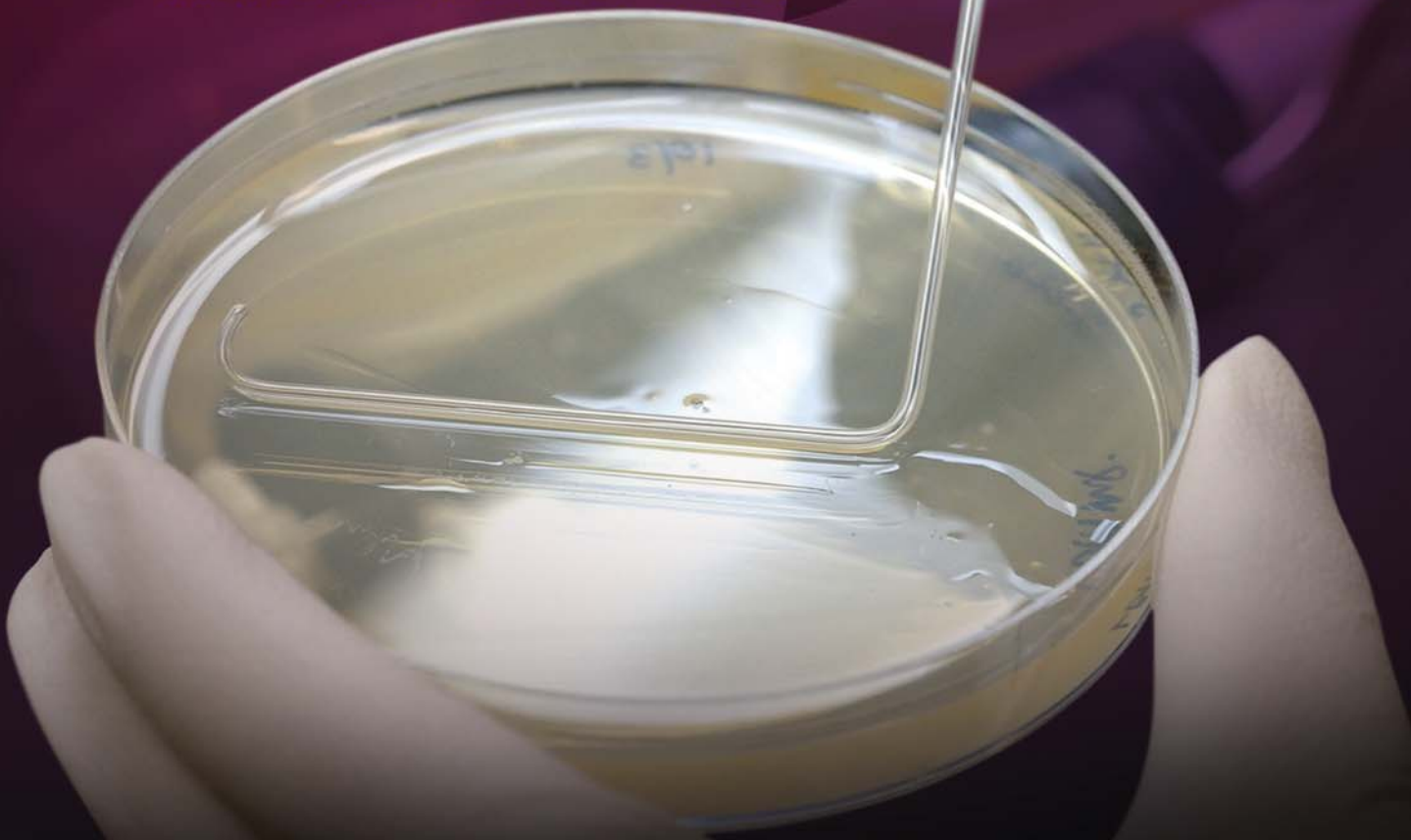




**translating
research
for better health**

ANNUAL REPORT 2006



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 exchange to
improve human health.***

NMRC Mission Statement

02 FOREWORD

- By NMRC Executive Chairman, Prof. Edward Holmes
- By NMRC Executive Director, Dr. Edwin Low

06 THE BIRTH OF BMS

- Singapore Biomedical Sciences (BMS) Initiative Phase 1

07 BMS INITIATIVE PHASE 2 MOVING FRONTIERS IN TRANSLATIONAL & CLINICAL RESEARCH

- The Next Step Forward
- Translational & Clinical Research
- Key Initiatives Under BMS Phase 2
- Integrated Biomedical Sciences Initiative

10 NATIONAL MEDICAL RESEARCH COUNCIL (NMRC)

- Playing An Evermore Important Role
 - *Commitment To Organisational Excellence*
- Overall Grant Framework
- NMRC Board of Members
- A Brief History of NMRC

16 TALENT DEVELOPMENT GRANTS

- Clinician-Scientist Investigator (CSI) Award
- Clinician Scientists Under The Microscope
- NMRC Medical Research Fellowship/Scientist Award
 - *Introduction*
 - *Awards Commencing in FY2006*
 - *NMRC Fellows*
- Singapore Translational Research (STaR) Investigator Award

29 INDIVIDUAL RESEARCH GRANTS

- Introduction
- IRG Funding Exercise 2004-2006
- Reviewing, Approving and Monitoring System (Up to Nov 2006)
- Approved Projects in FY2006
- Ongoing Projects in FY2006
- Completed Projects in FY2006

32 INSTITUTIONAL BLOCK GRANTS & ENABLING GRANTS

- Research Activities and Outcomes of IBG & EG Recipients

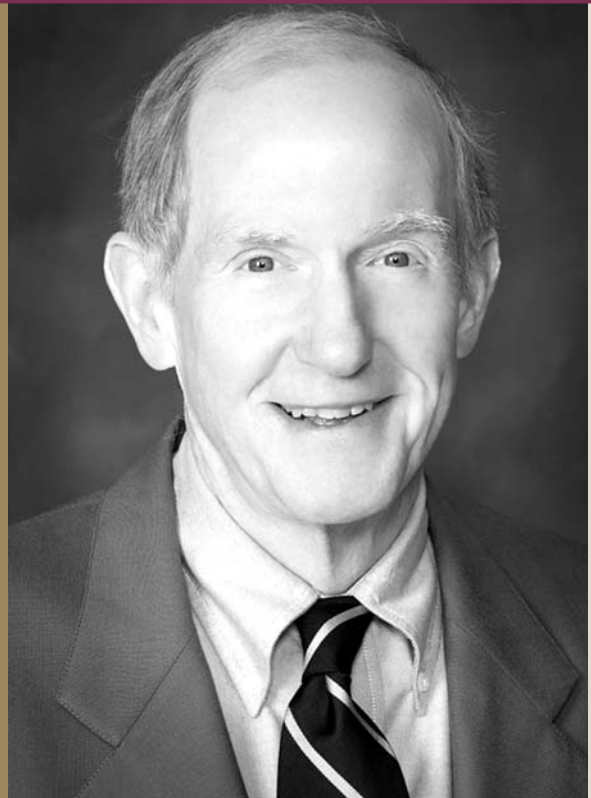
43 TRANSLATIONAL CLINICAL RESEARCH (TCR) FLAGSHIP PROGRAMME

44 FINANCIAL REPORT

foreword BY NMRC EXECUTIVE CHAIRMAN

prof. edward holmes

...translational science begins with and ends with the patient, 'bedside to bench and back again', it is not a one-way street.



Year 2006 saw many milestones for NMRC as it assumed a larger role in the Biomedical Sciences Phase 2 initiative. As Singapore embarks on this next phase, translational and clinical research will assume an even more important role.

Why translational medicine?

Scientific discoveries typically begin at the bench with basic research into the pathogenesis of disease. These findings then progress to the clinical level, or the patient's bedside, in the form of therapeutic intervention, hence "bench to bedside".

However, translational science begins with and ends with the patient, i.e. "bedside to bench and back again", it is not a one-way street. Increasingly, basic and physician scientists realise that for the system to be effective, it has to work both ways. Translational science requires a team approach that fosters collaboration between clinical and basic scientists.

In recent years, translational research has proven to be a powerful process that drives the clinical research engine. To further strengthen the foundation of translational research, a good matrix is needed, which includes infrastructure, intellectual and human capital.

The goals of translational medicine can be broadly categorised into three key areas:

- Advancement of our insights and understanding of human diseases
- Translation of these medical advances to improve the health of individuals and populations
- Innovations in the way medicine is practised and the way we care for patients

In realising these goals, NMRC has a special role in setting the funding framework for translational and clinical research in Singapore. This goes beyond providing financial means, looking at and spearheading strategic programmes of national interest.

The key players will be our physician investigators and local clinician investigators at public institutions – people who are skilled in carrying out the type of translational and clinical research that will make this effort successful.

While NMRC has achieved much in 2006, going forward, we have a larger challenge to ensure that Singapore stays on track in her quest to be the biomedical hub of Asia!



Prof. Edward Holmes
Executive Chairman

foreword BY NMRC EXECUTIVE DIRECTOR

dr. edwin low

It has been a challenging and exciting 2006 for NMRC. Much has happened since clinical research was incorporated as part of MOH's mandate.



It has been a challenging and exciting 2006 for NMRC. Much has happened since clinical research was incorporated as part of MOH's mandate.

With the research mandate came additional funds from MOH and the NRF, managed by NMRC, to fund new initiatives in translational and clinical research at Singapore's public hospitals, institutions and disease centres. A total of S\$1.55 billion was committed by the government to develop human capital in research and promote translational and clinical research in public hospitals and disease centres. Professor Edward Holmes came onboard as the Executive Chairman of NMRC in October 2006 and we shifted to our office to Helios @ Biopolis in October 2007 to accommodate our rapid growth in staff strength.

NMRC has launched several strategic programmes such as the Translational Clinical Research (TCR) Flagship Programme and the Singapore Translational Research (STaR) Investigatorship Award. Besides funding for these strategic research programmes, new money has been injected for the new Exploratory and Developmental Grants (EDG) to harness the creative talent of our investigators to venture into new ground and explore novel ideas.

The Biomedical Science (BMS) EXCO recognises the importance of developing the talent pipeline and this is evidenced by the launch of the new Clinician Scientist Award (CSA) as well as the NRF-MOH Healthcare Research Scholarships.

In rolling out these programmes, NMRC is committed to a framework of organisational excellence and will endeavour to reduce administrative burden as much as

possible, balanced against the need for accountability of public funds.

We are also committed to engaging stakeholders for your feedback to improve the system and processes. We welcome and appreciate all the constructive feedback and suggestions we have received – we will implement good ideas but where it is not possible, we will explain why we are unable to do so.

This annual report, which has been significantly revamped in its format, provides insights and examples of the high-quality research that NMRC has funded in year 2006. I would like to take this opportunity to commend the achievements of all the dedicated researchers, and the people who work at the front line of research and contribute to Singapore's BMS effort.

Last but not least, I would like to thank the NMRC Board for their leadership and counsel that they provide to NMRC to help us fulfil our mission of translating research for better health for Singapore. I would also like to pay a special tribute to the immediate past Board and the Chairman, Prof Woo Keng Thye, as well as all the local review subcommittee members for their contributions to the research community and setting the stage for what is to come.

We look forward to the future, which holds many promises, opportunities and challenges, and to working closely with the research and medical community.



Dr. Edwin Low
Executive Director

THE BIRTH OF BMS

SINGAPORE BIOMEDICAL SCIENCES (BMS) INITIATIVE PHASE 1

The Singapore Biomedical Sciences (BMS) initiative was launched in June 2000 to develop the Biomedical Sciences cluster as one of the key pillars of Singapore's economy, alongside Electronics, Engineering and Chemicals. To achieve its aim, the BMS initiative is led and coordinated both by a Steering Committee on Life Sciences, comprising the Ministers for Trade & Industry, Health and Education, and the BMS Executive Committee, co-chaired by Permanent Secretary (Health), Ms Yong Ying-I, and Chairman of A*STAR, formerly Mr Philip Yeo and now Mr Lim Chuan Poh. The Executive Committee draws on the combined experience of the BMS International Advisory Council (IAC) comprising renowned scientists for strategic advice and guidance.

Three key agencies work in close coordination and in an integrated fashion to develop the BMS cluster: the Biomedical Research Council (BMRC) of the Agency for Science, Technology and Research (A*STAR) funds and supports public research initiatives; the Economic Development Board's (EDB) Biomedical Sciences Group (BMSG) promotes private sector manufacturing and R&D activities; and EDB's Bio*One Capital functions as an investment arm. This integrated approach involves various initiatives such as establishing the research infrastructure, supporting the industry, providing venture capital support and strengthening manpower capabilities.



BMS INITIATIVE PHASE 2

MOVING FRONTIERS IN TRANSLATIONAL & CLINICAL RESEARCH

MOH formally incorporated clinical research as part of its mandate... we will begin to devote new resources to supporting clinical research. Our focus remains our patients, and clinical research must help enhance our care for our patients.

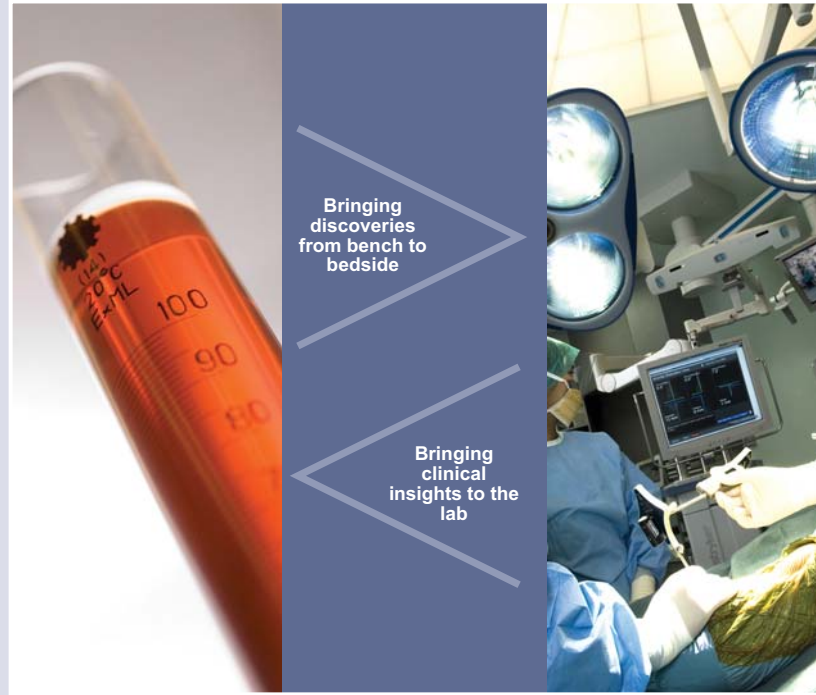
Mr Khaw Boon Wan, Minister for Health



THE NEXT STEP FORWARD

Phase 2 of the BMS Initiative, from 2006 to 2010, will see a total of S\$1.55b committed by the Government to support the biomedical research effort. Phase 2 will build on existing and ongoing basic sciences capabilities and build up a strong translational and clinical research capability to facilitate the translation of scientific discoveries from bench to bedside and from bench to industries. There is also a strong focus to develop a critical mass of human capital for translational and clinical research by nurturing more clinician scientists through research fellowships and scholarships. The major efforts in translational and clinical research will be strongly multidisciplinary, leveraging on the existing strengths in different disciplines from A*STAR, universities, research centres and hospitals, and will concentrate on diseases where Singapore has comparative advantages.

