

COURSE REQUIREMENTS FOR ENVIRONMENTAL BIOLOGY SPECIALISATION

Course Code	Course Name
Core Course	
MLS900	Science Communication
Required Courses	
MLS964	Global Environmental Change and Vulnerable Ecosystems
MLS972	Advances in Ecology
MLS973	Physiological and Molecular Responses of Plants and Animals to Environmental Stress I
Specialisation Elective Courses <i>(Select 2 for those on the dissertation route; 3 for those on the complete coursework route)</i>	
MLS903	Seminars on Special Topics in Applied Plant Sciences
MLS962	Environmental Health and Toxicology
MLS963	Conservation and Management
MLS965	Evolution and Phylogeny
MLS967	Forest Ecology and Management
MLS974	Physiological and Molecular Responses of Plant and Animals to Environmental Stress II
MLS975	Seminars on Plant Developmental Responses in a Changing Environment
MLS982	Comparative Functional Anatomy
MLS985	Chemical Ecology
MLS987	Contemporary Topics in Zoological Sciences
Plus Either:	
-	Dissertation (6AU); or
MLS971	Critical Inquiry (Environmental Biology) (2AU)

Description of courses

MLS900 Science Communication

It is important for Science to be communicated effectively across all levels, given its large impact on society and vice versa. All science professionals, whether they are in education, research or industry, will need to engage different audiences in science communication at various points in their career. This course aims to equip participants with the knowledge and skills to evaluate scientific information and to communicate it effectively to both expert and lay audiences. The following broad topics will be covered: mutual roles and influence of Science and society, principles of effective science communication, evaluating the quality of scientific evidence, and current science-related issues affecting society. Opportunities for practice in science communication will be provided.

MLS964 Global Environmental Change and Vulnerable Ecosystems

Accelerated change in the environment on a global scale has been observed in the Anthropocene. The drivers of these global scale changes are attributed to human activities that relate to an unsustainable rate of development. Natural ecosystems (both terrestrial and aquatic) are impacted by environmental change, particularly when the scale and intensity of change exceeds the natural resilience and tolerance states of these ecosystems. It is important to be able to monitor and understand the impacts of environmental change to whole systems, especially vulnerable tropical ecosystems which largely support more than half of the earth's human populations. This course aims to look at global environmental change and their impacts on vulnerable ecosystems from a scientific perspective, utilising state of the science technologies and newly developing knowledge. The course will be delivered as a practice-based field-orientated programme, which will have a compulsory overseas field component.

MLS971 Critical Inquiry (Environmental Biology)

This is a compulsory course offered to participants who are enrolled in the Critical Inquiry (CI) route. Participants in this course will acquire experimental skills/techniques specific to the Environmental Biology specialisation of the Life Science Programme. This field and lab-based course introduces current research approaches and methods employed by scientists in gathering data pertaining to plant and animal physiology, biochemistry and molecular biology, adaptations and behaviours. Participants will have the opportunity to conduct field experiments under the guidance of experts using field instrumentation and laboratory analyses. Techniques include plant physiology, ecotoxicology, chemical ecology, microbiology, molecular biology and pharmacognosy. Participants will also conduct field experiments and analyses of research data.

MLS972 Advances in Ecology

Besides introducing the various concepts in ecology, the course focuses on the complexity and interplay of ecology at the different levels of biological organisation (e.g., individual ↔ populations ↔ communities). In today's highly altered environments, knowledge about ecology has immense value in real-world applications to ensure a sustainable Earth for future generations. Singaporean issues are central, but are set in a global context. For example, the construction of the EcoLink@BKE in Singapore is an attempt to address habitat fragmentation, an issue also faced by many developing countries due to deforestation and habitat degradation. Topics include population growth models, competition, niche partitioning, trophic interactions, succession, and island biogeography.

MLS973 Physiological and Molecular Responses of Plants and Animals to Environmental Stress I

Environmental stress can be caused by both abiotic (physical and chemical) and biotic (effects of other organisms) factors. How plants and animals sense and respond to environmental stress have fascinated scientists. Due to both anthropogenic-driven and nature-driven environmental changes like changing solar radiation (both visible and UV radiation), global warming or increasing temperatures, increasing periods of freezing temperatures and droughts, ocean acidification, and increasing pollutants, determining the ability of plants and animals to sense and respond to different environmental stress becomes increasingly important. Participants in this course will learn about the molecular and physiological mechanisms used by both plants and animals to cope with environmental stress in the different environments.

MLS903 Seminars on Special Topics in the Applied Plant Sciences

This course is intended to broaden exposure of higher degree students to current and relevant topics and issues in the applied plant sciences field through discussion and dialogue with both academics and industry players. It will cover broad areas such as microbial soil biology, ecophysiology, horticulture, urban greening and natural resources usage.

MLS962 Environmental Health and Toxicology

The study of the effect of pollution on natural ecosystems by examining biological responses at all organismal levels (molecular to whole organism) using biomarkers is an increasingly popular tool for managing environmental health by various governmental bodies. Candidates who take this course will have an opportunity to run laboratory experiments using known pollutants. Field sampling will be conducted to examine possible correlations with environmental contamination, allowing candidates to experience a direct application of ecotoxicology techniques as an environmental management tool. This experimental extension allows for a more rigorous assessment of a research-based course.

