

# Where Your Choices Can Take You

In CDE's interdisciplinary learning environment, the possibilities are limitless.

## Materials Science and Engineering

Materials engineers design, develop, and enhance materials to solve challenges in technology, sustainability, and everyday life, enabling advancements across industries.

## Environmental and Sustainability Engineering

Environmental and sustainable engineers draw from the science of biology, chemistry, ecology, and hydrology, to devise sustainable solutions to improve our quality of life, while maintaining a clean and healthy environment.

## Architecture

Architects plan the future as well as design places for purpose and inspiration.

## Landscape Architecture

Landscape architects plan, design, and manage outdoor spaces such as parks, gardens, waterfronts, and urban plazas to create functional, sustainable, and aesthetically pleasing environments.

## Civil Engineering

Civil engineers plan, design, construct, maintain, and operate a liveable city while ensuring human safety, climate resilience, and environmental sustainability.

## Infrastructure and Project Management

Project managers apply their knowledge in the areas of engineering, management, and law to manage a variety of construction and infrastructure projects and systems in the built environment and other sectors.

## Computer Engineering

Computer engineers design and build computing systems at all scales, from microcircuits to large-scale intelligent systems. They innovate in energy-efficient devices, advanced communication networks, and smart technologies, driving the digital transformation across industries globally.

## Electrical Engineering

Electrical engineers are innovators and problem solvers who design and optimise systems powering modern technology. Their expertise advances communication networks, AI solutions, energy systems, and medical technologies, driving progress across industries like electronics, aerospace, and robotics.

## Robotics and Machine Intelligence

Robotics engineers design and build robots and automated systems for applications across many industries, including defence, manufacturing, logistics, healthcare, and consumer electronics.

## Engineering Science

Engineering scientists use mathematics and science to create practical solutions for complex problems that involve multiple areas of engineering.

## Mechanical Engineering

Mechanical engineers use the principles of motion, force and energy to design, develop and manufacture mechanical devices and thermal systems, creating technologies that meet human needs.

## Industrial and Systems Engineering

Industrial and systems engineers solve problems in multiple domains, backed by scientific approaches in data analytics, systems modelling, decision-making and management.

## Biomedical Engineering

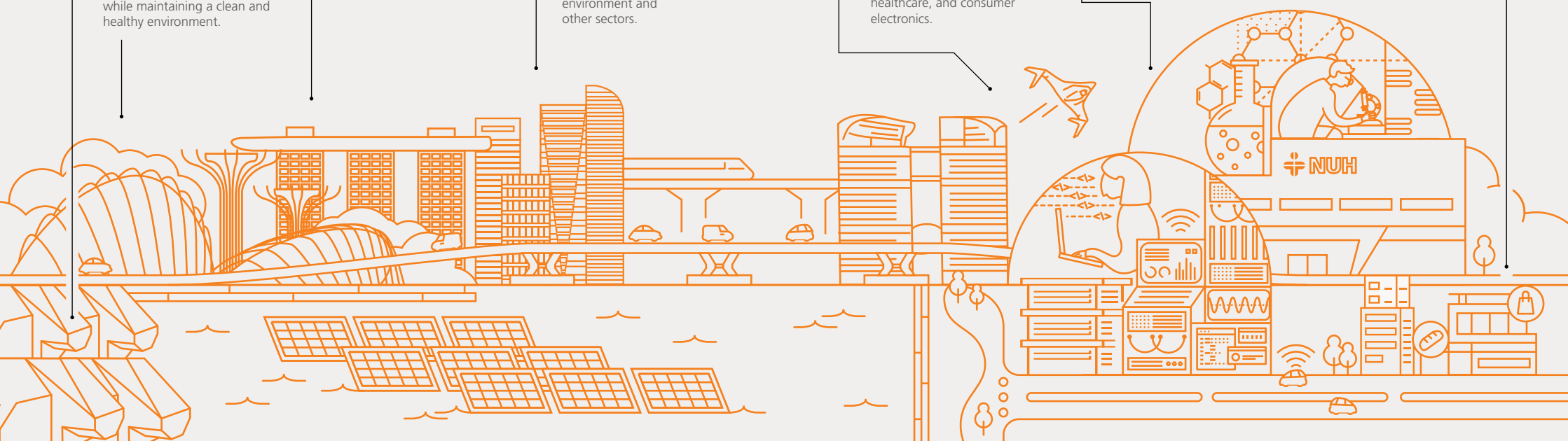
Biomedical engineers design innovative solutions to improve patients' lives and elevate the quality of care.

