SCELSE Quorum
Singapore Centre for Environmental Life Sciences Engineering
June 2017

New Postdoc Club promotes interdisciplinary discourse

The Postdoc Club is a new initiative by a group of research fellows from NTU School of Biological Sciences (SBS), SCELSE and Lee Kong Chian School of Medicine (LKCMedicine) aiming to create more presentation opportunities for research fellows and promote interdisciplinary discourse across the three organisations.

The meeting, which is organised by Dr Alexander Ludwig and Dr Jaishree Tripathi from SBS, will be held on the last Wednesday of each month. Each session will have four speakers, and the format will be five to seven minutes for introductory talks followed by 15 to 30 minutes for research, methods or journal club type seminars.

"Currently we have about 30 research fellows interested in the Postdoc Club and we encourage more people to participate," said SCELSE research fellow Dr Viduthalai Rasheedkan Regina.

The first round of introductory seminars was held at 5:00pm on 28th June, at SBS Classroom 2.

The next seminar is slated for 26th July.

If you are interested to give a seminar, please sign up at:

http://doodle.com/poll/9acfvaeqxspa446m#table

Calendar

SCELSE Seminars

12 Jul: Prof. Gerard Wong, University of California, Los Angeles. 3:00pm - 4:00pm. EMB Seminar Room 1.

19 Jul: Dr Serena Teo, St John's Island National Marine Laboratory. 3:00pm - 4:00pm. ASE Seminar Room B.

24 Jul: Dr Nika Pende, University of Vienna, Austria. 3:00pm - 4:00pm. ASE Seminar Room B.

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.

27 Jun - 15 Jul: SCELSE 7th Summer Course.

12 Jul: NIMBELS Grant Call 2017. Call for proposals.

21 Jul: SCELSE Happy Hour. 5:00pm onwards. B2 Coffee Lounge.

24 - 28 Jul: Real-time PCR course - Applications in Environmental Microbiology by Dr Veronica Rajal.

26 Jul: SBS/SCELSE/LKCMedicine Postdoc Club. 5:00pm. SBS-CR2.

Conferences and Courses

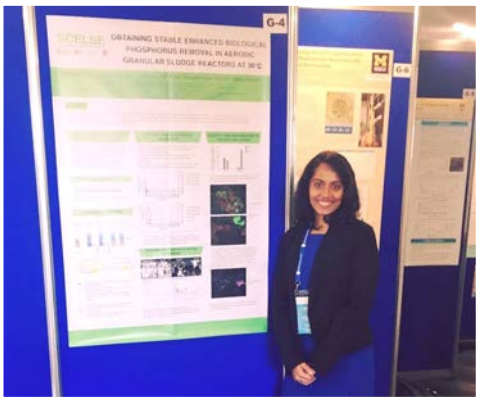
17 - 21 Jul: International Union of Microbiological Societies (IUMS) Congresses 2017. Marina Bay Sands Convention Centre, Singapore.

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 PhD student wins poster award at international water conference in Ireland

SCELSE PhD student Samarpita Roy won the 3rd prize for her poster at the International Water Association (IWA) 10th International Conference on Biofilm Reactors held in Dublin, Ireland. Prof. Stefan Wuertz, Dr Law Yingyu, Dr Gayathri Natarajan and Dr Ding Zhiji also attended the conference and presented their work from the Anammox project.



Samarpita with her prize winning poster at the IWA conference in Dublin, Ireland

"The poster sessions served as a good platform to start talking to researchers and discuss their projects. The work I presented was an interdisciplinary project with A/Prof. Scott Rice and Dr Grant Tan who lent their expertise on granulation strategies that were employed in a wastewater treatment process to achieve stable enhanced biological phosphorus removal in tropical climates," Samarpita explained.

Congratulations to Samarpita for her achievement!

