Appendix

Brief introduction of the five research projects:

1. **Microfluidics-Based Detection Platform for Circulating Tumor Cells and Its Applications in Cancer Early Screening and Disease Monitoring**

Project leader: Professor Michael Yang Mengsu, Yeung Kin Man Chair Professor of Biomedical Sciences

This project focuses on circulating tumor cells (CTCs), which are one of the key biomarkers in liquid biopsies. It is dedicated to the development, advances and clinical applications of CTC detection technology to address core challenges, such as sensitivity, specificity, automation and downstream analysis in CTC detection.

Building upon previous work in tumor biology and liquid biopsy technology, with a proven track record of research and successful translation of research results for commercialisation, the team is committed to developing an internationally leading fourth-generation CTC detection technology platform with compatible gene and protein detection assay kits for downstream CTC analysis, based systems for efficient CTC enrichment and expansion modes. This comprehensive product offering will enable more accurate CTC counting, protein expression profiling and genetic characterisation, addressing key sensitivity, specificity and automation challenges. The project aims to meet clinical demand in cancer prevention, diagnosis and treatment through these advances, including early screening, adjunctive diagnostics, recurrence monitoring, drug guidance, treatment response monitoring and prognostic evaluation.

The project will develop corresponding clinical application scenarios for different products and validate their clinical performance by conducting large-scale clinical trials to obtain the necessary medical device/IVD registration permits for the respective products, thereby filling gaps in domestic and international industries and markets.

2. **Commercialisation of Pulse Hollow Cone Hybrid Transmission Electron Microscopy (TEM) /Scanning Electron Microscopy (SEM)**

Project leader: Professor Chen Fu-rong, Chair Professor in the Department of Materials Science and Engineering

The aim of this project is to design and manufacture a commercialised pulse electron hollow cone illumination hybrid TEM/SEM compact system, based on technology incubated in the CityUHK Futian Research Institute, and establish a mass production line.

A pulse electron source can reduce the radiation damage of soft material samples, and hollow cone illumination offers image contrast about four times higher than that of bright field images in transmission electron mode. The pulse hollow cone Electron Microscopy (EM) system can potentially be applied in three-dimensional protein reconstruction at room temperature, which is currently carried out with cryo-EM. The EM system has already been demonstrated in imaging metal contact of printed circuit boards, Sn nanoparticles, and other biological samples at 10 nm resolution.

The compact system can be operated at 15–30 keV, which allows the option of environmental liquid pool and external stimuli pulsed electric fields and lasers. This pulse hollow electron microscope structure is unique, as there are no similar products in the market.

### 3. Scalable Production of Next-Generation High-Performance Printable Solar Cells

Project leader: Professor Alex Jen Kwan-yue, Lee Shau Kee Chair Professor of Materials Science

Perovskites are an emerging PV technology with facile and scalable solution processability. The performance of perovskite solar cells (PSCs) has surpassed other 2nd-generation thin-film PVs (e.g., CdTe, CIGS). The advantages allow PSCs to be easily used in different applications.

But there are still challenges ahead in PSC commercialisation. The key concerns are related to their stability and the upscaling potential. The team aims to establish a pilot production line with 25 MW annual capacity to manufacture low-cost, printable PSCs in an energy-saving and scalable way to complement or replace current PV products.

### 4. Research and Development of Federated Learning Technology with Research Knowledge Graphs and Large Language Models for the Digital Transformation of Science, Technology and Innovation Services

Project leader: Professor Ma Jian, Department of Information Systems, College of Business

To address the problem of information silos, the team developed ScholarMate, which they have been improving since 2007. ScholarMate connects government funding agencies, universities/research institutes and technology companies via API interfaces, enabling the exchange of research output such as papers and patents.

With over 10 million registered users in 4,000 universities/research institutes and 100,000 technology companies, ScholarMate hosts a repository of 78 million research papers and patents.

Based on the well-established platform, the project aims to develop research and development of federated learning technology with Research Knowledge Graphs and Large Language Models for the digital transformation of science, technology and innovation services, providing Smart research management services, Smart academic conference publishing services, Smart achievement promotion services, and Smart technology transfer services.

5. **Revolutionising Climate Resilience: A Universal Solution via Next-Generation Radiative Cooling Technologies for a Greener Community**

   Project leader: Professor Tso Chi-yan of the School of Energy and Environment

   To help tackle the global warming crisis, the energy and ecological crisis due to the increased use of space cooling, and the humanitarian crisis for residents with inadequate thermal comfort in developing regions, the project aims to develop and commercialise a next-generation cooling technology/product, namely passive radiative cooling (PRC), providing a promising solution to mitigate the impact of higher temperatures.

   Building on the success of current-generation PRC products, such as cooling paint for roofs and walls, the team aims to advance PRC technology and products further. Since 2022, its PRC product has been applied to over 500,000 square feet in 39 countries through the start-up i2cool, thus significantly reducing carbon emissions.

   The project envisions expanding the benefits and applications of PRC technology into three additional realms, and they are Passive Radiative Cooling Ceramics for use in building envelopes, pedestrian paths and public squares, a Passive Radiative Cooling Pavement for roads, and a biodegradable dual-mode thermal management textile that incorporates thermochromic particles for personal clothing.