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ASIA EDITION

# Singapore's biotech ecosystem on a growth spree

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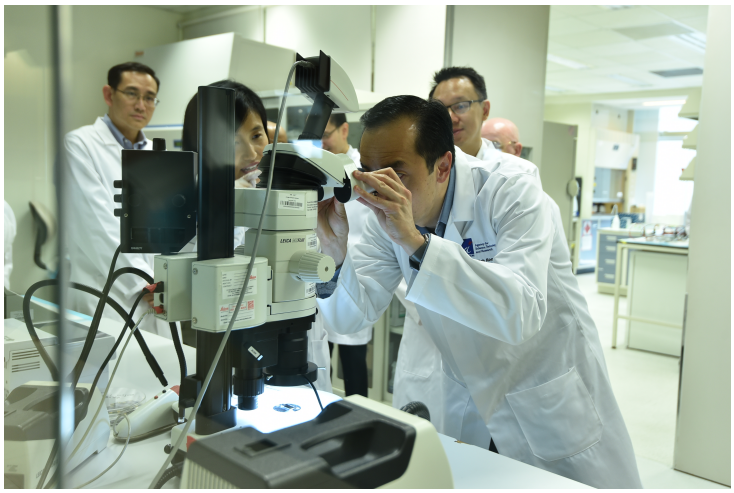
**The Whole Genome Sequencing Centre, supports super-scale sequencing projects in Singapore and the region.**



**Singapore** – Singapore's Senior Ministers of State **Dr Koh Poh Koon and SPS Dr Tan Wu Meng** were present for a round-off session at the A*STAR's Genome Institute of Singapore (GIS) on 6th July, 2018 to share the latest unpublished numbers on the progress of Singapore's Biotech ecosystem. Founders of local biotech startups as well as A*STAR Senior Leadership were also present at the event. A few key highlights shared on the day are:

**1. A*STAR has played a key role in fostering the growth of the local ecosystem in a variety of ways by nurturing start-ups; spinning off companies; working with industry on joint research and co-development projects; transferring talent to companies; and licensing IP.**

- About 50% of all biotechs operating in Singapore have R&D links with A*STAR (collaborations, IP licensing, joint lab agreements, incubations, etc.)
- 25% of all biotechs currently operating in Singapore are A*STAR spinoffs
- A*STAR also contributes to the talent flow in the biotech ecosystem by seconding promising researchers to these start-ups. (More information in Annex A)
- A*STAR works closely with the industry to establish a conducive environment for biotechs. To tackle Singapore's healthcare challenges, open innovation and publicprivate partnerships between research institutions, clinicians and the industry are necessary for the development of the most effective solutions. (Refer to Annex A for examples of A*STAR's partnerships with the industry)

**2. Biopolis has been playing the important role of incubator and accelerator for biotech startups. This has resulted in the local biotech ecosystem gaining good momentum.**

- Biopolis plays an important role as an incubator and accelerator for biotech startups. There, start-ups can access facilities such as co-innovation spaces that aim to incubate, develop, train and support technopreneurs to build successful business ventures. This also includes access to life science labs with facilities and equipment which start-

ups may not otherwise be able to afford. Furthermore, there is close proximity between the start-ups, A*STAR RIs with cutting edge biomedical research, as well as MNCS, that will facilitate the exchange of ideas and establishment of joint labs.

- Singapore's biotech ecosystem has been growing rapidly with an increasing number of larger biotech companies and start-ups operating here. Their R&D expenditure has also steadily increased in the past few years.
- There are 79 home-grown biotechs operating in Singapore as of 2017.
- The number of operational biotechs incorporated in Singapore within the last three years has doubled (32 incorporations between the years 2015 and 2017; compared to 16 between the years 2012 and 2014)
- Over US$200 million (S$273 million) of private sector funding has been raised in the first six months of 2018. (Tessa - US$130m, ASLAN - US$42m, MediSix - US$20m, Lion TCR - US$20m, Engine Biosciences - US$10m)
- Between 2011 and 2016, R&D expenditure of biotechs increased nine times (from S$21m to S$186m)

**3. The rapid growth of the local biotech ecosystem helps position Singapore as a hub for biomedical sciences in Asia. A*STAR's deep research capabilities in Asian-specific diseases is complemented by a vibrant community of biotechs developing a strong pipeline of therapeutics and diagnostics.**

