

# **Academic / Government Partnership: The Development of Academic Medicine in Singapore**

**John E.L. Wong**

**Dean, Yong Loo Lin School of Medicine**

**National University of Singapore**

*“A New Era of Patient Care”*



# Outline

- **About Singapore**
- **Medicine in Singapore**
- **Singapore's transformation from Third World to First World**
- **Development of Academic Medicine in Singapore**



# Profile of Singapore



**Size: 700 sq km**

**Population: 4.6 M ( 3.6M )**

**Chinese: 76%**

**Malay: 14%**

**Indian: 9%**

**Language of business and education: English**

**Other official languages: Mandarin, Malay, Tamil**

# Profile of Singapore

- **General literacy rate (over 15 years of age): 95%**
- **GDP: US\$161 billion**
- **Per Capita GDP: US\$ 37,489 (17<sup>th</sup> in the world)**
- **Official foreign exchange reserves: US\$ 171 billion**

# Outline

- **About Singapore**
- **Medicine in Singapore**
- **Singapore's transformation from Third World to First World**
- **Development of Academic Medicine in Singapore**

# Medicine in Singapore

- **5 public hospitals; 1 women's and children hospital; 1 mental health hospital**
- **80% of public obtain their chronic health care in public hospitals**
- **Co-payment with Govt subsidy / co-payment with employer / self payment; private insurance being encouraged as “top-up”**
- **Ranked 6<sup>th</sup> in world by WHO for quality of health care**
- **Currently, health care is 3% of GDP; planned to slowly rise to 7% with aging population**

# Medicine in Singapore:

## Top 10 Causes of Death

<b>1. Cancer</b>	<b>28%</b>
<b>2. Ischemic Heart Disease</b>	<b>21%</b>
<b>3. Pneumonia</b>	<b>16%</b>
<b>4. Cerebrovascular Disease</b>	<b>12%</b>
<b>5. Trauma</b>	<b>5%</b>
<b>6. Other Heart Disease</b>	<b>4%</b>
<b>7. COPD</b>	<b>4%</b>
<b>8. Diabetes Mellitus</b>	<b>4%</b>
<b>9. Urosepsis</b>	<b>3%</b>
<b>10. Chronic Renal Failure</b>	<b>3%</b>



# Medicine in Singapore

- **National University of Singapore Medical School founded in 1905**
- **The first institution of higher learning in Singapore**
- **An undergraduate medical school, modeled on the British system, with entry after high school. The degree is an MBBS, or Bachelor of Medicine, Bachelor of Surgery.**

# Medicine in Singapore

- **Medicine remains the most competitive School for University admission in Singapore and the region**
- **Each year, over 2,000 top students apply for only 250 places**

# Outline

- **About Singapore**
- **About Medicine in Singapore**
- **Singapore's transformation from Third World to First World**
- **Development of Academic Medicine in Singapore**

# Singapore's Development: From Third World to First World

**1965: Geography: Port**

**1970s: Petrochemicals, Singapore Airlines**

**1980s: Electronics and Computers**

**1990s: Financial Services**

**1997: ?**

# The Case for Developing Biomedical Sciences in Singapore

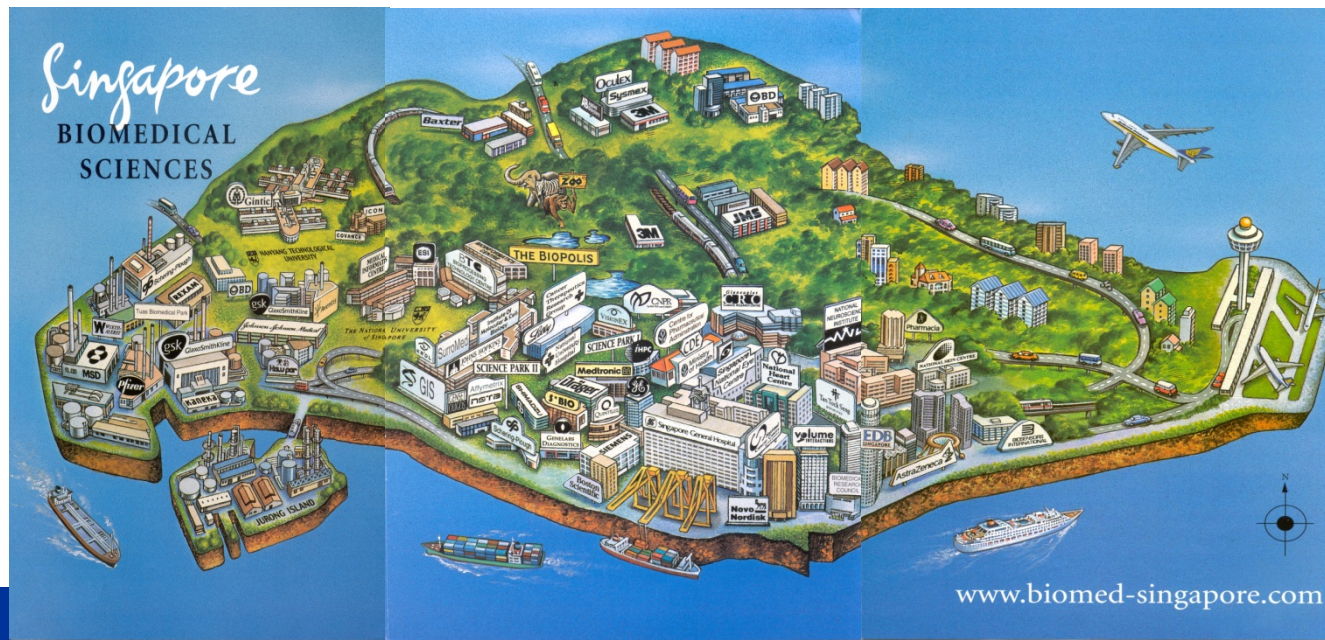
- **Tilting of world's economic center towards Asia**
- **Rapidly growing educated middle class want treatment for chronic disease**
- **By 2020, burden of world's chronic disease will be in Asia**
- **Major repository of scientific talent – especially young talent in IT, engineering, mathematics**

# The Case for Developing Biomedical Sciences in Singapore

- **Asians and Caucasians have differences in biology and drug handling that are not well characterized**
- **Pharmaceutical industry understands this**
- **Need for centers of excellence to complement those in the West**

# Singapore: Unique Features for Biomedical Research

- Compact; easy to get around and meet collaborators
- 80% of population get medical care from 7 public hospitals
- All citizens have unique identifier number when born
- Chinese, Malay, Indian populations
- High degree of IT use
- English is language of education, science, and business
- Supportive government for research, education, and healthcare



# Ethnic diversity



**76% Chinese**  
**14% Malay**  
**9% Indian**  
**1% Others**



# The Case for Developing Biomedical Sciences in Singapore

With the 3 different populations: Chinese, Indian, and Malay, we can:

- help develop therapies relevant to our community and nearly half of humankind

With a supportive government, compact size, and competitive infrastructure, we can:

- help accelerate drug and technology development and attract industry to invest and create high value jobs

