

AutoSIP: Low-Cost Robotic System for Automated Density Gradient Fractionation in Molecular Biology Labs

A low-cost, 3D-printed syringe-pump robot automates density-gradient fractionation with programmable volumes, tubes, and formats to boost SIP throughput.

Researchers at Purdue University have developed an automated, low-cost solution for density gradient fractionation. Their innovation takes the form of a benchtop robot called autoSIP, which is a three-component, syringe pump-based robotic system built from 3D printed material. AutoSIP, which is named for the classic stable isotope probing (SIP) experiment common in molecular biology labs, accommodates versatile gradient fractioning workflows with an easy-to-use programmable interface. AutoSIP is not only convenient, but also extremely versatile, enabling customizable fractionation volumes, tube sizes, and receptacle formats. Unlike existing alternatives, autoSIP is low-cost and eliminates the need for manual processing. With autoSIP, researchers will be able to standardize and enhance the throughput of their density gradient fractionation experiments.

Technology Validation:

Researchers have produced and tested a prototype autoSIP robot, which can be viewed in the demonstration video linked below. The system uses commercially available electronics and custom 3D printed parts to achieve its goals of accuracy and autonomy at a low cost.

Advantages:

- Combines all functions into a single platform
- Easy to print and build
- Low cost
- Easy-to-use programmable interface
- Customizable fractionation volumes, tube sizes, and receptacle -formats

Technology ID

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Category

Robotics &
Automation/Automation &
Control
Materials Science &
Nanotechnology/Materials
Testing & Characterization Tools

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Applications:

- Tracking of carbon in the environment
- DNA/RNA SIP probing in molecular biology experiments
- Isopycnic/density gradient fractionation

Publications:

Demo video posted to YouTube in July 2023:

<https://www.youtube.com/watch?v=qtA23hSMj8U>

TRL: 5

Intellectual Property:

Provisional-Patent, 2024-07-26, United States

Keywords: automated gradient fractionation, low cost lab automation, stable isotope probing robot, programmable liquid handling, 3D printed lab equipment, density gradient workflow, benchtop fractionation system, molecular biology automation, customizable lab robotics, isopycnic separation tool, syringe pump fractionator, carbon tracking experiments