THE NUH has acquired high-tech equipment to keep superbugs—antibiotic-resistant bacteria—at bay. It spent $350,000 on five hydrogen peroxide (H₂O₂) and four macerator machines.

In operation since March, the H₂O₂—a bleaching agent—machines work in pairs, one to emit vapour to decontaminate the room, the other to break down the compound into harmless water and oxygen. “There is only so much you can do with manual cleaning,” admits Associate Professor Dale Fisher, NUH’s infectious diseases division head. He reveals that hard-to-reach spots and “innocuous items” such as remote controls don’t get the attention they need from manual cleaning. For now, “we’re focusing on the intensive care units and isolation units because that’s where most multi-drug resistant organisms are.”

Thanks to this system, patients don’t have to lug around their medical records, nor repeat their history each time they consult a doctor.

Located in City Vibe in Clementi Central, Frontier FMC is open Mondays–Fridays (8.30am–7.30pm) and Saturdays (8.30am–4.30pm). It is closed on Sundays and public holidays.

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n a nondescript building on the National University of Singapore Yong Loo Lin School of Medicine campus, a group of students are about to come face to face with the dead.

With gloved hands placed on cadavers lying on gurneys in front of them, students solemnly recite a pledge to respect the dignity and integrity of the human remains that they are about to work on. Earlier, they had learned of the care that the School takes in receiving and embalming the bodies to prepare them for prosection.

The students had also been told about the importance of according these once-living bodies proper care and respect, and also to recognise the generosity of their owners in bequeathing their bodies to the School for medical education. Video interviews with body donors were also shown to drive home the point that cadavers, referred to by Department of Anatomy professors as “silent mentors”, were once sentient, living people.

When it comes to training the doctors of tomorrow in the science of anatomy, cadavers are indispensable teachers that impart more than mere facts and information.
Silent teachers speak volumes

Cadavers at the School are used in anatomical teaching to help medicine, dentistry, pharmacy, nursing and life sciences students to understand the structural organisation of the human body as relevant to normal function, as well as to clinical examinations and surgical procedures, says the head of the Department of Anatomy, Professor Bay Boon Huat. Anatomical studies also prepare students for the study of pathology, so as to appreciate the basis of diseases in their clinical years.

Prof Bay adds, “There is currently no other mode of learning that can replace the hands-on experience derived from working with cadavers. While computer-aided learning has its benefits, many pedagogical studies have shown that practical experience with cadavers remains superior: how else can a medical student appreciate three-dimensional relationships and anatomical variations in the human body, and have a tactile understanding of real human tissue, organs, bones? How is that student to gain an understanding of normal and diseased tissue and their texture if he or she has no formative experience derived from working with cadavers?”

“In the year that they spend in anatomy studies, the students gain insights and understanding of the workings and structures of the human body. It is a deeply profound learning experience, one that we encourage them to express in words, even music.”

— Prof Bay Boon Huat
Catholic missionary Sister Genevieve Ng, MSS (Missionary Sister of Service), might be 75 years old, but she has the energy and the high-wattage smile of a teenager. It was her father, a Zen master who dedicated his life to serving his community, who inspired her to will her body to medical education.

“The Zen compassion was very strong. He said, ‘God put you here for one purpose: to make this world a better place for you, for the whole universe. So when you die, continue to do that good,’ she says with yet another smile.

Currently undergoing treatment for cancer, Sister Genevieve is a regular visitor to the National University Cancer Institute, Singapore. She has these words for people contemplating the idea: “What are you scared of? Your fear is the unknown. Yet the more you read of how it would benefit people, the more you’ll be filled with the knowledge of the good you will achieve, and the fear will disappear. It’s only a feeling. A feeling is neither good nor bad; it’s what you do with it that counts. If only people could see the results of what this research does.”

While software or computerised models for anatomy classes or dissection are a boon, “imbibing values like respect, responsibility and gratitude can never be achieved using web-based or other tools,” comments Associate Professor Ng Yee Kong. Also, computer-based learning takes away the human side of things, adds Associate Professor Rajendran K. “That’s the point of using real cadavers,” he insists. “It also drives home the point that every person is different. Each cadaver is different—like real patients.”

Since 2009, the department has used cadavers to emphasise the humanistic side of medicine. This stresses core values such respect, responsibility and gratitude, and is meant to inculcate in students the ethos that will guide them into becoming professional, caring and compassionate doctors.