- As the global pharmbio industry continues to grow, it presents a strong opportunity for Singapore's biotech ecosystem. The maturing base of public and private R&D capabilities available in Singapore and the increasing importance of the Asian markets will lead to a continued demand for therapeutic and diagnostic solutions catered to the Asian phenotype.
- Singapore is well-placed to emerge as a major player in this market due to its diverse population base, deep capabilities in biomedical research, and conducive environment for R&D. It is not coincidental that many of the biotechs here are focused on therapeutics and diagnostics for Asian-specific diseases.
- A*STAR has been ranked among the top 10 biotech innovators in cancer research in Asia in the 2017 State of Innovation Report released by Clarivate Analytics. The analysis was based on the volume of inventions for the period 2012-2016.

**Examples of A*STAR working with the biotech industry for open innovation**

**Local biotech start-up One BioMed**

- An A*STAR spinoff which specialises in molecular diagnostics, One BioMed was founded by Dr Park Mi Kyoung, formerly a scientist from A*STAR's Institute of Microelectronics. The company's specialty is in the use of silicon photonics technology for biomedical diagnostics.
- Working together with A*STAR's Genome Institute of Singapore (GIS) through a joint lab at Biopolis, Dr Park and her team are currently developing a simple, rapid, costeffective test kit to diagnose infectious diseases such as drug resistant tuberculosis and mosquito-borne illnesses in a quick and reliable manner.

**Local biotech start-up Lion TCR**

- Founded in 2015 by Dr Victor Li, Lion TCR recently raised US$20 million to fund its personalised T cell therapy clinical trials against liver cancer. The company focuses on the development and commercialisation of redirected TCR (T cell receptor) therapy that harnesses a patient's own immune system against viral-related cancers widespread in Asia such as nasopharyngeal carcinoma.
- Lion TCR's technology was developed based on research led by Professor Antonio Bertoletti, who holds an adjunct appointment at A*STAR's Singapore Immunology Network (SIgN). The company has since obtained a global exclusive license for the technology from A*STAR.
- Located at Biopolis, Lion TCR is also currently conducting research with A*STAR's Institute of Molecular and Cell Biology (IMCB) through a joint lab.
- To support the development of Lion TCR's therapeutic solutions, two of A*STAR's scholars are currently seconded to the company through the T-Up scheme. Dr. Sarene Koh (SICS) has been the company's scientific director overseeing the product development of TCR-T cells since Jan 2016, while Dr. Wai Lu-En (SICS) has been overseeing the development of the TCR library since Dec 2016.

**Multi-party partnership with NovogeneAIT**

- To enhance Singapore's R&D infrastructure, A*STAR's GIS, Novogene (a leading global provider of genomic services and solutions) and local biotech AITbiotech, came together to establish a whole genome sequencing (WGS) centre at Biopolis in Dec 2016.
- The centre provides whole genome sequencing and bioinformatics analysis of human, plant and animal samples for biomedical and agricultural researchers. The centre devotes a major portion of its sequencing capability to supporting

public research projects (e.g. POLARIS) and super-scale sequencing initiatives in Singapore and the region.

**Joint lab with PerkinElmer**

- The PerkinElmer-GIS Centre for Precision Oncology is a joint laboratory that features a state-of-the-art high-throughput screening (HTS) platform that will help to predict the effectiveness of cancer drugs on tumour models in real-time. Precision oncology is the medical model of giving the right drug to the right patient at the right time.
- Using this technology, researchers affiliated with the centre collaborated with the National Cancer Centre Singapore in 2017 and successfully grew 24 “avatars” or microtumour models outside the human body. These are used to identify alternative treatment options for cancer patients failing to respond to standard-of-care cancer drugs. This is considered a pioneering method of cancer treatment for precision oncology.
- The collaborations benefit the local biotech companies which can now access cutting-edge genomic technologies to advance important research initiatives or carry out product development for health outcomes in Asian populations and beyond.
    - An example: Local biotech startup Invitrocue is currently using the facilities at the PerkinElmer-GIS Centre for Precision Oncology to develop novel drug testing models for cancer therapeutics.