جامعة الفرات الاوسط التقنية /المعهد التقني سماوة

قسم تقنيات صحة مجتمع

المحاضرة 14و15

اسم المادة / وظائف اعضاء 1.

المرحلة الدراسية / الاولى

العام الدراسي / 2022 - 2023

استاذ المادة. م .م شيماء جبار حسين

Lec14&15

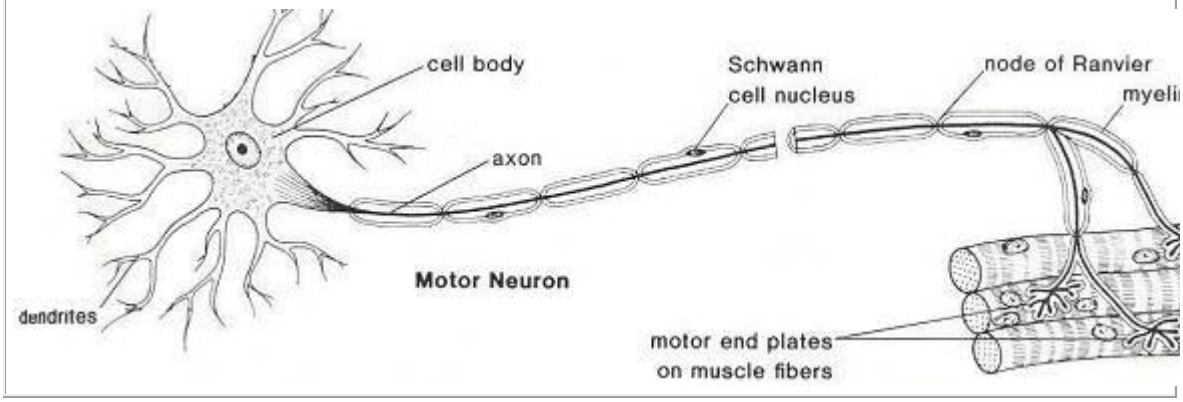
The nervous system

1-20 The nerve cells

The nervous system composed of nerve cells, or neurons:

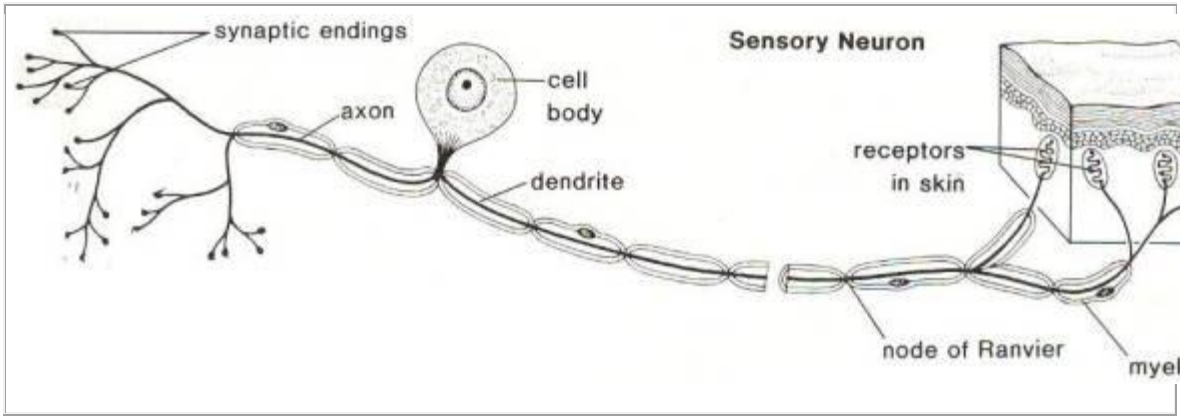
Motor Neurone:

- **Efferent Neuron – Moving toward a central organ or point**
- **Relays messages from the brain or spinal cord to the muscles and organs**



