Biopolis

About Biopolis

Biopolis is a biomedical R&D hub at one-north, purpose-built to house key public and private biomedical research institutes and organisations. It is also the first major development in one-north.

Phase 1

Phase 1 of Biopolis is a cluster of seven buildings that was launched in October 2003. Two of the buildings (Chromos and Helios) are dedicated to biomedical players from the private sector. The other five buildings (Centros, Genome, Matrix, Nanos and Proteos) house the biomedical research institutes of the Agency for Science, Technology and Research (A*STAR), Singapore's lead agency for scientific research and development. Phase 1 of Biopolis is home to more than 2,000 scientists, researchers, technicians and administrators. The research community is fully supported by state-of-the-art infrastructure and services catering to the full spectrum of biomedical R&D activities. The 185,000 sqm seven-building development is at present more than 95% occupied.

Phase 2

Phase 2 of Biopolis was launched in 2006. It yielded an additional 37,000 sqm of biomedical R&D space for research institutions and biomedical companies. The multi-tenanted buildings are sited on a 0.8 ha site next to Phase 1. Comprising two buildings (Neuros and Immunos), Phase 2 is almost fully occupied.

Phase 3

Phase 3 of Biopolis broke ground in April 2008. This multi-tenanted research facility is intended to extend basic research activities into translational and clinical research as well as medical technology research. The facility is scheduled for completion in 2010.

(Please refer to Appendix for additional information on Biopolis.)

For more information on one-north and Biopolis,

Please log on to JTC's web site at http://www.jtc.gov.sg

About JTC Corporation

JTC Corporation (JTC) is the lead agency in Singapore to plan, promote and develop a dynamic industrial landscape, in support of the nation's economic advancement. Currently, the Corporation has under its management many developments including four wafer fab parks, an advanced display park, two business parks, a chemicals hub at Jurong Island, biomedical parks in Tuas as well as logistics hubs for aerospace, chemical and general warehousing industries.

JTC also plays a catalytic role in introducing leading-edge real estate solutions - such as specialised research facilities and underground caverns -- to anchor important activities critical to the growth of the economy. It is the master developer for one-north at Buona Vista -- a 200-hectare development for research and entrepreneurial activities. With a focus on knowledge-intensive activities in the biomedical, infocomms and media industries, one-north is a niche environment for innovation and creativity.

In line with its vision of making Singapore the choice investment location, JTC is committed to providing a pro-business environment for its customers and optimising land resources to meet the needs of industries and enterprises. JTC's home page address is http://www.jtc.gov.sg.

APPENDIX

Key Players Behind Biopolis

Besides JTC, the other key players in Biopolis include:

Agency for Science, Technology and Research (A*STAR)

A*STAR is Singapore's lead agency for fostering world-class scientific research and talent for a vibrant knowledge-based Singapore. A*STAR actively nurtures public sector research and development in Biomedical Sciences, Physical Sciences and Engineering, with a particular focus on fields essential to Singapore's manufacturing industry and new growth industries. It oversees 19 research institutes and consortia and supports extramural research with the universities, hospital research centres and other local and international partners. Its biomedical research institutes are headquartered at Biopolis, a world-class biomedical science hub. Its 7 science and engineering research institutes will be headquartered at Fusionopolis, Singapore's science and technology powerhouse that will foster global innovations and jumpstart future industries. For more information about A*STAR, please visit www.a-star.edu.sg.

Biomedical Research Council (BMRC)

The Biomedical Research Council (BMRC) oversees the development of core research capabilities within A*STAR research units specialising in bioprocessing; chemical synthesis; genomics and proteomics; molecular and cell biology; bioengineering and nanotechnology and computational biology. Through competitive grants, the Council also supports research in the wider scientific community such as public universities and hospitals. As part of its efforts to advance human healthcare, BMRC actively promotes translational medicine and cross-disciplinary research. The Council also engages in human capital development in the biomedical sciences and promotes societal awareness of biomedical research through outreach programmes.

Singapore Economic Development Board (EDB)

The Economic Development Board (EDB) is the lead government agency responsible for planning and executing economic strategies to enhance Singapore's position as a global hub for business and investment. We are the one-stop agency that facilitates and supports local and foreign investors in both the manufacturing and services sectors as they seek more value-creating operations, higher sustainable returns and new business opportunities.

