School of Biological Sciences
A School of the College of Science
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### WHAT CAN YOU LEARN?

#### The Major
20. B.Sc. (Hons) in Biological Sciences

#### Second Major
21. B.Sc. (Hons) in Biological Sciences with Second Major in Biomedical Materials
22. B.Sc. (Hons) in Biological Sciences with Second Major in Biomedical Structural Biology
23. B.Sc. (Hons) in Biological Sciences with Second Major in Medicinal Chemistry and Pharmacology
24. B.Sc. (Hons) in Biological Sciences with Second Major in Food Science & Technology (Nanyang Scholarship Programme)

#### Double Major
25. B.Sc. (Hons) in Biological Sciences and Psychology

#### Double Degree
26. B.Sc. (Hons) in Biomedical Sciences and B.Med. in Chinese Medicine

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In 1953, the structure of DNA was discovered, laying the foundation for the identification of the complete human genome in 2003, exactly 50 years later. Just a few years after the completion of the human genome, a bacterial defence system against viral infection was described as CRISPR. Who would have thought then, that this discovery would be the basis of human genome editing a decade later? There are many more examples like this, and they highlight the rapid advance in our understanding of biology. What is more, they show how fundamental discoveries made by one scientist will provide another the information she or he needs to develop exciting and valuable applications. However, while these breakthroughs create immense opportunities, they also represent significant challenges to humanity.

Challenges such as climate change, food security, ageing societies and obesity, infectious diseases and antimicrobial drug resistance, are not only of global concern, but also impact Singapore directly. They are complicated and require a broad and multidisciplinary approach. Biology will play a critical role in the development of sustainable solutions for the future. Biological research will contribute hugely to finding solutions to these solutions, and this makes it such an exciting as well as a relevant subject to study. Irrespective of your personal aspirations, the School of Biological Sciences (SBS) aims to ensure that each graduate has the necessary skillset and training to fulfill their dreams and make a lasting impact in solving the problems facing humanity today.

Today, the rate of data generation vastly outstrips anything we have seen in history. This creates new challenges to students and universities, who need to prioritise, learn and communicate the essential information effectively within a defined curriculum. Similarly, changes in the work environment require a wide range of new skills which are not traditionally associated with the subject of biology.

At SBS we recognise that our courses need to keep up with these technology driven developments, and we have developed new teaching styles to do so. Using technology enabled learning platforms and linking them to outcome-based learning objectives, our courses provide students with continuous access to the subject content, while at the same time create a more interactive classroom environment. This allows our students to develop creative skills in applying their knowledge, which is essential in their future work environment.

Complementing this change in teaching pedagogy is our effort to constantly identify and evaluate current developments in the marketplace. This is to ensure that our curriculum remains relevant for our students. SBS has established joint programs in biomaterials, psychology, food science and technology, as well as biomedical structural biology. These new programs of focused interest provide students with an in-depth opportunity to explore defined areas of interdisciplinary training. At the same time, we continue to evaluate and upgrade our B.Sc. (Hons) in Biological Sciences courses. This is to ensure that the courses help students to build a solid foundation and enable them to succeed in the current working environment. Our industry attachment program provides students with an opportunity to understand the unique requirements needed to be successful in an industrial setting, while our research attachment and final-year projects (FYDP) not only provide students with a first glimpse of cutting edge research, but also give them essential skills in teamwork and problem solving.

To maintain our teaching and research excellence, SBS has and continues to recruit the best academic staff from around the world. Our professors are highly successful in competing for research funding and this is reflected in the high numbers of top quality scientific publications and patents awarded. Students have ample opportunity to learn and to gain hands-on training from our experts, at both undergraduate and post-graduate levels.

Students graduating from SBS have obtained employment in a wide range of industries ranging from the pharmaceutical industry to the financial sector. Others have chosen careers in teaching and medicine, or have continued in the areas of research, gaining academic research posts at universities and research centres in Singapore and around the world. And above all: a degree from SBS opens the door for our graduates to pursue PhDs at the top universities globally, including the University of Cambridge, Karolinska Institute and Yale University, to name but a few.

The rich mix of culture and nationalities among our professors and students, our varied opportunities for overseas studies and our partnerships with renowned institutes worldwide, provide for a global perspective on science and industry for all of our students. I sincerely hope that you will make a decision to embark on an exciting journey of discovery with SBS!

