taken with or after BIOL 300; BIOL 302; BIOL 303.

Offering Faculty: Faculty of Arts and Science

BIOL 200 Diversity Of Life Units: 3.00

This course provides a phylogenetically based overview of biodiversity across the Tree of Life including viruses; archaea, bacteria, algae, fungi, plants, invertebrates and vertebrates. Patterns of organizational complexity and species diversity are explained in the context of evolutionary processes, structure function relationships and ecology.

NOTE Textbook and onQ course site for distributing reading material.

LEARNING HOURS 120 (36L;18T;18O;48P)

Requirements: Prerequisite None. Exclusion BIOL 201; BIOL 202. Equivalency BIOL 201; BIOL 202. Recommended BIOL 102 and BIOL 103.

Offering Faculty: Faculty of Arts and Science

BIOL 205 Mendelian and Molecular Genetics Units: 3.00

An introduction to Mendelian and molecular genetics covering the basic mechanisms of genetic transmission, gene structure and function, as well as the application of molecular genetics in medicine and biotechnology.

LEARNING HOURS 120 (36L;18T;18O;48P).

Requirements: Prerequisite A GPA of 1.90 in (BIOL 102 and BIOL 103).

Offering Faculty: Faculty of Arts and Science

BIOL 206 Evolutionary Genetics Units: 3.00

An introduction to the genetic mechanisms of population differentiation and evolutionary change - from molecules to species. The genetical theory of evolution is also applied to problems involving conservation, biotechnology and the evolution of disease.

NOTE Priority to BIOL concentrators will be given during course selection.

LEARNING HOURS 120 (36L;18T;18O;48P).

Requirements: Prerequisite A minimum grade of a C- in BIOL 205.

Offering Faculty: Faculty of Arts and Science

BIOL 212 Scientific Methods in Biology Units: 3.00

A hands on laboratory course that establishes the fundamentals of scientific investigation and applies them to selected biological questions. Students will learn to develop hypotheses, design and execute experiments, and to analyze and present results. There will be four modules structured as: Cell, Organism, Population and Ecosystem.

NOTE Blended learning, online material and hands on activities in the lab.

NOTE QUBS Field Trip. Estimated cost \$35.

LEARNING HOURS 122 (8L;66Lb;24O;24P).

Requirements: Prerequisite A GPA of 1.90 in (BIOL 102 and BIOL 103).

Offering Faculty: Faculty of Arts and Science

BIOL 243 Introduction to Statistics Units: 3.00

An introduction to the analysis of data from real life situations. Covers study design, descriptive and inferential statistics. Topics include probability, t-tests, regression, Chi-square tests, analysis of variance. Emphasis is in the foundation of statistical inference and practical application of statistical methods using statistical software.

LEARNING HOURS 120 (36L;12T;72P)

Requirements: Prerequisite None. Exclusion CHEE 209; COMM 162; ECON 250; GPHY 247; KNPE 251; NURS 323; PHED 251; POLS 385; PSYC 202; SOCY 211; STAM 200; STAT 263; STAT 267; STAT 367. One-Way Exclusion May not be taken with or after STAT 269.

Offering Faculty: Faculty of Arts and Science

BIOL 300 Ecology Units: 3.00

An exploration of the relationships between living things and their environment in an evolutionary framework. Topics include constraints, organismal ecology, population dynamics, interactions, community structure, energy and elemental flow through ecosystems, and global diversity patterns. We will collect, analyze, and interpret ecological data.

NOTE In-person version includes a required field trip (additional cost)

LEARNING HOURS 118 (36L;21Lb;12O;16Oc;33P)

EQUIVALENCY BIOL 302/3.0 and/or BIOL 303/3.0.

Requirements: Prerequisite BIOL 103. Exclusion BIOL 302; BIOL 303. Recommended BIOL 206, BIOL 212, and second year statistics (e.g. BIOL 243, PSYC 202, STAT 269).

Offering Faculty: Faculty of Arts and Science

BIOL 307 Field Biology I Units: 3.00

Two weeks of field work plus written assignments in one or two areas of study to be done when specialized modules are available in May, July, August or February. Studies may include ecology of birds, fish, insects, small mammals, plants, tundra and taiga, lakes and caves. The schedule of offerings for each year is available in January.

NOTE Field trip: estimated cost of each module and the schedule of offerings for each year is available in January.

Requirements: Prerequisite (BIOL 102 and BIOL 103) and registration in a (BIOL Major, BIOL Science Minor/General or a BIMA, BIPS, BTEC or EBIO Specialization).

Offering Faculty: Faculty of Arts and Science

BIOL 308 Field Studies in Biology I Units: 1.50

One week of field work plus written assignments in one or two areas of study to be done when specialized modules are available in May, July, August or February. Studies may include ecology of birds, fish, insects, small mammals, plants, tundra and taiga, lakes and caves. The schedule of offerings for each year is available in January.

NOTE Field trip: estimated cost of each module and the schedule of offerings for each year is available in January.

Requirements: (BIOL201 AND BIOL202)

Offering Faculty: Faculty of Arts and Science

BIOL 315 Plants and Human Culture Units: 3.00

Human civilization depends on plants. We have changed them and they have changed us. This course investigates the biology and evolution of valuable economic plants, the science of plant domestication and genetic manipulation, and how our interactions with plants have altered the economy, politics, and sociology of human civilization.

LEARNING HOURS 120 (36L;24O;60P)

Requirements: Prerequisite BIOL 102 and BIOL 103.

Corequisite (BIOL 200 or BIOL 201).

