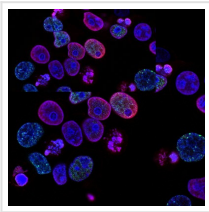
New Plant-based Gel to Fast-track 'Mini-organs' Growth, Improve Cancer Treatment



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Monash University researchers have created the world’s first bioactive plant-based nanocellulose hydrogel to support organoid growth and help significantly reduce the costs of studies into cancer and COVID-19.

This discovery by researchers at BioPRIA (Bioresource Processing Institute of Australia), Monash University's Department of Chemical Engineering and the Monash Biomedicine Discovery Institute will develop organoids cheaper, faster and more ethically.

The hydrogel can also improve drug screening and disease modeling for infectious diseases, like COVID-19; metabolic diseases, such as obesity and diabetes; and cancer.

The findings, published in Advanced Science, emerge as a promising finding for growth of organoids for essential laboratory testing across the world. With additional testing, this hydrogel could be available to researchers and health professionals across the world in less than 12 months.

Nanocellulose gels cost just cents for every 10ml used, compared to $600 or more for the current gold standard.

Above all, nanocellulose gels are completely plant-based, preventing the harvesting of animal organs and unknown biomolecules for any advanced medical testing.

Professor Gil Garnier and Dr. Rodrigo Curvello from BioPRIA within Monash University's Department of Chemical Engineering led the study.

"Organoids provide a robust model for key applications in biomedicine, including drug screening and disease modeling. But current approaches remain expensive, biochemically

variable and undefined," Professor Garnier, Director of BioPRIA, said.

"These are major obstacles for fundamental research studies and the translation of organoids to clinics. Alternative matrices able to sustain organoid systems are required to reduce costs drastically and to eliminate the unreliability of unknown biomolecules.

"As nanocellulose hydrogel is animal-free, its composition is controlled perfectly and reproducible—unlike the current progress—and fully mimic the human body conditions."

Organoids are three-dimensional, miniaturized and simplified versions of organs produced in vitro that can replicate behaviors and functionalities of developed organs.

Commonly referred to as 'organs in a dish' or 'mini-organs', organoids are an excellent tool to study basic biological processes. Through organoids, we can understand how cells interact in an organ, how diseases affect them and the effects of drugs in disease reduction.

Organoids are generated from embryonic, adult, pluripotent or induced pluripotent stem cells, as well as from primary healthy or cancerous tissues. For long-term use, organoids are commonly embedded within an Engelbreth-Holm Swarm (EHS) matrix derived from the reconstituted basement membrane of mouse sarcoma.

Currently, organoid culture is dependent of this expensive and undefined tumor-derived material that hinders its application in high-throughput screening, regenerative medicine and diagnostics.

"Our study was essentially able to use an engineered plant-based nanocellulose hydrogel that can replicate the growth of small intestinal organoids derived from mice," Dr. Curvello said.

"It is essentially made from 99.9% water and only 0.1% solids, functionalised with a single cell adhesive peptide. Cellulose nanofibers are linked with salts that provide the microenvironment needed for small intestinal organoid growth and proliferation.

"Engineered nanocellulose gel represents a sustainable alternative for the growth of organoids, contributing to reducing the costs of studies on diseases of global concern,

particularly in developing countries."

Read the original article on Monash University.