Flanders
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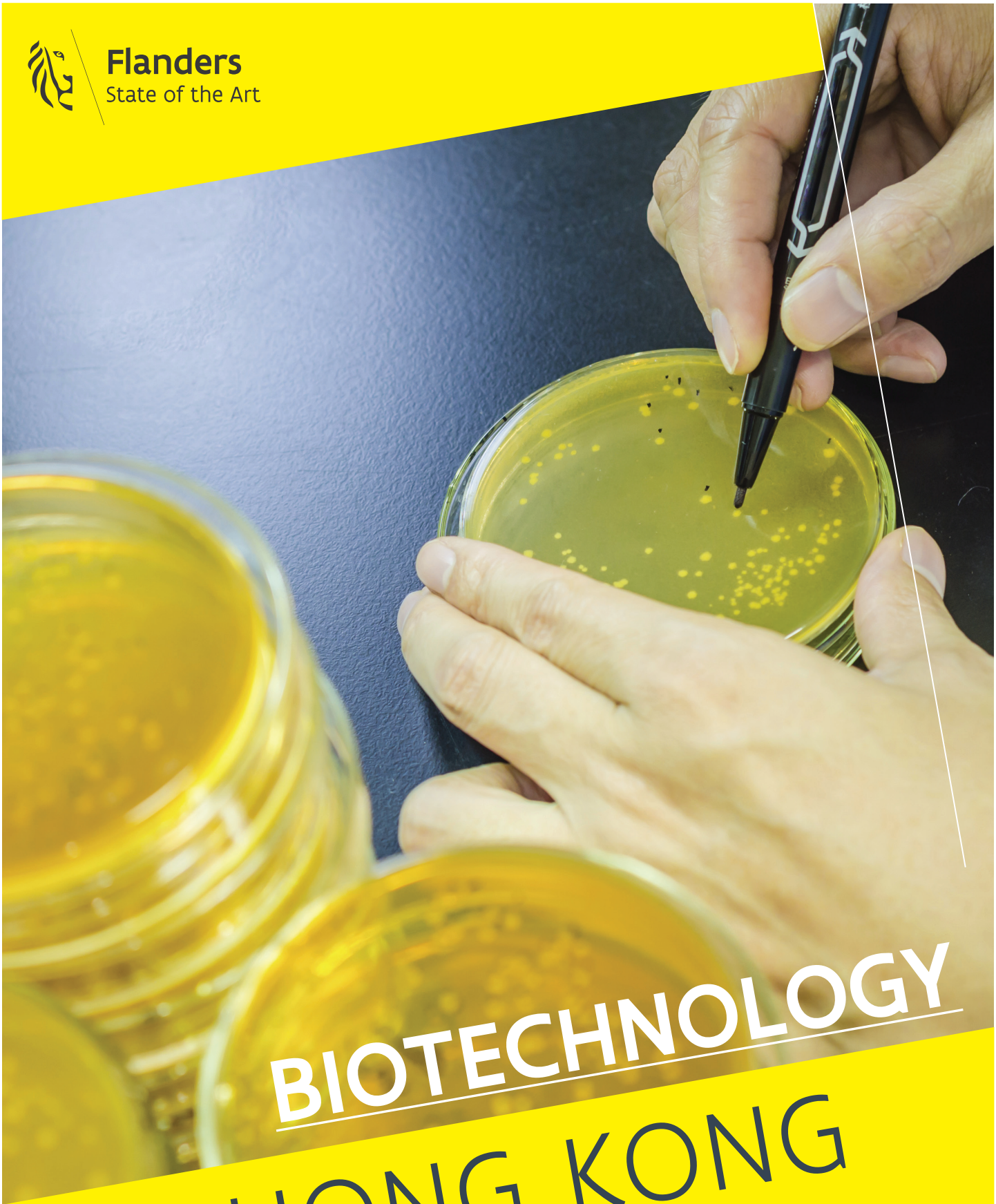

BIOTECHNOLOGY IN HONG KONG

FLANDERS INVESTMENT & TRADE MARKET SURVEY

Flanders
State of the Art

Biotechnology in Hong Kong

June 2017

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FLANDERS INVESTMENT & TRADE

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1 GENERAL INTRODUCTION OF HONG KONG

Hong Kong, officially known as Hong Kong Special Administrative Region of the People's Republic of China, is a city on the southern coast of China. Following British rule from 1842 to 1997, China assumed sovereignty under the 'one country, two systems' principle. The Hong Kong's constitutional document, the Basic Law, ensures "a high degree of autonomy" and "Hong Kong People administering Hong Kong" and that the current political situation will remain in effect for 50 years after the handover. The rights and freedoms of people in Hong Kong are based on the impartial rule of law and an independent judiciary.

- Head of Government: Chief Executive
- Cabinet: Executive Council
- Legislature: Legislative Council, 70 seats
- Highest Court: Court of Final Appeal

Hong Kong covers a total area: 1 104 square kilometres, including Hong Kong Island, Lantau Island, the Kowloon Peninsula, the New Territories and 262 outlying islands. Between Hong Kong Island and the Kowloon Peninsula lies Victoria Harbour, one of the world's most renowned deep-water harbours. Hong Kong's population is about 7.37 million (2016)[1]. Chinese and English are the official languages of Hong Kong.

- GDP: HK$2,489.1 billion (2016)[2]
- GDP per capita: HK$339,273 (2016)[3]
- Labour force: 3.9 million (2016)[4]
- Unemployment rate: 3.3 percent (2016)[5]
- Inflation rate: 2.4 percent (2016)[6]

The main characters of Hong Kong include free trade, low taxation and minimum government interventions. "Hong Kong ranked the world's freest economy in the Cato Institute's Economic Freedom of the World: 2015 Annual Report, and the Heritage Foundation's 2016 Index of Economic Freedom."[7] Hong Kong is also a major service economy, with particularly strong links to mainland China and the rest of the Asia-Pacific region.

Being one of the freest markets in the world, Hong Kong has minimal trade barriers for imports. The market is therefore extremely competitive, which means quality products are often competing on price.

Hong Kong is a trading port. As of Jan 2017, the Mainland China remains the number one trading partner of Hong Kong both in terms of import, export and re-export. Hong Kong is an important trade terminal between the Mainland China and the EU. In 2015, over €10 billion of the Mainland's imports from the EU routed through Hong Kong. On the other hand, re-exports of Mainland-origin goods to the EU through Hong Kong exceeded €33 billion in 2015. Hong Kong has set-up three Economic and Trade Offices (ETOs) in the EU, one of them based in Brussels. Belgium ranked 15 on the list of Hong Kong's Merchandise Trade with EU and Individual Member States 2015.[8]

[1] Hong Kong Census & Statistics Department http://www.censtatd.gov.hk/hkstat/hkif/index.jsp
[2] Ibid
[3] Ibid
[4] Ibid
[5] Ibid
[6] Ibid
[7] Trade and Industry Department https://www.tid.gov.hk/english/aboutus/publications/factsheet/eu.html
[8] Trade and Industry Department https://www.tid.gov.hk/english/aboutus/publications/factsheet/eu.html

2 BIOTECHNOLOGY IN HONG KONG

2.1 OVERVIEW

In the 21st century, biotechnology and life sciences become one of the fast-growing industries and sources of innovation. This knowledge-based industry can greatly improve our living standard and business efficiency. Cutting-edge technologies and products generated from different kinds of biotechnology research have demonstrated vast impacts on various industries, especially in the pharmaceutical and agricultural sectors.

Trying to diversify itself from being the world's leading financial centre, Hong Kong has entered the biotechnology sector since early 1990s.Through the years, biotechnology became one of the emerging sectors with steady growth in Hong Kong. The HKSAR Government greatly supports the research and development in Biotechnology. Since 1990s, The Government has continuously increased the investment into the sector through various funds.[9][10] Recently, Hong Kong's total R&D expenditure increased more than double from HK$5.9 billion (US$761million) in 1999 to HK$13.3 billion (US$1.7 billion) in 2010. The number of full time R&D employees also doubled, from around 10,000 to 24,100.[11]

With the government support, several associations, research institutes and incubation centres were established to cope with the development of life science and biotechnology, such as The Hong Kong Institute of Biotechnology (HKIB), The Biotechnology Research Institute (BRI), Hong Kong Biotechnology Organization (HKBIO), The Hong Kong Science and Technology Park (HKSTP), etc.

It is estimated that Hong Kong has approximately 250-300 biotechnology-related companies, comprising of mainly healthcare-related companies with business on pharmaceuticals, medicinal or healthcare products of traditional Chinese medicine origin, and medical devices and diagnostics. Activities engaged by these companies generally include product research & development, manufacturing, marketing and sales. Because of Hong Kong's strategic geographical location and the huge economic potential of the Chinese market, there is a constant stream of overseas biotechnology companies interested in setting up regional headquarters or offices in Hong Kong to capitalize on the growth of the region.

In addition to the biotechnology companies and R&D centres located in the Hong Kong Science and Technology Park, 16 Partner State Key Laboratories have been established in 6 out of 9 tertiary institutes in Hong Kong. They are engaged in various extent of biotechnology-related research, offering undergraduate courses and higher degree training on relevant subjects.

2.2 INNOVATION AND TECHNOLOGY BUREAU

Newly established in 2015, the Innovation and Technology Bureau is responsible for policy matters on the development of innovation and technology and information technology. It aims to create a vibrant ecosystem for the government, industry, academia and research sector to interact under a favourable environment with excellent software and hardware support for developing and applying innovation and technology.

The Bureau oversees the operation of the Innovation and Technology Commission and other departments.

2.2.1 Innovation and Technology Commission

[9] Tsang, J.C. and Y.L. Lo, "*Biotechnology Development in Hong Kong: Infrastructural Support for Biotechnology and Related Industries*," Biochemical Education, Vol. 26, 1998

[10] Joseph WONG, "*Biotechnology in Hong Kong: Prospects and Challenges*", Department of Political Science, University of Toronto

[11]Hong Kong Biotechnology Organizationhttp://www.hkbio.org.hk

Under the Innovation and Technology Bureau, the Innovation and Technology Commission (ITC) helps to develop Hong Kong into a knowledge-based economy and an innovation hub for technology and its application in the region. It aims to:

- promote and support applied research and development, and technology transfer and application;
- foster an innovation and technology culture in the community, and promote technological entrepreneurship;
- facilitate the provision of infrastructure and development of human resources to support innovation and technology;
- formulate, develop and implement the Government's policies, programmes and measures to promote innovation and technology;
- promote internationally accepted standards and conformity assessment services to underpin technological development and international trade;
- develop high calibre and motivated staff to contribute to Hong Kong's technological advancement.