# Why May Ethnicity and Population Matter?

## PHENOTYPE

Toxicity

Response

## Patient characteristics

Organ function

Nutritional and  
inflammatory status

## GENOTYPE

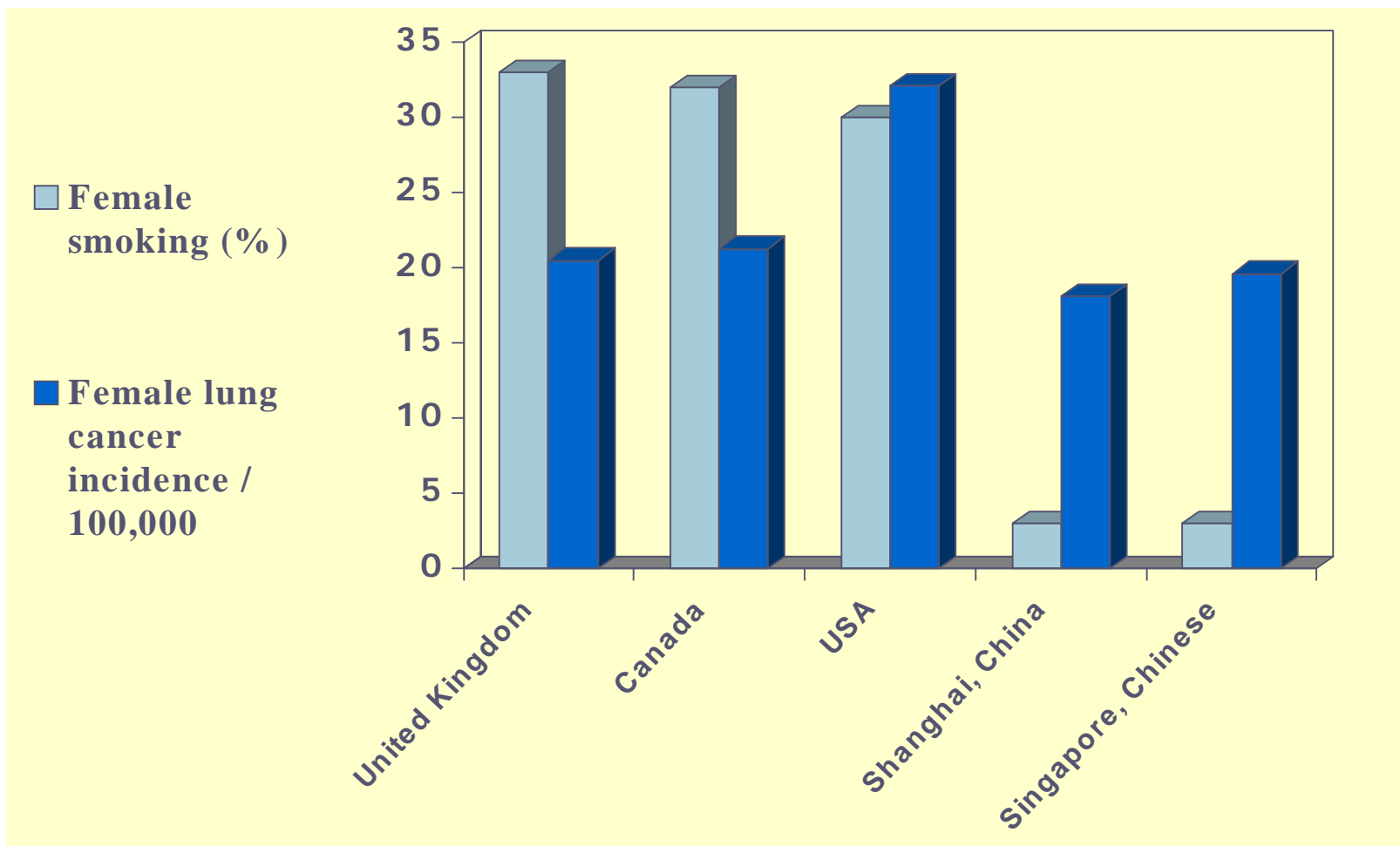
Drug metabolising  
enzymes

Drug transporters

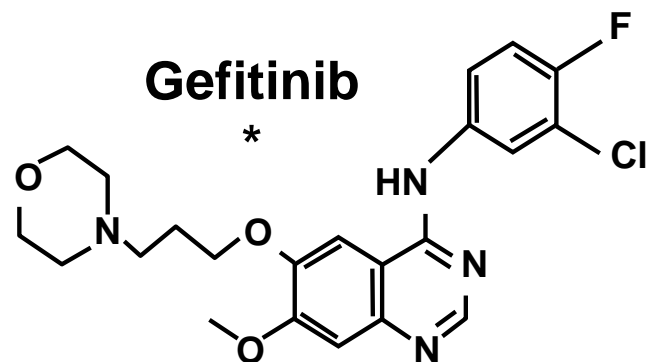
Receptors

Serum proteins

# Lung Cancer In Asians May Be Different From North America



# EGFR Selective Small Molecule Tyrosine Kinase Inhibitors

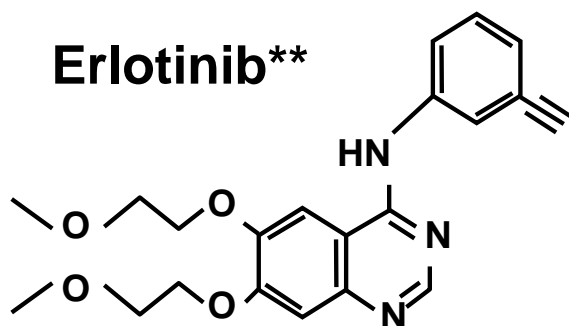


EGFR tyrosine kinase activity requires ATP

Gefitinib and Erlotinib compete for ATP binding

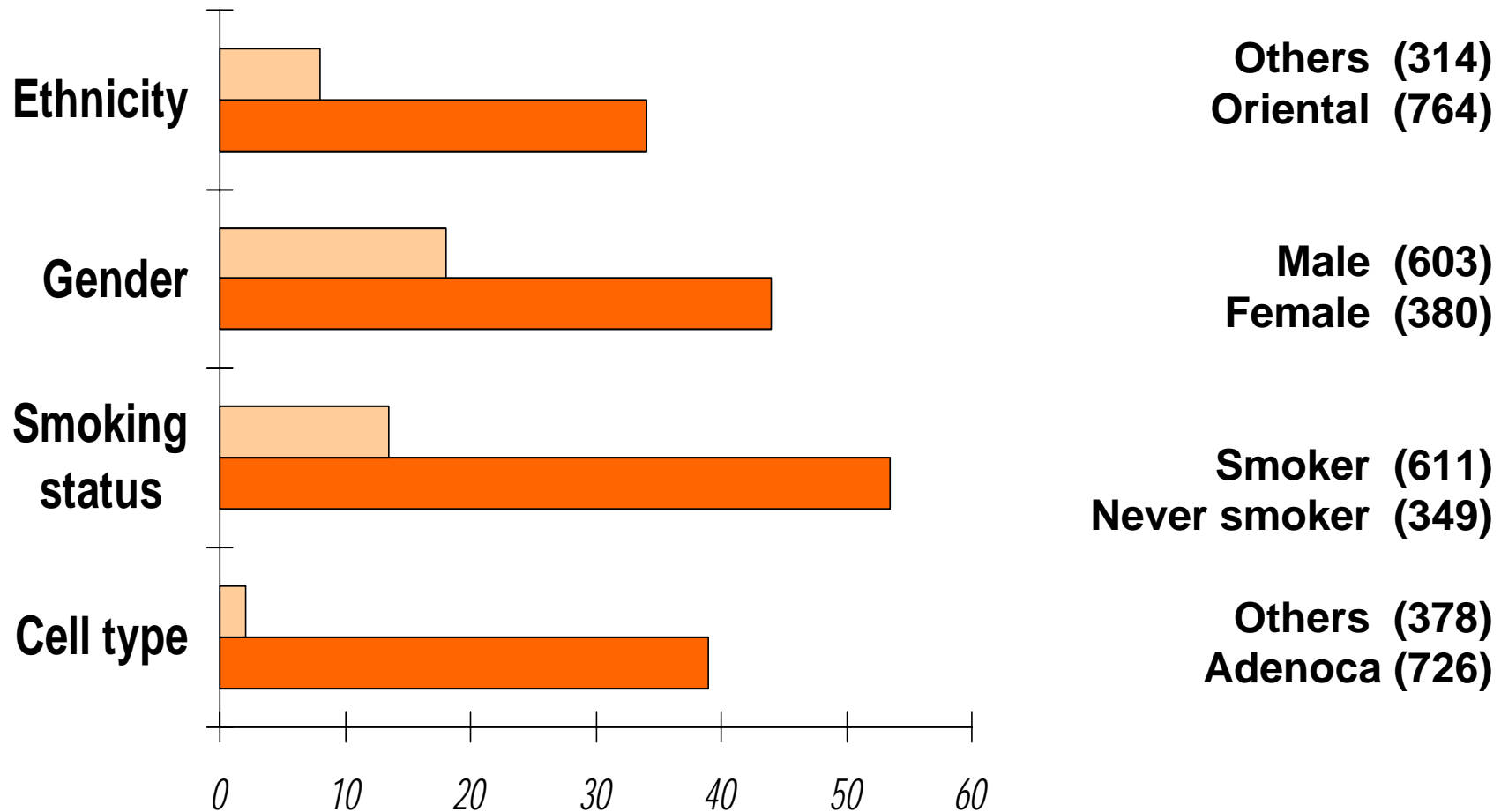
Reversible inhibitors

Orally bioavailable small molecules