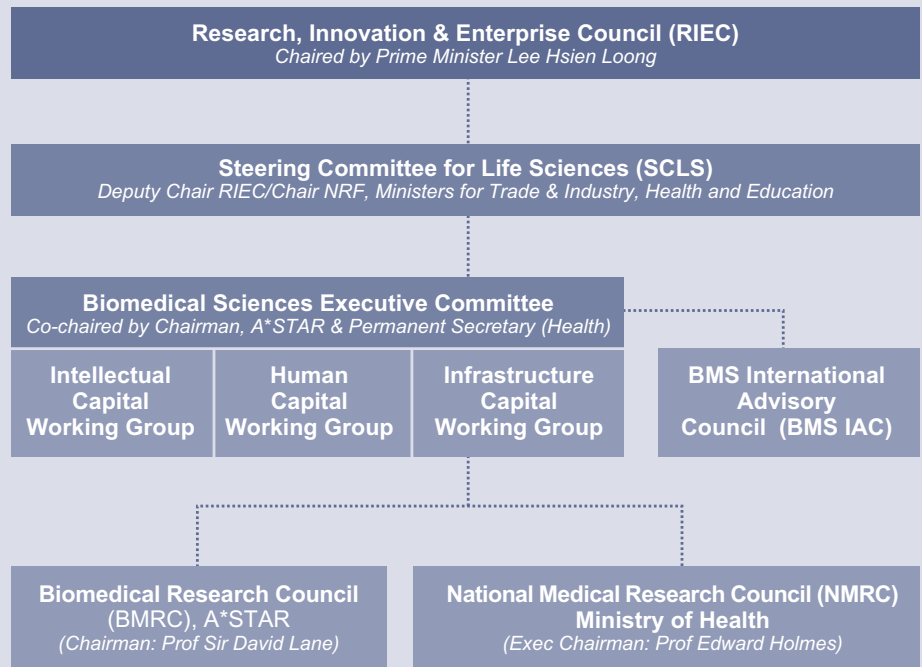
TRANSLATIONAL & CLINICAL RESEARCH



KEY INITIATIVES UNDER BMS PHASE 2

Under the BMS Initiative Phase 2, three core working groups were formed to look at the various aspects of the initiative with an overriding aim to drive Singapore’s translational and clinical research. These include the development and implementation of internationally competitive Translational and Clinical Research (TCR) programmes in Singapore; training and retaining clinical research manpower and ancillary support staff with the requisite basic and advanced training to undertake TCR and to develop Singapore’s research infrastructure to support ongoing and future research work.

INTEGRATED BIOMEDICAL SCIENCES INITIATIVE



The NMRC has a special role in leading the efforts to develop new funding mechanisms to support the translational and clinical research initiative, which is at the forefront of Phase 2 in Singapore's Biomedical Sciences initiative. The key players will be our local clinician investigators at public institutions – people who are skilled in carrying out the type of translational and clinical research that will make this effort successful.

*Prof. Edward Holmes
Executive Chairman of NMRC*

NATIONAL MEDICAL RESEARCH COUNCIL (NMRC)

PLAYING AN EVERMORE IMPORTANT ROLE

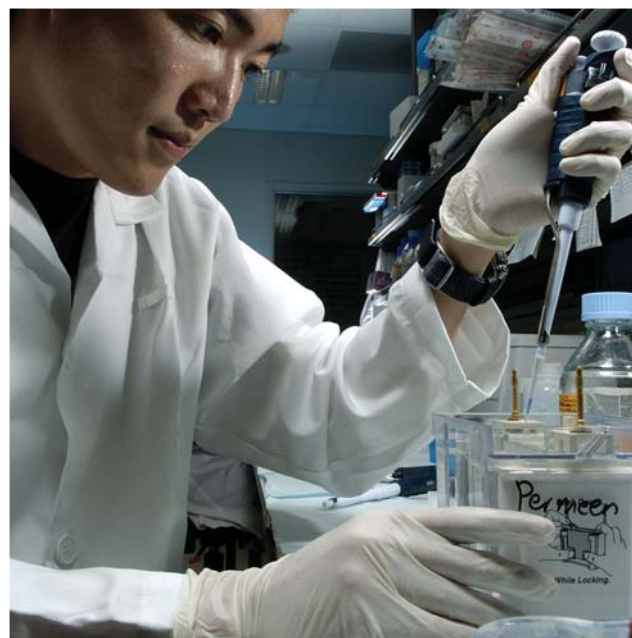
In 2006, the Ministry of Health established a new mandate to support translational and clinical research in areas where Singapore has great potential. With this in mind, National Medical Research Council is tasked with leading, coordinating and funding of medical research in Singapore.

The NMRC oversees the development and advancement of medical research in Singapore. It strategises research directions and is in charge of the administration of research funds to healthcare institutions via the awarding of competitive research funds for individual projects.

The council also has a special role in talent attraction and development. In a bid to attract top scientists, clinicians and students to engage in biomedical sciences research, several programmes have been designed to meet this end; such as the clinician scientists programme, fellowships and the Singapore Translational Research (STaR) Investigator Award introduced in 2007.

NMRC-funded research has led to inter-disciplinary partnerships and international collaborations. It also evaluates the outcomes of the research projects and facilitates the commercialisation of research findings.

Since its inception, it has built up the medical research capabilities in Singapore through the funding of more than 1000 individual research projects and 13 national research programmes.



COMMITMENT TO ORGANISATIONAL EXCELLENCE

In a bid to streamline processes and adopt international best practices, NMRC has recently introduced the following:

1. *Revised Financial and Administration Guidelines*

NMRC revamped its financial and administration guidelines to streamline approval and variation processes for researchers. Processes are revised to cut down on time spent at paper work, without compromising accountability and audit requirements.

One example is the introduction of a “no cost extension”. Previously, fellows and researchers who wished to extend their studies had to write in for formal approval. With the revised guidelines, fellows and researchers now only need to inform NMRC of their intent to extend their project by a year – this is on the basis that there is no increase in budget.

2. *New Peer Review Process*

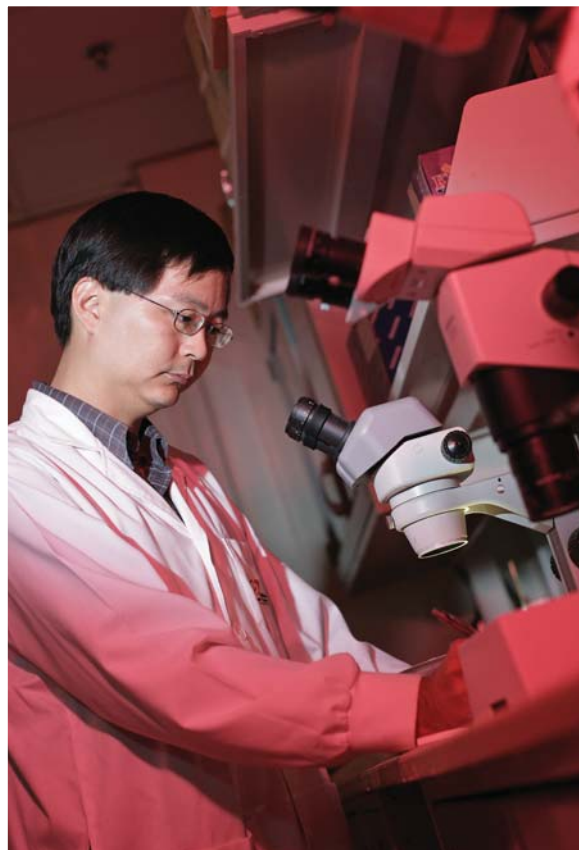
Moving towards greater consistency in scoring, instead of having numerous peer review panels, NMRC has introduced a single multi-disciplinary local review panel (LRP) consisting of over 20 specialists in a variety of areas to evaluate the Individual Research Grant (IRG) applications. A shortlisting process has been put in place and for proposals that are shortlisted, applicants will have the opportunity to respond to the international shortlisted will have the reviewers’ comments to provide constructive feedback which will help in future re-submission.

3. *Introduction of Indirects*

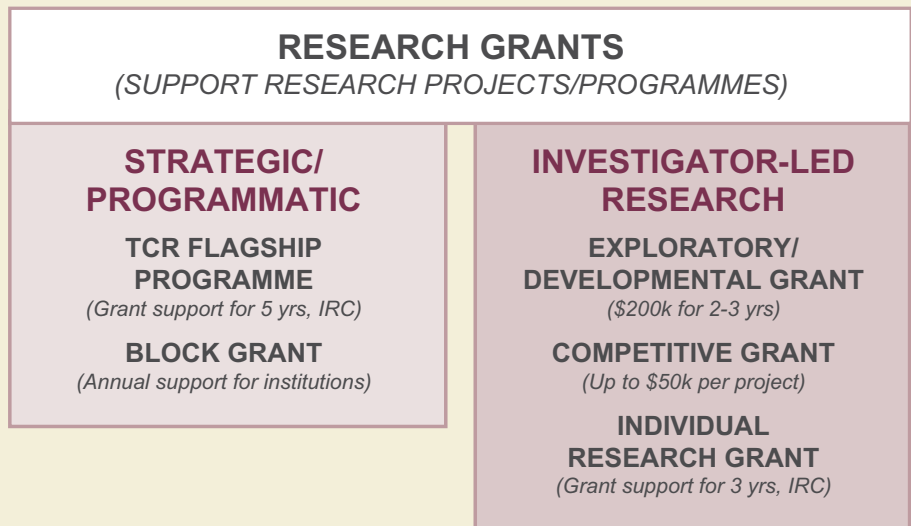
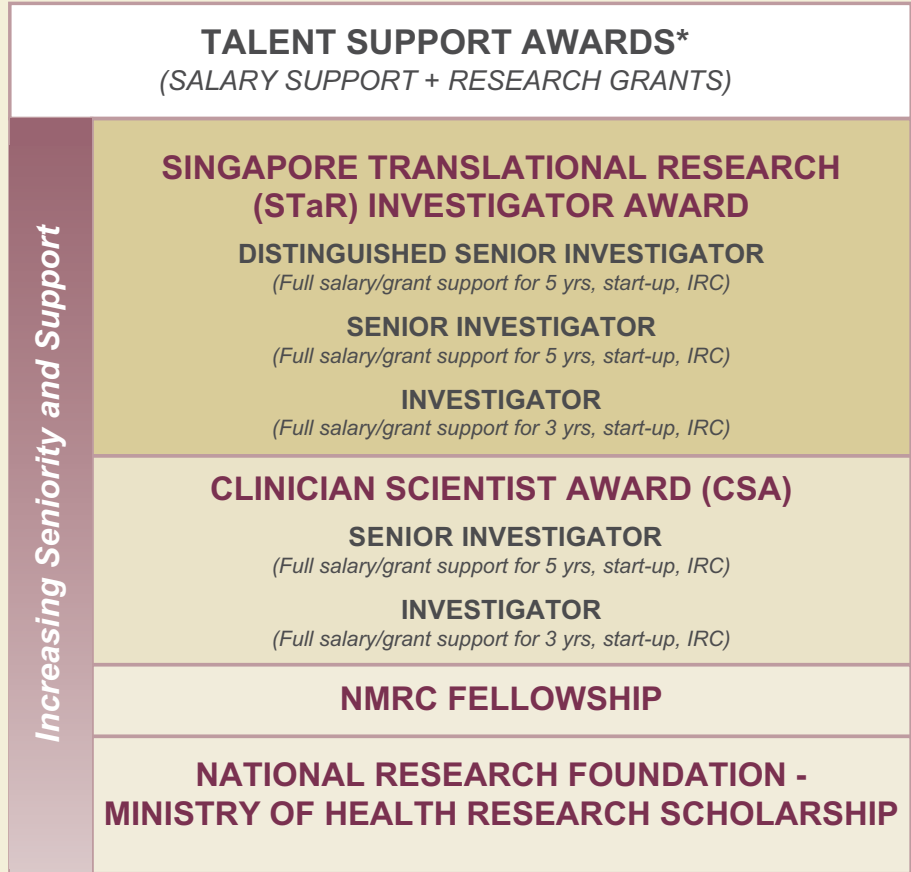
Recognizing the overhead costs to support research, from 2007, NMRC will introduce a 20% reimbursement of indirects to the researchers’ institutions to defray research operating costs.

4. *Engagement of Stakeholders*

NMRC recognises the importance of the inputs and contributions of the various stakeholders in process improvement. It has been engaging not only the researchers but also the research offices of the institutions and clusters as well as Finance and Human Resource personnel in developing and revising its policies.



OVERALL GRANT FRAMEWORK



* In addition, there will be partial salary for clinicians to conduct research IRC – Indirect Research Cost

Information accurate as of January 2008.

NMRC BOARD MEMBERS (with effect from Oct 2006)



Prof Edward Holmes
Executive Chairman
National Medical Research Council



Prof Soo Khee Chee
Director
National Cancer Centre



Prof Donald Tan
Director
Singapore Eye Research Institute



Assoc Prof Ivy Ng
Chief Executive Officer
KK Women's & Children's Hospital



Prof Yap Hui Kim
Head Nephrology,
Immunology & Urology
The Children's Medical Institute
National University Hospital



Prof John Wong Eu Li
Dean
Yong Loo Lin School of Medicine
National University of Singapore



Prof Edison Liu
Executive Director
Genome Institute of Singapore



Dr Mabel Yap
Director
Health Services Research
& Evaluation Division



Assoc Prof Chong Siow Ann
Director of Research
Institute of Mental Health



Dr Beh Swan Gin
Executive Director
Biomedical Research Council
(Ex Officio Member)



Dr Edwin Low
Executive Director
National Medical Research Council
(Ex Officio Member)



Prof Alex Matter
Director
Novartis Institute for
Tropical Diseases



Prof Barry Coller
Vice President for Medical
Affairs & Physician in Chief
The Rockefeller University, USA



Dr John Potter
Senior Vice President & Director
Public Health Sciences Fred Hutchinson
Cancer Research Center, USA



Prof Patrick Sissons
Regius Professor of Physics
School of Clinical Medicine
University of Cambridge, UK



Prof Robert Sanders Williams
Dean
Duke University School of
Medicine, USA

A BRIEF HISTORY OF NMRC

A succession of four councils have administered the NMRC, and the accomplishments achieved by each council can be considered tremendous, particularly because of the constraints of the relatively short timeframe, and the initial limited access to local expertise. Each council in its own right has achieved successes that have allowed the current council to capitalise on and to dynamically move forward in its mission.

