

DIPLOMA IN BIOMEDICAL SCIENCE

Fascinated by the structure of living organisms and how the human body functions? Or interested in making the next big breakthrough in diagnosing, treating or preventing diseases like COVID-19? With the rising quality of health care, our reputable Diploma in Biomedical Science (BMS) will give you a head start if you are keen on a dynamic career in the biotechnology sector or medical field, including allied healthcare.

Known for its rigorous and broad-based curriculum, BMS will prepare you well for both further studies and work.

In your first year, you will take modules that will give you a firm foundation in bioscience and chemistry. In your second year, you will develop research and problem-solving skills that are highly valued by the industry. You will acquire knowledge and skills in analytical chemistry, molecular biology, cell culture & bioprocess engineering, and immunological techniques. Elective modules in biomanufacturing and food science & technology will also broaden your career opportunities.

In your third year, you will deepen your skills in Genomics, Proteomics and Translational Medicine & Clinical Trials, and apply your knowledge in conducting translation research.

You will also work on your capstone project and undertake a six-month internship with local or overseas research institutes such as A*STAR's Genome Institute of Singapore (GIS), Institute of Bioengineering and Nanotechnology (IBN) and Institute of Molecular and Cell Biology (IMCB); biopharmaceutical and pharmaceutical companies such as Lonza, Procter and Gamble, and Thermo Fisher Scientific; and healthcare institutes like Singhealth (National Cancer Centre Singapore).

YEAR 1 COURSE MODULES

LEVEL 1.1

Anatomy & Physiology

This module equips students with an understanding of the basic principles of homeostatic mechanisms and the cardiovascular, respiratory, renal, gastrointestinal, neuromuscular, endocrine and reproductive physiological systems that exist in the human body. It also covers basic skeletal system and anatomy.

Career & Professional Preparation 1

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, along with basic teamwork and interpersonal skills.

Cell Biology & Genetics

This module exposes students to key themes and experimental techniques in eukaryotic cell biology and genetics. It covers cell structure and function of cellular organelles, regulations of cell cycle and cell division, study of genes, genetic variation and heredity. Fundamentals of molecular biology such as the structure of DNA, DNA replication, transcription and protein synthesis will also be outlined.

School of Life Sciences & Chemical Technology

Inorganic & Physical Chemistry

This module covers the structure of matter, chemical bonding, orbital hybridisation, thermochemistry, chemical equilibria, kinetics, electrochemistry and redox reactions, transition metal chemistry, chemistry of solutions, including acids, bases and buffers.

Mathematics

This module provides students with a fundamental analytical knowledge of mathematics essential for the study of life sciences. The module is designed to equip students with the necessary mathematical techniques to solve biological and chemical problems, as well as to carry out analytical studies in their future work. Topics include exponential and logarithmic functions, integration, differentiation and differential equations.

LEVEL 1.2

Biosafety & Risk Management

This module is designed based on the curriculum of the WSQ "Follow Good Biosafety Practices" course. This module aims to equip students with essential knowledge and skills for safe handling of chemicals and biological agents as well as fundamentals of decontamination and waste management. Topics such as following biosafety and biosecurity principles and practices, risk assessment and mitigation, national and international biosafety guidelines and legislation, and emergency response programmes will also be covered.

Biostatistics

This module is designed to provide students with basic statistical skills to analyse and interpret simple biological, pre-clinical and clinical data. The basic statistical skills covered are 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. Students will learn about the presentation of data in graphical forms using Microsoft Excel, including selection and preparation of different types of graphs, how to write titles and legends, and interpretation of results and drawing of conclusions.

Microbiology

This module introduces a basic understanding of microorganisms and techniques in microbiology. Topics include cell structure and function, classification, viruses and fungi, nutrition, growth and regulation, environmental factors affecting growth, microscopy, staining, size measurement, cell enumeration, media preparation, isolation and cultivation of pure cultures.

Organic Chemistry

In this module, students are introduced to the main classes of organic compounds e.g. alcohols, aromatic and carbonyl compounds. The properties and chemical reactivity of these compounds will be discussed especially in their application to the chemistry of life sciences. In addition, some basic organic reaction mechanisms e.g. nucleophilic substitutions (SN2 and SN1 mechanisms) will be covered.

