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Neuroinflammation

Neuroinflammation

Neuroinflammation, defined as an inflammatory reaction within nervous tissue, arises as a mechanism to protect the brain and spinal cord against potential harm from a variety of toxic stimuli including protein aggregates, neuronal injury, and infection. In recent years, research has shown that a sustained inflammatory response can contribute to the development and progression of many neurodegenerative diseases and neurological disorders. Bio-Techne offers an unparalleled selection of high-quality solutions for investigating all aspects of neuroinflammation.



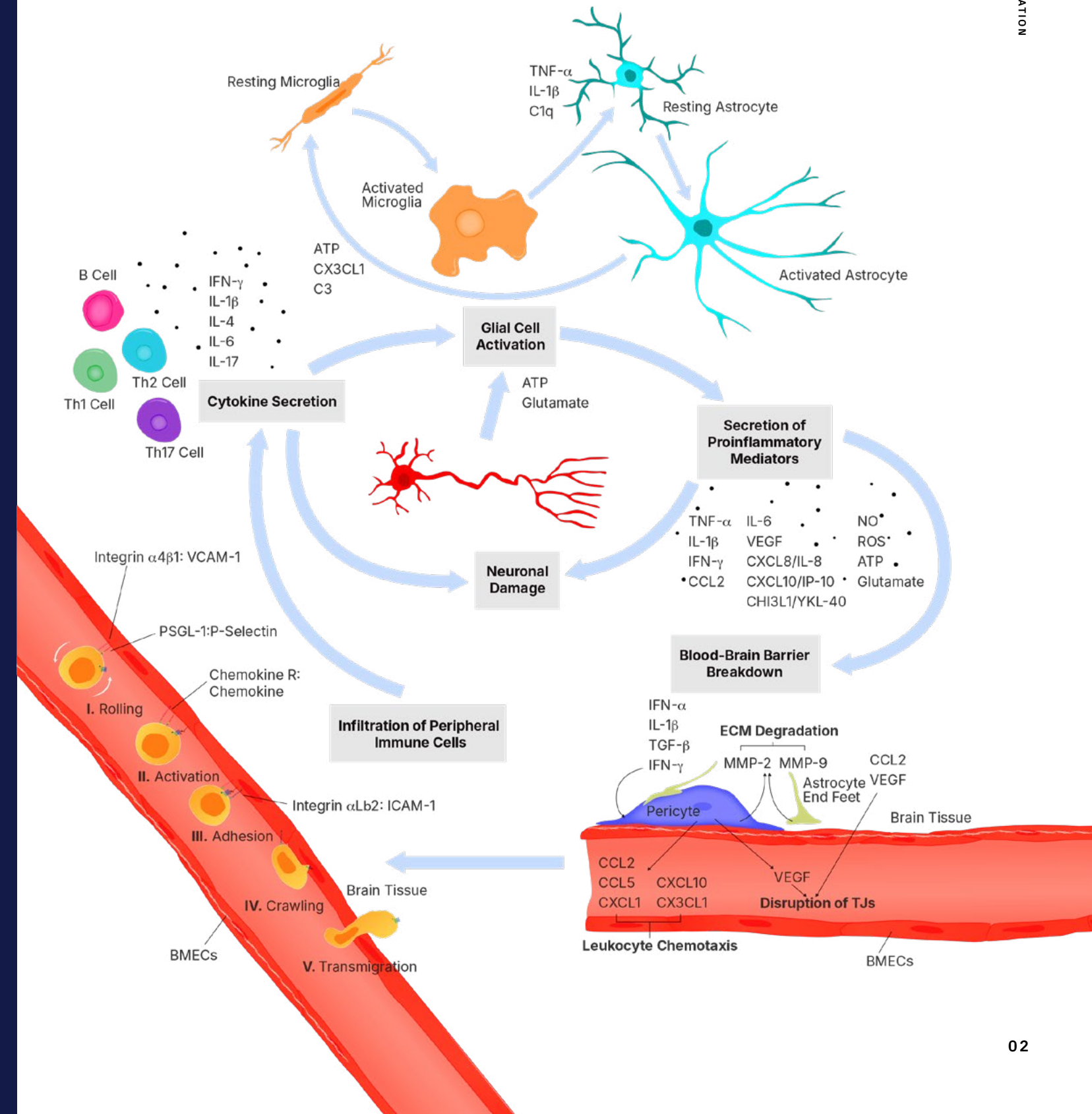
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The Neuro-inflammation Cycle

Neuroinflammation is a complex response that involves activation of glial cells, secretion of inflammatory mediators, and production of reactive oxygen species (ROS) and nitric oxide (NO). It is a highly controlled process that tends to be quickly resolved. However, continued exposure to a harmful stimulus can lead to chronic neuroinflammation, which is characterized by the persistent activation of glial cells, sustained release of inflammatory mediators, breakdown of the blood-brain barrier (BBB), and increased migration of peripheral immune cells into the central nervous system (CNS). These events establish a feedback loop that perpetuates and prolongs neuroinflammation, leading to neurodegeneration.



Glial Cells in Neuroinflammation

In the CNS, glial cells comprise about 70% of the total cell population. These cells, which consist of microglia, astrocytes, oligodendrocytes, and perivascular glia, carry out a wide range of functions to support and protect neurons, and regulate the neuronal microenvironment.

Recently, research has shown that microglia and astrocytes play key roles in the neuropathology of many neurodegenerative diseases and neurological disorders, in part, via the activation and propagation of neuroinflammation. Microglia are the principal resident immune cells in the brain. In response to harmful stimuli, they initiate an inflammatory response to clear the damaging agents and maintain brain homeostasis. Astrocytes, the most abundant glial cells in the CNS, are also activated in response to a variety of CNS insults. Reactive astrocytes initiate a range of beneficial responses including removing cellular debris, repairing the BBB, and enclosing the necrotic lesion. Both activated microglia and astrocytes can adopt either a neurotoxic (M1 or A1, respectively) or neuroprotective (M2 or A2, respectively) phenotype that display different markers and secrete different compounds.

→ Detecting and Identifying Glial Cells

Neuroinflammation is commonly assessed by monitoring microglial activation and astrocytic responses via immunohistochemistry/immunocytochemistry. Our offering of 155,000 antibodies from the R&D Systems and Novus Biologicals brands includes many monoclonal and polyclonal antibodies to markers of steady-state and activated microglia and astrocytes. The quality and performance of our antibodies are unmatched, and we stand by our antibody reproducibility by offering a 100% guarantee on their performance for their validated applications and species.

Steady-State Microglia Markers

Marker	Catalog #	Species	Clone	Applications
◆	NB100-1028	H M R +	Poly	WB, ICC, IHC, PEP-ELISA
◆ AIF-1/Iba1	NBP2-75755*	H	rAIF1/1909	IHC
◆	MAB7308	H	603102	IHC
◆	NB110-89474	H M R +	Poly	WB, ICC, IHC, FC, SCW, SW
◆ CD11b/Integrin αM	MAB16991	H +	238446	ICC, IHC, CyTOF, FC
◆	MAB1430	H	2D1	ICC, IHC, CyTOF, FC
◆ CD45 ^{low}	NB100-77417	H M	30-F11	WB, ICC, IHC, CyTOF, FC, IP
◆	NBP1-76949	H M R	Poly	ICC, IHC, ELISA, FC
◆ F4/80/EMR1	NB600-404	H M	CI-A3-1	WB, ICC, IHC, EM, FC, IP, RI
◆ P2Y12/P2RY12	NBP1-78249	H R +	Poly	WB, ICC, IHC, DB, ELISA, IP
◆ TMEM119	NBP2-30551	H R +	Poly	ICC, IHC

M1 Microglia Markers

Marker	Catalog #	Species	Clone	Applications
◆	NBP2-67417*	H R +	SJ20-00	WB, ICC, IHC, FC
◆ B7-2/CD86	AF-141-NA	H	Poly	WB, IHC, B/N
◆	MAB741	M	GL1	WB, B/N, CyTOF, FC
◆	MAB1430	H	2D1	ICC, IHC, CyTOF, FC
◆	NB100-77417	H M	30-F11	WB, ICC, IHC, CyTOF, FC, IP
◆	NB100-683	H M R	KP1	WB, ICC, IHC, FC, IP
◆ CD68/SR-D1	MAB101141*	M	2449D	IHC, CyTOF, FC
◆	AF1330	H	Poly	WB, ICC, B/N, CyTOF, FC
◆	NBP2-42228	H M R	5B11	ICC, IHC, ELISA, FC, IP
◆	AF1460	M	Poly	WB, ICC
◆	NBP2-34848	H +	CVS20	IHC, FC, IP
◆	NBP1-43312	H M	M5/114.15.2	WB, IHC, FC, IP
◆	NB300-605	H M R	Poly	WB, ICC, IHC
◆ iNOS	MAB9502	H M R	2D2-B2	WB, IHC, SW

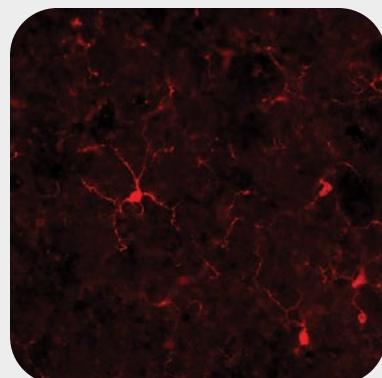
M2 Microglia Markers

Marker	Catalog #	Species	Clone	Applications
◆	NBP1-32731	H M R +	Poly	WB, ICC, IHC, FC, IP
◆	NBP1-30148*	H	K20-T	ICC/IF, IHC
◆	NBP2-29355	M	Poly	WB, ICC, IHC, FC
◆	MAB1523	M	226033	WB, ICC
◆	NBP1-90020	H M +	Poly	WB, ICC, IHC
◆	AF2535	M	Poly	WB, IHC, CyTOF, FC
◆	NBP1-07101	H	2B5	WB, ICC, IHC, ELISA, FC, SW
◆	AF1828	H	Poly	WB, ICC, CyTOF, ELISA, FC
◆	AF2446	M	Poly	WB, SW

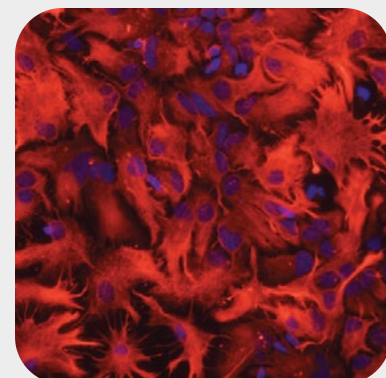
Astrocyte Markers

Marker	Catalog #	Species	Clone	Applications
◆	NBP2-50045	H M R	4A12	WB, ICC, IHC
◆	NBP1-87679	H M R	Poly	WB, ICC, IHC
◆	NB100-81867	H M R	Poly	WB, IHC
◆	NBP1-20136	H M R	Poly	WB, ICC, IHC, FC, IV
◆	NB300-141	H M R +	Poly	WB, ICC, IHC, SW
◆	AF2594	H R	Poly	WB, ICC, SW
◆	NBP2-67572*	H M R +	SC57-02	WB, ICC, IHC, IP
◆	AF1820	H	Poly	WB, IHC, SW

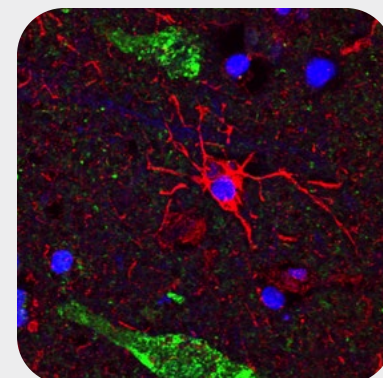
Species Key: (H) Human, (M) Mouse, (R) Rat, (Ms) Multispecies, + Additional Species Available
Applications Key: (B/N) Blocking/Neutralization, (CyTOF) CyTOF-Ready, (DB) Dot Blot, (ELISA) ELISA Capture and/or Detection, (EM) Electron Microscopy, (FC) Flow Cytometry, (ICC) Immunocytochemistry, (IHC) Immunohistochemistry, (IP) Immunoprecipitation, (IV) In Vivo, (PEP-ELISA) Peptide ELISA, (RI) Radioimmunoassay, (SCW) Single-Cell Western, (SW) Simple Western™, (WB) Western Blot
 ◆ Indicates a R&D Systems brand antibody ◆ Indicates a Novus Biologicals brand antibody *Indicates a recombinant monoclonal antibody



AIF-1/Iba1 in Mouse Spinal Cord.
AIF-1/Iba1 was detected in perfusion-fixed sections of mouse spinal cord using a Goat Anti-Human/Mouse/Rat Anti-AIF-1/Iba1 Polyclonal Antibody (Novus Biologicals, Catalog # NB100-1028). The tissue was stained using an Alexa Fluor® 555-conjugated donkey anti-goat IgG secondary antibody (red).



GFAP in Rat Astrocytes.
Glial Fibrillary Acidic Protein (GFAP) was detected in immersion-fixed rat astrocytes using a Sheep Anti-Human GFAP Antigen Affinity-Purified Polyclonal Antibody (Catalog # AF2594). The cells were stained using the NorthernLights™ (NL) 557-conjugated Donkey Anti-Sheep IgG Secondary Antibody (Catalog # NL010; red) and counterstained with DAPI (blue). Specific staining was localized to cytoplasm. All cited reagents are from Bio-Techne's R&D Systems brand.



CD11b/Integrin αM in Human Brain.
CD11b/Integrin αM was detected in immersion-fixed paraffin-embedded tissue sections of human brain (cerebral cortex) using a Mouse Anti-Human/Equine CD11b/Integrin αM Monoclonal Antibody (Catalog # MAB16991). The tissue was subjected to antigen retrieval and stained using the NL557-conjugated Donkey Anti-Mouse IgG Secondary Antibody (Catalog # NL007; red). Nuclei were counterstained with DAPI (blue). Specific staining was localized to the cytoplasm of microglia. The tissue was co-stained using a Sheep Anti-Human/Mouse/Rat Neurogranin Antigen Affinity-Purified Polyclonal Antibody (Catalog # AF7947) and an Alexa Fluor 488-conjugated donkey anti-sheep IgG secondary antibody (green). All cited reagents are from Bio-Techne's R&D Systems brand.



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R&D Systems Recombinant Proteins

Molecule	Catalog #	Species	Source
Classical Microglia Activation (M1 Phenotype)			
CX3CL1/ Fractalkine	365-FR	H	NSO
	472-FF	M	Sf21
GM-CSF	536-FR	R	Sf21
	7954-GM	H	CHO
	415-ML	M	E. coli
HMG1	518-GM	R	E. coli
	1690-HMB	H	NSO
HSP70/HSPA1A	AP-100	H	E. coli
	285-IF	H	E. coli
IFN-γ	485-MI	M	E. coli
	585-IF	R	E. coli
IL-1β/IL-1F2	201-LB	H	E. coli
	401-ML	M	E. coli
IL-6	501-RL	R	E. coli
	206-IL	H	E. coli
α-Synuclein	406-ML	M	E. coli
	506-RL	R	E. coli
TNF-α	SP-485	H	E. coli
	210-TA	H	E. coli
TNF-α	410-MT	M	E. coli
	510-RT	R	E. coli
Alternative Microglia Activation (M2 Phenotype)			
IL-4	BT-004	H	E. coli
	404-ML	M	E. coli
IL-13	504-RL	R	E. coli
	213-ILB	H	E. coli
IL-13	413-ML	M	E. coli
	1945-RL	R	E. coli

Molecule	Catalog #	Species	Source
Classical Astrocyte Activation (A1 Phenotype)			
IL-1α/IL-1F1	200-LA	H	E. coli
	400-ML	M	E. coli
	500-RL	R	E. coli
TNF-α	210-TA	H	E. coli
	410-MT	M	E. coli
	510-RT	R	E. coli
Lipocalin-2/ NGAL	1757-LC	H	NSO
	1857-LC	M	NSO
	3508-LC	R	NSO
Alternative Astrocyte Activation (A2 Phenotype)			
EphB1	1596-B1	R	NSO
IL-4	BT-004	H	E. coli
	404-ML	M	E. coli
IL-10	504-RL	R	E. coli
	217-IL	H	Sf21
IL-10	417-ML	M	E. coli
	522-RLB	R	E. coli
Inhibition of Astrocyte Activation			
FGF basic/FGF2 (146 aa)	BT-FGFB	H	E. coli
FGF basic/FGF2	3139-FB	M	E. coli
	3339-FB	R	E. coli

Species Key: (H) Human, (M) Mouse, (R) Rat

→ **Modulating Glial Cell Activation**

Fully understanding the initiation and propagation of neuroinflammation requires unraveling the complex mechanism underlying glial cell activation. Though LPS is commonly used to activate glial cells, they can be activated by multiple factors. Additionally, the phenotype of activated glia will differ depending on the activating stimulus. R&D Systems™ biologically active recombinant and natural proteins can be used to activate glial cells *in vitro*, while Tocris™ highly pure small molecules can be used to modulate glial cell proliferation and activation both *in vitro* and *in vivo*.