Prof. Peter Preiser
Chair, School of Biological Sciences
Constantly in-tuned with future market needs, our School offers a range of relevant bioscience degrees:

| Since 2017 | Double Major in Biomedical Sciences and Psychology |
| Since 2016 | Second Major in Biomedical Materials |
| Since 2015 | Second Major in Biomedical Structural Biology |
| Since 2014 | Second Major in Medicinal Chemistry and Pharmacology |
| Since 2013 | Second Major in Food Science & Technology (Nanyang Scholarship Programme) |

ONLY Biomedical Science & Chinese Medicine Programme

Our School offers the only double degree programme in B.Sc. (Hons) in Biomedical Sciences and B.Med. in Chinese Medicine in the region since 2005. [See page 26]
OUR DEGREES AT A GLANCE

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
- Choice of final-year projects or internship
- Option to take a minor in any discipline

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

B.Sc. (Hons) in Biological Sciences with Second Major in Food Science and Technology (Nanyang Scholarship Programme)
- Interdisciplinary content that combines Biological Sciences with Food Science, Processing and Engineering

B.Sc. (Hons) in Biological Sciences with Second Major in Biomedical Materials
- Cross-trained in Biology and Biomedical Materials including nanomedicine and drug delivery.
- Increased working opportunities in the development of new clinical treatments for injury and diseases.

Double Major: B.Sc. (Hons) in Biological Sciences and Psychology
- Psychology modules taught by a unique course that combines Biological Sciences with fields of Psychology such as Human Memory, Motivation and Cognitive Development.

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

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 Division of Chemistry & Biological Chemistry

Partnership with Wageningen University, the best university in the Netherlands.

3 years in Singapore
2 years at the Beijing University of Chinese Medicine
OUR CULTURE
OUR DNA

Excellence in Teaching

Our community of international professors not only come from renowned universities such as Cambridge, Oxford, Stanford and Harvard but are also mentors dedicated to imparting invaluable knowledge to students. They are also research-active faculty working on problems that impact Singapore and the world.

Unique Partnership

The school has established an Industry Advisory Panel from leading players in the life sciences industry and government agencies to help the school align its curriculum and prepare students for real world challenges in the next 5 to 10 years ahead.

Progressive Curriculum

Our broad-based curriculum grounds students in core modules and allows for flexibility to take on electives throughout the years. The wide range of interdisciplinary modules available equip students with specialised knowledge in their area of interest.

1 Progressive Curriculum

2 Excellence in Teaching

3 Unique Partnership
Global Exposure & Industrial Internship Opportunities

Students have the opportunity to go for overseas exchange at partner universities in countries such as USA, Sweden, UK, Korea, Japan and Canada. With strong industry partnerships, students can intern at KK Women’s & Children Hospital, Singapore General Hospital, Lonza, Merck and Baxter, among others.

Vibrant Student Life

The Biological Sciences Club is a student-run club that brings the SBS community together through a variety of welfare and campus events throughout the year. Alumni-student sharing events are organized during term time where students get to interact and gain insight into various industries.
EXCELLENCE IN TEACHING & RESEARCH

The School of Biological Sciences is a place where exciting research takes place daily. The people who work and teach here are also working to solving some of the world’s global problems.

ASSOC. PROF. AJAI VYAS
Mind and body are twins housed in the same body. This program seeks to remove artificial distinctions between these two. In doing so, it provides a unified understanding of biology and psychology.

ASSOC. PROF. KIMBERLY KLINE
Assoc. Prof Kimberly Kline is focused on understanding the molecular mechanisms by which Enterococcus faecalis, and related Gram positive pathogens, interact with one another to form bacterial communities and interact with the host to cause disease.

ASST. PROF. DALTON TAY
Asst. Prof. Dalton Tay’s team is seeking to develop hydrogels-enabled 3D bio-inspired culture systems and apply them for regenerative medicine and cancer research.

ASSOC. PROF. JULIEN LESCAR
There is probably no better time than now to join this exciting program. We are at the beginning of a revolution for the discovery of new therapeutics for human health and biomedical structural biology is already playing a significant and increasingly important part in enabling these advances and discoveries. Joining this program will allow you to play an active role as a member of a multidisciplinary team, working towards the development of new drugs, therapeutic antibodies and biologics in industry or in academy.
OUR UNDERGRADUATE ADVANCED EXPERIMENTAL BIOLOGY (UAEB) PROGRAMME PROVIDES AN EXCITING TASTE OF HANDS-ON RESEARCH.

It is a unique opportunity to experience what research encompasses and to advance your skillsets in specific areas of biology. The typical one-week intensive, small class workshops, held during vacation breaks are very much sought after by students.

