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COLLEGE OF ENGINEERING

SCHOOL OF CHEMICAL AND BIOMEDICAL ENGINEERING

- Food Science & Technology
- Translational Medicine
- Translational Healthcare Technology/Bioinstrumentation
- Pharmaceutical Engineering
- Biotechnology & Synthetic Biology
- Energy & Chemical Technologies

SCHOOL OF CIVIL & ENVIRONMENTAL ENGINEERING

Construction Technology and Management

- Construction Technology and Management
- Building Information Modeling (BIM) for built environment and infrastructure engineering
- IT Applications for Construction Industry
- Construction Productivity and Safety Studies
- Prefabricated Prefinished Volumetric Construction
- Deep learning and computer in infrastructure engineering
- Smart robotics development in infrastructure engineering

Geotechnical Engineering

- Foundations of Coastal Structures
- Land Reclamation and Coastal Protections
- Soil improvement using Biocement or Other Innovative Technologies
- Underground Construction and Space Development
- Rock Mechanics and Engineering Geology
- Space Creation via Intensification of Land Use
- Climate Change Impact on Urban Environment

Maritime Studies

- Maritime Logistics
- Strategic and Quality Management in Shipping
- Supply Chain Management
- Sustainable Maritime Operations
- Data Analytics for Maritime Applications

Structures and Mechanics

- Structural Dynamics
- Protective Technology
- Concrete and Steel Technology
- Sustainable Timber Technology
- Structural Health Monitoring

Environmental Engineering

- Membrane science and technology
- Environmental microbiology and biotechnology
- Environmental chemistry and materials
- Environmental toxicology and public health
- Simulation and modelling of environmental processes
- Solid waste management

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Water Resources Engineering

- Water Resources and Flood Management

Transportation Engineering

- Active mobility
- Public transport
- Urban and last-mile logistics
- Electric vehicle (EV), automated vehicles (AT), and connected vehicle (CV)
- Transportation safety engineering & practices
- Driver & traveller behaviours
- Traffic management & control tools
-

Civil Engineering

- Impact of Climate Change on Urban Liveability

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

- Artificial Intelligence
- Audio, Speech and Signal Processing
- Biomedical Informatics
- Blockchain / Fintech
- Cloud Computing
- Cognitive Modelling
- Computational Neuroscience
- Computer Graphics and Interactive Visual Computing
- Computer Networks and Communication
- Computer Vision and Multimedia
- Custom / Re-configurable Computing
- Cyber Physical Systems
- Cybersecurity
- Data Management and Analytics
- Hardware and Embedded systems
- High Performance Computing
- Human Computer Interaction
- Image Processing
- Information Retrieval
- Internet of Things
- Machine Learning
- Modeling and Simulation
- Natural Language Processing
- Parallel and Distributed Systems
- Robotics
- Software Engineering
- Wireless and Smart Sensor Systems

SCHOOL OF ELECTRICAL AND ELECTRONIC ENGINEERING

- Renewable Power and Energy Systems
- Smart Power Grids
- Electric cars and vehicles
- Electric motors
- Autonomous vehicles
- Intelligent Transportation
- Power Electronics
- Energy Efficient Buildings
- RF, Analog/Mixed-signal and Low-power Digital ICs
- Edge Computing
- Neuromorphic Computing
- System-on-Chip/System-in-Package and Testing
- Terahertz and Si Millimeter Wave ICs
- Intelligent Computing
- Computer Audio, Vision, Image and Video Processing
- Cybersecurity
- Big Data Analytics
- Artificial Intelligence, Machine/Deep Learning
- Modeling and Control of Complex Systems
- Intelligent and autonomous Systems
- Robotics and Human-Robotic Interactions
- 5G and Beyond 5G Communications
- Vehicle to Vehicle (V2V) and V2X communications
- Sensor Networks, Network Design, Network Security and Network Performance
- Nanoelectronics: Semiconductor Materials, Devices, Systems
- Bioelectronics, Biophotonics , Bio-Sensors
- Internet of Things (IoT), Internet of Everything (IoE) and Smart Nations
- Future and Smart Mobility
- Satellite Engineering and Space Technology
- Photonics, Optoelectronics, and Nanophotonics
- Specialty Fiber and Fiber Technology
- Quantum Engineering

