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Microinjection for Single Cell Gene Manipulation

Technology No. 20180069

IP Status: US Patent Pending; **Application #:** 16/642,986

Automated Microinjection of Genetic Material into Single Cells

An auto-injector injects molecules of interest (e.g., dye, mRNA, etc.) into single cells in intact tissue, enabling single cell resolution with increased yield. The technology uses a 3-axis micromanipulator and a custom pressure rig controlled by user input and computer vision feedback. Incoming pressure is downregulated to a desired pressure set in the interface and delivered to a glass pipette capillary. The micromanipulator guides the pipette along a user-defined line guided by the microscope camera feed and injects cells. The custom, open-sourced platform is readily adaptable for broad adaptation across labs.

Overcomes Electroporation and Manual Microinjection Limitations

Current methods of delivering biological components into cells in tissues include viral delivery and electroporation, both of which affect large populations of cells and do not allow for single cell specificity. Additionally, they can only deliver several gene products at once with uncontrolled concentrations. Another method, manual microinjection, requires extensive training and expertise and still often results in low numbers of attempts and low yield. These limitations restrict the scope of experiments and inhibit broad uptake of the technology across labs. This new robotic platform uses microinjection to circumvent these issues by customizing injection medium and spatial selection of injected cells. The auto-injector uses a micromanipulator to inject controlled solutions into cells and achieves higher yield than manual injection (approximately 44% vs 15%). The resulting higher throughput enables scientists to screen molecules and genes of interest in tissue to study genetic logic of brain development and evolution.

BENEFITS AND FEATURES:

- Custom, open-sourced platform adaptable for broad adaptation across labs.
- Auto-injector injects molecules of interest (e.g., dye, mRNA, etc.) into cells in intact tissue
- 3-axis micromanipulator and a custom pressure rig controlled by user input and computer vision feedback
- Single cell resolution/specificity
- Increased yield

- High throughput
- Customization of injection medium
- Spatial selection of injected cells

APPLICATIONS:

- Application
- Research tools
- Tissue engineering
- Nanoscale 3D printing for organs
- Drug screening
- The computer vision guided automated microinjection platform has a wide variety of applications including injection of various tissues in diverse species, nanoscale 3D printing, and drug screening. The modular design allows for users to choose their own camera and micromanipulators by adjusting the settings in the interface

Phase of Development - Prototype Developed

Working prototype in organotypic slices of developing mouse and human telencephalon using dye and mRNA of genes of interest showed 44% of attempts resulted in successful injections.

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