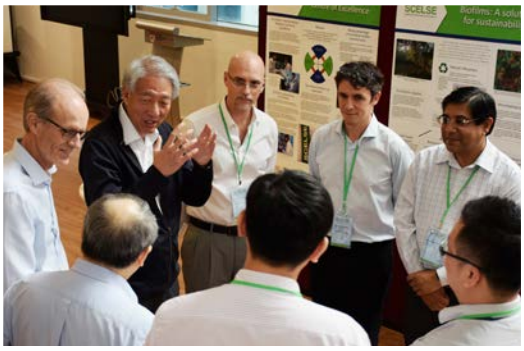
SCELSE Quorum
Singapore Centre for Environmental Life Sciences Engineering
December 2017

DPM Teo briefed on SCELSE's organisation and progress

Deputy Prime Minister Mr Teo Chee Hean visited the Singapore Centre for Environmental Life Sciences Engineering (SCELSE) and was briefed on SCELSE's interdisciplinary organisation, collaborative network and progress towards its objectives in research and creating value. Mr Teo, who is the Chairman of the National Research Foundation (NRF) Singapore, participated in a series of presentations, toured the facility, and met SCELSE researchers to learn more about the research that is conducted at the centre.



Mr Teo interacting with SCELSE researchers. From left: Prof. Staffan Kjelleberg, DPM Teo Chee Hean, A/Prof. Scott Rice, Dr Enrico Marsili and A/Prof. Sanjay Swarup

SCELSE Centre Director Prof. Staffan Kjelleberg introduced SCELSE's biofilm research, emphasising the multidisciplinary nature of the centre that encompasses both fundamental research and practical applications. When Mr Teo asked about other similar research centres in the world, Prof. Kjelleberg pointed out the Centre for Biofilm Engineering in Montana, USA and the Costerton Biofilm Centre in Copenhagen, Denmark. He added that there was a new National Biofilms Innovation Centre that recently opened in the United Kingdom, which was broadly modelled after SCELSE.

This was followed by A/Prof. Sanjay Swarup's presentation about the Urban Water Cycle project - part of Singapore's Active, Beautiful, Clean Waters (ABC Waters) programme - which investigates the role of microbes for cleaning water in the waterways. He explained the importance of

cont. p. 4

Calendar

SCELSE Seminars

23 Jan: Prof. Christof M. Niemeyer. Karlsruhe Institute of Technology, Germany. 3:00pm - 4:00pm. SBS-CR4.

31 Jan: Prof. Stephen Pointing. Yale-NUS College. 3:00pm - 4:00pm. SBS-CR4.

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.

19 Jan: SCELSE Happy Hour. 5:00pm onwards. B2 Coffee Lounge.

31 Jan: SBS/SCELSE/LKCMedicine Postdoc Club. 5:00pm. SBS-CR2.

Conferences 2018

18 - 21 Mar: International Water Association (IWA) Biofilms: Granular Sludge Conference 2018. Delft University of Technology, The Netherlands.

19 - 22 Mar: International Conference on Microbial Communication (MiCom 2018). Jena, Germany.

27 - 29 May: 8th Biofilms Conference (Biofilms 8). Aarhus, Denmark.

07 - 11 Oct: 8th American Society for Microbiology (ASM) Conference on Biofilms. Washington DC, USA.

Centre Director's year end message

Although 2017 is coming to an end, the year marks the beginning of many exciting new endeavours for SCELSE, and I would like to thank everyone for their efforts in elevating the centre towards greater levels of achievement and academic excellence.

Prof. Staffan Kjelleberg presenting a farewell gift to Prof. Bertil Andersson (right)

This year, SCELSE's research has been featured in more international media outlets than before, and is gaining increasing prominence on the world stage. We have accomplished much this year, across all research domains. There are too many achievements to mention, but here are some highlights.

SCELSE's air microbiome team has uncovered details of a novel ecosystem, revealing diel cycling of tropical air microbiomes and the public health impact of carrion fly microbiomes. The Environmental Engineering cluster has made significant advancements in understanding water treatment processes that will enable implementation to full-scale operations.

Also, chemical compounds discovered by SCELSE's chemical biology team can potentially be used to fight biofilm infections, and the year has brought us closer to a significantly improved understanding of the role of specific matrix components for biofilm structure, function and development.

SCELSE's new marine science programme also started in earnest this year with eight NRF Marine Science Research & Development Programme projects now underway, adding another large-scale ecosystem to the centre's environmental research portfolio.

On the collaboration front, SCELSE has established strategic ties with the new National Biofilms Innovation Centre in the UK, and with the Israel Institute for Biological Research and University of Haifa in Israel, among other groups.

