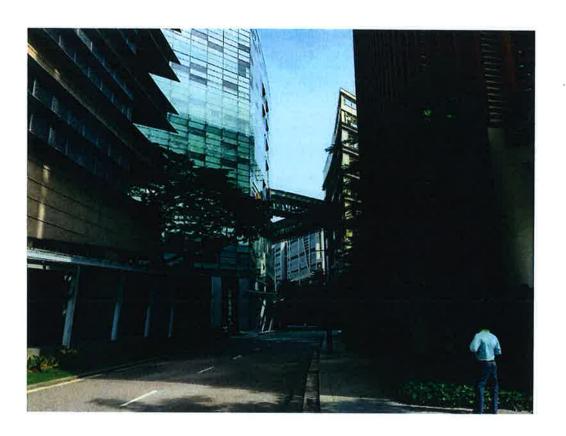
The Christchurch Health Precinct Study Tour to Singapore

November 10-14, 2014



Report for CERA/CCDU and MBIE lan Town and Ingrid van Elst

December 2014

Background

The proposal to undertake a study tour to Singapore was initiated by Professor Sir Peter Gluckman, the Prime Minister's Chief Science Advisor. Sir Peter considered that the emergence of Academic Health Centres in Singapore has matured and was worthy of detailed assessment. Further, the significant investment in research and development through A-STAR provides one example of how a government can invest in a long term strategy.

The visit was hosted jointly by the Biomedical Research Council and the New Zealand High Commission.

The overall approach was to undertake detailed visits to A*STAR on Days 1 and 2 then spend the balance of the week engaging with the health and education sector institutions.

Acknowledgements

Many people contributed in many ways to the success of the visit:

- 1. Professor Sir Peter Gluckman for the introductions to A*STAR and NZ High Commissioner.
- 2. HE Mrs Bernadette Cavanagh, the New Zealand High Commissioner in Singapore.
- 3. Associate Professor Tan Sze Wee for introductions and suggestions for the programme.
- 4. Dr Marvin Lee for his assistance with the programme.
- 5. Professor Mark Richards for his advice and assistance with the report.
- 6. Paula Skilling at the NZHC for her meticulous research and planning.
- 7. New Zealand High Commission staff for their interest and support.
- 8. CCDU and MBIE for supporting the costs of the delegates.

Programme

A copy of the final programme for the visit is in Appendix A

Disclaimer

The views expressed in this report are those of the Authors alone.

This Report does not represent Government policy and the findings are not binding on CCDU or MBIE.

Notes of Meetings

1. Meeting with New Zealand High Commission

HE Mrs Bernadette Cavanagh and colleagues from NZTE

- Paula Skilling, Policy Advisor
- Tony Robinson, Trade Commissioner
- Nicole Sze, Trade Advisor

Provided a briefing on the rationale for the delegation, summarised the collateral available and some of the expected outcomes from the visit.

NZHC staff provided contextual information about relationships between Singapore and New Zealand in the Health and Education sectors.

2. Courtesy Call to A*STAR

Joint meeting between NZ High Commissioner, Delegation members and Associate Prof Tan Sze Wee, Deputy Director of the Biomedical Research Council.

The High Commissioner rehearsed recent engagements between A*STAR and New Zealand Government agencies including the Memorandum Of Agreement that has been entered into in the food science areas (joint funding from International Relations fund and A*STAR).

3. Meeting with A*STAR

Associate Professor Tan Sze Wee, Dr Marvin Lee and delegation

Prof TAN explained the history of A*STAR and the overarching philosophy of the Singaporean Government.

Mr S. Iswaran, Second Minister for Trade and Industry for Singapore noted the following in 2013: "Under the Research, Innovation and Enterprise 2015 (RIE2015) master plan, the government has committed to invest \$16.1 billion between 2011 and 2015 to support R&D in Singapore. This public expenditure on R&D (PUBERD), representing 1 per cent of Singapore's GDP, is aimed at raising the overall gross expenditure on R&D (GERD) by catalysing private sector R&D."

The approach at a high level was to make a substantial multibillion dollar investment in facilities and top talent with the express aim of attracting major multinational corporations to a number of key precincts Biopolis (Biosciences) and Fusionopolis (Engineering and Technology).

Research themes have been evolving – initially a large investment in pharmacological discovery has not proved sustainable with the initial companies such as Elli Lilly pulling out after 5 years.

The Biomedical Research Council has adopted the Academic Health Science systems approach. The key areas identified for future research include pharmaceutical manufacturing, biologics, epigenetics, MedTech, and Health IT.

Two big projects have been initiated:

- 1. GUSTO longitudinal cohort
- 2. ATTRaCT a project to identify and validate novel pathways and targets in cardiovascular disease progression

Across the wider Research Science and Technology sectors the Government coordinates with other key agencies in a strategic manner including the Economic Development Board (International partnerships) and SPRING Singapore (a Ministry of Trade and Industry agency).

In the next (5th wave) of Government funding, A*STAR will move to a strong emphasis on translational research with an emphasis on food, nutrition and consumer care; along with MedTech.

As projects mature and gain traction further funding is available for partnerships with industry including a master agreement, governance committee and funding. A recent example has been the move by Proctor and Gamble to set up a major presence in Singapore.

For a copy of the A*STAR slides see Appendix B

4. Meeting with Exploit Technologies Ltd (ETPL)

Dr Muhammad Tani Bin Tabiin – Senior Vice-President, Biomedical Sciences Ltd

The commercialisation ecosystem has 3 major elements which work to support commercialisation and engagement with the private sector.

- SPRING Singapore
- FTPI
- Economic Development Board (EDB)

SPRING Singapore has recently developed a Master IP agreement to ensure a consistent and even handed approach to all potential partners. Consortia are generally developed on the basis of non-exclusive world-wide licensing agreements.

The strategy has been for the government to build facilities to attract multinational corporations then in time hands the facilities over to them on a commercial basis.

ETPL delivers a range of services to support the ecosystem including pipeline management, horizon scanning, research workshops and provides oversight of major initiatives through steering groups.

Human capacity is also enhanced through the A*STAR scholarship scheme which includes a rotation through ETPL.

ETPL has 3 main divisions:

- 1. IP Management Division
- 2. Commercial Division
- 3. Investment and spin-outs Division

A significant amount of funding is available for "gap" funding which essentially means providing funding through a project life cycle to ensure commercialisation is successful – grants may vary from a few thousand to several million dollars.

All scientific papers and conference presentations are screened by ETPL for commercial potential and to allow time for IP protection to be put in place. Generally takes about 2 months maximum.

Follow-up: ETPL would consider hosting an intern from New Zealand by agreement.

For a copy of the ETPL slides, see Appendix C

5. Meeting with Clinical Nutrition Research centre (CNRC)

Professor Jeya Henry, Director and Dr Melvin Leow

The CNRC was established 5 years ago as a major investment in nutrition research. The 3 main areas of focus are

- 1. Optimal growth
- 2. Reduction in chronic diseases
- 3. Foods that improve human health

Specific research into the "Asian Phenotype" has been a fertile area for research looking for example at the emergence of pre-diabetes as a major issue.

The staff numbers are expanding with several recent key appointments and a total complement of 40 expected. The laboratory has state-of-the –art equipment including whole body calorimetry, DEXA scanning and support wet laboratories.

New Zealand researchers are involved in 5 major projects in collaboration with CNRC as part of an MOA between A*STAR and MBIE. These projects are going well and an expanded relationship may be possible. Sir Peter Gluckman has been instrumental in setting up these arrangements.

Follow up: There are opportunities to link the Singapore work with the wider food science and technology work in NZ both a Food HQ (Massey), the Lincoln Hub and the Riddet Centre.

For a copy of the CNRC slides see Appendix D

6. Meeting with Clinical Imaging Research Centre (CIRC)

Dr John Totman, Head of Imaging Operations

The CIRC was founded in 2008 and after a slow start Professor David Townsend was appointed Director in 2012. There is a key vacancy for the role of Research Director.

The 2000 sq m centre has state-of-the-art equipment in terms of Magnetic Resonance Imaging (MRI); Positive Emission Tomography (PET); PET/MRI; and PET/CT. They have installed a cyclotron to generate their own short life radioisotopes for PET scanning.

Currently the Centre is supporting 50+ projects including animal and human work. Some of the studies in human subjects are progressing only slowly because of some barriers to recruitment amongst the older generation.

Special interest areas include head and neck cancer (high prevalence amongst Asian communities) and monitoring the treatment of tuberculosis.

Follow up:

- 1. John is very willing to assist with the design of the proposed Christchurch Imaging suite and has already met with Dr Ross Keenan from the Pacific Radiology Group.
- 2. John may be able to assist with discussions being held with GE Healthcare although their principal relationship is with Siemens.

For a copy of the CIRC slides, see Appendix E

7. Meeting with Eastern Health Alliance

Mr T K Udairam, Group CEO and colleagues

Mr Udairam visited New Zealand as part of a Singaporean delegation earlier in 2014.

The EHA, one of 6 Regional Health Systems serves a population of some 1.4M. The Changi General Hospital is the key tertiary facility. Overall the alliance is asset light and operates through a variety of partnerships each with their own facilities.

They run the Health Management Unit which aims to support early discharge from hospital and uses telephone follow-up to maintain contact.

The focus for the next few years is to strengthen primary care, focus on chronic diseases, and provide support for vulnerable and at-risk patient groups.

Specific initiative include:

- 1. Screening all residents for pre-diabetes, hypertension and hyperlipidaemia
- 2. GP first promoting the GP as the first place to go for health requirements being assisted by a subsidy for the GP and provision of rapid access to specialist advice (158/300+ GPs are enrolled)
- 3. Neighbours for Active Living using trained volunteers to assist with home cares and hospice care
- 4. Targeting "frequent fliers" those with multiple hospital admissions.

The EHA has also been identified as a test bed for health technologies in partnership with A*STAR. Have developed an Innovation centre where they are working with CIMIT in Boston to prototype technologies including a stand-alone measuring station that can assess BP, height, weight, Sa02. They are also experimenting with in-home sensors to detect falls. Health IT initiatives are also being developed including work on a patient portal.

Follow-up: Ongoing contacts about smart technologies and Health IT.

8. Meeting with Yong Loo Lin School of Medicine, National University of Singapore

Associate Professor Yeoh Khay Guan, Dean; Professor Lee Chuen Neng, Head of Surgery, Professor Mark Richards, Director Cardiovascular Research Institute, and colleagues

This is the main Medical School for Singapore and has very strong research programmes in cardiovascular, surgery, cancer, infectious diseases and neurosciences. A recent initiative being led by Professor Lee is a MERCI, a centre to focus on medical technologies and bioengineering. In partnership with A-STAR and the National Medical Research Council (NMRC) the emphasis will be on translational research.

The school has partnerships with the Havard Beth-Israel system in Boston and Cambridge UK with regular collaborative research symposia.

The School is poised to take advantage of the new Strategic Positioning Fund which will allow more strategic iterative research programmes to be established in existing areas of strength.

Follow-up: The existing model whereby Professor Richards acts as the Director of the Cardiovascular Research Institute of the National University Heart Centre Singapore whilst continuing as the Director of the Christchurch Heart Institute at the University of Otago, Christchurch has worked well and could be expanded or emulated.

9. Meeting with Lee Kong Chian School of Medicine, National Technical University

Professor James Best, Dean, Associate Professor Josip Car

This is a very new initiative been Nanyang Technological University (NTU) and Imperial College London. Professor Best has recently commenced as the founding Dean. Josip Car has been the key link with Imperial. The curriculum will be focussed on modern science and technology with team based learning, simulation and e-learning featuring strongly. Curriculum development is being led by Imperial.

They will be deploying the adaptive e-learning platform Smart Sparrow https://www.smartsparrow.com/ which allows collaboration amongst teachers and students.

Research will initially focus on specific themes which are reflected in the nearby institutes which include national centres for Infectious Diseases, Skin, Neurosciences and Mental Health. A new initiative led by Josip Car will be a Health Services Research Institute. Other plan include a centre for Regenerative Medicine and a Phenome Centre focussing on metabolic issues.

The links with NTU will allow a strong emphasis on MedTech in association with A-STAR.

Follow-up: Most likely in the e-learning area. Ian to discuss with Professor Tim Wilkinson at University of Otago who is the lead for the Faculty of Medicine undergraduate curriculum. Health Services Research is also an area where New Zealand colleagues could collaborate.