Offering Faculty: Faculty of Arts and Science

BIOL 316 Fisheries Biology Units: 3.00

An introduction to the basic principles of fisheries biology and examination of the biological foundations of current problems affecting the world's fisheries, with an emphasis on developing sound science-based strategies to resolve these problems.

LEARNING HOURS 120 (36L;84P)

Requirements: Prerequisite BIOL 103. Corequisite (BIOL 200 or BIOL 202). Equivalency BIOL 415.

Course Equivalencies: BIOL316, BIOL415

Offering Faculty: Faculty of Arts and Science

**BIOL 317 Field Biology II Units: 3.00**

Two weeks of field work plus written assignments in one or two areas of study to be done when specialized modules are available in May, July, August or February. Studies may include ecology of birds, fish, insects, small mammals, plants, tundra and taiga, lakes and caves. The schedule of offerings for each year is available in January.

NOTE Field trip: estimated cost of each module and the schedule of offerings for each year is available in January.

Requirements: Prerequisite BIOL 307 and prior to registering in this course students must complete the application process, be placed in a module and complete the field work. Equivalency BIOL 407.

Course Equivalencies: BIOL317, BIOL407

Offering Faculty: Faculty of Arts and Science

BIOL 319 Introduction to Ethnobotany Units: 3.00

Ethnobotany is the study of the relationships that exist between indigenous cultures and local flora. Case studies will be presented to examine the various categories of plant use, the importance of traditional knowledge to Western culture, and the role of plant conservation and cultural sustainability. NOTE Only offered online. Consult Arts and Science Online.

Requirements: Prerequisite BIOL 102 and BIOL 103. Recommended BIOL 200 or BIOL 201.

Offering Faculty: Faculty of Arts and Science

BIOL 321 Animal Behaviour Units: 3.00

An evolutionary approach to the study of animal behaviour. This course explores processes and patterns in behaviour, with emphasis on perception, communication, foraging, spacing, reproduction and social behaviour in a variety of animals. Methods of studying and analyzing behaviour are explored through laboratory exercises.

NOTE Also offered online. Consult Arts and Science Online. Learning Hours may vary.

LEARNING HOURS 132 (36L;12T;12I;12O;24O;36P)

RECOMMENDATION BIOL 202/3.0.

Requirements: Prerequisite None. Corequisite 6.0 units from (BIOL 200; BIOL 201; BIOL 202; BIOL 205; BIOL 206). Recommended BIOL 200 or BIOL 202.

Offering Faculty: Faculty of Arts and Science

BIOL 322 Environmental Physiology of Animals Units: 3.00

A comparative examination of interaction between animals and their environment including: physiological adaptations to extreme environments (e.g., arctic, desert); responses to acute and chronic environmental stress (e.g., hypoxia, temperature); environmental regulation of normal physiological processes; uses of comparative models in other fields.

LEARNING HOURS 120 (36L;24O;60P)

Requirements: Prerequisite BIOL 339.

Offering Faculty: Faculty of Arts and Science

BIOL 323 Vertebrate Diversity and Evolution Units: 3.00

Vertebrate biodiversity including characteristics and adaptations of the major classes of the living vertebrates; major environmental and geological changes associated with vertebrate evolution.

NOTE Field trip: estimated cost \$35.

LEARNING HOURS 120 (36L;12Lb;72P)

Requirements: Prerequisite BIOL 206 and (BIOL 200 or BIOL 201 or BIOL 202).

Offering Faculty: Faculty of Arts and Science

BIOL 327 Field Biology III Units: 3.00

Two weeks of field work plus written assignments in one or two areas of study to be done when specialized modules are available in May, July, August or February. Studies may include ecology of birds, fish, insects, small mammals, plants, tundra and taiga, lakes and caves. The schedule of offerings for each year is available in January.

NOTE Field trip: estimated cost of each module and the schedule of offerings for each year is available in January.

Requirements: Prerequisite (BIOL 307 and BIOL 317) and prior to registering in this course, students must complete the application process, be placed in a module and complete the field work.

Offering Faculty: Faculty of Arts and Science

BIOL 330 Cell Biology Units: 3.00

An introduction to the cellular basis of biological variation. The course explores the control of cell function exerted by the nucleus, the pathways for building and fuelling cells, and the control of integrative cellular events.

NOTE Also offered online. Consult Arts and Science Online. Learning Hours may vary.

LEARNING HOURS 120 (36L;12T;24O;48P)

Requirements: Prerequisite BIOL 205 or BCHM 218.

Offering Faculty: Faculty of Arts and Science

BIOL 331 Analytical Genomics Units: 3.00

This course will explore the structure of genomes and the nature and origin of gene families as well as large scale functional genomics methods for analysis of novel gene function.

LEARNING HOURS 124 (36L;12T;40O;36P)

Requirements: Prerequisite BIOL 205 or BCHM 218.

Exclusion BCHM 370; BMED 370.

Offering Faculty: Faculty of Arts and Science

BIOL 333 Applied Biology Units: 3.00

The course explores biological contributions to society in the fields of environmental assessment and management, materials and food production, and biotechnology. Emphasis is placed on understanding of applied processes in relevant service and production industries.

Requirements: Prerequisite BIOL 205 and (BIOL 200 or BIOL 201).

Offering Faculty: Faculty of Arts and Science

BIOL 334 Comparative Biochemistry Units: 3.00

A survey of selected topics including: general principles of enzymology; bioenergetics; metabolism and its control; the importance of proteomic and enzyme research in functional genomics and biotechnology; mechanisms whereby animals and plants acclimate at the biochemical level to environmental stress.

