

WORKING TOGETHER FOR RESEARCH EXCELLENCE

WORKING TOGETHER FOR RESEARCH EXCELLENCE
NMRC ANNUAL REPORT 2011



CONTENTS



NMRC Governance and Portfolio

- 01 NMRC Vision and Mission Statement
- 02 Executive Chairman's Message
- 04 Executive Director's Message
- 06 About NMRC
- 08 NMRC Board
- 12 NMRC Portfolio
- 13 NMRC Funding Framework



Human Capital and Talent Development Programmes

- 16 Human Capital Awards
- 21 Talent Development Programmes
- 24 Budding Clinician Scientists – The Next Generation of Leaders



National Medical Excellence Awards 2011

- 32 NMEA 2011 Award Winners



Research Grants

- 38 Strategic/Thematic Research
 - TCR Flagship Programme
 - TCR Flagship Symposium
 - IP Awareness Forum
- 46 Investigator-led Research
 - Past Initiatives
 - New Initiatives
- 49 A Message for Our Reviewers
- 50 News and Highlights
- 52 Financial Highlights

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.



EXECUTIVE CHAIRMAN'S MESSAGE

TAKING A LONG-TERM VIEW

At NMRC, we recognise that achieving results in translational and clinical research requires a long-term commitment. Successes rarely come overnight, but instead require years of dedication and diligent work. Fortunately, Singapore's government shares this long-term view of the value of investing in R&D.

At a time when research funding in many countries is stagnant or declining, Singapore has earmarked \$16.1 billion for research and innovation over a five-year period under the Research, Innovation and Enterprise (RIE) 2015 plan. NMRC is one of the beneficiaries of this boost in funding, sending a clear signal that Singapore is committed to biomedical and life sciences research.

For NMRC, our priority is to ensure that these funds are allocated to research with the potential to result in significant improvements in healthcare. We believe strongly in the value of investing in the future while strategically guiding the development of translational and clinical research in Singapore in areas where we see the greatest potential.

BUILDING TALENT AND COLLABORATION

While talent development and collaboration have long been at the heart of NMRC's mission, we are placing even greater emphasis on these two areas going forward.

For talent development, our focus is primarily on developing and training more clinician scientists—experienced doctors with unique skill sets that include expertise in basic science and medicine. They represent a crucial link in the chain for successful translational and clinical research initiatives: their clinical experience enable them to prioritize key medical challenges or opportunities, from a clinical perspective, while their research background provides them with the ability to use the appropriate basic science approaches to solve these problems, and also to identify basic scientists with the right skill sets to collaborate with, both locally and in the international arena.

As mentioned in last year's annual report, we are aiming to double the number of clinician scientists in Singapore to 160 by 2015. We continued to emphasise the development of clinician scientists throughout 2011 by enhancing the support available via our existing programmes.

However, if Singapore's translational and clinical research sector is to continue flourishing, boosting the number of clinician scientists is not enough—increasing the breadth and depth of collaboration

is another crucial part of the equation. We need to operate less in silos, and instead bridge the gaps amongst institutions, across medical disciplines, and across research and technology platforms. To achieve this objective, we have incorporated requirements related to collaboration into many of the grants that we offer.

EXPLORING NEW FRONTIERS

Certain drugs for certain diseases may work well in the West, but when applied to Asian populations they may be less effective or more toxic. Stratified medicine is a personalised approach to healthcare that aims to provide individuals with the right medication and the right treatment at the right time. Singapore offers an excellent environment in which to carry out research into stratified medicine for Asian phenotypes—something that major pharmaceutical and medical technology companies are taking notice of. Together with A*STAR, we have set up a high-level workgroup to look into opportunities related to stratified medicine. Our hope is to foster greater collaboration between researchers, leveraging the strengths on both sides to develop unique solutions that are relevant to our population and the types of diseases that we see in Asia.

Another area where we are seeing promising developments and great potential for Singapore is in medical technology, which encompasses a wide range of devices used for diagnosing, monitoring and treating diseases. New medical devices can lead to significant improvements in health outcomes, while typically requiring much smaller investments in time and money compared to the development of new drugs. In Singapore, we have the unique advantage of vibrant advanced microelectronics and nanotechnology industries, making medical technology and research into medical devices an attractive proposition given that there are plenty of potential technology partners with whom clinicians can collaborate. Given these advantages, we have increased NMRC's attention to and support for medical technology as one of our key growth areas.

With many exciting plans and promising projects underway, we are confident that translational and clinical research in Singapore will continue to gain momentum. And as we work closely with all of our stakeholders, we are optimistic that these initiatives will continue to generate positive health outcomes for patients in Singapore and around the world.

Prof Donald Tan
Executive Chairman

EXECUTIVE DIRECTOR'S MESSAGE

Under the Research, Innovation and Enterprise (RIE) 2015 plan, the Singapore government has committed \$16.1 billion over five years (2011–2015) to fund research and innovation in a variety of sectors, including biomedical sciences which had \$3.7 billion committed. This represents a 15% increase in funding for biomedical sciences compared to the previous five-year plan.

The increase in funding provides an exciting opportunity for NMRC, and enables us to roll out new programmes, while continuing to support current ones which are doing well. In particular, some of the key new initiatives that were rolled out in the past year include the Cooperative Basic Research Grant (CBRG), the Bedside and Bench Grant (B&B) as well as the Transition Award, which is a talent development award for new investigators.

The past year has also seen NMRC expand its function as a division of the Ministry of Health (MOH), taking over the teams and the coordination of the Health Services Research (HSR) Grant and HSR training functions of MOH, as well as the Research Policy Branch. These positive developments have allowed NMRC to better work towards its vision of 'Translating Research for Better Health', doing so in close partnership with other MOH divisions and external stakeholders.

As part of our efforts to continually improve our processes and to responsibly manage the funds we disburse, we also begun work on developing a post-award management framework for the various NMRC programmes. This work will continue into the coming year, but we will develop the framework in a manner that seeks to strike a balance between NMRC being an effective and responsible administrator of research funding, while at the same time, being a partner with researchers to help carry out good science and generate both health and economic outcomes for the country.

Other new initiatives that we expect to launch in the coming year include the Clinical Trials Grant, the HSR New Investigators Grant, as well as working with the Economic Development Board (EDB) and the BMS Industry Partnership Office (BMS IPO) to improve the commercialisation capability in our clinical research community.

For NMRC, 2011 was a year of transition with a number of new team members coming onboard, including both Professor Donald Tan as the new Executive Chairman and myself as Executive Director. As we reflect on the past year and look forward to the coming one, I would like to take this opportunity to thank the senior management and colleagues of MOH, as well as the former Permanent Secretary for Health, Ms Yong Ying-I, for all their help and support in the past year. Also friends and colleagues in the healthcare clusters, universities and other agencies.

Finally, to say a big thank you to all NMRC colleagues, both past and present, for the hard work and contribution to the work of NMRC. In particular, the immediate past Executive Chairman Professor Edward Holmes as well as my predecessor, Dr Loke Wai Chiong.

We very much look forward to continuing to work closely with everyone as we push ahead with the plans and objectives for 2012 and beyond.

A/Prof Tan Say Beng
Executive Director



ABOUT NMRC

The National Medical Research Council (NMRC), established in 1994, 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 foster 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 1,750 competitive research projects and five Translational and Clinical Research Flagship Programmes. To ensure that its budget is appropriately managed and optimally utilised, NMRC evaluates the outcomes of the research projects it funds and facilitates the commercialisation of research findings.



NMRC BOARD

The NMRC Board advises 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 Council is 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.

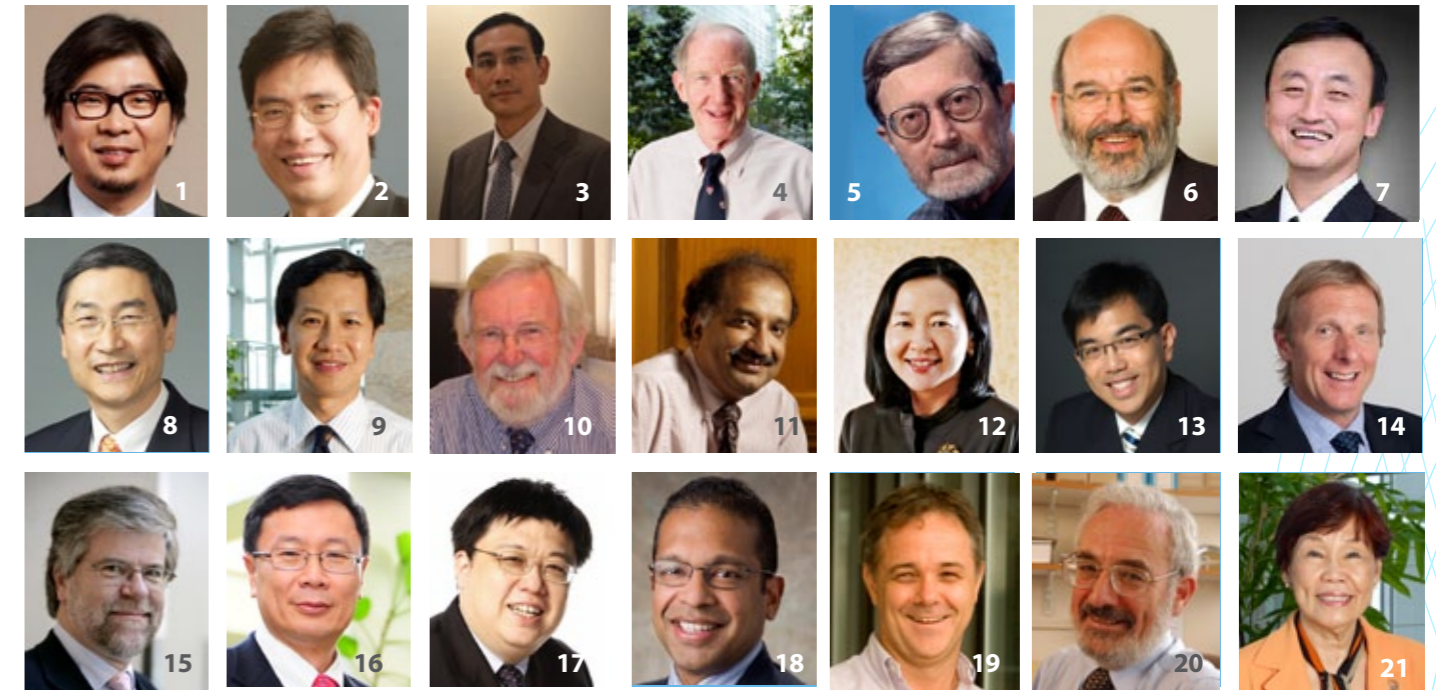
The Board saw four members step down in 2011:

- Prof Lee Eng Hin, A*STAR Senior Fellow, Biomedical Research Council (11 years on the NMRC Board)
- Prof John Potter, Senior Vice President and Director, Public Health Sciences, Fred Hutchinson Cancer Research Center (5 years on the NMRC Board)
- A/Prof Mabel Yap, Director, Health Services Research & Evaluation Division, Ministry of Health (5 years on the NMRC Board)
- Prof Robert Sanders Williams, President, The J. David Gladstone Institutes (5 years on the NMRC Board)

Through their dedicated service on the Board, Prof Lee, Prof Potter, A/Prof Yap and Prof Williams each played integral roles in shaping Singapore's translational and clinical research landscape. Sharing their wealth of experience and wisdom, these four outgoing Board members supported NMRC by providing key oversight of its activities and invaluable input into its strategies.

NMRC also welcomed five new members who joined the Board in 2011—Dr Benjamin Seet, Prof Chia Kee Seng, Adjunct A/Prof Lee Chien Earn, Dr Anand Tharmaratnam and Prof Jeremy Farrar.

As of end-2011, the NMRC Board consists of 21 members.



BOARD MEMBERS

1. Prof Donald Tan
Executive Chairman
National Medical Research Council

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

3. Dr Benjamin Seet
Executive Director
Biomedical Research Council

4. Prof Edward Holmes
Deputy Executive Chairman
Biomedical Research Council

5. Prof Alex Matter
Chief Executive Officer
Experimental Therapeutics Centre

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

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

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

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

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

11. Prof Ranga Krishnan
Dean
Duke-NUS Graduate Medical School

12. Prof Ivy Ng
Group Chief Executive Officer
SingHealth

13. Prof Wong Tien Yin
Director
Singapore Eye Research Institute

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

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

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

17. Adjunct A/Prof Lee Chien Earn*
Deputy Director of Medical Services
Ministry of Health

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

19. Prof Jeremy Farrar
Director
Oxford University Clinical Research Unit

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

21. Carmee Lim
Mentor Principal
MindChamps Holdings Pte Ltd

*A/Prof Lee Chien Earn is currently CEO of Changi General Hospital with effect from 1 May 2012.