10.Meeting with SPRING Singapore

Executive Director, Edwin Chow and colleagues

SPRING Singapore is a key player in the innovation ecosystem providing a wide range of services and funding for commercialisation. Their work covers the micro and SME territory and they are part of the Ministry of Trade and Industry. The strategy is "Start, Scale, Soar" and there is major emphasis is

on what they term Gap funding to ensure the company's progress to commercialisation is smooth and un-interrupted. They have platforms to support this through:

- Innovation Strategy: Innovation which aims to enhance translation and develop effective
 IP Management (such as development of a Master IP agreement for cluster members);
 and
- (ii) Enterprise Strategy: Enterprise aims to develop technology through funding and proactively encourage entrepreneurship.

Centres of Innovation offer technical consultancy and facilities to develop technical projects and solutions.

Metrics included the establishment of 7 Centres of Innovation, funding of over 1600 projects and supporting over 3000 SMEs. Future focus will be in MedTech (A-*STAR) and GreenTech.

Follow up: Potential for an intern placement from New Zealand.

11.Meeting with SingHealth

Dr Ivy Ng, Chief Executive; Prof KH Tan, Academic Medicine lead; Quay Keng Wah, Director Strategy

SingHealth is the largest of the academic clusters and manages the relationship with Duke. The focus is on integrated care.

The journey from a clinical centre to an academic centre was reviewed with a frank discussion of the challenges and change management process. The relationship with Duke and development of the graduate entry medical programme has been the cornerstone of research aligned with SGH aligning the teaching and research alongside the Duke leading themes.

Two Academic Institutes have been established. AMEI for education and AMRI for research. These provide underpinning support for their respective areas.

The new building "Academia" consists of 2 towers carefully planned to link researchers with clinical scientists. The lower floors comprise a lecture suite, extensive simulation facilities including endoscopy simulators along with ward based environment for training nurses.

HR interventions have included developing shared values and mission statement and progressively implementing IEAs defining teaching/clinical/research load:

- (i) Clinician teacher (90:10) support teaching, no research
- (ii) Clinician Educator (50:50) lead reaching and curriculum
- (iii) Clinician scientist (up to 75:25) principal investigators and research leaders

Performance reviews now conducted jointly with Duke NUS and all HODs selected by a joint panel to ensure support for teaching and research.

SingHealth is very clearly 100% committed to their role an Academic Medical Centre

Follow-up: Likely to be mainly through the Duke: NUS connections

For slides see Appendix F

12. Meeting with Ministry of Health

Associate Professor Low Cheng Ooi, Chief Medical Informatics Officer

Discussed global trends in Health IT and recent initiatives being undertaken in Singapore. There is good progress towards an electronic medical record for all citizens. GPs have been somewhat resistant to this initiative as they tend to used paper based systems. They are keen to use mHealth approaches to support public health initiatives.

The MOH has developed a 2020 Health IT Master Plan which will include establishing a health portal for all citizens.

Follow up: Nil specific

13. Meeting with the National Medical Research Council

Professor, Tan Say Beng, Executive Director

The NMRC provides a wide range of funds for health research. The overall RS &T budget for the 2015 5 year cycle will be in the region of \$16.1B with about \$4.5B for biomedical research. The NMRC has a primary focus on clinical research and funds both projects and programmes. Although the NMTC requires reports the accountability for research outcomes is through the Institute/Medical School.

The 3 main funding streams are

- 1. Talent development and human capital (\$353M in 2014)
- 2. Research grants and programmes (\$810M)
- 3. Enablers and infrastructure (\$40M)

Co-funding from the Ministry of Health and A*STAR is often coordinated.

Other initiatives include a National Health Innovation Centre and funding for early phase Clinical Trials.

Follow up: Explore the option of International Partnership Funding

For a copy of slides see Appendix G

14. Meeting with Professor Philip Choo

Deputy Group CEO of Regional health, National Healthcare Group, Tan Tock Seng Hospital

Professor Choo was a participant in the Singapore visits to New Zealand earlier this year.

He summarised the mandate of NHG with an emphasis on the community engagement and initiatives. The relationship with the Lee Kong Chian School of Medicine is evolving and research will initially focus on the existing research centres (see above meeting with J Best).

He anticipates that they will have 15-30 clinician scientists and that all staff will be involved in a small amount of teaching.

Follow-up - Nil specific

15. Duke: NUS Medical School

Professor Pat Casey, Vice-Dean Research (And founding Acting Dean)

Prof Casey was the "the pioneer" for the partnership and moved to Singapore in 2005 to lead the Duke initiative. There are now 55 FTE faculty of whom a small number came from Duke. There are 120 joint appointments and some 1120 fractional appointment.

The first intake of medical students was in 2007 with a class size of 65 students. 20% of students have an undergraduate degree in engineering. The aim is to have 30% international students. Premedical courses are now being delivered at NUS and NTU.

The Medical curriculum has been devised specifically for this initiative. All content is delivered on a CD-ROM at the beginning of the academic year and classes focus on problem based learning with small group teams.

A PhD and intercalated MBBS-PhD programme has also started with everyone doing a foundation biomedical semester before selecting their research project. All students will spend one year on research.

All students both medical and research will get the opportunity to spend some time on the Duke, North Carolina campus in the US.

A new initiative is the Centre for Technology development headed by Dr David Epstein which is scanning for technology to commercialise and will be working in collaboration with A-STAR. Success factors have been excellent leadership and careful selection of Heads of Department, who are appointed by a joint SingHealth:Duke Committee.

Follow-up:

- 1. Investigate possible elearning collaborations.
- 2. Discuss a placement of 1-2 New Zealand students into Duke: NUS programme (leveraging off the good standing of NZ engineering graduates).
- Contact Dr Epstein to discuss MedTech collaborations.

For a copy of the slides see Appendix H

16.Debrief with High Commissioner and Staff

This final session was a useful opportunity to review the week's activities and summarise our impressions, findings and recommendations. The latter with a focus on opportunities for those involved in the Health precinct and New Zealand institutions more generally to collaborate with colleagues across the Singapore health and research systems.

The visits and meetings provided a comprehensive overview of the health and biomedical research environment in Singapore.

Conclusions and Recommendations

1. The strengthening role of Academic Medical Centres

Over the last 5 years there has been a real focus on developing strategic relationships between the Health and Research systems. This is best exemplified by the two lead clusters SIngHealth and the National Health group. Teaching is increasingly seen as something that all doctors contribute to and the emerging role of clinician-scientist will further lift capacity. The framework has the potential to yield increasing benefits to patients through translational research.

2. The Role of A*STAR

A*STAR and its various institutes, research centres and clusters represents a well-coordinated strategy to lift the performance and outcomes from of biomedical research across the Singapore research sector. There is evidence of an increasingly integrated strategy that includes IP management and commercialisation services, which are well organised and funded, with few apparent gaps. It is hoped that this ecosystem will mature and progressively lead to a commercial return on the investment.

3. New Zealand is Highly Regarded

New Zealand has a relatively high profile amongst clinicians and researchers in the various hospital/university/A*STAR institutions. There is a recognition that New Zealand Medical Schools and Hospitals are of a high standard but we would not be 1st choice partners purely on merit/global rankings.

4. Building Stronger Links Between Singapore and New Zealand

Further relationships will most likely have to be built through individual researcher-to researcher-connections supported by New Zealand Government institutions and agencies. Current initiatives such as the A*STAR:MBIE Memorandum Of Agreement around food science and nutrition are an excellent model and have potential for broader application.

5. Specific Areas to Consider:

- (a) Current linkages between the Christchurch Heart Institute (CHI) and the Cardiovascular Research Institute of the National University Heart Centre Singapore could be expanded to include participation by cardiovascular investigators in Auckland, Wellington and Dunedin who are already linked in collaborative basic and clinical research projects led by the CHI. Professor Richards has played a leading role in the establishment of the ATTRaCT project which links clinical and basic science researchers across Singapore. This provides a potential conduit for many collaborations including data pooling, development of common protocols between New Zealand and Singapore, technology transfer and other useful research interchanges.
- (b) Large animal imaging. Colour CT and MRI/PET modalities for cardiac imaging. There are opportunities to undertake new work on models of heart failure and ischaemic heart disease in sheep/pigs.
- (c) Medical devices and technologies (based on matching/linking health and engineering research in the two countries).
- (d) Medical Imaging including the emerging project with the University of Canterbury Spectral CT scanning in conjunction with GE Healthcare.
- (e) Infectious Diseases based on the New Zealand expertise in rapid diagnostic techniques (in conjunction with Duke University).
- (f) Health IT, ehealth/mhealth opportunities. The Singaporean health sector is moving to provide a national health identity number which would create

opportunities for New Zealand and Singaporean authorities to conduct outcome based population health research.

(g) Health Services research is in it's infancy in Singapore and could prove a useful collaboration with New Zealand.

6. Other Opportunities

Placement of one or more New Zealand engineering graduates in the Duke: NUS graduate medical programme. A scholarship could be developed for Auckland or Canterbury engineering students to enter the graduate programme as an international student with a view to them returning to New Zealand to take up leadership roles in the public sector.

7. Government Strategies

- a. New Zealand Government initiatives and additional funding could make a dramatic difference to the impression of New Zealand in Singapore and lead to enhanced co-investment by A*STAR and other institution in collaborative research projects.
- **b.** Briefings of Key New Zealand Ministers (Ministers Joyce/Brownlee/Coleman) is critical to the success of the health precinct project and the related international opportunities.
- c. NMRC Singapore is open to international cooperation and co-funding.
- d. The Health Precinct can be used as case study for New Zealand Inc initiatives
- e. Links with CoREs and National Science Challenges should be articulated

8. Other Considerations

- a. Further visits by senior Medical School/Health leaders in one or more specific areas of potential collaboration.
- b. Invitations to key leaders from Singapore to visit New Zealand in 2015.
- c. Consideration of using the 50th Anniversary Celebrations of Singapore to announce a significant initiative in the medical research area.

Ian Town and Ingrid van Elst

December 2014

Selected Photographs



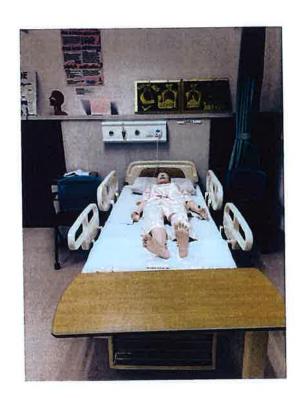
Visiting Group (I Town, I van Elst P Skilling) with Professor Tan, SingHealth



Academia Simulation Suite
Colonoscopy Training Station

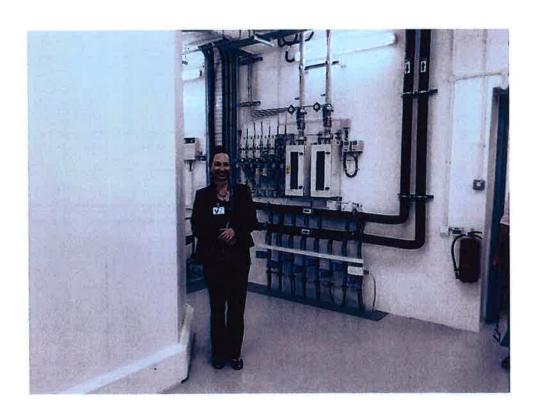


Academia Clinical Simulation Suite Endoscopy Stations



Academia Clinical Simulation Suite
Ward environment with mannikin





Clinical Imaging Research Centre

Cyclotron and PET-MRI Scanner

Appendix A: Singapore Delegation Programme





New Zealand High Commission 1 George Street Level 21-04 Singapore 049145 Tel: +65 6235 9966

Professor Ian Town 9-14 November 2014

Accompanied by:

Ms Ingrid VAN ELST, Principal Adviser, Science and Innovation Policy Ministry of Business, Innovation & Employment, New Zealand

12-14 November also accompanied by: Paula Skilling, Policy Adviser, NZHC Singapore Ms Nicole Sze, Business Development Manager (ICT and Health), NZTE Singapore

Sunday 9 November

Arrive in Singapore on Singapore Airlines flight SQ 298 at 5:40PM Own arrangements for taxi to hotel

Accommodation:

Hotel Jen Singapore, 1A Cuscaden road, Singapore 249716

Telephone: +65 65 67382222 (Reservations)

Facsimile: +65 65 68314314

Monday 10 Nove	Monday 10 November Own arrangements with A* STAR from noon	
8:30-9:00am	Own arrangements to transit by taxi to NZHC: pre-book from hotel (20-30 minute	
9:00-9:45am	NZ Inc Bernadette Cavanagh NZ High Commissioner Paula Skilling Policy Adviser, NZHC Tony Robinson NZTE Trade Commissioner Nicole Sze	Venue VIP Room New Zealand High Commission One George Street #21-04 Singapore 049145 Tel: NZHC +65 6235 9966
9:45-10:30am	NZTE Health & ICT Work in NZHC offices	NZHC
10:30-11:00am	NZHC vehicle for transit	
11:00-11:30am	A/Prof Tan Sze Wee Deputy Executive Director	Venue

