SCHOOL OF BIOLOGICAL SCIENCES
SCHOOL OF THE COLLEGE OF SCIENCE
UNDERGRADUATE BROCHURE
ntu.edu.sg/sbs
Welcome to the School of Biological Sciences (SBS)

Since the establishment of the School of Biological Sciences (SBS) in 2002, we have always focused on equipping students with the skills and knowledge essential for today’s global environment. The development of technology enabled learning platforms linked to outcome-based learning objectives enabled our courses to provide students with continuous access to the subject content. This not only created a more interactive classroom environment for students, but also provides an avenue for them to develop creative skills in applying their knowledge, essential for future work environment.

Over the years, the School has been constantly taking efforts to ensure our curriculum remains relevant for our students through the establishment of joint programmes in psychology, food science and technology, biomedical structural biology and biobusiness, as well as the NTU-Duke-NUS Medicine Pathway for students admitted to our double major programmes. Successful applicants for the pathway will be provided an avenue to develop their aspirations in the medical field through a myriad of engagement activities designed to provide insights into the medical school experience and a career in medicine.

This year, we are pleased to share that we are offering a new second major: Biological Sciences with Second Major in Data Analytics. This new second major provides students with the foundation and practical tools for data analytics that is essential for biological sciences research, biopharma and healthcare industry. All our students will also have the opportunity to understand the unique requirements of being successful in an industrial setting through our compulsory internship programme.

Furthermore, with the new Work Study Degree Programme, students admitted to this programme, will now have the option to gain even more industry experience whilst completing their degree. Students can also get a first glimpse of cutting edge research through our research attachment and final-year projects, which will equip them with the essential skills in teamwork and scientific problem solving. Last but not least, the rich mix of culture and nationalities among our professors and students, our varied opportunities for overseas study, and our partnerships with renowned institutes worldwide, will provide a global perspective on science and industry for our students.

So I look forward to having you join our SBS family, as you embark on an exciting learning journey with us. I believe this will be the best decision made as you will be well equipped and prepared with the essential skills and knowledge to face the imminent challenges in the working world without compromising on an exuberant student life.

Prof Lars Nordenskiöld
Chair, School of Biological Sciences
WHY CHOOSE SBS?

Progressive and Relevant Curriculum

Students are well prepared to adapt to the rapidly changing yet competitive life sciences environment and real world challenges in the 5 to 10 years ahead. The availability of a wide range of interdisciplinary modules, partnerships with various schools around the world to offer niche programmes equips students with specialized knowledge in their area of interest.

Studying in SBS also provides a head start for a career in bio-data science as students will be taught essential data science skills, allowing them to be well equipped with the right skills in this digital age.

Global Exposure

Students have the opportunity to go for overseas exchange at various partner universities in countries such as the United States of America, Sweden, United Kingdom, South Korea, Japan and Canada.

Guaranteed Industrial Internship

Implementation of compulsory internship in their third year of study coupled with strong industry partnerships, enables students to intern at organizations such as Tan Tock Seng Hospital, KK Women’s & Children Hospital, Singapore General Hospital, Lonza, Merck and Baxter, amongst others, which enables them to obtain first-hand experience in the real world, giving them a competitive edge as they enter the workforce.

Extensive Research Experience

SBS has a community of international professors who not only come from renowned universities such as Cambridge, Oxford, Stanford and Harvard but are also research-active faculty working on problems that impact Singapore and the World. Our students will also be provided a unique opportunity to experience what research encompasses and advance their skill sets in specific areas of biology through innovative courses.

Vibrant Student Life

The Biological Sciences Club is a student-run club that brings the SBS community through a variety of welfare and campus events throughout the year. Alumni-student sharing events are also organized during term time where students get to interact and gain insight into various industries.
B.SC. (HONS) IN BIOLOGICAL SCIENCES
• An established and recognised direct honours Biological Sciences degree programme
• Option for international exchange with over 150 partner universities
• Compulsory Internship
• Option to take up a final year project
• Option to take a minor in any discipline

SECOND MAJOR
B.SC. (HONS) IN BIOLOGICAL SCIENCES WITH SECOND MAJOR IN DATA ANALYTICS
• Cross-trained in Biological Sciences and Data Analytics
• All 2nd major courses taught by different schools across College of Science and College of Engineering in Nanyang Technological University
• Gain critical knowledge and skills in mathematics, statistics and algorithm, & learn the essentials in data analytics

SECOND MAJOR
B.SC. (HONS) IN BIOLOGICAL SCIENCES WITH SECOND MAJOR IN MEDICINAL CHEMISTRY AND PHARMACOLOGY
• Cross-trained in Biological Sciences and Chemistry
• Selected modules taught by School of Chemistry, Chemical Engineering and Biotechnology, Nanyang Technological University

SECOND MAJOR
B.SC. (HONS) IN BIOLOGICAL SCIENCES WITH SECOND MAJOR IN BIOMEDICAL STRUCTURAL BIOLOGY
• Cross-trained in Biology and Structural Biology including Medicinal Chemistry and Biotechnological aspects
• Enhanced working opportunities in areas such as drug discovery, protein engineering and vaccine design

SECOND MAJOR
B.SC. (HONS) IN BIOLOGICAL SCIENCES WITH SECOND MAJOR IN FOOD SCIENCE AND TECHNOLOGY
• Interdisciplinary curriculum content that combines Biological Sciences with Food Science, Processing and Engineering

