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

Structure and Function of the Spinal Cord and Central Nervous System

The spinal cord is the communication highway of the body; it connects the brain to the entire body to allow us to move and perceive our environment. It starts at the base of the skull and runs through the center of the spinal column, ending where the lower back begins, before the end of the spinal column. It is made up of a fluid-filled central canal surrounded by nerve cells, called neurons, and several other types of cells collectively referred to as glial cells.

Neurons relay information back and forth between the brain and body by transmitting electrical and chemical signals.

Glial cells include many different types of cells that have different jobs: Some glial cells surround neurons and hold them in place. Some glial cells supply nutrients and oxygen to neurons. There are special types of glial cells that fight infections and remove dead cells. Others help neurons transmit information by producing insulation that protects neurons and improves their ability to send electric signals. Some glial cells also produce chemicals that neurons need to communicate, or eliminate chemicals that prevent neurons from communicating.

The neurons and glial cells are arranged within the spinal cord in a way that helps organize communication to and from the brain. It is easiest to see this by looking at a cross-section of the spinal cord, which looks like an oval that contains a butterfly-like shape.

The oval is called the “white matter.” The butterfly is called the “gray matter.” The hole in the middle is the central canal that contains spinal fluid.

The white matter and gray matter are divided into columns of nerve tissue that communicate information in a one-way direction. The sensory regions of the white and gray matter carry information from the body to the brain. The motor regions carry information from the brain to the body to instruct muscles to move.

The spinal nerves themselves are also divided into sensory roots, which carry information from the body to the brain, and motor roots, which carry information from the brain to the body.

Whether an SCI affects only the sensory regions, only the motor regions, or both is one of the factors that determines whether a person will have a loss of sensation, a loss of movement, or both after an SCI.