



National University of Singapore

# Developing Asian-inspired solutions to global problems

**The National University of Singapore is becoming an attractive launch pad for postdoctoral researchers, who are drawn by world-class laboratories, ground-breaking science and extensive links to government, academia and industry both in Singapore and globally.**

In recent years, the National University of Singapore (NUS) has consistently come up tops in the regional and global assessments of academic institutions. The *Times Higher Education* World University Rankings 2016 ranked NUS first in Asia and among the top 30 universities in the world. And the 2016 Nature Index places it among the world's top 50 research institutions.

These rankings are recognition of the university's ongoing accomplishments in education and research. NUS' achievements have made it a hub for postdoctoral researchers hoping to take their science to

a new level. The opportunity to perform high-quality research in a well-connected, interdisciplinary environment with some of the world's best facilities and science leaders makes NUS a highly attractive launch pad for a successful research career. Adding to this, NUS' location in the midst of a rapidly transforming Asia offers the chance to be at the forefront of new discovery as the focus of research in fields such as health and the environment intensifies in the region.

The 111-year-old institution began as a medical school with 23 students in 1905, but it has gone on to become Singapore's premier research-intensive university with more than 3,300 researchers working in 17 schools and faculties. In addition, there are 27 university-level research institutes and centres, as well as three prestigious national Research Centres of Excellence (RCE) on campus, with NUS being a key partner in Singapore's fifth RCE.

Responding to the environmental, economic, health and social needs of Asia and the world, the university's areas of focus include materials science, integrative sustainability solutions, biomedical science, translational medicine and ageing. The highly organized and integrated nature of the island-state means that NUS researchers working in these and other areas can directly impact government policy, translating their research into real-world impact.

And while medicine continues to play a central role in the institution's research portfolio, the university also has teams pushing the boundaries of quantum physics, nanotechnology, chemical and biomolecular engineering, water and environmental research, and other fields.

## Space entanglement

On 16 December 2015, tensions were high among one of those teams at the NUS Centre for Quantum Technologies, an RCE.



Assistant Professor Alexander Ling (top left image on adjacent page) and his research group of 12, including five postdoctoral researchers and four PhD students, were waiting for the first data back from *Galassia* — an NUS-built experimental cube-satellite weighing about two kilograms — on which their quantum communication and computing device, called Small Photon Entangling Quantum System (SPEQS), had been propelled into orbit. It was a world-first attempt to see whether quantum technology functions in space — an early step in a much larger project to develop a highly secure quantum internet.

“The experiment was a success, and plans are already underway for further trials of the equipment,” says Ling. “Our aim is to establish space-to-ground links from satellites in low Earth orbit for quantum key distribution, a technique for secure communication. Having space-to-ground links will enable the development of a global network for distributing quantum entanglement.” Ling’s multinational team is one of the pioneering groups to use nanosatellites for performing fundamental science experiments in space.

In addition to being a multinational team, the work requires Ling’s lab to be multidisciplinary — bringing together a combination of deep scientific knowledge and instrumentation skills. Specialists in experimental quantum physics as well as mechanical and electrical engineering are working alongside each other towards a common goal. “Every single person in my team learns new things all the time, but this synthesis allows us to develop the solutions that are necessary for the instruments to operate in space.”

Back on Earth, strong government support means that NUS offers some of the world’s most sophisticated equipment and facilities, including the Singapore Synchrotron Light Source and the Centre for Ion Beam Applications.

In 2014, the Centre for Advanced 2D Materials was established with S\$50 million funding over 10 years from Singapore’s National Research Foundation. The funding is helping to run laboratories and micro- and nano-fabrication facilities used to explore and synthesize two-dimensional materials

such as graphene, as well as to develop new devices based on these exceptional materials. “There are very few places in the world that offer similar access to the tools optimized for research into graphene and two-dimensional materials,” says Assistant Professor Slavan Garaj (top centre image on adjacent page), leader of the centre’s Nano/Bio Physics Laboratory.

One of the benefits of having different research groups and disciplines working in these facilities is what Garaj calls the cluster effect. “Our community of like-minded researchers tackling different problems with the same tools leads to free permeation of practical know-how.”

His team includes seven postdoctoral researchers from five countries and among them are physicists, materials scientists, chemists and biotechnologists. “They are constantly learning from each other,” says Garaj. “The work offers an experience of nanoscience at its finest, with different scientific disciplines fused together.”

