Quanterix®

Fact Sheet

Simoa® Glial Fibrillary Acidic Protein (GFAP)

What is GFAP?

Glial Fibrillary Acidic Protein (GFAP) is a 55 kDa intermediate filament protein predominantly expressed in astrocytes, a type of glial cell in the central nervous system. GFAP plays a crucial role in providing structural support and maintaining the integrity of astrocytes, contributing significantly to the formation of the astrocytic cytoskeleton. It interacts with other cytoskeletal proteins to form a network that supports the structural framework of astrocytes and regulates their morphology.

Under normal physiological conditions, GFAP is primarily localized within the cytoplasm of astrocytes, where it contributes to various cellular functions, including cell motility, shape maintenance, and response to mechanical stress. Additionally, GFAP is involved in regulating the homeostasis of ions and neurotransmitters in the extracellular environment, thus influencing neuronal function and synaptic transmission.

In pathological conditions, such as brain injury, neuroinflammation, or neurodegenerative diseases, the expression and distribution of GFAP are altered. Astrocytes respond to these environments by upregulating GFAP expression, leading to astrocyte hypertrophy and the formation of reactive astrocytes, a hallmark of gliosis. Elevated levels of GFAP are often observed in the cerebrospinal fluid (CSF) and blood following brain injury, making GFAP a potential biomarker for assessing the severity of neurological damage and monitoring disease progression.

Furthermore, GFAP has been implicated in various neurological disorders, including traumatic brain injury (TBI), stroke, Alzheimer's disease (AD), multiple sclerosis (MS), and gliomas. The detection and quantification of GFAP levels hold promise for improving diagnostic accuracy, prognostic evaluation, and therapeutic monitoring in these conditions, highlighting the clinical significance of GFAP as a biomarker in neurology and neuroscience research.

How to Measure GFAP?

The Simoa® GFAP assay is an ultra-sensitive digital immunoassay for the quantitative determination of GFAP human EDTA plasma and CSF. Additionally, the Simoa® neurology assay family offers several multi-marker assay options that provide measurement of GFAP in various combinations with other key neurology biomarkers, such as neurofilament light chain (NfL), Aβ40, Aβ42, total Tau, and brain-derived Tau (BD-Tau), enabling broader insights in a single assay workflow.

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)

Neurological disorders continue to be among the most challenging to diagnose early and treat. Unlike 'visible' illnesses, neuronal injury and neurodegeneration can be overlooked or mistaken for other conditions. The subtlety of symptoms and the subjective nature of today's assessments also make it difficult to identify these diseases early. Currently, no definitive tests exist for the early detection of neurodegenerative diseases such as MS. 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.

GFAP has been established as a biomarker of brain injury with the potential to aid in improving early diagnosis and patient care for neuroinflammation and neurodegeneration. 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.

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