NEW BOARD MEMBERS SHARE THEIR THOUGHTS



Dr Benjamin Seet
Executive Director
Biomedical Research Council

While we have come a long way in the past 10 years, the biomedical and clinical research community in Singapore still has some way to go to become truly internationally competitive. There are some peaks of excellence, but there are also gaps in between. Various parts of the community still work in relative isolation, although the new collaborative funds have provided some incentives for cross-institution research cooperation.

By serving as a member of the NMRC Board, I look forward to serving as a bridge between the scientists and engineers in A*STAR and the clinical research community in Singapore. When we are able to work well together, we will achieve much greater impact and outcomes for Singapore's investments in the biomedical and clinical sciences.



Adjunct A/Prof Lee Chien Earn*
Deputy Director of Medical Services
Ministry of Health

It is a privilege to serve on NMRC's Board. I have much to learn from other members of the Board as this is a relatively new area for me. My previous exposure to research has been mainly from the regulatory and health services research perspective.

I hope to be able to share with the Board relevant MOH strategic plans and key initiatives to assist in focusing research efforts to achieve better health, better care and better value for Singaporeans.

*A/Prof Lee Chien Earn is currently CEO of Changi General Hospital with effect from 1 May 2012.



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

It is a great honour to be appointed a member of NMRC's Board and I am excited at the opportunity to contribute an industry point of view.

Singapore's success in the health sciences is undeniably attributed to its government's mandate to support translational and clinical research. Through guidance and funding from NMRC, Singapore has been building up its capabilities in translational and clinical research, attracting top talent from around the world.

Improving human health warrants close collaboration between multiple stakeholders, namely government, academia and industry. I hope to contribute an industry perspective, providing counsel in the formulation of strategies and priorities for the Board. I also look forward to discussing what the future holds for private sector research, and ensuring Singapore has the necessary local skill sets and infrastructure to meet these challenges to be a global research and development hub.

Prof Jeremy Farrar
Director of the Oxford University Clinical Research Unit & Adjunct Professor
Department of Medicine, Yong Loo Lin School of Medicine,
National University of Singapore



I am honoured and delighted to join the Board of Singapore's National Medical Research Council. I started life in Singapore and it is an enormous pleasure to return and help play a role in the shaping of the future of clinical research in Singapore. I am a clinician scientist with a particular interest in infectious diseases important in South East Asia, having worked in the region full time for almost 17 years.

The NMRC mission statement could not be clearer or more aligned with my own perspective and view of the role of research in society. Singapore has established over the last few years an incredibly strong biomedical research community. I believe Singapore is now on the cusp of translating that wonderful basic science into tangible benefits to the citizens of Singapore and the wider global community.

In my own area of interest I believe Singapore has all the foundations in place to become one of the world's leading centres for basic, epidemiological and clinical research in infectious diseases. With the continued challenge of endemic infections (TB, dengue, HIV, EV71), the development of resistance to many antibiotics, and the emergence of new pathogens including Influenza H5N1 and SARS, there has never been a more important time to enhance our understanding of infectious diseases at the basic science level and apply that knowledge to prevention and treatment.

NMRC plays a crucial role in supporting this within Singapore and I hope to help the Council to realise its ambition and meet its mission 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".

NMRC PORTFOLIO

Under Singapore's Biomedical Sciences (BMS) Initiative Phase II (2006–2010), NMRC invested heavily in translational and clinical research (TCR) through a variety of funding initiatives. To date, these investments have created five flagship programmes in key disease areas, supported the development of major research infrastructure, attracted and nurtured high-quality researchers, and funded hundreds of research projects.

Having made enormous progress in BMS Phase II, NMRC is now pushing ahead under BMS Phase III (2011–2015) to consolidate and secure its earlier gains into a sustainable path forward for TCR in Singapore. The Council will do so through continued strategic investment in TCR 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**
 - » Healthcare Research Scholarship (PhD)
 - » Healthcare Research Scholarship (Master of Clinical Investigation)
 - » NMRC Research Training Fellowship

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:

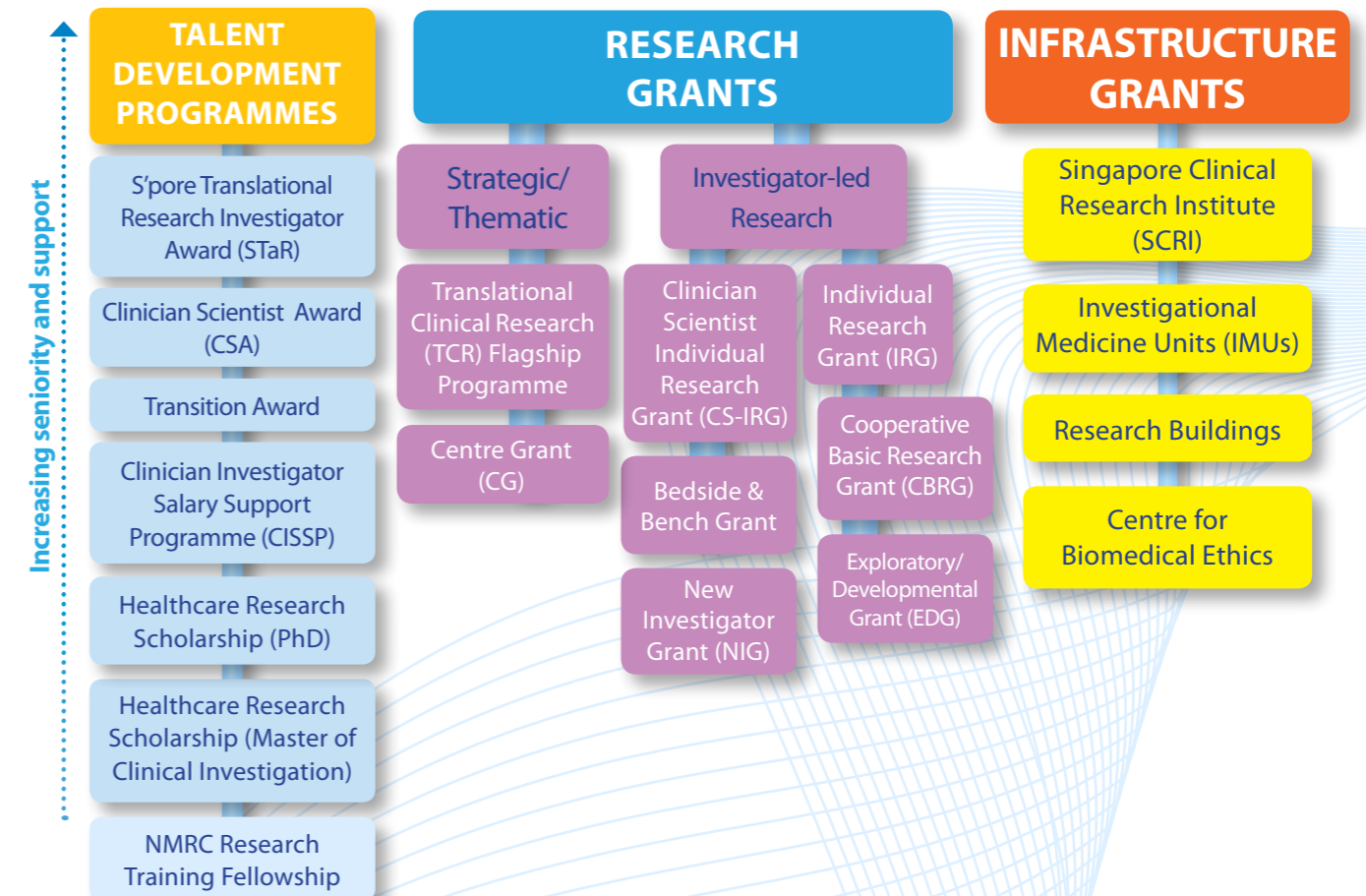
- **Strategic/Thematic**
 - » Translational and Clinical Research Flagship Programme
 - » Centre Grants
- **Investigator-led**
 - » Individual Research Grant (IRG)
 - » Exploratory/Developmental Grant (EDG)
 - » New Investigator Grant (NIG)
 - » Clinician Scientist Individual Research Grant (CS-IRG)
 - » CS-IRG New Investigator Grant (CS-IRG-NIG)
 - » Cooperative Basic Research Grant (CBRG)
 - » CBRG New Investigator Grant (CBRG-NIG)
 - » Bedside & Bench Grant (B&B)

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, as well as by supporting the development of core clinical research infrastructure. The major infrastructure initiatives supported by NMRC include:

- Singapore Clinical Research Institute (SCRI)
- Investigational Medicine Units (IMUs) at SingHealth Services (SHS) and National University Health System (NUHS)
- Research buildings at Outram and Kent Ridge Campuses
- Centre for Biomedical Ethics (CBME)

NMRC FUNDING FRAMEWORK



HUMAN CAPITAL & TALENT DEVELOPMENT PROGRAMME

NURTURING CLINICIAN SCIENTISTS

A key objective in BMS Initiative Phase III is to grow the pool of clinician scientists in Singapore. Clinician scientists play a critical role in the translational and clinical research (TCR) process: their close interactions with patients enable them to identify gaps related to causes, diagnosis and treatment of diseases, while their experience and expertise as scientists allow them to frame these clinical insights as relevant research questions.

NMRC recognises the need to train and develop clinician scientists who are able to plug these knowledge gaps and, over time, develop breakthrough research that will eventually result in positive outcomes for patients.

Through its Human Capital Awards and Talent Development Programmes, NMRC offers comprehensive support to clinician scientists at every stage of their career, ranging from fellowship and scholarship programmes to sponsor budding clinician scientists for local or overseas training to prestigious awards to support excellent TCR researchers. 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
 - » Healthcare Research Scholarship (PhD)
 - » Healthcare Research Scholarship (Master of Clinical Investigation)
 - » NMRC Research Training Fellowship



HUMAN CAPITAL AWARDS

SINGAPORE TRANSLATIONAL RESEARCH (STaR) INVESTIGATOR AWARD

The prestigious STaR Investigator Award is designed to recruit and nurture world-class clinician scientists to undertake cutting-edge translational and clinical research in Singapore. STaR Investigators must commit to a full-time appointment in Singapore and their proposed research must be conducted here. The STaR Award includes five years of 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 and caters 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 full salary support, together with a competitive research grant.

TRANSITION AWARD

Launched in September 2011, the Transition Award provides research funding and salary support for budding clinician scientists who have just completed formal research training. This award is designed to help them 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. 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 was launched in September 2010 to encourage more clinicians to participate in clinical research involving human subjects by providing funding for clinicians' research time in the form of salary support. To help protect clinicians' time and participation in clinical research, the awarded funding is channelled to clinical departments, which then have the flexibility to use the funds for activities related to clinical research. Clinician Investigators involved in projects under the following NMRC programmes funded by NRF are eligible to apply:

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

CLINICIAN SCIENTIST AWARD (CSA) AWARDEES

In 2011, six CSAs (three at the Senior Investigator, or SI, level) were awarded, adding to Singapore's growing pool of clinician scientists.

ASSOCIATE PROFESSOR CHNG WEE JOO (CSA-SI)

Yong Loo Lin School of Medicine
National University of Singapore
Senior Consultant
Department of Haematology-Oncology
National University Cancer Institute

Genomic-based Diagnosis, Classification, and Targeted Treatment of Multiple Myeloma

A/Prof Chng's research focuses on multiple myeloma, a type of bone marrow cancer that is the second most common blood cancer in the world. His work focuses on identifying genetic factors that lead to the transformation from a pre-cancerous state to a cancerous state where treatment is required, and also genetic factors that are associated with survival and that may predict response to different drugs.

Over the last three years A/Prof Chng has made tremendous strides in identifying these genetic factors, identifying MYC activation as an important and common factor in the malignant transformation of myeloma. He has also defined the clinical importance of p53 abnormalities as a poor prognostic factor in myeloma.

In the next phase of research, A/Prof Chng will focus on translating these discoveries into clinical use to benefit patients. He has developed an automated algorithm that allows the analysis of gene expression data in real time to identify the major genetic abnormalities of clinical relevance in myeloma. In the next two years, he will assess the feasibility of applying genomics-based diagnosis in the prospective cohort of patients both in terms of accuracy and economy. In addition, he will focus on understanding the biology of high-risk myeloma subtypes such as those with p53 abnormalities and also t(4;14). These will eventually allow him develop a more novel and rational approach to treatment of this high-risk disease.



