

Overview of Singapore's Pharmaceutical and Biotechnology Industry



Asia Presents New Growth Opportunities

Asia's healthcare market is valued at US\$240 billion in the year 2008 and is expected to grow between 5% to 10% (Frost & Sullivan, 2009). While Asia presents a dynamic and fresh playing field that offers tremendous opportunities for those who dare to think differently, its diversity in political systems, culture and economic development constitute challenging new grounds. Success will thus depend on an in-depth understanding of local conditions and regulatory regimes.

Driving Expansion in Asia

Located in the heart of Asia, Singapore is a choice location for companies' international and regional headquarters to drive global companies' expansion into Asia and Asian companies' global outreach.

Key advantages include:

- **World's Easiest Place to Do Business** (World Bank, 2009) – Singapore has established a strong legal system and a stable political system that prides itself on honesty, quality and reliability. At the same time, the city-state offers an international business environment with the world's global industry leaders setting up business activities that include headquarters, R&D and manufacturing. Leveraging its world-class infrastructure and reliable public utilities, Singapore presents a trusted location to manage companies' business expansion while being attuned with global developments.
- **Excellent Connectivity** – Singapore is well connected with regional markets within seven-hour flight radius. As a leading

aviation hub in Asia, Singapore's Changi Airport serves over 80 international airlines, with over 4,500 flights each week, connecting to 190 cities in more than 60 countries. Coupled with its world-class infrastructure, Singapore has been a location of choice for companies to host regional meetings and conferences. Furthermore, Singapore is connected to the most extensive network of Free Trade Agreements (FTAs) in Asia, having concluded 19 FTAs that cover 60% of the world's GDP.



- **Access to Talent** – Singapore offers top quality of life in Asia (Mercer HR, 2009) and has drawn both global and regional talent, who seek to experience the best international experience at the cultural crossroads of the East and the West. Singapore's safe environment and its base of renowned international schools have also made it easier for executives to relocate their families.

Leveraging Singapore's advantages, 30 leading biomedical sciences companies have set up regional and international headquarters in Singapore. In 2009, Takeda opened its regional headquarters in Singapore to drive its commercial growth and reach in Asia Pacific; Quintiles also doubled the size of its Asia-Pacific headquarters to an 80,000 square-foot facility to meet the region's growing demand.

Manufacturing Innovative Medicines

As global companies seek to manage their risks by diversifying the geography of their

production plants, Singapore presents a reliable manufacturing site where they can effectively transfer technology, efficiently scale-up manufacturing and ensure quality control of their products. Today, leading pharmaceutical and biotechnology companies have invested in 30 commercial-scale facilities, where some of their most innovative medicines are produced.

Some of the key benefits of manufacturing in Singapore include:

- **Rapid set-up and export** – Companies setting up in Singapore can construct and validate a manufacturing plant within 24-36 months, given the city-state's quality manpower, world-class infrastructure and reliable supporting services. In addition, Singapore has established a good track record with regulatory authorities, as well as strong trade linkages with major markets. Together with its excellent logistics connectivity, companies can

quickly export and distribute their products to global markets.

- Pro-Business Environment – Singapore is well-known for its business-friendly environment, with its good corporate governance, clear and consistent government guidelines and excellent IP protection. Singapore also offers a politically stable and favourable tax environment. This ease of doing business is complemented by the country's support for the adoption of environmentally-friendly practices and technologies in the manufacturing sector.
- Quality Manpower – Singapore offers a base of skilled local talent who are well-trained in science and mathematics. Singapore's workforce is consistently ranked the world's best labour force (BERI). Since the 1970s, the city-state has had zero man-days loss on strikes, due to its tripartite system that brings together the government, employers and unions to

address manpower issues harmoniously. Manpower costs remain competitive with entry salaries for B.Eng graduates pegged at US\$1,500 each month for about 50 working hours each week.

- Industry's partner in process development – Companies (e.g. GlaxoSmithKline, Novartis) are extending beyond commercial manufacturing into process development. In addition to setting up their own process development units, companies can also partner our research institutes (e.g. Institute of Chemical Engineering and Sciences, Bioprocessing Technology Institute) to optimise manufacturing processes and the formulation of new products. The Singapore Institute of Manufacturing Technology has partnered companies to develop automation solutions to streamline operations.

Singapore is strengthening its position as Asia's leading site for biopharmaceutical manufacturing. In 2009, leading companies located their first-in-Asia facilities in Singapore – GlaxoSmithKline opened its vaccine plant that will produce purified bulk polysaccharides and conjugates which are used to manufacture GSK's new pneumococcal conjugate vaccine, meningitis, and other new innovative vaccines; Baxter commenced construction for its Advate plant; Roche purchased Lonza's mammalian-cell facility to manufacture Avastin and officially opened its microbial-cell facility to manufacture Lucentis. Singapore also made headway in cell therapy with Lonza's first-in-Asia cell therapy plant.



Within five years since the first biologics announcement, leading companies have invested about US\$2 billion in six major plants. In 2009, Millipore set up its first regional training centre for biopharmaceutical manufacturing, in response to the growing base of biologics plants in Singapore.

