

PRESS RELEASE

10 February 2010

NTU SETS UP CENTRE ON MICRO-ORGANISM RESEARCH FOR ENVIRONMENTAL ENGINEERING AND SUSTAINABILITY, IN COLLABORATION WITH NUS

- *The Singapore Centre on Environmental Life Sciences Engineering established to be a world leading centre in biofilm research*
- *This is the 5th Research Centre of Excellence (RCE) supported by NRF and MOE, bringing the total funding to S\$750 million for 5 RCEs since 2007*

1. The National Research Foundation (NRF) and the Ministry of Education (MOE) announced today the funding support for a Research Centre of Excellence (RCE) called the Singapore Centre on Environmental Life Sciences Engineering (SCELSE) to be set up at the Nanyang Technological University (NTU). The RCE, with strong research collaboration with the National University of Singapore (NUS), is expected to be in operation by January 2011, and aims to become one of the world's top research centres in the emerging area of microbial biofilms within five years, conducting cutting edge research on microbial biofilm communities with the purpose of harnessing their powers for water and environmental sustainability (see **Annex A**).

2. A budget of S\$750 million (S\$500 million from NRF and S\$250 million from MOE) had been set aside in 2007 to fund such RCEs. The SCELSE will receive S\$120 million from this budget over 10 years. In addition, the NTU and NUS would provide contributions of S\$62 million and S\$24 million respectively to the Centre.

3. Dr Tony Tan, Chairman of NRF said: "Since its inception in 2006, the NRF has put in place major initiatives such as the RCE programme, to advance research, innovation and enterprise in Singapore. Research Centres of Excellence are long-term investments aimed at developing a virtuous cycle of research excellence in our universities that would attract research talent contributing to significant economic and societal impact. Led by world renowned experts in their fields, these RCEs are helping to catalyse the development of our local universities into research-intensive institutions with international standing. This will help establish Singapore as a leading centre for world class R&D attracting research talent from Singapore and other parts of the world. We expect such RCEs to come out with research breakthroughs as well as innovative technologies that will make Singapore a hotbed for innovation."

4. Dr Ng Eng Hen, Minister for Education, said: “Besides scientific excellence, the work of SCELSE will also contribute to Singapore’s national priorities in water, energy and urban sustainability. SCELSE is also the first RCE to feature a strong collaboration between NUS and NTU. We believe that harnessing the synergy of the two universities would greatly advance research and lead to the development of solutions to pressing problems of a rapidly urbanizing Asia. ”

5. SCELSE will be led by Professor Staffan Kjelleberg, founder of the Centre for Marine Bio-Innovation at the University of New South Wales (UNSW) in Australia, and a research leader at NTU since late 2008 (see **Annex B**). Prof Kjelleberg plans to develop the SCELSE into a world leader on biofilm science research and to transfer this knowledge to the industry for the betterment of the environment.

6. SCELSE will build upon NTU’s strengths in engineering, environment and water technologies as well as NUS’ leading position in life science research. In addition to recruiting several world experts in environmental research, the RCE will draw on interdisciplinary talent from NTU’s Nanyang Environment & Water Research Institute (NEWRI), School of Civil and Environmental Engineering and collaborate with the Earth Observatory of Singapore and the Mechanobiology RCE at the NUS.

7. NTU President Dr Su Guaning said, “NTU is proud to lead the development of the Research Centre of Excellence on Environmental Life Sciences Engineering. NTU has been building upon the theme of ‘Sustainable Earth’ as one of its peaks of excellence. We have in place multidisciplinary research platforms to address key challenges in water, the environment, and energy. SCELSE is an outcome of our efforts to build a world leading team to exploit a unique window of opportunity in applying life sciences advances to Sustainable Earth. With SCELSE providing the leading science, the university is poised to scale greater heights in Sustainable Earth. We are pleased to partner NUS in this effort as each university contributes its own unique strengths to make SCELSE a world leader in Biofilm research. I am confident SCELSE will bolster Singapore’s drive to be a global scientific and technological hub in the domain of environmental life sciences engineering, and contribute to our nation’s environmental sustainability efforts and economic growth into the next decade.”

8. NUS President Prof Tan Chorh Chuan said, “NUS is delighted to work with NTU in this strategic partnership. SCELSE is special because it sits at the interface between engineering and life sciences, and draws on complementary strengths from NUS and NTU in these disciplines. It has the potential to develop novel technologies that can be applied to many different industry sectors. For NUS, the unique skills that will be delivered by SCELSE will also be of value to our researchers working in the NUS integrative sustainability research cluster which aims to help enhance Singapore as a global city.”

9. On the importance of the SCELSE’s research, Professor Kjelleberg, director-designate of SCELSE noted, “We now know that microorganisms live as biofilm communities as the dominant mode of life. Their communal action is central to environmental sustainability. With SCELSE, we will harness the research synergies across NTU and NUS, and work closely with NEWRI and the Life Sciences Institute, to deliver the first comprehensive understanding of the biofilm mode of life. In this

way, we will translate fundamental knowledge on biofilms into life science based environmental engineering to effectively address the ever increasing water and environmental challenges.”