ASSOCIATE PROFESSOR CHRISTOPHER CHEN (CSA-SI)

Department of Pharmacology
National University of Singapore
Senior Consultant Neurologist
National Neuroscience Institute
Singapore General Hospital

Translational Research in Dementia: Mechanisms of Disease, Pathophysiology and Biomarker Discovery

In his initial application for the CSI Category A award in 2005, A/Prof Chen stated that he intended to develop upon the theme of "Translational Research and Clinical Trials in Stroke and Dementia" so as to lead a productive and integrated research programme.

In many important respects, he has made much progress in achieving this aim by a) the establishment of the NUHS Dementia Translational Programme in 2008; b) the award of a National Research Foundation Competitive Research Programme grant focusing on intracranial disease and stroke in 2009; c) the award of an NMRC Centre Grant for the Memory Aging and Cognition Centre to investigate the interaction between cerebrovascular and neurodegenerative diseases in 2010; and d) the award of an NMRC grant in 2011 to complete CHIMES, the largest trial of traditional Chinese medicine in stroke recovery.

Under the revised theme of "Translational Research in Cognitive Impairment & Dementia: Biomarkers Discovery", A/Prof Chen plans to combine his research interests in dementia and stroke. His aim is to deepen existing collaborations and to develop new ones so as to benefit neuroscience research in Singapore and provide a basis for the training of young clinicians and scientists keen on pursuing and developing a research career.



ASSOCIATE PROFESSOR RAYMOND SEET (CSA-INV)

Department of Medicine
Yong Loo Lin School of Medicine
Consultant
Division of Neurology
National University Hospital

Can oxidative stress markers predict early ischemic stroke outcomes? A prospective study using oxidative stress biomarkers, perfusion-weighted imaging and clinical stroke severity scales

Stroke is caused by a myriad of risk factors that contribute to the development and growth of blood clots within the brain. The purpose of A/Prof Seet's study is to decipher the biochemical and molecular changes that occur within the brain following stroke onset. These biomarkers, which reflect the burden of oxidative stress and inflammation, are compared with outcomes of stroke patients using neuroimaging methods that reflect the cerebral infarct and penumbra volumes.

As the lipid-rich environment of the brain is susceptible to free radical damage, A/Prof Seet hypothesises that, compared to inflammatory markers, oxidative stress markers are better surrogates of the cerebral infarct/penumbra volumes, and stroke severity. By determining the time-course of production and release of these biomarkers into the circulation, this study has the potential to translate state-of-the-art research to a clinical setting by identifying patients who may potentially benefit from antioxidant therapy, assessing early response to treatment, and accurately predicting the extent of neuronal damage following ischemic stroke.



PROFESSOR YONG EU LEONG (CSA-SI)

Head and Senior Consultant
Department of Obstetrics & Gynaecology
National University Hospital

Novel Anti-androgens of Botanical Origin as Multiple-Site Modulators of Androgen Receptor Signalling to Inhibit Prostate Cancer Development and Growth

Prostate cancer ranks third, behind lung and colon cancers, as a cause of death in Singapore, and epidemiological studies indicate that consumption of some compounds of botanical origin can reduce its prevalence and incidence. Tapping into Singapore's heritage of traditional therapies, Prof Yong has established that compounds from the traditional medicinal plant Epimedium have anti-tumour properties against breast cancer cells. Epimedium compounds such as Icaritin (ICT) can also act as multiple-site modulators of androgen receptor signalling to inhibit prostate cancer development and growth.

The hallmarks of Prof Yong's findings include ICT's significant effect in inhibiting the growth of prostate cancer cells in both androgen receptor (AR) dependent and independent mechanisms, proving its worth in both androgen responsive and castrate resistant prostate cancer. He is currently making steady progress in mapping ICT's critical mechanisms of action.

Receiving the CSA award has enabled Prof Yong to host several renowned figures from the US in the field of AR translational research. These visits have resulted in fruitful collaborations whereby young NUS Graduate School PhD scholars, whom Prof Yong is supervising, can benefit from attachments in overseas laboratories. The award has also freed up Prof Yong's time to mentor young trainee doctors to join the NUHS O&G clinician-scientist resident programme. Currently half of the six residents in the O&G Department are on the clinician-scientist track, undertaking novel research in the field of steroid hormone receptor action such as lung cancer and polycystic ovarian syndrome.

ASSISTANT PROFESSOR MARK CHAN (CSA-INV)

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

Predicting Outcomes in Acute Coronary Syndrome: A Translational Approach Integrating Population-specific Clinical Risk Models, Platelet Reactivity and Metabolomic Biomarkers

Heart attacks remain a leading global cause of death. A/Prof Chan is investigating the ability of novel blood metabolomic markers, identified in his previous work, to predict adverse outcomes in a multinational cohort of patients presenting with heart attacks, and studying the relationship of these metabolomic markers with platelet function. He hopes that investigations will lead to better methods of predicting heart attack patient outcomes and identifying high-risk patients for treatment escalation.

A/Prof Chan is working together with two hospitals in Singapore and one each in Hong Kong, New Zealand and Sarawak, Malaysia. The two heart centres in Singapore are running on-site platelet flow cytometric analysis and all five hospitals now have fully functional near-patient platelet function testing capabilities. Negotiations with five centres in Brazil are also ongoing.

The Cardiovascular Research Institute is coordinating the study and Duke-NUS Graduate Medical School will be performing the metabolomics analysis. A longer-term goal is to establish a network of academic research hospitals with high-end clinical and applied science capabilities to run complex protocols of biomarker discovery and personalised platelet-directed treatment strategies in patients with heart attacks.



DR LOUIS CHAI (CSA-INV)

Consultant
Division of Infectious Diseases
University Medicine Cluster
National University Health System

Anti-Fungal Agents with Immune Modulator as Novel Drug Combinations for Enhanced Treatment of Invasive Fungal Infections

The number of patients with compromised immune systems is increasing, especially from haematology, oncology, transplant and intensive care units. These patients are susceptible to opportunistic infections, among which mortality rates from invasive fungal infections (IFI) have remained high, approaching 50%.

This issue is further confounded by 1) the limited range of effective anti-fungal medications available; 2) the toxic effects of certain anti-fungal agents; 3) the exceedingly high costs of these drugs; and 4) the inability of the host to respond appropriately to the infection and drugs.

Dr Chai aims to investigate how modulation of the host immune response to fungal pathogens may influence clinical response to infection. His hypothesis is that concurrent administration of an immune modulator together with conventional anti-fungal agents enhances host immune capability against invasive yeast and mould infections, and augments microbicidal activity. This is being investigated in in-vivo systems using immunocompetent and immunosuppressed mice models of invasive candidiasis and invasive aspergillosis.

Preliminary results to date have been promising, and Dr Chai's goal is to create novel combination drug/treatment regimens incorporating immune modulators that are efficacious and financially viable for patients, especially in Asia.



TALENT DEVELOPMENT PROGRAMMES

HEALTHCARE RESEARCH SCHOLARSHIP (PHD)

This scholarship provides support to Advanced Specialty Trainee (AST) doctors who wish to enrol in a PhD programme locally or overseas. It is targeted at young clinicians intending to pursue a career in research. The scholarship provides a 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.

HEALTHCARE RESEARCH SCHOLARSHIP (MASTER OF CLINICAL INVESTIGATION)

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

NMRC RESEARCH TRAINING FELLOWSHIP

The NMRC Research Training Fellowship aims to provide doctors with the training necessary to become clinician scientists. This can include overseas research training or pursuing a graduate degree in research at a local or overseas institution. The award is available to medical doctors and dental surgeons registered with the Singapore Medical Council or Singapore Dental Board. The award is also open to allied health professionals and biostatisticians who support translational and clinical research. Recipients of the fellowship receive 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 AND RECIPIENTS FOR 2011

NMRC RESEARCH TRAINING FELLOWSHIPS AWARDED IN 2011

There were seven awardees under the NMRC Research Training Fellowship in 2011. Four awardees are undergoing training leading to PhD degrees, two awardees are undergoing training leading to Master's degrees, and one awardee is doing an overseas research attachment not leading to a degree.

Name	Institution/Type of Training	Area of Research/Projects
Goh Tze Jui	Institute of Mental Health PhD (Full-time, local)	MENTAL HEALTH Cognitive-behavioural therapy for children with autism spectrum disorder: incorporating the internet to increase motivation
Lena Lim Hui-Xiang	National University of Singapore PhD (Full-time, overseas)	NEUROLOGICAL Neuroimaging correlates of physical abuse in childhood
Dong Yanhong	National University of Singapore PhD (Part-time, overseas)	NEUROLOGICAL, STROKE a) Cognitive outcome after stroke (COAST) b) Improving the diagnosis of vascular cognitive impairment by prospective longitudinal clinical studies
Max Lam Zhan Yang	Institute of Mental Health PhD (Full-time, local)	NEUROPSYCHOLOGY, GENETICS Elucidating the genetic architecture of neuropsychological performance
Errol Chan Wei'en	National University Health System Master (Full-time, overseas)	EYE Cost-effectiveness analysis of ranibizumab for diabetic retinal disease
Johnson Fam	Singapore General Hospital Master (Full-time, overseas)	PSYCHIATRY Effect of NMDA antagonist on glutamate and glutamine in depression
Joanne Ngeow Yuen Yie	National Cancer Centre Singapore Fellowship (Full-time, overseas)	CANCER Understanding germline mutations in patients with unexplained gastrointestinal polyposis

Six awardees completed their training under the NMRC Research Training Fellowship in 2011.

Name	Institution/Type of Training	Area of Research/Projects
Chan Mei Leng	Tan Tock Seng Hospital PhD (Full-time, overseas)	GERIATRIC Improving outcome for older retired drivers
Ng Oon Tek	Tan Tock Seng Hospital Fellowship (Full-time, local)	INFECTIOUS DISEASES Using serological and molecular techniques to better understand the HIV epidemic in Singapore
Hsu Li Yang	National University Health System Fellowship (Full-time, overseas)	INFECTIOUS DISEASES The application of whole genome typing to major lineages of methicillin-resistant staphalococcus aureus (MRSA) in the UK and Singapore
Daniel Chan Boon Yeow	National University Health System Fellowship (Full-time, overseas)	CANCER Identification of genomic changes as lymphoma progresses from low to high grade: an opportunity to discover new therapeutic targets
Khoo Chin Meng	National University Health System Fellowship (Full-time, overseas)	METABOLIC DISEASE Biochemical mechanisms of improved insulin sensitivity in response to weight loss
Subramaniam Tavintharan	National University Health System Fellowship (Full-time, overseas)	METABOLIC DISEASE Riboregulators as potential biomarkers and therapeutic targets in common metabolic diseases

HEALTHCARE RESEARCH SCHOLARSHIP (PHD) AWARDED IN 2011

There was one awardee under the NRF-MOH Healthcare Research Scholarship (PhD) in 2011.

Name	Institution/Type of Training	Area of Research/Projects
Calvin Chin Woon Loong	National Heart Centre Singapore (Full-time, overseas)	CARDIOVASCULAR RANKL Inhibition with denosumab in patients with aortic stenosis

HEALTHCARE RESEARCH SCHOLARSHIP (MASTER OF CLINICAL INVESTIGATION) AWARDED IN 2011

There were seven awardees under the NRF-MOH Healthcare Research Scholarship for the NUS Master of Clinical Investigation (MCI) in 2011.

Name	Institution	Department
Go Yun Yun	National Heart Centre Singapore	Cardiology
Goh Ting Hui Angeline	Singapore General Hospital	Renal Medicine
Hey Hwee Weng Dennis	National University Health System	Orthopaedic Surgery
Nadira binte Hamid	National Heart Centre Singapore	Cardiology
Colin Ngeow	St Luke's Hospital	Medical Services
Tay Bee Gek Laura	Tan Tock Seng Hospital	Geriatric Medicine
Wu Mei Wen Fiona	National University Health System	Urology

A total of seven awardees completed their NUS Master of Clinical Investigation (MCI) training under the NRF-MOH Healthcare Research Scholarship in 2011.