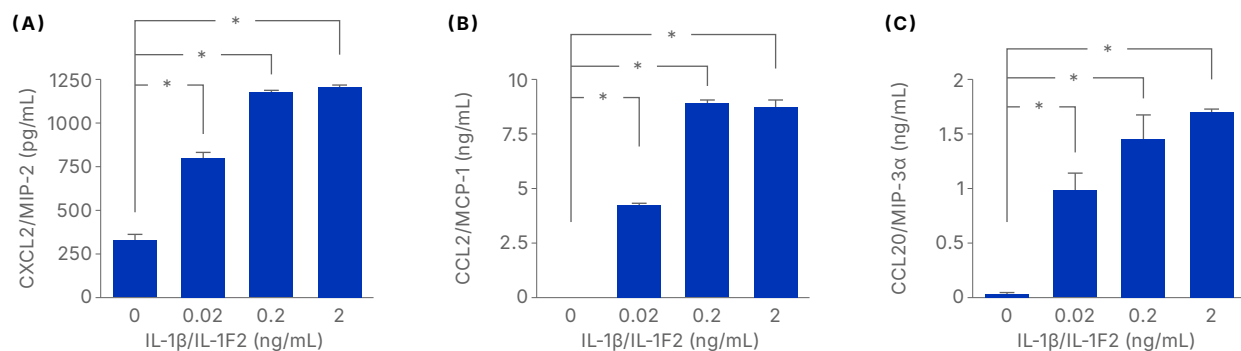


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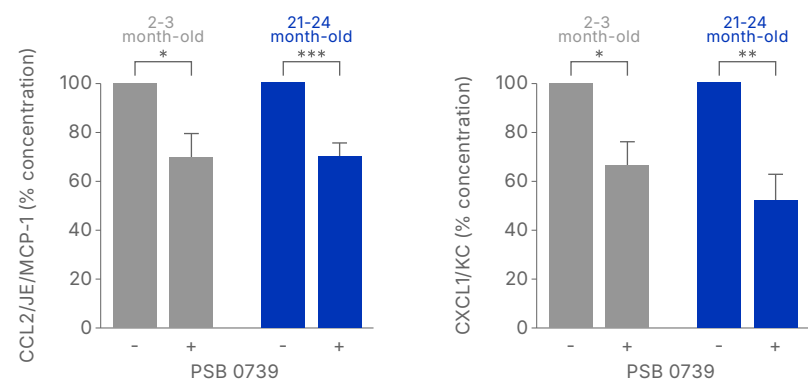
Tocris™ Small Molecules

Catalog #	Name	Target	Description
5425	TGN 020	Aquaporin 4	Aquaporin 4 channel blocker; increases regional cerebral blood flow after ischemia in mice
6370	Nor NOHA	Arginase 1	Arginase inhibitor
6227	TAT-Gap19	Connexin43	Connexin43 hemichannel blocker; brain penetrant and active <i>in vivo</i>
5870	Cilengitide	Integrins αvβ3 and αvβ5	Potent and selective inhibitor of Integrins αvβ3 and αvβ5
3983	PSB 0739	Purinergic P2Y ₁₂ Receptor	Highly potent P2Y ₁₂ antagonist
4530	ONO 2506	S-100β	Inhibits S-100β synthesis; neuroprotective in mouse models of Alzheimer's and Parkinson's disease



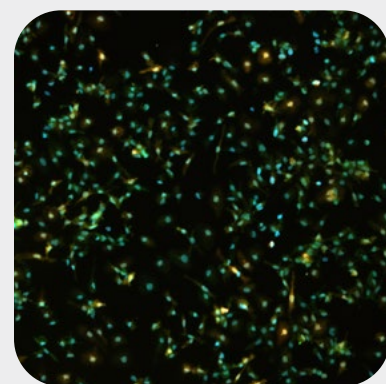
IL-β/IL-1F2 Induces Cytokine Secretion from Astrocytes.

Primary astrocyte cell cultures from C57BL/6J mice were treated with increasing concentrations of Recombinant Mouse IL-1β/IL-1F2 (R&D Systems, Catalog # 401-ML) for 24 hours or remained untreated. Conditioned media from the cultures were harvested and the levels of CXCL2/MIP-2 (A), CCL2/MCP-1 (B), and CCL20/MIP-3α (C) were analyzed by ELISA. **p*<0.05. Graph adapted from Wang, Y. et al. (2014) *PLoS One* 10:e110024.



Inhibiting Microglia P2Y12 Receptors Attenuates Chemokine Secretion.

Coronal brain slices from 2-3-month-old (gray bars; N=17) and 21-24-month-old (blue bars; N=16) C57BL/6 mice were treated with PSB 0739, a highly potent P2Y₁₂ Receptor antagonist (Tocris, Catalog # 3983), or remained untreated. Concentrations of CCL2/JE/MCP-1 (A) and CXCL1/KC (B) in the culture medium were measured using the Mouse CCL2/JE/MCP-1 Quantikine® ELISA Kit (R&D Systems, Catalog # MJE00) and the Mouse CXCL1/KC Quantikine ELISA Kit (R&D Systems, Catalog # MJE00B), respectively. Chemokine concentrations from treated slices were normalized to concentrations from untreated slices. **p*<0.05. ****p*<0.001. Graph adapted from Charolidi, N. et al. (2015) *PLoS One* 10:e0128463.



IL-1β/IL-1F2 in Rat M1 Microglia.

Isolated rat microglia were polarized to the M1 phenotype using Recombinant Rat IFN-γ (R&D Systems, Catalog # 585-IF) and Recombinant Rat TNF-α (R&D Systems, Catalog # 510-RT). IL-1 β/IL-1F2 was then detected in the immersion-fixed rat M1 microglia using a Goat Anti-Rat IL-1β/IL-1F2 Antigen Affinity-Purified Polyclonal Antibody (R&D Systems, Catalog # AF-501-NA). The cells were stained using the NL557-conjugated Donkey Anti-Goat IgG Secondary Antibody (R&D Systems, Catalog # NL001; red). Nuclei were counterstained with DAPI (blue). The cells were co-stained using a Rabbit Anti-Human/Mouse/Rat AIF-1/Iba1 Antigen Affinity-Purified Polyclonal Antibody (Novus Biologicals, Catalog # NBP2-16908) and the NL493-conjugated Donkey Anti-Rabbit IgG Secondary Antibody (R&D Systems, Catalog # NL006; green).

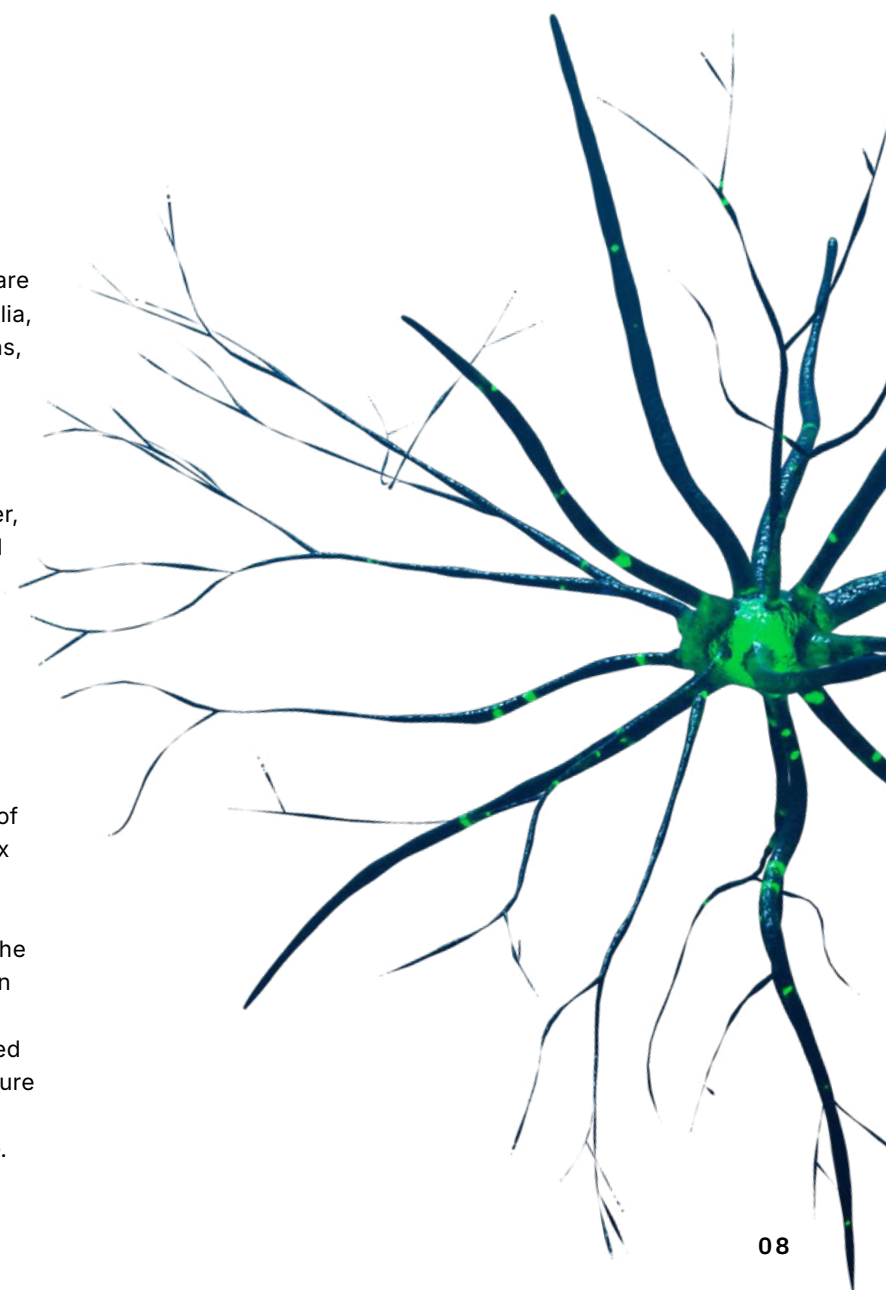
Cytokine Mediators of Neuroinflammation

Cytokines and chemokines are secreted signaling molecules that are essential for maintaining homeostasis of the immune system and regulating immune responses throughout the body.

Cytokines are a large group of structurally diverse molecular families that have many roles in immune system functioning. They are typically classified as having either pro- or anti-inflammatory actions. Chemokines are chemotactic cytokines that are involved in leukocyte trafficking, recruitment, and activation. In the CNS, cytokines and chemokines are secreted from multiple cell types, including microglia, astrocytes, microvascular endothelial cells, neurons, and peripheral immune cells, upon stimulation by pathogens, abnormal cells, or protein aggregates. The primary purpose of the initial inflammatory response is to remove the harmful stimulus, repair damaged tissue, and restore homeostasis. However, prolonged stimulation can lead to uncontrolled and continual release of inflammatory factors, which causes a chronic neuroinflammatory state.

→ **Detecting and Measuring Neuroinflammatory Factors**

Fully understanding the initiation and propagation of neuroinflammation requires unraveling the complex mechanism underlying glial cell activation. Though LPS is commonly used to activate glial cells, they can be activated by multiple factors. Additionally, the phenotype of activated glia will differ depending on the activating stimulus. R&D Systems™ biologically active recombinant and natural proteins can be used to activate glial cells *in vitro*, while Tocris™ highly pure small molecules can be used to modulate glial cell proliferation and activation both *in vitro* and *in vivo*.

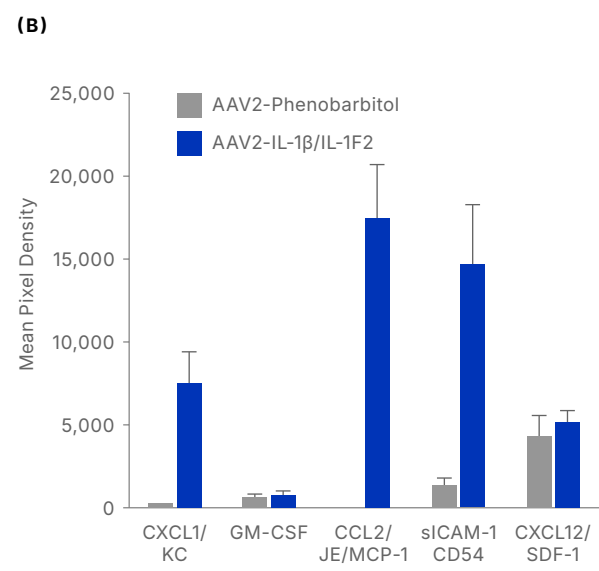
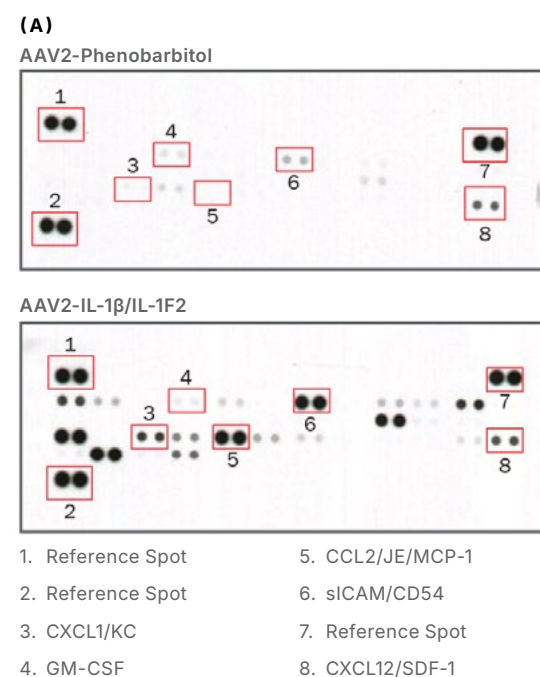


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Proteome Profiler™ Antibody Arrays

R&D Systems™ Proteome Profiler Antibody Arrays offer a quick and inexpensive analysis of many analytes simultaneously, in less time than it takes to perform a Western blot. Highly cited and rated 5 stars by our customers, these membrane-based arrays are ideal for detecting cytokines in neural tissue samples.

Select R&D Systems Proteome Profiler Arrays	Descriptions	Catalog #
Human Cytokine Antibody Array	Detects 36 different cytokines, chemokines, and acute phase proteins	ARY005B
Human XL Cytokine Antibody	Detects 105 different cytokines, chemokines, and acute phase proteins	ARY022B
Human Chemokine Antibody Array	Detects 31 different chemokines	ARY017
Mouse Cytokine Antibody Array	Detects 40 different cytokines, chemokines, and acute phase proteins	ARY006
Mouse XL Cytokine Antibody	Detects 111 different cytokines, chemokines, and acute phase proteins	ARY028
Mouse Chemokine Antibody Array	Detects 25 different chemokines	ARY020
Rat Cytokine Antibody Array	Detects 29 different cytokines and chemokines	ARY008
Rat XL Cytokine Antibody Array	Detects 79 different cytokines and chemokines	ARY030



Cytokine Expression Induced by IL-1β/IL-1F2 in Mouse Brain.

C57BL/6 mice received a bilateral intrahippocampal injection of adeno-associated virus (AAV2) vector expressing either a single chain antibody to phenobarbital (for a control) or IL-1β/IL-1F2. After 4 weeks, brains of the mice were collected, and cytokine expression in brain homogenates was analyzed using the Proteome Profiler Mouse Cytokine Antibody Array (R&D Systems, Catalog # ARY006). Representative arrays (A) and histogram profiles (B) for select analytes from control (gray bars) and IL-1β/IL-1F2 treated (blue bars) mice. Data were generated by analysis of the mean pixel density of individual antibody spots using image software analysis. Data courtesy of Dr. Jonathan Cherry, University of Rochester Medical Center, Rochester, NY.



