# VITAL SCIENCE

APRIL 2009

DUKE NUS
GRADUATE MEDICAL SCHOOL SINGAPORE

## MESSAGE FROM THE DEAN

**Welcome to our first electronic Vital Science - a Duke-NUS Medical School publication that lets us share our latest advances in research and news about our students, key appointments and upcoming events.**

*Vital Science* started on a modest note with just two 2 printed issues in 2008. As part of our plans to stay closely connected to our faculty, students, staff, donors and stakeholders, we will be communicating our updates through this electronic publication on a quarterly basis.

This first issue gives insights into our medical training and innovative learning methodologies, and also touches on our unique team based learning approach where students are challenged to think critically and creatively. 2 of our young faculty members also outline their exciting research plans - plans that will greatly be accelerated by their National Research Fellowship awards. Lastly, as we all gear up to move into our new building by the middle of this year, we take you on a visual journey of our spectacular campus at 8 College Road.

To kick off this inaugural e-version of Vital Science, I agreed to sit down with the editor for an interview…

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## Teaming up for medical education

The faculty at Duke-NUS describes themselves as charged with creating tomorrow's leaders in medicine - and beyond that, giving their students a global perspective on emerging diseases. From devoting a year of the curriculum to research to ensuring close access to a world-renown faculty, the deans have initiated a new kind of medical training for their students.

This innovative, ambitious spirit perhaps is best witnessed in the classroom, where students team up to solve medical conundrums based on real clinical cases.

"For a traditional medical education, students sit through lectures and are expected to memorize information that quickly becomes out-of-date," says Dr. Sandy Cook, Associate Dean of Education. "We hope to instill more than that. In an open, creative classroom where students solve problems as teams, we have the opportunity to draw their attention to the core vales of medicine - to emphasize professionalism and humanism as well as knowledge."

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Neutralizing dengue

Illuminating the pathways of neural stem cells

## 2 young scientists win coveted National Research Foundation Fellowship awards

The National Research Foundation (NRF) Fellowship awards provide funding to exceptional young researchers from around the world to do independent research in Singapore. This year, 2 out of the 10 winners of this prestigious research award are assistant professors at Duke-NUS Medical School - Dr. Lok Shee Mei and Dr. Wang Hongyan. Each with US$1.5 million to spend on their research over the next 3 years, Dr. Lok will use the most leading-edge technologies in her attempts to neutralize the dengue virus, while Dr. Wang plans to expand her studies of neural stem cell proliferation and brain tumor formation to other cancers and model organisms.

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## Glimpses of the new campus

By end of May 09, all Duke-NUS staff will be moving into the new Khoo Teck Puat Building, located within the Singapore General Hospital grounds. Here is a sneak peek at some interior and exterior photos of the new premises.

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Editor: **Maureen Murray**
A quarterly publication by the Office of Communications and Development.

*For this issue, the banner features research from Dr. Wang Hongyan's lab (one of the NRF award recipients). Dr. Wang shows that the overgrowth of neural stem cells in the drosophila (fruit fly) leads to brain tumor formation - lending insight into cancer.*

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Dean Ranga Krishrian

## A Unique Opportunity

**Editor: When I recently interviewed Dr. John Rush, Vice Dean of Clinical Sciences, he said that medicine has been pretty much taught the same way for the past 100 years. Do you agree with him? And how is medical training here at Duke-NUS so divergent?**

**Dean:** John is right. Medical education has been relatively stagnant for 100 years. We have been fortunate to have this opportunity in Singapore. As a faculty, we can ask ourselves: Knowing everything we know now about medicine, research and teaching, what is the best way to train our students?

**Editor: How would you describe your students?**

**Dean:** I would say we have a more diverse group than most American medical schools. Our students tend to be older, some with other post-graduate degrees. We look at more global diseases than other medical schools, so we attract a more international student body with 13 countries represented. Interestingly, our students' educational backgrounds also are more diverse. We have engineers and even an anthropology major - they bring different perspectives and interests into our classrooms.

