



Advancing
Medical Care
Through
Research

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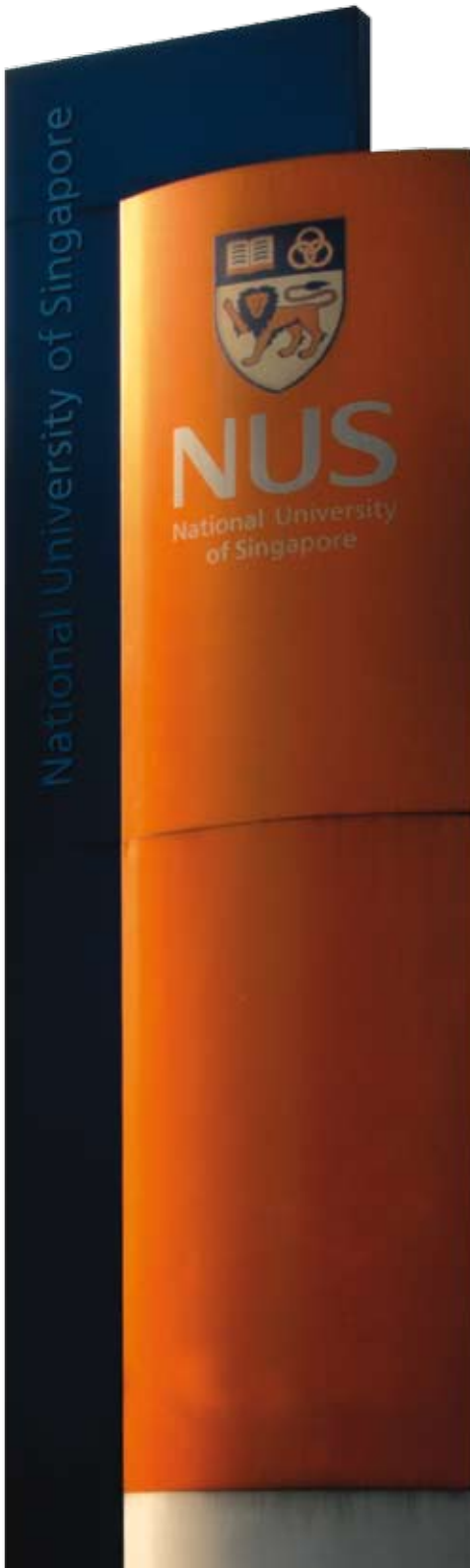
SHAPING

medicine for the future

Advancing health by integrating excellent clinical care, research and education.







The inaugural Journal of Clinical Research Milestones 2006/2007 is published by the National University Health System (NUHS) to commemorate notable research achievements made by our clinicians and basic scientists at NUHS. NUHS is the joint entity that brings the National University Hospital (NUH), the National University of Singapore (NUS) Yong Loo Lin School of Medicine (NUS-YLLSoM) and the NUS Faculty of Dentistry (NUS-FoD) under a common governance framework.

The establishment of NUHS is a historic landmark for NUS and NUH. NUHS will create a dynamic and exciting environment that will actively enable clinicians, basic science and clinical researchers to work closely together. This collaborative framework will help focus the full power of the basic science research expertise in Singapore and beyond, to bear on studying important health problems and diseases, particularly those which are most relevant to Singapore and Asia. In turn, this will lead to better quality of clinical care, better outcomes, and significant locally-developed medical advances.

In this inaugural Journal of Clinical Research Milestones, you will read about inspiring discoveries in varied fields in the past 2 years, ranging from new treatment for knee pain to customised therapy to cure children with leukaemia. These are but a sampling of the exciting work that our researchers and clinicians are carrying out at NUHS, to improve the quality of patient care and enhance health for all.

At NUHS, we are greatly energised by the opportunity to bring more basic science discoveries into useful application in human health and disease. We hope through these success stories, to share our excitement and aspirations with you. Happy reading and thank you for your interest and support!

Sincerely,

Prof Tan Chorh Chuan,
Chief Executive, NUHS



National University Hospital

Researchers spot adaptive brain in schizophrenia study

Order parts of brain can be recruited to compensate for damaged areas

Researchers at the National University Hospital (NUH) have found that the brains of people with schizophrenia are not as damaged as once thought. In a study published in the journal *Biological Psychiatry*, the team led by Associate Professor Dr. Lim Ee Teng, found that the brains of people with schizophrenia are able to recruit other parts of the brain to compensate for the damage caused by the disease.

Kids' tummy aches may be linked to parents' job loss

A change of school or learning stress can also trigger recurrent stomach pain in children, according to an NNU study

A study by researchers at the National University Hospital (NUH) has found that children's stomach aches can be linked to their parents' job loss. The study, published in the journal *Journal of Child Psychology and Psychiatry*, found that children whose parents had lost their jobs were more likely to experience recurrent stomach pain. The researchers also found that a change of school or learning stress can also trigger recurrent stomach pain in children.

5 patients get 'new' knees in NUH stem-cell trial

Once torn or worn out, the damaged cartilage created both because it has no direct access to oxygenated blood. The body is able to repair surface damage to the cartilage only very slowly, and usually by repair a scar tissue.

The new technique is expected to allow the creation of kind of stem cells needed, known as mesenchymal stem cells (MSCs), even only in small numbers in the bone marrow.

The bone marrow carries three types of stem cells — the blood-forming cells...

the study shows how easy to get children's stomach aches. In fact, the study found that children whose parents had lost their jobs were more likely to experience recurrent stomach pain. The researchers also found that a change of school or learning stress can also trigger recurrent stomach pain in children.

Why junior has stomach pains

SOME of the factors found to contribute to the problem of recurrent stomach pain in children are:

- A change of school
- Stress from school work
- Constipation
- A diet high in...

S'porean helps find to grow liver cells

Scientists from the National University Hospital (NUH) have found that S'porean can help in the growth of liver cells. The study, published in the journal *Journal of Cellular Biochemistry*, found that S'porean can help in the growth of liver cells.

The ethnic difference

same ethnic group. Dr Goh noted that the forefathers of the Chinese and Indian subjects were mostly from the south of both countries.

The study found that there are variations in the makeup of the gene in different races.

This means that Indians need 6mg a day of warfarin, compared to 3.5mg a day for the Chinese. Malays need an intermediate dosage.

Dr Goh added that a person with mixed heritage may have "intermediate" genetic makeup and may thus require an intermediate dosage of warfarin.

The study was published in the January issue of the prestigious international peer reviewed journal, *Clinical Pharmacology and Therapeutics*.

As the study is clinically significant and has immediate application, NUH will soon embark on another project to validate the findings of the study, this time among volunteer patients. If validated, warfarin may well be the first drug in the world to be prescribed in dosages based on the patient's ethnic group.

The NUH is also studying some 10 drugs — mostly used in chemotherapy — which the various ethnic groups demonstrate different reactions to.

"Currently, we prescribe according to literature that comes from the West," said Dr Goh. Recent studies conducted in the West show that Caucasian patients may require higher dosages compared to non-Caucasians.

What if the patient shows ad versus side-effects? The obvious step would be to reduce the dosage if subsequent treatment, he said though there is also the possibility that the initial dosage can result in fatal consequences.

Dr Goh added that doctors Singapore often have to adjust dosage of chemotherapeutic drug in 20 to 30 per cent of patients.

CARPARK ENTRANCE

Vereflu, a new test kit that can identify 15 influenza strains at the same time, is on trial at NUH.

A collaborative effort between Veredus Laboratories in Singapore and ST Microelectronics in Geneva, Vereflu combines Singapore biotech research with European semi-conductor technology.

The test kit uses a fingernail-sized lab-on-chip that integrates the DNA process of polymerase chain reaction (PCR) test and the semi-conductor device, microarray.