Real-time PCR course for quantitative analysis of environmental microbes

Quantitative PCR (qPCR) or real-time PCR is an indispensible technique to identify and characterise living organisms, but is associated with unique challenges for environmental microbial samples. SCELSE visiting scientist Dr Veronica Rajal (National University of Salta, Argentina) and Environmental Engineering Research Director Prof. Stefan Wuertz will be conducting a real-time PCR course from 24 - 28th July, focusing on applications in environmental microbiology.

The four-day course comprises 40 hours in total and consists of three topics: a review of prokaryotic cells, eukaryotic cells, viruses, RNA and DNA; an introduction to PCR; and the fundamentals of qPCR and its various applications.

Prerequisites for this course include basic or general microbiology and chemistry.

For registration, please contact Dr Rajal by email:

VBRajal@ntu.edu.sg

SCELSE STAFF PROFILE

Joeri Coppens
Research Fellow

When exploring new scientific horizons, it is very helpful to have broad interests and an adventurous character to drive ideas from diverse fields towards new research directions. Dr Joeri Coppens brings to SCELSE his strong background in interdisciplinary research and his zeal for exploration - even for topics beyond planet Earth.

"Because of my broad research interests, I pursued a multidisciplinary PhD to investigate and connect the different aspects related to biological nutrient recycling. This allowed me to study a spectrum of research topics, ranging from marine microbial ecology, the use of algal fertilisers for tomato cultivation, to urine treatment for long-duration space missions," Joeri explained.

At SCELSE, Joeri is working as a research fellow on the Used Water Treatment Project, which focuses on developing mainstream autotrophic nitrogen removal in tropical conditions. He collaborates with Prof. Stefan Wuertz, Dr Rohan Williams, Dr Thomas Seviour, Dr Law Yingyu, Dr Gayathri Natarajan, Dr Ding Zhiji, Cheryl Tsan, Nguyen Thi Quynh Ngoc, Sara Swa Thi and Eganathan Kaliyamoorthy. By obtaining a better understanding of mainstream partial nitritation Anammox the SCELSE research team already developed novel control strategies that can lead to the creation of energy-positive used water treatment plants in Singapore.

"It is very enjoyable to be part of a large and diverse research team that combines microbial ecology expertise with environmental engineering knowhow. Furthermore, at SCELSE in general there is a broad range of research tools and scientific expertise available," Joeri said. He added that because of this he feels fully supported as a researcher to produce qualitative research and initiate new collaborations and research projects.

Joeri began his research journey in Belgium, obtaining his Masters in Industrial Engineering in Biochemistry from Ghent University in 2010. After an internship as an R&D Engineer at Procter & Gamble, he returned to Ghent and started his PhD in Applied Biological Sciences in Environmental Technology at the Centre for Microbial Ecology and Technology.

"My doctoral research focused on the recovery and valorisation of nitrogen and phosphorus nutrients from waste streams. Having studied and worked in Belgium until then, I was committed to continue my career abroad," he said. Joeri added that he was attracted by the dynamic region of Southeast Asia, especially the large opportunities for water research and technology development in Singapore.

"I learned about the excellent research facilities and pleasant work environment at SCELSE through former colleagues who visited the centre, and decided to apply for a research position here," he said.

For students who are new to research, Joeri recommends attending more seminars, even those that are not in their field.

"Singapore is the Asian hub for research and technology development. As a result, scientific symposiums and seminars are organised on a weekly basis at SCELSE, NTU, NUS and other research centres. Listening to the perspectives, experiences and challenges of colleagues and experts from both inside and outside your research field is very important to broaden your view on research and generate innovative research ideas," he said.

About life in Singapore, Joeri said that the sunny weather and Asian food is a key attraction.

"As a Belgian, I am used to dark, cold winters and grey, rainy summers. To be living in a place where it is summer all year long is definitely a plus, although my Singaporean colleagues might disagree," he said. Joeri also has a passion for travelling and good food, and finds it wonderful to be able to travel and discover the cultures and cuisines of the rest of Southeast Asia during long weekends.

