

RESEARCH & INNOVATION FOR BETTER HEALTH

NATIONAL MEDICAL RESEARCH COUNCIL ANNUAL REPORT 2012

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TRANSLATING RESEARCH FOR BETTER HEALTH

TO PROMOTE EXCELLENCE IN TRANSLATIONAL AND
CLINICAL RESEARCH, NURTURE A VIBRANT RESEARCH
COMMUNITY OF CLINICIANS AND SCIENTISTS IN
SINGAPORE, AND ENHANCE KNOWLEDGE TRANSLATION
FOR HEALTH AND ECONOMIC OUTCOMES.

MESSAGE FROM EXECUTIVE CHAIRMAN

R RESEARCH AND INNOVATION FOR BETTER HEALTH

Research and development (R&D) are key drivers of growth in a knowledge-based economy, and the Singapore Government's continuous support for and investment in biomedical R&D are encouraging. In particular, the increase in Singapore's biomedical sciences (BMS) research budget under Phase III (2011–2015) of the BMS Initiative sends a strong signal that our nation remains committed to developing this key sector and supporting Singapore's ongoing journey towards being a leader in Asia for BMS research.

At NMRC, our mission is to promote excellence in translational and clinical research (TCR), nurture a vibrant research community of clinicians and scientists in Singapore, and enhance knowledge translation for health and economic outcomes. Having invested significantly in BMS research since 2006, it is timely for us to take stock of the outcomes of our investments. This will allow us to determine how NMRC can work most effectively with our partners to support R&D that results in both health benefits for patients and positive economic outcomes for Singapore.

Our funding initiatives enable Singapore's clinical and research communities to develop their research ideas. At the same time, they also signal that Singapore is strategically investing in areas where there is significant potential to develop excellence in TCR, with the ultimate goal of achieving better health.

A key trend that will shape the development of Singapore's TCR efforts going forward is a greater emphasis on aligning our R&D efforts with the disease burden in Singapore and globally. This will contribute to a more strategic approach to identifying key research priorities for Singapore, enabling us to channel R&D investments to research areas with the greatest potential for health and economic outcomes.

Supporting academic medicine

Our efforts to promote excellence in TCR remain focused on two key areas: first, facilitating synergistic collaborations between basic scientists and clinician scientists and between the public sector and private sector; and second, developing the talent needed to successfully drive TCR in Singapore by training and supporting more clinician scientists.

We firmly believe that achieving cutting-edge biomedical breakthroughs requires a group effort from clinicians, healthcare professionals, basic scientists and other key stakeholders. With their varied and complementary skills and knowledge, these groups need to work together towards the common goal of bringing about better healthcare outcomes for patients through new treatments, technologies and innovations.

The academic medicine model—which integrates research, clinical care and education towards this common purpose—provides an effective approach for facilitating such collaboration. Therefore, our investment in academic medicine represents a key move towards the goal of achieving better health for Singapore.

Strengthening our position

Singapore's TCR sector has come a long way in recent years, contributing to scientific developments and healthcare advances that are increasingly having an impact on the global stage. However, there will always be scope for further growth as we continue to build on our existing achievements. Working with our key stakeholders, we will continue to contribute to the planning and development of TCR initiatives and health services research as we strive to generate better health outcomes for patients and better health for Singapore.

Prof Donald Tan
Executive Chairman



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**ACHIEVING CUTTING-EDGE BIOMEDICAL
BREAKTHROUGHS REQUIRES A GROUP EFFORT FROM
CLINICIANS, HEALTHCARE PROFESSIONALS, BASIC
SCIENTISTS AND OTHER KEY STAKEHOLDERS.**



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A STRATEGIC APPROACH REQUIRES US TO ADOPT A FORWARD-THINKING MINDSET TO CONSIDER WHAT IS IMPORTANT TO OUR STAKEHOLDERS AND HOW NMRC SHOULD EVOLVE.

MESSAGE FROM EXECUTIVE DIRECTOR

NMRC is the biomedical research funding arm of the Ministry of Health. We take the lead in operationalising and running the various research funding programmes rolled out by the ministry, as well as developing the biomedical research strategy. This requires us to balance supporting the day-to-day research funding needs of the community, while at the same time, keeping in mind the longer-term trends and priorities of biomedical research in Singapore.

Currently in the midst of the Research, Innovation and Enterprise (RIE) 2015 funding tranche, we have rolled out various new initiatives over the past two years, with more to come in 2013. At the same time, we have already started to look ahead to the next funding cycle, to develop plans for post-2015.

Central to this is the development of a sound strategy. Rather than simply maintaining the status quo, a strategic approach requires us to adopt a forward-thinking mindset to consider what is important to our stakeholders and how NMRC should evolve. Many of the present NMRC grant schemes involve a bottom-up approach, taking in good ideas from all areas of biomedical sciences, with funding awarded to the strongest proposals representing the best science. While it is important to continue doing this, we also recognise that there is a need to prioritise to ensure optimal use of the limited research funds available.

A key question then would be: what are the strategic areas of research that we should focus on? In the past year, we have started a systematic process of identifying the research priorities for the healthcare family. This process is ongoing and takes into account a variety of factors, including local disease burden, research strengths and opportunities, as well as existing competitive advantages. We expect to complete this exercise in the coming months, after which we will work with our stakeholders to achieve strategic alignment regarding priorities for the next funding cycle.

In undertaking such an exercise, we recognise the importance of working closely with other agencies involved in biomedical research funding in Singapore—in particular, A*STAR's Biomedical Research Council, the National Research Foundation and the Ministry of Education. In the past year,

much progress has been made in working with these and other agencies, under the umbrella of the Biomedical Sciences Executive Committee (BMS Exco).

We launched several new initiatives in 2012 as part of our ongoing efforts to promote excellence in translational and clinical research (TCR). Among these was the new Centre Grant scheme, which provides a competitive mechanism for providing core research funding to clinical institutions. Other new initiatives include the Clinical Trial Grant, which supports clinicians in carrying out clinical trials for the development of new therapies, and the Ministry of Health Industry Alignment Fund, which aims to strengthen public-private collaboration in biomedical sciences research and position public sector research for future industry needs. We also introduced a New Investigator Category for our Health Services Research (HSR) Grant, which aims to encourage less established investigators to undertake research in HSR, and to enable the translation of HSR findings into policy and practice.

There were also noteworthy developments in our existing TCR Flagship Programme. After an open call for applications, two of our five pioneer TCR Flagship Programmes were awarded a fresh tranche of \$25 million over the next five years via a competitive renewal process. Despite competition from a number of new applicants, these two programmes were identified by both our local and international review panels as being the strongest applications. This is a testament to the good science that these two programmes are doing and their strong progress to date. In addition to these renewals, we introduced a new funding tier (\$9 million over five years) in 2012 for smaller TCR Flagship Programmes. Two such programmes were awarded funding in the past year—one focused on lung cancer and the other on cardiovascular diseases.

It has been an eventful year for NMRC. We have been greatly helped by the support provided by colleagues in the Ministry of Health, the wider healthcare family and other government agencies and stakeholders. With many exciting new plans already underway, we look forward to continuing to work closely with everyone in 2013 and beyond.

A/Prof Tan Say Beng
Executive Director

ABOUT NMRC





Established in 1994, the National Medical Research Council (NMRC) oversees the development and advancement of translational and clinical research in Singapore. It provides competitive research funds to publicly funded healthcare institutions, awards competitive research funds for programmes and projects, supports the development of core clinical research infrastructure, is responsible for the development of clinician scientists through awards and fellowships, and fosters interactions and knowledge exchange among researchers.

In 2006, the Ministry of Health established a new mandate to support translational and clinical research in areas where Singapore has great potential. With this in mind, NMRC's role is ever more important in leading, promoting, coordinating, and funding translational and clinical research in Singapore. NMRC-funded research has led to inter-disciplinary partnerships and international collaborations, helping to boost the role played by Singapore's biomedical sector on the global stage.

Under the Research, Innovation and Enterprise (RIE) 2015 plan, Singapore has earmarked \$16.1 billion over a five-year period (2011–2015) to fund research and innovation in a variety of sectors, including biomedical and life sciences research. NMRC is one of the beneficiaries of this boost in funding, reinforcing the Council's mandate as the champion for translational and clinical research in Singapore.

Human capital plays a key role in the success of Singapore's translational and clinical research industry. Having a critical mass of clinician scientists is crucial for providing thought leadership and driving the translation of bench discoveries to bedside applications to improve human health. As such, NMRC actively supports clinician scientists with funding through research grants, human capital awards and talent development programmes. Under Singapore's Biomedical Sciences (BMS) Initiative Phase III (2011–2015), NMRC is stepping up its efforts to boost the number of clinician scientists in Singapore from around 80 in 2010 to 160 by 2015.

Since its inception, NMRC has supported over 200 clinicians with scholarships, fellowships and various talent development awards. The Council has also built up the translational and clinical research capabilities in Singapore through the funding of more than 1,900 competitive research projects and nine Translational and Clinical Research Flagship Programmes. To ensure that the budget is appropriately managed and optimally utilised, NMRC also evaluates the outcomes of the research projects it funds and facilitates the commercialisation of research findings.



NMRC BOARD

The NMRC Board advises on the Council on the formulation of strategies and priorities to promote excellence in translational and clinical research in Singapore with the objective of improving human health. By overseeing the implementation of the research programmes approved by the Ministry of Health (MOH) and the Biomedical Sciences Executive Committee (BMS Exco), the Board ensures that the funding initiatives are being effectively managed to meet its mission and key performance targets. The Board also ensures that governance frameworks are in place such that NMRC's budget is appropriately managed and optimally utilised.

BOARD MEMBERS



Prof Donald Tan
Executive Chairman
National Medical Research Council



A/Prof Tan Say Beng
Executive Director
National Medical Research Council



Dr Benjamin Seet
Executive Director
Biomedical Research Council



Prof Edward Holmes
Deputy Executive Chairman
Biomedical Research Council



Prof Alex Matter
Chief Executive Officer
Experimental Therapeutics Centre



Prof Sir Peter Gluckman
Programme Director (Growth Development and Metabolism)
Singapore Institute for Clinical Sciences



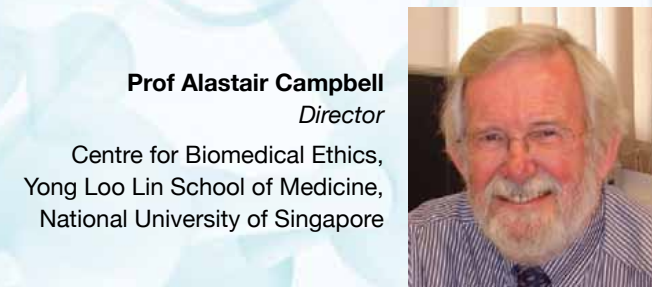
Prof Chia Kee Seng
Dean
Saw Swee Hock School of Public Health, National University of Singapore



Prof John Wong
Vice Provost (Academic Medicine)
National University of Singapore



A/Prof Allen Yeoh
Senior Consultant
Department of Paediatrics,
National University of Singapore



Prof Alastair Campbell
Director
Centre for Biomedical Ethics,
Yong Loo Lin School of Medicine,
National University of Singapore



Prof Ranga Krishnan
Dean
Duke-NUS Graduate Medical
School



Prof Ivy Ng
Group Chief Executive Officer
SingHealth



Prof Wong Tien Yin
Director
Singapore Eye Research Institute



Prof Stephen Smith
Vice-President (Research)
Nanyang Technological University



Prof Jan Carlstedt-Duke
Director, Medical School Project
Nanyang Technological University



A/Prof Chong Siow Ann
Vice Chairman
Medical Board (Research),
Institute of Mental Health



Dr Lee Chien Earn
Chief Executive Officer
Changi General Hospital



Dr Anand Tharmaratnam
*Senior Vice President and Head of
Clinical Development*
Quintiles Asia-Pacific



Prof Jeremy Farrar
Director
Oxford University Clinical Research
Unit



Prof Patrick Sissons
Regius Professor of Physics
Cambridge University Hospitals,
NHS Foundation Trust



Mrs Carmee Lim
Mentor Principal
MindChamps Holdings Pte Ltd

NMRC PORTFOLIO

Under Singapore's Biomedical Sciences (BMS) Initiative Phase III (2011–2015), NMRC continues to drive translational and clinical research (TCR) through sustained and strategic investment in three key areas: research grants, talent development programmes, and knowledge exchange and enablers.

TALENT DEVELOPMENT PROGRAMMES

In order to grow, nurture and anchor the pool of clinician scientists in Singapore, NMRC offers a range of human capital awards and talent development programmes aimed at supporting individuals in their research and career progression. These awards and programmes include:

- ▶ **Human Capital Awards**
 - Singapore Translational Research (STaR) Investigator Award
 - Clinician Scientist Award (CSA)
 - Transition Award
 - Clinician Investigator Salary Support Programme (CISSP)
- ▶ **Talent Development Programmes**
 - NRF-MOH Healthcare Research Scholarship (PhD)
 - NRF-MOH Healthcare Research Scholarship (Master of Clinical Investigation)
 - NMRC Research Training Fellowship
- ▶ **Investigator-led**
 - Individual Research Grant (IRG)
 - Exploratory/Developmental Grant (EDG)
 - New Investigator Grant (NIG)
 - Clinician Scientist Individual Research Grant (CS-IRG)
 - CS-IRG New Investigator Grant (CS-IRG-NIG)
 - Cooperative Basic Research Grant (CBRG)
 - CBRG New Investigator Grant (CBRG-NIG)
 - Bedside & Bench Grant (B&B)
 - Health Services Research Competitive Research Grant (HSR CRG)

KNOWLEDGE EXCHANGE AND ENABLERS

NMRC strives to grow and strengthen Singapore's TCR ecosystem by facilitating various events and platforms that foster interactions and knowledge exchange among researchers, supporting the development of core clinical research infrastructure and implementing new strategic research grant initiatives. These include:

