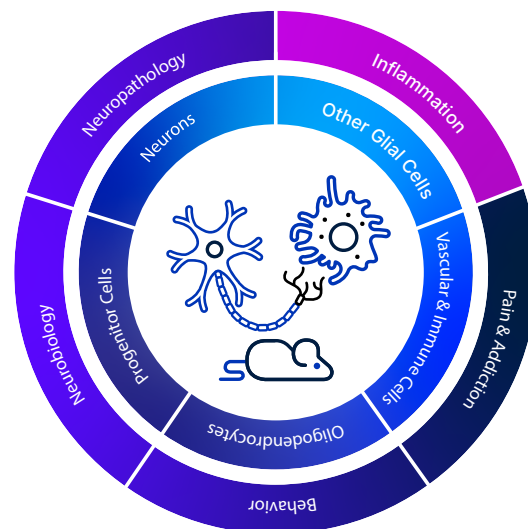


# Reveal New Spatial Insights in Neuroinflammation Mouse Models with RNAscope™ ISH Assays

## Your Genes. Your Way.

Easily interrogate just the genes you want in the combinations you need to achieve your research goals.

Select from a list of proven probes for cell type identification and add any additional RNA markers from an online catalog of 1000's of predesigned neural probes. If we don't have the target you need, you can easily design a new custom probe using our expert probe design.



## Your Success.

- Spatially interrogate mediators of neuron-glia signaling.
- Characterize central inflammatory response involving resident cell types.
- Study the role of infiltrating immune cells and cell activation in spatial context.
- Easily visualize emerging targets including chemokines and cytokines with high specificity.

## RNAscope Probes for Mouse Neuronal Cell Types

Cell Type	Top Probes	Reference RNAscope Probe Publications
Mature neurons	<i>Map2, Rbfox3, Tubb3</i>	<ul style="list-style-type: none"> <li>• Meneghello <i>et al.</i>, <i>Neuroscience</i>, 2015.</li> <li>• Nakazato <i>et al.</i>, <i>Sec. Multiple Sclerosis and Neuroimmunology</i>, 2020.</li> <li>• Lorsch <i>et al.</i>, <i>Nature neuroscience</i>, 2019.</li> </ul>
Cholinergic neurons	<i>Ache, Chat, Slc18a3</i>	<ul style="list-style-type: none"> <li>• Steinkellner, Thomas <i>et al.</i>, <i>eNeuro</i>, 2019.</li> <li>• Skirzewski, M. <i>et al.</i>, <i>Nature Communications</i>, 2022.</li> <li>• Francis, T. Chase <i>et al.</i>, <i>Neuron</i>, 2019.</li> </ul>
Dopaminergic neurons	<i>Slc6a3, Slc17a6, Th</i>	<ul style="list-style-type: none"> <li>• Buck, Silas A <i>et al.</i>, <i>The Journal of neuroscience</i>, 2021.</li> <li>• Venkataraman, A. <i>et al.</i>, <i>Neuropsychopharmacology</i>, 2021.</li> <li>• Chefer, Vladimir I <i>et al.</i>, <i>Neuropsychopharmacology</i>, 2013.</li> </ul>
GABAergic neurons	<i>Gad1, Slc6a1, Slc32a1</i>	<ul style="list-style-type: none"> <li>• Wang, Lei <i>et al.</i>, <i>Neuropharmacology</i>, 2016.</li> <li>• Rizzi, Giorgio, and Kelly R Tan. <i>Cell reports</i>, 2019.</li> <li>• Szlaga, Agata <i>et al.</i>, <i>Neuropharmacology</i>, 2022.</li> </ul>
Glutamatergic neurons	<i>Gls, Slc17a6, Slc17a7</i>	<ul style="list-style-type: none"> <li>• Maldonado <i>et al.</i>, <i>Current biology</i>, 2021.</li> <li>• Kroeger <i>et al.</i>, <i>Sleep</i>, 2022.</li> </ul>
Serotonergic neurons	<i>Pet-1, Slc6a4, Tph</i>	<ul style="list-style-type: none"> <li>• Xiao, Xing <i>et al.</i>, <i>Nature communications</i>, 2021.</li> <li>• Kast, Ryan J <i>et al.</i>, <i>ACS chemical neuroscience</i>, 2017.</li> </ul>

