SCELSE Quorum
Singapore Centre for Environmental Life Sciences Engineering
August 2017

SCELSE Seventh Year Review

SCELSE will undergo its Year 7 Review in 2018, and preparations are already well underway.

A major component of the review will be a self-assessment report that comprehensively presents and analyses SCELSE's activities since it began in 2011. The SCELSE Self Assessment Report 2011-2018 (SAR-2018) will be submitted to Singapore's Academic Research Council in October 2017, prior to assessment and redistribution to the Year 7 Review International Review Panel (IRP) in January 2018).

SAR-2018 will comprise three volumes. Volume 1 will contain an analysis of all aspects of SCELSE's activities, from strategic objectives, organisation, and technological capacities, to research output and quality, personnel, innovation/tech transfer and metrics. SCELSE will also be benchmarked against international biofilm centres to gauge its relevance beyond Singapore. Volume 1 will conclude with a section detailing the centre's strategic focus to 2021 and beyond.

SAR2017 Volume 2 serves as a supporting document to Volume 1, providing details of SCELSE's research endeavours, past and present. This volume will be structured according to research clusters and IAU. Sub-categories of research topics will be further divided into specific projects that outline significance/scope, key accomplishments and ongoing research.

SAR2017 Volume 3 will contain the CVs of all SCELSE members, presenting the relative contributions of each individual.

SCELSE's Year 7 review is expected to take place in the second quarter of 2018. An international review panel will provide a critical assessment of SCELSE's performance, strategic relevance and future potential.

Assessment criteria include quality of research and organisation; success in talent development; the impact on NTU and NUS; and strategic positioning within Singapore's research landscape.

Calendar

SCELSE Seminars

20 Sep: Prof. Jorgen Schlundt, Nanyang Technological University. 3:00pm - 4:00pm. SBS-CR5.

27 Sep: Prof. Chen Sheng, Hong Kong Polytechnic University. 3:00pm - 4:00pm. SBS-CR5.

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.

15 Sep: SCELSE Happy Hour. 5:00pm onwards. B2 Coffee Lounge.

27 Sep: SBS/SCELSE/LKCMedicine Postdoc Club. 5:00pm. SBS-CR2.

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.

SCELSE Open House 2017

SCELSE's annual Open House this year attracted a record number of about 140 registrants, featured twice as many exhibition booths as last year - including new bioreactor, electrochemistry and antimicrobial drug booths - and projected a strong impression of the centre's research expertise and career opportunities for the visitors.

Ms Noele Ng (left) explaining the novel antimicrobials exhibit to a visitor

The event also exhibited for the first time SCELSE's Marine Science Research and Development Programme (MSRDP) projects at the St. John's Island National Marine Laboratory.

NTU 4th-year student Karine from the School of Biological Sciences participated in the Open House activities and found it eye-opening.

"I first saw this event advertised on a wall poster. Before this, I didn't know much about SCELSE, but this visit

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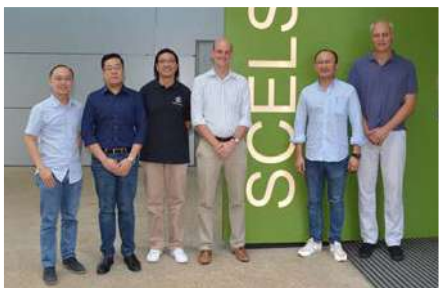
Inaugural SCELSE Microscopy Seminar

SCELSE's inaugural Microscopy Seminar marked an important first step in the establishment of a training platform to develop advanced microscopy expertise not only within SCELSE but for the wider research community as well.



SCELSE Microscopy Seminar speakers and organisers. From left: Dr Foo Yong Hwee, Dr Jaron Liu, Dr Samuel Ko, Dr Graham Wright, Mr Talgat Sailov and Prof. Peter Török

"For us, this is a big step forward," said SCELSE Centre Director, Prof. Staffan Kjelleberg.

"We are improving and expanding our imaging facility, and training people to utilise it to the fullest. We are becoming a part of a rapidly growing network in advanced imaging, and I look forward to more such meetings in the future."

