Tissue Embedded Flexible Nanoelectronics to Capture Development in Cyborg Brain Organoids

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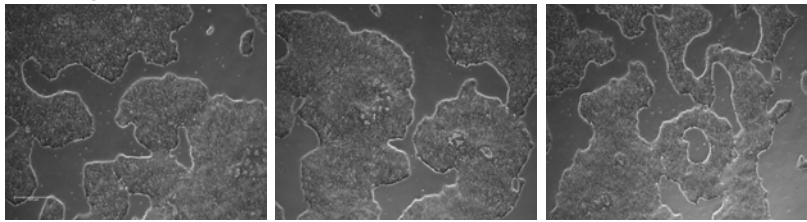
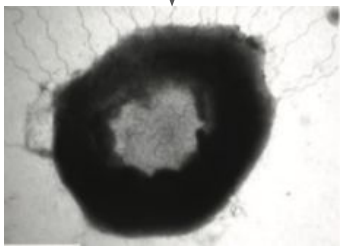
Brain organoids are three-dimensional (3D) models derived from human induced pluripotent stem cells (hiPSCs), and they can be employed to further our understanding of human brain development and disease progression. It is crucial to understand the evolution of both electrophysiological function and gene expression over time in brain organoids, and methods such as MEA plates and calcium imaging fail to provide long term and high resolution readings. By introducing flexible nanoelectronics during the organogenesis process a cyborg organoid system is created. The nanoelectronics are embedded and can provide real time readings over extended periods of time. In combination with RNA sequencing, we can gain insight into which neurons and genes are active at specific times. Using this information we can understand manipulations to the system with the goal of replacing animal models which fail to fully capture the genetic, molecular, structural, and functional complexity of the human brain.



Differentiate hIPSCs until the nanoelectronics can be integrated



Top: Shows cell morphology of hIPSC cells before undergoing differentiation. Bottom: Shows flexible nanoelectronics successfully integrated to brain organoid.

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Leonardo Claure is a rising senior from Arlington, Virginia attending Emory University. Currently, I am pursuing a Bachelor's of Science in Biology and I plan on pursuing a PhD in Biomedical Engineering with an interest in stem cell and regenerative medicine.

Through my participation in the Harvard SEAS REU and in Dr. Jia Liu's Lab this summer I have confirmed that I want to pursue stem cell research as a graduate student. I have learned proper cell culture procedures and have been entrusted to take care of multiple cell lines and grow numerous types of organoids including heart and brain organoids. Aside from lab techniques, I have experienced a glimpse of what it is like to do research as a graduate student. My positive experience in the program and in the lab has further solidified my interest in pursuing my PhD.