

Research Assessment Exercise 2020

Impact Overview Statement

University: The University of Hong Kong (HKU)

Unit of Assessment (UoA): 01 - Biological sciences (incl. environmental biology, biotechnology, agriculture & food science, veterinary studies)

Total number of eligible staff of the university in the UoA: 30

(1) Context

The School of Biological Sciences (SBS) at HKU is strongly committed to producing societally relevant research, policies, and services that bring practical benefits, constructive knowledge exchange, and two-way public engagement with science. SBS works with local, national, regional, and international communities, companies, governments, NGOs, and intergovernmental bodies.

Products include improving crop plant resistance to drought (patents granted), novel molecular and AI identification techniques to limit the illegal wildlife trade, and ground-breaking probiotic products with the potential to treat liver cancer (patent licenced, Gold medal at the 47th International Exhibition of Inventions of Geneva). In total, 65 patents were filed (31 granted) between 2013 and 2019. Product licenses (17), market investment (HKD8.5 million) and spin-off from these patents from 2013–2019 have led to the creation of companies with a market value of over HKD42 million. Further investment is expected in two recently licensed patents on plant growth and drought resistance. Services provided to HKSAR Government agencies (e.g., Agriculture, Fisheries & Conservation Department (AFCD) and Environmental Protection Department (EPD)) include contract research, consultancy and advisory reports and staff from SBS serving on government committees (e.g., Marine Parks Advisory Committee). Links with AFCD and EPD are further strengthened through the large number of SBS alumni (PhD graduates) employed by these agencies. Improved Hong Kong Government policies on food security (e.g., enhancing aquaculture production), food quality, and public awareness of nutritional health (e.g., the role of healthy omega-oils in diets) also stem directly from SBS research. Interaction with regional NGOs (e.g., The Nature Conservancy (TNC)) and international conservation bodies (e.g., International Union for Conservation of Nature (IUCN), WWF, and Conservation International), as well as with government bodies, has led to several major successes. These include the establishment of Marine Protected Areas (e.g., by HKSAR, Malaysia and The Philippines), the restoration of water quality in Hong Kong's inshore waters through enhanced government policies and water treatment infrastructure, and the conservation of vulnerable and endangered species (e.g., illegally imported tropical hump-headed wrasse, European glass eels, pangolins, and freshwater turtles; and the Hong Kong ivory ban in 2018). Ecologically sensitive designs have enhanced biodiversity and ecosystem services on the urbanized and highly engineered coastlines across Hong Kong and south-eastern China (the longest reclaimed coastline in the world). In addition to UGC/RGC research grants (**HKD97.2 million**), SBS received **HKD40.2 million** in research grants and **HKD12 million** from contract research (47% of total research funding) for the Government (AFCD, EPD), conservation bodies (e.g., TNC, WWF) or philanthropic organisations (e.g., Ocean Park Conservation Foundation) over the assessment period.

(2) Approach to impact

SBS maximizes opportunities to foster and develop impact provided by University initiatives (e.g., internal funding for projects contributing to United Nations Sustainable Development Goals) and Faculty schemes (e.g., funding for the acceleration of research translation) and strong interaction with the HKU Technology Transfer Office and Versitech (HKU's business arm). A culture of entrepreneurship and societal service is promoted within SBS and valued in applications for tenure and promotion. The School's overall philosophy is: scientific excellence coupled with translation, where possible, to society, commerce, and industry in Hong Kong and across the globe. SBS promotes research aimed at sustainable development for the benefit of not only society, but also the natural environment. **This approach has proven to be effective, with annual service-related and industry-based contract research funding increasing by >340% from 2013 to 2019.**

Translation of research has emerged from four of the strategic research themes in SBS: 1) Biomolecular Science relevant to Human Health; 2) Food Security and Healthy Diets; 3) Marine Science; and 4) Global Change and Conservation. During the period of assessment, two research divisions were formed within SBS: **Molecular and Cell Biology (MCB) fosters biotechnologies and product development, while Ecology and Biodiversity (EB) engages with sustainable development, government policy, and public outreach. Both divisions impact food security, health, and well-being.** The division's directors have key deliverables in research enterprise and outreach plus engagement with external stakeholders to establish industry-driven research programmes, be they biotechnology or environmental end-users. To strengthen these links, an External Stakeholder Advisory Board has been established to align research within the research divisions to the aims of industry and government stakeholders. In addition, an annual Professional Review of Development (PRD) for academic staff incorporates Knowledge Exchange (KE) as a key component, with KE strategy developed and coordinated by the Assistant Dean (KE).

(3) Strategy and plans

Building on the approach and successes above, SBS's major thrust from 2020 onwards will be to consolidate its leading role in service-based research in Hong Kong while expanding international partnerships for translation of research into products, services, and policy-relevant KE. The first step was the appointment of an Impact Champion in 2019 to identify research with translational potential and to support impact development. The Champion achieved the first milestone of establishing the External Stakeholder Advisory Board, including a broad range of industry and government stakeholders. The future strategy developed by the Champion and Board is to:

- Enhance internal funding to stakeholder-linked projects to develop products, services, and KE;
- Encourage diversity of funding sources, further increasing the proportion of industry and stakeholder-based funding;
- Build social impact, guided by government stakeholders and advisors, into annual staff appraisals and continue to value such contributions in making recommendations for tenure/promotion;
- Build internal clusters of staff working within identified themes, especially across the research divisions – this has already proven successful in the presented case studies;
- Accelerate the development of research programmes in China in line with HKU's China Strategy.

(4) Relationship to case studies

The presented Impact Case Studies relate to the themes of (1) Global Change and Conservation; and (2) Marine Science, reflecting their maturity following > 30 years of research and synchrony with the assessment window. **Impact Cases from the remaining themes are being developed for future assessment exercises**, including research in **MCB** into development of (1) probiotics which can potentially treat common liver cancer (licenced as "Prohep", starting clinical trials), the second most deadly cancer globally; and (2) skincare products with cultural appeal across Asia, the largest market in the world (patents licenced; awarded "Most Investment Potential" in Greater Bay Area High Value Patent Contest 2019). **Ecology and Biodiversity** has a long-established policy of engagement with international NGOs and local and regional government agencies to translate research into impact on the ground. The two Impact Case Studies exemplify this strategy. **Case Study 1** (conservation forensics) demonstrates how the application of cutting-edge molecular and geochemical techniques for species identification in products being shipped through Hong Kong, and engagement with government agencies, can lead to changes in legislation, increased enforcement, and limiting illegal trade. **Case Study 2** (fish conservation) shows how engagement with NGOs and international communities can lead to the listing of threatened species on the IUCN Red List and under the Convention on International Trade of Endangered Species (CITES), subsequent changes to legislation in Hong Kong and neighbouring countries (Indonesia and Malaysia), the establishment of marine protected areas, and international trade bans. The consequent reduction in the trade of hump-head wrasse can be linked to increased populations in some regions, potentially reducing the risk of extinction of this species across much of the Indian and Pacific Oceans.