Singapore commands global leadership positions in many areas. EDB is expanding and extending existing industry clusters, as well as exploring new growth areas to create good jobs and secure Singapore's future competitiveness. Our emphasis is on capital-intensive, knowledge-intensive and innovation-intensive activities. EDB is constantly identifying new business areas to develop both in terms of new technologies as well as new consumer demands, such as our 'clean and green' focus - environmental technologies, urban solutions and clean energy, lifestyle, healthcare and wellness. EDB is also expanding our geographical reach, such as Middle East, in addition to North America, Europe, Japan, China, India and ASEAN.

Tenants in Biopolis

No.	Company
Phase 1	
1.	Agency for Science, Technology and Research (A*STAR)
2.	A*STAR Bioinformatics Institute (BII)
3.	A*STAR Biomedical Research Council (BMRC)
4.	A*STAR Bioprocessing Technology Institute (BTI)
5.	A*STAR Centre for Molecular Medicine (CMM)
6.	A*STAR Exploit Technologies Pte Ltd (ETPL)
7.	A*STAR Genome Institute of Singapore (GIS)
8.	A*STAR Institute of Bioengineering and Nanotechnology (IBN)
9.	A*STAR Institute of Chemical and Engineering Sciences (ICES)
10.	A*STAR Institute of Medical Biology
11.	A*STAR Institute of Molecular and Cell Biology (IMCB)
12.	A*STAR Science and Engineering Research Council (SERC)
13.	Abbott Laboratories (Singapore) Pte Ltd
14.	Applied Biosystems Asia Pte Ltd
15.	Bio*One Capital Pte Ltd
16.	Bioethics Advisory Committee (BAC)
17.	Biomerieux Singapore Pte Ltd
18.	BioVenture Centre Pte Ltd
19.	British High Commission Science and Technology Office
20.	CombinatoRx Singapore Pte Ltd
21.	Davos Life Science Pte Ltd
22.	Energhy Pte Ltd
23.	Environmental Health Institute
24.	ES Cell International Pte Ltd (ESI)
25.	GlaxoSmithKline (GSK) Centre for Research in Cognitive & Neurodegenerative Disorders
26.	Health Sciences Authority (HSA)
27.	Helix Life Science Pte. Ltd.
28.	Illumina Singapore Pte Ltd
29.	Inventa Technologies (S) Pte Ltd
30.	Invitrogen (Singapore) Pte Ltd
31.	Lilly Singapore Centre for Drug Discovery (LSCDD)
32.	Merial Asia Pte Ltd
33.	Moleac Pte Ltd
34.	National Environment Agency (NEA)
35.	National Medical Research Council
36.	Novartis Institute for Tropical Diseases (NITD)
37.	PharmaLogicals Research Pte Ltd
38.	Proligo Singapore Pte Ltd
39.	Regional Emerging Diseases Intervention Centre (REDI)
40.	RIKEN Singapore Representative Office
41.	Schering-Plough Translational Medicine Research Centre (TMRC)
42.	Scientific Products (Asia Pacific) Pte Ltd
43.	Sigma-Aldrich Pte Ltd
44.	Singapore Bioimaging Consortium
45.	Singapore Immunology Network
46.	Singapore Stem Cell Consortium

47.	Singapore Tissue Network
48.	SingVax Pte Ltd
49.	Swiss House Singapore
50.	Takeda Singapore Pte Ltd
51.	Thermo Fisher Scientific Pte Ltd
52.	Varian Technologies Pte Ltd
53.	Veeco Asia Pte Ltd
54.	Waseda-Olympus Bioscience Research Pte Ltd

Biopolis' Architectural Features

Radical Masterplan Idea

The Biopolis masterplan was put up with reference to the flowing groundform, undulating terrain and the dramatic skyline. The building forms are never rectilinear, thus reflecting the dynamism of the interaction between physical and human "force-fields".

Epicentre for Human Interaction

The radical building design also explores ways to promote human interaction and the exchange of ideas in public spaces. For example, at the heart of the Biopolis is the Epicentre - designed to be the hotspot for human interaction. In making use of wind-tunnel movements to effectively cool the public space, it allows for a conducive outdoor environment amidst our humid tropical climate. Retail belts lining strategic areas also serve to add vibrancy to the biomedical community.