EARN ACADEMIC UNITS (3 AUs)

SMALL PROFESSOR-STUDENT ENGAGEMENT

GREAT REASONS WHY STUDENTS CAN’T WAIT TO SIGN UP FOR UAEB

1. Get first-hand experience
2. Take existing interests to new depths
3. Develop new ideas and skills

UAEB ACROSS-DISCIPLINES

• Applied Immunology
• Methods in Histology
• Neurobiology
• Proteomics
• DNA engineering for fluorescent in-situ hybridisation (FISH)
• 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
• Genetics of Human Diseases
• Microbial Biotechnology and Systems Biology
• Macromolecular 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

For more information, please visit http://www.sbs.ntu.edu.sg/prospective/undergraduate
My time as an exchange student in London was the best six months of my undergraduate life. From experiencing everyday life as a Londoner to travelling to 30 destinations across Europe and Scandinavia, I met so many new friends, immersed myself in different cultures and of course, had so much fun exploring the world!

Hey you, considering Northern Europe as your next itinerary? Like me, I did my exchange at DTU Denmark and it was super amazing. Made lots of international friends & broadened my learning horizon & I travelled to Iceland, Amsterdam, Italy .... and much more, so all the best!!

I had the opportunity to participate in several eye-opening field trips like visiting a gull colony and bird-watching. A big part of my everyday life consists of cycling around the quaint university town, which became one of my favourite pastimes, along with visiting the many cafes for fika with friends.

Going on exchange truly is the best period of my graduation life!
Julianne Lee Siwen
2016 Exchange at Macquarie University, Sydney Australia

Kelvin Tan Chong Yin
2017 Exchange at McGill University, Canada

Koh Hwee Kwan Rebecca
2017 Exchange at Kyung Hee University, South Korea

Jolene Lee Wei Ling
2017 Exchange at Sungkyunkwan University, South Korea

Bernadette Lee Jia Rong
2016 Exchange at Arizona State University, United States of America

Ong Kai Xun
2017 Exchange at National Taiwan University, Taiwan

Chu En Xian
2016 Exchange at Seoul National University, South Korea

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

Experiencing a semester in a vibrant country like America has been an eye opening and enriching journey that enabled me to experience and understand other cultures.

Studying for a semester in South Korea under the GEM Explorer Programme had been a once-in-a-lifetime experience for me. From being more responsible and independent to making many new friends, I wouldn’t forget this exchange. I am currently in my final year in NTU and I have to admit that I am bittersweet about graduating and entering the working world. So to all undergraduates, study hard, take time to explore and understand yourself better, and make every moment count!

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

My exchange experience was very enriching! Living abroad, barely knowing their language, pushed me out of my comfort zone but in a good way! I loved how exploring the country, building new friendships and experiencing a different education system can all be done during the exchange!

Travelling to Montreal, Canada for exchange was the best decisions ever. I was fortunate to experience the infamous Canadian winter. Apart from the weather, the students at McGill University are extremely welcoming.

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

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

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Experiencing a semester in a vibrant country like America has been an eye opening and enriching journey that enabled me to experience and understand other cultures.
As part of Biological Science curriculum, I had a lot of exposure to laboratory work in schools and institutions, such as URECA, UAEB and the summer Research Experience [BS9001]. When I was given an opportunity to do research with an established R&D team of a multinational corporation, I quickly agreed knowing that the experience will benefit me greatly.

I interned at Coca-Cola R&D juice product development! I have to do market research, and identify trends and present possible directions. After directions to focus and on and I brainstormed concepts and ideas. Eventually, I constructed a few beverages from lab prototypes down to details on its factory production. These ideas were screened through a consumer panel.

Many of the beverages I knew were created at the very same place where I interned! I even aid to reformulate one of them! I also make my own beverages during my free time, testing out new ingredients and flavours. One of those that I made ‘freestyle’ was well-liked by my supervisors and will join the ranks amongst those being sent for consumer testing. Hopefully, the next time I see my products again, they will be on the shelves of the supermarkets.

Experience in SBS has moulded me to be an independent researcher and persevere throughout my work. Not every product I made was chosen to go to the next stage of production, and there were more ideas rejected than approved when I first conducted my study. Thanks to my background in biology, I also understood shelf life and micro-organism tests very well. Technical skills wise, I was glad that I was trained in microscopes and image acquisition as it was required for a major project in my internship.

Skills! I used to think that beverages were magical and only discovered by a combination of luck and art. Now I know that skill and knowledge are part of the equation as well. I started off lost in the lab, but ended up being able to create prototypes within a week.

