List of projects available in SCELSE

Nutritional based bacterial-algal symbiosis
(Supervisory team: Assoc Prof Rebecca Case)
Offered in SCELSE-NTU

Algae are a rich source of protein, essential fatty acids and vitamins which make them an important sustainable food source. The Case lab has developed a small volume screening methodology and is funded through SFS and ASTAR to optimise the protein and nutritional content of algae. We have identified a bacterium which stimulates lipid metabolism and transport in microalgae and aim to use this symbiosis to harvest healthy lipids from microalgae. We are using transcripomics and manipulative experiments to identify the genetic and chemical interaction driving this symbiosis.

Apoptotic like - programmed cell death (AL-PCD) in *Emiliania huxleyi*
(Supervisory team: Assoc Prof Rebecca
Case)Offered in SCELSE-NTU

AL-PCD in E. huxleyi was first thought to be a response to viruses, however, the Case research team have shown it is a response to bacterial infection. Current research is focused on elucidating the cellular and genetic interaction between E. Huxleyi and various Roseobacteraceae species. Genetic studies have identified candidate effectors the move from the bacterium to algal host through the Type 4 Secretion System. These effector proteins are hypothesised to stimulate host ubiquination and the caspase cascade leading to apoptotic cell death.

Singapore's seagrass meadows
(Supervisory team: Assoc Prof Rebecca Case)
Offered in SCELSE-NTU

Meadows are an important coastal habitat in Singapore as they protect our coastline from rising sea level and are a site for blue carbon storage. Our focus ison the seagrass microbiome, the microbial community that coats its above and below ground structures, and how they increase the plant host resilience, modify the sediment environment to be habitable and play a role in carbon storage. Of particular interest are the roles of the microbiome in protecting seagrasses from disease and how increasing temperature due to climate change and urbanisation impact disease in seagrasses.

Antibiotic producing bacteria in Singapore's corals
(Supervisory team: Assoc Prof Rebecca Case)
Offered in SCELSE-NTU

Singapore's coral reefs have shown greater resilience to rising ocean temperature compared to other regions and this project aims to describe the role bacteria play in conveying this resilience to our reefs. We have identified a commonly occurring group of antibiotic-producing bacteria in Singaporean corals. This project aims to describe the role of these bacteria and the antibiotic in protecting or corals from pathogens.

Chemical ecology in trophic interactions
(Supervisory team: Assoc Prof Rebecca Case)
Offered in SCELSE-NTU

Macro and micro algae are essential in marine ecosystems as primary producers and habitat forming species. Algae are known to communicate with bacterial and eukaryote microbes through a sophisticated lexicon of biologically produced chemicals, or bioactives. The Case lab is interested in both the discovery and determining the biological activity of bioactive molecules which play a role in

trophic interactions that impact the microbial loop. Specifically, this project will identify the natural role of various novel antibiotics produced by bacteria to mediate their complex relationship with their host.

For more information, please contact:
Assoc Prof Rebecca Case
rj.case@ntu.edu.sg

August 2024

Studying biofilm development on food chain surfaces: identifying opportunities for increasing food shelf life and food safety

One 4-year PhD Studentship in Assistant Professor Laura Nolan's lab at the Singapore Centre for Environmental Life Sciences Engineering (SCELSE) at Nanyang Technological University (NTU), Singapore – starting January 2026.

Applications are invited from candidates with a Bachelors degree with Honours (2nd class upper division) or equivalent, or Masters degree in Microbiology, Biochemistry, Biomedical Sciences or a related discipline. Additionally, experience in molecular microbiology, microscopy and microbial genomics would be advantageous. However, in the absence of this additional experience the applicant should be keen to learn relevant skills in these areas.

The studentship will be funded for 4 years which includes tuition fees and a bursary. Students can be from Singapore or overseas.

Note that the following will be required of the candidate that is selected for this studentship (the application has to be submitted by the July 31st 2025):

1. Valid TOEFL/IELTS/GRE/GMAT/GATE scores (*A valid GRE/GMAT score is required for applicants who are not graduates of the Autonomous Universities in Singapore, unless there is specific requirement stated in the school's website for the respective programme. Test dates must be within 5 years or less from the date of your application. Applicants from India may use the Graduate Aptitude Test in Engineering [GATE] score of at least 90th percentile in place of GRE. Test date must be within 3 years or less from the date of your application*)
2. Degree certification and official transcripts (Bachelor and/or Masters)
3. Two academic referees' reports (*These will be requested automatically upon submission of the online application)*
4. Research proposal (*This will be written in consultation with A/Prof Laura Nolan*)

See here for more details on the admission guidelines:
https://www.ntu.edu.sg/admissions/graduate/radmissionguide

Project summary

Almost 10% of the world's population do not have enough to eat. Despite this ~1/3 of food produced for human consumption worldwide is wasted. Two key contributors to this wastage are food spoilage by spoilage microbes, and food poisoning by foodborne pathogens. In both cases these microbes grow on food and food chain surfaces in complex communities called biofilms. A biofilm is a community of microbes that are encased in an extracellular matrix slime that is attached to a surface. While we have a good understanding of the microbes that ultimately cause food spoilage and food poisoning we know relatively little about how these microbes survive in biofilms in the food chain. This PhD project aims to address this knowledge gap by obtaining a detailed molecular mechanistic understanding of biofilm development on food chain surfaces. The project will also explore ways to prevent and/or reduce biofilm development on these surfaces. The project will use a range of cutting-edge approaches including metagenomics, metabolomics, transcriptomics, advanced microscopy and molecular microbiology.

How to Apply

To apply please email the following to laura.nolan@ntu.edu.sg:

1. A cover letter detailing why you want to undertake this PhD project at SCELSE, NTU in Assistant Professor Nolan's lab
2. Your CV
3. Expected date of Bachelor's/Master's degree award and any relevant transcripts for your degree(s)

Application deadline: 30th March 2025

Tentative online interview for shortlisted candidates: Mid-April 2025

Only shortlisted applicants will be notified of the outcome.