Human DNA, taken from a patient's mouth or nose, is transferred onto the chip. If a virus is present, the PCR test will magnify a minute sample of the genetic material found in it within 20 to 45 minutes.

By picking out the key feature of the virus, which act like fingerprints, the microarray is then able to match these "fingerprints" to those of a database of known viruses. Diagnosis is achieved in 1½ hours. In contrast, current tests take 1 to 4 hours to detect a single virus.

15 flu strains have been programmed



into the chip. As Dr Rosemary Tan, CEO of Veredus Laboratories, said, "If you have any one of them, the test will pick it up and tell you which one it is."

Vereflu can also indicate if the virus is drug-resistant or has mutated. Capable of detecting avian flu strains that have not crossed over to humans, Vereflu can therefore provide a first line of detection.

Found to be 99 per cent accurate in the manufacturers' laboratories, Vereflu is being tested by NUH using patient samples in a real-life laboratory. Each sample is tested twice, using current technology and the lab-on-chip technology, to determine how sensitive, accurate and usable Vereflu is.

Associate Professor Raymond Lin, Department of Microbiology, Yong Loo Lin School of Medicine, NUS and Clinical Director of NUH's Molecular Diagnosis Centre, said, "We hope to test a few hundred samples and have results to show in 6 months."

If the trial proves successful, Vereflu is expected to be used at clinics, immigration checkpoints and even farms caught in the middle of a flu pandemic.

Assoc Prof Raymond Lin said, "In a pandemic, it slows things down if all samples have to be sent to only a few laboratories with expensive equipment and trained personnel. This test, on the other hand, can be rolled out to more places."

Identifying 15 Flu Viruses at Once

"In a pandemic, it slows things down if all samples have to be sent to only a few labs with expensive equipment and trained personnel. This test, on the other hand, can be rolled out to more places."



New Blood Vessel Stent Improves Outcomes in Patients with Heart Attacks

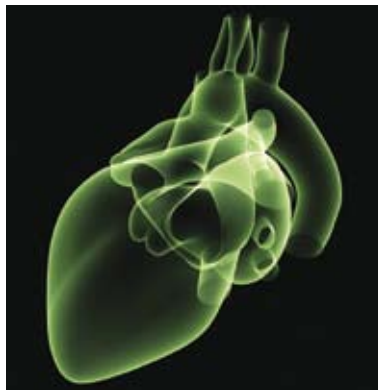
NUH doctors have pioneered the use of a new type of blood vessel stent that can promote coronary artery repair. It is safe and effective and keeps the probability of recurrence at below 5% at 1 year.

Coronary Heart Disease (CHD) is the most common form of heart disease. It is a result of coronary atherosclerosis (“hardening of artery”) and plaque (“fatty deposits”) formation, which narrow the coronary artery such that the supply of blood to the heart is affected, thereby resulting in myocardial ischemia.

The primary treatment for CHD is coronary angioplasty. Through balloon angioplasty and stenting, doctors expand the narrow vessel and implant a metal stent to support the vessel so that the blood supply to the cardiac muscle is restored.

Associate Professor Tan Huay Cheem, Department of Medicine, Yong Loo Lin School of Medicine, NUS, and Head of NUH’s Cardiac Department, explained that with the current technology, the success rate of stent implantations is as high as 95 per cent. The probability of CHD patients getting post-surgery heart attacks, stroke and other complications is very low.

However, the implantation of a stent in the patient’s blood vessel can injure the inner wall of the vessel, and vessel narrowing is also likely to occur in 20 to 30 percent of the patients.



Assoc Prof Tan pointed out that over the years, the medical fraternity has been improving on coronary angioplasty techniques and product development to increase the patients’ survival rates and prevent subsequent heart attacks.

In recent years, NUH doctors have been using the new Endothelial Progenitor Cell (EPC) capture stent when performing coronary angioplasty on non-shock patients with heart attacks. By capturing the circulating stem cells in the blood, these cells can then quickly form new layer of blood vessel cells, speed up the normal repair of vessels and prevent them from narrowing.

The NUH study led by Assoc Prof Tan showed that not only is the EPC capture stent safe, it is also highly effective in reducing the need for a patient to return for a repeat interventional procedure as a result of artery re-narrowing.

“The safety of the EPC capturing stent is the same as the normal metal stent, but it comes with an additional function of early vessel repair,” said Assoc Prof Tan.

The incidence of cardiac mortality in patients who received this stent during hospitalisation was about 5%, and this is low considering the high risk nature of their illness.

Assoc Prof Tan said that of the 320 patients who underwent the new treatment, none exhibited problems of stent thrombosis 30 days after their surgeries.

“The safety of the EPC capturing stent is the same as the normal metal stent, but it comes with an additional function of early vessel repair,” said Assoc Prof Tan. He added that after the surgery, the patient will only need to be kept on combination blood-thinning drugs for only a month to prevent thrombosis from forming within the stent.

With new reports showing that the implantation of drug-coated stents increases the chances of late vessel thrombosis, hospitals have been careful in the use of drug-coated stents. Given such a situation, the EPC capture stent may prove to be an ideal substitute in this group of patients. With the NUH experience, the stage is set for a potential wider use of ‘pro-healing’ stent like EPC capture stent in patients with heart attacks.

Moving forward, Assoc Prof Tan said, “The next step is to conduct more tests to confirm that the EPC capturing stent is more ideal than the current treatments available.”

From 2 Days to 2 Hours - Testing for Down's Syndrome in Unborn Babies



There is now relief for anxious mothers-to-be who currently have to wait for days before they know whether their baby has Down's Syndrome. NUH doctors have developed a groundbreaking procedure that cuts the waiting time significantly.

Patented as FlashFish, the technique was developed by a group of doctors led by Associate Professor Mahesh Choolani, Department of Obstetrics and Gynaecology, Yong Loo Lin School of Medicine, NUS, and a Senior Consultant in NUH's Department of Obstetrics and Gynaecology. Down's Syndrome is a genetic condition that causes delays in physical and intellectual development. About 1 in 700 babies are born with Down's. They have 47 chromosomes instead of the usual 46.

Both FlashFish and the current test, called Fish, use the number of chromosomes to detect if a baby has Down's. Both use a needle, inserted through the mother's abdominal wall, to draw amniotic fluid from the

womb. But only 2ml of fluid is needed for FlashFish, as compared to 5ml for Fish. The fluid is full of fetal cells, through which chromosomes are then scrutinised.

According to Assoc Prof Choolani, the breakthrough was achieved using advanced biology techniques. By manoeuvring a molecular probe directly into the cell's nucleus, the probe (which is a tiny piece of DNA) can latch on to a matching sequence in the cell to determine if it is defective. Chromosomal abnormalities are detected by FlashFish in 2 hours, marking the first time prenatal diagnosis can take place within the same day. According to Assoc Prof Choolani, the research showed that the test is 99 per cent accurate, matching the accuracy of the current Fish test.

The findings of this 2-year research project were published in the prestigious British medical journal *Molecular Human Reproduction* in June 2007.

“By shortening the waiting time, this rapid service is one practical help we can offer to parents to reduce their anxiety.”

This test, said Assoc Prof Choolani, will come in useful, as more and more women become mothers later in life. In Singapore, 1 in 4 pregnant women are aged above 35 years. According to statistics, the risk of giving birth to a Down's baby is 1 in 350 for women aged 35, rising to 1 in 100 at age 40. Every year in Singapore, about 10,000 mothers-to-be choose to have an amniocentesis, which uses the current Fish technique to test for genetic abnormalities.

The patent has been licensed to INEX Innovations Exchange and NUH is now the first in the world to offer the FlashFish test.

As FlashFish poses no additional risks to the mother and costs about the same as the standard test, Assoc Prof Choolani expects that other institutions, both in Singapore and beyond, to adopt it in time to come.