**Editor: Your approach to training medical students is considered very innovative. What's the philosophy behind it?**

**Dean:** We're trying to build what we consider "physician-scientists" rather than so-called medical doctors and by that I mean physicians who will end up doing research, either clinical or at the bench. We also hope many of our students will enter the health sciences field. I guess you could say we try to attract "inquiring minds" to Duke-NUS and our objective is to train them to be the future leaders in global medicine.

**Editor: The faculty and staff will be moving into the building this month. With the construction behind you, what lies ahead in terms of planning?**

**Dean:** We will be recruiting one or two more senior faculty and continue to build up our research by hiring young faculty. But you're right, we're entering our next phase of growth. We'll be working on creating an organizational culture for Duke-NUS. Every organization has 2 parts - its structure and function or its DNA and personality, if you will. Our goal is to create a matrix organization - one that learns and grows as time passes. It's more difficult to do than mapping out an organizational chart. We will be developing the tools and language for better communications. I think we're off to a good start with that. I know I'm surrounded by very high quality people.

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# Teaming up for medical education

At the newly established Duke-NUS Medical School in Singapore, deans and faculty have a rare opportunity to take a step back from the traditional medical school curriculum and start down a different path in training medical students. For instance, they have begun to question the importance of memorization for medical training. With rapid advances in medical technology and so much good information available on line, the faculty believe students need to develop a different skill set.

"As Vice Dean of Education Dr. Robert Kamei has pointed out, the best doctor is no longer the doctor with the best memory," says
Dr. Doyle Graham who teaches Duke-NUS first-year medical students.

"Our emphasis in teaching has shifted to learning and problem solving," Dr. Graham explains. "As a faculty, we're asking ourselves how we can promote creativity and critical thinking and how course material will actually be used down the line in the students' professional lives."

*"This class is the most powerful learning situation I've ever been in", says Dr. Graham (left). "It's the highlight of my teacher career." Dr. Puthucheary (right) co-teaches the course and is a consultant at the KK Women's & Children's Hospital.*

## *Team Based Learning takes root*

At Duke-NUS, lecture based courses have been replaced by a learning methodology that involves teamwork, called TeamLEAD - representing the core values of Learn, Engage, and Develop. With TeamLEAD, the students spend their class time divided into teams that work together to solve actual (and sometimes fictional) medical cases. It is a competitive, high energy and very animated process. To succeed, students must apply their book knowledge to diagnose and treat the patients in the faculty-written case studies.

"For me, establishing a new kind of training for medical students is a dream come true," says Dr. Kamei. "And the case studies allow the students to not only access their medical and scientific knowledge, but to apply it to real-life situations. The studies are very clear: the more you apply something you've learned the more likely you are to retain it."

## *Accountability for pre-class learning*

Interestingly, the burden is placed on the students to learn the content of the class material ahead of time and on their own. They download lectures from Duke Medical School in Durham, North Carolina and receive a long syllabus with textbook chapters and timely medical articles to read for each subject such as immunology or pharmacology.

"We're really standing on the shoulders of the Duke faculty," Dr. Graham says. "They offer us superb lectures. Our only variation is to try to present more Southeast Asian diseases than they do at Duke."

For typical medical school courses, students reportedly often come to class unprepared, hoping to absorb information from the lecture with plans to catch up on

*The applications push the students beyond memorizing core principles and facts, as they must understand how the information can be applied to a medical situation.*

the reading before exams. At Duke-NUS, the students are held more accountable for their pre-class preparation. A typical TeamLEAD session begins with an Individual Readiness Assessment that tests the student's understanding of the key concepts and most important information on any given topic.

Faculty members can easily extol the benefits of the pre-class preparation. For one, they say instructors do not have to waste time covering material the students can master on their own; instead they can give students a better sense of the clinical application of their studies.

