



لجان الدفوعات

PHYSIOLOGY

MORPHINE ACADEMY

MORPHINE
ACADEMY

عَدَلِي حَالِك بَلْشَنَّا بِالْجَد



PHYSIOLOGY

FACULTY OF PHARMACEUTICAL SCIENCES

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LECTURE 3, PART (2): INTRODUCTION OF THE NERVOUS SYSTEM

Objectives

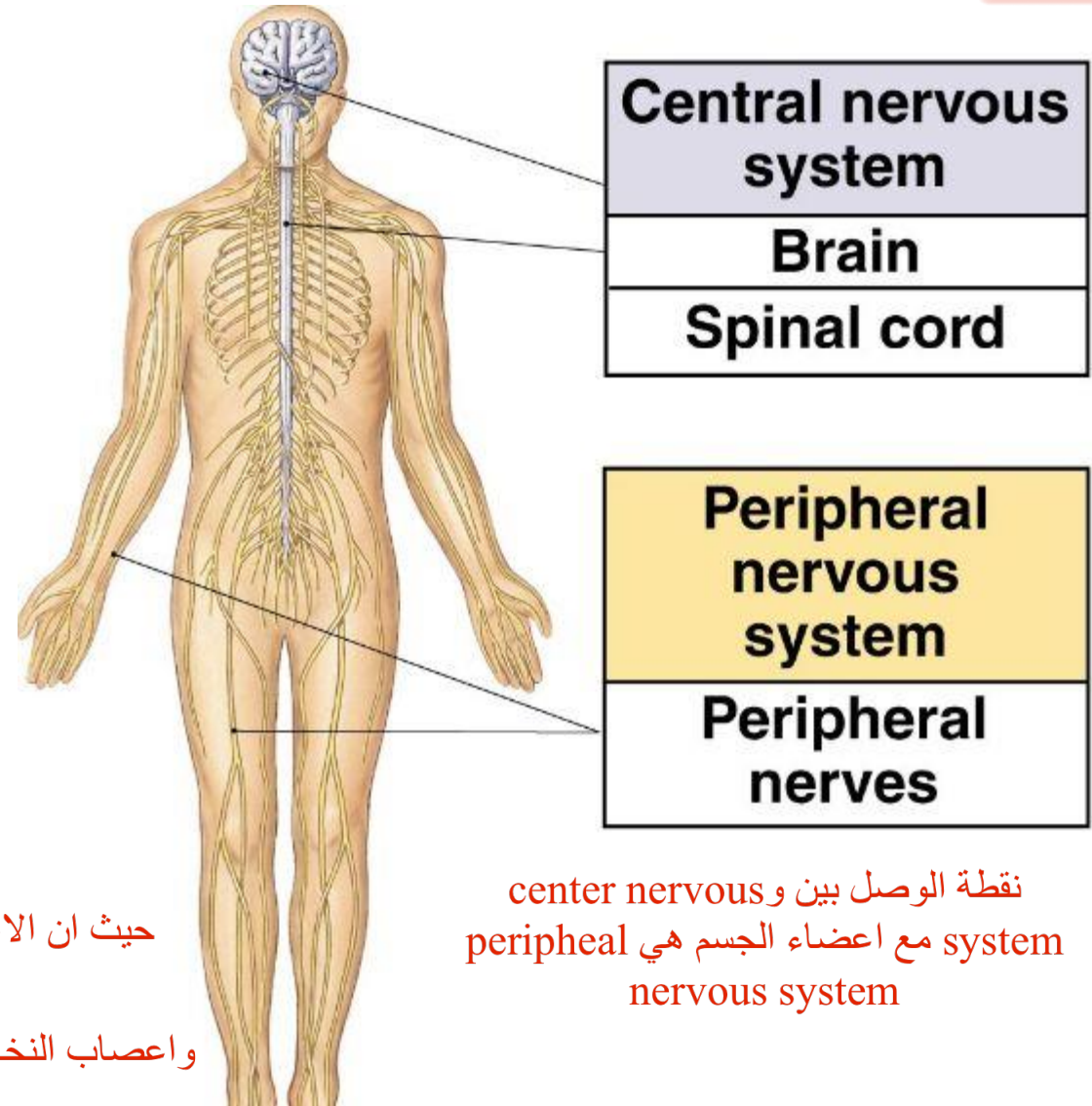
1. Discuss **central nervous system (CNS) as well as peripheral nervous system (PNS).**
2. Describe **functions of the nervous system.**
3. Explore **classification of neurons.**

(Pages 400- 408 of the reference)

في جسمنا 11 system و nervous system و controlling system وهو اصلا في عنا two controlling systems و nervous system و endocrine system

General Overview

The nervous system is one of the smallest (3% of the total body weight) but the most complex of the 11 body systems.



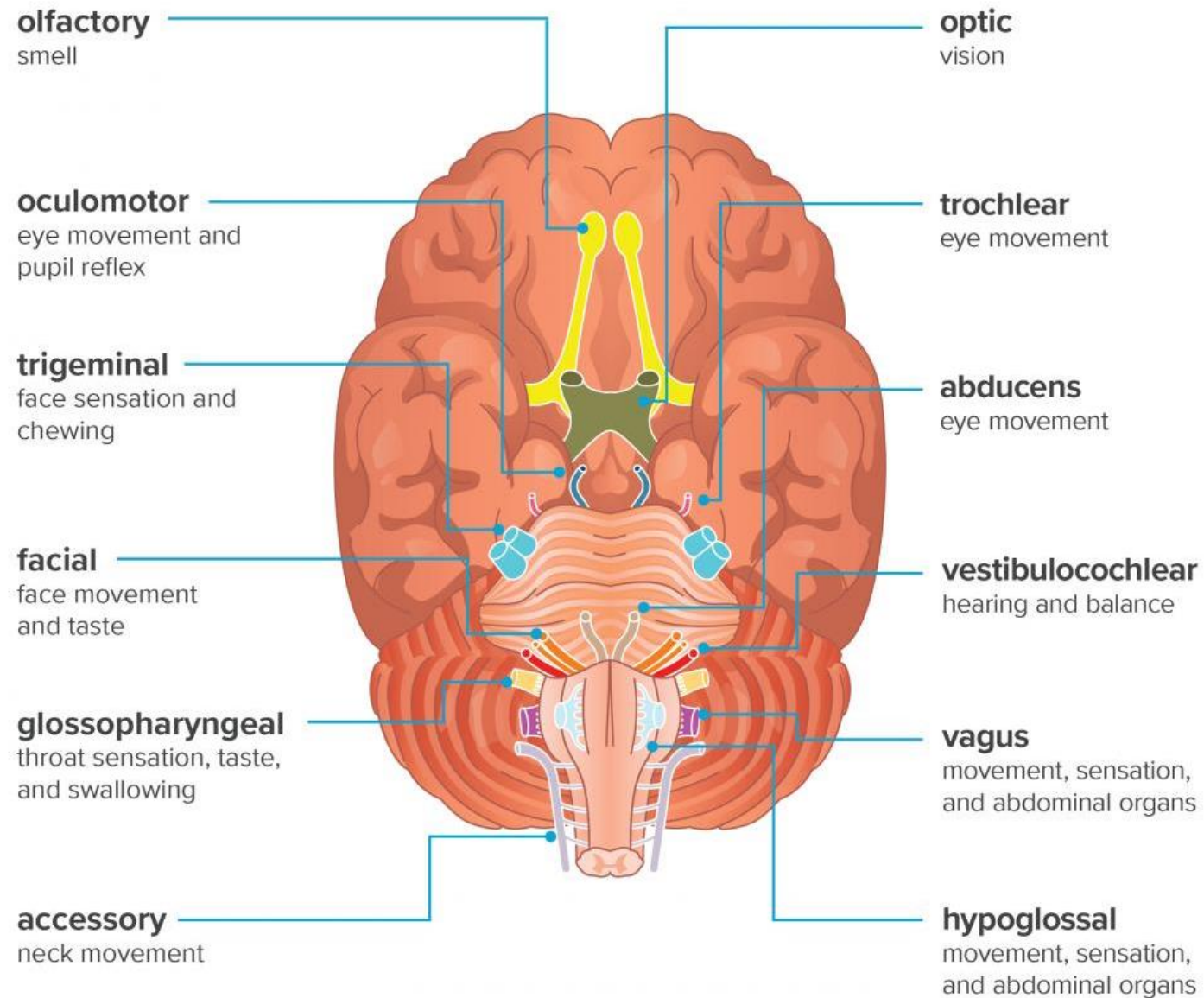
نقطة الوصل بين و center nervous system
peripheal مع اعضاء الجسم هي nervous system

حيث ان الاعصاب الدماغية cranial nerves متصلة مع peripheral nerves
الي بتوصل action potential للاعضاء

واعصاب النخاع الشوكي spinal nerves متصلة مع العامود الفقري spinal cord
مع periphral nerves مع الاعضاء