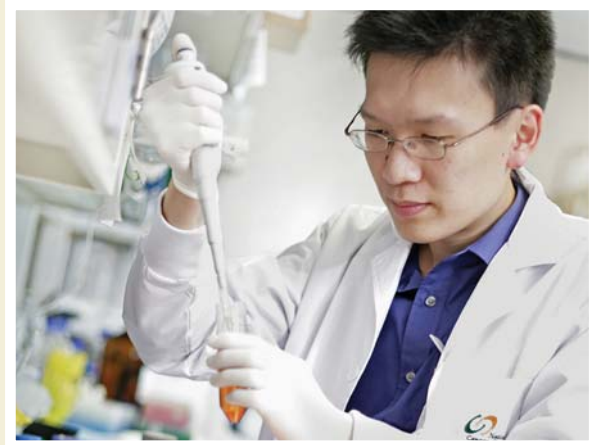
The first council was chaired by **Dr Charles Toh**, a well known cardiologist in Singapore, back in 1994, with a wide range of research areas represented by the various professionals.

The second council was chaired by **Prof Lim Yean Leng**, who is an internationally renowned cardiologist and was, at that time, the Director of the National Heart Centre. The members of the second council also had more of an international representation. The second council continued its efforts to promote and fund medical research. However, its focus was to ensure that the research funded had international worthiness and would contribute significantly to the advancement of medical knowledge locally and internationally.

The third council was chaired by **Prof Woo Keng Thye**, an emeritus advisor in Renal Medicine. The council held its first strategic retreat during this term. The event was a major milestone which allowed the council and key stakeholders and partners to reflect and debate on the needs of biomedical research in Singapore, in addition to strategising on enhancing the level of research for the benefit of Singaporeans. Consequently, the council developed its strategic plan, consisting of 3 key elements:

- Development of a research landscape
- Building up a critical mass of clinician scientists
- Development of greater depth and breadth of clinical research expertise

The current and fourth council is chaired by **Prof Edward Holmes**, who is also the Deputy Chairman for the Translational and Clinical Sciences Group at the Biomedical Research Council. The NMRC Board comprises of representatives from the universities and leading medical and scientific institutions in Singapore.



A SPECIAL TRIBUTE TO PREVIOUS NMRC BOARD MEMBERS & PEER REVIEW SUB-COMMITTEES (2003-2006)

Prof Woo Keng Thye (Chairman)

Prof Barry Haliwell

Assoc Prof Chew Suok Kai

Prof Donald Tan

Assoc Prof Fong Kok Yong

Prof Hong Wan Jin

Assoc Prof Ivy Ng

Assoc Prof Jorgen Selddrup

Assoc Prof Lam Kong Peng

Prof Lee Eng Hin

Assoc Prof London Lucien Ooi Peng Jin

Prof Louis Lim

Assoc Prof S M Krishnan

Assoc Prof Shazib Pervaiz

Prof Soo Khee Chee

Dr Stephen Wise

Assoc Prof Tay Eng Hseon

Prof V Prem Kumar

Prof Yap Hui Kim

Dr Yee Woon Chee

NATIONAL MEDICAL RESEARCH COUNCIL PEER REVIEW SUBCOMMITTEES (2003-2006)

SUBCOM 1: IMMUNOLOGY/ MICROBIOLOGY

Chairman:

- **Prof Chan Soh Ha**
National University of Singapore

Members:

- **Assoc Prof Vincent Chow**
National University of Singapore
- **Assoc Prof Koh Dow Rhoon**
National University of Singapore
- **Assoc Prof Lee Bee Wah**
Mt Elizabeth Medical Centre
- **Dr Mark Taylor**
National University of Singapore
- **Dr Raymond Lin Tzer Pin**
KK Women's & Children's Hospital
- **Assoc Prof Fong Kok Yong**
Singapore General Hospital
- **Assoc Prof Ren Ee Chee**
Genome Institute of Singapore
- **Dr Leong Khai Pang**
Tan Tock Seng Hospital

SUBCOM 2: PATHOLOGY/INFLAMMATION/ ONCOLOGY/ NUCLEAR MEDICINE

Chairman:

- **Assoc Prof London Lucien Ooi**
National Cancer Centre

Members:

- **Prof Hui Kam Man**
National Cancer Centre
- **Dr Tan Puay Hoon**
Singapore General Hospital
- **Prof Shazib Pervaiz**
National University of Singapore
- **Dr Patrick Tan**
National Cancer Centre
- **Assoc Prof Bay Boon Huat**
National University of Singapore
- **Dr Benjamin Mow Ming Fook**
National University Hospital

SUBCOM 3: BIOCHEMISTRY/CELL & MOLECULAR BIOLOGY

Chairman:

- **Prof Barry Halliwell**
National University of Singapore

Members:

- **Prof K Jeyaseelan**
National University of Singapore
- **Dr Koh Cheng Gee**
Institute of Molecular and Cell Biology
- **Prof Hong Wan Jin**
Institute of Molecular and Cell Biology
- **Assoc Prof Kanaga Sabapathy**
National Cancer Centre

- **Prof Malcolm Paterson**
SingHealth
- **Prof Alex Law**
Nanyang Technological University
- **Assoc Prof Chia Sing Joo**
Tan Tock Seng Hospital

SUBCOM 4: EPIDEMIOLOGY/ HEALTH SCIENCES/ PUBLIC HEALTH & HEALTH SERVICES

Chairman:

- **Dr Tan Say Beng**
National Cancer Centre

Members:

- **Assoc Prof Chew Suok Kai**
Ministry of Health
- **Dr Shanta Emmanuel**
Singapore General Hospital
- **Assoc Prof Chia Kee Seng**
National University of Singapore
- **Dr Tan Chee Beng**
SingHealth Polyclinics
- **Dr Saw Seang Mei**
National University of Singapore
- **Dr Seong Peck Suet**
Tan Tock Seng Hospital

- **Dr Julian Thumboo**
Singapore General Hospital
- **Dr Mabel Yap Mei Poh**
Health Promotion Board

SUBCOM 5: PERIPHERAL, CENTRAL, SENSORY & CELLULAR NERVOUS SYSTEM/ MENTAL HEALTH

Chairman:

- **Dr Yee Woon Chee**
National Neuroscience Institute

Members:

- **Prof Kua Ee Heok**
National University of Singapore
- **Assoc Prof Thomas Leung**
Institute of Molecular & Cell Biology
- **Dr Liu Jian Jun**
Genome Institute of Singapore
- **Dr Shu Wang**
Institute of Bioengineering & Nanotechnology
- **Assoc Prof Soong Tuck Wah**
National University of Singapore
- **Assoc Prof Michael Chee**
Duke-NUS Graduate Medical School Singapore
- **Dr S Thameem Dheen**
National University of Singapore
- **Assoc Prof Einar Wilder-Smith**
National University of Singapore
- **Dr Lim Kah Leong**
Neurodegeneration Research Laboratory

SUBCOM 6: GENETICS/ PAEDIATRIC/ REPRODUCTION

Chairman:

- **Prof Yap Hui Kim**
National University Hospital

Members:

- **Assoc Prof Ivy Ng Swee Lian**
KK Women's & Children's Hospital
- **Dr William Yip Chin Ling**
Gleneagles Medical Centre
- **Assoc Prof Yong Eu Leong**
National University Hospital
- **Assoc Prof Samuel Chong Siong-Chuan**
National University Hospital
- **Dr Kenneth Kwek Yung Chiang**
KK Women's & Children's Hospital
- **Dr Lee Soo Chin**
National University Hospital
- **Dr Allen Yeoh Eng Juh**
National University Hospital

SUBCOM 7: CARDIOVASCULAR/ RESPIRATORY

Chairman:

- **Dr Mak Koon Hou**
Gleneagles Medical Centre

Members:

- **Prof Phillip Keith Moore**
National University of Singapore
- **Dr Chay Oh Moh**
KK Women's & Children's Hospital
- **Dr Chua Yeow Leng**
National Heart Centre
- **Assoc Prof Lim Tow Keang**
National University Hospital
- **Assoc Prof Ling Lieng Hsi**
National University Hospital
- **Assoc Prof Eugene Sim Kwang Wei**
National University Hospital
- **Dr Sonny Wang Yee Tang**
Tan Tock Seng Hospital
- **Dr Yong Quek Wei**
Tan Tock Seng Hospital
- **Dr Winston Shim**
National Heart Centre

SUBCOM 8: RENAL/ ENDOCRINE/ PHARMACOLOGY

Chairman:

- **Prof Lee Kok Onn**
National University of Singapore

Members:

- **Prof Edmund Lee**
National University of Singapore

- **Dr Grace Lee Siew Luan**
Gleneagles Medical Centre
- **Dr Stephen Wise**
Lilly-NUS Centre for Clinical Pharmacology
- **Prof Thai Ah Chuan**
National University Hospital
- **Dr Goh Boon Cher**
National University Hospital
- **Dr Lye Wai Choong**
Mt Elizabeth Medical Centre
- **Dr A Vathsala**
Singapore General Hospital

SUBCOM 9: GIT/ LIVER/ NUTRITION

Chairman:

- **Dr Aw Swee Eng**
Singapore General Hospital

Members:

- **Assoc Prof Ng Keng Yeen**
Singapore General Hospital
- **Assoc Prof Lim Seng Gee**
National University Hospital
- **Dr Liau Kui Hin**
Tan Tock Seng Hospital
- **Dr Teo Eng Kiong**
Changi General Hospital
- **Dr Lim Chee Chian**
Tan Tock Seng Hospital
- **Dr Tan Chee Kiat**
Singapore General Hospital

SUBCOM 10: DENTISTRY/ SURGERY/ OPHTHALMOLOGY

Chairman:

- **Prof Lee Eng Hin**
National University of Singapore

Members:

- **Dr Raymond Peck**
National Dental Centre
- **Prof Lee Seng Teik**
Singapore General Hospital
- **Dr Chan Wing Kwong**
Singapore National Eye Centre
- **Assoc Prof Kelvin Foong Weng Chiong**
National University of Singapore
- **Dr Wong Wai Keong**
Singapore General Hospital
- **Dr Chumpon Chan**
National Neuroscience Institute
- **Dr Lim Tock Han**
Tan Tock Seng Hospital

TALENT DEVELOPMENT GRANTS



CLINICIAN-SCIENTIST INVESTIGATOR (CSI) AWARD

The Clinician Scientist Investigator (CSI) Award, launched in 2004, is an initiative by MOH's National Medical Research Council (NMRC) and A*STAR's Biomedical Research Council (BMRC). The prestigious CSI Award is meant to:

- i. recognise the achievements of a selected few outstanding clinicians who possess a consistent record of excellence and potential leadership in research
- ii. support the career development of clinician-scientists and
- iii. promote clinical and translational research in Singapore

This new breed of researchers will thrust clinically relevant questions to the basic research laboratories and also bring the rigors of scientific investigation into the patient care arena.

The Award provides between three and five years of support to clinician-scientists working in public hospitals and disease centres, including part of the recipient's salary commensurate with the amount of time spent on research.

The Award is divided into two categories:

Category A - for senior clinician-scientists who demonstrate a consistent, high level of productivity and leadership

Category B - for younger clinician-scientists who show good potential to become independent researchers and who can develop careers in translational medicine

In FY2004, NMRC awarded eight CSIs. Six more medical doctors joined Singapore's drive to bridge the gap between basic scientific research and clinical applications the following year in FY2005 and another six joined in FY2006. To-date, there are 20 CSI awardees.

The table below shows the CSI awardees who received their CSI awards from FY2004 to FY2006 respectively:

Name	Host Institution	Clinical Specialisation	Research Area/Project
CSI AWARDEES IN FY2006:			
CATEGORY A: SENIOR CLINICIAN SCIENTISTS			
1 Assoc. Prof. Wong Meng Cheong	National Cancer Centre (wef Nov 2007)	Neurology	Working on DNA damage repair signalling, brain tumour stem cells, biological agents and immunotherapy for brain tumour relapsed patients
2 Assoc. Prof. Chong Siow Ann	Institute of Mental Health	Psychiatry	Psychopharmacology, genetics and brain imaging of schizophrenia and related psychoses
CATEGORY B: JUNIOR CLINICIAN SCIENTISTS			
3 Dr Charles Chuah Thuan Heng	Singapore General Hospital	Haematology	Targeting downstream signalling pathways to overcome drug resistance and improve responses in chronic myeloid leukaemia
4 Dr Yong Wei Peng	National University Hospital	Haematology-Oncology	The effect of pharmacogenetics on treatment toxicities and outcomes in East Asian and Caucasian patients undergoing docetaxel or gemcitabine-based chemotherapy
5 Dr Tan Hao Yang	National University of Singapore	Psychological Medicine	Functional neurophysiology of working memory processes using genetic imaging
6 Dr Philip Karuman	National Cancer Centre	Surgical Oncology	Lipid signalling and gene regulation in cancer

Name	Host Institution	Clinical Specialisation	Research Area/Project
CSI AWARDEES IN FY2005:			
CATEGORY A: SENIOR CLINICIAN SCIENTISTS			
1 Assoc. Prof. James Hui Hoi Po	National University of Singapore	Orthopaedic Surgery	Use of cell-based therapy and injectable supplements for the repair of cartilage defects in knee joints
2 Assoc. Prof. Christopher Chen Li Hsian	National University of Singapore	Pharmacology	Translational research and clinical trials in stroke and dementia
CATEGORY B: JUNIOR CLINICIAN SCIENTISTS			
3 Dr Lee Soo Chin	National University Hospital	Haematology-Oncology	To improve drug selection through predictive molecular markers for breast cancer treatment
4 Dr Dan Yock Young	National University Hospital	Gastroenterology	To define optimal conditions for isolation and culture of human liver stem cells and unravel the mechanisms of differentiation and translate this knowledge for cell therapy
5 Dr Lee Yung Seng	National University of Singapore	Paediatrics	To study the monogenic causes of human obesity, and uncover susceptible genes which are predisposed to obesity
6 Dr Chan Ling Ling	Singapore General Hospital	Radiology	To study the utility of advances and functional imaging as a diagnostic, prognostic and research tool in the areas of neuroscience, oncology, ophthalmology, orthopaedic and dental disorders

Name	Host Institution	Clinical Specialisation	Research Area/Project
CSI AWARDEES IN FY2004			
CATEGORY A: SENIOR CLINICIAN SCIENTISTS			
1 Assoc. Prof. Yong Eu Leong	National University of Singapore	Obstetrics & Gynaecology	Spatial and temporal patterns of hormone disrupters in Singapore's marine environment
2 Prof Michael Chee Wei Liang	Duke-NUS Graduate Medical School (currently)	Cognitive Neuroscience	Use of magnetic resonance in brain imaging to study the neural correlates of memory and language processing in healthy individuals
3 Dr Goh Boon Cher	National University Hospital	Haematology-Oncology	Understanding inter-individual pharmacological variability of chemotherapy
CATEGORY B: JUNIOR CLINICIAN SCIENTISTS			
4 Dr Allen Yeoh Eng Juh	National University of Singapore	Paediatrics	Developing new molecular signatures for disease prognostication for childhood acute lymphoblastic leukaemia using gene expression profiling
5 Dr Lynette Shek Pei-Chi	National University of Singapore	Paediatrics	Cord blood mononuclear cell responses to probiotics as a predictor for and therapeutic tool in allergic diseases
6 Assoc. Prof. Aung Tin	Singapore National Eye Centre	Ophthalmology	A search for quantitative trait loci in angle closure glaucoma
7 Dr Tan Eng King	Singapore Health Services	Neurology	Analysis of alpha synuclein in Parkinson's Disease
8 Dr Tai E Shyong	Singapore Health Services	Endocrinology	Inflammation, immunity and risk factors for cardiovascular disease in Chinese, Malays and Indians living in Singapore

Clinician Scientists Under The Microscope

Assoc. Prof Chong Siow Ann

Institute of Mental Health (CSI Awardee 2006)



I'd started out wanting to be just a clinician. I think that is how our training has been structured. But being confronted daily with people who suffer from severe mental illness and the often limited amount of good that we could do, made me ask what else we could do. I suppose that led me to research.