Also, based on the students' multiple choice test results (which immediately and electronically are reported), the instructors can focus on areas where the students have struggled most.

Dr. John Rush, Vice Dean for Clinical Sciences, also points out that with Team Based Learning, students are asked to quickly retrieve and apply what they have learned. "This approach fosters deeper learning," he says, "and with medical information growing so quickly, our teaching cannot be simply content driven."

*This team is relying on their studies of pharmacology to diagnose and treat a fictional patient who has overdosed.*

## *The making of a team*

After the students have taken the Individual Readiness Assessment and learned their scores (they typically score 70% to 75%), class time truly begins with the Group Readiness Test. The students gather into teams of 6 or 7 and retake the closed-book exam but this time in a small group. They are given a fixed amount of time, usually 30 - 45 minutes, and report their answers again through the multiple-choice format.

The group test-taking also simulates another aspect of medicine: medical professionals usually work as a team to treat patients. With the group working together, the test scores soar to 95% on average.

"Being on a team is fun," says first-year medical student Valerie Tan. "And it augments my learning process. It's surprising how much you can gain from opinions other than your own."

The instructor steps into the spotlight only when the teams simultaneously report their answers. The instructor helps the teams verbalize their answers, directs discussion and facilitates debate.

"There is nothing like the power of the moment," says Dr. Graham, "watching the students' faces and energy after having struggled as an individual, and then working with other students, their colleagues really, as they are forced to reach consensus and present their decision to the rest of the class."

After a break, the students reconvene for a 3 hour "application session", devoted to a number of clinically oriented questions. Relying on their understanding of the material they just were tested on, the teams must come to consensus for each question. After 1 ½ hours, the faculty rejoins the class and the students report their answers. The faculty, accompanied by guest medical and research experts facilitate debate between teams about the merits of differing answers and stimulate the students to think like doctors, constructing differential diagnoses and treatment plans that become increasingly sophisticated as the course progresses.

## *A shift in emphasis*

Dr. Graham describes how the burden of the faculty shifts from writing lectures to coming up with patient cases that spawn open, spirited debate. “We’re always faced with the big decision,” he says, “how to present the content as a case, often rewriting questions, refining them after each session and continuously making judgments about which material is important.

As for the students, the emphasis changes from self-advancement to problem solving as a team. To ensure the success of the team (and to receive a good grade), students are accountable to their teammates for their individual preparation as well as their performance on the team.

Students are divided into teams simply based on their educational backgrounds. The teams are self-managed and evolve over the year-long series of basic science courses - with some of the more confident and assertive students eventually drawing out the quieter ones who may know the path to the right answer. Usually the more talkative students also become better listeners. The desire for the team to be successful motivates students and pushes them to reflect on their own style in the group.

*For the Body and Disease course, the faculty form their own team of course directors, content experts and administrators. Pictured here (from left to right) are: Dr. Tan Soo Yong, Pathology; Dr Hwang Nian Chih, Pharmacology; Dr. Puthucheary, TeamLEAD facilitator; Dr. Ponampalan, Emergency Room Physician and Content Expert for this exercise, Dr. Graham, Course Director.*

Faculty members find that over time, students usually adapt to each other to form a cohesive team, and then, with the aid of good case studies, the learning objective in the class becomes the same objective in the health care profession - to diagnose and treat patients in a setting that necessitates trust.

“Medical school has been practically taught the same way for the past 100 years,” says Dr. Rush. “At Duke-NUS, we’re starting to feel that we’re teaching the right skill set: problem-solving as a team, putting your hands on the right information quickly, and asking the right questions."

