

BIOLOGY

ASSOCIATE PROFESSOR(S)

P. Antunes, B.Sc. (Hons), (University of Evora), Ph.D. (Guelph)

ASSISTANT PROFESSOR(S)

I. Imre, B.Sc. (Hons), M.Sc. (Guelph), Ph.D. (Concordia);

B. Schamp, B.Sc. (Hons) (Wilfrid Laurier), M.Sc., Ph.D. (Queen's);

J. Foote, B.Sc. (Hons) (St. Mary's), M.Sc. (Dalhousie), Ph.D. (Queen's);

I. Molina, B.Sc., M.Sc. (National University of La Plata), Ph.D. (Michigan State)

ADJUNCT PROFESSOR(S)

T. Noland, B.Sc. (Hons) (Ohio State),

M.Sc. (Wisconsin), Ph.D. (Arkansas);

R. Schwartz, B.Sc. (Hons), M.Sc., Ph.D. (UCSD)

SESSIONAL FACULTY

S. Bowman B.Sc. (Lakehead);

A. Boyonoski, B.Sc. (Hons), M.Sc., Ph.D. (Guelph);

C. Gagné, B.Sc. (Lake Superior State), Doctor of Chiropractic (Canadian Memorial Chiropractic College);

A. Smith, B.Sc. (Hons) (Toronto), M.Sc. (Laurentian);

S. Rowell-Garvon, B.Sc. (N. Michigan), M.Sc. (Texas A&M);

K. Pinkney, B.Sc. (Hons) (Laurentian);

E. Muto, B.Sc. Lake Superior State, M.Sc. (Guelph);

I. Horvath, B.A. (Hons) (Toronto), M.Sc. (Toronto)

PROFESSOR(S) EMERITUS

S. Sanders, B.Sc. (Hons) (Hillsdale), M.Sc., Ph.D. (Michigan)

LABORATORY COORDINATOR(S)

S. Rowell-Garvon, B.Sc. (N. Michigan), M.Sc. (Texas A&M)

DEGREE REQUIREMENTS

Please refer to the degree regulations pertaining to academic programs.

BACHELOR OF SCIENCE (Honours) BIOLOGY

Year 1

- BIOL 1506* Biology I
- BIOL 1507* Biology II
- MATH 1036 Calculus I
- MATH 1037 Calculus II or MATH 1057 Linear Algebra
- CHMI 1006 Chemistry I
- CHMI 1007 Chemistry II
- 6 credits from:
 - GEOL 1021 Understanding the Earth I
 - GEOL 1022 Understanding the Earth II
 - PHYS 1006 Introduction to Physics I
 - PHYS 1007 Introduction to Physics II
- 6 credits from Group I (Humanities) and/or Group II (Social Sciences)

Year 2

- STAT 2126 Introduction to Statistics
- BIOL 2026 Microbiology
- BIOL 2056 Principles of Scientific Inquiry
- BIOL 2126 Cell Biology
- Two of the following three:
 - BIOL 2706 Vertebrate Form and Function
 - BIOL 2716 Invertebrate Form and Function
 - BIOL 2127 Plant Form and Function
- CHMI 2426 Organic Chemistry
- 3 credits BIOL 2000 series
- 6 credits from Group I (Humanities) and/or Group II (Social Sciences)

Year 3

- BIOL 3006 Evolutionary Biology
- BIOL 3017 Genetics
- BIOL 3356 Population Ecology
- BIOL 3357 Community Ecology
- CHMI 3016 Biochemistry I
- BIOL 2996 Scientific Method and Analysis
- 6 credits from BIOL 3000 or 4000 series
- 6 non-biology elective credits

Year 4

- BIOL 4105 Honours Thesis
- 18 credits from BIOL 3000 or 4000 series, with at least 9 credits BIOL 4000 series
- 6 non-biology elective credits

* Minimum grade of 60% required.