SECOND MAJOR
B.SC. (HONS) IN BIOLOGICAL SCIENCES WITH SECOND MAJOR IN BIOENGINEERING AND BIOTECHNOLOGY
• Cross-trained in biomedical sciences, biotechnology and business management with relevance to the biomedical, healthcare sector in Singapore and Southeast Asia, including biomedical manufacturing operations management and regulatory matters

DOUBLE MAJOR
B.SC. (HONS) IN BIOMEDICAL SCIENCES AND BIOBUSINESS
• Cross-trained in biomedical sciences, biotechnology and business management with relevance to the biomedical, healthcare sector in Singapore and Southeast Asia, including biomedical manufacturing operations management and regulatory matters

DOUBLE MAJOR
B.SC. (HONS) IN BIOMEDICAL SCIENCES AND B.MED. IN CHINESE MEDICINE
• This innovative ‘East meets West’ programme trains students in biomedical research and Chinese Medicine
• 3 years in Nanyang Technological University, Singapore and 2 years at the Beijing University of Chinese Medicine

DOUBLE DEGREE
B.SC. (HONS) IN BIOMEDICAL SCIENCES AND B.MED. IN CHINESE MEDICINE
• This innovative ‘East meets West’ programme trains students in biomedical research and Chinese Medicine
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Eligible for Work Study Degree Programme *NEW*

*NEW*
SECOND MAJOR
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• Cross-trained in Biological Sciences and Data Analytics
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Eligible for NTU-Duke-NUS Medicine Pathway

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Conducted in partnership with Wageningen University, the best university in the Netherlands

Conducted in collaboration with Copenhagen Business School, Denmark and Nanyang Business School, Nanyang Technological University

Eligible for NTU-Duke-NUS Medicine Pathway
INTERNSHIP

The implementation of compulsory internship in their 3rd year of study (for students joining the School from AY2018 onwards) provides an avenue for students to experience working in an industrial and professional setting as well as hone their career-enhancing skills. Students may select internship placement from the list provided by NTU Career Office (CAO) or self-source their own internship. Having interned at a specific organization also offers students the opportunity to take up available positions directly after graduation.

These are a list of organizations that our students have interned at:

- Abbott Nutrition Research and Development
- AbbVie Operations Singapore Pte Ltd
- Accelerate Technologies (f.k.a Exploit Technologies Pte Ltd)
- Achievers Dream Learning Centre Pte Ltd
- Agency for Integrated Care Pte Ltd
- AGRader Learning Centre (AGRader LC)
- AgriProtein Singapore Pte Ltd
- Archisen Pte Ltd
- Ascend International Training Pte Ltd
- Changi General Hospital Pte Ltd
- Compass Foods Pte Ltd
- Conservation International Singapore
- Corning Singapore Holdings Pte Ltd
- Davos Life Science Pte Ltd
- DoctorxDentist Pte Ltd
- DSM Nutritional Products Asia Pacific
- Eurofins Mechem Pte. Ltd.
- Expressions Pte Ltd
- Firmenich Asia Pte Ltd
- Flowcast Pte. Ltd.
- Genecet Biotechnologies Private Limited
- Genome Institute of Singapore
- Grasshopper Pte Ltd
- Health Promotion Board
- Hummingbird Bioscience Pte Ltd
- Iqvia Solutions Asia Pte. Ltd
- KaVo Dental Asia Pacific Pte Ltd
- Khoo Teck Puat Hospital
- Kruger Engineering Pte Ltd
- Learning Smart
- Lonza Biologics Tuas Pte Ltd
- Mandai Park Development Pte Ltd
- Mead Johnson Nutrition (Asia Pacific) Pte Ltd
- Ministry of Home Affairs (HQ)
- My Gym Singapore Pte. Ltd.
- National Cancer Centre Singapore
- National Neuroscience Institute
- National Parks Board
- National University of Singapore, Department of Surgery
- National University Polyclinics
- Nestle R&D Center (Pte) Ltd
- Ngee Ann Polytechnic
- OCBC Bank
- Orchid Medical Pte Ltd
- Pascific Private Limited
- Prestige BioPharma Pte Ltd
- Roquette Asia Pacific Pte Ltd
- Science Centre Singapore
- ScienTec Consulting Pte Ltd
- Sentosa Development Corporation
- Singapore Eye Research Institute
- Singapore General Hospital
- Singapore Health Services Pte Ltd (SingHealth)
- Singapore Institute of Manufacturing Technology, A*STAR
- Smartfuture Pte Ltd
- St. Luke’s Hospital
- Star Array Pte Ltd
- Temasek Lifesciences Accelerator Pte. Ltd.
- Tessa Therapeutics Pte Ltd
- Times Publishing Limited
- TÜV SÜD PSB Pte. Ltd.
- Udders Pte Ltd
- Wildlife Reserves Singapore
- Young Nautilus
INTERNATIONAL EXCHANGE

Shineen Tan Ming Yin
2014 Exchange at University of Western Ontario, Canada

“I really love this slow-paced country and their awesome culture!”

Korean Ze Qirong
2017 Exchange at University of Leeds, United Kingdom

“Fascinating, inspirational, and eye-opening experience filled with spontaneous fun and excitement. I had the opportunity to share Singapore’s multi-cultural, racial, religious society with my exchange friends, who were surprised when they heard of the existence of such a dynamic profile in the world.”

