SPEECH BY DR FRANCIS YEOH, CEO OF NATIONAL RESEARCH FOUNDATION, AT THE CONFERENCE IN HONOUR OF PROFESSOR GELL-MANN'S 80TH BIRTHDAY ON 24 FEBRUARY 2010 AT 9AM AT THE NANYANG TECHNOLOGICAL UNIVERSITY

Strengthening Research, Growing Innovation and Enterprise

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Distinguished Guests

Ladies and Gentlemen

1. I would like to thank the Institute of Advanced Studies, Nanyang Technological University, for giving me the privilege of speaking to such a distinguished group of international scientists, gathered here in this conference organized in honour of Professor Gell-Mann's 80th birthday. I have been asked to talk for a few minutes about Singapore's science and technology policies and the National Research Foundation. I am most happy to do so.

R&D as a driver of economic growth

2. Let me start first with some background about Singapore's development as a young nation. In the 1960s, newly independent Singapore faced the challenge of weak economic fundamentals. Unemployment was high at 14% and the labour force was poorly educated. The Singapore government adopted the strategy of export-led industrialisation. Going against conventional wisdom at that time, Singapore opened its economy to foreign investments and leveraged on Multi-National Companies (MNCs) to gain access to technologies, markets and most importantly, jobs.

3. In the 1970s, when other economies in the region followed our example, we adopted a skills-intensive economic strategy by training our workers to achieve

higher productivity. In the 1980s, we shifted to a capital-intensive phase of development with investments in expensive infrastructure and equipment. In the 90s, to ensure sustainable productivity, we moved to a technology-intensive phase by building up our R&D capability to support industrial development. We are now in the knowledge-based phase of development, in an economy which is characterized by information intensity, high technology, globalization and rapid change.

R&D in Singapore

4. For Singapore to continue to grow and prosper, the government realizes that the country needs to upgrade its capabilities and move towards a diversified knowledge-based economy with high value-added industries and services. Such a knowledge-based economy requires strong research and development capabilities. So even though Singapore had invested heavily in R&D over the years, the government decided that such investments needed to be sharply increased. So in 2006, the budget for R&D was raised from $5b during the preceding 5 year period to $13.9b, almost 3 times more, for the current 2006-2010 period.

National Research Foundation

5. At the same time, R&D was elevated to a national priority with the creation of a high level Research, Innovation and Enterprise Council (RIEC) chaired by the Prime Minister and the establishment of the National Research Foundation, as its secretariat to drive national R&D strategies. A $5b National Research Fund was committed to the NRF to drive 3 major thrusts, which were:

- Catalyse new industries through strategic research programmes;
- Expand research capacity to create new knowledge; and
- Nurture innovation and entrepreneurship to exploit the knowledge created.

6. Let me now talk a little about the programmes that the NRF has put in place for the 3 thrusts.

Catalyse new industries through strategic research programmes

7. Under the first thrust to catalyse new industries through strategic research programmes, 3 strategic research programmes (SRPs) were chosen, supported by a budget of $1.55b. These were:

i) Translational and Clinical Research in Biomedical Sciences (BMS-TCR);
ii) Environment and Water Technologies (EWT) with two areas, Clean Water and Clean Energy; and
iii) Interactive and Digital Media (IDM).

8. These were chosen in a top down way because Singapore has a unique competitive advantage to gain a leadership position and create new industries in each of the three sectors.

9. NRF has just concluded the mid-term reviews of the 3 strategic research programmes. Review panels convened by the NRF have observed good progress in each programme. For example, under the Biomedical Sciences programme, a translational research project in gastric cancer has helped the research team detect gastric cancer early in several patients. Under Clean Water, Singapore has been able to continue to reduce the cost of water purification through R&D. This has raised Singapore's international standing as a water hub and the reputation of our industry for greater competitiveness. It has transformed an inherent national water resource constraint into a new economic growth engine. The IDM programme has similarly attracted the attention of large IT companies to expand their R&D presence here and also led to a proliferation of technology start-up companies that gave much vibrancy to Singapore's rapidly developing innovation eco-system.