Outside of research, Joeri enjoys an active lifestyle. "While I was active as a long-distance runner and ski instructor in Europe, I spend my leisure time in Singapore mainly in the swimming pool or in the gym. Yet, I am also very eager to get to know my SCELSE colleagues better over a Belgian beer," he said.

Publication profile

Combination treatment suppresses the emergence of antibiotic resistance

SCELSE researchers have demonstrated a combination drug treatment against *Pseudomonas aeruginosa* biofilms that can also suppress the formation of antibiotic-resistant subpopulations.

Antibiotic resistance is a rapidly worsening global healthcare problem, especially in Gram-negative bacteria which have a protective outer membrane that impedes the entry of antibiotics. *P. aeruginosa* is a Gram-negative opportunistic pathogen that is involved in a wide range of infections, including chronic infections which are usually associated with biofilms.

Colistin is a natural antibiotic that kills Gram-negative bacteria by targeting the outer membrane and causing it to leak. It is used as a last-resort treatment for multidrug-resistant Gram-negative bacteria, however in recent years there has been increasing reports of colistin resistance, which is worrying because very few new antibiotics are entering the market.

In the last decade, compounds called LpxC inhibitors have been identified as potential antibiotics. These compounds inhibit the function of LpxC, an enzyme involved in the synthesis of lipid A, which is an essential component of the outer membrane. Among them, CHIR-090 was the first LpxC inhibitor known to be active against *P. aeruginosa*, but it has not yet been tested against biofilms.

SCELSE researchers hypothesise that colistin and CHIR-090 may work together to eliminate biofilms because colistin distorts the outer membrane, which facilitates the uptake of CHIR-090. They tested this combination treatment against *P. aeruginosa* cells under both planktonic and biofilm conditions.

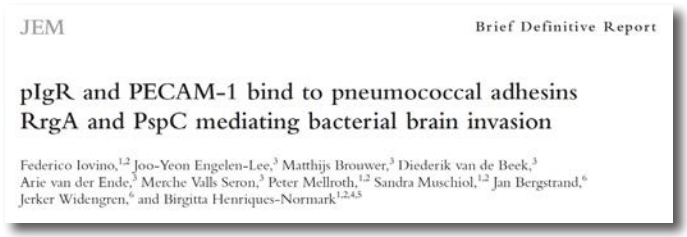
In planktonic cells, when CHIR-090 was added to colistin, they observed a population shift towards lower colistin minimum inhibitory concentration (MIC) values, suggesting that the drug combination has potential for synergy. The combinatory effect was confirmed for two colistin-resistant isolates.

In biofilms, synergy was observed against both colistin-susceptible and resistant biofilms. Using a biofilm flow cell model, the researchers found that CHIR-090 alone had limited effect, and colistin alone had killing effect at the colistin-susceptible bottom layer only. The combination of both, however, completely eliminated colistin-resistant subpopulations, which include the top layer of the biofilm.

In mouse implant model *in vivo* experiments, CHIR-090 used alone resulted in a 100 times reduction of the *P. aeruginosa* colony forming units (CFUs), while colistin alone caused a 1,000 times reduction. The combination of both resulted in an enhanced reduction of up to 10,000 times.

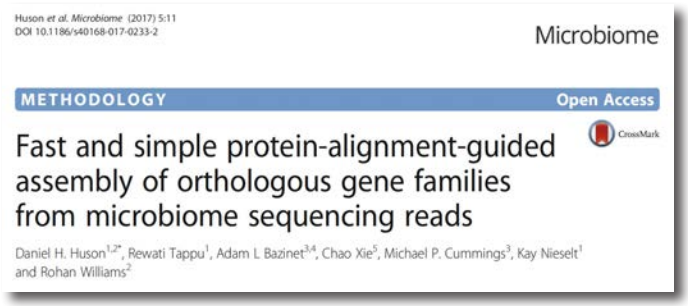
In this study, researchers demonstrate for the first time the antimicrobial effectiveness of this combination treatment on biofilms, which showed synergistic effects and did not exhibit cross-resistance. These results show the potential of CHIR-090 as an adjunct treatment to prevent the emergence of colistin resistance.