Goh Shoo Yean Carissa
2017 Exchange at Lund University, Sweden

“Perhaps exchange is not only about what the host university teaches you in the curriculum, rather, it is what the world is going to teach you by taking you away from your comfort zone.”

Jasly Ee Hui Ting
2014 Exchange at Tokyo Institute of Technology, Japan

“The nation is called wabi-sabi, like the cherry blossom, its beautiful because of its impermanence, not in spite of it, more exquisite for the inevitability of less... Peggy Orenstein

Yang Ning
2016 Exchange at Ludwig Maximilian University of Munich, Germany

“A semester exchange in Munich, Germany gave me a chance to merge into European culture and lifestyles. Life in Munich was calm and peaceful, but at the same time, exciting and adventurous. Bus, S-Bahn and Bahn are two things you just cannot miss out in Munich! (They still appear in my dreams)”

Luan Yan Yu
2017 Exchange at UMEA University, Sweden

“It was the best 6 months of my life! I got to experience different cultures, people and education system. I learnt to plan trips and take charge of the experience I wanted to have.”

Chou Ee Xian
2016 Exchange at Seoul National University, South Korea

“What I love most about South Korea is its boundless beauty of nature from its mountainous landscapes to the massive waterfalls, they were truly breathtaking.”

Huihui Lee Steven
2016 Exchange at Macquarie University, Sydney, Australia

“No regrets in getting out of my own comfort zone to Australia, for a journey of self-discovery, enriched learning and fun!”

Maree Lissaw
2017 Summer Exchange at Umeå University, Sweden

“Something I really enjoy about the summer exchange is definitely the chance to travel. But what’s more important is the friendship made during the summer exchange. I met people across the world, built bonds with them, and hey, I can visit to a few countries around the world having my accommodations settled.”

Ong Kai Xin
2017 Exchange at National Taiwan University, Taiwan

“Taiwan is a fantastic country filled with rich Chinese heritage and offers excellent opportunities to experience both urban and rural life. Moreover, National Taiwan University has a beautiful campus, lectures that are passionate in teaching and friendly classmates. It is a fun and fulfilling experience.”

Ng Ai Lok
2017 Exchange at Upsala University, Sweden

“The initial daunting thoughts about leaving Singapore turned out to be an unforgettable experience for a university student, both for the learning process and the amalgamation of horizons. Do not be afraid to take advantage of the unique opportunity you have, to learn from the locals or the friends you made during exchange.”
CAREER OPTIONS

Graduates from SBS will have a good set of career options ahead. A career as a medical doctor or research scientist are popular routes of our graduates, amongst others.

The opportunities for our undergraduates in general, include careers outside of biology where transferable skills taught in the degree programme will be beneficial in management, financial sectors and human resources.
CAREER SERVICES

CAREER EXPLORATION WITH ALUMNI

ALUMNI CAREER SHARING SERIES

Through the Alumni Career Sharing Series, our SBS undergraduates stay connected with their seniors who come back to campus as alumni guest speakers to share their career paths.

ALUMNI HAPPY HOUR & SOCIAL NETWORKING EVENTS

Various events such as the Alumni Happy Hour and other Alumni social networking events are organised to provide an avenue for the Alumni, Students and Faculty members to connect and learn from one another.

CAREER & ATTACHMENT OFFICE (CAO)

Working closely with CAO, the School has a dedicated Career Coach to guide students on your career journey through your 4 years here in SBS. The role of the Career Coach is not solely on getting you a job, but also to help you with establishing and/or planning for a career. You can meet in a one-on-one coaching session to share your career concerns, challenges, and certainly the good news that you have!

Here are some ways that CAO can support you on your career journey:

1. **Career Coaching**
   CAO offers personalised one-on-one coaching with your Career Coach to explore your career options and interests, resume critique and mock interview practice. Career Coach also conduct career workshops to cater to the needs of the students.

2. **Career Consultations**
   CAO offers a comprehensive range of career events and recruitment services to facilitate your employment. You can also speak to the Career Consultant of your industry of interest to gain deeper insights and connect to the industry.

3. **Career & Employability Skills Workshops**
   CAO offers a suite of career and employability skills workshops, designed to encourage in-depth participatory learning and equip you to be career-savvy for the Future of Work.
   - Workshops in our Career STARTER Series help kickstart your career preparation & allow you to gain essential skills in the hiring process.
   - Workshops in our Career BOOSTER Series help boost your workplace readiness by equipping you with in-demand skills

Register for the workshops here:

4. **Career Experiential Education**
   CAO collaborates with industry partners to help you explore career options through a suite of experiential education programmes including Company Visits, Alumni Networking Sessions, Hackathons, Job Shadowing and Mentorship Programmes.

Learn more about CAO experiential programmes:
SCHOOL OF BIOLOGICAL SCIENCES CLUB (BS CLUB)

The student-run School of Biological Sciences Student’s Club (BS Club) is an active unit of the School working with the School Management to address issues concerning students, from academic matters to welfare matters and beyond, as well as enhancing their University’s experience through the Club’s activities.