The two-day seminar, which was attended by more than 30 participants, featured an impressive

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SCELSE STAFF PROFILE

Goran Biukovic
Senior Research Fellow

Embarking on a research endeavour can be like answering a call to adventure: setting sail to distant lands to gain new experiences and broaden one's horizons. In his career as an engineer and scientist, Dr Goran Biukovic has ventured afar - sometimes literally on a sailboat - and the journey has not always been easy.

"In a long research career, I helped to make many discoveries that redeemed the sometimes painstaking research, like finding and characterising the giant linear plasmids responsible for antibiotic production and involved in genomic instability of antibiotic-producing industrial strains, successfully deciphering the biotransformation pathway of fusidic acid by *Streptomyces* spp., and finding a previous unknown interaction of the mycobacterial drug bedaquiline with ATP synthase," Goran said.

At SCELSE, Goran works in A/Prof. Kimberly Kline's group and his research focuses on the interaction of *Enterococcus faecalis* and *Pseudomonas aeruginosa*, particularly in an iron-depleted environment.

"Both bacteria are common culprits in wound infections and are associated with difficulties of wound healing. There is initial data that *E. faecalis* efficiently inhibits the growth of *P. aeruginosa* in the presence of a suboptimal concentration of Fe ions, and we would like to understand the biochemistry behind it," Goran explained. In parallel with this project, he is also developing the tools for *in vivo* mutagenesis of *Enterococcus* genome.

"Currently, we are in the initial phase of the project: screening and characterising the likely genes and their proteins that are involved. We plan to expand the project later by studying it in the animal wound model," Goran said.

Goran began his academic journey at the University of Zagreb, Croatia where he studied Food Science and Biotechnology. As an undergraduate, he received a scholarship by Pliva, the leading pharmaceutical company at that time in former Yugoslavia, and after graduating in 1989 he worked for eight years at the Pliva research institute on the development of new polyketide antibiotics.

"A wish to broaden my knowledge, especially related to the proteins and microbial biochemistry, led me to accept the PhD offer by Prof. Schrempf at University Osnabrück in Germany," he said. After graduating with his PhD in 2004, Goran joined Prof. Gerhard Grüber in his new laboratory of structural biology at NTU in Singapore. He moved to A/Prof. Thomas Dick's lab in 2014, working on the genomic mutagenesis of *Mycobacterium smegmatis* to study mycobacterial physiology, before coming to SCELSE in April this year.

For students starting out in research, Goran advised against too much focus on publications.

"If it is only about being in the publication pipeline, then one should just join a laboratory that frequently publishes. After all these years, I think that the continuous development of scientific curiosity combined with systematic research based on critical and honest evaluation of research data, plus read, read and read, would ultimately lead to good research and new ideas. Consequently, good publications will come up too," he said.

Goran said that Singapore offers excellent research and working conditions and is a great melting pot of different cultures.

"People here have genuinely good manners and you don't feel as a foreigner. As a cosmopolitan city, we can enjoy first class cultural events throughout the year. All these factors influenced my decision to stay here and to be a part of this multicultural society," he said.

Goran spends most of his free time in the water or cycling to the water, either sailing with his friends at Raffles Marina or wind surfing at East Coast Park.

"If there is no wind then simply swimming in a pool can make my day too," he added.

Publication profile

Enhancing eye infection drug treatment by adding DNase to break down biofilm eDNA

SCELSE researchers, together with their colleagues at the Singapore Eye Research Institute, have demonstrated a new drug therapy for eye infections caused by pathogenic nontuberculous mycobacteria (NTM). During the process, they used a novel NTM mouse corneal infection (keratitis) model, which can be used to evaluate future drug treatments.

The mycobacteria genus is associated with mammalian diseases such as tuberculosis (*Mycobacterium tuberculosis*) and leprosy (*M. leprae*). NTM includes species such as *M. fortuitum* and *M. chelonae*, which are involved in a variety of eye infections. NTM keratitis is uncommon, however its incidence has been rising in recent years. This may be due to the popularity of LASIK eye surgery for vision correction and NTM is becoming a leading cause of post-LASIK infection.

NTM infections are difficult to treat with antibiotics because NTMs are slow-growing and readily form biofilms on soft tissues. The antibiotic amikacin is the clinical gold standard for most NTM infections, however the treatment is often unsatisfactory due to poor biofilm penetration and antibiotic resistance. Thus, NTM infections sometimes require long-term treatment with a combination of two or more drugs.