Similar to other NUS lab leaders, Garaj pays particular attention to the postdoctoral members of his team. “My firm belief is that my laboratory is only as successful as its alumni,” he says. He takes time to discuss their specific research career goals, works with them to adjust their projects in order to better achieve those goals, and helps to position them well within research and industrial collaborations.

### Crossing boundaries

Collaboration and interdisciplinary connections are an important facet of all major research activities at NUS. Some of these are housed on campus, such as those with the Massachusetts Institute of Technology and ETH Zurich. There are also important partnerships with top research institutions from around the world, including Harvard University and Stanford University. The newly formed Global Alliance between NUS, the University of Cambridge and University of California, Berkeley, will soon see the establishment of joint research programmes shared by the three universities.

Connections with industry also play an important role in research translation, commercialization and entrepreneurship. Professor Liu Bin (top right image on



adjacent page), a chemist, has been working with the healthcare industry and has co-founded the spin-off company LuminiCell to develop and commercialize her work at the forefront of cell luminescence. “The opportunities and schemes to encourage collaboration between academia and industry are tremendous in Singapore,” says Liu, who is acclaimed as one of the world’s most influential minds in science.

Work by Liu’s group in the Department of Chemical and Biomolecular Engineering at the NUS Faculty of Engineering looks at the design and synthesis of polymers with optimized light harvesting and small molecules with aggregation-induced emission, with a particular focus on water-soluble materials. “Our research has a direct impact on everyday life, from light-emitting devices to healthcare products,” she says.

And just as Liu’s work in cell luminescence enables us to shine a light in hard-to-reach areas — more effectively tracking diseases and transmitting communications — postdoctoral research at NUS provides an exciting podium for some of the best emerging scientific talents to spotlight the research questions of their choice with the finest facilities, the support of global science leaders and the opportunity for multidisciplinary collaboration on and off campus.

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Cleveland Clinic, a top two hospital in the United States by US News and World Report, is home to the Lerner Research Institute (LRI), consistently ranked in the top 10 of NIH funded research institutes in the US. A hallmark of the LRI is a focus on disease-oriented and high-impact research, representing collaborative interactions between scientists working in basic research laboratories and multiple clinical specialties. Major research areas include cardiovascular disease (Zhu, et al., Gut Microbial Metabolite TMAO Enhances Platelet Hyperreactivity and Thrombosis Risk 2016 *Cell* 165:111-24; Chen, et al., PCSK6-Mediated Corin Activation is Essential for Normal Blood Pressure, 2015 *Nat Med.*21:1048-53), cancer (Li, et al., Conversion of Abiraterone to D4A Drives Anti-Tumour Activity in Prostate Cancer, 2015 *Nature* 523:347-51; Schonberg, et al., Preferential Iron Trafficking Characterizes Glioblastoma Stem-like Cells, 2015 *Cancer Cell* 28:441-55; Eswarappa, et al., Programmed Translational Readthrough Generates Antiangiogenic VEGF-Ax, 2014 *Cell* 157:1605-8), and autoimmune and inflammatory disease (Kang Z, et al, Act1 mediates IL-17-induced EAE pathogenesis selectively in NG2+ glial cells. *Nat Neurosci*, 2013 16:1401-8; Martin BN, IKKalpha negatively regulates ASC-dependent inflammasome activation, 2014 *Nat Commun* 5:4977).

Postdoctoral opportunities are available for highly motivated individuals in multiple laboratories. Specific fellowship descriptions are available at <http://www.lerner.ccf.org/jobs/postdoctoral/>

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**FACULTY POSITIONS FOR PHYSICIAN-SCIENTISTS IN IMMUNO-ONCOLOGY**

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Please send curriculum vitae, a summary of current and proposed research programs, and arrange for three letters of recommendation to be sent to: Jedd Wolchok, MD, PhD and Marcel van den Brink, MD, PhD c/o Maria Alexander, Memorial Sloan-Kettering Cancer Center, 1275 York Avenue Mailbox #340, New York, NY 10065; E-mail: [facultyrecruit.mskcc@gmail.com](mailto:facultyrecruit.mskcc@gmail.com). Memorial Sloan-Kettering Cancer Center is an affirmative action, equal opportunity employer.

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More information and the online application are available on our website at [www.cellnetworks.uni-hd.de](http://www.cellnetworks.uni-hd.de).



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