The ITC looks after the development of the below technology areas:

- Automotive Parts & Accessory Systems
- Biotechnology
- Chinese Medicines
- Communication Technologies
- Consumer Electronics
- Environmental Technologies
- Integrated Circuit Design
- Logistics & Supply Chain Management Enabling Technologies
- Nanotechnology & Advanced Materials
- Opto-electronics
- Textile & Clothing

ITC also works closely with the public institutions involved in innovation and technology, such as Hong Kong Science and Technology Parks Corporation, Hong Kong Productivity Council, Hong Kong Applied Science and Technology Research Institute Company Limited and various universities, to facilitate development of innovation and technology activities.

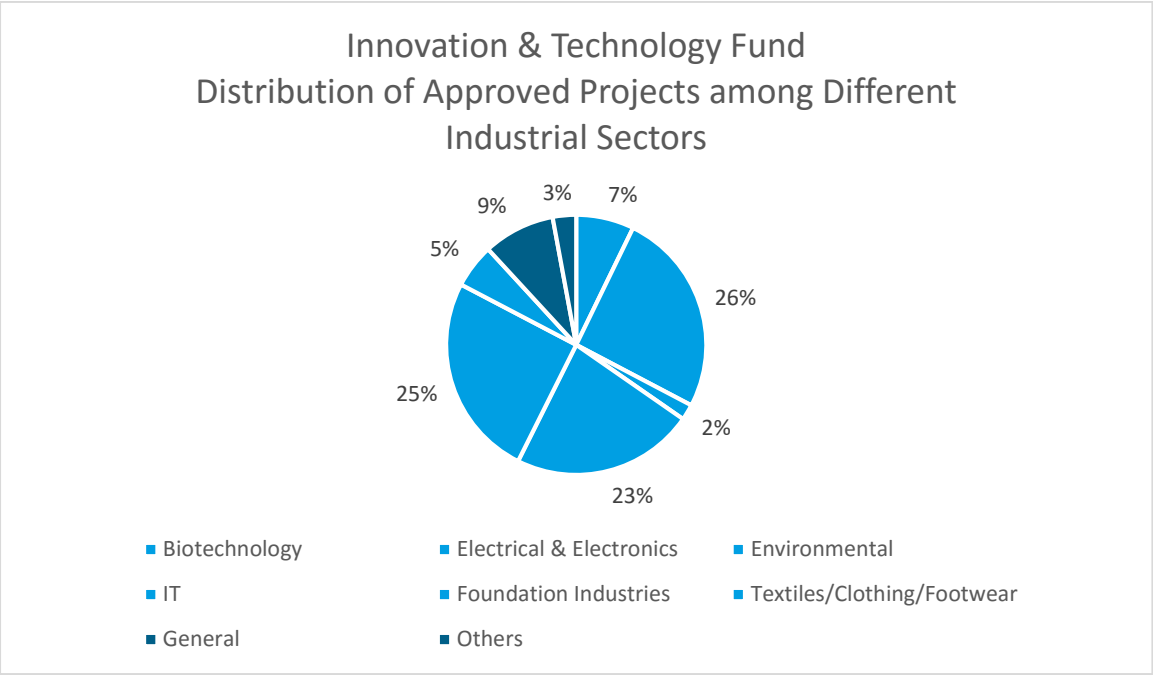
2.3 GOVERNMENT FUNDING AND INVESTMENT TO BIOTECHNOLOGY SECTOR

The HKSAR government has set up various public funds to support the research and development of the Biotechnology in Hong Kong.

Innovation and Technology Fund (ITF), Health and Medical Research Fund (HMRF) and General Research Fund (GRF) of the University Grant Council have been providing financial support to the establishment of a variety of state-of-the-art biotechnology facilities and applied R&D projects that contribute to innovation and technology upgrading in biotechnology industry throughout the years.

2.3.1 Innovation and Technology Fund (ITF)

The Innovation and Technology Fund (ITF), administered by the Innovation and Technology Commission, aims to increase the added value, productivity and competitiveness of our economic activities. As of 30thDecember 2016, HK$825.5 million of ITF funding has been approved for 418 biotechnology-related projects. Around 7% of the total investment of ITF was allocated to biotechnology-related applications (please refer to the below chart). Projects funded cover a wide array of research areas, ranging from bioinformatics, molecular diagnostics, drug/therapeutic discovery and development, modernization of traditional Chinese medicine, to biopharmaceutical manufacturing.



The above figure includes funding to Partner State Key Laboratories, Hong Kong Branch(es) of Chinese National Engineering Research Centre(s), Technology Transfer Offices of universities and Technology Start-up Support Scheme for Universities.

Below are some of the major programmes/schemes under the ITF that supported Biotechnology related projects:

- **The Innovation and Technology Support Programme (ITSP)**

  ITSP supports midstream/downstream research and development (R&D) projects undertaken mainly by universities, R&D Centres, industry support organisations, professional bodies and trade and industry associations. ITSP invites applications for funding every six months. For more details, please refer to http://www.itf.gov.hk/l-eng/ITSP.asp

- **The General Support Programme (GSP)**

  GSP caters for non-R&D projects that contribute to the upgrading and development of industries as well as fostering an innovation and technology culture in Hong Kong.

  Projects to be supported under GSP may include conferences, exhibitions, seminars, workshops, promotional events, studies and surveys, youth activities, events or projects to support platform building / upgrading of industry, etc. In general, the GSP does not support projects for promotion of products/services of a specific commercial entity.

  For more details, please refer to http://www.itf.gov.hk/l-eng/GSP.asp

- **The University-Industry Collaboration Programme (UICP)**

  UICP aims to stimulate private sector interest in R&D through leveraging the knowledge and resources of universities. The emphasis is on close collaboration between private companies and universities in Hong Kong.

  For more details, please refer to http://www.itf.gov.hk/l-eng/UICP.asp

- **Enterprise Support Scheme (ESS)**

  ESS is a major funding initiative under the Innovation and Technology Fund (ITF), which is designed to encourage the private sector to invest in research and development (R&D). It

replaced the Small Entrepreneur Research Assistance Programme (SERAP) since 2015. Funding support of each approved project is up to HK$10 million and will be provided on a dollar-for-dollar matching basis. Project period should not be longer than 2 years.

For more details, please refer to http://www.itf.gov.hk/l-eng/ESS.asp

- **Research and Development Cash Rebate Scheme**

  It aims to reinforce the research culture among private companies and encourage them to establish stronger partnership with designated local public research institutions. Under the Scheme, a company will receive a cash rebate equivalent to 40% of its expenditure in two types of applied R&D projects.

  For more details, please refer to http://www.itf.gov.hk/l-eng/CRS.asp

2.3.2 Health and Medical Research Fund (HMRF)

Before the set-up of Health and Medical Research Fund (HMRF), the Research Fund for Control of Infectious Disease (RFCID) used to support the Biotechnology research in health and medical aspects.

In 2011, Food and Health Bureau established the HMRF by consolidating former research funds, including the Health and Health Services Research Fund(HHSRF) and Research Fund for the Control of Infectious Diseases (RFCID), expanding the funding scope to cover more areas of health and medical research and injecting an additional HK$1 billion.

With the total capital commitment of HK$1.4 billion, the HMRF provides support to researchers working in the following areas:

- public health, human health and health services (e.g. primary care, non-communicable diseases, Chinese medicine, etc.) (previously funded by HHSRF);
- prevention, treatment and control of infectious diseases, particularly in emerging and re-emerging infectious diseases (previously funded by RFCID); and
- advanced medical research in the fields of paediatrics, neuroscience, clinical genetics and clinical trials

The HMRF aims to build research capacity and to encourage, facilitate and support health and medical research to inform health policies, improve population health, strengthen the health system, enhance healthcare practices, advance standard and quality of care, and promote clinical excellence, through the generation and application of evidence-based scientific knowledge in health and medicine.

HMRF is managed by a Research Council of the Food and Health Bureau and advised by the Grant Review Board and a panel of external referees. In general, members of any discipline or profession in the health or health-related field can apply for research funding through investigator-initiated projects. Grants may be awarded for research in tertiary institutions, hospitals, medical schools or other appropriate centres, units or services. In year 2015-2016, 753 projects of the 1,249 Investigator-initiated Research Projects funded under the HMRF have been completed. All grant applications undergo a two-tier peer review process to ensure scientific rigour and standards. The Research Fund Secretariat supports both the Research Council and the Grant Review Board.

HMRF also organises Health Research Symposium from time to time for researchers and health care professionals to share their knowledge and achievements in various research topics, and knowledge the outstanding research projects funded by the HMRF. The upcoming Health Research Symposium will be held in 2017.

For more details about HMRF, please visit the Research Fund Secretariat website:
http://rfs2.fhb.gov.hk/index.html

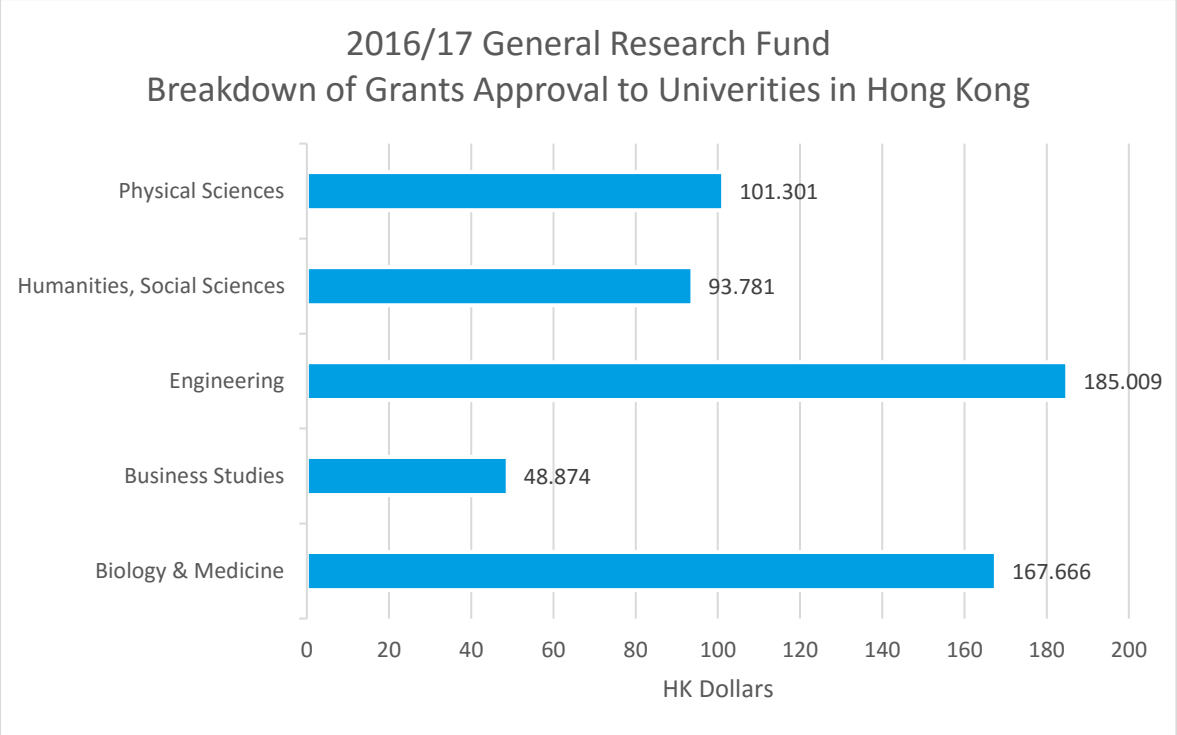
2.3.3 General Research Fund (GRF)

General Research Fund (GRF) is one of the funding schemes managed by Research Grant Council (RGC).