10. Outfitting of SCELSE’s laboratories and offices at NTU and NUS has started. At full strength, envisaged in 5 years, the Centre will have 25 faculty members, supported by a strong team of technical and administrative staff. It expects to train some 100 graduate students and 40 post-doctoral fellows over the first 10 years of operation. Each of its principal areas of study will be led by an accomplished scientist. These scientists have already committed to serving at the Centre.

11. SCELSE is the fifth RCE funded by NRF and MOE. Four other RCEs had been set up since 2007. They are the Centre for Quantum Technologies (CQT), the Cancer Science Institute of Singapore (CSIS), both at NUS, the Earth Observatory of Singapore (EOS) at the NTU and the Mechanobiology RCE at NUS. These RCEs are established to build peaks of excellence in research in specific fields in the local universities (see **Annex C**).

12. Besides attracting world-class scientists and researchers, the RCEs have provided a platform from which our universities could pursue cross-disciplinary research and achieve intra- and inter- university synergies. The research output of the RCE programme has the potential of seeding new economic activities centred on the creation of intellectual property.

The National Research Foundation (NRF)

The National Research Foundation (NRF), set up on 1 January 2006, is a department under the Prime Minister's Office.

The NRF sets the national direction for research and development (R&D) by developing policies, plans and strategies for research, innovation and enterprise, funds strategic initiatives, builds up R&D capabilities and capacities through nurturing our own and attracting foreign talent, and coordinates the research agenda of different agencies to transform Singapore into a knowledge-intensive, innovative and entrepreneurial economy. It provides secretariat support to the Research, Innovation and Enterprise Council (RIEC), chaired by the Prime Minister. A five-year budget of S\$5 billion has been allocated to the NRF in 2006 to achieve this mission.

The NRF aims to:

- Transform Singapore into a vibrant R&D hub that contributes towards a knowledge-intensive, innovative and entrepreneurial economy; and
- Make Singapore a talent magnet for scientific and innovation excellence.

For more information, please visit www.nrf.gov.sg.

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Fact Sheet on the Research Centre on Environmental Life Sciences Engineering

Vision and Mission

The Singapore Centre on Environmental Life Sciences Engineering (SCELSE) will generate practical environmental solutions from leading-edge interdisciplinary research on microbial biofilms - the central mode of life on our planet, essential for all life support processes on earth and pivotal for the sustainability of our environment.

Surprisingly, while biofilms are everywhere and affect each and every facet of our lives and the environment we live in, our understanding of how they are organized and how they function is lacking. New powerful technologies in life sciences will allow the SCELSE Research Centre of Excellence to explore, for the first time, the hidden powers of the biofilm mode of life and to harness its activities for novel environmental engineering.

SCELSE will be an indispensable environmental life sciences and biotechnology component which, when synergized with environmental engineering, will establish a unique international powerhouse for science-based engineering and biotechnology in the 21st century.

Enthusiastic support for SCELSE has already been expressed by key Singapore public institutions and leading national and international industries in the water and environment arena.

World Class Research Group

SCELSE is hosted by Nanyang Technological University (NTU) and is a joint interactive venture between NTU and National University of Singapore (NUS). This collaboration effort resonates with the key strategic priorities on sustainability expressed by the two universities.

SCELSE will be helmed at NTU by two internationally renowned scientific leaders, Professor Staffan Kjelleberg from the University of New South Wales (UNSW), Australia and Professor Yehuda Cohen from the Hebrew University of Jerusalem, Israel, as Director and Deputy Director, respectively.

To take full advantage and generate added value on the skills base of the two universities, Professor Wun-Jern Ng, Executive Director of Nanyang Environmental and Water Research Institute (NEWRI, NTU) and Professor Peter Little, Director of the Life Sciences Institute at NUS will serve as the SCELSE integrators and ensure a seamless interaction across the various science and engineering colleges of the two universities.

An additional team of outstanding international scientific leaders; Professors Michael Givskov, (University of Copenhagen, Denmark), Stephan Schuster (Penn State University, USA), Ian Head (University of Newcastle, UK), and Stefan Wuertz

(University of California Davis, USA) will soon join the SCELSE endeavor. With their skills base and expertise, SCELSE will have a unique complementary team dedicated to deliver on the multidisciplinary objective of the RCE.

Delivering Practical Solutions

Solutions to the environmental challenges articulated and faced by Singapore, and globally, must be based upon an understanding of complex microbial communities organised as biofilms. Biofilms are everywhere. Their manipulation and control will generate profound, long term environmental and economic benefits.

SCELSE will develop the first ever comprehensive description of truly complex and functionally diverse biofilm communities relevant to industrial applications in water and the environment. This will enable the development of novel technologies to cater for practical solutions for environmental problems including unsafe water, toxic pollutants, damage of structures such as water distribution pipes and membranes used for water purification and desalination, as well as biofilm-related infectious diseases.

SCELSE will develop the first Biofilm International Database to manage the expected massive research data generated. The database will become a powerful, predictive tool for research affecting a spectrum of water and environmental issues. Other research organizations will be encouraged to submit their data into this central database for the collaborative development of environmental solutions. This International Biofilm Database shall anchor SCELSE's and Singapore's claim to being the global hub for biofilm R&D.