Building on our strong track record for chemical-based pharmaceutical and biologics manufacturing, Singapore is building up capabilities in process development and green manufacturing. In 2009, Bioprocessing Technology Institute partnered GlaxoSmithKline Biologicals for vaccine and process development. GlaxoSmithKline also announced a S\$50 million endowment fund, jointly launched with the EDB, to fund graduate studies in green manufacturing and public health policy.

Accelerating Drug Discovery & Development

Singapore has established world-class scientific and clinical excellence, which enables

companies to carry out candidate to proof-of-concept activities. Complementing these advantages with Singapore's established base of contract research organisations and global central labs, Singapore presents a one-stop location for companies to carry out drug discovery and development activities. In addition, Singapore's focus on diseases prevalent in Asia and its base of global researchers will help to accelerate companies' innovation for the fast-growing Asian markets.

Singapore has developed the following capabilities and resources that enable companies to accelerate drug discovery and development in Asia:

- Integrated Countrywide Research Network – Global biomedical sciences companies are leveraging Singapore's integrated countrywide network that connects research institutes at the Biopolis with Academic Medical Centres (AMC), where public hospitals and





medical institutes that attend to 80% of Singapore's patients and Investigational Medicine Units (IMUs) are co-located with institutes of higher learning. This integration not only enables an efficient flow of knowledge from the bench to the bedside; equally importantly, it provides a platform for clinician-scientists to address hypotheses derived from the bedside.

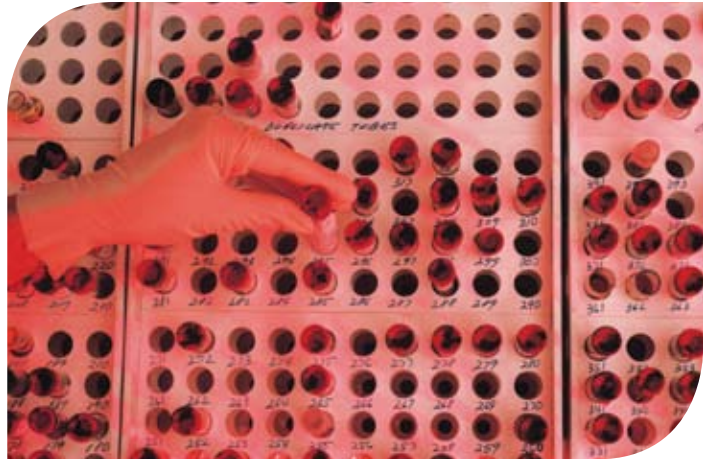
- Excellent Intellectual Property Protection – Building on its world-class legal system, Singapore ranks no. 1 in the world for intellectual property (IP) protection (World Economic Forum Global Competitiveness Report 2009-2010). Singapore has signed major international IP conventions and treaties that allow IP filed here to receive global protection. Singapore has also established an extensive infrastructure with professional consultancies and institutes that provide advisory services for IP management. In 2005, the World Intellectual Property Office set up its first Asian regional office in Singapore.
- Regulatory Framework that facilitates innovation – Singapore seeks to achieve a regulatory framework that facilitates the development of innovative therapies, while ensuring global standards of safety, quality and efficacy. The Singapore's Health Sciences Authority (HSA) is actively involved in defining new regulatory frameworks and pursuing new areas of research in regulatory science. HSA hosted the 3rd Summit of Heads of Medicines Regulatory Agencies in December 2008 and will co-host the 14th International Conference of Drug Regulatory Authorities with World Health Organisation (WHO) in September 2010. HSA has also forged MOUs with world's leading regulatory agencies such as the US Food and Drug Administration, China's State Food and Drug Administration and UK's Medicines and Healthcare Products Regulatory Agency. In October 2009, Singapore was accepted into OECD's Mutual Acceptance of Data framework that enables data from GLP-compliant pre-clinical trials conducted in Singapore to be accepted by 30 OECD and non-OECD members that include the U.S., EU and Japan.
- Plugged into Asia – Located at the heart of Asia, Singapore offers excellent connectivity to key Asian markets and provides medical insights from its pan-Asian population base. In 2006, Singapore launched the Translational and Clinical Research (TCR) Flagship programmes that present a key platform for researchers and clinician-scientists to develop therapies

for key diseases relevant to Singapore and Asia. Companies can carry out pre-clinical and first-in-man trials for drug candidates that are developed outside Singapore, and manage later-phase trials in Asia from in-house control tower units or via CROs in Singapore.

- Access to Global Talent – To continually grow its pool of global biomedical talent, Singapore is committed to driving innovation and offers a high standard of living that is comparable to leading cities worldwide. Today, 4,000 international and local researchers carry out biomedical sciences R&D in Singapore. Local researchers make up about 70% of the private-sector researcher pool, and top scientists have relocated to Singapore to lead our research institutes. In addition, leading pharmaceutical and biotech companies have teams with an international representation in their Singapore corporate labs. The Novartis Institute for Tropical Diseases, for example, employs more than 100 researchers from 18 nationalities.

