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Nayar Prize II Quarterly Progress Report – April 2018

Project: Microfluidic Drug-Microbiota Interaction Platform
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Progress Summary

Our primary activities have been toward establishing cultures of primary colon and characterizing the role of bacteria in modulating the enzymatic activity of colon cells. Our overall project goals are to study the role microbiota play in influencing drug metabolism. To facilitate study of interactions between the large number of potential combinations of drugs and microbiota, we are developing a microfluidic platform to carry out the study in high-throughput.

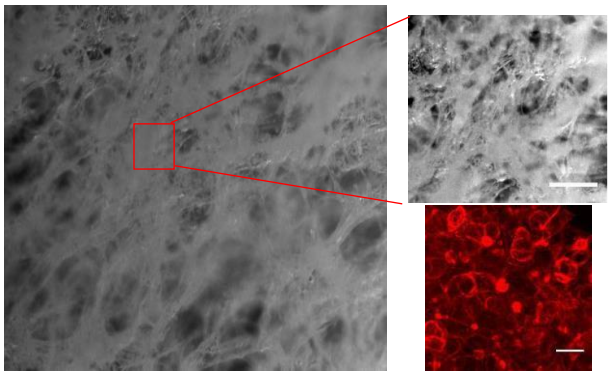

Figure 1. Microstructure of the collagen membrane and tight junctions of the cells on the membrane (red).

Our paper detailing the novel microfluidic device with an integrated collagen membrane was accepted and published in *American Chemical Society Biomaterials Science and Engineering* (Figure 1). One of the findings of the study was that the cells grown on the collagen membrane had tighter cell-to-cell junctions than the other devices, providing a more realistic organ-on-chip representation. The journal covered the science in a special feature entitled “More realistic and accurate organs-on-chips.” The intellectual property concerning the collagen membrane device was filed by the university for a provisional patent. Our studies with bacterial co-culture are indicating a differential response in cytochrome P450 activity due to the bacteria. One of our innovations is overcoming the technical challenge of long-term co-culture of intestinal cells and bacteria as each requires a different environment with intestinal cells needing physiological oxygen concentration and gut bacteria requiring anaerobic conditions. We expect to share the results of this study in the next quarter.

In order to translate our overall studies to human conditions, we have started conversations with Rush University Medical Center. One option is to incorporate cells from human patients into the devices. Another option is to isolate patient cells and microbiota to create a patient-specific organ mimic. Yet another option we are considering is the investigation of the role of microbiota in neurodegenerative disorders. We are currently developing all of these strategies, including preliminary experiments, and expect to report more in upcoming quarters and to submit grant proposals.