SCELSE expects to train some 100 graduate students and 40 post-doctoral fellows over the first 10 years of operation. New graduate programs in Life Sciences and Environmental Engineering across NTU and NUS will allow graduate students to capitalize on the high level expertise of the two universities and thereby provide an important mechanism for grooming the next generation of Singaporean scientific leaders and engineers in the environmental sustainability domain.

Singapore has declared water and environmental sustainability as national priorities. These priorities will be effectively implemented by the timely establishment of both SCELSE and the JTC Cleantech Park, Singapore's first science and business park for environment, water and clean energy, to be based immediately adjacent to the NTU campus. This will allow SCELSE innovations to be readily translated into novel environmental biotechnology and engineering solutions within a dedicated incubator environment.

Curriculum Vitae**Professor Staffan Lars Åke Kjelleberg**

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| Position | Director-designate, Singapore Centre on Environmental Life Sciences (SCELSE) |
| Summary of research profile | <p>My major research achievements have been in:</p> <ol style="list-style-type: none"> 1) Understanding mechanisms, functions and ecology of bacterial biofilms, for which notable discoveries, achievements and strong IP protection has been accomplished; 2) Role of chemical signals in mediating biological interactions at surfaces, including a recently launched program on climate change induced bacterial disease and bleaching in marine benthic algae; 3) Microbial genomics, including whole organisms and marine microbial communities; 4) Identification of novel bioactives with signalling, adaptation and inhibitory function and activity. <p>The research structures enabling my research activities over the past 10 years are:</p> <ol style="list-style-type: none"> 1) The Centre for Marine Bio-Innovation, with more than 50 staff, students and researchers, and attracting \$3.5-4 M p.a. in external funds; 2) Biosignal Ltd, an ASX listed company with a novel antibacterial technology which arose from research at the CMB; 3) The CRC for Environmental Biotechnology for which CMB is a key research provider; 4) Collaborations with the JC Venter Institute, The Moore Foundation, and the Joint Genome Initiative (DoE, USA). |
| Qualifications | <ul style="list-style-type: none"> • B.Sc in Chemistry and Biology, University of Göteborg, Sweden (1975) • Ph.D. (Microbiology) University of Göteborg (1981) • Docent (Microbiology) University of Göteborg (1983) |
| Professional experience | <p>At the University of New South Wales, Sydney Australia</p> <p>2003 – present UNSW Scientia Professor</p> <p>1994 – present Director, Centre for Marine Bio-Innovation (previously Centre for Marine Biofouling and Bio-</p> |

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| | <p>Innovation)</p> <p>1994 – present Professor, School of Biotechnology and Biomolecular Sciences (previously named School of Microbiology and Immunology)</p> <p>2007 – present Co-Director Environmental Microbiology Initiative</p> <p>1999 – 2006 Research Director, Biosignal Pty Ltd</p> <p>1998 – 2000 Head of School of Microbiology and Immunology</p> <p>1981 – 1982 Research Fellow</p> <p>At the Nanyang Technological University, Singapore</p> <p>2008 – present Visiting Professor</p> <p>At the University of Göteborg, Sweden</p> <p>1987 – 1993 Professor and Chairman Department of General Marine Microbiology</p> <p>1983 – 1986 Researcher, Swedish Natural Science Research Council</p> <p>1975 – 1980 Assistant Lecturer and Research Associate</p> |
| Other experience (i.e. editorial positions, conference organisation, etc.) | <p>Member of the Editorial Board of International Journals including: ISME Journal (2006-present); Environmental Microbiology (2000-present); Microbial Biotechnology (2007-present); Journal Biologia (General Biology Section) (1994-present); Ophelia (1989-present); Applied and Environmental Microbiology (1985-1995 and 2005-present); Microbes and the Environment (2005-present)</p> <p>Editor of international journals and books including: Aquatic Microbial Ecology (2005 – present); FEMS Microbiology Ecology (1988 – 2004); Editor of Current Opinions in Biotechnology: Environmental Biotechnology Section (2002); Editor of “The Biofilm Mode of Life – Mechanisms and Adaptations” Monograph published by Horizon Scientific Press, (2007); Editor of “Biofouling: Problems and Solutions” Symposium Proceedings published by UNSW press (1994); Editor of “Starvation in Bacteria” Monograph published by Plenum Publishing Corp (1993); Editor of “Nutrient Limitation: Global Responses and Prokaryotic Development” Symposium issue of FEMS Microbiology Ecology (1990)</p> <p>Other Current Professional Activities: Chair of the Scientific Advisory Board, Biosignal Ltd (2006-2008); Executive Organising Committee Member for ISME-10, 11 and 12 (2004, 2006 and 2008); Past president and member of the Executive Board of ISME (2006-present)</p> |
| Scholarships, fellowships and awards | <ul style="list-style-type: none"> • Elected Fellow of the American Academy of Microbiology • Elected Fellow of The Japan Society for the promotion of Science • Elected Division lecturer of the American Society of Microbiology |
| Examples of competitive grants obtained in the last 5 years | <p>Total competitive grants (since 2003): ~\$15 M including: 16 ARC Linkage, Discovery, Large and LIEF Grants, 5 NHMRC Grants, 4 Gordon and Betty Moore Foundation and the J. Craig Venter Institute Sequencing Grants. The most recently awarded grants include: NHMRC Project Grant - \$529,000 (2009); ARC Linkage International Grant - \$57,000 (2009); ARC Linkage Grant - \$390,000 (2009-2011); Swedish Foundation for International Cooperation in Research and Higher Education (STINT) - \$400,000 (2008-2011); Australian Cystic Fibrosis Research Trust - \$80,000 (2008)</p> |
| Total Number of Publications | 262 |