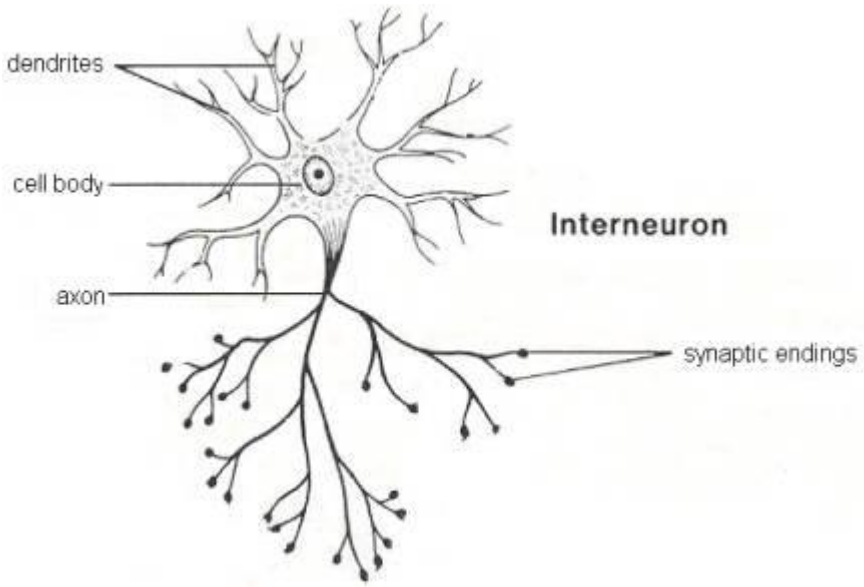
Sensory Neurone:

- **Afferent Neuron – Moving away from a central organ or point**
- **Relays messages from receptors to the brain or spinal cord**



Interneuron (relay neurone):

- **Relays message from sensory neurone to motor neurone**
- **Make up the brain and spinal cord**

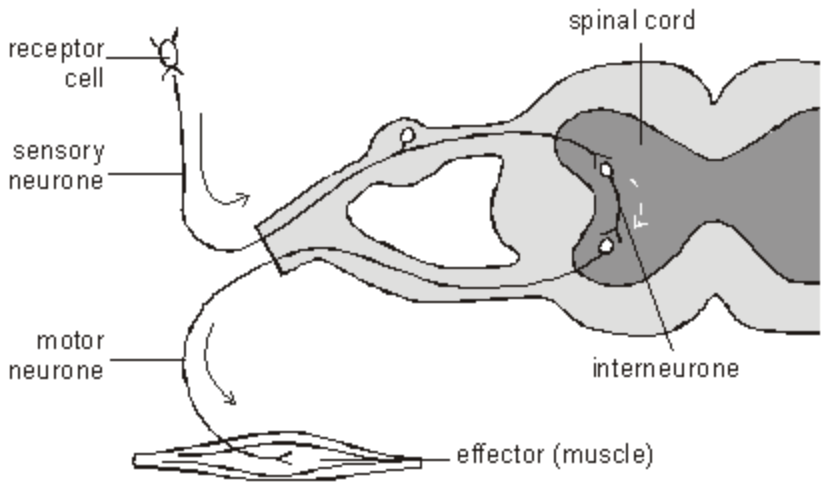


There are several differences between axons and dendrites:

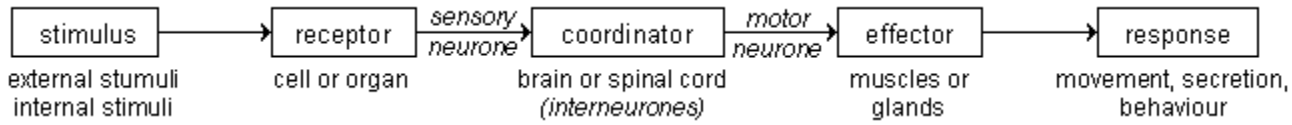
Axons	Dendrites
• Take information away from the cell body • Smooth Surface • Generally only 1 axon per cell • No ribosomes • Can have myelin • Branch further from the cell body	• Bring information to the cell body • Rough Surface (dendritic spines) • Usually many dendrites per cell • Have ribosomes • No myelin insulation • Branch near the cell body

Humans have three types of neurons:
• Sensory neurons have long axons and transmit nerve impulses from sensory receptors all over the body to the central nervous system. • Motor neurons also have long axons and transmit nerve impulses from the central nervous system to effectors (muscles and glands) all over the body. • Interneurones (also called connector neurons or relay neurons) are usually much smaller cells, with many interconnections

The three types of neurons are arranged in circuits and networks, the simplest of which is the reflex arc.

