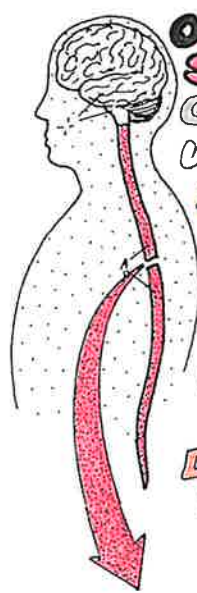


FUNCTIONS OF SPINAL CORD
SENSORY SIGNALS
PATHWAYS TO & FROM BRAIN
MOTOR SIGNALS

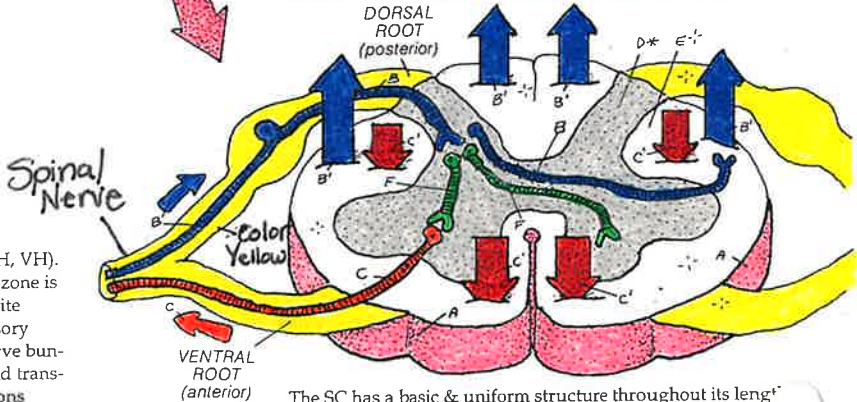
The spinal cord (SC) is a major CNS structure that runs through the vertebral column, from the neck to lower back. It receives sensory messages from all body parts (except the head) and sends motor fibers to voluntary muscles for movements of the limbs, trunk, and neck, as well as to involuntary muscles and glands of visceral organs. Through its multitudes of sensory and motor connections with the brain, the SC mediates communication between the body and the brain. The SC also acts as an independent integrative center for involuntary (spinal) reflexes.



ORGANIZATION OF SPINAL CORD Segment
GRAY MATTER
WHITE MATTER
SENSORY NEURON
INTERNEURON (ASSOCIATION)
MOTOR NEURON
ASCENDING TRACT (SENSORY RELAY N.)
DESCENDING TRACT (UPPER MOTOR N.)