Ten best
publications in
the last ten years

- Schleheck, D., N. Barraud, J. Klebensberger, J. S. Webb, D. McDougald, S. A. Rice, and **S. Kjelleberg** (2009) *Pseudomonas aeruginosa* PAO1 Preferentially Grows as Aggregates in Liquid Batch Cultures and Disperses upon Starvation. *PLoS ONE* 4:e5513.
- Rice, S. A., C. H. Tan, P. J. Mikkelsen, V. Kung, J. Woo, M. Tay, A. Hauser, D. McDougald, J. S. Webb, and **S. Kjelleberg** (2009) The biofilm life cycle and virulence of *Pseudomonas aeruginosa* are dependent on a filamentous prophage. *ISME J* 3:271-282.
- Lauro, F. M., D. McDougald, T. Thomas, T. J. Williams, S. Egan, S. Rice, M. Z. DeMaere, L. Ting, H. Ertan, J. Johnson, S. Ferriera, A. Lapidus, I. Anderson, N. Kyrpides, A. C. Munk, C. Detter, C. S. Han, M. V. Brown, F. T. Robb, **S. Kjelleberg**, and R. Cavicchioli (2009) The genomic basis of trophic strategy in marine bacteria. *Proc Natl Acad Sci U S A* 106:15527-33.
- Matz, C., J. S. Webb, P. J. Schupp, S. Y. Phang, A. Penesyan, S. Egan, P. Steinberg, and **S. Kjelleberg** (2008) Marine biofilm bacteria evade eukaryotic predation by targeted chemical defense. *PLoS ONE* 3:e2744.
- Kjelleberg, S.**, and M. Givskov (2007) *The Biofilm Mode of Life - Mechanisms and Adaptations*. Horizon Scientific Press Norwich, UK.
- Battin, T. J., W. T. Sloan, **S. Kjelleberg**, H. Daims, I. M. Head, T. P. Curtis, and L. Eberl (2007) Microbial landscapes: new paths to biofilm research. *Nat Rev Micro* 5:76-81.
- Barraud, N., D. J. Hassett, S. Hwang, S. A. Rice, **S. Kjelleberg**, and J. S. Webb (2006) Involvement of nitric oxide in biofilm dispersal of *Pseudomonas aeruginosa*. *Journal of Bacteriology* 188:7344-7353.
- Matz, C., D. McDougald, A. M. Moreno, P. Y. Yung, F. Yildiz, and **S. Kjelleberg** (2005) Biofilm formation and phenotypic enhance predation-driven persistence of *Vibrio cholerae*. *Proceedings of the National Academy of Science, USA* 102:16819-16824.
- Webb, J. S., L. S. Thompson, S. James, T. Charlton, T. Tolker-Nielsen, B. Koch, M. Givskov, and **S. Kjelleberg** (2003) Cell death in *Pseudomonas aeruginosa* biofilm development. *Journal Of Bacteriology* 185:4585-4592.
- Hentzer, M., Wu, H., Andersen, J. B., Riedel, K., Rasmussen, T. B., Bagge, N., Kumar, N., Schembri, M. A., Song, Z. J., Kristoffersen, P., Manefield, M., Costerton, J. W., Molin, S., Eberl, L., Steinberg, P., **Kjelleberg, S.**, Hoiby, N. & Givskov, M. (2003) Attenuation Of *Pseudomonas Aeruginosa* Virulence By Quorum Sensing Inhibitors. *Embo Journal*, 22, 3803-3815.