## Chemical Engineering

Chemical engineers transform molecules and materials from nature, including living matter, into a wide range of products that shape our modern lives, from medicines and cosmetics products to fuels and computer chips.

## Industrial Design

Industrial designers create new products, services, spaces, apps, experiences, and businesses that people need and love.





# CDE is Globally Recognised

NUS emerged **eighth** in the latest UK-based **Quacquarelli Symonds (QS) World University Rankings 2024**.

NUS is the **highest-ranked Asian university** and the **first from Asia** to place among the top 10 institutions in the world. That's not all — CDE also shines in the subject-specific rankings.

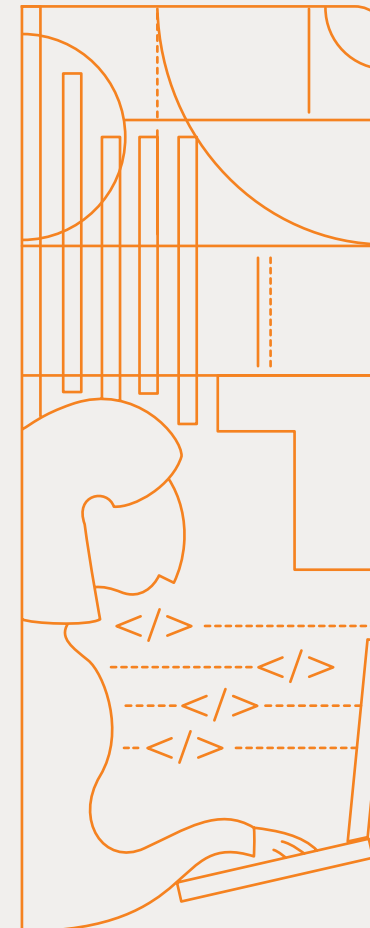
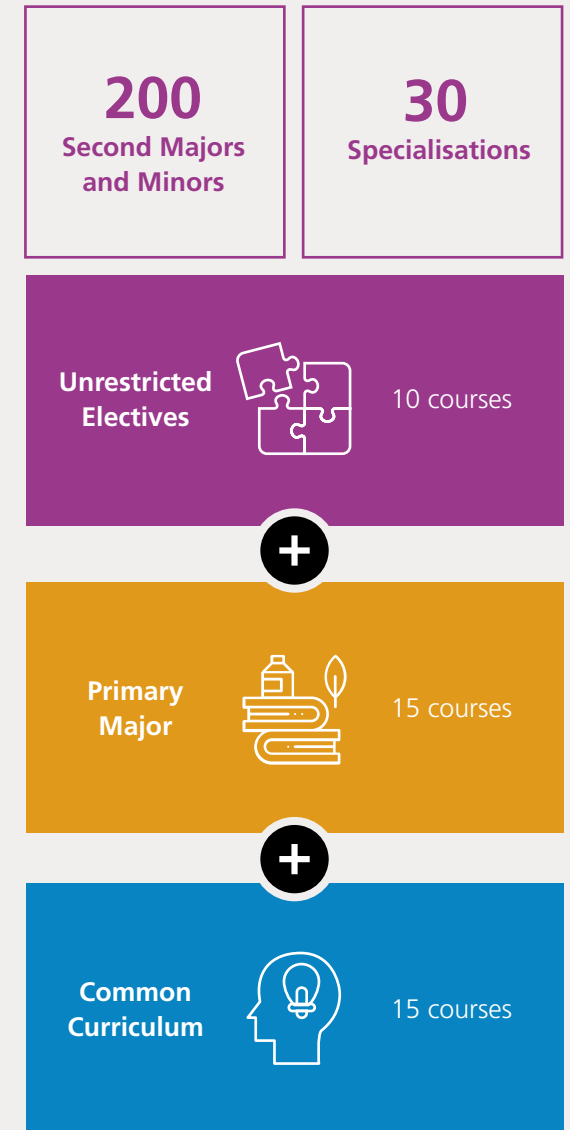
**8th**  
in the world