\*Gefitinib = ZD1839, Iressa®  
\*\*Erlotinib = OSI-774, Tarceva™ 20

# Factors Predicting Response to Gefitinib & Erlotinib



**Others (314)**  
**Oriental (764)**

**Male (603)**  
**Female (380)**

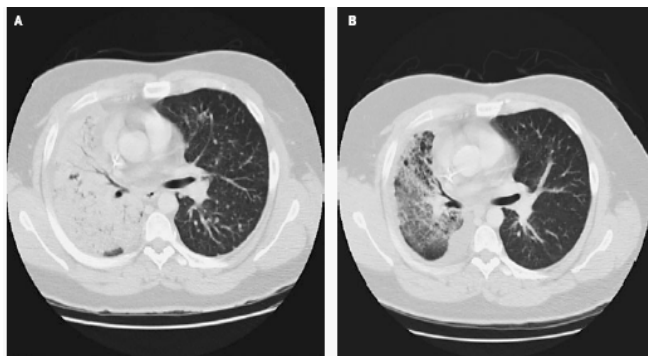
**Smoker (611)**  
**Never smoker (349)**

**Others (378)**  
**Adenoca (726)**

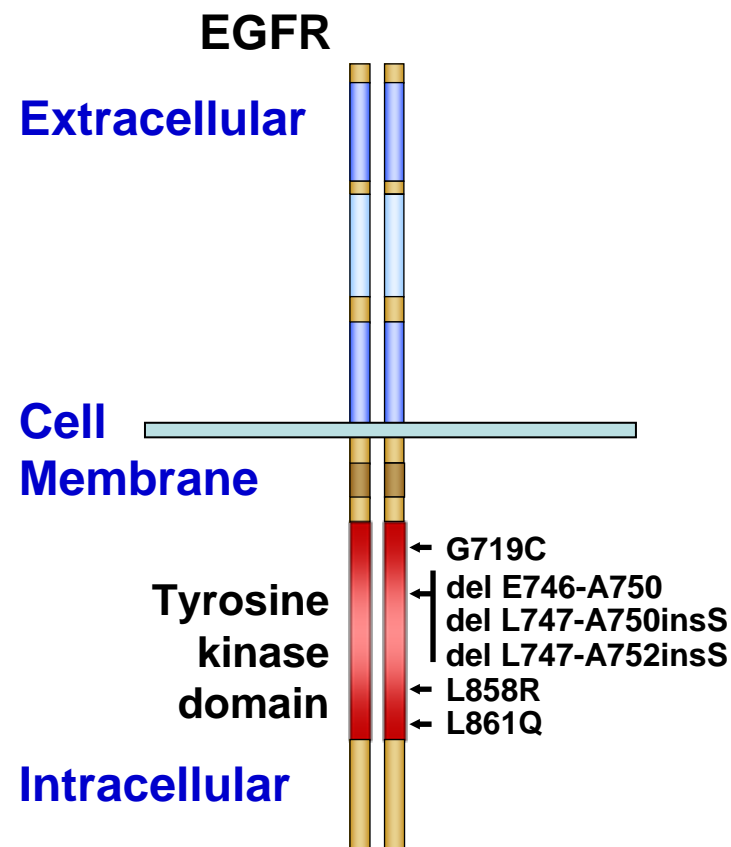
Activating Mutations in the Epidermal Growth Factor  
Receptor Underlying Responsiveness of Non-Small-Cell  
Lung Cancer to Gefitinib

Somatic mutations of the EGFR genes was  
identified in 8/9 pts with gefitinib-responsive  
NSCLC.

No mutations were detected in 7 pts with no  
response to gefitinib.