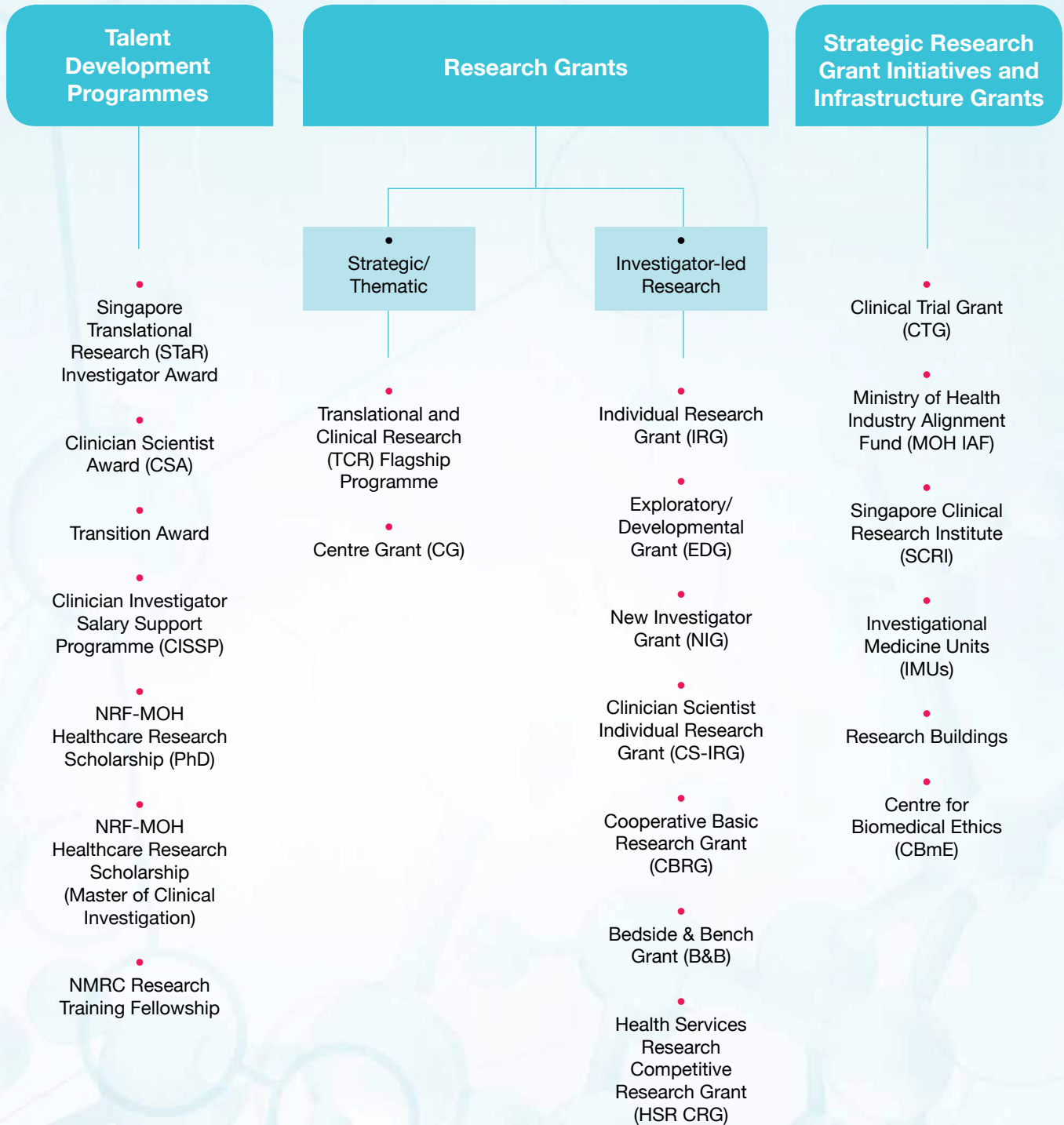
- Clinical Trial Grant (CTG)
- Ministry of Health Industry Alignment Fund (MOH IAF)
- Singapore Clinical Research Institute (SCRI)
- Investigational Medicine Units (IMUs) at SingHealth Services (SHS) and National University Hospital System (NUHS)
- Research buildings at Outram Campus and Kent Ridge Campus
- Centre for Biomedical Ethics (CBmE)

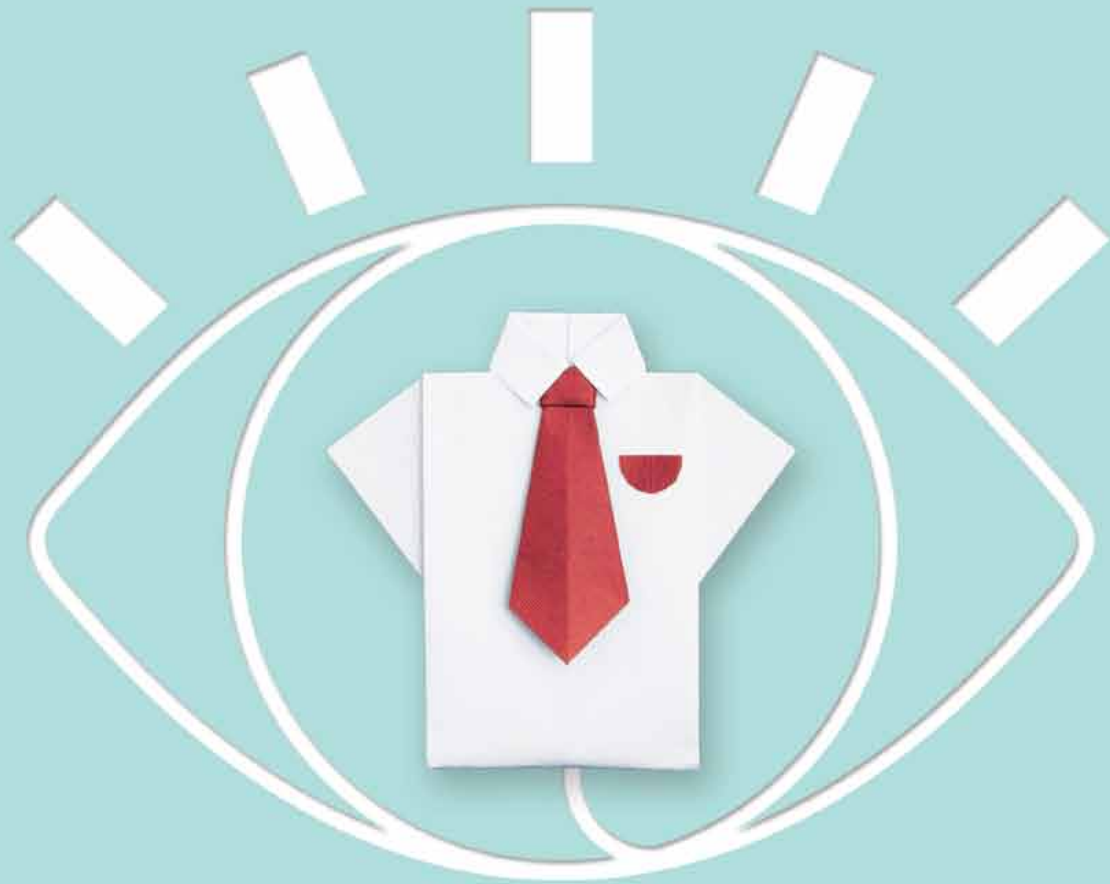
RESEARCH GRANTS

NMRC directly supports research initiatives through a series of competitive grants. These grants are defined as either strategic/thematic or investigator-led, allowing NMRC to support specific areas of research as well as promising individual researchers. The grants include:

- ▶ **Strategic/Thematic**
 - Translational and Clinical Research Flagship Programme
 - Centre Grant

NMRC FUNDING FRAMEWORK





HUMAN CAPITAL & TALENT DEVELOPMENT PROGRAMMES

NURTURING CLINICIAN SCIENTISTS

HUMAN CAPITAL AWARDS

SINGAPORE TRANSLATIONAL RESEARCH (STAR) INVESTIGATOR AWARD

The prestigious STaR Investigator Award is the highest level of NMRC's Human Capital Awards. Designed to recruit and nurture world-class clinician scientists to undertake cutting-edge TCR in Singapore, the STaR Investigator Award includes five-year funding for the researcher's salary, an annual budget for research support and a one-time start-up grant.

CLINICIAN SCIENTIST AWARD (CSA)

The CSA is structured to develop local research talent and give clinician scientists valuable protected time to focus on their research. The Senior Investigator (SI) level of the CSA offers funding for up to five years, catering to senior doctors who are already actively involved in highly productive research. The Investigator (INV) level offers funding for three years and targets younger doctors with the potential to become independent investigators. The CSA provides funding for salary support, together with a competitive research grant.

TRANSITION AWARD (TA)

The Transition Award is designed to help budding clinician scientists who have just completed formal research training.

This award provides research funding and salary support to help recipients build up their research capabilities by facilitating their transition to a stable, independent research position, which in turn will enhance their ability to successfully obtain independent research support later on. The Transition Award is non-renewable, as awardees are encouraged to apply for national-level independent research grants after they have completed this award.

CLINICIAN INVESTIGATOR SALARY SUPPORT PROGRAMME (CISSP)

The CISSP supports clinical research by providing funding for clinicians' research time in the form of salary support or full-time-equivalent (FTE). In recognition for the support from clinical departments for their clinicians' time and participation in clinical research, the awarded funding is channelled to the respective departments, which are given flexibility in using the funds to support clinical research. Clinician investigators and clinician scientists involved in projects under the following NMRC programmes funded by NRF were eligible to apply:

- Exploratory/Developmental Grant (EDG)
- New Investigator Grant (NIG)
- Translational and Clinical Research (TCR) Flagship Programme
- Singapore Translational Research (STaR) Investigator Award
- Clinician Scientist Award (CSA)

SINGAPORE TRANSLATIONAL RESEARCH (STAR) INVESTIGATOR AWARD AWARDEES



PROFESSOR KARL TRYGGVASON

A key focus of Prof Tryggvason's research has been on understanding the role of basement membrane proteins in normal physiology and disease. In particular, his laboratory has made major contributions in the understanding of the molecular features of the filtration barrier in the kidney. Through this work, he determined the causes of human kidney diseases such as congenital nephropathy of the Finnish type and Alport's syndrome. Moreover, his findings opened a new and burgeoning field of research around the role of the glomerular epithelial cell, or podocyte, in human glomerular diseases.

Prof Tryggvason's work has also led to understanding the molecular basis of other non-renal basement membrane diseases such as junctional epidermolysis bullosa and congenital muscular dystrophy. More recently, his laboratory has developed methodologies for synthesising laminins, a large family of basement membrane proteins, and has shown that these proteins can be used to control stem cell growth and differentiation, as well as support phenotype stability.

**Tanoto Professor of Diabetes Research
Cardiovascular and Metabolic Disorders
Program
Duke-NUS Graduate Medical School**

PROFESSOR STUART COOK

Prof Cook's research uses state-of-the-art approaches to discover genes that cause heart and artery diseases, which are the most common cause of death and disability worldwide. He and his team integrate advanced cardiac imaging with genomic data to derive unbiased and novel insights into human disease. The overall aim of Prof Cook's research is to identify new ways of preventing, diagnosing, stratifying and treating patients with cardiovascular disease. In Singapore, there are a number of areas where this research could have an impact on local healthcare.

One of the new programs Prof Cook's team will be running at Singapore's National Heart Centre will investigate why some people's hearts go into abnormal rhythms that can cause them to have strokes. The team hopes to find new ways to predict and prevent heart rhythm problems, with the ultimate goal of preventing strokes. Prof Cook's research interests also extend to sudden cardiac death—including clinical diagnostic tools that could be used for screening and prevention—and healthy cardiovascular ageing. Over the last five years, Prof Cook and his team have identified a number of new genes for heart disease and published their findings in premier scientific journals that include *Nature* and *Nature Genetics*.



**Professor
Department of Cardiology
National Heart Centre Singapore
Duke-NUS Graduate Medical School**

CLINICIAN SCIENTIST AWARD (CSA) AWARDEES



Professor
Centre for Quantitative Medicine
Duke-NUS Graduate Medical School

PROFESSOR CHEUNG YIN BUN (CSA-SI)

Research on vaccines and vaccination strategies plays a vital role in protecting people against infectious diseases. Statistical analysis of clinical, serological and biological data is an important part of this research. Such data often suffer two problems: complex censoring (such as detection limit) and data clumping at zero. Prof Cheung's research aims to develop novel statistical methods that can improve the analysis of such data. The novel methods will improve the accuracy of estimates and inference of important parameters needed for the evaluation of vaccines and vaccination strategies. Although this research is mainly motivated by vaccine and vaccination studies, the methodological problems are general and thus the results will benefit other fields of research, such as studies of censored and/or zero-inflated chemical contaminant data.

ASSOCIATE PROFESSOR LOUIS TONG (CSA-SI)

Dry eye disease (DED) is a major health problem in Singapore and worldwide, but the multifactorial nature of DED makes it difficult to evaluate. Moreover, treatment is expensive and often ineffective. Prof Tong's research focuses on the major intrinsic type of evaporative DED, meibomian gland dysfunction (MGD), and two important types of extrinsic evaporative dry eye (chronic preservative exposure and pterygium). His team is exploring novel methods of evaluating (tear interferometry and evaporimetry) and treating DED (e.g. thermopulsation treatment of MGD). Ultimately, Prof Tong aims to better understand the specific causes of these types of DED in order to contribute to the development of more effective diagnosis and treatment.



Senior Consultant
Department of Cornea and External Eye
Disease
Singapore National Eye Centre
Office of Clinical Sciences
Duke-NUS Graduate Medical School



Senior Consultant
Cardiac Department
National University Heart Centre, Singapore
Yong Loo Lin School of Medicine
National University of Singapore

ASSOCIATE PROFESSOR ROGER FOO (CSA-SI)

Sequencing of genomes gives us the “code of life”, but it does not tell us how the code is “utilised”. Instead, the different ways in which cells utilise their genetic information are determined by the epigenome. The epigenome refers to “marks” on the genome (including histone modifications and DNA methylation) that govern the way that the genome is organised and the way that chromatin is folded. Chromatin architecture in turn regulates gene expression. Heart failure—a major cause of human mortality and morbidity—is a disease of deregulated gene expression. Prof Foo’s research aims to address whether heart failure is also a disease of the epigenome and whether there is deregulated chromatin remodelling in heart failure. This research will allow Prof Foo’s team to define the cardiac epigenome in disease and in health, thereby opening exciting new avenues for heart failure research.

PROFESSOR NOBUHIRO YUKI (CSA-SI)

Autoimmune neuropathies are treatable conditions, which include Guillain-Barré syndrome (GBS), chronic inflammatory demyelinating polyneuropathy (CIDP), multifocal motor neuropathy (MMN) and IgM paraproteinemic neuropathy. Clinical and electrophysiological findings are essential for each diagnosis, but biomarkers such as CSF albuminocytological dissociation, IgM paraproteins and autoantibodies are helpful for supporting accurate diagnosis and appropriate treatment. Prof Yuki’s research focuses on identifying pathogenic autoantibodies and developing accurate serological diagnostic tools, as this will play a crucial role in further understanding the pathogenesis of autoimmune neuropathies and supporting better patient management.



Professor
Department of Medicine
Yong Loo Lin School of Medicine
National University of Singapore



Assistant Professor
Department of Ophthalmology
Yong Loo Lin School of Medicine
National University of Singapore
Clinician Scientist
Singapore Eye Research Institute

ASSISTANT PROFESSOR CHENG CHING-YU (CSA-INV)

Age-related macular degeneration (AMD) is the leading causes of irreversible blindness in the elderly both in Western countries and in Asia. Recent genome-wide association studies have identified a few common genetic variants associated with the risk of AMD, but the studies were mostly conducted in Western populations. A key difference in the clinical presentation and treatment of AMD in Western populations and Asians is a “subtype” of AMD called polypoidal choroidal vasculopathy (PCV), which is more common in Asians. Prof Cheng’s research focuses on understanding the genetic architecture of Asian AMD, especially the PCV sub-type, via the Singapore Age-related Macular Degeneration Genetic Architecture (SAGA) study.



ASSISTANT PROFESSOR SUE-ANNE TOH EE SHIOW (CSA-INV)

Insulin resistance (IR) is a hallmark of type 2 diabetes mellitus (T2DM) and IR in offspring of patients with T2DM predicts development of the disease. Traditionally, obesity is associated with IR, T2DM and increased cardio-metabolic risk. In Asians, cardiovascular risk increases with body mass index (BMI), but—in contrast to Caucasians—it is already apparent at low BMI levels. This supports the hypothesis that it is not just the amount of fat, but rather the function of fat that really matters. A/Prof Toh's research aims to improve the detection, diagnosis and treatment of patients at risk for or suffering from T2DM by understanding the role of fat function. Her team hypothesises that there are inherited traits in fat function (adipose tissue biology) that contribute to the development of IR and that these factors can be modulated for improved prevention and treatment of T2DM.

