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Human-on-a-chip systems to direct or possible augment clinical trials

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One of the primary limitations in drug discovery and toxicology research is the lack of good model systems between the single cell level and animal or human systems. This is especially true for neurodegenerative diseases as well as for cardiac disease and cardiac side effect determination during the drug discovery process. In addition, with the banning of animals for toxicology testing in many industries, body-on-a-chip systems to replace animals with human mimics is essential for product development and safety testing. There is also a push to utilize *in vitro* systems to establish biomarkers to select subsets of the population for clinical trials and even to augment human testing during clinical trials. Our research focus is on the establishment of functional *in vitro* systems to address this need where we seek to create organs and subsystems to model motor control and cognitive function, as well as cardiac and liver subsystems. The idea is to then integrate microsystems fabrication technology and cellular components, with the aim of initiating and maintaining self-assembly and growth into biologically, mechanically and electronically interactive functional multi-component systems. Our advances in culturing human stem cell derived neurons, glial cells, muscle, liver and cardiomyocytes in a defined serum-free medium, and integrate them with MEMS devices suggest outstanding potential for answering questions during all phases of the drug discovery process using functional body-on-a-chip systems.

Biography

James J Hickman is the Founding Director of the NanoScience Technology Center and a Professor of Nanoscience Technology, Chemistry, Biomolecular Science, Physics, Material Science and Electrical Engineering at the University of Central Florida. Previously, he held the position of the Hunter Endowed Chair in the Bioengineering Department at Clemson University. He has a PhD from the Massachusetts Institute of Technology in Chemistry, as well as BS and MS from Penn State University in Chemistry. For the past twenty-five years, he has been studying the interaction of biological species with modified surfaces, first in industry and in the latter years in academia. While in industry he established one of the first bioelectronics labs in the country that focused on cell-based sensors and their integration with electronic devices. He has extensive experience in surface modification and surface analysis for biological and neuroscience applications, and the integration of these systems with MEMS devices and components for human body-on-a-chip applications. He is also the Founder and current Chief Scientist of a biotechnology company, Hesperos that is focusing on cell-based systems for drug discovery and toxicity. He has 110 publications and 18 book chapters, in addition to 26 patents.

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