

Chapter 1

Introduction to the Central Nervous System

The Central Nervous System consists of the spinal cord and brain. The spinal cord is found in the vertebral column and the brain is housed in the cranium/skull. The spinal cord has 32 segments and the brain consists of the brain stem, diencephalon, cerebellum, and cerebrum. At the foramen magnum, the highest cervical segment of the spinal cord is continuous with the lowest level of the medulla of the brain stem. The 12 cranial nerves attached to the brain form the upper part of the part of the peripheral nervous system and record general sensations of pain, temperature, touch, and pressure; in addition, we now find the presence of the special senses of smell, vision, hearing, balance, and taste. The blood supply to the brain originates from the first major arterial branches from the heart, ensuring that over 20% of the entire supply of oxygenated blood flows directly into the brain.

I. The Neuron

Human beings enter the world naked but equipped with a nervous system that, with experience, is ready to function in almost any environment. One word summarizes the function of the nervous system: “protection.” The central nervous system (brain and spinal cord) monitors and controls the entire body by its peripheral divisions, which are distributed to all the muscles, organs, and tissues. The brain has an advantageous site in the head and above the neck, which can move in about a 140° arc. Close to the brain are all of the specialized sense organs, which permit us to see, smell, taste, and hear our world. The central nervous system is protected by fluid-filled membranes, the meninges, and surrounded by the bony skull and vertebrae.

The basic conducting element in the nervous system is the nerve cell, or neuron (Fig. 1.1). A neuron has a cell body, dendrite, and axon. The cell body contains many of the organelles vital to maintain the cells structure and function, including the nucleus and nucleolus, and is considered the tropic center of the nerve cell. The dendrites extend from the cell body and increase the receptive surface of the neuron. The axon leaves the cell body and connects to other cells. Axons are covered by a lipoproteinaceous membrane called *myelin* that insulates the axons from the

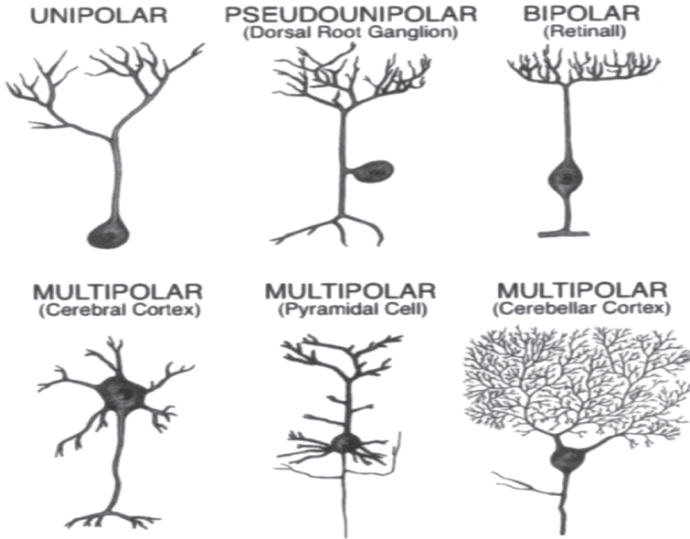


Fig. 1.1 Types of neurons in the central nervous system (From EM Marcus and S Jacobson, *Integrated neuroscience*, Kluwer, 2003)

Table 1.1 Types of neurons in the nervous system

Neuronal type	% of neurons	Location
Unipolar	0.05	Dorsal root ganglia of spinal cord Cranial nerve ganglia of brain stem Mesencephalic nucleus of CN V in midbrain
Bipolar	0.05	Retina, inner ear, taste buds
Multipolar:		
Peripheral	0.1	Autonomic ganglia
Central	99.8	Brain and spinal cord

fluids in the central nervous system. The site of contact between the axon of one nerve cell and the dendrites and cell body of another neuron is the *synapse* (see Chapter 2). The cells in the nervous system are classified based on their shapes: unipolar, bipolar, and multipolar (Table 1.1). In the central nervous system, the nerve cells are supported by glia and blood vessels; in the peripheral nervous system, they are supported by satellite cells, fibroblasts, Schwann cells, and blood vessels.

There are three basic categories of neurons: (1) receptors, the ganglia of the spinal dorsal roots and of the cranial nerves with general sensory components; (2) effectors, the ventral horn cells, motor cranial nerve nuclei, and motor division of the autonomic nervous system; and (3) interneurons, the vast majority of the neurons in the central nervous system. The areas in the central nervous system that contain high