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Magnetic Levitation Platform for Extracellular Vesicle Isolation (EV-Lev)

Stanford researchers have developed an innovative microfluidic platform, EV-Lev, for the isolation and sorting of extracellular vesicles (EVs) from human plasma. EVs, including exosomes and microvesicles, are released by cells and play a crucial role in cell communication and are considered promising biomarkers for diseases like cancer and other conditions. However, isolating EVs using traditional methods such as ultracentrifugation is often time-consuming, inefficient, and requires large sample volumes.

The EV-Lev platform uses polymer beads coated with antibodies that bind to specific EV markers. These beads are placed in a magnetic levitation system, where they float to different heights based on their density. This allows the device to sort and isolate different EV subpopulations quickly and with high precision. The system works with small sample volumes (as little as 20–50 µL of plasma) and maintains the structural integrity of the isolated EVs for further analysis. Its compact design and cost-effectiveness make it a practical tool for both research and clinical applications.

Stage of Development: Prototype

Applications

- Diagnostic tools for early disease detection (e.g., cancer biomarkers).
- Research tools for studying cellular communication.
- Therapeutic development, including drug delivery and regenerative medicine.
- Quality control systems for biopharmaceutical manufacturing.

Advantages

- Faster and more efficient than traditional methods
- High purity and specificity in isolating EV subpopulations.
- Requires minimal sample volume.
- Real-time monitoring capability during the sorting process.
- Scalable design suitable for clinical use or large-scale research applications.

Publications

- Yaman, S., Devoe, T., et al. (2025). EV-Lev: Extracellular Vesicle Isolation from Human Plasma Using Microfluidic Magnetic Levitation Device. *Lab Chip*, 2025, 25, 1439-1451.

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