The Club organizes various events such as Back to School Day to welcome students back to campus for a new semester; College of Science (CoS) Day for greater engagement with the other CoS students; Exam Welfare Packs for students preparing for examinations; and also the Freshmen Orientation Camp to guide new students to campus resources. All students have the opportunity to contribute ideas, time, and energy to the Club and other SBS events, making the NTU experience more than just about academics!
Our UAEB workshops provide an exciting taste of hands-on research. It is a unique opportunity to experience what research encompasses and to advance your skill sets in specific areas of biology. The one-week intensive, small class workshops held during vacation breaks are very much sought after by students.

**3 EARN ACADEMIC UNITS (3 AUS)**

Small class teaching, greater engagement between professor and students

**3 Reasons why students can’t wait to sign up for UAEB**

- Get first-hand experience on research
- Take existing interests to new depths
- Develop new ideas and skills

**12 UAEB across disciplines**

- Applied Immunology
- Methods in Histology
- The Toolbox of Modern Genome Editing
- Plant Taxonomy and Molecular Phylogenetics
- Field Studies in Functional Plant Ecology
- Protein Behavior in Health and Disease - Biophysics Tools
- Effect of Anti-Mitotic Drugs on Cancer Cells
- Science of Aging and Life Extension in C. elegans
- Role of Actin Cytoskeleton Regulators in Metastasis
- Introduction to R programming
- Macromolecular X-ray Crystallography
- Metabolomics and Lipidomics

**TEACHING AND LEARNING RESOURCES OUTCOMES-BASED TEACHING AND LEARNING (OBTL)**

“Outcomes-based Teaching and Learning (OBTL) is an approach to teaching and learning that focuses on first identifying the intended outcomes or goals of a module or programme and then aligning teaching, learning, and assessment to maximise the likelihood that students achieve those outcomes or goals.”

- Deneen, Brown, Bond, & Shroff, 2013
ABOUT THE COURSE

The study of biology is highly relevant to everyday life. At some point, we discovered that we are fascinated by living systems. As the knowledge base in the biological sciences grows exponentially and technology becomes ever more sophisticated, the ability to think broadly about biology and to apply your knowledge across boundaries of disciplines will inevitably become a very valuable and powerful asset both in the scientific environment and many walks of life.

This programme will prepare you for a variety of careers where you can make a difference in the world. Our mission is to enable you to reach your potential while celebrating the study of life. The curriculum covers specialized and advanced topics in stem cells, cancer biology and therapy, physiology, evolutionary biology, neurosciences, among others. Students are required to do a compulsory internship in the 3rd year of study and given the option to do a research project in their final year.

CURRICULUM FOR BIOLOGICAL SCIENCES

Year 1 Core courses
- Foundations of Chemistry I
- Foundations of Chemistry II
- Physiology
- Biostatistics
- Biochemistry I
- Principles of Genetics
- Molecular and Cell Biology I
- Introduction to Computational Thinking
- Molecular and Cell Biology Techniques Level 1

Year 2 Core courses
- Biophysical Methods Applied to Biological Sciences
- Microbiology
- Biochemistry II
- Molecular & Cell Biology II

Foundational Core Courses*
- Introduction to Data Science
- Communication Across the Sciences
- Professional Internship

ICC Common courses*
- Inquiry and Communication in an Interdisciplinary World
- Ethics & Civics in a Multi-Cultural World
- Healthy Living & Wellbeing
- Science & Technology for Humanity
- Career & Entrepreneurial Development for the Future World
- Navigating the Digital World
- Sustainability: Society, Economy and Environment

*Career & Entrepreneurial Development for the Future World

CAREERS

Our students have been successful in a range of careers including healthcare, pharmaceutical and biologics manufacturing, forensic science, research in bioscience sectors, education, media and publishing. Many have gone on to further their studies taking on Masters and PhDs in prestigious universities globally.
The NTU Work Study Degree Programme (WSDeg) is a pathway offered to NTU students consisting of four work terms:
- 1 Professional Attachment - 10 weeks
- 1 Professional Attachment - 11 weeks
- 1 Winter Professional Attachment (5 weeks)
- 1 (20-week Professional Internship) and
- a WSDeg Final Year Project (FYP)

**PROGRAMME HIGHLIGHTS**

1. Be awarded credits for all internship work terms undertaken
2. Gain industry experience whilst completing your degree
3. Possibility of an industry sponsored Final Year Project

**KEY AIMS**

1. Apply knowledge and skills learnt in the university in an authentic work environment
2. Develop practical industry experiences and skills
3. Enhance your employability and lifelong learning capabilities

**ELIGIBLE UNDERGRADUATE COURSES**

B.Sc. (Hons) in Biological Sciences

Note: Students undertaking any second majors, double majors or double degrees are not eligible to apply for WSDeg.
ABOUT THE COURSE

Structural biology has gained importance in the biomedical field, with an increasing impact on healthcare and medicine. Areas of study include structure-based discovery, structure-based vaccine design, structure-based design of biologics, structure-based design of novel biomaterials and structure-based design of protein engineering.

CAREERS

Graduates of this programme have enhanced career opportunities to work in pharmaceutical and biotechnology companies in the research and development of areas such as drug discovery, protein engineering and vaccine design.

