The Body on a Chip is a microfluidic biomems project that aims to replicate major organs of the human body on a chip, providing an in vitro drug testing platform without the need to resort to animal model testing. Using a human model also provides significantly more accurate drug response data, and may even open the door to personalized drug treatments. Microelectrode arrays covered with human neuronal or human cardiac cells that remain on the electrodes themselves are an essential component for the body on a chip project. Currently, creating these substrates relies heavily on chemically patterned surfaces to control the orientation and growth of the cells. Cells are plated by hand onto the surface of the chemically patterned microelectrode array. The cells that land on the cytophobic poly-ethelyene glycol (PEG) coating die and easily release from the surface, while the cells that land on the cytophilic diethylenetriamine (DETA) coating survive and begin the process of attaching to the surface and performing their normal functions. The current technique wastes a significant amount of cells, some of which are extremely expensive, and is a manual process. Cell printing, the process of dispensing cells through a 3D printer, makes it possible to pinpoint the placement of cells onto the microelectrodes, drastically reducing the number of cells wasted. Scaled-up manufacturing is also possible due to the automation capabilities provided by printing. The specific conditions for printing each cell type is unique; the printing of human motor neurons, human sensory neurons and human cardiac cells is discussed. The healthy viability and functionality of the printed cells are shown by phase images, immunostaining and electrical signal recordings. The superior resolution of cell printing is then taken one step further by successfully printing two different cell types in close proximity to encourage controlled innervation.

Major: Materials Science and Engineering

Educational Career:
Bachelor's of Materials Science and Engineering, BS, 2013, University of Minnesota

Committee in Charge:
James Hickman, Chair, Materials Science and Engineering
Kevin Coffey, Materials Science and Engineering Department, UCF
Stephen Lambert, College of Medicine, UCF

Approved for distribution by James Hickman, Committee Chair, on November 21, 2017.

The public is welcome to attend.