Connections! I kept in touch with my awesome colleagues from all around the world and I still bring them around when they come to Singapore for work or holiday.

Try something new and do not be afraid of change. I did not like the idea of going overseas as I will be away from my family, friends and everything that I am familiar with but I felt that I learnt many new things at a much faster pace in a foreign environment.

If you are not sure of what you want, explore and try before settling on something. Aim to accumulate as many skills and experience before you graduate. Ignore the disapproving glares that you may receive when you tell your friends that you will be working in the labs during the summer holidays of your freshman year.
My internship was at the Physiotherapy (PT) Department at TTSH. I was involved in various clinical projects that transform and redesign patient care through evidence-based guidelines and data-driven research. My work comprised of managing data which are integral to improving patients’ clinical outcomes while maintaining high service standards. It was a meaningful and holistic experience as I was exposed to the clinical, research and administrative aspects of the hospital. The internship has allowed me to see both frontline and backend operations that contribute to the delivery of better care for the community.

The internship reaffirmed my passion for joining the healthcare industry after graduation and applying for internships early to secure the roles of your interest. Take this chance to determine if the field/position is suitable for you.

I started to chart the direction of my career accordingly. Furthermore, this internship also served as a checkpoint for self-discovery, development, and growth.

One of the biggest takeaways I received from the programme was that no learning opportunity is too small. As interns or fresh graduates, it is important for us to actively seek what we do not know and reconfirm what we already know. There is this mantra in TTSH that to be effective employees, one must be able to learn, unlearn, and relearn. I find this to be quite useful during my internship as it kept me grounded and I could gain a broad, but also deep, understanding of different areas within the healthcare sector.

With an unyielding sense of determination and confidence, I managed to clinch one of the few coveted spots in the NHG-TTSH Management Associate Programme (MAP) – a two-year programme aimed at developing future healthcare leaders. This offer was made to me during my internship period, essentially cementing my job security post-graduation. I would recommend all my juniors to develop an open mind to learning all sorts of skills and always maintain a child-like curiosity for knowledge. We determine our own path hence the onus lies on us to create our own opportunities to our success.

Ong Sher Lyn
Class of 2017
GlaxoSmithKline (GSK)

I was part of the Sensory and Product Understanding team in GSK! I was involved in project team meetings, consumer studies, market researching, and even organizing workshops. I wanted to explore different career opportunities beyond those typically assumed from my degree.

To always be open to challenges – that’s the best and fastest way to learn new things. Do not limit yourself with the thinking of being ‘just an intern’ but strive to perform your best at work and keeping a positive attitude.

Network and talk to your more experienced colleagues, especially if you’re keen to learn about the industry or job progression. Start out by
A MYRIAD OF CAREER OPTIONS

**HEALTHCARE**

ZHANG RUIFEN
Traditional Chinese Medicine Physician
Eu Yan Sang International Ltd

YAN YEW WAI
Acupuncturist
Tan Tock Seng Hospital

ALLISTER THAM
Management Associate
Tan Tock Seng Hospital

MOHAMMAD IQBAL FIRDAUS BIN MOHD. KAMAL
Management Associate
Tan Tock Seng Hospital

**BANKING, FINANCE & LEGAL**

ZENG RENCHUN
Vice President
Institutional Banking
DBS Bank

SUBHAJEET PARIDA
Fixed Income Trader
Citibank

PHILLIS KHOO
Asst. Vice President
Moody’s Singapore

CARLENE YAP TIEN LING
Patent Executive
Drew & Napier LLC

**RESEARCH**

CHEN HUIJIA
Postdoctorate Research Scientist
University of Oxford

EUNICE ONG MEI JING
Embryologist
Singapore General Hospital

TEO SHUN XIE
Research Officer
IMCB A*STAR

LIM RUI YI
Research Officer
Singapore Eye Research Institute

SONG HUI CHNG
Postdoctoral Training Fellow
Francis Crick Institute

**BIOMEDICAL & PHARMACEUTICAL**

CHIA NA YU
Investigator II
Novartis

LIM TIAN ZHAN
Manufacturing Biotechnologist
Lonza Biologics Tuas Pte Ltd

ANGELINE CHONG RUN MEI
Biotechnologist
Lonza Biologics Tuas Pte Ltd

MICHELLE SOH SEE MUN
Microbiologist
Schering-Plough

DR. SHARRADA SUBRAMANIA
Scientific Manager
A*STAR

**EDUCATION**

SHERRY TAN
Head of Dept (Science)
Ministry of Education

WU BIN
Asst Professor
Nanyang Technological University

GLENDON PHUA
Teacher
Temasek Junior College

DR. SHOVANLAL GAYEN
Assistant Professor
Dr. Harisingh Gour University

EDMUND CHONG
School Counsellor
Ministry of Education

**POSTGRADUATE STUDIES**

LIM SHUHAN
Medical Student
Duke-NUS Medical School

EUGENE SEAH
Ph.D. Student
Cambridge University

CHNG WEN BIN
PhD Student
Ecole Polytechnique Federale De Lausanne (EPFL), Switzerland