**1st**  
in asia



# The CDE Edge

When you pursue a four-year direct Honours degree at CDE, you gain breadth, depth and flexibility through a combination of the **common curriculum**; a **major** of your choice; and a wide range of **unrestricted electives**.



## Building Your CDE Degree

### What does an education at CDE entail?

An education at CDE will be an exciting, interdisciplinary experience for students where their learning journey takes centre stage. We are equipping students with an adaptable toolbox of skills across disciplines, moving them beyond a knowledge-based education to a mindset-based approach to problem-solving. The CDE common curriculum provides a broad intellectual foundation on which you can continuously upgrade, evolve and re-pivot in a fast-changing world. Our Majors build on top of the common curriculum to allow you to explore your chosen field, and our unrestricted elective space gives you the freedom to customise your educational experience.

### What is Build Your Own Degree? How do Unrestricted Electives work?

Each of our undergraduate degrees is a four-year direct honours degree and you need an equivalent of 40 courses to graduate. Your major is your primary area of study, comprising 15 courses. The Common Curriculum accounts for another 15 courses. This leaves 10 courses in the Unrestricted Electives (UE) space that you can use to decide how broad, deep or integrated you want your education to be. You can choose what you want to take from anywhere at NUS. Second majors (10 courses) and minors (5 courses) allow you to broaden your knowledge and skills in a complementary or contrasting area. A specialisation (5 courses) is a focus area within your chosen discipline. Alternatively, you can choose from over 4000 courses available across NUS as electives based on your interest.

## Planning Your CDE Journey

### What courses do we need to take each year in CDE? Is there a curriculum schedule assigned to students?

Some courses under the Common Curriculum will be pre-allocated to students. Each programme also has a recommended curriculum schedule that students can use to plan the courses they need to take each semester. You may then ballot for the courses you want during the course registration exercise before each semester. The recommended schedule is available on each department's website.

### What are the other opportunities available to CDE students?

CDE and the wider NUS community offer a wide range of global opportunities and special programmes to enhance your learning experience such as the NUS Overseas Colleges, Residential Programmes, Student Exchange Programme and Summer/Winter Schools. Those interested in NUS College will be pleased to know it is compatible with all CDE degree programmes. Beyond academics, we have a vibrant College life and offer a wide range of activities from wellness workshops to cooking lessons. With NUS' huge range of clubs and societies there is never a problem with finding your niche!

## Key Activities During The Academic Year



# PIONEER THE FUTURE OF ROBOTICS

Unlock the future of **Robotics and AI** with NTU's cutting-edge curriculum

- Robotics engineering is set to be one of the fastest growing global careers by 2027<sup>1</sup>
- 12 million new robotics-related jobs will emerge across various sectors by 2025<sup>2</sup>
- Robotics and AI are driving industry innovation and growth<sup>3</sup>

Sources:

1. World Economic Forum's Future of Jobs Report 2023
2. International Federation of Robotics, The Impact of Robots on Productivity, Employment and Jobs, Sep 2023
3. Forbes, Why robotics and artificial intelligence are the future of mankind. Helfrich, T. 2022

## WHAT WILL YOU LEARN IN NTU'S FUTURE-FORWARD ROBOTICS PROGRAMME?

Full-Spectrum Robotics Experience

Versatile

Specialised



### Robot **User**

Transform robots for various industry applications with hands-on robotics projects



### Robot **Integrator**

Optimise robot performance with advanced system integration for practical solutions



### Robot **Builder**

Engineer intelligent robots with AI and advanced hardware to solve real-world challenges

## WHY STUDY ROBOTICS AT NTU?

NTU's Robotics Programme emphasises a balance between modern learning and hands-on experience. Our curriculum and practical projects provide a holistic journey, equipping you with the in-demand skills for future career opportunities.