My particular interest is psychosis - arguably the most severe form of mental illness, and much is still not known about the causes, the trajectory of the illness, and how best to treat it. This is a disorder of the brain and it's very complex with myriads of psychosocial and societal implications and consequences. I believe that the way to achieve great understanding of this disorder - for that matter any mental disorder - is to integrate different domains of epidemiology, genomics, brain imaging, and clinical trial and evaluation into a common platform that will effectively - and in great depth - enable us to better understand mental illnesses, better evaluate treatment, and develop even better treatments, and that is something I'm striving to do.

And the ultimate payoff should be that the research should give us greater insights into the mechanism of this disorder which will pave the way for more research, change the way we think about this disorder, and change the way we treat our patients with psychosis for the better.

I do not believe everyone is cut out to do research - this is not meant to romanticise research or to make research sound elitist; it just takes a certain type of people to want to do research on a sustained basis. Someone has once compared research to flying. "Flying is hours and hours of tedium occasionally and unpredictably interrupted by a few seconds of stark terror" but there are moments of excitement and fulfilment. Joseph Goldstein and Michael Brown have once said that clinician-scientists have the following in common: a passionate curiosity, infinite patience, and being intimately involved in the care of patients. I think these factors plus the desire to make a difference for our patients are what make us push on.

Clinician Scientists Under The Microscope

Assoc. Prof. Christopher Chen Li-Hsian

National University of Singapore (CSI Awardee 2005)

We are facing an immense public health challenge because the prevalence of both stroke and dementia increase with age. As Singapore is a rapidly aging society, unless we develop better means of prevention or treatment, we will be dealing with an epidemic.

My current research falls into three categories. Firstly, by investigating the neurochemistry of patients with Alzheimer's Disease and Vascular Dementia, we hope to identify novel therapeutic targets. Secondly, we have been studying biochemical and genetic markers of stroke, again to discover new therapeutic approaches. Thirdly, we are developing a regional network for innovative trials that target brain diseases prevalent and pertinent to Asia.

However, it is a long way from discovering a biologically plausible target and showing that it works in a safe and effective manner. It is not easy to translate a scientific idea into a real world treatment but this is where the true pay-off is -- not just for patients, but also for society as a whole.



I enjoy my work and if there is "stress", it comes from the need to deftly negotiate the increasingly complex processes which sustains the development of academic medicine. Hence I "de-stress" by spending time with my young family (hones my teaching and management skills), as well as travelling to satisfy my interest in architecture and wines.

Dr Lee Yung Seng

National University Hospital (CSI Awardee 2005)



Obesity is one of the most common health problems in Singapore, and it is the substrate for other chronic diseases such as diabetes mellitus and hypertension.

Though obesity is the result of poor dietary habits and physical inactivity, it is believed that certain individuals are more prone to develop severe obesity because of their genetic makeup.

Our research aim is to uncover the genetic factors which predispose an individual to the development of severe obesity, as well as obesity-related complications. We are screening the DNA of an existing group of obese children in a bid to uncover these genetic factors. The research will contribute to efforts to unravel the biology of our weight regulating mechanism.

By understanding the pathogenesis of common obesity and obesity-related complications, we can then identify and validate molecules as critical mediators of the human weight regulation mechanism, and these in turn can be targeted development of new drugs and novel therapeutic approaches.

Having to juggle both research & clinical duties is always a challenge.

Support and understanding from the department and colleagues is key to a successful and fulfilling career as a clinician-scientist. Gaining the CSI award has provided more recognition, and the department and hospital are more aware and conscious to make time for the awardees to realise their research ambitions.

Clinician Scientists Under The Microscope

Prof. Michael Chee Wei-liang

Duke-NUS Graduate Medical School (CSI Awardee 2004)

Sleep deprivation affects many aspects of our well being. It impairs vigilance, flexible thinking, working memory, and executive functioning. My lab has been investigating the effects of sleep deprivation on neural activation as measured by fMRI. Over the last year, we found that changes in parietal lobe activation appear to be a promising marker of vulnerability to memory decline in sleep deprivation. We have used this know-how to begin evaluating cognitive enhancers.

We also found that it may not be memory storage failure per se but decline in attention and visual processing that may underlie performance drops in short term memory after sleep deprivation. This is manifest in the visual and parietal cortices and these regions and suggested to us a new line of investigation Our findings appeared in PNAS – a great feather in the cap!

We followed up with another intriguing result– when sleep-deprived subjects make risky decisions, we found that the nucleus accumbens, an area in the brain involved with the anticipation of reward, becomes selectively more active when making high-risk choices. Additionally, the orbito-frontal cortex and the insula, regions important in responding to losses were under-recruited when losses were encountered. This represents a double jeopardy – expecting a higher payout when none is really offered and being less sensitive to loss, when it might be prudent to be. This work attracted considerable interest in the US and has raised awareness of the work we are doing.

We are recognised as one of the leading cognitive brain imaging labs in the world specialising in the investigation of sleep deprivation. Alumni from the lab have gone on to

top graduate programmes in cognitive neuroscience in the US.

The research on cognition in sleep deprivation is part of a two-pronged effort to find ways to optimise human cognitive potential. I've chosen this rather novel route to improving human health– to promote and enhance function rather than to attack disease. I believe that the current approach to health can be much more proactive.

It's a tremendous feeling to be on the cutting edge of discovery – I really love what I do and currently, Singapore is a great place to do science. That's something I can't afford to take for granted. However, there are currently limited ways one can advocate – everything is very 'official' here, maybe this yearbook is a signal that things are changing.

I like walking in the forest at dusk and getting away from the city and have learnt to find silver linings in unobvious places.



Prof. Michael Chee (extreme right) with his team

NMRC MEDICAL RESEARCH FELLOWSHIP/SCIENTIST AWARD

INTRODUCTION

The NMRC Medical Research Fellowship and Scientist Awards are awarded to aspiring and talented researchers to enable them to receive research training in their areas of interest or to pursue an MSc or PhD in health and medical research in leading local or overseas institutions. The scheme is funded by the Ministry of Health.

All applications for fellowships and scientist awards are assessed and evaluated by the Fellowship subcommittee which will provide awarding recommendations to the Council.

AWARDS COMMENCING IN FY2006

Medical Research Fellowship Award

14 doctors commenced their NMRC Medical Research Fellowship in FY2006; nine of which were training for a degree whereas the rest were in training not leading to a degree.

Training leading to a degree (MSc/PhD)

1. **Dr Lee Pyng** from the Department of Respiratory and Critical Care Medicine, SGH received a full-time fellowship for 36 months. Her project at the Free University Medical Centre Amsterdam, Netherlands was “Chemoprevention of pulmonary carcinogenesis, expression profiles and molecular markers of premalignant lesions, field carcinogenesis, and smoking patterns”. Dr Lee’s training would lead to a PhD.
2. **Dr Wong Ting Hway** from the Department of General Surgery, SGH received a full-time fellowship for 12 months. Her project at the Johns Hopkins Bloomberg School of Public Health, Baltimore, USA was “A critical survey of trauma systems: Comparison of trauma systems in developed and developing countries and conclusions for trauma management in Singapore”. Dr Wong’s training would lead to an MSc.
3. **Dr Chung Hsi-Wei** from Singhealth received a full-time fellowship for 20 months. Her project at the Mayo Clinic College of Medicine, Rochester, USA was “Arthroscopic osteocapsular arthroplasty for primary degenerative osteoarthritis of the elbow: Outcome and complications”. Dr Chung’s training would lead to an MSc.
4. **Dr Lee Guan Huei** from the Department of Medicine, NUS received a part-time fellowship for 36 months. His project at the National University of Singapore was “Expression profiling and gene silencing in Hepatocellular Carcinoma”. Dr Lee’s training would lead to a PhD.
5. **Dr Irwani Binte Ibrahim** from the Department of Emergency Medicine, NUH received a full-time fellowship for 24 months. Her project at the University of Western Australia was “Emergency Medicine Research”. Dr Irwani’s training would lead to an MSc.



6. **Dr Mark Chan Yan Yee** from the Cardiac Department, NUH received a full-time fellowship for 24 months. His project at the Duke Clinical Research Institute, USA was “Determining the optimal loading dose of clopidogrel during primary percutaneous coronary intervention for ST-segment elevation myocardial infarction”. Dr Chan’s training would lead to an MSc.
7. **Dr Martin Chio Tze-Wei** from the Department of Dermatology, NSC received a full-time fellowship for 12 months. His project at the Royal Free & University College London Medical School, UK was identifying key social determinants for high-risk behaviour among groups vulnerable to STI & HIV infection in Singapore in order to develop improved prevention and intervention strategies“. Dr Chio’s training would lead to an MSc.
8. **Dr Deborah Lai Chooi Mun** from the Department of Radiation Oncology, NCC received a full-time fellowship for 36 months. Her project at the Institute of Molecular and Cell Biology & the National University of Singapore was “Molecular mechanisms of apoptosis-inducing factors and their inhibitors in cancer cells”. Dr Lai’s training would lead to a PhD.
9. **Dr Winston Kon Yin Chian** from the Department of Endocrinology, TTSH received a part-time fellowship for 36 months. His projects at the National University of Singapore were “1) Long-term health outcome and complications of obesity in obese NS recruits: A retrospective case-control study; 2) Analysis of familial clustering of obesity among obese NS recruit probands in Singapore– genes, environment or both and 3) Predictors of diabetes in obese probands and their family members in Singapore”. Dr Kon’s training would lead to a PhD.

Training not leading to a degree

10. **Dr Nicola Ngiam Siew Pei** from the Department of Paediatrics, NUS received a full-time fellowship for 6 months. Her project at the Hospital for Sick Children, Research Institute (Lung Biology), Canada was “To determine the mechanisms of hypercapnic protection against lung injury in experimental lung injury models”.
11. **Dr Ding Yew Yoong** from the Division of Medicine, TTSH received a full-time fellowship for 6 months. His project at the CHQOER & Boston University School of Public Health, USA was “Risk adjustment for health care outcomes – with special focus on geriatric care”.
12. **Dr Poh Kian Keong** from the Cardiac Department, NUH received a full-time fellowship for 6 months. His project at the Massachusetts General Hospital, Boston, USA was “Influence of myocardial perfusion upon success of cardiac resynchronization therapy”.
13. **Dr Ng Kar Hui** from the Department of Paediatrics, NUH received a full-time fellowship for 20 months. Her project at the Children’s Hospital Boston, USA was “The role of bone-morphogenetic protein-7 in renal fibrosis”.
14. **Dr Wong Jen San** from the Department of Surgery, SGH received a full-time fellowship for 10 months. His project at the Sarah W. Sedman Nutrition and Metabolism Center, Duke University Medical Center, USA was “The effects of prolonged Nkx6.1 expression in primary islets and its influence on glucose-stimulated insulin secretion and islet proliferation”.

Medical Research Scientist Award

One scientist commenced her NMRC Medical Research Scientist Award in FY2006 for training leading to a degree.

Training leading to a degree (MSc/PhD)

1. **Ms Tan Sze Huey** from NCC received a full-time research scientist award for 12 months. Her project at the London School of Hygiene & Tropical Medicine, UK was "MSc in Medical Statistics". Ms Tan's training would lead to an MSc.

Training Completed in FY2006

7 completed their training under the Medical Research Fellowship/Scientist Award in FY2006:

1. **Dr Ding Yew Yoong** from the Division of Medicine, TTSH completed 6 months of training at the CHQOER & Boston University School of Public Health, USA. His project was "Risk adjustment for health care outcomes – with special focus on geriatric care".
2. **Dr Poh Kian Keong** from the Cardiac Department, NUH completed 6 months of training at the Massachusetts General Hospital, Boston, USA. His project was "Influence of myocardial perfusion upon success of cardiac resynchronisation therapy".
3. **Dr Nicola Ngiam Siew Pei** from the Department of Paediatrics, NUS completed 6 months of training at the Hospital for Sick Children, Research Institute (Lung Biology), Canada. Her project was "To determine the mechanisms of hypercapnic protection against lung injury in experimental lung injury models".
4. **Dr Leong Hoe Nam** from the Department of Internal Medicine, SGH completed 36 months of training at the Royal Free and University College Medical School, London, UK. His project was "Studies on the viral host relationship of Human Herpesvirus 6 (HHV6) using DNA microarray technology".
5. **Dr Tan Thuan Tong** from the Department of Internal Medicine, SGH completed 24 months of training at the Malmo University Hospital, Lund University, Sweden. His project was "Host cell interactions of the respiratory pathogen *Moraxella catarrhalis*".
6. **Mr Wang Ling Zhi** from the Department of Haematology-Oncology, NUH completed 20 months of part-time training at the National University of Singapore. His project was "Pharmacology of Gemcitabine in the Asian population".
7. **Dr Chong Kian Tai** from the Department of General Surgery, TTSH completed 15 months of part-time training at the National University of Singapore. His project was "Detection of cancer-specific peptides in prostate cancer using MHC tetramer technology".



NMRC Fellows

Dr Ding Yew Yoong

Tan Tock Seng Hospital (NMRC Fellowship Awardee, 2006)

The bulk of my work time has been spent on clinical practice in geriatric medicine. While also keen on teaching and relevant health administration, research and evaluation holds a special place among the things I do. I realised quite early that to engage meaningfully in that activity, there is a need to study research and quantitative methods. The continual learning process has both been challenging and humbling. One highlight of my training was the privilege of going on a NMRC fellowship in health services research (HSR) in 2006, at Boston University School of Public Health and Veterans Affairs (VA) Center for Health Quality Outcomes and Economic Research (CHQOER) in Bedford, Massachusetts. It was a rewarding time of learning through interaction with experienced multi-disciplinary health services researchers and work on a VA research study.

Right now, I spend a portion of my time with the NHG Health Services and Outcomes Research (HSOR) group, participating in research and evaluation projects there. In addition, I am also busy with a NMRC-funded study and a VA study that both focus on the application of risk adjustment in evaluating health outcomes.

Patient care in health intervention programmes can be informed by evidence based on valid answers to relevant research or policy questions. I see my role in this process as helping to gather credible evidence through appropriate application of evaluative methods. When this is achieved, the extra time and effort spent would be worthwhile.



Dr Ding and his wife.

It is well-known that juggling clinical work and research is challenging and not an easy task. I have found this to be true. On the other hand, I have realised that the support of my clinical department and colleagues has been very great – and for that, I am thankful. Because research work inevitably extends to time after office hours, a fair amount of discipline, commitment, stamina, and long-suffering support of my family is crucial. When not working, I relax by walking, reading, making music on the piano, playing board games or cards, engaging in a gentle dose of weekend park soccer, and spending time with my family.