Consultant
Department of Medicine
National University Health System
Yong Loo Lin School of Medicine
National University of Singapore

ASSISTANT PROFESSOR CHESTER LEE DRUM (CSA-INV)

A practicing cardiologist in Singapore, Dr Drum runs a lab in the translational medicine building at the National University of Singapore and the Cardiovascular Research Institute that is working on technologies aimed at fundamentally altering the way in which patients and regulators interact with therapies and diagnostics. The lab is particularly focused on very low-cost devices that empower patients to make medical decisions at home and in rural healthcare environments. One research focus is biomarker detection and generation technologies using novel materials sourced from Singapore's research community. Using protein engineering, Dr Drum's lab is also developing highly interactive therapeutic technologies that actively respond to diseases on a molecular scale through engineered allosteric changes.



Associate Consultant
Department of Medicine
National University Health System
Yong Loo Lin School of Medicine
National University of Singapore



ASSISTANT PROFESSOR LING KHOON LIN (CSA-INV)

Crohn's disease (CD) is a chronic inflammatory bowel disease with an increasing prevalence in Asia. It has no known cure and is associated with significant morbidity. Increased numbers of myeloid derived suppressor cells (MDSCs) are found in the peripheral blood of CD patients, although it is not known if they are found in the intestinal mucosa and if their function is normal. Prof Ling's research aims to determine the number and function of MDSCs in the peripheral blood and intestinal mucosa of CD patients and normal controls, and to correlate MDSC numbers with disease activity. This project will examine the mechanistic relationship between short chain fatty acids (SCFAs), bacteria known to produce SCFAs, and MDSC differentiation and function. Prof Ling's team also aims to determine the amount of fructooligosaccharides in the diet of CD patients and the concentration of SCFAs in the serum, and to correlate this with the MDSC number and function in the peripheral blood.

Senior Consultant
Department of Gastroenterology
Singapore General Hospital
Duke-NUS Graduate Medical School

ASSOCIATE PROFESSOR VIJAY KUMAR SHARMA (CSA-INV)

Intravenously administered tissue plasminogen activator (IV-tPA) remains the only approved therapeutic agent to achieve arterial recanalization and improve functional outcomes in acute ischemic stroke. However, this therapy is associated with the complication of symptomatic intracranial haemorrhage. Elevated blood pressure prior to IV-tPA or during the first couple of days is strongly associated with the risk of intracranial haemorrhage. Various clinical trials of IV-tPA and observational studies have demonstrated that a modest reduction of systolic blood pressure during the acute phase might reduce mortality and the risk of intracranial haemorrhage. A/Prof Sharma is evaluating this relationship in a randomised clinical trial. Also, he is currently working closely with Australian colleagues on 'ENCHANTED', a multinational randomised clinical trial that aims to recruit about 5,000 patients worldwide to compare a low-dose IV-tPA regimen with the FDA-approved standard dose, as well as evaluating the impact of intensive blood pressure lowering on stroke outcomes. A/Prof Sharma serves on the central steering committee of the globally run 'ENCHANTED' and 'CLOTBUST-ER' clinical trials.



Senior Consultant
Department of Medicine
National University Health System
Yong Loo Lin School of Medicine
National University of Singapore



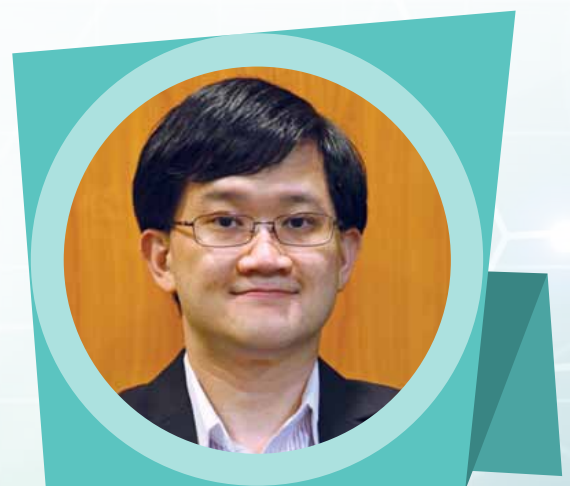
ASSISTANT PROFESSOR MOHAMMAD KAMRAN IKRAM (CSA-INV)

Transient ischemic attacks (TIA) represent a heterogeneous group with a wide range of symptoms and pathophysiology. Nevertheless, many patients with TIA are at an increased risk of developing a full clinical stroke. While a role of microvascular pathology is increasingly recognised in the pathogenesis of acute stroke, the exact role for small vessel disease in TIA pathogenesis is less certain. Prof Ikram's previous research has served as a proof-of-concept that retinal changes provide insights into microvascular pathology and predict the risk of stroke. His team's current research aims to examine the contribution of microvascular pathology in the pathophysiology of TIA using novel retinal vascular imaging. These retinal vascular imaging techniques will provide novel insights into TIA pathophysiology, and may be of additional value in the prediction of strokes in patients with TIA.

Department of Ophthalmology and
Memory Aging & Cognition Centre
(MACC)
Yong Loo Lin School of Medicine
National University of Singapore

ASSOCIATE PROFESSOR GEORGE YIP (CSA-INV)

Breast cancer is the most common form of cancer among women worldwide. In Singapore, it accounts for approximately one quarter of all female malignant neoplasms. Although advances have been made in its treatment, breast cancer remains the most frequent cause of cancer-related death in females. Prof Yip's research aims to better understand the biological roles of heparan sulphate and other glycosaminoglycans in breast and other cancer types. His team aims to analyse the changes in heparan sulphate expression in breast cancer and to evaluate whether these changes can be used for predicting patient survival and cancer recurrence. The data generated may lead to better prediction of breast cancer aggressiveness and result in the development of novel therapeutic targets.



Associate Professor of Anatomy and
Assistant Dean of Research (Grants)
Department of Anatomy
Yong Loo Lin School of Medicine
National University Singapore



ASSOCIATE PROFESSOR DARREN LIM (CSA-INV)

Cancer is the leading cause of mortality in Singapore. Patient selection for treatment is more important now with the advent of targeted therapies and in the context of biomarker-directed clinical trials. Prof Lim's research aims to use a locally developed label-free microfluidic device to establish circulating tumour cells (CTC) as a technology to guide treatment allocation based on molecular profiles. If successful, this will overcome the constraints of repeated/multiple tumour biopsies and current antibody-based capture methods that limit downstream analysis of these rare cells. Prof Lim's team will examine the hypothesis that CTCs can be molecularly profiled for each individual patient in order to guide therapy. If this hypothesis is confirmed, it will pave the way forward for guided treatment allocation using an easily accessible source of cancer cells.

Senior Consultant
Department of Medical Oncology
National Cancer Centre Singapore
Office of Clinical Sciences
Duke-NUS Graduate Medical School

ASSISTANT PROFESSOR GOPAL IYER (CSA-INV)

Oral squamous-cell carcinomas (SCC) represent a significant public health problem both worldwide and locally. With better tobacco control in developed countries, there has been a steady decline in incidence, except for a disturbing increase in the number of younger patients presenting with tongue cancers. This increase is seen in a low-risk population and tends to be more aggressive. Prof Iyer's team hypothesises that this population harbours specific genetic alterations with potentially targetable pathways, which need to be translated to the clinic. By analysing phenotype and molecular pathways, Prof Iyer aims to identify driver pathways and targets in order to find new ways to treat these patients who have otherwise failed treatment with conventional approaches.



Senior Consultant
Department of Surgical Oncology
National Cancer Centre Singapore
Office of Clinical & Faculty Affairs
Duke-NUS Graduate Medical School

ASSOCIATE PROFESSOR KOJI KONO (CSA-INV)

Gastric cancer is the second leading cause of cancer death worldwide and is strongly associated with the Asian phenotype. The prognosis for patients with advanced gastric cancer remains poor despite multimodal therapy (e.g. surgical resection combined with chemotherapy, or chemoradiotherapy). New treatment modalities such as molecular-targeted therapy or immunotherapy are thus urgently needed for these patients. Prof Kono's research has two major focuses: (1) antigen-specific immunotherapy based on cancer vaccines with multiple peptide epitopes and (2) the adoptive transfer of ex vivo expanded NK cells. Through research into these two approaches, Prof Kono's team aims to develop novel therapeutic immunotherapy strategies for combating gastric cancer.



Senior Consultant
Department of Surgery
Cancer Science Institute of Singapore
Yong Loo Lin School of Medicine
National University of Singapore



Consultant
Department of Reproductive Medicine
Director, KK Research Centre
KK Women's and Children's Hospital
Department of Cancer & Stem Cell Biology
Duke-NUS Graduate Medical School

ASSOCIATE PROFESSOR JERRY CHAN (CSA-INV)

Inherited monogenic diseases pose a significant clinical burden globally. Post-natal treatment approaches have generally been sub-optimal or completely ineffective. An evolving strategy is to treat the foetus pre-emptively before damage has occurred and to use haploidentical HSCT due to the unique ontological opportunities existing only during foetal life. Prof Chan's team has developed a clinically and ontologically relevant non-human primate (NHP) model to investigate intrauterine gene transfer (IUGT) and intrauterine HSCT (IUHSCT) in order to develop the scientific, technical and safety parameters to guide its eventual clinical translation. Through this research, Prof Chan aims to set the stage for the effective treatment of genetic diseases of perinatal onset for which no curative or satisfactory post-natal treatment exists.

TRANSITION AWARD AWARDEES



ASSISTANT PROFESSOR JIMMY LEE

Schizophrenia affects one in a hundred people and is one of the leading causes of disability in Singapore and around the world. In clinical practice, psychiatrists currently rely on reliable accounts and behavioural observations to make a diagnosis and monitor improvements following treatment. However, these observations and reports can be difficult to obtain, and result in delays in treatment. Previous research by Dr Lee and his team has demonstrated the potential of blood-based biomarkers in identifying individuals with schizophrenia. Dr Lee's current research is focused on reproducing the earlier results in a large sample and evaluating the ability of these blood-based biomarkers to predict clinical outcomes, especially with regard to the selection of a suitable therapeutic regimen.

Consultant
Department of General Psychiatry 1 & Research
Institute of Mental Health
Office of Clinical Sciences
Duke-NUS Graduate Medical School

ASSISTANT PROFESSOR NG OON TEK

Dr Ng's research focuses on how different strains of HIV virus affect the immune system differently. In Singapore, there are three strains of HIV virus circulating: subtype B, CRF01_AE and CRF51_01B. The impact of HIV strain on patient outcome is important as public health and treatment strategies may need to be adapted for the differences. Dr Ng's team has preliminary evidence demonstrating that individuals infected with CRF51_01B present with more severe immune-compromise. The team is now conducting epidemiological and laboratory research to determine if this is due to increased aggressiveness of CRF51_01B.



Consultant
Department of Infectious Disease
Tan Tock Seng Hospital
Assistant Professor
Saw Swee Hock School of Public Health
National University of Singapore



ASSISTANT PROFESSOR CITRA NURFARAH BINTE ZAINI MATTAR

Haemoglobinopathies are the most common monogenic disorders with a global carrier rate of 5 percent, resulting in enormous medical and socioeconomic costs. β -thalassaemia major requires life-long blood transfusion, while α -thalassaemia major is almost uniformly lethal perinatally. To avoid the immune and physical barriers that complicate post-natal therapy, it may be beneficial to instigate treatment during early foetal development. Dr Mattar's research seeks to assess intrauterine gene therapy (IUGT) and intrauterine HSC transplantation (IUHST) in a murine foetal model of severe thalassaemia.

Associate Consultant
Department of Obstetrics and Gynaecology
National University Health System
Yong Loo Lin School of Medicine
National University of Singapore

ASSISTANT PROFESSOR CHONG TSUNG WEN

Intra-vesical Bacillus Calmette-Guerin (BCG) immunotherapy is the standard of care for high-risk superficial bladder cancer. There is an urgent need for improving the efficacy of intra-vesical BCG therapy whilst minimising side effects. Recently, natural killer T (NKT) cell activation by BCG has been proposed as a possible anti-tumour mechanism in patients treated with BCG. Dr Chong's research focuses on the hypothesis that combined immunotherapy with BCG stably incorporated with a glycolipid α -galactosylceramide (α -GalCer) will improve the efficacy of intra-vesical BCG treatment against bladder cancer by potently stimulating NKT cells. More broadly, Dr Chong is also exploring the use of NKT-based immunotherapy in other urological cancers such as Renal cell carcinoma.



Senior Consultant
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Singapore General Hospital
Office of Clinical Sciences
Duke-NUS Graduate Medical School



Consultant
Department of Rheumatology & Immunology
Singapore General Hospital
Office of Clinical Sciences
Duke-NUS Graduate Medical School

ASSISTANT PROFESSOR LEUNG YING YING

Knee osteoarthritis (OA) causes disability and results in a high economic burden on society. Currently, the standard diagnostic investigation for knee OA is the plain radiograph (X-ray), which lacks sensitivity. Changes in cartilage biomarkers predate structural damage in joints, so a combination of these biomarkers has the potential to predict pre-radiographic structural changes as seen via magnetic resonance imaging (MRI). Dr Leung's research aims to evaluate the utility of a combination of cartilage biomarkers as an inexpensive tool to identify subjects in an early stage of knee OA. This will provide baseline data for further research aimed at evaluating the prognostic value of these biomarkers in predicting the progression of knee OA over time.

ASSISTANT PROFESSOR NICHOLAS CHEW SERN YAN

Osteoporosis is a systemic skeletal disease characterised by low bone mass and micro-architectural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture. The prevalence of HIV in Singapore is 0.1 percent, and the current emphasis of HIV medicine is on the consequences of life-long treatment and associated toxicities, including osteoporosis. The silent epidemic of HIV-associated osteoporosis and fragility fracture remains underdiagnosed and contributes to a significant economic and health burden. However, the pathogenesis underlying the initiation and progression of osteoporosis in HIV patients remains unclear. Dr Chew's research explores the hypothesis that a direct interaction between HIV and osteoblast(OB)/osteoclasts(OC) drives alterations in bone biology that ultimately result in HIV-associated osteoporosis. Specifically, Dr Chew aims to identify the mechanism responsible to HIV-driven bone dysregulation.



Consultant
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National University Health System
Yong Loo Lin School of Medicine
National University of Singapore



Clinician Scientist
Singapore Eye Research Institute
Assistant Professor
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Duke-NUS Graduate Medical School
Department of Ophthalmology
Yong Loo Lin School of Medicine
National University of Singapore

ASSISTANT PROFESSOR CHARUMATHI SABANAYAGAM

Chronic kidney disease (CKD) is an emerging public health problem associated with adverse renal and cardiovascular outcomes, while age related macular degeneration (AMD) is a leading cause of irreversible blindness worldwide. Renal and retinal diseases share similar pathogenetic mechanisms including inflammation, oxidative stress, microvascular dysfunction and vascular risk factors. Therefore, identification of new, modifiable risk factors or biomarkers for CKD and AMD may present new avenues for understanding the underlying disease pathogenesis and possibly prevention and treatment. Dr Sabanayagam's research focuses on the association between novel biomarkers and the risk of CKD and AMD in a multi-ethnic Asian population in Singapore.