12 Cranial Nerves

اعصاب الدماغ



Spinal Nerve Function

Every Cell of Your Body Has a Nerve Component

اعصاب النخاع الشوكي



VERTEBRAL LEVEL	NERVE ROOT*	INNERVATION	POSSIBLE SYMPTOMS
C1	C1	Intracranial Blood Vessels	Headaches • Migraine Headaches
C2	C2	• Eyes • Lacrimal Gland	• Dizziness • Sinus Problems
C3	C3	• Parotid Gland • Scalp	• Allergies • Head Colds • Fatigue
C4	C4	• Base of Skull • Neck Muscles • Diaphragm	• Vision Problems • Runny Nose • Sore Throat • Stiff Neck
C5	C5	• Neck Muscles • Shoulders	• Cough • Croup • Arm Pain
C6	C6	• Elbows • Arms • Wrists	• Hand and Finger Numbness
C7	C7	• Hands • Fingers • Esophagus • Heart • Lungs • Chest	or Tingling • Asthma • Heart Conditions • High Blood Pressure
C8	C8		
T1	T1	Arms • Esophagus	Wrist, Hand and Finger
T2	T2	• Heart • Lungs • Chest	Numbness or Pain • Middle Back Pain • Congestion • Difficulty Breathing • Asthma • High Blood Pressure • Heart Conditions
T3	T3	• Larynx • Trachea	• Bronchitis • Pneumonia
T4	T4		• Gallbladder Conditions
T5	T5	Gallbladder • Liver	• Jaundice • Liver Conditions
T6	T6	• Diaphragm • Stomach	• Stomach Problems • Ulcers
T7	T7	• Pancreas • Spleen	• Gastritis • Kidney Problems
T8	T8	• Kidneys • Small Intestine	
T9	T9	• Appendix • Adrenals	
T10	T10	Small Intestines • Colon	
T11	T11	• Uterus	
T12	T12	Uterus • Colon • Buttocks	
L1	L1	Large Intestines	Constipation • Colitis • Diarrhea
L2	L2	• Buttocks • Groin	• Gas Pain • Irritable Bowel
L3	L3	• Reproductive Organs	• Bladder Problems • Menstrual Problems • Low Back Pain
L4	L4	• Colon • Thighs • Knees	• Pain or Numbness in Legs
L5	L5	• Legs • Feet	
S1	S1	Buttocks • Reproductive Organs • Bladder	Constipation • Diarrhea • Bladder Problems • Menstrual Problems
S2	S2	• Prostate Gland • Legs	• Lower Back Pain • Pain or Numbness in Legs
S3	S3	• Ankles • Feet • Toes	

REFERENCES:
*C. D. Ph.D. Neuroanatomy, 4th Edition, Lippincott Williams & Wilkins, 2002.
Undel, E. R., Schwartz, J. H., Russell, T. M., Principles of Physical Examination of the Spine and Extremities, Lippincott-Century-Crofts, 1976.
*C. D. Ph.D. Neuroanatomy, 4th Edition, Lippincott Williams & Wilkins, 2002.
*C. D. Ph.D. Neuroanatomy, 4th Edition, Lippincott Williams & Wilkins, 2002.

مش كثير مهم انك تعرف كل
عصب وين مكانه وشو
اعراضه هذول لجماعة الطب
بحفظوا كل اشي 😊😊
بس بدنا نحفظهم كمجموعات

عشان لما يتضرر اي شخص
يعرف من الاعراض اي
عصب هو الذي تضرر

Spinal Nerves

31 زوج من الاعصاب مش 31 عصب

طبعًا جدول
المجموعات
حفظ

- 31 Pairs of spinal nerves
- Named & numbered by the cord level of their origin

في منطقة الرأس
والرقبة
والأكتاف

8 pairs of cervical nerves
(C1 to C8)

في منطقة الصدر
ومنتقة البطن

12 pairs of thoracic nerves
(T1 to T12)

في منطقة الارجل

5 pairs of lumbar nerves
(L1 to L5)

في منطقة الاقدام

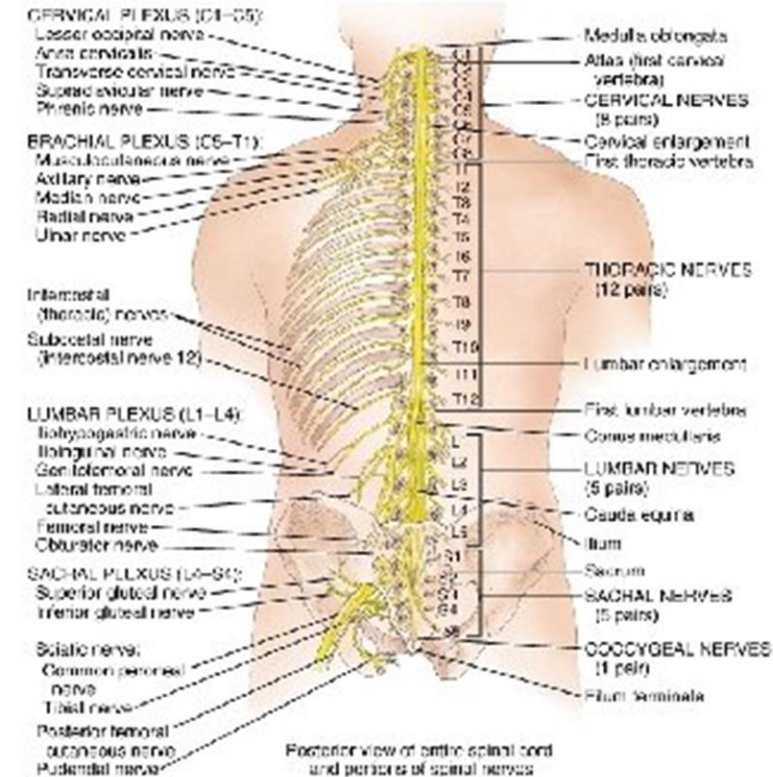
5 pairs of sacral nerves
(S1 to S5)

في منطقة الحوض

1 pair of coccygeal nerves

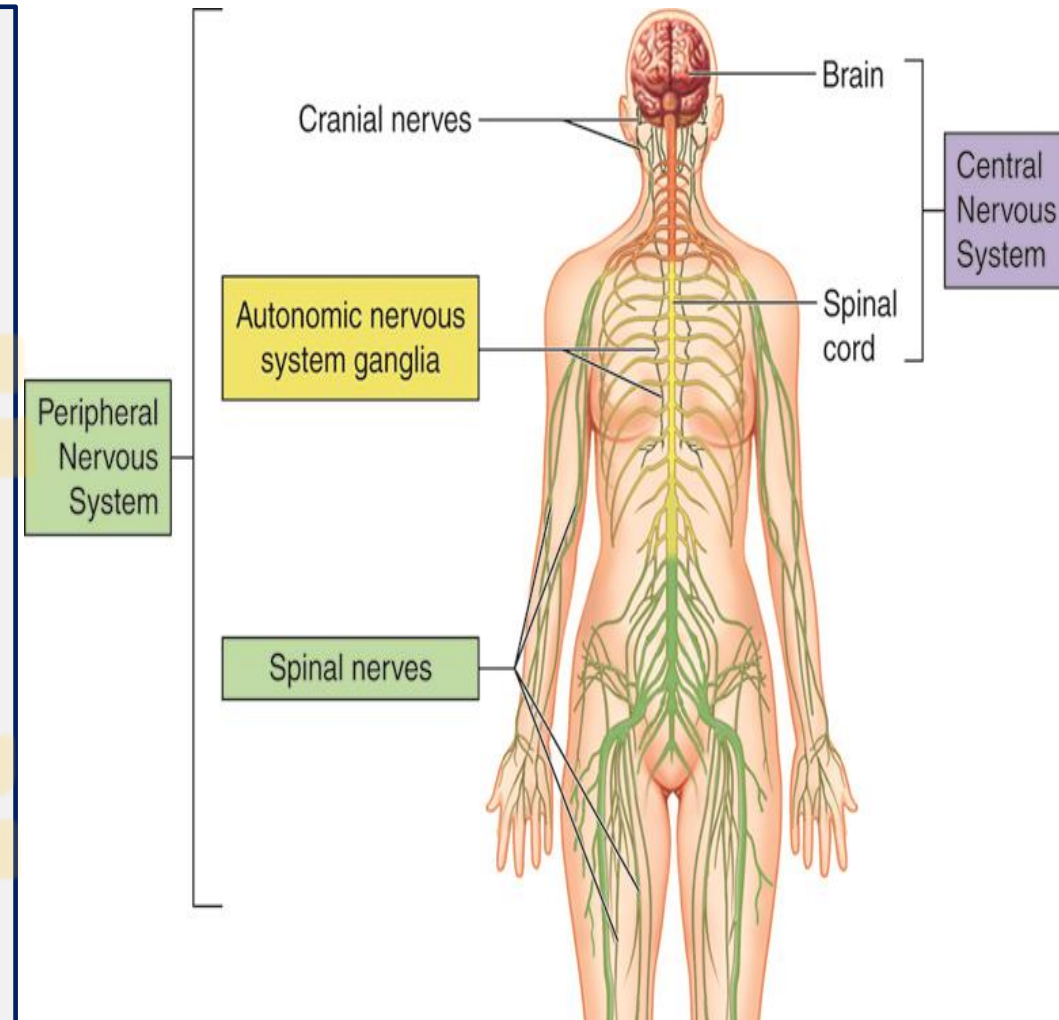
- Mixed sensory & motor nerves

طبعًا هذه الازواج كل زوج كل واحد منهم واحد
sensory neuron والثاني motor neuron



NERVOUS SYSTEM

- It consists of **central nervous system (CNS)** and **peripheral nervous system (PNS)**.
- The **CNS** consists of brain (85 billion neurons) and spinal cord (100 million neurons.).
- The **PNS** consists of all nervous tissue outside the CNS, which include nerves, ganglia, enteric plexuses, and sensory receptors.