LIM GIM HUI
Medical Student
Duke NUS Medical School

ZHANG FUQUAN
Medical Student
Duke NUS Medical School
As a life sciences graduate from the School of Biological Sciences, you will have a good set of career options ahead of you. For those seeking out a career as a medical doctor, veterinarian or research scientist, these among others are the popular routes of our graduates.

In the public sector, life science graduates are well sought after in hospitals, research institutes, government agencies and forensic departments.

Commercial sectors that actively seek out graduates from the life sciences include the pharmaceutical, biotechnology, food, water and agriculture industries for roles such as process engineers, biotechnologists, QA specialists and clinical researchers. There is also demand for life science graduates to contribute to the public understanding of science as journalists, scientific writers and information/liaison officers.

Financial and legal sectors also require analysts with life science knowledge for risk assessments, patents for molecular biology and biotechnology used for drug and medical applications.

A postgraduate qualification with National Institute of Education for entry into the teaching profession is also an option.

For those with an entrepreneurial spirit, the broad range of electives to choose from will endow graduates with the necessary skills and tools to start their own businesses.

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

With the “Alumni Career Sharing Series”, students of the School stay connected with their seniors as we invite alumni guest speakers to share their career path with the fellow students on campus.

Ku Chee Wai
Class of 2009, Resident in SingHealth Obstetrics & Gynecology (O&G) Residency Program

Marc Wong
Class of 2009, Resident in SingHealth Internal Medicine Residency Program

Qi Li Hua
Class of 2009, Medical Student in Duke NUS Medical School

Benjamin Foo
Class of 2016, Management Associate at Tan Tock Seng Hospital

Loo Wei Sheng
Class of 2016, Management Associate at Tan Tock Seng Hospital

Sunny Choong
Class of 2006 (Sales Manager at Spectra-Teknik (S) Pte Ltd

Kristin Goh
Class of 2008, Assistant Sales Manager at Spectra-Teknik (S) Pte Ltd

Xie XinYan
Class of 2008, Assistant Manager at LF Asia Distribution

Ng Kar Hwee
Class of 2008, Assistant Manager at LF Asia Distribution

Dr. Brian Teo
Class of 2010, Medical Science Liaison (Oncology) at Takeda Pharmaceuticals Asia Pacific

Dr. William Tan
Postgraduate Class of 2013, Medical Affairs Associate at Ferrings Pharmaceutical

Dr. Ronne Yeo
Class of 2009, Project Manager at Esco ventures

Dr. Jonathan Lee
Class of 2010, Senior Medical Writer at MediTech Media

Kellie Wong
Class of 2008, Product Manager Asia Pacific at Cook Medical

Chow Chung Ping
Class of 2010, Consultant at Genedata
Glendon Phua
Class of 2015, Educator at Ministry of Education

Edmund Chong
Class of 2008, School Counsellor at Ministry of Education

Monthly Alumni Happy Hour Social is another opportunity where Alumni, Students, and Faculty Members get to connect and learn from one another in an informal setting at one of the NTU Alumni Houses.
CAREER SERVICES

Working closely with the Career & Attachment Office (CAO), SBS have a dedicated Career Coach, Ms. Rachel Wang, who will be with you on the career journey for your 4 years here in SBS. The Career Coach role is not just about getting you a job, but to help you with establishing and/or planning for a career. You can meet in a one-to-one coaching session to share your career concerns, challenges, and certainly the good news that you have!

You can find out more about CAO here http://www.ntu.edu.sg/cao/Pages/index.aspx

OTHER AVENUES OF KNOWING MORE ABOUT THE INDUSTRY

CAO SERVICES

1. SBS ResumeFITNESS and InterviewFITNESS customized to the needs of SBS students.

2. Seeking clarity on future career? Attend the Self-Assess WORKOUT to discover your career Values, Interest, Personality, Skills, and more. The 3-hour small classes, are designed to help you gain greater self-awareness and explore career options for a fulfilling and meaningful career.

3. Personalized 45 min one-to-one Career Coaching with Career Coach Rachel Wang to explore your career options/interests.