LEARNING HOURS 110.4 (36L;24O;50.4P).

Requirements: Prerequisite BIOL 103 and CHEM 112 and (BIOL 205 or BCHM 218). Note Priority enrolment will be given to students registered in a BIOL Plan or who require this course for their program.

Course Equivalencies: BIOL234, BIOL334

Offering Faculty: Faculty of Arts and Science

BIOL 335 Limnology and Aquatic Ecology Units: 3.00

Physics, chemistry and biology of freshwater lakes. Emphasis on: morphometry; light and temperature; water chemistry in relation to nutrients; physiological requirements; composition and interaction of algal and invertebrate populations; eutrophication; pollution; environmental change.

NOTE Field trip: estimated cost \$35.

LEARNING HOURS 113 (36L;18Lb;8O;51P).

Requirements: Prerequisite CHEM 112. Recommended BIOL 200 or BIOL 201 or BIOL 202.

Offering Faculty: Faculty of Arts and Science

BIOL 338 Marine Biology Units: 3.00

Introduction to life in the World's oceans and seas from a global, ecological, and evolutionary perspective. Study of marine habitats, food webs, biodiversity, ecological processes, functional biology, adaptations of marine organisms, and human impacts on marine life (fisheries and environmental impacts).

NOTE Only offered at the Bader International Study Centre, Herstmonceux. Learning hours include four days of fieldwork. LEARNING HOURS 116 (18L;24Lb;12T;12O;32O;18P).

Offering Faculty: Faculty of Arts and Science

BIOL 339 Animal Physiology Units: 3.00

Focus is placed on adaptive physiology and integrative function (nervous and hormonal, movement, excretion, circulation and digestion) with examples selected from various phylogenetic levels as appropriate.

LEARNING HOURS 120 (36L;18O;66P)

Requirements: Prerequisite BIOL 205 or BCHM 218.

Offering Faculty: Faculty of Arts and Science

BIOL 341 Plant Physiology Units: 3.00

The course examines various aspects of plant cell biology, physiology, and biochemistry including carbon and nitrogen metabolism (photosynthesis, respiration, etc.), water relations, mineral nutrition, response to environmental stress, roles of plant hormones, plant biotechnology.

LEARNING HOURS 115 (36L;10G;15O;54P)

Requirements: Prerequisite BIOL 205 or BCHM 218.

Offering Faculty: Faculty of Arts and Science

BIOL 343 Data Analysis for Biologists Units: 3.00

Advanced topics in using R for data management, exploratory data analysis, data visualization, and statistical analysis using the general linear model, with particular focus on statistical literacy and biological examples from both laboratory and field research.

LEARNING HOURS 120 (36L;12T;12O;60P)

Requirements: Prerequisite BIOL 243 or PSYC 202 or STAT 269.

Offering Faculty: Faculty of Arts and Science

BIOL 350 Evolution and Human Affairs Units: 3.00

An exploration of how evolutionary thinking can affect our understanding of our lives, our species, and our ability to share the planet with other species.

NOTE Also offered online. Consult Arts and Science Online. Learning Hours may vary.

LEARNING HOURS 120 (36L;24O;60P)

Requirements: Prerequisite Level 3 or above.

Offering Faculty: Faculty of Arts and Science

**BIOL 360 Biotechnology and Society Units: 3.00**

The contributions and effects of biotechnology on humanity will be explored from the perspective of their impacts on society including moral and ethical issues. Biotechnological contributions to society to be explored will include those in medicine, industry, and agriculture.

LEARNING HOURS 120 (36L;12T;72P)

Requirements: Prerequisite BIOL 205 or BCHM 218.

Offering Faculty: Faculty of Arts and Science

BIOL 369 Sex and Evolution Units: 3.00

Why sex? The evolutionary origins and consequences of sex and sexual reproduction. Topics include costs and benefits of sexual reproduction, the evolution and coevolution of sexes, gametes and genitalia, mating systems, gender differences and sex determination throughout the biotic world.

LEARNING HOURS 122 (36L;8T;18O;60P)

RECOMMENDATION BIOL 206/3.0.

Requirements: Prerequisite (BIOL 102 and BIOL 103) and 3.0 units from (BCHM 218; BIOL 200; BIOL 201; BIOL 202; BIOL 205 or BIOL 206). Recommended BIOL 206.

Course Equivalencies: BIOL210; BIOL369

Offering Faculty: Faculty of Arts and Science

BIOL 401 Experimental Approaches to Animal Physiology Units: 3.00

Laboratory-based course emphasizing experimental approaches to understanding the principles of animal physiology covered in BIOL 339/3.0.

LEARNING HOURS 108 (36Lb;12T;60P)

Requirements: Prerequisite A minimum GPA of 2.0 in the Biological Foundations List. Corequisite BIOL 339.

Course Equivalencies: BIOL340; BIOL401

Offering Faculty: Faculty of Arts and Science

BIOL 402 Experiments in Plant Physiology Units: 3.00

Laboratory-based course emphasizing experimental approaches to understanding the principles of plant physiology covered in BIOL 341/3.0.

LEARNING HOURS 114 (36Lb;24T;6O;48P)

Requirements: Prerequisite A minimum GPA of 2.0 in the Biological Foundations List. Corequisite BIOL 341.

Course Equivalencies: BIOL342; BIOL402

Offering Faculty: Faculty of Arts and Science

BIOL 403 Experimental Techniques in Biology Units: 3.00

Self-directed and self-selected hands-on experimental techniques used in fundamental biology research, biotechnologies, and medical sciences.