Dynamic Landscaping and Lighting

The landscape design is intuitive and fluid, in tune with the terrain and the changes in physical levels. Designed with the tropical weather in mind, big mature trees and rich foliage provide the necessary shade and soft greenery for the physical environment. This is further enhanced by the use of creative and imaginative lighting design, such as the "firefly" LED (light-emitting diode) lights planted on the Epicentre rain tree and the multi-coloured facade lighting.

Green Features

Biopolis spearheaded innovation in environment performance and sustainability. It serves as a test-bed for promising environmental technologies. Examples of the initaives include:

- A building-integrated photovoltaic or solar powered system to validate the cost effectiveness of clean energy
- Intelligent Building Automation Systems to optimise energy usage
- A District Cooling System to provide centralised chilled water supply to optimise the use of space and minimise energy costs for air-conditioning
- Building design to reduce heat absorption while making better use of daylight to reduce lighting requirement
- An automated and environmentally-friendly Pneumatic Waste Conveyance System that centralises general waste collection using vacuum transmission, thereby creating a cleaner and a more pleasant environment
- Solar-powered, LED lights with ultra capacitor as energy storage device. This is currently being used as a landscape feature
- Recycling collection points incorporated in the design of the building to promote recycling amongst the tenants
- Skygardens and 'Green' balconies

Scientific and Conference Facilities

Scientific resources

Scientists can tap on the scientific resources offered at the Biopolis Shared Facilities (BSF) to bring about time and cost savings. This is a facility with dedicated resources to manage and provide scientific equipment, services and supplies to researchers.

Core services, comprising glassware washing, media preparation and supply center, are operational since end 2004. The media preparation service provides in-house production of a variety of the most commonly used tissue culture and bacterial culture media while the supply center stocks a wide range of chemical, plastics and glassware that enable users to reduce both purchasing delays and cost. In addition, BSF has a number of scientific platforms which are coupled with support from technical expertise. Services currently available include Confocal Microscopy, DNA Sequencing, Flow Cytometry, High Content Screening, Histology, Microarray, NMR (Nuclear Magnetic Resonance), Protein Analytics and X-ray Crystallography.

These resources are currently available to the Biopolis community and other academic and research organizations in Singapore.

Conference facilities

The Biopolis is an ideal venue for scientific conferences, symposiums, seminars and lectures. Amenities available at the Biopolis include:

- 480-seater Auditorium equipped with the latest audiovisual technology
- Five 180-seater Theatrettes (of which two can be combined to form a larger theatrette)
- Video Conferencing Room
- 12 Meeting Rooms

Amenities include retail, food & beverage outlets, banking, science and technology consulate as well as biomedical related intellectual property companies.

ICT-Utility-On-Tap

'ICT-Utility-on-Tap' is an innovative service-on-demand, pay-as-you-use model that will help Biopolis tenants save cost and time as well as provide them with convenience and access to the latest technologies. Besides saving hefty up-front capital expenditure investments, tenants will also enjoy quicker set up time with ICT utility ready 'on tap'. Under this new arrangement, tenants can pick and choose the ICT services they would like to install on their premises via a web-based service portal that will be available round-the-clock. The core services that will be rolled out in the first phase can be broadly classified under office connectivity, managed IT services, data centre hosting, business continuity and equipment leasing.

A*STAR's Research Institutes in Biopolis

BioInformatics Institute (BII)

Established in 2001, the Bioinformatics Institute (BII)'s mission is to encourage, develop and support trained expertise with in-depth knowledge of biology and information technology, to advance biomedical research and development in Singapore. Some of the institute's key research areas include biomedicine, systems biology, computational genomics, as well as structural and functional genomics.

Bioprocessing Technology Institute (BTI)

Established in 1990 as the Bioprocessing Technology Unit, the institute was renamed the Bioprocessing Technology Institute (BTI) in 2003. The institute spearheads bioprocess science and engineering research. Some of the institute's key research areas include expression engineering, animal cell technology, stem cell research and downstream purification and analytics.