NOTE:

- Students can complete a maximum of 42 credits at the first year level
- Minimum major average 60%
- Major average for 'honours' designation 70%
- Students must complete a minimum 12 credits from Group I (Humanities) and/or Group II (Social Sciences)

HONOURS DIPLOMA

Admission to the Honours Diploma Program will require successful completion of a general three-year Bachelor of Science degree in Biology with at least 70% in all Biology courses required for the degree. An overall average of 70% or greater is required to obtain the Honours Diploma. Please contact the Office of the Registrar for more information.

BACHELOR OF SCIENCE (General) BIOLOGY

This program is designed for those interested in studying biology and/or acquiring a strong pre-professional background in science.

Year 1

- BIOL 1506* Biology I
- BIOL 1507* Biology II
- MATH 1036 Calculus I
- MATH 1037 Calculus II or MATH 1057 Linear Algebra
- CHMI 1006 Chemistry I
- CHMI 1007 Chemistry II
- 6 credits from:
 - GEOL 1021 Understanding the Earth I
 - GEOL 1022 Understanding the Earth II
 - PHYS 1006 Introduction to Physics I
 - PHYS 1007 Introduction to Physics II
- 6 credits from Group I (Humanities) and/or Group II (Social Sciences)

Year 2

- STAT 2126 Introduction to Statistics
- BIOL 2026 Microbiology
- BIOL 2056 Principles of Scientific Inquiry
- BIOL 2126 Cell Biology
- Two of the following three:
 - BIOL 2706 Vertebrate Form and Function
 - BIOL 2716 Invertebrate Form and Function
 - BIOL 2127 Plant Form and Function
- CHMI 2426 Organic Chemistry
- 3 credits BIOL 2000 series
- 6 credits from Group I (Humanities) and/or Group II (Social Sciences)

Year 3

- BIOL 2996 Scientific Method and Analysis
- BIOL 3006 Evolutionary Biology
- BIOL 3017 Genetics
- BIOL 3356 Population Ecology
- BIOL 3357 Community Ecology
- CHMI 3016 Biochemistry I
- 6 credits from BIOL 3000 or 4000 series
- 6 non-biology elective credits

* Minimum grade of 60% required.

MINOR IN BIOLOGY

A minor in Biology is available to students who are qualifying for a degree program. In all cases, students will be expected to respect all course prerequisite requirements.

The minor in Biology consists of the following:

BIOL 1506 Biology I
BIOL 1507 Biology II

18 credits BIOL, upper year

More information on minors is available in Chapter Three: Academic Policies, Procedures and Regulations.

COURSE DESCRIPTIONS**BIOL 1021 Biology I**

This introductory course will address selected topics in biology and applied to prokaryotes and eukaryotes. Cell biology, genetics, respiration, photosynthesis, evolution and ecology will be discussed. This course consists of the lecture portion of BIOL 1506 without the lab component and is directed at non-biology students. *Students may not retain credit for both BIOL 1021 and BIOL 1506. Students intending to major or minor in Biology must complete BIOL 1506/1507 to proceed to upper year BIOL courses. (LEC 3) (3 cr)*

BIOL 1022 Biology II

This introductory course will address selected topics in biology and applied to prokaryotes and eukaryotes. Cell biology, genetics, respiration, photosynthesis, evolution and ecology will be discussed. This course consists of the lecture portion of BIOL 1507 without the lab component and is directed at non-biology students. *Students may not retain credit for both BIOL 1022 and BIOL 1507. Students intending to major or minor in Biology must complete BIOL 1506/1507 to proceed to upper year BIOL courses. (LEC 3) (3 cr)*

BIOL 1506 Biology I

This introductory course explores selected topics in biology as applied to prokaryotes and eukaryotes. Cell biology, genetics, respiration, photosynthesis, and evolution will be discussed. Students lacking OAC Chemistry must take CHMI 1041 concurrently. *(LEC 3, LAB 3) (3 cr)*

BIOL 1507 Biology II

This course includes a study of existing biological diversity with special emphasis on structure and function. Botanical topics include plant anatomy, reproduction, water relations, mineral nutrition, and control of growth and development. The zoological component includes the anatomy and physiology of animal tissues, organs and systems, and their functional integration. *(LEC 3, LAB 3) (3 cr)*