LEARNING HOURS 120 (36Lb;12T;72Oc)

Requirements: Prerequisite BIOL 205 and a minimum GPA of 2.0 in the Biological Foundations List.

Course Equivalencies: BIOL325;BIOL403

Offering Faculty: Faculty of Arts and Science

BIOL 404 Techniques in Molecular Biology Units: 3.00

Intensive laboratory work (8h/day) to be carried out over two and a half weeks in May. Practical work includes DNA isolations, DNA cloning, PCR, production of proteins, biochemical and immunological analysis of proteins.

NOTE Priority to students registered in BIOL Major and Specialization degree Plans. See course website for details.

LEARNING HOURS 112.5 (100Lb;12.5P)

Requirements: Prerequisite (BCHM 218 or BIOL 330) and a minimum GPA of 2.0 in the Biological Foundations List.

Course Equivalencies: BIOL304, BIOL404

Offering Faculty: Faculty of Arts and Science

BIOL 407 Field Biology II Units: 3.00

Requirements: BIOL307

Course Equivalencies: BIOL317, BIOL407

Offering Faculty: Faculty of Arts and Science

BIOL 409 Bioremediation Units: 3.00

The use of living organisms to address environmental problems. Topics include mechanisms of contaminant extraction, absorption, concentration, and degradation using bacteria and plants to detoxify organic compounds, sequester heavy metals or clean up excess nutrients.

NOTE Field trip: estimated cost \$40.

RECOMMENDATION BIOL 301/3.0 or BIOL 322/3.0 or BIOL 339/3.0 or BIOL 341/3.0 is recommended.

Requirements: Prerequisite BIOL 330 and a minimum GPA of 2.0 in the Biological Foundations List. Recommended BIOL 322 or BIOL 341 or BIOL 339.

Offering Faculty: Faculty of Arts and Science

BIOL 410 Ecology of Lakes and Streams Units: 3.00

An in-depth look at the ecology and evolution of freshwater aquatic ecosystems, considering the role of populations, interspecific interactions, and the flow of energy and matter. There will be an emphasis on linking ecological theory with empirical evidence from aquatic systems. Topics will include dispersal and colonization, ecological genetics, resource competition, predator-prey interaction, evolution of life-history strategies, habitat coupling, and biogeochemical cycling.

LEARNING HOURS 120 (24L;12S;84P)

RECOMMENDATION BIOL 335/3.0.

Requirements: Prerequisite (BIOL 300 or BIOL 302 or BIOL 303) and a minimum GPA of 2.0 in the Biological Foundations List. Recommended BIOL 335.

Offering Faculty: Faculty of Arts and Science

BIOL 411 Global Change Biology Units: 3.00

This course focuses on the fundamental biology underlying the major global change issues that humanity currently faces. Strong emphasis will be placed on the critical interconnections among issues across hierarchical levels from molecule to biosphere that explain the patterns and mechanisms which have led to our current environmental predicament.

LEARNING HOURS 117(24L;18T;12G;30c;36P)

Requirements: Prerequisite BIOL 300 and a minimum GPA of 2.0 in the Biological Foundations List.

Offering Faculty: Faculty of Arts and Science

BIOL 416 Terrestrial Ecosystems Units: 3.00

Principles of terrestrial ecosystem ecology: soils; plant-soil interactions; energy and water balance; carbon and nutrient cycling; species effects; landscape-level and whole earth biogeochemistry; global change.

NOTE Overnight field trip: cost \$75.

LEARNING HOURS 124

(12L,24S;18Lb;12Pc;12G;12O;16Oc;18P)

Requirements: Prerequisite (BIOL 300 or BIOL 302 or BIOL 303 or GPHY 317) and a minimum GPA of 2.0 in the Biological Foundations List. One-Way Exclusion May not be taken with or after BIOL 510.

Offering Faculty: Faculty of Arts and Science

BIOL 418 Fisheries Techniques Units: 3.00

This course will introduce students to many "hands-on" techniques currently used in fisheries. This will include fish identification, different capture techniques for fisheries assessment, bioacoustics, environmental monitoring, techniques for ageing fish, diet analysis, fish tracking (biotelemetry approaches), and data management.

LEARNING HOURS 120 (30Lb;10T;40G;40P)

PREREQUISITES BIOL 316/3.0 and a minimum GPA of 2.0 in the Biological Foundations List.

Requirements: Prerequisite BIOL 316 and a minimum GPA of 2.0 in the Biological Foundations List.

Offering Faculty: Faculty of Arts and Science

BIOL 422 Conservation Biology Units: 3.00

The application of biological research to the conservation of biodiversity and natural resources, as well as the interaction of biology with philosophy, politics and economics in influencing conservation policy.

NOTE A course fee to cover guest speakers and field trips of not more than \$40.

LEARNING HOURS 108 (36L;36T;36P)

Requirements: Prerequisite (BIOL 300 or BIOL 302 or BIOL 303) and a minimum GPA of 2.0 in the Biological Foundations List. Exclusion ENSC 320.

Offering Faculty: Faculty of Arts and Science

BIOL 423 Modern Insect Science Units: 3.00

An exploration into the world of insects, one of the most abundantly successful group of organisms on the earth.

NOTE An overnight field trip is estimated to cost \$65; a limited number of bursaries may be available for exceptional circumstances; contact the instructor early in the previous term.

RECOMMENDATION BIOL 330/3.0 or MBIO 218/3.0

Requirements: Prerequisite BIOL 205 and a minimum GPA of 2.0 in the Biological Foundations List. One-Way Exclusion May not be taken with or after BIOL 507. Recommended BIOL 330 or BCHM 218.

