

Pharmaceutical & Biotechnology Manufacturing

As pharmaceutical and biotechnology companies seek to achieve greater efficiencies while maintaining the highest standards of quality and reliability, Singapore presents a strategic partner to develop innovative manufacturing solutions and pioneer manufacturing excellence.

Strong track record in API manufacturing

Singapore has established a strong track record in chemical-based active pharmaceutical ingredient (API) manufacturing. Leading companies (e.g. GlaxoSmithKline, Merck Sharp & Dohme, Pfizer, sanofi-aventis, Novartis) have invested in about 20 commercial-scale facilities that have achieved high quality standards with no man-hour loss and zero major observations from regulatory authorities worldwide (e.g. U.S. FDA and EMEA). Pfizer and Merck Sharp & Dohme have partnered Tuas Power, which is a leading Singapore-based energy and utilities solutions provider, to tap state-of-the-art trigeneration facilities that can yield greater energy efficiency and cost-savings by producing electricity, steam and chilled water from a single integrated system.

Ready partners in process R&D

Singapore's strong and growing process R&D capabilities are helping companies based here to break new ground in both small-molecule and biologics production. There are currently seven major collaborations between Singapore's public institutes and leading pharmaceutical companies, including a S\$2 million public-private partnership between GSK Biologicals and A*STAR's Bioprocessing Technology Institute to collaborate on vaccine and adjuvant system-related research projects. In 2009, Singapore's Institute of Chemical and Engineering Services (ICES) opened a pilot-scale laboratory facility that will enable greater collaborations with pharmaceutical companies in process development.

Manufacturing novel medicines

Singapore has become a leading site in Asia for biologics manufacturing with leading biotechnology companies (e.g. Baxter, GSK Biologicals, Roche, Lonza) investing US\$2 billion in biologics facilities within the last half of 2000s. Singapore continues to push ahead of the curve in new modalities, as evidenced by a cutting-edge cell therapy facility currently being developed by Lonza.

A commitment to developing manpower for the future

Singapore has established a strong base of more than 4,800 skilled engineers and technicians in the pharmaceutical and biotechnology manufacturing sector. Companies can also access a strong base of more than 300,000 skilled employees in related sectors (e.g. chemicals, electronics, engineering).

Singapore remains committed to further enhancing its manpower capabilities to meet companies' evolving needs. Key talent development initiatives include the National University of Singapore Academy of GxP Excellence (NUSAGE) that offers post-graduate training in pharmaceutical manufacturing, and the GSK-EDB partnership to build up capabilities in sustainable manufacturing. Singapore also actively partners leading companies to train Singaporeans in complex manufacturing processes to facilitate technology transfer. These programmes demonstrate Singapore's commitment to develop a manpower base that is ready for your future manufacturing requirements.



Tuas Biomedical Park (TBP) offers a 360-hectare specialised zoned area for pharmaceutical and biotechnology manufacturing; equipped with a ready supply of water and utilities, established sewerage system and road network, TBP presents a plug-and-play environment that reduces lead time to commence commercial operations.

GlaxoSmithKline: Strengthening partnerships in manufacturing excellence

Starting from a single *amoxicillin* plant in Singapore in 1972, GlaxoSmithKline (GSK) has expanded its manufacturing presence in Singapore to a network of three API production buildings, its first R&D pilot plant in Asia Pacific and a new industrialisation module for improved capabilities and flexibility to introduce new API products. This network will further enhance Singapore's capabilities in chemical-based API manufacturing excellence. Under the 10-year GSK-EDB strategic road-map, a S\$50 million joint endowment fund was launched to build up capabilities and develop solutions in sustainable manufacturing.

In June 2009, GSK Biologicals opened its first primary vaccines manufacturing plant in Asia, which will produce polysaccharides, recombinant-proteins and conjugates for the manufacturing of GSK's innovative vaccines that provide protection against *Streptococcus pneumoniae*. GSK Biologicals is also working with Bioprocessing Technology Institute (A*STAR) in vaccine and process development to further enhance its manufacturing operations.

Roche: Leveraging Singapore as a base for biologics manufacturing in Asia

In November 2009, Genentech, a wholly-owned member of Roche, opened its first Asia-Pacific biologics manufacturing site in Tuas Biomedical Park, Singapore. With a combined investment of about US\$500 million, the 12.6-hectare manufacturing site comprises two state-of-the-art facilities.

The mammalian-based facility will manufacture *Avastin*, a targeted cancer therapy for multiple cancer tumours; Genentech has acquired this mammalian-based facility from Swiss-based contract manufacturer, Lonza.

Meantime, the microbial-based facility will manufacture *Lucentis*, which is used to treat patients with age-related macular degeneration. In 2010, Genentech was awarded the Facility of the Year Award for Project Execution by ISPE, INTERPHEX and *Pharmaceutical Processing* magazine, for building up this fully-integrated, high-quality microbial-based facility from engineering kick-off through initiation of GMP qualification batches in 24 months. This was achieved in partnership with its contractors Jacobs Engineering Group and Bovis Lend Lease Pharmaceutical.



Roche Singapore Technical Operations is Roche's first biologics manufacturing site in Asia Pacific and comprises a microbial-based facility which received the Facility of the Year Award for Project Execution 2010 (ISPE, INTERPHEX, *Pharmaceutical Processing*) and a mammalian-based facility (insert) which was acquired from Lonza.