Said Assoc Prof Benjamin Ong, Chairman of the Medical Board at NUH, “By shortening the waiting time, this rapid service is one practical help we can offer to parents to reduce their anxiety.”

How Gene Affects Dosage

Why do Indian, Chinese and Malay patients require different dosages of warfarin, the commonly-used anti-clotting drug, to achieve the same effect?

NUH doctors have solved this long-standing mystery by successfully tracking down the gene that determines why Indians need 60 to 70 percent more warfarin than their Chinese and Malay counterparts.

This discovery stands to benefit thousands of patients, as warfarin is widely used by doctors, including orthopaedic specialists, cardiologists, surgeons and gynaecologists. Additionally, it also raises the possibility of prescribing medicine based on ethnicity in the future.

“That drug behaviour is different between races is something we have always been very interested in,” said Associate Professor Goh Boon Cher, leader of the research team from the Department of Pharmacology, Yong Loo Lin School of Medicine, NUS and a Senior Consultant in NUH’s Haematology-Oncology Department.

The difference in drug behaviour in different ethnic groups poses problems in the case of warfarin. When too little is given, the clot persists. If too much is given, the patient will bleed to death.

“One has to be very accurate with dosage. Previously, after the drug was given, blood tests would be carried out to determine the amount of thinning in the blood,” said Assoc Prof Goh.

This procedure to establish how much warfarin a patient needs takes hospitals up to 3 weeks of laboratory work. But that’s set to change with the NUH discovery.



In the course of the 2-month study conducted in 2005, the NUH team analysed the gene that recycles the body’s Vitamin K. “The latter is the target of warfarin in the anti-clotting process,” explained Dr Lee Soo Chin, a Consultant and member of the team in NUH’s Haematology-Oncology Department.

The breakthrough came when the team discovered that there are variations in the genetic makeup of different races: Indians need 6mg of warfarin a day, compared to 3.5mg a day for Chinese, and an intermediate dosage for Malays.

The study focused on 275 people comprising Chinese, Indians and Malays, whose parents and grandparents were from the same ethnic group. From this focus group, Assoc Prof Goh observed that most of the Chinese and Indian forefathers came from the south of their respective countries.

Published in the January 2006 issue of the prestigious internationally peer-reviewed journal, *Clinical Pharmacology and Therapeutics*, the study is clinically significant and has immediate application. As such, NUH has embarked on a project with

“That drug behaviour is different between races is something we have always been very interested in.”

volunteer patients to validate the findings of the study.

If validated, warfarin is likely to be the world’s first drug that is prescribed according to the patient’s ethnic group.

NUH has launched similar studies on 10 drugs, mostly used in chemotherapy, which also derive different reactions from various ethnic groups. This will prove vital as doctors in Singapore often have to adjust the dosage of chemotherapeutic drugs in 20 to 30 percent of patients.

“Currently, we prescribe according to literature that comes from the West,” said Assoc Prof Goh. While the dosage is subsequently reduced if the patient shows adverse side-effects, Assoc Prof Goh highlighted that the initial dosage can result in fatal consequences. On top of this, recent studies from the West show that Caucasian patients may require higher dosages than non-Caucasians.

These factors underline the importance of this NUH study in determining how gene affects the drug dosage that is required by patients of different races.



NUH has adopted a new, highly accurate scanning software that can effectively detect the early signs of glaucoma from the surface of the optic nerve, allowing doctors to step in at an early stage.

Glaucoma is an eye disease caused by an increase in intraocular pressure. This is the balanced pressure exerted by the aqueous humour – liquid that fills the anterior and posterior chambers of the eye – lens and blood quantity in the eye on the eyeball wall.

With age, the production of aqueous humour increases while the discharge of it decreases, thereby adding to the pressure on the eye. This gradually results in the damage of the optic nerve and loss of sight. In some cases, patients have gone blind in just a few months.

Glaucoma has no obvious symptoms. Patients may have the disease for years before they realise that their eyesight is deteriorating.

Dr Jovina See, Head of Glaucoma Services at NUH, noted that while this scanning procedure, called HRT3, seems no different from the common scans, it is differentiated by its ability to construct a 3D image of the patient's optic nerve and surrounding tissue based on the scan.

This provides doctors with a clear view of the changes in the optic nerve

Detecting Glaucoma Early

structure, which is important because past studies have shown that structural changes emerge in the optic nerve before glaucoma patients experience changes in their visions.

The most apparent symptom is the necrosis of up to 40 per cent of the ganglion. Some studies have shown that it takes up to 6 years from the time structural changes in the optic discs are detected, for the eyesight to begin deteriorating

With NUH's precise screening device, doctors are now able to identify glaucoma patients at the earliest stage of their condition.

Having specially installed a computer network at the NUH Eye Department, doctors are now able to conduct examinations and track the structural transformations in their patients' optic nerves.

Dr See said, "The patients can now see clearly for themselves the changes in their optic nerves. This will help them to understand their condition better and convince them to take their medication regularly."

The entire scanning procedure is simple and fast. Patients just have to look at the mark inside the imagery device and the screening is completed in a few seconds. There is no additional fee for this apart from the usual glaucoma screening fee.

The NUH Eye Department receives 300 to 350 glaucoma patients every week, 90 per cent of whom are aged above 60. This examination is especially useful to those with a family history of glaucoma or those whose intraocular pressures are abnormal. This examination can

With NUH's precise screening device, doctors are now able to identify glaucoma patients at the earliest stage of their conditions.

determine if they do have glaucoma so that doctors can commence treatment before their eyesight worsens.

Making milestones in a similar field is the Ocular Genetics Research Group.

Led by Associate Prof Aung Tin and Adjunct Assistant Professor Eranga Vithana, Department of Ophthalmology, Yong Loo Lin School of Medicine, NUS, the Ocular Genetics Research Group is involved in a variety of research projects investigating the genetic basis of inherited ocular disorders.

These include linkage analysis of pedigrees with closed angle glaucoma, candidate gene studies of glaucoma, genetic studies of inherited retinal degeneration, as well as corneal dystrophies, to name a few.

In 2006, the group was the first to discover a gene for a blinding childhood eye disorder called Congenital Hereditary Endothelial Dystrophy (CHED). Published in *Nature Genetics*, this discovery is fundamental as it opens new avenues of genetic research into the most common form of age-related corneal degeneration, Fuchs' Dystrophy - a condition which blinds millions each year and is a major indication for corneal transplantation.

Liver Cells Successfully Grown in Laboratory

There is hope for more than 100 people who die of liver failure in Singapore every year. For the first time, scientists have succeeded in growing liver cells in the laboratory.

Dr Dan Yock Young, Assistant Professor, Department of Medicine, Yong Loo Lin School of Medicine, NUS and a Consultant in the Department of Gastroenterology and Hepatology, NUH, was one of the research teams in the United States that achieved this medical first. Dr Dan spent 2 years at the University of Washington in Seattle, where the team used cells from aborted fetuses to grow liver cells successfully.

Dr Dan explained that the team used progenitor or stem cells to do so, as they have the ability to become specialised cells that can carry out different functions in the body. These cells have the potential to multiply after being placed in the liver. Based on this, the team injected human stem cells into healthy mice and 3 months later, they reported that the cells were still thriving, and were performing as healthy liver cells.

The next step is to inject these cells into mice with diseased livers, to see if they can regenerate the sick livers. Dr Dan said, "I hope that these cells will be able to replace a significant portion of their liver."

However, he did caution that it would be some years before the treatment would be ready for trials in humans.

The work has been published for other researchers in this field to build on. Dr Dan, 1 of the 26 clinician-scientists at NUH, has brought his new expertise back to Singapore, where he continues

Dr Dan has achieved "100 population doublings" of the cells without affecting their quality. This doubling of the same cells 100 times is a key step to getting enough liver cells for clinical use – patients with liver failure need about 50 million healthy liver cells.

his research whilst regularly returning to Seattle to keep abreast of the latest developments.