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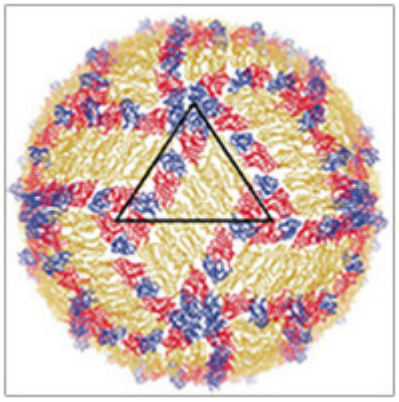
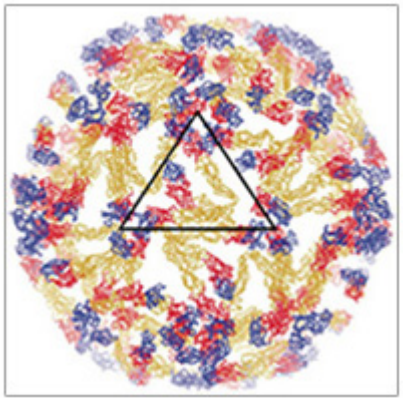
# 2 young scientists win coveted National Research Foundation Fellowship awards

## Neutralizing dengue



Native Dengue virus



Dengue virus complexed with antibody 1A1D-2, only E proteins are shown

Legend: Organization of surface proteins of dengue virus (left) and after complexed with antibody 1A1D-2 (right). This figure showed that the antibody could disrupt the surface protein organization of virus thus leading to the inability of virus to infect cells.

Over the next three years, Duke-NUS assistant professor Dr. Lok Shee Mei plans to use her $1.5 million in National Research Foundation funds to attempt to disarm dengue fever and dengue haemorrhagic fever, the most common mosquito-born viral diseases in the world.

Dr. Lok Shee Mei

“I have taken up the challenge of helping to develop a vaccine for dengue virus,” says Dr. Lok. “At Duke-NUS, in our research area of Emerging Infectious Diseases, there are 6 labs studying dengue and many other collaborations in Singapore beyond that. I believe our efforts will complement each other and accelerate our understanding of the dengue virus. You can feel the excitement here.”

A strong theme has shaped Dr. Lok’s work since she was a young graduate student: examining the strategies the immune system employs to combat viral disease and how viruses, in turn, evolve to counteract these strategies. “It is a constantly evolving battle,” says Dr. Lok. “We turn to many disciplines including genetic engineering, immunology and virology, to uncover these dynamics.”

Dr. Lok also relies on the most leading-edge technologies to gain better understanding of how dengue infects cells. During her graduate work at the Institute of Molecular and Cell Biology, Singapore, she was trained in X-ray crystallography, a technique that allows scientists to determine the structure of proteins.

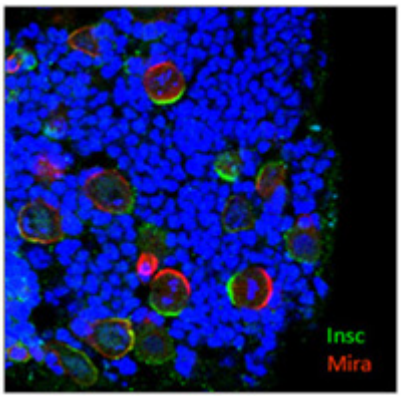
As a postdoctoral fellow at Purdue University, Dr. Lok used X-ray crystallography to show how antibodies can neutralize dengue by disrupting the virus’s structure (see figure). The antibody binds to the dengue virus and rearranges the proteins on its outer shell in a manner that prevents the virus from binding to other cells, rendering the virus incapable of infecting other cells.

With these experiments, Dr. Lok provided proof for a long-suspected mechanism of virus neutralization by antibodies. Many scientists believe this work could offer a promising approach for therapies and treatment for dengue and other infectious

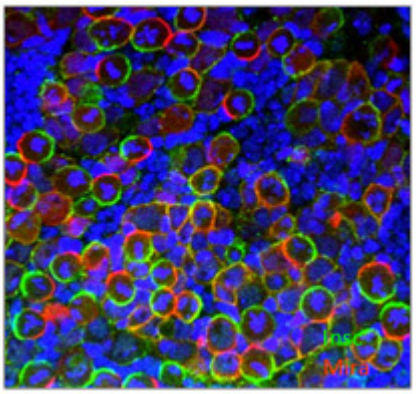
diseases, even possibly cancer.