SCHOOL OF MATERIALS SCIENCE AND ENGINEERING

- Biomaterials and Biomedical Devices
- Biomimetic Materials
- Combinatorial Materials and Materials Simulation
- Computational Materials Science
- Metals, Ceramics and Polymers
- Functional Materials and Composites
- Materials for Sustainability
- Materials Characterization
- Nanoelectronics, Nanomaterials and Multiferroics
- Nanomedicine

SCHOOL OF MECHANICAL AND AEROSPACE ENGINEERING

- Aerospace Engineering (Aerodynamics, Flight dynamics & control, Propulsion & UAV, Smart materials, Aircraft Design, Aero-elasticity & aircraft structure)
- Air Traffic Management (Human Factors, Operation Research, Environment and Weather, Information management systems)
- Future mobility (Advanced power systems and drivetrains, electric mobility, autonomous vehicles, driver-automation collaboration)
- Biomedical Engineering (Bio-design and bio-manufacturing of tools/devices, Biomechanics, Medical simulation, Bio-sensors/biomedical devices, bio-inspired engineering and materials)
- Clean Energy & Sustainable Environment (Fuel Cells, Wind/Tidal energy, Clean technology & environment, Advanced cooling technologies, Waste heat recovery, Alternative energy, Environmental acoustics)
- Micro/nanofabrication and Micro Systems (Thin films & coatings, MEMS & BioMEMS, Data storage, Sensors & actuators)
- Naval architecture and marine engineering (Fluid-marine structure interactions, Ship structure design, Marine engine emissions, LNG ships, Hull-propulsor design)
- Optical and laser engineering (Computational Optics, Nanoscale Optical Engineering, Precision Optics, Laser Structuring and Processing)
- Robotics and Intelligent Systems (Industrial robots, Surgical robots & remote diagnosis, Rehabilitation robots, Cobots, Soft robots, Virtual reality, Intelligent systems)
- Systems Engineering and Management (Human Factors Engineering, Operations Research, Systems Engineering, Design Studies)
- Additive Manufacturing (Selective Laser Melting, Selective Laser Sintering, Electron Beam Melting, Laser Additive Manufacturing, Bioprinting, Modelling and Simulation)
- Precision Machining (Laser-material interactions, surface modifications, non-traditional machining, ultra-precision machining)
- Advanced & Sustainable Manufacturing (Factory of the Future, Industry 4.0, Smart manufacturing, Industrial Internet of Things, Cyber-physical manufacturing system optimization, Non-destructive testing and evaluation)
- Mechanics of materials (Fracture mechanics, Material fatigue, Micromechanics, Soft matters, Computational mechanics)

COLLEGE OF SCIENCE

ASIAN SCHOOL OF THE ENVIRONMENT

The Asian School of the Environment (ASE) is an interdisciplinary school in the College of Science that focuses on Asian environmental challenges. By integrating earth sciences, ecosystems ecology, natural hazards and coupled human-natural systems, the school will address key issues of climate change, environmental science and sustainability. The school aims to fill a significant gap in our understanding of the tropical landscapes and Asian urban environments.

Our fields of research include:

Climate change (sea-level rise, storms)
Coupled human-natural systems
Ecosystems and ecology
Environmental systems science
Environmental genomics
Natural hazards (earthquakes, tsunamis and volcanoes)
Marine sciences (ocean chemistry and biogeochemistry)
Microbial ecology
Megacities and urban risk
Paleoclimate

SCHOOL OF BIOLOGICAL SCIENCES

The School of Biological Sciences (SBS), which belongs to the College of Science, was established in 2002 with a mission to make a strong contribution to biological and biomedical sciences. Since then, many talented individuals from around the world and Singapore have joined us, from scientific leaders, researchers, postgraduate students, working across our various fields of research.

SBS collaborates with local and international research institutes, universities and hospitals, sharing a common goal to advance basic knowledge and translational application in the biological and biomedical sciences.