### Multidisciplinary Programme

Master a blend of mechanical, electrical, and computer engineering, along with AI and intelligent mechatronics



### Future-Forward Pedagogy

Combines theoretical knowledge with hands-on experience to meet evolving industry demands



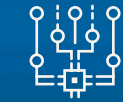
### Long-Standing Excellence

25 years of excellence in robotics, with an extensive network of over 1,000 alumni



# Global Top 20 in 7 Subjects

2023 QS World University Rankings  
By Subject



Electrical and Electronic  
Engineering  
**#10**



Mechanical  
Engineering  
**#10**



Architecture and  
Built environment  
**#7**



Engineering and  
Technology  
**#16**



Materials Sciences  
**#12**

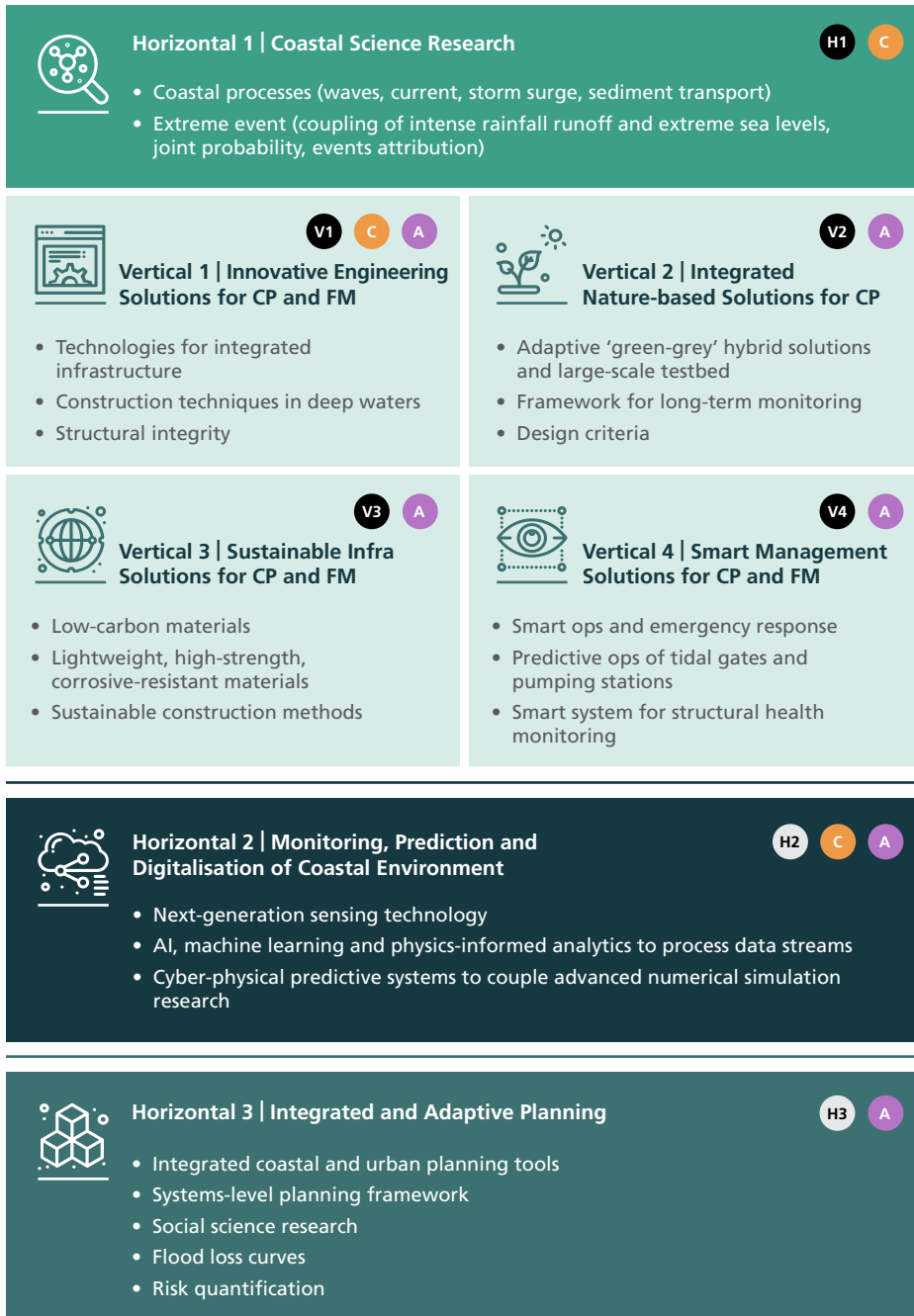


Chemical Engineering  
**#4**



Civil and Structural  
Engineering  
**#4**

# RESEARCH



## Coastal Science Research

- High-confidence design parameters for coastal processes
- Impact of climate change on coastal processes
- Impact on coastal protection measures

## Integrated Nature-based Solutions

- Develop novel hybrid solutions
- Establish planning guidelines and engineering parameters for hybrid solutions
- Innovative approaches to implement
- Develop science-based monitoring and maintenance approaches



## Monitoring, Prediction and Digitalisation of Coastal Environment

- Enhance predictive systems for coastal processes
- Enhance Singapore's convective rainfall prediction
