complex motor control and tasks that require integration of information over time (Gazzaniga, Ivry, & Mangun, 2002).

4.2. The parietal lobe

It is at the upper back portion of the brain and associated with somatosensory processing. It receives inputs from the neurons regarding touch, pain, temperature sense, and limb position when you are perceiving space and your relationship to it—how you are situated relative to the space you are occupying (Culham, 2003). The parietal lobe is also involved in consciousness and paying attention. If you are paying attention to what you are reading, your parietal lobe is activated.

4.3. The temporal lobe

It is directly under your temples and associated with auditory processing (Murray, 2003) and comprehending language. It is also involved in your retention of visual memories. For example, if you are trying to keep in memory then your temporal lobe is involved. The temporal lobe also matches new things you see to what you have retained in visual memory.

4.4. The occipital lobe

It is associated with visual processing (De Weerd, 2003b). The occipital lobe contains numerous visual areas, each specialized to analyze specific aspects of a scene, including color, motion, location, and form (Gazzaniga, Ivry, & Mangun, 2002). When you go to pick strawberries, your occipital lobe is involved in helping you find the red strawberries in between the green leaves.

Projection areas are the areas in the lobes in which sensory processing occurs. These areas are referred to as projection areas because the nerves contain sensory information going to (projecting to) the thalamus. It is from here that the sensory information is communicated to the appropriate area in the relevant lobe. Similarly, the projection areas communicate motor information downward through the spinal cord to the appropriate muscles via the peripheral nervous system (PNS).

5. Neuronal Structure and Function

Individual neural cells, called neurons, transmit electrical signals from one location to another in the nervous system (Carlson, 2006). The greatest concentration of neurons is in the neocortex of the brain. The neocortex is the part of the brain associated with complex cognition. This tissue can contain as many as 100,000 neurons per cubic millimeter (Churchland & Sejnowski, 2004). The neurons tend to be arranged in the form of networks, which provide information and feedback to each other within various kinds of information processing (Vogels, Rajan, & Abbott, 2005). Neurons vary in their structure, but almost all neurons have four basic parts, as illustrated in Figure (04). These include **a soma** (cell body), **dendrites**, **an axon**, and **terminal buttons**.

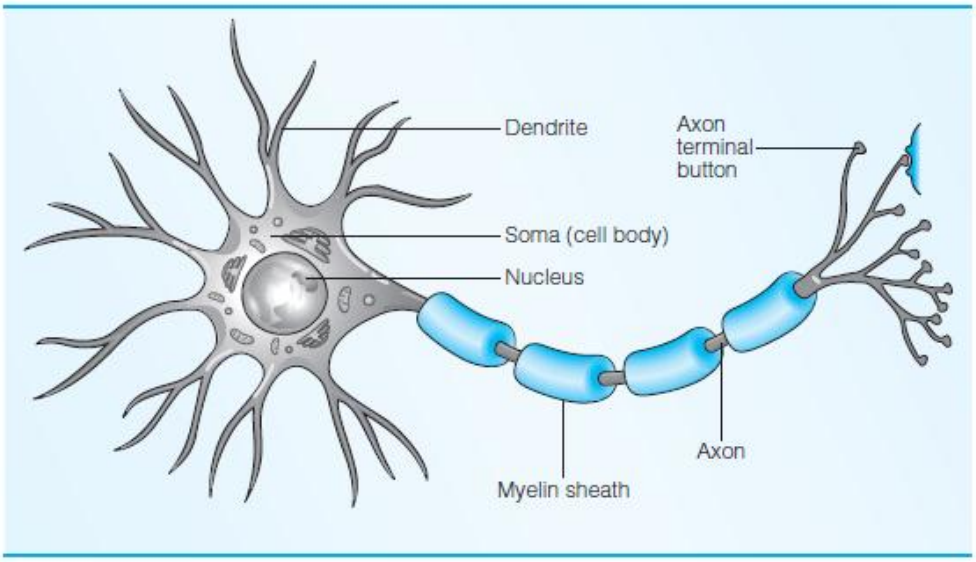

Figure (04): The composition of a Neuron (Sternberg, 1998)

5.1. The soma

It contains the nucleus of the cell (the center portion that performs metabolic and reproductive functions for the cell), is responsible for the life of the neuron and connects the dendrites to the axon.