Consistent findings were also reported in  
Science (2004;vol 304) and PNAS (2004;vol



# Help From Friends.....



Ed Holmes



Judy Swain



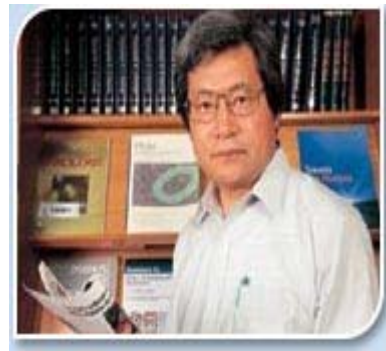
Dan Tenen



Edison Liu



Axel Ullrich



Yoshiaki Ito

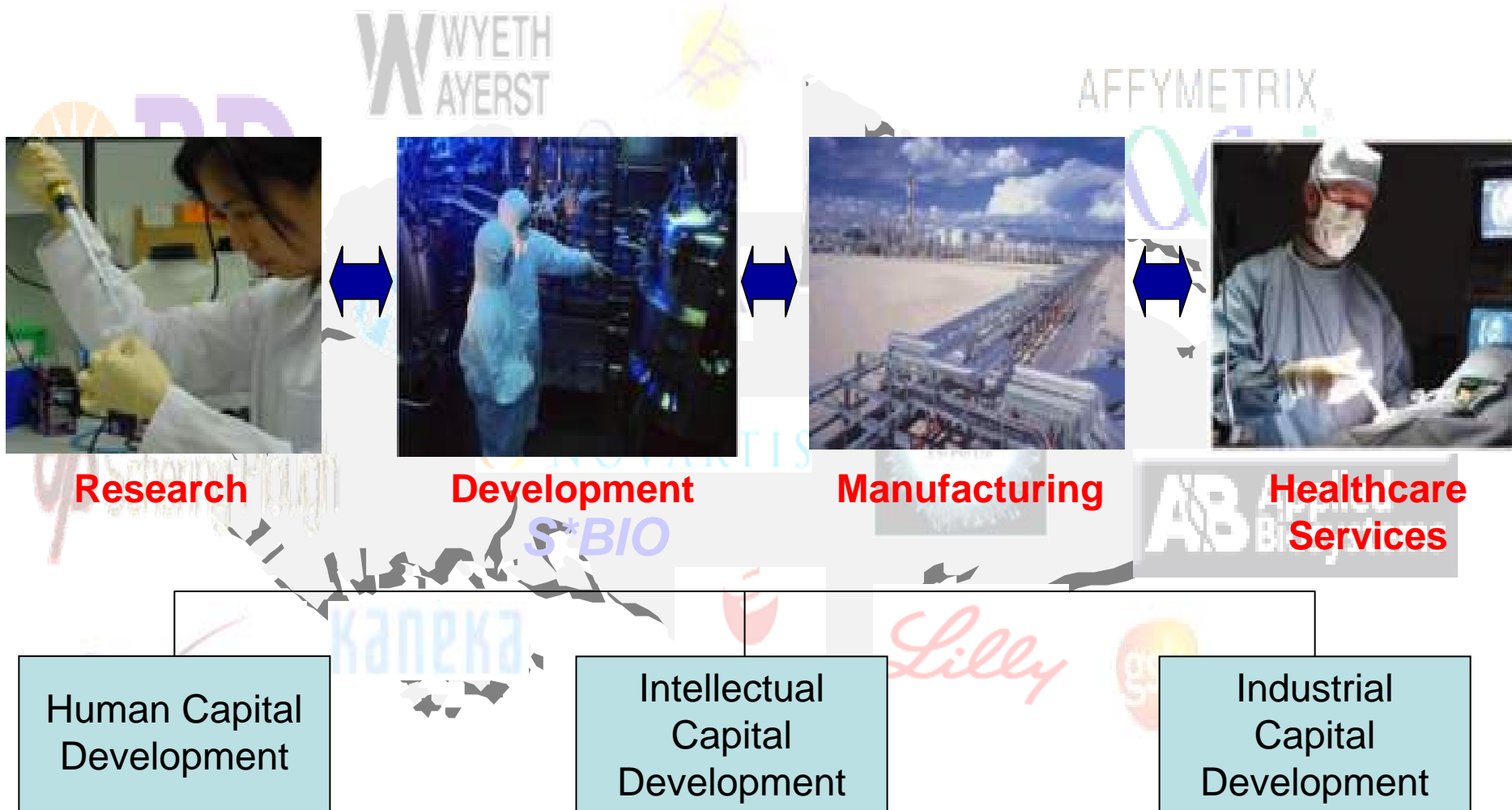


Neal Copeland