YEAR 1 COURSE CURRICULUM

Module Name	Credit Units
Level 1.1 (18 hours per week)	
Anatomy & Physiology	3
Career & Professional Preparation 1	1
Cell Biology & Genetics	4
English Language Express*	NA
Innovation Made Possible^	3
Inorganic & Physical Chemistry	4
Mathematics	3
Level 1.2 (17 hours per week)	
Biosafety & Risk Management	2
Biostatistics	3
Communication Essentials^	3
Health & Wellness^	1
Microbiology	4
Organic Chemistry	4

Notes:

^ For more details on Interdisciplinary Studies (IS) electives, please log on to www.np.edu.sg/is * This module is only offered to students who are weaker in the English Language.

IS Modules

The School of Interdisciplinary Studies (IS) delivers a broad-based curriculum, which nurtures a new generation of professionals with multidisciplinary skills and an innovative and entrepreneurial spirit to meet the challenges of a knowledge economy. IS offers both prescribed modules and electives to challenge boundaries. Prescribed modules develop students' competencies in core areas such as Communication, Innovation and Enterprise, Culture and Communication, and Personal Mastery and Development, while elective modules provide insights into Arts and Humanities, Business, Design, and Science and Technology.

YEAR 2 COURSE MODULES**LEVEL 2.1****Applied Microbiology**

This is an advanced module in microbiology for second year students and is a continuation of the basic microbiology module. This module focuses on the importance of microorganisms as contaminating agents in the production of foods and pharmaceuticals. It focuses on the techniques and methodologies involved in the analyses and prevention of microbiological contamination. This module also provides a foundation in medical, food, environmental and industrial microbiology as well as skills and knowledge in Good Manufacturing Practices, food hygiene auditing and the preparation of a HACCP plan.

School of Life Sciences & Chemical Technology

Biochemistry

This module introduces fundamental biochemical concepts and practices. The subject integrates biological and chemical concepts as they relate to biochemistry and biochemical disorders. The module prepares students to work in biochemical industries and research institutions, and covers three major areas of protein chemistry, enzymology and metabolism.

Career & Professional Preparation 2

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.

Molecular Biology & Bioinformatics

This module covers advanced topics in molecular biology. Topics include regulation of gene expression, gene mutation and DNA repair mechanisms. In the area of recombinant DNA technology and molecular techniques, students will learn about nucleic acid isolation, polymerase chain reaction (PCR), DNA cloning, identification of recombinant clones, DNA sequencing and microarrays. Students will also be introduced to computational approaches and bioinformatics tools that can be used for the analysis of nucleic acid and protein sequences, and for designing PCR primers.

ELECTIVES: Choose any 1

Biomanufacturing Practices

This module focuses on principles and practices in the manufacturing of biological agents such as vaccines, biologic drugs and antibodies by mammalian and microbial catalysts. Topics include an overview of kinetic and stoichiometric analysis of bioreactors, biomanufacturing process operations, bioreactor design principles, single use systems, agitation and mixing, heat transfer and temperature culture, and process scale-up.

Food Science & Technology

This module covers key topics in modern food science, focusing on key issues which affect the import, production, testing and regulation of processed foods in Singapore. This module introduces students to local and international food standards, and they will learn to interpret data and information presented in the scientific and non-scientific literature. Laboratory classes will focus on the analyses of processed foods.

LEVEL 2.2

Analytical Chemistry

This module covers various instruments which are used in analytical chemistry/biochemistry with the emphasis on their practical use. Students will study the workings of the UV-Vis, HPLC (including IEX, gel filtration, affinity chromatography), capillary and gel electrophoresis. This module also covers the interpretation of mass spectrometry as applied to small molecules and proteins; proton and ¹³C-NMR and infrared spectroscopy in the structural elucidation of organic molecules.

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 are 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 & regression analysis for non-linear data. Students will perform statistical analysis using statistical software such as SPSS and Excel. The scientific presentation section covers how to organise data, prepare and incorporate statistical results on graphs and interpretation of results.

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Cell Culture & Bioprocess Engineering

This module equips students with strong aseptic techniques and application of cell culture in bioprocess engineering. Topics include regulatory affairs, biologics, cell lines, media, maintenance of cell cultures, and understanding of bioprocessing. Students will also acquire practical and theoretical knowledge of developing fermentation processes and manufacturing biological products. This module covers the application of bioprocess technology principles to scale-up production, economics, and regulatory considerations of bio-products derived from recombinant organisms and animal cell culture.

