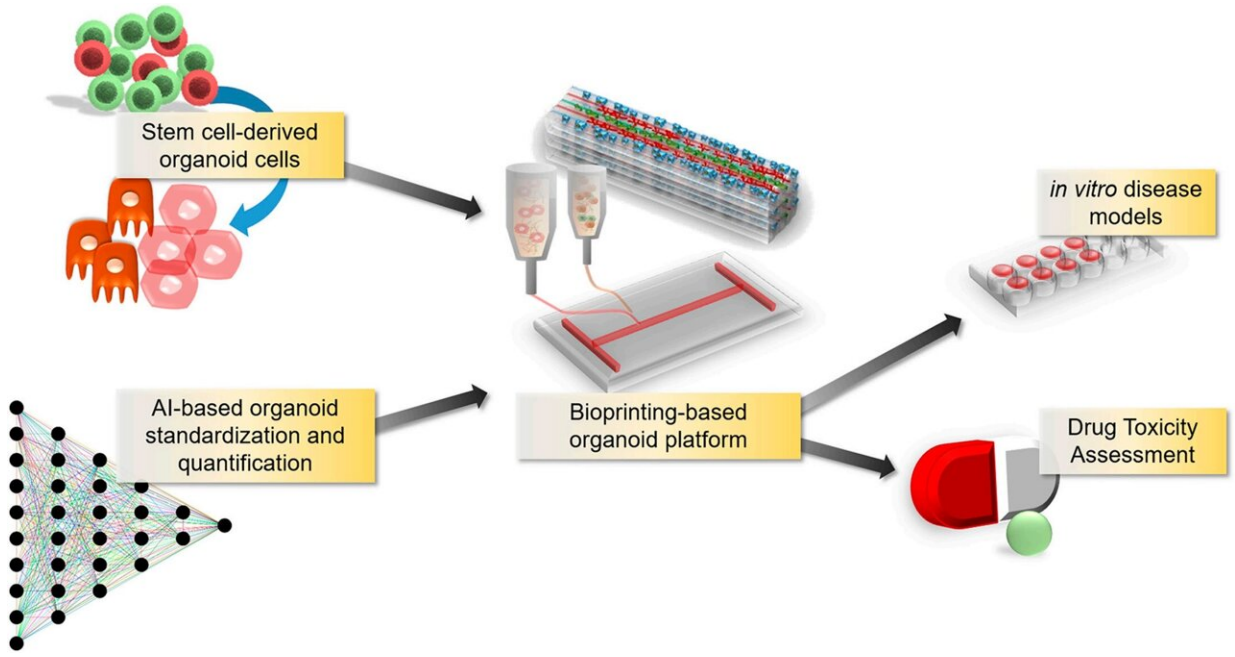
Bioprinting technology combined with artificial intelligence allows high quality in vitro models

April 11 2023



Standardized organoid produced by bioprinting combined with artificial intelligence promises to replace experimental animals as disease models and for drug screening. Credit: Dr. Hyungseok Lee

In the process of organoid manufacturing, bioprinting technology can not only facilitate the creation and maintenance of complex biological 3D shapes and structures, but also allow for standardization and quality

control during production. The addition of artificial intelligence, which can validate the product potential in the manufacturing process, can provide a more standardized source of cells for the organoid in terms of viability, function, and more.

In other words, bioprinting combined with artificial intelligence is expected to perform real-time diagnostics of organoids and ultimately obtain high-quality homogenized in vitro models.

Professor Hyungseok Lee, from the Department of Mechanical and Biomedical Engineering at Kangwon National University, presented his views on the future development of organoid manufacturing on March 6 in *Cyborg and Bionic Systems*.

Organoids with the ability to self-organize and assemble have a wide range of research and application prospects. Besides the most basic simulation of human organ development that cannot be studied in animal models, organoids can also replicate human pathology in place of using animals to complete the research. In addition, because of the convenient customization of cell sources, organoids could also be used as "stand-ins" for clinical patients to personally predict the best therapeutic agents.

However, such a widely used organoid faces the difficulty of standardizing its production. Due to differences in experimenters, culture conditions, and cellular conditions, the organoid—while enabling disease modeling—cannot exhibit strictly consistent properties for application in the screening of new drugs, especially in the process of quantification. In addition, keeping all nutrients, growth factors and metabolites in constant equilibrium is a technical challenge during organoid growth, which can also cause discrepancies with the actual target tissue.

Bioprinting, especially extrusion bioprinting, enables standardized

manufacturing of organoid components with complex cellular composition and structure, controlling quality and minimizing human intervention. Moreover, bioprinting technology could also facilitate the automation of manufacturing processes. High resolution is critical for bioprinting organoids, and is expected to facilitate the fabrication of vascularized organoids with perfusion networks to overcome the limitation of passive transport of substances.

Artificial intelligence is currently gaining attention for its ability to monitor and control the quality of the final object being exploited. The bioprinting process it incorporates to create organoids monitors cell status and printed structures in real time, providing feedback for fine printing to ensure resolution. The direction of this kind of organ manufacturing points to possibilities for the modeling of complex diseases and the combinatorial testing of new drugs.

More information: Hyungseok Lee, Engineering In vitro Models: Bioprinting of Organoids with Artificial Intelligence, *Cyborg and Bionic Systems* (2023). DOI: 10.34133/cbsystems.0018

Provided by Beijing Institute of Technology Press Co.