

Detailed atlas of the nervous system

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Researchers at Karolinska Institutet have created a systematic and detailed map of the cell types of the mouse nervous system. The map, which can provide new clues about the origin of neurological diseases, is presented in the journal *Cell*. The researchers will now use the same methods to map out the human brain on a detailed level.

The nervous [system](#) consists of hundreds, perhaps thousands, of different neurons, but also [immune cells](#), supporting [glia cells](#) and cells that constitute vessels and membranes. Our knowledge of these cell types mainly stems from microscopy, which provides information about the shape of cells and can detect certain proteins, and from electrophysiology, where cells are distinguished based on their electrical properties. However, these methods are limited, and there is currently no systematic atlas of the various cell types that make up the mammalian nervous system.

In recent years, Sten Linnarson's research group, and others, have developed methods to map cell types of the brain more systematically in much greater detail than ever before, by measuring gene activity in individual cells.

"You can compare it to the difference between a medieval map and a satellite image: thousands of details that were previously invisible become visible with the use of these new techniques, and the entire map becomes more reliable, explains Sten Linnarson, professor at the Department of Medical Biochemistry and Biophysics at Karolinska Institute.

Largest study of the architecture of the mammalian nervous system to date

His research group now publishes the largest study of the architecture and composition of the mammalian nervous system to date, using the mouse as a model system. The researchers identified 265 different types of cells, and found that neurons had the greatest diversity with over 200 different types.

"What surprised us most was that we discovered several different types of astrocytes that were specialised in different parts of the brain. This

suggests that astrocytes have specific functions in different parts of the brain, and that they play more of a key role in the functions of the brain than previously understood," says Sten Linnarson.

The knowledge of the cell types of the brain can be used to understand the origin of different diseases. Roughly one third of all [neurological diseases](#) arise during embryonic development. In the past fifteen years a large number of genetic studies have identified the genes that contribute to diseases such as schizophrenia, multiple sclerosis, autism, Alzheimer's and Parkinson's disease. However, diseases originate from a specific type of cells, in a specific location and at a specific time depending on where and when the relevant genes are active.

Atlas of the nervous system gives clues as to how the disease occurs

With the help of our new atlas of the nervous system, researchers are now able to place disease-causing genes in specific [cell types](#), which provides us with clues as to how the disease occurs. In the long run this might contribute to the development of new drugs or other therapies, says Sten Linnarson.

The mapping of the mouse nervous system is an important first step in a larger project where researchers are now mapping the [human brain](#) by using the same methods.

More information: Amit Zeisel et al. Molecular architecture of the mouse nervous system, *Cell* (2018). [DOI: 10.1101/294918](https://doi.org/10.1101/294918)

Provided by Karolinska Institutet

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