	Biomedical Research Council (BMRC) A*STAR	Meeting Room 2, L21 Connexis North Tower Fusionopolis Way, Singapore 138632
	Dr Marvin Lee BMRC A*STAR Bernadette Cavanagh NZ High Commissioner Paula Skilling Policy Adviser, NZHC Nicole Sze NZTE Health & ICT	Contact: Dr Marvin Lee DID: 6826 6132 Mob: 9146 1547
11:00-11:30am	NZHC vehicle returns High Commissioner, NZH NZ visitors remain at BMRC	IC and NZTE staff
11:30am-12:30pm	A/Prof Tan Sze Wee Deputy Executive Director Biomedical Research Council (BMRC) A*STAR Dr Marvin Lee BMRC A*STAR	Venue Meeting Room 2, L21 Connexis North Tower Fusionopolis Way, Singapore 138632 Contact: Dr Marvin Lee DID: 6826 6132 Mob: 9146 1547
12:30-1:30pm	Own arrangements for lunch and transit	
2:00-3:30pm	Dr Muhammad Tani Bin Tabiin Senior Vice President Biomedical Sciences Division Exploit Technologies Pte Ltd	Venue Einstein Room, Level 9 Matrix Building Biopolis Contact: Dr Marvin Lee DID: 6826 6132 Mob: 9146 1547
3:30-6:10pm	Own arrangements to transit by taxi	
6:10-6:30pm	Own arrangements to walk or taxi 1km from Hotel Jen to Forum	
6:30pm onwards	A*STAR: Dinner Meeting	Venue

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	DED DIVING	583 Orchard Road, B1-13
		Forum the Shopping Mall Singapore 238884 Contact: Dr Marvin Lee
	Chairman, University Surgical Cluster, National University Health System, Singapore Head, Department of Surgery, School of Medicine, National University of Singapore	DID: 6826 6132 Mob: 9146 1547
	Own arrangements to walk or transit by taxi to	hotel
Tuesday 11 Novem		S. L. (1/20 minutes)
3:45am	Own arrangements to transit by taxi: pre-book	
)9.30am–11.00am	A*STAR: Meeting with Clinical Nutrition Research Centre (CNRC) Prof Jeyakumar Henry (D CNRC) Dr Melvin Leow (Growth, Development and Metabolism Programme Clinical Investigator)	CNRC Centre for Translational Medicine 14 Medical Drive #07-02 MD 6 Building, Yong Loo Lin School of Medicine Singapore 117599 POC: Ms Aminah Abu Bakar Tel: 6407 0778 or 90667451. Aminah will meet guests in the lobby of MD6.
11:00am-2:00pm	Own arrangements	
2.00pm–4.00pm	A*STAR: Meeting with Clinical Imaging Research Centre (CIRC) Dr John Totman (Head of Imaging Operations, CIRC)	CIRC Centre for Translational Medicine 14 Medical Drive, #B1-01, Singapore 117599 POC: Dr John Totman Tel: 6516 5057
4:00pm	Own arrangements to transit by taxi to hotel	
Wednesday 12 No		
8:10am	NZHC vehicle departs One George St (Paula) to collect delegation at Hotel Jen, then proceeds to Tampines	

0.00-10:00am	Mr T K Udairam	Venue
	Group CEO Eastern Health Alliance	Boardroom
	Edstern Hearth Amarice	Eastern Health Alliance Office
8		No: 5, Tampines Central 1
		# 08 -01/5
		Tampines Plaza
		Singapore 529541
		Contact:
		Teoh Lee Hua
		Exec. Secretary
		DID: 6850 2889
		Lee.Hua.Teoh@easternhealth.sg
		http://www.easternhealth.sg
10:00-10:45am	NZHC vehicle for transit	
11:00-12:00pm	Associate Professor YEOH Khay Guan	Venue
(May finish	Dean and Deputy CE	National University of Singapore
11:45am)	Yong Loo Lin School of Medicine	Meeting Room T11-04, level 11
	National University of Singapore	NUHS Tower Block
	Burf LEE Church Nong	1E Kent Ridge Road
	Prof LEE Chuen Neng Chair, Medical Engineering Research and	TE Neme Mage Mode
	Commercialisation Initiative (MERCI)	Contact:
	National University of Singapore	Tracy Tham
	National University of Singapore	PA to A/Prof Yeoh Khay Guan
		DID: 6772 3732
		tracytham@nus.edu.sg http://www.med.nus.edu.sg/corporate
		NUHS to advise on parking – front porch Meet Nicole Sze in foyer before proceeding to meeting.
12:00-12:45	NZHC vehicle for transit (Paula, Nicole, Ian, I	ngrid for the remainder of the day)
1:00-2:00pm	Professor James Best	Venue
1.00-2.00pm	Dean, Lee Kong Chian School of Medicine	
	Nanyang Technological University	Lee Kong Chian School of Medicine
		Nanyang Technological University
	A/Prof Josip Car	Novena Campus
	Director of Health Services and Outcomes	Dean's meeting room, Level 3
	Research Programme	11 Mandalay Road
	Nanyang Technological University	Singapore 308232
		Contact:
		Ms LEOW Hui Ling
		PA to Dean
		Tel: 6592-3221 or 6592 2653

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		Email: lhl@ntu.edu.sg www.lkcmedicine.ntu.edu.sg
2:00-2:30pm	NZHC vehicle for transit	
3:00-4:00pm	Edwin Chow Executive Director Innovations & Start-Ups Group Spring Singapore edwin_chow@spring.gov.sg DID for ED: 6279 1831	SPRING Singapore Boardroom, Level 20 #20-01 Connexis South 1 Fusionopolis Way Contact: Ms Sock Leng TAN PA to Edwin Chow Email: tan sock leng@spring.gov.sg DID: 6279 3601 (Exchange photo ID for a visitor pass at Connexis South Tower Security. See attached map.)
4:00pm	NZHC vehicle for transit to hotel and NZHC	
Thursday 13 Nov		to collect delegation at Untelling 10
8:15am	NZTE (Andy) departs One George St (Paula) to collect delegation at Hotel Jen, 1A Cuscaden Road, then proceeds to Singapore Health Services.	
9:00-10:00am	Prof Ivy Ng Group CEO SingHealth Prof Tan Kok Hian Group Director, Academic Medicine Ms Quay Keng Wah Director, Office of Strategy Management Ms Kathryn Ng Director, Marketing Communications	Singapore Health Services 31 Third Hospital Avenue #03-03 Bowyer Block C Singapore 168753 See attached map. Take the lift located between the Eye Centre (SNEC) and the Mistri Wing to Level 3, and inform reception. Contact: Colleen Lo Executive Secretary to GCEO Singapore Health Services DID: (65) 6557-4907 colleen.lo.s.y@singhealth.com.sg

10:00am-10:30am	NZTE (Andy) vehicle returns Paula to NZHC. NZ health delegation may accompany to work from NZHC, or arrange private appointments and transport	
12:30pm	NZTE (Andy) vehicle departs One George St for Harbourfront	
1:00-2:00pm	Ministry of Health	Venue
	Prof. Low Cheng Ooi Chief Information Officer	MOH Holdings Meeting room M11-08, 11th floor 1 Maritime Square, #11-25 HarbourFront Centre (via lobby C) Singapore 099253. Contact: Chua Yong Khian Manager (International Cooperation) Public Health Group Ministry of Health (65) 6325 1633 CHUA_Yong_Khian@moh.gov.sg
2:00-2:30pm	Individual arrangements: Quick lunch at Harbourfront	
2:30-3:00pm	NZTE vehicle for Paula and NZ delegation leave Harbourfront for NMRC	
2:30-3:00pm	NZHC vehicle for High Commissioner and Nicole departs One George St for Helios.	
3:00-3:45pm	Prof Tan Say Beng Executive Director National Medical Research Council (NMRC) HE Bernadette Cavanagh New Zealand High Commissioner	National Medical Research Council Conference Room, 11 Biopolis Way #09-10/11 Helios Building Singapore 138667 Contact: PA Ms Shanthi BALA (65) 6325 8135 Shanthi BALA@moh.gov.sg All meet at ground floor of Helios before proceeding
3:45-4:15pm	NZHC vehicle transits High Commissioner	
3:45-4:15pm	NZTE vehicle (Andy) returns from Helios with health delegation	
Friday 14 Novem		
9:20am	NZHC vehicle (Paula) departs One George St to collect delegation at Hotel Jen, then proceeds to appointment	

Γ

Π

10:00am-10:45am	Prof Philip CHOO	Venue
	Deputy Group CEO, Regional Health National Healthcare Group	Tan Tock Seng Hospital Annex 1, Level 2, Executive Office No. 11 Jalan Tan Tock Seng Singapore 308433
		Contact: Joan Khoo Secretary to Prof Choo DID: 63578101 joan khoo@ttsh.com.sg Meet Nicole at entrance before proceeding
10:45-11:00am	NZHC vehicle for transit	7
11:00am-12:00	Prof Patrick J. CASEY	Venue
noon	Senior Vice Dean for Research Duke-NUS Graduate Medical School	Duke-NUS Graduate Medical School 10A meeting room, Level 10 8 College Road Singapore 169857 Contact: Dolliss Ang, PA Tel: 65167251 Email: dolliss.ang@duke-nus.edu.sg Call Dolliss on arrival at the building and she will come down to collect.
12:00-12:30	NZHC vehicle for transit to visitors' hotel (if desired) and to NZHC	
12:30-3:00pm	Own arrangements for transit to NZHC, if required	
3:00-4:00pm	NZ Inc debrief	Venue New Zealand High Commission One George Street #21-04 Singapore 049145 Tel: NZHC +65 6235 9966
4:00pm	Own arrangements to return to hotel/airport	
7:45pm	Depart Singapore for Christchurch Singapore Airlines Flight SQ 297	

Appendix B: Singapore: Creating the Biopolis of Asia (A*STAR Presentation)



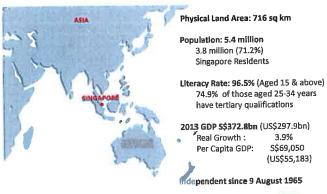
Singapore : Creating the Biopolis of Asia

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CREATING AND INCOVATION & CONORD



An Overview of Singapore



CREATING AN BRIOVATION ECONOR



Singapore's Competitive Advantage



CHINOYATION ECONOMY



1

Overview of Singapore's Economy and R&D Framework

CREATING AN INNOVATION ECONOMY



Singapore, A Vibrant Business Hub



Multinational Corporations 60% with global or regional headquarters.

▶ 37,400

International Companies Including 3,200 from China, 4,400 from India, and 7,900 from ASEAN.

170,000

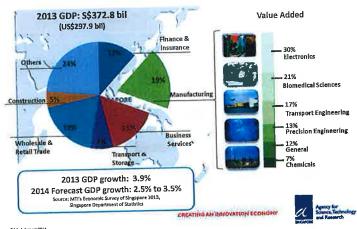
Small & Medium Enterprises

1,000 identified with the goal of growing revenues to \$\$100

Source: Accounting & Corporate Regulatory
Authority (2Q 2010), Department of Statistics,

CREATING AN INNOVATION ECONOMIS

Singapore's Economy Today



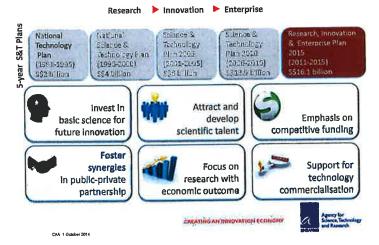
R&D Landscape in Singapore

Singapore's R&D Framework

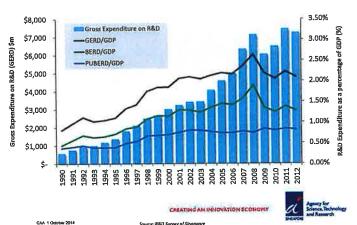


CREATING AN INNOVATION ECONOMY

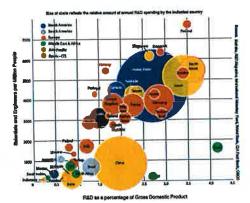
RIE 2015



Singapore's R&D Expenditure



Research & Innovation Intensity - 2013



CREATING AN INNOVATION ECONOMY

Among by San Rabanan and Rabanan Singapore's Biomedical Sciences Initiative

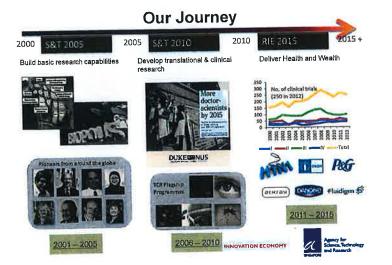




Why Biomedical Sciences (BMS)? 280 260 70 240 BMS identified as the 4th Pillar of the Manufacturing 220 60 200 50 180 160 Asian Financial Crisis: New area of growth was needed to boost and diversify the Singapore economy 140 120 30 🗟 100 20 ह Technology Plan 1991 60 1960: GDP: US\$0.7 bil 9550 40 20 10 Per Capita GDP: US\$428 2005 2010 CREATING AN INNOVATION ECONOMY

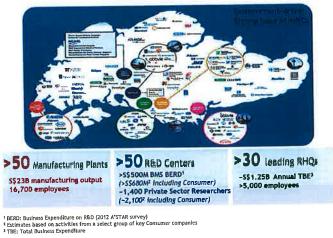
Creating the Biopolis of Asia





Biomedical Sciences Industry

Where are we now?