Every year, more than 100 people die of liver failure in Singapore because liver transplants are few and far between. There were only 2 cadaveric livers available in 2006 and a total of 13 from 2007 through the first half of 2008.

With this technique, Dr Dan has achieved "100 population doublings" of the cells without affecting their quality. As patients with liver failure need about 50 million healthy liver cells, this doubling of the same cells by 100 times is a key step towards having enough liver cells for clinical use.

As it is unrealistic to obtain cells from an aborted foetus all the time, the plan is to grow large quantities of foetal liver cells in the laboratory and store them for future use, with sufficient varieties to provide a close match for any patient.

Even if injecting the liver cells into patients does not work, Dr Dan explained that the cells might still help to sustain life by providing external dialysis for liver patients. This will be extremely useful as those with end-stage liver failure cannot undergo dialysis for years the way patients with kidney failure can. Also, liver dialysis machines can only keep patients alive for a couple of days.

Hence, dialysis machines made with these progenitor liver cells might solve the problem and buy valuable time for patients until they can obtain a liver and undergo a liver transplant.



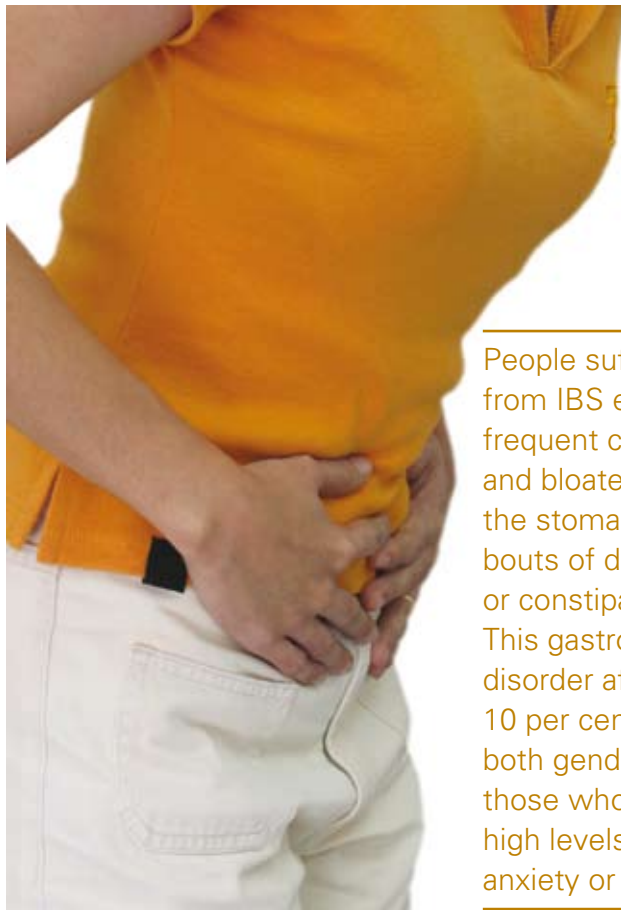
Discovering the Link Between Pain and Irritable Bowel Syndrome

An NUH study has found that Irritable Bowel Syndrome (IBS) sufferers are more inclined towards a lower threshold of pain. As defined by Professor Ho Khek Yu, Head and Senior Consultant, Department of Medicine, Yong Loo Lin School of Medicine, NUS and Department of Medicine, NUH, "IBS is a functional bowel disorder characterised by abdominal pain and changes in bowel habits, which are not associated with any abnormalities seen in routine clinical testing."

People suffering from IBS experience frequent cramping and bloatedness in the stomach, painful bouts of diarrhoea or constipation. This gastrointestinal disorder affects about 10 per cent of adults of both genders, striking those who experience high levels of stress, anxiety or depression.

Said Prof Ho, "The purpose of this research is to find out why IBS patients have abdominal pain. We were investigating whether the processing of pain in, and by, the brain, is different in these patients compared to healthy individuals."

Undertaken by Prof Ho and Prof Clive H Wilder-Smith, Visiting Professor, Department of Medicine, Yong Loo Lin School of Medicine, NUS, the study involved groups of IBS patients and healthy individuals. Each group was given two sets of the same visceral pain stimuli to determine the effectiveness of their pain filter.



People suffering from IBS experience frequent cramping and bloatedness in the stomach, painful bouts of diarrhoea or constipation. This gastrointestinal disorder affects about 10 per cent of adults of both genders, striking those who experience high levels of stress, anxiety or depression.

In a medical first, the doctors used an imaging tool to view the activation and deactivation of the brain processing.

They found that the emotional and cognitive processing areas, the main brain areas associated with the pain

filter, showed abnormal activation in IBS patients, but not in healthy individuals.

This helps to explain why the intensity of pain felt by IBS patients does not diminish when a second pain stimuli is introduced. For a healthy person, the intensity of pain felt from one source can be mitigated by a second pain stimulus.

For example, shaking one's hand violently after it has been cut reduces the pain of the cut. However, the opposite is true for IBS patients. With the defect in their pain filters, introducing an additional pain stimulus actually increases the pain from the first.

"Our studies have indicated that there may be a problem in certain centres of the brain, especially those pathways linking the emotional, cognitive and automatic nervous system responses of the brain in people with IBS," said Prof Ho.

As a result, people with IBS have a lower pain threshold. Their pain filters appear to malfunction, amplifying instead of dampening the nervous input from the gut to the brain, leading to a propensity for both abdominal pain and an increased sensitivity to somatic (skin or surface) pain.

Said Prof Ho, "Compared to healthy subjects, IBS patients tend to have

a more sensitive bowel. This can be explained by the finding that IBS sufferers have a lower pain threshold for perceiving abdominal pain, when compared to individuals who don't have IBS. Hence, IBS patients may feel pain even when the intensity of a stimulation they receive is within a normal range."

To aid the management of pain in IBS patients, the most commonly used medications are antispasmodics to prevent spasms in the stomach, intestine or bladder. These include anti-muscarinics (to inhibit the muscarine toxin), smooth muscle relaxants and calcium channel blockers. Low-dose antidepressants are also used as pain relievers.

This study has broader implications for other pain syndromes in future.

Noted Prof Wilder-Smith, "Our group is the first to demonstrate a filter dysfunction in IBS and the first to perform brain imaging of this dysfunction to demonstrate which areas are involved."

The research group is looking at the function of the pain filter during post-operative pain, to see if its function in an individual predicts the amount of pain that the individual will have after surgery.

"Thus, there are wide applications for any area involving pain and treatment," said Prof Wilder-Smith.



"Our studies have indicated that there may be a problem in certain centres of the brain, especially those pathways linking the emotional, cognitive and automatic nervous system responses of the brain in people with IBS," said Prof Ho.

New Treatment for Knee Pain

An innovative new treatment for knee cartilage problems, devised by a team from NUH's Department of Orthopaedic Surgery, has entered the clinical trial phase.

In the first of 2 stages, patients undergo a minor operation to harvest mesenchymal stem cells (MSCs) from their bone marrow. MSCs are used to kickstart a regeneration of new cartilage, as they typically replenish bone marrow and provide new cartilage and bone cells.

Microfracture surgery is also performed in the same operation, where tiny holes 3mm in diameter are drilled into the patient's knee.

The second stage of treatment takes place 3 weeks later, when the stem cells are injected into the knee. Simulating damage to the joint, the tiny holes "attract" these stem cells to the localised area, where they begin growing into new cartilage.

"This minor, one time surgery is the key difference between this new treatment and the more invasive open surgery of current methods used at hospitals here," said Dr Kevin Lee, the principal investigator of the project.

Conventional treatment comprises the extraction of the MSCs, followed by an invasive operation of plugging gaps in the defective joint and injecting the harvested cells into it in order to repair the damaged cartilage.