Name	Institution	Area of Research/Projects
Low Hsiu Ling Andrea	Singapore General Hospital	RHEUMATOLOGY & IMMUNOLOGY Optimal screening strategy for systemic sclerosis and connective tissue disease associated pulmonary arterial hypertension
Subramaniam Tavintharan	Alexandra Hospital	MEDICINE Riboregulators and their roles in common metabolic diseases
Chan Wei Shih, Derrick	KK Women's and Children's Hospital	PAEDIATRIC MEDICINE Focal epilepsy in childhood: differentiation of benign and severe course based on clinical presentation
Thia Teck Joo, Kelvin	Singapore General Hospital	GASTROENTEROLOGY & HEPATOLOGY Epidemiology of inflammatory bowel disease in Singapore: assessing incidence and prevalence of Crohn's disease and ulcerative colitis
How Choon How	SingHealth Polyclinic (Sengkang)	METABOLIC DISEASE Obesity and quality of life in Singapore
Monica Chan	Tan Tock Seng Hospital	INFECTIOUS DISEASES Comparison of intermittent dosing versus continuous infusion vancomycin therapy in outpatient parenteral therapy setting (OPAT)
Kuan Win Sen	National University Health System	EMERGENCY MEDICINE Using signal peptides for diagnostic and prognostic evaluation of patients presenting with chest pain: allowing for a more quick and accurate assessment of patients presenting to the Emergency Department to enable efficient utilisation

BUDDING CLINICIAN SCIENTISTS – THE NEXT GENERATION OF LEADERS

A WINNING GAME PLAN

A/Prof Chng Wee Joo

Associate Professor, Yong Loo Lin School of Medicine, National University of Singapore
Senior Consultant, Department of Haematology-Oncology, National University Cancer Institute

To build a successful career as a clinician scientist, you can't simply dive in blindly and hope that things will work out—it is important to have a game plan.

"You need to have some idea of a short-term and long-term plan for where you see yourself because you want to build up resources while you are a young researcher that will facilitate your research for the next 10–15 years", advises A/Prof Chng Wee Joo, who is an Associate Professor at Yong Loo Lin School of Medicine, National University of Singapore, and a Senior Consultant in the Department of Haematology-Oncology at the National University Cancer Institute.

As a seasoned researcher specialising in multiple myeloma—a type of bone marrow cancer—and a recipient of a Clinician Scientist Award (CSA) (Senior Investigator level) in 2011 from NMRC, A/Prof Chng can certainly speak from experience.

Taking to the field

For A/Prof Chng, the desire to become a clinician researcher began early during his medical training in the UK. He notes, "I've always been interested in research. I feel it is so much more exciting and meaningful to be able to effect some change in the treatment of patients, rather than always being the one to follow what is currently available."

After nine and a half years in the UK, he returned to Singapore in 2000 for three years of haematology specialist training at National University Hospital. He subsequently applied and was chosen for an A*STAR International Fellowship to study multiple myeloma genetics at the Mayo Clinic in the US. During his three years at the Mayo Clinic, A/Prof Chng learnt a great deal through his research and the mentorship that he received, which helped to accelerate his research career. Ahead of his return to Singapore in 2007, he applied for a grant from the Singapore Cancer Syndicate so that he could hit the ground running and carry on with the work that he was doing in the US.

"In my final year at Mayo Clinic I submitted a grant application back to Singapore because I knew that I would definitely be returning. For me there is always a lot of planning ahead because I want to always be in control of the situation", explains A/Prof Chng. "So I got a big grant and thus when I came back to Singapore I was already a principal investigator and I already had funding to build a small lab with some research assistants and two post-docs, as well as a bank of myeloma samples. The other lucky thing was that when I came back, a senior investigator was about to go back to the US, and since my research is in the same area as his, I took over his remaining grants and projects."

In 2008, A/Prof Chng received new funding in the form of a CSA (Investigator level) award from NMRC. This funding was used to try to identify genetic mutations or genes that are important for the early transformation from a pre-malignant condition into myeloma. The ultimate goal was to identify early events that could potentially be used to screen patients or enable early intervention to prevent the disease's progression.

Having completed what they set out to do in that project, A/Prof Chng and his team are now moving on to the next step: "We have identified one or two important factors in the early progression, so now we are trying to see if we can identify drugs that can impact or inhibit these abnormal molecular events that lead to the transformation of myeloma cells."

Building the right team

For A/Prof Chng, research is not a solo endeavour; instead, it is by working with a strong team that one can make the biggest impact. One place to start is with a good mentor. In addition to teaching young clinician scientists the ropes in terms of how to carry out good research, mentors can help open doors to new opportunities.

"I think the most important advice that I would give to aspiring clinician scientists is that they need to find good mentors. We often have this thinking that the senior or most famous people are the best, but sometimes these individuals do not have time to mentor you in the way that you would like", says A/Prof Chng. As with other aspects of career development, he recommends taking a planned, strategic approach to finding a mentor: "Don't make rash decisions; get to know the people and their labs before you jump in."

Having a strong team also means finding appropriate collaborators who are also interested in translational and clinical research. Working together with other researchers and scientists can enable a project team to apply a wide range of knowledge and skill sets to tackle complex problems.

A/Prof Chng notes, "I am highly collaborative in the sense that I don't believe that you can do everything yourself. And by collaborating, you also grow your network and your publication rate can increase exponentially because your speed of doing the research will be much faster."

For his various research initiatives, A/Prof Chng works with collaborators across different disciplines at universities and research institutes both within Singapore and overseas. More recently, he has also been seeking collaborations with industry partners to help translate his team's genetic findings into clinical applications.

He explains,

"We want to find companies with drugs in development that perhaps can target the genetic mutations we have found, that can help my patients. So I go out and say: these are my discoveries, and we are also setting up our capabilities to do pre-clinical drug development. If you have a compound that targets our disease pathways but you are maybe working in more common cancers like breast and so on, why don't I work with you to help with the development of your drug in myeloma?"

With promising research efforts underway and more no doubt coming soon, A/Prof Chng looks set to continue making headway in the fight against multiple myeloma. And while the battle likely remains long and arduous, A/Prof Chng—in his well-planned way—will continue to tackle it together with his team through smart collaborations and strategically conceived research.





TRANSFORMING EMERGENCY MEDICINE

Dr Marcus Ong

Senior Consultant, Department of Emergency Medicine, Singapore General Hospital
Associate Professor, Office of Clinical Sciences, Duke-NUS Graduate Medical School

For Dr Marcus Ong, a Senior Consultant in the Department of Emergency Medicine at Singapore General Hospital, the reason for carrying out translational and clinical research (TCR) is very simple: to improve outcomes for patients. He explains, "I want to do things that will have a near or immediate impact on patient care. Whatever we do should be driven by our patients because we want to improve outcomes for them."

As a clinician scientist, Dr Ong splits his time between clinical work in the accident and emergency (A&E) department at SGH and researching ways to do such clinical work—as well as pre-hospital emergency care—better. Explaining why he has chosen to follow this particular career path, he notes, "As a clinician, I can save patients one life at a time, but through research I can help many more people and have a much wider impact."

A humble start

Dr Ong's first steps down the path to becoming a clinician scientist came in 1999 when he was still a doctor in training. "My first research project was when I was still a medical officer. My interest in research started by asking questions about everyday practice."

Specifically, his interest was piqued by dealing with patients who came to the A&E department with scalp lacerations—often the result of a drunken fight in which someone was hit on the head with a beer bottle. Dealing with such injuries was never fun, recalls Dr Ong with a laugh, because the procedure for treating them was rather unpleasant for the patient. Following the protocols at the time, he would clean the wound and stitch it shut, which required shaving part of the scalp on either side of the wound and injecting a local anaesthetic. This approach was quite painful, resulted in an ugly bald patch and required the patient to return a week later to have the stitches removed.

Dr Ong wondered whether there was a better way to do things. He experimented with two different approaches to closing lacerations without stitches, one involving tying the patient's hair in a knot and the other using medical-grade glue to close the wound. However, both approaches had their downsides.

Undeterred, Dr Ong had the novel idea to combine the two: twist (rather than tie) the patient's hair together to close the laceration, then apply glue to the twisted hair to keep it in place while the wound healed. He adds, "The beauty of it is that if you wash your hair, medical glue is biodegradable, so after a week or two the glue degrades and the hair falls back in place."

This proved to be an excellent solution. Dubbed the hair apposition technique (HAT), it was faster, less painful and resulted in better wound healing than the traditional suturing treatment—this was confirmed by a randomised controlled trial carried out by Dr Ong and his colleagues. They published a journal article about their study in 2002, and since then HAT has been adopted by emergency departments at many hospitals around the world.

Improving the system

Encouraged by this early success, Dr Ong has been actively engaged in TCR since then. Since 2001, he has been leading the multi-phase Cardiac Arrest and Resuscitation Epidemiology (CARE) Study, which is the most comprehensive study to date of out-of-hospital cardiac arrest (OHCA) in Singapore. His team has framed their research from a public health perspective to better understand some of the obstacles that hinder the success of resuscitation and health services aimed at helping OHCA patients.

"When we talk about resuscitation, we talk about the chain of survival: in order to save a person who has a sudden cardiac arrest, there are a few links in the chain, and each link is equally important and time dependent", explains Dr Ong. Over the various phases of the CARE Study, the team has been researching these links in the chain of survival—namely, early access, early cardiopulmonary resuscitation (CPR), early defibrillation, and early advanced care—to identify ways to strengthen them.

Their efforts have already had a positive impact. A geospatial-time analysis of ambulance deployment found that deploying ambulances at more locations around Singapore rather than being based at a small number of fire stations resulted in better response times. The study also found the introduction of Fast Response Paramedics (FRPs)—individual paramedics on motorcycles—could cut down response times as FRPs are more nimble in traffic.

The team's research has also brought about changes to the training for telephone operators at the Singapore Civil Defence Force's "995" ambulance hotline. Dr Ong explains, "We have trained the telephone operators to give instructions over the phone via a computerised protocol so that they can actually tell a bystander what to do in order to pump the chest and restart the heart." Given that survival rates following a cardiac arrest are highly time sensitive, developments like this that result in early intervention can have a significant impact.

Thinking big

In September 2010, Dr Ong was the recipient of a Clinician Scientist Award (CSA) (Investigator level), which comes with three years of research funding from NMRC. With this funding, Dr Ong and his colleagues are pushing ahead with their work.

In 2010, they launched the Pan-Asian Resuscitation Outcomes Study (PAROS) Clinical Research Network, which expands the research carried out in Singapore on a much broader scale covering nine Asia Pacific countries: Singapore, Japan, South Korea, Taiwan, Thailand, United Arab Emirates, Turkey, Malaysia and Australia. As a result, there are now more data to work with and more researchers applying their expertise to tackling the challenges related to pre-hospital and emergency care.

"In the real world, there are frustrations for clinicians because we know that we can do better for our patients, but because of lack of knowledge or lack of evidence or poor practices, care is sub-optimal", notes Dr Ong. "I believe that is where research comes in. Research is finding better ways to do things and to show evidence that it is better so that it can be adopted by others and more patients can benefit."



"In the clinic it frustrates me if I have to tell my patients that there's nothing more I can do for them because I've run out of options. So if I have to say that to them, at least I can be encouraged by the fact that I am doing something about it through the research I conduct", notes Dr Wong. "At the end of the day, advances in medicine will come only through research that combines scientific breakthroughs with clinical needs."

SEEING THE BIG PICTURE

Dr Tina Wong

**Consultant Ophthalmologist, Glaucoma Service, Singapore National Eye Centre
Head, Ocular Therapeutics and Drug Delivery Research Group, Singapore Eye Research Institute**

"Whatever we do in our research has to be something that patients want", says Dr Tina Wong, Consultant Ophthalmologist at the Singapore National Eye Centre (SNEC) and Head of the Ocular Therapeutics and Drug Delivery Research Group at the Singapore Eye Research Institute (SERI). This, in a nutshell, sums up the key principle guiding her approach to translational and clinical research (TCR).

"Research has to be relevant, but it also has to be accepted", she explains. "If it's going to be effectively translational and successfully commercialised, who are the consumers? Who are the end-users? Are they actually going to use your new device or drug or treatment?"

The idea of developing patient-centric and patient-friendly solutions is something that can occasionally become lost in the detached environment of the lab, away from the realities of the clinic. This is where clinician scientists have a key role to play in balancing the heavy focus on scientific advances and new discoveries in the lab with the needs of the end-consumer—the patient.

Translating patient needs into research

These issues are of great relevance to Dr Wong's work. As a clinician scientist, she uses her interaction with patients in the clinical setting to better understand the shortcomings of existing practices from both a medical and patient quality-of-life perspective, which she then translates into research questions to be addressed in the lab.

Sub-specialising in glaucoma, Dr Wong's research focuses primarily on the modulation of ocular wound healing and inflammation in the eye, as well as the development of sustained ocular drug delivery systems. She is actively involved in the NMRC-funded Eye Diseases TCR Flagship Programme, but Dr Wong also heads several of her own studies as the Principal Investigator.