Genome Institute of Singapore

Established in 2001, the Genome Institute of Singapore's (GIS) mission is to be a world-class genomics institute and a centre for genomic discovery. GIS pursues the integration of technology, genetics, and biology towards the goal of individualised medicine The genomics infrastructure at GIS is utilized to train new scientific talent, to act as a bridge between academic and industrial research, and explore scientific questions of high impact.

Institute of Bioengineering & Nanotechnology

Established in 2002, the Institute of Bioengineering and Nanotechnology's (IBN) mission is to establish a broad knowledge base and conduct innovative research at the interface of bioengineering and nanotechnology. Positioned at the frontiers of engineering, IBN is focused on creating knowledge and cultivating talent to develop technology platforms that will spur the growth of new industries. IBN also fosters an exciting, multidisciplinary research environment for the training of students and young researchers to spearhead biomedical advancement in Singapore.

Institute of Molecular & Cell Biology

Established in 1987, the Institute of Molecular and Cell Biology's (IMCB) mission is to foster a vibrant research culture for biomedical sciences and high quality manpower training to facilitate development of the biotechnological and pharmaceutical industries in Singapore. Key research areas include cell, developmental and structural biology, infectious diseases and cancer biology.

Singapore Institute for Clinical Sciences

Established in 2007, the Singapore Institute for Clinical Sciences (SICS) aims to accelerate the translation of basic discoveries into new diagnostics and therapeutics. SICS will be distinguished by its focus on clinical science and the use of innovative approaches and technologies that enable the efficient and effective study of human health and disease. In so doing, the institute will attract, train and nurture a new type of clinician scientist. SICS will collaborate with universities, research institutes and clinical programs to achieve the ultimate goal of improving human health as well as Singapore's economic well-being. The research focus of SICS will be centered on the human as the model system, and will complement other A*STAR Research Institutes by focusing on the clinical and translational research portion of the spectrum of biomedical research. The initial programs at SICS, focused on specific disease areas, are Genetic Medicine, Hepatic Infectious Diseases and Metabolic Diseases.

Institute of Medical Biology

Established in 2007, the Institute of Medical Biology (IMB) has a strategic, programme-directed portfolio of research focused on issues at the critical interface between basic science and medicine. The aim is to facilitate the development of translational research by building bridges between clinical and basic science. IMB is currently hosting research programmes concerned with different aspects of human disease. The current programmes within IMB are the Singapore Onco-Genome project, Regenerative Medicine, Papillomavirology, Epithelial Biology and the Lab of Stem Cell Biology from Singapore Stem Cell Consortium (SSCC). IMB will help scientists and clinicians to work closely together to support, inform and refine each other's strengths and specializations to increase the efficiency of the translation process, and ultimately contribute towards a better quality of life for all.

Glossary

Biological Resource Centre
This service facility is responsible for the provision of research animals to Biopolis scientists. There is extensive housing, primarily for rodents, under Specific Pathogen Free (SPF) conditions. This is necessary in order to maintain their high health status – an essential platform for top quality research.

DNA Sequencing
Decoding the sequence of nucleotide bases in an organism's DNA is the first step to discovering new genes. This unit provides rapid, high through-put sequencing services.

Flow Cytometry
A flow cytometer is able to sort a single stream of cells into different populations according to certain biochemical properties. For example, dying cells can be separated from live ones by this method. This unit provides flow activated cell sorting and table-top analysis facilities.

Glassware Washing
Washing and sterilising of laboratory glassware services are provided at this facility.

Histology
This unit produces thin sections of biological material for close examination under the light microscope. This allows scientists to study tissue structures invisible to the naked eye.

Lab Supplies
This facility stocks labware and reagents.

Media Preparation
This unit provides labs with prepared and sterile media for tissue and cell culture.

Nuclear Magnetic Resonance
Nuclear Magnetic Resonance is a technique used to obtain the physical, chemical and electronic properties of molecules. Spectra produced by the machines can allow researchers to determine the structure of various chemical compounds.

Proteomics
This unit provides services such as protein identification, sequencing and weight determination of peptides and proteins. Proteomics is the study of all the proteins produced by the body and the determination of their physiological role in health and disease. This information could lead to the identification of new drug targets and disease markers.

X-ray Crystallography
X-ray Crystallography is the types of method for studying proteins and their functions at the atomic level. For example, the diffraction patterns created when X-rays were bounced off the DNA molecule led to the discovery of its unique double helical structure.