Aside from the Biological Sciences course requirements, students will be required to read:

- Organic & Bioorganic Chemistry
- Physical and Biophysical Chemistry I
- Mathematics and Physics Topics for Structural Biologists
- NMR in Structural Biology
- Bioimaging Techniques in EM
- RNA Structured & RNA Based Drug Development
- Foundations of Chemistry I
- Foundations of Chemistry II
- Laboratory for Foundations of Chemistry I
- Laboratory for Foundations of Chemistry II

Select 3 from the following:

- Natural Product Chemistry
- Drug Design and Synthesis
- Spectroscopic Methods in Biomedical Structural Biology – Undergraduate Advanced Experimental Biology (UAEB) Workshop (Series I) – Macromolecular X-ray Crystallography
- Advanced Bioorganic Chemistry
- Medicinal Chemistry
- Molecular Modeling: Principle and Applications
- Molecular Basis of Diseases
- Computer Aided Drug Discovery
- Light and Biomolecule Behavior in Health and Disease
- Drug Discovery and Development, Biotechnology
- Natural Products in Medicinal Chemistry
- Analytical & Manufacturing Techniques in Pharmaceutical Industry
ABOUT THE COURSE

Combining with the biological sciences programme and in partnership with the School of Chemistry, Chemical Engineering and Biotechnology at the Nanyang Technological University, enrolled students will be cross-trained in biological sciences and chemistry, building a relevant foundation to embark on research and development in the area of chemical biology.

CAREERS

Graduates are sought after by pharmaceutical and biotechnology companies due to the added edge of interdisciplinary knowledge.

Aside from the Biological Sciences course requirements, students will be required to learn:

- Foundations of Chemistry I
- Foundations of Chemistry II
- Laboratory for Foundations of Chemistry I
- Laboratory for Foundations of Chemistry II
- Physical & Biophysical Chemistry I
- Organic & Bioorganic Chemistry
- Organic Reaction Mechanisms and Synthesis

Select 5 of these electives:

- Chemistry and Biological Chemistry Laboratory 1 / 2 / 3 / 4
- Chemical Spectroscopy
- Current Topics in Synthetic Organic Chemistry
- Advanced Bioorganic Chemistry
- Medicinal Chemistry
- Food Chemistry & Nutrition
- Physical and Biophysical Chemistry II
- Molecular Modelling: Principle and Applications
- Analytical and Bioanalytical Chemistry
- Metal Mediated Reactions
- Drug Design and Synthesis
- Heterocyclic Chemistry
- Pharmaceutical Chemistry
- Biomedical Imaging and Sensing
- Artificial Intelligence in Chemistry
- Organometallic Chemistry
- Materials Chemistry
- Polymer Chemistry
- Nanoscience and Nanotechnology
- Analytical & Manufacturing Techniques in Pharmaceutical Industry
- Regulation in the Pharmaceutical, Biotechnology, and Medical Device Industries
- Quality Assurance for Medical Products
About the Course

This course is for students with an interest in biology and wish to gain further understanding on food processes through an engineering and industrial point of view.

Careers

Graduates have better career opportunities in food related industries and government agencies, such as food processing, food safety and packaging.

Aside from the Biological Sciences course requirements, students will be required to learn:

- Food Microbiology
- Food Chemistry
- Food Physics
- Food Process Engineering
- Quality Systems Operations

Select 4 of these electives:

- Biomedical Nanotechnology
- Bioseparations
- Bioanalytical Techniques
- Pharmacokinetics & Biopharmaceutics
- Food Analysis (with Laboratory)
- Food standards in Food Production and Trade
- Current Topics in Analytical Chemistry
- Plant Biology (with laboratory)
- Food Industry Seminar Series
- Principles of Nutrition
- Plant Biotechnology
ABOUT THE COURSE

Incorporating relevant courses across different schools under College of Science (CoS) & College of Engineering (CoE), this programme provides students with the foundation and practical tools for data analytics. The curriculum has been curated to ensure that students receive critical knowledge and skills in the following areas:
1) Foundation in Mathematics, Statistics & Algorithms
2) Essentials in Data Analytics
3) Advanced Electives in Data Analytics.

CAREERS

The Second Major in Data Analytics will open up a broad and diverse range of career prospects including:
- Data Scientist
- Research Scientist
- R&D Engineer
- Business Intelligence Developer
- Data Analyst
- Data Architect

Aside from the Biological Sciences course requirements, students will be required to read a minimum of 30AU for the Second Major.

7 Compulsory Courses:
1) MH2500 Probability & Introduction to Statistics
2) MH2802 Linear Algebra for Scientists
3) BS1009 Introduction to Computational Thinking
4) MH1403 Algorithms and Computing
5) BC2402 Designing & Developing Databases / EE4791 Database Systems / SC2207 Introduction to Database*
6) MH4510 Statistical Learning & Data Mining* / EE4483 Artificial Intelligence & Data Mining* / SC4020 Data Analytics and Mining
7) BC2406 Analytics I: Visual and Predictive Techniques / SC4023 Big Data Management* / SC4024 Data Visualization*

& 3 Elective Courses (Minimum 9AU).

For full list of electives, scan or click on QR code above.

*Pre-requisites apply
ABOUT THE COURSE

In collaboration with the School of Social Sciences, this highly interdisciplinary degree offers students the opportunity to specialize in two major academic disciplines from the two Schools. The programme equips students with the transferrable skills of a combined education for successful careers in the rapidly changing environment of the 21st century. In Singapore with its population encountering higher levels of stress, there is a growing emphasis on awareness of mental health and a demand for professionals with interdisciplinary training in Psychology.