5.2. The dendrites

They are branchlike structures that receive information from other neurons, and the soma integrates the information. Learning is associated with the formation of

new neuronal connections. Hence, it occurs in conjunction with increased complexity or ramification in the branching structure of dendrites in the brain.

5.3. The axon

It is a long, thin tube that extends (and sometimes splits) from the soma and responds to the information, when appropriate, by transmitting an electrochemical signal, which travels to the terminus (end), where the signal can be transmitted to other neurons. Axons are of two basic, roughly equally occurring kinds, distinguished by the presence or absence of myelin. Myelin is a white, fatty substance that surrounds some of the axons of the nervous system, which accounts for some of the whiteness of the white matter of the brain.

1) **Myelinated axons** (in that they are surrounded by a myelin sheath): This sheath, which insulates and protects longer axons from electrical interference by other neurons in the area, also speeds up the
2) **Unmyelinated axons:** they are smaller and shorter (as well as slower) than the myelinated axons. As a result, they do not need the increased conduction velocity myelin provides for longer axons (Giuliodori & DiCarlo, 2004).

In fact, transmission in myelinated axons can reach 100 meters per second (equal to about 224 miles per hour). Moreover, myelin is not distributed continuously along the axon. It is distributed in segments broken up by **nodes of Ranvier**. **Nodes of Ranvier** are small gaps in the myelin coating along the axon, which serve to increase conduction speed even more by helping to create electrical signals, also called action potentials, which are then conducted down the axon. The degeneration of myelin sheaths along axons in certain nerves is associated with multiple sclerosis, an autoimmune disease. It results in impairments of coordination and balance. In severe cases this disease is fatal.

5.4. The terminal buttons

They are small knobs found at the ends of the branches of an axon that do not directly touch the dendrites of the next neuron. Rather, there is a very small gap, the synapse. The synapse serves as a juncture between the terminal buttons of

one or more neurons and the dendrites (or sometimes the soma) of one or more other neurons (Carlson, 2006). Synapses are important in cognition.

6. Brain Disorders

A number of brain disorders can impair cognitive functioning.

6.1. Stroke

Strokes occur when the flow of blood to the brain undergoes a sudden disruption. People who experience stroke typically show marked loss of cognitive functioning. The nature of the loss depends on the area of the brain that is affected by the stroke. There may be paralysis, pain, numbness, a loss of speech, a loss of language comprehension, impairments in thought processes, a loss of movement in parts of the body, or other symptoms.

6.2. Brain Tumors

Brain tumors, also called neoplasms, can affect cognitive functioning in very serious ways. Tumors can occur in either the gray or the white matter of the brain. Tumors of the white matter are more common (Gazzaniga, Ivry, & Mangun, 2009). Following are the most common symptoms of brain tumors.

- Headaches (usually worse in the morning)
- Nausea or vomiting
- Changes in speech, vision, or hearing
- Problems balancing or walking
- Changes in mood, personality, or ability to concentrate
- Problems with memory
- Muscle jerking or twitching (seizures or convulsions)
- Numbness or tingling in the arms or legs

6.3. Head Injuries

Head injuries result from many causes, such as a car accident, contact with a hard object, or a bullet wound. Head injuries are of two types:

- **In closed-head injuries**: the skull remains intact but there is damage to the brain, typically from the mechanical force of a blow to the head. Slamming one's head against a windshield in a car accident might result in such an injury.

- **In open-head injuries**: the skull does not remain intact but rather is penetrated, for example, by a bullet.