Editorial
Volume 13:3, 2022

Journal of Biosensors & Bioelectronics

ISSN: 2155-6210 Open Access

The Impact of Microfluidics on Biomedical Research

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Editorial

More than a decade ago, we predicted that microfluidics will revolutionise the way modern biology is conducted. Indeed, we were among a group of scientists that saw the potential for new microfluidic technologies to make significant contributions to biology and medical research. Given the obvious benefits that microfluidic techniques may potentially offer over traditional cell biology experiments, the excitement around microfluidics seemed well-founded [1].

Microfluidics is based on the concept that fluids may be precisely controlled using a microscale device made with technologies established first by the semiconductor industry and later broadened by the micro-electromechanical systems sector. These devices, also known as miniaturised total analysis systems or lab-on-a-chip technologies, could be used in biology research to simplify complex assay protocols, reduce sample volume, lower reagent costs, and maximise information gleaned from precious samples; provide scalability for screening applications and batch sample processing similar to multi-well plates; and provide the investigator with substantial data.

Microfluidics is defined as the study and manipulation of fluids on a submillimetre size. At this length scale, the fluid phenomena that govern liquids are vastly different from those that dominate at the macro size. For example, compared to its dominance at the macro scale, the relative influence of gravity's force at micro scale dimensions is substantially diminished. At the micro scale, however, surface tension and capillary forces are more powerful. These forces can be used for a variety of tasks, including passively pumping fluids in micro channels, precisely patterning surfaces with user-defined substrates, filtering various analyses, and forming monodisperse droplets in multiphase fluid streams for a variety of applications [2].

These examples are only a few of the many issues that microfluidic technologies have sought to solve. Engineers have welcomed the creation of complete microfluidic solutions to meet difficulties in biology and clinical research. Despite material breakthroughs in microfluidics as a technological platform, the adoption of innovative mTAS techniques in mainstream biology research has not kept pace with the field's early excitement. Some say that the technique is still in quest of a "killer application," in which the sample-to-answer approach gives a solution that surpasses current methods significantly.

We will look at the influence of microfluidic technology on cell biology and medical research during the last decade from this perspective. We examine some of the roadblocks to mainstream biomedical research adoption of microfluidic technology, and we utilise a case study to demonstrate and emphasise these issues. We concentrate on current advancements in the area that make it easier to use microfluidic technologies to solve difficulties in diagnostics and biology research. We analyse how researchers are adopting mTAS approaches to enable scientific inquiry in ways that were not conceivable using previous methods, and we emphasise the unique usage of diverse materials that are more optimally suited to accomplishing a certain job [3].

Finally, we'll look at some of the field's good tendencies and draw conclusions that might be used to future microfluidic technology development. The development of technologies that increase the capacities of investigators in biology and medical research is a main focus for many of the microfluidics community. Many microfluidic studies outline strategies for replacing old technologies are often large size tests, and they generally include proof-of-concept trials to illustrate the new method's usefulness. These revolutionary microfluidic published in 'engineering' journals or publications with an audience primarily comprised of engineers and other members of the physical sciences, such as chemists and physicists.

If publishing proof-of-concept research in engineering journals is the development phase for a new biology assay, then the technique's implementation may be defined as when the technology is applied and published in a biology or medical publication. After all, the declared purpose of nearly every PoC study is to demonstrate new technologies that will aid biologists in their daily research [4].

The state of the art for most traditional cell biology tests is always developing and improving. Individual groups periodically create modifications to classic tests that are accepted more widely by other biology researchers. Biologists recognise the shortcomings of the procedures they employ better than anybody else. Visual chemotaxis tests, for example, are one illustration of this technical progress [5].

Conflict of Interest

None.

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Received: 17 February, 2022, Manuscript No. jbsbe-22- 66138; **Editor Assigned:** 20 February, 2022, PreQC No. P-66138; **Reviewed:** 25 February, 2022, QC No. Q-66138; **Revised:** 04 March, 2022; Manuscript No R-66138; **Published:** 08 March, 2022, DOI: 10.37421/2155-6210.22.13.323

How to cite this article: Galarneau, Ane. "The Impact of Microfluidics on Biomedical Research." J Biosens Bioelectron 13 (2022): 323.