



Agilent Case Study: NovoCyte Opteon Spectral Flow Cytometer

A Multi-omics Approach Facilitates the Development of New Vaccines

In March 2024, the 2023 National Key R&D Program "Research on Etiology and Epidemic Prevention Technology System" Key Special Project "Precision Medicine Research on Immune Responses to Important Preventive Vaccines" led by Yunnan University was officially launched. With increasing global attention to public health, research and development of new vaccines is not only a hot topic in the scientific community, but also an area of social concern. State Key Laboratory of Conservation and Utilization of Biological Resources Professor Zhang Zijie at Yunnan University leads a multidisciplinary team that seeks to conquer challenges in systemic vaccinology in the postgenomic era through a multi-omics approach. Two of these challenges include understanding how genetic variation and environmental factors affect gene expression, as well as how differences in gene regulation affect complex human traits like vaccine immune response and disease occurrence.

"In new vaccine research, the concept of a 'system' is particularly important," Professor Zhang Zijie explained. "Integrating information from multiple dimensions and conducting comprehensive analysis of complex biological phenomena requires the use of multi-omics or multiparametric research methods, such as high-parameter immunological detection tools, single-cell sequencing technology, and whole genome analysis. It is multilayered data integration that enables systemic correlation studies of biological systems to advance vaccinology and immunology."

In addition to systemic vaccinology, the group works closely with hospitals to apply their multi-omics technology to analyze clinical samples and explore pathogenesis. Part of their work focuses on research in disease prevention and treatment based on complex clinically relevant traits.

"As vaccine research continues to advance to a more refined and complex level, the requirements for experimental equipment are also getting higher and higher," said Professor Zhang Zijie. Scientists are increasingly reliant on advanced instruments that can provide high precision, high-throughput data, particularly while exploring how vaccines stimulate the body's immune response. Therefore, stable high-throughput abilities and reliable performance are key factors while selecting experimental equipment, like flow cytometers. Strong support in these areas greatly accelerates the pace of scientific research and advances the vaccine development process.



State Key Laboratory of Conservation and Utilization of Biological Resources
Professor Zhang Zijie at Yunnan University

A pioneering purchase

To analyze immunology-related indicators from different angles and levels broadly, more parameters are crucial to provide detailed information, putting forward high-performance requirements. When Professor Zhang's group began the process of purchasing a flow cytometer, in the early stages, the research team conducted a detailed comparison of similar products on the market, focusing on flow cytometers with high parameter detection, detection speed, and stability. They were specifically looking for devices that can detect up to 30 or even 40 biomarkers at the same time.

In early 2024, his group settled on and purchased the Agilent NovoCyte Opteon Spectral Flow Cytometer system with five lasers, becoming one of the first NovoCyte Opteon customer in the world.

"It was a great honor to be the first user of the NovoCyte Opteon spectral flow cytometer in mainland China," said Dr. Chen Yanli, postdoctoral researcher in Professor Zhang Zijie's group. Her work focuses on vaccine immunization research and operates the NovoCyte almost daily. "Conventional flow cytometry is limited to the number of detectors in the system, often rendering the data obtained insufficient to support an in-depth study of more granular cell subsets and their functions. The NovoCyte Opteon, on the other hand, functions at the molecular level and offers more granular detection."

NovoCyte Opteon also offers autofluorescence removal. When detecting low-frequency cell subsets, autofluorescence often causes significant interference with the detection signal. This feature can precisely identify and rule out the effects of autofluorescence, ensuring that obtained cell subpopulation data is more accurate and reliable.

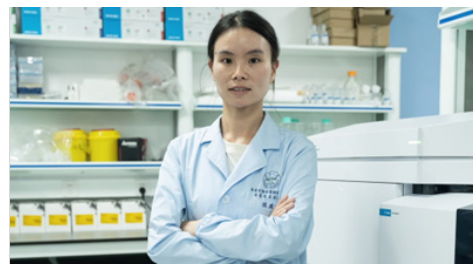
The top-end version of the instrument is equipped with five lasers and 73 detectors, supporting more than 50 color experimental designs. This capability is critical to elucidate the mechanisms of vaccine-induced immune responses. In addition, the detection sensitivity of the NovoCyte Opteon is higher than that of traditional flow cytometers. The higher detection sensitivity captures low-frequency cell populations more efficiently while studying vaccine-induced cellular responses, where subsets like memory T and B cells are crucial despite their low expression.

Driving excellence with an intuitive platform

Feedback from group members during the testing stage included praise for the easy to operate software, as well as functions that greatly facilitated daily usage, like one-key button power on/off and automatic detection.

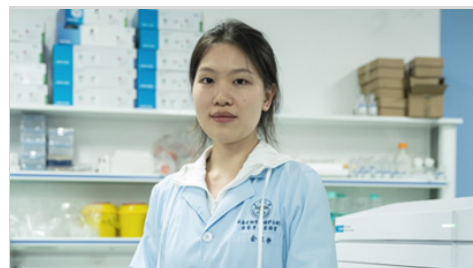
Ph.D. student Hyunjing Yu, who focuses on the immune-related research of clinical cohorts, spoke on the benefits of NovoCyte Opteon, highlighting the user-friendliness of the software, even for lab members with little to no flow cytometry experience at all. Ease of use does not compromise ability, however, as the software is quite comprehensive, greatly improving the intuitiveness and convenience of complex data analysis. Features like heatmap density can be used to map and visualize different cell populations when segmenting

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Yanli Chen, postdoctoral researcher

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Xuanjing Yu, Ph.D. student

gated cell subpopulations to better understand the relationships between them. Additionally, the software shows a high degree of fluency in data processing capabilities. Even when handling large and complex data sets, the data processing interface and analysis workspace maintains a smooth operation experience without significant buffering.

For experiment-focused researchers like Professor Zhang's team, simplifying and streamlining data analysis means more time for experimental design and results interpretation, and less spent on tedious data processing. It not only improves research efficiency but also propels more in-depth scientific discovery.

Continued field support and training

A specific experience during the testing stage helped the team lock in on the NovoCyte Opteon spectral flow cytometer. Prior to arriving in Professor Zhang's lab, the demo instrument was sent to another facility for testing. When it arrived, shipped directly to the lab in simple packaging, the instrument passed QC inspection after basic installation, power supply, and initial commissioning. The process served as a testament to the robust stability of the instrument and ability to be put to use after challenges experienced during transport.

Additionally, when the demo instrument first arrived, the software engineer providing training not only introduced the hardware structure and software operation process in detail, they also patiently answered every question raised by the research team and quickly gave professional feedback. The technical support team also demonstrated their technical expertise in their post-sales service, which helped the team seamlessly transition from the testing stage to the daily use stage.

"Whether it's further technical training or problems encountered during use, Agilent's response is always fast and timely," said Yu Hyunjing Xuanjing. "The post sales service maintained its high standard even after the NovoCyte Opteon was officially put into operation in the laboratory."

Focus on the future

From Professor Zhang Zijie's research group, it is clear new vaccine research development and preparation technology not only promotes the progress of vaccine science, but also provides new strategies to prevent and control of infectious disease. There is reason to believe that with the introduction and application of high-performance equipment such as the Agilent NovoCyte Opteon spectral flow cytometer, work of the group will become more efficient and accurate.

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