Offering Faculty: Faculty of Arts and Science

BIOL 430 Molecular Genetics of Development Units: 3.00

The use of genetic analysis to understand developmental processes such as cell fate determination, pattern formation and morphogenesis. Emphasis will be on the molecular pathways used during embryonic development, highlighting applications and techniques using model organisms.

LEARNING HOURS 126 (36L;18S;24G;12I;12O;24P)

Requirements: Prerequisite (BCHM 218 or BIOL 330) and a minimum GPA of 2.0 in the Biological Foundations List.

Offering Faculty: Faculty of Arts and Science

BIOL 431 Cellular Basis of Adaptation Units: 3.00

The cellular origins of diversity in physiological processes, with consideration of the role of evolutionary, developmental and molecular mechanisms.

LEARNING HOURS 108 (6L;30S;8T;4G;60P)

Requirements: Prerequisite (BIOL 330 or BCHM 218) and (BIOL 301 or BIOL 334 or BIOL 338 or BIOL 339 or BIOL 341) and a minimum GPA of 2.0 in the Biological Foundation List.

Offering Faculty: Faculty of Arts and Science

BIOL 432 Computation and Big Data in Biology Units: 3.00

Application of basic coding and analytical methods to obtain, organize, analyze, visualize, and interpret information from large, complex datasets (i.e. 'Big Data') in biology. Datasets may include climate/weather records, 'omics' data, specimen collections, long-term observational studies, journal articles, and other historical and online sources.

LEARNING HOURS 120 (36L;12T;72P)

Requirements: Prerequisite A minimum GPA of 2.0 in the Biological Foundations List.

Offering Faculty: Faculty of Arts and Science

**BIOL 433 History and Philosophy of Biology Units: 3.00**

An examination of the foundations of evolution, classification and other selected topics from historical, philosophical and scientific perspectives.

LEARNING HOURS 120 (36L;24T;60P)

Requirements: Prerequisite (BIOL 300 or BIOL 302 or BIOL 303) and a minimum GPA of 2.0 in the Biological Foundations List.

Offering Faculty: Faculty of Arts and Science

BIOL 439 Natural Selection and Microevolution Units: 3.00

The mechanisms of evolutionary change - from genes to societies. How natural selection interacts with genetic and population processes to make organisms adapted to their environment and to create biological diversity.

LEARNING HOURS 120 (36L;6S;18Lb;60P)

Requirements: Prerequisite (BIOL 300 or BIOL 302 or BIOL 303) and a minimum GPA of 2.0 in the Biological Foundations List.

Offering Faculty: Faculty of Arts and Science

BIOL 440 Speciation and Macroevolution Units: 3.00

An exploration of higher-level processes in evolution spanning considerations of mechanisms of speciation, extinction, adaptive radiation, and phylogenetics.

LEARNING HOURS 120 (24L;24T;60G;12O)

Requirements: Prerequisite (BIOL 300 or BIOL 302 or BIOL 303) and a minimum GPA of 2.0 in the Biological Foundations List.

Offering Faculty: Faculty of Arts and Science

BIOL 441 Molecular Genetics Units: 3.00

Research in eukaryotic molecular genetics with an emphasis on epigenetics. Epigenetic phenomena will be examined in a range of models from single-celled organisms to metazoans, with student discussions on topics as diverse as bioethics, disease controls, and eugenics.

LEARNING HOURS 125 (30L;8S;12Lb;10G;65P)

Requirements: Prerequisite (BIOL 330 or BCHM 218) and a minimum GPA of 2.0 in the Biological Foundations List. Exclusion PATH 425.

Offering Faculty: Faculty of Arts and Science

BIOL 442 Evolutionary Medicine Units: 3.00

An exploration of human disease, illness, and injury, and the symptoms and treatments of medical conditions, with an evolutionary framework.

LEARNING HOURS 120 (24L;20T;10O;66P)

Requirements: Prerequisite BIOL 206 and a minimum GPA of 2.0 in the Biological Foundations List. Equivalency BIOL 522.

Course Equivalencies: BIOL442; BIOL522

Offering Faculty: Faculty of Arts and Science

BIOL 445 Neuroethology Units: 3.00

The current status of research in the study of the neural control of the natural behaviour of animals. Topics include the detection and coding of information in the environment, the integration of this information in the process of decision-making, the generation of the motor patterns that underlie behaviour, and general constraints on form and function of neural circuits.

LEARNING HOURS 126 (36L;18T;24O;48P).

Requirements: Prerequisite (BIOL 339 or [PHGY 215 and PHGY 216] or PHGY 214) and a minimum GPA of 2.0 in the Biological Foundations List.

Offering Faculty: Faculty of Arts and Science

BIOL 501 Recent Research in Molecular Units: 3.00

This course will focus on how molecular biology is used in basic and medical research to dissect the mechanisms involved in a large variety of biological problems. Students in the course will explore molecular literature and techniques that are relevant to their interest through seminar presentations, writing critiques, scientific reviews.

LEARNING HOURS 120 (36S;84P)

RECOMMENDATION BIOL 430/3.0.

Requirements: Prerequisite Level 4 or above and registration in a Biology Honours Plan (BIOL-M-BSH, BIOL-P-BSH, BIMA-P-BSH, BIPS-P-BSH, BTEC-P-BSH, EBIO-P-BSH) and a minimum GPA of 2.0 in the Biological Foundations List or permission of the Department. Recommended BIOL 430.

