Docket #: S22-238

Array Platform for High-Throughput Organoid Profiling

Researchers at Stanford have developed a new methodology for image processing that allows for high-throughput characterization of organoid phenotypes.

Organoids represent a major step forward in in vitro research studies into a myriad of disease states. 3D organoid models possess key advantages over conventional 2D cell culture models including a closer approximation of in vivo settings as well as a reduction of genomic background signal which in turn enables editing with CRISPR/Cas9 technology to further reproduce disease states. Current organoid construction involves resuspending aggregated cells in commercially available extracellular matrix (ECM) mimics, rather than from a single cell. Due to this property of their construction, it is difficult to determine whether an organoid phenotype has arisen from the stochasticity of the deposited cell population, or from an intrinsic property of individual cells. Single organoid phenotypic characterization remains a challenge.

Stage of Development
Research - in vitro

Stage of Research
The inventors have identified a new microwell based technique for the high-throughput quantification of image-based parameters at single organoid resolution. This method can be used to phenotypically monitor thousands of organoids in parallel. Phenotypes such as organoid growth rates, migration behavior, and fluorescently labeled protein expression and localization are all parameters that can be assessed through this pipeline. Once profiled, organoids can be retrieved from their microwells for sequencing and molecular profiling to determine the genomic or proteomic origin of the organoid's phenotypic state.

Technology Reference Nos.

- CZ Biohub ref. no. CZB-257S
- Stanford ref. no. S22-238

Applications

- High-throughput drug screening of patient-derived human organoids
- Characterization of genetic mutations of interest in parallel
- Elucidation of genetic mutations that contribute to tumor microenvironments

Advantages

- Organoid profiling is not restricted to bulk averages for parameters such as growth rates or division times.
- Does not require specialized instrumentation and is therefore an easy addition to existing cell culture workflows.
- Organoids can be generated from single cells rather than aggregated cell populations.

Publications

- Sockell, A., Wong, W., Longwell, S., Vu, T., Karlsson, K., Mokhtari, D., Schaepe, J., Lo, Y.-H., Cornelius, V., Kuo, C., Van Valen, D., Curtis, C., & Fordyce, P.M., "A microwell platform for high-throughput longitudinal phenotyping and selective retrieval of organoids." Cell Systems (in press); bioRXiv (2022).

Patents

- Published Application: WO2024076910
- Published Application: 20260049289

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