BIOL 2026 Microbiology

This course examines the classification, morphology and structure, physiology, ecology and genetics of micro-organisms, with emphasis on the bacteria. The course will study the beneficial and antagonistic relationships we have with microorganisms and will survey different groups of microorganisms and examine their biology. Topics will include the epidemiology of microbial diseases, industrial microbiology and biotechnology. Examples of mutualistic or symbiotic relationships between groups of microorganisms and/or higher plant and animal taxa will also be covered. *Prerequisites: BIOL 1506/1507. Students may not retain credit for both BIOL 2026 and BIOL 3025. (LEC 3, LAB 3) (3 cr)*

BIOL 2056 Principles of Scientific Inquiry

This course introduces students to the history, philosophy, and practice of the scientific method. Humans are continually faced with difficult questions about physical reality and the scientific method has emerged as an important tool used to address such questions. This course will teach students about the strengths and weaknesses of the scientific method, as well as how to apply it correctly. The central goal of this course is to leave students with an enriched and expanded perspective on science, as well as an increased understanding of how they can apply elements of the scientific method to complex problems both in science, and in general in their lives. Specifically, this course will discuss science's pre-suppositions, limits, and domain, as well as the foundations of deductive and inductive logic and parsimony. *Students may not retain credit for more than one of BIOL 2056, BIOL 3327 and PSYC 2056. (LEC 3) (3 cr)*

BIOL 2126 Cell Biology

This course focuses on the molecular, structural and functional organization in both prokaryotic and eukaryotic cells. *Prerequisites: BIOL 1506 and CHMI 1006/1007. (LEC 3, LAB 3) (3 cr)*

BIOL 2127 Plant Form and Function

This course introduces students to the diversity of form and function existing in the plant world. Students learn the language of botany as they are exposed to the comparative study of plant morphology, patterns of homology and analogy in plant form, as well as plant physiology. *Prerequisite: BIOL 1506/1507. Students may not retain credit for both BIOL 2127 and BIOL 2386. (LEC 3, LAB 3) (3 cr)*

BIOL 2216 Principles of Environmental Ethics

Students critically examine the philosophy of the environment by addressing both theoretical and practical issues. Through the exploration of the foundations of ethical theory, students develop their understanding of modern environmental challenges. Areas of study in this course include animal rights, future generations, deep ecology, and the connection between science, technology and the environment. A focus of the course is on students developing their own skills in moral decision making and policy formation by analyzing various philosophical perspectives. *Students may not retain credit for more than one of BIOL 2216, PHIL 2216 and PHIL 2215. (LEC 3) (3 cr)*

BIOL 2346 Principles of Biomedical Ethics

This course examines current themes in biomedical sciences and draws connections with traditional ethical theory in medical decision making. Special attention is given to the issues of patient consent, reproductive technology, and research with human and animal subjects and abortion. Comprehensive understanding of the issues at stake and ability to analyze the positions taken in these controversies define the aims of this course. *Students may not retain credit for more than one of BIOL 2346, PHIL 2346 and PHIL 2345. (LEC 3) (3 cr)*

BIOL 2606 Brain and Behaviour

This course is an introduction to the general relationships between the human brain and human behaviour. Human behaviour, including sleep, dreams, memory, thought, motivation, and emotion will be discussed in terms of brain structure, chemistry and electrical activity. Both known facts and realistic possibilities of brain function will be considered. Some emphasis will be placed upon the contribution of psychological (and social) factors to brain structure, physiology and human disease. Students will also receive a general introduction to psychopharmacology. *Prerequisite: BIOL 1506/1507. Students may not retain credit for both BIOL 2606 and PSYC 2606. (LEC 3, LAB 3) (3 cr)*

BIOL 2706 Vertebrate Form and Function

A comparative study of anatomy of organ systems of, primarily, vertebrate animals; general vertebrate classification. Dissection of selected vertebrate types. *Prerequisite: BIOL 1506/1507 or equivalent. Students may not retain credit for both BIOL 2607 and BIOL 2605. (LEC 3, LAB 3) (3 cr)*