ASSISTANT PROFESSOR NOBUYO YAWATA

Epidemic keratoconjunctivitis (EKC) is a severe, prolonged inflammation triggered by ocular adenovirus infection, the mechanisms of which are underexplored. Currently, there is no specific treatment for adenovirus infection. Dr Yawata's research focuses on understanding the molecular and cellular mechanisms of the inflammatory processes in EKC in order to support the development of targeted treatments. This involves profiling immune-modulating soluble factors and the cells infiltrating the ocular surface during the course of EKC using tear fluid and conjunctival/corneal samples from patients. The aim of the research is to find approaches that will enable a reduction of excessive inflammation without exacerbating the adenovirus infection.



Assistant Professor
Ocular Inflammation and Immunology
Singapore Eye Research Institute
Clinical Sciences
Duke-NUS Graduate Medical School



Assistant Professor
Department of Paediatrics
National University Health System

ASSISTANT PROFESSOR MAKOTO YAWATA

Multiple myeloma is one of the top five hematologic malignancies in Singapore. Immunomodulatory drugs are a new therapeutic option for myeloma that has contributed to an improvement in patient survival. However, this treatment is expensive and is effective in less than half of myeloma patients. There is thus an urgent need to develop biomarkers to identify the patients who are most likely to benefit from this treatment. Dr Yawata's research is testing the hypothesis that cellular and genetic immune profiles of natural killer cells can provide useful biomarkers for predicting the response to therapy. With a better understanding of the immunomodulatory mechanisms of these drugs, it will also be possible to further enhance their efficacy. Dr Yawata has been supporting haematology-oncology treatment in the Department of Paediatrics in NUHS and will be joining the department to conduct this study.

ASSOCIATE PROFESSOR LEE CHI-HANG, RONALD

Previous research carried out by Dr Lee found a high prevalence of obstructive sleep apnea (OSA) during the acute phase of myocardial infarction, and the OSA independently predicted adverse cardiovascular events at 18-month follow-up. His current research focuses on understanding the temporal change in apnea-hypopnea index (AHI)—an index of OSA severity—and its relationship with changes in left ventricular ejection fraction (LVEF) after acute myocardial infarction. Dr Lee hypothesises that the AHI detected during the acute phase of myocardial infarction may decrease at six-month follow-up, and that the decrease in AHI correlates with an increase in LVEF.



Senior Consultant
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National University Health System
Yong Loo Lin School of Medicine
National University of Singapore



Consultant and Assistant Professor
Department of Medicine
National University Health System
Yong Loo Lin School of Medicine
National University of Singapore

ASSISTANT PROFESSOR TEO BOON WEE

Chronic kidney disease (CKD) is a major public health problem worldwide, but it is often underdiagnosed and undertreated due to its asymptomatic nature. It is therefore essential to identify novel biomarkers that can help in the early detection of CKD, improve risk stratification of progressive CKD, and monitor and adjust therapy more accurately. Retinal microvasculature reflects the systemic circulation in health and disease elsewhere in the body, allowing for non-invasive visualisation of microcirculation and studying its structural and pathological changes directly. Dr Teo hypothesises that retinal vascular imaging can predict progressive CKD. His research aims to correlate retinal microvascular findings to patients with diabetic and non-diabetic CKD, and in a future study he hopes to correlate these findings to the progression of CKD.

ASSISTANT PROFESSOR ANDREA LOW HSIU LING

Systemic sclerosis (SSc) is an autoimmune disease characterised by inflammation, fibrosis and vasculopathy. SSc-associated gastrointestinal (GI) involvement is common, with no effective treatment. Probiotics may have beneficial effects on symptoms and disease progression by influencing the microbiota. In this two site, double-blind, randomised, placebo-controlled trial, Dr Low aims to determine whether probiotics result in greater GI symptom improvement than placebo in SSc outpatients, assessed using an interview-administered gastrointestinal tract questionnaire. This proof-of-concept treatment trial will set the stage for a definitive trial to evaluate efficacy, safety and mechanisms associated with probiotic treatment in SSc.



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TALENT DEVELOPMENT PROGRAMMES

NRF-MOH HEALTHCARE RESEARCH SCHOLARSHIP (PHD)

This scholarship provides support to Basic Specialist Trainees, Advanced Specialist Trainees and Residents who wish to enrol in a PhD programme locally or overseas. It is targeted at young clinicians who wish to pursue a career in translational and clinical research. The scholarship provides funding for the recipient's salary, tuition fees and a maintenance allowance (for overseas PhDs), as well as protected time for research during the clinical training period. Funding for post-doctoral research is also available.

NRF-MOH HEALTHCARE RESEARCH SCHOLARSHIP (MCI)

This scholarship aims to encourage clinicians to pursue advanced clinical research training through the Master of Clinical Investigation (MCI) programme at the Yong Loo Lin School of Medicine at National University of Singapore. The scholarship covers the tuition and research fees for the programme.

NMRC RESEARCH TRAINING FELLOWSHIP

The NMRC Research Training Fellowship aims to provide doctors and allied health professionals with the training necessary to become clinician scientists. Medical doctors registered with the Singapore Medical Council, dental surgeons registered with the Singapore Dental Board, allied health professionals and biostatisticians are all eligible to apply. The fellowship covers both overseas research training and graduate research degree programmes at local or overseas institutions. Awardees of the fellowship receive funding for salary and tuition fees for local graduate degree programmes, or allowances and other benefits in line with the host institution's policies for overseas research attachments.



LIST OF AWARDEES FOR 2012

NMRC RESEARCH TRAINING FELLOWSHIPS AWARDED IN 2012

There were 10 awardees under the NMRC Research Training Fellowship in 2012: 7 awardees are undergoing training leading to a PhD, 2 awardees are undergoing training leading to a Master's degree, and 1 awardee is doing an overseas research attachment.

Name	Institution and Type of Training	Area of Research and Project
Dr Mythily Subramaniam	IMH, SSHSPH PhD (Part-time, overseas)	ADDICTION Qualitative research on elderly gamblers exploring initiation, maintenance and consequences
Dr Amos Loh Hong Pheng	KKH Fellowship (Full-time, overseas)	CANCER Comprehensive preclinical testing of molecular targeted therapies against the PI3K/Akt/mTOR pathway for paediatric solid tumours
Dr Connie Yip Siew Poh	KKH PhD (Full-time, local)	CANCER Imaging tumour heterogeneity with a multimodality functional approach in primary oesophageal cancer
Dr Amartya Mukhopadhyay	NUH MPH (Part-time, local)	CRITICAL CARE Age-related inverse correlation of sedative and analgesic medication dosage in medical ICU patients
Ms Venetia Ong Hui Ling	NUS MPH (Part-time, local)	CRITICAL CARE DATABASE Singapore intensive care unit database
Ms Lan Wanwen	SERI PhD (Part-time, local)	EYE, INFLAMMATORY AND IMMUNE SYSTEM A translational health science approach to evaluation and treatment in pterygium
Ms Nikki Lim-Ashworth Shi Jie	IMH PsyD (Full-time, overseas)	NEUROPSYCHOLOGY Evaluating the efficacy of an emotion regulation component in cognitive behavioural therapy for children with anxiety: a pilot study
Dr Christina Sim Poh Choo	NDC PhD (Part-time, overseas)	ORAL HEALTH, CANCER Radiotherapy in nasopharyngeal carcinoma patients and oral health
Mr Mcvin Cheen Hua Heng	NUS PhD (Part-time, local)	PHARMACOECONOMICS AND OUTCOMES RESEARCH Cost-effectiveness of home-based medication reviews in reducing health services utilisation and drug-related problems and improving health-related quality of life among multi-ethnic Singaporeans
Mrs Sylvia Mun Bee Suan	KKH PhD (Full-time, local)	SOCIAL WORK Resilience of mothers in children with chronic illnesses: pre and post bereavement

COMPLETED IN 2012

Seven awardees completed their training under the NMRC Research Training Fellowship in 2012.

Name	Institution and Type of Training	Area of Research and Project
Dr Joanne Ngeow Yuen Yie	NCCS Fellowship (Full-time, overseas)	CANCER Prevalence of germline PTEN, BMPR1A SMAD4, STK11 and ENG mutations in patients with moderate-load colorectal polyps
Dr Lee Lui Shiong	SGH Fellowship (Full-time, overseas)	CANCER Genomic profiling of patients with adenocarcinoma of the prostate with clinical correlation to pathological outcomes and oncological outcomes
Ms Loo Hooi Yin Jenny	NUH PhD (Full-time, overseas)	EAR Management for children with auditory processing deficits due to PAX6 mutation
Dr Nattharee Chanchareonsook	NDC PhD (Part-time, overseas)	ORAL HEALTH Mandibular reconstruction polycaprolactone endoprosthetic scaffold: a monkey study
Dr Johnson Fam	SGH Fellowship (Full-time, overseas)	PSYCHIATRY Effect of NMDA antagonist on glutamate and glutamine in depression
Dr Tan Yung Khan	TTSH Fellowship (Full-time, overseas)	RENAL, UROGENITAL Novel use of paramagnetic iron-oxide nanoparticles to improve the efficiency and effectiveness of endoscopic stone fragment retrieval
Dr Gerald Koh Choon Huat	SSHSPH PhD (Full-time, overseas)	STROKE Rehabilitation effectiveness and efficiency in post-acute in-patient rehabilitation facilities in Singapore

NRF-MOH HEALTHCARE RESEARCH SCHOLARSHIPS (PHD) COMPLETED IN 2012

Two awardees completed their training under the NRF-MOH Healthcare Research Scholarship (PhD) in 2012.

Name	Institution	Area of Research and Project
Dr Thomas Chan Kong Ngai	Cardiothoracic Surgery, Singapore General Hospital	INFLAMMATORY AND IMMUNE SYSTEM Regulatory T cell therapy in experimental organ transplantation
Dr Yeo Wee Song	Paediatrics, National University Health System	INFLAMMATORY AND IMMUNE SYSTEM Role of monocytes in paediatric patients with minimal change nephrotic syndrome

NRF-MOH HEALTHCARE RESEARCH SCHOLARSHIPS (MCI) AWARDED IN 2012

There were nine awardees under the NRF-MOH Healthcare Research Scholarship (MCI) for the NUS Master of Clinical Investigation in 2012.

Name	Institution	Department
Dr Lee Jan Hau	KKH	Children's Intensive Care Unit
Dr Quek May Lin Amy	NUHS	Department of Medicine, Division of Neurology
Dr Kwek Boon Eu, Andrew	CGH	Gastroenterology
Dr Veerendra Melagireppa Chadachan	TTSH	General Medicine
Dr Zhang Zhiyong Edward	CGH	Otolaryngology
Dr Tan Sheng Neng	CGH	Psychological Medicine
Dr Loh Yong Joo	TTSH	Rehabilitation Medicine
Dr Shelat Vishalkumar Girishchandra	TTSH	Surgery
Dr Tay Kae Jack	SGH	Urology

COMPLETED IN 2012

Nine awardees completed their NUS Master of Clinical Investigation training under the NRF-MOH Healthcare Research Scholarship (MCI) in 2012.

Name	Institution	Area of Research and Project
Dr Sng Ban Leong	KKH	ANAESTHESIA To predict risk factors for developing chronic pain in women after abdominal hysterectomy
Dr Wee Kien Han Andrew	SingHealth (Marine Parade)	FAMILY MEDICINE Evaluating vitamin B12 deficiency in diabetic patients of the Family Physician Clinic (FPC) of Marine Parade Polyclinic
Dr Tan Shu Yun	SGH	FAMILY MEDICINE, CONTINUING CARE Survival pattern of adult patient after first stroke by level of disability
Dr Ng Chin Hin	NUH	HAEMATOLOGY-ONCOLOGY To identify a biomarker in the plasma of a newly diagnosed AML which could correlate well with leukemic stem cell load in the marrow
Dr Teng Gim Gee	NUH	MEDICINE, RHEUMATOLOGY A prospective study of dietary and lifestyle risk factors of gout among the middle-aged and elderly in the Singapore Chinese Health Study
Dr Rajinder Singh	NNI	NEUROLOGY Neuroprotection with high dose statins in acute ischemic stroke trial: a randomised, double-blind, placebo-controlled study
Dr Ang Han Nian, Marcus	SNEC	OPHTHALMOLOGY Small incision lenticule extraction (SMILE) versus LASIK: a randomised, non-inferiority trial
Dr Tan Pei Lin, Lynnette	TTSH	PSYCHOLOGICAL MEDICINE The influence of treatment of depression in stroke patients on functional outcome post-rehabilitation
Dr Ch'ng Jack Kian	SGH	SURGERY Idiopathic peptic ulcer: the role of IL17, IL22 and defensins

CLINICIAN SCIENTISTS IN THE SPOTLIGHT



A JOURNEY OF LEARNING

Assistant Professor Jimmy Lee

Consultant, Department of General Psychiatry 1 & Research, Institute of Mental Health
Assistant Professor, Office of Clinical Sciences, Duke-NUS Graduate Medical School

Affecting 1 in 100 people, schizophrenia is one of the leading causes of disability in Singapore and around the world, yet diagnosing the disease is challenging. Psychiatrists currently rely on reliable accounts and behavioural observations to make a diagnosis, so there is a need for more reliable and objective tools.

This is the focus of a research group led by Dr Jimmy Lee, which is aiming to identify clinically relevant molecular signatures in the blood of patients with psychosis that can be attributed to disease processes or treatments. He notes: “If successful, we might have an objective marker that could aid clinicians in patient care.”

Dr Lee’s research is being funded by a Transition Award from NMRC, which he was awarded in 2012. This award has helped Dr Lee kick-start his independent research efforts after recently completing the two-year, part-time Master of Clinical Investigation (MCI) programme at the Yong Loo Lin School of Medicine at National University of Singapore—studies for which he received an NRF-MOH Healthcare Research Scholarship (MCI) in 2008.

Seeking a better way

Dr Lee had already been dabbling in clinical research projects prior to 2008, and it was through these efforts that he recognised the need for formal training in research. “I felt that although I had a medical education, I lacked a research education. I looked around for research courses and started with the NHG Clinician Leadership in Research Programme in 2007. When the MCI came along, I seized the opportunity to get ‘formally’ educated in research”, he explains.

A key turning point that spurred Dr Lee’s interest in research came when he started seeing patients and questioning certain clinical practices. At times, these interactions with patients left him wondering whether there might be a better way of doing things.

“The possibility of changing the way psychiatric care is delivered to patients is one of the biggest rewards. I use the word ‘possibility’ as success can never be guaranteed, but at least we can make an attempt”, Dr Lee says. He adds that he also tries to provide research participants with “benefits” through his daily research work, whether in the form of clinical laboratory results or health advice. This allows his research to have an immediate and longer-term impact on patient care.

Getting started

To become a successful clinician scientist can take years or even decades of hard work and perseverance, but everyone has to start somewhere. For clinicians interested in playing an active role in translational and clinical research, Dr Lee has the following advice: “First, get a research education, whether it is a Master’s degree or a PhD. Second, get trained by spending a good amount of time immersing yourself in research. If a good centre isn’t available here, go overseas and seek out the best—you will benefit from the intellectual stimulation and the opportunities for future collaborations. Third, find good mentors who can help you focus your research and refine your capabilities.”



PRIVILEGE AND RESPONSIBILITY

Assistant Professor Sue-Anne Toh Ee Shiew

Consultant, Department of Medicine, National University Health System

Assistant Professor, Office of Clinical Sciences, Duke-NUS Graduate Medical School

With type 2 diabetes mellitus (T2DM) affecting approximately 1 in 10 people in Singapore, the health and economic burden of this disease is huge. Although T2DM and its complications are preventable, the challenge lies in identifying those at risk in order to improve the prevention and early detection of the disease.