NMRC Fellows

Dr Adrian Low

National University of Singapore (NMRC Fellowship Awardee, 2004)

I had the fortune of an NMRC Fellowship together with an HMDP (Health Manpower Development Programme) award to pursue basic research and clinical cardiology at the Massachusetts General Hospital, USA for 2 years. I was attached to a basic science lab run by physician-scientists from Harvard Medical School and underwent comprehensive training in the methods of human genetic studies as well as molecular genetic analysis. This work involved studying the hypothesis that certain genes involved in premature aging might result in premature narrowing of the heart arteries. In another study involving a well characterised cohort of patients with lone atrial fibrillation (a specific heart condition where the heart beats irregularly), we identified several new blood markers (biomarkers) that may potentially identify patients at risk of this condition. This work was extended to include patients with heart failure. The pursuit of these biomarkers required the application of ELISA techniques as well as statistical analyses which are useful in subsequent research work.

Apart from the above projects involving human blood samples, I was also using the zebrafish as a model system for the study of vascular biology. The zebrafish is a ubiquitous tropical pet-fish that is a popular choice in genetic studies. This is due to its high reproductive rate, genetic trackability, optical transparency, and easy management. Its optical transparency and rapid development allows one to follow developmental changes of the embryo easily and hence ascertain the effect of an external drug applied at early development. This work with the zebrafish has allowed me to acquire a broad range of vascular and molecular biology techniques, including bioinformatics, small molecule screens, assay development, genomic analyses, cDNA and genomic cloning, in situ and quantitative RNA analyses, transgenesis, and morpholino "knockdown" experiments.

Like most colleagues, it has been a struggle balancing the demands of a heavy clinical work load with research upon my return to Singapore. Much of my time is currently spent with patient care and student teaching and I am engaged in several clinical research projects either as principal investigator or in collaboration with colleagues. Although I am currently not having as much "hands-on" research as before, the experience was definitely rewarding. I am now better able to critically appraise scientific literature and I've gained a better insight towards translating a clinical situation to a basic science question. This skill is critical in collaborative work with basic scientists. It is increasingly realised that current major research endeavors involve close collaboration among clinicians and basic scientists; hence this ability to "speak both languages" is a welcome asset.

Time off work is spent with family and the pursuit of hobbies. I enjoy my weekly runs in the Botanical Gardens.





SINGAPORE TRANSLATIONAL RESEARCH (STaR) INVESTIGATOR AWARD

The STaR Award, started in 2007, aims to recruit and nurture world-class clinician scientists and clinician investigators to undertake cutting-edge Translational and Clinical Research (TCR) in Singapore and sprout strong human capital in TCR.

The STaR Award will also serve as a catalyst to foster strong collaborations between different research groups and institutions in Singapore, mentor young TCR researchers and help network the community with other prestigious research institutions.

The award is divided into three levels:

- 1 Distinguished Senior Investigator (DSI)
- 2 Senior Investigator (SI)
- 3 Investigator (INV) awards

The STaR Awards are renewable after three or five years, depending on the initial award period and subject to rigorous review.

The programme targets:

- 1 Medical doctors internationally renowned in their own fields of translational and clinical research
- 2 PhD scientists who have made a significant impact in TCR internationally may be considered

Both groups are preferred to have expertise in population genetics, epidemiology and health services research as these play an important part in the BMS Phase II initiative.

INDIVIDUAL RESEARCH GRANTS

INTRODUCTION

Individual Research Grants (IRG) are provided to researchers for carrying out specific research projects. The grants are awarded based on the scientific merits of the projects. In FY2006, the NMRC received 306 applications. A total of 73 applications were approved, amounting to S\$20.4 million and are currently in progress. A systematic reviewing, approving and monitoring system is in place to administer the IRG.

IRG FUNDING EXERCISES 2004-2006

Figure 1 and 2 present the statistics of each IRG Funding Exercise over the last three years.

Figure 1 **Number of IRG Applications and Amount Received and Approved (FY2004 to FY2006)**

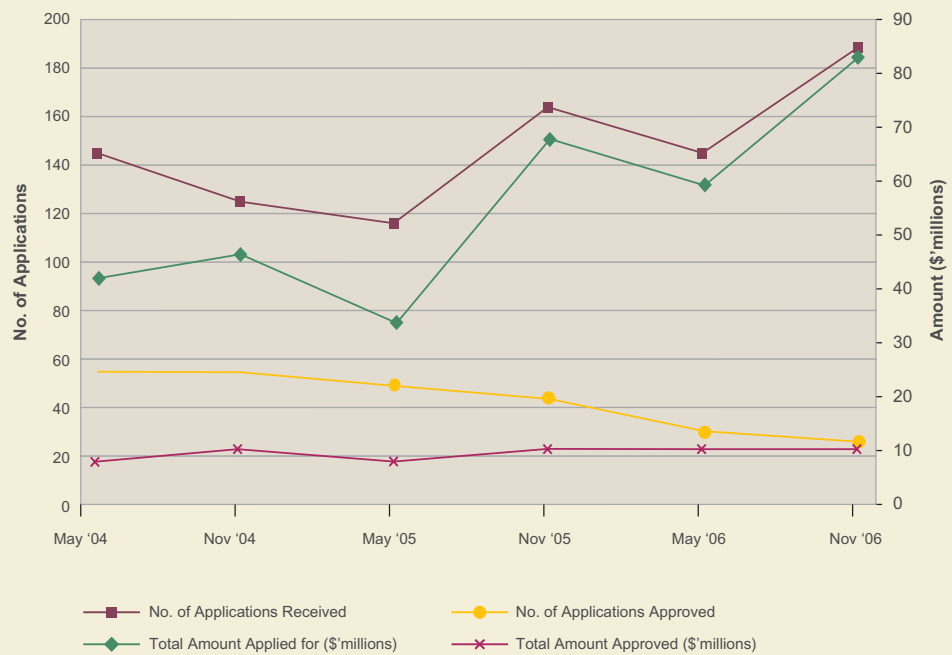
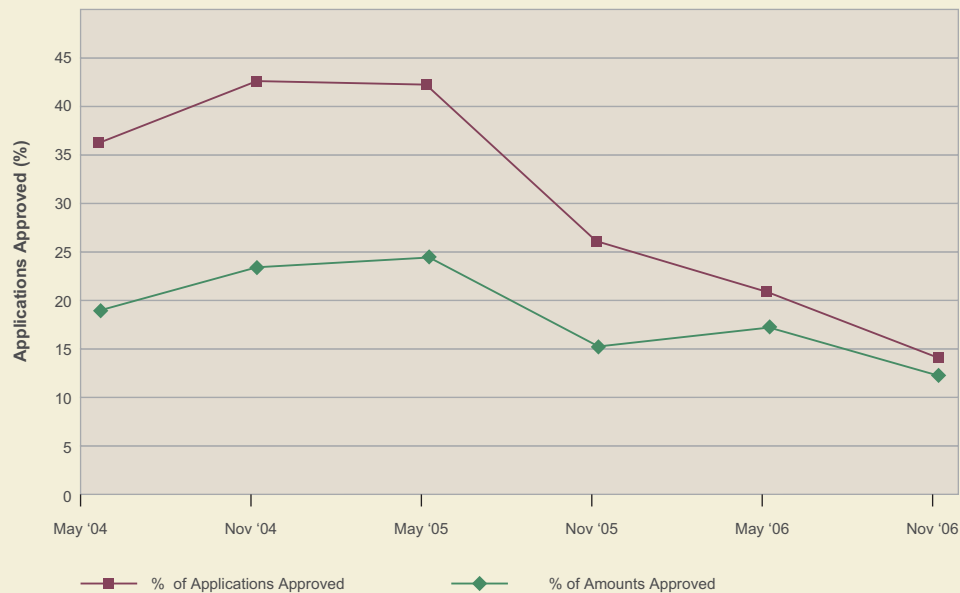


Figure 2 **IRG Applications and Amount Approved (FY2004 to FY2006)**

Note: The decrease in % of grants approved in Nov '06 is noted as there is no budget cut across the board for the grant call.

REVIEWING, APPROVING AND MONITORING SYSTEM (Up to Nov 2006)

(a) Reviewing

The reviewing process for IRG applications has evolved into a stringent and robust two-step system of review and assessment. The NMRC Secretariat selects appropriate reviewers (at least two for each application) from a local and overseas pool of reviewers with the following guiding principles:

- Reviewers are selected by matching their expertise and area of research to that of the request
- To safeguard against any situational bias, reviewers have to be from different institution as the Principal Investigators, Co-Principal Investigators and collaborators
- More reviewers will be assigned in the event of great disparity in reviewing grading

Review Subspecialty Committee Selection

Following the first round of review by external reviewers, the 10 peer review subspecialty committees, which comprise representatives from the various institutions, will then assess the research proposals based on the comments given by the reviewers on the proposals. Each subspecialty committee will rank the proposals under its own subspecialty and make funding recommendations to the Executive Committee or the Council.

The 10 subspecialty areas are as follows:

1. Immunology/Microbiology
2. Pathology/Inflammation/Oncology/Nuclear Medicine
3. Biochemistry/Cell and Molecular Biology
4. Epidemiology/Health Sciences/Public Health & Health Services
5. Peripheral, Central, Sensory & Cellular Nervous System/Mental Health
6. Genetics/Paediatrics/Reproduction
7. Cardiovascular/Respiratory
8. Renal/Endocrine/Pharmacology
9. GIT/Liver/Nutrition
10. Dentistry/Surgery/Ophthalmology

(b) Approval

The NMRC will approve the final prospects.

(c) Monitoring

Approved projects are tracked and monitored on an annual basis. This is carried out through progress reports submitted by the Principal Investigators. Requests for grant variations or extensions are accepted upon review of their progress.

A final report on the researchers' findings and achievements is submitted when a project is completed. Each project is required to report on key performance indicators. A total of 86 projects were completed with final reports submitted in FY2005.

APPROVED PROJECTS IN FY2006

No. of IRG Projects Approved in FY2006 (By Institution)

Changi General Hospital (CGH)	1
National Cancer Centre (NCC)	6
National Heart Centre (NHC)	1
National Neuroscience Institute (NNI)	5
Nanyang Technological University (NTU)	3
National University Hospital (NUH)	6
National University of Singapore (NUS)	38
Singapore Eye Research Institute (SERI)	3
Singapore General Hospital (SGH)	7
Singapore Health Services (SHS)	1
Tan Tock Seng Hospital (TTSH)	2



ONGOING PROJECTS IN FY2006

A total of 294 projects were still ongoing at the close of FY2006. Table below shows the number of projects being carried out in each institution.

Ongoing Research Projects at the end of FY2006 (By Institution)

Alexandra Hospital (AH)	1
Institute of Mental Health (IMH)	3
KK Women's & Children's Hospital (KKH)	6
Changi General Hospital (CGH)	2
National Cancer Centre (NCC)	35
National Heart Centre (NHC)	4
National Neuroscience Institute (NNI)	28
National Skin Centre (NSC)	2
Nanyang Technological University (NTU)	5
National University Hospital (NUH)	12
National University Medical Institute (NUMI)	4
National University of Singapore (NUS, SOM)	132
Singapore Eye Research Institute (SERI)	10
Singapore General Hospital (SGH)	30
Singapore Health Services (SHS)	7
Singapore National Eye Centre (SNEC)	3
Tan Tock Seng Hospital (TTSH)	10

COMPLETED PROJECTS IN FY2006

A total of 79 IRG projects reported their final findings in FY2006. Table below shows the number of IRG projects that reported final findings in FY2006, by institution.

No. of Projects Completed in FY2006 (By Institution)

KK Women's & Children's Hospital (KKH)	1
National Cancer Centre (NCC)	11
National Heart Centre (NHC)	2
National Neuroscience Institute (NNI)	5
National University Hospital (NUH)	3
National University Medical Institute (NUMI)	3
National University of Singapore (NUS, SOM)	31
Singapore Eye Research Institute (SERI)	2
Singapore General Hospital (SGH)	17
Singapore Health Services (SHS)	1
Tan Tock Seng Hospital (TTSH)	3

INSTITUTIONAL BLOCK GRANTS & ENABLING GRANTS

NMRC's block grants facilitate the development of core manpower and research capabilities as well as fund research programmes carried out by the various research institutions. The goal of block grant funding is to enable the institutions to develop sufficient research capabilities to compete for competitive grants.

Block grants are awarded annually and there are 23 block grants in two block grant categories: the Institutional Block Grant (IBG) and the Enabling Grant (EG).

IBG is provided to restructured hospitals and public research institutions to facilitate the development of core expertise and research capabilities. 15 institutions received IBG funding totalling S\$29 million, in FY2006.

EG was set up in 2003 and is given to institutions to build up research capabilities and nurture a research culture through providing grants for clinical trials support and pilot studies. EGs totalling S\$2 million were awarded to the following institutions in FY2006.

RESEARCH ACTIVITIES AND OUTCOMES OF IBG & EG RECIPIENTS

ALEXANDRA HOSPITAL (AH)

The Enabling Grant came at an opportune time in 2003 as AH gathered its momentum in the development of clinically relevant research. The mission of AH is to improve health and reduce illness through patient-centred quality healthcare that is accessible, seamless, comprehensive, appropriate and cost effective, in an environment of continuous learning and relevant research.

In FY2006, the EG (and supplementary grant) has supported the procurement of a Flow Cytometer System with FACStation Data Management System and a Liquid Scintillation Counter. The enhanced capability has truly enabled the institution to pursue new research directions and forge fruitful collaboration with established research institution.

A multi-disciplinary team of investigators from orthopedic surgery, sports medicine, physiotherapy and endocrinology came together in FY2006 to setup a core exercise physiology laboratory and started clinical studies on human volunteers and athletes.

AH continued to fund research related training to enhance the research capability of its investigators. These included statistics and courses in epidemiological and bio-banking.

The physical availability of a research clinic is an important resource to investigators who wish to conduct clinical study but has space constraint in the usual service clinic. EG FY2006 has continued to support the day-to-day operations of this research clinic.

CHANGI GENERAL HOSPITAL (CGH)

The Clinical Trials and Research Unit of CGH (CTRU) was set up in 1988 and expanded in 2003. It now supports the conduct of phase I, II, III and IV clinical trials and the administration of the Institutional Review Board and other research-related committees in CGH. The Enabling Grant was utilised to achieve the following objectives in FY2006:

- i. The Phase 1 clinical trial facilities have been improved. This helps CGH to be more self-sufficient and able to meet the stringent requirements of conducting and completing the trials in a shorter time
- ii. The manpower resources help to share the workload and improve project management
- iii. The staff attended research forum and external seminars and courses on research and ethics. These training and educational programmes improved staff confidence and work efficiency
- iv. The article retrieval services with NUS were renewed, and the doctors have found them useful for their research work and paper writing
- v. More staff were able to conduct small research projects and continue the ongoing ones



CLINICAL TRIALS & EPIDEMIOLOGICAL RESEARCH UNIT (CTERU)

The Clinical Trials & Epidemiological Research Unit (CTERU) was established in 1996 with funding from NMRC, and is managed by a Joint Management Committee including representatives from both healthcare clusters.