Manufacturing Landscape

BMS R&D Landscape

TODAY: Strong Public Research Capabilities / Infrastructure







Lonzagroup Bulk biologics manufacturing plant Cell Therapy Facility





















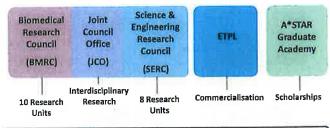
Manufacturing for the world

- 28 commercial scale manufacturing facilities 7 of the top 10 Big Pharma SGD 29.7 billion manufacturing output in 2012



A*STAR

Mission: Fostering World-Class Scientific Research and Talent for a Vibrant, Knowledge-Based Singapore

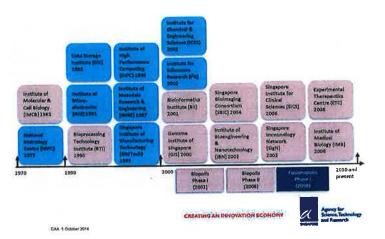


>5,300 Staff >4,300 Researchers, Engineers and Technical Support Staff
>40% of whom come from ~60 countries



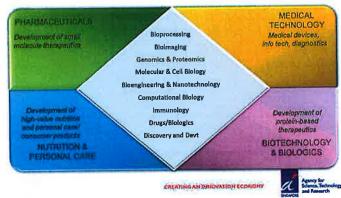
Introduction to A*STAR

A*STAR



Biomedical Research Council (BMRC)

Creating economic value for Singapore through delivering excellent science; building world-class research infrastructure; growing our research talent base and enhancing public-private partnerships



BMRC Organizational Structure BMRC restructured to industry clusters & put in place new leadership

10 research institutes, 5 industry clusters, 2100 people, 1 mission



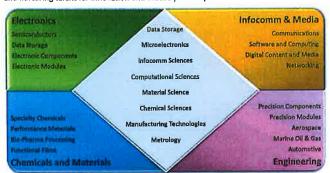
Biopolis and Fusionopolis





Science and Engineering Research Council

Supporting a wide spectrum of leading edge science and engineering R&D capabilities and nurturing talent for innovation and industry development



CREATING AN INHOVATION ECONORY



A*STAR Graduate Academy

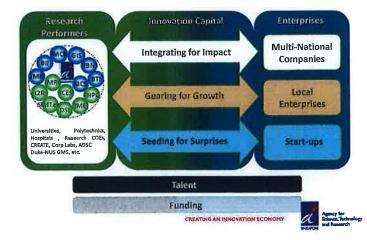
Nurturing a Pipeline of >1,100 Singaporean PhD Talent



CREATING AN INNOVATION ECONOMY



RIE2015 Strategy



Creating differentiated value for companies through PPP

CABATING AN INNOVATION ECONOMY



Forging Integrated Partnerships

Bringing Science to Patient Care THE STRUMENTH SHOWS SHOWED AND THE STRUMENTS AND

Personalised Medicine:

- · Bringing -omics to patient care & safety
- Supporting next gen of clinical trials





- Brings together the pharmacovigilance expertise of HSA, science of A*STAR & clinical management at public
- Establish active ADR surveillance network
- State-of-the-art pharmacogenomics programme.
- Strategic partnership between A*STAR, SingHealth & NUHS.
- Embed OMIC Information into disease
- diagnosis & treatment in Singapore.
- Transform current practice of medicine by paving the way for personalized clinical care.



SIPRAD: SERI-IMCB Partnership in Retinal **Angiogenic Diseases**

Differentiated platforms

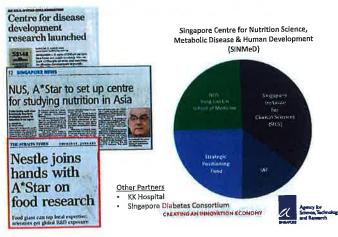




- Comprehensive industry standard platform to identify, develop and validate novel targets, pathways, biomarkers as well as evaluate potential therapeutics in Retinal Angiogenic Diseases (RAD).
- · Focus on diabetic retinopathy and agerelated macular degeneration.
- Leverages complementary expertise of SERI and IMCB in clinical and basic science.
- · Pharma MNC participation at the onset to co-shape programme and milestones.
- · Partnership interests from several large biopharmaceutical companies



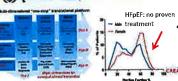
Singapore Centre for Nutrition Science, Metabolic Diseases & Human Development (SiNMeD)



ATTRaCT: Asian Network for Translational Research and Cardiovascular Trials

Opening Doorway to Asian Markets NUHS DESCRIPTION

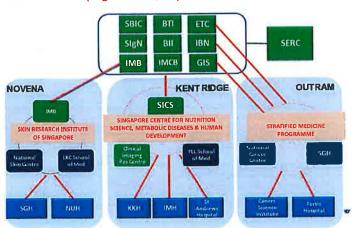




- Aims to identify novel imaging, genetic, epigenetic, and immunologic biomarkers that may be targeted for early detection, treatment, or prevention of CV disease progression.
- · Integrates top expertise in CV research across Sgp, partnering 4 BMRC Ris (SBIC, GIS, SIgN, IMCB) with 2 national heart institutions (NHCS, NUHCS) & academic institutions (NUS, Duke-NUS).
- Exploits current capacity around the Singapore-led ASIAN-HF network involving 6 sites within local hospitals and >40 sites in 10 Asian countries.

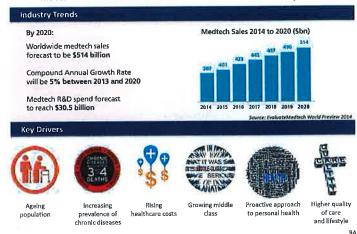
Integrating for Impact

Joint centres and programmes developed with clinical & university partners.



Growing Medtech Market

Medtech Market to Achieve Global Sales of \$514 Billion by 2020



Growing Medtech Market

A key growth sector in Singapore with the basic foundations to support innovation & commercialisation (I&C)



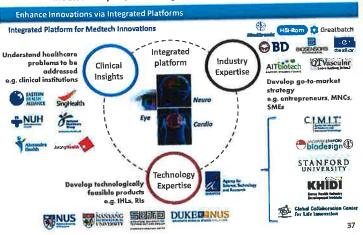
RIE2020: Build a Vibrant I&C Ecosystem

Medtech as pilot, for scaling to other sectors in the future



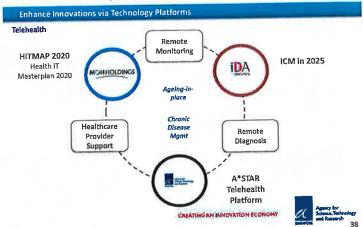
RIE2020: Build a Vibrant I&C Ecosystem

Medtech as pilot, for scaling to other sectors in the future



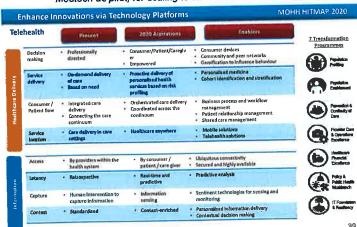
RIE2020: Build a Vibrant I&C Ecosystem

Medtech as pilot, for scaling to other sectors in the future



RIE2020: Build a Vibrant I&C Ecosystem

Medtech as pilot, for scaling to other sectors in the future



Growing Industry Engagement







- Master RCA with A*STAR (2010), renewed \$60M RCA, 80 additional jobs (2013)
- Research collaborations in beauty and grooming, health and well-being & household





- 60-man research facility in Biopolis (operational 2012)
- To develop novel antibody engineering technologies

Nestle Research Agreement

- 3-year framework research agreement signed with A*STAR in Jan 2014





-Collaborations in packaged food and beverages, food ingredients, nutrition, food manufacturing processes, food science and technology, & biotransformation

Arkray's 1st R&D Centre outside Japan



 Partnering for better diagnosis
 Novel detection kits for infectiou diseases



\$9.1 million investment 5-year partnership

CREATING AN INNOVATION ECONOMY



Thank You



Appendix C: ETPL Presentation

ETPL CORPORATE PRESENTATION PROFIAN TOWN VISIT

Md Tani Tabiin, SVP, BMS Division

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SINGAPORE'S EVOLVING ECONOMY



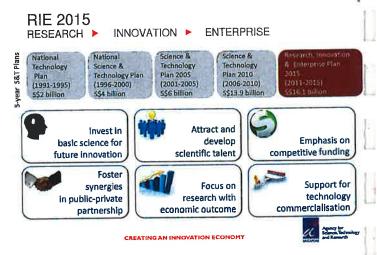
CREATING AN INNOVATION ECONOMY
South: Suggest Deportment of Statistics

SINGAPORE'S R&D FRAMEWORK

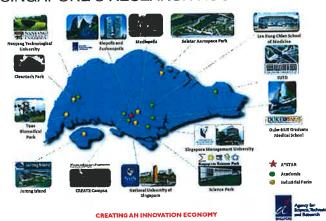
Coordinated approach to R&D

- Strong nationwide coordination strategic directions laid out by RIEC
- Integration of research capabilities across various research performers



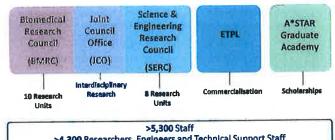


SINGAPORE'S RESEARCH ECOSYSTEM



A*STAR

Mission: Fostering World-Class Scientific Research and Talent for a Vibrant, Knowledge-Based Singapore



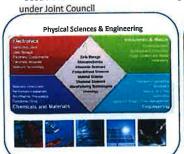
>4,300 Researchers, Engineers and Technical Support Staff
>40% of whom come from ~60 countries



R&D IN A*STAR

Fostering Science and Intellectual Capital

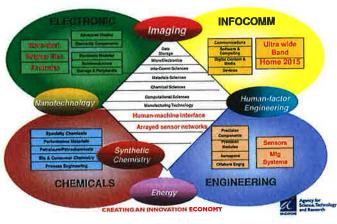
- Oversees R&D in SG through 18 Research Institutes (Ris) and Centres
- Seed novel scientific discoveries leveraging on A*STAR's spectrum of capabilities





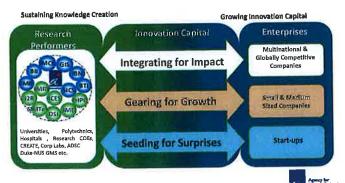
CREATING AN INNOVATION ECONOMY

Growing new capability areas



A*STAR'S STRATEGY MAP

Emphasis on supporting private sector growth through public-private partnerships



INTEGRATING FOR IMPACT

Complex Partnerships

- · Step change in our partnerships with companies.
- More public-private partnerships at bigger scale and across more domains eg. P&G MRCA, MERCK MRCA, Lloyd's Register, Rolls-Royce (ARTC), Nestlé.
- · Corresponding increase in complexity of partnerships.

Roche

When managed well, complexity of partnerships increases barrier to competition.

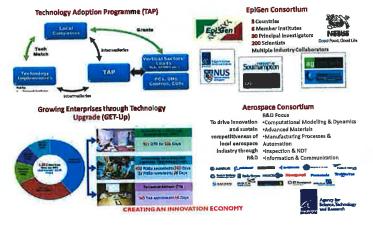


Joint Labs with Companies

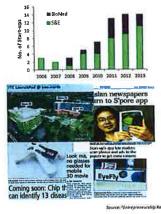


CREATING AN INNOVATION ECONOMY

GEARING FOR GROWTH



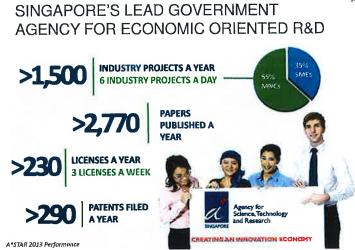
STEERING FOR SUCCESS



- Increasing focus on start-ups as key to diversifying and spurring innovation in the economy1.
- Local entrepreneurial landscape is taking off.
- Active start-ups in Singapore jumped by almost 60% to 39,000 from 2005 to 2012¹.
- Rate of start-up formation at A*STAR has more than doubled.
- A*STAR can and should make a difference in the research-based hitech start-ups.