PERIPHERAL NERVOUS SYSTEM

1. **Nerve** is a bundle of hundreds to thousands of axons plus associated connective tissue and blood vessels that lies outside the brain and spinal cord (i.e., **cranial nerves** emerge from the **brain** and **spinal nerves** emerge from the spinal cord).
2. **Ganglia** are small masses of nervous tissue, that are located outside of the brain and spinal cord.
هي عبارة عن عقدة من مجموعة من الخلايا العصبية
3. **Enteric plexuses** are extensive networks of neurons located in the walls of organs of the gastrointestinal tract (regulating the digestive system).
دائما كلمة Enteric اربطها مع الجهاز الهضمي GI
هي عبارة عن مجموعة من الاعصاب
الجهاز الهضمي
هنا في GI لما تاكل الاكل ويصير هضم كامل full digestion لازم يكون عندك two type من actions عن طريق المعدة واحد انه لازم يصير زيادة بإفرازات المعدة والثاني بصير لازم contraction الانقباضات والطريقتين عن طريق مجموعة من الاعصاب تسمى plexuses
4. **Sensory receptor** refers to a structure of the nervous system that monitors changes in the external or internal environment.
يراقب

PERIPHERAL NERVOUS SYSTEM

كلياتهم فيهم sensory neurons و motor neurons

بس يختلفوا عن بعض في
١- المكان الي صار فيه stimulant
٢- وكمان effector الي بدو يَأْثُر

في SNS يكون effector هو العضلات الهيكلية skeletal muscles فقط Somatic nervous system (SNS)

هسا على حسب المثال الي حكينا قبل هذا السلايد مجموعة الاعصاب المسؤولة عن زيادة الانقباضات في smooth muscles في GI هو ANS

في ANS يكون effector هو العضلات الملساء smooth muscles وعضلة القلب cardiac muscles والغدد glands Autonomic nervous system (ANS)

هسا على حسب المثال الي حكينا قبل هذا السلايد مجموعة الاعصاب المسؤولة عن زيادة الافرازات في المعدة هو ENS

في ENS يكون effector هو الجهاز الهضمي gastrointestinal (GI) Enteric nervous system (ENS)

SOMATIC NERVOUS SYSTEM (SNS) (CONSCIOUSLY CONTROLLED)

يعني مش تحكم كليًا

هسا بحكيك انه هو semi consciously controlled مش consciously controlled عشان زي لما مثلا الرنتين انت بتقدر اتوقف تنفسك بس بنفس الوقت الرنتين شغالات وانت مش واعي عنها

1. **Sensory neurons** that ^{يوصل} convey information to CNS from somatic receptors in the head, body wall, and limbs and from receptors for the special senses of vision, hearing, taste, and smell.
2. **Motor neurons** that ^{تنقل} conduct impulses from the CNS to skeletal muscles only.

AUTONOMIC NERVOUS SYSTEM (ANS) (INVOLUNTARY)

1. **Sensory neurons** that convey information to CNS from autonomic sensory receptors, located primarily in visceral organs such as the stomach and lungs.
2. **Motor neurons** that conduct nerve impulses from the CNS to smooth muscle, cardiac muscle, and glands.

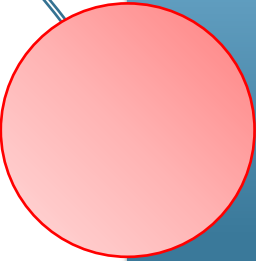
Note: The motor part of the ANS consists of two branches, the **sympathetic division** and the **parasympathetic division**.

ANS ينقسم الى sympathetic يسمى (fight and flight) والى parasympathetic يسمى (rest and digest)

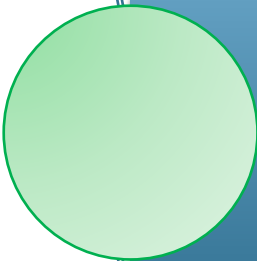
ENTERIC NERVOUS SYSTEM (ENS) (THE BRAIN OF THE GUT) (INVOLUNTARY)

1. **Sensory neurons** of the ENS monitor chemical changes within the GI tract as well as the stretching of its walls.
2. **Motor neurons** govern contractions of GI tract smooth muscle to propel food through the GI tract, secretions of GI tract organs (such as acid from the stomach and hormones from GI tract endocrine cells).

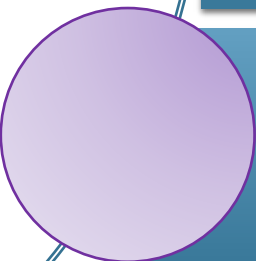
FUNCTIONS OF THE NERVOUS SYSTEM



Sensory function (detecting internal stimuli or external stimuli through cranial and spinal nerves).



Integrative function (analyzing sensory information and making decisions for appropriate responses).



Motor function (eliciting an appropriate motor response by activating effectors (muscles and glands) through cranial and spinal nerves).

انواع الاعصاب

(Sensory neurons أو Afferent neurons)

الاعصاب المسؤولة عن نقل المعلومات الحسية من مكان المحفز stimulant الى control centre في عملية انتقال الاشارات الحسية sensory information من المستقبل reseptor الى control centre عن طريق pathway يسمى afferant pathway

(Interneurons)

الاعصاب الموجودة في control centre عشان تعملك تحليل analyzing من خلال الدماغ للمعلومات

(Motor neurons أو Efferent neurons)

الاعصاب المسؤولة عن نقل السيالان العصبي على شكل أوامر الى بطلع من control centre الى effector عشان يعمل استجابة عشان يرجع من الحالة عدم التوازن الى حالة التوازن في عملية انتقال الاشارات الحسية sensory information من control centre الى effector عن طريق pathway يسمى efferant pathway

NERVOUS TISSUE

نوعين من الخلايا

لا تتجدد ولا تنقسم اذا صار فيها خلل وبالتالي عددها ثابت وهي المسؤولة عن انتاج action potential او السيالان العصبي nerve impulse وتعمل على نقله الى مسافات طويلة propagation

Neurons (provide most of the unique functions of the nervous system, such as ^{الاستشعار} sensing as they connect all regions of the body to the brain and spinal cord). No ability to undergo dividing throughout an individual's lifetime.

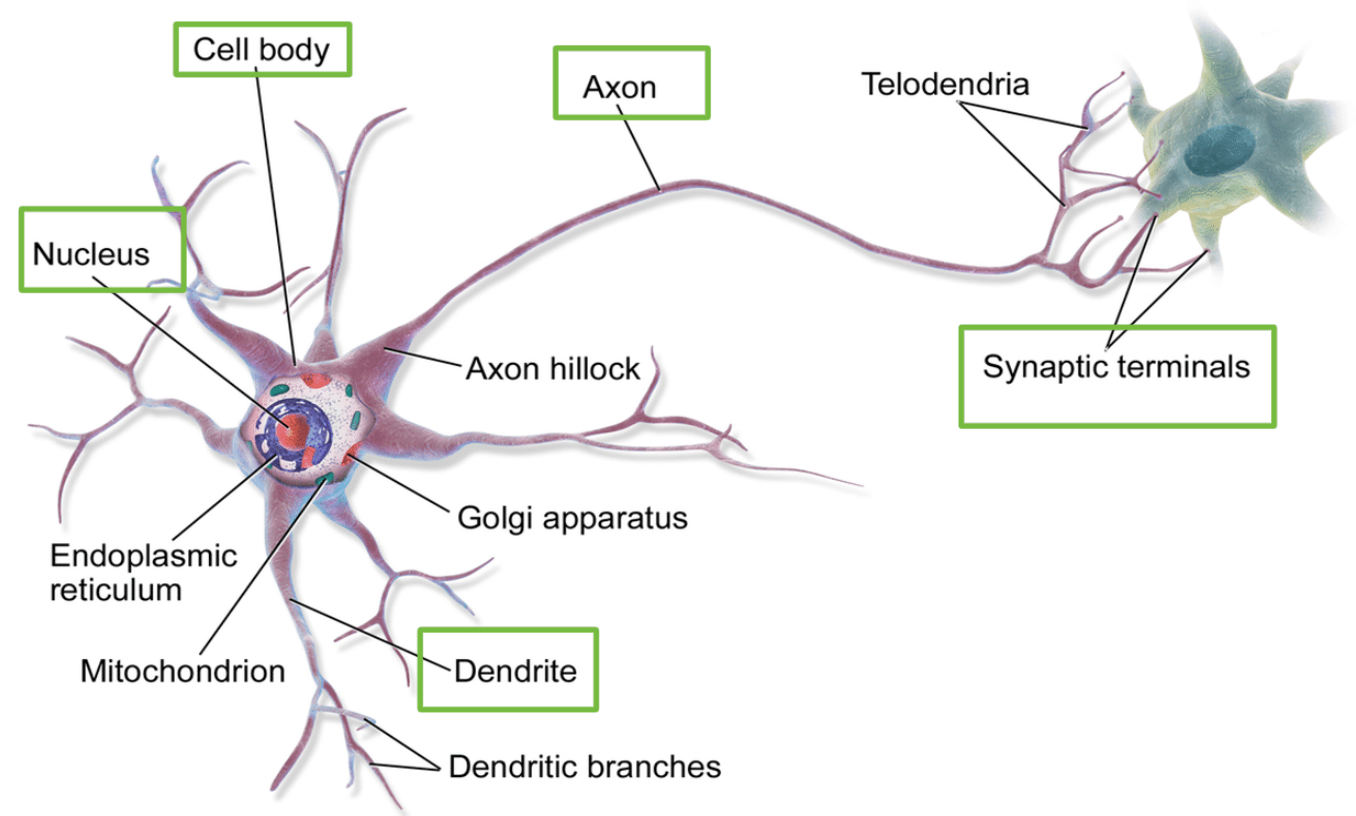
تتجد وتنقسم وبالتالي عددها غير ثابت وغير مسؤولة عن انتاج السيالان العصبي هي فقط مسؤولة عن دعم لعمل وتركيبه neurons