In FY2006, the primary objective of the CTERU is to promote and support the conduct of academic clinical trials, evidence-based medicine (EBM) and related research in Singapore. In particular, it aims to support clinical studies which are of high scientific value and which have the potential to influence clinical practice. This is done by providing biostatistical, epidemiological, EBM, data and project management support for these studies. The IBG supports the ongoing work of CTERU in such a way that existing and future collaborations with the healthcare community can be undertaken in a timely fashion and to the highest international standards. The IBG also funds a critical mass of key clinical research infrastructure and expertise in one location that may not be cost-effective for individual hospitals and centres to maintain in isolation.

In FY2006, CTERU's achievements are as follows:

- i. 105 inter-institutional collaborations, including 38 clinical trials, 28 biostatistical projects and 39 evidence-based medicine projects
- ii. 32 publications, 16 poster and oral presentations



DEPARTMENT OF CLINICAL RESEARCH (DCR), SINGAPORE GENERAL HOSPITAL (SGH)

The Department of Clinical Research (DCR), is one of the three departments under the Division of Research of the Singapore General Hospital (SGH). The Department continues as a core basic research facility in the Hospital, supporting laboratory-based research activities on Outram Campus, and collaborating closely with researchers in the hospital and research institutions under SingHealth.

DCR's Scientists continues to provide scientific advise to clinicians and collaborate in their research projects, take care of major core equipments and pursue their respective areas of research. Some supervised postgraduate and undergraduate students on formal research programmes as well as students from local Polytechnic and Secondary Schools. Regular talks and seminars, including specialised end-user training were also organised during the year.

Operational expenses goes towards the running of core research facilities which supports and is used by many SGH Clinicians. These expenses include common consumables and costs of regular equipment maintenance and part replacements. IBG is a useful source of funds for small and start-up projects in SGH, especially for younger researchers with research ideas upon their return from overseas HMDP training.

DCR produced 36 publications in FY2006 of which 23 are in journals of impact factor 2 and above.

DEPARTMENT OF EXPERIMENTAL SURGERY (DES), SINGAPORE GENERAL HOSPITAL

The Department of Experimental Surgery (DES) under SGH provides services for translational research with clinical relevance for potential progression to clinical trial support from the hospital, which provides the "bench to bedside" conceptual option.

An expansion plan was implemented due to request from NUS-Duke Graduate Medical School and Principal Investigators from SingHealth to increase capacity for training and translational research activities especially those involving the use of non-human primates.

The expansion and improvement projects included the following:

- i. Construction of an enlarged Cadaver Repository
- ii. Revamping of rodent research centre
- iii. Relocation and construction of two dedicated non-human primate holding areas
- iv. Enlarging the bioimaging laboratory

Besides SGH, DES also collaborates with NCC, NHC, NDC, SERI, KKH, DSO, NUS, NTU, John Hopkins, PsiOncology, NUS-Duke GMS, IMCB and the medical industries.

34 surgical skills training courses were conducted for the year at the Clinical Skills Laboratory attracting a total of 700 local and overseas participants. After a long absence, DES also hosted the Advanced Trauma Life Support course.

In FY2006, DES generated:

- i. 12 publications with six in the top 20% international peer review journals
- ii. 5 external awards for research at national and international level
- iii. 11 of the programmes/projects using DES' core facilities had direct or potential clinical applications
- iv. DES was also involved in 14 inter-institutional

HEALTH SCIENCE AUTHORITY (HSA)

FY2003 was the first year of funding by NMRC. The EG has since assisted HSA to develop and promote a vibrant research culture as well as a strong research capability.

The EG is mainly used to fund some of its Clinical Trials Support and Small Grants programmes.

The development of an online clinical trials safety reporting system was funded by the EG. This system would enhance the efficiency of the submission of safety reports by automating data entry. The EG is also used to fund an online clinical trials licensing system. The latter has served the clinical trials community well and has increased the convenience and speed of regulatory submissions.

The EG was also used as small grants to fund the purchase of test samples, reference materials, laboratory consumables and reagents in support of some research projects in HSA.

The research achievements/outcomes for FY2006 are as follows:

- i. Two papers published in top 20% international peer review journals with impact factor greater than 2.0
- ii. Four presentations at conferences
- iii. One master student trained



INSTITUTE OF MENTAL HEALTH (IMH)

The Institute of Mental Health (IMH) is the largest tertiary psychiatric hospital located in Singapore. IMH is equipped with modern facilities and offers a multi-faceted and comprehensive range of psychiatric, rehabilitative and counselling services designed to meet the needs of children, adults and the elderly.

A key mission of this Institute is to engage in scientifically and clinically relevant research. The Research Division of IMH has been established with an Institutional Block Grant (IBG) from National Medical Research Council (NMRC). The Division was incepted in year 2000.

In the past year, IMH has continued to support a slew of pilot and start-up studies through IBG, and a formal training programme in research. The areas of focus are psychiatric genomics, neuroimaging, clinical drug trials, health service research/epidemiology and ethics of psychiatric research. These areas would constitute the core competencies.

The Clinical Trial Unit, which is a subdivision of the Research Division has continued to provide high level support and co-ordination of clinical trials. IMH has secured two new trials, has three phase 3 trials and four phase 4 trials ongoing in FY2006.

Various courses and seminars have been conducted in research-related topics.

Performance indicators have been fully met and there was an increase in the number of publications and presentations, as compared to FY2005.

- i. Publications: 33 publications (9 of impact factor 2 or more)
- ii. Presentations: 49
- iii. One Post-Doctoral Fellow funded by Singapore Millennium Foundation,
- iv. One Master in Health Service Management
- v. One CSI Award, one NHG RISE Award, two NHG MAP Award
- vi. One WHO State of Kuwait Prize for Research in Health Promotion

KK WOMEN'S & CHILDREN'S HOSPITAL (KKH)

KKH is the largest hospital in Singapore which provides medical care for women, infants and children. It also trains specialists and nurses in obstetrics, gynecology and pediatrics. Therefore, there are excellent opportunities for research in KKH. Medical advances in obstetrics, gynaecology and pediatrics originate here. The Enabling Grant has provided the means for the clinicians and practitioners across KKH divisions to nurture their research interests and build the research culture within the institution. Better usage of the funds led to KKH having a two fold increase in new research projects and output in presentations and publications in FY2006. The Enabling Grant has continued to support the day-to-day operations of the KK Research Centre which is the central body overseeing the conduct of research activities in the hospital. Research nurses have been trained specifically to assist in clinical and administrative duties for investigator initiated studies as well as pharmaceutical sponsored studies.

With the purchase of laboratory equipment and statistical software enhancements, KKH was able to promote and support the growth of basic and translational research activities. There was an increase of approximately 50% of new projects, from 88 to 134 for FY2006.

KKH's research achievements/ outcomes for FY2006 are as follows:

- i. 147 presentations at conferences
- ii. two external awards for research at national and international level
- iii. two competitive research grants were awarded from NMRC, BMRC or industry, the total quantum amounting to \$1.1 million
- iv. three clinically relevant research with potential / direct application
- v. seven inter-institutional collaboration



MINISTRY OF HEALTH - NURSING RESEARCH COMMITTEE (MOH-NRC)

The IBG is used to fund research projects and the use of literature databases and SPSS for nurses in Singapore. It is also used to fund Clinical Practice Guidelines (CPG) development and systematic reviews.

There were 38 nursing research projects from the public institutions. The majority of these projects utilised the core resources funded by the IBG. 13 articles were published in peer-reviewed journals and 9 presentations were made at conferences.

NATIONAL BIRTH DEFECTS REGISTRY (NBDR)

The National Birth Defects Registry (NBDR) was set up by the Ministry of Health in 1993. Its aims are to collate and analyse epidemiological data on congenital birth defects in Singapore, in order to evaluate birth defects prevalence and trends; facilitate planning programme for antenatal screening and detection of birth defects; and prenatal genetic counselling, paediatric medical and surgical services.

The NBDR database is a collection of live births, stillbirths and abortuses with fetal anomalies delivered/occurred in Singapore. Data from NBDR have been used in the annual report for MOH and scientific articles, answering queries from MOH and the media, helping various medical professionals in their planning and work.

In FY2006, one paper was published and five presentations were made at local and international conferences by NBDR.

NATIONAL CANCER CENTRE (NCC)

The Division of Cellular & Molecular Research is an active research department within the NCC. The Division's interests are wide-ranging and engages in vigorous basic clinical and translational research leading to novel clinical applications in oncology. The strategy is to focus on testing the applicability of scientific discoveries to solve clinical problems.

The Division of Medical Sciences engages predominantly in translational research with special interest in improved methods for early cancer diagnosis and novel treatments. It is also host to young clinicians who undertake research training. The Division provides space and infrastructural support for clinical oncologists who return to Singapore having acquired research experience abroad as a means of nurturing young investigators to independence.

Joint Programme with Van Andel Institute, USA - A laboratory focused on translational research in hepatobiliary, head and neck cancers, and lymphoma was established with a special commitment to provide research training and experience to clinical oncologists. To this end, several projects have been initiated with clinicians and pathologists in a short time.

In FY2006, the Biostatistics and Epidemiology Unit primarily provided statistical and epidemiological support for clinical trials and other studies conducted at NCC. It also provided teaching and training support, much of which were in collaboration with the local universities.

The Clinical Trials Office (CTO) provided secretarial support to the NCC Institutional Review Board (IRB) and the Clinical Trials Steering Committee (CTSC). In 2006, the IRB with the assistance of the CTSC, reviewed 26 new clinical trials and 44 lab-based research applications.

In 2006, NCC conducted 73 clinical trials. 13 of these trials were completed in 2006 and 60 continue into the following year. In addition, there were 21 new studies planned for the following year.

The IBG provided support for 326 research projects/clinical trials in FY06. These resulted in 162 publications, 87 of these published papers were internationally ranked at Journal Impact Factor greater than or equal to 2.0.

NCC also published 42 conference papers. In FY2006, NCC researchers also received two international and 23 national awards.

NATIONAL DENTAL CENTRE (NDC)

NDC is the main centre providing oral medical care in Singapore, treating 160,000 patients per year. This serves as a large patient base for research. NDC recognises the importance of research and is committed to becoming an important centre for dental research in Singapore. NDC conducts clinical and translational research as well as epidemiological studies on oral diseases and their management.

The objectives of the National Dental Centre Enabling Grant in FY2006 were to fund:

- i. the NDC Research Resource Unit that assists clinicians in their research activities
- ii. research advisor which directs the research directions and programme for NDC
- iii. small projects, inclusive of protected time in addition to materials and supplies
- iv. pilot projects within the institution
- v. the thematic research programmes
 - a. TL Modular Endoprosthetic Replacement of Mandibular Defects
 - b. PCL-TCP Scaffolds for Bone Engineering

NDC's research achievements/outcomes for FY2006 were as follows:

- i. 30 published papers, seven of which are in journals with impact factor greater than 2.0
- ii. 10 presentations at international conferences
- iii. A research with potential/direct application
- iv. 16 inter-institutional collaborations
- v. A research infrastructure improved Research Resource Unit & Research Coordination Section
- vi. Seven MDS and seven advanced specialty trainees trained
- vii. One NMRC Fellowship Award, one SHS Clinician Scientist Award, one SHS Mentorship Programme Award and one SHS Talent Development Grant

NATIONAL HEART CENTRE (NHC)

The NHC research focuses on cell and molecular studies in order to understand the genetic variations, risk factors, and role of vascular endothelial cells in cardiovascular diseases. These may help to develop novel therapeutic targets and strategies to improve outcomes. NHC is also exploring the ability of using stem cells in the treatment of heart-failure patients. Clinical trials are conducted to compare alternative or novel diagnostic tests and therapies against current ones.

For FY2006, the objectives of NHC's IBG were used to:

- i. expand the basic and translational research capabilities of the MHC
- ii. develop, test and commercialise innovative mechanical devices for various common cardiac conditions and to bring them rapidly to patient care
- iii. establish a core team for the tissue engineering facility with biomaterials engineers from Nanyang Technological University to identify and nurture technological solutions to cardiovascular diseases
- iv. cultivate a research culture in the National Heart Centre conducive to training creative and talented scientist clinicians in the area of cardiovascular research
- v. fund and maintain a critical mass of core research scientists to provide continuity of research at the National Heart Centre
- vi. integrate and facilitate various researches across disciplines
- vii. consolidate existing projects with renowned and established overseas investigators and promote further collaboration with them
- viii. bring successful projects rapidly to the patient, and for patent filing and eventual commercialisation

There are seven publications in journals with impact factor greater than 2, 33 presentations at conferences, six awards at national and international levels, one master and PhD students trained in FY2006.



NATIONAL NEUROSCIENCE INSTITUTE (NNI)

Since its inception in late 2000, the NNI has effectively set up its neuroscience research laboratories, recruited a core team of talented neuroscientists, supported the development of a vigorous research faculty and provided effective research administration and governance, all leading to laudable research output and results. These achievements are a clear measure of the effectiveness of the NMRC's IBG to the NNI's research effort.

The IBG provides funding that is essential for NNI's mission to advance neuroscience research in Singapore, primarily to enhance the nation's health, establish itself as an international centre for excellence in medical care and research and contribute to the nation's Biomedical Initiative.

The IBG supports the core faculty of research scientists, basic research staff, and research administration for NNI research infrastructure and general operations, the NNI IRB Secretariat and the NNI-TTSH IACUC Secretariat.

The core equipment budget in FY2006 supported the purchase of additional core/communal equipment and specialised equipment that is essential and beneficial for use by the team of researchers at NNI. IT infrastructure was upgraded to facilitate data transfer, storage and improved backup systems.

Of note is the support the IBG provided to promote research collaboration between NNI's scientists/researchers and leading international researchers and institutions. In addition, the IBG also supported training and educational activities related to research.

In FY2006, a total of 58 scientific publications were produced by NNI researchers, with 34 scientific journals with impact factor 2.0 and above. 66 scientific presentations were made at scientific meetings. 16 post-doctoral researchers were employed and one each of master and PhD student were trained. In addition, there are 10 ongoing clinical/drug trials linked to industry, with four new clinical/drug trials initiated during the year.

ANIMAL RESEARCH LABORATORY (NNI-TTSH ARL)

The Animal Research Laboratory co-managed by both National Neuroscience Institute and Tan Tock Seng Hospital provides central animal care, housing services and surgical skills training courses for all researchers and doctors at both institutions. The IBG funded the core equipment, facility development, manpower and activities related to governance and administration.

Core equipments include the expansion of large animal cages and dehumidifiers to control the levels of humidity in each of the animal holding rooms. There were also new purchases to meet the specialised needs of the researchers using the Facility. The IBG also funds the cost of education and training of the IACUC members.

NATIONAL UNIVERSITY HOSPITAL (NUH)

Research plays an important role in NUH and maintains NUH as a leader at the cutting-edge of medical technology and expertise.