Expand Research Capacity to Create New Knowledge

10. Key to our ability to create new knowledge and intellectual property is talent and the facilitation of top talent to do research. Thrust 2 consists of several initiatives to expand research capacity and create new knowledge. We seek to put in place a virtuous cycle for the development of R&D talent, making Singapore an attractive place for research for both accomplished and young researchers. NRF has implemented several initiatives to achieve this. These are (a) Research Centres of Excellence (RCE) in collaboration with the Ministry of Education; (b) Campus for

Research Excellence and Technological Enterprise (CREATE); (c) NRF Research Fellowship and (d) Competitive Research Programme (CRP) Funding Scheme. Let me describe each of these briefly.

11. The Research Centres of Excellence (RCE) supported by NRF and MOE with US$100m funding for each centre, are expected to be among the top research centres worldwide in their respective fields within a decade of establishment, so that they would be able to raise our universities' research capacity and international standing. They serve to help orientate our universities from teaching universities to internationally competitive research-intensive universities that are attractive to researchers and students. Four have been established so far, with 61 PIs, 74 post-docs and 36 PhD students. A fifth and last RCE was approved just this month, in Environmental Life Sciences Engineering.

12. The **C**ampus for **R**esearch **E**xcellence **A**nd **T**echnological **E**nterprise (CREATE) is a project to build a hub of research centres from some of the world's best research universities in Singapore. CREATE would act as a magnet for talent, making Singapore an R&D hub that congregates the best of research talent from diverse cultures and backgrounds. At steady state, CREATE would house some 1,000 researchers from top research institutions, universities and corporate labs. MIT was the first university to set up a research centre in CREATE. Since its inception in Jul 2007, the MIT SMART Centre now has about 400 researchers, including collaborators from NUS, NTU and government agencies. A smaller program is the Technion Research Programme in Regenerative Medicine, which started in Oct 2009. Switzerland's ETH would set up a Singapore-ETH Centre (SEC) for Global Environmental Sustainability later this year. Several other top universities are in advanced stages of discussion with NRF to establish similar centres under CREATE.

13. The Competitive Research Programme (CRP) funding scheme is a merit-based competitive funding framework which provides opportunities for local researchers from the universities and industry to compete for substantial research grants of up to S$10 million each. In addition to building up the research capacity in our universities and companies, the CRP grant complements NRF's top-down

approach of identifying specific research areas by having researchers identify, via a bottom-up process, new potential strategic research areas which may become industries of the future. Twenty-five projects in diverse fields have been awarded CRP grants in the five calls. Some projects have made significant scientific discoveries. For example, the project on "Graphene-related Materials and Devices" reported the first room temperature chemical synthesis of carbon nano-tubes in liquid, and was the first to demonstrate the use of graphene and its derivatives as optical elements in lasers. The potential exploitation of graphene research could lead to the creation of novel energy storage materials or new molecules which could be applied in solar cells.

14. The NRF Research Fellowship was introduced to grow a critical mass of top young scientists in Singapore. The Programme targets brilliant young researchers who are ready for their first independent research appointments. Awarded NRF Fellows were given research grants and tenure-track faculty appointments at their host universities in Singapore and are expected to be absorbed as faculty after completing their research projects. Since 2007, 28 fellowships have been awarded to young scientists from all over the world.

Nurture innovation and entrepreneurship to exploit the knowledge created

15. The substantial investments in R&D over the years must ultimately be expected to bring economic or societal benefits to Singapore. This is addressed by the 3rd thrust, which seeks to nurture innovation and entrepreneurship.

16. The NRF introduced the National Framework for Innovation and Enterprise to create a supportive environment for innovative ideas to grow and be turned into businesses. The NFIE consists of a slew of projects to promote academic entrepreneurship. These included proof-of-concept grants, early stage venture capital and technology incubations schemes.

Conclusion

17. The NRF has put in place certain structures and systems into the R&D landscape in Singapore. The government is now planning ahead for supporting R&D in the next 5 year period. While it is premature to discuss plans for the next 5 years, what is clear is that the commitment to R&D will remain strong. Singapore's Gross Expenditure on R&D was 2.8% of GDP in 2008 and we expect to reach the 3% target by 2010. The government has already indicated a target for GERD to reach 3.5% by 2015.

18. Singapore has always positioned itself as an international hub in Asia – a hub for trade, for tourism and for transportation & logistics. In the same way, we also aspire to be a hub for research, innovation and enterprise. Your participation in scientific meetings like today's conference will help us with this goal.

19. With that, let me conclude by wishing you a very stimulating conference.

20. Thank you.