Our Fields of Research includes:

- Cancer
- Cell biology
- Chemical biology
- Gene regulation
- Immunology
- Infectious disease and microbiology
- Metabolism and diseases
- Neuroscience
- Plant Biology
- Stem cells and ageing
- Structural biology

SCHOOL OF PHYSICAL AND MATHEMATICAL SCIENCES

Mathematical Sciences

- Probability and Statistics
- Number Theory, Algebra and Combinatorics
- Analysis and Topology
- Coding Theory & Cryptography
- Mathematical Logic
- Scientific Computing and Computational Mathematics
- Theoretical Computer Science and Algorithms
- Financial Mathematics
- Optimization
- Applied Geometry

Chemistry & Biological Chemistry

- Analytical Chemistry
- Bioinorganic, Bioorganic and Biophysical Chemistry
- Green Chemistry
- Inorganic and Organic Chemistry
- Medicinal Chemistry
- Nanotechnology, Nanomaterials and Nanobiotechnology
- Physical, Theoretical and Computational Chemistry
- Synthesis, Methodology and Catalysis
- Total Synthesis of Natural Products and Drugs

Physics & Applied Physics

- Condensed Matter, Semiconductor Physics and Spintronics
- Photonics and Quantum Electronics
- Quantum Technology and Quantum Information Science
- Nanoscience and Nanotechnology, Surface and Interface Science
- Biophysics, Bioimaging and Soft Condensed Matter
- Nonlinear and Complex Systems

LEE KONG CHIAN SCHOOL OF MEDICINE

LEE KONG CHIAN SCHOOL OF MEDICINE

In line with its mission of transforming healthcare, LKCMedicine is a young, thriving medical school working to make disruptive discoveries and inventions that will shape future medicine in Singapore and around the world.

LKCMedicine aims to do so by focusing on addressing therapeutic priority areas important both locally and globally. These research foci are: Neuroscience and Mental Health, Population Health, Respiratory and Infectious Diseases, Vascular/Metabolic Diseases, and Skin Diseases and Wound Repair. These strategic programmes directly address Singapore's future healthcare challenges, in particular those that arise from a rapidly ageing population.

In addition to these research foci are cross-cutting themes including Health Technologies, Developmental Biology & Regenerative Medicine and Microbiome Medicine, areas where LKCMedicine is uniquely equipped with relevant expertise.

Another defining approach of LKCMedicine's research strategy is the "system medicine" approach, where LKCMedicine researchers participate in multiple programmes, which promote inter-disciplinary collaborations. In integrating medical education research into LKCMedicine's research framework, which bridges the gap between biomedical research with medical education, allowing for cross-talk between research and education critical for advancing the science and practice of medicine.

To enable such research work, LKCMedicine provides access to state-of-the art platforms and facilities. LKCMedicine researchers work at the centre of international and national networks, delivering world-class science and medicine via collaborative initiatives and Research Centres.

By investing in people, creating the best research environment, and approaching healthcare's most complex translational challenges through focused interdisciplinary research between clinical and engineering sciences, we do transformative science, provide innovative education, and ultimately, change lives for the better.

RESEARCH CENTRES

EARTH OBSERVATORY OF SINGAPORE (EOS)



Climate

Climate research at EOS aims to fill a gap of much-needed information on climatic forces in Southeast Asia, which will allow for a more accurate projection of regional consequences that can be expected from global climate change. Several major drivers of global climate, including the Western Pacific Warm Pool and the Indian Ocean Dipole, are active in this tropical region, yet scientific knowledge about these drivers has been relatively scarce. Research conducted by the climate group focuses on regional climate monitoring, and the measurement and modelling of past and modern tropical climates.



Hazards, Risk, and Society

EOS conducts research that links policy and social science inquiry with natural science research, education, and engagement in areas affected by natural hazards. One project in Aceh aims to produce a comprehensive and integrated approach to post-disaster recovery and resilience. Another project is to assess current risk perceptions and mitigative actions related to earthquakes and tsunamis and the degree to which science communication has influenced those perceptions and actions. The Hazards, Risk, and

Society group seeks to improve understanding of how and why societies are impacted by natural hazards and to identify strategies that reduce vulnerability and increase resilience.



Tectonics

Southeast Asia and its surrounding regions have many large, active faults, as well as a number of major subduction zones that are responsible for some of the world's biggest earthquakes. Researchers in the tectonics group aim to increase understanding of the region's tectonic and seismic behaviour, to identify signs of previous earthquakes and tsunamis, their size, their recurrence, and their potential for destruction, as a basis for more reliable forecasting.



Volcano

Volcanic arcs in Southeast Asia are among the most active on Earth. The EOS Volcano Group conducts geologic, geochemical, and geophysical studies to improve understanding of volcanic activity, particularly processes related to eruptions. EOS research in this field is designed to build on knowledge and tools that will aid in the forecasting of volcanic eruptions, assessment of their environmental and societal impacts, and efforts to mitigate the hazards.