Noted Associate Professor James Hui, Department of Orthopaedic Surgery, Yong Loo Lin School of Medicine, NUS



This is timely given the estimate that in less than 20 years, 1 in 4 persons in Singapore will be aged above 60. "Better treatment options will be needed as knee cartilage problems become prevalent among Singapore's rapidly greying population," Assoc Prof Hui noted.

and Senior Consultant, Department of Orthopaedic Surgery, NUH, a co-investigator of the project, "Current treatment methods of arthroscopic microfracture and the autologous chondrocyte implantation involve either invasive surgery or are often unable to provide permanent relief.

With results of the clinical trials available since the end of 2007, Dr Lee expressed hope that the new technique would change the current situation.

To date, the project has received \$100,000 from the National Healthcare

Group to make this new treatment available at Singapore hospitals within 2 years.

This is timely given that 1 in 4 persons in Singapore will be aged above 60 in less than 20 years' time. "Better treatment options will be needed as knee cartilage problems become prevalent among Singapore's rapidly greying population," Assoc Prof Hui noted.

New Generation Drug Prolongs the Lives of Cancer Patients

It is a new generation drug and it may just become an alternative to chemotherapy, with fewer side effects.

An early clinical trial of a “small molecule” drug used for treating advanced stages of cancer has concluded at NUH. The trial, which began in January 2006 and lasted for 12 months showed that the 25 lung and liver cancer patients involved had their conditions stabilised.

“While the drug does not shrink the tumours, it stunts their growth and makes them less solid, and hence less deadly,” said Associate Professor Goh Boon Cher, Department of pharmacology, Yong Loo Lin School of Medicine, NUS and Senior Consultant of NUH’s Haematology-Oncology Department who led the trial.

These are promising results that offer hope in prolonging the lives of patients. Most of the patients, who would have died within 3 months without treatment, “could survive for another 4 to 5 months”, explained Assoc Prof Goh who led the trial.

While Assoc Prof Goh acknowledged that this might not seem like much, he

“But these trials involve new and novel agents with different mechanisms of action so the potential to help is there,” said Dr Lim.

also pointed out that it is so far the only alternative to chemotherapy.

Chemotherapy is the conventional treatment that may help terminally ill patients live for another 2 months. However it comes with more side effects - chemotherapy kills cancerous cells but ends up destroying healthy cells at the same time.

This is where small molecule drugs differ from chemotherapy. Small molecule drugs, a new generation of cancer drugs that were first introduced in 2001, target and block specific proteins that are involved in cancer growth.

The new drug inhibits “tyrosine kinases”, which are molecules that help transmit messages to cancer cells to proliferate or ignore death signals.

Although Assoc Prof Goh noted that the strategy appears to have worked well on the patients involved in the trials, he added, “We are also still quite far from knowing the true potential of this new drug, which is why we are starting the second phase of trials on it soon.”

The next stage of the trials has begun and it involves about 100 liver and lung cancer patients.

As yet unnamed, the drug is being developed by a United States-based pharmaceutical company. This trial marks the first time that a new generation cancer drug is tested here, “which is good for Singapore’s reputation for holding clinical trials,” Assoc Prof Goh said.

As part of a move to grow the country’s

biomedical industry, Singapore has been trying to develop this nation into a preferred destination for companies to conduct early-stage trials of their products.

The early-stage trials, being Phases 1 and 2, are more scientifically challenging, and demand a higher level of expertise. Out of the 4 phases of tests which new drugs typically go through, most new drugs fail at these stages.

Singapore has been on the clinical trial track for a while now, with the number of Phase 1 trials conducted here increasing more than two-fold since 2000. According to the Health Sciences Authority, 48 Phase 1 trials were conducted in the financial year 2006/2007 as compared to 21 in 2000.

Today, Department of Haematology-Oncology, NUH has developed a niche in first-in-man clinical trials.

“It’s the very early stage of drug development, and the aim is to determine what’s the right dosage to prescribe and how patients will take to the drugs,” explained Dr Robert Lim, Chief of Department of Haematology-Oncology, NUH.

These trials are designed to ensure patient safety as bodily functions are closely monitored and tests are done in a scientific and graduated manner.

Not all cancer patients want to participate in such drug trials, nor do they meet the eligibility criteria. “But these trials involve new and novel agents with different mechanisms of action. Hence the potential to help is there,” said Dr Lim.

Customised Therapy to Cure Children with Leukaemia

For high-risk patients, they intensified therapy and even used bone marrow transplants at the outset. This doubled the chance of cure to 60 per cent.

Acute lymphoblastic leukaemia is the most common form of childhood cancer, accounting for 1 in 3 cases of cancer in children. According to a recent NUH study, this once uniformly fatal disease in children is now curable in 8 out of 10 children.

In light of this development, the research focus of NUH's University Children's Medical Institute has progressed to that of refining therapy.

This relates to the delicate balance of treating aggressively enough to kill the cancer cells, whilst minimising harm to normal cells and the long-term side effects. The latter is significant because long-term survivors of childhood cancer have at least 60 years of life ahead of them.

The study group comprised 50 children with leukaemia diagnosed in NUH between 1995 and 2000.

Said Associate Professor Allen Yeoh, Department of Paediatrics, Yong Loo Lin School of Medicine, NUS, team member and a Senior Consultant at NUH's University Children's Medical Institute, "We figured that patients who responded quickly to therapy would have a much better outcome than those who responded more slowly."

The problem lay in discerning the difference.

Assoc Prof Yeoh described how a month after therapy, leukaemia cells were no longer visible under the microscope in almost every child. But given the 30 to 40 per cent relapse rate, it was obvious that some of the children still harboured leukaemia.

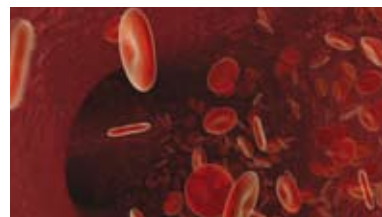
The persistent leukaemia cells after therapy are the main cause of relapse. These resistant leukaemia cells are also difficult to detect.

"If we could develop a highly sensitive technique to detect and accurately reflect the number of these persistent leukaemia cells, we would be able to tailor the intensity of therapy based on their response," noted Assoc Prof Yeoh.

The team developed unique molecular markers for each leukaemia patient, which are designed to amplify only the DNA of cancer cells. "This enabled us to accurately detect one leukaemia cell hiding among 10,000 normal cells, in almost every child," said Assoc Prof Yeoh.

The team also designed a specific DNA probe that stuck only to the chemical letters unique to the cancer cell. After they homed in on the cancer cells, they put in enzymes that increased the number of specific leukaemia DNA copies by up to 100,000 times.

This marked a 50-fold improvement



in sensitivity, as compared to a conventional microscope, which can detect 5 leukaemia cells in the background of 100 normal cells.

In a promising discovery, the team found that a patient had more than 90 per cent chance of being cured when he had fewer than 1 leukaemia cell out of every 10,000 normal cells within the first 3 months of therapy. When this figure was not reached, the patient had only a one-third cure rate.

This ability to predict the outcome early on allowed the team to personalise therapy.

For the low-risk patients, the team decreased the intensity of therapy, reducing more toxic chemotherapy by 60 per cent without compromising the outcome.

For high-risk patients, they intensified therapy and even used bone marrow transplants at the outset. This doubled the chance of cure to 60 per cent.

"Making treatment decisions early is critical because in cancer, we have only one good shot at a cure," said Assoc Prof Yeoh. "Optimal treatment strikes the best balance between cure and long term side-effects," he added.

The lessons learned from these studies have in turn helped to achieve a high cure rate for children with cancer.

Said Assoc Prof Yeoh, "A cure means a return to normal life; allowing these children to move past their shaky start, to have a fair shot at schooling, working, and having families of their own."

The RUNX family genes, comprising RUNX1, RUNX2 and RUNX3, have attracted intense interest in recent years due to the discovery that these genes are widely involved in human cancer.