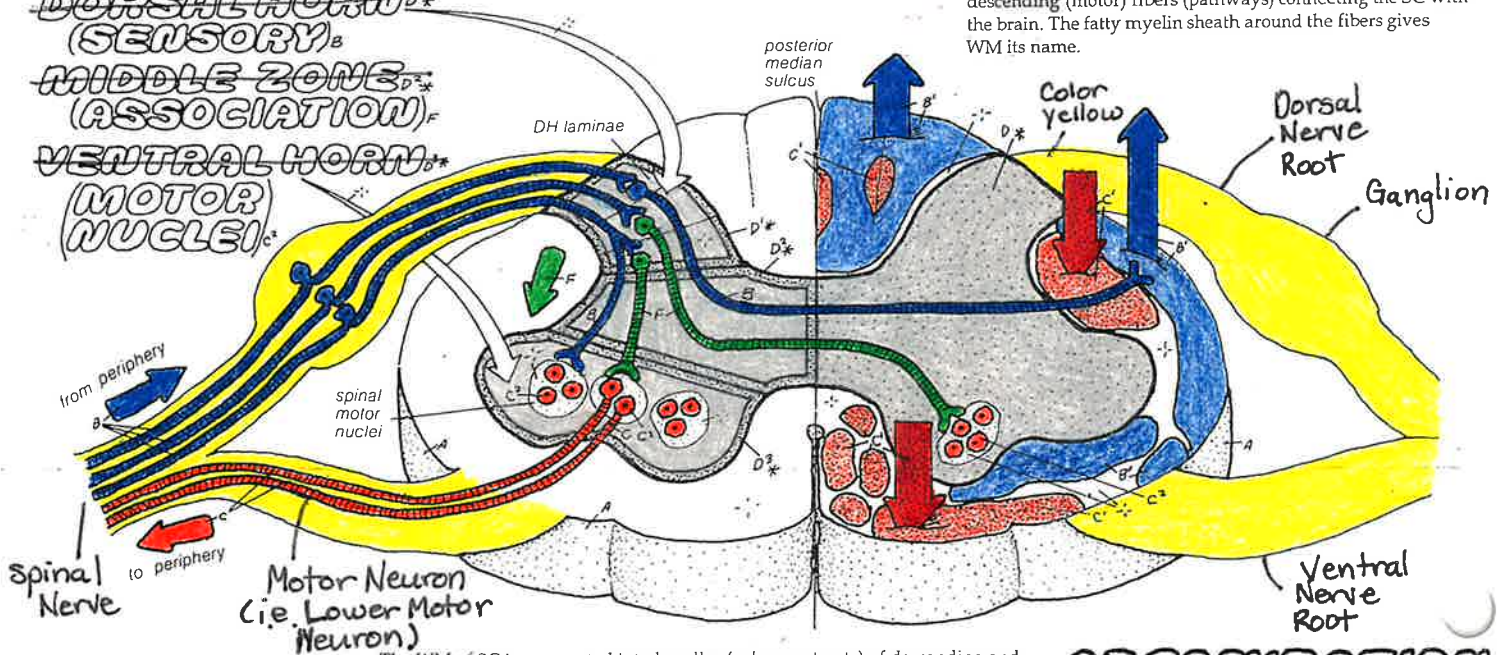
ORGANIZATION OF GRAY MATTER

The gray matter (GM) of the SC is organized into dorsal and ventral horns (DH, VH). The DH carries out sensory functions and the VH, motor functions. A middle zone is involved in association functions between DH and VH of the same and opposite sides. The DH receives sensory signals, which arrive via the dorsal roots. Sensory afferents conveying various modalities (pain, touch, etc.) travel in separate nerve bundles and terminate in different laminae of the DH. DH analyzes, integrates, and transmits these signals to association and motor neurons in the SC or to relay neurons going to the brain. The VH contains cell bodies of spinal motor neurons, the fibers of which leave the SC through the ventral (motor) roots, innervating voluntary muscles. Within each VH, motor neurons are grouped in discrete nuclei, each related to a separate muscle. The middle association zone contains inhibitory and excitatory interneurons whose short axons make specific connections between the sensory and motor elements of the DH and VH of the same and other segments. These connections underlie spinal integration and spinal reflexes.



The SC has a basic & uniform structure throughout its length. It is arranged into an inner mass of gray matter (GM) surrounded by an outer band of white matter (WM). In cross section, GM of SC is shaped like an H or butterfly. GM consists of cell bodies of neurons, their dendrites, short axons, and synapses, making it the site of neural (synaptic) analysis, integration, and transmission. The GM is connected with the dorsal and ventral roots through which the SC communicates with the periphery. The WM consists of ascending (sensory) and descending (motor) fibers (pathways) connecting the SC with the brain. The fatty myelin sheath around the fibers gives WM its name.

DORSAL HORN (SENSORY)
MIDDLE ZONE (ASSOCIATION)
VENTRAL HORN (MOTOR NUCLEI)



ORGANIZATION OF WHITE MATTER

The WM of SC is segregated into bundles (columns, tracts) of descending and ascending fibers (axons of large neurons). Ascending fibers are generally sensory and descending fibers are motor. Some descending fibers are for regulation of sensory input. Major ascending sensory pathways connect the SC with the medulla, brainstem reticular formation, and thalamus. Major descending tracts connect the forebrain voluntary motor areas as well as midbrain involuntary motor centers with the SC motor centers (ventral horns).