As this programme offers more consistent depth in both disciplines, students who have a curiosity in areas such as human emotions, behaviours and thoughts can now adopt a more integrated approach towards its understanding.

Note: Students admitted to this course are eligible for the NTU-Duke-NUS Medicine Pathway.

CAREERS

Students can enter the field of research, teaching, healthcare management, human resource management, criminal rehabilitation. Research careers are even more wide-ranging, including contributing to government policy development (in areas such as healthy eating and exercise) or issues of importance for industry (improving work productivity, for example). Graduates from this programme can also explore further education leading to professions such as clinical psychologist and neuropsychologist.

Aside from the Biological Sciences major requirements, students will be required to learn:

- Introduction to Psychology
- Fundamentals of Social Science Research
- Research Design and Data Analysis in Psychology
- Biological Psychology
- Cognitive Psychology
- Abnormal Psychology

Select 8 Psychology Electives courses from a wide range of Psychology Prescribed Elective with 5 level HP2xxx/HP3xxx and minimum of 3 level HP4000 courses.

HP Level 2xxx/3xxx courses:
- Developmental Psychology
- Social Psychology
- Personality and Individual Differences
- Evolutionary Psychology
- An Ape’s Guide to Human Language

HP Level 4xxx courses:
- Clinical Psychology
- Agent-Based Computational Psychology
- The Neuroscience of Love
- Advanced Topics in Social Cognition
- The Last Dance: Psycho-socio-cultural perspectives of Death, Dying and Bereavement
- The Forensic Psychology of Crime, Terrorism and Disasters

(Scan or click on QR code above for full list of HP elective courses)
DOUBLE MAJOR

B.SC. (HONS) IN BIOMEDICAL SCIENCES AND BIOBUSINESS

ABOUT THE COURSE

In collaboration with the Copenhagen Business School (CBS) and Nanyang Business School, students will be provided a unique opportunity to be cross-trained in biomedical sciences/biotechnology along with business management relating to the biomedical and healthcare sector. This includes biomedical manufacturing operations management and regulatory matters relating to biomedical and healthcare industry.

Integral to this programme, immersion components are included to strengthen the foundational knowledge and skills of students through internship in various business functions at multinational pharmaceutical, biotechnology and medical technology companies and local healthcare institutions. Students will spend their Year 4 Semester 1 in CBS for their biobusiness coursework, which will require them to bring their observations from the immersion experience into their coursework discussion. Students will then close the learning loop through a final year project in the final semester where they can fully explore and synthesize the theoretical knowledge and internship experience in a biobusiness-related project, or participate in laboratory based biomedical science research prior to understanding the relevance of research and development for bio-products in the industry.

Note: Students admitted to this course are eligible for the NTU-Duke-NUS Medicine Pathway.

CAREERS

Graduates from this programme are expected to have good employment prospects in the growing biomedical and healthcare sector in executive, management and entrepreneurial roles.

Biomedical Sciences major requirements
- Foundations of Chemistry I
- Biophysical Methods Applied to Biological Sciences
- Biochemistry I
- Biochemistry II
- Principles of Genetics
- Molecular and Cell Biology I
- Molecular and Cell Biology II
- Molecular and Cell Biology Techniques Level 1
- Molecular and Cell Biology Techniques Level 2
- Introduction to Computational Thinking
- Fundamentals of Immunology
- Drug Discovery and Development, Biotechnology
- RNA Structure and RNA-based Drug Development

Biobusiness major requirements
- Understanding Singapore Healthcare System
- Regulatory Control of Healthcare Products and Medical Devices
- Good Manufacturing Practice and Sterilisation for Medical Devices
- Bioentrepreneurship
- Intellectual Property Rights Related to BioBusiness
- Introduction to BioBusiness
- Innovation, Entrepreneurship and Strategy in BioBusiness
- Bio Markets and Contracts
- Finance and Accounting in BioBusiness
- BioBusiness Immersion (10 weeks)
- Bioentrepreneurship @ CBS

Select 1 of these electives:
- Biomedical Nanotechnology
- Bioanalytical Techniques
- Commercialization of Molecular and Cell Biology Techniques
- Making and Tinkering
- Advanced Medical Technologies (MedTech)
The NTU-Duke-NUS Medicine Pathway provides motivated individuals the opportunity to develop their entrepreneurial aspirations in the medical field through a myriad of engagement activities. Through the stimulating and challenging curriculum devised by the School of Biological Sciences, graduates will be well-trained to meet the demands of the biomedical and healthcare industries, ensuring that they maintain relevance in the industry.

Successful applicants will receive a conditional admissions offer for the Doctor of Medicine (MD) programme at Duke-NUS after graduation.

**PROGRAMME HIGHLIGHTS**

As part of the core requirement, both double major programmes will be required to complete a Final Year Project related to their key discipline: Neuroscience & Psychology (for BSPY) and Business of Biomedical sector (for BSB). The former is often done in partnership with (but not limited to) the Institute of Mental Health and the latter with organisations in the Biomedical Sector.

Students can also expect to stay engaged with Duke-NUS through periodic meetings with Duke-NUS faculty on campus and invitations to activities designed to provide insights into the medical school experience and a career in medicine.

