Modern Organoid Research Platform System and Methods

Tech ID: 33987 / UC Case 2024-803-0

BACKGROUND

Advances in biological research have been greatly influenced by the development of organoids, a specialized form of 3D cell culture. Created from pluripotent stem cells, organoids are effective in vitro models in replicating the structure and progression of organ development, providing an exceptional tool for studying the complexities of biology. Among these, cerebral cortex organoids (hereafter “organoid”) have become particularly instrumental in providing valuable insights into brain formation, function, and pathology. Despite their potential, organoid experiments present several challenges. Organoids require a rigorous, months-long developmental process, demanding substantial resources and meticulous care to yield valuable data on aspects of biology such as neural unit electrophysiology, cytoarchitecture, and transcriptional regulation. Traditionally the data has been difficult to collect on a more frequent and consistent basis, which limits the breadth and depth of modern organoid biology. Generating and measuring organoids depend on media manipulations, imaging, and electrophysiological measurements. Historically these are labor- and skill-intensive processes which can increase risks associated with known human error and contamination.

TECHNOLOGY DESCRIPTION

To overcome these challenges, a research team at UC Santa Cruz (UCSC) has developed a more intelligent in-incubator system, with related subsystems and methods, with a primary aim to modernize organoid biology experiments. The current demonstration reflects a cohesive, automated organoid system for sophisticated long-term organoid culture and analysis. A computer vision-based feedback subsystem monitors and adjusts media levels with little to no human intervention. The internet-of-things (IoT) infrastructure, plus cloud-based management system, supports integration multiple data types (electrophysiology, imaging, culture conditions) in addition to simpler system scaling. This in turn enables higher dimensionality and temporal resolution in data collection and analyses involving organoid biology experiments.

APPLICATIONS

- diagnostics – neuro
- therapeutics – neuro
- research tools – neuro

FEATURES/BENEFITS

- Higher dimensionality and temporal resolution in data collection
- Robust consistency and reproducibility in organoid culture conditions through automated feeding and monitoring
- Enhanced integration multiple data types (electrophysiology, imaging, culture conditions) through a unified IoT platform

INTELLECTUAL PROPERTY INFORMATION

Patent Pending

RELATED MATERIALS

- Voitiuk, Kateryna, et al. "A feedback-driven IoT microfluidic, electrophysiology, and imaging platform for brain organoid studies." bioRxiv (2024) - 12/07/2024

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OTHER INFORMATION

KEYWORDS

organoid, cortex organoid, brain organoid, cell culture, 3-D cell culture, 3D cell culture, hands free cell culture, electrophysiology, neuro, neuroscience, neurotechnology

CATEGORIZED AS

- **Computer**
  - Software
- **Medical**
  - Disease: Central Nervous System
  - Research Tools
  - Screening
- **Research Tools**
  - Other
  - Screening Assays
- **Sensors & Instrumentation**
  - Process Control
  - Scientific/Research
- **Engineering**
  - Robotics and Automation

RELATED CASES

2024-803-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Immobilization Devices for Biological Tissues
- Organoid Training System and Methods

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