



# Microglia

**(the Brain's Innate Immune Cells) in**

**Neuro-Developmental & Psychiatric Disorders**

**A Neuro-Immune Paradigm Shift**

## What are Microglia?

- [Microglia maintain structural integrity during fetal brain morphogenesis.](#)  
**Cell. 2024.**

“**Microglia** (MG), the brain-resident macrophages, play major roles in health and disease via a diversity of cellular states. ...At these boundaries between structures that grow in distinct directions, embryonic MG accumulate, display a state resembling post-natal axon-tract- ... “

- [Microglia regulation of central nervous system myelin health and regeneration.](#)  
**Nature Reviews Immunology. 2024**

“**Microglia** are resident macrophages of the central nervous system that have key functions in its development, homeostasis and response to damage and infection. ...However, the mechanisms by which **microglia** regulate myelin loss or integrity are still being uncovered. ...

- [Tuning neural circuits and behaviors by microglia in the adult brain.](#)  
**Trends Neuroscience. 2024**

“**Microglia** are the primary immune cells of the CNS, contributing to both inflammatory damage and tissue repair in neurological disorder. ...We discuss current studies utilizing microglial optogenetic and chemogenetic approaches to modulate adult neural circuits. These manip ... “

- [Microglia and Systemic Immunity.](#)  
**Advanced Neurobiology. 2024**

“**Microglia** are specialized immune cells that reside in the central nervous system (CNS) and play a crucial role in maintaining the homeostasis of the brain microenvironment. ...Understanding the complex interplay between **microglia** and systemic immunity is crucial for ... “

- [Microglia in Central Control of Metabolism.](#)  
**Physiology (Bethesda). 2024**

“Beyond their role as brain immune cells, **microglia** act as metabolic sensors in response to changes in nutrient availability, thus playing a role in energy homeostasis. This review highlights the evidence and challenges of studying the role of **microglia** in metabolism ... “

## How are Microglia affected by Maternal Immune Activation?

- [The role of microglia in early neurodevelopment and the effects of maternal immune activation](#)  
**(Seminars in Immunopathology, 2024)**

### Abstract

“Activation of the maternal immune system during gestation has been associated with an increased risk for neurodevelopmental disorders in the offspring, particularly schizophrenia and autism spectrum disorder. Microglia, the tissue-resident macrophages of the central nervous system, are implicated as potential mediators of this increased risk.

“Early in development, microglia start populating the embryonic central nervous system and in addition to their traditional role as immune responders under homeostatic conditions, microglia are also intricately involved in various early neurodevelopmental processes.

“**The timing of immune activation may interfere with microglia functioning during early neurodevelopment, potentially leading to long-term consequences in postnatal life.**”

“In this review we will discuss the involvement of microglia in brain development during the prenatal and early postnatal stages of life, while also examining the effects of maternal immune activation on microglia and neurodevelopmental processes.

“Additionally, we discuss recent single cell RNA-sequencing studies focusing on microglia during prenatal development, and hypothesize how early life microglial priming, potentially through epigenetic reprogramming, may be related to neurodevelopmental disorders.

## What is the relationship of Microglia to Mitochondria?

- [Neuronal control of microglia through the mitochondria.](#)  
**Biochimica et Biophysica Acta (BBA) --Molecular Basis of Disease. 2024**

“In this scenario, the NLRP3 pro-inflammatory pathway is activated due to mitochondrial impairment in N9 cells. These results demonstrate that **microglia** activation in the presence of BMAA is dependent on neuronal signaling. This study provides evidence that neurons may trig ... “

## What is the role of Microglia in Neurodevelopmental Disorders such as ADHD and Autism?

- [The Impact of Microglia on Neurodevelopment and Brain Function in Autism.](#)  
**Biomedicines. 2024**

“**Autism spectrum disorder** (ASD) is a highly heterogeneous neurodevelopmental **disorder**, and patients with ASD have severe deficits in behavior, social skills, and communication. ...Based on this, we summarize recent research on **microglia** in ASD, focusing ...”

- [Role of Microglial Modulation in Therapies for Perinatal Brain Injuries Leading to Neurodevelopmental Disorders.](#)  
**Advanced Neurobiology. 2024**

“Neurodevelopmental disorders (NDDs) encompass various conditions stemming from changes during brain development, typically diagnosed early in life. Examples include autism spectrum **disorder**, intellectual disability, cerebral palsy, seizures, dyslexia, and **attention ... “**

## What is the role of Microglia in Psychiatric Disorders such as Bipolar Disorder, Depression & Schizophrenia?

- [\*\*Suicide in bipolar disorder patients is associated with hippocampal microglia activation and reduction of lymphocytes-activation gene 3 \(LAG3\) microglial checkpoint expression.\*\*](#)

**Brain Behavior & Immun. 2023**

“**Bipolar disorder** (BD) is associated with marked functional impairments along with increased rate of suicide. ...Furthermore, the percent of **microglia** expressing LAG3 was significantly reduced only in suicidal BD patients, with significant negative ... “

- [\*\*The emerging neuroimmune hypothesis of bipolar disorder: An updated overview of neuroimmune and microglial findings.\*\*](#)

**Journal of Neurochemistry. 2024**

“**Bipolar disorder** (BD) is a severe and multifactorial disease, with onset usually in young adulthood, which follows a progressive course throughout life. ...Combining these different shreds of evidence, we aim to propose a unifying hypothesis for BD pathophysiology c ... “

- [\*\*Microglia and HPA axis in depression: An overview of participation and relationship.\*\*](#)

**World J Biol Psychiatry. 2022**

“Objectives: This narrative review article provides an overview on the involvement of **microglia** and the hypothalamic-pituitary-adrenal (HPA) axis in the pathophysiology of **depression**, as well investigates the mutual relationship between these two entities: how microg ... “

- [Microglia in depression: an overview of microglia in the pathogenesis and treatment of depression](#)  
**Journal of Neuroinflammation (2022)**

“Microglia are the predominant resident immune cells in the brain and exhibit a critical role in depression.

“Recent studies have suggested that depression can be regarded as a microglial disease.

“Microglia regulate inflammation, synaptic plasticity, and the formation of neural networks, all of which affect depression. . .”

- [Microglia-neuron interactions in schizophrenia.](#)  
**Frontiers in Cell Neuroscience. 2024**

“Schizophrenia risk factors as genetics or environmental influences may further be linked to increased activation of **microglia**, an increase of pro-inflammatory cytokine levels and activation of the inflammasome resulting in an overall elevated neuroinflammatory state”

...

- [Neurodevelopmental and Neuropsychiatric Disorders.](#)  
**Advanced Neurobiology. 2024.**

“This chapter will focus on microglial involvement in neurodevelopmental and neuropsychiatric disorders, particularly autism spectrum **disorder** (ASD), schizophrenia and major **depressive disorder** (MDD).”