



Singapore, New Research Hub

It may be a young country and a relatively new player in the world of research, but Singapore is making a name for itself in Asia. With an aggressive government policy of investment in technology and biomedical research, the small island nation is attracting international attention and partners.

The Republic of Singapore gained its independence just 45 years ago. It is now the world's fourth-largest financial center with a healthy economy, despite the recent recession. The fledgling country began investing in science early on with the creation of the Science Council in 1967. Yet the real push for research development began in the 1990s, when the government decided to turn Singapore into a major regional and international player in the field. Unlike many other countries, Singapore took a top-down approach, and its ambitious program paid off.

In 1991, the country founded the National Science and Technology Board (NTSB), renamed in 2002 A*STAR (Agency for Science, Technology

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The Fusionopolis complex in Singapore.

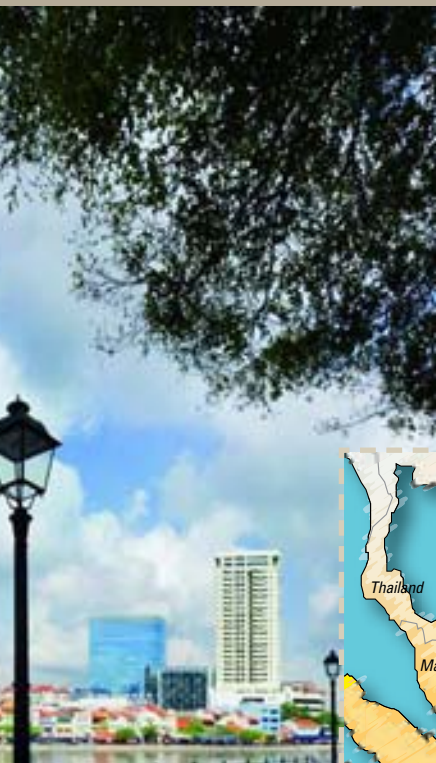
and Research). In 2006, the National Research Foundation (NRF) was set up. It commits considerable funding to research. Four Research Centres of Excellence (RCEs) were established over the next four years and three campuses for Research Excellence and Technological Enterprise were created to ensure a supply of skilled workers for the new technological Singapore. Moreover, Singapore also boasts three autonomous universities: the National University of Singapore (NUS), the Nanyang Technological University (NTU), and Singapore Management University. A fourth public university, the Singapore University of Technology and Design, will open its doors in 2011. The past few years have seen the addition of the futuristic Biopolis and Fusionopolis, built as twin hubs of biomedical and engineering research.

Completed in 2006, Biopolis is an international research and development center for biomedical sciences. It was conceived as the cornerstone enabling to establish biomedical sciences as a key pillar of the Singapore economy. The nine towers of the

Biopolis complex cover an area of 222,000 m² and bring together more than 2000 scientists, researchers, technicians, and administrators in one location.

Officially inaugurated in October 2008, Fusionopolis is the science and engineering research powerhouse. It accommodates various research organizations, high-tech companies, government agencies, retail outlets, and serviced apartments in its distinctive cluster of buildings. Phase II of the hub is set to include a green building featuring the world's longest continuous artificial strip of vertical vegetation.

This environment-friendly approach is not only applied to architecture. More recently, Singapore has committed itself to becoming a global hub for cleantech investment, development, and education. The government has set aside \$700 million to develop R&D in the sector and has announced 200 scholarships for doctoral degrees in clean technology. The government has also created a solar energy research institute and has announced a 50-hectare cleantech park aimed at creating, testing, and commercializing products such as energy-efficient buildings and electric vehicles.



As part of its drive to become a major player in research, Singapore set about wooing international partners. Although CNRS's involvement in the country is recent—cooperation started in 1998—its activities in Singapore have significantly developed over the past two years. CNRS now operates two international joint research units (UMI) in Singapore, almost 10% of its total number of UMIs worldwide.

