

# Organ-on-a-Chip System

## Summary

Vanderbilt researchers have developed a group of microfluidic organ-on-chip devices that include perfusion controllers, microclinical analyzers, microformulators, and integrated microfluidic measurement chips. Together, these devices can measure and control multiple organ-on-chip systems in order to model the multi-organ physiology of humans.

## Addressed Need

Organs-on-chips are a promising technique to explore drug efficacy, toxicity, and organ-organ interactions at both the chemical and biological level without the need for animal testing. This has the potential to greatly reduce the overall cost and time required to develop new therapeutic drugs. However, little thought has been put into how best to integrate multiple organ systems in order to recreate the multi-organ physiology of humans. The present technology addresses the need for an organ-on-chip system that effectively accounts for the multiple organ scenario.

## Technology Description

The microfluidic systems developed for organ-on-chip research at Vanderbilt contain living human cells that have been cultured within microfluidic devices that recapitulate the behavior of the cells *in vivo*. This includes 3D tissue-tissue interactions, mechanically active microenvironments, electrical stimulation, chemical conditions, and complex organ-level functions such as the blood-brain barrier and the beating heart, among others. The systems include means for linking the organ chips together for physiological and pharmacological analysis.

## Unique Features

- ◇ Low-volume microfluidics to avoid dilution of paracrine and endocrine factors and drug and toxin metabolites
- ◇ Stand-alone or coupled operation of multiple organs and analysis instruments
- ◇ Low cost and small size to enable massively parallel experimentation

## Technology Development Status

Numerous organ-on-chip systems have been developed, prototyped, and tested, including perfusion controllers, micro-valves, and micro-pumps that are integrated into microfluidic devices. Continued development and testing are ongoing.

## Intellectual Property Status

Multiple patent applications have been filed.

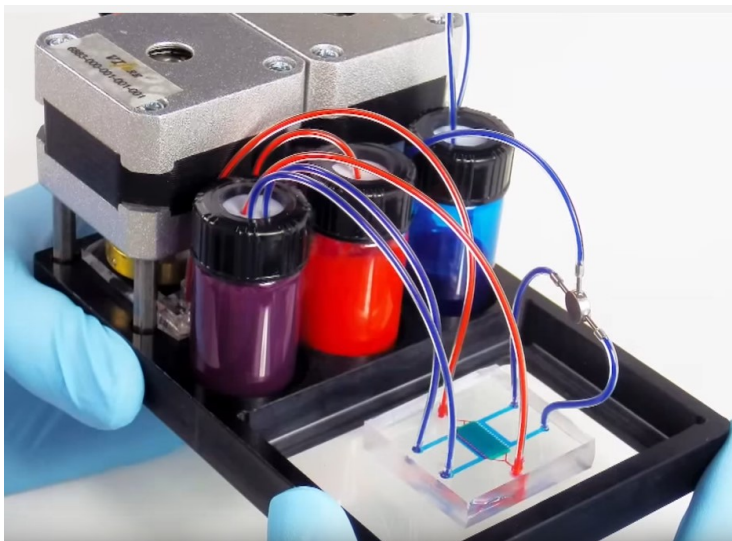


Figure 1: An example organ-on-chip system is shown

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