ENERGY RESEARCH INSTITUTE @ NTU (ERI@N)

Established in 2010, the Energy Research Institute @ NTU (ERI@N) distinguishes itself through research excellence directed towards outcomes of industry relevance, with focus on systems-level research for tropical megacities. The Institute integrates research across NTU in the context of the energy challenge, and then helps translate outcomes into industry and practice.

The Institute's research focuses on a host of Interdisciplinary Research Programmes, Flagship Programmes, Consortium Platform and an Accelerator Programme that covers the energy value chain from generation to innovative end-use solutions, motivated by industrialisation and deployment.

The IRPs are the core of ERI@N's applied research focus:

- i) Renewables and Low-carbon Generation – Solar, Wind & Marine
- ii) Energy Storage, Hydrogen & Fuel Cells
- iii) Renewables' Integration & Microgrids
- iv) Multi-Energy Systems and Grids
- v) Smart & Sustainable Building Technologies
- vi) Future Mobility Solutions
- vii) Power Electronics & Electrification

ERI@N has two Flagship Programmes that serve as strong “Living Lab” platforms to engage industry developed innovation, focusing on solutions that achieve energy efficiency and renewable energy integration into smart micro grids, respectively:

- i) Renewable Energy Integration Demonstrator – Singapore (REIDS)
- ii) EcoCampus

The Institute also embarked on initiatives to bring technologies to the market place and galvanize entrepreneurship through the ERI@N Accelerator Programme (EAP) – the EcoLabs Centre of Innovation for Energy. The Institute also setup the Smart Grid & Power Electronics Consortium as a platform for domain companies to access and commercialize technologies developed by researchers in Institutes of Higher Learning (IHLs) and Research Institute (RIs).

ERI@N is committed to enable knowledge creation and technology transfer by building strong alliances with government agencies, leading industry players and SMEs and global universities to support Singapore's national objectives. These collaborations are ratified in part through the development of green buildings, renewable energy deployment, grid management systems, proliferation of energy efficient solutions, creation of a “car-lite” society, digitalisation of the energy system enabling a ubiquitous smart grid architecture and establishing low carbon districts.

ERI@N has a numerous state-of-the-art facilities and laboratories to support and drive our research work. Located at CleanTech One and the NTU Campus, these include:

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- Mobility and Systems Engineering Lab
- Energy Storage Prototyping Lab
- Singapore-CEA Alliance for Research in Circular Economy (SCARCE) Lab
- Fuel Cells Catalyst Lab
- Smart Grid & Advanced Power Electronics Lab
- Thermal Energy Systems Lab
- Solar Lab

Other facilities located around Singapore include:

- Renewable Energy Integration Demonstrator – Singapore (REIDS) on Semakau Island
- Experimental Power Grid Centre (EPGC) on Jurong Island
- Centre of Excellence for Testing & Research of Autonomous Vehicles NTU (CETRAN) at CleanTech Park

ERI@N has over 270 researchers and staff coming from 24 nations around the world. As a leading Institute that is equipped with a wide range of skillsets and expertise in Science, Engineering, Technology, Policy and Social Science that contributes to a vibrant, multidisciplinary and collaborative research environment, ERI@N strives to achieve our mission for distinction and contribute to National aspirations for a Smart and Sustainable Nation.

INSTITUTE OF CATASTROPHE RISK MANAGEMENT (ICRM)

In recent years, we have witnessed massive increase of human and economic losses due to catastrophic events. These events are either natural or manmade. This increase of losses is due to globalization, urbanization, and climatic change. As a result, the nature and effects of these disasters have also changed. The high level of economic activities and the inter-relationship of man-made systems have brought out some unique and non-traditional risk management issues.

