Research Assessment Exercise 2020
Impact Overview Statement

University: The Hong Kong University of Science and Technology
Unit of Assessment (UoA): 1 - Biological Sciences
Total number of eligible staff of the university in the UoA: 42

(1) Context

The primary non-academic users of this UoA's research include health and environment-related government bodies; regional and international policy-makers; biotech and traditional Chinese medicine (TCM) manufacturers in Hong Kong; entrepreneurs and global venture capitalists; the South-East Asian bird's nest industry; doctors and hospitals in Hong Kong and mainland China; and international and local non-profit organizations (NGOs). Beneficiaries include neurodegenerative disease and brain cancer patients (particularly in East Asia), skincare product consumers, Greater Bay Area employees, Hong Kong schools and science museum visitors. Our diverse impacts include:

- **Healthcare:** Through novel understanding and therapeutic approaches to neurodegenerative diseases; and cost-effective production of high-efficacy skin growth factors to create skin repair products (e.g. for diabetic ulcers, pressure sores, and burns).
- **Environment and sustainability:** Through local and international government water monitoring protocols and guidelines to tackle metal pollution; and research-based development of novel eco-friendly anti-fouling agents from natural compounds to assist the shipping industry.
- **Economy:** Research-based production processes based on new biotechnology IP, leading to revitalization and upgrading of traditional industry, start-ups, and best-selling consumer products.
- **Global, national, and local science policy-making**: For example, biomedical contribution to global think tanks such as the World Economic Forum.
- **Raising public awareness of societal impacts of science:** Through the dissemination of scientific research and knowledge via local and international media appearances, education talks to schools and nature-related bodies (wetlands nature reserve), and others (e.g. science museum).

(2) Approach to impact

The Unit, comprising the Division of Life Science and Department of Ocean Science (OCES) in the School of Science, used six main approaches to deliver societal impact and to engage with non-academic users over the RAE2020 period:

i) Translating basic research into healthcare applications: Through *collaborations* with local and international *medical teams and hospitals* (>10), our faculty members have achieved research breakthroughs in novel therapeutic approaches for incurable diseases, such as Alzheimer's (Ip), brain cancer (Wang), and new technologies, e.g., microfluidic devices for intensive care units (Wu).

ii) Commercialization and entrepreneurship: (1) *129 patents* were filed between 2013-19 via HKUST's Technology Transfer Center and *our relationships with manufacturers* have led to mass production of best-selling well-being and skincare products (e.g., Tsim, Wong, Ko); (2) Formation of many start-ups over the RAE2020 period (e.g. SeaSafe Limited (2016); Infitech Limited (2018); SGC Cosmotech Company Limited (2019); (3) Funding and licensing agreements to translate Alzheimer's disease-associated technologies into treatments and diagnostics (Morningside Group/IP).

iii) Engagement with government departments: Our faculty in the newly established OCES have actively engaged the Environmental Protection Department, Drainage Services Department, and Hong Kong Observatory through *consultancies and forums* for sharing knowledge and research findings. OCES provides a focal point for external users and beneficiaries to connect with our marine biologists and ocean scientists.

iv) Advisory and public outreach: We encourage faculty at all levels to disseminate their research and expertise *to widen understanding of science in social and economic development* at local, national and international levels through the following activities: participation in major international forums, e.g. World Economic Forum (Ip, Wu), membership of government committees, e.g. the Committee on Research and Development of Chinese Medicines under the Innovation and

Technology Commission (ITC) (Tsim); Biomedical Technology Cluster Expert Panel for the Hong Kong Science and Technology Park (Wong); Advisory Committee on Innovation and Technology under ITC (Ip); media coverage (Ip, Zhang, Qian); liaison and outreach with NGOs (Herrup); science talks to local schools (Mak, Leung); and partnering with community organizations such as Wetlands Park and Science Museum (Ip).

v) Research Institutes and Centers: Our faculty have established several research platforms that help to connect with outside partners, including for translation of research through product development. Examples are the Center for Epigenomics Research (Leung, 2017), Mannay-HKUST Cosmetic Innovation R&D Center (Tsim, 2015); Center for Marine Bioactive Substances (Qian, 2001); and Hong Kong Branch of the Southern Marine Science and Engineering Guangdong Laboratory (Qian, 2015).

vi) Internal mechanisms: (1) We have participated in regular School-based reviews on knowledge transfer by external reviewers with rich entrepreneurial expertise. (2) We have recruited many junior faculty (e.g. Wang, Semmelheck, Wu, Hu, Park) with cross-departmental appointments by leveraging School and University-level initiatives in cluster hiring to promote interdisciplinary collaborations. This is necessary to address complex scientific challenges in areas such as identifying breakthrough medical treatments. (3) We have given special consideration to faculty involved in translational research during our annual performance review/merit review and tenure promotion.

(3) Strategy and plans

Over the next six years, we intend to continue to follow our six major pathways to impact but also to extend our types of impacts, users, and beneficiaries through the following actions:

- By further pursuing research innovation and excellence, we will promote and expand entrepreneurship within our group;
- We will leverage international and community collaboration in the new InnoHK project (led by Ip), and its strong emphasis on translation, through the new Hong Kong Center for Neurodegenerative Diseases;
- We will encourage engagement of our members in science, politics, and global biomedical policy by recommending our faculty to various government and international committees;
- We will hire more outstanding young faculty in areas of strategic importance to biology and the community, such as aging and neurobiology; immunology; and biotechnology;
- We will further break the walls of academic silos that have separated biology from math, chemistry, physics, and engineering to promote cross-disciplinary collaboration;
- By leveraging the development of the HKUST Guangzhou campus, we will create additional exciting opportunities for impact over the next six years, through recruitment of more faculty and greater access to funding for translating research to industry partners and a large market.

(4) Relationship to case studies

Ip and Herrup's case, addressing the **challenges of dementia**, demonstrates the importance within the Unit of basic and translational research to achieving impact, in this example through the understanding and treatment of the disease, and their influence on policy; pharmaceutical companies; and funding agencies for future directions in research and drug development. It has used all six approaches to impact above, as has *Tsim and Wong's* case, that has made use of biotechnology to develop **new skincare and skin regenerative products** from natural sources, including bird's nest, achieving significant economic impact and impact on human well-being. This is a strong example of impact achieved through highly successful commercialization and entrepreneurship. *Wang's case,* on understanding of **metal ecotoxicity** in marine species, has had impact through engagement with, and influence on, public policy related to marine pollution and food safety standards, monitoring and control. This has been achieved by providing contracted services and sharing expertise on policy committees, using expert knowledge and laboratory facilities within the OCES.