RGC was established in 1991 and operates under the University Grants Committee (UGC). It functions as an advisory body on research matters within the organizational structure of the Committee. It is a non-statutory advisory body responsible for advising the Government of the Hong Kong Special Administrative Region of the People's Republic of China on the needs of Hong Kong's higher education institutions in the field of academic research and for the distribution of funding for academic research projects undertaken by academic staff of those UGC-funded institutions.

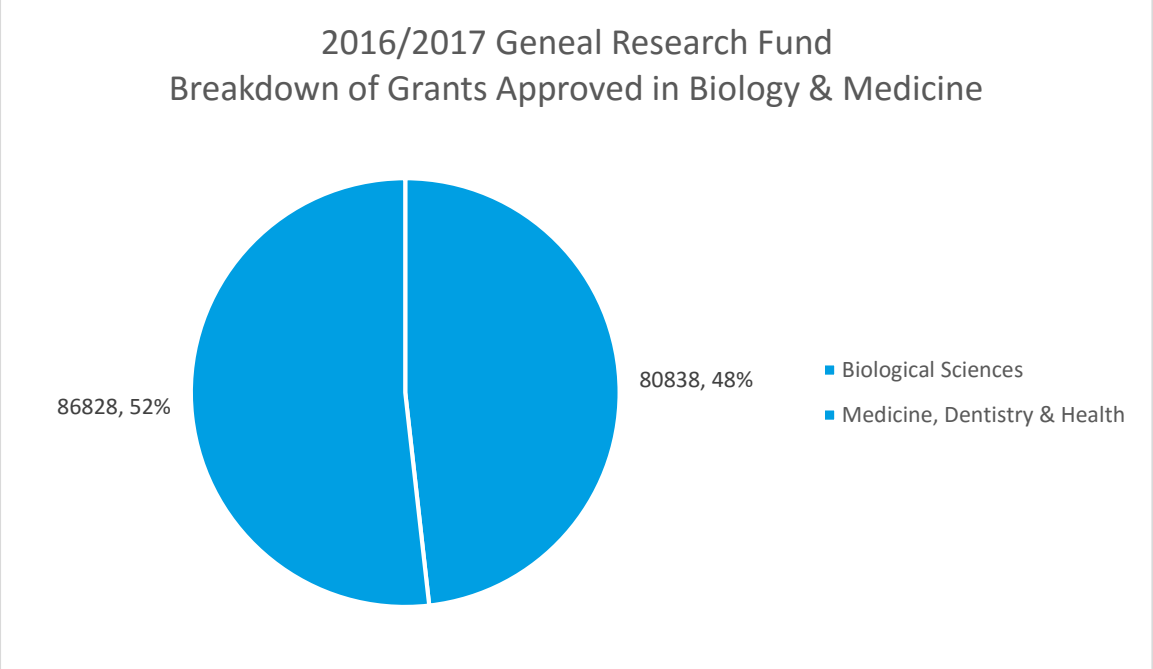
The RGC operates through subject panels and committees responsible for considering applications for research grants and fellowship applications. Five subject panels namely Biology & Medicine, Business Studies, Engineering, Humanities & Social Sciences and Physical Sciences are set up under each pool.

In the year 2016-2017, GRF has approved a total grant of HK$596,630 to support 964 projects conducted by eight local universities in Hong Kong. Among the total grant, HK$167,666 was allocated to support 176 projects in Biology & Medicine discipline, the second largest discipline among the five subject panels in RGC (refer to below chart).



Source: Funding results, General Research Fund, University Grants Committee, http://www.ugc.edu.hk/eng/doc/rgc/result/grf/inst_16proj.pdf

In the year 2016-2017, a total of HK$80,838 of GRF has been invested to 82 projects in Biological Science, accounting to 48% in the Biology & Medicine discipline (refer to the below chart).



Source: Funding results, General Research Fund, University Grants Committee, http://www.ugc.edu.hk/eng/doc/rgc/result/grf/inst_16proj.pdf

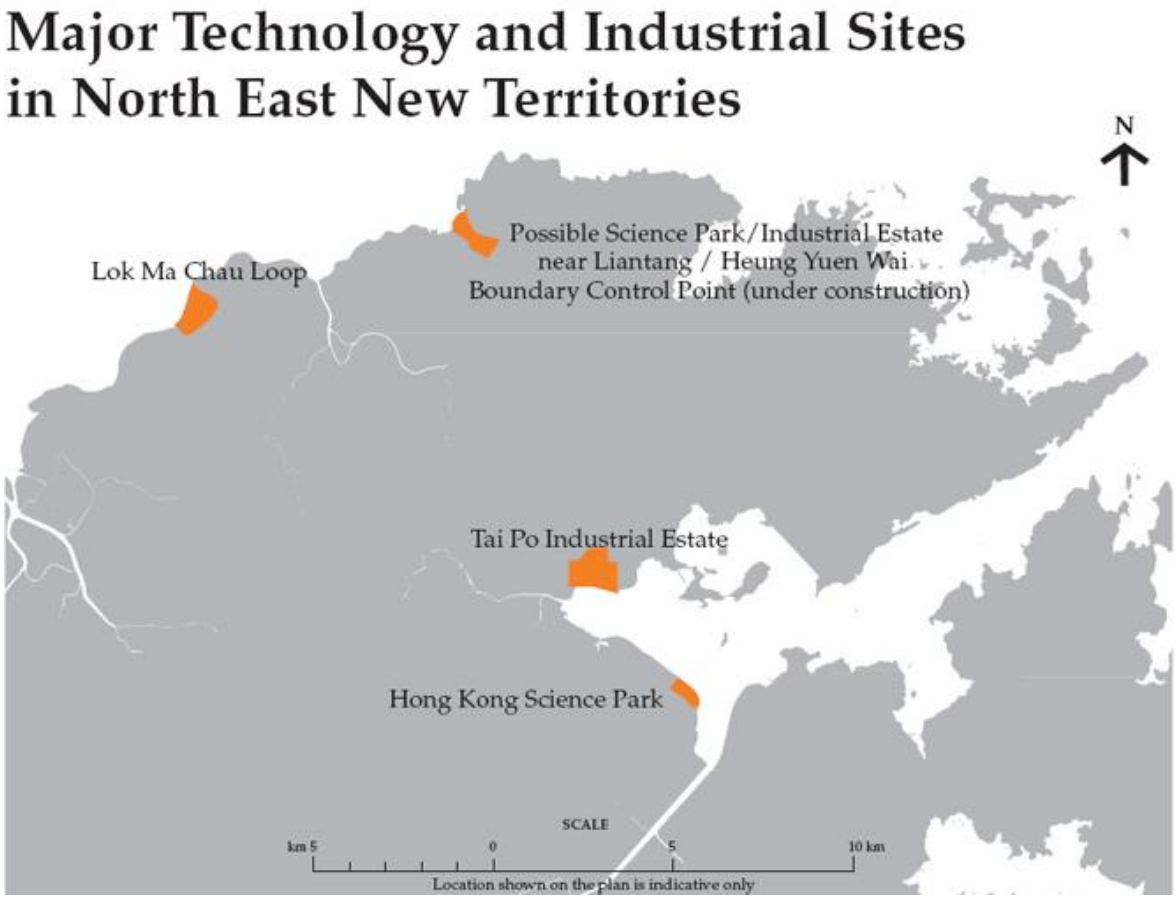
For more information about the General Research Fund and the University Grants Committee, please refer to http://www.ugc.edu.hk

2.4 FUTURE DEVELOPMENTS ON INNOVATION & TECHNOLOGY IN HONG KONG

According to the 2017 Policy Address published by the HKSAR Government, the Government will continue to stress importance by putting extra effort and resources to promote the innovation and technology development, including biotechnology, in Hong Kong in the coming years.

To cater the needs of this fast-growing industry, in January 2017, the HKSAR Government and the Shenzhen Municipal Government signed a memorandum of understanding on the development of a Hong Kong/Shenzhen Innovation and Technology Park in the Lok Ma Chau Loop in Hong Kong, with a site area 4 times bigger than that of the Hong Kong Science Park. According to the Mr. C. Y. Leung, Chief Executive of HKSAR Government, this new park will serve as "a key base for co-operation in innovation and technology research. Related higher education, cultural and creative, as well as other complementary facilities, will also be provided at the site, creating unprecedented space and opportunities for the development of innovation and technology in Hong Kong and Shenzhen."[12]

[12]"Hong Kong and Shenzhen settle border dispute as they join hands to develop technology park", South China Morning Post, 03 January, 2017http://www.scmp.com/news/hong-kong/economy/article/2058878/hong-kong-and-shenzhen-set-partner-innovation-and-technology



Source: 2017 Policy Address http://www.policyaddress.gov.hk/2017

On the other hand, the Government has also made an investment of HK$18 billion to enhance Hong Kong's innovation and technology ecosystem. These measures include promoting re-industrialisation, funding universities to conduct mid-stream and applied research projects, subsidising industry adoption of technology to upgrade and transform, and supporting start-ups.

As mentioned in last year's Policy Address, the Government planned to earmark HK$2 billion to the Innovation and Technology Bureau to further encourage public universities to carry out more mid-stream applied research projects in Innovation and Technology sector. The fund will commence operation by the middle of 2017.

To promote re-industrialisation, the Government is preparing to build a Data Technology Hub and an Advanced Manufacturing Centre in the Tseung Kwan O Industrial Estate, to be completed in three and five years respectively. Furthermore, the Government has recently introduced a Technology Voucher Programme to subsidise the use of technology by SMEs to improve productivity or facilitate upgrading and transformation. Biotechnology will definitely be one of the industry sectors that enjoys the advantages during the process of the re-industrialisation.

2.5 ASSOCIATIONS & ORGANISATIONS

2.5.1 Hong Kong Biotechnology Organization (HKBIO)

Hong Kong Biotechnology Organisation (HKBIO) is an independent non-profit organization founded by pioneering scientists with extensive life science backgrounds and multi-cultural experience in research and development, engineering and business. The vision of HKBIO is to establish and facilitate a worldwide platform for the Hong Kong biotech industry, promoting awareness, encouraging and enabling international collaboration and providing informed opinion and technical advice to government bodies, healthcare institutions and the public. Another part of HKBIO's mission is to bring in venture capitalists

and other funding agents to the industry, so that they will have opportunities to match each other's needs and resources

HKBIO has connections worldwide, bringing together local companies and potential global partners. Collaborations with overseas partners include the signing of memoranda of understanding with the Taiwan Bio Industry Organization and AusBiotech, and the various delegations to build global platforms for industry.