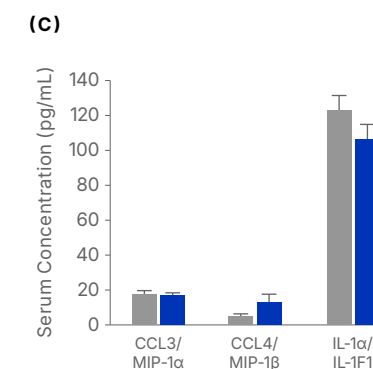
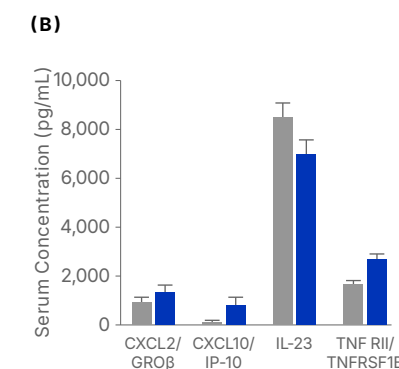
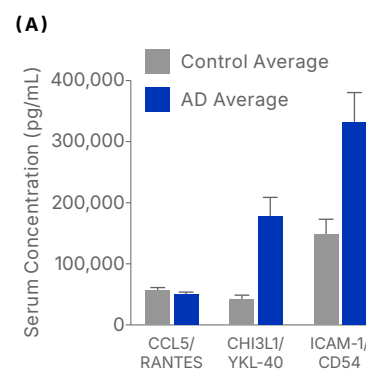
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Luminex® Assays

Bio-Techne offers two bead-based multiplex immunoassay formats utilizing Luminex xMAP® microparticle technology allowing users to better tailor assay selection to their individual research needs. Design the multiplexing assay you need for your preliminary investigations with our R&D Systems™ Luminex Assays, which are optimized to simultaneously analyze a wide variety and large number of analytes. Take Luminex assays to the next level by customizing one of our Luminex High Performance panels to get the most accurate and precise Luminex assays that deliver near single ELISA performance.

R&D Systems Luminex Assays	
Human Luminex Screening Assay	Choose from >340 analytes
Mouse Luminex Screen Assay	Choose from 110 analytes
Rat Luminex Screening Assay	Choose from 17 analytes
Select R&D Systems Luminex Assays - Preconfigured Panels	
Human Cytokine/Chemokine (Ordering Tool Reference # mT7JPjTJ)	Detects 37 different cytokines and chemokines
Human Cytokine/Chemokine 2 (Ordering Tool Reference # j7Mgc7hb)	Detects 21 different cytokines and chemokines
Human MMP Panel 1 (Ordering Tool Reference # hdHTPZeW)	Detects MMP-3, MMP-12, MMP-13
Human MMP Panel 2 (Ordering Tool Reference # Q8L7arGj)	Detects MMP-1, MMP-7, MMP-9, MMP-10
Human Soluble Cytokine Receptor (Ordering Tool Reference # Zjh6M6LC)	Detects 11 different soluble cytokine receptors
Select R&D Systems Luminex High Performance Assays	
Human Cytokine Panel A	Detects 22 different cytokines
Human Cytokine Panel B	Detects 9 different cytokines
Human High Sensitivity Cytokine Panel A	Detects 12 different cytokines
Human High Sensitivity Cytokine Panel B	Detects 17 different cytokines
Human XL Cytokine Discovery Panel	Detects 45 different cytokines
Human MMP Panel	Detects 10 different MMPs
Multispecies TGF-β Panel (Human, Mouse, Rat, Porcine)	Detects TGF-β1, TGF-β2, TGF-β3



Detection of Neuroinflammation and Alzheimer's Disease Biomarkers in Human Serum.

The Human Luminex Assay (Catalog # LXSAMH) was used to measure 32 markers of neuroinflammation and Alzheimer's disease (AD) pathology in human serum samples. Samples were collected from individuals with AD (Blue bars; N=20) and from apparently healthy individuals (gray bars; N=20); no medical histories were available. Histogram profiles for select analytes measured at high (A), moderate (B), and low (C) expression levels.

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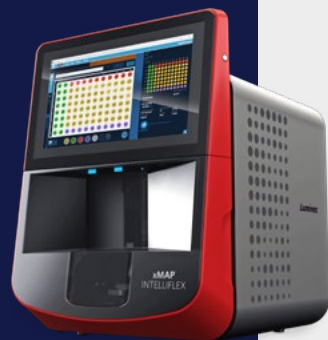
Luminex® Instrumentation

R&D Systems Luminex Assays are compatible with all Luminex instrumentation systems. These systems can be obtained from Bio-Techne's R&D Systems brand.



Luminex 200™

Flexible multiplexing instrument based upon the principles of flow cytometry. Multiplex up to 100 analytes per sample volume with a read time of only 45 minutes for a 96-well plate.



Luminex INTELLIFLEX Single Reporter

Designed for a 96- or 384-well high throughput format, the xMAP INTELLIFLEX system can save substantial time. With features such as a large dynamic range, integrated touchscreen PC, built-in barcode reader, and automated startup, shutdown, and maintenance, this instrument provides a simplified user experience.



Luminex FLEXMAP 3D®

Flexible multiplexing instrument based upon the principles of flow cytometry. Multiplex up to 100 analytes per sample volume with a read time of only 45 minutes for a 96-well plate.

Luminex® is a registered trademark of Luminex Corporation.

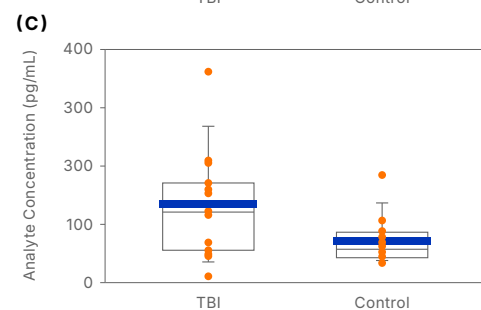
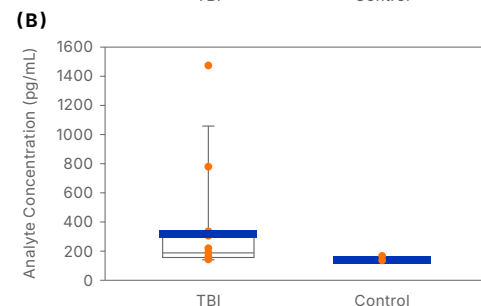
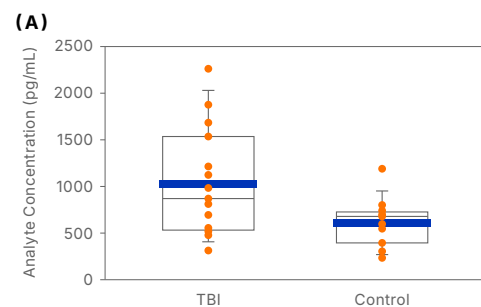


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Simple Plex™ Assays

Simple Plex assays are highly sensitive, reproducible immunoassays that will transform your research possibilities. Run on the Ella™ platform, these novel assays split samples across isolated microfluidic channels, allowing for the analysis of multiple analytes in very low sample volumes, but with no risk of antibody cross-reactivity. Simple Plex assays exhibit the same specificity of a singleplex ELISA, but with greater sensitivity and a broader dynamic range.



Detection of Neuroinflammation Biomarkers in Serum and Plasma of Humans Diagnosed with Traumatic Brain Injury (TBI) versus Healthy Controls.

Simple Plex assays (ProteinSimple) were used to measure 14 markers of neuroinflammation, including CCL2/MCP-1 (A), CXCL8/IL-8 (B), and CXCL10/IP-10 (C), in human serum and plasma samples. Samples were collected from individuals diagnosed with varying symptoms of TBI (N=15) and from apparently healthy individuals (N=15); no medical histories were available.



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Select Human Simple Plex Assays

Axl	IL-7
BAFF/BLyS/TNFSF13	IL-10
BDNF (Free)	IL-12-p70
E-Cadherin	IL-13
Caspase-1	IL-15
CCL2/MCP-1	IL-17/IL-17A
CCL3/MIP-1α	IL-18
CCL4/MIP-1β	IL-18 BPa
CCL5/RANTES	IL-33
CCL7/MCP-3/MARC	IL-34
CCL16/HCC-4	Leptin
CCL17/TARC	Lipocalin-2/NGAL
CD14	M-CSF
CD25/IL-2 Rα	MIF
CD40/TNFRSF5	MMP-1
CHI3L1/YKL-40	MMP-2
	MMP-7
C-Reactive Protein/CRP	MMP-8
CX3CL1/Fractalkine	MMP-9
CXCL5/ENA-78	Myeloperoxidase/MPO
	NF-H
CXCL8/IL-8	NF-L
	β-NGF
CXCL9/MIG	β-NGF
CXCL10/IP-10	NGFR/TNFRSF16
CXCL12/SDF-1α	Osteopontin/OPN
CXCL13/ BLC/BCA-1	PDGF-BB
Endothelin-1	Prolactin
Erythropoietin	RAGE
Galectin-3	E-Selectin
GFAP	ST2/IL-33 R
GM-CSF	TGF-β1
ICAM-1/CD54	TNF-α
IFN-β	TNF R1/TNFRSF1A
IFN-γ	TNF RII/TNFRSF1B
IFN-γ (2nd generation)	TRAIL/TNFSF10
IFN-γ (3rd generation)	TRAIL/TNFSF10
IL-1α/IL-1F1	TREM-2
IL-1β/IL-1F2	VCAM-1/CD106
IL-1ra/IL-1F3	VEGF
IL-2	VEGF-B
IL-4	VEGF-C
IL-5	VEGFR1/Flt-1
IL-6	VEGFR2/KDR/Flk-1
IL-6Rα	

Select Mouse Simple Plex Assays

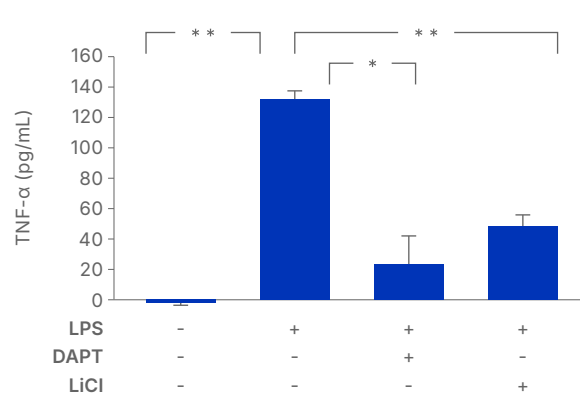
CCL2/MCP-1/JE	IFN-γ
CXCL2/MIP-2	IL-6
CXCL10/IP-10	TGF-β1
CXCL12/SDF-1α	TNF-α

Select Rat Simple Plex Assays

CCL2/MCP-1/JE	TGF-β1
Osteopontin/OPN	

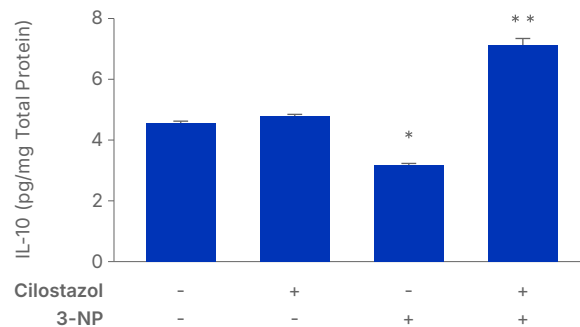
Quantikine™ and Parameter™ ELISA Kits

R&D Systems™ Quantikine and Parameter ELISA Kits are complete, fully validated, ready-to-run sandwich ELISAs that are designed to measure the concentrations of a range of analytes and small molecules, respectively. These kits can be used to measure molecules in multiple complex tissue types including cerebrospinal fluid and brain homogenates. In-house manufacturing and extensive validation testing ensure these kits provide the highest levels of specificity, accuracy, precision, and sensitivity, making them the industry gold standard.



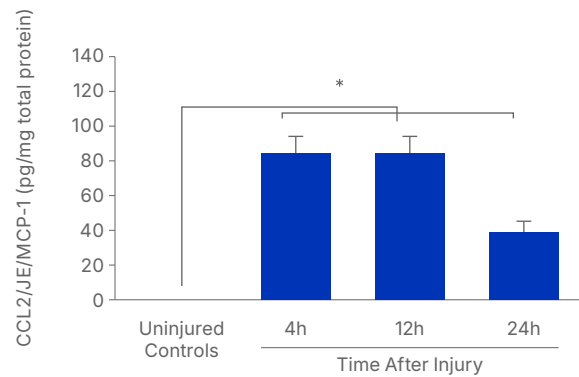
LPS-Induced Secretion of TNF-α by Microglia is Mediated in Part by Notch-1 and GSK-3β.

The BV-2 murine microglia cell line was treated with lipopolysaccharide (LPS) for 4 hours or remained untreated. Prior to LPS exposure, some of the cells were treated with either 20 μM of DAPT, a γ-secretase inhibitor, for 3 hours or 20 mM lithium chloride (LiCl), a GSK-3β inhibitor, for 30 minutes. The levels of TNF-α in cell culture supernatants were measured using the Mouse TNF-α Quantikine ELISA Kit (R&D Systems, Catalog # MTA00B). **p*<0.05. ***p*<0.01. Graph adapted from Cao, Q. et al. (2017) *PLoS One* 12:e0186764.



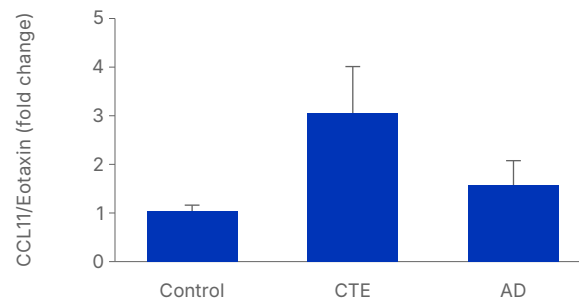
Cilostazol Inhibits 3-Nitropropionic Acid (3-NP)-Induced Attenuation of IL-10 Secretion.

Adult male Wistar rats were injected (i.p.) for 14 days with 3-NP (10/mg/kg/day), an inhibitor of the mitochondrial citric acid cycle used to induce progressive locomotor deterioration similar to what is seen in Huntington's disease, with or without the administration of cilostazol (100 mg/kg/day, p.o.), a Phosphodiesterase 3 inhibitor. Control animals were administered cilostazol only or remained untreated. The striatum was extracted from the animals, and IL-10 levels were measured in the tissue homogenates using the Rat IL-10 Quantikine ELISA Kit (R&D Systems, Catalog # R1000). **p*<0.05 compared to untreated. ***p*<0.05 compared to untreated and 3-NP only. Graph adapted from El-Abhar, H. et al. (2018) *PLoS One* 13:e0203837.



CCL2/JE/MCP-1 Expression Following Brain Injury.

CCL2/JE/MCP-1 levels were measured in brain homogenates of C57BL/6 mice at various time points after closed head injury (weight-drop model) using the Mouse CCL2/JE/ MCP-1 Quantikine ELISA Kit (R&D Systems, Catalog # MJE00B). Brain CCL2/JE/MCP-1 levels were also analyzed in uninjured controls. **p*<0.01 at all time points compared to uninjured controls. Graph adapted from Woodcock, T.M. et al. (2017) *PLoS One* 12:e0188305.



CCL11/Eotaxin Levels in CSF of Humans Diagnosed with Chronic Traumatic Encephalopathy (CTE).

The Human CCL11/Eotaxin Quantikine ELISA Kit (R&D Systems, Catalog # DTX00) was used to measure CCL11/Eotaxin levels in cerebrospinal fluid (CSF) taken post-mortem from brains displaying CTE pathology (N=7), Alzheimer's disease pathology (AD; N=4), or no disease pathology (Control; N=4). Graph adapted from Cherry, J.D. et al. (2017) *PLoS One* 12:e0185541.