The ceremony described earlier introduces first-year students to the...
THE ANATOMY STUDENT’S OATH

I, ___________, solemnly pledge to:
• uphold the honour and traditions of the noble medical profession
• conduct myself in a manner in line with the highest standards of professionalism
• treat this once-living human body with dignity, as I use it to further my professional goals
• show due respect and gratitude to my teachers
• constantly strive to add my knowledge and skills
• treat my colleagues as my professional brothers and sisters
I make these promises solemnly, freely and upon my honour.

study of anatomy. At the end of their year-long module, another ceremony rounds off this formative experience for the students. Then, the students are encouraged to reflect upon their work with cadavers in prose, poetry and music, explains Prof Bay. “In the year that they spend in anatomy studies, the students gain insights into and understanding of the workings and structures of the human body. It is a deeply profound learning experience, one that we encourage them to express in words, even music.”

Reflections
The music is stirring and the sharing heartfelt at the School’s recent 2013 Silent Mentor ceremony, during which fifth-year student Kwek Lee Koon speaks of her experiences as an exchange student at Tzu Chi University in Taiwan.

The cadaver she worked on belonged to a man who decided to donate his body to make a contribution to society. “He felt that throughout his 89 years of life, he had not really done anything. And he didn’t want to die being someone who hadn’t done anything,” she recalls. “So he said, ‘I want to make better doctors out of the young people today.’”

Seeing the person inside the patient
While the specimens that students work on here at the Yong Loo Lin School of Medicine are, in most cases, already dissected or prepared, the emotional experience is, nonetheless, memorable.

“Although the faces of these cadavers were unrecognisable, fingernails at the fingertips and strands of hair on the scalps were still visible, reminding me that these silent mentors were once alive and were people like us, with dreams, hopes, aspirations, disappointments and despair,” says first-year medical student Lynn Ong.

“They were my first patients, and also my irreplaceable, unique teachers of the human anatomy. My silent mentors taught by letting me explore the wonders of the human anatomy and learn the structures of the organs and vessels. Each encounter with them was also a lesson on the importance of the right frame of mind and corresponding attitude that I should always adopt as a student and later, a practitioner of medical science. Other than the knowledge of human anatomy, my silent mentors also taught me the importance of according each and every one of my future patients with the dignity and respect that they deserve.”

In many ways, these formative experiences are precisely what the NUS Yong Loo Lin School of Medicine intends: the aim is to turn out caring, informative, and clinically better doctors, says Prof Bay. “Doctors who develop emotionally as they improve practically, always considerate of the man, woman or child inside the patient.”

Very special people
Equally special are the people who donate their bodies to medical education, added A/Prof Rajendran.

While the number of people willing to gift their bodies is still very small in Singapore, the professors are hopeful that greater public awareness of the importance and benefits of body donation to medical science will lead to more of such bequests. They stress that the act of donating one’s body is a service to society. “This is a very noble act,” explains A/Prof Rajendran. “It benefits a lot of people; it’s appreciated. The process is not difficult and we are willing to advise and counsel the family or community on how body donation can be effected.”

After about three years of edifying and enlightening medical students, the body will be cremated and returned to the family. A/Prof Ng remembers a case when a family requested a sea burial for the ashes of their loved one. “So we accompanied them out to sea. The relatives were very touched,” he reveals.

If you would like to donate your body to the NUS Yong Loo Lin School of Medicine, or want more information about the donation process, visit http://medicine.nus.edu.sg/ant/body-donation/index.shtml or call 6516 3200 / 6516 3201.

The anatomy student's oath
In 2005, a pioneering form of heart surgery was performed in the US, in which surgeons entered a patient’s body through small incisions. Because the technique did not require the opening of the chest cavity, the patient faced fewer risks, felt less pain, recovered faster, and was discharged within a much shorter time compared to conventional open-heart surgery.

Minimally invasive cardiac surgery techniques continued to be refined, with even fewer incisions needed to accommodate increasingly miniaturised surgical tools and instruments. Now, Associate Professor Theodoros Kofidis at the NUHCS is helping to take heart surgery forward by introducing a procedure that requires only one cut—called single incision minimally invasive cardiac surgery (SIMICS).

**Past Methods**

Traditionally, heart surgery required the breastbone to be split open. This evolved to minimally invasive surgery, in which six cuts and portholes are made so that a surgeon’s tools can access the heart. “You need a hole for the heart retractor, a hole for the cross-clamp for the aorta, a hole for the camera, a hole for the CO₂, a hole down in the femoral artery, around the groin area to put in the cannulas—and you also need a cut [along the chest],” A/Prof Kofidis describes.

**Legend**

- Porthole
- Incision

**Figure 1:** Four portholes and two incisions are required in minimally invasive cardiac surgery.
A new approach to keyhole heart surgery at the National University Heart Centre Singapore (NUHCS) makes only one incision, and patients recover within days.