Offering Faculty: Faculty of Arts and Science

BIOL 502 Plant Cell Responses to Environmental Stress Units: 3.00

This course will dissect signal transduction pathways and molecular responses in plants exposed to environmental stresses such as pathogen infection, drought, or temperature fluctuations. Emphasis is on understanding techniques used to investigate changes in gene expression, protein-protein interactions, sub-cellular localization, as well as the analysis of mutant and transgenic plant lines.

LEARNING HOURS 120 (36S;84P)

Requirements: Prerequisite Level 4 or above and registration in a Biology Honours Plan (BIOL-M-BSH, BIOL-P-BSH, BIMA-P-BSH, BIPS-P-BSH, BTEC-P-BSH, EBIO-P-BSH) and a minimum GPA of 2.0 in the Biological Foundations List and (BIOL 330 or BIOL 334 or BIOL 341 or BIOL 430) or permission of the Department.

Offering Faculty: Faculty of Arts and Science

BIOL 503 Plant Biotechnology Units: 3.00

This is an experiential course on the business of science and the steps leading to the commercialization of an agrobiotech product. Students will go through a series of workshops to develop their own ideas into a commercially valuable product, plus an assessment of all related social and economic issues using business-oriented exercises.

LEARNING HOURS 120 (15L;9S;24G;72P).

Requirements: Prerequisite Level 4 or above and registration in a Biology Honours Plan (BIOL-M-BSH, BIOL-P-BSH, BIMA-P-BSH, BIPS-P-BSH, BTEC-P-BSH, EBIO-P-BSH) and a minimum GPA of 2.0 in the Biological Foundations List and ([BIOL 205 or BCHM 218] and BIOL 341) or permission of the Department.

Offering Faculty: Faculty of Arts and Science

BIOL 504 Extremophiles Units: 3.00

The course explores biology of extraordinary organisms that flourish under conditions of stress and how more ordinary organisms deal with periodically unfavourable circumstances. Emphasis is placed on understanding of the relevant adaptations and processes involved.

NOTE No textbook is required. The course website will be used to provide lecture notes and assigned readings from scientific books, journals and selected websites.

LEARNING HOURS 116 (30L;2S;12G;12O;60P)

Requirements: Prerequisite Level 4 or above and registration in a Biology Honours Plan (BIOL-M-BSH, BIOL-P-BSH, BIMA-P-BSH, BIPS-P-BSH, BTEC-P-BSH, EBIO-P-BSH) and a minimum GPA of 2.0 in the Biological Foundations List and (BIOL 339 or BIOL 341) or permission of Department. Exclusion BIOL 533.

Offering Faculty: Faculty of Arts and Science

BIOL 505 Cell Signaling in Development and Disease Units: 3.00

Organisms arise from a single cell into functional tissues, patterns, and structures by orchestrating cell behaviors, such as cell divisions, cell differentiation, pattern formations, cell shape changes and cell movements. This course will focus on the genetic and molecular analyses of how these cell behaviors occur.

NOTE No textbook is required. The course website will be used to provide lecture notes and assigned readings from scientific books, journals and selected websites.

LEARNING HOURS 120 (24L;12S;12I;24O;48P)

Requirements: Prerequisite Level 4 or above and registration in a Biology Honours Plan (BIOL-M-BSH, BIOL-P-BSH, BIMA-P-BSH, BIPS-P-BSH, BTEC-P-BSH, EBIO-P-BSH) and a minimum GPA of 2.0 in the Biological Foundations List and BIOL 330 or permission of Department. Exclusion BIOL 535.

Offering Faculty: Faculty of Arts and Science

BIOL 506 Biochemical Adaptations to Life Under Extreme Conditions Units: 3.00

Biochemical adaptation is a fundamental aspect of biological diversity because it integrates molecular structure, with metabolic function and control. The course evaluates the mechanisms whereby animals, plants, and microbes acclimate at the biochemical level to 'extreme' environmental conditions such as temperature stress, high pressure, hypoxia, salt stress, oxidative stress, and desiccation.

LEARNING HOURS 120 (36S;84P)

RECOMMENDATION (BIOL 301/3.0 or BIOL 341/3.0) and BIOL 322/3.0.

Requirements: Prerequisite Level 4 or above and registration in a Biology Honours Plan (BIOL-M-BSH, BIOL-P-BSH, BIMA-P-BSH, BIPS-P-BSH, BTEC-P-BSH, EBIO-P-BSH) and a minimum GPA of 2.0 in the Biological Foundations List and [BIOL 334 or (BCHM 315 and BCHM 316) or BCHM 310] or permission of the Department.

Offering Faculty: Faculty of Arts and Science

BIOL 507 Biotechnology Units: 3.00

This course covers the ethical, societal and environmental impacts of biotechnology. There will be critical analysis of public policy and the value of biotechnologies to science and the public. Topics will likely include synthetic biology, human cloning, xenotransplants, stem cells, nanomaterials, marine biotechnology, eugenics, patenting, GMOs and the release of biotech products to the environment.

LEARNING HOURS 120 (36S;84P).

Requirements: Prerequisite Level 4 or above and registration in a Biology Honours Plan (BIOL-M-BSH, BIOL-P-BSH, BIMA-P-BSH, BIPS-P-BSH, BTEC-P-BSH, EBIO-P-BSH) and a minimum GPA of 2.0 in the Biological Foundations List or permission of the Department. One-Way Exclusion May not be taken with or after BIOL 441.

Offering Faculty: Faculty of Arts and Science

BIOL 508 Biology of the Cell Cycle Units: 3.00

Cell proliferation underlies development and tissue renewal and is implicated in many diseases. Our universal model of eukaryotic cell cycle control is based on studies in a number of model systems. The course will focus on control mechanisms, deriving information from systems as diverse as yeast and human cells.