IN FIGURES

- 4,987,600 inhabitants (2009)
- 2.77% of GDP allocated to R&D (2008)
- 33,365 researchers
- 191 CNRS trips to Singapore in 2009 (up 125% on 2004)
- 5480 scientific publications (2007)
- 41 co-publications with CNRS (2007)

The most recent, CINTRA,¹ (see box) was set up last October, as a joint operation by CNRS, the Nanyang Technological University (NTU), and Thales. The new UMI will conduct research in nanotechnologies for electronics, photonics, and related applications.

The first joint unit, IPAL (Image & Pervasive Access Lab),² dates back to 1998. It was set up by French researchers from CNRS and the Joseph Fourier University in Grenoble, together with Singaporean researchers from A*STAR, the Institute for Infocomm Research (I2R), and the National University of Singapore (NUS). Under the management of Director Daniel Racocceanu (CNRS), IPAL focuses on two research themes: Medical Image Understanding (MIU), targeting semantic and cognitive exploration of medical images for diagnosis and prognosis; and Pervasive Access and Wellbeing Management (PAWM), focusing on ambient intelligence dedicated to aging and dependents. Today, IPAL is mainly located in Fusionopolis with additional research offices at the National University of Singapore. In 2009, IPAL organized the Singaporean French IPAL Symposium on ICT and imaging, with a keynote lecture by Joseph Sifakis, recipient of the prestigious 2007 A.M. Turing award.

CNRS commitment to Singapore has increased rapidly over the past

few years. In 2004, CNRS researchers only organized 85 trips to the country. In 2009, there were 191 trips, an increase of 125%. That makes Singapore the second most frequent destination for CNRS researchers in Southeast Asia, after Vietnam.

An example of how initiatives can quickly generate major endeavors in Singapore is the cooperation between CNRS and the Centre for Quantum Technologies (CQT). In 2006, Christian Miniatura, a CNRS researcher specialized in quantum transport, was already working at the National University of Singapore, where the CQT was being developed. When the CQT officially became a national Research Centre of Excellence, in December 2007, it took just seven months for two CNRS researchers to integrate its teams. A third researcher joined them a few months later. An International Associated Laboratory (LIA) is expected to be created shortly.

Fundamental research is also being boosted in Singapore's universities. For instance, thanks to an initiative by French researchers at CQT, the prestigious physics school Ecole des Houches, which is organized every year by CNRS in the French Alps, held an exceptional session at the NUS during the summer of 2009—its first session abroad since 1951.

The Institute of Chemistry is the latest CNRS Institute to get involved in Singapore, with the temporary transfer of a senior researcher to the Nanyang Technological University last September. The two most recent Centres of excellence established by the NRF are the Earth Observatory of Singapore and the Mechanobiology RCE, which has already captured the attention of several CNRS researchers in Earth sciences and biological sciences.

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1. <http://cintra.ntu.edu.sg/>
2. <http://ipal.i2r.a-star.edu.sg/>

CINTRA: A SUCCESSFUL PARTNERSHIP

CINTRA was set up in Singapore last October to develop nanotechnology for electronics, photonics, and related applications. It answered a need to strengthen pathways between technological breakthroughs and industrial innovation, and became the first CNRS international joint research unit with an industrial partner in Asia. The name is an acronym of the three partners: CNRS International, Singapore's Nanyang Technological University (NTU), and Thales Research Alliance. The CINTRA Laboratory is located at NTU's Research Techno Plaza and is managed by a scientific committee with representatives from all three partners. The lab's director, Dominique Baillargeat of CNRS, believes CINTRA is a great opportunity for researchers. "NTU sees CINTRA as an important

research center. They believe in it," he says. "It's a showcase for NTU and Singapore, but it's also important for CNRS's international recognition." There are approximately 30 researchers currently based at CINTRA, not all full-time. That number could rise to 40 by September with the arrival of NTU and CNRS senior researchers and PhD and post-doctoral recruits. Research focuses on nanocomponents and the new circuit architectures needed to overcome current limitations. One example of such application-driven challenges is the development of innovative technologies for co-integrating electronics and photonics on a single chip, to take advantage of their combined capabilities for next-generation computing, sensing, and communication applications.

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