## Mouse Glial, Oligodendrocytes, and Immune Cells

Cell Type	Top Probes	Reference RNAscope <sup>®</sup> Probe Publications
Astrocytes	<i>Aldh1l1, Aqp4, Gfap</i>	<ul style="list-style-type: none"><li>Boulay <i>et al.</i>, Cell discovery, 2017.</li><li>Mazumder <i>et al.</i>, iScience, 2022.</li><li>Becker-Krail <i>et al.</i>, Biological psychiatry, 2022.</li></ul>
Brain microvascular endothelial cells	<i>Cd31, Cldn5, Vwf</i>	<ul style="list-style-type: none"><li>Chen, Michelle B <i>et al.</i>, Cell reports, 2020.</li><li>Dudek, Katarzyna A <i>et al.</i>, PNAS United States of America, 2020.</li><li>Liu, CC. <i>et al.</i>, Nature Neuroscience, 2022.</li></ul>
Ependymal cells	<i>Cd24, Foxj1, Mia</i>	<ul style="list-style-type: none"><li>MacDonald, Adam <i>et al.</i>, Frontiers in cellular neuroscience, 2021.</li><li>Rodrigo A., Aida <i>et al.</i>, Developmental cell, 2023.</li></ul>
Microglia	<i>Aif1, Cd68, Tmem119</i>	<ul style="list-style-type: none"><li>Lovatt <i>et al.</i>, Communications biology, 2022.</li><li>He, Baixuan <i>et al.</i>, FASEB journal, 2020.</li><li>Liu, Yu-Yan <i>et al.</i>, Neural regeneration research, 2023.</li></ul>
Oligodendrocytes	<i>Mbp, Mog, Olig2</i>	<ul style="list-style-type: none"><li>Barak <i>et al.</i>, Nature neuroscience, 2019.</li><li>Flygt <i>et al.</i>, Journal of neurotrauma, 2018.</li><li>Losurdo <i>et al.</i>, Brain sciences, 2020.</li></ul>
Pericytes	<i>Asma, Pdgfra, Rgs5</i>	<ul style="list-style-type: none"><li>Smyth, L.C.D. <i>et al.</i>, Communications Biology, 2022.</li><li>Ayloo, Swathi <i>et al.</i> Neuron, 2022.</li><li>Chasseigneaux, S. <i>et al.</i>, Scientific Reports, 2018.</li></ul>
T cells	<i>Cd3, Cd4, Cd8</i>	<ul style="list-style-type: none"><li>Lee, S.H. <i>et al.</i>, Cell Rep, 2021.</li></ul>
Schwann cells	<i>Gap43, Mpz, S100</i>	<ul style="list-style-type: none"><li>Renthal <i>et al.</i>, Neuron, 2020.</li><li>Shadrach <i>et al.</i>, iScience, 2021.</li><li>Matson <i>et al.</i>, Nature Communications, 2022.</li></ul>

## Hear what our customers are saying about RNAscope

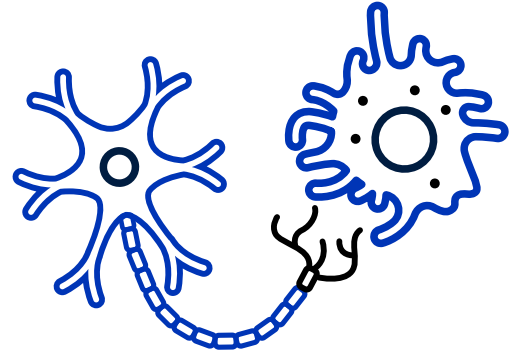


In our projects, we mainly use multiplex fluorescent assays combined with confocal microscopy on sectioned mouse brains. We are extremely pleased with the high resolution and the quality of the images we obtained. We compared RNAscope to other similar products developed recently and found that RNAscope's sensitivity is much higher, the background is much lower, and assays are much easier to perform. Bio-Techne's service and technical team is another important asset. They are fast to answer our purchasing and technical questions via email and are always attentive to our requests. I highly recommend Bio-Techne's RNAscope Assay for any kind of multiplex ISH assay.

