Quanterix®

Fact Sheet

Simoa® IFN-α, Multi-Subtype

What is IFN-α?

Interferon alpha (IFN-α) is a 21.5 kDa cytokine belonging to the type I interferon family, crucial for innate immunity and antiviral defense mechanisms. There are multiple subtypes of IFN-α, each encoded by a distinct gene. In humans, the IFN-α family consists of at least 13 subtypes, including IFN-α1, IFN-α2, IFN-α4, IFN-α5, IFN-α6, IFN-α7, IFN-α8, IFN-α10, IFN-α14, IFN-α16, IFN-α17, and IFN-α21 (more variants have been reported). Typically produced by leukocytes, IFN-α plays an important role in modulating the body's response against viral infections and tumor cells.

Upon secretion, IFN-α binds to the IFN-α/β, initiating a cascade of signaling events that lead to the expression of interferon-stimulated genes (ISGs). These ISGs encode proteins that inhibit viral replication, enhance the immune system's ability to detect infected cells, and activate immune cells like natural killer cells and macrophages. Physiologically, IFN-α is vital in the innate immune response, providing an early defense mechanism against viral infections.

Given its immunomodulator properties, IFN-α has been utilized in therapeutic applications for viral infections such as hepatitis C, as well as certain cancers like leukemia and melanoma. However, the role of IFN-α in pathophysiology is complex. While it helps control viral infections and demonstrates antiproliferative and antiangiogenic properties, dysregulated IFNα signaling has been implicated in various autoimmune disorders, including systemic lupus erythematosus (SLE) and type I diabetes mellitus, where overexpression of IFN-α contributes to aberrant immune activation and tissue damage.

The quantification and monitoring of IFN-α levels hold significant clinical relevance, particularly in the context of infectious diseases, autoimmune disorders, and certain cancers. Monitoring the levels of IFN-α and its subtypes can help assess the severity of the disease and the effectiveness of the treatment during drug development. IFN-α often exerts its biological effects at very low concentrations in serum and plasma, underscoring the importance of ultra-sensitive detection for tracking viral infections, autoimmune diseases, immunotherapies, and a range of malignancies.

How to Measure IFN-α?

The Simoa® IFN-α, Multi-Subtype assay is an ultra-sensitive digital immunoassay for the quantitative determination of IFN-α in human EDTA plasma and serum. It measures the IFN-α different subtypes IFN-α1, IFN-α1 (Val114), IFN-α2a, IFN-α2b, IFN-α2c, IFN-α4a, IFN-α4b, IFN-α5, IFN-α6, IFN-α7, IFN-α8, IFN-α10, IFN-α14, IFN-α16, IFN-α17, and IFN-α21 in a single sample.

What is the Simoa® Difference?

Simoa® is a powerful digital immunoassay technology that is up to 1000 times more sensitive than standard sandwich-based immunoassay techniques. Traditional ELISA measurements are limited to pg/ml levels of detection. Quanterix Simoa® can achieve sensitivity as low as femtogram (fg/ml) levels, delivering the gold standard for early, ultra-sensitive detection and quantification of proteins far below the typical lower limit of quantification (LLOQ).

Simoa® is based upon the isolation of individual immunocomplexes on paramagnetic beads using standard ELISA reagents. The main difference between Simoa® and conventional immunoassays lies in the ability to trap single molecules in femtoliter-sized wells, allowing for a "digital" readout of each individual bead to determine if it is bound to the target analyte or not.

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What is the Simoa® Difference? continued

Cancers and neurological, autoimmune, and inflammatory disorders continue to be challenging to diagnose early and treat. Unlike 'visible' illnesses, the subtle progression of these conditions can be overlooked or mistaken for other ailments. Additionally, no definitive tests exist for early detection of many of these disorders, and clinicians can only conclusively diagnose them once symptoms start to present. As a result, many patients may wait years for a diagnosis or a clear treatment pathway.

IFN-α has garnered increasing attention in recent years as a promising biomarker, particularly within the context of monitoring the biological response of viral infections, autoimmune disorders, cancers, and immunotherapies. Thousands of studies have validated the use of Simoa® immunoassays to detect and measure biomarkers that hold promise as tools for early detection, prognosis, and monitoring treatment for a range of neurodegenerative conditions. Simoa® technology enables the precise detection and quantification of IFN-α levels, as well as of its subtypes which may serve as valuable tools to evaluate pathophysiological mechanisms, disease progression and therapeutic interventions.