She has two main research groups. One is at SERI and focuses on ocular wound-healing research using animal models to investigate ocular scarring, as well as drug discovery of new molecules and targets that can be further developed into new anti-scarring therapeutics. The second is at the School of Materials Science and Engineering at Nanyang Technological University (NTU), where the team focuses on drug delivery and surgical innovations through the use of materials science and nano-engineering technology. SNEC forms a third piece of the puzzle, carrying out clinical trials as well as patient-based glaucoma research.

In September 2010, Dr Wong received a Clinician Scientist Award (CSA) (Investigator level) from NMRC to fund her research into the development a delivery system of RNA knock-down to improve anti-scarring treatments. Explaining the objective of the CSA-funded research, Dr Wong says, "We are looking at how to deliver a sustained release of siRNA into the eye so that it retains a sustained anti-fibrotic effect for the time we require. Scarring takes several weeks to months, so a one-off injection doesn't work."

Dr Wong and her team believe that this approach will provide more effective anti-scarring outcomes by delivering a steady drug dose over an extended timeframe. At the same time, they believe that patients will benefit from a drug-delivery system that will reduce both the number of visits to the clinic and dependency on patient compliance with taking their prescribed medications.

A patient-centric approach

However, for Dr Wong it is crucial to be on the same page as her patients. Therefore, to ensure that she is on the right path, she looks at the practical patient-specific implications and health services issues related to her research.

She explains, "For example, if I'm developing a new drug therapy and it involves an injection, it might mean that a patient will not need to use eye drops every day and that instead they will only need to do an injection three times per year. But is that something that they're going to accept? And if so, at what cost?"

Dr Wong finds the answers to such questions through another sort of research: "I conduct patient questionnaires to help provide the answers to some of these pre-market questions. So I ask patients: if there's an alternative to their eye drops, are they actually going to want to use this instead of continuing to take their eye drops? Understanding this is a very important aspect of getting your 'product' right. If it works well from a medical or surgical perspective but the consumer is not going to use it, then I will have wasted a significant amount of my time and grant funding on something that may never fly."

However, even when an idea turns out to have shortcomings, this doesn't mean you just give up; instead, it simply means reassessing patient needs to push ahead with your research from a different angle.

NATIONAL MEDICAL EXCELLENCE AWARDS 2011

NATIONAL MEDICAL EXCELLENCE AWARDS

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 success and hold up role models for the younger generation of clinicians and clinician researchers.

In 2011, the NMEA recognised five outstanding individuals and one four-member team for their efforts as mentors, clinical researchers and scientists, celebrating their work and the example they have set for the rest of the medical community in Singapore.

A new award category, the National Outstanding Clinical Educator Award, was introduced in 2011 to recognise the tireless efforts of clinician educators who teach, guide and inspire the next generation of clinicians. This new award is timely as Singapore ramps up its development of structured postgraduate medical education under the residency programmes at public healthcare institutions.



NMEA 2011 AWARD WINNERS

NATIONAL OUTSTANDING CLINICIAN MENTOR AWARD

Professor Lee Tat Leang
National University Hospital
Department of Anaesthesia

Prof Lee has been with NUH since its inception in 1985 and headed up the Department of Anaesthesia from 1993 to 2003. As a leading educator, mentor and clinician, he has also made immense contributions to clinical education in Singapore through his work at NUS Yong Loo Lin School of Medicine, both in the areas of undergraduate medical studies and postgraduate specialty training in anaesthesiology.

Prof Lee set up the first human-patient simulator laboratory in Singapore in 1998. He also pioneered the use of acupuncture alongside Western medicine in Singapore, setting up an acupuncture outpatient clinic in NUH in 1997—the first among the restructured hospitals in Singapore to do so. In addition, he chaired an acupuncture research committee that spearheaded various acupuncture-related projects to promote awareness of acupuncture among Western-trained doctors.

Prof Lee is a well-respected leader in the anaesthesiology community both in Singapore and internationally. His ability to relate to people has made him a popular mentor to clinicians, scholars and researchers. He has mentored several research graduate students, one of whom went on to become the first PhD student in the department at NUH.

Heavily involved in postgraduate training, Prof Lee chairs the Ministry of Health (MOH) Specialist Training Committee for Anaesthesiology and the Residency Advisory Committee (RAC) for the Anaesthesiology residency training programme. He has been an examiner for anaesthesiology since 1984 and chief examiner since 2000 for the NUS MMed (Anaesthesiology) examinations. He continues to oversee new developments in examinations for anaesthesiology through the RAC and in MOH's Steering Committee for Post Graduate Medical Examinations.



NATIONAL OUTSTANDING CLINICIAN MENTOR AWARD

Associate Professor Wong Kim Eng
Institute of Mental Health

In a career that spans more than 30 years, A/Prof Wong has assumed the responsibilities of a clinician, mentor, clinical tutor, facilitator and administrator. She is a committed teacher, a coordinator of examinations, and an examiner for local and external examinations. Medical students and Specialist Trainees in psychiatry have benefited from her supervision and mentorship.

A/Prof Wong has been a strong advocate for training and has done much to realise the potential in her doctors. She helped to establish a conducive training and research infrastructure at the Institute of Mental Health (IMH), as well as mentoring several outstanding psychiatrists and clinician scientists.

A/Prof Wong was the Co-Chairperson of the National Mental Health Committee, which produced Singapore's first National Mental Health Blueprint in 2005, and was thereafter appointed as Chairman of the National Mental Health Blueprint Medical Committee in 2007 to oversee the implementation of its medical programmes. She also chairs MOH's Chronic Disease Management Programme Mental Illness Clinical Advisory Committee.

She currently oversees the National Addictions Management Services (NAMS) as Clinical Director at IMH. During the course of her career, A/Prof Wong served a six-year term as Chairman, Medical Board, from 2002 to 2008. She was appointed Chairman, NHG Research Ethics Committee, from 2003 to 2009. She has also chaired IMH's Hospital Ethics Committee since 2009. In recognition of her contributions, IMH conferred the "Emeritus Consultant" title on her in 2010.



NATIONAL OUTSTANDING CLINICIAN AWARD

Dr C Sivathanan
Department of Cardiothoracic Surgery
National Heart Centre Singapore

Dr Siva has been actively involved in the development of cardiothoracic surgery in Singapore for nearly 30 years. He was part of the pioneer team that established the heart and lung transplant programme and was involved in Singapore's first heart transplant in 1990 and first lung transplant in 2000.

To improve the quality of life for end-stage heart failure patients, Dr Siva introduced new treatments such as ventricular assist devices in Singapore. He also started the Mechanical Heart Device Programme in 2001 to support patients with terminal heart failure, and is currently the programme's Director.

Dr Siva also pioneered robotic-assisted minimally invasive cardiothoracic surgery in Singapore in 2005, which allows heart patients to experience faster post-operation recovery and less pain while enjoying a lower risk of infection and transfusion due to reduced blood loss. The programme has since expanded to cover lung surgery. His selfless dedication and compassion for patients earned him the Healthcare Humanity Award in 2010.

In 1988, Dr Siva established the management protocols for the cardiothoracic surgery intensive care unit (CTSICU), laying a strong foundation for the current level of care and safety, which is comparable to international standards.

Although now in private practice, Dr Siva continues to serve as the Co-Director of the Heart and Lung Transplant Programme at the National Heart Centre. As a well-respected leader in the field of transplant, he also holds several appointments with local and international organisations.



NATIONAL OUTSTANDING CLINICIAN EDUCATOR AWARD

Professor C Rajasoorya
Khoo Teck Puat Hospital
Ministry of Health
Faculty of Medicine, National University of Singapore
Duke-NUS Graduate Medical School

Inspired by his experience when he was in training, Prof Raja believes that the responsibility to train the next generation of doctors rests largely with established clinicians. With this in mind, he has tirelessly dedicated his time and effort to impart and share his experience and knowledge with budding clinicians. A fervent advocate of clinical education, Prof Raja has taught and inspired countless medical students and doctors.

Prof Raja's research into postgraduate education was instrumental in the decisions that led the Ministry of Health and the Specialists Accreditation Board to seek a more structured and effective postgraduate training programme. His most recent undertaking is to chair the National Medical Undergraduate Curriculum Committee, which seeks to establish the standards across all three medical schools in Singapore and to raise the standard of medical learning in Singapore.

With his enthusiastic approach, Prof Raja has encouraged other established clinicians to assume teaching, supervisory or chief examiner roles. He has also been instrumental in persuading various committees to share their knowledge and experience at symposiums, plenary lectures and meet-the-expert sessions, which have contributed significantly to medical learning in Singapore.

Prof Raja is currently a Senior Consultant Endocrinologist at the Department of Medicine at Khoo Teck Puat Hospital (KTPH); Clinical Professor, Faculty of Medicine, Yong Loo Lin School of Medicine, National University of Singapore; and Adjunct Professor, Duke-NUS Graduate Medical School. He is also since 2007 a Senior Consultant (Specialist Training) to the Manpower Standards and Development Division, Ministry of Health. He chaired the Specialist Training Committee for Endocrinology.



NATIONAL OUTSTANDING CLINICIAN SCIENTIST AWARD

Associate Professor Tan Eng King
 Department of Neurology (NNI-SGH Campus)
 National Neuroscience Institute

Selected by the Ministry of Health in 2005 as one of its pioneer cohort of clinician scientists, A/Prof Tan is currently a senior consultant neurologist and clinician scientist at the National Neuroscience Institute (NNI), Singapore General Hospital (SGH) campus, and an Associate Professor at Duke-NUS Graduate Medical School (Neuroscience and Behavioral Disorders).

An accomplished researcher, A/Prof Tan has been instrumental in leading research in the field of Parkinson's disease and movement disorders, particularly in the discovery of genetic risk factors unique to Asians, and has made many clinical observations that have helped in clinical care of patients with movement disorders.

His achievements include the setting up of the Movement Disorders Service at SGH in 2000, which benefited patients with gait problems and involuntary movements and paved the way for the establishment of a fully integrated programme at NNI.

In addition to being recognised as a researcher in the international healthcare arena, A/Prof Tan is also an opinion leader and well-known clinician with patient referrals from Europe, the US and Asia. He is the only Singaporean to be elected into the American Neurological Association for his contributions to academic neuroscience.

A/Prof Tan's work has been recognised internationally and he has authored more than 200 peer-reviewed papers in international journals and book chapters. He is presently an editor of three prestigious international journals and Chief Editor of *Annals Academy of Medicine*, Singapore's leading medical journal.

He is the Director of Research at NNI and of the Genomics Core at SGH Research Division, and co-director of the NNI Movement Disorders Centre.



NATIONAL CLINICAL EXCELLENCE TEAM AWARD

Associate Professor Tan Huay Cheem
 Associate Professor Shirley Ooi
 Associate Professor Ronald Lee
 Dr Edgar Tay
 National University Heart Centre
 Department of Emergency Medicine, National University Hospital

This multidisciplinary team from National University Heart Centre and National University Hospital (NUH) made it their goal to reduce the time required for a patient with acute myocardial infarction to receive treatment. Their focus was door-to-balloon (D2B) time—the time taken for a patient to have their blocked arteries 'opened up' through balloon inflation from the time they arrive at the hospital.

Through careful study, the team identified operational and clinical processes for treating patients with acute myocardial infarction and instituted changes in March 2007. This included having the emergency department physicians activate the intervention team directly, immediately transferring patients to the cardiac catheterisation laboratory upon activation, converting pagers to cell phones for all intervention team members and cross-training of CCU nurses to function as catheterisation laboratory nurses after office hours. This reduced the median D2B time to 68 minutes within six months of implementing the changes, well below the internationally recommended 90 minutes.

These innovative efforts had a significant impact at the hospital, such that NUH not only managed to sustain the results three years later but also further reduced the median D2B time to 57 minutes as of end-December 2010. Because of these impressive results, NUH has been recognised internationally as one of the best hospitals in the world for D2B timings. In addition, the mortality rate for patients was lowered, saving more lives.



RESEARCH GRANTS

FUNDING TRANSLATIONAL AND CLINICAL RESEARCH

The funding of translational and clinical research 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:

- Strategic/thematic research
- Investigator-led research

The first category consists of the Translational and Clinical Research Flagship Programmes, which provide significant levels of funding to large-scale strategic studies, as well as Centre Grants and Programme Project Grants (awarded in 2009 and 2010), which offer two different types of institution/group-based funding.

