

COURSE MODULES

LEVEL 1.1

Animal Anatomy & Physiology

This module introduces the anatomy and functions of the animal body. This module equips students with an understanding of the anatomy and physiology of the integumentary, musculoskeletal, respiratory, cardiovascular, gastrointestinal, urinary, reproductive, nervous and endocrine systems.

Animal Nutrition

This module provides students with an opportunity to understand animal nutrition and its importance in growth and well-being of laboratory, domesticated and farm animals. Students will have an insight into the nutritional requirements of large and small animals and the use of animal feed additives and growth promoters. The digestive processes and functions of the gastrointestinal tract will be studied. This module will provide some knowledge on the feed milling processes, management of a feedmill, evaluation methods of the nutrients for feed rations and formulation of animal feed.

Students will understand the use of raw ingredients in the formulation of commercial feed and the regulatory procedures involved to ensure safe production of animal feedstuffs. Students will also acquire knowledge regarding the different types of pet foods and regulation of pet foods in Singapore. Alternative sources of animal feed such as the use of unconventional animal feeds and feed replacement will be studied.

Inorganic & Physical Chemistry

This module introduces students to aspects of inorganic and physical chemistry. Topics covered comprise the structure of matter, chemical bonding, thermochemistry, chemical equilibria, kinetics, electrochemistry, redox reactions, transition metal chemistry, and chemistry of solutions including acids, bases and buffers.

Veterinary Microbiology

This module provides students with an understanding of how bacteria of veterinary importance cause disease in animals. Pathogenic bacteria studied will include those that cause gastrointestinal diseases, respiratory diseases, reproductive diseases, skin and nervous system diseases. This module also includes the study of molecular mechanisms underlying host/pathogen interactions in the pathogenesis of animal diseases, as well as aspects of disease control, including diagnosis, antibiotic treatment and vaccination. Standard microbial laboratory techniques involving the isolation, culture and identification bacteria (based on microbial metabolic characterisation and microscopy examination) will also be covered.

LEVEL 1.2

Animal Welfare, Behaviour & Handling

This module provides students with an understanding of the proper handling and restraint of domestic animals, as well as the responsible care and use of laboratory animals for research purposes. The techniques include step-by-step instructions for performing each procedure and the purposes, followed by learning the potential complications. This module also covers the fundamental principles underlying animal behaviour, such as animal learning behaviour, sexual selection and mating behaviours, kinship, cooperation, foraging, communication, aggression and elimination behaviours. The basic principles of animal welfare will also be explained, including methods of measuring animal welfare (such as the 'Five Freedoms' and preference testing) and the limitations of such assessment methods.

Biostatistics

This module is designed to provide students with basic statistical skills to analyse and interpret simple biological, pre-clinical and clinical data. Students will acquire proficiency in the quantitative analysis of scientific data. The statistical skills covered include descriptive statistics, data distribution, set sample size, measurement of central tendency, scatter diagram, cluster analysis and simple linear correlation and regression analysis for linear data. The presentation of data in graphical forms using Microsoft Excel covers selection and preparation of different types of graphs, how to write titles

and legends and interpretation of results. Students will have proficiency in the use statistical software for data analysis, preparation of documents and presentation of results.

Career & Professional Preparation I

This module is part of the Education and Career Guidance framework to provide students with the tools and resources necessary for their career and/ or further education. In this first module, students will undergo personal discovery and exploration of industry and career prospects. Students will learn how to plan and set achievable goals in preparation for their future. Students will also learn the importance of passion and professionalism, and basic teamwork and interpersonal skills.

Cell Biology

This module explores mammalian cells, tissue and organ systems, and prokaryotic and eukaryotic genetics at the molecular level. Topics include the fundamental chemicals of life, structure and the function of cells and organelles, DNA structure, replication, transcription and translation, protein synthesis, gene mutation, cell communication, cell division (mitosis and meiosis), genetics and hereditary, apoptosis and cancer.

Organic & Biological Chemistry

This module gives students a strong foundation in basic organic chemistry. Topics include the IUPAC nomenclature, structural formulae, preparations and reactions of the main classes of organic compounds namely alkanes, alkenes, alkynes, benzene, alcohols, thiols, ether, aldehydes, ketones, amines, carboxylic acids and derivatives.