HKBIO also organized different seminars and events regularly to bring together the community of scientific researchers, technology developers and entrepreneurs. Some of the events were co-organised with other associations and government organisations such as The Chinese Manufacture's Association of Hong Kong (CMA), Hong Kong Trade and Development Council (HKTDC), Hong Kong Science & Technology Parks (HKSTP), etc. As part of the Hong Kong Biotech Horizons series 2016, HKBIO co-organised the "12th International Conference on Brain Energy Metabolism"(ICBEM) with focus on "Ageing Brain in Health" together with CMA and Neuroscience Research Institute of Peking University. Over 250 participants from over 20 countries and regions attended the conference, including graduate students, postdoctoral researcher, professors, research scientists and research directors.

Official website: http://www.hkbio.org.hk

2.5.2 Hong Kong Trade & Development Council (HKTDC)

The non-profit Hong Kong Trade Development Council (HKTDC) was established in 1966 as the international marketing arm for Hong Kong-based traders, manufacturers, and service providers. With over 40 global offices, HKTDC's mission is to create and promote business opportunities for Hong Kong worldwide.

HKTDC hosts the annual Hong Kong International Medical Devices and Supplies Fair and receives biotech missions from myriad countries looking for collaboration. The organization also brings Hong Kong biotech companies to the rest of the world. Each year, it organizes a trade mission to bring Hong Kong biotech companies to the annual BIO International Convention held in the United States (http://hkmb.hktdc.com/en/1X04T70F/event/Hong-Kong-Pavilion-at-BIO-International-Convention-San-Diego-USA).

HKTDC also works closely with local R&D institutions and organisations to facilitate commercialization of local innovation and technology by providing different outreach and marketing platforms. It works closely with Hong Kong Biotechnology Organisation (HKBIO) and Hong Kong Science & Technology Parks (HKSTP) to organize seminars and trade forums for the biotech and life sciences companies to publicize and promote their latest achievements in the technology field, such as the ongoing series of Nanotechnology Forums (i.e. Nanotechnology & Advanced Materials Symposium) co-organized with the Nano and Advanced Materials Institute Limited (NAMI).

Through its 11 offices in Mainland China, HKTDC has developed a close working relationship at different levels in China. HKTDC brings Hong Kong delegations to different cities and provinces in China, carrying out many promotional activities throughout the country across various technology sectors regularly. On the other hand, HKTDC also invites Chinese delegations to visit Hong Kong. It organizes seminars, networking events and business matching activities to help them reach their potential buyers.

Official website: http://aboutus.hktdc.com/en/#home

2.5.3 Hong Kong Medical & Healthcare Device Industries Association Limited (HKMHDIA)

Established in 2003, Hong Kong Medical and Healthcare Device Industries Association is to represent the interest of the medical & healthcare device industries in Hong Kong. Apart from manufacturers and importers of medical devices, their members also include many biotech companies, especially pharmaceutical manufacturers. The association works closely with Hong Kong Science & Technology Park and Hong Kong Trade & Development Council. It helps to promote international co-operation for their member companies and to publicize their products and services internationally through organizing trade fairs, exhibitions and trade missions.

Official website: http://www.medicaldevice.org.hk

2.5.4 The Hong Kong Association of the Pharmaceutical Industry

The Hong Kong Association of the Pharmaceutical Industry was formed in 1968. All 42 members are all international companies engaged in the research and development of pharmaceuticals including the world's top 20. Their member companies provide over 70% of the prescription medicines in Hong Kong. Another major role of the Association is to improve the relationship between their member companies and the government, all healthcare related societies and the community. It also provides suggestions on healthcare policies to improve the overall well-being of Hong Kong people.

Official website: http://www.hkapi.hk

3 MAJOR PLAYERS AND R&D CENTRES IN BIOTECHNOLOGY

3.1 HONG KONG SCIENCE & TECHNOLOGY PARK

Opened in 2001 and managed by Hong Kong Science and Technology Parks Corporation (HKSTPC), the 22-hectare Hong Kong Science Park was constructed to attract technology firms to base operations and R&D in Hong Kong. The Park aims to help Hong Kong build its capability in technology and innovation development and to turn discoveries and new inventions from an idea or concept into a commercial product or service. HKSTP offers state-of-the-art infrastructure and offices for applied R&D activities, and shared laboratories with technical support to help reduce capital investment of R&D companies in product design and development. Rather than targeting multi-national enterprises, the Park's main focus is to serve as an incubator for medium-sized companies and start-ups, nurturing them and providing them with financial and non-financial assistance. As of January 2017, the total number of companies in the Park is 628; with 72% local and 28% overseas technology companies, with an estimated annual turnover of around HK$200 billion.[13]

3.1.1 Biotechnology in Hong Kong Science Park

"Biomedical Technology" is one of the five major technology clusters in the Park. The others are Electronics, Green technology, Information technology & telecommunications, and Material & precision engineering.

The Biotech Cluster at the Hong Kong Science Park plays an important role in uniting biomedical and biotechnology researchers, entrepreneurs, investors and the government to achieve biomedical and biotechnological success. The Biotech Support Centre at Hong Kong Science Park is a shared facility that fully equipped with advanced machinery such as next generation sequencer (NGS) for targeted sequencing and cancer profiling, confocal microscopy with enhanced resolution for cell imaging and cell imaging reader for high speed cell proliferation study and phenotypic analysis, flow cytometer, fast protein liquid chromatography system, fluorescent microscope and high resolution mass spectrometer, etc. The Biotech Centres offers more than 263,000 sqft (24,430 sq m) of lettable laboratories and technical centres. In addition, HKSTP also provides professional advice and support to biotech entrepreneurs in terms of project direction, technological methodologies, plus connections with relevant biotech/healthcare investors, including government funding agencies and potential corporate partners to turn their innovation into applications. As of June 2015, there are 61 biomedical companies at HKSTP which comprises 26 biotherapeutics,11 biotech and 24 med-tech companies.[14]

HKSTP also organizes international summits and events regularly to attract biotech researchers, specialists and entrepreneurs from different parts of the world. Among the events organised, recently in December 2015, HKSTP and the Guangzhou Institutes of Biomedicine and Health (GIBH) co-organised a satellite event – the Hong Kong & Guangzhou International Conference on Stem Cell & Regenerative Medicine – at Science Park. Keynote speakers included Professor Peter Greenberg, the Shaw Prize Winner in Life Science & Medicine 2015, and other speakers included researchers from globally renowned institutes, such as GIBH and Karolinska Institutet. The conference covered topics on stem cell research and applications and featured over 25 exhibits from promising local start-ups and researchers. The event was a great success and a clear demonstration of Hong Kong's weight in biotechnology.

3.1.2 Incubation programmes related to Biotechnology

The incubation programmes operated by HKSTP provide incubation services to assist technology start-ups in their vulnerable inception stages, enabling them to grow and flourish.

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[13]Development Updates, The Hong Kong Science & Technology Park
https://www.hkstp.org/hkstp_web/en/About/at-a-glance
[14] Biomedical Technology Cluster Brochure, Hong Kong Science & Technology Park
https://www.hkstp.org/hkstp_web/Files/Brochure/HKSTP_Biomedical%20_accessible%20pdf.pdf

Incu-bio is a 4-year incubation programme custom-made to support biotech start-ups that require wet lab environment for their work. Each incubate has access to an independent laboratory space in the Biotech Centres in Science Park with subsidised rent and various supporting services. An account manager is assigned to offer consultation on business operation. From recruiting staff members to business and management training, incubates are given guidance to kick-start their enterprise smoothly. Financial aid, lab facilities and advanced equipment are also available. Incubates can join regular networking events that allow them to meet potential investors and partners while exposing their newly founded businesses to a wider audience.

More information can be found: https://www.hkstp.org/hkstp_web/en/what-we-do/nurture-technology-talents/incubation-programme/incu-bio

3.1.3 Bio-samples "Green Channel" with Mainland China

HKSTP has maintained an excellent connections with the authorities, private entities and regulatory bodies in Mainland China which help biotech companies to develop their business in China. In 2012, HKSTP has signed an agreement between Hong Kong Science and Technology Parks Corporation and the Guangzhou Development District to establish a "Green Channel" to facilitate biological specimens transfer for companies located at Hong Kong Science Park and their subsidiary/partner companies located within the Guangzhou Development District at the Pearl River Delta. The "Green Channel" marked the beginning of a series of "game changer" administrative arrangements as Hong Kong endeavours to become Asia's biotech hub.

3.1.4 Future development of Hong Kong Science Park

As mentioned in the 2017 Policy Address, to further foster the development of the innovation and technology ecosystem, the Government will support the construction of an InnoCell adjacent to the Hong Kong Science Park in the coming years. The "InnoCell will provide residential units with flexible design and ancillary facilities, such as shared working spaces, for leasing to staff of the incubates and start-ups in the Science Park. It will also be open to scientific research personnel from outside Hong Kong who work for other companies in the park. The HKSTPC is conducting a detailed study with a view to completing the construction of InnoCell in three years."[15]

Official website: https://www.hkstp.org

3.2 HONG KONG APPLIED SCIENCE AND TECHNOLOGY RESEARCH INSTITUTE (ASTRI)

The Hong Kong Applied Science and Technology Research Institute Company Limited (ASTRI) was set up in 2000 funded primarily by the Innovation and Technology Commission (ITC) aiming to increase Hong Kong's competitiveness in innovation and technology through applied research. ASTRI's R&D strategic focus covers five areas of applications: Financial Technologies, Intelligent Manufacturing, Next Generation Network, Health Technologies, and Smart City. As of March 2016, it has a workforce of around 500 people. From its inception until 31 March 2016, ASTRI has been granted a total of 655 patents, filed in China, the U.S. and other countries.[16]

In 2009, Bio-Medical Electronics (BME) team was formed to expand information and communication technologies into biomedical applications to meet the increasing needs of the community and the industry. BME interacted closely with health care and medical professionals and users, to understand better how R&D can help enhance their professional practices.

Currently there are 3 major research areas under Health Technologies:

[15]2017 Policy Address, HKSAR Government http://www.policyaddress.gov.hk/2017/eng/index.html
[16]2015-16 Annual Report, ASTRI https://www.astri.org/about/corporate-info/publications/

- Miniaturised Diagnostic Device
- Medical Image Analytics
- Bioinformatics Computing

Since its establishment, ASTRI has set-up a state-of-art Health Technology platform which guides and facilitates the growth of Hong Kong's healthcare industry and its ecosystems successfully. Through continuous effort in R&D and different collaborations with universities and companies in medical and healthcare industries, new applications and devices are being developed especially in the areas of preventive health monitoring and medical diagnosis, medical computing and data analytics.