In line with plans to further develop the Clinical Trials Unit (CTU) to become an academic centre for academic studies, the primary focus was on the provision of additional services and facilities to investigators to create a conducive environment for the conduct of clinical trials. This would also promote the research-focused culture in NUH which has been cultivated over the years. This was accomplished through:

- i. additional manpower to cope with the increase in workload
- ii. new services for PI-initiated trials (application and submission of research proposals for ethics approval and / or grant- funding organisations, facilities for review of research data and statistical analysis)
- iii. purchase of additional equipment and infrastructure to support the new services and to facilitate clinical research
- iv. training of CTU staff to promote expertise in clinical research

CTU conducted a total of 43 clinical trials in FY2006 compared to 35 in FY2005 (an increment of 20%).

NATIONAL UNIVERSITY OF SINGAPORE (NUS)

NUS aims to achieve an internationally competitive level of research and build a global network between research and graduate education. IBG is allocated to the NUS Yong Loo Lin School of Medicine (SoM) and the National University of Singapore Medical Institute (NUMI) within the SoM. Objectives of the IBG are to: fund small and start-up grants for new academic staff to conduct pilot studies, assist new faculty members in setting up their laboratories and to sustain and enhance capabilities of research programmes by the school.

A major role for NUMI is to support and strengthen multidisciplinary programmes in particular focusing on translational and disease relevant research themes. To this end, NUMI has committed to developing the cancer biology programme, which has resulted in a very strong Oncology Research Institute (ORI).

ORI has expanded and performed exceedingly well in terms of publications output and also in attracting top-notch scientists to Singapore, as well as setting up a state-of-the-art Core Translational Interface (TRI) facility within NUMI for clinician scientists/scientists at SoM.

The other key focus is cardiovascular biology with particular reference to metabolic diseases such as diabetes and NUMI is currently working hard to build up the critical mass to move this programme forward and also into other areas such as stem cells.

The continued success of the Core Services funded under the IBG is reflected by the steady increase in the number of end-users. With the increasing emphasis on biomedical research, NUMI keenly anticipates this trend to continue and hence the need for continued support for upgrading its Core services within the SoM. With the growing technological advances, a faculty level state-of-the-art Core facility is an essential requirement.

27 publications in journals of impact factor 2 and above have arisen in FY2006. 23 presentations were made in conferences. Four master students and five PhD students were trained and three post-doctoral researchers were funded under IBG.

NATIONAL SKIN CENTRE (NSC)

The Research Division in NSC has four sections, the Laboratory-based Research section, the Clinical Trials section, the Epidemiological and Clinical Research section, and the Skin Physiology Studies section. Each is headed by an NSC consultant. The objectives of the Enabling Grant for FY 2006 were:

- i. To develop the Cell Culture Laboratory for melanocyte/keratinocyte research
- ii. To support the existing infrastructure for clinical trials, along GCP guidelines
- iii. To enhance current capabilities in molecular diagnostics, with mycobacteria PCR tests as NSC's niche area
- iv. To provide alternative funding source for research who are conducting small or pilot studies in areas of clinical importance

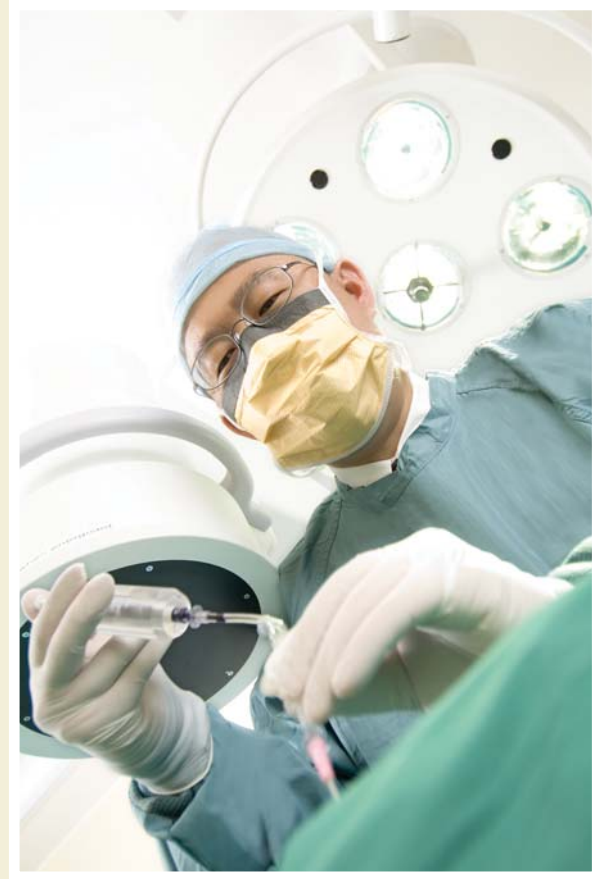
A collaborative pilot project with the Genome Institute of Singapore was conducted to study the gene expression profiles of cultured human keratinocytes induced by various toxicants. A new collaborative project with the School of Biological Sciences, Nanyang Technological University, was initiated to study skin cancers.

The NMRC Enabling Grant remains an importance source of funding for NSC young doctors to pursue new research projects. In collaboration with the Department of Pathology SGH, a pilot study of the genetic clonality and virulence factors of staphylococcus aureus found in atopic dermatitis patients and their household contacts was completed. A large survey of general practitioners was conducted to understand the management practices of sexually transmitted diseases in the community.

Further collaborative work with Center for Molecular Medicine, Biopolis, is ongoing to study filaggrin mutations in patients with ichthyosis vulgaris and atopic dermatitis.

NSC's research outcomes for FY2006 are summarised as follows:

- i. two papers published in journals of impact factor 2 and above
- ii. 14 presentations at local and overseas conferences
- iii. five projects with direct or potential clinical applications
- iv. six inter-institutional collaborations
- v. two research facilities developed/improved



SINGAPORE CARDIAC DATA BANK (SCDB)

In view of the importance of coronary heart disease as a cause of mortality, morbidity and the top 10 condition of hospitalisation in Singapore, Singapore Cardiac Data Bank (SCDB) was set up in year 1999.

SCDB is a collaboration project and joint effort among the cardiac departments from Alexandra Hospital, Changi General Hospital, National Heart Centre, National University Hospital, Singapore General Hospital and Tan Tock Seng Hospital.

In FY2006, outcome data collected in ongoing collaborations with the various hospitals were presented at the National Medical Audit Meeting (Cardiovascular Discipline). Two papers were also drafted by Clinical Quality Division, MOH & SCDB.

SINGAPORE EYE RESEARCH INSTITUTE (SERI)

SERI is the leading centre in Asia for ophthalmic and visual science research and has established an international reputation as an eye research centre of excellence with an internationally recognised high profile.

Research priorities remain those most relevant to Asian eye disease and with significant ocular morbidity such as myopia, angle closure glaucoma, corneal diseases and diabetes.

The major objective of this year's IBG is to maintain the level of activity and scientific output within the four established research divisions, namely, the Clinical Research Unit, the Epidemiological Unit, the Visual Psychophysics Unit and the Laboratory Sciences Unit.

The SERI Clinical Research Unit conducts ocular therapeutics, surgical and laser-related human clinical trials, and clinical studies in visual psychophysics. During the year, the clinic supported a total of 25 prospective clinical trials.

The SERI Epidemiological Unit conducts and coordinates large-scale epidemiological and population-based projects studying eye diseases in our community. Six major SERI epidemiological studies are currently ongoing, to evaluate risk factors and prevalence of recognised complex traits in different ethnic groups.

The SERI Visual Psychophysics Unit focuses on visual function and the improvement of visual performance. In 2006/07, the unit conducted several visual neuroscience-oriented clinical trials on perceptual learning and vision enhancement in myopia and post-refractive surgery ametropia, in collaboration with the DMERI and NeuroVision.

The SERI Laboratory Sciences Unit scientists continued to consolidate various translational studies on myopia and eye growth, wound healing, tear film studies, ocular surface stem cells and artificial substrates for tissue engineering.

SERI hosted an important and major event, the Inaugural Asia-ARVO Meeting on Vision and Ophthalmology. Over 1000 people from over 36 countries attended the four day Meeting held at the Suntec Singapore International Convention and Exhibition Centre from 2 - 5 March 2007.

In FY2006, SERI scientists and clinicians published 104 scientific articles and 68 had an impact factor of more than 2.

In addition, 189 scientific abstracts were presented at clinical and research meetings. 9 new research projects were approved and initiated during the year. SERI scientists and affiliated clinicians were awarded a total of \$4,532,684 in individual research grants and commercially funded grants.



TAN TOCK SENG HOSPITAL - CLINICAL RESEARCH UNIT (TTSH-CRU)

TTSH-CRU is set up to foster an environment conducive for research in TTSH. As such, the main objective of the IBG is to provide administrative, scientific and technical support in promoting the growth of research talent and research culture in TTSH.

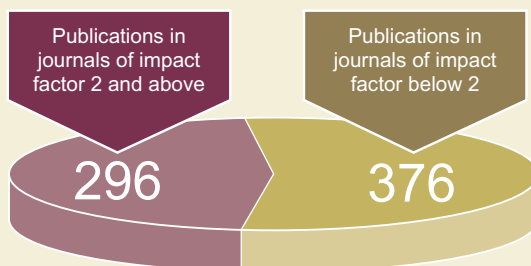
Support was also extended to developing research programmes that have genuine potential of output in terms of high quality publications and improvement in medical and health care. Through the provision of new equipment, research infrastructure, capabilities, culture and quality of research in TTSH were improved upon.

A few initiatives were implemented to promote research, which continued to grow in strength and activity. Some of the initiatives include the conduct of research talks every month to create research interest and promoting research culture, the setting up of the research intranet in TTSH for better disbursement of research information and the putting up of research posters which is a result of the research activity of TTSH researchers in recognition of their work and creating awareness for the public on the research work in TTSH. TTSH researchers working on NMRC funded studies and investigator-initiated studies will continue to be provided with central support.

The manpower support, through the FY2006 IBG for the second year running, had helped in the formation and continuity of the Publication Team, whose main tasks is in aiding researchers with the preparation of the grant application, study costing, establishment of study protocol and case report form design, randomisation, management of data (including data entry) and management of the projects, design of databases, literature searching, statistical analysis and consultation and preparation of the manuscript for publication and conference presentation.

TTSH-CRU has 38 publications in journals of impact factor 2 and above, out of a total of 109 publications.

PUBLICATIONS IN FY2006 ARISING FROM IBG/EG-FUNDED RESEARCH



TOTAL NUMBER OF PUBLICATIONS FUNDED BY IBG & EG IN FY2006

Table 12 Publications Generated by the IBG/EG-funded Institutions

Institution	Total Publications	Publications in journals of impact factor 2 and above
AH	0	0
CGH	0	0
CTERU	23	7
DCR	36	23
DES	12	6
HSA	2	2
IMH	33	9
KKH	85	5
MOH-NRC	13	0
NBDR	1	0
NCC	162	87
NDC	30	7
NHC	13	7
NNI	58	34
NNI-TTSH ARL	0	0
NUH	0	0
NUS	35	24
NSC	4	2
SCDB	0	0
SERI	104	68
TTSH	109	38

■ Total Publications
■ Publications in journals of impact factor 2 and above

TRANSLATIONAL CLINICAL RESEARCH (TCR) FLAGSHIP PROGRAMME

Funded by the National Research Foundation (NRF), this programme has a budget of S\$125 million over 5 years.

The aim is to help build up critical mass of excellent researchers in selected areas and establish Singapore as a leader in the following five disease-oriented areas:

- 1) Cancer
- 2) Cardiovascular / Metabolic Disorders
- 3) Neurosciences
- 4) Infectious Diseases
- 5) Eye Diseases

The programme will build on existing, local, highly competitive programmes and provide highly productive platforms for collaboration with top overseas research institutions and industry. By improving the quality of clinical care, we hope to attract more foreign patients to seek medical care in Singapore, and attract biotech, medical devices and pharmaceutical companies to re-locate here.

Researchers, clinicians and clinician scientists working in one of the above strategic areas are all applicable for this award. The proposed programme has to be integrative and demonstrate a strong collaborative nature. It also has to be scientifically competitive with the potential of being a leader in its field internationally. Grants calls are made regularly every 6 months.

Applications will be evaluated by the TCR Flagship Review Committee comprising of local and international members. Short-listed applicants would have to submit a more detailed proposal for review by international experts before a final evaluation by the TCR Flagship Review Committee.

The first TCR grant call was recently awarded to the Singapore Gastric Cancer Consortium. The consortium has been awarded a total of S\$25 million over five years. The project aims to improve the early detection of gastric cancer by discovering biomarkers at an early stage and developing molecular classifications that can robustly predict disease behaviour and treat response.

FINANCIAL REPORT

NMRC'S BUDGET FOR FY2006

NMRC's annual budget is part of MOH's Operating Expenses Budget. For FY2006, NMRC was allocated a total of S\$50.8 million for medical research expenditure from MOH. The budget was utilised for both on-going projects and programmes committed in previous years, as well as new initiatives in FY2006.

In addition to the funding from MOH, Singapore Totalisator Board (STB) also donated \$1.0 million for funding of fellowship in medical research in FY2006.

Table 8 NMRC's Allocated Budget, FY2006

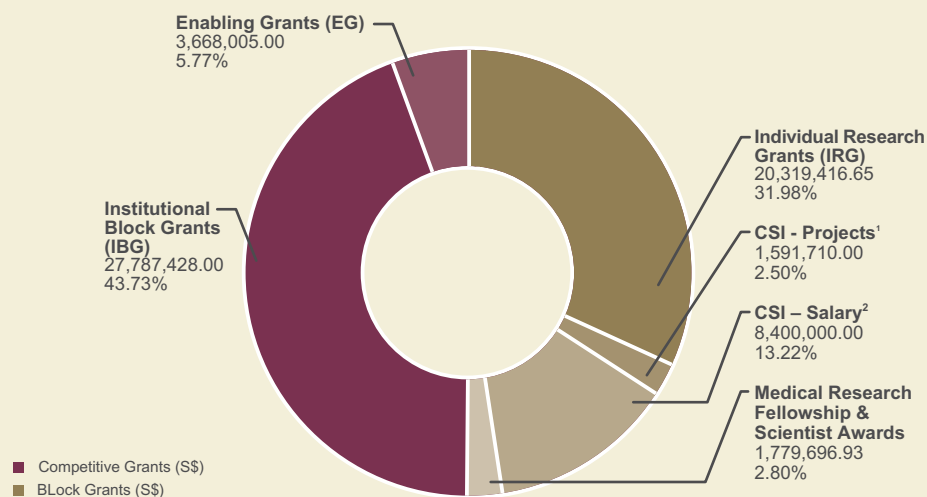
	AMOUNT
MOH's OOE Budget for Medical Research Expenditure	S\$50,825,108
STB's Sponsorship for Medical Fellowship Programme	S\$1,000,000
NMRC FY2006 Total Budget	S\$51,825,108

COMMITMENTS IN FY2006

A total of \$63.5 million was committed to the various programmes by NMRC, in FY2006. The breakdown of the commitments is shown in Table 9.