- Enhance predictive systems for runoff generation

## Innovative Engineering Solutions

- Adaptive, multi-functional and integrated solutions
- Develop local design standards

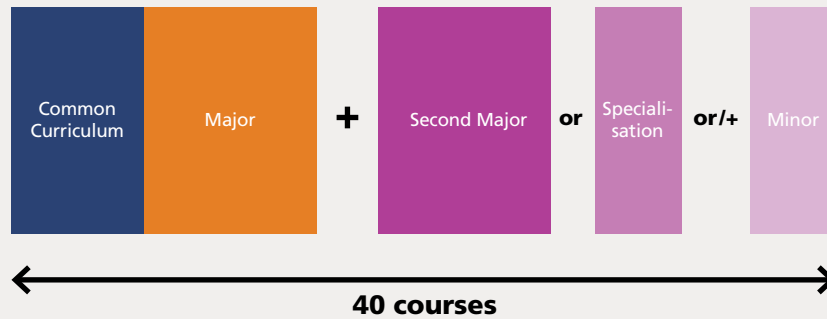
## Programme Overview

The MSE programme at NUS is a four-year undergraduate programme that combines a solid foundation in solid-state physics and chemistry with practical aspects of materials design and engineering. Besides theoretical training, experimental work forms a crucial component of the MSE curriculum, paving the way for students to specialise in their desired career paths in research, industry practice or technopreneurship.

### The programme has six specialisations:

- Biomedical Materials
- Nanostructured Materials & Nano Technology
- Functional Intelligent Materials
- Materials for Renewable Energy & Sustainability
- Robotics
- Microelectronics & Quantum Materials

## Build Your Own Degree



MSE students have the option to expand their expertise through double degrees, second majors or minors in a variety of disciplines:

- BEng Double Degree in MSE with Business Administration
- BEng in MSE and Doctor of Medicine (seven-year programme with Duke-NUS)
- Double major in MSE with Innovation & Design
- Minor programmes are available in Data Engineering, Optics and Semiconductors, Mathematics, Cultural Studies, Technopreneurship, Analytical Chemistry, Physics, Economics, Artificial Intelligence and more.

