

## Senior Design Project Description for FALL 2016

### Project Title: Construction of a Mini Brain System (UNCC\_BRAIN)

Supporter: UNC Charlotte MEES

Supporter Technical Representative: ASSIGNED

Faculty Mentor:  ASSIGNED  TBD (check one)

Single Team  Dual Team  (check one)

Personnel (EN/ET):  E,  Cp,  Cv,  1 M,  SE

(Complete if the number of students required is known)

Expected person-hours: (250 per student)

#### Description of Project:

The objective of this project is to develop micro to millimeter-sized mini brain models for the replacement of complicated and expensive animal models and to evaluate the efficacy of drug candidates for the treatment of neurodegenerative disorders including Alzheimer's disease with higher throughput and better efficiency by using the models. The mini brain models will be fabricated by generating droplets for high-throughput assay and size control and forming a cellular monolayer at the interface of two phases of droplet and surrounding in a single microfluidic platform.

#### Initial Project Requirements (e.g. weight, size, etc.):

The principle of the separation is either density-driven or charge-driven between a pair of solutions. The separation will be optimized by testing different combinations of solutions with variation of the ratios of the paired solutions, oxygen level in the solution to keep cells alive. To miniaturize and improve the productivity of the models, a paired solution, including brain endothelial cells, will be injected into arrayed chambers through droplet generators in a microfluidic platform. Individual droplets will become a single model to assess individual drug compounds. To expedite cell separation, the platform will be rotated and droplets will roll inside the chambers while polymerizing gel solutions. After placing cells on the polymerized droplet, cells will be cultured to form a tight monolayer on top of the spheroid gel. Drug assessment will be achieved by measuring penetration of dyes with equivalent molecular weight of drug compounds across the constructed monolayer.

#### Expected Deliverables/Results:

The deliverable will be a functional prototype. A report showing the results of all the measurements and tests is required.

#### List here any specific skills or knowledge needed or suggested (If none please state none):

Student must be MEES student and have experiences of cell culturing and microfluidic fabrication.

This project is approved as a Bioengineering project