When it comes to engagement, it is great to see SCELSE members from different clusters get together and participate in the centre's

cont. p. 3

SCELSE STAFF PROFILE

Lindsey Deignan
Research Fellow

Life on Earth is highly dependent on healthy oceans, but human beings have explored only an estimated 5% of our oceans, which is why many people consider the oceans - instead of outer space - to be the final frontier. Dr Lindsey Deignan has first-hand experience of exploring the sea as an "aquanaut" at the Aquarius Reef Base, an underwater research station attached to the ocean floor 19 metres below the surface in the Florida Keys National Marine Sanctuary, USA.

"I was based at the Aquarius twice, for 10 days each in 2011 and 2012, mapping sponges and doing data monitoring. We had to maximise our time there to gather as much data as possible, and my work together with three colleagues resulted in many research publications. These experiences inspired me to choose my PhD programme," Lindsey said.

At SCELSE, Lindsey works on coral reef microbiology in A/Prof. Diane McDougald's and A/Prof. Scott Rice's group in the Microbial Biofilms cluster.

"I am studying the microbiomes of coral and algae, and the response of microbial communities to stress, in order to understand the resilience of reefs around Singapore, and how to further improve their resilience," she explained.

Lindsey also works closely with Marine Science Research and Development Programme (MSRDP) collaborators in NUS, especially Asst. Prof Huang Danwei - the primary lead for the coral reef resilience project - and A/Prof. Peter Todd and his group.

"There was a steep learning curve to get settled in the lab, such as getting supplies ordered, but things are finally coming together," she said. Lindsey added that she enjoys the combination of both field and lab work in her project, where she has time for diving and also to test samples more closely in the laboratory.

Lindsey started her research journey at the University of Tampa, obtaining her bachelor's degree in marine biology in 2007. She then spent four years working in an environmental consulting company, as a fisheries technician at Oregon State University and later as a research assistant studying wildfires in Hawaii. In 2011, Lindsey headed back to school at the University of North Carolina Wilmington to embark on her PhD programme in marine biology, graduating in 2017. She wanted to work at the Pacific Ocean and when she saw the MSRDP project posted on a coral listserv, she seized the opportunity to come to SCELSE.

For new students in research, Lindsey advises them to follow their passion.

"Don't be afraid to pursue what you are most interested in, even if you don't have enough experience. Following what you are most passionate about will keep you going and is also more fulfilling," she said.

About life in Singapore, Lindsey enjoys the work environment at SCELSE, with colleagues who are fun and easy to work with.

"It is easy to get around in Singapore, to go out on weekends and explore new foods, places and meet new people," she said.

Outside of research, Lindsey enjoys almost all water sports, which includes diving, stand up paddle boarding and surfing.

"A couple of months ago I started dragon boating, for leisure and not for competition. I also like running and yoga, and spending time just walking and exploring the city," she said.

Publication profile

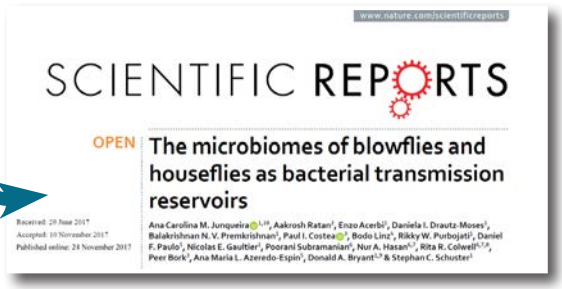
Carrion flies: Both an overlooked threat and a potential ally to public health

An international research team led by Prof. Stephan Schuster at SCELSE found that houseflies and blowflies contain a host-specific microbiome, but with more than 55% of the microbial species shared between the two carrion flies. The results suggest that the flies harbour a stochastic component in their microbiome, serving as mechanical vectors of bacteria largely derived from contact with the environment. Experiments on the mechanisms of dispersal revealed that the flies mainly spread bacteria via their legs, and not as much from the contact of the abdomen or mouthparts as previously thought.

"Carrion flies have microscopic hairs on every part of the body excluding the eye and these bristles make them the perfect carrier for pollen and also bacteria. It is an evolutionarily optimised vehicle for the dispersal of microorganisms in the environment," said first author Dr Ana Carolina Martins Junqueira, previously a senior research fellow at SCELSE and currently a professor at the Federal University of Rio de Janeiro in Brazil.

Using a newly developed method to collect and extract the genetic material of flies and associated microorganisms without contamination, the team sequenced 116 houseflies and blowflies from different environments on three continents, and performed detailed genomic and metagenomic analyses of the host-associated microbiome at the species level.

