Immunophenotyping, Above and Beyond

Targeting the immune system has dramatically increased the need for tracking the native, and more recently, engineered phenotypes of multiple cell lineages.

Flow cytometry has developed from being a quantitative tool for identifying and classifying mixtures of cells using fluorochrome-labeled monoclonal antibodies, to becoming an essential workhorse for cell analysis research and development. The last decade has brought a series of advancements in instrumentation and software along with an exponential expansion of antibodies and fluorochromes. This has dramatically expanded the applications and cell phenotypes that can be accurately measured with the blink of an eye.[1] It is no longer a characterization tool but a comprehensive phenotyping system with blazing speed and a growing rainbow of fluorophores to maximize the number of parameters that can be measured per cell.

In human testing, cytometric immunophenotyping is now employed routinely to diagnose, classify, stage and monitor therapy in blood cancers and a growing list of age-related diseases.[2] It can be used to determine the origin and stage of differentiation of leukemias and lymphomas.[3] Sampling is nominally invasive, making it an ideal method for monitoring treatment and detecting recurrence, especially in cell-based immunotherapies.[4]

The deep roots and recent successes of immunotherapy in cancer treatment is rapidly changing the research and development paradigms for how to intervene in disease. However, immune parameters capable of sufficiently characterizing antitumor responses across various immune networks are underdeveloped. Converting the recent successes of immunotherapy into broadly applicable clinical research strategies with improved response rates necessitates improving our ability to monitor immunity at all stages of research, development, diagnosis, and treatment.

Additional Info

Visit the Immunophenotyping by Flow Cytometry webpage to learn more

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Flow cytometry holds great potential to address this gap as it is more compact, adaptable and accessible than ever. Customizable and compatible with autosampling and high-throughput technology, increasingly sensitive to a growing array of fluorophores, parallel processing multiple inputs, cytometers allow us to collect vast amounts of information from easily obtained and processed samples. "We engineered a new generation of cytometry to ensure that every increment of enhanced performance was accessible at the benchtop, with software that is easy to use. The result is that investigators would be better able to keep pace with the demand for the discovery and implementation of novel immunotherapies", explained Xiaobo Wang, (Figure 1) General Manager of the Flow Cytometry and Real-Time Cell Analysis business. "Our goal is to bring the best possible performance and experience to the benchtop. We will know we have succeeded when you get the same answer, again and again, no matter who is operating the cytometer."

As inferred by Dr. Wang , the resolution wars in cytometry are drawing to a close. Fluorescence resolution in most instruments is comparable and sufficient. The competition is, therefore, rightfully shifting to usability features that are dramatically improving accessibility, efficiency, and decision making. Many experts in the field predict software experience and automation to be the top differentiators among cytometers going forward, especially at the bench, where everyone wants them to be.

As a cell engineering tool, flow cytometry is employed from screening through validation of accurate targeting to comprehensive phenotypic characterization. A great example is Precision BioSciences. This company is applying its ARCUS genome editing technology to develop allogeneic cell-based immunotherapies. Their immunotherapies are derived from select, healthy subjects as opposed to compromised cancer patients to overcome inherent problems of consistent and scalable manufacturing of autologous cells. "Cytometry is the key tool in our work. This is how we analyze our cells before, during and after the manufacturing, including how we trace our cells in patients and analyze the cellular component of their immune system during treatment", explained Vladimir Senyukov, the Director of BioAnalytical Development at Precision BioSciences. He went on to explain, "What I like about the NovoCyte Quanteon is that it's compact, fast and it has accurate volumetric-based cell counting. It is a robust and stable instrument."
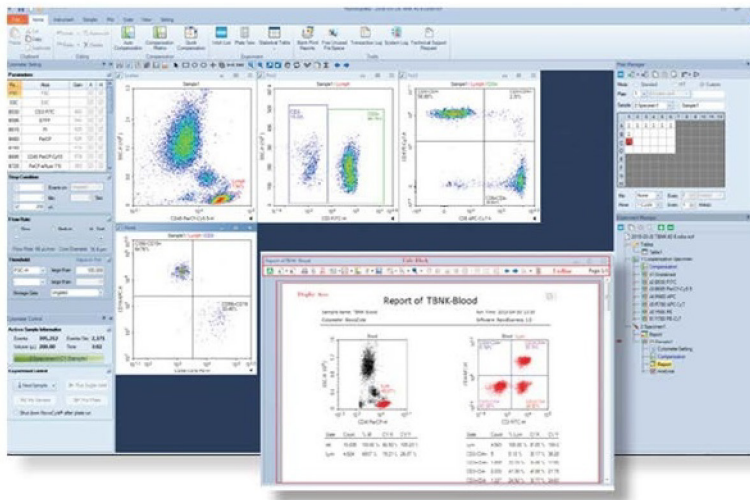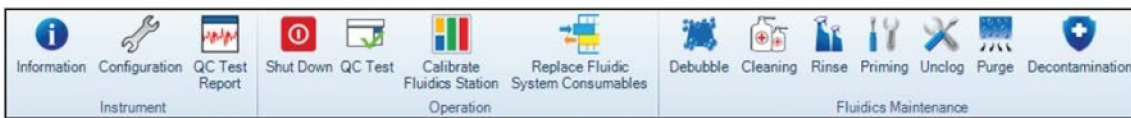

Figure 1. NovoExpress has a user-friendly interface for easy access to settings, analysis, reports, and plates/sample layout.

In summary, the Agilent line of NovoCyte cytometers is delivering in an industry that was already considered too crowded for new entrants by pushing the boundaries of accessibility and performance. Democratization is at the roots of its appeal and adoption, especially in the fields of immuno-oncology and immunotherapy. As flow cytometry continues to drive new applications, especially in nontraditional workflows such as cell engineering and manufacturing, it must continue to become less complex. The solution is to make the platforms smarter by being able to configure to the customer's on-demand expectations and preferences. This is where Agilent NovoCyte excels.

The following are common features cited by users when speaking about the NovoCyte line of cytometers:

– The wider dynamic range for detecting signals eliminates the need to adjust PMT voltage. This feature makes data acquisition simple, especially for new users. Consequentially, this leads to a reduction in time and mistakes.

– The NovoCyte has an accurate volumetric-based cell counting system that performs direct absolute cell counting during data acquisition without the need for reference counting beads or extra steps.

– The NovoExpress software is straightforward and easy to use for sample acquisition and analysis. Samples can be analyzed with the same setting by a simple drag-and-drop function, making the process of data analysis quick and efficient.

– The report function on the NovoExpress software can generate PDF reports with one click, making data-sharing simple.

– The groundbreaking fluidics provide pulse-free sample delivery resulting in higher reproducibility and exceptionally low CVs.

– The fully automated flow cell wash and shut down features mitigate flow cell clogging. The system is always ready-to-go for the next user.

– Walk-away automation can be achieved with the NovoSampler Q. This provides superior shaking, even at ultralow volumes, and accommodates the most popular plate formats, bar coding, and built-in APIs for lab automation systems.[5]

NovoCyte advantages

– Wider dynamic range for detecting leads to a reduction in time and mistakes.

– Accurate volumetric-based, direct cell counting system.

– NovoExpress drag-and drop function, makes data analysis quick and efficient.

– NovoExpress can generate PDF reports with one click.

– Innovative fluidics deliver higher reproducibility and exceptionally low CVs.

– Fully automated wash and shut down; ready-to-go for the next user.

– Walk-away automation can be achieved with the NovoSampler Q.

References

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