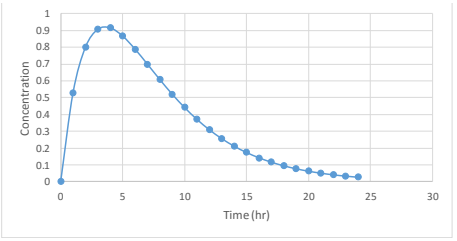
A Novel Organs-On-Chip Platform

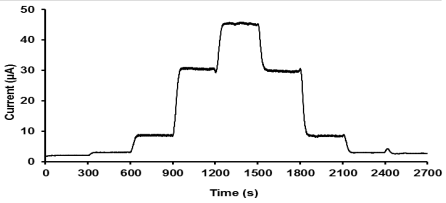
VANDERBILT UNIVERSITY
CTTC Center for Technology Transfer & Commercialization

Summary

Vanderbilt researchers have created a new multi-organs-on-chip platform that comprises Perfusion Control systems, MicroFormulators, and MicroClinical Analyzers connected via fluidic networks. The real-time combination of multiple different solutions to create customized perfusion media and the analysis of the effluents from each well are both controlled by the intelligent use of a computer-operated system of pumps and valves. This permits, for the first time, a compact, low-cost system for creating a time-dependent drug dosage profile in a tissue system inside each well.

Time Dependent Concentration





Addressed Need

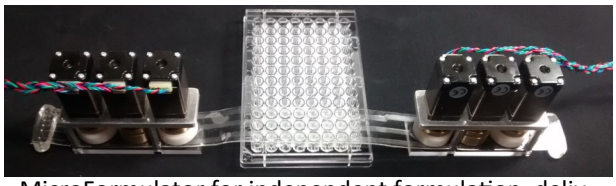
This invention overcomes limitations of existing fluid-handling pipetting robots in HTS systems and enables the delivery of a physiologically realistic, time-controlled concentration profile of drugs or toxins to cells being cultured in a well plate. Having the pumps, valves, splitters, fluid delivery networks and other sensors and actuators mounted on the lid of the well plate allows fluid-handling operations to be performed in a massively parallel fashion, with different well plates being controlled independently and asynchronously by their own Multi-MicroFormulator, rather than having the fluid delivery process limited to operations performed serially by a single fluid-handling robot that has to service a multitude of well plates.

Technology Description

This technology utilizes computer-control of a Multi-MicroFormulator system consisting of pumps, valves, and fluidic networks to deliver the desired mix of solutions to individual wells in a cell-culture well plate and withdraw excess fluid as required. The well plate can be controlled in zones, each with its own input and output selector valves and pumps. The integration of pumps, valves, splitters, fluidic networks, sensors and actuators on the lid of a standard well plate makes this a low-cost architecture that can remain attached to a well plate for a long-duration drug or toxin exposure experiment, thereby eliminating the need remove the plate from an incubator for fluid servicing or to change pipettes after every fluid-handling operation. The disposable, low-cost fluidic module can be replaced after such an experiment.

Technology Features

- Wireless communication with an on-board microcontroller.
- Remote operation of pumps, valves, sensors and actuators.
- Automated MultiPump Experiment Running Environment (AMPERE) software.
- Point-and-click and drag-and-drop control of well selection and pharmacokinetic (PK) exposure profiles.
- Massively parallel, week- to month-long experiments on well plates with time-dependent drug profiles.



MicroFormulator for independent formulation, delivery and removal of fluid from each of 24 wells.

Intellectual Property Status

- A patent application has been filed.
- Visit http://www.vanderbilt.edu/viibre for detailed description of ongoing research programs, core research capabilities, and a list of publications.

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