Submit your application to Dr. Judith Fulton

Organ-on-Chip Technology for Kidney and Liver Toxicity Testing

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NEOMED C-127

Project Abstract
Clinical trials often fail due to liver and/or kidney toxicities. If a method could be perfected to accurately screen newly designed drugs to weed out highly toxic compounds and identify the less toxic candidates prior to beginning the long clinical trial process, then drug development would become quicker, cheaper and safer for patients. Current screening methods are not adequate – static cell culture methods do not closely mimic the human condition, and animal trials do not translate well to humans. One of the most promising new technologies with the potential to solve this problem is organ-on-chip, which involves growing human cells in a microfluidic system that more closely mimics human organs.

This project involves creation of kidney tubules and livers that are constantly perfused within the Nortis organ-on-chip system (www.nortisbio.com). These organoids can then be used to test panels of drugs with known and unknown toxicities. Further testing can often elucidate the mechanism of drug toxicity for a specific organ through mapping of a variety of biomolecules.

Project Objectives
Learn about organ-on-chip systems
Choose a drug and complete a literature search on its toxicities and prior testing
Learn human kidney and/or liver cell culture techniques
Learn extracellular matrix preparation techniques
Learn to use the Nortis organ-on-chip equipment
Design experiment
Create a kidney- and/or liver-on-chip
Test drug toxicity in kidney- and/or liver-on-chip
Compare results to literature
Make a presentation to the Pharmacy Proof of Concept Center Committee

Research Methods & Analyses
Human cell culture methods
Extracellular matrix preparation
Microfluidic system
Organ-on-chip techniques
Microscopy observations
CX5 microarray scanner for imaging and analysis

Student Contribution to the Future

1. Student will gather valuable data on drug toxicity that will be added to the repertoire of the Pharmacy Proof of Concept Center
2. A course for credit on organ-on-chip technology is planned for the fall of 2020 and this summer fellowship will serve as a trial run for the course.

Training

Dr. Fulton will train the student on all techniques involved in the organ-on-chip technologies and will closely monitor progress on the project to assure all project objectives (outlined above) are met. All resources (biosafety cabinet, incubator, centrifuge, Nortis system, microscope, CX5 imaging, freezers, cell lines, lab supplies, chemicals, etc.) required to meet the objectives of this project are available in the Pharmacy Proof of Concept Center Lab, the REDIzone Common Lab or on the NEOMED campus. Most work will be done in the Proof of Concept Center Lab (C-127).

Student Requirements

Must follow protocols EXACTLY
Must be meticulous and pay attention to details
Must use good laboratory practices and etiquette
Immunizations are up to date – student will be working with human cells
Must have access to his/her own computer
Should be able to work in a biosafety cabinet using aseptic techniques
Cell culture experience is preferable