



UNIVERSITY
OF MANITOBA

Department of Zoology

Faculty of Science

information for prospective students

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Areas of study within zoology

Zoology offers students the opportunity to explore five different areas of study:

- **Animal Behaviour and Behavioural Ecology**

These areas involve the study of how animals behave in relation to their environment and to each other. Studies are conducted in a wide range of habitats and involve a range of species, especially fish, birds and mammals. A combination of observational, historical and experimental approaches is used, including controlled laboratory studies of specific issues identified during field work. Areas of emphasis include studies of fishing fleet dynamics, implications of behaviour for fisheries management, behavioural mechanisms of predator-prey interactions in fish, interactions between parasitic cowbirds and songbirds in whose nests they lay their eggs, responses of host species to cowbird parasitism, and courtship behavior, mating systems and parent-offspring interactions in colonial birds.

Specialized zoology courses of direct relevance to this area include Behavioural Ecology, Animal Behaviour, Mammalogy, Biology of Fishes, Ornithology, Principles of Wildlife Management, and Quantitative and Theoretical Ecology II. These courses are frequently combined with Population Ecology, Community Ecology and Field Ecology.

Career opportunities:

Graduates of either undergraduate or graduate programs in this area find employment as biologists with business/consulting firms, senior levels of government or with educational institutions.

- **Animal Physiology**

This is the study of the numerous bodily processes that enable animals to function effectively in a variety of

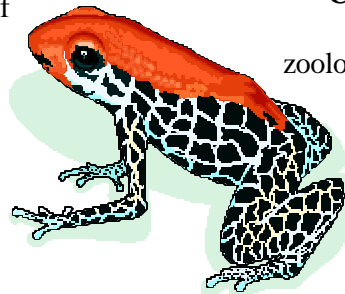
environments. Beyond third year core courses in Comparative Animal Physiology, the Zoology Department offers advanced courses and research opportunities in several areas of physiology. Studies in *comparative endocrinology* involve research on how enzymatic conversions of thyroid hormones are regulated in fish. Since these hormones affect growth, development and reproduction of fish, understanding their actions is important for aquaculture and fish management. Research in *animal energetics* include studies of thermal biology, diving physiology and bioenergetics of semiaquatic mammals, in particular the physiological problems encountered during swimming and diving in cold water. Research in *neurobiology* is investigating how inhibitory motor neurons contribute to the control of limb movements in arthropods, and how these neurons are related among arthropod classes. Advanced courses in physiology include Environmental Physiology, Sensory-Motor Physiology, Comparative Endocrinology and Comparative Animal Energetics.

Career opportunities:

Graduates of either undergraduate or graduate programs with emphasis in physiology may find employment in research or teaching programs in universities, hospitals, government or non-government agencies. Physiology also forms an ideal basis for further study of human or veterinary medicine, and in other training programs in health science or related areas.

- **Cell and Developmental Biology**

These are two active areas of study within zoology. With the advent of an impressive array of experimental tools including new types of microscopy, molecular, genetic, and biochemical/physical techniques, new and significant insights are being gained into the working of the fundamental unit of life, the cell.



Advanced courses include Comparative Animal Histology, Developmental Molecular Biology, Microtechnique, and Advanced Cell & Developmental Biology. These courses provide a solid foundation for continuing into a variety of biological and biochemical fields.

Research focuses on developmental aspects of cell biology. The zebrafish is used as a model system to study genome imprinting and the role of DNA methyl transferase and methylation in early development. The cloning of zebrafish genes and the generation of transgenics are being used to study control of gene expression. Other research focuses on how the oocyte accumulates essential compounds, how its structural framework arises and the role of bioelectrical currents in development. This involves investigating various invertebrate model systems using analytical microscopy and electrophysiological approaches. The oocyte is a key cell in the life cycle of most metazoan organisms.

Career opportunities:

Potential career options include postgraduate research programs, medical school and/or research, pharmacology and pharmaceuticals, biotechnology, toxicology and education. Cell/Developmental Biology also interfaces with a variety of disciplines such as biochemistry, microbiology, genetics, ecology, bioengineering and biophysics.

• **Ecology**

This area involves studies of relationships between living organisms and their environment. Much of the work takes place in the field with natural populations and communities of plants, animals and microorganisms. However, controlled experiments are frequently conducted in either the field or laboratory to test ideas derived from field studies. Most students interested in ecology complete the degree requirements in the Ecology program offered jointly by the Departments of Botany and Zoology because a well trained ecologist must know something about both plants and animals. This joint program is described in a separate information sheet.

Opportunities for study and research are available in wetland ecology, limnology, aquatic ecology, paleoecology, boreal ecology and ecological studies of a range of invertebrate and vertebrate animals. Specialized courses include Population Ecology, Community Ecology, Field Ecology, Boreal Ecology, Limnology, Fish Biology and Management, Wildlife

Management, Wetland Ecology, Ecology Project, and intensive faunal courses (Ornithology, Fish Biology, Mammalogy, Biology of Amphibians and Reptiles).