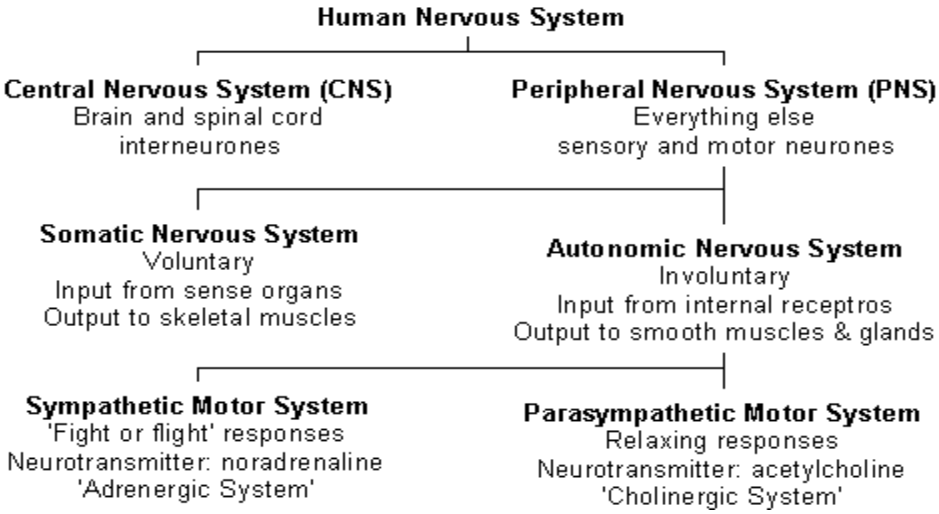


Reflex arc can also be represented by a simple flow diagram:



2-20 The organization of nervous system

. **The organization of the human nervous system is shown in this diagram:**



It is easy to forget that much of the human nervous system is concerned with routine,

involuntary jobs, such as homeostasis, digestion, posture, breathing, etc. This is the job of the autonomic nervous system, and its motor functions are split into two divisions, with anatomically distinct neurones. Most body organs are innervated by two separate sets of motor neurones; one from the sympathetic system and one from the parasympathetic system. These neurones have opposite (or antagonistic) effects. In general the sympathetic system stimulates the "fight or flight" responses to threatening situations, while the parasympathetic system relaxes the body. The details are listed in this table:-

Organ	Sympathetic System	Parasympathetic System
Eye	Dilates pupil	Constricts pupil
Tear glands	No effect	Stimulates tear secretion
Salivary glands	Inhibits saliva production	Stimulates saliva production
Lungs	Dilates bronchi	Constricts bronchi
Heart	Speeds up heart rate	Slows down heart rate
Gut	Inhibits peristalsis	Stimulates peristalsis
Liver	Stimulates glucose production	Stimulates bile production
Bladder	Inhibits urination	Stimulates urination

1-21 The central nervous system

The central nervous system is made up by

- **spinal cord and brain**

The spinal cord (functions)

- **conducts sensory information from the peripheral nervous system (both somatic and autonomic) to the brain**
- **conducts motor information from the brain to our various effectors**
  - **skeletal muscles**
  - **cardiac muscle**
  - **smooth muscle**
  - **glands**
- **serves as a minor reflex center**

The brain (functions)

- **receives sensory input from the spinal cord as well as from its own nerves (e.g., olfactory and optic nerves)**
- **devotes most of its volume (and computational power) to processing its various sensory inputs and initiating appropriate — and coordinated — motor outputs.**

Both the spinal cord and the brain consist of

- **white matter = bundles of axons each coated with a sheath of myelin**
- **gray matter = masses of the cell bodies and dendrites — each covered with synapses.**

In the spinal cord, the white matter is at the surface, the gray matter inside. .

The Meninges

Both the spinal cord and brain are covered in three continuous sheets of connective tissue, the meninges. From outside in, these are the

- **dura mater — pressed against the bony surface of the interior of the vertebrae and the cranium**
- **the arachnoid**
- **the pia mater**

The region between the arachnoid and pia mater is filled with cerebrospinal fluid (CSF).