Select R&D Systems Quantikine ELISA Kits

Analyte	Species	Catalog #
Amyloid β (aa 1-40)	H	DAB140B
Amyloid β (aa 1-42)	H	DAB142
BDNF (Free)	H	DBD00
BDNF (Total)	H M R +	DBNT00
CCL2/MCP-1	H	DCP00
CCL2/JE/MCP-1	M	MJE00B
CCL5/RANTES	H	DRN00B
	MR	MMR00
CCL11/Eotaxin	H	DTX00
	M	MME00
CHI3L1/YKL-40	H	DC3L10
	M	MC3L10
CX3CL1/Fractalkine	H	DCX310
	M	MCX310
CXCL1/GROα	H	DGR00B
CXCL1/KC	M	MKC00B
CXCL1/CINC-1	R	RCN100
CXCL8/IL-8	H*	D8000C
CXCL10/IP-10	H	DIP100
	H	DIF50C
IFN-γ	M	MIF00
	R	RIF00
IL-1β/IL-1F2	H*	DLB50
	M*	MLB00C
IL-1ra/IL-1F3	R	RLB00
	H	DRA00B
IL-2	M	MRA00
	H*	D2050
IL-4	M	M2000
	R	R2000
IL-6	H*	D4050
	M	M4000B
IL-10	R	R4000
	H*	D6050B
IL-17	M	M6000B
	R	R6000B
IL-18	H*	D1000B
	M	M1000B
MMP-2	R	R1000
	H*	D1700
MMP-9	M	M1700
	R	R1700
TGF-β1	H	DL180
	M R +	MMP200
TNF-α	H	DMP900
	M	MMP900
VEGF	R	RMP900
	H	DB100C
VEGF	M R +	MB100B
	H*	DTA00D
VEGF	M*	MTA00B
	R	RTA00
VEGF	H	DVE00
	M	MMV00
VEGF	R	RRV00

Select R&D Systems Parameter ELISA Kits

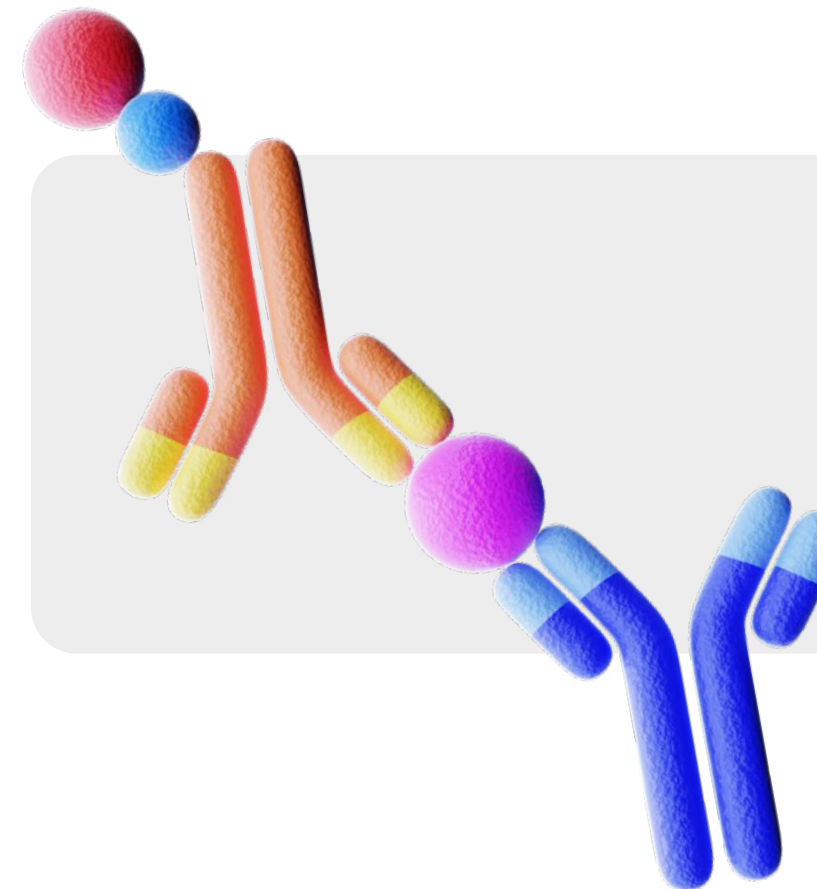
Analyte	Species	Catalog #
Nitric Oxide	MS	KGE001

*Indicates a Quantikine High Sensitivity kit is available for this analyte and species.
Species Key: (H) Human, (M) Mouse, (R) Rat, (MS) Multispecies, + Additional Species Available



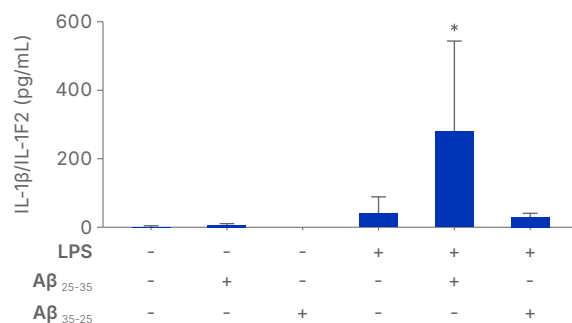
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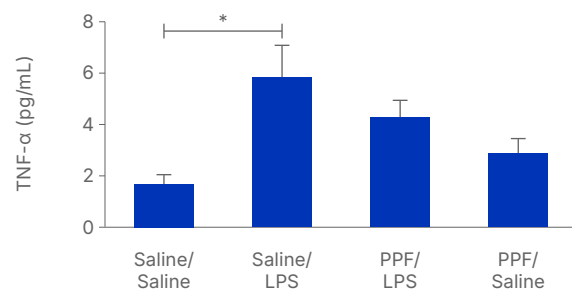


DuoSet® ELISA Development Systems

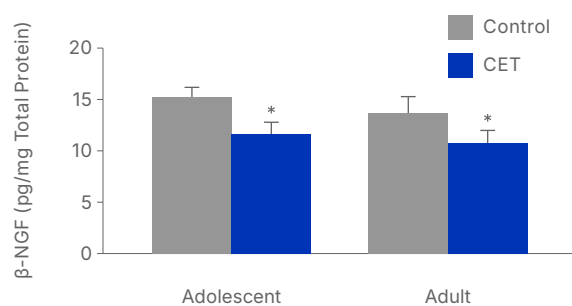
R&D Systems™ DuoSet ELISA Development Systems allow you to develop the immunoassay that you need using our gold-standard ELISA reagents. They are an economical alternative to buying separate antibodies and protein standards when complete kits are not an option.



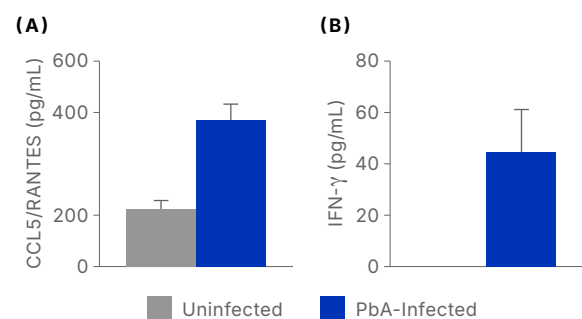
Aβ Induces IL-1β/IL-1F2 Secretion in LPS-Primed Microglia. Primary microglia cell cultures were prepared from newborn C57BL/6J-OlaHsd mice. Cells were primed with LPS and then treated with 50 μM of the Amyloid-β (Aβ) peptide Aβ₂₅₋₃₅ or the control Aβ peptide Aβ₃₅₋₂₅. Levels of IL-1β/IL-1F2 were measured in the cell culture supernatants using the Mouse IL-1β/IL-1F2 DuoSet ELISA Development System (R&D Systems, Catalog # DY401). **p*<0.05. Graph adapted from Gustin, A. et al. (2015) PLoS One 10:e0130624.



Propentofylline Attenuates LPS-Induced Increases in Plasma TNF-α. Wistar male rats, 3-4 months of age, were treated with propentofylline (PPF; 12.5 mg/kg/day, i.p.), a phosphodiesterase inhibitor and glial cell modulator, for 5 consecutive days or given saline. On injection days 3 and 4, half of the PPF-treated and half of the saline-treated rats were also injected with LPS (1 mg/kg/day, i.p.) while the remaining animals were given saline. Trunk blood was collected from animals from all four treatment groups: saline/saline, saline/LPS, PPF/LPS, PPF/saline (N=10 for all groups). Levels of TNF-α were measured in the plasma using the Rat TNF-α DuoSet ELISA Development System (R&D Systems, Catalog # DY510). **p*<0.01. Graph adapted from Moraes, M.M. et al. (2017) PLoS One 12:e0169446.



Brain β-NGF Levels Following Chronic Ethanol Treatment. Male adolescent and adult Sprague-Dawley rats were given chronic ethanol treatment (CET), which consisted of 20% ethanol exposure for 6 months (blue bars; N=23 for adolescent; N=24 for adult). Control animals were given tap water during that time (gray bars; N=16 for adolescent and adult). The prefrontal cortex was extracted from animals, and β-NGF levels were measured in the tissue homogenates using the Rat β-NGF DuoSet ELISA Development System (R&D Systems, Catalog # DY556). **p*<0.05 compared to controls. Graph adapted from Fernandez, G.M. et al. (2016) PLoS One 11:e0149987



Serum CCL5/RANTES and IFN-γ Levels in Mice with Experimental Cerebral Malaria. Female C57BL/6 mice were infected with the Plasmodium berghei ANKA (PbA) strain to induce experimental cerebral malaria (blue bars) or remained uninfected (gray bars). Levels of CCL5/RANTES (A) and IFN-γ (B) were measured in the serum from the animals using the Mouse CCL5/RANTES (Catalog # DY478) and IFN-γ (Catalog # DY485) DuoSet ELISA Development Systems, respectively. Graph adapted from Lacerda-Queiroz, N. et al. (2015) PLoS One 10:e0119633. All cited reagents are from Bio-Techne's R&D Systems brand.

Select R&D Systems DuoSet ELISA Development Systems

Analyte	Species	Catalog #
BDNF	H M	DY248
CCL2/MCP-1	H	DY279
CCL2/JE/MCP-1	M	DY479
	R	DY3144
CCL5/RANTES	H	DY278
	M	DY478
CHI3L1/YKL-40	H	DY2599
	M	DY2649
	H	DY365
CX3CL1/Fractalkine	M	DY472
	R	DY537
CXCL1/GROα	H	DY275
CXCL1/KC	M	DY453
CXCL1/CINC-1	R	DY515
CXCL8/IL-8	H	DY208
CXCL10/IP-10	H	DY266
CXCL10/IP-10/CRG-2	M	DY466
GFAP	H	DY2594
	H	DY720
ICAM-1/CD54	M	DY796
	R	DY583
	H	DY285B
IFN-γ	M	DY485
	R	DY585
	H	DY201
IL-1β/IL-1F2	M	DY401
	R	DY501
	H	DY202
IL-2	M	DY402
	R	DY502
	H	DY204
IL-4	M	DY404
	R	DY504
	H	DY206
IL-6	M	DY406
	R	DY506
	H	DY217B
IL-10	M	DY417
	R	DY522
	H	DY317
IL-17	M	DY421
IL-17A/F Heterodimer	H	DY5194
	M	DY5390
IL-18	H	DY318
MBP	H	DY4228
MMP-2	H	DY902
	H	DY911
MMP-9	M	DY6718
	R	DY8174

Analyte	Species	Catalog #
β-NGF	H	DY256
	R	DY556
RAGE	R	DY1616
α-Synuclein	H	DY1338
TGF-β1	H	DY240
	M	DY1679
	H	DY210
TNF-α	M	DY410
	R	DY510
TREM-2	H	DY1828

Species Key: (H) Human, (M) Mouse, (R) Rat



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→ Investigate Inflammatory Signaling Pathways

Intracellular signaling pathways play a key role in the communication of pro- and anti-inflammatory signals. Cytokines, such as TNF- α and IL-1 β , bind to their receptors and activate the IKK complex via recruitment of adaptor proteins, such as interleukin-1 receptor-associated kinases (IRAKs). The IKK complex phosphorylates and enables degradation of I κ B allowing NF- κ B to translocate to the nucleus, where it can act alone or with other transcription factors to modulate gene expression. Cytokine receptors are also associated with the JAK-STAT pathway, which integrates with the NF- κ B pathway. The activation of the NF- κ B and JAK-STAT pathways controls the gene expression of cytokines, chemokines and inducible enzymes, such as inducible nitric oxide synthase (iNOS) and cyclooxygenase-2 (COX-2).

The complement system is an innate immune response pathway that triggers inflammation and phagocytosis. Glial cells and neurons can synthesize components of the complement system, including key initiators and receptors. Activation of the complement system has been demonstrated in neuroinflammatory and neurodegenerative disorders. For example, in Alzheimer's disease (AD) the complement system is involved in clearance of A β from the brain in the early stages of disease, however in the later stages, it is involved in neuronal cell death. Tocris™ high purity small molecules can be used to investigate inflammatory signaling pathways activated in models of neuroinflammation and neurodegenerative diseases.

Ser-Ala-Leu-Leu-Arg-Ser-Ile-Pro-Ala-Pro-Ala-Gly-Ala-Ser-Arg-Leu-Leu-Leu-Leu-Thr-Gly-Glu-Ile-Asp-Leu-Pro

Activation of STAT3 Protects Against A β Neurotoxicity. Colivelin (Tocris, Catalog # 3945) is a peptide activator of STAT3. *In vitro*, Colivelin protects against A β -induced neurotoxicity and NMDA-induced excitotoxicity. Following repeated intracerebroventricular injection of A β peptides, Colivelin treatment reversed impairment in spatial working memory and degradation of Choline Acetyltransferase (ChAT)-positive neurons in the medial septum. Similarly, intranasal delivery of Colivelin alleviates memory impairment in AD mouse models, mediated by STAT3-dependent transcriptional upregulation of ChAT and Vesicular Acetylcholine Transferase (VACHT).

Cyclo[N²-(1-Oxo-3-phenylpropyl)-Orn-Pro-D-Cha-Trp-Arg]

Antagonism of C5a Complement Receptor Ameliorates Amyotrophic Lateral Sclerosis (ALS) Disease Pathology. PMX 205 (Tocris, Catalog # 5196) is a potent antagonist of the C5a Complement Receptor, which is upregulated on microglia in the hSOD1^{G93A} mouse model of ALS. Following chronic administration in drinking water, PMX 205 displays brain penetration that correlates with blood-brain barrier breakdown from the early stages of disease pathology. PMX 205 slows disease progression, measured by maximal hindlimb grip strength, and extends survival of hSOD1^{G93A} mice when given from a 'pre-onset' age. Disease progression was also slowed by PMX 205 when given from a 'post-onset' age.

Tocris Small Molecules

Catalog #	Name	Target	Description
1311	MK 886	5-lipoxygenase-activating protein (FLAP)	Inhibitor of FLAP; inhibits leukotriene biosynthesis and is orally active <i>in vivo</i>
5196	PMX 205	C5a Complement Receptor	Potent C5a Receptor peptide antagonist; displays anti-inflammatory effects in mouse models of Alzheimer's disease and amyotrophic lateral sclerosis (ALS)
0942	NS 398	COX-2	COX-2 inhibitor; orally active and anti-inflammatory <i>in vivo</i>
3786	Celecoxib	COX-2	Selective COX-2 inhibitor; anti-inflammatory <i>in vivo</i>
5698	1-Methyl-D-tryptophan	Indoleamine 2,3-dioxygenase (IDO)	IDO inhibitor
1415	1400W	iNOS	Potent and highly selective iNOS inhibitor; active <i>in vivo</i>
5479	CRID3 sodium salt	NLRP3 inflammasome	Potent NLRP3 inflammasome inhibitor; inhibits IL-1 β , IL-1 α and IL-18 production
6436	CY 09	NLRP3 inflammasome	NLRP3 inhibitor; active <i>in vivo</i>
5821	C-DIM 12	Nurr1	Nurr1 activator; inhibits NF- κ B and cytokine expression in microglia
3945	Colivelin	STAT3	STAT3 activator; protects against β -amyloid neurotoxicity <i>in vitro</i> and <i>in vivo</i>
1743	Bay 11-7085	TNF- α	Irreversible inhibitor of TNF- α -induced I κ B α phosphorylation; anti-inflammatory <i>in vivo</i>
4884	CU CPT 22	Toll-like Receptor 1/2 heterodimer	Selective TLR1/2 inhibitor; inhibits release of proinflammatory cytokines TNF- α and IL-1 β
4633	Pam3CSK4	Toll-like Receptor 1/2 heterodimer	TLR1/2 agonist; induces TNF- α and IL-6 production
5373	C34	Toll-like Receptor 4	TLR4 inhibitor; reduces systemic inflammation in mice
6479	CU CPT 9a	Toll-like Receptor 8	Potent TLR8 inhibitor; suppresses proinflammatory signaling
1793	AF 12198	Type I IL-1 Receptor	Potent and selective human Type I IL-1 Receptor antagonist; anti-inflammatory <i>in vivo</i>



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Blood-Brain Barrier and Immune Cell Transmigration

The BBB is a highly specialized, multicellular structure that functions as a selective diffusion barrier between the peripheral circulation and the CNS. It is composed of specialized endothelial cells, termed brain microvascular endothelial cells (BMECs), which are linked by complex tight and adherens junctions (TJs and AJs, respectively) and is surrounded by astrocytes and pericytes.

Under normal conditions, the specialized structure of the BBB hinders paracellular transport of most hydrophilic compounds across the cerebral endothelium and restricts migration of blood-borne cells into the CNS. As a result, resident immune cells, such as microglia, are the initial responders to pathogens or tissue damage. However, prolonged tissue insult triggers inflammatory conditions that cause the BBB to lose its restrictive features, resulting in the subsequent infiltration of peripheral immune cells.

→ Investigate Inflammatory Signaling Pathways

The permeability of the BBB is strictly regulated by numerous factors including cell-cell interactions and cell-derived factors. The BMECs that constitute the BBB are interconnected by TJs and AJs. These junctions, which are composed of integral membrane proteins, such as Claudin-5 and VE-Cadherin, bind homotypically to their respective molecule in adjacent

cells to hold the BMECs in close apposition. These transmembrane proteins also associate with cytoplasmic proteins, which tether them to the Actin cytoskeleton. The junction complexes seal the paracellular spaces between adjacent BMECs, thereby restricting the movement of molecules between the blood and the brain. Brain BMECs are also encircled by the extracellular matrix (ECM). ECM components are produced by BMECs, pericytes, and astrocytes and help maintain the integrity of the BBB. Damage to the junctional complexes, the ECM, or cells comprising the BBB causes increased BBB permeability. This results in the influx of neurotoxic molecules, pathogens, and cells. Investigation of junctional or ECM proteins can provide information on the integrity of the BBB. Bio-Techne's R&D Systems and Novus Biologicals brands offer an extensive collection of antibodies for the detection of many components of the BBB including specific cell types, ECM and adhesion molecules, and transporter proteins.