Latest SCELSE publications


JEM Brief Definitive Report

pIgR and PECAM-1 bind to pneumococcal adhesins RrgA and PspC mediating bacterial brain invasion

Federico Iovino,[1,2] Joo-Yeon Engelen-Lee,[3] Matthijs Brouwer,[3] Diederik van de Beek,[3] Arie van der Ende,[3] Merche Valls Seron,[3] Peter Mellroth,[1,2] Sandra Muschiol,[1,2] Jan Bergstrand,[6] Jerker Widengren,[6] and Birgitta Henriques-Normark[1,2,4,5]


Huson et al. Microbiome (2017) 5:11
DOI 10.1186/s40168-017-0233-2

Microbiome

METHODOLOGY Open Access

Fast and simple protein-alignment-guided assembly of orthologous gene families from microbiome sequencing reads

Daniel H. Huson[1,2*], Rewati Tappu[1], Adam L Bazinet[3,4], Chao Xie[5], Michael P. Cummings[3], Kay Nieselt[1] and Rohan Williams[2]

SCELSE social

New SCELSE PhDs

Congratulations to SCELSE students Jean Pierre Nshimyimana (left) and Nandini Shome (right) who successfully completed their PhD oral defences this month!

SAB BBQ dinner

SCELSE's annual Scientific Advisory Board (SAB) meeting was held in June and an informal BBQ dinner was hosted on the night of the 8th June at NTU North Spine Sky Deck for SAB members to get to know SCELSE at a more personal level. Prof. Joan Rose (left photo, facing the camera) said that she is very pleased to see the evolution of SCELSE in the past seven years.

Temasek Polytechnic visit

SCELSE hosted a guided tour of the research facilities for a group of students and lecturers from Temasek Polytechnic on 19th June. Dr Chan Giek Far (right photo, first from left), section head of biotechnology, said that their students enjoyed the visit and learned a lot.

Conference report

Science, medicine and culture in Vienna

SCELSE researchers presented leading edge biofilm research at the 27th European Congress of Clinical Microbiology and Infectious Diseases (ECCMID) held in Vienna, Austria, and also benefited from the accumulated wealth of knowledge and experience assembled at the conference.

"It is the largest convention in clinical microbiology and infectious diseases in Europe, with over 3,000 attendees and at least ten talks running simultaneously. The topics were very varied and include infectious diseases, disease control, and research in bacteria, viruses and parasites," said PhD student Dan Roizman, who attended the conference and shared his experience with Quorum.

During the conference, Dan presented a poster of his work on the *in vitro* evaluation of biofilm dispersal as a therapeutic strategy to restore antimicrobial efficacy, which has been submitted to a journal as a research paper and is currently under review. SCELSE PhD students Ding Yichen and Tan Jun Hou also presented posters, and there were two talks from Singapore by National University Hospital (NUH) and NTU LKCMedicine researchers.

Dan presenting his poster at the ECCMID conference in Vienna, Austria

"Comparing broadly with other research organisations, SCELSE's research really epitomises the state-of-the-art technology, for example in terms of flow cells, reactors and staining techniques," Dan said. He observed that other research groups use electrical impedance as an indicator of biofilm growth. Others use a wound biofilm model that includes pathogens from the three kingdoms. Also, a lot of effort is put into studying antibiofilm agent synergy with existing antibiotics.

"The most interesting talk was given by Prof. Evelina Tacconelli of the World Health Organisation (WHO), using data visualisation to compare the evolution of antibiotic resistance in different European countries such as Finland vs Greece. They found that the emergence of resistance is correlated

cont. p. 4

SCELSE STUDENT PROFILE

Adeline Yong
PhD Student

This month's student profile features Adeline Yong!