This challenge is the focus of research into the role of fat function being carried out by Assistant Professor Sue-Anne Toh Ee Shiew, who was awarded a Clinician Scientist Award (Investigator) by NMRC in 2012. Dr Toh and her team hypothesise that there are inherited traits in fat function—or adipose tissue biology—that contribute to the development of insulin resistance and that these factors can be modulated for improved prevention and treatment of T2DM.

“The potential implications are that we may identify a signature pattern of adipose markers in individuals at risk for diabetes, which could translate into improved prediction and risk stratification tools for this disease”, says Dr Toh. “Insights into adipose tissue function gained from this project could also highlight novel pathways in fat that can be pharmacologically targeted for treatment of T2DM and help identify the population subsets that might benefit most from this approach in drug development trials.”

Dr Toh notes that clinician scientists have both the privilege and the responsibility to make a difference at a macro level via discoveries that could translate into widely applicable clinical practice. “What I find particularly rewarding is the prospect that our research findings could contribute towards a solution to a larger problem. The realisation that our research work could contribute towards changing the course of diabetes in Singapore is most rewarding to me.”

On a quest for answers

Touching on how she ended up pursuing a career in medical research, Dr Toh says, “It really bothered me that certain clinical observations cannot be adequately explained or optimally managed with existing knowledge. Doing research was a positive way of channelling some of those frustrations into productive efforts to push the boundaries of existing knowledge so we can provide better care.”

While she is encouraged by the progress in her research, Dr Toh has faced challenges along the way. Despite rapid growth in the local biomedical research landscape, she notes that Singapore must still play catch-up with more mature research programmes in countries such as the UK and US. “One of the challenges I have faced is establishing a team with the experience and expertise to independently drive translational research activities and accelerate progress through innovation.”

Another challenge is maintaining favourable visibility for her team’s work on the international stage, which Dr Toh strives to overcome through active engagement with parties outside Singapore: “We maintain productive collaborations with a network of international investigators, facilitate training and exposure for our staff at world-class research programmes abroad, and participate in international conferences and collaborative meetings to expand our reach.”

Although it may not always be smooth sailing, Dr Toh remains driven in her quest for answers. For aspiring clinician scientists considering following in her footsteps, she has this advice: “Choose an area of interest that you are truly passionate about. You will need stamina that can only be maintained if you wake up to something you are genuinely excited about each day.”



SEEING BEYOND SILOS

Associate Professor Louis Tong

**Senior Consultant, Department of Cornea and External Eye Disease, Singapore National Eye Centre
Associate Professor, Office of Clinical Sciences, Duke-NUS Graduate Medical School**

Dry eye disease (DED) is a major chronic health problem in Singapore and worldwide, with significant implications in terms of reduced quality of life. Numerous underlying causes make DED difficult to evaluate, and treatment is often expensive and ineffective.

Associate Professor Louis Tong, who was awarded a Clinician Scientist Award (Senior Investigator) by NMRC in 2012, is trying to tackle this challenge. His research aims to develop more effective diagnosis and treatment of DED, with a primary focus on the major intrinsic type of evaporative DED, meibomian gland dysfunction, and two important types of extrinsic evaporative DED (chronic preservative exposure and pterygium). With an international reputation in DED research and as head of the only dedicated DED clinical service in Southeast Asia, A/Prof Tong is well placed to take on these problems.

Innovative solutions

Translational research requires innovative thinking. For A/Prof Tong and his team of collaborators, this requires a willingness to cast a wide net for solutions by thinking beyond established medical practices. For example, his team has developed a novel way to produce eye drops by processing plasma from patients' own blood. Seeking an alternative to eye drops from artificial sources, the team came up with the idea of using a biological agent with properties similar to natural tears and eventually settled on plasma.

"The rationale is that any kind of commercial eye drops are normally very artificial. They don't contain the essential proteins and growth factors that keep your ocular surface healthy", explains A/Prof Tong. "With plasma, because it is

autologous, you don't have to be as worried about infection from another person."

This outside-the-box approach helps A/Prof Tong in his research. Yet one of the key challenges he faces as a clinician scientist is bridging the gap between novel thinking and entrenched mindsets.

Shaking up the status quo

"Part of the challenge is how to get the entire healthcare system working together. People are currently working in silos. Traditionally, eye departments work in one place and haematology works in another place and blood banks work in another place. Basically, no one really wants to step outside their comfort zone", says A/Prof Tong.

He acknowledges that there can be legitimate reasons—for example, regulatory requirements—that prevent healthcare players from trying new things. However, this just means that wider coordinated efforts are needed to bring about change, rather than simply giving up on opportunities for progress because it is easier to stick with the status quo. "That's one of those challenges that you face in inter-disciplinary science. How do you get beyond this thinking of doing what is safe and what is established?" he adds.

Getting others to adopt an innovative mindset will remain a challenge for the foreseeable future. In the meantime, A/Prof Tong and his team continue to push ahead with their research and collaborations, while in the process further enhancing patient care and strengthening Singapore's reputation as a leading research centre for ocular surface diseases.

EXCELLENCE THROUGH COLLABORATION

Professor Stuart Cook

**Professor, Department of Cardiology, National Heart Centre Singapore
Professor, Office of Research, Duke-NUS Graduate Medical School**

Heart failure is a disease of epidemic proportions and increasing prevalence, but the molecular mechanisms leading to systolic and diastolic dysfunction remain poorly understood. These mechanisms are the primary research focus of Professor Stuart Cook, who was awarded a STaR Investigator Award by NMRC in 2012.

In collaboration with leading laboratories around the world, Prof Cook's team is studying cohorts of intricately phenotyped patients to better understand the why and how of human heart dysfunction at the molecular level. Specifically, the team aims to shed light on the genetic and genomic determinants of systolic and diastolic dysfunction and define the mechanisms underlying cardiac fibroblast-induced heart disease, which is a common pathway underlying both inherited and acquired heart disease.

Why Singapore?

Prof Cook and his family moved to Singapore in October 2012. Despite having a well-established research programme in the UK, he saw the move to Singapore as an excellent opportunity to broaden his horizons. "The opportunities in Singapore are very significant as there is a big push into the space that I work in, which is the link between the patients and the science. So it was very opportune", he explains.

From a research perspective, Prof Cook notes that he was attracted by a gap in the existing knowledge regarding heart failure in Southeast Asia, which he hopes to address. "A lot of what I do is in the genetics of sudden death and what causes the heart's electrical or pump activity to go wrong. We've done lots of studies of that in Caucasians, but almost nothing has been done in local Singaporean and Southeast Asian populations, where it is an issue."

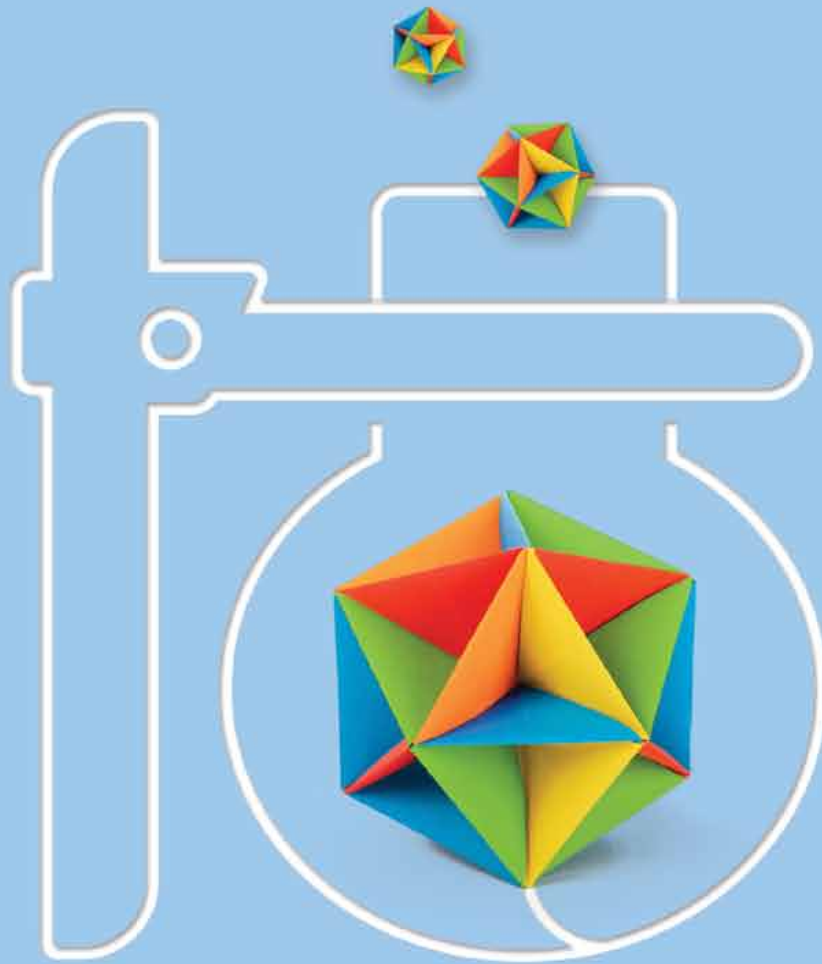
A conducive research environment is another big attraction that encouraged Prof Cook's decision to relocate to Singapore. "A big advantage here is that some of the bigger hospitals like the National Heart Centre have large volumes of patients. In the UK it is a bit more distributed, whereas here I think they do more than 750 bypass operations per year. That's really quite high and gives us the patient throughput required for our research."

Working with the best

Collaboration features prominently in Prof Cook's research as he works actively with his peers at top labs around the world. "The best way to deliver research in this area is with a team, and the team has to have distributed expertise. As one of my mentors once said, never be the most intelligent person in the room. If you have only clinicians with a clinical point of view or if you have only basic scientists, it won't work. It is when you put excellent people together and work at the interface that you get a synergistic boost", he says.

Building on the point about distributed expertise, Prof Cook notes that he is seeing a trend in many countries where translational research is being pushed too much into the hands of clinicians, rather than maintaining a balance between clinicians and basic scientists. "I think that's something to be wary of because if you just have clinicians running the show, thinking that they can deliver the basic science insights, it's going to fail because they simply don't have the training. Imagine the flip side where you would have basic scientists trying to drive the clinical agenda..."

While collaboration is crucial in translational research, Prof Cook adds a caveat: "Work with the best people. The way that you become excellent is to work with excellent people."



RESEARCH GRANTS

FUNDING TRANSLATIONAL AND CLINICAL RESEARCH



The funding of translational and clinical research (TCR) is one of the core pillars of NMRC's mandate. To carry out this function, NMRC offers several grant programmes that support small-scale and large-scale Singapore-based research initiatives covering a broad spectrum of biomedical sciences.

NMRC's grant programmes are divided into two main categories:

1. Strategic/thematic research
2. Investigator-led research

The first category consists of TCR Flagship Programmes and Centre Grants. TCR Flagship Programmes provide significant levels of funding to large-scale strategic studies that span across the spectrum of basic, translational and clinical research. Centre Grants are awarded via a performance-based competitive mechanism to provide core research funding to clinical institutions with the aim to strengthen the overall research competitiveness of the institutions.

The second category supports different types of investigator-led studies via the following grant schemes:

- Individual Research Grant (IRG)*
- Exploratory/Developmental Grant (EDG)*
- New Investigator Grant (NIG)*
- Clinician Scientist Individual Research Grant (CS-IRG)
- CS-IRG New Investigator Grant (CS-IRG-NIG)
- Cooperative Basic Research Grant (CBRG)
- CBRG New Investigator Grant (CBRG-NIG)
- Bedside & Bench Grant (B&B)
- Health Services Research Competitive Research Grant (HSR CRG)

*While there are still ongoing projects that were funded via the IRG, EDG and NIG schemes, the final grant call for these schemes was held in May 2011. The newer grant schemes were launched in November 2011.

To ensure that its limited funds are put to the best possible use by funding the best science, NMRC awards all of its research grants on a competitive, peer-reviewed basis.

STRATEGIC/THEMATIC RESEARCH

TRANSLATIONAL AND CLINICAL RESEARCH (TCR) FLAGSHIP PROGRAMME

The TCR Flagship Programme is a strategic initiative that was launched by NMRC in 2007 to fund TCR in key disease areas that are clinically relevant to Singapore. The programme's aims are:

- To bring together the best complementary research strengths in hospitals, national disease centres, universities and A*STAR research institutes to focus on diseases or research themes of strategic importance.
- To build up a critical mass of experienced high-level researchers to facilitate a broader research platform, and increase collaboration both locally and internationally.
- To establish Singapore as a global leader in the study of key strategic medical research fields by integrating, coordinating and leveraging the full spectrum of research capabilities in Singapore from basic science to clinical research in a comprehensive manner.

Under the S&T2010 funding, five TCR flagship programmes in the areas of gastric cancer, neuroscience (schizophrenia), eye diseases, infectious diseases (dengue) and metabolic diseases, were each awarded \$25 million to carry out research over a period of five years under the leadership of a well-qualified clinician-scientist.

Further funding of \$175 million has been secured from the National Research Foundation's (NRF) Research, Innovation and Enterprise 2015 (RIE2015) Open Collaborative Funds (OCF) for this important initiative. The money will be distributed across three grant calls to provide opportunities for new programmes to be funded and existing programmes to be renewed on a competitive basis.

Under RIE2015, two tiers of TCR flagship programme funding are available:

- Tier 1: capped at \$9 million, inclusive of indirect costs, over a period of five years.
- Tier 2: capped at \$25 million, inclusive of indirect costs, over a period of five years.

Progress update

As of Q1 2013, there are a total of nine ongoing TCR Flagship Programmes: five funded under the S&T2010 funding and four under the RIE2015 framework (two Tier 1 programmes and two Tier 2 programmes). The Tier 2 awards were renewals for two of the five pioneer TCR Flagship Programmes.