Table 9 Total Commitment in FY2006

	AMOUNT (S\$)	% OF TOTAL
COMPETITIVE GRANTS		
Sub-Total	32,090,823.58	50.50%
BLOCK GRANTS		
Sub-Total	31,455,433.00	49.50%
Total Commitments for FY2006	63,546,256.58	100.00%



¹ Includes 2 batches of CSI awardees – (1) Awarded in FY2005 & commenced in FY2006 & (2) Awarded in FY2006 & will commence in FY2007.

² As per footnote 1. The amount stated is the maximum commitment for the full award duration by NMRC to the 10 recipients of the CSI Award 2005 & 2006.

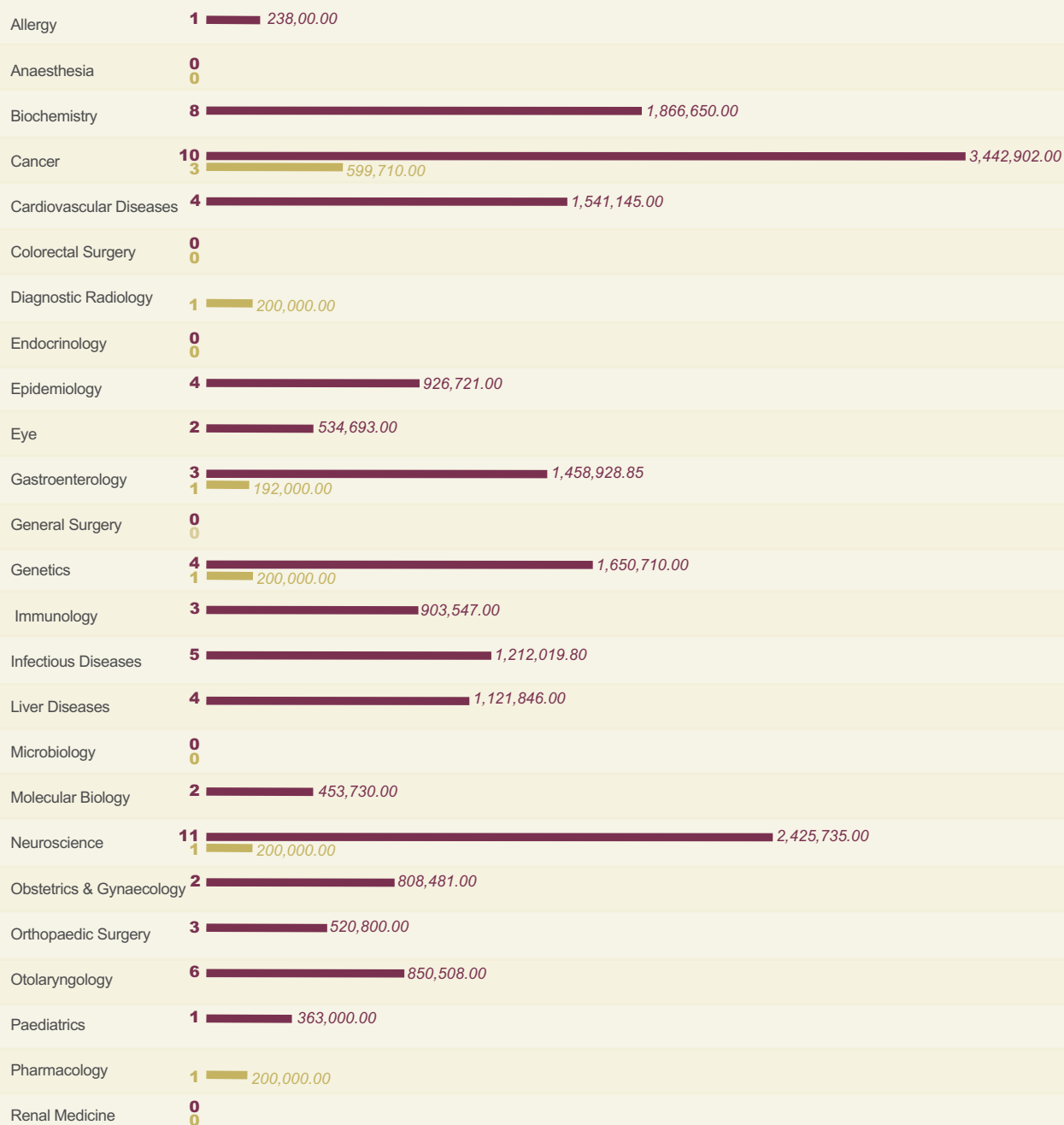
COMPETITIVE GRANTS

- (1) Individual Research Grants (IRG) are awarded to researchers over a period of up to 3 years. The commitment of S\$20.3 million will be used to support 73 projects for the 3-year period. The distribution of the IRG by institutions and the area of research are shown in Table 10 and 11 respectively (Refer to Chapter 3 on Competitive Grants).
- (2) The Clinician Scientist Investigator Award (CSI) is an annual award held jointly by NMRC and BMRC. For the grant call in FY2005, NMRC committed S\$3.49 million to support four clinician-scientists' salary and their research projects under the Junior CSI scheme (Category B). For FY2005, S\$6.50 million was committed to fund six clinician-scientists, of which four of the awardees are under the Junior CSI scheme (Category B) and two are under Senior CSI scheme (Category A) (Refer to Chapter 5 on the CSI Award).
- (3) In FY2006, NMRC committed S\$1.78 million to fund 15 fellowship & scientist awards. (Refer to Chapter 6 for the Medical Research Fellowship & Scientist Award).

Table 10 **Commitments for Competitive Grants by Institutions, FY2006**

Institution	IRG		CSI Projects		Total	
	No. of Projects	Amount (S\$)	No. of Projects	Amount (S\$)	No. of Projects	Amount (S\$)
CGH	1	299,447.00	-	-	1	299,447.00
NCC	6	1,280,543.00	-	200,000.00	7	1,480,543.00
NHC	1	276,150.00	-	-	1	276,150.00
NNI	5	1,397,450.00	-	-	5	1,397,450.00
NTU	3	1,552,393.85	-	-	3	1,552,393.85
NUH	6	827,089.00	3	591,710.00	9	1,418,799.00
NUS	38	11,669,700.80	2	400,000.00	40	12,069,700.80
SERI	3	934,693.00	-	-	3	934,693.00
SGH	7	1,497,500.00	2	400,000.00	9	1,897,500.00
SHS	1	448,000.00	-	-	1	448,000.00
TTSH	2	136,450.00	-	-	2	136,450.00
Total	73	20,319,416.65	8	1,591,710.00	81	21,911,126.65

Table 11 Commitments for IRG and CSI by Area of Research, FY2006



	NO. OF PROJECTS	TOTAL AMOUNT
IRG	73	S\$ 20,319,416.65
CSI Projects	8	S\$ 1,591,710.00

■ IRG Amount (S\$)
■ CSI Projects Amount (S\$)

BLOCK GRANTS

The commitment for Institutional Block Grants (IBG) and Enabling Grants (EG) is given on an annual basis, and any unutilised commitments will lapse at the end of the financial year. In FY2006, S\$27.8 million was committed for IBG and S\$3.7 million was committed for EG, distributed as shown in Table 12.

Table 12 **Commitment for IBG and EG by Research Centre Block Vote, FY2006**

	AMOUNT (S\$)
IBG	27,787,428.00
Clinical Trials and Epidemiology Research Unit (CTERU)	2,470,587.00
Department of Clinical Research (SGH)	2,091,832.00
Department of Experimental Surgery (SGH)	583,000.00
Division of Research (SGH)	450,000.00
Institute of Mental Health (IMH)	445,140.00
National Birth Defect Registry (NBDR)	242,344.00
National Cancer Centre (NCC)	8,064,800.00
National Heart Centre (NHC)	1,825,816.00
National Neuroscience Institute (NNI)	3,991,856.00
National University Medical Institute (NUMI)	1,240,000.00
National University of Singapore (NUS)	300,000.00
NNI-TTSH Animal facilities (ARL)	265,000.00
Nursing Research Committee (NRC)	141,900.00
Singapore Cardiac Data Bank (SCDB)	899,424.00
Singapore Eye Research Institute (SERI)	3,838,015.00
Tan Tock Seng Clinical Research Unit (CRU)	937,714.00
ENABLING GRANTS	3,668,005.00
Alexandra Hospital (AH)	722,540.00
Changi General Hospital (CGH)	351,690.00
Health Science Authority (HSA)	234,800.00
KK Women's & Children's Hospital (KKH)	620,000.00
National Dental Centre (NDC)	622,000.00
National Skin Centre (NSC)	261,975.00
National University Hospital (NUH)	855,000.00
Total	31,455,433.00

NMRC RESEARCH EXPENDITURE FOR FY2006

Of the S\$50.8 million allocated for research expenditure from MOH for FY2006, the full sum of S\$50.8 million was utilised, achieving a full 100% utilisation. The fund utilisation consisted of: S\$18.0 million for competitive grants, S\$28.0 million for IBG, S\$3.5 million for EG, S\$0.9 million for CSI and the remaining S\$0.3 million for other expenses.

Table 13 shows the distribution of research expenditure and Table 14, the expenditure for IBG and EG in FY2005.

Table 13 *Research Expenditure, FY2006*

TYPE OF GRANT	AMOUNT OF EXPENDITURE (S\$)	% OF TOTAL EXPENDITURE (S\$)
Competitive Grants	18,043,587.64	35.50%
Individual Research Projects (IRG)	18,009,856.92	
Competitive Programme Grant (CPG)	6,913.08	
SARS Grant	26,817.64	
CSI Award	899,922.92	1.77%
CSI Research Projects	266,513.87	
CSI Protected Time	633,409.05	
IBG	28,008,681.23	55.10%
Department of Experimental Surgery (SGH)	582,747.30	
Department of Clinical Research (SGH)	2,078,321.49	
Singapore Eye Research Institute (SERI)	3,838,015.00	
National University Medical Institute (NUMI)	1,401,010.18	
Singapore Cardiac Data Bank (SCDB)	922,824.03	
National University of Singapore (NUS)	411,397.66	
Institute of Mental Health (IMH)	450,855.43	
Nursing Research Committee (NRC)	141,900.00	
National Cancer Centre (NCC)	8,064,364.63	
National Heart Centre (NHC)	1,808,833.38	
National Neuroscience Institute (NNI)	3,960,888.11	
National Birth Defect Registry (NBDR)	238,369.14	
Tan Tock Seng Clinical Research Unit (CRU)	901,280.03	
NNI-TTSH Animal facilities (ARL)	207,961.54	
Division of Research (SGH)	450,000.00	
Clinical Trials and Epidemiology Research Unit (CTERU)	2,549,913.31	
Enabling Grants	3,546,628.82	6.98%
Alexandra Hospital (AH)	631,507.54	
Changi General Hospital (CGH)	351,684.43	
KK Women's & Children's Hospital (KKH)	617,069.74	
National Dental Centre (NDC)	616,422.47	
National Skin Centre (NSC)	258,129.50	
National University Hospital (NUH)	858,831.81	
Health Science Authority (HSA)	212,983.33	
Others	332,523.74	0.65%
Patenting Cost	205,996.25	
Scientific Meeting	1,200.00	
Reviewers' Honorarium	125,327.49	
Total	50,831,146.59	100.00%

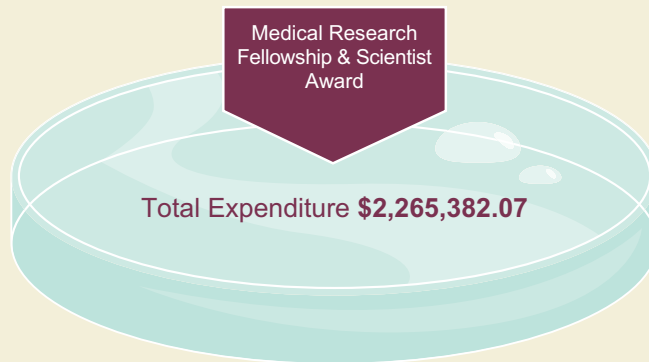
Table 14 Expenditure for IBG and EG, FY2006

Institution Block Vote	Manpower (S\$)	Equipment (S\$)	Other Expenses (S\$)	Small Grant (S\$)	Total
IBG					
DES - SGH	384,000.00	195,123.74	3,623.56	0.00	582,747.30
DCR - SGH	1,136,795.44	336,525.30	214,249.22	390751.53	2,078,321.49
SERI	2,244,400.00	418,057.56	1,118,110.80	57,446.64	3,838,015.00
NUMI	2,011,196.23	579,075.88	953,378.46	0.00	1,401,010.18
	(S\$2,142,640.39) (Revenue to be offset)				
SCDB	787,529.88	0.00	135,294.15	0.00	922,824.03
NUS	0.00	0.00	0.00	411,397.66	411,397.66
IMH	253,979.11	21,899.30	152,135.67	22841.35	450,855.43
NRC	0.00	65,640.00	0.00	76,260.00	141,900.00
NCC	5,029,371.00	583,038.83	2,451,954.8	0.00	8,064,364.63
NHC	613,699.36	1,095,508.11	99,625.91	0.00	1,808,833.38
NNI	2,355,469.71	497,154.84	1,108,263.56	0.00	3,960,888.11
NBDR	196,790.00	0.00	41,579.14	0.00	238,369.14
TTSH	426,125.95	472,334.49	2,819.59	0.00	901,280.03
NNI-TTSH ARL	98,546.99	62,236.60	47,177.95	0.00	207,961.54
DOR-SGH	0.00	450,000.00	0.00	0.00	450,000.00
Sub-Total	17,188,194.76	4,816,979.45	7,157,450.23	988,697.18	28,008,681.23
EG					
AH	90,274.50	278,556.92	56,218.21	206,457.91	631,507.54
CGH	114,898.73	126,514.04	39,372.85	70,898.81	351,684.43
KKH	130,000.10	337,282.09	6,000.00	143,787.55	617,069.74
NDC	197,574.91	0.00	6,977.45	411,870.11	616,422.47
NSC	99,264.69	85,343.00	7,386.31	66,135.50	258,129.50
NUH	53,239.98	795,601.00	9,990.83	0.00	858,831.81
HSA	0.00	0.00	0.00	66,000.00	66,000.00
HSACT	2,809.17	89,376.00	54,798.16	0.00	146,983.33
Sub-Total	688,062.08	1,712,673.05	180,743.81	965,149.88	3,546,628.82
Grand Total	17,876,256.84	6,529,652.50	7,338,194.04	1,953,847.06	31,555,310.05

EXPENDITURE FOR NMRC MEDICAL RESEARCH FELLOWSHIP & SCIENTIST AWARD

Table 15 shows the expenditure for Medical Research Fellowship & Scientist Award in FY2006. The expenditure includes those commitments made before and in FY2006. The expenditure was paid from previous years' donations from STB and the additional \$1.0 million obtained in FY2006.

Table 15 *Expenditure for Medical Research Fellowship & Scientist Award, FY2006*





NATIONAL MEDICAL RESEARCH COUNCIL

11 Biopolis Way #09-10/11 Helios Singapore 138667 • T: 6325 8130 • F: 6324 3735 • www.nmrc.gov.sg