“We are very excited about Dr. Lok joining the Duke-NUS Emerging Infectious Disease Program,” says Dr. Duane Gubler, who heads that research area. “She is doing world-class research that will greatly facilitate the development of antiviral drugs and vaccines for dengue fever and dengue haemorrhagic fever.”

## Illuminating the pathways of neural stem cells




Drosophila brain tumors
- Wild-type




Drosophila brain tumors
- a brain tumor mutant

Legend: Drosophila brain tumor suppressor prevents overgrowth of neural stem cells. Wild-type (normal) larval brain (left) and a brain tumor suppressor mutant brain (right) were labeled with two markers for neural stem cells (green and red). In the mutant, a lot more neural stem cells are generated in Drosophila larval brains, compared to the wild-type. This is because the mutant lacks a certain functional brain tumor suppressor that can inhibit the overgrowth of neural stem cells.

Dr. Wang Hongyan’s academic career has gotten off to a remarkably fast start as she won the Young Scientist 2008 and National Research Foundation Fellowship 2009 awards, two of the most coveted and competitive awards available to young scientists in Singapore.

“It is particularly noteworthy that while many of our faculty obtained their research training overseas, the seminal work that garnered Dr. Wang these awards was all done in Singapore,” says Dr. Shirish Shenolikar, interim program director of the Duke-NUS Neuroscience and Behavioral Disorders program.

He continues: “To me, this simply highlights the strength of the local training environment, that it can foster the successful development of talented young researchers like

Dr. Wang Hongyan

Dr. Wang’s expertise is at the intersection of neuroscience and cancer biology. She studies brain tumor formation and has worked alongside several laboratories around the world to establish Drosophila, the fruit fly, as a model organism for revealing the molecular mechanisms that control division of neural stem cells.

Neural stem cells divide asymmetrically: one cell becomes another neural stem cell while the other cell differentiates, heading down the path to become neurons or other mature cells in the brain.

Dr. Wang’s research has shed light on neural stem cell proliferation by examining how brain tumor suppressor genes regulate the division of neural stem cells to inhibit excess self-renewal that can lead to brain tumor formation.

Publishing in top international journals such as Nature and Genes & Development, Dr. Wang has received international recognition for this research.

To examine the function of human brain tumor suppressors, Dr. Wang is collaborating with Dr. Carol Tang and

Dr. Christopher Ang Beng Ti , National Neuroscience Institute, Singapore. In the future, she hopes her research also will

include the study of other cancerous tumors.

“The NRF award will help me to attract good, young scientists to my lab,” says Dr. Wang. “We can become more active in more areas, examining neural stem cell division in other model organisms such as the mouse and beginning to look at how asymmetric stem cell division can go awry in other tissues and organs. I chose to come to Duke-NUS because I think it’s one of the strongest neuroscience programs in Southeast Asia and the emphasis on medicine makes our study more meaningful for human beings. This extraordinary NRF funding allows my research to become much more expansive.”