OVERVIEW OF ALL TCR FLAGSHIP PROGRAMMES AS OF 15 MARCH 2013

S/N	Title	Disease Area of Research	Lead PI	Year of Award
1	The Singapore Gastric Cancer Consortium – Improving Outcomes for Our Patients	Oncology (gastric cancer)	A/Prof Yeoh Khay Guan	2007
2	Vulnerability, Disease Progression, and Treatment in Schizophrenia and Related Psychoses	Neuroscience (schizophrenia)	A/Prof Chong Siow Ann	2008
3	Singapore Eye Research Institute TRIOS Programme (Translational Research Innovations in Ocular Surgery)	Eye diseases	Prof Donald Tan	2008
4	Developmental Pathways to Metabolic Disease	Metabolic diseases	A/Prof Chong Yap Seng	2008
5	Scientific Exploration, Translational Research, Operational Evaluation of Disease Prevention and Preventative Measures Through New Treatment Strategies Against Dengue (STOP Dengue)	Infectious diseases (dengue)	A/Prof Leo Yee Sin	2008
6	Genetic Predisposition, Epigenetic Change, MicroRNA Profiling and Experimental Therapies in Heart Failure	Cardiovascular diseases	Prof Mark Richards	2013
7	Non-Small Cell Lung Cancer: Targeting Cancer Stem Cell and Drug Resistance	Oncology (lung cancer)	A/Prof Tan Eng Huat	2013
8	Eye Surgery and Innovative Technologies (EyeSITE)	Eye diseases	Prof Donald Tan	2013
9	Singapore Gastric Cancer Consortium – Re-defining Gastric Cancer Management	Oncology (gastric cancer)	A/Prof Yeoh Khay Guan	2013

KEY ACHIEVEMENTS OF THE FIVE PIONEER TCR FLAGSHIP PROGRAMMES UNDER BMS PHASE II

Human Capital	
PhD students trained and graduated	21
Master's degree students trained and graduated	18
Post-docs employed	70

Intellectual Capital	
Invention disclosures	28
Publications in peer-reviewed journals	382
Presentations at major conferences	659
Patents (primary & secondary) filed	59
Patents granted	7
Patents commercialised	2

Industry Relevance	
Industry funding	\$28.25 million
Spin-offs and start-ups emerging from research programmes	4
Clinical trials initiated	19

NEUROSCIENCE TCR FLAGSHIP PROGRAMME: VULNERABILITY, DISEASE PROGRESSION, AND TREATMENT IN SCHIZOPHRENIA AND RELATED PSYCHOSES

Principal Investigator:

A/Prof Chong Siow Ann
Vice Chairman, Medical Board (Research)
Senior Consultant Psychiatrist
Institute of Mental Health

Launched in July 2008, this TCR flagship programme aims to identify key genetic, biological, cognitive, clinical and social risk factors for psychotic disorders, and to establish the efficacy and safety of a neurocognitive-enhancing agent for patients with schizophrenia. The programme comprises three projects:

- A comprehensive genetic study of schizophrenia and its neurocognitive impairments
- The Longitudinal Youth At-Risk Study (LYRIKS), a public health initiative that aims to identify the biomarkers of disease vulnerability, progression and therapeutic response for psychosis
- A double-blind randomised clinical trial to evaluate the efficacy and safety of a putative neurocognitive-enhancing agent for patients with schizophrenia



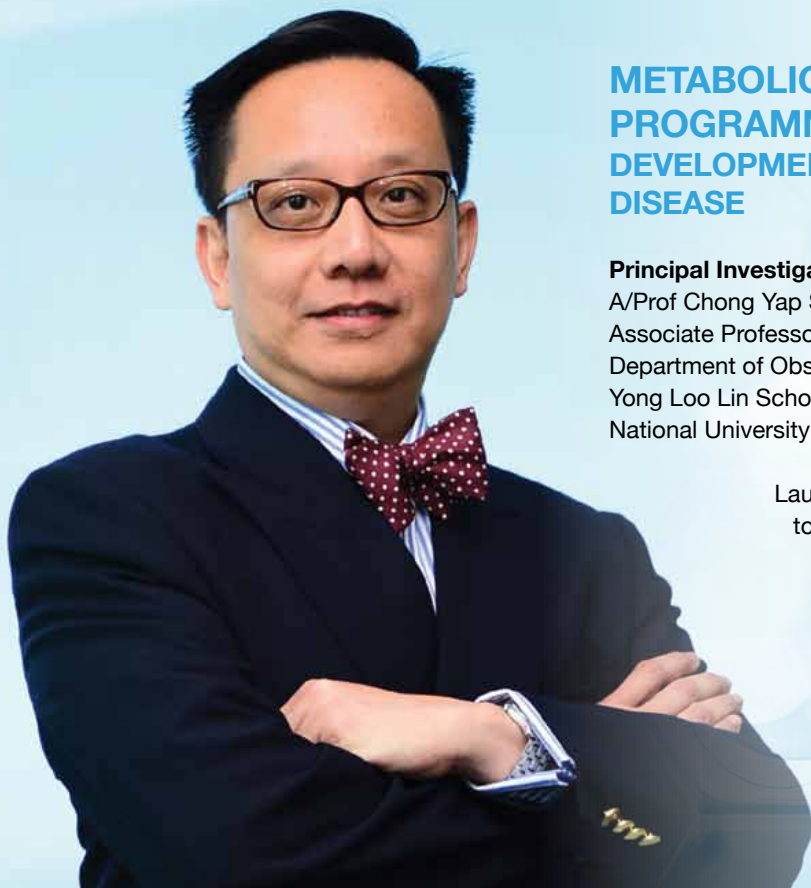
METABOLIC DISEASES TCR FLAGSHIP PROGRAMME: DEVELOPMENTAL PATHWAYS TO METABOLIC DISEASE

Principal Investigator:

A/Prof Chong Yap Seng
Associate Professor & Senior Consultant
Department of Obstetrics & Gynaecology
Yong Loo Lin School of Medicine
National University of Singapore

Launched in June 2009, this TCR flagship programme aims to provide a scientific base from which to design prevention and intervention strategies to reduce the burden of chronic diseases such as diabetes and obesity. The programme consists of three main sub-studies:

- A birth-cohort study: GUSTO (Growing Up in Singapore Towards healthy Outcomes)
- An adult metabolism study: SAMS (Singapore Adult Metabolism Study)
 - An animal study: GRACE (Growth Regulation in Animals and Cellular Epigenetics)



INFECTIOUS DISEASES TCR FLAGSHIP PROGRAMME: SCIENTIFIC EXPLORATION, TRANSLATIONAL RESEARCH, OPERATIONAL EVALUATION OF DISEASE PREVENTION AND PREVENTATIVE MEASURES THROUGH NEW TREATMENT STRATEGIES AGAINST DENGUE (STOP DENGUE)

Principal Investigator:

A/Prof Leo Yee Sin
Clinical Director
Communicable Disease Centre
Tan Tock Seng Hospital

Launched in December 2008, this TCR flagship programme has a simple objective: to stop dengue by studying the major gaps in treatment and management of dengue diseases. Specifically, the programme aims to:

- Create a global centre of excellence for the clinical study and management of dengue diseases
- Improve dengue prevention through epidemiological studies and entomological control
- Elucidate pathogenesis of adult dengue disease and identify those at risk of poor outcomes from dengue through better diagnostic and prognostic tools
- Improve clinical management of dengue illness through evaluation of current therapeutic strategies and development of new ways to treat dengue



LUNG CANCER TCR FLAGSHIP PROGRAMME: NON-SMALL CELL LUNG CANCER: TARGETING CANCER STEM CELL AND DRUG RESISTANCE



Principal Investigator:

A/Prof Tan Eng Huat
Director & Senior Consultant
Department of Medical Oncology (Research)
National Cancer Centre Singapore

In January 2013, NMRC awarded Tier 1 funding for this TCR flagship programme focused on lung cancer. The programme, which focuses primarily on individuals with lung cancer who have never smoked (termed “never-smokers”), has the following four objectives:

1. To conduct a comprehensive analysis of the cancer genome of never-smokers with lung cancer in order to gain a complete or near-complete view of the genomic mutations.
2. To look for novel genomic mutations other than those already known that can potentially be treated by new targeted agents. These new targeted agents can be used in combination with standard treatment in order to enhance the efficacy of standard therapies, thereby prolonging quality survival.
3. To determine the spectrum of acquired genomic alterations that can contribute to the onset of resistance to targeted agents and to design rational clinical studies combining newer targeted agents with standard therapies to address these mechanisms of resistance in patients.
4. To understand more deeply the behaviour of cancer stem cells that are believed to be the source of cancer cell proliferations and to develop strategies to target this subset of cancer cells that may lead to more durable remission of lung cancer and therefore improve survival outcomes.

To achieve these objectives, the team will ensure close collaboration both amongst the researchers and with the patients participating in the programme. It is crucial that the patients understand the importance of undergoing repeat and potentially invasive biopsies, as these will allow the team to carry out analysis of the cancer genomes and design the clinical studies in a more rational manner.

The team has already established close collaboration with major pharmaceutical companies that have a rich pipeline of new targeted compounds undergoing early phase clinical trials. As a result, the team has put in place several clinical trials that may potentially benefit patients in terms of tumour control.



EYE DISEASES TCR FLAGSHIP PROGRAMME: EYE SURGERY AND INNOVATIVE TECHNOLOGIES (EYESITE)

Principal Investigator:

Prof Donald Tan
Medical Director
Singapore National Eye Centre

In January 2013, NMRC awarded Tier 2 funding for this TCR flagship programme focused on eye diseases. It is a continuation of the previous eye diseases TCR flagship programme, named Translational Research Innovations in Ocular Surgery (TRIOS), which was launched in 2008 and is currently in its final year.

This new programme aims to develop novel clinical therapies and diagnostic applications to help alleviate ocular morbidity from major eye diseases, including corneal disease, infection, glaucoma, refractive errors and retinal disorders. The specific objectives are:

1. To develop new classes of antimicrobial small peptide and peptoid molecules that will help treat various types of corneal infection
2. To develop sustained drug delivery carriers to provide prolonged drug release without relying on patient compliance
3. To develop a novel artificial cornea to treat severe corneal blindness via a bionic cornea programme
4. To develop a new treatment for keratectasia, keratoconus and presbyopia utilising femtosecond laser refractive technology
5. To develop new diagnostic and prognostic approaches to primary angle closure glaucoma (PACG)

This programme builds on the notable achievements of the previous eye diseases TCR flagship programme, which include:

- Invention of the Tan EndoGlide, a disposable surgical device for corneal transplantation
- Development of three novel synthetic antimicrobial defensin molecules
- Development of a novel drug delivery system using advanced nanotechnology and biomaterials that allow for the timed release of drugs for treating glaucoma
- Development of corneal intrastromal lenticules from femtosecond refractive surgery for long-term cryopreservation and potential re-implantation
- Discovery of genes linked to PACG as part of an international consortium



GASTRIC CANCER TCR FLAGSHIP PROGRAMME: SINGAPORE GASTRIC CANCER CONSORTIUM – RE-DEFINING GASTRIC CANCER MANAGEMENT

Principal Investigator:

A/Prof Yeoh Khay Guan
Associate Professor
Department of Medicine
National University of Singapore

In January 2013, NMRC awarded Tier 2 funding to the Singapore Gastric Cancer Consortium (SGCC) for this TCR flagship programme, which is a continuation of the previous gastric cancer TCR flagship programme carried out by SGCC from 2007 to 2012. This new programme aims to improve the management of gastric cancer and patient outcomes for those suffering from the disease through research spanning three key themes:

1. Early detection. This theme will focus on developing a cost-effective gastric cancer screening strategy for Singapore patients by identifying suitable blood-based diagnostic biomarkers from candidate biomarkers identified in a previously assembled pre-disease high-risk cohort (Gastric Cancer Epidemiology Programme).
2. Therapeutics. This theme will focus on new and ongoing clinical trials aimed at establishing the clinical usefulness of the genomic classification of gastric cancer previously discovered by the team to be able to predict patient survival and drug responses in cell lines and patients, and testing the efficacy of new treatment options. The ultimate aim is to improve treatment.
3. Gastric carcinogenesis. This theme will focus on understanding the molecular biology of gastric cancer. The team aims to identify new therapeutic targets and early detection biomarkers through the use of animal models that faithfully recapitulate various aspects of gastric cancer development, including transitions from normal gastric tissue to precancerous states and eventual cancer.

This programme builds on the notable achievements of the previous gastric cancer TCR flagship programme, which include:

- Developing a new genomic classification of gastric cancer that may be superior to the classic Lauren classification
- Being the first team in the world to perform robotic Natural Orifice Transluminal Endoscopic Surgery (NOTES) in human patients
- Being the first team in Singapore to diagnose early stage 1 or stage 0 gastric cancer through endoscopic screening of a pre-disease high-risk cohort
- Carrying out biomarker discovery projects that resulted in the protection of two novel biomarkers for gastric cancer detection
- Carrying out a study of genomic copy number alternations in gastric cancer that suggests that close to 37 percent of gastric cancer cases diagnosed may be treatable by drugs targeting a single cell signalling pathway
- Achieving deeper understanding of the molecular pathways leading to gastric cancer development
- Discovering a way to overcome resistance to cisplatin, a commonly used chemotherapeutic agent



CARDIOVASCULAR DISEASES TCR FLAGSHIP PROGRAMME: GENETIC PREDILECTION, EPIGENETIC CHANGE, MICRORNA PROFILING AND EXPERIMENTAL THERAPIES IN HEART FAILURE

Principal Investigator:

Prof Mark Richards
Director
Cardiovascular Research Institute
National University Health System

In January 2013, NMRC awarded Tier 1 funding for this TCR flagship programme focused on cardiovascular diseases. The overall aim of the programme is to improve understanding of inherited factors for risk of heart failure, with a view to improving prediction of heart disease and identifying new treatments. This will be achieved through genetic studies and the identification of specific gene products.

The research under this programme will focus on four key areas:

1. Differences in genetic background
2. Different activation and de-activation of genes (epigenetics)
3. The role of intermediate gene products (microRNAs)
4. The potential of gene targets

The team will use cardiac ultrasounds to measure changes in heart function to determine any relation to genetic variation. It will also explore the use of microRNAs that are detected circulating freely in the blood of patients with heart failure or those afflicted with heart valve disease and heart attacks as potential biomarkers for the diagnosis of heart failure and as pointers to new therapeutic targets in heart failure.

Animal studies using mice with genetic modifications that lead to heart failure or with experimental induction of heart failure will be conducted in parallel to the programme's human studies. Corroboration of findings from both subject groups would open up the plausibility of using genetically engineered mice to find new treatments for heart failure.

The research team for this programme brings together essential skills and experience in both basic science and clinical care of heart failure via team members based in four sites: the National University Heart Centre, Singapore; the Genome Institute of Singapore; the Department of Biochemistry, Yong Loo Lin School of Medicine; and the Institute of Medical Biology.

CENTRE GRANT FUNDING FRAMEWORK

The aim of the revised Centre Grant (CG) funding framework is to provide core funding support to the public hospitals and national disease-specific centres to build up their core research capabilities in terms of common research platforms, shared equipment and core research manpower. One of the key aspects of the CG funding model is to also provide longer-term research funding to sustain core research activities in the eligible research institutions.

The revised CG funding framework adopts a competitive performance-based mechanism to award funding. It evolved from two previous NMRC research funding frameworks: the Institutional Block Grant/Enabling Block Grant (IBG/EG)¹ and the Centre Grant/Programmatic Project Grant (CG/PPG)², with integration of key successful components from the previous models

NMRC launched the first grant call of the revised CG funding framework in August 2012 and received applications from 17 eligible centres/institutions. Each application underwent two levels of evaluation: first, looking at the institution's research performance over the past three years, and second, assessing the institution's proposed four-year strategy for building up its core research capabilities.

CGs with a funding quantum ranging from \$3 million (for developing centres) to \$26 million (established centres) were awarded to the 17 eligible centres/institutions for a four-year funding period from 1 April 2013 to 31 March 2017. All the CG awardees will be subjected to a mid-term review in FY2015 by the Centre Grant Evaluation Panel and the Centre Grant Scientific Advisory Board.

¹ The IBG/EG scheme was launched in 1994 and it provided annual block funding to national disease-specific centres and research units in public hospitals.

² The CG/PPG scheme was implemented in 2009 to replace the IBG/EG scheme. CGs/PPGs were awarded through a competitive scientific review process to support research programmes involving a team of investigators working towards a central research themes, as well as being awarded to administration units.

INVESTIGATOR-LED RESEARCH GRANTS

Over the past five years, NMRC has funded a total of 529 investigator-led research projects via the Individual Research Grant (IRG) scheme (251 grants), Exploratory/Developmental Grant (EDG) scheme (141 grants) and New Investigator Grant (NIG) scheme (137 grants). The final grant call for these three schemes was held in May 2011.

To date, these projects have generated more than 3,000 high impact journal papers and contributed to the training and local employment of about 370 PhD-level scientists.