In Asia, where the risk awareness is low and the risk is high, the situation poses special problems and challenges. These include understanding and recognizing risk, risk quantification (monetary, social and human) as well as risk management. NTU's Risk Research Agenda is driven by the principle that catastrophic risk impacts the functioning and effectiveness of the whole fabric of society and businesses. Developing strategies for mitigating these risks will require a robust public-private partnership amongst government agencies, academia and industry players. ICRM is leading the charge at NTU through some of its current major research programs including:

1) Future Resilient Systems II (FRS II) as follow-on to the concluded FRS I

The urban environment is a complex system made up of interconnected socio-technical systems, such as transport, power, and financial systems, as well as human and community networks. Rapid urbanisation and densification of population and infrastructure have led to the emergence of high-density urban systems (HD-US), which tend to be vulnerable to disruptions and cascading failure. Devising mitigation, response and recovery plans for improving resiliency whilst accommodating the existing legacy systems is extremely difficult, exacerbated by incomplete understanding of interactions and interdependences amongst the various layered, interdependent systems. Therefore, a key part of the FRS II work is aimed at modelling the interdependencies within HD-US accounting for urban intensity of interactions, and to assess the impact of shocks on the resiliency of the HD-US fabric. Simulations using Digital Twins are to understand the urban systems that are increasingly under cyber control. Simultaneously, research in sense-making capabilities will enable better understanding of how humans and systems interact, in an effort towards promoting improved social resilience.

2) ASEAN Disaster Risk Financing and Insurance Phase 2 (ADRFI-2) Programme

ASEAN, comprising its 10 ASEAN Member States (AMS), forms one of the most exposed regions in the world to Natural Catastrophes (NatCat). This is primarily driven by floods, typhoons (tropical cyclones), earthquakes and volcanoes. ASEAN has stepped up collective efforts towards regional NatCat disaster relief and risk mitigation with the ASEAN Disaster Risk Financing and Insurance (ADRFI) Roadmap developed in 2011. The ADRFI Phase 2 (ADRFI-2) Programme, as continuing from its Phase 1, has been established to implement the strategies outlined in the roadmap, which specifically support a holistic approach in advancing regional cooperation on disaster risk financing and risk transfer. ADRFI's focus on the upstream activities supporting disaster risk financing will strengthen the region's overall disaster risk management capabilities, providing the foundation for future long-term public and private disaster risk financing solutions. In particular, the ADRFI-2 programme is

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founded on 3 pillars, Risk Assessment, Risk Financing Advisory and Capacity Building with ICRM spearheading the first two pillars. ICRM is further developing an ADRFI-2 Web-based GIS Platform with its NatCat databases and built-in analytics that further supports ASEAN-wide efforts towards meeting their Risk Assessment and Risk Financing Advisory needs.

NTU-UBC RESEARCH CENTER OF EXCELLENCE IN ACTIVE LIVING FOR THE ELDERLY (LILY)

The Joint NTU-UBC Research Centre of Excellence in Active Living for the Elderly (LILY)

Founded in 2012 with S\$26 million support from the National Research Foundation (NRF), Nanyang Technological University (NTU) and The University of British Columbia (UBC) and industries, LILY is Singapore's first research centre focusing on artificial intelligence (AI) research for successful aging. At LILY, we focus on developing Human-centred AI (HAI) technologies. Through cutting-edge research including curious AI, persuasive AI, explainable AI, AIoT technologies, edge computing, and cloud intelligence, LILY has developed an ecosystem of human-centred AI-powered platforms to help aging societies become "ageless". LILY's predictive analytics wellness game systems have extended high-quality healthcare service provision from hospitals to individual seniors' homes; the aging-in-place system enables seniors to lead an active, independent, and dignified lifestyle at home while encouraging inter-generational communication; and the productive aging system empowers retirees to continue to participate in social and economic development activities at their own pace in order to derive a sense of fulfilment while contributing their valuable wisdom and skills. By working closely with community organizations in Singapore, LILY has reached out to over 10,000 seniors. The Human-centred AI research championed by LILY has attracted strong interest from industry players such as Alibaba.

NANYANG ENVIRONMENT & WATER RESEARCH INSTITUTE (NEWRI)

VISION

Become the pre-eminent Water and Environment Research Institute, focused on leading-edge research, translation into world class products, and developing a highly skilled workforce.

MISSION

Address Singapore's national priorities in water and environmental needs. Perform fundamental Research, translate through robust Engineering to innovative solutions, and work with industrial and institutional partners, towards their Deployment to enhance Singapore's global standing and attract investment.

Ranked among top global organizations in the domains of environment & water technology, NEWRI responds to national needs and global sustainability concerns in such areas as desalination, water treatment, food waste management, solid waste management and climate change.

NEWRI's operating ecosystem is both multi and inter-disciplinary. It encompasses the domains of biotechnology & bioprocesses, environmental chemistry & materials, modelling and sensing, resource recovery, and membrane technology. Specifically, there are five Centres of Excellence (AEBC, ECMC, EPMC, R3C, and SMTC), a core analytics cluster, an engineering team, a business development team, a philanthropic initiative, and an education unit.