BIOL 2716 Invertebrate Form and Function

Invertebrates are a very diverse group of organisms that exhibit various physical adaptations. They represent the majority of animals found on earth making them an important group on which to focus; however, invertebrate zoology courses are often taught one of two ways. One approach, systematics, takes students on a journey through the phyla one by one and the second approach focuses on functionality by examining anatomical and physiological systems (movement, reproduction, feeding, excretion, etc.). This course incorporates both approaches by examining selected invertebrate phyla focusing on key morphological characteristics, feeding methods, life cycles, habitats, ecological roles, and importance to humans. *Prerequisites: BIOL 1506/1507 (LEC 3, LAB 3) (3 cr)*

BIOL 2996 Scientific Method and Analysis

This course examines descriptive, correlational and experimental research methods. The pedagogical objectives of this course are: to teach and foster the ability to think critically about scientific information; to develop an understanding of the methods used in science to create knowledge and test hypotheses; to develop a knowledge of the ethical principles important to scientific research. In addition, the course is intended to develop each student's ability to think clearly and to communicate effectively. *Students may not retain credit for both BIOL 2996 and PSYC 2127 (LEC 3) (3 cr)*

BIOL 3006 Evolutionary Biology

An understanding of evolution is fundamental to all aspects of biology. This course introduces the theory and concepts of evolutionary biology, emphasizing both macro and microevolution. Topics include the history of evolutionary thought, species concepts and speciation, adaptation, and the roles of natural selection, mutation, and genetic drift in evolutionary change. Students also apply evolutionary concepts to behavioural ecology, sexual selection, and life-history theory. *(LEC 3) (3 cr)*

BIOL 3017 Genetics

This course introduces students to the science of genetics. Course topics include Mendelian inheritance, the nature and behaviour of chromosomes, the chemical basis of heredity, linkage, crossing over, and the mapping of chromosomes, variations in chromosome structure and number, mutation, the structure and function of genes, and the use of statistics in the genetic analysis of quantitative characters. *Prerequisite: BIOL 1506/1507 (LEC 3, LAB 3) (3 cr)*

BIOL 3107 Behavioural Ecology

Students are introduced to the field of behavioural ecology through lectures, assignments, selected nature films and readings. Behaviour is what animals do, including patterns of movement used to survive, obtain nutrients and reproduce, and the many processes that ultimately serve these functions. While other fields study the internal mechanisms by which behaviour is organized and controlled, behavioural ecology asks how behaviour relates the organism to its physical, biological and social environment. It has an evolutionary perspective, seeing behaviour as a result of natural selection, adapting the organism to its environment, and as a component of natural selection, influencing the process of evolution. It also has an ecological perspective, seeing behaviour as a result of the current and past environment of the individual organism, and as one of many forces that influence the distribution and abundance of species. *Students may not retain credit for both BIOL 3107 and PSYC 3107. Prerequisites: BIOL 1506/1507 BIOL 3356/3357 recommended. (LEC 3) (3 cr)*

BIOL 3115 Biogeography

This course covers the study of dynamic responses of plant and animal distributions to physical factors such as climate and soils, as well as to human environmental factors. Emphasis is placed on conservation studies. *Prerequisite: BIOL 1506/1507. Students may not retain credit for BIOL 3115, and GEOG 3115. (LEC/LAB/EXP 3) (6 cr)*

BIOL 3126 Human Form and Function

This course introduces students to the biology of the human body. Students explore the human body with reference to the major systems: circulatory, digestive, muscular, nervous, endocrine, lymphatic, and reproductive. Additionally, students become familiar with the anatomy and physiology of each system, and learn about how these systems interact. The course emphasizes the function of systems in maintaining homeostasis and uses examples of disease that disrupt or alter the processes that regulate homeostasis. *Prerequisite: BIOL 1506/1507. Students may not retain credits for more than one of BIOL 1700, 2105 or BIOL 3126. (LEC 3, LAB 3) (3 cr)*