Neuroglia (support and protect neurons, and maintain the interstitial fluid that bathes them) (they outnumber neurons). It has a continuous ability to divide throughout an individual's lifetime.

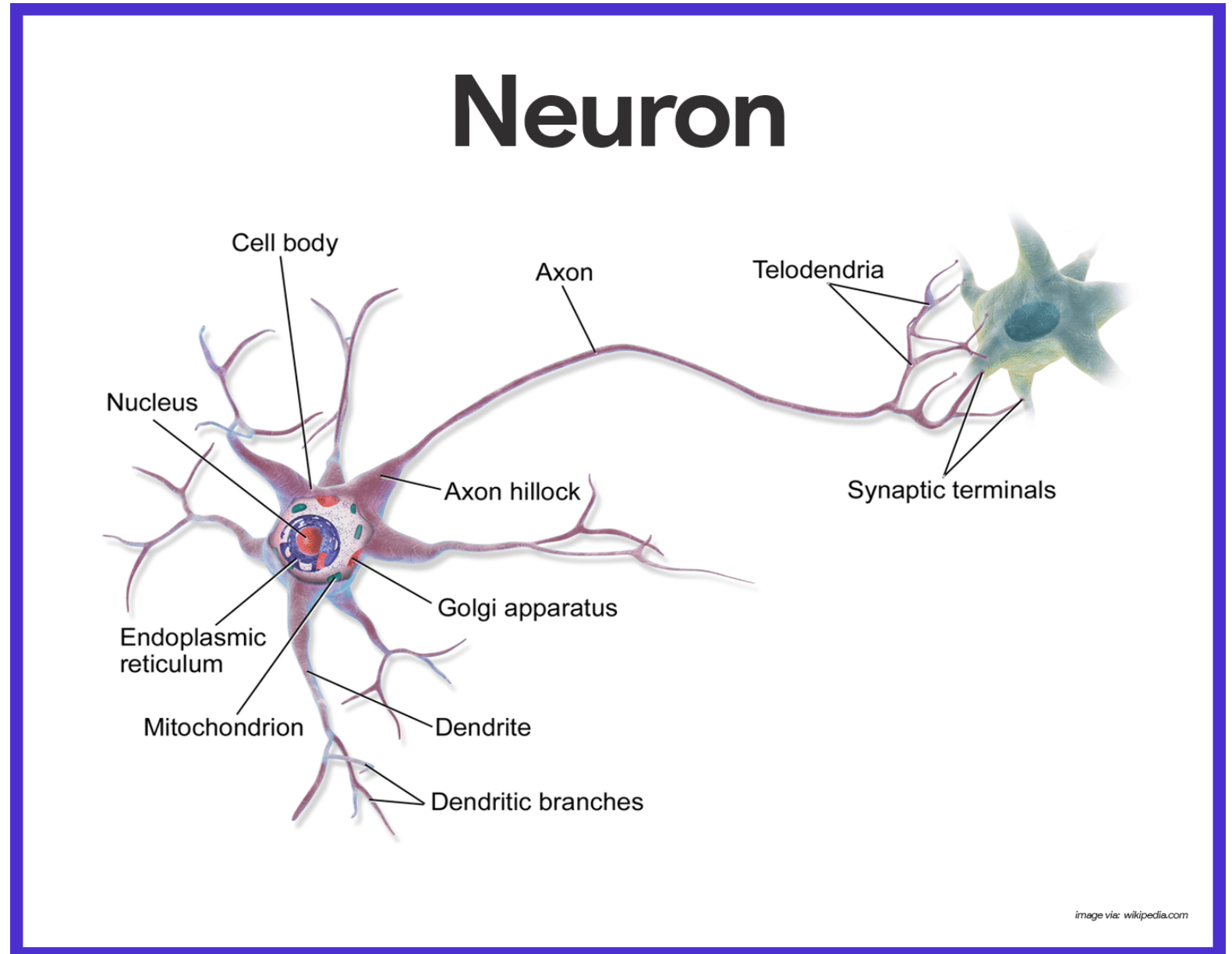
The neuron has the ability to respond to a stimulus and convert it into an action potential (nerve impulses).

The cell body contains free ribosomes and rough endoplasmic reticulum for synthesizing new proteins. .

Neuron



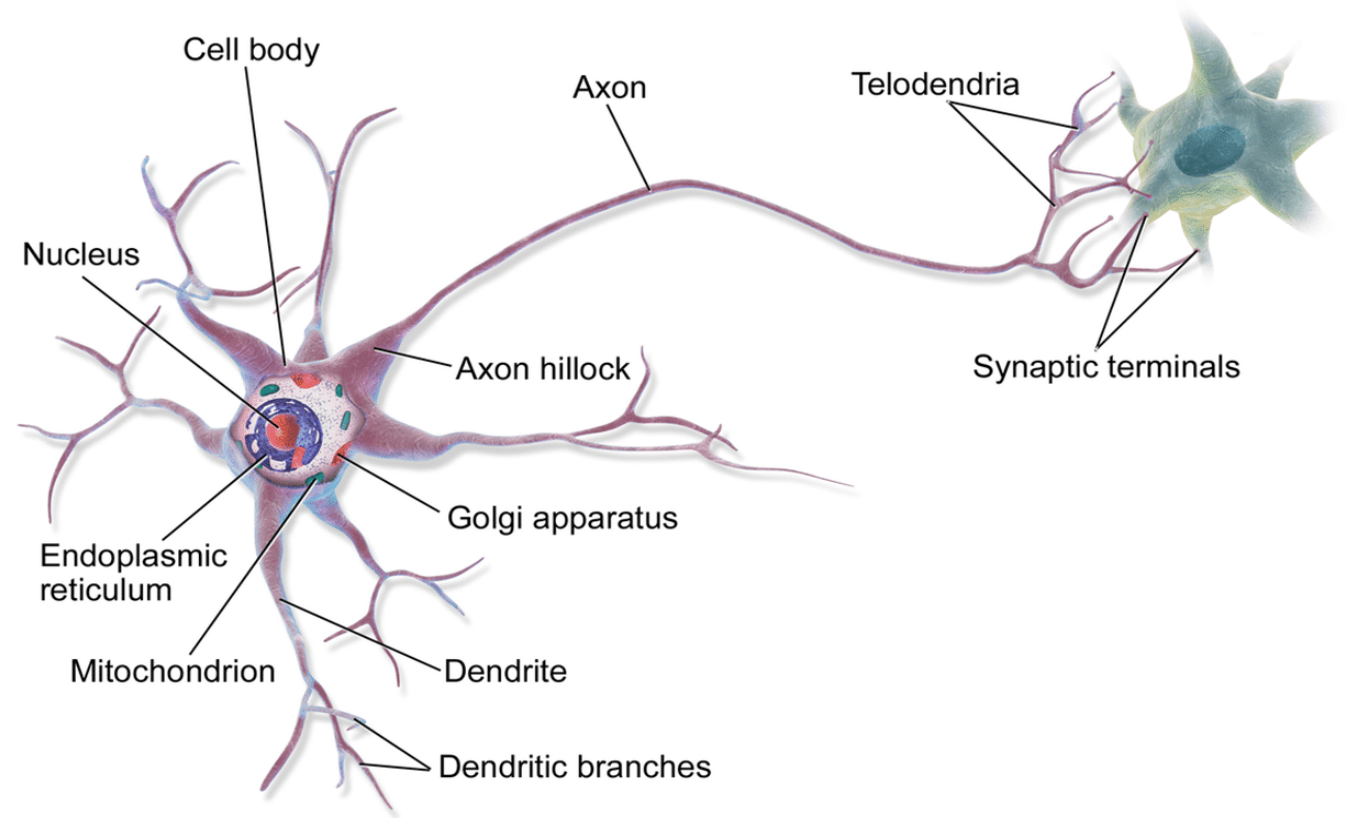
The dendrites (like little trees) are the receiving or input portions of a neuron because they contain numerous receptor sites for binding chemical messengers from other cells.