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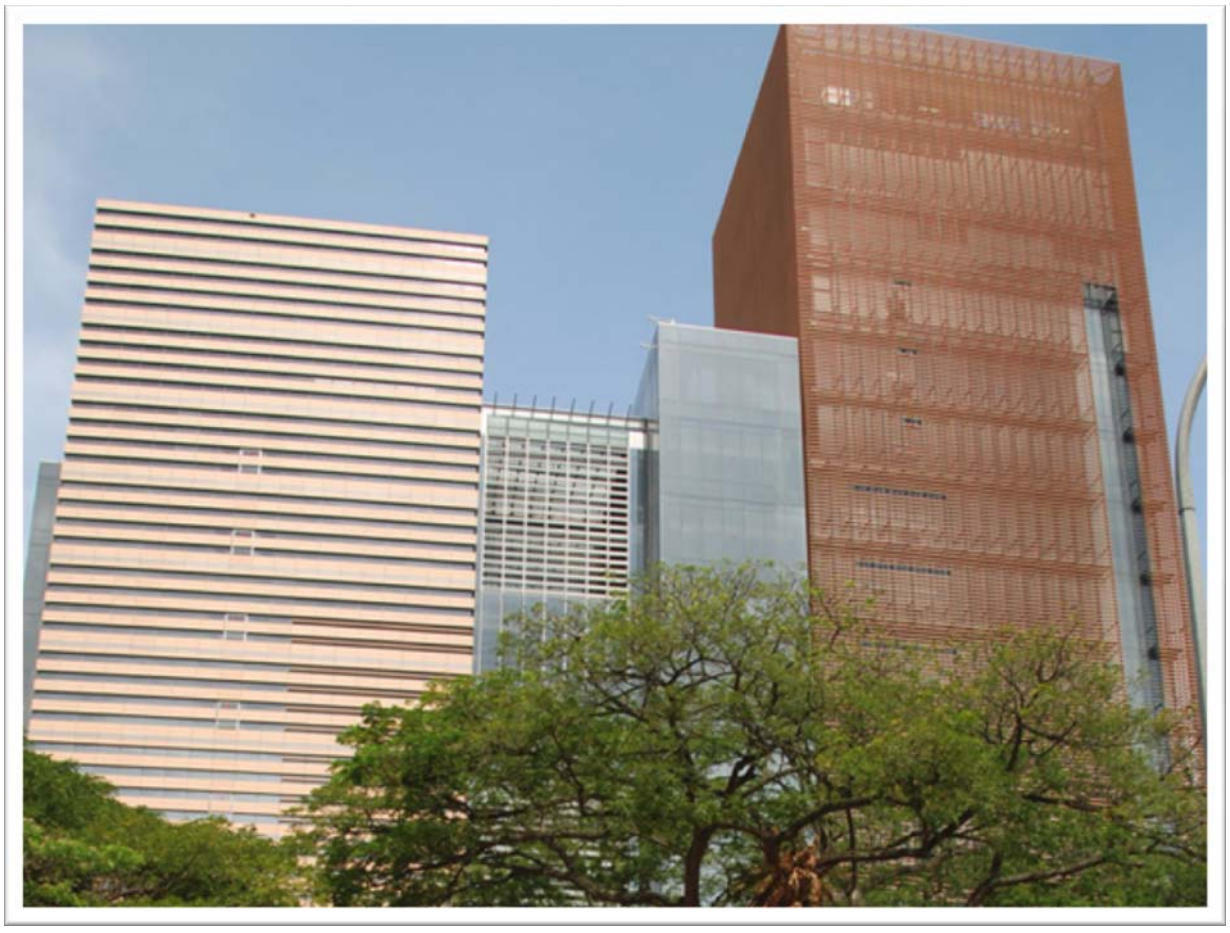