Professor Yoshiaki Ito, principal investigator at the Institute of Molecular and Cell Biology (IMCB) and Director of the NUS Oncology Research Institute, is one of the researchers who played an instrumental role in discovering the RUNX family genes.

Of particular interest is RUNX3, which belongs to a group of genes called tumour suppressors. When these genes are damaged for any reason, tumours develop. Disruption of the RUNX3 gene causes gastric cancer as well as many other types of cancers, including those of the bladder, breast, colon and lung.

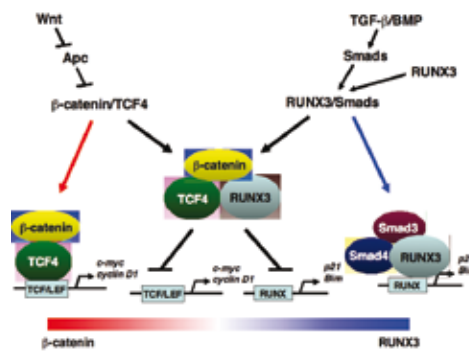
One of the areas of study which Prof Ito's team is placing much emphasis on is the analysis of tumours that develop in mice and human intestines as this allows them to examine how RUNX3 is involved in human colon carcinogenesis.

Cell growth is controlled by the signals that either stimulate cells to grow or inhibit them from growing. These signals come from outside of the cell and are transmitted to the nucleus which is at the centre of the cell. Inside the nucleus, proteins called transcription factors bind to DNA and induce the expression of genes that are required for stimulation or inhibition of cell growth.

Prof Ito's team had earlier reported that RUNX3 is one of these transcription factors which are controlled by a signal, called TGF- β , to inhibit cell growth. Another well-known signaling pathway that stimulates cell proliferation is called Wnt, and this signal reaches a transcription factor complex called β -catenin/TCF4 to induce the expression of genes required for the stimulation of cell growth.

RUNX3: A Novel Tumour Suppressor in Multiple Cancers

Wnt signaling is well-known to be highly activated in colon cancer and the tumor suppressor function of RUNX3 is to inhibit cancer causing Wnt signaling.



Recently, Prof Ito's team discovered that RUNX3 binds to the β -catenin/TCF4 complex and attenuates the activity of Wnt signaling. Wnt signaling is well-known to be highly activated in colon cancer and hence the tumour suppressor function of RUNX3 is to inhibit cancer causing Wnt signaling.

In most cases of human colon cancer, a gene called APC is disrupted and this results in the activation of β -catenin/TCF4. This has been considered the molecular basis to induce colon cancer. However, it has not been recognised that the activity of β -catenin/TCF4 is inhibited by RUNX3 and that the inactivation of RUNX3 is required for full-blown colon cancer to develop.

Prof Ito's work provides evidence that the inactivation of RUNX3 occurs at a very early stage of colon cancer. This work is groundbreaking because the

inactivation of RUNX3 is relatively easy to detect. As such, Prof Ito's research will lay the groundwork for a possible diagnostic kit to detect colon cancer. Based on this discovery, detection of colon cancer could be included in routine annual medical check-ups. Currently, most patients discover their cancer only in later stages where chances of remission and eventual cure are substantially reduced, but Prof Ito's work can detect colon cancer at early stages where survival rate is highly successful.

Even more exciting is the possibility that inactivated RUNX3 can be reactivated. If this can be achieved, it will have a tremendous impact internationally as colon cancer is cited to be the fourth most common cancer worldwide, and Prof Ito's discovery could lead to new therapeutic methods and treatment of colon cancer.

Bioscaffold Supports Bone Regrowth



The search for an ideal bioscaffold congenial to the regeneration of bone has led to an award-winning project. The project, In-Vitro, In Vivo and Clinical Trial for Bioscaffold for Bone Reconstruction and Implants, is led by Assistant Professor Victor Fan as the Principal Investigator with Associate Professor Cao Tong as the Co-PI, from the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, NUS. The project won The Enterprise Challenge (TEC) 2005's Enterprising Agency Award and Innovator Award, which was presented by the Prime Minister's Office. It has just been nominated for the 2008 National Science and Technology Award.

The regeneration of bone is an important aspect in reconstructive surgery for patients with facial deformities after cancer surgery or facial injuries. Current reconstructive techniques may involve obtaining tissues from another part of the body with potential morbidity of pain

and suffering or the use of artificial implants and reconstructive materials that remain in the body for life with complications of rejection and infection.

With the use of a bioscaffold, it will be possible to direct bone growth in certain defects to replace lost structures. This will greatly benefit patients who will not need to have these complicated grafting surgeries.

As a surgeon, Dr Fan's dedication to alleviating the suffering of oral cancer patients led him on an arduous search for the "perfect" bioscaffold. This resulted in the collaboration with Dr Cao who is a research scientist in the same department of Oral and Maxillofacial Surgery in NUS. Together with the bioengineers in Bioscaffold International, a home-grown biotechnology company, the design of the ideal scaffold was conceived. This scaffold is made of a polymer which can biodegrade in the body within 6 months without leaving any toxic side effects and yet retain the crucial strength and

The regeneration of bone is an important aspect in reconstructive surgery for patients with facial deformities after cancer surgery or facial injuries.

shape needed to guide the growth of bone within the first few months of implantation.

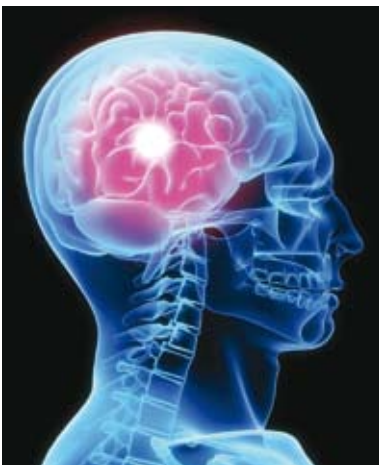
With further development, other tissues like cartilage and skin can also be directed to grow into these bioscaffolds which are important for facial cosmetic and reconstructive surgery. Bioscaffolds can also be used for dental implants and a bioscaffold for alveolar ridge preservation has just been launched commercially by the company for the benefit of patients who need their teeth removed.

Preventing Dementia

In the first-ever Asian study done on dementia, an NUS team has found that one's brain does not stop growing at 40.

The team also discovered that individuals who engaged in productive activities such as painting, gardening, active employment, and even preparing meals and shopping, had lower risks of dementia. As these activities involving thinking and planning, they have been found to be more effective than social activities like karaoke, dancing, parlour games and sports, in preventing dementia.

The 2-year study, led by Associate Professorial Fellow Ng Tze-Pin, Department of Psychological Medicine, Yong Loo Lin School of Medicine, NUS, who is also from the Gerontological Research Programme of NUS, involved 1,635 Chinese adults above 55 years of age. Examining the effects of physical, social and productive activities on cognitive decline, the study won the 2007 International Psychogeriatric Association Awards for Research in Psychogeriatrics.



“This study was significant as it directly compared the relationship between dementia and a specific type of activity,” noted Assoc Prof Ng. The study is also very relevant to Singapore, which has an ageing population where 5 per cent of people over the age of 65 suffer from dementia.

Respondents were interviewed on how often they took part in a list of 16 productive, physical and social activities common among older folks in Singapore. They were then put through tests to measure their “cognitive functioning”, which includes memory and concentration.

The respondents were tested 18 months later to measure their cognitive abilities again. The results revealed that those who performed a “productive” activity at least once a week had the lowest risk of cognitive decline compared to those who took part in “social” or “physical” activities at least once a week.