“ANY MORE MINIMAL AND WE’LL HAVE TO DO CLOSED- CHEST SURGERY, MAYBE VIA A SCANNER—BUT WE’RE NOT IN STAR TREK TERRITORY YET!”
— A/PROF THEODOROS KOFIDIS

NEW

This 6cm cut between the ribs is all SIMICS requires. A Glauber clamp keeps this incision open, while A/Prof Kofidis’ modified atrial retractor keeps the one on the heart open.

2 FEWER CUTS, MORE BENEFITS

By reducing the number of incisions from six to one, SIMICS offers a slew of benefits that regular minimally invasive surgery does not. Patients suffer far less trauma, which means they experience less pain and spend fewer days immobile on a hospital bed. These patients also recover more quickly—a mere four to five days compared to the nine on average that post-median sternotomy patients have to endure.

For the more than 200 patients in Singapore who suffer from mitral and tricuspid heart valve disease and present for surgery every year, SIMICS could turn out to be the gold standard—unless the patient has “too many conditions in the heart at the same time and requires expanded combined operations,” says the doctor. “Surgeons want patients to recover as quickly as possible, with the least difficulty, and I believe minimally invasive strategies promise that.”

LEARNING BY HEART

SIMICS didn’t come to A/Prof Kofidis in a single “Eureka!” moment.

Since 2009, he has been refining the procedure at NUHCS, gradually improving the technique and tools needed, one operation at a time. “I didn’t eliminate all the needed incisions at once,” he reveals. “I started by eliminating one cut in the first patient. Then on the second patient, I eliminated two. You don’t want to try too many things on the same patient until you are certain.” It took three for A/Prof Kofidis to do away with all but one incision.

“So, with all the incisions and portholes eliminated, we’re left with only one incision,” he beams. “And that is truly the least invasive cardiac surgery you can perform on a human being for open heart surgery. Any more minimal and we’ll have to do closed-chest surgery, maybe via a scanner—but we’re not in Star Trek territory yet!”

FIGURE 2: BY DEVELOPING NEW TOOLS AND TECHNIQUES, A/PROF KOFIDIS REDUCED THE NUMBER OF CUTS TO A SINGLE INCISION ALONG THE CHEST AND A “NEEDLE PRICK” IN THE THIGH.
BEGINNINGS

It all began when a newly graduated doctor realised he could contribute to the care of Singaporean children.

Like so many doctors who started their career in the 1970s, the young Dr Quak Seng Hock’s contact with the late Professor Wong Hock Boon—widely regarded as Singapore’s founding paediatrician—influenced his decision to care for children as a career.

“I was inspired by Prof Wong and chose paediatrics because it’s about the start of life. We have a chance to influence our patients, teach them about good healthcare.”

Back then, there were fewer sub-specialist fields within paediatric medicine, and trainees handled more patients and worked longer hours as general paediatricians. It also meant a wider and deeper exposure to the field of paediatrics. “We only had a few specialised departments, such as cardiology to treat heart diseases and neurology to treat mentally handicapped children and children with epilepsy,” he reveals.

THE PAEDIATRIC LANDSCAPE

Access to clean water, availability of vaccines, and convenient access to doctors...
and medical facilities are factors the veteran doctor says are key to Singapore’s success in paediatric care. Savvy parents also play a part: “Smaller families mean that parents know what’s going on with their children, and better-educated parents tend to seek medical opinions more readily,” he explains.

Another feather in the cap for paediatric medicine here is the decline in mortality among children with biliary atresia (defective bile duct). The condition was often diagnosed very late, with no effective treatments available. Thanks to the introduction of liver transplants in the 1980s, young patients are now able to enjoy a new lease of life, Prof Quak notes with quiet satisfaction.

Although Prof Quak and his team have steadily built a liver transplant programme comparable to the best in the world, he chooses to use another example of progress in paediatric medicine here: the treatment of children with cancer. New methods—such as bone marrow transplant, specialised care for the various other organs such as kidneys and livers, as well as special, personalised medication regimes developed by paediatric oncology colleagues at the National University Hospital and National University Cancer Institute, Singapore—have led to increased survival rates for childhood leukaemia. “Today, the survival rate stands at over 80 percent, and I think this is a truly great achievement.”

**DOCTOR TO GENERATIONS**

Happy clinical outcomes have also translated into enduring relationships with Prof Quak’s patients. Out of the thousands of patients that he has attended to, many have become friends.