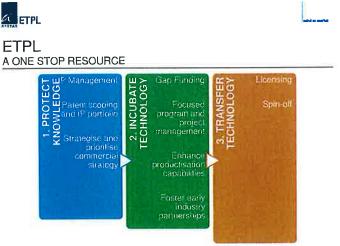
INTERNATIONALLY BENCHMARKED

Comparable to Leading Institutes Top tier in Patenting, Licensing & Start-ups

	Research budget (\$Bn)	Patents /SSBn	Licenses /S\$Bn	Start-Ups /S\$Bn	Licensing Income /\$\$M
A'STAR (FY13)	1	288	234	14	3.4
Duire	1.1	102	111	5.46	21.8
Harvard	1.07	190	72	9.35	10.2
IMIT.	2.03	209	52	7.89	67,4
Stanford	1.11	256	123	No data	68.4
Ucal	7.12	163	33	7.73	14.3
Franhoufer	3.23	154	100	3.1	61.5
Max Planck	2.61	48	38	3.45	No data
CSIRO	0.87	112	91	No data	384.4
Isis Oxford	1.09	91	98	3.67	No data

CREATING AN INNOVATION ECONOMY

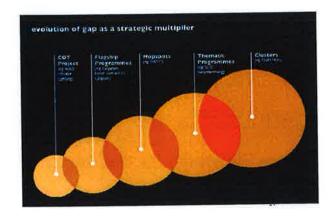


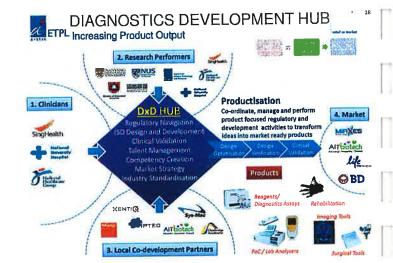




Evolving for Impacts of Impact







THANK YOU



Appendix D: Singapore Institute for Clinical Sciences – Clinical Nutrition Research Centre Presentation



Our Vision

To apply cutting edge nutritional science in order to deliver new and innovative solutions to enhance health and wellbeing.

Our Mission

To use innovative research focused on dietary factors that promote optimal growth and reduce chronic disease to develop foods that will improve human health across the life course.



Research Strategy at CNRC

- Basic & applied nutrition research with special reference to the Asian phenotype
- The application of basic and applied research to develop food and food products with enhanced health benefits



Nutritional Science Research Themes

- > Theme 1: Lifestyle, Nutrition and Metabolism in Asian Populations
- > Theme 2: Nutrition in Health Management and Disease Progression
- > Theme 3: Food Choice and Nutrition









The Nutritional Science Program



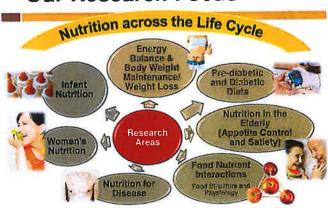
- Sensory science & nutrition
- Diet and behaviour
- Food structure and sensory function
- Eating behaviour

- Obesity, energy regulation, BAT
- Diabetes & diet Intervention
- Sarcopenia
- Nutrient requirements in adults



- Pre-pregnancy to pregnancy
- Infant, child nutrition
- Adult nutrition & women nutritlon
- Ageing & elderly

Our Research Focus





- calorimeter
- (Basal metabolic rate
- measurement)

 Bomb calorimeter

 Differential scanning
- catorimeter
- COSMED BodPod®
- PeaPod® Scanning
 Dual-energy X-ray
 Absorptiometry (DEXA)
 Scanning
 Laser Body Imaging





- Food chemistry analysis lab
 - In-vitro digetion system
 Product development kitchen
 Sensory analysis booths
 Computer-based cognitive

Blood blochemistry and

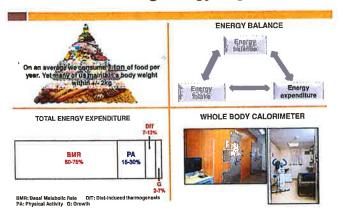
- booths Treadmill and Egometer Metabolic Rooms

Continuous Glucose Monitoring

- System Continuous Blood Pressure/heart Measurements Branchial artery flow-mediated
- Branchial artery flow-mediated dillation measurement Electromyography Measurements Muscle Blopsy Anthropometric Measurements Infra-red Camera Imaging

- Micro oxygen sensors

Understanding Energy Regulation



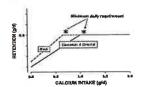
Whole-body Calorimeter





Theme I: Lifestyle, Nutrition and Metabolism in Asian Populations (Asian Nutrient Requirements)

- What are the nutrient requirements of Asian populations? (Energy, protein and calcium requirements known to be lower in Asians)
- What are the nutrient requirements for optimal growth and ageing Asian populations?
- Role of body composition in functional outcomes and life course processes
- Role of nutrients in prolonging lifespan and health



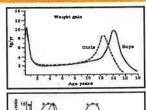


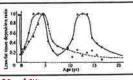


Theme II: Nutrition in Health Management and Disease Progression (Obesity And Energy Regulation)

- To understand how humans regulate energy balance (use of whole body calorimeter)
- What metabolic adaptation enables certain individuals to over-consume and yet maintain stable body weight?
- Determinants of food intake and satiety
- Children cohort study to investigate the role of body composition in the etlology of obesity







D Boys 🛆 Glirts

Dugdale AE, Payne PR. Pattern of lean and fat deposition in adults Nature. 1977 Mar 24:266(5600):349-51

Theme III: Food Choice and Nutrition (Sensory Science and Nutrition)

- To understand the mechanisms involved in sensory perception
- Is it possible to explain why certain foods are preferred by consumers over others?
- How does sensory perception influence food intake and satiety?
- > The Asian palate and food preference
- Elderly cohort study on the role of taste perception during aging

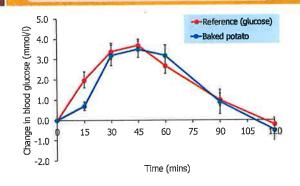
Theme III: Food Choice and Nutrition (Food Structure and Functions)

- An understanding of how macronutrients namely protein, fat and carbohydrate can be manipulated to produce foods with health benefits.
- How the fundamental principles of food structure may influence bioavailability, glycaemic and lipidimic response.

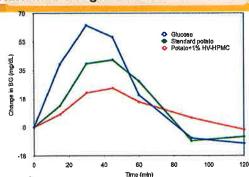




Glycaemic response curves for glucose and baked potato

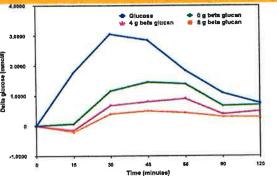


Glycaemic response to mashed potato containing HV-HPMC

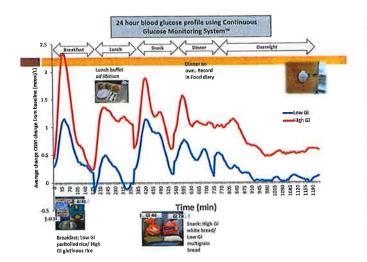


Lightowler and Henry (2009) Nutrition Research, (8): 551-557

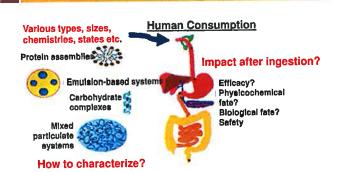
Glycaemic response to flatbreads containing barley β-glucan



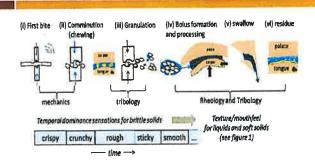
Thondre and Henry (2009), Nutrition Research, (7); 480-486



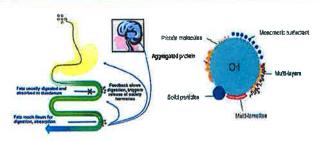
Microencapsulation and Nutrition



Oral Processing, Texture and Mouthfeel: From Rheology to Tribology and Beyond

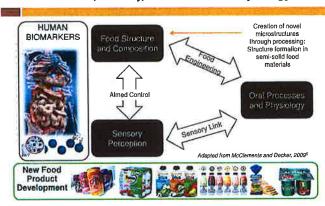


How Ileal Brake Influences Appetite Control



How activation of the ileal brake triggers the release of satiety hormones and neural afferents resulting in reduced food intake and control in appetite.

Inter-Relationships between Food Structure, Sensory, Biomarkers and Physiology





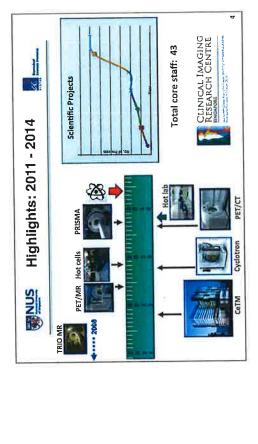
Appendix E: Clinical Imaging Research Centre Presentation

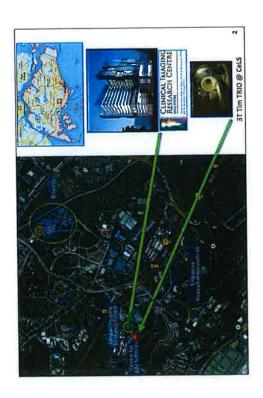


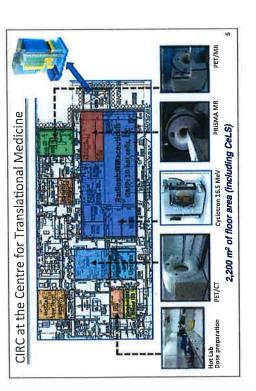
CUNICAL IMAGING RESEARCH CENTRE

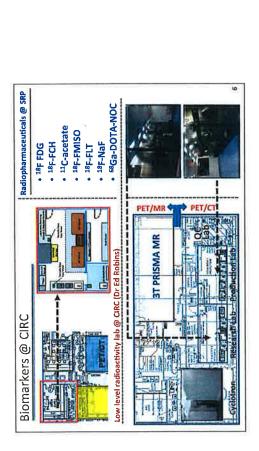
> Prof. John Wort (Chair) Prof. St George Radda C, BMRC Prof. Sarry Hallwell DPRT Dr Ben Seat ED, BMRC

NUS

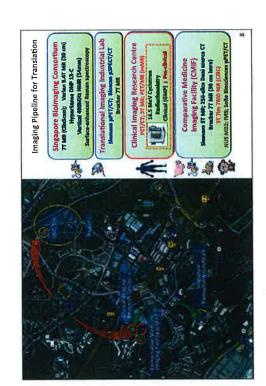












Appendix F: SingHealth Presentation



Singthealth DUKERANUS

Singthealth DUKERANUS

Whenders hather of Stepan Network of S

Singapore's Public Sector Healthcare Clusters

Academic Medicine



Ministry Of Health's Vision of Integrated Care

MOH HOLDINGS

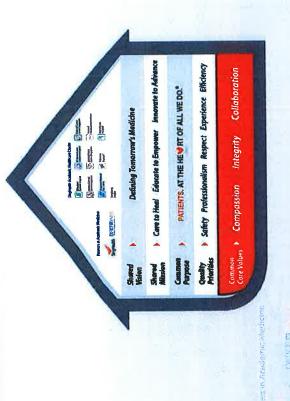
Nurse educators + wellness coordinators "Care Integrators" Long-Term Care Care Frail elderly Home Care Intermediate Care Mell | IT Infrastructure Acute & 푼 Polyclinics FPs Primary Care Screening & Prevention

Our Shared Vision, Vision and Core Values

Slide 3

S Hospite Vesion

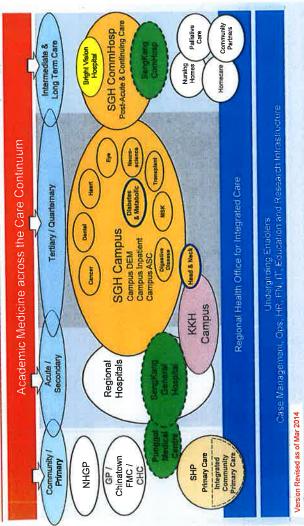
Academic Medicine



cademic Medicine

SingHealth Integrated Care Delivery Model

Academic Medicine





Singapore's BMS R&D Landscape

- Year 2000: launch of biomedical sciences (BMS) initiative
- Vision: Biopolis of Asia a leading international sciences cluster advancing human health
- Strong global positioning and national emphasis on BMS
- Focus on drug discovery and development, healthcare, pharmaceutical and biotechnology manufacturing, medical technology innovation and manufacturing
- **\$\$3.7 billion** government investment for BMS research for 2011-

amara in Academic Wedi

Singification (NUMB)

SingHealth Duke-NUS Academic Medicine Partnership

Slide B

Collective strengths of the SingHealth group & Duke-NUS' research and medical education capabilities

regether, we can build a vibiant scademic culture for hew discoveries, shather

Our Patients.