Professor Yehuda Cohen



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| Position | Deputy Director-designate, Singapore Centre on Environmental Life Sciences (SCELSE) | |
| Summary of research profile | <p>My research is focused on the interactions of microbial communities with their environment and the regulation of their metabolic activities under fluctuating environmental signals: i.e. detection of environmental gradients by a variety of microsensors and examination of microbial responses by physiological/molecular tools. These include the study of shifts from oxygenic to anoxygenic photosynthesis in cyanobacteria; shifts from anaerobic sulphate reduction to aerobic respiration in sulphate reducing bacteria as well as the regulation of the alternative use of oxygen and nitrate in sulphide oxidizing bacteria.</p> <p>Since 1995 my research basic environmental research included also the study of structure and function of microbial communities in industrial settings such as reverse osmosis seawater desalination, bioreactors in nutrient-poor waters and development of new antifouling agents. I serve as the head of academic research of the Water Consortium on novel antifouling agents in water treatment.</p> | |
| Qualifications | <p>B.Sc. in Biology, Hebrew University of Jerusalem, Israel (1969) M.Sc. in Microbiology and Genetics, Hebrew University of Jerusalem, Medical School with extinction (1971) Ph.D. Hebrew University of Jerusalem, Medical School, Summa Cum Laude (1976)</p> | |
| Professional experience | 2009 – present | Visiting Professor, Nanyang Technological University, Singapore |
| | 2008 – present | Visiting Professor, Chinese Academy of Sciences |
| | 1990 – present | Professor in Microbiology and Head Microbial & Molecular Ecology, Institute of Life Sciences, Hebrew University of Jerusalem |
| | 1991-2003 | Founder and director the Minerva Centre for Marine Biogeochemistry at the Hebrew University |
| | 1991-2001 | Member of the International Advisory Board Max-Planck Society, Germany (MPI – Bremen) |
| | 1991-2000 | Visiting faculty, Woods Hole, Mass, MBL Microbial Biodiversity Summer Course |
| | 1987-1990 | Associate Prof. in Marine Microbiology |
| | 1984-86 | Senior Scientist, National Research Council, USA at NASA |
| | 1977-1984 | Director of the Interuniversity Marine Institute (IUI) |

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| | <p>1982-87 at Eilat Senior Lecturer, Marine Microbiology</p> <p>1977-1990 Marine microbiologist at IUI, Israel</p> <p>1977-1982 Lecturer, Marine Microbiology, IUI, Hebrew University</p> |
| Other experience (i.e. editorial positions, conference organisation, etc.) | <p>-Co Founder of ISMEJ</p> <p>-Chair, publications board, ISME</p> <p>- Editor and member of editorial board of international journals: Applied Environmental Microbiology (2000-2004), International Microbiology (2000-), Biogeochemistry (1995-2003), Aquatic Microbiology (1995-2002);</p> <p>- Executive member of ICOME – International Committee on Microbial Ecology</p> <p>- Co-Founder of ISME – Secretary, Vice President, President, Past President and Honorary past President and member of executive committee during 1998-2008.</p> <p>-Organizer of major international symposia on Microbial Ecology: ISME 8-12 during 1995-2008</p> <p>- Scientific consultant for several international industries including Coca Cola, Atlanta, Atlantium, Hutchinson Water and Netafim.</p> |
| Examples of competitive grants obtained in the last 5 years | <p>2007-10, Water Consortium – Israel Chief Scientist, magnet program – 43.5M NIS (US\$12.5M)</p> <p>2002-2006, DFG, Germany, Bioremediation of coastal marine pollutants Euro 222,223</p> <p>1999-2004, EU, Role of microbial mats in bioremediation of marine organic contaminants Euro 246,900</p> <p>2000-2004, GIF, German-Israel Foundation, Contribution of oxygen-tolerant sulfate reducing bacteria to sulfate reduction in marine sediments Euro 100,560</p> |
| Total Number of Publications | 112 |
| h-index | 34 |
| Ten best publications | <p>Cohen, Y., Padan, E. and Shilo, M. 1975. Sulfide dependent anoxygenic photosynthesis in the cyanobacterium <i>Oscillatoria limnetica</i>. <i>Nature</i>, London, 257:489-491.</p> <p>Joergensen, B.B., Kuenen, J.G., and Cohen, Y. 1979. Microbial transformations of sulfur compounds in a stratified lake, Solar Lake, Sinai, Israel. <i>Limnol. Oceanogr.</i> 24:799-822.</p> <p>Walsbey, A.E., van Rijn, J. and Cohen, Y. 1983. The biology of a new gas vacuolate cyanobacterium <i>Dactylococcopsis salina</i>, new species in the Solar Lake, Sinai, Egypt. <i>Proc. Roy. Soc. London, B Biol. Sci.</i> 217:417-448.</p> <p>Allredge, A.L., and Cohen, Y. 1987. Can microscale chemical patches persist in the sea? Microelectrode study of marine snow, fecal pellets. <i>Science.</i> 235:689-691</p> <p>Cohen, Y., Rosenberg, E. (Eds.) 1989. <i>Microbial Mat: Physiological ecology of benthic microbial communities.</i> American Society for Microbiology, Washington, D.C. 494 pp.</p> <p>Sweerts J.P.R.D., D. de Beer, L.P. Nielsen, H. Verdouw, J.C. van</p> |