Researchers tested a simple idea - they added DNase to break down the matrix eDNA and promote penetration of the drugs using *in vitro* assays and a new *in vivo* mouse model to investigate mycobacterial keratitis.


Contents lists available at ScienceDirect

The Ocular Surface

journal homepage: www.theocularsurface.com

ELSEVIER

Original Research

Discovery of novel antimycobacterial drug therapy in biofilm of pathogenic nontuberculous mycobacterial keratitis

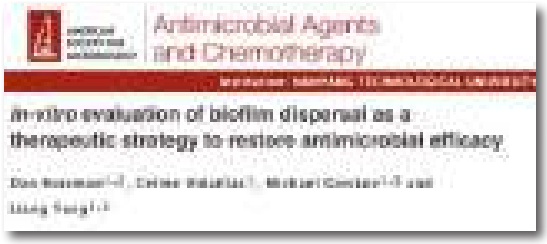
Thet Tun Aung [a, b], Wei Hong Jeff Chor [a], Joey Kuok Hoong Yam [c], Michael Givskov [c], Liang Yang [b, c, **], Roger W. Beuerman [a, d, e, *]

In vitro experiments showed increased biofilm mass of *M. fortuitum* and *M. chelonae* when supplemented with eDNA, suggesting that eDNA has a biofilm-enhancing effect. They demonstrated for the first time that mycobacteria infections on cornea exist in a biofilm mode of growth.

The combination treatment of amikacin and several fluoroquinolone drugs showed a synergistic effect in eliminating the bacteria. When DNase was added, this effect was further enhanced - in particular the combination of amikacin, gatifloxacin and DNase was the most effective treatment. This strategy also resulted in the best corneal clarity, low bacterial survival and no microcolony formation on the cornea.

The researchers concluded that DNase could enhance the effectiveness of antimycobacterial drugs by breaking down eDNA in the biofilm matrix, which acts as a barrier to their activity.

Latest SCELSE publications



SCELSE social

New SCELSE Baby

Congratulations to A/Prof. Cao Bin on the birth of his baby boy Cao Bowen (曹博文)!

New Associate Professors in SCELSE

SCELSE PIs Kimberly Kline (left) and Cao Bin (right) have been promoted to Associate Professor with Tenure at NTU SBS and CEE respectively.

Prof. Staffan Kjelleberg said, "These highly esteemed appointments reflect Kim's and Bin's exemplary achievements in research, teaching and service to NTU, and we are very proud to have them as valued members of SCELSE."

Congratulations to our new A/Profs!

SCELSE Sports

SCELSE members participated in Inter-Tertiary Institute Staff (ITIS) competitions. In ITIS 7-a-side football tournament, Team NTU came in second place. In ITIS 5.5 km running race, Team NTU came in first place in Men's Open category, first in Women's Open category, and second in Men's Senior category. In NTU staff bowling tournament, SCELSE's team came in fifth place.

Tremendous effort by SCELSE participants! Congratulations!

New SCELSE PhDs

Congratulations to SCELSE students Ms Irina Afonina (left) and Mr Kumaravel Kandaswamy (right) who successfully completed their PhD oral defence this month to become our latest PhDs!

Left photo: Ms Irina Afonina with A/Prof. Kimberly Kline. Right photo (from left): A/Prof. Cao Bin, A/Prof. Kevin Pethe, Mr Kumaravel Kandaswamy, Prof. Yehuda Cohen, Prof. Thorsten Wohland and A/Prof. Scott Rice.

SCELSE STUDENT PROFILE

Aditya Bandla
PhD Student

This month's student profile features Aditya Bandla!

Tell us a bit about your work in SCELSE.

I work with stormwater sediments, which perhaps harbour some of the most complex microbial communities in an urban setting. Using a combination of 'omics approaches coupled with field work and bench experiments, I have been trying to understand what are the edaphic drivers that structure the composition and function of such communities.

I am from the Swarup Lab, and I have had the pleasure of working with a big team with diverse skill sets. At SCELSE, I have worked closely with Dr Shailendra Mishra, Dr Ezequiel "Ziggy" Marzinelli, Jay Toh Jun Wei and Randolph during my field work, and with Dr Peter Benke, Dr Mohammad, Dr Shruti and Dr Shivshankar with regards to metabolomics.