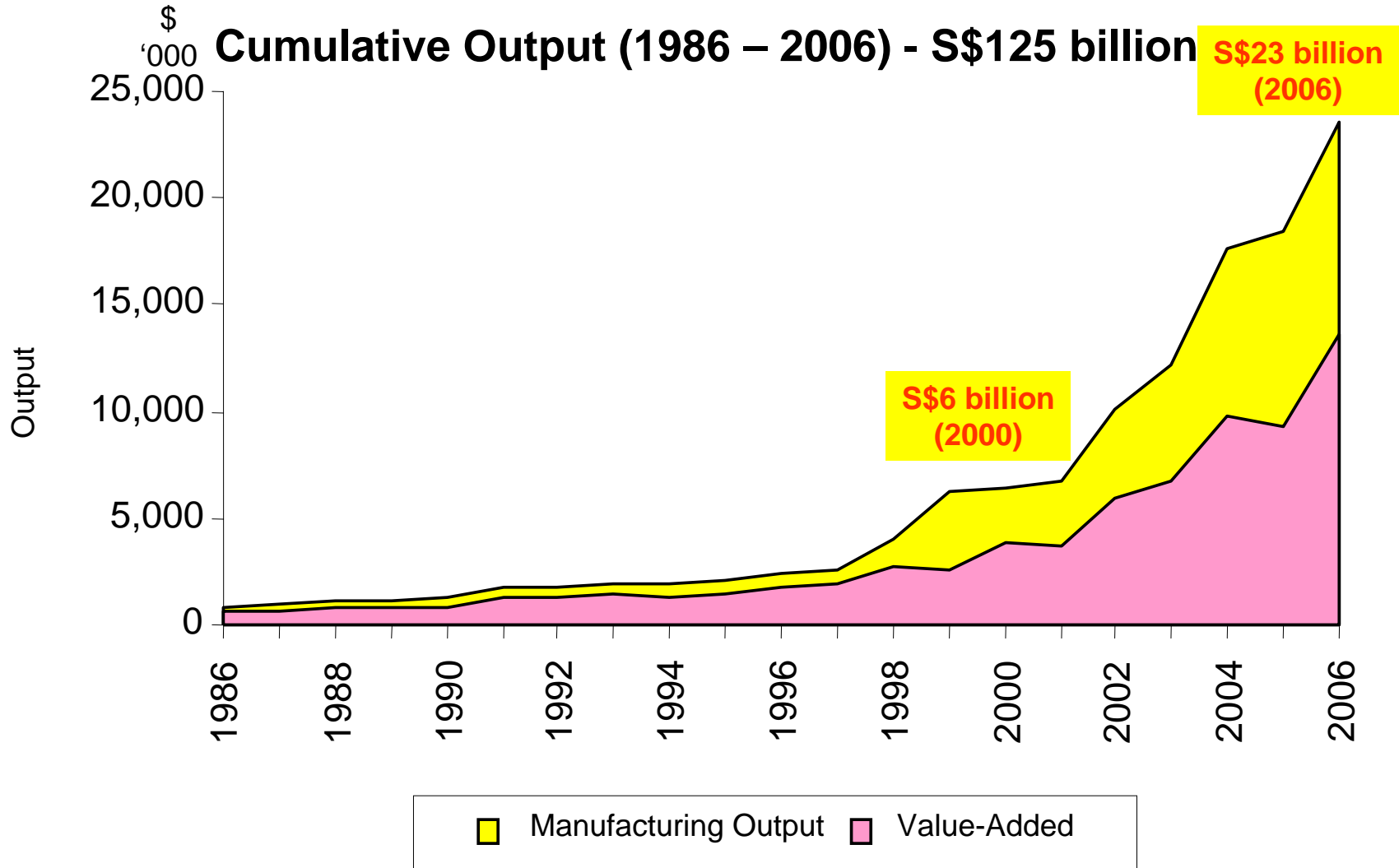
Nancy Jenkins

# Biomedical Sciences Value Chain

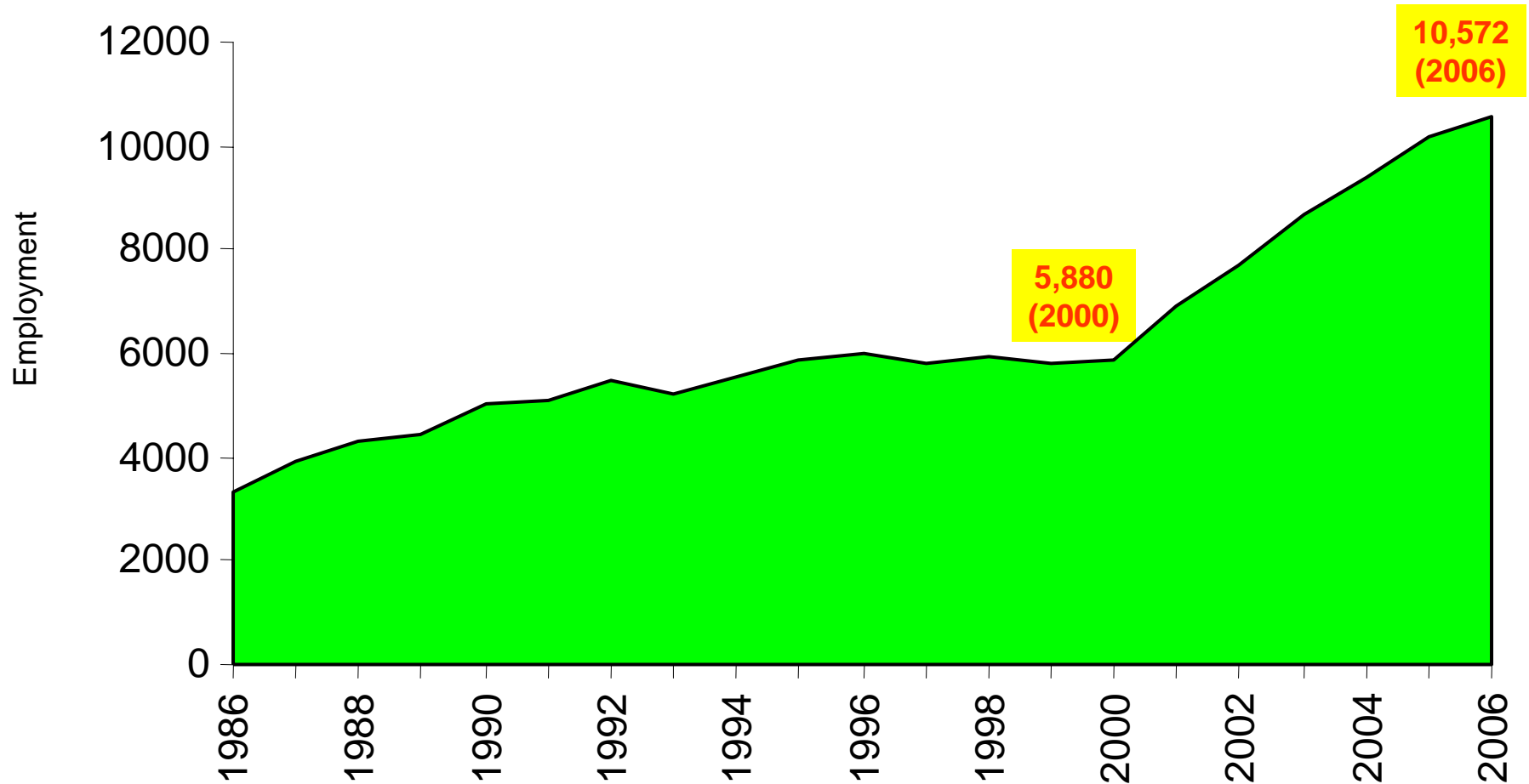




# Biomedical Sciences (BMS) Manufacturing Performance 1986-2006



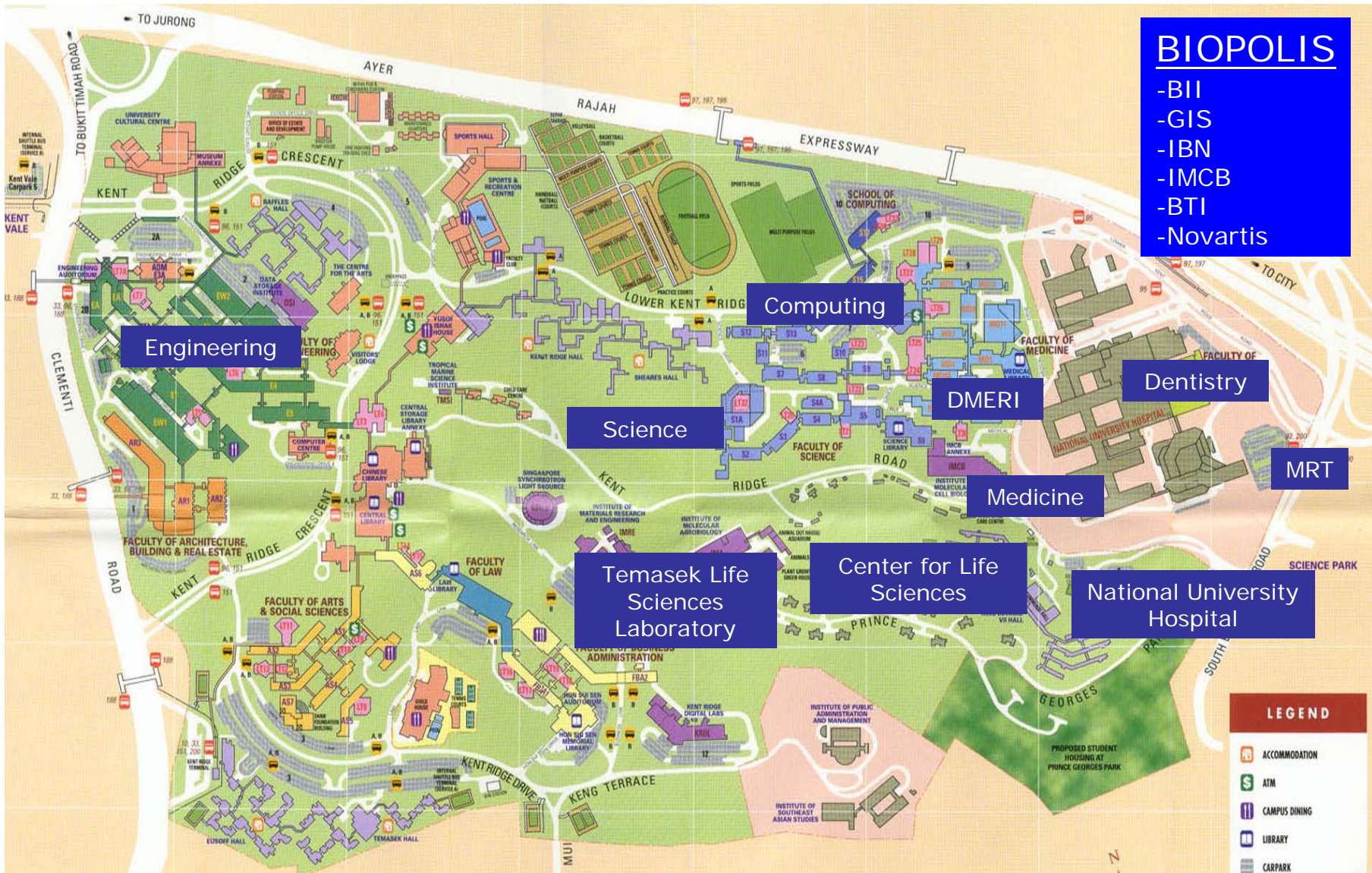
# Biomedical Sciences (BMS) Actual Employment 1986 - 2006



