

Research Assessment Exercise 2020
Impact Overview Statement

University: [The Hong Kong Polytechnic University |

Unit of Assessment (UoA): [15 chemical engineering, biomedical engineering, other technologies (incl. environmental engineering & nautical studies) and marine engineering]

Total number of eligible staff of the university in the UoA: [13]

(1) Context

[Biomedical Engineering is a multidisciplinary field, at the cutting edge between engineering solutions and biological and clinical needs. Our research activities cover fundamental biological engineering level (micro), such as mechanosensitive ion cell and mechanobiology, to whole body biomechanics (macro), such as posture and gait analysis. Our research and development on biomedical imaging, biosensing, and bioinstrumentation explores new modalities and applications in both micro and macro levels. While emerging impacts are coming from both micro and macro domains of our research, we have achieved demonstrable societal impacts at the macro level, including radiation-free assessment for scoliosis using 3D ultrasound imaging and stroke rehabilitation using intention-driven robotics. Some micro-level research is also leading to practical applications, such as nano-particle based biosensor for rapid virus and bacteria detection.]

(2) Approach to impact

[The impacts normally start with the cutting-edge research activities of our faculty members. Because of the interdisciplinary nature of our unit, our research projects are commonly rooted in clinical needs with innovative technology development. The unit encourages inter-disciplinary collaboration among departments in our university as well as collaboration with other local and international institutions. As a motivation, we count all co-authored papers during appraisal, and our Faculty has set an interdisciplinary research and development fund, with our unit being the most active team in securing this fund (7 projects were supported with total amount HKD2.8M from 2015-2019). Once innovative techniques are developed through interdisciplinary research, this unit encourages colleagues to apply for patents with the support of university and external funding. Every single faculty member owns at least 1 patent, and the maximum is over 40. During 2013-2019, this unit has 31 patents granted, 43 patents filed, royalty received over HKD1.6M). Colleagues in this unit have been very successful in securing funding from Hong Kong Innovation and Technology Fund (ITF) to transfer research results into prototypes, with the total funding that we received was HKD38.5M during HKD between 2013-2019. We received funding for two projects in 2019: ITF Midstream Research Programme to develop prototypes of using 3D ultrasound imaging for scoliosis progress prediction (MRP/022/18X, HKD7.2M), and ultrasound neurostimulation for brain degeneration (MRP/018/18X, HKD8.2M). In addition, most of our knowledge transfer is related to medical devices, thus clinical trial is important. We have been active in securing the ITF public trial fund to make our R&D results towards the clinical applications (4 projects during 2013-2019). Based on our success in 3D ultrasound imaging commercialization, we also secured a donation of HKD18M from HK Jockey Club to establish school screening program and community support service for scoliosis patients (5 years, 6000 kids).

To enhance the impact of our research, we encourage colleagues to collaborate with industries and medical clinics through consultancy projects and collaborative research, with collaborators including Huawei (华为) and Lining (李宁) (from 2013-2019, the total amount HKD11.5M, respectively). Our major clients are Telefield Medical Imaging Ltd (HKD1.3M royalty, HKD2.7M consultancy and HKD3.3M donation) in the area of radiation-free assessment of scoliosis, and Infinitus (China) Company Ltd (HKD5.1M collaborative research) in the area of cushion and mattress design. In 2016, this unit was awarded by the university for achieving the highest percentage of colleagues involved in consultancy, representing our engagement and commitment to achieve impact outside academia

with our research through this approach. Once the products are commercialized, the impact of related research works can be maximized. Meanwhile, with the commercially available devices, we can conduct more research projects in related areas and further develop diverse innovative technologies.

We have also established and benefited from different technology transfer platforms to maximize the impacts. This unit hosted the Jockey Club Rehabilitation Engineering Clinic (established in 2004) to provide services in Prosthetics and Orthotics as well as Assistive Technologies, it has also become a testing bed for our new technologies. We have also established the Jockey Club Smart Ageing Hub (a donation of HKD48M) to promote the technologies for ageing by bridging different stakeholders in this area. Through this platform, our technology eNightLog, a novel system for taking care of elderly during sleep, has been installed in different NGO's taking care of elderly people with different conditions (17 sets have been installed in one collaborating NGO for 9 months for trials) |

(3) Strategy and plans

[The first strategy is to continue stimulating interdisciplinary research and close collaboration with industries and clinics to generate novel technologies, and achieve high impact research works. The second strategy is to secure funding not only from research grants but also from other sources, such as Hong Kong Innovation and Technology Fund, Collaborative Research Funds or Consultancy Projects with industry. In the above-mentioned examples of technology transfer, we observed the importance and motivation of our graduates. Therefore, the third strategy is to encourage and facilitate the conditions for our graduates to establish start-ups based on our research results and support our colleagues to participate further with their expertise to maximize the impacts of our research.

We plan to bring further support to technologic transfer in the area of micro-level research, such as rapid detection of bacteria and virus with bio-nanotechnology, through collaboration with related government departments and industry. We will provide more supports to our research students (pairing up with staff) to establish start-ups supported by their supervisors using novel technologies that they have developed. A number of team of students from this unit have been selected for Micro-fund programs in our university. The novel technologies of this units have led to three companies supported by different programmes in Hong Kong Science and Technology Park, including Telefield Medical Imaging Ltd (Scolioscan: 3D ultrasound imaging for scoliosis assessment) selected by LEAP accelerating program (cash investment HKD4.7M plus professional supports) in Jun 2019, Eieling Technology Ltd (Liverscan: image-guided liver elasticity measurement for liver fibrosis) selected by Incu-Bio program (HKD6M funding support) in Jan 2019, and Interactive HealthTech Ltd (iBalax: cloud-based balance assessment and training device) enrolled in STEP program (HKD0.1M) in Apr 2019. With the increasing amount of income from our successful knowledge transfer, the unit has confirmed to use 50% of the overhead received by the unit to support research team having potential for generating impacts outside academia with internal funding supports. We also plan to invite those colleagues that have achieved successful knowledge transfer experiences to share with other colleagues and students as a way to continue stimulating high impact research. |

Relationship to case studies

[The above-mentioned interdisciplinary nature of this unit, strategy and approaches adopted over the years are reflected in the Scolioscan case study. Scolioscan uses novel engineering approaches in 3D ultrasound to solve a medical/clinical related challenge: the demand of radiation-free, accurate assessment of scoliosis. This case study entails a typical collaboration between engineers and clinicians, with our unit providing a spinal orthotist, and cooperating with orthopaedic surgeons and physiotherapists outside our unit even at very early stages of the research. We patented the core technologies in China, USA, Japan, Canada, EU, and Australia. With the great potential of commercial values, industry has closely collaborated with us and licensed our patents, since the early research stages. We continue cooperating with industry with the leverage of government supports, which allows us to access the latest technology for further research and development.]