Official website: www.astri.org

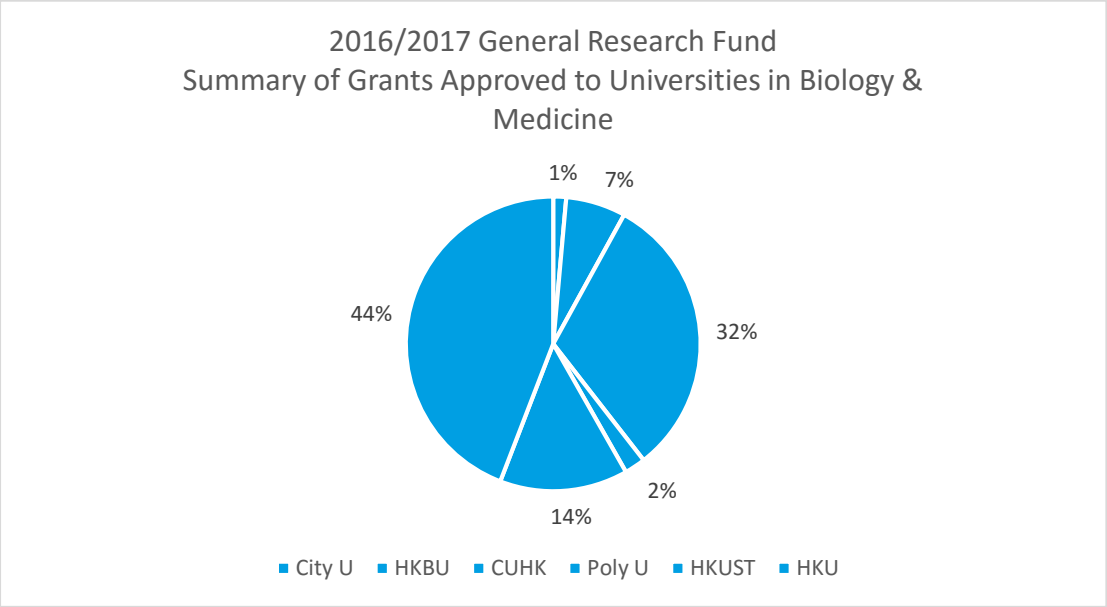
3.3 PUBLIC INSTITUTES AND PARTNER STATE KEY LABORATORIES (PSKLS)

3.3.1 Local universities that engaged in Biotechnology

Universities have always been fertile grounds of nurturing future professionals and R&D specialists in biotechnology, and definitely are important targets for promoting commercialisation of biotech R&D results. Six among eight local universities have set up academic departments of life sciences with research institutes, centres and programmes to help them develop their academic excellence and collaborations with industry players in biotechnology.

These six universities have also set up their Technology Transfer Offices (TTOs) to engage in technology transfer activity. The Government launched the Technology Start-up Support Scheme for Universities (TSSSU) to subsidise the six universities to set up over 120 technology start-ups, turning their research and development deliverables into businesses. Besides, the HKSAR Government provides annual funding to each university through the Innovation & Technology Fund (ITF) since 2013-2014 to enhance their capabilities.

As mentioned in the above chapter, the University Grant Council has been funding the research and development projects conducted by universities in Hong Kong. According to the grants approval summary of 2016-2017 General Research Fund, a total of HK$167,666 was allocated to support 176 projects in Biology & Medicine discipline conducted by six out of eight universities in Hong Kong (please refer to the chart below).



3.3.1.1 THE UNIVERSITY OF HONG KONG

Established in 1911, The University of Hong Kong (HKU) is the city's oldest university. HKU sits at the top of the Hong Kong league tables, ranked 27th globally according to the Quacquarelli Symonds World University Rankings 2016. [17]

Partnering with the Ministry of Science and Technology of Mainland China, HKU houses five State Key Laboratories which four of them are biotechnology related. Besides, HKU has set-up a few research centres and institutes particularly for biotechnology, such as the Clinical Trials Centre and Centre for Genomic Sciences at the Faculty of Medicine. Its affiliated teaching hospital – Queen Mary Hospital (QMH), also provides tremendous support to the biological and clinical research of the University.

Since 2004, HKU has been identifying themes of potential strength for strategic development to maximise the impact of its research. "Biomedicine" is one of the five strategic research areas of the University. It covers the research on Biomedical Engineering and Nanotechnology, Cancer, Development and Reproduction, Infection and Immunology, Stem Cell and Regenerative Medicine.

The University Grants Committee (UGC) has provided preferential funding to the local tertiary institutions to conduct research into selected Areas of Excellence (AoEs). Out of a total of 18 AoE projects, HKU has coordinated 8 and has participated in a further 6 coordinated by other local institutions. Among this, 5 of the AoE projects are biotech related:

- Control of Pandemic and Inter-pandemic Influenza
- Center for Nasopharyngeal Carcinoma Research
- The Institute of Molecular Technology for Drug Discovery and Synthesis
- Centre for Marine Environmental Research and Innovative Technology
- Developmental Genomics and Skeletal Research

School of Biological Sciences, Faculty of Science

Established in 2007, the School of Biological Sciences currently comprises a total of 39 academic staff, 12 post-doctoral fellows, 140 research students, and a team of 38 technical and administrative staff. The School focus on four research areas: Biology, Ecology & Biodiversity, Food for Health, Plant Evolution & Adaptation. It offers Major and Minor courses leading to a B.Sc. degree, with specializations in Biology, Biotechnology, Ecology & Biodiversity, Food & Nutritional Science, and Microbiology. The School enjoys excellent teaching and research facilities in the Kadoorie Biological Sciences Building and the works closely with Swire Institute of Marine Science.

Official website: http://www.biosch.hku.hk

Centre for Cancer Research

The Centre aims to establish strong research programmes to tackle key challenges in cancer by collaborating with other departments in the Faculty of Medicine. It works towards the development of cancer prevention, early detection and effective treatment. The focus research areas are: cancer stem cells; genetic, genomics and epigenetic study of cancer; cancer cell signalling; inflammation and cancer; cancer imaging and detection; molecular targeted therapies.

The Centre also works closely with other cancer research institutes worldwide. The Centre hosts The Hong Kong International Cancer Congress to facilitate knowledge exchange with scholars and scientists around the world.

Official website: http://www.med.hku.hk/ccr/

[17]QS World University Rankings https://www.topuniversities.com/qs-world-university-rankings

Centre for Genomic Sciences

The Centre for Genomic Sciences (formerly known as Genome Research Centre) was established to provide leadership in genome research in Hong Kong and the region by developing competence and infrastructure for studies in genomics, proteomics, and bioinformatics. It also aims to enhance the translation of knowledge into applications for the understanding of disease mechanisms and for the development of diagnostic and therapeutic measures.

The Core Service with advanced high-throughput technology platforms such as the Affymetrix Gene Chip, the Sequenom Mass Array, the Bio-Plex suspension array , etc. have served over 600 researchers since its establishment.

Official website: http://cgs.hku.hk/portal/

Institute of Cardiovascular Science and Medicine (ICSM)

Also located within the Faculty of Medicine, the Institute of Cardiovascular Science and Medicine (ICSM) was established in 1996 with the aim of achieving research excellence in cardiovascular sciences and medicine and to reduce the mortality and morbidity of cardiovascular disease.

The missions of the Centre are to promote integration and collaboration, and to conduct knowledge exchange among scientists and clinicians in the cardiovascular field at HKU and other medical centres in Hong Kong.

Official website: http://www.icsm-hk.org

Research Centre of Heart, Brain, Hormone & Healthy Aging (HBHA)

The Research Centre of Heart, Brain, Hormone & Healthy Aging (HBHA) is an inter-departmental centre established at Faculty of Medicine in 2004. Aiming to pursue medical problems associated with heart, brain, hormone and aging in depth, the Centre brings together the research expertise of its investigator members in the areas ranging from cell and molecular biology, to epidemiology, genetics, neuroscience, physiology, pharmacology, stem cells, tissue engineering and vascular biology.

Official website: http://www.med.hku.hk/hbha/

3.3.1.2 THE CHINESE UNIVERSITY OF HONG KONG

Founded in 1963, The Chinese University of Hong Kong (CUHK) is renowned for its research in the sciences and has a top medical school (i.e. The Prince of Wales Hospital), clinical trial center, Knowledge Transfer Office, and the affiliated Hong Kong Institute of Biotechnology offering technical support to the industry. The University houses five State Key Laboratories in collaboration with the Ministry of Science and Technology of Mainland China, four of them are biotechnology related. "Translational Biomedicine" is one of the four research priorities that CUHK has identified in its "Strategic Plan 2016–2020".

Areas of Excellence (AoEs). Out of a total of 18 UGC-funded AoE projects, 7 are led by CUHK researchers and 4 of them are biotechnology related:

- Centre for Organelle Biogenesis and Function
- Centre for Research into Circulating Fetal Nucleic Acids
- Chinese Medicine Research and Further Development
- Centre for Plant and Agricultural Biotechnology

The School of Life Sciences, Faculty of Science

Established in 2010 under the Faculty of Science, the School of Life Sciences offers six undergraduate major programmes, Biochemistry (BCHE), Biology (BIOL), Cell and Molecular Biology (CMBI), Environmental Science (ENSC), Food and Nutritional Sciences (FNSC), and Molecular Biotechnology (MBTE), with a total annual intake of about 200 students. The active research areas in the School include plant molecular

biology and biotechnology, protein structure and function, marine biology, environmental science, and food science and technology.

Official website: http://www.sls.cuhk.edu.hk/

Institute of Biotechnology (former Hong Kong Institute of Biotechnology)

Founded in 1988 with an initial endowment from the Hong Kong Jockey Club Charities Trust, the Institute of Biotechnology is now part of the Chinese University of Hong Kong which aims to promote the development of a biotechnology industry in Hong Kong and the Asian region. Its mission is to advance applied academic research and to provide the vital link between technology transfer and product commercialization. All in-house facilities, such as cleanrooms, bioreactors and various equipment for analytical, calibration and production purposes, are designed and purchased to meet Good Manufacturing Practice(GMP) standard. Biotech start-ups or entrepreneurs who are planning to test their R&D results in the market can rent these facilities at a very low cost (i.e. pay-per-use basis).

Official website: http://www.hkib.org.hk/

Institute of Plant Molecular Biology and Agricultural Biotechnology (IPMBAB)

Institute of Plant Molecular Biology and Agricultural Biotechnology (IPMBAB) is built on the outstanding research record of the University Grant Council's Areas of Excellence in the field of plant and agricultural biotechnology (i.e. Centre of Plant and Agricultural Biotechnology).The mission of IPMBAB is to create and combine new innovations from basic science researches and cutting-edge biotechnology with the traditional wisdom of farmers and the rich elite germplasm resources from China, to address the issue of food security, with emphasis on the improvement of major staple and economic crops such as rice and soybean.