BIOL 3206 Systematics and Phylogenetics

This course introduces students to the basic methods used by systematists/taxonomists, and allows students to develop these skills by making invertebrate, plant, and fish taxonomic collections. Students learn how to identify and classify species, as well as those procedures employed by scientists in the designation of new species. Students also learn to apply the skills used in systematics and phylogenetics to problems in biology. *Prerequisites: BIOL 1506/1507, STAT 2126 BIOL 2056. (LEC 3, LAB 3) (3 cr)*

BIOL 3346 Ethnobotany

In this course, students are introduced to the science of Ethnobotany, which is the study of the interactions between human cultures and plants. Students will learn about the general features of plant life that are of interest to humanity, how plants are currently used by humans, how they may be used in the future, and how cultures have shaped our present relationships with plants. *Prerequisites: BIOL 1506/1507. (LEC 3) (3 cr)*

BIOL 3356 Population Ecology

This course investigates factors influencing the structure and dynamics of plant and animal populations. The first part of the course is focused on the dynamics of single populations of organisms, considering the conditions leading to exponential growth, logistic growth, population stability and extinction. The second half of the course deals with interactions among populations of prey and predators, parasites and their hosts and applied population ecology problems such as harvesting populations, pest control and conservation biology. Through fieldwork, students are introduced to sampling techniques in aquatic and terrestrial environments. *Prerequisites: BIOL 1506/1507, STAT 2126 and BIOL 2056. Students may not retain credit for both BIOL 3356 and 2356. (LEC 3, LAB 3) (3 cr)*

BIOL 3357 Community Ecology

This course introduces students to the concept of the biological community and explores critical questions related to why different habitats host different numbers of species, why some species are more locally common than others, and how interactions among different species contribute these patterns. The course presents theory and experimental techniques used by ecologists to address these questions. *Prerequisites: BIOL 1506/1507, STAT 2126 and BIOL 2056. Students may not retain credit for both BIOL 3357 and 2357. (LEC 3, LAB 3) (3 cr)*

BIOL 3506 Neuropharmacology

This course consists of a detailed description and evaluation of drugs that influence human behaviour. Although the greatest emphasis is upon the biochemical mechanisms and psychological effects of drugs used within clinical settings, all major pharmacological classes will be covered. Since prediction of drug effects requires an understanding of chemical pathways and their location within the human brain, the student should have a basic understanding of chemistry and neuroanatomy. *Prerequisites: BIOL 1506/1507. Students may not retain credit for both BIOL 3506 and PSYC 3506 (LEC 3) (3 cr)*

BIOL 3906 Special Topics in Biology I

The course will examine particular topics in biology with accompanying lab when appropriate. Specific content varies from year to year depending on faculty expertise and research. *Prerequisite: completion of second year core program in Biology or permission from the instructor. (LEC 3, LAB 3) (3 cr)*

BIOL 3907 Special Topics in Biology II

The course examines particular topics in biology, with accompanying lab when appropriate. Specific content varies from year to year depending on faculty expertise and research. *Prerequisite: completion of second year core program in Biology or permission from the instructor. (LEC 3, LAB 3) (3 cr)*

BIOL 3977 Conservation Biology

Topics include: genetic, taxonomic, ecosystemic and functional levels of biodiversity, biodiversity and ecosystem integrity, biodiversity and ecosystem function in natural and anthropogenic systems, reasons for conserving species, species interactions and 'keystone' roles, the conservation of environments, habitat fragmentation, patch size and buffer zones in conservation, species and genetic richness and ecosystem resilience, ecosystem management for conservation and sustainable development, the role and validity of protected areas, captive breeding and reintroduction programs, the implications for conservation of ecotourism, global climate change and genetic engineering, and, the interface between conservation and restoration. *(LEC 3) (3 cr)*

BIOL 4016 Field Studies in Biology

This two-week field course introduces students to field surveys and techniques used to evaluate organismal populations and assess their habitats. *Prerequisites: BIOL 3356/3357 or permission from the instructor. (LEC, LAB, EXP) (3 cr)*