- den Heuvel. **Y. Cohen** and T.E. Capenberg. 1990. Denitrification of sulfur oxidizing *Beggiatoa* spp. in sediments. *Nature* (London). 334:762-763.
- Teske, A., N.B. Ramsing, M., K. Habicht, M. Fukui, J. Kuever, B.B. Joergensen and **Y. Cohen**. 1998. Sulfate-reducing bacterial populations in the diurnally oxic surface layers of a benthic cyanobacterial mat of Solar Lake (Sinai, Egypt). *Appl. Environ. Microbiol.* 64:2943-2951.
- Sigalevich P., E. Meshorer, Y. Helman and **Y. Cohen**. 2002. Transition from anaerobic to aerobic growth conditions for the sulfate-reducing bacterium *Desulfovibrio oxycliniae* results in flocculation. *Appl. Environ. Microbiol.* 66:5005-5012.
- Cohen Y.** 2004. Bioremediation of oil by marine microbial mats. *International Microbiology.* 5:189-193.
- Cohen, Y.** 2006. Cyanobacteria, Ecology and physiology. In: Dworkin M. et al (Eds.) *The Prokaryotes III*. Springer Verlag, Berlin, New York.
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Professor NG Wun Jern



Positions

Integrator-designate, Singapore Centre on Environmental Life Sciences (SCELSE)

Executive Director, Nanyang Environment & Water Research Institute (NEWRI)

Biography

NG WUN JERN graduated from Queen Mary College, London University with BSc (Civil Engineering) in 1977, Birmingham University with MSc (Water Resources Engineering) in 1978 and thereafter completed his PhD dissertation on chemical regeneration of activated carbon in 1980. He subsequently conducted post-doctoral research on biotreatment systems at Kyoto University, Japan. He is a registered professional engineer in Singapore.

His research interests are largely on water and wastewater management with focus on investigations into water quality, treatment science, and development of treatment technologies. These investigations span the water quality spectrum - ranging from ultra-pure water to high strength and potentially inhibitory wastewaters. He is presently arguing for a more sustainable approach to wastewater treatment through energy recovery. His research output may be found in some 400 publications. These include journal papers, conference presentations, book chapters and monographs, reports, and patents. His last book publication is titled "Industrial Wastewater Treatment" (Imperial College Press). He is presently co-authoring a book on application of engineered wetlands.

He interacts closely with the industry as a designer and advisor in the areas of effluent treatment, water reclamation, and surface and marine water quality - and has brought R&D from the laboratory to full-scale applications. Commercialized intellectual properties include biosystems such as the aeSBR (aerobic SBR), anSBR (anaerobic SBR), ANFIL (anaerobic filter) and HYBRIDAN (hybrid anaerobic reactor) and equipment such as the recirculating aerator and electrochemical system. His biopant design and operating protocols have been applied to some 120 full-scale installations. Projects have locations in ASEAN, the Far East, the Middle East and North Africa. He had managed a "spin-off" company (focusing on cyclic technologies), was chairman on the board of directors at MWH (Montgomery, Watson & Harza) Consultants, is presently the technical advisor on wastes to bio-energy and wastewater management to three companies operating in ASEAN, China and India, and had served on the Singapore national expert panel for water reclamation.

He teaches environmental engineering and science at the undergraduate and postgraduate levels and has mentored postdoctoral fellows and guided the research of numerous Masters

and PhD candidates. Additionally, he contributed to engineering education through his involvement with the Singapore Engineering Accreditation Board where he was a founding member and was a key contributor to the drafting of Singapore's first Accreditation Manual for university engineering education.

He was Vice-Dean at the Faculty of Engineering, National University of Singapore and was then Dean until 2003. In 2004 the Faculty was ranked 9th in a world ranking exercise of engineering schools conducted by Times London. From 2003 - 2004, he was founding Director of the Environmental Science & Engineering Program and initiated a review of its BEng and MSc environmental engineering curricula leading to a more coherent BEng-MSc curriculum. The program has since transited to Department status. In 2005 he was appointed Singapore director of the Singapore-MIT Alliance and served the alliance universities - National University of Singapore, Nanyang Technological University and Massachusetts Institute of Technology, till 2006. Thereafter he was Director - Capability Development at the Environment & Water Industry Development Council, Ministry of the Environment & Water Resources where he worked on national funding for environmental R&D and manpower development. In June 2007 he was appointed founding Executive Director at the Nanyang Environment & Water Research Institute (NEWRI). The NEWRI ecosystem operates with six research centres and a group covering education, research, development, and interface with industry and community for applications and commercialization.

His contributions to industry, research, and education have been recognized with the ASEAN Engineering Award, Outstanding University Researcher Award, and the Chevalier dans l'Ordre des Palmes Academiques. His project on the anaerobic process for low strength wastewater was placed first in the national innovation competition for environmental technologies in 2004, and in 2008 he was appointed Tan Chin Tuan Centennial Professor.

