Flow cytometry

Flow cytometry is a widely used technique in biology and medicine for analyzing and quantifying characteristics of individual cells within a heterogeneous population. It provides detailed information about various cellular parameters, such as cell surface markers, intracellular proteins, DNA content, and cell viability.

The fundamental principle of flow cytometry involves the measurement of light signals emitted or scattered by cells as they pass through a flow cytometer. This technique allows for rapid and simultaneous analysis of thousands of cells per second.

Here's a general overview of the flow cytometry workflow:

Cell preparation: Cells of interest are collected and prepared for analysis. This may involve cell culture, tissue dissociation, or sample processing to obtain a single-cell suspension.

Antibody labeling: Fluorescently labeled antibodies or other probes are used to target specific cell surface markers or intracellular molecules. These antibodies can bind to their respective targets, allowing for their detection by fluorescence.

Cell staining: The cell sample is incubated with the labeled antibodies, allowing them to bind to their targets within the cells. Staining may also involve the use of DNA dyes or viability markers to assess cell viability or cell cycle status.

Sample acquisition: The stained cell suspension is introduced into the flow cytometer. Cells are hydrodynamically focused into a single-cell stream and pass through a laser beam. The laser beam causes the fluorochromes to emit light signals, which are then collected by photodetectors.

Data acquisition and analysis: The emitted light signals are converted into electrical signals and processed by the flow cytometer's electronics. The resulting data, including fluorescence intensity and scatter characteristics, are recorded and stored for analysis. Specialized software is used to analyze the data, including gating to define specific cell populations and quantifying various parameters.

Flow cytometry has a wide range of applications in research and clinical settings. It is commonly used in immunology to analyze immune cell populations, assess cell activation or differentiation, and characterize immune responses. Additionally, flow cytometry is used in cancer research, stem cell analysis, microbiology, drug discovery, and more.

Flow cytometry provides researchers with a wealth of information about cellular heterogeneity within a population and allows for the identification and quantification of specific cell subsets. It is a versatile tool that has revolutionized cell analysis, enabling researchers to study complex biological systems with high resolution and throughput.

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see Imaging flow cytometry.

see Multiparameter flow cytometry