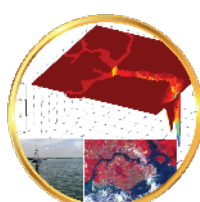
**Advanced
Environmental
Biotechnology
Centre**

(AEBC – NEWRI)



**Environment
Chemistry and
Materials Centre**

(ECMC – NEWRI)



**Environmental
Process Modelling
Centre**

(EPMC – NEWRI)



**Residues and
Resource
Reclamation Centre**

(R3C – NEWRI)



**Singapore Membrane
Technology Centre**

(SMTC – NEWRI)

Energy & resource recovery through sustainable water and biosolids management systems	Physical and chemical materials for environmental treatment applications	Translating and applying mathematical models and visualization	Solid waste value capture through waste to energy and waste to materials technologies	Membrane technologies for water, environment, energy and cleaner production
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Research interests include: • Energy self-sufficient wastewater reclamation processes (e.g. Novel treatment processes with lower energy) • Energy and resource recovery from biosolids (e.g. Activated sludge, food waste, agriculture waste etc) • Rapid biological assays for water safety (Transgenic zebrafish, human cell cultures, etc)	Research interests include: • Advanced Oxidation Processes (AOP) (e.g. Photocatalysis, Ozonation, Hybrid Combinations) • Catalysis (e.g. Novel materials for disinfection, lower energy, recyclable) • Sorption (e.g. Hydrogel, Activated Carbon) • Resource recovery (e.g. Valuable metal recovery from waste streams)	Research interests include: • Modelling & Hydrodynamics (e.g. Contaminant Fate and Transport in Water, Ocean Outfalls & Intakes) • Sensors & Networks (e.g. Water Quality Sensors, Tree Stability Sensors, IoT Networks) • Artificial Intelligence & Machine Learning (e.g. Industrial and Municipal Water System Simulation & Process Controls, Molecular Dynamics)	Research interests include: • Chemical Stabilisation (e.g. Ash/slag re-utilization, CO₂ sequestration, landfill remediation) • Gasification (e.g. Syngas upgrading, Chemical looping combustion) • Air Pollution Control (e.g. Portable analysis system, Corrosion control) • Energy & Resource recovery (e.g. Plastics to Oil & Carbon-based materials/Nanotubes)	Research interests include: • Novel Membranes (e.g. FO/PRO, low pressure NF, MD, biomimetic) • Enhanced Module & System Design (e.g. Multi-stage approach, 3D Printed spacer & module) • Fouling Control & Sensors (e.g. Preventing membrane damage, optimizing performance) • Novel Membrane Bioreactors (MBRs) (e.g. AnMBR, extractive MBR, fluidized bed MBR)
 Applied Research and Translation (ART) NEWRI translates lab research to scale-up and piloting, through 3 capabilities: • START (Separation Technology Applied Research and Translation), a national facility separately funded by EDB and supported by NTUitive and NTU as its lead partner, with a focus on scale-up and piloting of separating-related technologies system • WW-ART (Wastewater Applied Research and Translation) a demo plant for biosolids pre-treatment and enhanced energy recovery • WtE-ART (Waste-to-Energy Applied Research and Translation), an open platform for innovative technologies in the waste-to-energy and waste-to-materials domains using gasification technology.				
				
NEWRITech NEWRITech bridges NEWRI and industry, as a conduit to link research to commercialisation, developing positive business and economic outcomes.	NEWRIComm The Lien Environmental Fellowship (LEF) Programme – endowed by Lien Foundation and NTU's Nanyang Environment and Water Research Institute (NEWRI) - aims to improve water, sanitation, and renewable energy for developing communities in Asia.	NEWRIEdu The NEWRI Education Unit aims to ground students in research fundamentals whilst preparing them for future professional careers. Students have access to cutting-edge laboratory facilities, and gain valuable exposure collaborating on industry-related projects.		

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Please visit <http://newri.ntu.edu.sg> for more information.

RAPID-RICH OBJECT SEARCH (ROSE) LAB

In Internet searches, a picture could be worth a thousand words. The Rapid-Rich Object Search (ROSE) Lab was conceived in view of the proliferation of mobile internet devices and the growing need to expand search beyond text's limited capability in describing real-world objects. The Lab is focusing on visual object search; video analytics & deep learning; image processing, as well as multimedia forensics & biometrics.