The programme also offers extensive overseas and industrial opportunities, including:

- Student Exchange Programme (SEP)
- International Summer (& Winter) Programmes (i-SP)
- NUS Overseas Colleges (NOC)
- Other Global Internship experiences

NUS offers financial aids such as bursaries, awards and loans.



For more information, scan this QR code.

## Educational Journey

### Year 1

Students begin their journey by establishing a solid foundation in engineering, mathematics and science, complemented by an introduction to data analytics and project management. Engagement in MSE student club activities broadens networks and provides insights into the field, enhancing the campus experience.

### Year 2

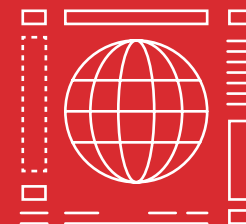
The curriculum deepens with core principles of Materials Science and Engineering courses, including an introduction to artificial intelligence. The Undergraduate Research Opportunity Programme (UROP) is available for students interested in exploring research opportunities early in their academic career.

### Year 3

Opportunities for international exposure are available through student exchange programmes at prestigious universities worldwide. For those interested in entrepreneurship, the NUS Overseas Colleges (NOC) programme offers insights into the startup culture. Industrial attachments and vacation internships provide practical exposure to the materials industries, enriching students' understanding and experience.

### Year 4

Students apply their comprehensive knowledge of materials to address industrial challenges. The Final Year Project offers a range of research opportunities, allowing students to explore advanced topics. Hands-on experience in materials processing and exploration of machine learning's impact on materials development equip students with innovative skills in the field.



# CHAIRMAN'S MESSAGE

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**Professor Tan Eng Chye**  
President, National University of Singapore

## 2024 AT A GLANCE

RESEARCH FUNDING

SGD **2.5** MILLION  
(RMB 13 million)



STARTUPS INCUBATED

**17**

**45** PATENT APPLICATIONS



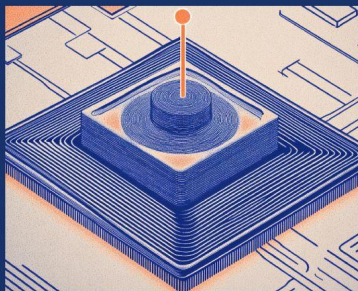
PAPERS PUBLISHED IN INTERNATIONAL JOURNALS

**565**

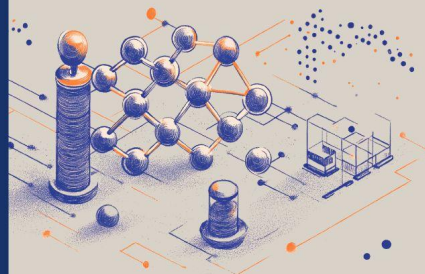


At Fuzhou RI, **Dr Gou Jian**, together with his colleagues, discovered ferroelectricity in a new single-element material known as two-dimensional black phosphorus-like bismuth. Dr Gou, who is the lead author of the paper published in the journal *Nature*, observed an inversion symmetry-breaking structure in the bismuth monolayer, demonstrating charge redistribution and buckling at the atomic level. This finding is significant because it shows that ionic polarisation is possible within a single-element substance, turning on its head the conventional wisdom that ferroelectricity requires compounds composed of cations and anions.

The team's breakthrough has far-reaching implications, particularly for the development of non-volatile memory devices and electronic sensors. The ability to induce and manipulate electric polarisation in a single-element layer brings new opportunities for integrating ferroelectric properties into nanoscale devices — catalysing future advances in electronics and materials science.



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Understanding how catalysts behave during chemical reactions is key to improving their efficiency. One major facet is dynamic reconstruction — a process where catalysts undergo structural changes while expediting reactions. This often enhances catalytic performance. However, how defects or minor flaws in the catalyst structure influence this reconstruction has remained unclear until now.

