

Physiology Team

430

Musculoskeletal Block

2<sup>nd</sup> lecture

Organization of the nervous system and  
the motor unit

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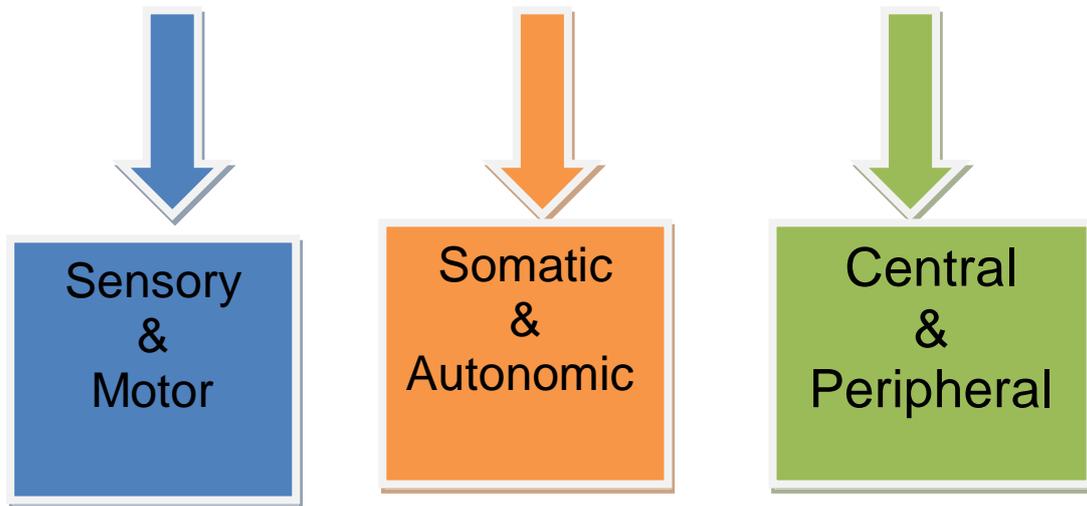
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\* هذا العمل شامل لجميع نقاط المحاضرة مع بعض الإضافات  
للتوضيح

## Classification of the Nervous System



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### 1- Central & Peripheral

Peripheral

Central

consisting of peripheral nerves ( whether somatic or autonomic peripheral nerves )

consisting of brain and spinal cord ( with its somatic and autonomic components )

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## Central

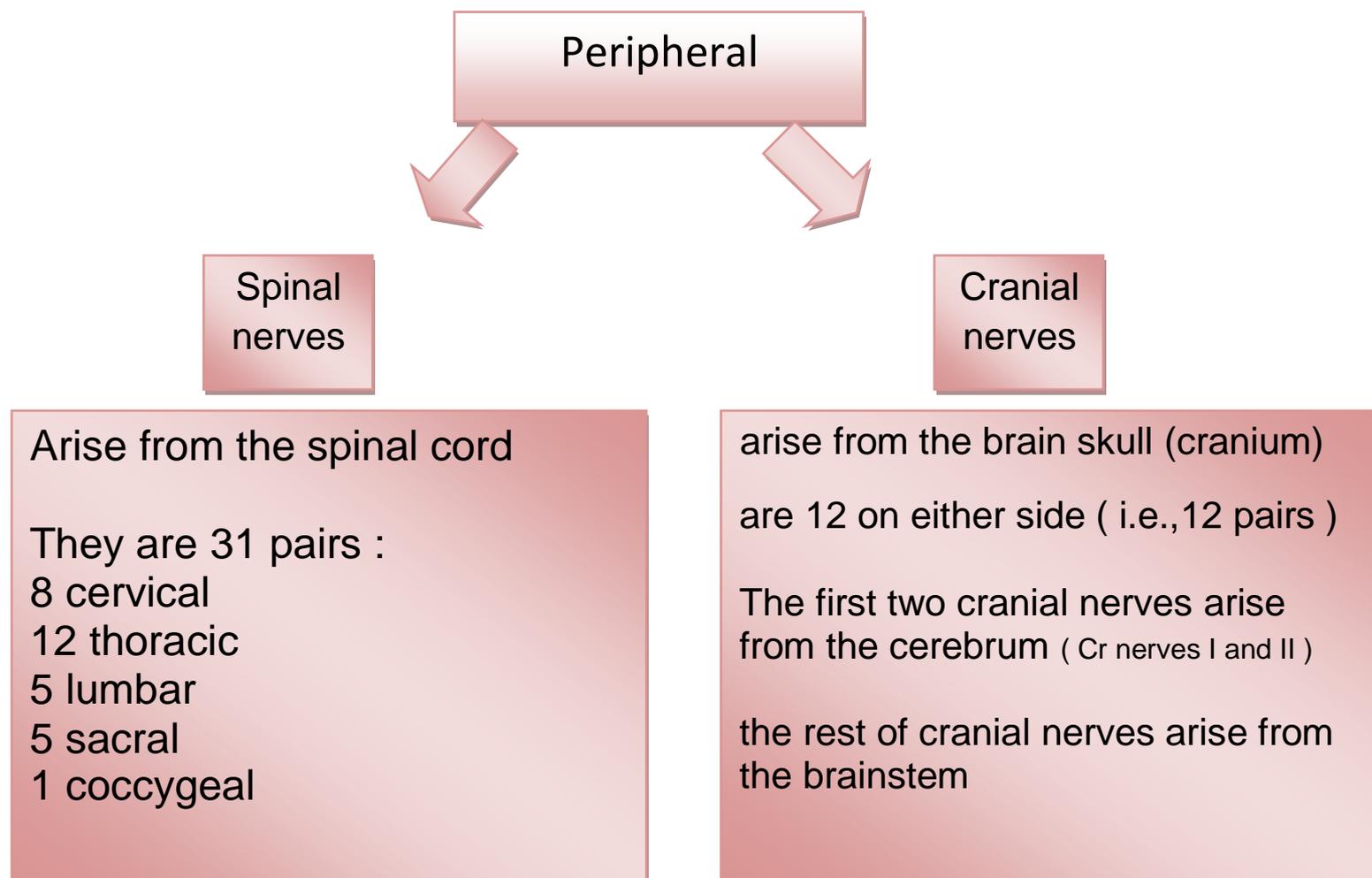
The CNS ( brain & spinal cord ) constitute the majority of the nervous system