The second category includes Individual Research Grants, Exploratory/Developmental Grants and New Investigator Grants, all three of which provide funding for investigator-led studies, but with different research focuses. In addition, three new types of grants for investigator-led research were introduced in 2011:

- Clinician Scientist Individual Research Grants (CS-IRG), which include the CS-IRG New Investigator Grant (CS-IRG-NIG) sub-category for new clinical investigators
- Cooperative Basic Research Grants (CBRG), which include the CBRG New Investigator Grant (CBRG-NIG) sub-category for new non-clinical investigators
- Bedside & Bench Grants (B&B)

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

TCR flagship programmes provide significant levels of funding to build up a critical mass of experienced high-level researchers, facilitate a broader research platform, and increase collaboration both locally and internationally. These programmes aim 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.

The TCR flagship programme grant was launched as a strategic initiative in BMS Initiative Phase II 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. Individual programmes can receive up to a maximum of \$25 million in funding, inclusive of indirect costs, and must be led by a well-qualified clinician scientist, who serves as the lead principal investigator (PI).

To date, three TCR flagship programme thematic grant calls have been conducted. The first grant call in 2007 focused on oncology. Two grant calls were conducted in 2008, with one focusing on neuroscience and eye diseases and another on infectious diseases and metabolic diseases. These five disease domains are key research areas selected for their relevance to Singapore and the existence of strong local expertise.

ONGOING PROGRAMMES

A total of five programmes, one for each of the five key research areas, were awarded across the three grant calls. Their progress thus far has received positive feedback from the members of the Scientific Advisory Board. The following is a brief overview of the key achievements across all five TCR flagship programmes as of Q3 2011:

- 23 invention disclosures
- 288 publications
- 501 presentations at major conferences
- 22 primary and 6 secondary patents
- 147 collaborations (academic/international)
- 27 projects with industry partners
- 8 spinoffs
- 12 clinical trials initiated
- \$30.41 million in industry funding

Highlights of each ongoing TCR flagship programme are included in the following section.

NEW TCR FLAGSHIP PROGRAMME FUNDING STRUCTURE

Since its inception in 2007, the TCR flagship programme grant has been tweaked to match the needs of Singapore's research landscape in BMS Initiative Phase III. One of the key changes has been in the grant's funding structure. Unlike the previous tranche, the new TCR flagship programme grant (launched in December 2011) offers two types of funding, both of which are administered by NMRC and funded over five years with funding provided by the National Research Foundation:

- The Tier 1 TCR Flagship Programme Grant is for programmes that require less than \$9 million in funding. The grant is capped at a quantum of \$9 million in total over five years, inclusive of indirect costs.
- The Tier 2 TCR Flagship Programme Grant is for programmes that require more than \$9 million in funding. The grant is capped at a quantum of \$25 million in total over five years, inclusive of indirect costs.

GASTRIC CANCER TCR FLAGSHIP PROGRAMME

The Singapore Gastric Cancer Consortium – Improving Outcomes for Our Patients

Principal Investigator:

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

Launched in August 2007, this was the first of NMRC's five TCR flagship programmes. The programme aims to improve the outcomes for gastric cancer—a leading killer in Singapore—via research focused on three key themes:

- Early detection by screening of high-risk groups
- Improving biologic understanding of gastric carcinogenesis
- Improving treatment by molecular profiling of tumours

The Singapore Gastric Cancer Consortium (SGCC) is a national coalition of leading clinicians and scientists working in gastric cancer research. The group focuses on solving important clinical questions to improve the care of gastric cancer patients. This is facilitated by close interaction between clinicians and scientists, and with synergy that enables biologic discoveries in the laboratory to be validated in the clinical setting. Important research projects include biomarker discovery and validation, the genetic mapping of gastric cancer, and clinical trials of new treatment agents.

Key highlights:

- A proposed new genomic classification of gastric cancer was published in *Gastroenterology* in 2011. It represents a completely new way of classifying gastric cancer that may be superior to the classic Lauren classification and diagnostically more robust.
- After a series of successful animal survival trials, the prototype robot endoscope system entered human clinical trials in 2011. The programme team is the first group in the world to perform robotic NOTES in human patients.
- Based on the new genomic classification, an important prospective multi-centre clinical trial for patients with advanced gastric cancer (the 3G Study) was launched in 2011. This is an important proof-of-concept trial for genomic-guided personalised treatment.
- A pre-disease high-risk cohort (Gastric Cancer Epidemiology Programme, GCEP cohort) comprising 3,000 subjects above 50 years old was recruited to explore the feasibility of early detection of gastric cancer by screening of high-risk groups. From this cohort, 15 patients were detected with early cancers, marking the first time that very early stage I or stage 0 gastric cancer has been diagnosed by screening in Singapore.
- A whole-genome sequencing project was completed in 2011 in collaboration with Genome Institute of Singapore (submitted for publication), and with Illumina where key genetic changes in early stage (I and II) gastric cancer were identified (being prepared for publication).
- The programme's biomarker discovery projects have resulted in the protection of two novel biomarkers for gastric cancer detection. The team has also secured a commercialisation grant to produce novel reagents (aptamers, monoclonal antibodies or peptides) against one of these biomarkers, C9, and it is in the process of developing a diagnostic kit for clinical applications.



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. A key objective is to contribute to the basic understanding of the disease process and enable earlier intervention through the development of better means of identifying individuals in imminent danger of developing psychosis.

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

Key highlights:

- The neuroscience TCR team has published to date a total of 29 scientific papers in both international and local peer-reviewed journals (12 papers with an impact factor value > 2, and 17 papers with an impact factor value < 2). In addition, the team has made nine presentations at international conferences to date.
- Through the neuroscience TCR flagship programme, IMH has now created an internationally competitive biomedical research infrastructure in schizophrenia, with high-quality phenotyping of Asian populations in terms of clinical and neurocognitive assessments. This will enable IMH to participate or collaborate effectively with other sites in international academic and pharmaceutical-based studies of schizophrenia. It can also position itself to play a leading role in forming a Chinese schizophrenia GWAS consortium and be a potential key player in international schizophrenia GWAS consortia.
- A close working relationship has been established between the IMH team and its overseas collaborators from Duke University Medical Center in the US in the area of neurocognition (Professor Richard Keefe and Associate Professor Christine Marx) and animal model work (Professor Bill Wetsel and Professor Marc Caron) to ensure knowledge transfer and development of local expertise, which are critical to the continued success of the programme.
- The IMH team has established an ethical, high-quality, efficient, and cost-effective system for engaging, recruiting and retaining a large population of patients within the Institute. This has been clearly demonstrated by the successful completion of the single-site randomised controlled trial involving a neurocognitive-enhancing agent.
- In terms of social impact, the extensive network built with community mental health partners for LYRIKS has equipped primary healthcare workers with the relevant knowledge to identify young people at risk of mental disorders, helped raised awareness of the importance of mental health and encouraged a change in public mindset towards mental illnesses. This has and will continue to result in early detection and better access to mental health care and a reduction in direct and indirect costs in mental health care.

EYE DISEASES TCR FLAGSHIP PROGRAMME

Singapore Eye Research Institute TRIOS Programme (Translational Research Innovations in Ocular Surgery)

Principal Investigator:

Prof Donald Tan
Medical Director, Singapore National Eye Centre

Launched in July 2008, this TCR flagship programme encompasses ophthalmic research focused on corneal disorders and glaucoma—two of the main causes of blindness globally, and particularly in Asia. The overall objective is to develop novel solutions to challenges facing medical and surgical therapies for these disorders.

The team's TRIOS (Translational Research Innovations in Ocular Surgery) programme aims to develop a "bench to bedside" eye research programme with a focus on wound healing, scarring and inflammation. While the primary area of study is surgical treatments for eye diseases, it is also recognised that many of the potential findings could have major implications for all forms of surgery and disease involving inflammation and scarring.

Key highlights:

- Ocular defensins: Naturally occurring defensin analogues have been synthesised and patented as a new group of antimicrobial agents for bacteria and fungus. The team has thus far successfully developed three novel synthetic defensin molecules: (1) a broad-spectrum antibiotic with excellent biocompatibility that is effective against gram positive and gram negative bacteria, as well as fungus; (2) an antifungal with excellent killing against fungus and yeast, ATCC standards and clinical isolates; and (3) a successfully modified natural product that is highly effective against all gram positive organisms, especially MRSA.
- Corneal transplantation devices: The team has invented a new donor insertion device, known as the Tan EndoGlide, for the current form of EK surgery (DSAEK – Descemet's Stripping Endothelial Keratoplasty). The device has been patented, out-licensed and bulk manufactured by Network Medical Products, UK, and is now commercially available worldwide. It is the first donor insertion device to be FDA-approved, and patients in Singapore have had first access to the device since 2009. The team has subsequently developed the Tan Endoglide 2, which is an enhancement of the original design, making it even easier and safer to perform this complex form of small incision keyhole surgery.
- Corneal lenticular storage in femtosecond laser surgery for use in presbyopia treatment: The team has pioneered a new form of corneal refractive surgery in collaboration with Carl Zeiss that may eventually rival LASIK. This procedure, known as Refractive Lenticule Extraction (ReLEx), is an evolution of laser refractive surgery. The team further came up with the idea of making ReLEx potentially reversible by developing the concept and technique of cryo-preserving (freezing in liquid nitrogen) and storing the lenticule for the potential future use of the patient; this process has been patented. Pre-clinical studies involving the re-implantation of ReLEx lenticules in monkeys and rabbits are currently underway.
- Nano-liposomal sustained-release ocular drug delivery system: A team led by SERI, together with collaborators from NTU, has come up with a way to free patients from the requirement to administer daily eye drops for years on end. The use of nanotechnology allows the successful delivery of the desired drugs via specific bioengineered carrier platforms, which are applied to the eye. These nanocarrier systems have now been shown to enable a steady release of the drug over several weeks.
- Commercialisation of the programme's work: A total of 16 patents have been filed together with two licenses to industry. Another four patents will potentially be filed within the next 6–12 months. To date, eight products with commercial potential have been developed. A further three projects have immediate potential for spin-off companies. The programme has collaborations with a wide range of pharmaceutical companies including Carl Zeiss, L'Oreal, Sirion Pharma, Network Medical Products, Allergan, ITC, India, Abbot Medical Optics and Alcon Lab.

METABOLIC DISEASES TCR FLAGSHIP PROGRAMME

Developmental Pathways to Metabolic Disease

Principal Investigator:

A/Prof Chong Yap Seng
Department of Obstetrics and 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. There are significant ethnic and individual differences in predisposition to these diseases, and thus one of the objectives of this programme is to examine the causal pathways and, in particular, the developmental factors that contribute to these differences.

The programme consists of three main sub-studies:

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

Key highlights:

- The programme's team of leading epigenetics researchers is part of an international alliance named the EpiGen Consortium, which on 22 November 2011 announced its collaboration with Nestlé Research Center in Switzerland and Nestlé Nutrition to undertake a research programme to understand and substantiate optimal nutrition for mothers during pregnancy and for infants to promote metabolic health throughout life.
- The team has nine PhD students and four MSc students in training. One student graduated with an MSc in January 2012, and five post-doctorates are currently employed by the programme. A TCR-specific advisory committee has been established to guide students in a coherent and efficient manner.
- The programme has established ties with several industry partners, with these partnerships valued at approximately \$11.5 million. The programme is in the midst of fulfilling its contractual obligations and continues to build long-term relationships with its industry partners.
- The GUSTO study has developed strong platforms in patient cohort, developmental epigenetics and computational biology, which are highly attractive to the nutrition industry.
 - » Cohort platform: covering the three major Asian ethnic groups, and the only Asian cohort with both maternal and infant nutrition data, as well as genetic and epigenetic information. This platform offers unprecedented depth of phenotyping—maternal, foetal, neonatal, and infant-child—in terms of growth, body composition and neurodevelopment.
 - » Developmental epigenetics platform: a good array of sequencing technologies and methodologies.
 - » Computational biology platform: support in bioinformatics, systems biology and biostatistics.
- The programme has raised the profile of biomedical research in Singapore with regards to the early origins of metabolic diseases.
 - » The programme's Lead Principal Investigator, A/Prof Chong Yap Seng, has been hand-picked by the international society Developmental Origins of Health and Disease (DOHaD) to serve as Congress Chair for the 8th World Congress on Developmental Origins of Health and Disease, to be held in Singapore on 17–20 November 2013.
 - » A/Prof Chong addressed the World Economic Forum (WEF) on 27 January 2012 in Davos-Klosters, Switzerland at its annual meeting, themed "The Great Transformation: Shaping New Models". His presentation, "Putting Women and Children First in Our Fight Against Obesity and Diabetes", focused on the effect of the prenatal environment on obesity and diabetes.
 - » A/Prof Chong has been invited to be one of 15 judges for the Google Science Fair 2012, which is expected to see at least 10,000 students aged 13–18 years from more than 90 countries take part in this second-ever global online science competition.