# Outline

- **About Singapore**
- **About Medicine in Singapore**
- **Singapore's transformation from Third World to First World**
- **Development of Academic Medicine in Singapore**

# The University and University Hospital



# National University Hospital

- **960 beds**
- **58,000 inpatient admissions. Average LoS: 5 days.**
- **85-90% occupancy**
- **600,000 outpatient attendances**
- **115,000 ER attendances**
- **560 medical and dental staff**
- **1900 nurses**
- **580 allied health**

# Yong Loo Lin School of Medicine



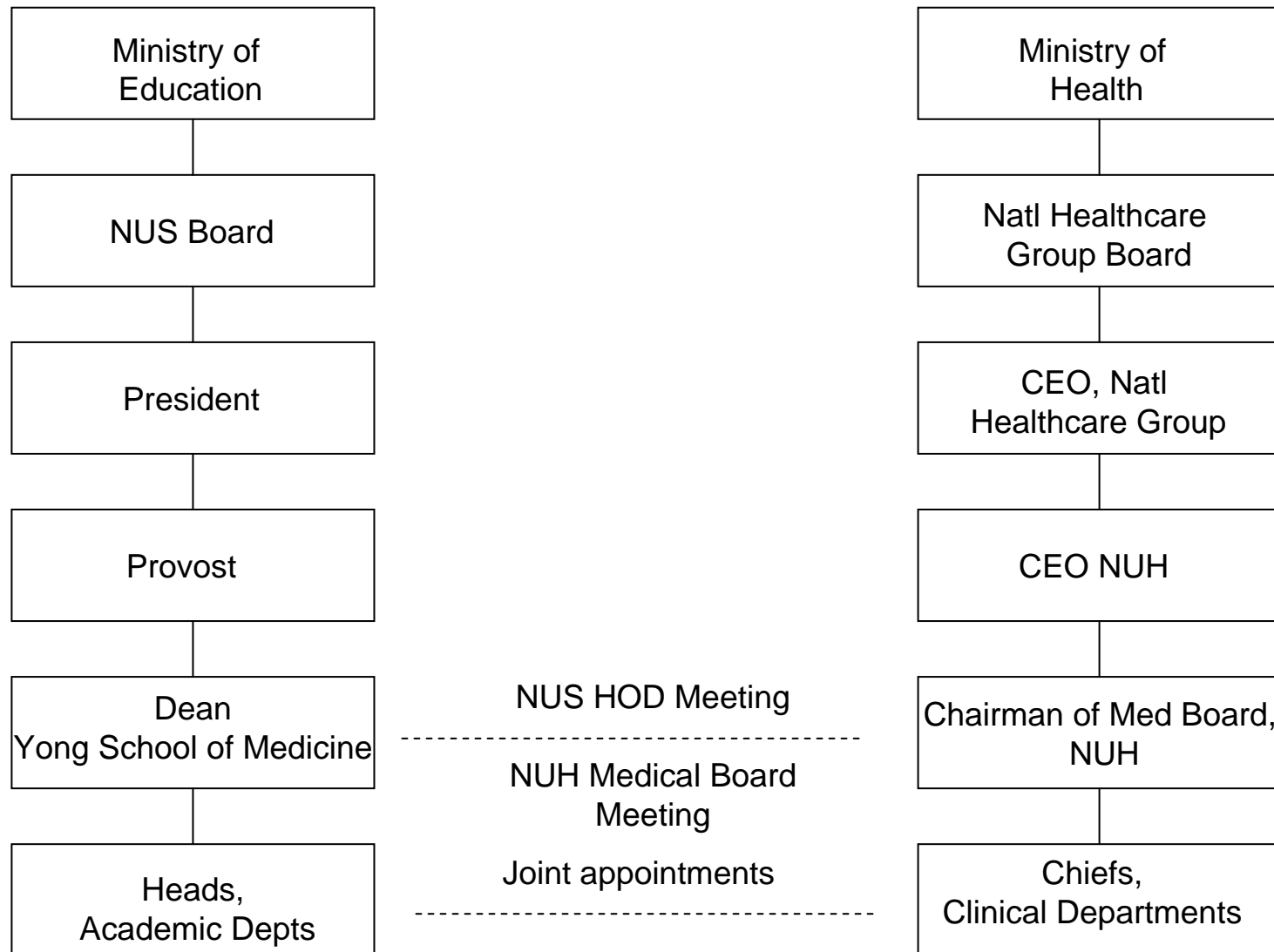
## Full Time Faculty

Full Professors	39
Associate Professors	102
Assistant Professors	86
Total	227

## Student Numbers

Undergraduate Medical Students	1,203
Graduate Students (MSc, PhD, Grad Diploma, Master of Nursing)	589
Master of Medicine (MMed)	49
Life Sciences Undergraduate Students	1,700+
Nursing Degree Students (2 intakes)	98

# Governance NUS and NUH: Pre-2008



# Thinking about academic medicine in Singapore

February 2006

**The School of Medicine's International Advisory Panel, comprising Ed Holmes (UCSD), Ralph Nachman (Cornell), and Tak Lee (King's College, London) recommend unification of the Medical School and the University Hospital under a common governance and led by an academic physician.**