MLS963 Conservation and Management

In a rapidly changing world where the utilisation of resources is inextricably linked to development, the challenge of ensuring the sustainable use of natural resources has global consequences. This course will deal with issues relating to the sustainable use, protection, conservation and management of the earth's natural resources through relevant case studies. Local, regional and international initiatives, which address the issue of sustainable development and natural resource management and the role of science in environmental management will be studied.

MLS965 Evolution and Phylogeny

While Physics and Chemistry have many fundamental laws that most science students are well acquainted with, Biology is fascinating in that there is a unity of all life, with the incredible diversity of living things and their innumerable adaptations for survival and reproduction. What made this shared ancestry and diversification possible? We will explore the process of evolution and the patterns of relationship among living things that follow from it. In addition, we will see how an evolutionary approach can help us better understand the interaction between organisms and their environment, as well as how an understanding of evolution and phylogeny can assist in the conservation and management of habitats and endangered species. Research themes and methods that are currently being actively pursued in the field will be highlighted.

MLS967 Forest Ecology and Management

Many countries depend on forests as natural resources that contribute towards economic growth. Large areas of the world's forests, however, are being cleared at a fast pace, which, left unchecked, may result in the loss of biodiversity as well as the degradation of the environment through soil erosion and the building up of greenhouse gases, not to mention a loss of a potentially sustainable source of income. How then do we achieve a balance to attain sustainable growth? This course will examine two overlapping yet very different issues. The first concerns the dynamics of forest ecosystems: their history, distribution, and ecology. The second issue is that of forest usage and management, timber and non-timber extraction methods, and silviculture. Policies pertaining to the international trade in timber, forest conservation, and sustainable forestry will also be examined in an attempt to better understand the forces that will determine the fate of our forest resources.

MLS974 Physiological and Molecular Responses of Plant and Animals to Environmental Stress II

This course is a continuation of Physiological and Molecular Responses of Plants and Animals to Environmental Stress I. Physical factors like carbon dioxide levels, pressure changes in the deep sea, water availability can affect the survival of many organisms living in that environment. In addition to physical factors, chemical factors such as availability of mineral nutrients, changes in salt contents, heavy metals contamination, use of fertilisers and air pollution can also affect both plant and animal survival. The presence and the behaviour of other organisms in the ecosystem can affect the survival of both plants and animals too. Participants in this course will learn about the molecular and physiological mechanisms used by plants and animals in coping with environmental stress (mineral stress, salinity stress, heavy metal contamination and air pollution in plants; ocean acidification, pressure changes, water availability and salinity stress in animals). The interactions between plants and animals in the environment will also be discussed.

MLS975 Seminars on Plant Developmental Responses in a Changing Environment

Multicellular photosynthesising plants existed on land around 850 million years ago. The ever-changing earth environment contributes to the diverse anatomy and morphology of leaves, roots, flowers, and seeds. Plants possess amazing phenotypic plasticity of which a single genotype produces different phenotypes in different environments. Comparative and quantitative genetics, as well as molecular approaches are leading to new insights into the adaptive nature of developmental plasticity, its underlying mechanisms and its role in the ecological distribution and evolutionary diversification of plants in a changing environment. With the growing concerns in climate change and global warming, identification of stress-responsive genes and their subsequent introgression within sensitive crop species are now being widely carried out by plant scientists to supply food to an ever-increasing population.

MLS982 Comparative Functional Anatomy

Animals adapt to their environments via a variety of anatomical modifications and behavioural strategies. Taking a comparative approach, this course focuses on the developmental morphology and functional characteristics of vertebrates and invertebrate at the organismic level. The study of this subject in contemporary zoology is vast; consequently, selected themes and taxa, their phylogeny, and systems will form the topics of study. Topics include adaptations for feeding, locomotion, and reproduction in the different taxonomic groups and environments.

MLS985 Chemical Ecology

This course on Chemical Ecology explores the role and function of chemistry in mediating interactions among a variety of organisms, including intraspecific and interspecific interactions. The course will cover the range of compound classes involved in chemical ecology. In addition, we will discuss the diversity of species interactions and chemical compounds in terrestrial and aquatic systems, and methods (e.g. analytical and molecular techniques) used to detect these compounds. We will cover defensive and offensive chemistry mediating antagonistic interactions; the evolution of defenses; chemicals mediating mutualisms, competition, and sociality; the physiology of chemical production and recognition; and how chemical ecology affects humans. The biotechnological applications of chemical ecology will also be discussed. This course will include paper discussions of relevant recent literature.

MLS987 Contemporary Topics in Zoological Sciences

This seminar course focuses on current research areas, topics and reviews of literature in zoological sciences. As graduate students are expected and encouraged to read current zoological science research literature critically and widely, each time this course is conducted, a recently published edited book in relevant zoological science themes will be selected by the instructors to be used as the course resource. Seminar resource material (i.e., the edited book) will be selected on a thematic or disciplinary basis, rather than on a taxon-specific basis. Each student is required to read, synthesise, critique and make a class presentation on an assigned chapter of the book. In addition, the students are expected to read the entire book so that they can engage each presenter in fruitful discussions during the seminar presentations. Through this method of individual in depth research on one topic plus the discourse with course mates on related topics, the learning is self-directed as well as collaborative in nature.