Any interesting findings or experiences so far?

Coming from an engineering

background, the shift to microbial ecology for my doctoral studies, has been a fascinating learning experience. From my first field study, we found that the sediment particle size stratified both microbial taxonomic composition and metabolic capacity. Genome reconstructions and metabolome profiles point to a highly inter-connected community. We just completed sampling sediments from every catchment in Singapore, to further validate these observations. Experiences from the field campaign were enriching both from a personal and a scientific perspective.

What excites you and what makes you go zzzzzz?

I have always been fascinated by wildlife and nature. Prolonged silence makes me go zzzz.

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

A stack of mystery novels.

Fill in the blanks: When _____ , I _____.

When I have been in the mountains, I have felt at peace.

Anything you would like to say to fellow students?

Talk to as many people at SCELSE about your work. I see that as the first step in building your scientific network and in improving your work.

SCELSE Open House 2017 *(from p. 1)*

opens up new opportunities for me. I'm very impressed with the state-of-the-art technology in imaging and sequencing," she said.

Karine added that she liked the exhibition booths very much because they gave a more accessible overview of SCELSE's research than simple poster displays, especially for people who are not familiar with the topics.

During the information seminar for prospective students, SCELSE Environmental Engineering Research Director Prof. Stefan Wuertz emphasised the interdisciplinary nature of SCELSE's research.

"Our researchers come from multidisciplinary backgrounds including microbiology and engineering, and yes, chemistry is also a very important area," he said as a group of chemistry undergraduates in the audience cheered.

A/Prof. Kimberly Kline gave an overview of biofilms and Dr Enrico Marsili discussed his research on electroactive microorganisms. PhD student Mr Nair Zeus Jaren provided his perspective about life as a new student in SCELSE, while recent PhD graduate Dr Lucinda Doyle recounted her PhD journey at SCELSE. Ms Loh Ying Ting from the Graduate Studies office outlined the PhD scholarship process.

During tea time there was a second seminar on SCELSE research where Prof. Wuertz presented used water treatment research and Dr Thomas Seviour gave a lighthearted talk about biofilm properties and behaviour.

Special thanks to all speakers, organisers and helpers who worked together to deliver this successful event.

Inaugural SCELSE Microscopy Seminar *(from p. 1)*

line up of microscopy experts such as Prof. Peter Török from Imperial College London, Dr Foo Yong Hwee from Mechanobiology Institute, Dr Graham Wright from Institute of Medical Biology at A*STAR, Dr Samuel Ko from Carl Zeiss Singapore and Dr Jaron Liu from GE Healthcare Life Sciences.

Prof. Török presented foundation optics, focusing on geometrical optics and aberrations.

"In order to use the microscopes, you need to have some understanding of the physics. It is also important to keep the applications in mind - you have to tell me what you need," he said.

Other lecture topics included fluorescent probes and proteins by Dr Foo, widefield fluorescence and confocal microscopy by Dr Wright, Lightsheet fluorescence microscopy by Dr Ko, and super-resolution microscopy by Dr Liu.

SCELSE researcher Ms Choo Pei Yi found the seminar informative and useful for both new and experienced microscope users.

"The talk by Prof. Török was the most interesting to me because he was able to explain complicated optics formulae in a way that was easy to absorb and understand. It allowed me to appreciate the art behind building a microscope," she said.

Pei Yi added that the seminar was a good refresher on selecting the right microscope, and using the correct techniques and dyes for the nature of the experiment.

SCELSE researcher Dr Tan Shi Ming felt that the most interesting thing about the workshop was the introduction of different microscopy technologies that have rapidly improved imaging resolution over time.

"The workshop brought many microscopy specialists together, both from industry and academia, and it was a great experience to interact and learn from the best," he said. Shi Ming also gained a practical benefit when he learnt that even with widefield microscopy, it is possible to perform deconvolution to get an image with good contrast.

"Widefield can be used and that might save me some time from using the confocal microscopes – which are often heavily utilised!" he said.

Prof. Török said that he planned to conduct such microscopy seminars once or twice a year in the future. A big thank you goes to Prof. Török, Mr Talgat Sailov and all SCELSE members who helped to organise the workshop.

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