Farmers to Academic Medicine Singhealth DUKER INVIS

SingHealth Duke-NUS Academic Medicine Partnership

ONE common purpose

Academic Medicine

Commitment of both Boards & Senior Management

Academic Medicine Oversight

Slide 9

Academic Medicine

SingHealth Board

> representation (Current) **Cross Board**

Duke-NUS Board

PATIENTS. AT THE HEW RT OF ALL WE DO. Attract and Retain the Best Patients have Access to

Clinical Outcomes and Better Care Continuous Improvement in

Vibrant Academic Culture committed to Leading-Edge Medicine

care innovation & teaching

SingHealth Institutions (Health Services)

SingHealth

AM Advisory

Acad & Research

Council (AMAC)

DUKERINUS

Medical School (Education)

AM EXCO

1) AM EXCO, as management of the Academic Medicine enterprise, is directly accountable to the two Boards. 2), AM Advisory Council to provide strategic independent advice to the two Boards. Singerealth 1978 Total

Academic Medicine Executive Committee (AM EXCO)

170,000



Co-Chair: Prof Ranga Krishnan, Dean, Duke-NUS

Co-Chair: Prof Ivy Ng, GCEO, SingHealth

- Prof Soo Khee Chee, Deputy GCEO (Research and Education) SingHealth; Director, NCCS; Senior Vice Dean, Clinical & Academic Faculty Affairs, Duke-NUS
- Prof Ang Chong Lye, Deputy GCEO (Clinical Services & Informatics), SingHealth; CEO, SGH
 - Prof Michael Merson, Vice Chancellor for Duke-NUS Affairs, Duke University
- Prof Thomas Coffman, Executive Vice Dean, Duke-NUS*
- Prof Patrick Casey, Senior Vice Dean, Research, Duke-NUS
 - Prof Robert Kamei, Vice Dean, Education, Duke-NUS
- Prof Wong Tien Yin, Vice Dean, Clinical Sciences, Duke-NUS*; Group Director Research, SingHealth
 - Prof Fong Kok Yong, Group Director, Medical; CMB, SGH (Co-opted)

Ex-Officio Member:

Prof Koo Wen Hsin, Group Director, Education, SingHealth

*New Member from Jan 2014

Academic Medicine Advisory Council (AMAC) 2nd Meeting in 7-9 April 2014

Slide 11

mic Medicine

Academic/Medicine

Tremendous

progress made.

Slide 12





collaborations are made

with Duke-NUS. "

Good that strong

EYE, ONCO NEUROSC, CVS. impressed by the ACPs:

Inaugural AIM Keynote Lecture: Prof Dame Sally Davies





Academic Medicine

SingHealth Duke-NUS Academic Medicine Partnership

Snapshot - From cross-board representation to AMC



SingHealth Duke-NUS Academic Clinical Programs (ACPs)



Academic Medicine Matrix

Slide 13

Achieving More Together



What are ACPs and Joint Institutes?

Slide 15

Slide 16

cademic Medicine

ACPs are a cluster-wide <u>framework for all clinical specialties to advance in Academic Medicine</u> with resources and funding support from SingHealth and

Duke-NUS.

- Brings together all specialists in the medical/surgical discipline across institutions for greater
- synergies in clinical care, education and research.

 All specialists (Associate Consultants and above) in the ACPs will be recommended for Academic Titles in accordance to their level of contribution and commitment of time in teaching and research
- ACPs to fulfil key performance Indicators (KPI) Number of Clinician Scientists, TCR grants, outcome of Resident Choices, etc.

Joint Institutes work in tandem with all ACPs to build-up Clinician Researchers & Clinician Educators, catalyzing cross-fertilization of ideas and sharing of resources.

Partners in Agademic Wedicine

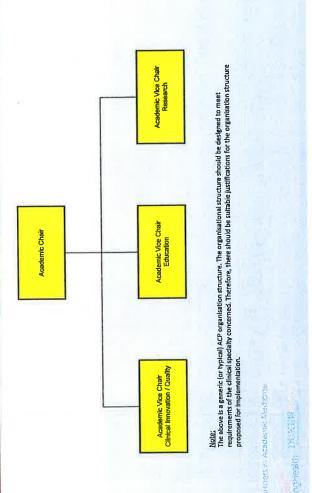
Singideath NUKSD

Academic Medicine

Generic ACP organization structure

Academic Medicine

Slide 17



Joint Institute - to build up Clinician Educators

Academic Medicine



Academic Medicine **Education Institute** Duke-NUS SingHealth Faculty Development Competency Framework

to sustain Education Excellence

- Building community of Excellent Educators across ACPs, Nursing and Allied Health
- Faculty Development, Educational Scholarships, **Professional Training**

Open to all healthcare professionals

Paristers to Adadenne Medicine

Educators Design and Planning of Learning Activities /alues for Medical Core Evidence based Practice eadership

Academic Medicine Leadership

Matric reporting structure

*All 3 Group Directors are ex-officio members of Academic Council VC Clinical are members of the Innovation & Quality Management Committee Cfln, Swc & Info., CEO, SGH GD Medical Group CEO StagHealth VC DECEO Gounell 8 DGECO (R&E) VC Research 8 ACP Chair "incumbent Vice Dean Clinical Sciences is also Director, AMRI & SingHealth Group Director Research. Vice Chancellor Duke-NUS Affairs Sing Health Truly III AM EXCO

Joint Institute to develop Clinician Researchers

cademic Medicine

Slide 20



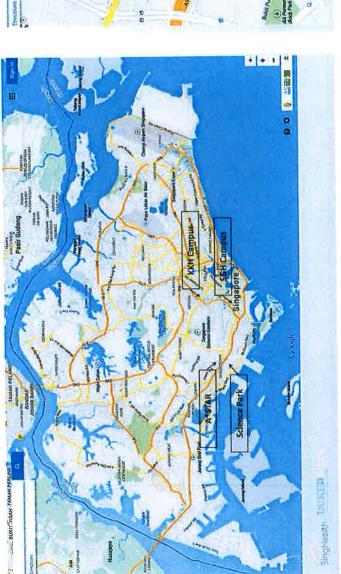
Academic Medicine Research Institute

Duke-NUS SingHealth

Framework to facilitate:

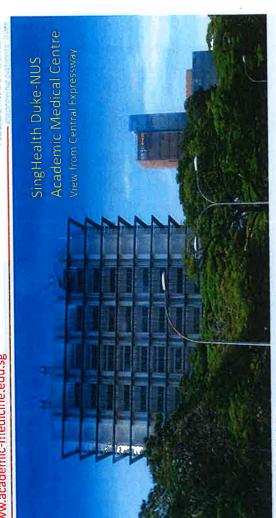
- Scientific support and development of clinician scientists across ACPs
- Translational Clinical Health Services Full continuum of research support: Basic

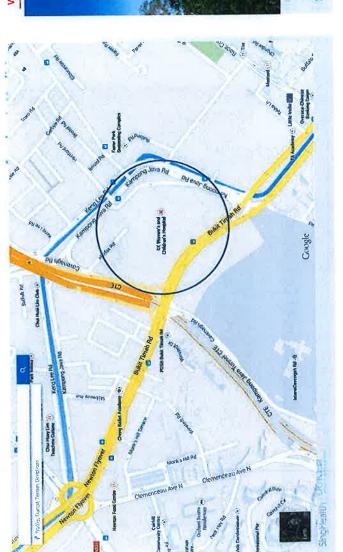
- Enable SingHealth & Duke-NUS to translational and health services achieve excellence in clinical, research.
- clinical research faculty (including CS, CI, enables and supports the development medical students, residents, post-doc AMRI is an "academic home" which of clinical research and careers of clinicians) and pipeline of faculty fellows)
- Development of Research Careers





Academic Medicine Partners Portal www.academic-medicine.edu.sg





Infrastructure – Building Bridge of Collaboration

Academic Medicine

Slide 25



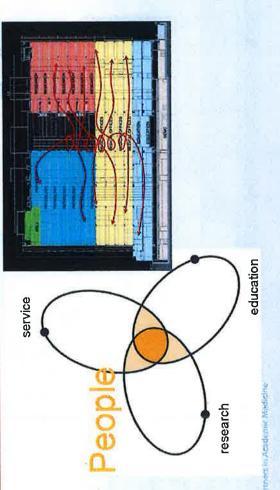
Overhead Link Bridge with F&B outlets for Academia & Duke-NUS

Shraiteath DUKER

Facilitate opportunities to spark innovation and collaboration Congregation of people & functions

Academic Medicine

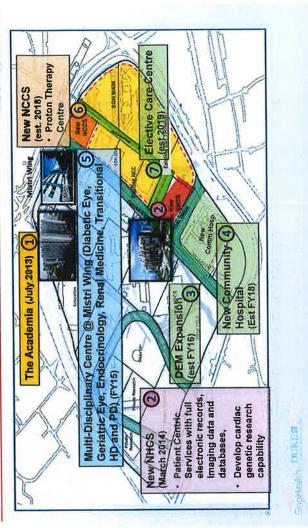
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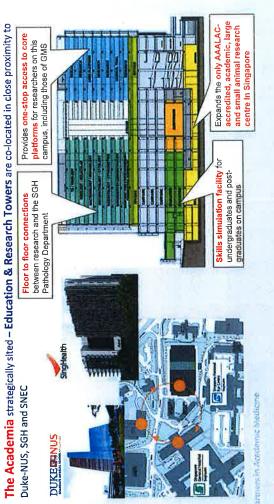
DUKING

Infrastructure Development at SGH Campus

Academic Medicine



Co-location of education, research & clinical infrastructure Foster innovation and collaboration

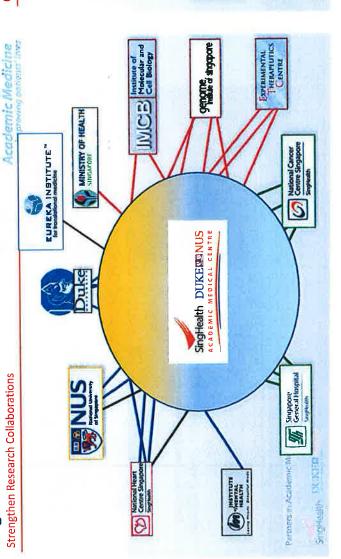


Co-location of research & diagnostic functions

511de 29

Foster innovation and collaboration

SingHealth & Duke-NUS Research



Closer To Home
Cores and Program Open for Business

Massive exercise
coordinated by Ook's
Facilities team completed
relocation of our Cores
and Programs
Facilities team completed
relocation of our Cores
and Programs
Facilities team completed
relocation of our Cores
and Programs
Facilities team completed
relocation of our Cores
and Programs
Facility
Repository
Repository
Advance
Inflammation Contre
Facility
POLARIS

SingHealth & Duke-NUS Research

Slide 31



Developing Scientific Discoveries into Diagnostic Tools,

Treatments & Cures for Patients



EUREKA INSTITUTE"

for translational medicine





science **Eransikon**

Slide 33

New Research Programs

Safer biopsy, thanks to Mona Lisa

Robot detects prostate cancer more accurately

prostate cancer more accurately and safely.

The invention is helping doctors at Singapore
General Hospital (SGH) achieve 90 per cent accuracy in their biopsy tests for the cancer, the third
most common cancer among Singapore men. A ROBOT named Mona Lisa is giving Singapore doc-tors plenty to smile about, with its ability to detect

Previously, the accuracy rate was 70 per cent.
The chole also reduces the risk of infection.
Currently, the manual method of collecting tissue for the bloopy by inserting a probe litrough the saus for the bloopy by inserting a probe litrough the saus is non-sterile, and can cause infections in one out of 20 partiests.
But with Mona Lisa, doctors are guided to produce two precise skin punctures between the anus

and the scrotum to get the tissue for testing.

There is no control with waste matter. As a result, only two out of 500 patients suffered infections, said urologist Henry Ho.

"Patients also can be more assured knowing the robolic prostate biopsy, if negative, means they are very unlikely to have cancer.