**Coursework Requirements**
- Final Year Project related to their respective programmes in Neuroscience & Psychology or Business in the Biomedical sector
- Duke-NUS Pre-medical Module (GMS1000)

**Mentorship and Enrichment Activities**
- Advising Sessions with Duke-NUS Medical School Faculty
- Duke-NUS Prehealth Experiential Programme
- Duke-NUS Medical Specialties Workshops
- Duke-NUS Alumni Clinical Observership
- Community Projects

**ELIGIBLE UNDERGRADUATE COURSES**

- B.Sc. (Hons) in Biological Sciences and Psychology
- B.Sc. (Hons) in Biomedical Sciences and BioBusiness

**REQUIREMENTS FOR NTU-DUKE-NUS MEDICINE PATHWAY**

Admission to the NTU-Duke-NUS Medicine Pathway is competitive and only Singapore Citizens or Singapore Permanent Residents (PR) may apply. The following will be considered in the selection process:
- Academic excellence and motivation to study in the indicated fields
- Records of experiences and activities
- Performance at interviews

Note: The admission process for the undergraduate programmes offered by NTU and the NTU-Duke-NUS Medicine Pathway are independent of each other. NTU SBS will be responsible for the selection process of their undergraduate students and also for the entire period that the students are in their course of study at NTU SBS. Duke-NUS will be responsible for the selection process of the conditional admissions and will continue to have engagement with the students prior to their graduation from NTU SBS, and also for the final admissions into the MD programme.
ABOUT THE COURSE

This unique five-year double degree programme is an amalgamation of the western approach to Biomedical Sciences with Traditional Chinese Medicine (TCM). The Bachelor of Science (Honours) in Biomedical Sciences is conferred by Nanyang Technological University (NTU), Singapore and the Bachelor of Medicine (Chinese Medicine) is conferred by the Beijing University of Chinese Medicine (BUCM). Year 1 to 3 of the double degree programme are taught at NTU, while year 4 and 5 are taught at BUCM in Beijing. This is a bilingual course with English and Mandarin as the medium of instruction.

*The Beijing University of Chinese Medicine is a prestigious university in China with traditional Chinese medicine (TCM) and Chinese materia medica as its leading subjects.*

YEAR 1 TO 3 AT NTU, SINGAPORE

YEAR 1
- Foundations of Chemistry II
- Physiology
- TCM in Ancient Chinese
- Anatomy
- Biochemistry I
- Principles of Genetics
- Molecular & Cell Biology I
- Molecular & Cell Biology Techniques Level 1
- Biostatistics
- Basics of TCM
- Introduction to Computational Thinking

YEAR 2
- Biophysical methods Applied To Biological Sciences
- Microbiology
- Chinese Materia Medica
- TCM Diagnostics
- Emperor’s Canon of Internal Medicine
- TCM Formulary
- Pathology

(Optional) Overseas TCM Enrichment Programmes

YEAR 3
- Plant Biology
- Treatise on Exogenous Febrile Diseases
- Acupuncture & Moxibustion
- Fundamentals of Immunology (TBC)
- Biomedical Pharmacology
- Synopsis of the Golden Chamber
- Seasonal Febrile Diseases
- Enterprise and Innovation
- Inter-semester – Final Year Project

ICC Common Courses
- Inquiry and Communication in an Interdisciplinary World
- Ethics & Civics in a Multi-Cultural World
- Healthy Living & Wellbeing
- Science & Technology for Humanity
- Career & Entrepreneurial Development for the Future World
- Navigating the Digital World
- Sustainability: Society, Economy and Environment

Foundational Core Courses
- Introduction to Data Science
- TCM Internship I/II/III

YEAR 4 AND 5 AT BUCM, BEIJING
- Basics of Diagnostics
- Internal Medicine of TCM
- Orthopaedics, Traumathology of TCM
- Ophthalmology of TCM
- Otolaryngology of TCM
- Selected Literature in TCM
- Modern Internal Medicine
- Gynaecology of TCM
- External Medicine of TCM
- Paediatrics of TCM
- Dermatology of TCM
- TCM Tui-Na
- Oncology of TCM