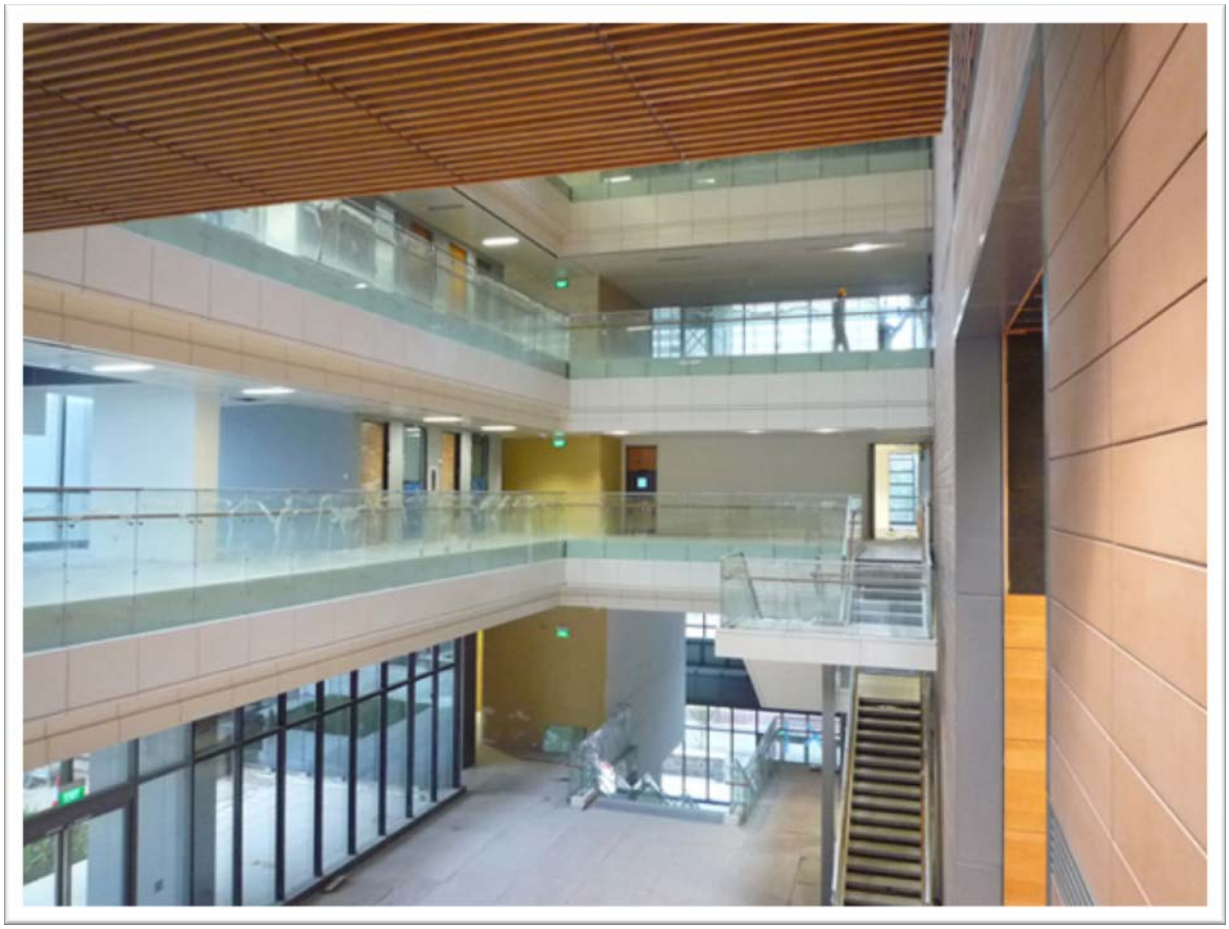
## Glimpses of the new campus