4. Quick tips on career matters ASAP but no appointment? Drop by for the 15 min drop in session.

Professional Career Development Undergraduates attend Professional Career Development course and work closely with our School’s Career Coach to chart their future careers.
ABOUT SBS CLUB

SBS Club aims to promote the academic pursuits of the student body here at SBS, and to enhance their University experience through the Club’s activities. The Club also acts as a recognised means of communication between the students and the University or any external bodies.

COMMITTEE MEMBERS

Only matriculated full-time undergraduate students from the School of Biological Sciences may run for a position in the club. Roles are either elected for, or are co-opted via interviews.

OUR SBS CLUB
B.Sc. (Hons) in Biological Sciences

• An established and recognized, direct honours biological sciences degree programme
• Choice of final year projects or internship in the last semester with renowned research institutions and organizations
• An invitation for the accelerated programme (3.5 years) will be extended to the top 10% of the cohort that has completed the first year of study.

ABOUT THE COURSE

The study of biology is highly relevant to everyday life. At some point, we discovered that we are fascinated by livingsystems. As the knowledge base in the biological sciences grows exponentially and technology become 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. In the final year, students can choose to do a final year research project internship with industry partners.

FURTHER STUDIES

• Ross University, Doctor of Veterinary Medicine
• Warwick University
  – NTU Joint PhD Program in Neuroscience
• University of Konstanz
  – NTU Joint PhD Program in Chemical Biology
• Karolinska Institute
  – NTU Joint PhD Program in Biomedical Sciences
• A*STAR
  – SIgN-NTU Immunology PhD Program
• NTU
  – Interdisciplinary Graduate School
• NTU, School of Biological Sciences
  – Masters & PhD Program

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.

REQUIREMENTS

Singapore-Cambridge GCE ’A’ Level
Minimum Subject Requirements
H1 Level pass in Mathematics and H2 Level pass in Physics/Chemistry/Biology

International Baccalaureate Diploma
Minimum Subject Requirements
Mathematics at Standard Level and Physics/Chemistry/Biology at Higher Level

B.Sc. (Hons) in Biological Sciences with Second Major in Biomedical Materials

- First in Singapore to offer this interdisciplinary programme, providing a comprehensive background in the biological science and engineering of biomedical materials for regenerative medicine, tissue engineering, drug delivery, among others
- Conducted in partnership with School of Materials Science and Engineering, NTU

ABOUT THE COURSE

Biomaterials science is a rapidly growing field. Biomedical materials have an enormous impact on healthcare throughout the world, and they will continue to be important in advancing patient care and in the medical industry. With the emergence of tissue engineering and regenerative medicine, it also means increasing opportunities for young scientists to work on new clinical treatments for injury and diseases. Students of this interdisciplinary programme will undergo training in biological sciences and biomedical materials areas such as immunology, physiology, advanced biomaterials and nanomaterials.

On top of the Biological Sciences course requirements, students will be required to learn:

- Materials Chemistry II
- Materials Science
- Thermodynamics of Materials
- Phase Transformation and Kinetics
- Metallic & Ceramic Materials
- Biomaterials
- Nanomaterials: Fundamentals and Application
- Advanced Biomaterials

Select 3 of these electives:
- Materials Physics
- Polymer and Composites
- Mechanical Behaviour of Materials
- Analysis of Materials
- Biomedical Devices
- Drug Delivery and Tissue Engineering

CAREERS

Equipped with the knowledge and skillset of the programme, graduates can look forward to a Research and Development career in emerging areas such as regenerative medicine and tissue engineering, as well as in pharmaceutical industries.

REQUIREMENTS

Singapore-Cambridge GCE ‘A’ Level
Minimum Subject Requirements
H2 Level pass in Mathematics and H2 Level pass in Physics/Chemistry/Biology and H1 Level/’O’ Level pass in Physics/equivalent+

International Baccalaureate Diploma
Minimum Subject Requirements
Mathematics at Higher Level and Physics/Chemistry/Biology at Higher Level and Physics at Standard Level/equivalent+

+ Singapore-Cambridge GCE ‘A’ Level: ’O’ Level pass in Physics/equivalent is only applicable to applicants who have not read Physics at H2/H1 Level.

International Baccalaureate Diploma: Physics at Standard Level/equivalent is only applicable to applicants who have not read Physics at Higher Level.