In addition, NMRC has also funded investigator-led research via the following five grant schemes launched in 2011:

CLINICIAN SCIENTIST-INDIVIDUAL RESEARCH GRANTS

Clinician Scientist-Individual Research Grants (CS-IRGs) are provided to clinician scientists to enable them to carry out medical research on a specifically defined topic for a period of three years in a local public institution. The focus of the research should be translational and clinical in nature. The quantum supported for CS-IRGs is up to \$1.5 million over a period of three years. CS-IRG grant calls are made twice per year, with closing dates on 1 June and 1 December.

Period	Proposals Reviewed	Grants Awarded	Total Sum Awarded (\$ millions)
Nov 2011	93	19	19.9
May 2012	79	15	17.5
Total	172	34	37.4

CS-IRG NEW INVESTIGATOR GRANTS

The CS-IRG New Investigator Grant (CS-IRG-NIG) is a sub-category of the CS-IRG that is targeted specifically at new clinical investigators. The CS-IRG-NIG is intended to serve as a career stepping stone, providing new investigators with their first independent national-level grant. Applicants with substantial research experience are not eligible to apply for this grant. The quantum supported for CS-IRG-NIGs is up to \$200,000 over a period of two years.

Period	Proposals Reviewed	Grants Awarded	Total Sum Awarded (\$ millions)
Nov 2011	44	9	2.04
May 2012	40	9	2.01
Total	84	18	4.05



COOPERATIVE BASIC RESEARCH GRANTS

Cooperative Basic Research Grants (CBRGs) are provided to non-clinician researchers to carry out basic and translational clinical research that is relevant to human health, as well as research that looks at the causes, consequences, diagnosis and treatment of human diseases. CBRGs also aim to promote basic biomedical sciences (BMS) research collaborations across institutions in Singapore. The quantum supported for CBRGs is up to \$1.5 million over a period of three years. CBRG grant calls are made once a year, with the closing date on 1 December.

Period	Proposals Reviewed	Grants Awarded	Total Sum Awarded (\$ millions)
Nov 2011	109	27	31.4

CBRG NEW INVESTIGATOR GRANTS

The CBRG New Investigator Grant (CBRG-NIG) is a subcategory of the CBRG that is targeted specifically at new non-clinical investigators. The CBRG-NIG is intended to serve as a career stepping stone, providing new investigators with their first independent national-level grant. Applicants with substantial research experience are not eligible to apply for this grant. The quantum supported for CBRG-NIGs is up to \$200,000 over a period of two years.

Period	Proposals Reviewed	Grants Awarded	Total Sum Awarded (\$ millions)
Nov 2011	20	11	2.52

BEDSIDE & BENCH GRANTS

Bedside & Bench (B&B) Grants aim to foster closer interactions between basic scientists and clinicians in order to translate scientific discoveries in the laboratory into clinically useful and commercially viable applications to improve health outcomes.

For B&B Grants, each Co-Principal Investigator must provide symmetrical intellectual inputs for the project. Partnerships with industry collaborators are strongly encouraged and additional consideration will be given to proposals that demonstrate industrial interest or engagement. The scheme supports up to \$5 million per project depending on the host institutions of the Co-Principal Investigators, with funding provided for up to three years. B&B grant calls are made once a year, with the closing date in mid-January.

Period	Letters of Intent Received	Full Proposals Reviewed	Grants Awarded	Total Sum Awarded (\$ millions)
Dec 2011	69	11	5	19.5 ³

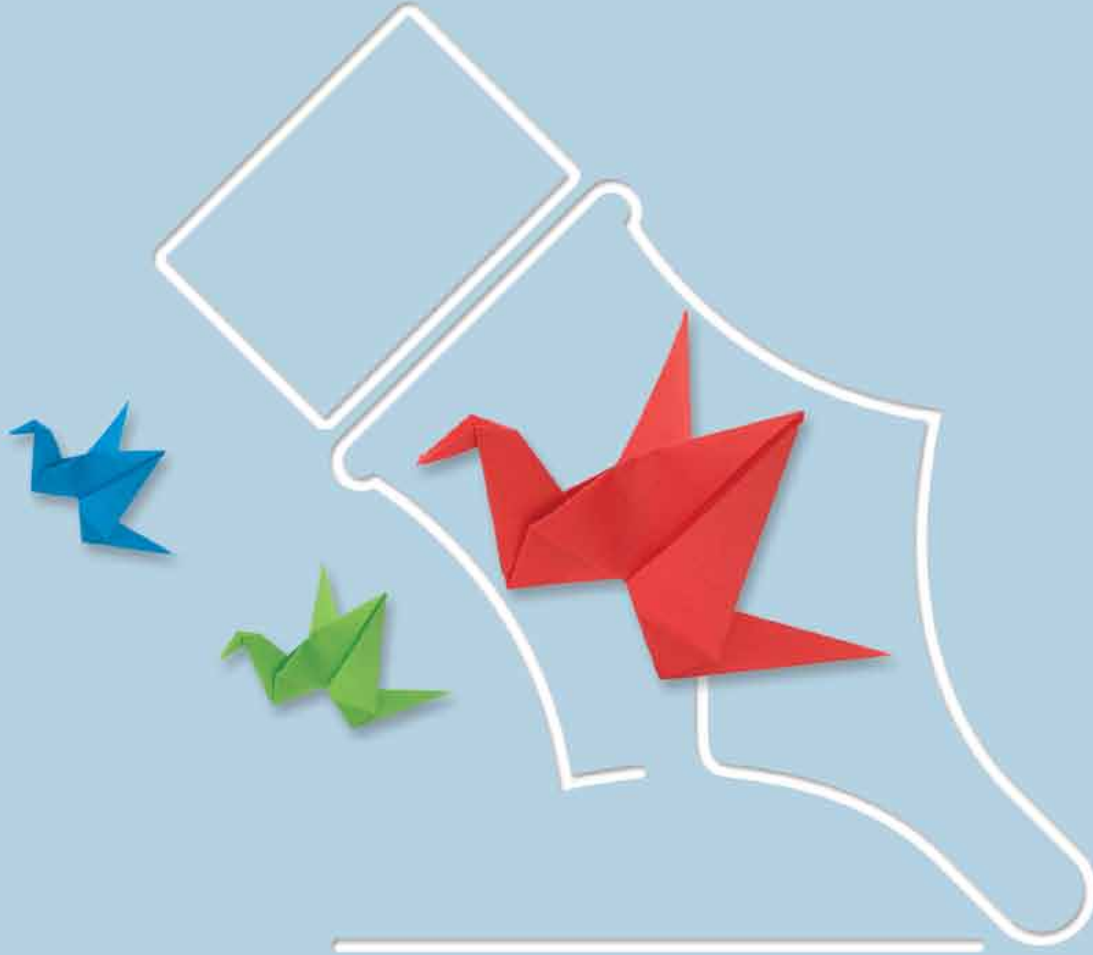
HEALTH SERVICES RESEARCH GRANTS

The Health Services Research Competitive Research Grant (HSR CRG) is a MOH research grant established in 2009. This Competitive Research Grant aims to promote the conduct of HSR and enable the translation of HSR findings into policy and practice. The quantum supported for HSR CRG is up to \$1 million over a period of two years. HSR CRG grant calls are made once a year, with the closing date on 1 June.

Period	Proposals Reviewed	Grants Awarded	Total Sum Awarded (\$ millions)
May 2012	38	10	4.0

In Nov 2012, a New Investigator Grant (HSR NIG) subcategory of the HSR CRG was launched with the aim to support new HSR researchers. The quantum supported for this new subcategory is \$100,000 over 2 years. The HSR NIG grant calls are made once a year, with the closing date on 1 December.

³ This includes \$8.3 million in funding from the Biomedical Research Council (BMRC) for B&B projects that involve BMRC scientists.



KNOWLEDGE EXCHANGE AND ENABLERS

STRENGTHENING THE TRANSLATIONAL AND CLINICAL RESEARCH LANDSCAPE

NEW STRATEGIC RESEARCH GRANT INITIATIVES

The growing biomedical sciences (BMS) landscape in Singapore has to be constantly reviewed and strengthened to support the growing translational and clinical research carried out by our clinical research community.

In view of the researchers' need for support in strategic investigator-led research and collaborative research with industry, NMRC has launched two new competitive research grants initiatives.

CLINICAL TRIAL GRANT

The Clinical Trial Grant (CTG), launched in late 2012, is intended to support clinicians carrying out clinical trial studies for the development of novel therapies, moving promising ideas from bench to bedside, to improve health outcomes. There are three schemes under the CTG programme:

1. The **Co-Development Scheme (Co-D)** supports clinical trial projects carried out via a public-private partnership (PPP) model in which a clinician collaborates with an industry partner. The clinician can apply for Co-D funding for 50 percent or less of the total project cost. An industry partner must provide co-investment (either cash or in-kind contributions) representing 50 percent or more of the total project cost. The quantum for Co-D funding is up to \$5 million over three years.
2. The **Investigator-Initiated Trials – Early Phase Scheme (IIT-E)** supports investigator-initiated Phase I and II clinical trials carried out by clinicians. The scheme is intended to support the development of locally produced assets, ideas and compounds. Partnership with industry for carrying out the trial is optional. The intellectual property must reside in Singapore. The quantum for IIT-E funding is up to \$5 million over three years.
3. The **Investigator-Initiated Trials – Late Phase Scheme (IIT-L)** supports investigator-initiated Phase III and IV clinical trials carried out by clinicians. Partnership with industry for carrying out the trial is optional. The quantum for IIT-L funding is up to \$2 million over three years.

MINISTRY OF HEALTH INDUSTRY ALIGNMENT FUND

The Ministry of Health Industry Alignment Fund (MOH IAF) aims to strengthen public-private collaboration in biomedical sciences (BMS) research and encourage commercially relevant research for better health outcomes. This programme was jointly developed with the Singapore Economic Development Board.

There are two categories of funding under the MOH IAF. Category 1 (Cat 1) funding, launched in early 2013, supports both clinicians and non-clinicians in their partnerships with industry in pre-clinical and clinical research.

Joint funding from industry is a prerequisite, with an industry partner covering at least 70 percent of the total project cost via cash or in-kind contributions.

The quantum for MOH IAF Cat 1 funding is up to \$500,000 for pre-clinical projects and \$1 million for clinical projects. In the case of projects involving both pre-clinical and clinical research, the funding quantum is up to \$1.5 million. Cat 1 funding is provided for up to two years.

The MOH IAF Category 2 (Cat 2) funding aims at supporting the development of pre-clinical and clinical platforms or programmes that will pre-position Singapore as a desirable location for industry to undertake translational and clinical research activities. These should contribute directly or indirectly to enhancing Singapore's capabilities in clinical research and support multiple projects and industry partnerships, leading to substantial collaboration with industry, attracting long term private sector investment and financial support. The call for applications will be launched in late 2013.



EVENTS

FOSTERING SYNERGISTIC COLLABORATIONS AND NURTURING TALENTS

NATIONAL MEDICAL EXCELLENCE AWARDS 2012

The National Medical Excellence Awards (NMEA) is held annually to honour and recognise clinicians, clinician scientists and healthcare professionals for their invaluable contributions toward medical excellence in the areas of clinical care, clinical research, clinical quality, training and mentorship in Singapore. The awards also provide an opportunity to celebrate successes and hold up role models for the younger generation of clinicians and clinician researchers.

In 2012, the NMEA recognised six individuals and one four-member team for their outstanding contributions to medical research, training and clinical practice. Awards were given out in six categories:

- **National Outstanding Clinician Award**
- **National Outstanding Clinician Scientist Award**
- **National Outstanding Clinician Mentor Award**
- **National Outstanding Clinician Educator Award**
- **National Outstanding Clinical Quality Activist Award**
- **National Clinical Excellence Team Award**

The recipients of this year's awards represented a wide range of disciplines, including paediatric liver transplantation, obstetrics and gynaecology, orthopaedic surgery, and ophthalmology. Despite their diverse backgrounds, the award winners all share a common commitment to excellence, which is reflected in their selfless dedication to raising the standards of medicine ever higher in Singapore.



AWARD WINNERS

NATIONAL OUTSTANDING CLINICIAN AWARD 2012

PROFESSOR K PRABHAKARAN
Department of Paediatric Surgery
National University Hospital

Professor K Prabhakaran is Director of the Paediatric Organ Transplant Programme and Head and Senior Consultant of the Department of Paediatric Surgery, University Children's Medical Institute, at National University Hospital (NUH).

Recognised as the pioneer of paediatric liver transplantation in Singapore, Prof Prabhakaran is credited with many firsts in paediatric surgery in Singapore. He established the Paediatric Renal Transplant Programme in Singapore—now ranked among the leading centres in the world—and performed the first living-related renal transplant in 1989. Two years ago, Prof Prabhakaran led the NUH team that successfully performed Southeast Asia's first combined liver and kidney transplant in a paediatric patient.

As a leading paediatric surgeon, Prof Prabhakaran has operated on innumerable children with complex surgical problems and is highly sought after in Singapore and the region. He has trained surgeons in developing countries in Asia to perform complex surgeries in children and has led teams to various countries to develop local liver transplant programmes. Under Prof Prabhakaran's leadership, an NUH team was invited to provide advice for the setting up of paediatric live donor liver transplant programmes in Malaysia in 2002 and in Indonesia in 2006.

As a strong advocate of training and education, Prof Prabhakaran has written and authored various book chapters and journal articles, as well as founding the South-East Asian Paediatric Endosurgery Group. An active researcher, Prof Prabhakaran's research in the areas of paediatric organ transplantation (renal and liver), paediatric urology and biliary atresia has been published in high-impact journals regionally and internationally. He is also a peer reviewer for international journals and a regular invited speaker at international meetings.



NATIONAL OUTSTANDING CLINICIAN AWARD 2012

PROFESSOR WONG HEE KIT
Department of Orthopaedic Surgery
National University Hospital

Professor Wong Hee Kit is Head and Senior Consultant in the Department of Orthopaedic Surgery at National University Hospital (NUH). Concurrently, he is Head of the University Spine Centre at NUH; Chair of the University Orthopaedic, Hand & Reconstructive Microsurgery Cluster in the National University Health System; and Head of the Department of Orthopaedic Surgery, Yong Loo Lin School of Medicine, at the National University of Singapore.

Prof Wong is a trailblazer in the field of orthopaedic surgery. The advances that he has introduced in the surgical treatment of musculoskeletal disorders, in particular spinal surgery, have put both NUH and Singapore on the world map.

He is credited with pioneering many new treatment methods, including the minimally invasive surgical technique of thoracoscopic anterior spinal fusion for scoliosis. Other treatment methods introduced by Prof Wong include posterior lumbar interbody fusion, transforaminal lumbar interbody fusion, minimally invasive anterior lumbar interbody fusion, artificial lumbar disc replacement and artificial cervical disc replacement. His surgical case profile includes many complex spinal surgical procedures and minimally invasive spinal surgery. In 2007, Prof Wong set up the University Spine Centre at NUH—the first of its kind in Singapore—which is dedicated to the management of spinal disorders.

Widely respected for his leadership and clinical expertise, Prof Wong's reputation as an outstanding clinician has attracted many students and international fellows to train in spinal surgery at NUH. He receives countless invitations to lecture at international spine conferences and postgraduate training programmes, as well as regular international referrals—from Asia, the Middle East and North America—and second-opinion referrals for complex cases.



