



Cytokine Biomarker Analysis with Simoa® for Neurology Research

Our understanding of neuroinflammation and its role in central nervous system (CNS) diseases has significantly advanced. Neuroinflammation is pivotal in both the acute response and long-term recovery from acquired brain injuries like traumatic brain injury (TBI) and stroke, and in the pathology of diseases such as multiple sclerosis (MS). It's also increasingly recognized as a key factor in neurodegenerative diseases like Alzheimer's (AD) and Parkinson's (PD), as well as neuropsychiatric conditions such as depression.

Cytokines, critical proteins involved in cell signaling during inflammation, are emerging as important biomarkers in understanding, diagnosing, and tracking the progression of neurological disorders. Research has consistently demonstrated altered cytokine levels in these diseases, highlighting their diagnostic potential.

This brief showcases a sampling of studies utilizing Simoa® digital immunoassay technology for ultra-sensitive cytokine measurement in neurology research. These studies often combine cytokine analysis with other key biomarkers like neurofilament light chain (NfL), glial fibrillary acidic protein (GFAP), Tau, phosphorylated Tau, and amyloid beta (Aβ).

Quanterix is now offering a new line of cytokine assays developed with our innovative Advantage PLUS Assay platform, including the three cytokine 4-plex Advantage PLUS assays covering a total of 11 essential cytokine biomarkers. With full automation on the HD-X Analyzer, these advanced cytokine assays deliver ultra-sensitivity with workflow efficiency, enhanced reproducibility, and lot-to-lot consistency, offering a seamless solution with scalability and consistency for both research and clinical studies.

Acquired Brain Injury		
Disease	Target(s)	Publication
Brain Hypoxia	Cytokine 3-Plex A (IL-6, IL-10, and TNF-α)	Hoiland RL, Ainslie PN, Wellington CL, et al. Brain Hypoxia Is Associated With Neuroglial Injury in Humans Post-Cardiac Arrest. <i>Circ Res.</i> 2021;129(5):583-597. doi:10.1161/CIRCRESAHA.121.319157
Blast	Cytokine 3-Plex A (IL-6, IL-10, and TNF-α), AB42, NfL, total tau	Stone JR, Avants BB, Tustison NJ, et al. Functional and Structural Neuroimaging Correlates of Repetitive Low-Level Blast Exposure in Career Breachers. <i>J Neurotrauma.</i> 2020;37(23):2468-2481. doi:10.1089/neu.2020.7141
Concussion, TBI	Cytokine 3-Plex A (IL-6, IL-10, and TNF-α)	Edwards KA, Gill JM, Pattinson CL, et al. Interleukin-6 is associated with acute concussion in military combat personnel. <i>BMC Neurol.</i> 2020;20(1):209. Published 2020 May 25. doi:10.1186/s12883-020-01760-x