— Assistant Professor  
Children's Hospital Los Angeles

## Mouse Models of Neuroinflammation

Inflammatory responses are crucial to combat infection and repair injuries. The Central Nervous System (CNS) also demonstrates characteristics of inflammation when infected or injured by producing inflammatory mediators, which recruit and stimulate the immune cells and glial cells. Mouse models developed to study inflammation associated with neurodegenerative diseases, injury, infection, aging *etc.*, include several cell types and related cytokines implicated in neuroinflammation. Here are a few examples of common targets studied in these models that can be used with cell-type marker probes.



Neuroinflammation Models	Cell Types	Top Probes	Reference RNAscope™ Probe Publications
Neurodegenerative disease associated	Macrophages, NK cells, T cells, Microglia, Astrocytes, Oligodendrocytes	<i>Tnfa</i> , <i>Il6</i> , <i>Ifng</i> , <i>Il2</i> , <i>Il1b</i> , <i>Cxcl3</i> , <i>Cxcr3</i>	<ul style="list-style-type: none"> <li>Villapol, S.L., <i>et al.</i>, <i>Glia</i>, 2017.</li> <li>Choi, B.R., <i>et al.</i>, <i>Nat Immunol</i>, 2023.</li> <li>Aguado, J., <i>et al.</i>, <i>Nature communications</i>, 2019.</li> <li>Martin, O.C.B., <i>et al.</i>, <i>Cell Rep</i>, 2021.</li> <li>Cheadle, L., <i>et al.</i>, <i>Neuron</i>, 2020.</li> <li>Voronova, A.Y., <i>et al.</i>, <i>Neuron</i>, 2017.</li> </ul>
Injury associated	Microglia, Astrocytes	<i>Il1b</i> , <i>Tnfa</i> , <i>Nos2</i> , <i>Ccl2</i> , <i>Cxcl10</i>	<ul style="list-style-type: none"> <li>Errede, M., <i>et al.</i>, <i>Fluids Barriers CNS</i>, 2022.</li> <li>Jiang, Y., <i>et al.</i>, <i>Cell Death Dis</i>, 2015.</li> <li>Villapol, S.L., <i>et al.</i>, <i>Glia</i>, 2017.</li> <li>Cinar, R., <i>et al.</i>, <i>Clin Transl Med</i>, 2021.</li> </ul>
Infection associated	Microglia, Neutrophils, Macrophages, T cells, B cells	<i>Il1b</i> , <i>Tnfa</i> , <i>Il6</i> , <i>Tlr4</i> , <i>Tlr2</i> , <i>Ifng</i>	<ul style="list-style-type: none"> <li>Molnár, K., <i>et al.</i>, <i>J Neuroinflammation</i>, 2022.</li> <li>Namineni, S., <i>et al.</i>, <i>J Hepatol</i>, 2020.</li> <li>Martin, O.C.B., <i>et al.</i>, <i>Cell Rep</i>, 2021.</li> <li>Tsoti, I., <i>et al.</i>, <i>Ocul Immunol Inflamm</i>, 2022.</li> <li>Liu, Y.-Y., <i>et al.</i>, <i>Neural Regeneration Research</i>, 2023.</li> </ul>
Aging associated	Microglia, T cells	<i>Il1b</i> , <i>Il6</i> , <i>Il12</i> , <i>Tlr2</i> , <i>Tnfa</i>	<ul style="list-style-type: none"> <li>Molnár, K., <i>et al.</i>, <i>J Neuroinflammation</i>, 2022.</li> <li>Vennekens, A., <i>et al.</i>, <i>Proc Natl Acad Sci</i>, 2021.</li> <li>Drokhlyansky, E., <i>et al.</i>, <i>Cell</i>, 2020.</li> <li>Liu, Y.-Y., <i>et al.</i>, <i>Neural Regeneration Research</i>, 2023.</li> <li>Villapol, S.L., <i>et al.</i>, <i>Glia</i>, 2017.</li> </ul>

Our catalog has a broad list of probes for inflammation-associated cytokines and chemokines. Here is a list of some of the most popular probes studied in inflammatory mouse models.