NATIONAL OUTSTANDING CLINICIAN SCIENTIST AWARD 2012

PROFESSOR PIERCE CHOW KAH HOE Department of General Surgery Singapore General Hospital

Professor Pierce Chow is a Senior Consultant in the Department of General Surgery at Singapore General Hospital (SGH) and a Visiting Senior Consultant at the National Cancer Centre Singapore (NCCS). He is concurrently a Professor and Course Director at the Duke-NUS Graduate Medical School (GMS).

Juggling numerous roles, Prof Chow works tirelessly to care for his patients, inspire the next generation of doctors through his teaching, and foster collaboration with researchers in other countries in pursuit of better patient outcomes.

To develop new and better therapies for patients with hepatocellular carcinoma (HCC)—the third most common cancer in Asia—Prof Chow co-founded the Asia-Pacific Hepatocellular Carcinoma (AHCC) Trials Group in 1997. Besides securing peer-reviewed research grant funding, it has successfully drawn industrial participation and funding for its investigator-initiated trials. Prof Chow has been the protocol chair for five multi-centre trials involving patients from 30 centres in 16 countries.

As Director of the former Department of Experimental Surgery at SGH (now renamed the SingHealth Experimental Medicine Centre) from 2001 to 2007, Prof Chow helped it become the first research facility in Southeast Asia outside the US military to be accredited by the Association for Assessment and Accreditation of Laboratory Animal Care International in 2006. In collaboration with industry partners, he led a multidisciplinary team from SingHealth that conceptualised and successfully carried out translational research and first-in-man studies that resulted in the development of a novel radiotherapy device for HCC in 2005. Prof Chow's work is widely recognised and he has more than 160 publications indexed on MEDLINE, not including books and book chapters.



NATIONAL OUTSTANDING CLINICIAN MENTOR AWARD 2012

PROFESSOR GEORGE YEO SEOW HEONG Department of Maternal Fetal Medicine KK Women's and Children's Hospital

Professor George Yeo holds several appointments at KK Women's and Children's Hospital (KKH). He is the Chief of Obstetrics; Head and Senior Consultant of the Department of Maternal Fetal Medicine; Director of the Antenatal Diagnostic Centre; and Director of Research, Academic Clinical Programme for Obstetrics & Gynaecology (O&G), in the SingHealth-Duke-NUS Academic Medicine Partnership.

Prof Yeo was the first Head of the Department of Maternal Fetal Medicine at KKH from 1993 to 2006 and was reappointed in January 2012. He is also the immediate past Director of the National Birth Defects Registry under the Ministry of Health and Director, International Medical Programmes (O&G), at KKH.

Through his mentorship, commitment and passion for academic medicine, many clinicians and young doctors have been inspired to pursue academic medicine. For the past 20 years, Prof Yeo has mentored many talented individuals who have gone on to make significant contributions in the fields of obstetrics, gynaecology and foetal medicine. Under his guidance, his mentees have also spearheaded the development of evidence-based management of gestational diabetes mellitus, pre-eclampsia and preterm labour through the development of clinical protocols and guidelines.

Prof Yeo currently mentors and supervises many O&G residents and clinician scientist residents, and he continues to organise and conduct educational programmes both nationally and internationally. As organising chairman, he has led the organisation of about 77 national, regional and international courses and scientific meetings.



NATIONAL OUTSTANDING CLINICIAN EDUCATOR AWARD 2012

ASSOCIATE PROFESSOR LIM TOCK HAN
National Healthcare Group
NHG Eye Institute, Tan Tock Seng Hospital

Associate Professor Lim Tock Han is the Assistant Chief Executive Officer (Education and Research) at the National Healthcare Group (NHG), as well as a Senior Consultant and past Medical Director of the NHG Eye Institute at Tan Tock Seng Hospital (TTSH). While serving as NHG's first Designated Institutional Official (DIO) from 2009 to 2011, he oversaw the newly introduced residency system and was instrumental in cultivating support for the new training system.



A/Prof Lim's vision enabled TTSH, the Institute of Mental Health, the National Skin Centre, the National Healthcare Group Polyclinics and Khoo Teck Puat Hospital to work together to develop residency programmes and provide a conducive training environment. He and his team built and organised the system to support the NHG residency programmes and collaborated with the NUHS and SingHealth sponsoring institutions, the Ministry of Health, MOH Holdings (MOHH), and the Accreditation Council for Graduate Medical Education International (ACGME-International) to collectively achieve success for all the residency programmes at the national level.

A/Prof Lim firmly believes in the importance of imparting clinical knowledge to the younger generation of doctors. As a notable educator and teacher in ophthalmology, both locally and internationally, he shares his expertise in retinal imaging and his pioneering work in polypoidal choroidal vasculopathy.

As Assistant CEO (Education & Research) at NHG, he now plays a key role in the team that is establishing Singapore's third medical school—the Lee Kong Chian School of Medicine. He leads NHG's Education Office, which is linked to other NHG Institutions; the NHG Education & IT Taskforce; the NHG College; and the Simulation and Integrated Medical Training Advancement Centre at TTSH.

NATIONAL OUTSTANDING CLINICAL QUALITY ACTIVIST AWARD 2012

ADJUNCT ASSOCIATE PROFESSOR TAI HWEI YEE
Department of Anaesthesiology, Intensive Care and Pain Medicine
Tan Tock Seng Hospital

Adjunct Associate Professor Tai Hwei Yee is a Senior Consultant in the Department of Anaesthesiology, Intensive Care and Pain Medicine at Tan Tock Seng Hospital (TTSH). Between 2003 and 2011, she served as the Assistant Chairman of the Medical Board for Clinical Quality and Audit. In this capacity, she introduced Patient Safety Officers and championed the development of a "Just Culture" and non-punitive approach to supporting patient safety initiatives.



As an outstanding mentor and teacher, Dr Tai has developed training programmes to improve the understanding of patient safety concepts, human factors, root cause analysis, and failure modes and effects analysis. Besides leading the Clinical Practice Improvement Program in the National Healthcare Group, she guides improvement teams from other acute and community hospitals.

Under Dr Tai's strong leadership, a clinical incident management process was put in place at TTSH to address complaints and reduce the risk level of adverse events, thus ensuring safer patient care. In 1999, Dr Tai instituted the Pre-Admission Counselling and Evaluation Service (PACE) and established Singapore's first outpatient, nurse-based peri-operative evaluation of patients.

Throughout her career, Dr Tai has spearheaded initiatives to improve safety and clinical outcomes. Examples include a clinical review programme, safety culture surveys, adverse event studies, patient safety executive walkabouts, and projects on improving communication of critical results and improving peri-operative surgical safety. She chairs the Safe Medication Practices workgroup in the National Medication Safety Taskforce and serves as senior consultant to the Standards and Quality Improvement Division at the Ministry of Health.

NATIONAL CLINICAL EXCELLENCE TEAM AWARD 2012

ASSOCIATE PROFESSOR SOPHIA ONG
DR SHARON SAW
ASSOCIATE PROFESSOR JAMES YIP
DR SANDHYA MUJUMDAR
National University Hospital



Delays in the communication of critical test results to the requesting clinician can result in serious adverse outcomes for patients as time is of the essence in the treatment and management of critical illnesses. In 2006, a team at National University Hospital (NUH) under the leadership of Associate Professor Sophia Ang embarked on an innovative project to achieve effective and timely closed-loop communication of critical results.

The team leveraged the hospital's messaging system by pulling data and information from various IT applications to automatically assemble a concise message that is routed to the ordering clinician via mobile phone. If the critical laboratory test is not acknowledged within 10 minutes, a manual escalation system gives staff at the hospital's call centre a visual cue to contact the relevant clinician or escalate the matter to the next level of clinical staff. Staff at the laboratory can also view the real-time status of all outstanding critical results notifications via a large-screen dashboard.

These innovative efforts resulted in marked improvement in the outcomes, standards, safety and quality of patient care at NUH. Since its implementation, this system has improved the reliability of clinicians being informed of critical tests to nearly 100 percent and reduced the median response to action time by clinicians from 109 minutes to 21 minutes.

The project was published by the *American Journal of Clinical Pathology* and was named as one of the top 10 game changers in pathology in 2011 by Medscape. It also appeared in the *British Medical Journal of Quality and Safety*, where it was named the editor's choice article of August 2012.



NMRC AWARDS CEREMONY AND TCR FLAGSHIP SYMPOSIUM 2012



In 2012, the NMRC Awards Ceremony and the Translational and Clinical Research (TCR) Flagship Symposium were for the first time held concurrently during a two-day event that attracted approximately 400 leading clinician scientists and other key players in medical research. Held at the Resorts World Sentosa Convention Centre from 31 October to 1 November, the event provided a strategic platform for networking and dialogue among clinicians, researchers and industry partners.

Organised by NMRC, this year's event was themed "Pursuing Healthcare Research Excellence and Innovations" to signal the importance on ensuring quality healthcare through concerted efforts to develop and support innovative research.

Day One

The first day featured an awards presentation for NMRC's Human Capital Awards and Talent Development Programmes, which was attended by Mrs Tan Ching Yee, Permanent Secretary for Health, and Mr Lim Chuan Poh, Chairman of A*STAR.

Commenting on the event, Mrs Tan said, "The annual awards ceremony is a good way to recognise the good work of clinician scientists who are supported through various NMRC awards. It is particularly meaningful to invest in our new researchers, through the Transition Award, given out to the first batch of eight recipients. We look forward to these outstanding individuals progressing to become independent, full-fledged clinician scientists."

Mr Lim added, "I am heartened to see the growing pool of clinician scientists and clinical investigators in Singapore. They form the core of the clinical research community to advance translational and clinical research and bolster the increasing partnerships between the basic research and clinical communities in Singapore. Such integration of capabilities along the translational value chain is pivotal to translate research findings into medically meaningful applications and impactful industry collaborations."

Another highlight of the first day was a plenary lecture by Dr Juan Carlos Lopez Garcia, Chief Editor of the renowned journal *Nature Medicine*, who shared his thoughts on how the world views Singapore's push in the biomedical sciences. Later in the day, the lead principal investigators from the five TCR Flagship Programmes shared their latest research findings and how their projects have been successful in pursuing academic excellence, forging stronger partnerships and contributing towards better healthcare outcomes.

Day Two

The second day of the event featured workshops aimed at facilitating discussions on a variety of important TCR-related topics, including clinical trials, health economics, and the process of developing a research idea, drug or medical device into a product that can be used by patients. A key highlight of the second day was an opportunity for the clinicians and industry partners to come together in a forum discussion to share their thoughts on how to improve clinician-industry partnerships.



BIOMEDICAL SCIENCES INTERNATIONAL ADVISORY COUNCIL MEETING 2012

On 9 November 2012, Singapore’s Biomedical Sciences International Advisory Council (BMS IAC) held its annual meeting to discuss the progress of Singapore’s BMS Initiative and how to synergise the efforts of the BMS research players in Singapore. The IAC members also shared insights with the local research community regarding international BMS developments, including the UK Life Sciences strategy and how its system is structured for integration.

Chaired by Sir Richard Sykes, the BMS IAC endorsed eight newly funded BMS research programmes aimed at advancing the understanding and treatment of diseases prevalent amongst Asian populations. These programmes will see biomedical scientists and clinicians collaborating to bring about greater healthcare benefits for society and create economic growth for Singapore. Four Translational and Clinical Research (TCR) Flagship Programmes were awarded \$68 million under the Open Collaborative Fund, which is administered by NMRC. The other four programmes were awarded \$58 million under the A*STAR Biomedical Research Council’s Strategic Positioning Fund.

Commenting on the research programmes, Mrs Tan Ching Yee, Co-Chair of the Biomedical Sciences Executive Committee and Permanent Secretary, Ministry of Health said, “MOH recognises the value that research can bring to addressing Singapore’s healthcare challenges. These stem from our rapidly ageing population and changing lifestyles that will see a rise in chronic diseases. I am pleased to note that the TCR Flagship grants will go a long way to support the good work of our clinician scientists and I look forward to greater synergy and dynamic and meaningful collaborations among our healthcare institutions, industry and our partners such as A*STAR.”

Progress in BMS efforts

The BMS IAC commended Singapore for its progress in BMS-related basic research and TCR over the past 12 years, as well as its efforts in driving the convergence of talent, R&D capabilities and resources for maximum impact.

On a macro level, Singapore’s BMS Initiative has made a significant impact and contributed substantially to the economy. The BMS manufacturing output for 2011 was \$27 billion—more than four times the output of \$6.3 billion at the start of the initiative in 2000. In terms of employment, in 2011, there were over 15,000 people employed in manufacturing in the BMS sector, 2.5 times more than the 6,000 employed in 2000.

In addition, Singapore has developed excellent clinical research capabilities in the public hospitals as well as deep capabilities in basic science research in A*STAR and the Institutes of Higher Learning in the past 12 years. Initiatives have also been put in place to groom clinician-scientists and support their research, such as the Singapore Translational Research (STaR) Investigator Award, Clinician Scientist Award (CSA) and Transition Award. Over the past five years, MOH’s investment in TCR has also generated promising results which have made a positive impact on healthcare.

Sir Richard Sykes said, “I have been impressed by how far Singapore has come in its biomedical sciences journey in all of 12 years. Now that Singapore is in the third phase of its BMS Initiative with the greater emphasis on convergence for economic and health outcomes, I believe we can expect to see Singapore attracting more pharma, biologics, medtech, personal care and nutrition companies here. The attendant social benefits will come from having early access to cost-effective and novel health solutions.”



Biomedical Sciences
International Advisory
Council Meeting
9 November 2012

EDB Bio*One
an EDB initiative

17th Biomedical Sciences
International Advisory Council Meeting

November 2012



FINANCIAL HIGHLIGHTS

AS OF END MAR 2013

\$83.19 M

Enablers & Infrastructure

- SCRI – \$4.585 M
- IRB – \$2.642 M
- IMUs – \$2.199 M
- Research Buildings – \$23.12 M
- Centre for Biomedical Ethics – \$610,659
- Communities of Practice for Clinician Scientists – \$33,092
- Research Space Funding – \$10 M
- Animal Research Facilities – \$40 M



CS-IRG – 34 projects
 CBRG – 27 projects
 NIG – 29 projects
 B&B – 5 projects

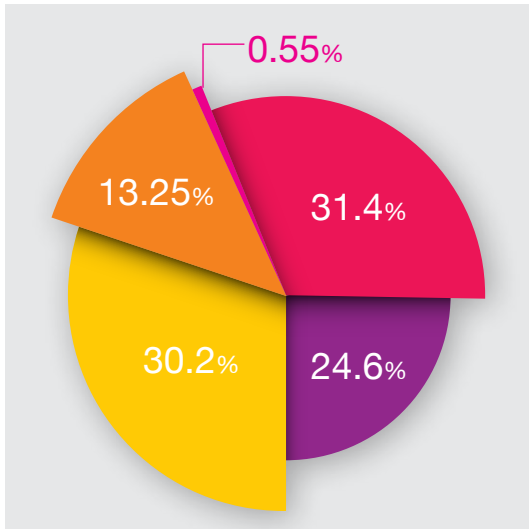
\$36.55 M

Human Capital

STaR – 5 awardees
 CSA – 8 awardees
 TA – 5 awardees
 CISSP – 34 awardees

\$86.6 M

Individual PI-initiated Research Grants (inclusive of New Investigator Grants)



OVERALL FUNDING DISTRIBUTION FOR NMRC FUNDING INITIATIVES (FY 2012)

\$1.58 M

Talent Development
17 scholars/fellows



\$68 M

Strategic Research Grant Programmes

2 Tier One TCR Flagships (\$9 M each)
 2 Tier Two TCR Flagships (\$25 M each)