# BMS International Advisory Council



**Sir Richard Sykes (Chairman)**  
Imperial College (UK)



**Dr John Mendelsohn (Co-Chairman)**  
MD Anderson (USA)



**Dr David Baltimore**  
California Institute of Technology  
(USA)



**Dr Sydney Brenner**  
The Salk Institute  
(USA)



**Dr Leland Hartwell**  
Fred Hutchinson Cancer  
Research Center (USA)



**Dr Peter Gruss**  
Max Planck Society  
(Germany)



**Dr John Reed**  
Burnham Institute  
(USA)



**Dr John Bell**  
University of Oxford  
(UK)



**Dr Colin Blakemore**  
Medical Research Council  
(UK)



**Dr Philippe Kourilsky**  
College de France  
(France)



**Dr Harriet Wallberg-Henriksson**  
Karolinska Institutet  
(Sweden)



**Dr Suzanne Cory**  
WEHI  
(Australia)



**Dr William Evans**  
St Jude (USA)



**Dr Helen Hobbs**  
UT Southwestern  
(USA)



**Dr Tadataka Yamada**  
Gates Foundation  
(USA)



**Dr Rolf Zinkernagel**  
University of Zurich  
(Switzerland)



**Sir Philip Cohen**  
University of Dundee  
(UK)



**Dr Alan Bernstein (Emeritus)**  
Canadian Institutes of Health  
Research (Canada)



**Dr Richard Lerner (Emeritus)**  
Scripps Research Institute  
(USA)



**Sir George Radda (Emeritus)**  
University of Oxford  
(UK)



**Dr Samuel Barondes (Emeritus)**  
University of California, San  
Francisco (USA)



**Dr Stanley N. Cohen (Emeritus)**  
Stanford University  
(USA)



**Dr David I. Hirsh (Emeritus)**  
Columbia University  
(USA)



**Dr Susan Lindquist (Emeritus)**  
Whitehead Institute of  
Biomedical Research (USA)



**Dr Paul A. Marks (Emeritus)**  
Memorial Sloan-Kettering Cancer  
Center (USA)



**Dr Alan Munro (Emeritus)**  
University of Cambridge  
(UK)



**Sir Keith Peters (Emeritus)**  
GlaxoSmithKline  
(UK)



**Dr Hans Wigzell (Emeritus)**  
Karolinska Institutet  
(Sweden)



**Dr Axel Ullrich (Emeritus)**  
Max-Planck Institute of  
Biochemistry (Germany)



**Dr John Shine (Emeritus)**  
Garvan Institute of Medical  
Research (Australia)

# Thinking about academic medicine in Singapore



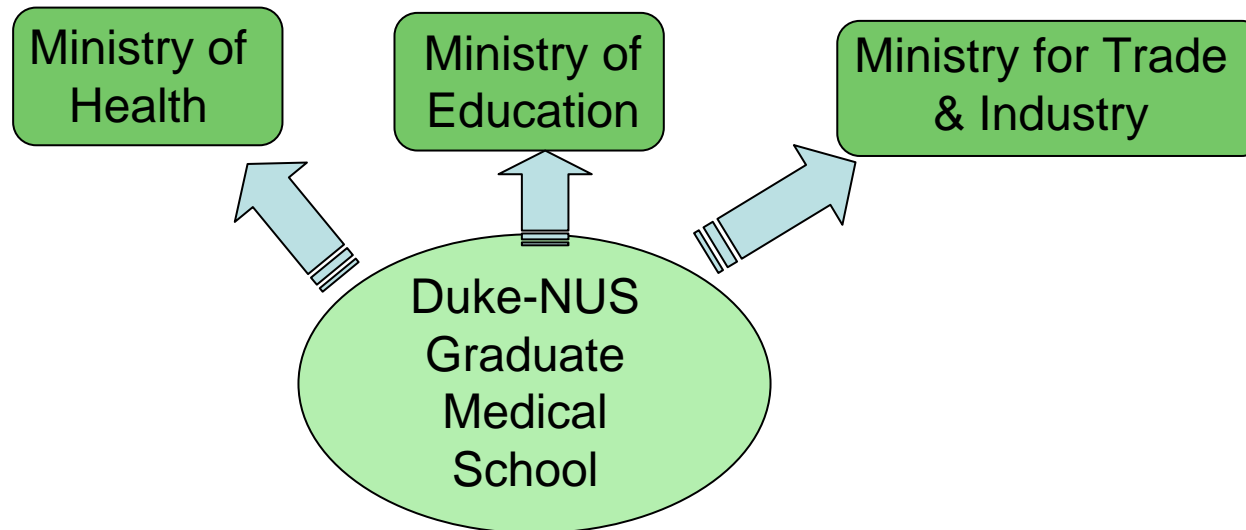
December 2006:

Singapore's International Advisory Council for Biomedical Sciences chaired by John Mendelsohn and Sir Richard Sykes recommends management and governance structures to help advance medical education, research, and healthcare delivery in an integrated fashion. The Council recommends development of Academic Health Centers – hospitals which do not focus solely on clinical service, but whose missions encompass and integrate teaching and research as equally important pillars.

# The Second Medical School

## Duke-NUS Graduate Medical School

### Developing New Models of Governance



# Thinking about academic medicine in Singapore

March 2007

**A Study Team, led by the Permanent Secretary of the Ministry of Health, meets with the Association of Academic Health Centers in the U.S. and discusses pros and cons of unified governance between University Hospital and Medical School**

# Development of Academic Medicine at the National University of Singapore campus



**July 2007**

**The Govt approves the formation of the National University Health System, unifying the governance of the National University Hospital with the Yong Loo Lin School of Medicine and the Faculty of Dentistry into an integrated healthcare system with a tripartite mission.**

**MOH (Lead)**

**MOE**



**Governing Board**

**CE**

**National University Health System:  
NUH -- SoM -- FOD**

Alexandra Hospital

Tan Tock Seng Hospital

Institute of Mental Health / Woodbridge Hospital

National Skin Centre

NHG Polyclinics

Other NHG Members...

Engineering Faculty

Law Faculty

School of Computing

Science Faculty

Faculty of Arts & Social Sciences

NUS Business School

Others – Other Faculties, NUS Graduate schools, Overseas Colleges, Teaching Centres etc.