**Dr Zhang Rongrong** and her colleagues at Fuzhou RI unravelled the mechanisms through which cobalt oxide catalysts undergo reconstruction during the oxygen evolution reaction (OER), the oxygen-generating process in water splitting. They found that oxygen and cobalt vacancies play distinct roles during the reconstruction process. In particular, oxygen defects promote stronger \*OH adsorption, driving structural changes, while cobalt vacancies facilitate dehydrogenation, which puts the brakes on the rate of reconstruction. Interestingly, both defect types lead to the formation of highly active bridge Co sites, with cobalt-defected catalysts showing the best OER performance.

TRAILBLAZING RESEARCH TO SHAPE A BETTER FUTURE

Dr Zhang's work, published in the *Journal of the American Chemical Society*, highlights the potential of tailoring defect types to control catalyst reconstruction, introducing a new approach to designing efficient electrocatalysts for energy-related applications.

## OVER THE YEARS, NUSRI CHINA HAS...



\*All figures are cumulative as at December 2024

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# GROWING THE SEEDS OF TALENT AND ENTREPRENEURSHIP

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GROWING THE SEEDS OF TALENT AND ENTREPRENEURSHIP

In producing the next generation of creators and innovators, cultivating talent and fostering entrepreneurship are essential. At NUSRI China, this remains our focus as we aim to create a positive impact on society through the talent and enterprises we nurture.

OVER THE YEARS, NUSRI CHINA HAS...

ENROLLED  
**000**  
STUDENTS

IN THE  
**“3+1+1”**  
JOINT PROGRAMME AND  
NUSRI-AFFILIATED PHD  
PROGRAMME.



\*All figures are cumulative as of December 2024

## NUS-GRTII-affiliated PhD Scholarship

4

For a four-year programme  
based in NUS, Singapore

40 scholarships  
available every year,  
including 2024



Sponsored by the  
China-Singapore  
Guangzhou Knowledge City  
Administrative Committee

Scholars will conduct  
research based on the  
China-Singapore  
Guangzhou Knowledge  
City's strategic areas:



- Smart City
- Information and Communication
- Electronic Science and Technology
- Advanced Manufacturing
- Artificial Intelligence
- Biomedical Technology
- Financial Technology

Scholars are required to fulfil a  
two-year service obligation in  
Huangpu District of Guangzhou  
City upon graduation



The first scholarship  
programme information  
session was held on 24  
May 2024 at the Zhongxin  
Guangzhou Intellectual  
City, Huangpu District

A welcome session for the first  
batch of students was held on  
12 August 2024

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In June 2024, 54 NUS students went on a Study Trips for Engagement and EnRichment (STEER) trip to Chongqing and Chengdu, jointly organised by NUSRI Chongqing and the NUS Global Relations Office. The two-week programme was led by Emeritus Professor Seah Kar Heng and Associate Professor Loh Wai Lam, both from the College of Design and Engineering, NUS.

STEER programmes are designed to expose students to the diverse sociocultural environments of emerging regions through a mix of thematic classroom-based learning, experiential site visits and immersive interactions with various local communities.



The STEER Chongqing and Chengdu trip yielded a unique experience where classroom learning was complemented by outdoor and cultural exposure.

Renewable energy was the theme of this trip. Ten classroom sessions held at NUSRI Chongqing gave the students an understanding of the socio-cultural-economic context of renewable energy and its evolving role in China and other countries. In particular, students gained insights into the challenges of weaning the world off oil and gas, even as renewables such as solar, hydro and wind power take up an increasingly larger share of the energy market. They also had the opportunity to visit HG Group, a leading photovoltaic (PV) cell manufacturer in China, where they witnessed the



In addition to classroom sessions, students also embraced experiential learning through industry visits to companies such as the HG Group, a leading photovoltaic (PV) cell manufacturer in China.

production of PV cells, learnt about how discarded solar panels are recycled and interacted with scientists working on the latest and greatest solar technologies.