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. The overall goal of this programme is to study the major gaps in treatment and management of dengue diseases through translation of bench-to-bedside research activities.

Specifically, the programme aims to:

- Create a global centre of excellence for the clinical study and management of dengue diseases
- Improve dengue outcomes by improving 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

Key highlights:

- The team has recruited 3,562 subjects in two major prospective cohort studies with well-characterised clinical samples highly valuable for diagnostic and prognostic test development and validation.
- Clinical virus isolates have been characterised and can be used for fundamental research and DENV drug testing.
- The team has carried out non-invasive saliva testing using in-house IgA ELISA, which has proven to be particularly sensitive in detecting secondary infection. This is crucial in hyper-endemic areas. Saliva-based PCR testing also shows promise on initial evaluation.
- The programme has successfully established a mouse model of severe dengue based on a non-mouse adapted DEN2 strain in AG129 mice of dengue-associated vascular leakage.
- The programme has produced and successfully tested in-vivo in AG-129 mice the first fully characterised human anti-dengue antibody with prophylactic plus therapeutic effects.
- Research findings predicting risk of disease progression have been translated into clinical practice, leading to a 42% reduction in hospital admission rates without any adverse consequences to patient outcomes. Further fine-tuning of identified biomarkers should help clinicians single out for early medical intervention cases that are likely to do worse.
- The team has developed two in-house platforms: a high through-put quantitative cell-based fluorescence assay and a monovalent and tetravalent biotin-streptavidin ELISA.



TRANSLATIONAL AND CLINICAL RESEARCH (TCR) FLAGSHIP SYMPOSIUM 2011

Promoting Collaborations, Driving Innovations in Translational and Clinical Research

The TCR Flagship Symposium 2011 was held on 7 October at the Genexis Theatre at Fusionopolis. The aim of the event was to facilitate introductions, dialogues and connections between participants. In its second year, the symposium brought together over 400 participants from Singapore's medical research community and biomedical and pharmaceuticals industries. Compared to the inaugural event in 2010, this year's instalment attracted a larger and more diverse crowd.

Investigators from the five TCR Flagship Programmes and Centre Grant/Project Programme Grant teams were invited to give presentations. They provided a detailed overview of their research areas and the progress they are making, particularly in five disease domains that are highly relevant to Singapore: metabolic diseases, infectious diseases, neuroscience, ophthalmology and oncology.

These presentations were complemented by five industry speakers—from Bayer Healthcare, MSD, Roche, Lilly-NUS Centre for Clinical Pharmacology, and GlaxoSmithKline—who shared their companies' latest initiatives. Encouraging collaboration between the research community and industry is an important element of NMRC's overall efforts to drive TCR under Biomedical Sciences (BMS) Initiative Phase III (2011–2015), especially given that much of the research supported in BMS Phase II is approaching or has reached the commercialisation phase.

Following the presentations, a two-hour interactive networking session was held, with unique concepts such as speed networking introduced to initiate quick, intense discussions between participants and the TCR Flagship Programmes. A focused networking approach was also introduced to focus discussions on five specific research platforms and leverage the expertise of the symposium's participants. The research platforms were: 1) clinical trials, 2) biomarkers, 3) diagnostics and devices, 4) drug development and vaccines, and 5) funding. In addition, participants were given the opportunity to interact with key research enablers such as the Singapore Clinical Research Institute (SCRI), National University Health System (NUHS) Investigational Medicine Unit (IMU), and Singapore Health Services (SHS) IMU, which had booths at the symposium.

The result was a series of highly focused, interactive and lively discussions that allowed for the building of new connections, leading to possible new collaborations and synergies within the medical research community in Singapore.

The participants and TCR teams provided feedback that the content of the symposium was largely informative and relevant to both the clinical research community and the market, and that it provided a succinct introduction to Singapore's areas of strength in biomedical sciences. Some participants also shared that they enjoyed the sessions by top scientists from the pharmaceutical industry, which provided a different perspective.

The positive response is encouraging, providing strong motivation for NMRC to make the next symposium an even better experience for everyone by continuing to refine the content and format to address all participants' thirst for knowledge.

Testimonials

- Good networking opportunities with clinicians and good learning experience for researchers
- Superb insight into the way medicine is shaping up in the 21st century, and how we must grab the emerging possibilities!
- Excellent organisation and well-informed speakers
- A very useful symposium. Hope to attend again next year with new research findings from the projects.
- The TCR Flagship Symposium provided a rich nutshell-overview of the strengths of biomedical research in Singapore. It is a platform to learn from the crème-de-la-crème and know what are the requirements to put up a competitive TCR.

IP AWARENESS FORUM

On 12 January 2012, NMRC hosted its first Intellectual Property Awareness Forum. The event attracted 130 participants, including clinicians, scientists and research administrators from healthcare institutions, for an informative discussion on IP.

The topic is particularly relevant to those involved in TCR as one of the major objectives of Singapore's Biomedical Sciences (BMS) Initiative Phase III is to increase the commercialisation resulting from Singapore's growing TCR capabilities. Commercialisation brings with it significant issues relating to IP, and several of these were covered during the forum.

Speakers at the event included Suresh Sachi, General Counsel, A*STAR Legal, who spoke on IP in technology transfer arrangements, and Ho Cheng Huat, Executive Vice President, Intellectual Property Management Divisions at Exploit Technologies, who presented "Patenting Basics: What You Need to Consider in Patenting".

Also speaking were Irene Cheong, Director, Industry Liaison Office at NUS Enterprise, who shared what it takes to commercialise technologies, and Dr Lye Whye Kei, Director of Business Development (Future Health Care) at NTU's Nanyang Innovation & Enterprise Office, who spoke on IP for medical technology start-ups.

Feedback on the forum was positive, with the majority of participants saying the information shared was useful and improved their understanding of the issues surrounding IP. With this first IP forum well received, NMRC plans to organise similar events in the future to further raise IP awareness within Singapore.

INVESTIGATOR-LED RESEARCH

PAST INITIATIVES

Individual Research Grants

Individual Research Grants (IRGs) are awarded for up to three years to individual researchers for translational or clinical studies on a specific topic. The proposed projects must be based in Singapore, and the Principal Investigator should reside in Singapore and work in one of the local health clusters or a local academic institution.

IRGs play a critical role in funding investigator-led studies that are deemed to be both important and innovative, and which have the potential to make a significant impact in their respective field. The quantum supported for IRGs is up to \$1.5 million over a period of three years.

There are two IRG grant calls per year, opening in May and November each year, with submission deadlines of 1 June and 1 December. The table below indicates the number of IRG applications and awards since May 2006, as well as the total sum of the IRGs awarded in each grant call.

Period	Proposals Reviewed	Grants Awarded	Success Rate	Total Sum Awarded (\$ millions)
May-06	142	30	21.1%	10.15
Nov-06	188	27	14.4%	10.23
May-07	129	22	17.1%	13.59
Nov-07	139	27	19.4%	17.99
May-08	115	24	20.9%	16.67
Nov-08	92	23	25.0%	16.45
May-09	94	19	20.2%	17.77
Nov-09	103	21	20.4%	20.60
May-10	118	19	16.1%	19.96
Nov-10	132	20	15.2%	17.41
May-11*	132	19	14.4%	16.49
Total	1,384	251	18.1%	177.31

Exploratory/Developmental Grants

Exploratory/Developmental Grants (EDGs) support the development of innovative and new areas of research. They are applicable to investigator-led studies involving untested and novel ideas, original research fields, and the application of new expertise or approaches to established research topics. EDGs play an important role in supporting research that might have difficulty competing for funding with more conventional studies.

EDG funding is available for a two-year period, with the possibility of a one-year extension. The quantum supported for EDGs is up to \$200,000.

There are two EDG grant calls per year, similar to the IRG, with deadlines of 1 June and 1 December. The following table indicates the number of EDG applications and awards since May 2007, as well as the total sum of the EDGs awarded in each grant call.

Period	Proposals Reviewed	Grants Awarded	Success Rate	Total Sum Awarded (\$ millions)
May-07	55	17	30.9%	2.70
Nov-07	42	15	35.7%	2.62
May-08	34	15	44.1%	2.65
Nov-08	48	14	29.2%	2.68
May-09	71	16	22.5%	2.84
Nov-09	79	16	20.3%	2.75
May-10	64	15	23.4%	2.86
Nov-10	78	18	23.1%	3.46
May-11*	96	15	15.6%	2.75
Total	567	141	24.9%	25.31

New Investigator Grants

A sub-category under the EDG, the New Investigator Grant (NIG) is open to investigators who have not previously held a reputable national or international grant. Structured as a mentorship in which awardees work with a mentor for guidance in their research, NIGs represent an attractive opportunity for researchers who might otherwise lack the experience necessary to compete for grants with more seasoned investigators.

This mentorship provides support for a period of supervised research leading eventually to the clinician researcher conducting larger-scale research projects independently. The quantum supported for NIGs is up to \$200,000 for two years.

There are two NIG grant calls per year, similar to the IRG, with deadlines of 1 June and 1 December. The table below indicates the number of NIG applications and awards since May 2007, as well as the total sum of the NIGs awarded in each grant call.

Period	Proposals Reviewed	Grants Awarded	Success Rate	Total Sum Awarded (\$ millions)
May-07	57	16	28.1%	2.64
Nov-07	55	16	29.1%	2.89
May-08	36	17	47.2%	2.86
Nov-08	33	12	36.4%	2.33
May-09	33	16	48.5%	2.78
Nov-09	50	14	28.0%	2.50
May-10	55	16	29.1%	2.67
Nov-10	51	14	27.5%	2.74
May-11*	49	16	32.7%	2.91
Total	419	137	32.7%	24.32

*Last grant call for these categories. From Nov 2011 onwards, please refer to the New Initiatives.

NEW INITIATIVES

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 local public institutions. The focus of the research should be translational and clinical in nature. CS-IRG grant calls are made twice a year, with closing dates on 1 June and 1 December.

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.

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. CBRG grant calls are made once a year, with the closing date on 1 December.

CBRG New Investigator Grants

The CBRG New Investigator Grant (CBRG-NIG) is a sub-category 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.

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. This grant does not support stand-alone pre-clinical studies, studies in model systems and approaches such as genetic association studies that do not link to direct commercial outcomes. B&B grant calls are made once a year, with the closing date in mid-January.

A MESSAGE FOR OUR REVIEWERS

“Thank You!”

The Biomedical Sciences (BMS) Initiative was introduced in June 2000 to develop the BMS cluster as one of the core pillars of Singapore's economy. Phase I of the initiative (2000–2005) involved establishing a strong foundation for basic biomedical research in Singapore. Phase II (2006–2010) subsequently focused on strengthening translational and clinical research capabilities.

NMRC has played an active role in driving the BMS Initiative—especially in Phase II through the disbursement of \$900 million in funding for its various programmes. As many of the Council's funding programmes are awarded on a competitive, peer-reviewed basis, NMRC relies on the expertise and commitment of its panel of reviewers to review applications and recommend the award of funding to ensure that its limited funds are put to good use.

These reviewers play a key role in ensuring that the best scientific proposals are funded and that the more deserving clinician scientists are supported in and recognised for their research work. Without their support and dedication, the BMS Initiative Phase II would not have achieved the level of success that it did. Moreover, the effort and time invested by NMRC's panel of reviewers has facilitated ground-breaking research over the years, which in turn has resulted in improving medical care and better outcomes for patients.

With Phase III of the BMS Initiative now underway and an increasing need for translational and clinical research, the panel members remain a crucial link in NMRC's efforts to fund high-quality research. NMRC would thus like to sincerely thank all of its panel members for their help to date and seek their continued commitment in helping to drive the BMS landscape in Singapore to a higher level.

NEWS AND HIGHLIGHTS

prime.news THE STRAITS TIMES WEDNESDAY, JULY 6 2011 PAGE 4

Going for surgery? Say Ahhhh

The world's first flexible endoscope with small robotic hands can enter the body through a patient's mouth. Tumours in the stomach can be removed in 17 minutes, down from the usual eight hours.

Hook cuts and cauterises the tumour to prevent bleeding.

Grasper can open up to 180 degrees while the hook can be rotated 360 degrees.

1 A 2cm-wide, 40cm-long hollow tube is inserted into the patient's mouth and oesophagus. The flexible endoscope is then inserted into this tube to reach the stomach.