“I remember a patient whom I first saw when he was four or five years old,” he reminisces. “He was afflicted with ulcerative colitis.” The inflammation of the bowels was a rare, chronic condition at that time and required many bouts of treatment over a long period of time. As a result, Prof Quak got to know his patient over the course of more than 20 years.

Today, the patient is a police officer, and the kindly doctor who cared for him through those long years has become a friend and trusted family physician. “The family calls me ‘Ah Quak’, and contacts me even for minor medical problems.”

**THE NURTURER**

Father to two adult children, the professor’s propensity to nurture finds expression in the Penang laksa that he occasionally surprises his staff with. “Everything I know, I learnt from my mother and aunts,” he discloses. Some of the ingredients for the tangy noodle dish are grown in his garden, also home to some carefully tended orchids.

Cooking and gardening are therapeutic to the good doctor, and he applies the same diligence and care that characterise his work as a children’s doctor. In many ways, his efforts in the kitchen and garden express his belief in the twin virtues of careful preparation and attentive nurturing; his patients would testify to that—as would those who have sampled his Penang laksa!

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**NUHS TRIBUTE NIGHT 2013 AWARD WINNERS**

Held biennially, the NUHS Tribute Night honours members of the medical community who have had an impact on clinical care, research and education. Here are the other awardees:

**MASTER CLINICIAN AWARD:**
Professor Arijit Biswas, for his leadership of the Department of Obstetrics and Gynaecology, and aligning the standards of its obstetric services with international benchmarks.

**OUTSTANDING MENTOR AWARD:**
Associate Professor Koh Dow Rhoon, for his contributions, mentorship and leadership in clinical education in the NUHS and in Singapore.

**TRANSLATIONAL RESEARCH INNOVATOR AWARD:**
Associate Professor Allen Yeoh Eng Juh, for his continued leadership in the field of paediatric oncology to further strengthen the NUHS’ position in this field.

**EXCELLENCE AWARD:**
Associate Professor Quek Swee Chye, Associate Professor Dale Fisher and Associate Professor Fred Wong Wai-Shiu, for their contributions towards the NUHS’ clinical, research and education missions.

**YOUNG ACHIEVER AWARD:**
Dr Jason Phua, Dr Lynette Teo Li San, Dennie Hsu Der Li and Joann Pang Wei Shen, for their demonstrated excellence in their professional fields, promising leadership skills and exemplary role modelling.
The experts who prepare cadavers for medical education possess cool, clinical detachment and a visceral awareness of the preciousness and impermanence of human life.

Dr Omid Iravani looks up from the corpse before him. “He had heart surgery!” he notes, tapping a scalpel on a thin strip of wire deeply embedded in the cadaver’s chest. On the other side of the room, 12 more embalmed bodies lie on gurneys, surrounded by first-year medical students busily scrutinising various organs and tissue.

Dr Iravani teaches at the Department of Anatomy in the NUS Yong Loo Lin School of Medicine. When he isn’t enlightening students in lecture theatres, he can most often be found in the department’s Anatomy Hall, preparing bodies so his charges can see—and feel—what constitutes a human body.

THE REAL DEAL

“Prosection is a prior dissection, preserving the body in the best shape and structure for educational purposes,” Dr Iravani says. Prosectors are experts in the field, and may be MBBS- or PhD-qualified.

The Yong Loo Lin School of Medicine emphasises a hands-on approach to the study of anatomy, and students are taught about body systems and parts through examination, touch and feel of cadaveric tissue. These classes are supplemented by sessions involving the use of computerised models and other IT-based teaching tools. “Whatever we read is two-dimensional, while a real-time, three-dimensional view of the human body cannot be found in the textbooks or computers,” Dr Iravani maintains. “Without studying human anatomy in actuality, medicine is meaningless. Anatomy is really the mother of all medical sciences, and it cannot be thoroughly learnt without the use of prosected cadavers.”

The Iran-born prosector outlined three key roles that a teacher of anatomy has to fulfil. Firstly, to consolidate his
own knowledge, gleaned from theory, by physically handling cadavers; next, to pass on that knowledge to his students; finally, to prepare the prosected specimens for the Department of Anatomy.

During a typical class, students are handed a list of tissue parts to locate and identify, based on the previous day’s lecture. Dr Iravani looks on as an aorta and a liver are pointed out, then he goes on to explain the forms and functions of each viscera to his class. What he is especially interested in, however, is finding structural variations—for instance, supernumerary arteries and nerves with aberrant courses and pathologies such as a fibrotic liver or a diseased lobe of the lung. “These variations and pathologies can also be used in anatomical research,” he adds.