The trip was also a treat for the students' senses. They enjoyed various activities from a Sichuan hotpot feast and a live opera performance to a visit to Chengdu's *Dujiangyan* Panda Valley and the ancient *Dujiangyan* irrigation system, where they stood in awe of the engineering marvel built around 256 BC as an irrigation and flood control project.



NUS students posing for a group photo with performers from the Chongqing Sichuan Opera Theatre, after watching their thrilling Sichuan opera performance.

GROWING THE SEEDS OF TALENT AND ENTREPRENEURSHIP

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## NUS Graduate Research Innovation Programme (GRIP)



A programme that enables researchers and postgraduate students to transform research into deep technology startups

### AREAS OF FOCUS:

Advanced manufacturing

Agrifood

Sustainability

Health & biomed



### TRACK RECORD SINCE 2018:

12  
Runs

167  
Teams



504  
Participants

99  
Spinoffs

\$64m+  
external  
funding raised



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## Suzhou Liloss Biotechnology Co., Ltd.

is another startup cooking up its success story with the support of BLOCK71 Suzhou — making waves in the health and wellness space.

Founded in Singapore in 2022, Liloss specialises in natural health supplements derived from fruits and vegetables. The minds behind the startup developed a sweet potato resin glycoside with anti-obesity properties — an innovation that earned them a slice of NUS GRIP's (Run 7) seed funding. Since joining BLOCK71 Suzhou this year, Liloss has gained access to office space, research facilities and business connections that have fuelled their entry into the Chinese market.

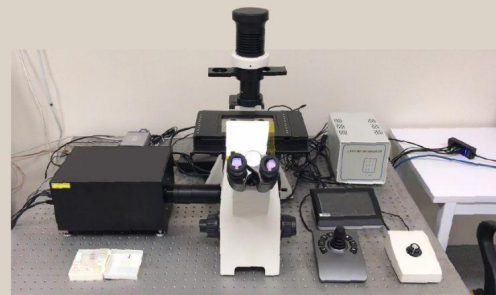


Liloss offers a high-quality sweet potato extract that addresses consumer concerns about the safety of weight-loss supplements. This naturally-derived ingredient helps regulate lipid digestion and reduce calorie absorption — letting consumers have their cake and eat it too. Produced on a pilot scale in China, the extract is already gaining traction in both China and Singapore, supported by positive user feedback and promising animal test results. With the backing of BLOCK71 Suzhou, Liloss is now refining its supply chain and expanding its footprint in China.

Founded by NUS alumni with a mission to supercharge robotics, **Vilota** is a startup at NUSRI Chongqing (BLOCK71) that specialises in visual positioning systems (VPS). Responding to the growing need for precise localisation in complex environments like drone navigation and warehouse optimisation, Vilota's VPS combines computer vision and deep neural network algorithms to provide pseudo-GPS positioning.

Incubated under NUS GRIP in 2021, Vilota's technology excels where traditional global navigation satellite systems fall short, such as indoors and underground. The startup's VPS integrates object recognition, visual-inertial odometry and depth sensing to ensure accurate positioning and autonomous navigation. Its flagship product, Depth Pilot 180, offers precise localisation in obstacle-laden settings — boosting efficiency and safety across sectors like mining, construction, robotics and mobility.

Among the first batch of startups incubated at NUS GRTII (BLOCK71), **MicroVeNUS Pte. Ltd.** specialises in developing advanced optical imaging technologies, including super-resolution confocal microscopes and light sheet microscopes. Founded in March 2024 by Professor Chen Nanguang from the Department of Biomedical Engineering, College of Design and Engineering, NUS, the startup zooms in on the demanding needs of life sciences and medical research. It offers superior imaging solutions that measure up to international standards while maintaining competitive pricing and providing the advantage of local service support. It has since successfully developed several prototypes with independent intellectual property rights.



Focal modulation confocal microscope developed by MicroVeNUS Pte. Ltd.

GROWING THE SEEDS OF TALENT AND ENTREPRENEURSHIP

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