LEARNING HOURS 120 (36S;84P).

Requirements: Prerequisite Level 4 or above and registration in a Biology Honours Plan (BIOL-M-BSH, BIOL-P-BSH, BIMA-P-BSH, BIPS-P-BSH, BTEC-P-BSH, EBIO-P-BSH) and a minimum GPA of 2.0 in the Biological Foundations List and (BIOL 330 or BCHM 218) or permission of the Department.

Offering Faculty: Faculty of Arts and Science



BIOL 509 Limnological Environmental Studies Units: 3.00

This course will explore ecological and evolutionary aspects of species invasions, with an emphasis on aquatic invaders. Course discussions will include such topics as invasive species and factors that influence their arrival, establishment, and spread, as well as management strategies that can be employed to reduce the arrival, establishment, and spread of invasive species.

LEARNING HOURS 120 (9L;9S;18G;84P).

Requirements: Prerequisite Level 4 or above and registration in a Biology Honours Plan (BIOL-M-BSH, BIOL-P-BSH, BIMA-P-BSH, BIPS-P-BSH, BTEC-P-BSH, EBIO-P-BSH) and a minimum GPA of 2.0 in the Biological Foundations List or permission of the Department. Recommended BIOL 335.

Offering Faculty: Faculty of Arts and Science

BIOL 510 The Biology of Sustainability Units: 3.00

This ecology course will identify and critique potential mechanisms by which our civilization could most effectively move toward more sustainable living. The topic incorporates many fundamental aspects of biology, and each course iteration may include biogeochemical, ecological, economic, social, genetic, philosophical, and behavioural components. LEARNING HOURS 120 (36S;12T;12G;36I;12O;12P).

Requirements: Prerequisite Level 4 or above and registration in a Biology Honours Plan (BIOL-M-BSH, BIOL-P-BSH, BIMA-P-BSH, BIPS-P-BSH, BTEC-P-BSH, EBIO-P-BSH) and a minimum GPA of 2.0 in the Biological Foundations List or permission of the Department. Recommended BIOL 300 or (BIOL 302 and 303).

Offering Faculty: Faculty of Arts and Science

BIOL 515 Aquaculture Units: 3.00

This course will examine the influence of biotic and/or abiotic factors in aquaculture industries around the globe. We will explore the application of different biotechnologies in fishery industries and assess the potential impacts of various types of aquaculture practices on the environment and our fundamental socio-economical values.

LEARNING HOURS 120 (9L;9S;18G;84P)

Requirements: Prerequisite Level 4 or above and registration in a Biology Honours Plan (BIOL-M-BSH, BIOL-P-BSH, BIMA-P-BSH, BIPS-P-BSH, BTEC-P-BSH, EBIO-P-BSH) and a minimum GPA of 2.0 in the Biological Foundations List or permission of the Department.

Offering Faculty: Faculty of Arts and Science

BIOL 527 Paleolimnology and Global Environmental Change Units: 3.00

This course is mainly to provide students with a background in studies of long-term environmental change, with a focus on research that is especially relevant to today's environmental problems. Key topics include: climatic change, lake pollution, atmospheric deposition of contaminants and related topics.

LEARNING HOURS 132 (21L;15S;96P)

RECOMMENDATION BIOL 335/3.0.

Requirements: Prerequisite Level 4 or above and registration in a Biology Honours Plan (BIOL-M-BSH, BIOL-P-BSH, BIMA-P-BSH, BIPS-P-BSH, BTEC-P-BSH, EBIO-P-BSH) and a minimum GPA of 2.0 in the Biological Foundations List or permission of the Department. Recommended BIOL 335.

Offering Faculty: Faculty of Arts and Science

BIOL 530 Origins of Biodiversity Units: 3.00

This course uses the latitudinal increase in diversity towards the equator as a launching point to explore how diversity forms, is maintained, and disappears, and why we find such dramatic variation in diversity around the world. Discussions will focus on both evolutionary and ecological perspectives of diversity, and we will review various hypotheses to explain latitudinal diversity gradients.

LEARNING HOURS 120 (9L;9S;18G;84P)

RECOMMENDATION BIOL 201/3.0 and BIOL 202/3.0 and (BIOL 302/3.0 or BIOL 303/3.0 or BIOL 439/3.0)

Requirements: Prerequisite Level 4 or above and registration in a Biology Honours Plan (BIOL-M-BSH, BIOL-P-BSH, BIMA-P-BSH, BIPS-P-BSH, BTEC-P-BSH, EBIO-P-BSH) and a minimum GPA of 2.0 in the Biological Foundations List or permission of the Department.

Offering Faculty: Faculty of Arts and Science

BIOL 531 Darwinism and Cultural Evolution Units: 3.00

Through seminars, essays, and group discussions, students explore ideas, research objectives, and recent discoveries in the application of Darwinian evolutionary theory to the interpretation of human nature, social life, and culture and how these advances impact on our understanding of civilization and the challenges it faces for the 21st century.

LEARNING HOURS 120 (9L;9S;18G;84P)

Requirements: pre BIOL350

Offering Faculty: Faculty of Arts and Science

BIOL 532 Selected Topics in Biology I Units: 3.00

LEARNING HOURS 120 (9L;9S;18G;84P)

Requirements: Pre 4th yr in BIOL Honours Plan and a min. GPA of 2.0 in the BIOL_FNDS list and BIOL330.