Career opportunities:

Opportunities for employment include public education and environmental awareness (museums, Parks Canada, Fort Whyte, Oak Hammock), natural resources management, conservation and endangered species management (governments and universities) and environmental consulting (business).

• **Parasitology**

Studies in parasitology encompass at least half of all biological species known to humankind. The association between the host and parasite varies from a benign, non-pathological association to severe and lethal pathology. The worldwide economic impact of parasitism is immense causing loss of human, plant and animal life or affecting quality and price of marketable whitefish and production of beef, poultry and crops. The host/parasite relationship is an unique biological association as it involves the ecology of both host and parasite. Research in parasitology involves studies of adaptations of parasites to survive environmental factors such as low temperatures and water loss as well as the immune systems of the hosts. Additional studies focus on hosts to determine how they modify behaviour, ecology and genetics to reduce the effects of parasitism.

Advanced courses include Introductory Parasitology, Wildlife and Fisheries Parasitology and Experimental Parasitology.

Career opportunities:

A knowledge of parasitism is important for personnel in diagnostics laboratories, for wildlife and fisheries biologists, veterinary and medical doctors. Advanced degrees for positions in academic, government and research institutions can be taken in Zoology and/or in related fields such as immunology, molecular biology, biochemistry, ecology, systematics, evolution and biogeography.

Zoology at the University of Manitoba

The Zoology Department at the University of Manitoba is a strong unit with excellent teachers, up-to-date teaching facilities and staff with international research reputations. The Department offers opportunities for study in the basic areas of zoology, including physiology, ecology, animal behaviour and

behavioural ecology, parasitology, cell and developmental biology.

Students enter the Zoology program in the Faculty of Science after completing first year requirements in University 1. All students take a group of core courses, mainly in Years II and III, to provide a background in basic fields of zoology. Students also complete specialized advanced courses of their choice in Years III and IV.

Undergraduate programs in Zoology prepare students not only for careers or further study in Zoology, but also in related areas including medicine, veterinary science, dentistry, agriculture, pharmacy, teaching and natural resources management.

Two degree programs are offered leading to either a Major Degree or Honours Degree. Students enter at the beginning of Year II and should have 30 credit hours of courses completed within University 1 including *Biology Band Introductory University Chemistry I and II*. To enter a Major Program students must have a "C+" in one of the above subjects and not less than a "C" in the other. An Honours Program requires a "B" in one subject and not less than a "C+" in the other. Honours students are required to complete a research thesis (one full course) during Year IV. Major students do not have this opportunity.

The Honours program prepares students for either employment or graduate study with the possibility of direct entry into a PhD program. Graduates with a Major degree can seek employment or enter a MSc program. The MSc provides an important edge when competing for positions. PhD graduates are qualified for a variety of research positions or academic appointments at universities and many of our former students hold such positions. Courses in Zoology typically consist of lectures, seminars, experimental laboratory studies, field trips and projects. In Years III and IV, courses provide, wherever possible, "hands-on" experiences and skills that are required by employers. There is a faculty advisor appointed for each student to provide guidance.

Zoology students have access to excellent teaching and research facilities including controlled environment rooms for holding terrestrial and aquatic organisms, a computer laboratory, the Stewart Hay Memorial teaching museum, electron microscope, the Taiga Biological Station, and the University Field Station at Delta Marsh.

Is Zoology for you?

Zoological study at the undergraduate level requires a knowledge of chemistry and in some disciplines botany, mathematics, statistics and physics. Consequently, students must be able to perform well in several related science subjects as well as zoology.

The study of living systems is exciting and integrates the molecular, cellular, tissue, organismal and ecological levels. Are you fascinated by the structure and function of organisms; how they have evolved; how they interact with each other and the environment? Do you enjoy a sense of adventure? Then zoology is for you.

Success in the initial years leads to research, a very rewarding activity. If you find these goals interesting and challenging, then Zoology is for you!

Entering the Zoology program

Students need Chemistry 40S and Mathematics 40S in their high school program. After completing University 1, students will transit to the Faculty of Science and enter second year of the Zoology program.

University 1 courses

University 1 courses MUST include:

- Biology 071.125 *Biology B*
- Chemistry 002.130 *University I Chemistry: Structure and Modeling in Chemistry*
- Chemistry 002.131 *University I Chemistry: An Introduction to Physical Chemistry*

Of the six credit hours from the Faculty of Arts that are required in University 1, three credit hours should be from the list of courses that fulfils the University's written English requirement.

It is highly recommended that students complete 3 hours of Mathematics or Physics from 136.120, 136.130, 136.150, 016.102 or 016.105 plus Statistics 005.100 in University 1.

For further information:

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Note: In the event of any inconsistencies between the information found in this Infosheet and the University's annual General Calendar, the Calendar entry shall prevail. The effective date of this information is September 2004.