Glial cells can cross from the central to the peripheral nervous system (w/ Video)

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Glial cells, which help neurons communicate with each other, can leave the central nervous system and cross into the peripheral nervous system to compensate for missing cells, according to new research in the Dec. 2 issue of *The Journal of Neuroscience.* The animal study contributes to researchers' basic understanding of how the two nervous systems develop and are maintained, which is essential for the effective treatment of diseases such as multiple sclerosis.

The nervous system is divided into the central nervous system (the brain and spinal cord) and the peripheral nervous system (sensory organs, muscles, and glands). A major difference between the systems is that each has its own type of glial cells. In a healthy body, glial cells are tightly segregated and aren't known to travel between the two systems. The peripheral nervous system also regenerates more than the central nervous system, due in part to its glial cells — a characteristic that, if better understood, might be used to improve the regenerative capabilities of the central nervous system.

Glial cells serve nerve cells by insulating them with layers of fats and proteins called myelin. Myelin coatings are necessary for nerve signals to be transmitted normally; when the sheaths are lost, disorders involving impairment in sensation, movement and cognition such as multiple sclerosis or amyotrophic lateral sclerosis develop. Glial cells named oligodendrocytes produce myelin around nerves of the central nervous system, while those named Schwann cells make myelin that insulates peripheral nerves.

This study shows that in the absence of Schwann cells, oligodendrocytes migrate from the central nervous system along motor nerves and form myelin on peripheral nerves, indicating that glial cell movement across the border is controlled by a self-policing mechanism.

"Past studies have hinted that Schwann cells can cross into the central nervous system after peripheral nerves near the border are damaged, or after central nerves lose their myelin sheath," said Bruce Appel, PhD, of the University of Colorado Denver Anschutz Medical Campus, one of the study's authors. "However, migration across the border has never been observed directly, nor was there any evidence that oligodendrocytes can move in the opposite direction."

The authors used time-lapse video of mutant zebrafish to study the glial cell movement. Movies of translucent live zebrafish that lacked Schwann cells showed that oligodendrocytes left the central nervous system to wrap peripheral nerves with myelin — effectively attempting to compensate for the missing Schwann cells.

"This new observation is not only relevant to normal nerve function, but also to potential causes of disease in the peripheral nervous system. We're still unsure as to exactly how foreign glial cells interact with the other system. Do they help heal or do they act as a toxin?" said Bruce Trapp, PhD, at the Cleveland Clinic, who is unaffiliated with the study. "Knowing the mechanisms that anatomically restrict peripheral and central nervous system glia could help develop therapies that treat or prevent certain nervous system diseases."

Appel and his colleagues said that future investigations are needed to determine how different glial cells communicate to restrict their movements between nervous systems, and whether oligodendrocyte myelin can fully substitute for Schwann cell myelin on motor nerves.

Source: Society for Neuroscience (news : web)