Dr Iravani constantly refers to the cadavers that he works on as “treasures” or “precious materials”. When a body is received by the Department of Anatomy, prosectors begin the process of preparing the human remains for eventual study. An embalming liquid is first injected into an artery before the body is submerged into a formalin tank for a few months. This preserves the body and keeps tissues intact. Then, dissection is performed to clearly reveal the structures within the human body; thereafter, classes can commence.

After two to three years, the cadavers are cremated or returned to their families, their mission of educating and preparing a new generation of budding doctors accomplished.

**LIFE AS A CHERRY BLOSSOM**

The cadavers also serve to constantly remind the prosector about the impermanence of life. “Human beings are delicate, fragile, prone to death. It doesn’t matter if you are strong or not. Life is very short, and people should try to get the maximum benefit out of it while respecting each other; it shouldn’t be wasted away carelessly. It is also about acknowledging and accepting what the Japanese call mono no aware: the impermanence and transient nature of things, especially mortal beings.”

Contemplation of life aside, prosectors need to be inquisitive. “Without curiosity and interest, nobody would be able to draw full benefit from the practice of dissection,” Dr Iravani notes. Those qualities are what compelled him to sign up as a forensic pathologist in his native Iran, a position he held for six years. He arrived in Singapore in 2007 on an A*STAR scholarship to obtain his PhD in Cancer Biology and Genomics, which eventually led to his current academic post in the Department of Anatomy.

“Human structures are quite complicated. The more you read and dissect, the more knowledge you can gain in Anatomy. We cannot say we know everything. The anatomical sciences are really vast.”

— DR OMID IRAVANI

Top: First-year medical students learn the basics of the human body with hands-on practical sessions. Above: Dr Omid Iravani points out the forms and functions of organs and tissue while curious students look on, with one clutching a list of the organs and tissue to be identified.

“HUMAN STRUCTURES ARE QUITE COMPLICATED. THE MORE YOU READ AND DISSECT, THE MORE KNOWLEDGE YOU CAN GAIN IN ANATOMY. WE CANNOT SAY WE KNOW EVERYTHING. THE ANATOMICAL SCIENCES ARE REALLY VAST.”

— DR OMID IRAVANI

11
CRUSTACEAN CREATIVITY

Inspired by delicious chilli crabs, two professors seize on a “Eureka!” moment to develop a device that makes gastric tumour removal a breeze. Food for thought, indeed!

**GASTRIC TUMOUR REMOVAL** has always been one of the trickier surgical procedures. Many man-hours are required for this invasive surgery, and patients usually need extensive post-surgery care.

However, in 2004, Associate Professor Louis Phee from the Nanyang Technological University and Professor Ho Khek Yu from the National University Hospital had an epiphany that would forever change the way gastric tumours are removed.

The two men were sharing a meal with Hong Kong surgeon Sydney Chung when they noticed the efficiency of a crab’s pincers. Six years later, they completed the development of the Master and Slave Transluminal Endoscopic Robot (MASTER), which uses two small robotic arms at the end of an endoscope, controlled by a console and monitored via a computer screen. The surgeon manipulates the arms to remove gastric tumours much more quickly and with fewer procedural difficulties.

Introduced in 2011, this new procedure reduces surgery time from eight hours to a mere 17 minutes—no hospitalisation needed, and without any noticeable scarring, either.

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**THE GRASPER**
The grasper is an extension of the surgeon’s hands and can open up to 180 degrees to provide a firm grip on the targeted tissue, such as a tumour.

**THE HOOK KNIFE**
The hook knife cuts and cauterises the targeted tissue at the same time, thus minimising bleeding.

**ARM CONTROLLERS**
The two arm controllers translate the surgeon’s motions into real-time movement by the endoscopic instruments with great accuracy. Having two end effectors allows the user to triangulate the position of the targeted tissue to perform the surgical procedure efficiently.

**SCREEN DISPLAYS**
The screen displays the distal end of the endoscope. It gives the surgeon a real-time look at the procedure.
A Digital Reflection of...

NUHS’ DEDICATED NURSES*

19:1
RATIO OF FEMALE TO MALE NURSES

66 Number of nurses who have been with NUHS for at least 25 years

3,054 TOTAL NUMBER OF NURSES

53.2 PERCENTAGE OF NURSES WHO POSSESS A BASIC DEGREE OR HIGHER QUALIFICATION

14 NUMBER OF COUNTRIES OUR FOREIGN NURSES HAIL FROM

22 NUMBER OF FULL-FLEDGED ADVANCED PRACTICE NURSES

*as of 31 Mar 2013