Brain Microvascular Endothelial Cell Markers

Marker	Catalog #	Species	Clone	Applications
◆ CD31/PECAM-1	NB100-2284	H M R +	Poly	FC, ICC/IF, IHC, WB
◆	AF3628	M R	Poly	WB, ICC, IHC, CyTOF, FC
◆ Glut1	NB110-39113	H M R +	Poly	WB, ICC, IHC, ChIP, FC
◆ E-Selectin/CD62E	BBA16	H	BBIG-E4	WB, IHC, ICC, ELISA, IP
◆	NBP1-45545	H M R	Poly	WB, IHC, ICC, IP, SW
◆ Tight Junction Protein 1/ZO-1	NBP1-85047	H M R +	Poly	WB, ICC, IHC, SW
◆ VCAM-1/CD106	BBA5	H	BBIG-V1	WB, ICC, B/N, IP
◆	AF643	M	Poly	WB, IHC, B/N, CyTOF, FC, SW

Pericyte Markers

Marker	Catalog #	Species	Clone	Applications
◆ Aminopeptidase N/CD13	MAB3815	H	498001	WB, ICC, IHC, SW
◆	AF2335	M	Poly	WB, ICC, IHC, CyTOF, FC, IP
◆ MCAM/CD146	NBP2-15778	H M R	Poly	WB, ICC, IHC
◆ NG2/MCSP	MAB2585	H	LHM-2	WB, IHC, CyTOF, FC
◆	MAB6689	M	546930	IHC
◆ PDGF Rβ	AF385	H	Poly	WB, IHC, B/N, CyTOF, FC
◆	AF1042	M	Poly	WB, IHC
◆ α-Smooth Muscle Actin	NBP2-67440*	H M R	SY02-64	WB, ICC, IHC, FC
◆	MAB1420	H M R	1A4	WB, ICC, IHC, CyTOF, FC, SW

Astrocyte Endfeet Marker

Marker	Catalog #	Species	Clone	Applications
◆ Aquaporin-4	NBP1-87679	H M R	Poly	WB, ICC, IHC

Species Key: (H) Human, (M) Mouse, (R) Rat, (Ms) Multispecies, + Additional Species Available
Applications Key: (B/N) Blocking/Neutralization, (ChIP) Chromatin Immunoprecipitation, (CyTOF) CyTOF-Ready, (ELISA) ELISA Capture and/or Detection, (FA) Functional Assay, (FC) Flow Cytometry, (GS) Gel Supershift Assay, (IA) Immunoassay, (ICC) Immunocytochemistry, (IHC) Immunohistochemistry, (IP) Immunoprecipitation, (PAGE) SDS-PAGE, (PEP-ELISA) Peptide ELISA, (SCW) Single-Cell Western, (SW) Simple Western™, (WB) Western blot
 ◆ Indicates a R&D Systems brand antibody ◆ Indicates a Novus Biologicals brand antibody *Indicates a recombinant monoclonal antibody

Tight Junction Proteins

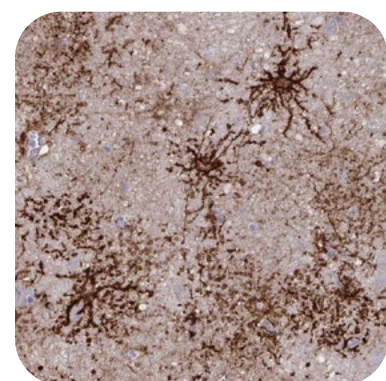
Molecule	Catalog #	Species	Clone	Applications
◆ Claudin-1	NBP1-77036	H M R +	Poly	WB, ICC, ELISA
◆ Claudin-3	MAB4620	H	385021	ICC, IHC, CyTOF, FC
◆ Claudin-5	NBP2-02259	H M R	OT11G4	FC, ICC/IF
◆	NBP2-61562*	H	RM275	WB, IHC
◆ JAM-A	AF1103	H	Poly	WB, ICC, IHC
◆	NB100-65340	M	H202-106	IHC, FC, IP
◆ JAM-B/VE-JAM	AF1074	H M	Poly	WB, IHC, B/N, SW
◆ JAM-C	NBP1-92032	H	Poly	WB, ICC, IHC
◆	AF1213	M	Poly	WB, ICC, IHC, B/N
◆ Occludin	NBP1-87402	H M	Poly	WB, ICC, IHC

Tight Junction Scaffolding Proteins

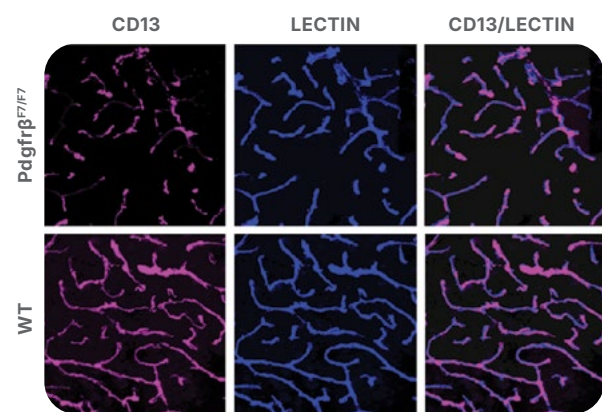
Molecule	Catalog #	Species	Clone	Applications
◆ Afadin/AF-6	NBP1-90218	H M R	Poly	WB, IHC, ICC
◆ Cingulin	NBP1-89600	H M R	Poly	WB, IHC
◆ PARD3/Par3	NBP1-88861	H M	Poly	WB, ICC, IHC, SW
◆ PARD6A	NBP1-41128	H M R	Poly	WB, IHC
◆ Tight Junction Protein 1/ZO-1	NBP1-85047	H M R +	Poly	WB, ICC, IHC, SW
◆ Tight Junction Protein 2/ZO-2	NBP1-86850	H M R	Poly	WB, ICC, IHC

Adherens Junction Proteins

Molecule	Catalog #	Species	Clone	Applications
◆ E-Cadherin	NBP2-67540*	H M R	ST54-01	WB, ICC, IHC, FC, IP
◆ E-Cadherin	AF748	H M	Poly	WB, ICC, IHC, CyTOF, FC, SW
◆ N-Cadherin	NBP1-48309	H M R	13A9	WB, ICC, IHC, FC
◆ VE-Cadherin	MAB9381	H	123413	WB, ICC, CyTOF, FC
◆ VE-Cadherin	AF1002	M	Poly	WB, IHC, SW
◆ β-Catenin	NBP2-67307*	H M R	SA30-04	WB, ICC, IHC, IP
◆ β-Catenin	AF1329	H M R	Poly	WB, ICC, IHC, ChIP, CyTOF, FC, SW
◆ γ-Catenin	NBP2-37557	H M	4C12	WB, ICC, IHC, ELISA
◆ p120-Catenin	NBP1-85383	H M R	Poly	WB, ICC, IHC



Aquaporin-4 in Human Brain.
Aquaporin-4 was detected in immersion-fixed paraffin-embedded sections of human brain using a Rabbit Anti-Human/Mouse/Rat Aquaporin-4 Antigen Affinity-Purified Polyclonal Antibody (Novus Biologicals, Catalog # NBP1-87679). The tissue was stained with DAB (brown). Specific staining was localized to astrocytes.



Pericyte Coverage of Cerebral Vessels in PDGF Rβ Mutant and Wild-Type Mice.
CD13-expressing pericytes were detected in perfusion-fixed frozen sections of mouse brain from 38-week old PDGF Rβ mutant mice (*Pdgfrβ^{F/F}*) and age matched wild-type (WT) controls using a Goat Anti-Mouse Aminopeptidase N/CD13 Antigen Affinity-Purified Polyclonal Antibody (R&D Systems, Catalog # AF2335), followed by an Alexa Fluor® 647-conjugated donkey anti-goat secondary antibody (red). Blood vessels in the tissue were visualized using a DyLight® 488-conjugated Lycopersicon esculentum lectin (blue). Image from Nikolakopoulou, A.M. et al. (2017) PLoS One 12:e0176225.



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Junction-Associated Cytoskeletal Proteins

Molecule	Catalog #	Species	Clone	Applications
◆ Actin	NBP2-67907*	H M R +	JJ09-29	WB, ICC, IHC, IP
◆ Actin	AF4000	H M R	Poly	WB, ICC
◆ Myosin Heavy Chain	MAB4470	MS	MF20	WB, ICC, IHC
◆ Non-Muscle Myosin IIA	NBP1-85244	H M R	Poly	WB, ICC, IHC
◆ α Tubulin	NB100-690	H M R +	DM1A	WB, ICC, IHC, CyTOF, FC, IP, SW
◆ β-III Tubulin, Neuron-Specific	MAB1195	MS	TuJ-1	WB, ICC, IHC, SW

Tight Junction Scaffolding Proteins

Molecule	Catalog #	Species	Clone	Applications
◆ CD11b/Integrin αM	NB110-89474	H M R +	Poly	WB, ICC, IHC, FC, SCW, SW
◆ Integrin α2/CD49b	MAB1233	H	HAS3	ICC, CyTOF, FC, IP
◆ Integrin α2/CD49b	NBP2-67691*	H M R	SN0752	FC, ICC/IF, IHC, IP, WB
◆ Integrin α4/CD49d	NBP1-77333	H M R	Poly	WB, ICC, ELISA
◆ Integrin α5/CD49e	NBP1-84576	H M	Poly	WB, IHC
◆ Integrin αL/CD11a	NBP1-51967	H	Poly	WB, IHC, PEP-ELISA
◆ Integrin αL/CD11a	NBP1-27870	M	I21/7	ICC, IHC, B/N, FC, IP
◆ Integrin αV/CD51	AF1219	H M R	Poly	WB, ICC, CyTOF, FC, SW
◆ Integrin β1/CD29	NBP2-16974	H M R	Poly	WB, ICC, IHC, SW, ChIP
◆ Integrin β2/CD18	AF1730	H	Poly	ICC, B/N, CyTOF, FC
◆ Integrin β2/CD18	NBP1-41272	M	M18/2	WB, IHC, FA, FC, IP
◆ Integrin β2/CD61	NB600-1342	H M R +	BV4	WB, IHC, IA, IP
◆ Integrin αVβ3	MAB3050	H	23C6	IHC, B/N, CyTOF, FC, IP

Tight Junction Scaffolding Proteins

Molecule	Catalog #	Species	Clone	Applications
◆ ALCAM/CD166	AF1172	H M R +	Poly	WB, ICC, IHC, CyTOF, FC, SW
◆ CD31/PECAM-1	NB100-2284	H M R +	Poly	WB, ICC/IF, IHC, FC
◆ CD31/PECAM-1	AF3628	M R	Poly	WB, ICC, IHC, CyTOF, FC
◆ CD99	AF3968	H	Poly	WB, ICC, CyTOF, FC, SW
◆ ICAM-1/CD54	NBP2-67518*	H	ST0487	WB, ICC, IHC
◆ ICAM-1/CD54	BBA3	H	BBIG-11 (11C81)	WB, ICC, B/N, IP
◆ ICAM-1/CD54	AF796	M	Poly	WB, IHC, B/N
◆ MAdCAM-1	NBP2-45706	H	OT11A5	WB, ICC
◆ MAdCAM-1	AF993	M	Poly	WB, IHC
◆ MCAM/CD146	NBP2-15778	H M R	Poly	WB, ICC, IHC
◆ Ninjurin-1	NBP1-92181	H M R	Poly	IHC
◆ E-Selectin/CD62E	NBP1-45545	H M R	Poly	WB, ICC, IHC, IP, SW
◆ E-Selectin/CD62E	BBA16	H	BBIG-E4	WB, ICC, IHC, ELISA, IP
◆ L-Selectin/CD62L	NB100-65388	H +	FMC46	IHC, FC, IP
◆ L-Selectin/CD62L	AF1534	R	Poly	WB, IHC
◆ P-Selectin/CD62P	NB100-65392	H M R +	Psel.KO.2.7	IHC, FC, IP
◆ VAP-1/AOC3	NBP1-89671	H	Poly	WB, IHC
◆ VAP-1/AOC3	NBP1-58374	M	7-88	ICC, IHC, FA, FC, IP
◆ VCAM-1/CD106	BBA5	H	BBIG-V1	WB, ICC, B/N, IP
◆ VCAM-1/CD106	AF643	M	Poly	WB, IHC, B/N, CyTOF, FC, SW

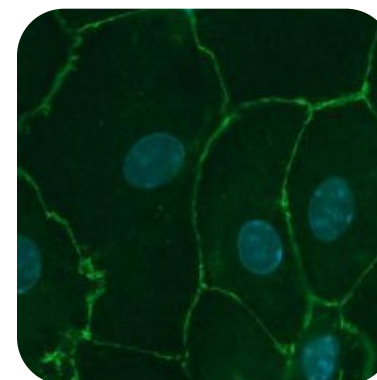
Blood-Brain Barrier Transporters

Molecule	Catalog #	Species	Clone	Applications
◆ ABCA1	NB400-105	H M R +	Poly	WB, ICC, IHC, B/N, ChIP, ELISA, FC, GS, IP, SW
	NBP2-54792*	H M	1276B	WB, ICC, IHC, FC
◆ ABCG2/CD338	NBP2-22124	H M +	3G8	WB, ICC, IHC, ELISA, FC
◆ Caveolin-1	NB100-615	H M R +	7C8	WB, ICC, IHC, FC, IP
◆ Glut1	NB110-39113	H M R +	Poly	WB, ICC, IHC, ChIP, FC
◆ LRP-1	NBP2-62753	H M R	Poly	WB, IHC
◆ LRP-1 (Intracellular Domain)	MAB6360	H	545503	WB, ICC, IHC
◆ LRP-1 (Cluster II)	AF2368	H	Poly	WB, ICC, IHC
◆ LRP-1 (Cluster III)	NBP2-67286*	H M R	SA0290	WB, ICC, IHC, FC, IP
◆ MDR1/ABCB1	NB100-80870	H M R +	Poly	WB, IHC, ELISA
	NBP2-67667*	H M R	SN06-42	WB, IHC
◆ MRP1	NB400-156	H M R	IU2H10	WB, ICC, CyTOF, ELISA, FC, IP
◆ MRP2	NBP1-42349	H R	M2III-6	WB, ICC, IHC, FC
◆ MRP4/ABCC4	NB100-1471	H M R	Poly	WB, ICC, IHC, PEP-ELISA
◆ RAGE	AF1145	H M R	Poly	WB, IHC, B/N
◆ TfR (Transferrin R)	AF2474	H	Poly	WB, IHC, B/N
	NB200-585	M R	OX26	WB, ICC, IHC, CyTOF, FC

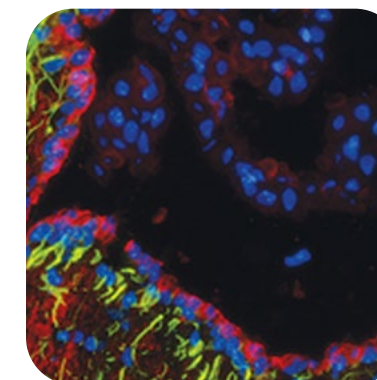
Blood-Brain Barrier Transporters

Molecule	Catalog #	Species	Clone	Applications
◆ Agrin	NBP1-90209	H M	Poly	ICC, IHC
	AF550	R	Poly	WB, IHC, B/N, ELISA
◆ Collagen IV α1	NB120-6586	H M R +	Poly	WB, ICC, IHC, ELISA, IP
◆ Endorepellin/Perlecan	NBP2-44448	H M +	A7L6	ICC, IHC, FC, PAGE
◆ Fibronectin	NBP1-91258	H M +	Poly	WB, ICC, IHC, SW
◆ Laminin (pan specific)	NB300-144	H M R +	Poly	WB, ICC, IHC, FC
◆ Laminin-1	MAB2549	M	AL-2	WB, IHC, B/N
◆ Laminin α1	AF4187	H	Poly	WB, IHC, FC
	MAB4656	M	AL-4	WB, IHC
◆ Laminin α2	NBP2-46624	H M R	CL3450	WB, IHC
◆ Laminin α3/Laminin-5	MAB2144	H	P3H9-2	WB, ICC, IHC, B/N, IP
◆ Laminin β1	NBP1-88073	H M R	Poly	WB, IHC
◆ Laminin β3	NBP2-46622	H R	CL3353	WB, IHC
◆ Laminin γ1	NBP2-42395	H M R	CL3196	WB, ICC, IHC
◆ Laminin S/Laminin β2	MAB2066	H R +	C4	WB, ICC, IP

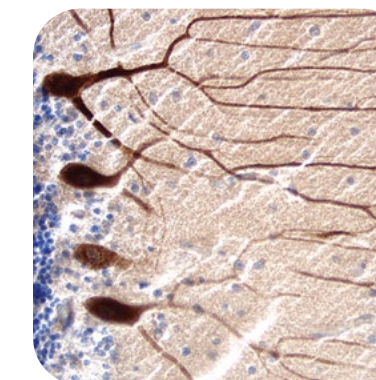
Species Key: (H) Human, (M) Mouse, (R) Rat, (Ms) Multispecies, + Additional Species Available
Applications Key: (B/N) Blocking/Neutralization, (ChIP) Chromatin Immunoprecipitation, (CyTOF) CyTOF-Ready, (ELISA) ELISA Capture and/or Detection, (FA) Functional Assay, (FC) Flow Cytometry, (GS) Gel Supershift Assay, (IA) Immunoassay, (ICC) Immunocytochemistry, (IHC) Immunohistochemistry, (IP) Immunoprecipitation, (PAGE) SDS-PAGE, (PEP-ELISA) Peptide ELISA, (SCW) Single-Cell Western, (SW) Simple Western™, (WB) Western blot
 ◆ Indicates a R&D Systems brand antibody ◆ Indicates a Novus Biologicals brand antibody *Indicates a recombinant monoclonal antibody



Occludin Expression in Mouse Choroid Plexus.
 Occludin was detected in immersion-fixed mouse choroid plexus cells using a Rabbit Anti-Human/Mouse Occludin Antigen Affinity-Purified Polyclonal Antibody (Novus Biologicals, Catalog # NBP1-87402). The cells were stained using an Alex Fluor® 488-conjugated anti-rabbit secondary antibody (green) and counterstained with DAPI (blue).