B.Sc. (Hons) in Biological Sciences with Second Major in Biomedical Structural Biology

- First in Singapore to offer this unique programme in 2015, students will be cross-trained in biology and structural biology, including medicinal chemistry and biotechnological aspects.
- Conducted in partnership with Lee Kong Chian School of Medicine, the Division of Chemistry and Biological Chemistry and School of Physical and Mathematical Sciences.

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.

On top of the Biological Sciences course requirements, students will be required to learn:

- Basic Organic Chemistry with Laboratory
- Basic Physical Chemistry with Laboratory
- 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

Select 4 from the following:

- Natural Product Chemistry
- Advanced Bioorganic Chemistry
- Medicinal Chemistry
- Drug Design and Synthesis
- Molecular Modelling: Principle and Applications
- Macromolecular X-ray Crystallography with Laboratory
- Physiological Systems: Animal Models for Drug Development
- Fragment Based Drug Discovery
- Spectroscopic Methods and Application

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.

REQUIREMENTS

Singapore-Cambridge GCE ‘A’ Level
Minimum Subject Requirements
H1 Level pass in Mathematics and H2 Level pass in Physics/Chemistry/Biology

International Baccalaureate Diploma
Minimum Subject Requirements
Mathematics at Standard Level and Physics/Chemistry/Biology at Higher Level

Visit
B.Sc. (Hons) in Biological Sciences with Second Major in Medicinal Chemistry and Pharmacology

- A course that combines biological sciences and chemistry to offer wider career options that requires this interdisciplinary knowledge
- Good foundation to embark on research and development in the area of chemical biology & pharmacology

ABOUT THE COURSE

Combining with the biological sciences programme and in partnership with the Division of Chemistry and Biological Chemistry, School of Physical and Mathematical Sciences, 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.

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

- Basic Inorganic Chemistry with Laboratory
- Basic Physical Chemistry with Laboratory
- Organic & Bioorganic Chemistry
- Physical & Biophysical Chemistry I
- Organic Reaction Mechanisms and Synthesis
- Chemical Biology

Select 5 of these electives:

- Chemistry and Biological Chemistry Laboratory 1 / 2 / 3 / 4
- Chemical Spectroscopy and Applications
- Asymmetric Synthesis
- Current Topics in Synthetic Organic Chemistry
- Natural Product Chemistry
- Advanced Bioorganic Chemistry
- Medicinal Chemistry
- Food Chemistry & Nutrition
- Physical and Biophysical Chemistry II
- Molecular Modeling: Principle and Applications
- Analytical and Bioanalytical Chemistry
- Metal Mediated Reactions
- Drug Design and Synthesis

CAREERS

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

REQUIREMENTS

Singapore-Cambridge GCE ‘A’ Level
Minimum Subject Requirements
H1 Level pass in Mathematics and H2 Level pass in Chemistry

International Baccalaureate Diploma
Minimum Subject Requirements
Mathematics at Standard Level and Chemistry at Higher Level

B.Sc. (Hons) in Biological Sciences with Second Major in Food Science & Technology (Nanyang Scholarship Programme)

- In partnership with the Wageningen University (The Netherlands), NTU School of Chemical and Biomedical Engineering and School of Physical and Mathematical Sciences
- Wageningen University professors will be teaching five of the compulsory courses

ABOUT THE COURSE

Students with an interest in biology and wish to gain further understanding about food processes with an engineering and industrial point of view.

FURTHER STUDIES

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 5 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)
- Functional Genomics and Proteomics
- Food Industry Seminar Series

CAREERS

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

REQUIREMENTS

Singapore-Cambridge GCE ‘A’ Level
Minimum Subject Requirements
H2 Level pass in Mathematics and H2 Level pass in Physics/Chemistry/Biology; or H1 Level pass in Mathematics and any two H2 Level passes in Physics/Chemistry/Biology

International Baccalaureate Diploma
Minimum Subject Requirements
Mathematics at Higher Level and Physics/Chemistry/Biology at Higher Level; or Mathematics at Standard Level and any two Physics/Chemistry/Biology at Higher Level

ABOUT THE COURSE

In collaboration with the School of Social Sciences, this highly inter-disciplinary 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. This programme offers more consistent depth in both disciplines. Students who have a curiosity in areas such as human emotions, behaviors and thoughts can now adopt a more integrated approach towards its understanding.

FURTHER STUDIES

Aside from the Biological Sciences Major, 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 5 of these electives:

- Developmental Psychology
- Social Psychology
- Personality and Individual Differences
- Learning and Behavioral Analysis
- Positive Psychology
- Engineering Psychology
- Applied Statistical Methods for Psychological Research
- Evolutionary Psychology
- Alcohol, Drugs and Behavior
- Qualitative Methods in Psychology
- Applied Multivariate Methods for Psychological Research
- Clinical Psychology

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 governmental 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.

