

SCELSE Quorum

Singapore Centre for Environmental Life Sciences Engineering

September 2017

New format for SCELSE annual retreat

SCELSE's annual scientific retreat from 16-17th November this year will have a new format with longer talks, to convey a better perspective of recent work at the centre and the interrelationships between the research clusters.

"While last year's lightning talks were enjoyable and informative, the longer talks allow for more time to highlight a good cross-section of research across the clusters," A/Prof. Rice said. Additionally, there will be no breakout sessions this year, but there will be more break time for interactions.

"There will be also a few more talks

Calendar

SCELSE Seminars

11 Oct: Dr Lindsey Deignan. SCELSE. 2:00pm - 3:00pm. SBS-CR3.

25 Oct: Dr Uwe John. Alfred Wegener Institute, Germany. 3:00pm - 4:00pm. SBS-CR3.

Group Meetings

Environmental Engineering meeting: Tuesdays 9am, B3 Meeting Room.

Kline Group meeting: Mondays 9:30am, B3 Meeting Room (please check with Kimberly prior to joining).

Events

Fridays: Shut Up and Write! 10:00am. Please see teamsites for location.

25 Oct: SBS/SCELSE/LKCMedicine Postdoc Club. 5:00pm. SBS-CR2.

27 Oct: SCELSE Happy Hour. 5:00pm onwards. B2 Coffee Lounge.

Conferences and Courses

10 - 11 Oct: Oxford Global Conferences 4th Annual Microbiology & Infectious Diseases Asia Congress 2017. Concorde Hotel, Singapore.

24 - 26 Oct: Asian Conference on Energy, Power and Transportation Electrification (ACEPT 2017). Marina Bay Sands Convention Centre, Singapore.

06 - 14 Dec: EMBO Global Exchange Lecture Course. Structural and biophysical methods for biological macromolecules in solution. NTU School of Biological Sciences, Singapore.

from senior investigators, to provide an overview of the Centre's work as



SCELSE members mingling during a coffee break at SCELSE annual retreat 2016

The retreat programme, co-organised by A/Prof. Scott Rice and Dr Rohan Williams, will also feature a new section on holobiont research. This is a reflection of now ongoing and upcoming projects for SCELSE in human and environmental arenas.

This year's retreat will not be at Sentosa despite the organiser's best efforts to find an available venue at Sentosa.

"Unfortunately, Sentosa is unusually popular this November, but for future retreats in 2018 and beyond, the island will be our preferred location," said Dr

part of the buildup to SCELSE's Seventh Year Review," said Dr Williams.

Williams.

ACLS Summer School visit to SCELSE

A delegation of 36 students and professors from the Education Academy of Computational Life Sciences (ACLS) visited SCELSE as part of their International Summer School programme.

"This is a group of very good students, I think they did a great job with the programme," said Prof. Stephan Schuster, Research Director of SCELSE's

Meta'-omics & Microbiomes cluster. The majority of the students came from the Tokyo Institute of Technology (Tokyo Tech), with a few others from other universities such as Cornell, Purdue and NTU in Singapore.

"The facility is very impressive, in particular the PacBio sequencer, but what I really like is the beautiful combination of people and technology, and the goal-oriented approach at SCELSE. For example, the large scale of projects such as the GenomeAsia 100K and Air Microbiome that can be done here,"

said Prof. Yutaka Akiyama, Director of ACLS and Professor at the School of Computing in Tokyo Tech.

Prof. Stephan Schuster took the visitors on a guided tour of the SCELSE sequencing facility and high performance compute cluster, and gave an overview of the whole process from sample processing to genome assembly.

Prof. Schuster then gave a talk entitled "The air



Prof. Stephan Schuster (left) leading a guided tour of the SCELSE sequencing facility for ACLS International Summer School visitors

microbiome: a missing ecosystem?" where he discussed the latest results from the project and upcoming goals, such as the construction of 100 reference genomes from air. He also mentioned related projects such as sampling leaf swabs for fungal genomes and sampling insect vectors of microbes such as houseflies and blowflies.

