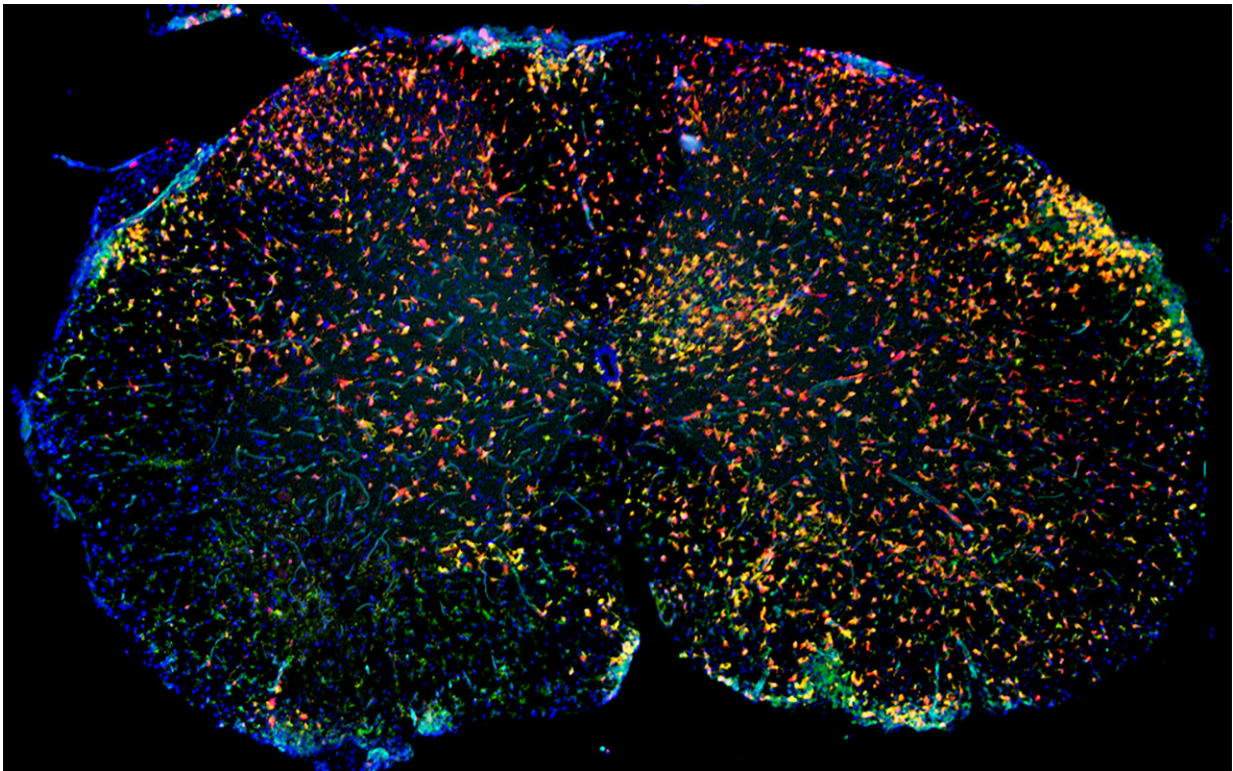


Newly discovered immune cells play role in inflammatory brain diseases

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Immune fluorescence of inflammatory microglia (depicted in red) and blood-derived invading blood monocytes (shown in green). Picture by MJC Jordao. Credit: University of Freiburg - Medical Center

A team of researchers under the direction of the Medical Center—University of Freiburg has observed in an animal model that

