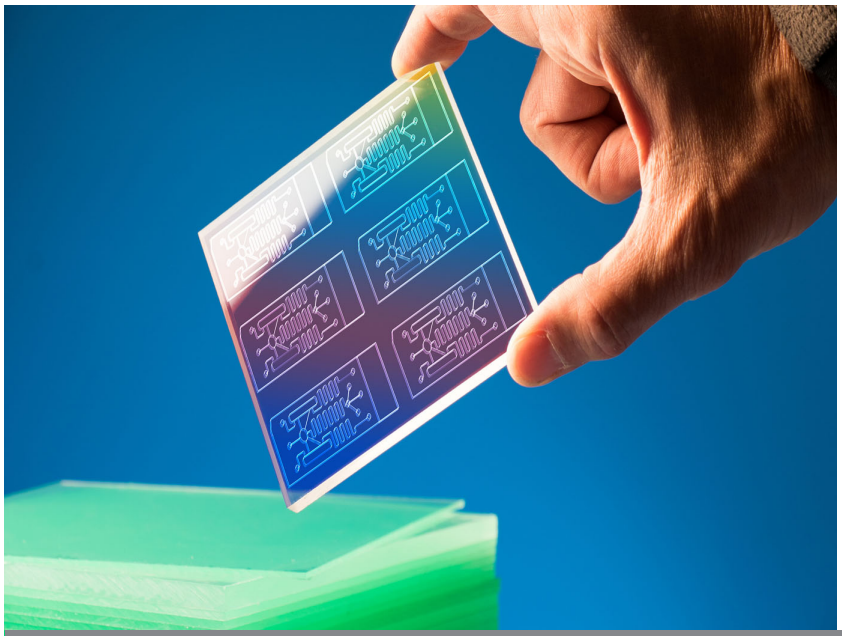


National Aeronautics and Space Administration

TECHNOLOGY SOLUTION

Health, Medicine and Biotechnology

Micro-Organ Device

Early Stage in vivo-like drug screening without animal experimentation

The NASA Johnson Space Center has developed the Micro-Organ Device (MOC) platform technology that serves as a drug screening system with human or animal cell micro-organs to supplement and reduce animal studies, while increasing the success of clinical trials with new drugs. The technology was originally developed to evaluate pharmaceuticals in zero gravity to accelerate development and validation of countermeasures for humans in space as well as evaluate space and planetary stressors on a biological level. The NASA developed Micro-Organ Device is a microfluidic device containing a variety of microstructures and assemblies of cells, all designed to mimic a complex in vivo microenvironment by modeling one or more in vivo micro-organ structures, the architectures and composition of the extracellular matrices in the organs of interest, and the in vivo fluid flows. The fully automated technology can be used to perform early stage in vivo drug screening without the use of animal experimentation, saving time, money, and resources.

This NASA Technology is available for your company to license and develop into a commercial product. NASA does not manufacture products for commercial sale.

BENEFITS

- 3D Tissue Models
- Quality Control
- Enhanced Accuracy
- Fully Automated
- Cost Efficient
- Minimal Resources Needed

APPLICATIONS

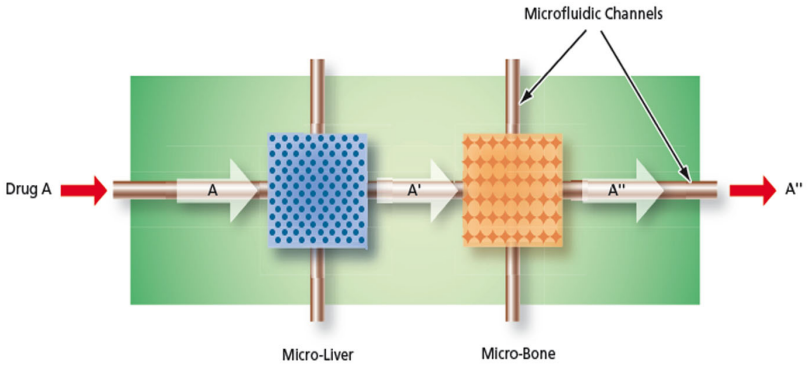
The technology has several potential applications:

- Pharmaceutical Drug Screening: Absorption, Distribution, Bioaccumulation, Metabolism, Efficacy, Toxicity
- Laboratory and Research Studies: Phamacokinetic and Pharmacodynamics studies

THE TECHNOLOGY

The NASA developed Micro-Organ Device (MOD) platform technology is a small, lightweight, and reproducible in vitro drug screening model that can inexpensively biomimic different mammalian tissues for a multitude of applications. The technology is automated and imposes minimal demands for resources (power, analytes, and fluids). The MOD technology uses titanium tetra(isopropoxide) to bond a microscale support to a substrate and uses biopattering and 3D tissue bioprinting on a microfluidic microchip to eliminate variations in local seeding density while minimizing selection pressure. With the MOD, pharmaceutical companies can test more candidates and concentrate on those with more promise therefore, reducing R&D overall cost.

This innovation overcomes major disadvantages of conventional in vitro and in vivo experimentation for purposes of investigating effects of medicines, toxins, and possibly other foreign substances. For example, the MOD platform technology could host life-like miniature assemblies of human cells and the effects observed in tests performed could potentially be extrapolated more readily to humans than could effects observed in conventional in vitro cell cultures, making it possible to reduce or eliminate experimentation on animals. The automated NASA developed technology with minimal footprint and power requirements, micro-volumes of fluids and waste, high throughput and parallel analyses on the same chip, will advance the research and development for new drugs and materials.



One of the MOD designs for a drug conversion study showing the conversion of an inactive drug form A to the active drug form A' by perfusion through a liver micro-organ, the effect of the active drug form A' on a secondary target bone micro-organ and the monitoring of A", a tertiary metabolite form of the drug.

The Micro-organ Device can develop different human micro-organs used to do early stage pharmaceutical drug screenings.

PUBLICATIONS

Patent No: 8343740; 8580546

R. Chang, B. Starly, C. Culbertson, H. Holtorf, S. Gonda, W. Sun (2006) Development of an in vitro Micro-organ Model for Pharmacokinetic Microanalysis, Bioengineering Conference IEEE, 183-184 pages. doi: 10.1109/NEBC.2006.1629813

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NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

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More Information

National Aeronautics and Space Administration

Agency Licensing Concierge

Johnson Space Center

2101 NASA Parkway
Houston, TX 77058
202-358-7432
Agency-Patent-Licensing@mail.nasa.gov

www.nasa.gov

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