

Key to blood-brain barrier opens way for treating Alzheimer's and stroke

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While the blood-brain barrier (BBB) protects the brain from harmful chemicals occurring naturally in the blood, it also obstructs the transport of drugs to the brain. In an article in *Nature* scientists at Karolinska Institutet now present a potential solution to the problem. The key to the BBB is a cell-type in the blood vessel walls called pericytes, and the researchers hope that their findings will one day contribute to new therapies for diseases like Alzheimer's and stroke.

"Our new results show that the [blood-brain barrier](#) is regulated by pericytes, and can be opened in a way that allows the passage of molecules of different sizes while keeping the brain's basic functions operating properly," says Christer Betsholtz, professor of vascular biology at the Department of Medical Biochemistry, who has led the study.

The blood-brain barrier is a term denoting the separation of [blood](#) from tissue by blood vessels that are extremely tight? Impermeable?. In other organs, the capillary walls let certain substances carried by the blood, such as the plasma proteins albumin and immunoglobulin, out into the surrounding tissue. In the [brain](#), however, this pathway is closed off. This is essential for many reasons, one being that the plasma proteins are harmful to [nerve cells](#).

In recent time, capillary permeability in the brain has been discussed as a factor of potential significance to neurodegenerative diseases, such as Alzheimer's, Parkinson's and ALS.

"Our new knowledge of how the BBB is regulated could be used in two ways," says Professor Betsholtz. "To protect the brain under conditions such as stroke and inflammation that lead to the opening of the BBB and the release of neurodamaging substances, and to open the barrier temporarily to allow the transport of drugs against neurodegenerative and other diseases of

the brain."

In the study, which is now published in *Nature*, Professor Betsholtz and his research group show how this would be possible. The pericytes normally maintain the barrier function through an as-yet unknown molecular mechanism; in their absence, a special transport process called transcytosis opens a path through the capillary walls so that molecules of different sizes, including large [plasma proteins](#), can pass from the blood into the brain. The pericytes also regulate another type of brain cell known as an astrocyte. Astrocytes contribute to the BBB through special extensions called end-feet which envelop the capillaries and regulate water and ion flows.

"Another interesting find is that the cancer drug Imatinib, which inhibits certain signal proteins for cell growth, has a similar effect in the presence of pericytes in that they also close the capillary wall transport paths," says Professor Christer Betsholtz.

More information: Annika Armulik, Guillem Genové, Maarja Mäe, Maya H. Nisancioglu, Elisabet Wallgard, Colin Niaudet, Liqun He, Jenny Norlin, Per Lindblom, Karin Strittmatter, Bengt R. Johansson & Christer Betsholtz, Pericytes regulate the blood-brain barrier, *Nature*, AOP 13 October 2010, DOI: [10.1038/nature09522](https://doi.org/10.1038/nature09522)

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