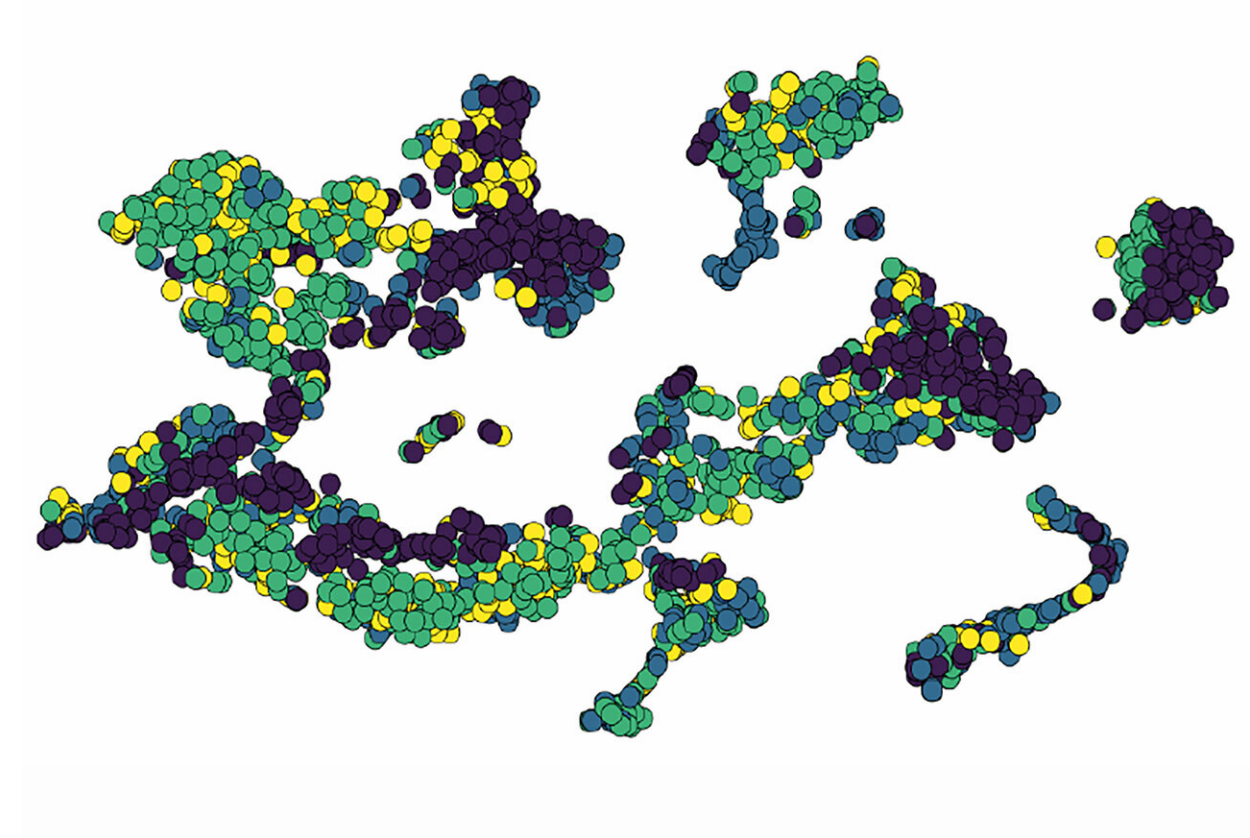
previously unknown types of immune cells are present in the inflamed brain in the course of multiple sclerosis (MS). The discovery was made through a new, high-resolution method for analyzing single cells. The method allowed the researchers from Freiburg and Munich to create a kind of immune cell atlas for the brain. They also report that these cells promote the development of the autoimmune disease MS. The study was published in the January issue of *Science*.

"Our findings constitute a breakthrough for the understanding of autoimmune diseases like [multiple sclerosis](#). We hope that it will now be possible to develop new, more cell-specific therapeutic approaches that are less prone to side effects for treating [inflammatory diseases](#) like MS," says project director Prof. Dr. Marco Prinz, medical director of the Institute of Neuropathology at the Medical Center—University of Freiburg. "The main problem with the previous, inadequate therapy was that it inhibited the entire immune system. However, we succeeded in finding new subtypes of cells that are specific for local inflammation and destruction in MS. They might therefore be selectively inactivated," says Prof. Prinz.

Women Suffer More Often from multiple sclerosis

Multiple sclerosis is one of the most common inflammatory diseases of the central nervous system (CNS). The [disease](#) develops in women more often than in men and typically first manifests between the ages of 20 and 40. In Germany, around 120,000 people suffer from MS. "It is assumed that MS is an autoimmune disease in which immune cells mistakenly attack structures of the central nervous system and cause the inflammation," explains Prof. Prinz, who is also involved in the Signalling Research Excellence Clusters BIOSS and CIBSS of the Albert-Ludwigs-Universität Freiburg. The fact that phagocytes from the blood and the [brain](#) play a role in MS has already long been known, but it was unclear until now precisely which subtypes are involved. After years of

research work, the scientists have now identified these subtypes in an [animal model](#) of multiple sclerosis.



Comprehensive map of the CNS immune cell populations during neuroinflammation. Each immune cell is represented as a dot and cluster together according to their transcriptomic profile, providing crucial information for the understanding of Multiple Sclerosis. Picture by MJC Jordao. Credit: University of Freiburg - Medical Center

A New Immune Cell Atlas

Using the latest high-resolution single-cell methods, the researchers succeeded in mapping the complex composition of cells located at the focus of inflammation, the so-called inflammation infiltrate. This enabled them to create a new immune cell atlas.

The single-cell analyses used by the researchers are new and can be used in medicine for studying individual cells from tissues. The researchers say they have enormous potential. "These methods allow us to paint an entirely new cellular picture of very complex tissues like the brain," says Dr. Dominic Gruen, one of the pioneers of this technique and research group leader at the Max Planck Institute of Immunobiology and Epigenetics in Freiburg, which participated in the study.

The first author of the study, Marta Joana Costa Jordao, doctoral candidate at the Institute of Neuropathology of the Medical Center—University of Freiburg, says that different phagocytes in the brain remain chronically activated in the course of the disease. It was previously assumed that they were quickly renewed by circulating blood [cells](#). "This permanent activation of the [immune cells](#) could explain why the brain of an MS patient is chronically attacked over the course of years," says Costa Jordao.

More information: Marta Joana Costa Jordão et al, Single-cell profiling identifies myeloid cell subsets with distinct fates during neuroinflammation, *Science* (2019). [DOI: 10.1126/science.aat7554](https://doi.org/10.1126/science.aat7554)

Provided by University of Freiburg

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