CAREERS

Graduates of this double degree programme are well positioned to consider a wide range of career options, which includes:
- TCM (Employment as Chinese Medicine physician is subject to passing the Traditional Chinese Medicine Practitioner’s Board Exam)
- Healthcare and Pharmaceutical Industries
- Bio-Botanical Products and Nutraceutical Industries
- Education and Public Sectors
- Bilateral Diplomats (Between China & Singapore)
- Further Education and/or Research
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<tr>
<th>Programmes</th>
<th>Minimum Subject Requirements</th>
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<tbody>
<tr>
<td>Biological Sciences</td>
<td>'A' Level and Polytechnic Applicants</td>
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<tr>
<td>Biological Sciences with Second Major in Biomedical Structural Biology</td>
<td>At least H1/SL or equivalent pass in Mathematics and a good H2/HL/A Level or equivalent pass in Physics, Chemistry or Biology</td>
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<tr>
<td>Biological Sciences with Second Major in Medicinal Chemistry and Pharmacology</td>
<td>'H2 Level pass in Chemistry</td>
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<tr>
<td>Biological Sciences with Minor in Business</td>
<td>International Baccalaureate Diploma Applicants</td>
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<tr>
<td>Double Major in Biomedical Sciences and BioBusiness</td>
<td>Mathematics at Standard Level and Physics/Chemistry/Biology at Higher Level</td>
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<td></td>
<td>'Mathematics at Standard Level and Chemistry at Higher Level</td>
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<tr>
<td>Biological Sciences with Second Major in Food Science and Technology</td>
<td>'A' Level and Polytechnic Applicants</td>
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<td></td>
<td>At least H2 or equivalent pass in Mathematics and a H2 Level or equivalent pass in Physics, Chemistry or Biology</td>
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<tr>
<td></td>
<td>At Least H1 or equivalent pass in Mathematics and two H2 Level or equivalent pass in Physics, Chemistry or Biology</td>
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<td>International Baccalaureate Diploma Applicants</td>
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<td></td>
<td>Mathematics at Higher Level and Physics/Chemistry/Biology at Higher Level; or</td>
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<td></td>
<td>Mathematics at Standard Level and any two Physics/Chemistry/Biology at Higher Level</td>
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<tr>
<td>Biological Sciences with Second Major in Data Analytics <em>NEW</em></td>
<td>'A' Level and Polytechnic Applicants</td>
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<tr>
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<td>Good H1/SL or equivalent pass in Mathematics, good H2/HL/A Level or equivalent pass in Physics, Chemistry or Biology, and a good grade in General Paper or Knowledge &amp; Inquiry</td>
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<td></td>
<td>International Baccalaureate Diploma Applicants</td>
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<td></td>
<td>A good grade in Mathematics at Standard Level and, Physics/Chemistry/Biology at Higher Level and a good grade in English at Standard Level</td>
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<tr>
<td>Double Major in Biological Sciences and Psychology</td>
<td>'A' Level and Polytechnic Applicants</td>
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<td></td>
<td>At least H1/SL or equivalent pass in Mathematics and a good H2/HL/A Level or equivalent pass in Physics, Chemistry or Biology</td>
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<td>PLUS</td>
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<td>at least an O Level/SL or equivalent pass in Chinese Language</td>
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<tr>
<td>Biomedical Sciences/Chinese Medicine</td>
<td>'A' Level and Polytechnic Applicants</td>
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<tr>
<td></td>
<td>Mathematics at Standard Level and Physics/Chemistry/Biology at Higher Level and Chinese at Standard Level</td>
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<tr>
<td></td>
<td>International Baccalaureate Diploma Applicants</td>
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EXEMPTIONS

<table>
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<tr>
<th>Qualifications</th>
<th>Exemption(s)</th>
<th>Criteria</th>
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<tbody>
<tr>
<td>Singapore Cambridge GCE ‘A’ Level</td>
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<tr>
<td>H3 Chemistry</td>
<td>BS1021 Foundations of Chemistry I</td>
<td>Distinction or Merit</td>
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<td></td>
<td>BS1031 Foundations of Chemistry II</td>
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<tr>
<td>H3 Molecular Biology</td>
<td>BS1007 Molecular &amp; Cell Biology I</td>
<td>Distinction or Merit</td>
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<tr>
<td>H3 Proteomics</td>
<td>BS1005 Biochemistry I</td>
<td>Distinction or Merit</td>
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<tr>
<td>Other H3 Subjects</td>
<td>Exemptions will be granted on case-by-case basis</td>
<td>Exemptions will be based on academic merit and relevance of polytechnic courses completed. Students admitted into Year 1 may be granted exemption from up to 3 Year 1 courses. Students with relevant diplomas may be exempted from BS1100 Molecular and Cell Biology Techniques level 1 as well.</td>
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<tr>
<td>Local Polytechnic Diploma</td>
<td>Exemptions from selected Year 1 courses will be offered to students in the Bachelor of Science in Biological Sciences degree programme on a case-by-case basis.</td>
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<tr>
<td>NUS HIGH SCHOOL DIPLOMA Qualifications</td>
<td>BS1021 Foundations of Chemistry I</td>
<td>Through Exemption Test Overall CAP in Chemistry &gt; 4.50</td>
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<tr>
<td></td>
<td>BS1031 Foundations of Chemistry II</td>
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<tr>
<td>INTERNATIONAL BACCALAUREATE DIPLOMA Qualifications</td>
<td>BS1021 Foundations of Chemistry I</td>
<td>Through Exemption Test Students with subject grade of 7 or higher may apply to take the exemption test. Exemption is only granted to those who pass the Exemption Test.</td>
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<tr>
<td></td>
<td>BS1031 Foundations of Chemistry II</td>
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<tr>
<td>INTERNATIONAL OLYMPIADS</td>
<td>BS1021 Foundations of Chemistry I</td>
<td>Through Exemption Test International Olympiad Medalist (Chemistry)</td>
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<td>BS1031 Foundations of Chemistry II</td>
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<tr>
<td>SM2</td>
<td>BS1021 Foundations of Chemistry I</td>
<td>Through Exemption Test</td>
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<td></td>
<td>BS1031 Foundations of Chemistry II</td>
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Exemptions for other qualifications, please refer to https://www.ntu.edu.sg/sbs/admissions/programmes/undergraduate/course-exemptions

SCHOLARSHIP

NTU offers a wide range of scholarship to students pursuing full-time undergraduate studies. Awarded based on academic merit and exceptional co-curricular records.

Some of the scholarships include:
- Nanyang Scholarship
- College Scholarship

Find out more at www.ntu.edu.sg/admissions

*Note: For scholars taking the Double Degree Programme in Biomedical Sciences & Chinese Medicine, the scholarship will only cover the first three years of study in NTU