Department of Biomedical Engineering
The Chinese University of Hong Kong

Organ-on-a-Chip and Precision Medicine



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Abstract

Organ-on-a-chip systems, also known as microphysiological systems, are a new generation of in vitro biomedical models that integrate technologies including stem cells, organoids, tissue engineering, microfluids, biomaterials, and multimodal detection. They can provide physiologically relevant human experimental systems and high-quality data sources for precision diagnosis and treatment, as well as for medical artifical intelligence.

Since the United States and China successively launched organ-on-a-chip-related research programs around 2012, the field has developed rapidly. In 2016, organ-on-a-chip technology was recognized as one of the Top 10 Emerging Technologies, further strengthening its strategic position in the global biomedical innovation landscape. In 2023, the first new drug in China screened using organ-on-a-chip data entered clinical trials and subsequently achieved overseas licensing, marking an important step toward validating the translational value of organ-on-a-chip technology in drug development. In 2024, China's drug regulatory authorities issued relevant guidelines on the application of organ-on-a-chip technology in rare-disease drug development. In the same year, China's first national standard for skin organ-on-a-chip technology, led by Southeast University, was officially released and implemented, indicating that organ-on-a-chip technology in China is accelerating toward standardization and regulatory science.

This presentation will provide a systematic overview of the latest advances in organ-on-a-chip technology in scientific research, industrial development, standardization, and laws and regulations, and will discuss its future trends in transforming drug-development paradigms, advancing precision medicine, and supporting biomedical artificial intelligence.

Biography

Zhongze Gu is a co-founder of the International Microphysiological Systems Society and co-chair for the Asia-Pacific region, and a fellow of the American Institute for Medical and Biological Engineering. He is Director of the State Key Laboratory of Digital Medical Engineering, Director of the Institute of Organ-on-a-Chip at Southeast University, a Changjiang Distinguished Professor, a recipient of the National Science Fund for Distinguished Young Scholars, and Vice Chair of the Teaching Steering Committee for Biomedical Engineering of the Ministry of Education. He has been engaged in organ-on-a-chip research and has led major research programs, including projects on key scientific issues in transformative technologies under the National Key R&D Program of China. He led the development and promulgation of China's first national standard for organ-on-a-chip technology. His research achievements have been recognized among the Top Ten Advances in Life Sciences in China and the Top Ten Scientific and Technological Advances in China's Cosmetics Industry. He has received honors including the Second Prize of the National Teaching Achievement Award and the First Prize of the Ministry of Education Natural Science Award.

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