The researchers found a surprisingly high incidence of the human pathogen *Helicobacter pylori* on the bodies of several blowflies caught in the wild in Brazil, mainly concentrated on the legs and wings. Previous studies of *H. pylori* focused on human-to-human modes of transmission, but these new findings showed that further study of fly-mediated *H. pylori* transmission is warranted. In addition, the stochastic distribution of *H. pylori* demonstrates the potential of flies as proxies for environmental, agricultural and public health surveillance.


www.nature.com/scientificreports

SCIENTIFIC REPORTS

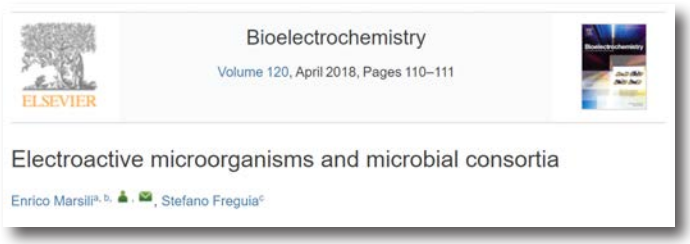
OPEN

The microbiomes of blowflies and houseflies as bacterial transmission reservoirs

"To date, diseases transmitted by a mechanical vector like flies have been a major overlooked pathway by both the medical and academic community. This is a great example of how observations from basic research on how diseases spread might be translated into viable and useful applications, opening up new avenues for future technology," said Prof. Schuster, senior author of the study.

This research is published in *Scientific Reports* and has been featured on many international news outlets and websites throughout the world.

Latest SCELSE publications


Bioelectrochemistry
Volume 120, April 2018, Pages 110–111
Electroactive microorganisms and microbial consortia
Enrico Marsili[a, b], Stefano Freguia[c]


Cell
Explore Online Now Current Issue Archive Journal Information For Authors
< Previous Article
Volume 171, Issue 7, p1481–1493, 14 December 2017
REVIEW
Our Gut Microbiome: The Evolving Inner Self
Parag Kundu[5], Eran Blacher[5], Eran Elinav[5], Sven Pettersson[5]

SCELSE social

Corporate Services Jolly Munch Munch Lunch

SCELSE corporate services staff got together to enjoy a delicious Jolly Munch Munch lunch and played a few rounds of "Taboo" party word games before the year end holidays.

Here's wishing everyone happy holidays and a great 2018 ahead!

New SCELSE PhD

Congratulations to SCELSE student Stan Chan who successfully completed his PhD oral defence this month!

Above right photo (from left): A/Prof. Scott Rice, A/Prof. Diane McDougald and Stan Chan.

Right photo: Stan (fifth from left) with his advisors and friends at the celebration party.

SCELSE Fire Warden Training

SCELSE fire wardens attended a training course at COSEM instructed by experienced ex-civil defence trainers with hands-on practicals that include putting out real fires with CO_2 extinguishers!

From left: Mr Talgat Sailov, Dr Freddie Lim, Ms Priscilla Lefort, Ms Michelle Koh, Ms Krithika Arumugam and Dr Qiu Guanglei.

Centre Director's year end message *(from p. 1)*

activities. SCELSE research is based on interdisciplinary engagement and we have matured to the stage where research teams are increasingly interactive, enabling innovative research outcomes. Indeed, SCELSE's inter-cluster integration and inclusiveness was praised by SCELSE SAB Chairman Prof. Alexander Zehnder during this year's Scientific Retreat, and Deputy Prime Minister Mr Teo Chee Hean when he visited SCELSE last month.

SCELSE's 7th year RCE review is scheduled for April, 2018, and the preparation has been arduous. I would like to thank those compiling the Self-Assessment Report and all SCELSE members for providing information and materials, as well as the excellent science that forms the foundation of the report.

2017 has been a great year for scientific meetings. SCELSE co-hosted the inaugural Nature Conference on Environmental Microbial Biofilms and Human Microbiomes together with NTU and npj Biofilms and Microbiomes, bringing together leading researchers to share their insights, debate current issues and inspire the next generation of researchers. Other examples include SCELSE members playing an integral role in the International Union of Microbiological Societies Congresses 2017, giving oral and poster presentations at the highest participation rate so far.

SCELSE members have developed new initiatives such as the inaugural SCELSE microscopy seminar training platform, the internal Tech Transfer team for guiding researchers through the technology transfer process, chemical handling facility upkeep roster, and many more. Such bottom up initiatives enable our researchers to maximise the centre's facilities, enhance their skills and expertise, thus ensuring a positive and productive research environment is maintained.

Finally, we had the opportunity to bid farewell to Prof. Andersson who is stepping down as president of NTU at a highly attended morning tea session hosted at SCELSE. This was an important event for us to recognise his contributions to and support of the centre since its inception. It was also humbling to see the level of enthusiasm for Prof. Andersson's involvement in SCELSE, as well as hearing his praise for the centre's legacy at NTU, NUS and in Singapore. We are very pleased for him to be the recipient of SCELSE's first "biofilm" award.

I'd like to thank all SCELSE members and associates - your efforts are very much appreciated. Please keep up the great work. I wish you all the best for the coming year.