Productive activities stimulate the growth of dendrites which are receptive fibres growing from neurons (brain cells). Dendrites connect and communicate with other neurons. Neglect of one's brain can lead to the shrinkage of dendrites, as evidenced by the scientific discovery that those who had pursued intellectually vigorous

One's brain does not stop growing at 40 – just one of many significant findings made by NUS in the first-ever Asian study on dementia.

lifestyles have longer dendrites than those who had not.

“However, physical activities are still beneficial to the brain as they promote overall wellness,” said Professor Kua Ee Heok, Head, Department of Psychological Medicine, Yong Loo Lin School of Medicine, NUS. Prof Kua, who is also a senior consultant in the Department of Psychological Medicine, NUH, and one of the authors of the paper, stressed that any type of activity would still be better than none at all. Physical activities considered in the study include walking, jogging, taiji and swimming. Social activities include attending church, temple, mosque; joining social group activities; playing cards, games, mahjong; going to the movies, eating out as well as excursion trips. Those in the productive activity list, besides shopping and preparing meals, include hobbies such as reading and music.

Looking ahead, the NUS research team plans to conduct a follow-up study, with another longitudinal study on elderly people with early dementia and how interventions can prevent a rapid decline of cognitive functions. They will also be looking at resilient old people, those who have little health problems and are staying mentally alert.

Gastric Cancer Research Wins Record Research Grant

Gastric cancer is the fourth most common cancer among males here, afflicting 1 in 50 Chinese men. But although it is the second leading cause of cancer deaths in the world, it does not get as much attention as colorectal cancer, due to its lower incidence in the West.

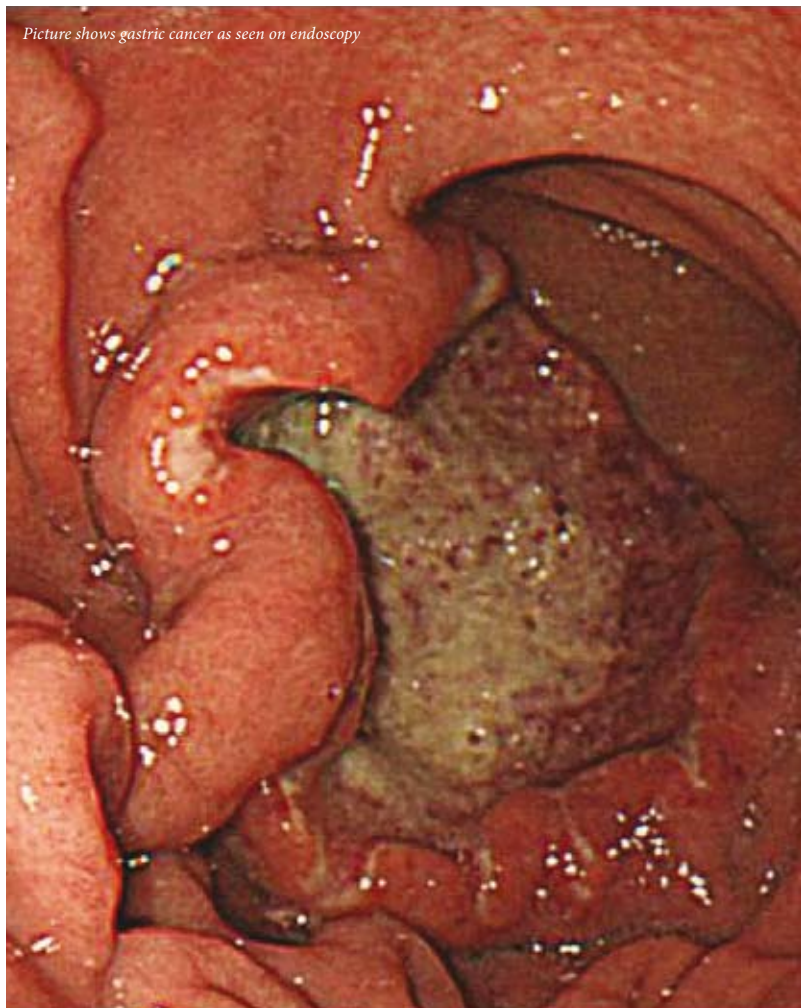
Gastric cancer is a curable cancer, easily treated at its early stages. However, almost half of all gastric cancer cases in Singapore are detected in their final stages, which is often too late.

Every year in Singapore, an average of 600 new patients are diagnosed with gastric cancer, and 400 people die from it.

Gastric cancer is the fourth most common cancer among males here, afflicting 1 in 50 Chinese men. But although it is the second leading cause of cancer deaths in the world, it does not get as much attention as colorectal cancer, due to its lower incidence in the West.

“It’s an Asian disease and should be solved by Asians because nobody else is going to do it. So we have to do the work,” said Associate Professor Yeoh Khay Guan, Department of Medicine, NUS and Senior Consultant, Department of Gastroenterology and Hepatology, NUH.

Assoc Prof Yeoh leads the Singapore Gastric Cancer Consortium (SGCC), the most extensive of its kind in Singapore, bringing together researchers from NUS, National Cancer Centre Singapore (NCCS), and NUH, as well as research institutes from A*STAR, and overseas cancer centres.



Picture shows gastric cancer as seen on endoscopy

This project would go all the way to cover both basic scientific research, as well as the translation of already available research findings into treatments for patients.



The SGCC is the winner of a record \$25 million research grant by the National Research Foundation/National Medical Research Council, the largest sum awarded to a single research project in Singapore.

The SGCC proposal was selected out of 17 applications for its significant benefits to patients and its strong potential. The landmark project aims to detect stomach cancer earlier and with greater ease than current invasive procedures, treat it better and, possibly, find a cure.

The SGCC won the research grant because of its bench-to-bedside approach, and its extensive network of collaborators to turn laboratory discoveries into medical treatments.

“This project would go all the way to cover both basic scientific research, as well as the translation of already available research findings into treatments for patients,” said Professor Tan Chorh Chuan, co-chairman of the council’s Translational and Clinical Research Flagship Programme review committee.

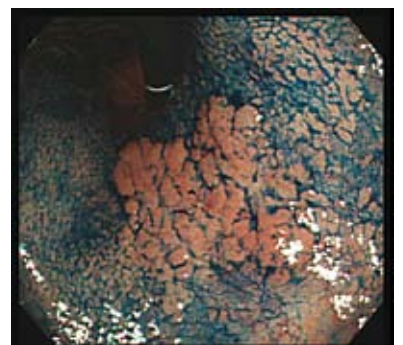
Currently, SGCC researchers are studying up to 4,000 people to identify cancer markers which can be used to detect cancer early by a simple blood test. Said Assoc Prof Yeoh, “Such a diagnostic method, currently

unavailable, will be less invasive than the current one whereby a tube is inserted into the stomach to check for diseased tissue.”

Assoc Prof Yeoh’s team also believes that what the team has learnt about the cells holds the key to prevention or a cure. They found that the gene RUNX3, is not functioning in about 80 per cent of gastric cancer patients in Singapore.

“One scientific idea that will be tested is whether re-introducing a functioning copy of this gene is able to control stomach cancer,” said Assoc Prof Yeoh.

Moving forward, the SGCC researchers will be working on cancer-causing genes to develop personalised treatment plans for different patients. These new treatment techniques and early development drug offerings will be clinically tested at NUH.



Detecting Early Gastric Cancer

As lipidomics is a discipline which is intrinsically allied with many other fields of research, Assoc Prof Wenk advocates that a multi-disciplinary approach be taken in this research.

At NUS, a team specialising in lipidomics is looking into the role of lipids and the intriguing mechanisms involved.

Lipids are fatty compounds and essential components of every cell membrane, so the forms of human cell lipids number in the thousands. Lipids coordinate the movement of substances in and out of cells, taking on crucial roles in the reception of signals in the body. This is why lipids are being studied for their role as “gatekeepers” in the body’s important chemical reactions.