Dr. Ho was in the SCH team that had set out as far back as 2003 to make the procedure safer and

Prostate cancer is slow-growing and does not easily form a tumour, it can affect both techsicles, explytoms include swelling testicles or pain when urinaling. In Singapore, about 620 new cases are unfaithing. In Singapore, about 620 new cases are

To detect it, a blood test is done as a first slep, "Usually, a blood test warns you of the cancer, but it is," br Hell you where

Singkealth DUKUTE

SingHealth Medical Technology Office (MTO)

Slide 36

SingHealth & Duke-NUS Research

Sing-Health Divicing

Making an impact on patients' lives

A Diva to manage mum's blood pressure 0

V V 0

sted System - or Owa - is all in development stage, a Hospilal (IOO) hope it will lead to safer

books 30 per cent of pathents at the hospital, which delivers 30 to 35 bables every day, underg Junearess britts.

HEALTHY LIVING IS REWARDING

nauses and in more severe cases, I reduces blood flow to the piscents - harming the baby

for patients 多 1,000,000kg Challenge

DIVA System's enhanced speed and accuracy delivers a safer and better birth experience

KKH. They were assisted by Mr Paul Tan Hon Sen, a third-year 2011 to July 2012. The principal Investigators were Professor The trial was conducted among KKH patients from October Leong, Consultant, Department of Women's Anaesthesia, Alex Sia, Chairman, Medical Board, KKH, and Dr Sng Ban medical student at Duke-NUS GMS

SingHealth & Duke-NUS Research Making an impact on patients' lives

Slide 35

Academic Medicine

Safer deliveries by caesareau

KKH scientists show paediatric patients with a particular variant of a gene common in Asia have increased risk of adverse allergic reaction to the drug carbamazepine.

Dr Derrick Chan and Dr Ene Choo, KKH

Cost effectiveness study on screening

for the genetic variant

HSA approval obtained and screening is part of

routine clinical protocol before Carbamazepine prescription at KKH

Shighestry Delikes

Singapore researchers identify new deadly cancer





Scientists uncover

Special for ten

chronic myeloid fouthernin (CML), u and had started Stophante on a ty- #OrOng So Thong could get merried, plan for a family blood cancer that almost killed her just i worker kines in killed to the starkers and mornifurm now and to week before. For week before.

m of a daily pill. The TKI attacks CML at its root

two weeks before. At that time, the leuksemis had re-

What would you pay for another year of life?

A NATIONAL CONVERSATION ON CANCER CARE

Profe Discoveries and Anti-Plute to society—

Fin cancer

by scientists

The second contract of the sec

Dr Sams Kause

DNG SIN TIONG

A/P Lim Soon Thye, A/Prof Tan Soo Yong Professor Teh Bin Tean,

hen I first saw Stepha-

From left) Dr Charles Chuah, CSA, Assoc. Prof Ong Sin Trong, CSA and Assoc. Prof Darren Llm, CSA

Satglies in DVINIE

intrinsic resistance and inferior responses to tyrosine A common BIM deletion polymorphism mediates kinase inhibitors in cancer

SingHealth & Duke-NUS Research

"Personalized OMIC Lattice for Advanced Research and Improving Stratification" and emic Medicine



National Cancer Centre Singapore

Singapore General Hospital Singhealth

Tony Lim

Singitealth

Bioprocessing Technology Institute Lam Kong Peng Ho Ying Swan

Christopher Wong

Pauline Ng

Liu Jianjun

Patrick Tan

Ng Huck Hui

Genome Instit of Singapore



Soo Khee Chee

Tan Eng Huat

an Puay Hoon Tan Soo Yong

Daniel Tan

ain Tan

Richard Quek

Eranga Vithana Wong Tien Yin **Aung Tin**

Jackie Ying Bing Lim (GIS)

Veronica Diermayr

Jeffrey Hill

Alex Matter

Tan Min Han (CTC SPF)

Experimental
Therapeutics Centre (Companion DX SPF)

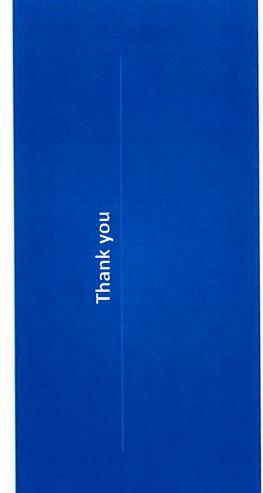
Secretariat Research

SingHealth

Evelyn Koay Dept of Lab Medicine

Slide 40

improving patients' lives Academic Medicine



SingHealth DUKE DUNG Partners in Academic Medicine

Appendix G: National Medical Research Council: Biomedical Research Landscape and Funding in Singapore



Ministry of Health (MOH) Restructuring of Healthcare Delivery System

Regional Health Systems

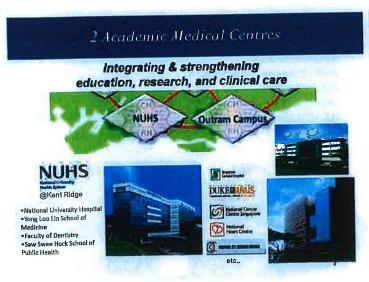
Alexandra

Health

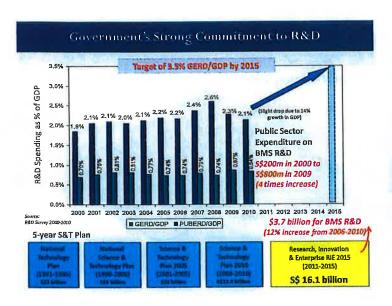
NHG

Classith Alliance

Academic Medical Centres

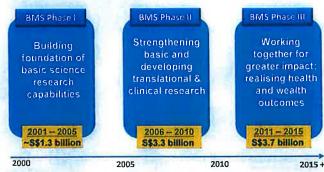






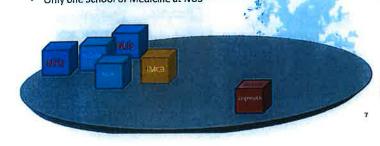
Development of BMS in Singapore

Singapore's BMS initiative was launched in 2000



Pre-2000s: Before Singapore's BMS Initiative

- · Pockets of BMS research capabilities
- Only one research institute dedicated to BMS Institute of Molecular and Cell Biology (IMCB)
- Only one university offering a degree program in the BMS National University of Singapore (NUS)
- Only one School of Medicine at NUS

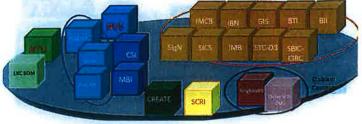


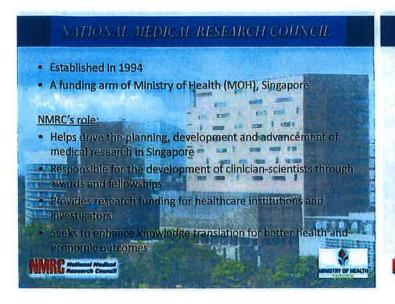
Today: Strong Public Research Capabilities/Infrastructure

- · Biopolis established in 2003
- Duke-NUS in 2005
- BMRC TCR institutes in 2006-10
- RCEs since 2007
- CREATE in 2007
- LKC SOM opening 2013
- SSH Sch of PH in 2011



Blopolls





Translational and Clinical Research (TCR)

Key focus in BMS Phase II (S&T2010) – included as MOH's mandate in June 2006

MOH has updated its portfolio and formally incorporated clinical research as part of its mandate.

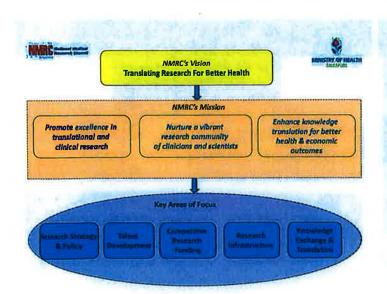
It is a significant step forward for the Ministry. We will continue to emphasize clinical services, but we will begin to devote new resources to supporting clinical research. The big money for clinical research will still come from MTI and A*STAR, but we will also put in some funds to register our new emphasis. Our focus remains our patients, and clinical research must help enhance our care for our patients."



Minister Khaw Boon Wan, 2006

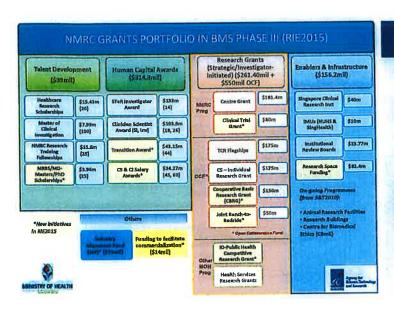








12



Highlights of BMS Lunding - TCR Flagship Programmes

- Flagship "all the way" programmes in strategic disease areas, with strong industry interface
- Each award is worth S\$25mil over 5 years
- It achieves this by building on existing, local, highly competitive programmes and by providing highly productive platforms for collaboration with top overseas research institutions and industry
- The initial 5 TCR programmes awarded were:







Translational
Research
Innovations in
Ocular Surgery



Vulnerability,
Disease Progression
and Treatment in
Schizophrenia and
related psychoses

DISPAGE



Developmental Pathways to Metabolio Diseases INFECTIOUS DISEASE



New Treatment Strategies against Dengue (STOP Dengue)





Clinical Research In Frantructure Investigational Phase 1 Phase 2 Phase 3 Phase 4, Eddemiology, HSOR studies Investigational Medicine Unit At Kent Ridge Campus Singapore Clinical Research Institute (SCRI) Investigational Medicine Unit At Outram Campus *National, one-stog centre for private/public Investigators who wish to conduct

Provides services such as study design,

Develops specialized training courses

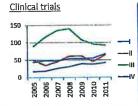
· Conducts In-house research

project & data management, biostatistics study reporting on a fee-for-service basis

BMS Initiative outcomes

- 1) Critical mass of talent and robust pipeline
 - A*STAR BMS Scholars Deployed: 69, In the pipeline: 362
 - A*STAR BTI: Training industry-ready scientists for biologics industry: 27 PhD scientists, 32 research officers, 40 industry Interns since 2003
 - NMRC Human Capital Development: 47 CSAs, 14 STaRs
- 2) Highly Competitive Science

3) Growing application & impact

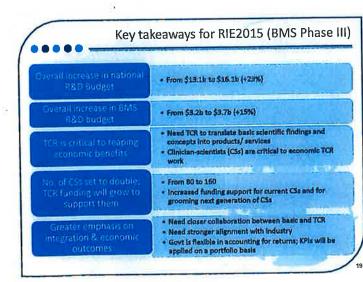


Healthcare Savings

\$1.8m saved from evidencebased dengue hospital admission criteria - Stratify patients by severity of infection. 40% reduction

in hospitalisation rate

Total of 265 clinical trials in 2011



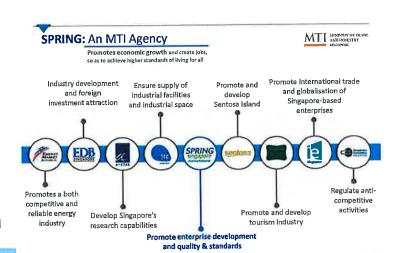


SPRING singapore

Welcome to SPRING Singapore

Presentation to Delegation from New Zealand

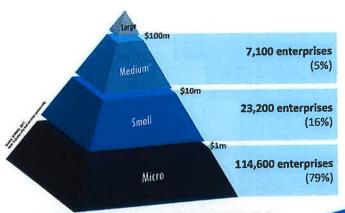
12 November 2014



SPRING's Vision and Mission



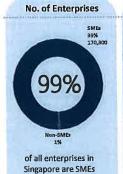
Enterprise Landscape in Singapore

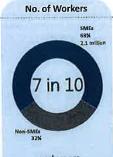


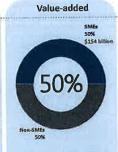
SME refer to enterprises with annual sales turnover of not more than \$100m, or employment not more than 200 workers

SPRING

SMEs in the Singapore Economy







of total enterprises' VA is contributed by SMEs

Enterprise Development Strategies









Strengthen Environment for Enterprise . Development

STATE STATE OF THE PARTY OF THE

Seed & Nurture Innovative Start-ups (ISUs)

Develop Competitive Clusters

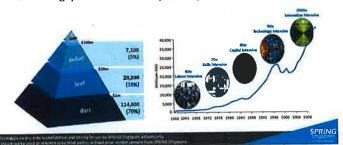
Groom Growth-Oriented Enterprises

In collaboration with other partners

employed by SMEs

Importance of Innovative Start-Ups

- Contribute to quality growth & economic diversification Source of good jobs; economic resilience and renewal in the face of change
- Anchor drive towards innovation-based economy Capture value from Government's R&D investment
- Offer Singaporeans different pathways to success

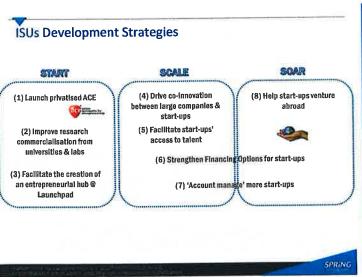


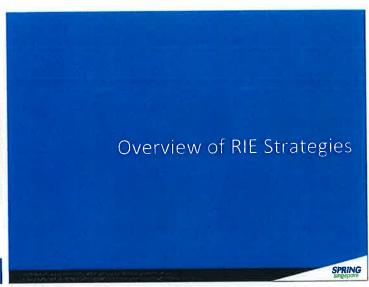
Holistic support for ISUs



Leverage partners & networks to support ISUs

Create environment conducive for





Move towards an innovation driven economy

Science & Technology Plan 2010 (2006 – 2010) S\$13.9 b Science & Technology Plan 2005 (2001 – 2005) S\$6 b National Science & Technology Plan (1996 – 2000) S\$4 b National Technology Plan (1991 – 1995) S\$2 b - Invest In public-sector BMS research - Deepen longterm S&T capabilities - Bulld critical

- Make targeted **R&D** Investments in areas of competitive advantage

- Intensify efforts mass of private-sector BMS R&D activities to engage private sector in R&D

- Focus on R&D with economic outcomes

rch, innovation & Enterprise Plan 2015 (2011 – 2015) S\$16.1 b

> - Foster public-private partnerships

- Increase support for commercialisation

1st steps to align public RIE Investments with industry needs

Research, Innovation & Enterprise 2015



Prime Minister Mr. Lee Hsien Loong

4th RIEC Meeting 17th Sept 2010

"Singapore's long term aim is to be among the most research intensive, innovative and entrepreneurial economies in the world in order to create high value jobs and prosperity for Singaporeans.