The CNS integrates the information that it receives from all parts of the body

it initiates and coordinates the motor activity of all parts of the body

Because they are delicate structures , the brain and spinal cord need to be protected from the external environment ( including mechanical injury )

the brain is protected by the skull, while the spinal cord is protected by the vertebrae, and both are enclosed in the meninges



## 2) Sensory(somatic) and Autonomic nervous system:

### :A) Sensory(somatic nerves system):

<b>Type of system</b>	Somatic(sensory)
<b>movement</b>	voluntary
<b>nerves</b>	12 pairs cranial: 10 originate from brain stem. Nuclei I,II located on forebrain & thalamus. 31 pairs spinal spinal.
<b>Type of neurons</b>	Mixed
<b>Number of fibers</b>	One long fiber.

**\*Note:** Sensory neurons carry information from the stimulus receptor to the CNS .

• Motor neurons emerge from the CNS carrying motor orders to the effector organs ( muscles and glands )

## b) Autonomic nervous system:

Type of system	Autonomic nerves
Origin and fate	From hypothalamus or medulla oblongata to heart, lungs, viscera, and glands.
movement	involuntary
Number of fibers	Pre and post ganglionic fibers. i.e. two fibers.

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### Motor neuron: (الخلية العصبية)

A cell that is the function unit of nervous system, consists of **5 parts:-**

1- Soma (cell body)

2- Dendrites : branches carry impulse from surroundings (هي ما يعرف بالزوائد الشجرية حيث تنقل النبضات والاحساسات من المكان المحيط بها لجسم الخلية)

3- **Axon hillock**: the source of nerve impulse and the site (مهم جدا ركزوا عليه ، حيث انه هو المكان الذي تبدأ عنده السيالات العصبية وتتجه في اتجاه واحد الى المحور)

4- Axon: very thin, about 1 meter long.

5- Axon terminals: where impulses end .

## Motor unit:

Composed of a single motor neuron+ muscle fibers innervated by it

many motor units control a single muscle > so together called **motor unit pool**, forming contraction. This happens when a motor unit gets activated, the whole muscle fibers contract

(إذا ال "motor unit" تتكون من نيورون "خلية عصبية" بالإضافة للعديد من الألياف العضلية . وعند وجود أكثر من "motor unit" فإنهم يسمون "motor unit pool". يقومون بالتحكم بانقباض عضلة واحدة. وهذا يحدث عندما يتم تحفيز خلية عصبية واحدة مما يؤدي لانقباض جميع الألياف العضلية وبالتالي انقباض العضلة .)

Important note: number of muscle fibers within each motor unit depend on the type of movement:

Fine movement(حركات خفيفة): small number of muscle fibers.

Gross movement: (حركات كبيرة وقوية): large number of muscle fibers.

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## Electrodiagnostic testing:

Used to determine **neuropathy** and **myopathy**, by testing motor units function

## Motor unit recruitment:

Is the activation of a muscle by recruitment of motor unit

It measures how many motor units are activated within in a particular muscle and therefore it measures how many muscle fibers are activated. .

**Note:** activation of one motor unit result in weak muscle contraction  
**the stronger the recruitment, the stronger the muscle contraction will be**

**Factors affect motor unit force after activation:**

- 1- the number of muscle fibers it innervate.
- 2- the frequency of muscle stimulation by there axon

**Motor unit firing rate:**

Is the rate required for the impulse to reach the muscle.

It varies from frequencies:

- 1- that are slow: produce weak contraction.

(في حالة كون معدل وصول النبضات بطيئ ، فهذا يعطي انقباض بطيئ)

- 2- that are fast: produce tetanic contraction.

(أما في حالة كونه سريع فهذا يعطي انقباضات سريعة جدا من الصعب مشاهدتها " وكل هذا يطبق بالمختبر "