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A*Star artificial liver to speed up drug R&D

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Singapore: Researchers at A*Star's IBN have engineered an artificial human liver piece, which mimics the natural tissue environment closely, to help companies to predict the toxicity of new drugs at earlier stages of drug development, potentially speeding up the drug development process and reducing the cost of manufacturing.

Using hydroxypropyl cellulose, an FDA-approved plant-based material that is the basic building block of cotton and paper, IBN fabricated a biocompatible porous scaffold that enables liver cells to spontaneously assemble into three-dimensional liver spheroids. These spheroids strongly resemble liver tissue, hence facilitating drug testing. This technology was licensed in 2010 to Bio-Byblos Biomedical Co. Ltd, a biomedical company based in Taiwan, for manufacturing.

IBN's innovative HepaTox chip is a 'liver-on-chip' that allows researchers to test the effect of drugs on the liver. By seeding liver cells within a microfluidic system, the micro device is used to screen the liver's capacity to process different drugs and other compounds. The HepaTox chip features eight channels, which enable multiple drug screening in parallel.

With miniaturization, the amount of liver cells and drugs can also be significantly reduced, saving cost without comprising efficiency. Using IBN's microfabricated microporous membrane, the liver cells are sandwiched between the membranes, which can control the transfer of drugs, nutrients and oxygen to the cells, and provide more reliable and reproducible screening results. The membrane surface has been engineered to simulate liver cell interaction with matrix and promote formation of liver tissues after the cells are seeded.

Experiments have shown that the microporous membranes can maintain long-term liver cell functions for more than two weeks and will be useful for chronic liver toxicity testing, and industry-scale drug screening. IBN's liver tissue models has the potential to be developed into test kits to support drug development and pre-clinical research.

Professor Jackie Y Ying, executive director, IBN, said, "This research advance is the first drug testing model available that can sensitively predict long-term drug responses in the liver. Such predictive toxicology platforms are useful research tools that aid and accelerate the discovery of new drugs. The ability to determine drug toxicity at an early stage would lead to significant cost savings for the pharmaceutical companies and consumers."

Professor Hanry Yu, group leader, IBN, elaborated, "Most materials and devices have been designed with little attention to what the cells need. By using a cell-centered approach and translating our basic understanding of tissue behavior, we have developed liver tissue models that can simulate conditions outside the body with striking similarity to organs inside the body."