The single axon (long and thin projection) of a neuron propagates nerve impulses toward another neuron, a muscle fiber, or a gland cell.

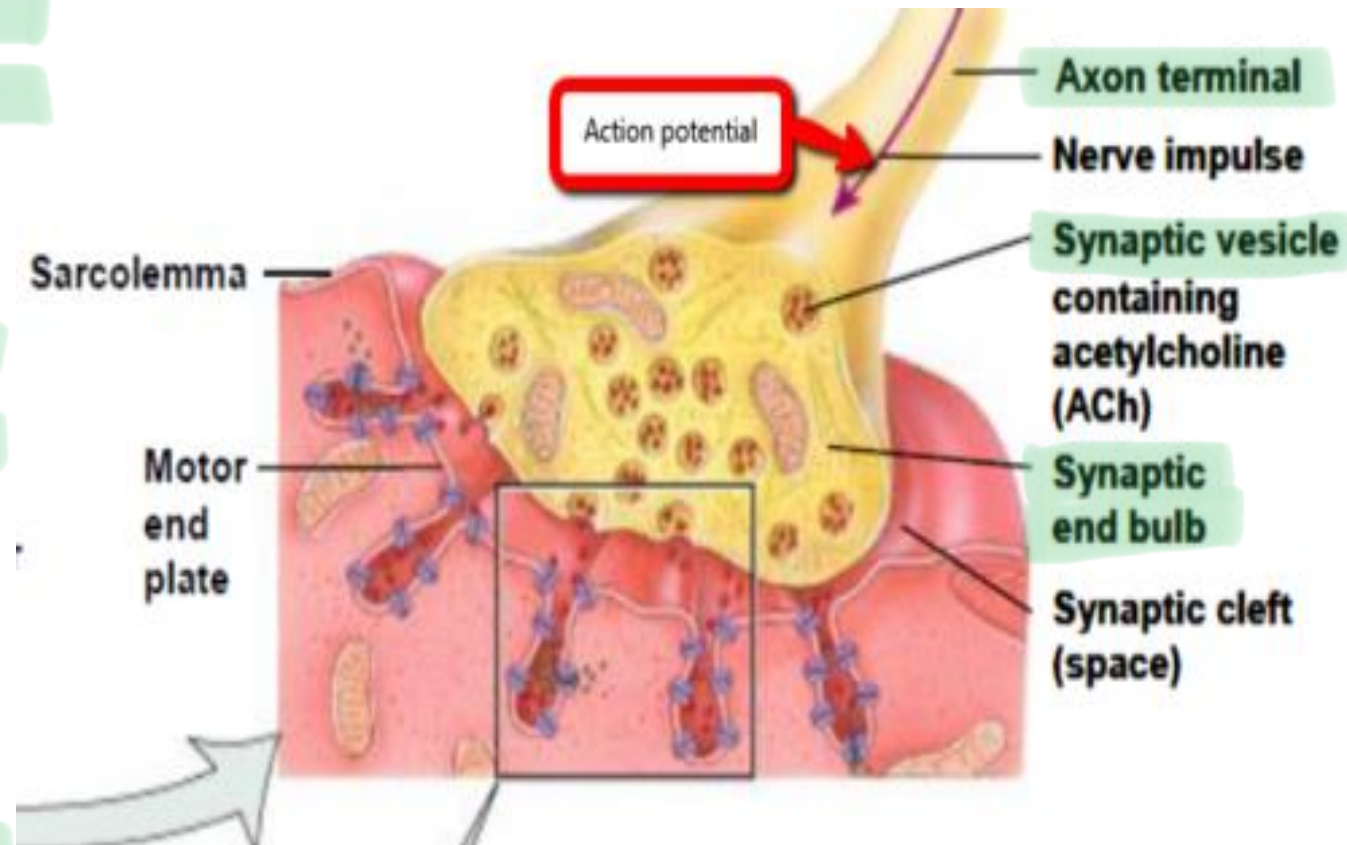
The axon ends by dividing into many fine processes called axon terminals.

Neuron



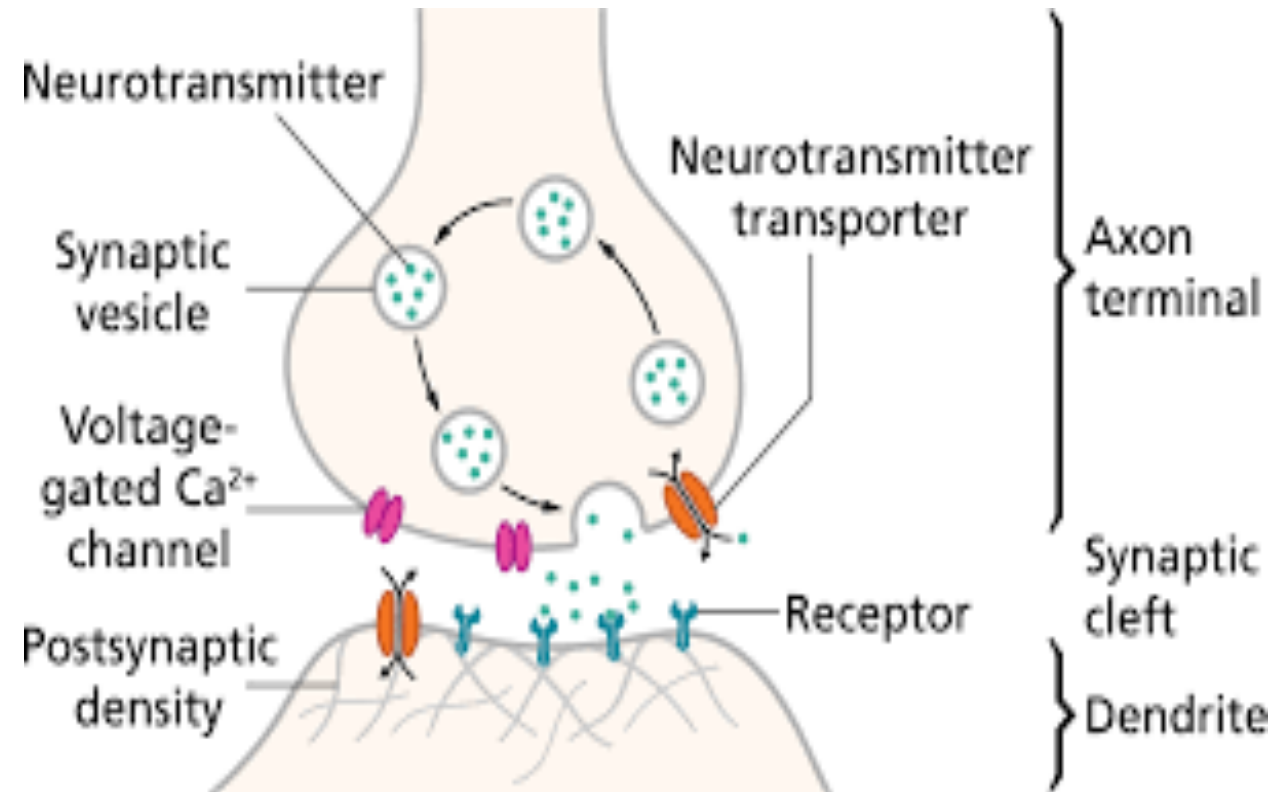
SYNAPSE

- **Synapse** is the site of communication between two neurons or between a neuron and an effector cell.
- Some axon terminals swell into bulb-shaped structures called **synaptic end bulbs**.
- **Synaptic end bulbs** contain many tiny membrane-enclosed sacs called **synaptic vesicles** that store a chemical called a **neurotransmitter**.



SYNAPSE

- **Neurotransmitter** ^{يتم اطلاقه} is a molecule released from a synaptic vesicle to excite or inhibit another neuron, muscle fiber, or gland cell.
- Many neurons have two or even three types of neurotransmitters, each with different effects on the postsynaptic cell.