Professor Peter Francis Russell LITTLE



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| Position | <p>2007 – Present: Director, Life Sciences Institute and Research Director, National University of Singapore.</p> <p>Responsibilities include strategic planning and analysis of life and biomedical research, University research performance indicators, co-ordination of NUS Virtual Institute for the Study of Ageing “VISA” and oversight of the Comparative Medicine Centre and Life Sciences Institute.</p> |
| Summary of research profile | <p>Research focused at the interface of biology and computing and combines genetic, microarray, statistical and bioinformatic expertise, building upon my past research strengths in genomics and molecular genetics. Our goal is to characterise the key factors underpinning the influence of genetic variation on the control of gene expression. To do this we have set up unique human and mouse model systems, and have created powerful genetic, statistical and quantitative genetic tools, featuring microarray analyses in a genetic context. We are extending these studies to protein levels and activity</p> |
| Qualifications | <p>1972 University of Bristol, B.Sc. Biochemistry 1976 University of Edinburgh, Ph.D. Molecular Biology</p> |
| Professional experience | <p>2009-present Director of Life Sciences Institute, NUS, Singapore 2008-present Professor of Biochemistry, Biochemistry Dept, NUS 2007-present Research Director, NUS, Singapore 2006 – 2007 Director of Research, UNSW Asia, Singapore 2003 - 2005 Head of School of Biotechnology & Biomedical Sciences, UNSW 2000 - 2007 Professor of Medical Biochemistry, UNSW 1992 - 2000 Reader in Molecular Genetics, Imperial College, London. 1987 - 1992 Lecturer, Imperial College, London. 1982 - 1987 Staff Scientist, Institute of Cancer Research, London 1981 - 1982 Research Fellow, Harvard University, USA; 1980 – 1981 Senior Research Fellow, California Institute of Technology, USA. 1976 – 1980 Postdoctoral Research Assistant. St. Mary's Hospital Medical School, London.</p> |
| Other experience (i.e. editorial positions, conference organisation, | <p>Present member of Editorial Board of Genome Research, Comparative & Functional Genomics, Briefings in Functional Genomics and Proteomics. Past; Int. Journal of Cell Biology, Editor of Technique (1995-7)</p> <p>Advisory roles: Australian NHMRC Program and Project</p> |

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| etc.) | <p>Grants, reviewer, interview panel; Australian ARC Reader</p> <p>UK Government committees:</p> <ul style="list-style-type: none"> • MRC: member of the MRC Human Genome Mapping Project Co-ordinating Directed Program Committee, the MRC Human Genome Project Co-ordinating Committee, Chair the MRC Human Genome Mapping Program Resource Centre Steering Committee, Chair of the MRC Comparative Genome Mapping Initiative • BBSRC: Member of the BBSRC Plant & Animal Genome Advisory Committee • OST: Member of the Office of Science and Technology expert working committee on the Human Genome Project, reporting to the Cabinet Office. • HSE: Member of the Advisory Committee on Genetic Manipulation risk assessment working group. <p>UK Charity Committees.</p> <ul style="list-style-type: none"> • The Wellcome Trust's International Interests Group, • The Leukaemia Research Fund Medical and Scientific Advisory Panel. <p>Academic and Industrial Consultancies Celltech Ltd., DNA Diagnostics, Amersham International plc., DuPont de Namours, Glaxo, Australian Genome Research Facility, Expert advisor in patent disputes, UK, Australia, New Zealand.</p> |
| Examples of competitive grants obtained in the last 5 years | <ol style="list-style-type: none"> 1. ARC discovery \$210,000, 2003-6 Genetic variation of transcriptional control. PFR Little 2. ARC Linkage Infrastructure. Functional Genomics \$532,000* - Linking Genomics and Proteomics: 2004 Prof Ian Dawes, Prof Peter Little, et al 3. ARC Linkage Infrastructure. \$505,000* Phenotype genotype comparisons using functional genomic approaches. 2005 Prof Ronald John Trent, et al |
| Total Number of Publications | 118 |
| h-index | 22 |
| Ten best publications | <ol style="list-style-type: none"> 1. Mark J Cowley, Chris J Cotsapas, Rohan BH Williams, Eva KF Chan, Jeremy N Pulvers, Michael Y Liu, David J Nott, and Peter FR Little. (2009) Intra- and inter- individual genetic differences in gene expression, Mammalian Genome 20: 281-95 2. RBH Williams CJ Cotsapas, MJ Cowley, E Chan, Nott DJ, PFR Little, (2006) Influence of microarray normalisation procedures on detection of linkage signal in genetical-genomics experiments, Nat. Genetics 38: 855 3. Peter FR Little (2005) Structure & Function of the Human Genome. Genome Research. 15 1759-66. 4. Little, P.F.R. (2002) Genetic Destinies. Oxford University Press. 5. Hoovers, J.M.N., Mannens, M., John, R., Blik, J., van Heyningen, V., Porteous, D.J., Leschot, N.J., Westerwald, A. and Little, P.F.R. (1992) High resolution localization of 69 potential human zinc finger proteins: a number are |

clustered. *Genomics* 12 254-263.