Wildlife Conservation & Biodiversity

This module covers aspects of biodiversity conservation, and discusses how biodiversity is generated and maintained. This module will also address issues such as how we can manage and restore habitats, the formulation of strategies for the conservation of species threatened with extinction, and human-wildlife conflict situations. National policies and legislation pertaining to conservation of local biodiversity will also be covered.

COURSE CURRICULUM

Module Name	Credit Units
YEAR 1	
Level 1.1 (28.5 hours per week)	
Animal Anatomy & Physiology	6
Animal Nutrition	3.5
Inorganic & Physical Chemistry	7
Veterinary Microbiology	6
Innovation Toolkit ^	4
Sports & Wellness ^	2
Level 1.2 (28.5 hours per week)	
Animal Welfare, Behaviour & Handling	4
Biostatistics	3
Career & Professional Preparation I	1.5
Cell Biology	7
Organic & Biological Chemistry	7
Wildlife Conservation & Biodiversity	2
Critical Thinking & Communication ^	4

Notes:

^ For more details on Interdisciplinary Studies (IS) electives, please log on to www.np.edu.sg/is/

IS Modules

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COURSE MODULES

LEVEL 2.1

Aquaculture & Fish Diseases

This module equips students with the knowledge of the anatomy, physiology, nutritional requirements and reproductive systems in mainly Teleost fish as well as provides an introduction to aquaculture and the various aquaculture systems employed today. Students will also be introduced to a variety of common and significant fish diseases, the principles of disease diagnosis, treatment and health management of various fisheries and aquariums.

Applied Biostatistics

This module covers advanced statistical skills to analyse and interpret a wide range of biological, pre-clinical and clinical data, and preparation of data for scientific presentation. The statistical skills covered include biological experiment design, hypothesis testing, quantitative data analysis by parametric and non-parametric methods, qualitative data analysis by Chi-square and Fisher tests, and simple correlation and regression analysis for non-linear data. The scientific presentation section covers how to organise data, prepare and incorporate statistical results on graphs and interpretation of results.

Career & Professional Preparation II

This module is part of the Education and Career Guidance framework to provide students with the tools and resources necessary for their further career and/ or education. In this module, students will explore basic job search strategies, practice writing effective resumes and cover letters, and learn interview skills. Students will also learn professional and intercultural communication skills to prepare them for a dynamic and diverse workplace.

Cell Culture & Tissue Applications

This module is a detailed study of the techniques used in the culturing of cells and tissues. Topics include the preparation of media, cell viability checks, passaging of inherent cells, cryopreservation, cloning and mycoplasma assays. Applications of animal cell culture, tissue engineering and rapid prototyping are also covered.

Veterinary Immunology

This module introduces students to the fundamentals of immunology and provides an understanding of how the immune system functions as an integrated defence system against disease. Topics include an overview of the immune system of vertebrates, innate and adaptive immunity, humoral and cell-mediated immunity, immunisation, vaccination, laboratory immunological techniques, diseases of the immune system and antibody-based therapies.

Veterinary Pharmacology & Toxicology

This module covers the basic principles of veterinary pharmacology, pharmacodynamics, pharmacokinetics (absorption, distribution, metabolism, elimination), the major drug classes, basic anaesthesiology, and an introduction to toxicology. Clinical and research applications of the drugs will be discussed in relation to the drug effects and mechanisms of action. Students will have the opportunity to practise animal handling skills and techniques for administration of medication, as well as perform drug calculations.

LEVEL 2.2

Animal Developmental Biology & Genetics

This module discusses developmental biology, genetics approaches to understanding animal embryonic development, and genes that are involved in body plan formation and morphogenesis. Other topics include the pattern of inheritance, mutation, and roles of genes and environmental factors in relation to animal health are also covered.

Animal Diseases & Pathology

This module trains students in the skills necessary for the investigation, prevention and control of common infectious and non-infectious animal diseases. The study of pathogenic mechanisms and the morphological aspects of disease will also be covered. Emphasis will be given to common diseases affecting small laboratory animals. Common diseases affecting laboratory animals will also be briefly discussed.

Clinical Biochemistry & Haematology

This module focuses on disease diagnosis and monitoring in clinical biochemistry and haematology as reflected in veterinary clinic practice. The clinical biochemistry component will cover enzyme kinetics and metabolism, and give students an understanding of metabolic diseases. The haematology component will cover aspects of blood analysis and will provide practical training in performing blood smears, carrying out blood biochemistry and completing blood count profiles, which are routinely conducted in veterinary clinics.