Offering Faculty: Faculty of Arts and Science

BIOL 533 Selected Topics in Biology II Units: 3.00

LEARNING HOURS 120 (9L;9S;18G;84P)

Requirements: Pre 4th yr in BIOL Honours Plan and a min. GPA of 2.0 in the BIOL_FNDS list.

Offering Faculty: Faculty of Arts and Science

BIOL 534 Selected Topics In Biology III Units: 3.00

LEARNING HOURS 120 (9L;9S;18G;84P)

Requirements: Pre 4th yr in BIOL Honours Plan and a min. GPA of 2.0 in the BIOL_FNDS list.

Offering Faculty: Faculty of Arts and Science

BIOL 535 Selected Topics in Biology Units: 3.00

LEARNING HOURS 120 (9L;9S;18G;84P)

Requirements: Prerequisite Level 4 or above and registration in a Biology Honours Plan (BIOL-M-BSH, BIOL-P-BSH, BIMA-P-BSH, BIPS-P-BSH, BTEC-P-BSH, EBIO-P-BSH) and a minimum GPA of 2.0 in the Biological Foundations List or permission of the Department.

Offering Faculty: Faculty of Arts and Science

BIOL 536 Selected Topics in Biology V Units: 3.00

LEARNING HOURS 120 (9L;9S;18G;84P)

Requirements: Pre 4th yr in BIOL Honours Plan and a min. GPA of 2.0 in the BIOL_FNDS list.

Offering Faculty: Faculty of Arts and Science

BIOL 537 Research in Biology Units: 12.00

Individual research projects under the supervision of a staff member; reported in the form of a thesis, poster and seminar.

NOTE In the spring preceding fourth year, students must select projects in consultation with potential supervisors. Registration is subject to availability of a supervisor. Work on the project during summer is advantageous if field studies are required. See also the statement on BIOL 501/3.0-BIOL 536/3.0 in the BIOL Department Information, preliminary information section.

LEARNING HOURS 444 (8L;36S;300Pc;1000)

Requirements: Prerequisite Admission to the final year of a BSCH program in Biology and a minimum GPA of 2.0 in the Biological Foundations List and permission of the project supervisor and course coordinator. Exclusion BIOL 541.

Offering Faculty: Faculty of Arts and Science

BIOL 538 Research Mentorship in Biology I Units: 3.00

Research practicum under the supervision of a Biology faculty member. The course will involve a combination of research in the host laboratory, attendance of BIOL 537 or other seminars in the Department, and literature research to present as a major paper and seminar.

NOTE Students will normally be enrolled in the fourth year of their Program, having completed the third year core requirements of their Plan.

Requirements: Prerequisite Registration in a Biology Honours Plan (BIOL-M-BSH, BIOL-P-BSH, BIMA-P-BSH, BIPS-P-BSH, EBIO-P-BSH) and a minimum GPA of 2.0 in the Biological Foundations List and permission of the Department. One-Way Exclusion Not to be taken concurrently with BIOL 537.

Offering Faculty: Faculty of Arts and Science

BIOL 539 Research Mentorship in Biology II Units: 3.00

Research practicum under the supervision of a Biology faculty member. The course will involve a combination of research in the host laboratory, attendance of BIOL 537 or other seminars in the Department, and literature research to present as a major paper and seminar.

NOTE Students will normally be enrolled in the fourth year of their Program, having completed the third year core requirements of their Plan.

Requirements: Prerequisite Registration in a Biology Honours Plan (BIOL-M-BSH, BIOL-P-BSH, BIMA-P-BSH, BIPS-P-BSH, EBIO-P-BSH) and a minimum GPA of 2.0 in the Biological Foundations List and permission of the Department.

Corequisite BIOL 538. One-Way Exclusion Not to be taken concurrently with BIOL 537.

Offering Faculty: Faculty of Arts and Science

BIOL 540 Research Mentorship in Biology Units: 6.00

Research practicum under the supervision of a Biology faculty member. The course will involve a combination of research in the host laboratory, attendance of BIOL 537 or other seminars in the Department, and literature research to present as a major paper and seminar.

NOTE Students will normally be enrolled in the fourth year of their Program, having completed the third year core requirements of their Plan.

Requirements: Prerequisite Registration in a Biology Honours Plan (BIOL-M-BSH, BIOL-P-BSH, BIMA-P-BSH, BIPS-P-BSH, EBIO-P-BSH) and a minimum GPA of 2.0 in the Biological Foundations List and permission of the Department. One-Way Exclusion Not to be taken concurrently with BIOL 537.

Course Equivalencies: BIOL540; BIOL540B

Offering Faculty: Faculty of Arts and Science



BIOL 541 Research in Biotechnology Units: 12.00

Individual research projects under the supervision of a staff member; reported in the form of a thesis, poster, and seminar.

NOTE Students must select projects in consultation with potential supervisors a minimum of one full term in advance of starting the course.

LEARNING HOURS 446 (8L;18S;360Pc;60P)

Requirements: Prerequisite Admission to the final year of the BTEC program in Biology and a minimum GPA of 2.0 in the Biological Foundations List and permission of the project supervisor and course coordinator. Exclusion BIOL 537.

Offering Faculty: Faculty of Arts and Science

BIOL 594 Independent Study Units: 3.00

Offering Faculty: Faculty of Arts and Science

BIOL 595 Independent Study Units: 6.00

Offering Faculty: Faculty of Arts and Science

BIOL 596 Independent Study Units: 12.00

Offering Faculty: Faculty of Arts and Science

BIOL 597 Independent Study Units: 18.00

Offering Faculty: Faculty of Arts and Science

BIOL 598 Independent Study Units: 9.00

Offering Faculty: Faculty of Arts and Science