Acquired Brain Injury continued		
Disease	Target(s)	Publication
Traumatic Brain Injury	IL-1 β	O'Brien WT, Pham L, Symons GF, Monif M, Shultz SR, McDonald SJ. The NLRP3 inflammasome in traumatic brain injury: potential as a biomarker and therapeutic target. <i>J Neuroinflammation</i> . 2020;17(1):104. Published 2020 Apr 6. doi:10.1186/s12974-020-01778-5
Traumatic Brain Injury	GFAP, NfL, IL-1 β , IL-6	Boucher ML, Conley G, Nowlin J, et al. Titrating the Translational Relevance of a Low-Level Repetitive Head Impact Model. <i>Front Neurol</i> . 2022;13:857654. Published 2022 Jun 16. doi:10.3389/fneur.2022.857654
Inflammatory CNS Disorder		
Multiple sclerosis	IL-10, IL-12p70, IFN γ , TNF- α , IL-6, IL-17, GM-CSF, NfL	Ruck T, Barman S, Schulte-Mecklenbeck A, et al. Alemtuzumab-induced immune phenotype and repertoire changes: implications for secondary autoimmunity. <i>Brain</i> . 2022;145(5):1711-1725. doi:10.1093/brain/awac064
Multiple sclerosis	IL-10	Kalluri HV, Rosebraugh MR, Misko TP, Ziemann A, Liu W, Cree BAC. Phase 1 Evaluation of Elezanumab (Anti-Repulsive Guidance Molecule A Monoclonal Antibody) in Healthy and Multiple Sclerosis Participants. <i>Ann Neurol</i> . 2023;93(2):285-296. doi:10.1002/ana.26503
Multiple sclerosis	Cytokine 3-plex B (IL-6, IL-17A, TNF- α), GM-CSF, IL-10, IFN γ , IL-1b, CXCL13	Fissolo N, Pappolla A, Rio J, et al. Serum Levels of CXCL13 Are Associated With Teriflunomide Response in Patients With Multiple Sclerosis. <i>Neurol Neuroimmunol Neuroinflamm</i> . 2022;10(1):e200050. Published 2022 Nov 21. doi:10.1212/NXI.0000000000200050
Neurdegenerative Disease		
Disease	Target(s)	Reference
Alzheimer's disease	AB40, AB42, pTau181, tau, NfL, TNF- α , IL-1b, IL-6, IL-8	Sun Q, Ni J, Wei M, et al. Plasma β -amyloid, tau, neurodegeneration biomarkers and inflammatory factors of probable Alzheimer's disease dementia in Chinese individuals. <i>Front Aging Neurosci</i> . 2022;14:963845. Published 2022 Aug 18. doi:10.3389/fnagi.2022.963845



Neurdegenerative Disease continued		
Disease	Target(s)	Reference
Alzheimer's disease	Neuro 3-plex A kit (Abeta 40, Abeta 42, tau), NfL, ptau181, TNF- α , IL6, IL8, IL10, and GFAP	Foley KE, Winder Z, Sudduth TL, et al. Alzheimer's disease and inflammatory biomarkers positively correlate in plasma in the UK-ADRC cohort. <i>Alzheimers Dement.</i> 2024;20(2):1374-1386. doi:10.1002/alz.13485
Parkinson's disease, PTSD	Cytokine 3-Plex A (IL-6, IL-10, and TNF- α), IFN- γ , IL-1 β	Lasseter HC, Provost AC, Chaby LE, Daskalakis NP, Haas M, Jeromin A. Cross-platform comparison of highly sensitive immunoassay technologies for cytokine markers: Platform performance in post-traumatic stress disorder and Parkinson's disease. <i>Cytokine X.</i> 2020;2(2):100027. Published 2020 Apr 28. doi:10.1016/j.cyttox.2020.100027
Neuropsychiatric Disorder		
Neuropsychiatric disorders	IL-6, IL-10, IL-1 β , TNF- α , and TGF- β	Triana-Baltzer G, Timmers M, De Boer P, et al. Profiling classical neuropsychiatric biomarkers across biological fluids and following continuous lumbar puncture: A guide to sample type and time. <i>Compr Psychoneuroendocrinol.</i> 2022;10:100116. Published 2022 Jan 15. doi:10.1016/j.cpnec.2022.100116
PTSD	IL-6, IL-10, NfL, TNF- α	Hawn SE, Neale Z, Wolf EJ, et al. Methylation of the AIM2 gene: An epigenetic mediator of PTSD-related inflammation and neuropathology plasma biomarkers. <i>Depress Anxiety.</i> 2022;39(4):323-333. doi:10.1002/da.23247
Depression	Cytokine 3-plex B (IL-6, IL-17A, TNF- α)	Loef D, Vansteelandt K, Oudega ML, et al. The ratio and interaction between neurotrophin and immune signaling during electroconvulsive therapy in late-life depression. <i>Brain Behav Immun Health.</i> 2021;18:100389. Published 2021 Nov 16. doi:10.1016/j.bbih.2021.100389