2-21 the spinal cord

31 pairs of spinal nerves arise along the spinal cord. These are "mixed" nerves because each contain both sensory and motor axons. However, within the spinal column,

- **all the sensory axons pass into the dorsal root ganglion where their cell bodies are located and then on into the spinal cord itself.**
- **all the motor axons pass into the ventral roots before uniting with the sensory axons to form the mixed nerves.**

The spinal cord carries out two main functions:

- **It connects a large part of the peripheral nervous system to the brain. Information (nerve impulses) reaching the spinal cord through sensory neurons are transmitted up into the brain. Signals arising in the motor areas of the brain travel back down the cord and leave in the motor neurons.**
- **The spinal cord also acts as a minor coordinating center responsible for some simple reflexes like the withdrawal reflex.**

The interneurons carrying impulses to and from specific receptors and effectors are grouped together in spinal tracts.

Crossing Over of the Spinal Tracts

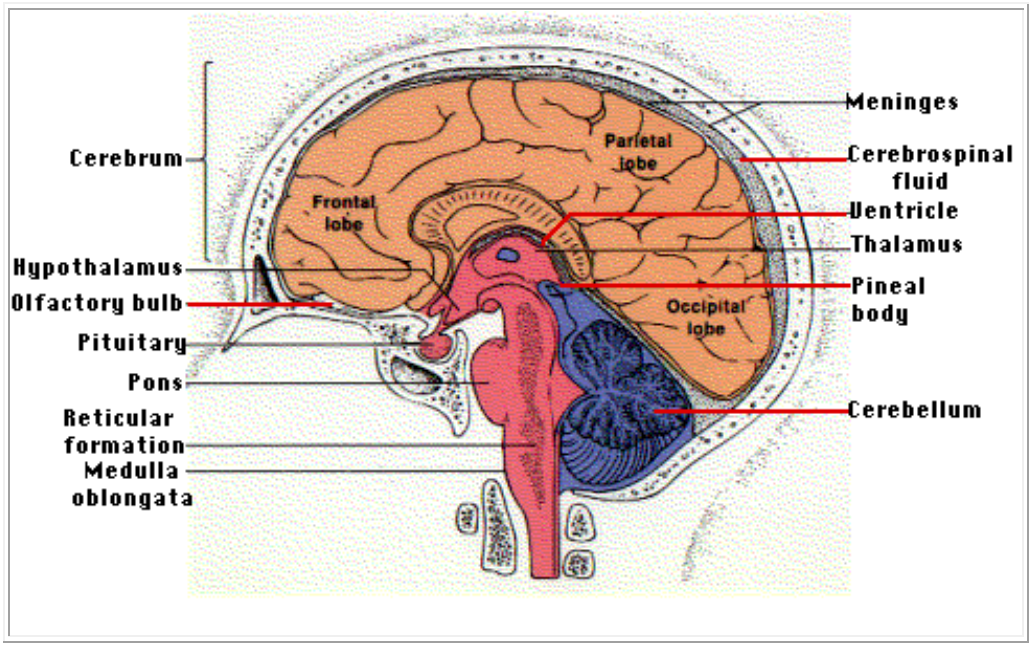
Impulses reaching the spinal cord from the left side of the body eventually pass over to tracts running up to the right side of the brain and vice versa. In some cases this crossing over occurs as soon as the impulses enter the cord. In other cases, it does not take place until the tracts enter the brain itself.

3-21 The Brain

- **forebrain**
- **midbrain**
- **hindbrain.**

The human brain receives nerve impulses from

- **the spinal cord and**
- **12 pairs of cranial nerves**
    - **Some of the cranial nerves are "mixed", containing both sensory and motor axons**
    - **Some, e.g., the optic and olfactory nerves (numbers I and II) contain sensory axons only**
    - **Some, e.g. number III that controls eyeball muscles, contain motor axons only.**



The Hindbrain

The main structures of the hindbrain are the

- **medulla oblongata**
- **pons and**
- **cerebellum**

Medulla oblongata

The medulla looks like a swollen tip to the spinal cord. Nerve impulses arising here

- **rhythmically stimulate the intercostal muscles and diaphragm — making breathing possible**
- **regulate heartbeat**
- **regulate the diameter of arterioles thus adjusting blood flow.**

The neurons controlling breathing have mu (μ) receptors, the receptors to which opiates, like heroin, bind. This accounts for the suppressive effect of opiates on breathing. Destruction of the medulla causes instant death.