JAM-C in Mouse Ventricle/Choroid Plexus.
 JAM-C was detected in perfusion-fixed O.C.T.- embedded sections of mouse brain using a Goat Anti-Mouse JAM-C Antigen Affinity-Purified Polyclonal Antibody (R&D Systems, Catalog # AF1213). The tissue was stained using a Cy3-conjugated donkey anti-goat IgG secondary antibody (red) and counterstained with DAPI (blue). The tissue was also costained for GFAP expression (green). Image from Wyss, L. et al. (2012) PLoS One 7:e45619.



RAGE in Alzheimer's Disease Brain.
 Receptor for Advanced Glycation End Products (RAGE) was detected in immersionfixed paraffin-embedded sections of human Alzheimer's disease brain using a Goat Anti-Human/Mouse/Rat RAGE Antigen Affinity-Purified Polyclonal Antibody (Catalog # AF1145). The tissue was stained using the Anti-Goat HRPDAB Cell & Tissue Staining Kit (Catalog # CTS008; brown) and counterstained with hematoxylin (blue). All cited reagents are from Bio-Techne's R&D Systems brand.



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→ Modulating Blood-Brain Barrier Transport Function

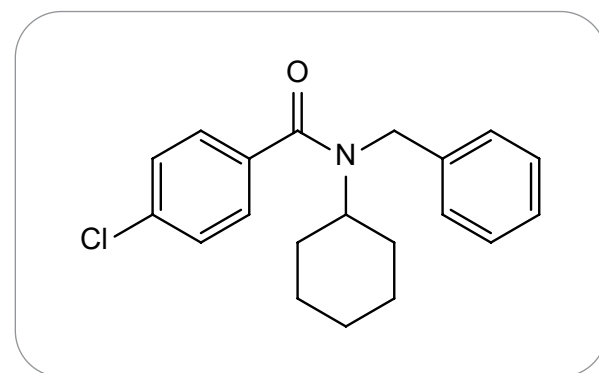
The TJ complexes of the BBB seal the paracellular spaces between adjacent BMECs, thereby restricting the movement of molecules between the blood and the brain. Only small lipid soluble molecules can passively pass through the BBB. Movement of most other molecules across the BBB is dependent on the presence of transporter proteins in the cell membranes of BMECs. These transporters are critical for regulating CNS homeostasis. The luminal and abluminal membranes of BMECs have polarized expression of transporters to ensure that nutrients, such as glucose and electrolytes, are delivered to the brain from the blood while metabolic waste products are removed. Hallmarks of neuroinflammation include

BBB dysfunction and modulation of transporter expression, which causes leakage of circulating substances from plasma into the CNS and leads to inadequate nutrient supply and the accumulation of waste products, respectively.

Key transporters on BMECs include glucose transporters, transporters from the ATP-binding cassette (ABC) family including multidrug transporters like P-glycoprotein (P-gp, also known as MDR1 and ABCB1), and the Receptor for Advanced Glycation End Products (RAGE). Bio-Techne offers Tocris™ small molecules for modulation and investigation of BBB transport.

Tocris Small Molecules

Catalog #	Name	Target	Description
4646	Elacridar	ABCB1/MDR1/P-glycoprotein (P-gp)	P-gp inhibitor; improves efficacy of ALS therapeutics in mice
4042	PSC 833	ABCB1/MDR1/P-glycoprotein (P-gp)	Inhibitor of P-gp-mediated MDR
5757	Tariquidar	ABCB1/MDR1/P-glycoprotein (P-gp)	Potent P-gp inhibitor
6199	BAY 876	Glucose Transporter 1 (GLUT1)	Potent and selective GLUT1 inhibitor; orally bioavailable
4484	STF 31	Glucose Transporter 1 (GLUT1)	GLUT1 inhibitor
3722	Reversan	Multidrug Resistance-associated Protein 1 (MRP1)/ABCC1	Selective MRP1 and P-gp inhibitor
2338	MK 571	Multidrug Resistance-associated Protein 1 (MRP1)/ABCC1	MRP1 inhibitor; also CysLT1 (LTD4) inverse agonist
5867	Ceefourin 1	Multidrug Resistance-associated Protein 4 (MRP4)/ABCC4	Selective MRP4 inhibitor
6237	FPS ZM1	Receptor for Advanced Glycation End Products (RAGE)	High affinity antagonist of RAGE; blocks microglial activation and neuroinflammation in mouse model of Alzheimer's disease
6259	RAGE antagonist peptide	Receptor for Advanced Glycation End Products (RAGE)	RAGE antagonist



RAGE Antagonists Block Aβ-Pathology and Neuroinflammation in AD.
FPS ZM1 (Tocris, Catalog # 6237) is a brain penetrant, high affinity antagonist of RAGE. RAGE is a cell surface protein belonging to the immunoglobulin superfamily, which acts as a receptor for Aβ at the BBB, on neurons and on microglia. FPS ZM1 inhibits Aβ-induced cellular stress and RAGE-mediated Aβ transport across the BBB in an aged AD mouse model. In this model, FPS ZM1 also suppressed microglial activation and neuroinflammatory response, as well as normalizing cognitive performance and cerebrovascular blood flow.



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→ Evaluating Blood-Brain Barrier Dysfunction

Disruption of the BBB is a hallmark of many neurological disorders. Researching the role of this barrier in these diseases requires suitable models and/or markers that allow scientists to evaluate and monitor the integrity of the barrier. Researchers have a choice of numerous tools for assessing the permeability of the BBB. Evans blue is one of the most commonly used tools as it has a very high affinity for serum Albumin, and Albumin-bound Evans blue will only enter the CNS if the BBB has been compromised.

Detection of other peripheral proteins, such as Fibrinogen and Fibronectin, in the brain can also indicate a breach of the BBB. Likewise, detection of brain-specific proteins, such as Occludin and S100b, in the peripheral blood can indicate BBB damage. Bio-Techne offers Evans blue through its Tocris brand, as well as R&D Systems™ and Novus Biologicals™ antibodies and R&D Systems™ ELISAs to detect and measure protein markers of BBB breakdown.

Exogenous Tracers

Tocris Product	Catalog #	Pharmacological Action
Evans Blue	0845	Potent inhibitor of L-glutamate uptake into synaptic vesicles; also non-NMDA iGluR antagonist; P2X antagonist

Brain-Derived Proteins

R&D Systems and Novus Biologicals Antibodies

R&D Systems ELISA Kits

Molecule	Catalog #	Species	Clone	Applications	Catalog #	Species	Kit Type
◆ Occludin	NBP1-77037	H M R	Poly	WB, ICC, IHC, ELISA			
◆ PDGF Rβ	NBP2-52529	H M	2G7B7	WB, IHC, CyTOF, ELISA, FC	DYC385	H	DuoSet®
◆	MAB1263	H	PR7212	WB, IHC, FC, IP			
◆	AF1042	M	Poly	WB, IHC			
◆ S100B	NBP2-67572*	H M R +	SC57-02	WB, ICC, IHC, IP	DY1820	H	DuoSet

Peripheral Proteins

R&D Systems and Novus Biologicals Antibodies

R&D Systems ELISA Kits

Molecule	Catalog #	Species	Clone	Applications	Catalog #	Species	Kit Type
◆ Fibrinogen	NBP2-50087	H	Poly	WB, IHC, ELISA			
◆ Fibronectin	NBP1-31369	H M R +	Poly	WB, ICC, IHC, IP	DFBN10	H	Quantikine®
◆	MAB1918	H	P1H11	ICC, IHC, IP, SW			
◆ Serum Albumin	MAB1455	H M R	188835	WB, ICC, IHC, CyTOF, FC, SW	DY1455	H	DuoSet
◆	NB600-41532	M	Poly	WB, ICC, IHC, ELISA			

Species Key: (H) Human, (M) Mouse, (R) Rat, + Additional Species Available
Applications Key: (CyTOF) CyTOF-Ready, (ELISA) ELISA Capture and/or Detection, (FC) Flow Cytometry, (ICC) Immunocytochemistry, (IHC) Immunohistochemistry, (IP) Immunoprecipitation, (SW) Simple Western™, (WB) Western blot
◆ Indicates a R&D Systems brand antibody ◆ Indicates a Novus Biologicals brand antibody *Indicates a recombinant monoclonal antibody



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→ **Detecting Peripheral Immune Cells**

Under steady-state conditions, peripheral immune cells are typically not present in the CNS. However, during neuroinflammation, the junction complexes of the BBB are remodeled to form interendothelial gaps that allow passage of peripheral immune cells into the brain where they execute distinct cell-mediated effects. Peripheral immune cells, such as T helper type 1 (Th1) and 17 (Th17) cells, have been detected in brains afflicted with neurodegenerative disease or neurotrauma. It has been suggested that CNS-infiltrating peripheral immune cells can contribute to disease progression by releasing proinflammatory

cytokines and promoting chronic neuroinflammation, inducing neuronal death, and mediating the switch from the M2 to the M1 microglia phenotype. However, studies have also shown that some CNS-infiltrating T cells, such as regulatory T cells, can exert neuroprotective effects such as releasing neurotrophic factors and activating the phagocytotic activity of microglial cells. Bio-Techne offers R&D Systems™ and Novus Biologicals™ antibodies validated for immunohistochemistry (IHC) and flow cytometry for the detection of peripheral immune cells in neural tissue.

Peripheral Immune Cell Markers

B Cells			
Memory B Cell Human CD19 ⁺ CD23/FCεRII ^{int} CD27/TNFRSF7 ⁺ Syndecan-1/CD138 ⁺		Plasma Cell Human CD19 ⁺ CD38 ^{high} Syndecan-1/CD138 ^{high}	
Mouse 5'-Nucleotidase/CD73 ⁺ B7-1/CD80 ⁺ CD19 ⁺ PD-L2/B7-DC ⁺		Mouse B220/CD45R ^{int} CD19 ^{int} Sca-1/Ly6 ⁺ Syndecan-1/CD138 ^{high}	
T Cells			
CD8⁺ Cytotoxic T Cell CD3 ⁺ CD8 ⁺ TCR α/β ⁺		γδ T Cell CD3 ⁺ TCR γ/δ ⁺	
Th2 Cell CD3 ⁺ CD4 ⁺ CCR3 ⁺ CCR4 ⁺ CCR8 ⁺		Th1 Cell CD3 ⁺ CD4 ⁺ CCR5 ⁺ CXCR3 ⁺ IFN-γ R2 ⁺	
CXCR4 ⁺ GATA-3 ⁺ ST2/IL-33R ⁺ STAT5 ⁺ STAT6 ⁺		IL-12 Rβ2 ⁺ IL-18 Rα/IL-1 R5 ⁺ IL-27Rα/WSX-1/TCCR ⁺ STAT4 ⁺ T-bet/TBX21 ⁺	
Th17 Cell CD3 ⁺ CD4 ⁺ IL-6Rα ⁺ IL-21R ⁺		Regulatory T Cell CD3 ⁺ CD4 ⁺ CD25/IL-2Rα ⁺ CTLA-4 ⁺ FoxP3 ⁺ GITR/TNFRSF18 ⁺	
IL-23R ⁺ RORγt/RORC2/NRIF3 ⁺ STAT3 ⁺ TGF-β RII ⁺		IL-23R ⁺ RORγt/RORC2/NRIF3 ⁺ STAT3 ⁺ TGF-β RII ⁺	
Natural Killer (NK) Cells			
NK Cell Human CD3 ⁺ CD7 ⁺ CD56/NCAM-1 ⁺ CD127/IL-7Rα ⁺		Mouse CD3 ⁺ CD11b/Integrin αM ⁺ CD27/TNFRSF7 ⁺ CD49b/Integrin α2 ⁺ CD127/IL-7Rα ⁺	
EOMES ⁺ Nkp46/NCR1 ⁺ T-bet/TBX21 ⁺		CD161/NK1.1 ⁺ EOMES ⁺ Nkp46/NCR1 ⁺ T-bet/TBX21 ⁺	



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IHC-Validated Antibodies

Marker	Catalog #	Species	Clone
5'-Nucleotidase/CD73	NBP2-48480	H	AD2
	AF4488	M +	Poly
B7-1/CD80	MAB140	H	37711
	MAB740	M	11114
B220/CD45R	MAB1217	M	RA3-6B2
CCR3	MAB155	H	61828
	NBP1-77065	M	Poly
CCR4	NB100-717	H	Poly
	NB100-721	M	Poly
CCR5	NBP2-31374	H M +	Poly
CCR8	NBP2-15767	H	Poly
	NB100-709	M	Poly
CD3	NB600-1441	H M +	SP7
	NBP2-52663*	H +	MT310
CD4	NBP2-52670*	H	13B8.2
	MAB554	M	GK1.5
CD7	AF7579	H	Poly
CD8	NBP1-49045	M R	53-6.7
	NBP2-25195	H	RPA-T8
CD11b/Integrin αM	NB110-89474	H M R +	Poly
	NBP2-15782	H M	Poly
CD19	NBP2-52662*	H	HD37
	MAB7489R	R	771404R
CD23/FCεRII	NBP1-43433	H	EBVCS2
CD25/IL-2Rα	MAB623	H	24204
CD27/TNFRSF7	NBP2-75434	R	JB40-98
	AF382	H	Poly
CD38	NBP2-25250	H M R	1G7F4
CD49b/Integrin α2	NBP2-67691	H M R	SN0752
CD56/NCAM-1	NBP2-52710*	H M R	735
	MAB24081	H	301021
CD161/NK1.1	NB100-77528	M	PK136
CTLA-4	NBP2-50286	H M R +	L4P2F5-F10
CXCR3	MAB160R*	H	49801R
	MAB172	H	44716
CXCR4	MAB21651R*	M	247506R
EOMES	NBP1-80699	H M R	Poly
	NB100-39002	H M R	Poly
FoxP3	MAB8214*	H M	1054C
GATA-3	MAB6330	H M	634913
	AF689	H	Poly
GITR/TNFRSF18	MAB52412*	M	2375B
	NBP1-90223	H	Poly
IFN-γ R2	NBP2-12430	M	RM0252-7A25

CONTINUED →

Marker	Catalog #	Species	Clone
◆ IL-6Rα	AF1830	M	Poly
◆ IL-12 Rβ2	NBP1-85983	H	Poly
◆ IL-18 Rα/IL-1 R5	MAB840	H	70625
◆ IL-21R	NBP1-76739	H M R	Poly
◆ IL-23R	NB600-1147	H M	Poly
◆ IL-27Rα/WSX-1/TCCR	NBP2-19015	H	34N4G11
◆ NKp46/NCR1	MAB1850	H	195314
◆	AF2225	M	Poly
◆ PD-L2/B7-DC	AF1022	M	Poly
◆ ROR-γ/RORC/NRIF3	NBP2-24503	H +	Poly
◆ ST2/IL-33R	AF523	H	Poly
◆ STAT3	NBP2-67432*	H M R +	SY24-08
◆ STAT4	NBP1-89474	H M R	Poly
◆ STAT5a	NBP2-00622	H M R	OT19F7
◆ STAT5b	H00006777-M03	H	2D1
◆ STAT6	NBP3-20516*	H	STAT6/7163R
◆	NB600-229	H M	Poly
◆	NBP2-67174*	H M R	JM11-21
◆ Syndecan-1/CD138	AF2780	H	Poly
◆	AF3190	M	Poly
◆ T-bet/TBX21	NBP1-43299	H M R	39D
◆ TCR α/β	NBP2-12941	R +	R73
◆ TCR γ/δ	NBP2-22510	H +	7A5
◆ TGF-β RII	AF-241-NA	H	Poly