By end of May 09, all Duke-NUS staff will be moving into the new Khoo Teck Puat Building, located within the Singapore General Hospital grounds. Here is a sneak peek at some interior and exterior photos of the new premises.



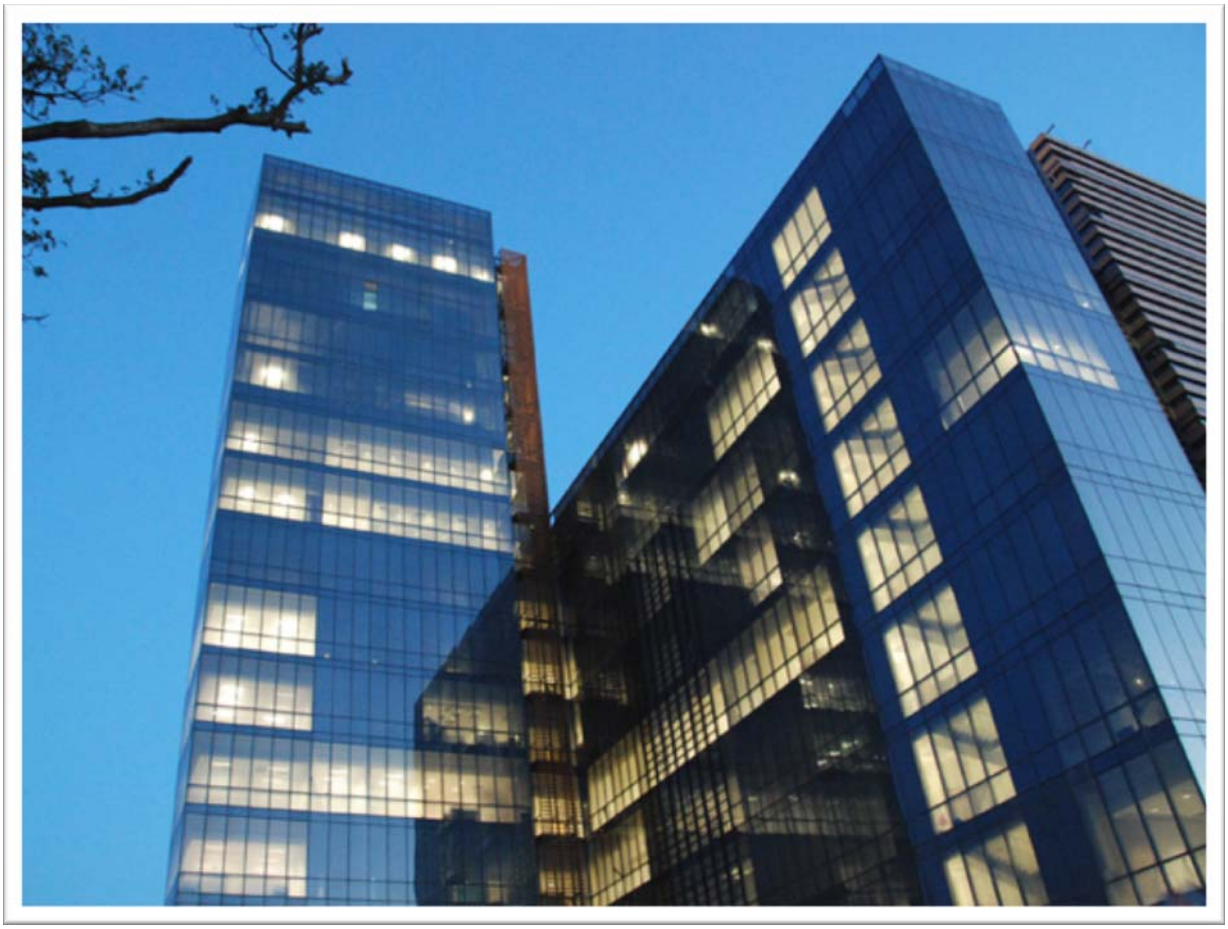
*The new Duke-NUS Medical School soars like a beacon within the grounds of Singapore General Hospital.*



*The strong architectural design encourages easy exchange between faculty, researchers, students and administrators - with its beautifully lit atrium, open staircases and hallways and its thoughtfully placed, casual meeting spots.*

*The interior of the building is organized around this 8-storey atrium - the heart of the very vertical campus. To one side of the atrium soars the 11-storey administrative tower with faculty offices, research support stations and “post-doc pods”. The deans’ office is on the top floor of this sophisticated tower and overlooks the hospital.*

*On the other side of the atrium, the 9-storey laboratory tower contains 5 research floors, organized according to targeted areas of study. The state-of-the-art teaching facilities are on the right.*



The Duke-NUS design is strongly influenced by Singapore's tropical climate, with an emphasis on sustainability. The primary materials are ceramics, glass and metal. It is a tranquil and spacious building with an open design that supports the Duke-NUS collaborative spirit.

*Photos by Tony Tay / Duke-NUS*

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