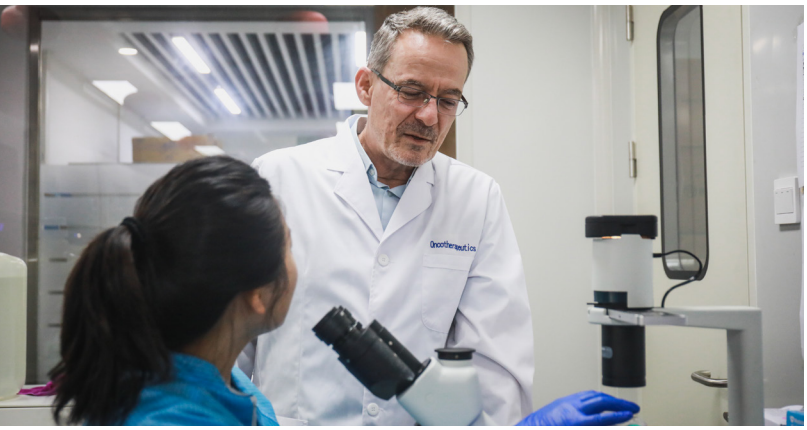

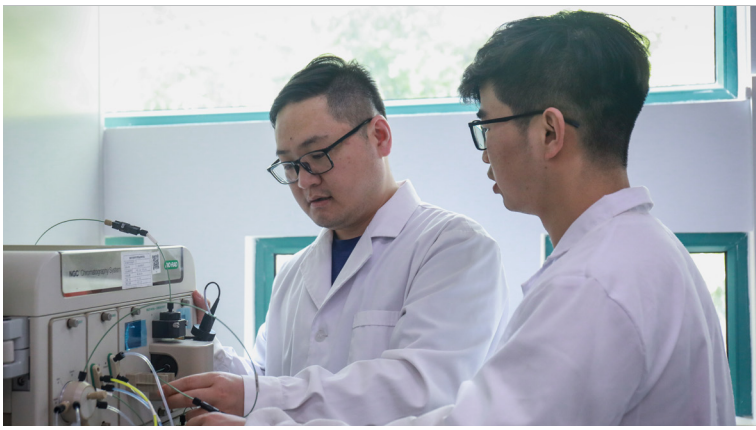

PRECISION MEDICINE ADVANCES WHERE DISCIPLINES MEET

BLURRING THE LINES BETWEEN DISCIPLINARY BOUNDARIES has enabled a young institute in Shenzhen to achieve rapid academic and research growth.

A legacy in chemical engineering provided Tsinghua Shenzhen International Graduate School with the capability and confidence to build its capacity in health engineering through its Institute of Biopharmaceutical and Health Engineering (iBHE). Since 2019, the institute has grown to become a pioneer in health engineering and has forged a unique path by integrating four key disciplines: health engineering, pharmaceutical engineering, vaccine manufacturing and cell engineering.

Precision medicine has become the focus of one team of iBHE pharmaceutical engineering professionals, that aims to deliver comprehensive scientific solutions and cutting-edge technologies for optimized therapeutic outcomes.

Evaluating personalized disease prevention, diagnosis and treatment options means accounting for the interconnected factors of a person's lifestyle, genetics and phenotypic biomarkers, as well as laboratory and clinical data. The scope of precision medicine is enormous, so collaboration across disciplines is essential. "We combine established biomedical and clinical sciences with novel engineering and data-driven technologies to advance innovation in the field," explains Peter E. Lobie, a professor from iBHE's pharmaceutical engineering department.

A team led by Canyang Zhang are working on integrating biological, chemical and materials engineering, along with artificial intelligence (AI) to investigate smart biomaterials for a wide range of applications in pharmaceutical engineering.

Their work on the precision control of neutrophil apoptosis (the process of programmed cell death to maintain immune homeostasis) holds promise for treating autoimmune and inflammatory diseases, such as sepsis and ischemic stroke, with few side-effects. By developing a mechanism for delivering therapeutic nanoparticles across blood vessel barriers, they have proposed a drug delivery method to selectively target the neutrophil apoptosis pathway, increasing efficacy while reducing possible systemic toxicity to other parts of the body.

Zhang is also exploring the potential of graphene-based nanomaterials as a photosensitizer for cancer phototherapy, and an activator of oxygen species that inhibit the growth of tumour cells or kill bacteria under laser irradiation.

Zhang and colleagues are preparing a bioresponsive polymer-graphene hybrid system. While they employ AI and synthetic biological skills to design and synthesize advanced materials, the preparation of the system is underpinned by the self-assembly and layer-by-layer technique of materials engineering.

iBHE's diverse discipline strategy also extends to recruiting and cultivating talents. Lobie explains how the institute welcomes postgraduate students from all disciplines worldwide, rather than from a narrow set of undergraduate majors. Current students are also encouraged to step out of their comfort zones and take courses outside their research focus, to prepare for future cross-disciplinary collaboration.

Through promoting interdisciplinary interaction and collaboration, and attracting top talent from diverse disciplines, iBHE has found a way to develop its own characteristics. "We plan to build a global hub to foster breakthroughs in precision medicine with focus on fundamental and translation research for human health," said Lobie. "We hope more talented researchers will join us in this endeavour." ■

▲ (Images, from left to right) Peter Lobie, a professor from iBHE's pharmaceutical engineering, uses data-driven technologies to find solutions; Canyang Zhang (left) explores the application of graphene nanomaterials for cancer phototherapy.

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