The NUS team is led by Associate Professor Markus Wenk, Department of Biochemistry, Yong Loo Lin School of Medicine and Department of Biological Sciences. He believes their work will play a key role in the understanding and controlling of important diseases.

For instance, working with the Novartis Institute for Tropical Diseases, his team is looking at tuberculosis (TB) and other diseases where the invading bacteria masquerade as a normal body cell by using its own lipids in order to enter the host cell.

“The critical role of lipids in cell, tissue and organ physiology is demonstrated by a large number of genetic studies and by many human diseases involving the disruption of lipid metabolic enzymes and pathways. Examples of such diseases include cancer, diabetes, neurodegenerative and infectious disorders,” said Assoc Prof Wenk.

The Role of Lipids in Controlling Diseases

“However, due to the complexity of lipids and the lack of powerful tools for their analysis, we still do not know enough about lipids. The explosion of information in the fields of genomics and proteomics has not been matched by a corresponding advancement of knowledge in the field of lipids,” he noted.

“Lipids are a critically important class of metabolites, and they can go through drastic changes and stimulate the cell to do different things. This includes how the cell communicates and reacts. Yet, many functions of lipids remain poorly understood, especially at the molecular level,” Assoc Prof Wenk added.

However, progress has been made lately, with lipid research gaining much from a number of recent achievements and developments. In particular, developments in genetic and cell biology research have provided new insights into molecular mechanisms of lipid action. “It is becoming increasingly clear that deregulated lipid metabolism plays an important role in many human diseases and novel tools for lipid detection are being developed at a very rapid pace,” said Assoc Prof Wenk.

As lipidomics is a discipline which is intrinsically allied with many other fields of research, Assoc Prof Wenk advocates that a multi-disciplinary approach be taken in this research.

1 of 4 projects in NUS to be given a generous grant from the National Research Foundation, his research



Associate Prof Markus Wenk and Research Fellow, Dr Shui Guanghou at the Lipidprofiles Lab at the Centre for Life Sciences. Their research is cross-disciplinary involving the Department of Biochemistry, Department of Biological Sciences, other laboratories in NUS as well as university and industry partners

project is built on basic research and engineering with a strong outlook on applications. 6 laboratories from NUS form the core team. Each member brings in unique expertise and research excellence in a highly integrated fashion, merging facets of medicine, cell biology, bioengineering, and organic chemistry.

Assoc Prof Wenk said one of their foci would be to research novel approaches in the global analysis of lipids for applications in the development of drugs and biomarkers for various diseases. “We aim to develop novel tools for lipid research which go far beyond current trends in biochemical lipidomics and to apply these approaches to biomedical and environmental research. These tools include hardware (chemical probes, antibodies) as well as software (search algorithms, analytical methods). We will include two prominent areas of R&D focus in Singapore - immunology/ infectious diseases and ageing/ neurodegeneration.”

Industry partners include the Novartis Institute for Tropical Diseases and instrument manufacturer Applied Biosystems, who will collaborate in the development and application of these tools. The programme will enhance international connections to major initiatives at partner universities, ETH Zurich via the Swiss initiative in systems biology, Systems.X.ch, as well as Yale.

The Discovery that Gives Hope to Mosquito-Borne Diseases

In a world's first, Professor Mary Ng and Dr Justin Chu Jang-Hann from the Department of Microbiology, Yong Loo Lin School of Medicine, NUS, have identified the receptor protein which facilitates the entry of the mosquito-borne West Nile virus into the human body.

As an essential step in viral infection is the very entry of the virus into the cell, this discovery brings scientists closer to finding a drug that can combat this virus.

This discovery is also significant given that there is much similarity between the West Nile virus and other viruses within the same family.

Member viruses within the Flavivirus genus are most relevant to this region because the mosquito vectors to transmit these viruses are present here. A cousin of the West Nile virus is the Dengue virus, a name every Singaporean knows. There is currently no vaccine or antiviral for human use against this family of viruses.

So far, West Nile virus infections have not been seen in this region. But the environment in Singapore is conducive for such an epidemic to occur. This is so because the mosquito vector is present, the population has no antibody against this virus, we are in the path of migratory birds and as a travel hub, imported cases are highly possible.

Dengue virus infections affect more than 100 countries, resulting in 51 million infections worldwide each year. Although the statistics are not as high for West Nile virus infections,

it is increasing and spreading across continents.

Previously confined to the Middle East regions and Africa, the West Nile virus was introduced to the United States by migratory birds in 1999. Within 4 years, the virus spread across the country and is now an established infection. From 1999 to 2007, the total number of infected cases in the United States was 27,573 and resulted in 1,083 fatalities.

Currently, there is no commercial vaccine or antiviral against the flaviviruses for human use. The team aims to design an effective and safe antiviral compound, vaccine or strategy against the West Nile virus infection and other flaviviruses, such as the Dengue viruses and Japanese encephalitis.

The discovery has been patented and published in international journals, like the Journal of Biological Chemistry and Journal of Virology. Moving forward, the team intends to collaborate with a pharmaceutical company to develop antiviral drugs against mosquito-borne viruses.

Dengue virus infections affect more than 100 countries, resulting in 51 million infections worldwide each year. Although the statistics are not as high for West Nile virus infections, it is increasing and spreading across continents.



MOVING FORWARD

Building World-Class Capabilities in Translational Research

Patients suffering from other major diseases such as Dementia, Metabolic Diseases including Diabetes and Obesity will also benefit from improved understanding of diseases and treatment protocols.

On 8 April 2008, Singapore's Prime Minister Lee Hsien Loong broke ground for the National University Health System Centre for Translational Medicine (NUHS CeTM). The NUHS CeTM is set to become an icon for translational research and education in Singapore. Costing about \$180 million, the construction of the building will be partially funded by the National University of Singapore, Ministry of Education, National Research Foundation and the Yong Loo Lin Trust.

Gracing the occasion as Guest-of-Honour, Prime Minister Lee highlighted in his opening speech the importance of translational research and how the CeTM will play an important role in Singapore's push to develop its life sciences industry. It will facilitate the cross pollination of doctors, scientists and teaching faculty to translate insights gained at the laboratory bench into better treatment protocols, therapies, diagnostic kits, drugs and devices, to benefit patients. PM Lee also emphasised that while healthcare still has to be kept affordable, clinical research now has to be seen in a new light: Singapore's push for Research and Development gives it scope for more research - especially if it is focused on key disease areas like cancer and cardiovascular disease.

Expected to be completed by the second half of 2010, the CeTM will stand tall at 15 storeys high with over 41,000sqm of space. It will house facilities essential for advancing research, such as a state-of-the-art Clinical Imaging Research Centre (CIRC), an Investigational Medicine Unit (IMU), and a Biosafety Level 3 Laboratory.

Research capabilities at the CeTM will be integrated with the work that will be done in the National University Heart Centre, Singapore and National University Cancer Institute, Singapore. NUHS cancer researchers working in the CeTM will collaborate actively with NUHS' cancer centre, other researchers in NUS, the National Cancer Centre (NCC), the Genome Institute of Singapore (GIS), the Institute of Molecular & Cell Biology (IMCB), the Experimental Therapeutics Centre (ETC), the Johns Hopkins Singapore International Medical Centre, the Duke-NUS Graduate Medical School, the Ludwig Institute of Cancer Research (LICR), the Temasek Life Sciences Laboratories (TLL) as well as the Institute of Bioengineering and Nanotechnology (IBN) among others.

Similarly, NUHS' researchers in cardiovascular disease will also work together with the NUHS' heart centre, the National Heart Centre and Agency for Science, Technology and Research (A*STAR) research institutes among others.

Patients suffering from other major diseases such as Dementia, Metabolic Diseases including Diabetes and Obesity will also benefit from improved understanding of diseases and treatment protocols. NUHS' researchers will also be carrying out major research in other fields including infectious disease, immunology and regenerative medicine through collaborations across Singapore and internationally.



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