### Top cytokines and chemokines associated with inflammation

<i>Cxcl3</i>	<i>Gzmb</i>	<i>Il8</i>	<i>Nos2</i>
<i>Cxcl9</i>	<i>Ifng</i>	<i>Il10</i>	<i>Tnfa</i>
<i>Cxcl10</i>	<i>Il1b</i>	<i>Il12</i>	<i>Tgfb</i>
<i>Cxcl13</i>	<i>Il6</i>	<i>Il23a</i>	<i>Tnfa</i>

## RNAscope™ Technology

RNAscope is the gold-standard for RNA *in situ* hybridization, backed by over 2,000 Neuroscience peer reviewed publications from around the globe.

- **Sensitive** — Industry leading single molecule sensitivity.
- **Specific** — Unrivaled target specificity.
- **Quantitative** — Accurately measure changes in gene expression *in situ*.
- **No instrument required** — Manual and automated assays available.

## Getting Started is Easy

### Extensive probe catalog

Select probes to your genes of interest from an extensive online catalog with over 80,000 RNA probes in over 400 species.

### Fast and flexible custom probe design

If you we don't have the probe you need, we can easily design it for you for virtually ANY gene in ANY species for use in ANY tissue.

### Expert technical support

Our experienced technical support team has supported thousands of neuroscience researchers to deliver high impact results. We will help you get up and running quickly.

## Probe Guarantee

Backed by over 14,000 peer-reviewed publications from around the world, we are confident that RNAscope probes will deliver excellent results in your study. If your target is not detectable using our probe but is detected by an orthogonal method on a serial section, we will provide either a replacement probe, an alternative probe design, or technical consultation to help you continue your research.



### Free RNAscope Project Consultation

Our specialists can help you choose the right probes and kits for your experiment.

**Request a Meeting:** Scan QR code or visit [learn.bio-techne.com/4s7ELwA](https://learn.bio-techne.com/4s7ELwA)

## RNAscope Spotlight

Neuronal damage induced by CD8+ T cells is not well understood. During neuroinflammation, T cells can cause synaptic loss leading to disruption of neuronal connectivity. Here, the researchers have utilized the Rasmussen's encephalitis mouse model to study the interactions between CD8+ T cells, neurons and phagocytes during T cell induced encephalitis.

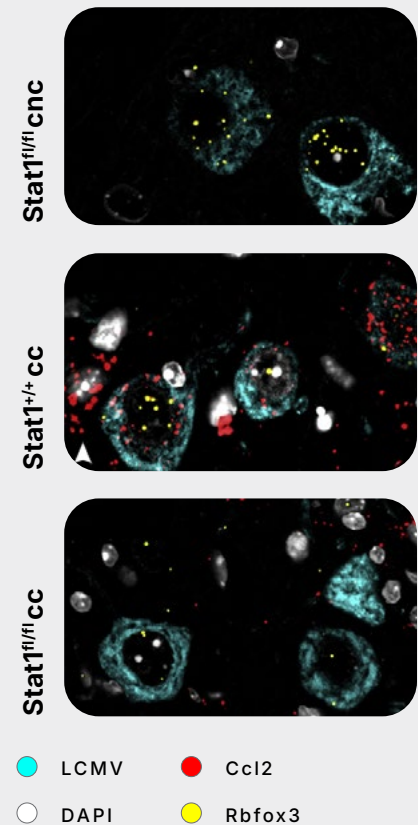


Figure 1. RNAscope Multiplex v2 assay demonstrated upregulation of Ccl2 transcripts in neurons indicated by cells positive for Rbfox3 transcripts in STAT1-competent mouse model with virus-induced encephalitis. Ccl2 positive staining in red and Rbfox3 positive staining in yellow.

Liberto *et al.*, Cell, 2018

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