BIOL 4105 Honours Thesis

Students will work with a faculty supervisor to complete an independent research project. With this supervisor, each student will develop a research question, and then work to investigate this question. Students will perform background research into their chosen topic, plan and execute a research strategy that addresses their chosen question, analyze their collected data, and produce a poster presentation, a PowerPoint (or equivalent) presentation, and a scientific paper using the general formatting associated with peer-reviewed journal publications in biology (formatting information provided). *Prerequisite: This course is restricted to students in the four-year program. (LEC, LAB, EXP) (6 cr)*

BIOL 4206 Concepts in Health Informatics

This course introduces students to the science of health informatics and investigates the application of computing and communications technology to health-care, health systems administration and biomedical research. This diverse area of inquiry deals with the design and optimization of information systems to support primary health care delivery, clinical practice, epidemiology and public health research, hospital administration and numerous other health sector fields. Health Informatics as a discipline deals with organizing, modeling, designing, processing, analyzing, communicating and protecting health information and bio-medical research data. *Prerequisite: completion of second year core program in Biology or permission from the instructor. (LEC 3, LAB 3) (3 cr)*

BIOL 4306 Aquatic Biology

This course introduces students to the diverse array of aquatic environments and the various organisms that inhabit them. The first third of the course focuses on the physical properties of the oceanic and freshwater environments. The second third of the course surveys the major components of aquatic food chains and the ecology and adaptations of representative groups. The final third of the course addresses issues related to harvesting, pollution and the value of aquatic biodiversity. *Prerequisites: BIOL 3356/3357 or permission of the instructor. (LEC 3, LAB 3) (3 cr)*

BIOL 4426 Advanced Studies in Ecology and Evolution

This course introduces students to various 'big' research questions in the fields of ecology and evolution. Students participate in class discussions in which they are expected to critically evaluate research papers, and discuss problems and possible solutions. Students also gain skill in writing research proposals and literature reviews, and in making presentations using computer media programs, and gain experience in collecting and analyzing data used to investigate scientific hypotheses. *Prerequisites: BIOL 2056, 3356/3357 or permission from the instructor. (LEC 3, LAB 3) (3 cr)*

BIOL 4506 Invasive Species Biology

This course introduces students to the basic problems posed globally by invasive species, and is focused on species that are a problem locally/regionally (e.g., Lamprey in the Great Lakes; Strangling Dog Vine and Garlic Mustard in southern Ontario). The course is presented as a series of questions posed to students directly in class, and includes discussion of particular case studies and guest lectures presented by scientists directly engaged in invasive species research. Students participate in class discussions and debates in which they are expected to critically evaluate research papers, and discuss problems and possible solutions regarding particular case studies. Students gain skills in writing research proposals and literature reviews, making presentations using computer media programs, and collecting and analyzing field data used to investigate scientific hypotheses. *Prerequisites: BIOL 3356/3357 or permission of the instructor. (LEC 3, LAB 3) (3 cr)*

BIOL 4726 The Scientific Enlightenment

This course is a historical examination of the development of scientific ideas and methods in the period from the early sixteenth century to the early eighteenth century, a time often referred to as the "scientific revolution". The seminar will focus on the establishment of the foundations of modern scientific principles and enquiry, and their relationship to intellectual, social, cultural, and political developments that led to the dawn of the modern era in Europe. *Prerequisite: related 2000 series course or permission from the department. Students may not retain credit for more than one of BIOL 4726, HIST 4726, HIST 4725, and PSYC 4726. (SEM 3) (3 cr)*

BIOL 4906 Advanced Topics in Biology I

The course examines advanced coverage of particular topics in biology with accompanying lab when appropriate. Specific content varies from year to year depending on faculty expertise and research. *Prerequisite: completion of the third year core program in Biology or permission from the instructor. (LEC 3, LAB 3) (3 cr)*

BIOL 4907 Advanced Topics in Biology II

The course examines advanced coverage of particular topics in biology with accompanying lab when appropriate. Specific content varies from year to year depending on faculty expertise and research. *Prerequisite: completion of the third year core program in Biology or permission from the instructor. (LEC 3, LAB 3) (3 cr)*