Clinical Diagnostics, Surgical & Veterinary Practices

This module covers introductory clinical diagnostics and basic surgical techniques. Students will be taught how to handle clinical samples, prepare and examine skin scrapings, urine, fecal bacteriological and cytological samples. Students will also learn to perform histological sections and stain tissues for diagnostic purposes. Students will be introduced to the perioperative preparation of an animal for surgery, monitoring of an animal during surgery, and surgical instrumentation. Management of a veterinary practice will also be briefly covered.

Molecular Biology & Bioinformatics

This module covers the fundamentals of molecular biology coupled with techniques in bioinformatics in order to provide students with analytical skills that are useful in analysis of molecular data. The molecular biology component covers topics such as DNA structure and replication, gene expression, gene mutation, DNA repair mechanisms and recombinant DNA technology. Students will learn how biological data such as nucleic acid and protein sequences are archived and how to retrieve such information from public databases. Students will be introduced to current bioinformatics software that can be used for analysis of nucleic acid and protein sequences, and for designing of PCR primers.

COURSE CURRICULUM

Module Name	Credit Units
YEAR 2	
Level 2.1 (27 hours per week)	
Applied Biostatistics	3
Aquaculture & Fish Diseases	5
Career & Professional Preparation II	2
Cell Culture & Tissue Applications	5
Veterinary Immunology	6
Veterinary Pharmacology & Toxicology	4
Interdisciplinary Studies (IS) elective ^	2
Level 2.2 (25.5 hours per week)	
Animal Developmental Biology & Genetics	2.5
Animal Diseases & Pathology	6

Clinical Biochemistry & Haematology	4.5
Clinical Diagnostics, Surgical & Veterinary Practice	4.5
Molecular Biology & Bioinformatics	6
Interdisciplinary Studies (IS) elective ^	2

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COURSE MODULES

LEVEL 3.1

Animal Genomics & Proteomics

This module provides current information on a range of topics, including animal genome projects, transgenic animals and cloning, and ethical issues involved in the genetic engineering of animals. Application of genomics & proteomics to the study of animal disease, reproduction & breeding will also be discussed. The practical component will cover gene and protein expression, with an emphasis on protein identification and separation strategies.

Animal Husbandry & Breeding

This module introduces students to the field of good animal husbandry management and breeding. Students will learn how to take proper care of farm and pet animals. Students will acquire knowledge and skills on animal husbandry and understand the role of animals and the impact of animal health in the economy. This module covers the essentials of farming practice, particularly the breeding and raising of livestock. The impact of genetics on breeding and the selection of desirable heritable traits will be discussed. Techniques which are used to improve herd genetics, such as artificial insemination and embryo transfer, will also be discussed.

Preclinical & Clinical Trials

The module introduces students to the various stages in biomedical research, ranging from preclinical to clinical trials. Students will be introduced to various important government authorities that are involved in the approval and establishment of both scientific and ethical guidelines pertaining to biomedical research.

Project A

In Project A, students will work on a research project in groups of two or three in an area that is of interest to them, under the supervision of a staff member. Students will commence Project A by attending a series of lectures covering aspects such as writing a literature review, basic laboratory safety, project management and statistical analysis of data, which is then followed by practical work in the laboratory.

LEVEL 3.2

4-Month Internship

Students will undertake a four-month internship, which will give them opportunities to relate and apply the knowledge acquired in classrooms to work situations and in research. Students will be attached to local research institutes and companies in various industries (such as veterinary clinics and hospitals, animal theme parks, animal

breeding facilities, biomedical science research laboratories, and veterinary regulatory bodies). Students will also have the opportunity to go on overseas internships.

Project B

In Project B, students will continue to work on their research project in the laboratory. Upon completion of their project, students will submit a written scientific report and present their findings by giving an oral PowerPoint presentation and a scientific poster presentation.

COURSE CURRICULUM

Module Name	Credit Units
YEAR 3	
Level 3.1 (24.5 hours per week)	
Animal Genomics & Proteomics	6
Animal Husbandry & Breeding	4
Preclinical & Clinical Trials	2.5
Project A	8
Interdisciplinary Studies (IS) elective ^	2
World Issues: A Singapore Perspective ^	2
Level 3.2 (24 hours per week)	
4-Month Internship	16
Project B	8

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