SCELSE STUDENT PROFILE

Chum Chun Lok
PhD Student

This month's student profile features Chum Chun Lok!

Tell us a bit about your work in SCELSE.

I work on predator-prey interactions between protozoa and bacteria. This work focuses on bacterial adaptations when encountering predators and how these co-incidentally evolved into virulence traits in host infections. I work with A/Prof. Kimberly Kline's and A/Prof. Diane McDougald's groups.

Chun Lok exploring the Great Smoky Mountains at Tennessee, USA

Any interesting findings or experiences so far?

Currently we are characterising the phenotypes of *Enterococcus faecalis* when met with a ciliate predator, *Tetrahymena pyriformis*. It is interesting to find out that not only did *E. faecalis* not get digested when internalised, they are packaged into membrane-bound vesicles which are expelled by *T. pyriformis*.

We think that this phenomenon actually protects the bacteria from external stresses and enhance their survival in the environment.

What excites you and what makes you go zzzzzz?

Badminton! I have been in the sport for more than 15 years and it is always fun to engage SCELSE colleagues in badminton games.

What makes me zzzzz is the long waiting time to take a z-stack image on the microscope. I am yawning while typing this.

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

If that happens, I would bring my optimism with me. And of course my phone, data plan, and my trusty 20000mAh portable charger.

Fill in the blanks: When _____ , I _____.

When I feel that life is hard at the moment, I will open my bottle of whiskey and have a drink (I already have two empty bottles under my desk).

Anything you would like to say to fellow students?

Ask questions! Never stop being inquisitive. There is no silly question that you can never ask. Would you rather live in regret not knowing something which you thought was too silly to ask?

DPM Teo briefed on SCELSE's organisation and progress

(from p. 1)

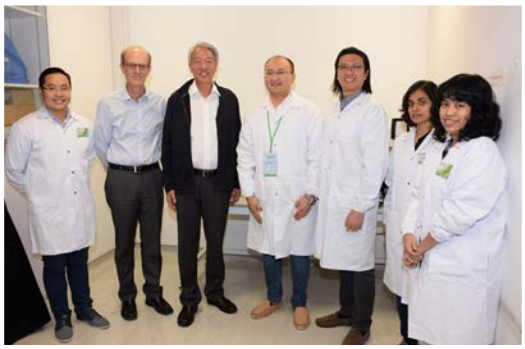
environmental drivers, especially metals, on the community function of the bacteria.

A/Prof. Scott Rice presented the basic biology and biophysics of biofilms, and elaborated on SCELSE's mixed species community models, artificial skin models and also new marine science and microbial ecology projects in the Marine Science Research and Development Programme.

Asst Prof. Yang Liang's presentation focused on emerging global healthcare threats such as hospital acquired infections and foodborne pathogens, which have a large proportion of biofilm involvement. He explained SCELSE's chemical biology approach to discover novel anti-biofilm compounds using high throughput screening of chemical libraries and recent results in the dispersal and elimination of biofilms.

Mr Teo also toured SCELSE's facilities to understand its research capabilities. Dr Daniela Moses gave an introduction to the sequencing facility and an overview of the Air Microbiome project, which showed a marked difference in microbial community composition between day and night.

Mr Rikky Wenang Purbojati presented the high performance computing facility and briefly talked about SCELSE's fly microbiome research, which recently received media coverage worldwide.



Mr Teo visiting the imaging facility. From left: Dr Joey Yam, Prof. Staffan Kjelleberg, DPM Teo Chee Hean, Mr Talgat Sailov, Dr Samuel Ko (Carl Zeiss), Dr Sujatha Subramoni and Dr Mya Mya Khin

At the imaging facility, Mr Talgat Sailov, Dr Sujatha Subramoni, Dr Joey Yam and Dr Samuel Ko gave quick demonstrations of the state-of-the-art equipment, including confocal and lightsheet microscopes.

Mr Sailov said that Mr Teo showed keen interest in the imaging facility.

"Mr Teo asked about the background of the people and the benefits of each instrument. He was very interested and eager to learn more," he said.

Dr Gayathri Natarajan presented the bioreactor facility and showed a sample of Anammox bacteria which can remove ammonium from used water. Mr Teo's interest stemmed from the presence of such bacteria in the Changi Water Reclamation Plant, and he enquired about other microbial water treatment processes.

"I'm surprised that Singapore is considered too warm for certain processes. I would have expected bacteria to grow better at higher temperatures," Mr Teo said, as Dr Natarajan explained the enhanced biological phosphorus removal (EBPR) process usually studied in temperate countries, which was shown by SCELSE to be achievable in tropical climates.

After the facility tour, Mr Teo met a number of SCELSE researchers during the tea reception and interacted with them on various topics, including their research areas and wider issues such as water treatment trends in the Southeast Asia region.

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