Tell us a bit about your work in SCELSE.

I work in Asst Prof. Kline's lab and I am currently going into my final year. My work focuses on a conserved protease which may have a possible role in pilus biogenesis and cellular morphology in *Enterococcus faecalis*.

Any interesting findings or experiences so far?

We found two two-component systems (TCSs) that may play a role in pili biogenesis and several genes responsible for the altered morphology.

When this conserved protease is absent, the cell is unable to regulate pili expression, signaling back to the cell via a known TCS that plays a possible role in pilus biogenesis and/or via a novel TCS. We proposed this may also affect downstream genes that contribute to the cell separation, serving as a sort of "checkpoint" for the cell during these times of stress.

What excites you and what makes you go zzzzzz?

It excites me when I manage to take time off to do volunteering work, be it locally or overseas and see the smiles on the faces of people whom we have helped.

Adeline having pizzas with children at Phisanulok, Thailand during a volunteering trip

It makes me go zzzzzz when an already optimised protocol does not work as expected.

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

I would bring my significant other, family, relatives, and friends to the island. Well, the more the merrier, right?

Fill in the blanks: When _____ , I _____.

When I travel to different countries, I would get local postcards and mail it back home or to my friends as a souvenir.

Anything you would like to say to fellow students?

Doing science is never smooth-sailing. You will experience both the worst and the best days of your life. Regardless of what happens, pick yourself up and try it again, because, if you never try, you will never know! =) Good luck!

Science, medicine and culture in Vienna *(from p. 3)*

with countries that have a weaker socioeconomic and educational environment," Dan said.

Another interesting talk was given by Dr Sophie Helaine from Imperial College London who is developing a new technique to look at persister cells and identify mechanisms of persistence.

"They developed many different fluorescent tags that can differentiate persister cells from active cells based on differences in their metabolism," Dan said.

A view of Vienna city

There was also a big symposium with many veterinarians and infectious disease experts in attendance.

"A major part of the antibiotic resistance emerged from livestock in agriculture, but there is a less obvious source - house pets," Dan said. He explained that when pets become sick, vets have a tendency to prescribe higher doses of antibiotics if the pet doesn't get well because they have fewer approved drugs compared to the options available to human patients. A subpopulation of resistant bacteria that survived can then spread from the pet to the owner during their regular interactions.

For Dan, the highlight of the conference was a round-table discussion during Trainees Day with Prof. Rafael Canton from the Hospital Universitario Ramón y Cajal in Spain and a chairperson of the European Committee on Antimicrobial Susceptibility Testing (EUCAST). Prof. Canton stressed that the emergence of antibiotic resistance in biofilms is a big problem in need of proper solutions, and this is a very important goal.

"I told Prof. Canton I read that in African countries, a lot of clinical research would not be possible without the free access to the clinical breakpoint database provided by EUCAST. They simply cannot afford it," Dan said. He explained that unlike the case in Europe, an equivalent document in the USA would cost hundreds of dollars. Prof. Canton and an African researcher both agreed with Dan.

"This highlights the importance of transparency and sharing," Dan said.

Aside from the conference activities, Dan took the opportunity to explore Vienna. He enjoyed good Wiener Schnitzels, Viennese beer and wine, and went on a city tour where he visited museums, appreciated Austro-Hungarian architecture and experienced a classical concert in a baroque ballroom.

Dan tasting a Wiener Schnitzel

"I found it odd that it is customary there to buy concert tickets from street sellers instead of the ticketing booth," Dan said.

Overall, Dan found the conference to be a fascinating and fruitful experience.

"After following the work of prominent researchers, it is really mind-blowing to actually meet them in person!" he said.

Newsletter contacts

Freddie: limlenghiong@ntu.edu.sg

Sharon: sharonlongford@ntu.edu.sg