لما يجي المؤثر stimulant زي ارتفاع الضغط بدو يآثر على العصب وأول جزء بيعمل كشف واستشعار detection لهذا المؤثر هو dendrite وبعدين بترسلها الى cell body وبتحكيه انه في محفز و هون داخل cell body بيصير في انتاج action potential وبعدين هذا السيال العصبي ينتقل من خلال axon حتى يوصل الى axonal terminal في هناك حويصلات زي vesicles تسمى synaptic end pump داخل هذه الحويصلات نواقل عصبية تسمى neurotransmitters الي بتروح تسبح في منطقة synapses وبعدين بتروح هذه الاعصاب وترتبط في مستقبلات لها في العصب الثاني وبيصير generation action potential لل

هسا ليش سميناها terminals بـ synaptic terminals او axonal terminals عشان في عندك مسافة بين العصب الاول والعصب الثاني بنسماها synapses

هل انتقال action potential في عضلة القلب زي اعضاء الجسم الاخرى؟ اكيد لا في وصلات gap junctions الي بتوصل بين cytosol للعصب الاول مع العصب الثاني يعني بس نحتاج انه العصب الاول يعمل action potential وينتقل للاعصاب الثانية بتكون موجودة ضمن عضلة القلب cardiac muscle بتربط neuron او nerves مع بعض



CLASSIFICATION OF NEURONS

1. Structural Classification (according to the number of processes extending from the cell body).

العمليات

2. Functional Classification (according to the direction in which the nerve impulse (action potential) is conveyed with respect to the CNS).

الاتجاه

STRUCTURAL CLASSIFICATION

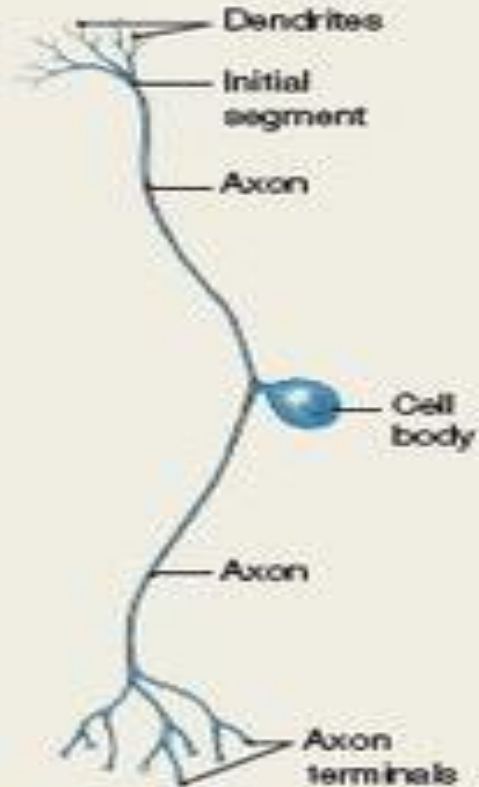
b Bipolar neuron

Bipolar neurons have two processes separated by the cell body.



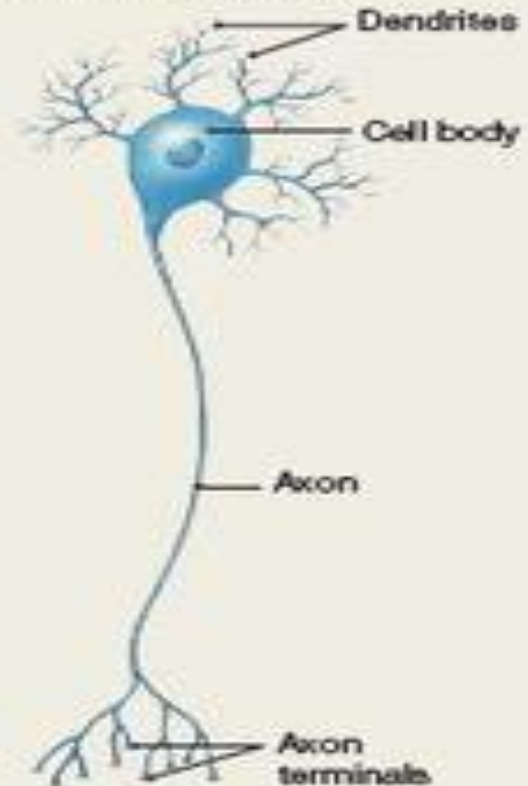
c Unipolar neuron

Unipolar neurons have a single elongated process, with the cell body located off to the side.



d Multipolar neuron

Multipolar neurons have more than two processes; there is a single axon and multiple dendrites.



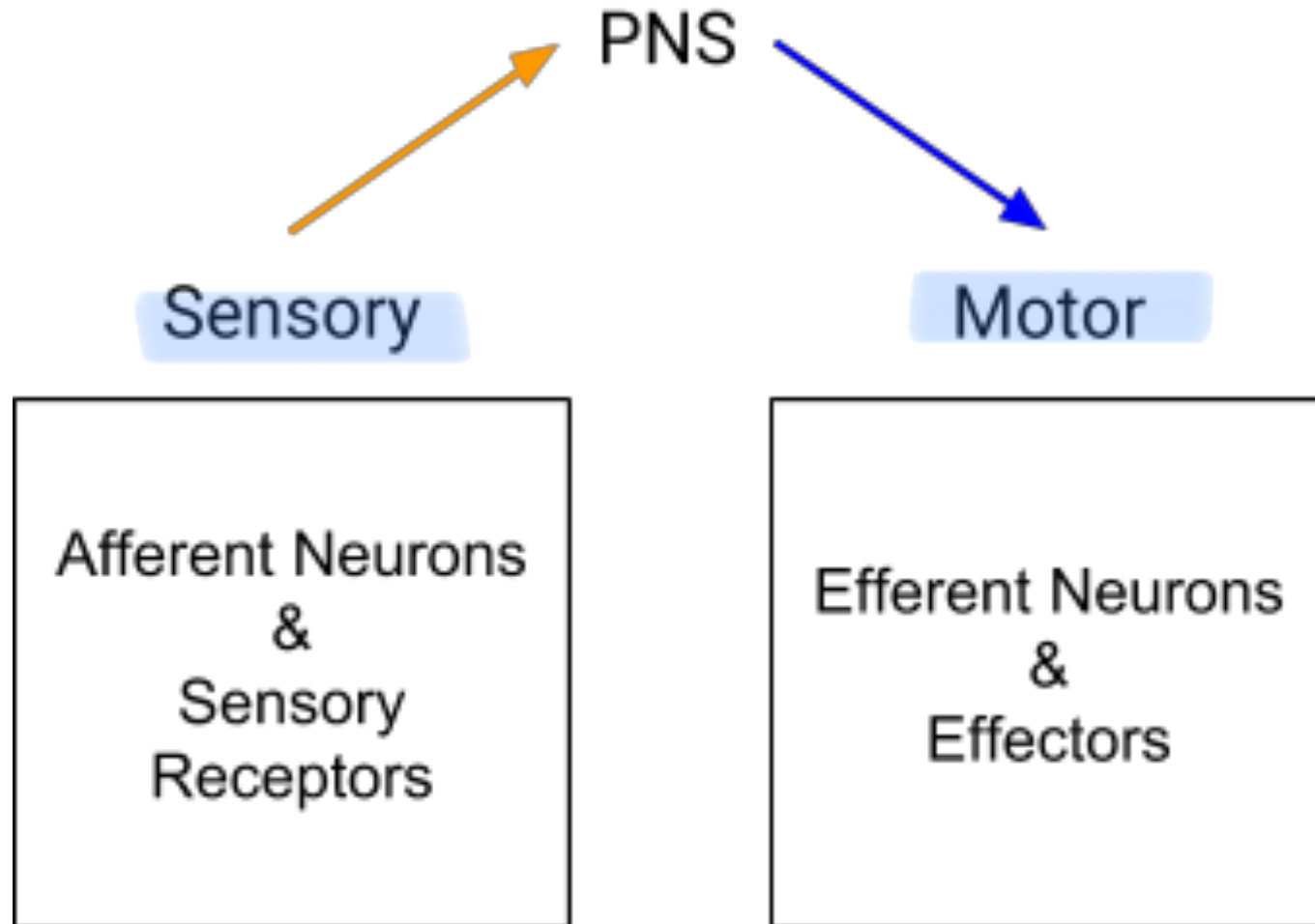
STRUCTURAL CLASSIFICATION

- A **multipolar neuron** has many processes extending from the cell body, a **bipolar neuron** has two, and a **unipolar neuron** has one.
- **Multipolar neurons** have several dendrites and one axon (i.e., neurons in the brain and spinal cord). They are found as motor neurons (all) and interneurons (many).