6. Koi, M., Johnson, L.A., Kalkin, L.M., Little, P.F.R., Nakamura, Y. and Feinberg, A. (1993). Tumor cell growth arrest caused by subchromosomal transferable DNA fragments from chromosome 11. *Science* 260 361- 364.
 7. Yoshida, T., Miyagawa, K., Odagiri, H., Sakamoto, H., Little, P. F. R., Terada, M. and Sugimura, T. (1987) Genomic sequence of hst, a transforming gene encoding a protein homologous to fibroblast growth factors and the int-2 protein. *Proc. Natl. Acad. Sci. USA.* 84, 7305 -7309.
 8. Orkin, S. H., Little, P. F. R., Kazazian, H. H. and Boehm, C. O. (1982) Improved detection of the Sickie mutation by DNA analysis- application to prenatal diagnosis. *New England J. Med.* 307, 32 - 36.
 9. Little P. F. R., Flavell, R. A., Kooter, J. M., Annison, G. and Williamson R. (1979) The structure of the human foetal globin gene locus. *Nature* 278, 227-231.
 10. Little, P. F. R., Curtis, P., Van Den Berg, J., Dalgleish, R., Malcolm, S., Courtney, M., Westaway, D. and Williamson, R. (1978) Isolation and partial sequence of recombinant plasmids containing human α -, β - and γ -globin cDNA fragments. *Nature* 273, 640 - 643.
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Fact Sheet on Research Centres of Excellence

Background

1. The Ministry of Education (MOE) and the National Research Foundation (NRF) established the Research Centres of Excellence (RCEs) Programme in order to spur research excellence in our local universities. RCEs focus on medium to long term world-class investigator-led research that is aligned with the long-term strategic interests of Singapore. The establishment of RCEs is co-funded by the NRF and MOE.
2. The RCE Programme aims to:
 - Attract, retain and support world-class academic investigators;
 - Catalyse the development of Singapore's autonomous universities (AUs) into research-intensive universities and strengthen their prestige globally;
 - Enhance graduate education in the AUs and train quality research manpower;
 - Engender interest in research among local students and encourage them to pursue research careers; and
 - Create new knowledge in selected areas of focus.

Organisation

3. Each RCE is hosted by a local university, and has significant autonomy in pursuing its own research mission and objectives. A Governing Board (GB) is established for each RCE to provide strategic direction and stewardship. The RCE is headed by a Director.
4. Each RCE typically has 15 to 20 principal investigators (PIs), although a larger RCE may have more PIs. Each PI leads a research team of post-doctoral fellows, postgraduate research students and support staff (technicians and administrative staff). RCE PIs also hold joint-faculty appointment at the host university or one of the other local universities.

Selection and Review

5. MOE administers the selection of quality RCE proposals through a two-stage selection process involving MOE's Academic Research Council (ARC).
 - a. Stage One: Universities submit whitepapers stating the vision of the proposed RCE and an indication of the resources and budget required. The ARC then shortlists RCE whitepapers to be developed into full proposals.
 - b. Stage Two: The ARC evaluates the full proposals, with input from external reviewers if necessary. Typically, the team that put up the

proposal would make a presentation to the ARC. The ARC then makes a recommendation to MOE and NRF.

6. An International Review Panel would be established by MOE/NRF to review the RCE's progress at regular intervals after the third year of its establishment.

Established RCEs

7. Four RCEs have been established since 2007. They are:

(a) Centre for Quantum Technologies (CQT). The CQT officially commenced on 7 Dec 2007, and is hosted by the National University of Singapore (NUS). CQT conducts interdisciplinary theoretical and experimental research aimed at overcoming the fundamental limits to information processing. It will develop quantum technologies that will be crucial in both cryptography and computation. In this respect, Singapore has joined a small group of nations that are capable of developing quantum information technology.

CQT is led by Professor Artur Ekert, previously Professor of Quantum Physics at the Mathematical Institute in the University of Oxford and the co-inventor of Quantum Cryptography.

(b) Earth Observatory of Singapore (EOS). The EOS officially commenced operations on 7 Dec 2008 and is hosted by the Nanyang Technological University (NTU). The EOS aims to create a pre-eminent world institution for understanding and addressing several of civilisation's most serious environmental threats.

Through fundamental knowledge of Southeast Asia's dynamic oceans, atmosphere and tectonic plates, the EOS will inspire and enable new approaches to ensure the stability, prosperity, sustainability and vitality of Southeast Asia through the coming decades and centuries. EOS is led by Professor Kerry Sieh, who was previously the Robert P. Sharp Professor of Geology at the Tectonic Observatory, California Institute of Technology.

(c) Cancer Science Institute, Singapore (CSIS). CSIS officially started operations on 18 Dec 2008. It is hosted by NUS, and conducts a multifaceted and coordinated approach to cancer research, extending from basic cancer studies all the way to experimental therapeutics. CSIS focuses on cancers endemic to Asian populations such as gastric, colorectal, leukaemia and breast cancers, and these advances will be applicable to cancers around the world. It is led by Professor Daniel Tenen who was previously Professor of Medicine at Beth Israel Deaconess Medical Centre, Harvard Medical School, and the Director of the Blood Program at the Harvard Stem Cell Institute.

(d) Research Centre of Excellence in Mechanobiology. The Mechanobiology RCE was approved on 19 Feb 09. It is hosted by NUS, and aims to develop a new paradigm for studying diseases by focusing on the mechanisms of cell and tissue mechanics. Physical factors, force and geometry play critical roles in defining tissue function, malfunction, morphology and regeneration. Researchers at the RCE endeavour to develop powerful quantitative physical and biochemical models to

define dynamic cellular functions, experimental reagents and tools for studying diseases of cells and tissues. The RCE is led by Professor Michael Sheetz, formerly the William R Kenan Jr. Professor from Columbia University.