Singapore's efforts to build up core capabilities in basic science as well as translational and clinical research have provided us with a strong scientific base to engage leading pharmaceutical and biotech companies in collaborative R&D activities.

Today, more than 50 biomedical sciences companies are carrying out R&D alongside 30 research institutes, medical institutes



and hospitals in Singapore. These companies include Abbott, GlaxoSmithKline, Novartis, Lilly, Schering-Plough, Takeda, S*Bio, Inviragen, MerLion Pharmaceuticals and PharmaLogicals.

Recent announcements include Schering-Plough's Translational Medicine Centre and Abbott's pharmaceutical analytical research lab. Recent biotech announcements include S*BIO's licensing agreements with Onyx and Tragara to develop oncology drugs, which will entitle S*BIO to receive more than US\$600 million in payment; FORMA Therapeutics' first overseas lab in Nanyang Technological University, Singapore; Inviragen's merger with SingVax, which raised US\$15 million in Series A financing.

Complementing Singapore's strengths in early innovation and translational research, the city-state has also established a core base of 20 leading contract research organisations (CROs) and pharmaceutical companies that manage regional clinical trials from Singapore.

Recent announcements in the year 2009 include Takeda's regional clinical coordination centre, ICON's expanded central lab, PPD's new global central lab and Quintiles' expansion of its Asia-Pacific headquarters facility.

Accessing Global Talents

Singapore is well-known for its ability to attract the world's top scientific and business talents. Edward Holmes (former Vice Chancellor, University of California, San Diego), Judith Swain (University of California, San Diego), Edison Liu (former director of clinical sciences, National Cancer Institute, US), Neal Copeland and Nancy Jenkins (National Cancer Institute, US), Sir George Radda (former Chief Executive, Medical Research Council), Colin Blakemore (UK Medical Research Council), Axel Ulrich (Max Planck Institute for Biochemistry, Germany), Philippe Kourilsky (College de France, France), Sydney Brenner (Nobel Laureate, Salk Institute of Biological Sciences), and Yoshiaki Ito (University of Kyoto, Japan) are amongst the scientific leaders who have come to

Singapore to head the city-state's research institutes, consortia and laboratories. Singapore is now home to more than 2,000 researchers from across the globe.

Singapore provides an enticing environment for professionals, and has been consistently ranked as Asia's top city in terms of quality of life (Mercer HR; ECA International) and offers an excellent education system. The city-state is English-speaking, cosmopolitan with foreigners making up a quarter of the population, and offers a range of dynamic entertainment and recreation options. Since 2008, Singapore has been hosting Formula One's first night race during Singapore Grand Prix. In 2010, two integrated resorts, which host world-class hotel, convention, entertainment facilities and a casino in one location, will officially open. These resorts are developed by Las Vegas Sands and Genting International. Singapore is also within a seven hour flight radius from the region's top tourist destinations (e.g. Angkor Wat in Cambodia, Bali in Indonesia, Hua Hin and Phuket in Thailand, Shangri La in China).

Singapore also recognises the need to nurture the next generation of scientists. Since the year 2001, Singapore's Agency for Science, Research and Technology (A*STAR) has launched a national scholarship programme that seeks to nurture 1,000 local PhD graduates in the world's top universities. To date, A*STAR has awarded more than 500 biomedical sciences scholarships. More than 100



awardees have completed their PhDs and returned to work in A*STAR research institutes and units.

In addition, Singapore has launched the A*STAR Investigatorship (A*I) award, which was modeled after the prestigious Howard Hughes Medical Institute (HHMI) Investigatorship award, to attract bright young researchers to carry out independent research in Singapore's public-sector research institutes. Bruno Reversade (France) and Prabha Sampath (India) are the first recipients of the award. In September 2009, Reversade led a group of German and Singaporean scientists to publish their findings in genetic mutation that led to premature skin ageing in the prestigious *Nature Genetics*.

Besides basic researchers, Singapore has also introduced various schemes to grow our cadre of clinician scientists. The Singapore Translational Research Investigator Award (STaR) is designed to recruit and nurture world-class clinician scientists to undertake cutting-edge translational and clinical research in Singapore; the Clinician Scientist Award (CSA) is another scheme that provides funding and salary support for clinicians to allocate at least 70% of their time on research.

Forging Long-Standing Partnerships

Singapore is committed to be in time for the future and is committed to partnering companies to co-create solutions to address unmet healthcare needs in Asia and the industry's challenges.



Key highlights in 2009 include Lonza's foray into cell therapy after investing in the first biologics plants in Singapore; Baxter's expansion from 30-years of medical device and implantable manufacturing into biopharmaceutical manufacturing; GSK's partnership with EDB in launching the S\$50 million endowment fund for graduate studies in green manufacturing and public health policy, on the occasion of its 50th anniversary of doing business in Singapore.

As global pharmaceutical and biotechnology companies seek to locate their key business functions and decision makers closer to the fast-growing Asian markets, Singapore presents a strategic base as these companies' home-base for the business expansion and innovation in Asia.

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