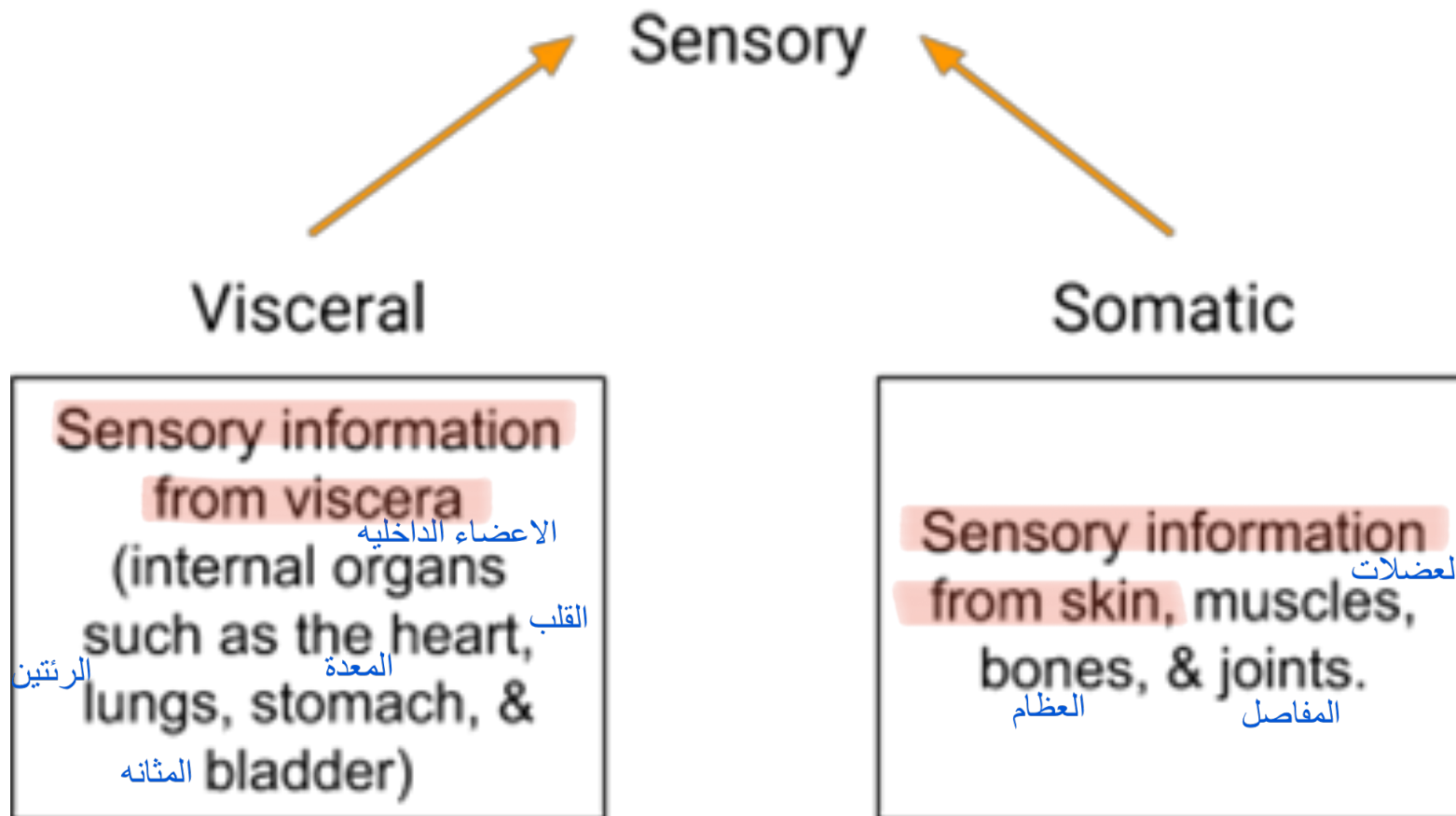
STRUCTURAL CLASSIFICATION

- **Bipolar neurons** have one main dendrite and one axon (i.e., neurons in the retina of the eye, the inner ear, and the olfactory area of the brain. Some of them are found as sensory neurons.
- **Unipolar neurons** have dendrites and one axon that are fused together to form a continuous process that emerges from the cell body. They are found as most of the body's sensory neurons.