The members of IPMBAB were pioneers who initiated close and deep collaborations with key agricultural institutes in Mainland China (such as China Hybrid Rice Center, The Chinese Academy of Agricultural Sciences, and Yangzhou University). More recently, IPMBAB co-operates with the Institute of Genetics and Developmental Biology of the Chinese Academy of Sciences, a top plant biology research institute in China. As a demonstration of important international partnership, IPMBAB's project is also part of the Pro VitaMin Rice Consortium in the Grand Challenges in Global Health Initiative of Bill and Melinda Gates Foundation.

Official website: http://www.cuhk.edu.hk/ipmbab/

Li Ka Shing Institute of Health Sciences (LiHS)

Established in 2007, the Li Ka Shing Institute of Health Sciences (LiHS) was initiated by Faculty of Medicine of CUHK, based on the donation of Li Ka Shing Foundation. LiHS aims to provide an environment conducive to cutting-edge scientific research and technological innovations in life sciences. With the support of The Prince of Wales Hospital , which acts as the medical training school of CUHK at the same time, LiHS strives to make contributions to the community in the areas of disease management, health education, healthcare training and medical technology, by promoting cross-disciplinary researches with a particular focus on the mechanisms, diagnosis, monitoring, treatment, clinical sciences and regenerative medicine for health promotion and disease prevention.

LiHS provides various advanced facilities that serve the needs of researchers at CUHK, namely the Biomedical Computing Centre and the Stem Cell Laboratory.

The scientists in LiHS conduct a broad range of research. The area covers diseases, pathobiology (such as cancers, diabetes, molecular microbiology, etc.) and latest technology (such as stem cells and tissue regeneration, bioinformatics, non-coding RNAs, etc.) One of the AoE projects in CUHK, the Research into Circulating Fetal Nucleic Acids, was also led by the scientists and researchers in LiHS.

Official website: https://www.lihs.cuhk.edu.hk/

Institute of Chinese Medicine (ICM)

The Institute of Chinese Medicine (ICM) was set up in 2000, expanded from former Chinese Medicinal Material Research Centre. ICM aims at to modernize, standardize, commercialize and internationalize Chinese medicines through scientific research, bringing east and west together, as well as to benefit more patients.

In 2001, the project "Chinese Medicine Research and Further Development", led by the Institute of Chinese Medicine, was selected as an "Area of Excellence" by the University Grants Committee and received an award of HK$25 million to develop 5 priority projects.

Official website: http://www.cuhk.edu.hk/icm

3.3.1.3 THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY (HKUST)

Founded in 1991 and is currently ranked 49th worldwide and 6th in Asia (Times Higher Education World University Rankings 2017[18], HKUST is a dynamic, international research university with focus on achieving excellence in science, technology, business and humanities. "Biological Sciences and Biotechnology" is one of the five "High-Impact Research Areas" of the University's Strategic Plan 2005-2020. HKUST's scientists are pioneers in several areas of larval biology research, such as larval 'omics'. It owns one of the world's leading labs in both the larval biology and biofouling/antifouling research.

On the other hand, through a decade's effort in biotechnology research, HKUST possesses expertise to explore neurobiological processes, identify neuro-proteins of therapeutic importance, discover novel drug candidates, and conduct early stage preclinical drug developments. GlaxoSmithKline R&D China has set up a laboratory in Neuroscience with HKUST to explicate the molecular mechanisms underlying the pathologies of neurodegenerative diseases, as well as to develop drug candidates for their treatment.

In addition, the Biosciences Central Research Facility (BioCRF) at HKUST provides state-of-the-art communal equipment, trainings, and other activities to aid R&D in all areas of biological sciences to researchers and scientists both inside and outside the University.

Division of Life Science, School of Science

Division of Life Science was set up to establish and sustain a program of scholarship that advances both research and education in the biological sciences. As of February 2017, the Division has a total of 746 Undergraduate and Postgraduate students. The Division is also the home of the State Key Laboratory of Molecular Neuroscience, the first Partner State Key Laboratory at HKUST.

The Division covers the below research areas:

- Cellular Regulation and Signaling
- Cancer Biology
- Developmental Biology
- Molecular and Cellular Neuroscience
- Macromolecular Structure and Function
- Marine and Environmental Science
- Biotechnology and Medicinal Biochemistry

Official website: http://life-sci.ust.hk/

The Biotechnology Research Institute (BRI)

BRI was built with a leading state-of-the-art infrastructure for the advancement of biotechnology. By leveraging its multi-disciplinary expertise, BRI-supported innovative research projects have resulted in

[18]The Times Higher Education World University Rankings 2016-2017https://www.timeshighereducation.com/world-university-rankings

increasing number of biomedical discoveries. The major research areas of BRI include Traditional Chinese Medicine, Plant Biotechnology, Protein Engineering & Design, Neuro-Proteins. Over the years, BRI has successfully carried out the many research programs with support from the Innovation and Technology Fund (ITF), such as applied genomics for drug discovery, establishing the SimBioDas "Artificial Gut" technologies, development of innovative gene chip technology and various research in regards to traditional Chinese medicine.

The Hong Kong Jockey Club Charities Trust has HK$175 million to set up a biotechnology company in partnership with HKUST to help bring viable drug candidates from the laboratory into the clinical arena.

Official website: http://www.bri.ust.hk/index.shtml

3.3.1.4 HONG KONG BAPTIST UNIVERSITY

Established in 1956 founded by the Baptist Convention of Hong Kong, the former Hong Kong Baptist College, renamed to Hong Kong Baptist University in 1984,has over half a century of experience educating Hong Kong's top students

Research is a top priority at HKBU. The University Grants Committee (UGC) Research Assessment Exercise released in 2006 showed that three out of every four full-time HKBU academics were actively engaged in research. With Vision 2020, the University's 10-year development plan, HKBU will focus on innovative research in four major areas: Health, Environment, Chinese and China studies, and Cross-cultural studies. HKBU is very renowned for its research excellence in Chinese Medicine. The School of Chinese Medicine is the first UGC-funded institution to provide full-time higher education in Chinese medicine in Hong Kong.

School of Chinese Medicine (SCM)

Founded in 1998, the School provides quality Chinese medicine programmes to nurture new generations of Chinese medicine professionals and scientists. Apart from offering undergraduate and postgraduate programmes, SCM has also identified three strategic research focuses: Precision Medicine and Phenomics study, translational medicine and innovative drug discovery, and authentication and testing of Chinese medicines. SCM houses seven research centres:

- Shum YiuFoon Shum Bik Chuen Memorial Centre for Cancer and Inflammation Research
- Institute for Advancing Translational Medicine in Bone and Joint Diseases
- Hong Kong Chinese Medicine Clinical Study Centre
- Mr. & Mrs. Ko Chi Ming Centre for Parkinson's Disease Research
- Consun Chinese Medicines Research Centre for Renal Diseases (CCRD)
- Research Centre for Standardization of Chinese Medicines(CSCM)
- Institute of Integrated Bioinformedicine and Translational Science

In recent years, the research team of SCM has won various external research grants, including those from the National Natural Science Foundation of China, the Science, Technology and Innovation Commission of Shenzhen, the Croucher Foundation, the General Research Fund of the University Grant Council, the Innovation and Technology Commission, etc. In the results of the Research Assessment Exercise 2014 announced by the University Grants Committee, SCM transcends other institutions in the percentage of four-star rating (international excellence) in the field of Chinese medicine.

In terms of clinical services, SCM possesses largest network of 15 Chinese medicine clinics among universities in Hong Kong, with 8 clinics operated by SCM and 7 operated in collaboration with Hospital Authority and Non-Government Organisations.

Official website: http://scm.hkbu.edu.hk

Department of Biology, Faculty of Science

The Department of Biology offers undergraduate and postgraduate programmes in Biotechnology and Environment Science. The Department focus on three strategic research area under the concept of "gene-

environment interactions": Environment and Health, Stress and Development Biology, Environmental Microbiology. The Department also has three research centres:

- Croucher Institute for Environmental Sciences (CIES)
- Hong Kong Organic Resource Centre (HKORC)
- Hong Kong Baptist University and the Research Center for Eco-Environmental Sciences (HKBU-RCEES) Joint Institute of Environmental Sciences

Official website: http://biol.hkbu.edu.hk/

3.3.1.5 THE HONG KONG POLYTECHNIC UNIVERSITY

Granted the full university status in 1994, The Hong Kong Polytechnic University (PolyU) is a pioneer in application-orientated education and research within Hong Kong. PolyU is actively engaged in two biotech Areas of Excellence (AoEs), supported by the University Grants Committee (UGC). It has been awarded funding for research in Chinese Medicine and Further Development as well as for the support of its Institute of Molecular Technology for Drug Discovery and Synthesis.

Areas of strength at PolyU include traditional Chinese medicine (TCM) modernization, food safety, myopia research, and biomedical ultrasound.

Department of Applied Biology and Chemical Technology (ABCT), Faculty of Applied Science and Textiles

Being the home of 2 research centres and 2 partner state key laboratories, Department of Applied Biology and Chemical Technology (ABCT) is a multi-disciplinary department brings together the expertise in molecular biology, biotechnology, biochemistry, proteomics, cancer biology, bioimaging, biofuel, physiology, organic and inorganic chemistry, analytical chemistry, chemical engineering, nanotechnology and food science.

The major research areas of ABCT include the following:

- New Materials and Nano-technology
- Drug Discovery and Traditional Chinese Medicine
- Cancer Research
- Organometallic and Catalysis
- Renewable Energy and Sustainable Development
- Chemical Imaging and Biosensing
- Food Safety and Technology

The researchers at ABCT have won various awards worldwide, including Second Class Prize in Natural Science Award (2013, 2014, 2015) and Second Class Prize in Scientific and Technological Progress Award (2014) awarded by the Science and Technology Development Centre, the Ministry of Education of China.

Official website: https://www.polyu.edu.hk/abct/en/home/index.html

Lo Ka Chung Centre for Natural Anti-Cancer Drug Development

The Lo Ka Chung Centre for Natural Anti-Cancer Drug Development was established in 2006. It focus on research in natural anti-cancer drugs. It also aims to educate the public through trainings co-organised with pharmaceutical companies. Throughout the years, the centre has successfully developed two novel drugs to treat cancer. The first drug (BCT-100) is under formal phase I/II clinical trials at Queen Mary Hospital in treating liver cancer with encouraging results. BCT-100 is Hong Kong's first ever drug to receive investigational new drug (IND) approval from the U.S. Food and Drug Administration (FDA), which is an important achievement in the development of the biotechnology and pharmaceutical industry in Hong Kong. The second drug (BCA-PEG20) represents a new prototype for treating various cancers.

With application of the most advanced biotechnology, these new drugs create opportunities for treating cancers.

Official website: https://www.polyu.edu.hk/abct/en/research/research_centres/lkcc/about_us/index.html

Food Safety and Technology Research Centre

Established in 2011 under by the Department of ABCT, the Food Safety and Technology Research Centre is equipped with state-of-the-art facilities and expertise to serve as the platform for research in food safety technology. The Centre has won several awards for its research excellence in improving food safety in Hong Kong. It focus the research and development of food safety and technology on six key areas: testing &certification, risk analysis & toxicology, functional food development, innovative technology development, nutrition & public health and education &professional development.