Immunological Techniques

This module introduces the fundamentals of immunology and provides an understanding of how the immune system functions as an integrated defense system against disease. Topics include an overview of the innate and adaptive immunity, humoral and cell mediated immunity, immunisation and vaccination. The module also covers the applications and advancements of immunological techniques in clinical, healthcare and diagnostic laboratories.

ELECTIVES: Choose any 1

Biopharmaceutical Analysis

This module is designed to equip students with knowledge and molecular techniques that are used to analyse raw materials and biological products. Topics include an overview on biologics production using microbial and mammalian systems, detection of adventitious agents in biological products using quantitative PCR (qPCR), endotoxin and pyrogen testing, bioburden test, and detection of residual host cell proteins using enzyme linked immunosorbent assay (HCP-ELISA). An overview on pharmaceutical law and regulatory landscape will also be covered.

Food Processing & Safety

This module covers principles and techniques used in the food industry which include mass and energy balance and their application in food unit operations, size reduction, thermal processing, non-thermal processing and equipment. Under food safety, proper handling, preparation and storage of food will be explored. Nature of contaminants, safety evaluation of food ingredients and food safety regulations (FDA, AVA) will also be covered

YEAR 2 COURSE CURRICULUM

Module Name	Credit Units
Level 2.1 (20 hours per week)	
Applied Microbiology	5
Biochemistry	4
Career & Professional Preparation 2	2
Molecular Biology & Bioinformatics	5
Electives: Choose any 1 Biomanufacturing Practices OR Food Science & Technology	4
Level 2.2 (22 hours per week)	
Analytical Chemistry	4
Applied Biostatistics	3
Cell Culture & Bioprocess Engineering	5

School of Life Sciences & Chemical Technology

Immunological Techniques	4
World Issues: A Singapore Perspective^	2
Electives: Choose any 1 Biopharmaceutical Analysis OR Food Processing & Safety	4

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YEAR 3 COURSE MODULES

LEVEL 3.1

Capstone Project

Students will complete a final year research project under the guidance of an academic staff or industry mentor. The Capstone Project can cover any of the key areas in life science research including Molecular Biosciences, Industrial Biotechnology, Food Technology, Aquatic Science & Technology, Environmental Technology and Urban Horticulture and Greenscape. Students will be able to integrate and apply the knowledge and skills learned from the course. They will be involved in report writing as well as presenting the outcomes of the project in poster and oral presentations. The Capstone Project will further strengthen their writing and communication skills as well as analytical and problem-solving skills, thus preparing them for the industry or further studies.

Genomics & Proteomics

This module provides an insight into the fields of genomics and proteomics. Students will study the functions of genes and their interaction within a genome, the human genome project, next-generation sequencing, genetically modified organisms and gene therapy, protein expression with emphasis on the structure and functions of proteins, methods of purification and analyses of proteins, and applications of proteomics.

Translational Medicine & Clinical Trials

This module builds on the previous modules taken in the first and second year of the Biomedical Science course. Upon completion of this module, students will be able to appreciate the difference between basic and clinical research and apply the knowledge learnt in conducting translation research. This module also covers bioethics, clinical trials and regulatory compliance, clinical informatics and big data analysis as well as emerging technologies in biomedical science.

LEVEL 3.2

6-Month Internship (Local/Overseas)

The six-month internship will provide students with exposure to real work environment, give them opportunities to relate and apply the knowledge acquired to work situations and enable them to make a better transition into the workplace. Clear learning outcomes, close mentorship, meaningful and real work activities allow for structured learning throughout the duration of the internship. Students will be attached to companies and institutes in various industries such as pharmaceuticals, biologics manufacturing, laboratory testing, food, healthcare and bioinformatics sectors. Students will also have opportunity to go for overseas internships.

YEAR 3 COURSE CURRICULUM

Module Name	Credit Units
Level 3.1 (20 hours per week)	
Capstone Project	8
Genomics & Proteomics	5
Translational Medicine & Clinical Trials	3
Project ID: Connecting the Dots^	4
Level 3.2 (20 hours per week)	
6-Month Internship (Local/Overseas)	20

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