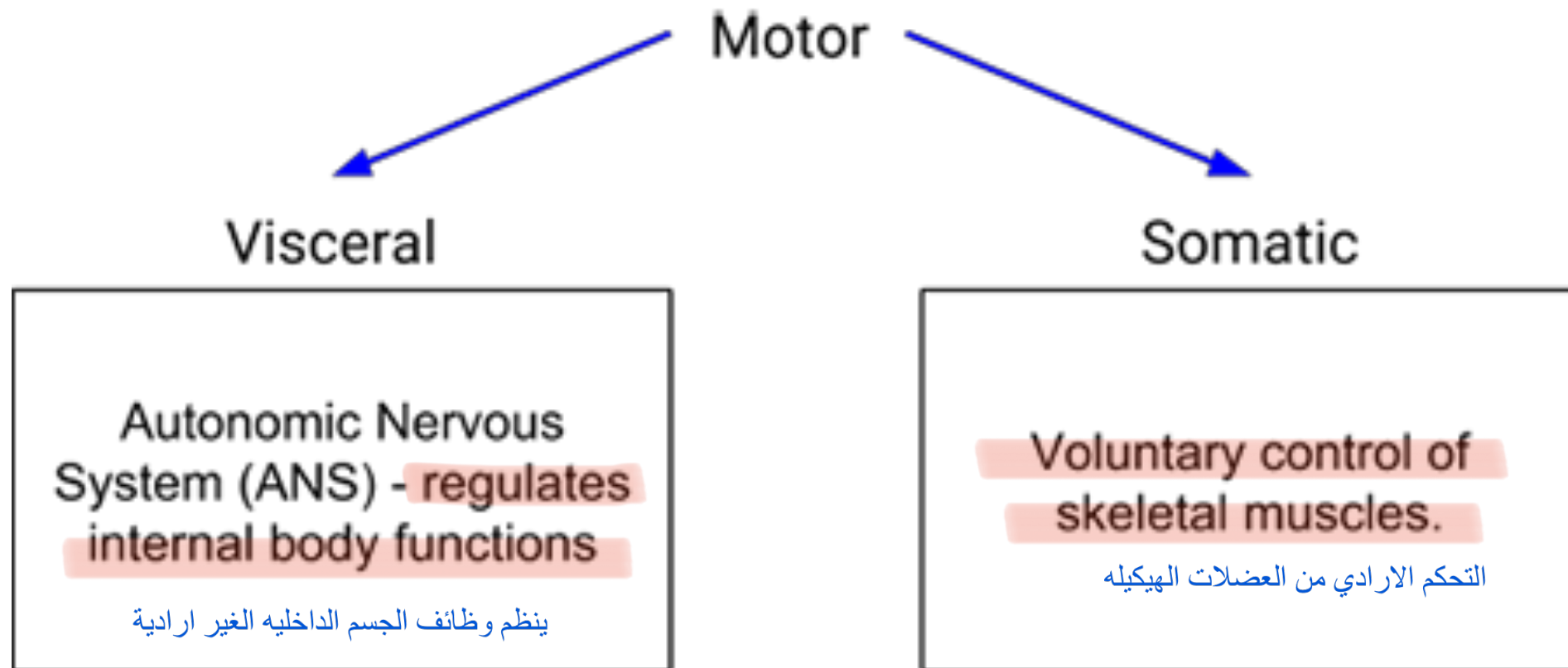
FUNCTIONAL CLASSIFICATION



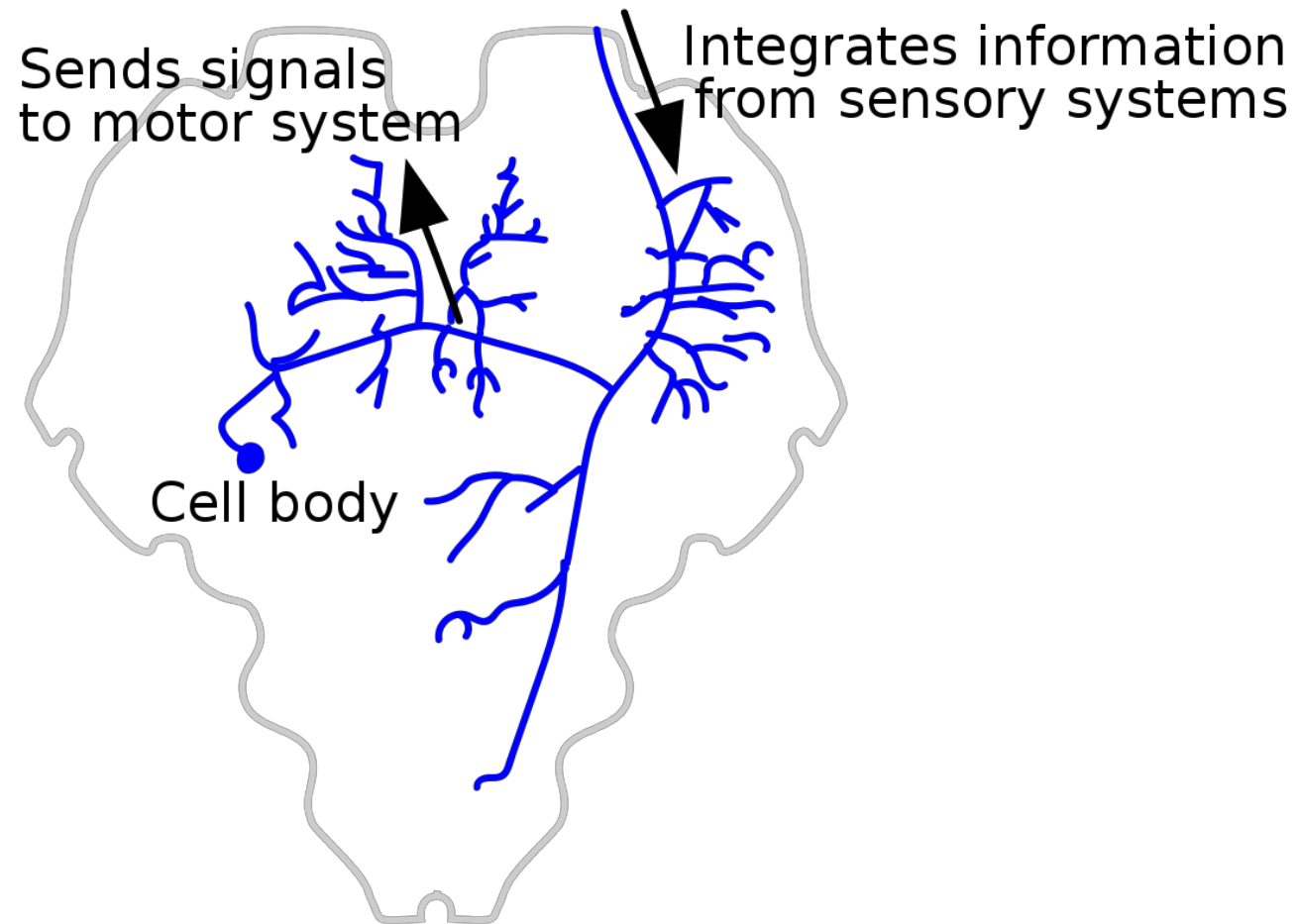
SENSORY OR AFFERENT NEURONS



MOTOR OR EFFERENT NEURONS



INTERNEURONS OR ASSOCIATION NEURONS



FUNCTIONAL CLASSIFICATION

- **Sensory or afferent neurons (most are unipolar):** appropriate stimulus activates a sensory receptor; the sensory neuron forms an action potential in its axon and the action potential is conveyed into the CNS through cranial or spinal nerves. Most sensory neurons are unipolar in structure.
- **Motor or efferent neurons (most are multipolar):** convey action potentials (commands) away from the CNS to effectors (muscles and glands) through cranial or spinal nerves.

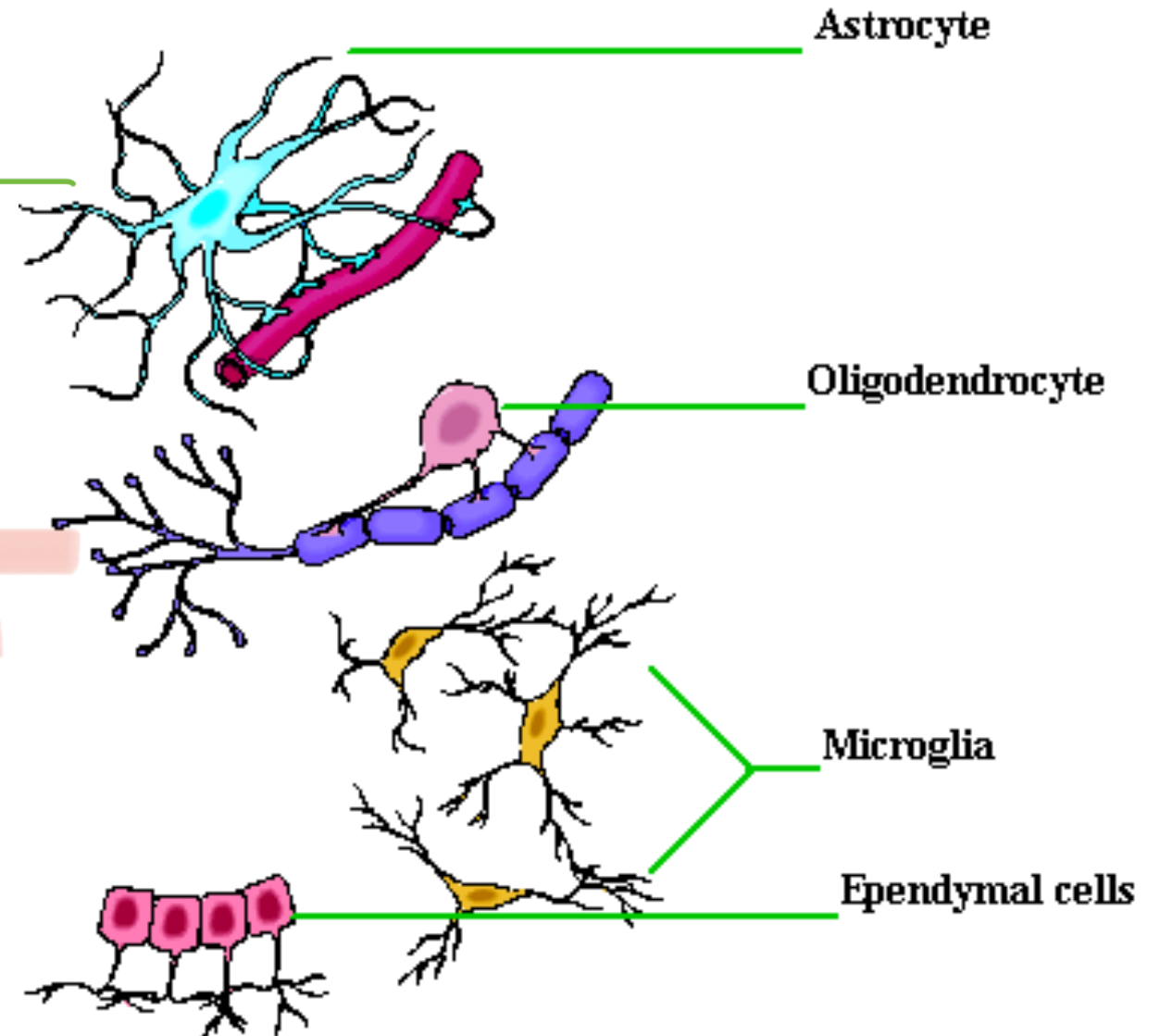
FUNCTIONAL CLASSIFICATION

- **Interneurons or association neurons (most are multipolar):**
 - They are located within the CNS (brain and spinal cord) between sensory and motor neurons.
 - They integrate the incoming sensory information from sensory neurons (transmit action potential from one neuron to another) and then elicit a motor response by activating the appropriate motor neurons.
 - Main functions are thinking, memory, decision making.

NEUROGLIA

- In contrast to neurons, neuroglia do not generate or propagate action potentials, and they can multiply and divide in the mature nervous system.
- Neuroglia of the CNS can be classified into four types: **astrocytes, oligodendrocytes, microglial cells, and ependymal cells.**

Neuroglial Cells of the CNS



1

ASTROCYTES

1. ^{دعم} Support neurons.
2. ^{عزل} Isolate neurons of the CNS from various potentially harmful substances in blood.
3. ^{تنظيم} Regulate the growth, migration, and interconnection among neurons in the brain.
4. ^{يحافظ} Maintain the appropriate chemical environment for the generation of nerve impulses.
5. Play a role in learning and memory by influencing the formation of neural synapses.

2

OLIGODENDROCYTES

- They are forming and maintaining the myelin sheath which increases the speed of nerve impulse conduction around CNS axons. (containing interneurons)

3

MICROGLIA

تقوم بإزالة حطام الخلية

- They remove cellular debris formed during normal development of the nervous system and phagocytize microbes and damaged nervous tissue. وتلتهم الميكروبات والأنسجة العصبية التالفة.

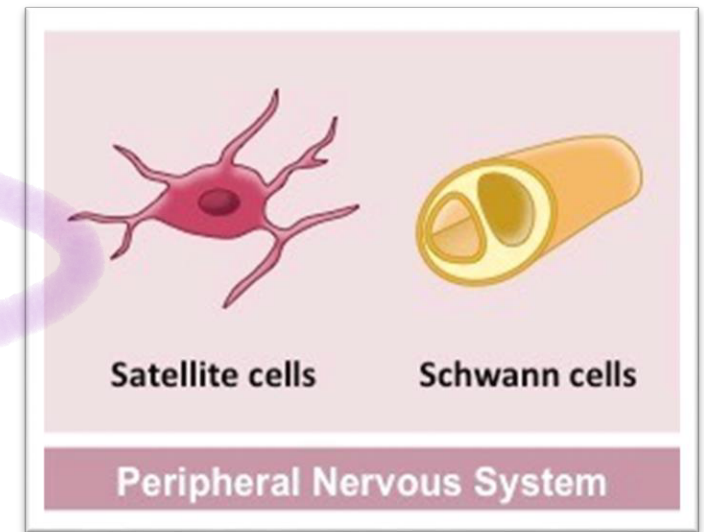
4

EPENDYMAL CELLS

تنتج وتساعد في دوران السائل CSF

- They produce and assist in the circulation of cerebrospinal fluid.

NEUROGLIA OF THE PNS



- The two types of glial cells in the PNS are **Schwann cells and Satellite cells.**

1

SCHWANN CELLS

- They form the myelin sheath around axons and participate in axon regeneration. (containing sensory and motor neurons).

2

SATELLITE CELLS

- They provide structural support and regulate the exchanges of materials between neuronal cell bodies and interstitial fluid.



THANK YOU

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