Apart from the PolyU's campus, the Centre has also set up different laboratories in Hong Kong Science and Technology Park and PolyU's Shenzhen Base in Nanshan District High-Tech Industrial Park to accommodate the needs of education, consultancy and collaborative research.

Official website:
https://www.polyu.edu.hk/abct/en/research/research_centres/fstrc/introduction/index.html

3.3.1.6 CITY UNIVERSITY OF HONG KONG

City University of Hong Kong (CityU) is a dynamic higher education institution founded in 1984 that provides professional education and research for the benefit of society. CityU is now ranked among the top 100 global universities by the Quacquarelli Symonds (QS) World University Rankings and is among the top five universities founded in the last 50 years. [19]

Well-known for its engineering program, the University also realises the urge for life science and biotech development nowadays. It starts expanding into the areas of veterinary medicine and biomedical engineering in recent years. After the establishment of Department of Mechanical and Biomedical Engineering and the School of Energy & Environment in past few years, CityU announced the newly established School of Veterinary Medicine will start offering a six-year bachelor of veterinary medicine programme (BVM) in the academic year 2017-2018. This represents a milestone in the development of veterinary education in Hong Kong and the region.

The Biotech related departments within CityU has also won several awards worldwide to prove their research and academic strength in this area. The University was awarded the Gold Medal at the iGEM Competition in USA for two consecutive years (2014, 2015) for their research achievements in gene-based remedy for lactose intolerance and genetic solution using genetically-modified E. coli to tackle obesity respectively.

Department of Biology and Chemistry, College of Science and Engineering

With 20 years of experience in teaching and research in biotech area, the Department of Biology and Chemistry is at the cutting edge of interdisciplinary research embracing biology, chemistry and environmental science. Being at the top of the leagues in both biology and chemistry in Hong Kong, the Department is also the home of the one out of two Partner State-Key Laboratories in CityU.

The Department conducts research in various areas, including catalysis, analytical chemistry, biotechnology and biochemistry, marine biology, cellular imaging, functional genomics ad proteomics, developmental and cell biology, neurobiology, RNA biology, nanobiotechnology, applied microbiology, food nutraceutical and Chinese medicine, etc.

Official website: http://www6.cityu.edu.hk/bhdbapp/deptweb/index.html

[19] Strategic Plan 2015-2020, The City University of Hong Kong
http://www.cityu.edu.hk/provost/strategic_plan/

Department of Biomedical Sciences, College of Science and Engineering

The Department of Biomedical Sciences was established in January 2014 to develop strategic growth areas in the life sciences. It aims to promote interdisciplinary collaboration and translational research in biomedical science.

The department focuses on three strategic research areas: systems neuroscience, cancer biology and regenerative medicine. Multidisciplinary approaches employed in areas including molecular and cell biology, genetics and genomics, physiology and pharmacology, systems biology and bioinformatics, microbiology and immunology, and biotechnology and nanotechnology.

Official website: http://www.cityu.edu.hk/bms/

Department of Mechanical and Biomedical Engineering, College of Science and Engineering

The Department was established in 2011, aiming to nurture professionals and scientists in this area to meet the increasing needs in the society. The Department currently offers majors in Mechanical Engineering, and two inter-disciplinary majors of Bioengineering and Nuclear & Risk Engineering. It mainly focus the research on following areas:

- Nano-engineering and nano-metrology
- Micro-robotics network and biomedical devices
- Advanced materials applications and data
- Table-top manufacturing science and technology
- Quality Engineering and Conformity
- Renewable Energy

Official website: http://www.cityu.edu.hk/mbe/

School of Energy and Environment

The School of Energy and Environment commenced to intake students in the academic year 2009-2010. It is the first in Hong Kong and one of the few in the region, to lead teaching and research in issues concerning energy and environment, with focus on the science and technology areas relating to renewable energy generation, energy storage, energy efficiency and conservation, green materials, climate change and air pollution. The research covers a wide spectrum as follow:

- Atmospheric and climate science
- Bio-science and its applications in energy and environment
- Energy efficiency and conservation
- Energy generation, conversion and storage
- Water Environment Technology

The School has also conducted joint-research with institutes in Mainland China, Korea, Taiwan and Australia.

Official website: http://www.cityu.edu.hk/see

School of Veterinary Medicine

Starting to intake students for a six-year undergraduate course in veterinary medicine in September 2017, the School of Veterinary Medicine is the first veterinary school in Asia modelled on DVM lines. This six-year bachelor programme was developed in collaboration with Cornell University in the United States, with the objective of offering the first American Veterinarian Medical Association-accredited veterinary program in Hong Kong and Asia. On the other hand, the School will focus the research on Emerging Infectious Diseases, Food Safety, Animal Welfare and Aquatic Production at the beginning stage.

To provide a suitable environment for pre-clinical training and sufficient clinical caseloads for students and researchers, the School recently acquired Hong Kong's biggest companion animal clinic (Peace Avenue Veterinary Clinic). It is also developing a two-hectare marine aquaculture research centre in Sha Tau Kok,

a marine centre on Kat O Island as well as a commercial fish farm in Sai Kung. In addition to the construction works of a veterinary disease research and diagnostic laboratory (operational early 2017), a production animal farm and ambulatory service, an equine hospital and teaching venues such as wet and dry labs and a clinical skills lab are almost completed.

Official website: http://www.cityu.edu.hk/svm

3.3.2 Partner State Key Laboratories (PSKLs) in Hong Kong

The Partner State Key Laboratory (PSKL) scheme is one of the major national science and technology development schemes managed by the Ministry of Science and Technology (MOST), The People's Republic of China. A PSKL is a laboratory in Hong Kong recognised by MOST as a R&D partner of a corresponding Mainland's State Key Laboratory for its research excellence in a particular technology area. Partner SKLs serve as a base for conducting quality R&D, congregating and nurturing outstanding researchers, as well as facilitating exchanges. There are currently 16 PSKLs in Hong Kong which 13 of them are biotech-related. The ITF committed a total of HK$80 million to support R&D related expenditure incurred by the PSKLs in the financial year 2015-16.

3.3.2.1 PARTNER STATE KEY LABORATORY OF BRAIN AND COGNITIVE SCIENCES , THE UNIVERSITY OF HONG KONG

Established in 2005, the Partner State Key Laboratory of Brain and Cognitive Sciences is located in the Faculty of Medicine and jointly operated by the Faculty of Social Sciences. Partnering with the Institute of Biophysics at the Chinese Academy of Sciences, Beijing, China, the Laboratory conducts interdisciplinary studies that combine functional and structural magnetic resonance imaging (fMRI), molecular biology, and genetic approaches to investigate brain functions and brain disorders. The researchers are from the School of Biomedical Sciences, Departments of Psychiatry, Diagnostic Radiology, Linguistics, Psychology; Centre for Genomices and Faculty of Education of the University of Hong Kong.

For further information: http://www.brain.hku.hk/

3.3.2.2 PARTNER STATE KEY LABORATORY OF EMERGING INFECTIOUS DISEASE, THE UNIVERSITY OF HONG KONG

The Partner State Key Laboratory of Emerging (PSKL) Infectious Diseases at HKU was established by the Ministry of Science and Technology (MOST) in recognition of the outstanding contribution made by HKU scientists in response to the SARS outbreak during 2003/2004. Through past a few years since its establishment, this PSKL has earned reputation nationally and internationally in the field of infectious diseases. This PSKL played an important role in supporting Hong Kong in response to several outbreaks of infectious diseases, including the pandemic H1N1 in 2009. It has become an essential component at HKU integrating research, training and building up interaction with partners on the Mainland on related research areas.

For further information: http://www.skleid.hku.hk/

3.3.2.3 PARTNER STATE KEY LABORATORY FOR LIVER RESEARCH, THE UNIVERSITY OF HONG KONG

Liver diseases, including hepatitis, liver cirrhosis and liver cancer, remain one of the leading causes of morbidity and mortality in Hong Kong and Mainland China. HBV, cirrhosis and liver cancer account for more than 2,000 deaths per year. The PSKL of Liver Research was set up to enhance the understanding in the pathogenetic mechanisms of HBV, cirrhosis and liver cancer by engaging in cutting-edge basic laboratory research, and devise better diagnoses and new or better treatment modalities for HBV infection and liver cancer, which could eventually reduce the incidence and mortality of hepatitis and liver diseases in Hong Kong by offering our patients the best possible management and treatments.

For further information: http://www.skllr.hku.hk

3.3.2.4 PARTNER STATE KEY LABORATORY OF PHARMACEUTICAL BIOTECHNOLOGY, THE UNIVERSITY OF HONG KONG

The Partner State Key Laboratory (PSKL) of Pharmaceutical Biotechnology was approved by MOST at July 2013, with the funding support from ITC. Its strategic partner is State Key Laboratory of Pharmaceutical Biotechnology at Nanjing University.

The PSKL at HKU consists of a group of leading clinicians and scientists in across various disciplines, including biochemistry, molecular biology, physiology, pharmacology and pharmacy, chemistry, nanotechnology and medical engineering, to establish an integrated, open platform for basic, clinical and translational research on obesity, diabetes and its associated chronic complications. The research focus on "discovery and characterization of new hormones and biomarkers, and exploration of their potential application in the pharmaceutical and biotechnology industry"

For further information: http://www.sklpb.hku.hk/

3.3.2.5 PARTNER STATE KEY LABORATORY OF SYNTHETIC CHEMISTRY, THE UNIVERSITY OF HONG KONG, COLLABORATE WITH THE CHINESE UNIVERSITY OF HONG KONG

The Partner State Key Laboratory (PSKL) of Synthetic Chemistry, established in partnership with the Chinese University of Hong Kong and the State Key Laboratory of Organometallic Chemistry located in the Shanghai Institute of Organic Chemistry. It aims to create and identify novel chemical entities that are of fundamental interest regarding to structure and bonding and/or have unique properties that have useful applications; and to develop new environmentally friendly methods for the synthesis of chemical entities of importance to society.

For further information: http://www.cuhk.edu.hk/english/research/statekeylab/synthetic-chemistry.html

3.3.2.6 PARTNER STATE KEY LABORATORY OF ONCOLOGY IN SOUTH CHINA, THE CHINESE UNIVERSITY OF HONG KONG

The Partner State Key Laboratory (PSKL) of Oncology in South China is located in the Prince of Wales Hospital. With CUHK's long-established partnership with Sun Yat-sen University in cancer research and the support of the Hospital Authority and the Food & Health Bureau of the Hong Kong SAR Government, the PSKL is in a good position to extend its scientific achievements to benefit the wider Chinese community. The PSKL has collaborated with over 20 top cancer trial centres in the world, including Johns Hopkins University, Oxford University, Fudan University and Peking University.