REQUIREMENTS

Singapore-Cambridge GCE ‘A’ Level
Minimum Subject Requirements
A good grade in H1 Level Mathematics and H2 Level pass in Physics/Chemistry/Biology and a good grade in General Paper/Knowledge & Inquiry

International Baccalaureate Diploma
Minimum Subject Requirements
A good grade in Mathematics at Standard Level and, Physics/Chemistry/Biology at Higher Level and a good grade in English at Standard Level


Double Major: B.Sc. (Hons) in Biological Sciences and Psychology

- This course integrates biological sciences with knowledge and understanding of psychology
- Conducted in partnership with the School of Humanities and Social Sciences
Double Degree: B.Sc. (Hons) in Biomedical Sciences and B.Med. in Chinese Medicine

生物医学与中医学双学士学位

• This innovative ‘East meets West’ programme trains students in Biomedical Sciences and Chinese Medicine.
• This 5-year curriculum consists of the first three years in NTU and two years of study in Beijing University of Chinese Medicine (BUCM), China.

ABOUT THE COURSE

This is a bilingual course with English and Mandarin as the medium of instruction. Students will learn aspects of Biomedical Sciences such as Genetics, Molecular & Cell Biology, Immunology as well as Traditional Chinese Medicine (TCM) Diagnostics, Medications, Acupuncture and Moxibustion.

WHAT WILL YOU LEARN

YEAR 1 TO 3 AT NTU, SINGAPORE

• Introductory Biology
• Organic Chemistry
• TCM in Ancient Chinese
• Anatomy
• Biochemistry I
• Principles of Genetics
• Molecular & Cell Biology I
• Molecular & Cell Biology Techniques Level 1
• Biostatistics

YEAR 2

• Physiology
• Microbiology
• Chinese Materia Medica
• TCM Diagnostics
• Emperor’s Canon of Internal Medicine
• TCM Formulary
• Pathology

YEAR 3

• Plant Biology
• Treatise on Exogenous Febrile Diseases
• Acupuncture & Moxibustion
• Immunology
• Biomedical Pharmacology
• Synopsis of the Golden Chamber

YEAR 4 AND 5 AT BUCM, CHINA

• Basics of Diagnostics
• Internal Medicine of TCM
• Orthopaedics, Traumatology 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
• TCM Hospital Internship

CAREERS

Graduates of this double degree programme are well positioned to consider a wide range of career options. Employment can include:
• 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

REQUIREMENTS

Singapore-Cambridge GCE ‘A’ Level
Minimum Subject Requirements
H1 Level pass in Mathematics and H2 Level pass in Physics/Chemistry/Biology and ‘O’ Level pass in Chinese

International Baccalaureate Diploma
Minimum Subject Requirements
Mathematics at Standard Level and Physics/Chemistry/Biology at Higher Level and Chinese at Standard Level

ADMISSION CRITERIA & EXEMPTIONS

INDICATIVE GRADE PROFILE FOR ‘A’ LEVEL AND POLYTECHNIC APPLICANTS

<table>
<thead>
<tr>
<th>A Level Subject</th>
<th>Exemptions</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>H2 Biology</td>
<td>BS1001 Introductory Biology</td>
<td>Grade A</td>
</tr>
<tr>
<td>H2 Chemistry</td>
<td>BS1003 Organic Chemistry</td>
<td>Grade A</td>
</tr>
<tr>
<td>H3 Molecular Biology</td>
<td>BS1007 Molecular &amp; Cell Biology I</td>
<td>Distinction or Merit</td>
</tr>
<tr>
<td>H3 Organic Synthesis &amp; Mechanism</td>
<td>BS1003 Organic Chemistry</td>
<td>Distinction or Merit</td>
</tr>
<tr>
<td>H3 Proteomics</td>
<td>BS1005 Biochemistry</td>
<td>Distinction or Merit</td>
</tr>
<tr>
<td>Other H3 Subjects</td>
<td>Exemption will be granted on a case-by-case basis</td>
<td>Distinction or Merit</td>
</tr>
</tbody>
</table>

Exemptions for other qualifications, please refer to [http://www.sbs.ntu.edu.sg/prospective/undergraduate/BS/Pages/Exemptions.aspx](http://www.sbs.ntu.edu.sg/prospective/undergraduate/BS/Pages/Exemptions.aspx)

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](http://www.ntu.edu.sg/admissions)

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