"This field is so new that we don't have a conference to go to yet," he joked.

Prof. Schuster emphasised that

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STAFF PROFILE

To travel is to seek out new paths instead of keeping within the confines of well-trodden roads. Dr Nirakar Pradhan takes pride in his many travels around the globe and his forging of new paths in the research world.

"During my PhD research in Europe, I developed a new dark fermentative metabolic pathway called capnophilic lactic fermentation (CLF) by using a bacterium called *Thermotoga neapolitana* DSMZ 4359T (which is registered as an industrial strain, *T. neapolitana* subsp. *capnolactica* by the research group) - that can simultaneously synthesise hydrogen and lactic acid from organic substrates, such as any organic waste - and our team has patented this process," he said. In the final year of his Master's research at the Asian Institute of Technology in Thailand, Nirakar studied the anthropogenic impact on fragile lake ecosystems in Myanmar, focusing on Lake Inle with respect to climate change.

At SCELSE, Nirakar works with Prof. Stefan Wuertz in the Environmental Engineering cluster, mainly on developing a predictive mathematical model for biological nitrogen removal from wastewater by the ANaerobic AMMOnia OXidation (Anammox) process. He works together with Dr

Joeri Coppens, Dr Law Yingyu and Dr Gayathri Natarajan.

"We have developed a predictive metabolic pathway model for Anammox, and a disproportionate model for metabolic intermediates



Nirakar at the UNESCO World Heritage Site Cesky Krumlov in Czech Republic

as well. Ultimately, this will help us improve large-scale bioreactor design by increasing the efficiency of nutrient removal while reducing sludge and operating costs," Nirakar said.

"It was my ambition and curiosity to learn, explore and expand my research knowledge in the field of food-water-energy nexus that brought me here to SCELSE," he said.

During daily work, Nirakar said the challenges in the scientific research may be tremendous with many unknowns, uncertainties and time pressures, but the rewards are always sweet when the work is appreciated in international forums and finally

Nirakar Pradhan Research Fellow

translated into real life applications.

"I find the work enjoyable because the Anammox project is mature and quite close to a real life application. In addition, the project has a diverse team - including scientists, engineers, biostatisticians and decision-making bodies such as PUB - with everyone playing their part effectively, and the project has a tremendous amount of findings and results are being disseminated through scientific publications," he said.

For students new to research, Nirakar advised that they should have updated knowledge of their field by keeping up-to-date with the literature and attending seminars and workshops.

"They should also be discussing science with professors, visiting scientists and lab researchers," he said.

Nirakar enjoys the active lifestyle in Singapore and the multicultural working environment in SCELSE. Outside of research, he loves to travel and has been to more than 30 countries.

"I love to explore the different walks of life by mingling with locals and enjoying local food. To stay active I make sure to hit the gym every day and do some cycling around the campus," Nirakar said. He also plans to start a blog on 'travel and food' soon.

Publication profile

SCELSE researchers have uncovered the rapid evolution of *Pseudomonas aeruginosa* in ventilator-associated pneumonia (VAP) patients.

After an invading force captures a territory, over time it tends to behave less aggressively as its role switches from conquest to consolidation, and military leaders hand over control to occupation administrators. In the microbial world, *P. aeruginosa* - an opportunistic pathogen which is one of the major causes of lung diseases such as VAP, cystic fibrosis and chronic obstructive pulmonary disease - undergoes adaptive evolution in the lung towards attenuated virulence at a time scale of six months or longer.

Researchers studied this evolutionary process in a shorter time scale and in greater detail. During a VAP outbreak at a teaching

Pseudomonas aeruginosa evolves rapidly during ventilator-associated pneumonia

hospital in China, 25 *P. aeruginosa* isolates were collected over 78 days from the sputum samples of four patients and sequenced them using Illumina HiSeq/MiSeq and PacBio RSII platforms. They also performed antibiotic susceptibility tests to identify the resistance profile of the isolates.

P. aeruginosa evolved rapidly in all four patients. An association between mutations of *mpl* and increased β -lactam antibiotic resistance resulted, showing a two to four-fold increase in the minimum inhibitory concentration of ceftazidime and piperacillin-tazobactam.

