Continuous flow insulator-based dielectrophoretic sorting of cancer cells

This research proposal focuses on developing a highly efficient, high-throughput method for sorting cancer cells using insulator-based dielectrophoresis in microfluidic channels. The goal is to optimize cell viability during sorting for more accurate and reliable diagnostic and research applications.

Objectives of the research

- High-efficiency sorting: Develop a method for sorting cancer cells with high efficiency and accuracy using insulator-based dielectrophoresis (iDEP)
- High-throughput capability: Optimize microfluidic channel design for high-throughput sorting of multiple cell types while maintaining accuracy and viability
- Improved cell viability & diagnostic reliability: Investigate the effect of iDEP sorting on cell viability and the implications for downstream diagnostic and research applications.

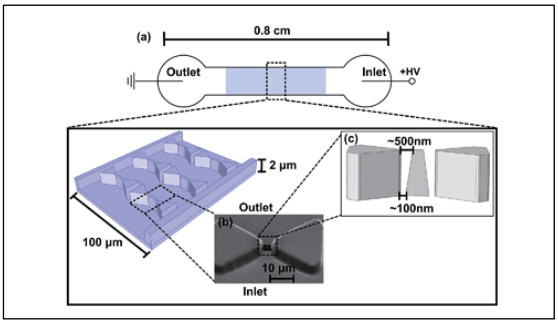
Background and significance of the study

Cancer is the second leading cause of death globally and early detection is critical for improved patient outcomes. Current cell sorting methods are often ineffective or damaging to the cells, limiting their applications in research and diagnostics. The development of a highly efficient and high-throughput sorting method that preserves cell viability could have a significant impact on cancer research and medical practice.

Research methodology and approach

We will use microfluidic channels where the wall geometry is specifically designed to create nonuniform electric field to isolate and sort cancer cells from white blood cells while investigating the effects on cell viability.

Microfluidic Channel Design
The microfluidic channels walls will be specifically designed to create nonuniform electric field and manipulating cancer cells and white blood cells into different outlets.



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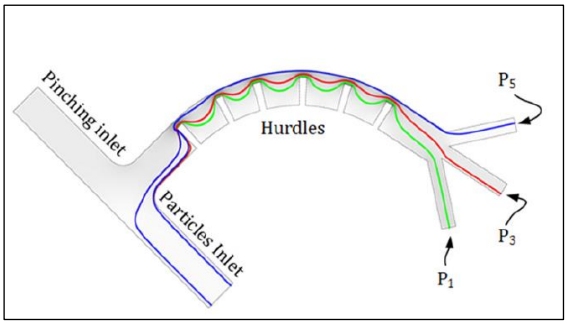

Amiri et al. Che. Eng. Res. and Design. 189 (2023) 652–663.

Results and expected outcomes

Evaluation of sorting efficiency and accuracy	Quantification of cell viability pre- and post-sorting
Optimized channel design for high-throughput sorting	Validation of sorting method using breast cancer cell lines (MCF7 and MDA-MB231)
Identification of limitations and challenges	Demonstration of the potential applications and impact of the sorting method in cancer research and diagnostics

References:

1. Nakano, Asuka, Fernanda Camacho-Alanis, and Alexandra Ros. "Insulator-based dielectrophoresis with β-galactosidase in nanostructured devices." Analyst 140.3 (2015): 860-868.
2. Amiri, Hoseyn A., Sasan Asiaei, and Farzad Vatandoust. "Design optimization and performance tuning of curved-DC-iDEP particle separation chips." Chemical Engineering Research and Design 189 (2023): 652-663.

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