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# Innovation in spectral flow cytometry: Advancing research and healthcare in India

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**India stands to benefit immensely from investing in advanced spectral flow cytometry**



In the ever-evolving realm of high-parameter single-cell data, high-speed imaging technology holds the potential to revolutionise research and cell-based therapeutic development. This transformative technology is especially pertinent in fields like virology and oncology, as well as various disease states.

By providing more accurate data and the ability to identify previously elusive cells, this innovation addresses a longstanding gap in biomedical research. A noteworthy advancement is in cell sorting, empowering scientists to conduct high-parameter experiments while rapidly viewing and sorting cells based on specific, visualisable traits.

**India's Ascendance in Biopharma Research**

Globally recognised as an optimal hub for clinical trials and medical research, India boasts international standards and a proficient workforce. The Indian government is proactively fostering this development, exemplified by initiatives such as the Biotechnology Industry Research Assistance Council (BIRAC) initiated by the Department of Biotechnology (DBT), which established the National Biopharma Mission. Within the realm of scientific and immunological studies, advanced spectral flow cytometry and novel imaging technology hold immense potential to expedite research, enhance accuracy, reliability, and monitoring, thus positioning India as a trailblazer for emerging nations.

**Crucial Role of Immunology**

The prominence of immunology and immunologists has surged, especially since the COVID-19 pandemic, as scientists globally raced to develop a vaccine. Immunology has propelled significant medical breakthroughs, including advanced vaccination methods that have saved more lives than any other medical intervention. It offers defense against emerging pathogens like Ebola and elucidates treatment strategies for various health issues. Malfunctions in the immune system underlie diseases such as autoimmunity, cancer, allergies, and even non-traditional conditions like cardiovascular, metabolic, and neurodegenerative disorders.

**Pioneering Cell Sorting**

The cell sorter, a landmark invention pioneered by Professor Herzenberg in the late 1960s, has profoundly impacted modern medicine, immunology, stem cell research, and proteomics. This technology has contributed to diagnosing, monitoring, and treating various cancers, including AIDS and infectious diseases. Immunology's influence extends to monoclonal antibodies, antibody technology, and flow cytometry. Spectral flow cytometry, particularly, is proving invaluable in fields ranging from cancer immunology to gene therapy.

**Empowering Research and Therapeutic Progress**

The Fluorescence Activated Cell Sorter (FACS), introduced commercially in the early 1970s, continues to evolve. Recent advancements in high-speed imaging technology, exemplified by a spectral cell sorter with sort-capable image analysis, enable researchers to visualise and sort cells at unprecedented speeds. This technology captures detailed microscopic images of cells, analysing more data than traditional methods, enhancing cell isolation and characterisation.

**Enhanced Cell Isolation and Characterisation**

For instance, powered by orthogonal frequency domain multiplexing, the BD CellView™ Image Technology revolutionises imaging in flow cytometers. This innovation enables real-time imaging for analysis and sorting. The images can be analysed using a specialised lens plugin on renowned FlowJo Software.

Advanced SpectralFX™ technology, incorporating a comprehensive array of detectors and full spectrum optimised hardware, ensures exceptional quality control and resolution power.

The Cell Sorter, equipped with advanced Image Technology and SpectralFX™ Technology, offers robust capabilities. It features multiple imaging detectors and analyses, enriching the fluorescent detector array. This sorter bridges cell images, traditional flow data, and downstream analysis, enabling comprehensive single-cell profiling with the potential to illuminate complex diseases and systems.

**Spectral Flow Cytometry's Multifaceted Benefits**

The synergy of spectral flow cytometry and image technology opens doors in numerous sectors. It promises cost-effective vaccine development, particularly for diseases like cervical cancer and pneumonia, which disproportionately affect developing countries due to limited screening and treatment options. It also addresses infectious diseases, like dengue, which plague India. Furthermore, it simplifies environmental monitoring, crucial in a country with severe air pollution, aiding in the detection of pollutants and understanding their biological mechanisms. Additionally, spectral flow cytometry contributes to tackling zoonotic diseases like visceral leishmaniasis and avian influenza.

**Shaping India's Healthcare Landscape**

With its unique challenges and opportunities, India stands to benefit immensely from investing in advanced spectral flow cytometry. By bridging gaps in biopharma research, India can make significant strides toward better health outcomes for its population. The convergence of technology, skilled professionals, and a motivated government positions India as a

frontrunner in harnessing the potential of spectral flow cytometry to reshape its healthcare landscape.

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