Research and innovation underpin the competitiveness of our industries, catalyse new growth areas, and transform our economy.

Increasingly, Intellectual capital will be critical for our next phase of economic development. Hence, the government will allocate \$\$16.1 billion [~1% of GDP] to support research, innovation and enterprise activities in the next 5 years."

Economic outcomes key focus since NTP 1991-1995*

- Encourage

Investment

R&D

private sector

Spur R&D

growth to

enhance

SPRING

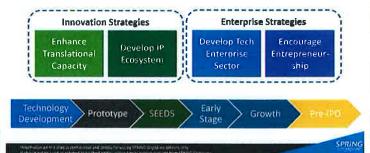
Fostering Innovation & Enterprise: An Integrated Strategy Innovation Research > Enterprise MTI ETTE EDB SPRING Same to Langue Cerre iAXil NASWANG TTOs & NUS MERCATUS Section 1

A Strong Ecosystem of Stakeholders

RIE 2015 Innovation & Enterprise Strategies

RIE2015 signaled an increase in focus on I&E as a key pillar of Singapore's R&D strategy

Innovation and enterprise strategies aimed to cover the entire value chain from technology development to pre-IPO, targeted primarily at technology enterprises in manufacturing & other export-oriented sectors.



Centres of Innovation (COIs)

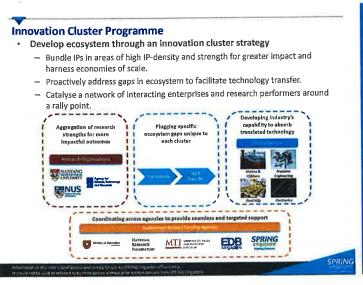
Offer technology consultancy and facilities to develop technology projects and solutions



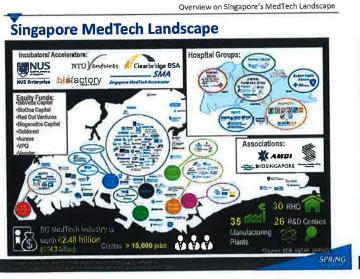
Private Sector Translators

Help SMEs develop technology differentiation





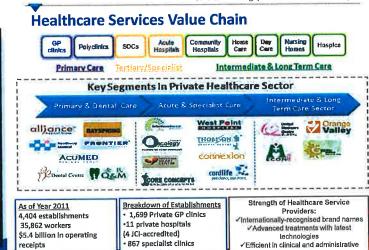












· 867 specialist clinics

•679 Dental Clinics

receipts

SPRING

Value-added of \$\$2.9 billion

SPRING Singapore's Healthcare Strategies

How SPRING supports Singapore Healthcare SMEs 3 BROAD STRATEGIES Strengthen Market Access Channels Enhance Clinician-Driven Create International Innovation **Partnerships** Singapore - Internationally recognized quality healthcare

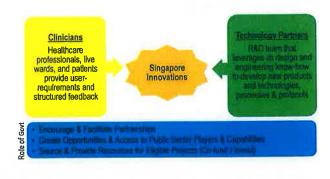
SPRING Singapore's Initiatives

processes

Clinician Driven Innovation

Developing SMEs' capabilities to Proactively Drive Innovation...

Develop Singapore healthcare products & services that are effective, tested and able to serve as immediate solutions to real patients or users' needs globally



Public – Private Collaboration

Model: Public Hospital-SPRING Co-innovation Program Office (CPO)

tech partner

Catalyzing Clinician-Driven Innovation
 A platform staffed by representatives from Public Hospital (e.g TTSH) and SPRING to facilitate collaboration in innovation projects between the hospital and SMEs that have the relevant technical and commercialization



Partnerships for Capability Transformation (PACT)

Foster collaboration between SMEs and Large Enterprises (LEs)

Collaborative partnership to drive knowledge transfer, capability upgrading and development and test-bedding of innovative solutions.



SPRING Singapore's Initiatives

MOU between SPRING Singapore & Maastricht UMC Holding













Focus Areas:

Life Sciences, Healthcare, Medical Technology Duration:

MOU will be in effect for 3 years from 13th June 2013 **Objectives**

Promote and facilitate partnerships /collaborations between Maastricht and Singapore entities:

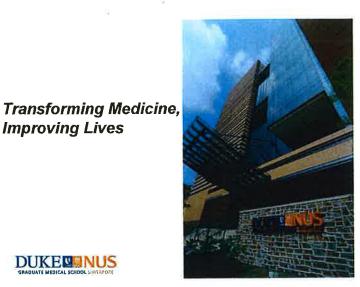
Enterprise level: Singapore SME — MUMCH commercial entities and affiliates

Industry level: Singapore Hospital — Singapore SME — MUMCH commercial entities and affiliates
 Others: Singapore entities - MUMCH Organizations/affiliates



Thank you

Appendix H: DUKE:NUS Presentation







Our Foundation

Improving Lives



School Designed to Produce A New Breed of Doctors / Clinician Scientists



Well-trained specialists to care for patients



Creative & critical thinkers

DUKE NUS



Clinician scientists who contribute to advancement of medical knowledge



Look at old problems in new creative ways



Have a pioneering spirit, willing & interested in blazing new trails in science & professional career

Setting up of Duke-NUS









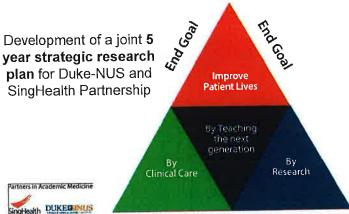








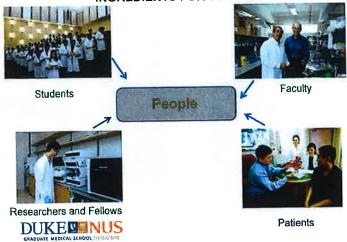
Our Mission in Academic Medicine



Planting The Seeds - The Academic Healthcare Cluster







INGREDIENTS FOR SUCCESS













The Early Years Cultivating Programs, People and Places

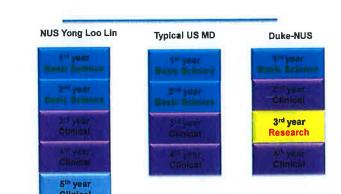
Duke & NUS signed partnership agreement School officially opened by PM Lee Histen Loong 1st MD Class graduated 1st MD Class graduated 1st MD Class started 1st MD Class started 1st MD Class graduated 1st MD Class gra

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DUKETINUS

Our Curriculum



DUKERINUS

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Moving Away From Traditional Form of Learning

The routine cognitive skills and rote learning have become irrelevant.

We need to encourage ways of thinking and learning as well as tools for working and communications

DUKE SNUS





Developing Innovative Learning Team LEAD (Learn, Engage, Apply, Develop)











PhD Program: Integrated Biology & Medicine



A/Prof. David Silver **Director of Graduate Studies**



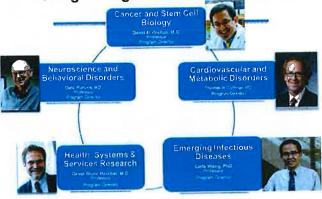
- · First class entered in August 2010
- Degree approved by NUS; process underway for approval of joint degree with Duke University
- Designed as a 4-year program that incorporates the innovative Team-Based Learning strategies
- Includes a foundation course and discipline-specific courses
- · Has separate Tracks that follow each of the Signature Research Programs

DUKERNUS

Goals of Duke-NUS Research Endeavors

Research that Creates Knowledge Research that Improves the Lives of Patients Research that has **Economic Impact**

Getting the Right Research Structure



Centers That Integrate Activities in Key Focus Areas



Expanding Our External Focus in Key Research Areas



Center for Technology & Development

David M. Epstein, Ph.D, Director

Mission: To identify and develop a portfolio of Duke-NUS research programs that have translational and commercial potential

Vision: To facilitate commercial development of our portfolio through sustained, long-term relationships with external partners

DUKERNUS

DUKESINUS



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Investigational Medicine Unit



Phase 1/2a – 30 bed unit Located at Singapore General Hospital Contains a 2-bed chronobiology suit

- First in SEA



DUKERNUS

- Joint Sponsorship
 - SingHealth
 - Duke-NUS Graduate Medical School
 - SICS (Singapore Institute for Clinical Sciences)



Getting the Right Students

Undergraduate Degrees	2014	2015	2016	2017
Blology/Life Sciences/Sciences/Biotechnology/Pathology	30	29	27	32
Engineering	16	15	10	7
Pharmacy/Pharmacology	2	1	4	7
Chemistry/Biochemistry	1	2	6	11
Psychology	0	1	1	3
Neuroscience	4	2	2	1
Nursing/Nutrition	2	0	1	0
Social Sciences/Humanities	2	3	0	1
Traditional Chinese Medicine	0	0	2	0
Business/Economics	2	6	6	3
Higher Dogrees			Y 55 -	
Masters Degree	5	9	9	11
l PhD	2	1	2	3

Getting the Best Clinical Faculty



DUKEMINUS



The PresentGrowing the Field

DUKEDUNUS

Duke-NUS in Numbers



Residency Training



Phase One Programs 1. Emergency Medicine 2. General Surgery 3. Internal Medicine 4. Pediatrics 5. Pathology 6. Transitional Year Phase Two Programs 1. Anaesthesiology 2. Diagnostic Radiology 3. Family Medicine 4. Obstatrics & Gynecology 5. Ophthalmology 6. Orthopsedics 7. Otorhinolaryngology 8. Surgery-in-General (Surgical Specialities) Cardiotheracic Hand Surgery Neurosurgery Plastic, Reconstructive & Aesthetic Surgery Plastic, Reconstructive & Aesthetic Surgery

GRADUATE MEDICAL SCHOOL

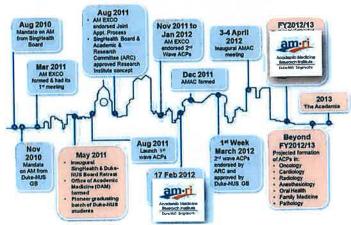
DUKE MINUS

Academic Medicine



Translational Medicine Cycle

The Duke-NUS/SingHealth Academic Journey



DUKENINUS **AMC Matrix Concept** Duke-NUS Academic Clinical Programs O&G Paeds Surg Cancer Cardio Institute rging Infectiou Diseases Cancer & Stem Cel Blology Neuroscience & Behavioral Disorders Health Systems & Services Research AM ducation institute

Developing Faculty

- Academic Medicine Education Institute (AMEI)
- Academic Medicine Research Institute (AMRI)
- Khoo Scholars Program



lesearch



Beginning to Fulfil Our Mission



Collaborations & Economic Growth



Antibody Englneering for molecular imaging







Oncology Research



Translational Medical Hub Tanslational Oncology Research





Research & Development





Research on Ceramide Synthases & Metabolic Disease





DUKERONUS



Extending Collaborations, Impacting Globally









Partnership in Translating the Academic Medicine Vision











THANK YOU