Pons

The pons seems to serve as a relay station carrying signals from various parts of the cerebral cortex to the cerebellum. Nerve impulses coming from the eyes, ears, and touch receptors are sent on the cerebellum. The pons also participates in the reflexes that regulate breathing.

The reticular formation is a region running through the middle of the hindbrain (and on into the midbrain). It receives sensory input (e.g., sound) from higher in the brain and passes these back up to the thalamus. The reticular formation is involved in sleep, arousal (and vomiting).

Cerebellum

The cerebellum consists of two deeply-convoluted hemispheres. Although it represents only 10% of the weight of the brain, it contains as many neurons as all the rest of the brain combined.

Its most clearly-understood function is to coordinate body movements. People with damage to their cerebellum are able to perceive the world as before and to contract their muscles, but their motions are jerky and uncoordinated.

So the cerebellum appears to be a center for learning motor skills (implicit memory). Laboratory studies have demonstrated both long-term potentiation (LTP) and long-term depression (LTD) in the cerebellum.

The Midbrain

The midbrain (mesencephalon) occupies only a small region in humans). We shall look at only three features:

- **the reticular formation: collects input from higher brain centers and passes it on to motor neurons.**
- **the substantia nigra: helps "smooth" out body movements; damage to the substantia nigra causes Parkinson's disease.**
- **the ventral tegmental area (VTA): packed with dopamine-releasing neurons that**
    - **are activated by nicotinic acetylcholine receptors and**
    - **whose projections synapse deep within the forebrain.**

  The VTA seems to be involved in pleasure: nicotine, amphetamines and cocaine bind to and activate its dopamine-releasing neurons and this may account — at least in part (see below)— for their addictive qualities.

Forebrain

The human forebrain is made up of

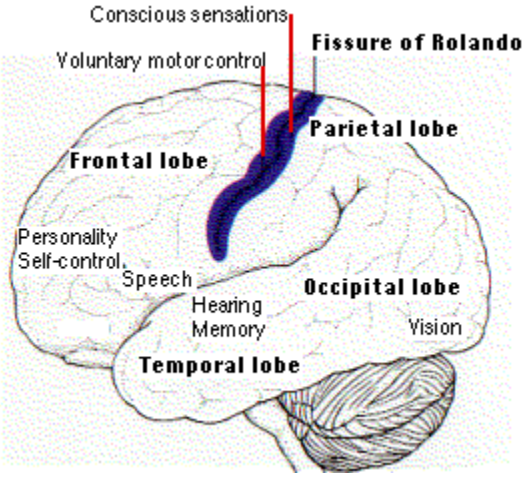
- **a pair of large cerebral hemispheres, called the telencephalon. Because of crossing over of the spinal tracts, the left hemisphere of the forebrain deals with the right side of the body and vice versa.**
- **a group of structures located deep within the cerebrum, that make up the diencephalon.**

Diencephalon

We shall consider four of its structures: the

- **Thalamus.**
  - **All sensory input (except for olfaction) passes through these paired structures on the way up to the somatic-sensory regions of the cerebral cortex and then returns to them from there.**
  - **signals from the cerebellum pass through them on the way to the motor areas of the cerebral cortex.**
- **Lateral geniculate nucleus (LGN). All signals entering the brain from each optic nerve enter a LGN and undergo some processing before moving on the various visual areas of the cerebral cortex.**
-
- **Hypothalamus.**
  - **The seat of the autonomic nervous system. Damage to the hypothalamus is quickly fatal as the normal homeostasis of body temperature, blood chemistry, etc. goes out of control.**
  - **The source of 8 hormones, two of which pass into the posterior lobe of the pituitary gland.**

The Cerebral Hemispheres

Each hemisphere of the cerebrum is subdivided into four lobes visible from the outside:

- **frontal**
- **parietal**
- **occipital**
- **temporal**