2 The endoscopist positions the scope for surgery using a screen showing the inside of the stomach taken by a camera in the tube.

3 The surgeon manipulates the master console to control the actions of the robotic hands to hold onto the tumour and cauterise it.

4 Once the tumour is cut off, the endoscope and hollow tube are also removed through the mouth.

SLAVE MANIPULATOR
Each stainless steel robotic hand has a diameter of 6mm.

ENDOSCOPE
The plastic tube has a camera and LED light to project images clearly on the screen, a device to remove excess fluid, a device that sprays out water to clean the camera, and a channel to blow out air to inflate the stomach.

MASTER CONSOLE

TODAY TUESDAY APRIL 5, 2011 20

SINGAPORE

Professor receives prestigious Honorary Citizen Award

SINGAPORE — For his contributions to Singapore in building its biomedical sciences sector, Professor Edward Holmes has been conferred the prestigious Honorary Citizen Award.

He received his award — the highest form of recognition given by the Government for outstanding contributions by individuals to Singapore's development — from President S R Nathan at the Istana yesterday.

Described as a "major thought leader in translational research and academic medicine", Prof Holmes is the deputy chairman of the Translational and Clinical Science Group under A*STAR and an executive chairman of the National Medical Research Council.

He led a translational and clinical research committee to develop many critical programmes, including the establishment of awards and training schemes for researchers such as the Singapore Translational Research Award and Clinician Scientist Awards.

Previous Honorary Citizens include Nobel Prize recipient Dr Sydney Brenner and Tata chairman Ratan Tata.

SARA GROSSE

Professor Edward Warren Holmes receiving his award from President S R Nathan. PHOTO COURTESY MOH

颜金勇：为加强医疗保健生态系统 卫生部正进行全面性政策检讨

卫生部正进行全面的政策检讨，以加强医疗保健生态系统。检讨将涵盖从预防、诊断、治疗到康复的各个环节。颜金勇表示，检讨将包括对现有政策的评估、对新政策的制定以及对资源的有效利用。他强调了预防医学的重要性，并指出通过早期发现和干预可以降低疾病的风险。此外，他还提到了对医疗服务的可及性和质量的关注，以及通过技术创新提高医疗效率的目标。

南大及国大医院花6年研发 新式内窥镜切除肿瘤 手术省时也不留疤痕

新加坡国立大学（NUS）和南洋理工大学（NTU）的科学家经过六年的研发，成功开发了一种新型的内窥镜手术技术。这种技术允许医生通过患者的口腔进行手术，而无需传统的腹部切口。这不仅大大缩短了手术时间，还避免了手术疤痕的形成，减少了患者的痛苦和恢复时间。该技术特别适用于切除胃部肿瘤，为微创手术提供了新的选择。

拉贾教授获颁全国卓越医学教育者奖

拉贾教授因其卓越的教学和领导才能，荣获了全国卓越医学教育者奖。他在医学教育领域有着丰富的经验和深厚的造诣，为培养新一代的医学人才做出了重要贡献。拉贾教授在临床教学和科研方面都取得了显著成就，他的领导力和创新精神激励了无数学生和年轻医生。此次获奖是对他在医学教育领域卓越贡献的肯定。

Winning doc lauded for tireless dedication

By Rachel Chan

PCBA speaker of a century, Professor C. Rajasekara has gone out of his way to mentor young doctors. Even though he is now semi-retired, he continues to work tirelessly in the field of medicine. He is all the more remarkable as he had to cope with a rare congenital disorder called arthrogryposis multiplex congenita, making it hard for him to climb stairs without his hands and to walk upright. For his tireless commitment, he received the inaugural National Outstanding Clinician Award from the Ministry of Health (MOH) yesterday.

Clinicians are those working in the field of medicine, clinical research and training, and who ensure clinical quality and safety of education. It is a new category under the National Medical Excellence Awards (NMEA), now into their fourth year.

Prof Rajasekara's dedication

Prof C. Rajasekara, senior consultant with the department of anaesthesia, at the National University Hospital (NUH), and Associate Professor Wong Kin Eng, clinical director of the National Addictions Management Services, at the Institute of Mental Health.

Dr Shirley Goh, from the Emergency Medicine Department at NUH, Associate Professor Tan Hui Chuan, Associate Professor Ronald Lee and Dr Edgar Tay (above) from the National University Hospital campus.

The team clinched the National Clinical Excellence Team Award.

Thanks to the team's efforts, the National University Hospital reduced the median door-to-balloon time from 30 minutes to 26 minutes six months after making changes to the emergency workflow in 2007.

At last December, the time was further reduced to 15 minutes below the internationally recommended timing of 30 minutes.

Dr Shirley Goh, Associate Professor Tan Hui Chuan, Associate Professor Ronald Lee and Dr Edgar Tay (above) from the National University Hospital campus.

Funding to boost work of clinician scientists

Research aims to translate discoveries in laboratories into real-world applications

By Jonathan Doran

CARDIOLOGIST Charles Lam will test his team's research during his first year as a research fellow at the National Medical Research Council (NMRC).

"I had to do research after my clinical work and I was not getting the time to do research during my busy work," he said. "I decided to dedicate myself to research, I had to take a huge salary cut and invest clinical time in order to pursue academic research."

He is glad that clinicians with little research experience can now apply for the NMRC's research fellowships. The council yesterday announced a new programme that provides doctors with funding to extract their ideas into real-world health and industrial applications.

Deputy Minister Tan Chee Chin said last year that Singapore needed to double its number of clinician scientists from 100 to 200 over the next five years.

To help do this, the NMRC programme — called the "Transition Award" — will give clinicians with little research experience salary support of up to \$250,000 a year for up to three years, so they can spend half their time on research while continuing to see their patients.

Dr Lam, who is currently a senior consultant in the department of cardiology at the National University Hospital, said the programme will help clinicians like him to translate their research into real-world applications.

Dr Lam, who is currently a senior consultant in the department of cardiology at the National University Hospital, said the programme will help clinicians like him to translate their research into real-world applications.

LONG LABOUR

Clinical work offers instant gratification, and you earn more. In research, you have to wait a long time for the fruits of your labour. Without support, it's very hard to pursue it when you're just starting out.

Cardiologist Carolyn Lam

Dr Lam welcomed the award, saying, "The majority of clinicians don't become researchers. Clinical work offers instant gratification, and you earn more. In research, you have to wait a long time for the fruits of your labour. Without support, it's very hard to pursue it when you're just starting out."

Dr Lam is now spending at the NMRC, a research fellow position at the National University Hospital (NUH) and the Institute of Health Sciences (IHS). She was given out to become a clinician for her good work.

Dr Danie Campagna, from St Jude Children's Research Hospital in the United States, was presented with the Singapore Translational Researcher International Award (STRIP) last year. He is now spending at the NMRC, a research fellow position at the National University Hospital (NUH) and the Institute of Health Sciences (IHS). He was given out to become a clinician for his good work.

Dr Danie Campagna, from St Jude Children's Research Hospital in the United States, was presented with the Singapore Translational Researcher International Award (STRIP) last year. He is now spending at the NMRC, a research fellow position at the National University Hospital (NUH) and the Institute of Health Sciences (IHS). He was given out to become a clinician for his good work.

全国医研会4300万元设奖 栽培更多初级临床科学家

获奖的年轻临床科学家不仅有研究津贴，还能获得薪金津贴，以确保他们能花至少一半的时间进行临床研究。研究员每年可获得高达15万元的奖励津贴，最多三年。

王冠琪 报道

国家医学研究委员会（NMRCA）最近宣布，将设立总额为4300万元的奖项，以培养和奖励更多的初级临床科学家。这些奖项旨在支持那些在临床研究和医学教育方面做出杰出贡献的年轻医生。获奖者将获得研究津贴和薪金津贴，确保他们能够将至少一半的时间投入到临床研究中。此外，研究员每年还可以获得高达15万元的奖励津贴，奖励期限最长可达三年。

李国杰 报道

国家医学研究委员会（NMRCA）最近宣布，将设立总额为4300万元的奖项，以培养和奖励更多的初级临床科学家。这些奖项旨在支持那些在临床研究和医学教育方面做出杰出贡献的年轻医生。获奖者将获得研究津贴和薪金津贴，确保他们能够将至少一半的时间投入到临床研究中。此外，研究员每年还可以获得高达15万元的奖励津贴，奖励期限最长可达三年。

MOH honours nine for medical excellence

Recognition for boosting standard of medical practice, clinical research

By Fiona Low

THE doctor is in — and not just to treat patients.

In the case of Professor C. Rajasekara, he also prepares lecture slides between seeing patients and takes time out after office hours to guide pre-graduate doctors.

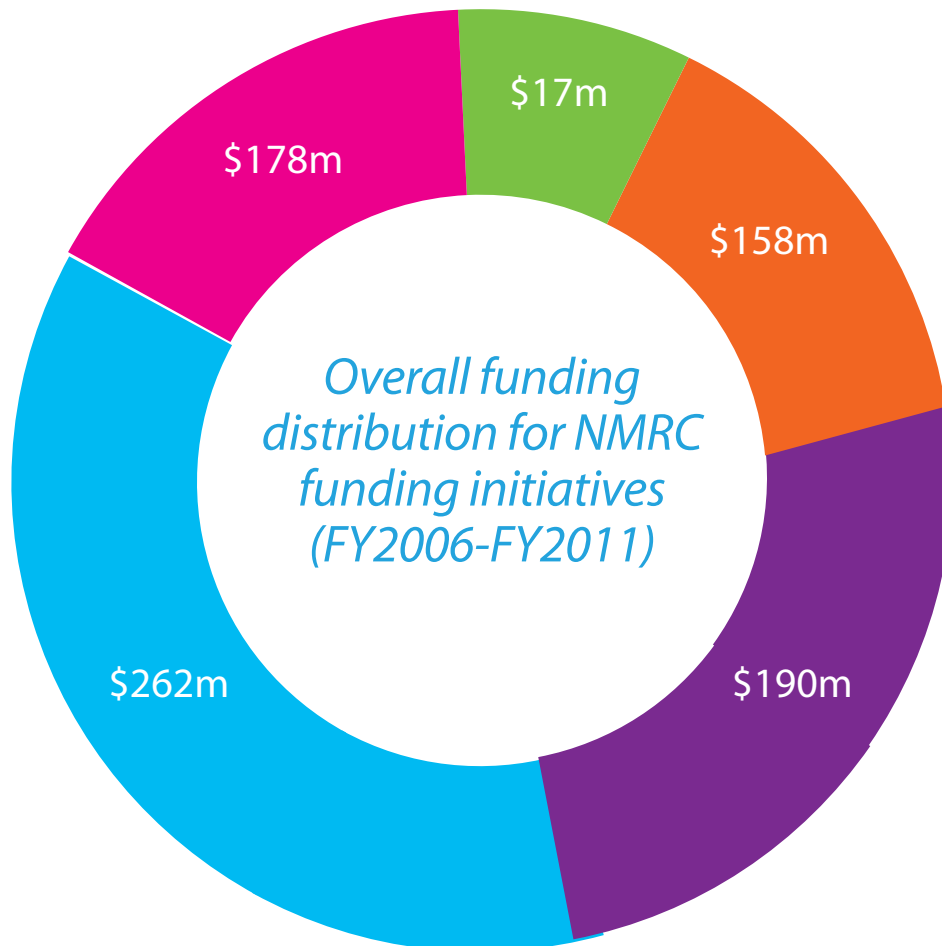
He is among the nine who were honoured at the annual National Medical Excellence Awards which recognise the efforts of health-care professionals to boost the standard of medical practice and clinical research.

The other awardee was Prof Wong Kin Eng, an Associate Professor at the National Addictions Management Services at the Institute of Mental Health (IMH). He was one of the winners of the National Outstanding Clinician Award.

Other honorees were Dr C. Siu-wah, 61, co-director of the Heart and Lung Transplant programme at the National Heart Centre who took home the National Outstanding Clinician Scientist Award.

Dr Siu-wah, 61, co-director of the Heart and Lung Transplant programme at the National Heart Centre who took home the National Outstanding Clinician Scientist Award.

FINANCIAL HIGHLIGHTS



-  Enablers & Infrastructure (SCRI, IMU, IRB, etc.)
-  Talent Development (90 scholars)
-  Human Capital (70 clinicians under CISSP; 39 STaRs and CSAs)
-  Individual PI-initiated Research Grants (519 new projects awarded under EDG and IRG)
-  Strategic Research Grant Programmes (11 CG PPG, 7 H1N1, 5 TCR Flagships)