For further information: http://www.cuhk.edu.hk/english/research/statekeylab/oncology.html

3.3.2.7 PARTNER STATE KEY LABORATORY OF AGROBIOTECHNOLOGY, THE CHINESE UNIVERSITY OF HONG KONG

Being as the partner of the State Key Laboratory of Agrobiotechnology at China Agricultural University (CAU) in Mainland China, the Partner State Key Laboratory (PSKL) in Agrobiotechnology at CUHK was set up in 2008with the mission of increasing agricultural productivity, safeguard food security and improve people's nutrition in China. The PSKL acts as an international hub for intellectual and scientific exchange in agrobiotechnology, aiming to achieve the world's leading position in various frontier research areas including gene discovery, efficient gene transformation, crop stress tolerance, functional genomics, proteomics, metabolomics and their applications.

Research priorities include Crop Improvement and Technology Platform. For further information: http://www.cuhk.edu.hk/ipmbab/SKL/

3.3.2.8 PARTNER STATE KEY LABORATORY OF PHYTOCHEMISTRY AND PLANT RESOURCES IN WEST CHINA, THE CHINESE UNIVERSITY OF HONG KONG

The Partner State Key Laboratory (PSKL) of Phytochemistry and Plant Resources in West China at CUHK was set up in 2009 to conduct research traditional Chinese medicine modernization and the application of biotechnology in medical science. The research focus on the photochemistry and sustainability of plant resources in west China, particularly in the areas of cancer, cardiovascular health, health supplements, authentication and DNA barcoding, and viral infection.

For further information: http://www.cuhk.edu.hk/english/research/statekeylab/phytochemistry.html

3.3.2.9 PARTNER STATE KEY LABORATORY OF DIGESTIVE DISEASE, THE CHINESE UNIVERSITY OF HONG KONG

The Partner State Key Laboratory (PSKL) of Digestive Disease was set up in 2013 to promote research and improve the level of diagnosis and treatment of digestive diseases in Hong Kong and mainland China through the collaboration between CUHK and Fourth Military Medical University, China. The Laboratory carries out basic, translational and clinical research on the gastrointestinal cancer, peptic ulcer bleeding, chronic liver disease and inflammatory bowel disease. The scientists and researchers of the PSKL are professionals coming from a range of academic fields in gastroenterology, surgery, pathology, interventional radiology, molecular and cellular biology, and oncology, which promoting cross-fertilization of ideas and enhancing synergism between different specialties.

For further information: http://www.cuhk.edu.hk/english/research/statekeylab/digestive-disease.html

3.3.2.10 PARTNER STATE KEY LABORATORY OF ENVIRONMENTAL AND BIOLOGICAL ANALYSIS, HONG KONG BAPTIST UNIVERSITY

Partnering with the State Key Laboratory of Environmental Chemistry and Eco-toxicology in Chinese Academy of Sciences, the Partner State Key Laboratory (PSKL) of Environmental and Biological Analysis at Hong Kong Baptist University was established in 2013 to serve as a research platform focusing on environmental science, biological science and material science. The PSKL promotes fundamental research and develops novel analytical methods for life science, with the effect of persistent organic pollutants (POPs) on environment, food safety and public health as its target research objectives.

For further information: http://skleba.hkbu.edu.hk/

3.3.2.11 PARTNER STATE KEY LABORATORY IN MARINE POLLUTION, CITY UNIVERSITY OF HONG KONG

Established in 2009, the Partner State Key Laboratory (PSKL) in Marine Pollution located in City University of Hong Kong is made up of a consortium of six partner universities: City University of Hong Kong, Hong Kong Baptist University, Chinese University of Hong Kong, Hong Kong Polytechnic University, The Hong Kong University of Science and Technology and The University of Hong Kong. Through this PSKL, the six collaborating universities aim to protect marine ecosystems through identifying the environmental threats caused by toxic contaminants, hypoxia, biotoxins and pathological bacteria, and their mitigation. The main research areas cover Pollution Monitoring Technology, Marine Ecosystem, Pollution Control and Bioremediation, Risk Assessment.

The partnership with the State Key Laboratory of Marine Environmental Science (MEL) at Xiamen University is dedicated to the development of innovative chemical, biological and engineering technologies for the early detection, assessment, prediction and control of pollution impacting the marine environment.

For further information: http://www6.cityu.edu.hk/sklmp/sklmp_en/index.asp

3.3.2.12 PARTNER STATE KEY LABORATORY OF CHIROSCIENCES, THE HONG KONG POLYTECHNIC UNIVERSITY

The Partner State Key Laboratory (PSKL) of Chirosciences is one of the two Partner State Key Laboratories located in Poly U. Established in 2010, the PSKL focus the research on organic synthesis, catalysis and chemical biology. The three major objectives are:

- Synthesis of and method development for novel chiral compounds and natural products;
- Research and development on pharmaceuticals and health products;
- Explore and develop new molecular techniques for drug discovery.

For further information: https://www.polyu.edu.hk/abct/en/research/research_centres/index.html

3.3.2.13 PARTNER STATE KEY LABORATORY OF MOLECULAR NEUROSCIENCE, THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY (HKUST)

The Partner State Key Laboratory (PSKL) of Molecular Neuroscience at HKUST is the first laboratory focused on neuroscience research in Hong Kong and the first PSKL at HKUST. With the support from the Innovation Technology Commission and the Hong Kong Jockey Club Charities Trust, the PSKL has set up world class research infrastructure on drug discovery, and has successfully identified promising drug leads for neurological disorders.

The research activities of the PSKL are directed towards investigating the important fundamental questions in the nervous system. It aims to further strengthen research capabilities in below areas:

1. Neuronal signal transduction pathways
2. Synapse development and plasticity
3. Regulation of neuronal survival
4. Neurodegenerative diseases
5. Learning and memory
6. Drug discovery and development

Further information can be found: http://skl-molneurosci.ust.hk/eng/index.html

4 CO-OPERATIONS WITH OVERSEAS PARTNERS

Through the years, Hong Kong Government has been encouraging institutions and private companies to co-operate with overseas biotech research centres and institutions. In December 2015, the Hong Kong Government announced the launch of the Hong Kong-Israel Research and Development (R&D) Cooperation Programme. This Programme is jointly implemented by the Innovation and Technology Commission of Hong Kong and MATIMOP - the Israeli Industry Centre for R&D of the Office of the Chief Scientist of the Ministry of Economy of Israel - under a bilateral framework to encourage industrial R&D collaboration and technology development between the two places. Biotechnology is also included. Under the Cooperation Programme, Hong Kong and Israeli companies that are engaged in industrial R&D collaboration can apply for government funding for their joint R&D projects by submitting proposals to the Enterprise Support Scheme under the Innovation and Technology Fund.

Apart from the Government, the Hong Kong Science & Technology Park (HKSTP) has always been seeking the opportunities to promote international collaborations between Hong Kong and overseas biotech companies. In 2013, HKSTP organised a biotech delegation to Brussels, visiting Brussels Enterprise Agency (BEA) and Brussels LifeTech Cluster. They signed a Memorandum of Understanding (MoU) to accelerate the growth of biotechnology in both Hong Kong and Belgium. This MoU offered support to facilitate the setting up of Brussels-based biotech companies in Hong Kong, helping them to expand their business into Mainland China and Asia. Vice versa, the Brussels partners will provide the same support to Hong Kong biotech companies who wish to explore the Belgian market. In 2016, Karolinska Institutet from Sweden has set up its first international stem cell translational research centre at HKSTP. And in the same year, the Guangzhou Institutes of Biomedicine and Health under the Chinese Academy of Sciences also announced it would set up a Guangzhou Hong Kong Stem Cell and Regenerative Medicine Research Centre in the Science Park as well.

5 EVENTS RELATED TO BIOTECHNOLOGY IN HONG KONG

International Conference & Exhibition of the Modernization of Chinese Medicine & Health Products (ICMCM)

Jointly organised with Modernised Chinese Medicine International Association Ltd (MCMIA), the International Conference & Exhibition of the Modernization of Chinese Medicine & Health Products (ICMCM) is an annual conference that hosted by Hong Kong Trade and Development Council (HKTDC) that bring together academic researchers, regulators and industry speakers from different countries to share their insights. Lots of products and research achievements in Chinese Medicine, medical and health care sector will be displayed at the exhibition.

Some of Hong Kong Science & Technology Parks partner companies such as Eu Yan Sang, PuraPharm as well as graduated incubates such as Rehab-Robotics and eNano Health have also participated in ICMCM in order to promote biomedical development and medical technology development in Hong Kong and Science Park's ecosystem. Through such events, participated incubates can network with medical device companies and stakeholders of the industry, and have the opportunities to conduct business promotion.

Fair website: http://m.hktdc.com/fair/icmcm-en/International-Conference-of-the-Modernization-of-Chinese-Medicine-and-Health-Products.html

The International Conference on Brain Energy Metabolism (ICBEM) 2016

Jointly organised by Hong Kong Biotechnology Organisation, Chinese Manufacturers Association and Neuroscience Research Institute of Peking University, the 12th International Conference on Brain Energy Metabolism, titled "Energy Metabolism and Neuron-Glia Interactions in Brain: from Molecular Mechanisms to Novel Therapeutic Approaches" was hosted in Hong Kong from 25th to 28th May 2016.

The programme's topics ranged from interactions of various substances of the brain, to regulations of brain metabolism through different mechanisms as well as solutions to effective treatments of metabolic disorders concerning the brain.258 participants from over 20 countries and regions attended the ICBEM, including graduate students, professors and research scientists, etc.

Fair website: http://www.hkbio.org.hk/icbem/

6 REGULATIONS

Currently, there is no existing regulation for biotechnology research and development in Hong Kong. And there is no mandatory regulation for Genetically Engineered (GE) products either.

In regards to the genetically modified products, the Hong Kong Government implemented a Genetically Modified Organisms (Control of Release) Ordinance and a Genetically Modified Organisms (Documentation for Import and Export) Regulation to comply with the Cartagena Protocol on Biosafety in 2011. Under the Ordinance, prior approval must be sought from the Director of Agriculture, Fisheries and Conservation before a GMO can be released into the environment or imported into Hong Kong intended for release into the environment. As cultivation of unapproved GM crops in the open environment may have adverse effects on the environment, cultivation or import intended for cultivation of GM seeds is subject to regulation under the Ordinance.

More information can be found on:
http://www.afcd.gov.hk/english/conservation/con_gmo/con_gmo.html

Concerning drugs and pharmaceutical products, the Hong Kong SAR Government has set up the Drug Office under the Department of Health as a law enforcement agency to oversee the legislations concerning medicines. It also provides for the procurement and dispensing of medicines at the clinics of the Department. The Drug Office comprises 5 divisions including Pharmacovigilance and Risk Management, Traders Licensing and Compliance, Drug Registration and Import/Export Control, Clinic Service and Business, Administration.

More information can be found on: https://www.drugoffice.gov.hk