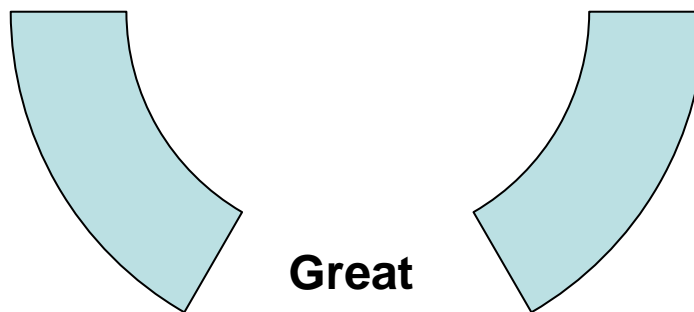
# The Tripartite Mission

Sets standard of care,  
esp for complex cases

**Best  
Clinical Care**

**Best  
Training**

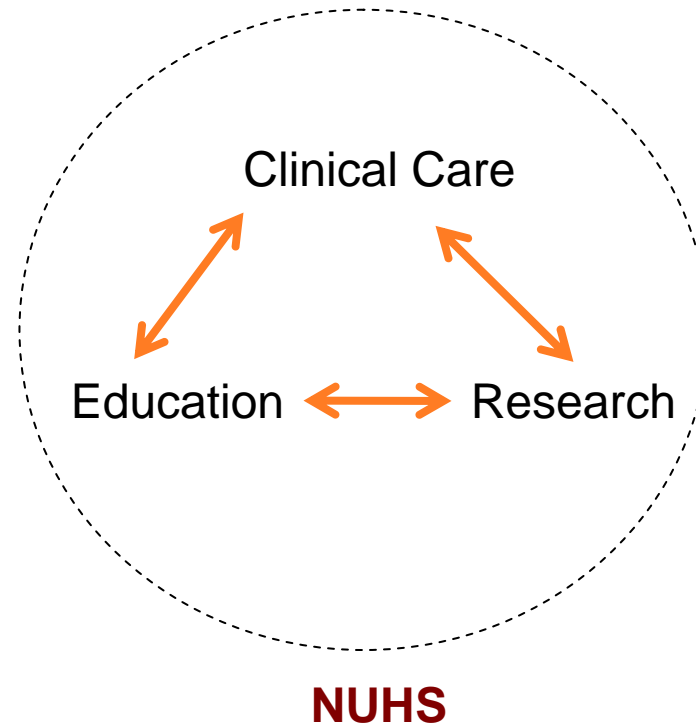
Attracts and anchors  
future leaders



**Great  
Research**

Brings hope, wins research  
\$, and inspires everyone

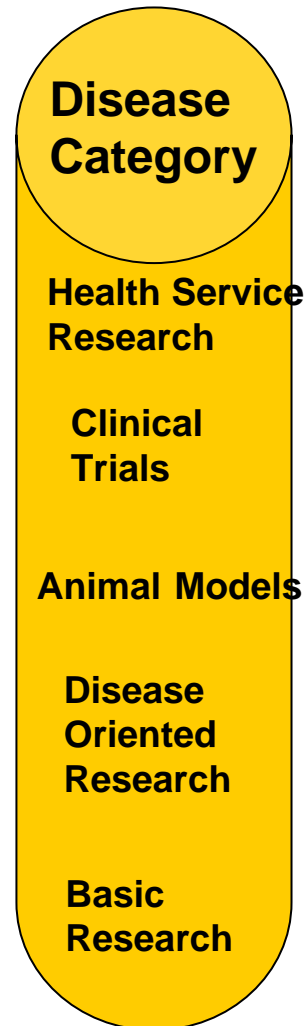
# Four Immediate Platforms



1. INTEGRATED strategic planning
2. ONE common budget & resource allocation system
3. HARMONISED HR framework
4. INTEGRATED space management

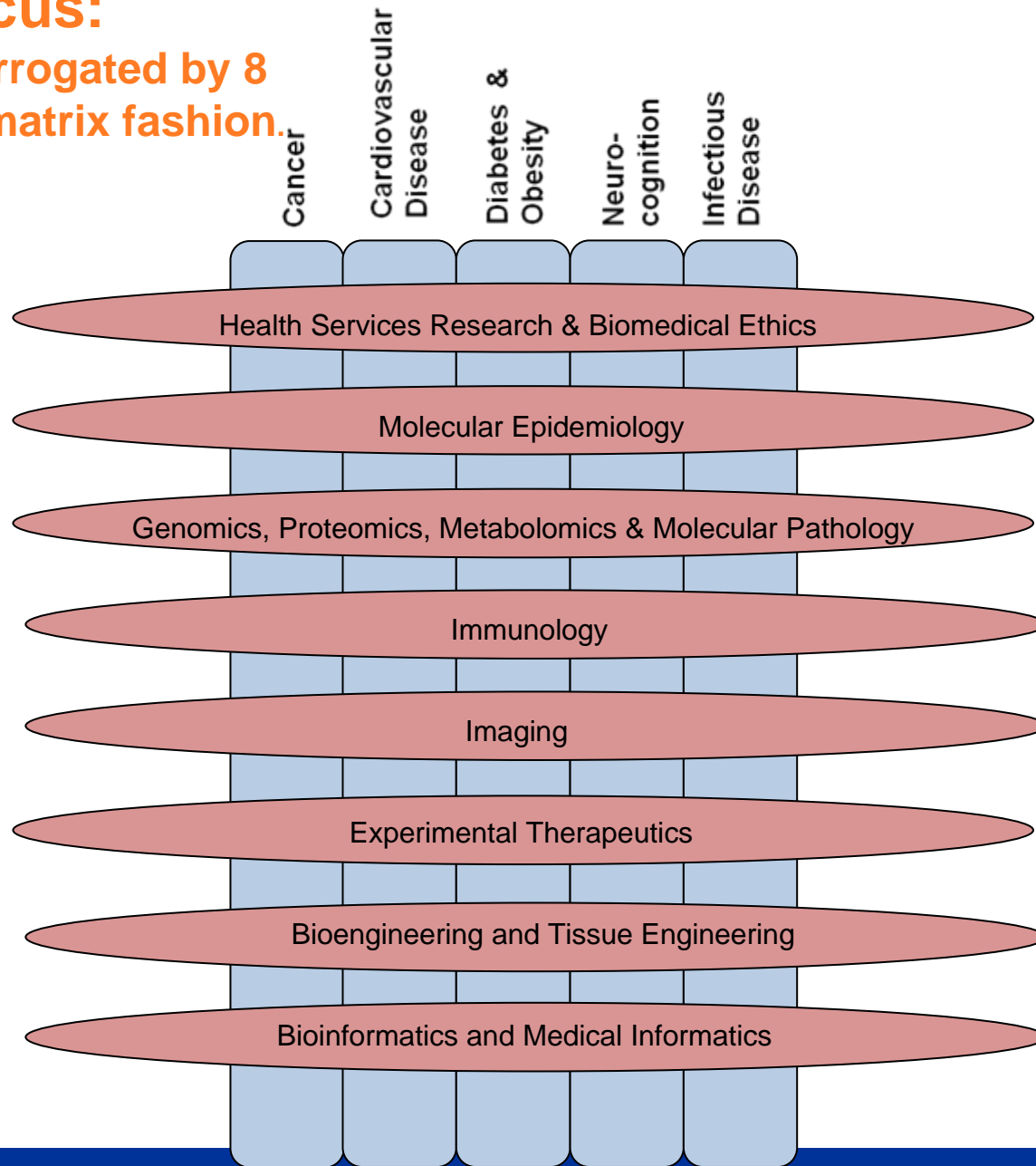


# Components of Academic Medical Research



# Areas of focus:

5 diseases interrogated by 8 platforms in a matrix fashion.



# Ultimately.....

- **Can we improve the health of our community?**
- **Can we shape the practice of medicine?**
- **Can we attract the best to a career in academic medicine?**
- **Can we contribute to the nation's economy?**

# Welcome to NUHS ...



## **Centre for Translational Medicine**

**Lecture theatres, seminar rooms, library, patient simulation, Investigational Medicine Unit, molecular pathology, Clinical Imaging Research Center  
Labs, BSL-3 facility: 40,000m<sup>2</sup>. Expected Completion: 2010**



**Welcome to Singapore !**

**Thank you**