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Organoid Microfluidic Chip for Psychotropic medication side effect prediction

Pharmacologic agents are commonly used to treat psychiatric diseases. These compounds, however, react differently across patients, are often followed by negative side effects and can have varied efficacy timeframes. Unfortunately, determining the efficacy and side-effect profile for therapeutics can be a time-consuming and costly process. To circumvent this issue, inventors at Stanford have designed a solution to analyze patient-specific drug responses by integrating organoids within a microfluidic chip for tissue culture and high-throughput screening. Microfluidics allows precision control of fluid flow to determine parameters like nutrient delivery, mechanical stimulus, and drug delivery at the microscale level, all by using a thousand-fold smaller volume of materials compared to standard plate assays. Using the chip, users can measure how drugs of interest would act in the patient's body by using a small skin sample. As a proof of concept, the inventors utilized the platform to model antidepressant effects on the gut-brain axis. The system seeds gut organoids with patient-representative gut microbiota onto a microfluidic chip, through which the drugs can be run through. Then, the inventors measured serotonin concentration as an output indicative of gut serotonin production over the course of treatment with Selective Serotonin Reuptake Inhibitors (SSRIs). The output provided a snapshot into how different SSRIs affect the gut microbiome and gut serotonin production on a patient-specific basis, while laying the foundation for understanding variability in treatment response. Overall, the platform enables a high accuracy, high throughput, patient-centered approach for screening drug responses that increases the potential for positive therapeutic outcomes.

Applications

- Precision medicine

- High-throughput screening assay for therapeutic compounds
- Microfluidic device

Advantages

- Predicts side effect profiles for psychiatric medications
- High-throughput, low-cost assay with microfluidics
- Customizable to patients with skin sample

Innovators

- Abigail Archer
- Suleman Qamar
- Julian Cheng
- Sakina Walji
- Madeleine Kriz

Licensing Contact

Cheryl Cathey

Senior Licensing and Strategic Alliance Manager

Email