Since 2012, the ROSE Lab has published over 350 papers in top conferences and journals in computer vision, pattern recognition, and machine learning. The Lab has also secured 28 industry partners, including Tencent (one of the largest Internet companies in Asia), NVIDIA (the world's leading visual computing company), Accenture (one of the world's leading management consulting companies), OMRON (a leading Japanese industry automation company), and Lockheed Martin (one of the world's leading defense contractors). These include multiple projects with Tencent's WeChat Pattern Recognition Center and Youtu Lab, as well as with OMRON, DSTA, and KLASS Engineering.

The lab's research topics include:

- Visual Object Search
 - Visual object representation and understanding
 - Fast object retrieval and recognition
 - Compact descriptors for visual search
 - Visual indoor localisation
 - Scene Text Recognition
- Video Analytics & Deep Learning
 - Deep Learning, transfer learning, and unsupervised learning
 - Domain adaptation and generalisation
 - Object detection and classification
 - Visual anomaly detection
 - Pedestrian detection
 - Person re-identification with multiple non-overlapping cameras
 - Object and human tracking
 - Action detection and recognition
 - Scene understanding and reconstruction
 - Image & Video Captioning
 - Compact descriptors for video analytics
 - GPU architecture design and optimization for machine learning
- Image Processing
 - Computational Photography
 - Image De-noising and Enhancement
 - Reflection removal

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- Image and video coding
- Image Quality measures

- Multimedia Forensics & Biometrics
 - Multimedia semantic forensics
 - Face spoofing and liveness detection
 - Soft biometrics recognition

SINGAPORE CENTRE FOR ENVIRONMENTAL LIFE SCIENCES ENGINEERING (SCELSE)

The Singapore Centre for Environmental Life Sciences Engineering (SCELSE) is a unique interdisciplinary Research Centre of Excellence (RCE) and global leader exploring microbial biofilms, communities and microbiomes established to discover, control, and direct their behaviour for sustainable environmental, engineering, public health and medical applications.

SCELSE is funded by Singapore's National Research Foundation, Singapore Ministry of Education, Nanyang Technological University (NTU) and National University of Singapore (NUS), and is hosted by NTU in partnership with NUS.

SCELSE research takes advantage of the universality of microbial biofilm communities and microbiomes, employing high resolution 'omics tools (genomics, proteomics, and metabolomics), computational biology, state-of-the-art biofilm imaging and laboratory-to-pilot scale bioreactors to investigate microbial biodiversity and function in complex systems, from environmental and industrial to medical and public health.

SCELSE has strong links with biomedical, life sciences and engineering schools/departments at NTU and NUS, together with industry, government and academic partners, and research institutes in Singapore and abroad. This is further supported by the NRF funded Singapore National Biofilm Consortium, which provides a platform to connect researchers and companies for translating biofilm and microbiome research into products and technologies to meet industry needs.

These underpin SCELSE's capacity to address cutting-edge multidisciplinary biofilm research questions. The centre's research model ensures all facets of biofilm research are rigorously investigated, employing ecological theories to link processes at difference scales to evaluate and predict microbial community biofilm behaviour under varying conditions, such key urban sustainability challenges.

The exploratory power available to SCELSE researchers, combined with a singular level of interdisciplinary expertise enable the delivery of a comprehensive understanding of microbial systems. This, in turn, feeds into the development of translational approaches that will deliver technological benefits and biofilm control applications.

SCElse's key research areas and capacities include:

- Experimental defined multispecies biofilm
- Emergent properties of biofilms based on matrix composition
- Biofilm-driven bioprocesses
- Host-microbiome (holobiont) interactions
- Urban water cycle: microbiomes and microbial processes in engineered waterways
- Urban water cycle: wastewater engineering
- Air microbiomes: Understanding & managing bioaerosols in clean and polluted environments
- Air microbiomes and respiratory health
- Marine host microbiomes, coastal engineering, and biotechnology
- Pathogen detection and control
- Population genomics and disease
- Microbiomes in urban agri- and aquaculture
- Antimicrobials and antibiofilm drugs
- High-resolution advanced biofilm imaging
- High-throughput sequencing and genomics
- Integrative analysis of complex microbial systems