Species Key: (H) Human, (M) Mouse, (R) Rat, + Additional Species Available

◆ Indicates a R&D Systems brand antibody ◆ Indicates a Novus Biologicals brand antibody *Indicates a recombinant monoclonal antibody

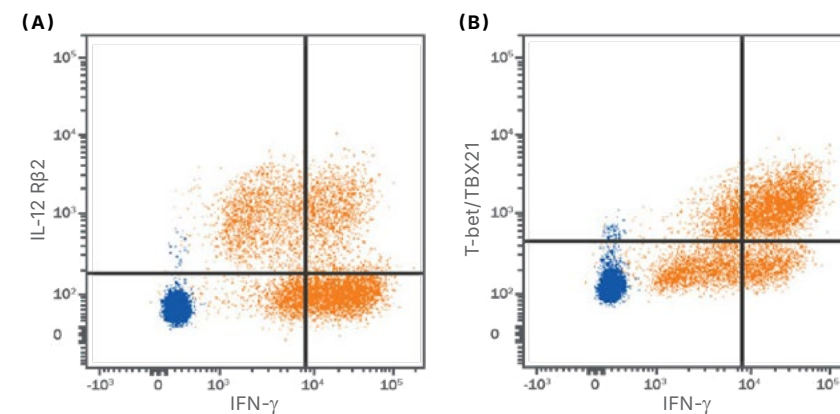
Flow Cytometry-Validated Antibodies

Molecule	Species	Clone	Unconjugated Antibody Catalog #	Applications
◆ 5'-Nucleotidase/CD73	M	496406	MAB4488	FAB4488-F, G, N, R, S, T, U, V
◆ B220/CD45R	M	RA3-6B2	MAB1217	FAB1217-A, F, G, N, P, R, S, T, U, V
◆ B7-1/CD80	H M	16-10A1	NBP1-43385	NBP1-43385
◆	H	61828	MAB155	FAB155-A, C, F, G, P, R, S, T, U, V
◆ CCR3	M	83103	MAB1551	FAB1551-G, N, R, S, T, U, V
◆	M	83101	MAB729	FAB729-C, F, G, P, R, S, T, U, V
◆ CCR4	H	205410	MAB1567	FAB1567-A, F, G, N, P, R, S, T, U, V
◆	H	CTC5	MAB1802	FAB1802-A, G, N, P, R, S, T, U, V
◆ CCR5	H	45531	MAB1429	FAB182-F, G, N, P, R, S, T, U, V
◆	H R	191704		FAB1429-A, C, P
◆ CCR8	M	1055C	MAB8324*	FAB8324-G, N, P, R, S, T, U, V *

CONTINUED →

Molecule	Species	Clone	Unconjugated Antibody Catalog #	Fluorochrome-Conjugated Antibodies Catalog #
◆	H	UCHT1	MAB100	FAB100-A, C, F, G, N, P, R, S, T, U, V
◆ CD3	M	17A2	MAB4841	FAB4841-A, C, F, G, N, P, R, S, T, U, V
◆	M	145-2C11	NBP2-52641*	NBP2-52641*
◆	H	RPA-T4	NBP2-25199	NBP2-25199
◆ CD4	H	13B8.2	NBP2-52670*	NBP2-52670*
◆	H	11830	MAB37911	FAB3791-A, C, F, G, N, P, R, S, T, V
◆	M	GK1.5	MAB554	FAB554-A, C, F, G, N, P, R, S, T, U, V
◆ CD7	H	MEM-186	NB500-326	NB500-326
◆	H	37006	MAB1509	FAB1509-A, C, F, G, N, P, R, S, T, U, V
◆ CD8	M	YTS 105.18	NBP2-52659*	NBP2-52659*
◆	M	53-6.7	MAB116	FAB116-A, F, G, N, P, R, S, T, U, V
◆ CD11b/Integrin αM	M	M1/70	MAB1124	FAB1124-A, F, G, N, P, R, S, T, U, V
◆	H M	1D3	NBP2-24965	NBP2-24965
◆ CD19	H	4G7	NBP2-52664*	NBP2-52664*
◆	H	SJ25-C1	NBP1-28375	NBP1-28375
◆	H	4G7-2E3R	MAB4867R*	FAB48671-G, N, R, S, T, U, V *
◆ CD23/FCεRII	H	EBVCS2	NBP1-43433	NBP1-43433
◆	H	138628	MAB123	FAB123-G, N, R, S, T, U, V
◆ CD25/IL-2Rα	H	24212	MAB1020	FAB1020-A, G, N, P, R, S, T, U, V
◆	M	280406	MAB2438	FAB2438-A, G, N, P, R, S, T, U, V

Species and Fluorochrome Key on page 33



Detection of Cell Surface and Intracellular Markers on Human Th1 Cells by Flow Cytometry.

CD4⁺ T cells were isolated from total human peripheral blood mononuclear cells (PBMCs) and differentiated in culture to Th1 cells. The cells were first stained for CD4 expression using an Alexa Fluor[®] 700-conjugated Mouse Anti-Human CD4 Monoclonal Antibody (Catalog # FAB3791N). The cells were also stained using a PerCP-conjugated Mouse Anti-Human IFN-γ Monoclonal Antibody (Catalog # IC285C), a PE-conjugated Mouse Anti-Human/ Mouse IL-12 Rβ2 Monoclonal Antibody (Catalog # FAB1959P; **(A)**), and an Alexa Fluor 488-conjugated Mouse Anti-Human T-bet/TBX21 Monoclonal Antibody (Catalog # IC53851G; **(B)**). To facilitate intracellular staining, cells were fixed and permeabilized with the FlowX™ FoxP3 Fixation & Permeabilization Buffer Kit (Catalog # FC012). Dot plots show the relative IL-12 Rβ2⁺, T-bet/TBX21⁺, and IFN-γ⁺ cells in CD4⁺ resting (blue dots, lower left quadrant) and Th1-differentiated (orange dots, right quadrants) cell populations. Quadrant markers were set based on staining with the appropriate isotype controls (Catalog # IC003N, # IC006T, # IC002P, # IC0041C, and # IC002G). All cited reagents are from Bio-Techne's R&D Systems brand.



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Flow Cytometry-Validated Antibodies

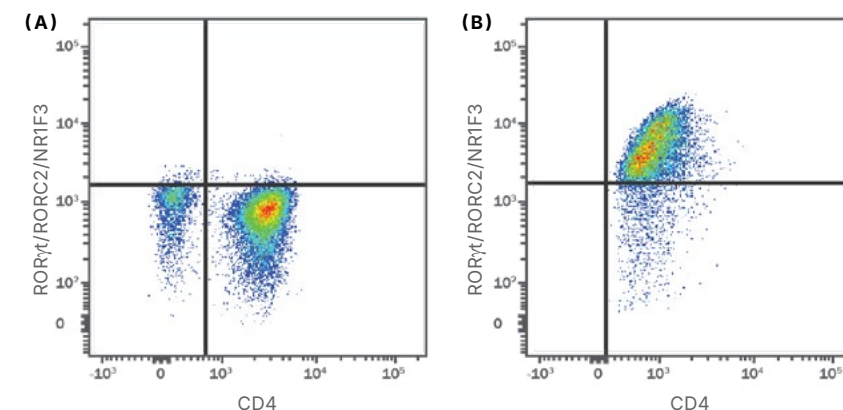
Molecule	Species	Clone	Unconjugated Antibody Catalog #	Fluorochrome-Conjugated Antibodies Catalog #
	H M R	LG.7F9	NBP1-43428	NBP1-43428
CD27/TNFRSF7	H	57703	MAB382	FAB382-A, G, N, P, R, S, T, U, V
	M	137915	MAB5741	FAB5741-G, N, R, S, T, U, V
CD38	H	HIT2	NB500-510	NB500-510
	H	HB7	NBP2-52647*	NBP2-52647*
CD49b/Integrin α2	H	240742	MAB2404	FAB2404-A, C, F, G, N, P, R, S, T, U, V
	H M	SN0752	NBP2-67691*	NBP2-67691
CD56/NCAM-1	H M R	735	NBP2-52669*	NBP2-52669*
	H R +	123C3 (123C3.D5)	NBP2-33132	NBP2-33132
CD127/IL-7Rα	H	ERIC-1	NB100-2718	NB100-2718
	H	40131	MAB306	FAB306-A, G, N, P, R, S, T, U, V
CD161/NK1.1	M	1140A	MAB7473*	FAB7473-G, N, R, S, T, U, V *
	M	PK136	NB100-77528	NB100-64849
CTLA-4	H	BNI3	NB100-64849	
	H	2188A	MAB3252*	FAB3252-G, N, R, S, T, U, V *
CXCR3	M	1B8	NBP1-41000	NBP1-41000
	H	49801	MAB160	FAB160-A, F, G, N, P, R, S, T, U, V
CXCR4	M	220803	MAB1685	FAB1685-A, G, N, P, R, S, T, U, V
	H	12G5	MAB170	FAB170-A, F, G, N, P, R, S, T, U, V
EOMES	H	44716	MAB172	FAB172-G, N, R, S, T, U, V
	M	247506	MAB21651	FAB21651-A, F, G, N, P, R, S, T, U, V
FoxP3	H	644730	MAB6166	IC6166-A, G, N, R, S, T, U, V
	M	1219A	MAB8889	IC8889-G, N, P, R, S, T, U, V *
GATA-3	H M R	376209	MAB8970*	IC8970- G, N, R, S, T, U, V *
	H M	3G3	NB100-56582	NB100-56582
GITR/TNFRSF18	H M	1054C	MAB8214*	IC8214-A, G, N, P, S, T, U, V *
	H	OT18H4	NBP2-45810	NBP2-45810
IFN-γ R2	H	110416	MAB689	FAB689-A, F, G, N, P, R, S, T, U, V
	M	DTA-1	NBP2-26661	NBP2-26661
IL-6Rα	M	108619	MAB5241	FAB5241-A, G, N, R, S, T, U, V
	M	2375B	MAB52412*	FAB52412-G, N, R, S, T, U, V *
IL-18 Rα/IL-1 R5	H	Poly	AF773	FAB773-A, F
	M	MOB47	MAB773	FAB773-G, N, R, S, T, U, V
IL-21R	H	17506	MAB227	FAB227-A, F, G, N, P, R, S, T, U, V
	M	255821	MAB1830	FAB1830-G, N, R, S, T, U, V

Species and Fluorochrome Key on page 33



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Detection of RORγt/RORC2/NRIF3 in Human PBMCs by Flow Cytometry. Human PBMCs either unstimulated (A) or stimulated to induce differentiation into Th17 cells (B) were stained with a Rabbit Anti-Human RORγt/RORC2/NRIF3 Monoclonal Antibody (Catalog # MAB61093) followed by Phycoerythrin-conjugated Anti-Rabbit IgG Secondary Antibody (Catalog # F0110) and an APC-conjugated Mouse Anti-Human CD4 Monoclonal Antibody (Catalog # FAB3791A). Quadrant markers were set based on control antibody staining (Catalog # MAB1050). To facilitate intracellular staining, cells were fixed and permeabilized with FlowX FoxP3 Fixation & Permeabilization Buffer Kit (Catalog # FC012). All cited reagents are from Bio-Techne's R&D Systems brand.

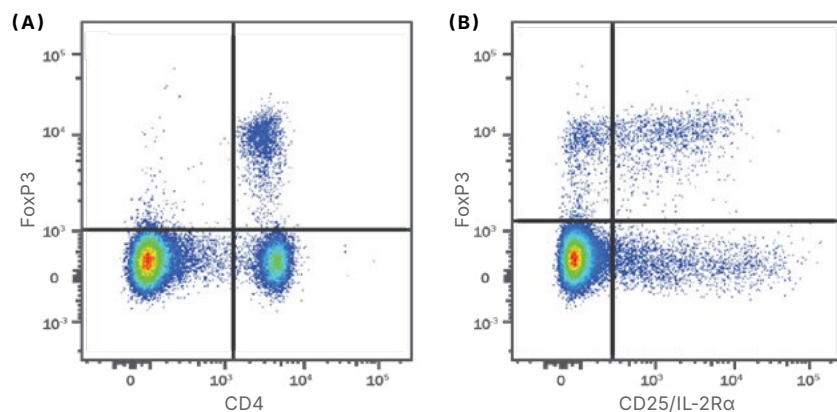
Flow Cytometry-Validated Antibodies

Molecule	Species	Clone	Unconjugated Antibody Catalog #	Fluorochrome-Conjugated Antibodies Catalog #
IL-12 Rβ2	H M	305719		FAB1959-A, C, G, P
IL-18 Rα/IL-1 R5	H	70625	MAB840	FAB840-A, G, N, P, R, S, T, U, V
	M	112614	MAB1216	FAB1216-A, F, G, N, R, S, T, U, V
IL-21R	H	152512	MAB9911	FAB9911-G, N, P, R, S, T, U, V
	M	Poly	AF596	
IL-23R	H	218213	MAB14001	FAB14001-A, C, F, N, P
	M	753317	MAB16861	FAB16861-C, G, N, P, R, S, T, U, V
IL-27Rα/WSX-1/TCCR	H	195314	MAB1850	FAB1850-A, F, G, N, P, R, S, T, U, V
	M	29A1.4	MAB22252	FAB22252-A, G, N, P, R, S, T, U, V
PD-L2/B7-DC	H M	600380		IC6006-A, C, P
	M	TY25	NB100-65332	NB100-65332
RORγt/RORC2/NRIF3	H	1181A	MAB61093*	IC9125-A, G, N, R, S, T, U, V *
	M	300506	MAB2966	FAB2966-A, F, G, N, P, R, S, T, U, V
Sca-1/Ly6	H	2154E	MAB10118*	FAB10118-G, N, R, S, T, U, V *
	M	177228	MAB1226	FAB1226-A, G, N, P, R, S, T, U, V
STAT3	H	245707	MAB10041	FAB10041-A, G, N, P, R, S, T, U, V
	M	245707	MAB10041	FAB10041-A, G, N, P, R, S, T, U, V
STAT4	H M R	232209	MAB1799	IC1799-F, G, N, P, R, S, T, U, V
	H	OT12F3	NBP2-00851	NBP2-00851
STAT5a	H	251610	MAB21741	IC21741-F, G, N, R, S, T, U, V
	H	389215	MAB1584	IC1584-G, N, R, S, T, U, V
STAT5b	H	253906	MAB2167	IC2167-A, G, N, R, S, T, U, V
	H	DL-101	NBP1-43351	NBP1-43351
STAT6	H	359103R	MAB2780R*	FAB2780R-G, N, R, S, T, U, V *
	M	300506	MAB2966	FAB2966-A, F, G, N, P, R, S, T, U, V

CONTINUED →

Molecule	Species	Clone	Unconjugated Antibody Catalog #	Fluorochrome-Conjugated Antibodies Catalog #
◆ T-bet/TBX21	H M +	4B10	NBP1-43298	NBP1-43298
◆	H	525831	MAB53851*	FAB53851-G, N, R, S, T, U, V *
◆ TCR α/β	R +	R73	NBP2-12941	NBP2-12941
◆	H	25508		FAB241-A, C, F, N, P
◆ TGF-β RII	H	Poly	AF-241-NA	FAB2411-A, F, N, P
◆	M	Poly	AF532	FAB532-A, F, N, P

Species Key: (H) Human, (M) Mouse, (R) Rat, + Additional Species Available
Fluorochrome Key: (A) Allophycocyanin, (C) PerCP, (F) Fluorescein, (G) Alexa Fluor® 488, (N) Alexa Fluor 700, (P) Phycoerythrin, (R) Alexa Fluor 647, (S) Alexa Fluor 750, (T) Alexa Fluor 594, (U) Alexa Fluor 350, (V) Alexa Fluor 405
 ◆ Indicates a R&D Systems brand antibody ◆ Indicates a Novus Biologicals brand antibody *Indicates a recombinant monoclonal antibody



Detection of FoxP3+ Regulatory T Cells in Mouse Splenocytes by Flow Cytometry. C57BL/6 mouse splenocytes were surface stained with an Alexa Fluor 488-conjugated Rat Anti-Mouse CD4 Monoclonal Antibody (Catalog # FAB554G; **(A)**) and an APC-conjugated Rat Anti-Mouse IL-2Rα/CD25 Monoclonal Antibody (Catalog # FAB2438A; **(B)**), followed by intracellular staining using a PEconjugated Mouse Anti-Human/Mouse/Rat FoxP3 Monoclonal Antibody (Catalog # IC8970P). To facilitate intracellular staining, cells were fixed and permeabilized with the FlowX FoxP3 Fixation and Permeabilization Buffer Kit (Catalog # FC012). Cells were gated on lymphocytes. All cited reagents are from Bio-Techne's R&D Systems brand.

