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Module 4 – SCI Biology Part I: How an SCI Causes Loss of Function

Glial Cells

While neurons are the essential messengers of the nervous system, they cannot function properly without glial cells. Four types of glial cells are particularly important in SCI biology and SCI research.

One of these types of glial cells are called “astrocytes.” Astrocytes in the brain and spinal cord are star-shaped cells with many arm-like structures called “processes.” Astrocytes provide nutrients to neurons and hold them in place. They also participate in repairing damage after an injury, but, as we’ll learn in the next video, they also can inhibit healing.

Another type are called “microglia.” Microglia are the main immune defense in the CNS. They are a special type of macrophage, which is an immune cell that engulfs and kills damaged cells and infectious pathogens like bacteria and viruses. Microglia are one of the first-responders after a spinal cord injury, but like astrocytes can also inhibit healing.

Next are glial cells called “oligodendrocytes,” which are found only in the CNS. Oligodendrocytes form a myelin sheath around the axons of neurons to help conduct electrical signals more quickly. This process is called myelination.

Myelin is a fatty coating that provides electrical insulation and physical protection and support. Following an SCI, myelin is damaged; researchers are trying to better understand why myelin repair often fails after an SCI.

A fourth type of glial cell that is important in SCI research is “Schwann cells.” They also myelinate neurons, but in the peripheral nervous system instead of in the CNS. Schwann cells also have additional functions that oligodendrocytes do not.

Unlike oligodendrocytes, Schwann cells can help damaged neurons in the peripheral nervous system grow back, or “regenerate,” their axons. One reason for this difference is the way that oligodendrocytes and Schwann cells attach themselves to axons during remyelination: One oligodendrocyte reaches out multiple arms, called “cellular processes,” that can wrap around and myelinate more than one axon at a time.

A Schwann cell wraps its cell body around a single axon to deposit a single section of myelin at a time; as a result, many Schwann cells lined up end-to-end can provide a protected canal in which an axon can grow.

Other reasons that axons regenerate after injury in the peripheral nervous system but not in the CNS are explained, at least in part, by events that happen at the site of injury; we will talk about these in the next video.