In addition, *lasR* mutants emerged from the earliest isolates that severely impaired or completely abolished LasR function, thus affecting the *las* quorum-sensing system.

Five pyoverdine-deficient mutants were identified in three of the patients, due to mutations of *pvdS*, a gene involved in iron uptake. A murine pulmonary infection model was used to identify the mutations causing the pyoverdine-deficient phenotype which more greatly impaired the *in vivo* virulence of *P. aeruginosa* than *lasR* mutations.

In conclusion, the researchers identified a novel *P. aeruginosa* strain and showed that it could undergo adaptive evolution in a surprisingly fast time scale of days, thus providing new insights into the short-term evolution of *P. aeruginosa* in the human airways during VAP infections.

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The rapid *in vivo* evolution of *Pseudomonas aeruginosa* in ventilator-associated pneumonia patients leads to attenuated virulence

Ke Wang, Yi-qiang Chen, May M. Salido, Gurjeet S. Kohli, Jin-liang Kong, Hong-jie Liang, Zi-ting Yao, Yan-tong Xie, Hua-yu Wu, Shuang-qi Cai, Daniela I. Drautz-Moses, Aaron E. Darling, Stephan C. Schuster, Liang Yang, Yichen Ding

Published 6 September 2017. DOI: 10.1093/molbev/msw329

Latest SCELSE publications



Research Article

Outer membrane lipid homeostasis via retrograde phospholipid transport in *Escherichia coli*

Rahul Shrivastava, XiangEr Jiang, Shu-Sin Chng

First published: 6 September 2017 [Full publication history](#)

DOI: 10.1111/mmi.13772 [View/Save citation](#)



From the journal:
Chemical Communications

Enzyme-responsive reporter molecules for selective localization and fluorescence imaging of pathogenic biofilms

Check for updates

Junxin Aw,^a Frances Widjaja,^a Yichen Ding,^{bc} Jing Mu,^a Liang Yang^b and Bengang Xing^{*ad}

SCELSE social

SCELSE members and friends hopped on their bikes one hot Saturday and set off on a cycling adventure! They started at Cashew MRT station and cycled on the old train tracks all the way to Holland Village, where they enjoyed beer and curry.

Left photo: (From left) Dr Cheng Zhou, Dr Thomas Seviour, Dr Stephen Summers, Mr Eamon Wuertz, Prof. Stefan Wuertz and Dr Sean Booth.

Right photo: Tracks at the old Bukit Timah railway station.

SCELSE Bike Ride



Channel NewsAsia filming at SCELSE



A Channel NewsAsia team visited SCELSE on 25th September for location shooting for their upcoming documentary on NEWater. Special thanks to Dr Lai Chee Hwee, Dr Joeri Coppens, Mr Ezequiel Santillan, Dr Gayathri Natarajan, Dr Qiu Guanglei, Ms Samarpita Roy and Mr Yap Zhei Hwee for their help during the filming.

Please keep a look out for the documentary when it airs in early 2018!

Left: Dr Joeri Coppens filmed by CNA crew at the bioreactor facility.

Workshop report

Metagenomics expertise of SCELSE's Integrative Analysis Unit (IAU) is kept at the forefront with the acquisition of new competencies in the rapidly advancing field of long read sequencing.

IAU Senior Research Fellow Dr Irina Bessarab attended a five-day workshop "Porecamp 2017", which was held at the University of Birmingham, UK - hands-on training on the practical use of Oxford Nanopore MinION sequencer.

"Nanopore sequencing is a very promising approach because it can generate long sequencing reads and allows direct sequencing of the

Nanopore sequencing workshop in the UK



Porecamp 2017 participants taking a break on the University of Birmingham grounds
(Photo: Jack Kennefick)

original DNA or RNA molecules" she explained. Oxford Nanopore sequencing is a technology where the single molecule of DNA or RNA is measured as it passes through

a protein nanopore, and the combination of nucleotides moving through it causes a characteristic disruption of an electric current.

