Research Assessment Exercise 2020
Impact Overview Statement

University: Hong Kong Baptist University
Unit of Assessment (UoA): 01 Biological Sciences
Total number of eligible staff of the university in the UoA: 12

(1) Context – Scientists from the Department of Biology at the Hong Kong Baptist University have developed a strong ethos of applied research, and strive to ensure the research is socially relevant and has both regional and global significance. The main impacts are in the following three areas.

- **Engaging with the public about waste management –** we collaborate with local companies on waste-recycling practices and the composting of organic waste and consult on the recycling of non-organic waste. These activities are currently essential in Hong Kong, due to the reduction of landfill space for solid wastes. (Reference: https://arcpe.hkbu.edu.hk/newspaper-and-magazine)
- **Delivering technology to exploit new understandings about plant and crop stress biology** – We work with government agencies and farmers to implement our newly developed technology. Prof Jianhua Zhang's impact case study illustrates how his new techniques for scheduling rice irrigation has influenced the practices of millions of farmers in mainland China. Changes in farming practices have so far generated billions of extra income in RMB for farmers in Jiangsu Province.
- **Improving the health consequences of environmental or ecological degradation –** We have conducted research on the impact of environmental pollutants and human behaviour. Dr Cathy Lui, one of our alumni, was cited by the MIT Technology Review as one of ten 'Innovators Under 35 for Asia Pacific' in 2019 (Reference: https://www.innovatorsunder35.com/the-list/cathy-np-lui/). Dr Lui is a cofounder of OPER Technology Ltd., a biotechnology start-up company established from our department with the aim of developing novel cures for neurological diseases. She is also the inventor of the patented 'autologous neural stem cell harvest' technology. Dr Lui graduated with a PhD in Neuroscience from our department and was granted a postdoctoral fellowship from the American Parkinson Disease Association. Under Dr Lui's leadership, OPER has gained widespread public recognition and won more than 30 industrial and technological awards (Reference: http://opertechnology.com/awards.php).

(2) Approach to impact – Our approach to achieving impact is informed by our overall research strategy and by our successful collaborations with government agencies and non-academic users. We have closely engaged with the local community to disseminate our findings, thus benefitting the industry and the public.

- **Collaboration with government agencies and industries –** Given the limited resources available from the RGC, we have made extra efforts to compete for other funding. To sustain our research activities, we have worked hard to establish strong ties with both the government and the industry, which offer either research grant/contracts or provide consultancy opportunities (See our Environment Data). These have included projects aimed at providing solutions for both government and the industry. We have obtained research funding of over HKD 40 million from these sources in this assessment period. The government agencies include but are not limited to the Agriculture, Fisheries and Conservation Department, the Environmental Protection Department, the Airport Authority and the Food and Health Bureau of Hong Kong. The industries include HSBC, Hong Kong Ocean Park and MTRC of Hong Kong.
- **Knowledge transfer –** As a publicly funded institution, we particularly aim to build our impact through knowledge transfer. As exemplified by our Impact Case Study, Prof Zhang developed a highly efficient method of water-saving irrigation for rice. Although he did obtain a patent for his technology, he chose to develop the impact of his research by training hundreds of thousands of local farmers for free, which generated billions in increased revenue in Jiangsu province. The training of hundreds of local farmers in organic farming provided by Prof Jonathan Wong is

another example, which helped him obtain a generous donation of HKD 37 million from HSBC (Reference: http://www.hkorc.org/?page_id=682).

- **Intellectual property and commercialisation –** The Department actively encourages its staff to protect and exploit their innovations through working with our university's Knowledge Transfer Office. Over the assessment period, our staff have lodged around 20 patent applications, one of which was commercialised via the setting up of the start-up company OPER Technology Ltd. through the Entrepreneurship and Innovation Centre (EIC). Led by Prof. Ken Yung, this start-up provides various nano-medicine technologies for individualised stem cell therapies and other personalised treatments, such as for Alzheimer's disease. The engagement of researchers in commercialisation is strongly encouraged and incentivised. Part of the income generated through licensing is allocated to the inventors. Consultancy and service work is another important route to economic, societal and policy impact, and 15% of all consultancy income is given directly to the researchers.
- **Investing strategically in our research areas to deliver research impacts that are relevant to societal need –** The research strategy described in our Environment Overview Statement underpins our future investments, particularly in staff recruitment. For example, we have invested heavily over the past six years in developing our strength in crop stress biology. We have recruited three academic members at the rank of Assistant Professor or above in this area: Dr Danny Ng and Prof Liming Xiong were both recruited from the US to complement our strengths in stress biology, and Dr Pan-Jun Kim was recruited as an Assistant Professor from South Korea to provide computational support for the analysis of large-scale data. We have also recently established the HKBU Institute of Bioresource and Agriculture to take advantage of our strength in plant stress biology and biowaste utilization, with the aim of preserving bioresources and increasing agricultural productivity.

(3) Strategy and plans – Our strategy and plans for supporting impact have been designed to build on the approach outlined above, and we will further nurture and expand our research culture with the following strategies.

- **Nurturing a culture of entrepreneurship –** In addition to the financial support provided by our university, our department has also set aside seed funding of up to HKD 50,000 per case for patent applications and to help develop entrepreneurial networks with industry, with the ultimate goal of developing commercial partnerships.
- **Identifying potential impact cases –** As our Impact Case Study shows, Prof Zhang was granted extra teaching leave to travel to mainland China and set up partnerships with local government agencies and to train farmers to implement his developed technology.
- With the launch of the Institute of Bioresource and Agriculture, more research will be conducted to further increase university engagement with the farming sector, which will have local and international significance.

(4) Relationship to case studies – Our selected case study exemplifies how our research outcomes can benefit end users, who in this case are rice farmers. The case study also shows how our approach and strategy facilitate the impact of our research on end-users. Our aim is to conduct world-class research on the stress response of rice, an important crop, and thus it addresses the global challenge of food security. Rice growth requires enormous volumes of fresh water: i.e., production of 1 kilogram of rice grains requires 2500 litres of water. One third of the world's fresh water is used to irrigate rice, and half of all freshwater supplies in Asia have been used for rice production. The excessive use of water in agriculture presents a significant global challenge. Our case study shows that HKBU is a major player addressing globally significant challenges, including food security and freshwater conservation. HKBU has and will continue to generate positive impacts regarding these challenges, both economically and environmentally. We will continue to develop and optimise these initiatives to increase the impact of our research in the future.