→ Modulating Immune Cell Transmigration

The transmigration of peripheral immune cells through the BBB is a complex process that requires an array of physiological changes in the blood vessel endothelia, resident CNS cells, and cells of the immune system. Reactive microglia, astrocytes, pericytes and BMECs release molecules that promote invasion of peripheral immune cells into CNS. Secreted inflammatory mediators, including CXCL8, CCL2/MCP-1, TNF-α, IL-1b/IL-1F2, recruit immune cells and stimulate the expression of adhesion molecules on BMECs that participate in integrin-mediated leukocyte tethering,

rolling, and activation. Engagement of adhesion molecules on the surface of BMECs by leukocyte integrins also activates diverse signaling pathways in BMECs that result in the dynamic reorganization of junction complexes and BMEC retraction. Proteases, such as matrix metalloproteases, are also released and degrade proteins present in the extracellular matrix to provide pathways for leukocyte migration into the CNS parenchyma. Bio-Techne offers tools, including blocking antibodies and small molecules, to modulate immune cell extravasation through the BBB.

Blocking Antibodies for Modulating Immune Cell Transmigration

Marker	Catalog #	Species	Clone
◆ ALCAM/CD166	MAB656	H	105901
◆ ICAM-1/CD54	BBA3	H	BBIG-I1 (11C81)
◆ Integrin α4/CD49d	AF796	M	Poly
◆ Integrin αL/CD11a	BBA37	H	2B4
◆ Integrin β1/CD29	NBP1-26661	H M	PS/2
◆ Integrin β2/CD18	NBP2-50447	H	38
◆ E-Selectin/CD62E	NBP1-27870	M	I21/7
◆ E-Selectin/P-Selectin (CD62E/P)	NBP2-36561	H M	P4C10
◆ P-Selectin/CD62P	MAB17781	H	P5D2
◆ VCAM-1/CD106	AF1730	H	Poly
◆	BBA26	H	BBIG-E1
◆	AF977	R	Poly
◆	BBA1	H	BBIG-E6 (13D5)
◆	AF137	H R	Poly
◆	BBA5	H	BBIG-V1
◆	AF643	M	Poly

Species Key: (H) Human, (M) Mouse, (R) Rat
 ◆ Indicates a R&D Systems brand antibody
 ◆ Indicates a Novus Biologicals brand antibody

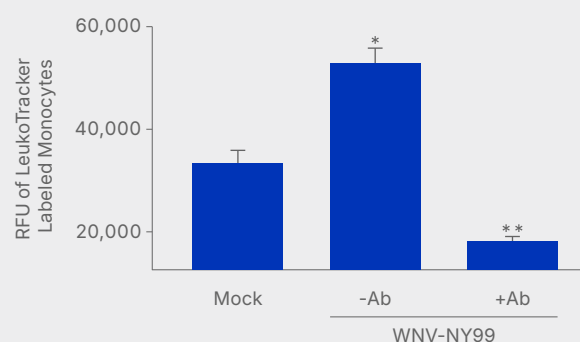


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Tocris Small Molecules

Cat #	Name	Target	Description
3973	Latrunculin A	Actin	Reversible inhibitor of Actin assembly and polymerization
2517	RS 504393	CCR2	Highly selective CCR2 antagonist; inhibits MCP-1-mediated chemotaxis
3581	C 021	CCR4	Potent CCR4 antagonist; reduces microglial activation and neuroinflammation
3756	Maraviroc	CCR5	Selective CCR5 antagonist
5872	AZ 10397767	CXCR2	Potent CXCR2 antagonist
4528	(±)-NBI 74330	CXCR3	Potent and selective CXCR3 antagonist
3299	AMD 3100	CXCR4	Highly selective CXCR4 antagonist; attenuates microglial activation and neurological function after ischemic stroke in mice
5904	Montelukast sodium	Cysteinyl Leukotriene Receptor 1 (CysLT1)	CysLT1 and GPR17 antagonist; reduces BBB disruption, leukocyte migration and neuroinflammation in aged rats
2792	Jasplakinolide	F-Actin	Stabilizes F-Actin; promotes Actin polymerization
3239	PF 573228	Focal Adhesion Kinase (FAK)	Potent and selective FAK inhibitor
3414	FAK Inhibitor 14	Focal Adhesion Kinase (FAK)	Selective FAK inhibitor
3910	BIO 1211	Integrin $\alpha4\beta1$ (VLA-4)	Selective Integrin $\alpha4\beta1$ (VLA-4) inhibitor
4577	LDV FITC	Integrin $\alpha4\beta1$ (VLA-4)	Fluorescent ligand for Integrin $\alpha4\beta1$ (VLA-4)
3900	TCS 2314	Integrin $\alpha4\beta1$ (VLA-4)	Integrin $\alpha4\beta1$ (VLA-4) antagonist
4970	BMS 688521	LFA-1/ICAM	Potent inhibitor of the LFA-1/ICAM interaction
4228	A 286982	LFA-1/ICAM	Potent inhibitor of the LFA-1/ICAM interaction



Blocking CAMs Attenuates Monocyte Transmigration in an *In Vitro* BBB Model.

For an *in vitro* BBB model, human brain microvascular endothelial cells (HBMVEs) were cultured on the porous membrane of a transwell migration assay. HBMVEs were infected with the West Nile virus, NY99 strain, (WNV-NY99) to induce membrane expression of cell adhesion molecules or were mock infected. Human monocytes stained with leukotracker dye were added to the upper compartment of the *in vitro* BBB model and incubated in the presence (+Ab) or absence (-Ab) of a cocktail of neutralizing antibodies composed of the Mouse Anti-Human ICAM-1/CD54 (Catalog # BBA3), Mouse Anti-Human VCAM-1/CD106 (Catalog # BBA5), and Mouse Anti-Human E-Selectin/P-Selectin (CD62E/P; Catalog # BBA1) Monoclonal Antibodies. After 4 hours, fluorescence in the lower chamber of the transwell migration assay was measured. All cited reagents are from Bio Techne's R&D Systems brand. * $p < 0.05$ compared to mock and ** $p < 0.05$ compared to WNV-NY99, -Ab group. Graph adapted from Roe, K. et al. (2014) *PLoS One* 9:e102598.



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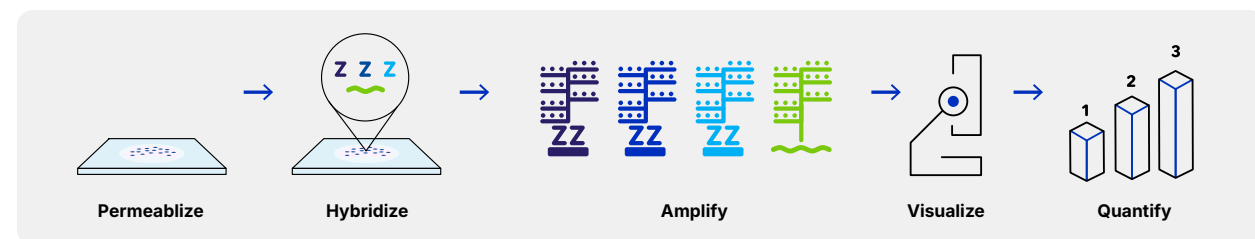
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Spatially Map Neuroinflammatory Markers and Cell Types

RNAscope™ *In Situ* Hybridization Assays

The RNAscope assay is an advanced and powerful *in situ* hybridization technology that allows the visualization of single RNA molecules within the morphological context and at single cell resolution. The proprietary double Z probe design, in combination with the advanced signal amplification, enables highly specific and sensitive detection of target RNAs in fresh frozen, fixed frozen, and formalin-fixed paraffin-embedded (FFPE) cells and tissues, with each dot representing a single RNA transcript.

RNAscope Assay Workflow



- | | | | | |
|--|---|--|--|--|
| <p>Step 01
Permeabilize
Cell or Tissue</p> <p>Fixed tissue sections or cells on slides are pre-treated with a Pre-treatment kit to block endogenous peroxidase activity and optimally permeabilize samples to allow probe access to target RNA.</p> | <p>Step 02
Hybridize Probe
to Target RNA</p> <p>With ~20 specific double Z probe pairs per target, probes hybridize to target RNA molecules.</p> | <p>Step 03
Amplify
Signal</p> <p>Detection reagents amplify the hybridization signal via sequential hybridization of amplifiers and labeled probes.</p> | <p>Step 04
Visualize with
Morphology</p> <p>Each punctuated dot signal represents a single target RNA molecule and can be visualized with a microscope.</p> | <p>Step 05
Quantify Single-
Cell Expression</p> <p>Single-molecule signal can be quantified on a cell-by-cell basis by manual counting or automated image analysis.</p> |
|--|---|--|--|--|

→ RNAscope Probes for Neuroinflammation Research

Select Human RNAscope Probes

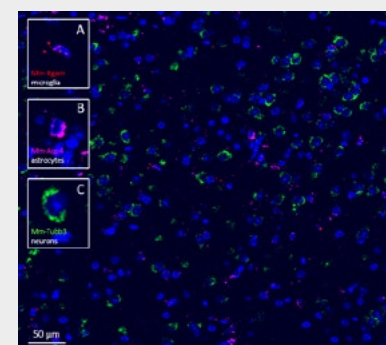
Probe Name	Catalog #
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Hs-ABCG2	422721
Hs-AIF1	433121
Hs-AIF1-O1	511091
Hs-ALDH1L1	438881
Hs-AQP4	482441
Hs-ARG1	401581
Hs-ARG2	401591
Hs-CCL1	468541
Hs-CCL2	423811
Hs-CCL5	549171
Hs-CCL7	425261
Hs-CCL8	466491
Hs-CCL11	438461
Hs-CCL17	468531
Hs-CCL18	486611
Hs-CCL19	474361
Hs-CCL20	409611
Hs-CCL21	474371
Hs-CCL22	468701
Hs-CCL23	476491
Hs-CCL24	463001
Hs-CCL25	474381
Hs-CCL28	418001
Hs-CCM2L	496331
Hs-CCN6	562911
Hs-CD68	560591
Hs-CXCL1	427151
Hs-CXCL2	425251
Hs-CXCL5	468451
Hs-CXCL9	440161
Hs-CXCL10	311851
Hs-CXCL11	312701
Hs-CXCL12	422991
Hs-CXCL13	311321
Hs-CXCL14	425291
Hs-CXCL17	513241
Hs-CXCR1	505511
Hs-CXCR2	468411
Hs-CXCR3	539251
Hs-CXCR4	310511
Hs-CXCR5	474171
Hs-CXCR6	468461
Hs-FGFR3	310791
Hs-IFNB1	417071

Hs-IFNG	310501
Hs-IL8	310381
Hs-LAMA1	530821
Hs-LAMA2	530661
Hs-LAMB1	550451
Hs-LAMB2	530671
Hs-PTPRC	601991
Hs-TUBB3	318901

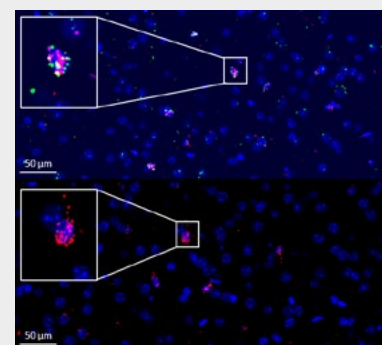
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RNAscope Assays Are Ideal for Multiplex Gene Expression Spatial Analysis

The multiplexing capabilities of the RNAscope assays facilitate the simultaneous visualization of multiple targets, enabling detection of multiple gene expression profiles and thorough characterization of cell populations within the nervous system. With the addition of the recently launched HiPlex Assay, this technology can detect up to 12 targets simultaneously and visualize co-expression of specific transcripts in different neural cell types.



Identification of Microglia, Astrocytes and Neurons using RNAscope Assays. The RNAscope Multiplex Fluorescent V2 Assay was used to detect Itgam (red), Aqp4 (magenta) and Tubb3 (green) in FFPE sections of mouse brain. Cells were counterstained with DAPI (blue). Insets show higher magnification of microglia (A), astrocytes (B) and neurons (C).



Identification of Microglia Subtypes using RNAscope Assays. The RNAscope Multiplex Fluorescent V2 Assay was used to identify M1 microglia (A) by detecting Itgam (red), Cd68 (green) and Fcgr3 (magenta), and M2 microglia (B) by detecting Trem2 (red) in FFPE sections of mouse brain. Cells were counterstained with DAPI (blue). Insets show higher magnification of M1 (A) and M2 (B) microglia.

See How Your Peers Are Using the RNAscope Assays

With more than 2,400 publications to date, and about one-third of them in the field of neuroscience, the RNAscope assay is a key method to spatially map gene expression within the central and peripheral nervous systems. View recent publications to see how researchers have taken advantage of the RNAscope technology to complement their neuroinflammation research.

- Hammond, T.R., *et al.* (2019) Single-cell RNA sequencing of microglia throughout the mouse lifespan and in the injured brain reveals complex cell-state changes. *Immunity* **50**:253.
- Elkjaer, M.L., *et al.* (2019) Unique RNA signature of different lesion types in the brain white matter in progressive multiple sclerosis. *Acta Neuropathol. Commun.* **7**:58.
- Duan, L., *et al.* (2018) PDGFRβ cells rapidly relay inflammatory signal from the circulatory system to neurons via chemokine CCL2. *Neuron* **100**:183.
- Lanfranco, M.F., *et al.* (2018) Glial- and neuronal-specific expression of CCL5 mRNA in the rat brain. *Front. Neuroanat.* **11**:137.



Select Mouse RNAscope Probes

Probe Name	Catalog #
Mm-Abca1	522251
Mm-Abcg2	510101
Mm-Aif1	319141
Mm-Aldh1l1	405891
Mm-Aqp4	417161
Mm-Arg1	403431
Mm-Arg2	427631
Mm-CCL2	311791
Mm-Ccl3	319471
Mm-Ccl4	421071
Mm-Ccl5	469601
Mm-Ccl7	446821
Mm-Ccl8	546211
Mm-Ccl9	537581
Mm-Ccl11	464031
Mm-Ccl12	437521
Mm-Ccl17	428491
Mm-Ccl20	434051
Mm-Ccl22	469591
Mm-Ccl24	464041
Mm-Ccl28	498591
Mm-Cd68	316611
Mm-Col1a1	319371
Mm-Col1a1-O1	537041
Mm-Col2a1	407221
Mm-Col4a1	412871
Mm-Cx3cl1	426211
Mm-Cx3cr1	314221
Mm-Cxcl1	407721
Mm-Cxcl2	437581
Mm-Cxcl3	492751
Mm-Cxcl5	467441
Mm-Cxcl9	489341
Mm-Cxcl10	408921
Mm-Cxcl12	422711
Mm-Cxcl13	406311
Mm-Cxcl14	459741
Mm-Cxcl15	409101
Mm-Cxcl16	466681
Mm-Cxcl17	519621
Mm-Cxcr1	497311
Mm-Cxcr2	461531
Mm-Cxcr2-CDS	487671
Mm-Cxcr3	402511
Mm-Cxcr4	425901
Mm-Fgf3	503101
Mm-ITGAM	311491
Mm-Madcam1	438681
Mm-Rbfox3	313311
Mm-Rbfox3-CDS	453771
Mm-Tmem119	472901
Mm-Tubb3	423391

Select Rat RNAscope Probes

Probe Name	Catalog #
Rn-Aif1	457731
Rn-Aldh1l1	459821
Rn-Arg1	438011
Rn-Arg2	438351
Rn-Ccl2	402691
Rn-Ccl5	473641
Rn-Ccl7	530991
Rn-Ccr2	526281
Rn-Ccr6	530381
Rn-Ccr7	426811
Rn-Cd68	402681
Rn-Cx3cl1	531141
Rn-Cx3cr1	447451
Rn-Cxcl1	504531
Rn-Cxcl13	510031
Rn-Cxcr4	482801
Rn-Fgfr3	416681
Rn-Gfap	407881
Rn-Gfap-NoXHs	539471
Rn-Itgam	409791
Rn-Rbfox3	436351
Rn-Tmem119	478921
Rn-Trem2	478931



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North America TEL 800 343 7475

Europe // Middle East // Africa TEL +44 (0)1235 529449

China info.cn@bio-techne.com, TEL 400.821.3475

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