The signal is then interpreted to determine the sequence of the nucleic acid strand. This method not only generates long reads up to the hundreds of kilobases, but since the data streams immediately, it also allows researchers to stop sequencing once they have sufficient data.

Nanopore technology can cover a wide range of applications, from sequencing individual genomes to microbial communities, it is also a promising technology in infectious disease diagnostics and field-based surveillance.

The workshop admission is by competitive entry and limited to

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STUDENT PROFILE

This month's student profile features Chen Qingyan!

Tell us a bit about your work in SCELSE.

I am working in A/Prof. Kimberly Kline's group on the pathogenic mechanism of *Enterococcus faecalis*. Basically, I am working on the role of phosphatidylglycerol of cell membrane in virulence factor assembly and cationic antimicrobial peptides resistance.

Any interesting findings or experiences so far?

I constructed a reducible mutant to examine the role of phosphatidylglycerol, as phosphatidylglycerol is essential for *E. faecalis*. The reducible mutant



Qingyan at the Prambanan temple near Yogyakarta, Indonesia

can only replicate in the presence of inducer.

What excites you and what makes you go zzzzzz?

Successful positive results always excites me and long long seminars out of my field makes me go zzzzzz.

ACLS Summer School visit to SCELSE (from p. 1)

the ability to make libraries from environmental samples is very challenging and stressed the need to be cautious about the "evils" of cultivation and amplification, which can introduce selection biases to the results.

The visitors asked many questions, including technical questions about the software used, and after the seminar some students lined up to talk to Prof. Schuster while others proceeded to set up their poster presentations at the Experimental Medicine Building (EMB).



Prof. Yutaka Akiyama asking a question during the air microbiome seminar

"SCELSE is the best place to learn. Our students come from varied backgrounds such as robotics and artificial intelligence (AI) and not only in genomics, so for many of them this is their first encounter with next generation sequencing. It is a very good stimulus for them," Prof. Akiyama said.

Nanopore sequencing workshop in the UK (from p. 3)

around 40 or so participants, who came from UK, Europe, Israel, Russia, Colombia and Vietnam.

Porecamp emphasises hands-on practice, so participants had to bring their own samples. The training covered all major steps of the process – sample processing, running the instrument and data analysis.

Irina said the organisation of the workshop was very good and the content was interesting and useful.

"I like everything about the workshop. The trainers were very generous when sharing practical knowledge, which is great because they are experts, involved in technology development, thus we had access to details that we could only get there. Also, it was nice to meet other participants with a broad spectrum of interests," she said. There were people who work for universities, hospitals and clinical units, government agencies and biotech companies.

"The spectrum of expertise was also very impressive, from wet lab to bioinformatics and with combination of both," Irina said.

The workshop makes very active use of Slack and Twitter to keep participants connected even after it finished. The workshop sessions were interwoven with social activities for attendees to interact.

"At the start of the workshop, there was a trip into the centre

Chen Qingyan PhD Student

If you were stranded on a deserted island, what would you want to bring with you?

Water, food and a satellite phone to call for help.

Fill in the blanks: When _____, I _____.

When I am stressed out, I would like to enjoy shopping and eating with friends.

Anything you would like to say to fellow students?

No matter how stressed or tired you feel now in your PhD life, it will be a precious memory you will never forget. Go for it and the future is promised to no one.

of Birmingham to demonstrate the capability of Nanopore sequencing to be performed in field setting. The field trip was conducted at a restaurant, where we set up a portable lab to extract DNA from bread starter cultures that were used to make bread



Porecamp participants having introductory training in a restaurant (Photo: Catherine Anscombe)

for the sandwiches we were eating - while running a Nanopore MinION over lunch!" Irina said, adding that there was also a museum visit and some very nice dinners together.

"The workshop greatly improved my understanding of Nanopore sequencing, and has been hugely beneficial to our attempts to recover whole genomes from microbial communities" she said.

As part of her trip, Irina also visited IAU collaborators at the Luxembourg Centre for Systems Biomedicine and the University of Tübingen.

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