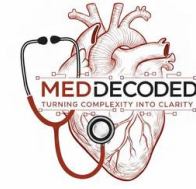


بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



الجارح



HISTOLOGY

FINAL | Lecture 7a

وَلَقَدْ خَلَقْنَا الْإِنْسَانَ وَنَعَلَهُمَّا تَوْسُوسًا بِهِ نَفْسُهُ وَنَحْنُ أَقْرَبُ إِلَيْهِ مِنْ حَبْلِ الْوَرِيدِ

Nervous Tissue Pt.2a

Written by : NST

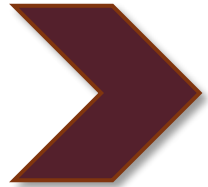
Reviewed by : مهند برهوم
Yamen Aljarrah



Color coding used in the modified:



Black: the original slides



Maroon: the doctor's explanation/words



Gray: additional information and explanation



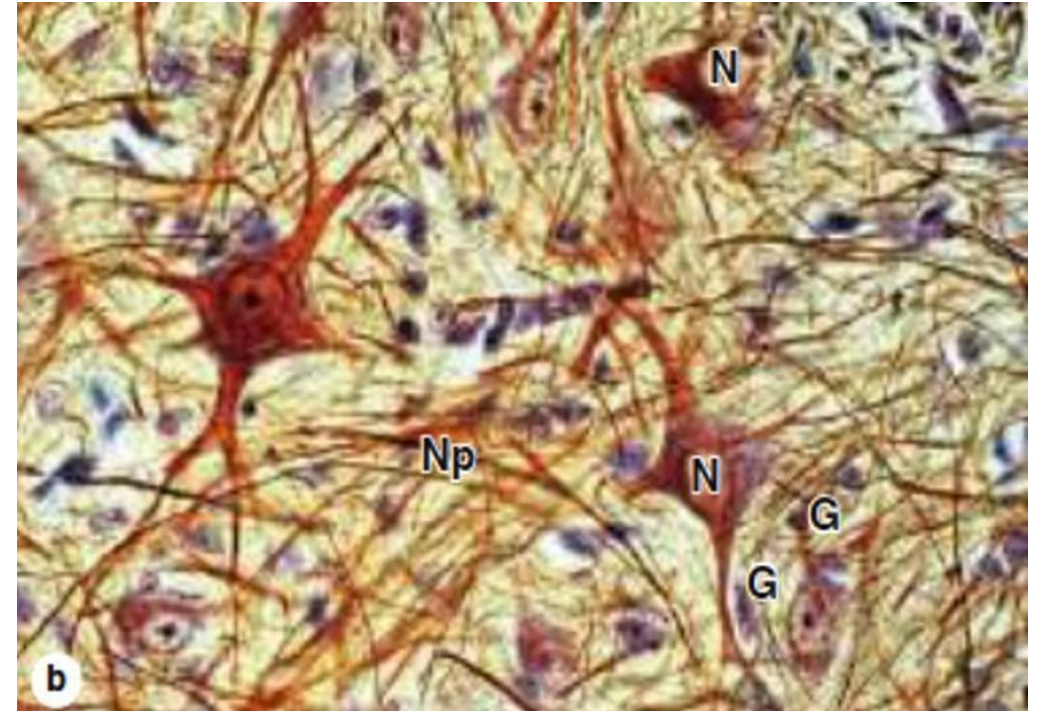
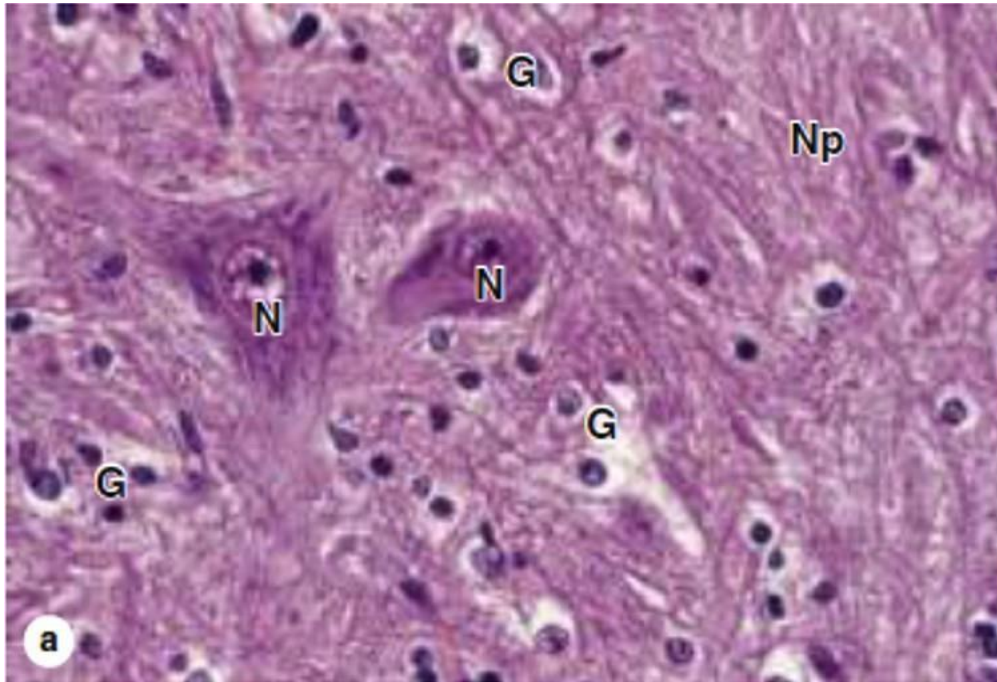
Red: important information

GLIAL CELLS

- Nervous tissue is composed of two main types of cells
- **Neurons** – These are the primary functional units of the nervous system.
- **Neuroglial (glial) cells** – These are the supporting cells that outnumber neurons and provide structural, metabolic, and immunological support.

GLIAL CELLS

- Support neuronal survival and activities.
- Tentimes more abundant.
- Most glial cells develop from neural plate cells
- In the CNS surrounds both the cell bodies and the of axons and dendrites (occupying the spaces between neurons).
- Substitute for cells of connective tissue creating immediately around those cells microenvironments that are optimal for neuronal activity.



This is a Hematoxylin and Eosin (H&E) stained sections, **neurons** are easily recognized as the largest cells in the field. Their prominent size and large nuclei make them stand out. Surrounding each neuron are numerous smaller nuclei, which belong to the **glial cells**.

Np = neuropil; network of fine cellular processes emerging from neurons and glial cells. Such processes are collectively called the neuropil

This is a gold-stained preparations, neurons again appear as the largest elements. The surrounding fine fibrillary background, known as the **neuropil**, is made up of the interwoven processes of neurons and glial cells. These structures may resemble collagen, but they are actually composed of axons, dendrites, and glial processes, not connective tissue.

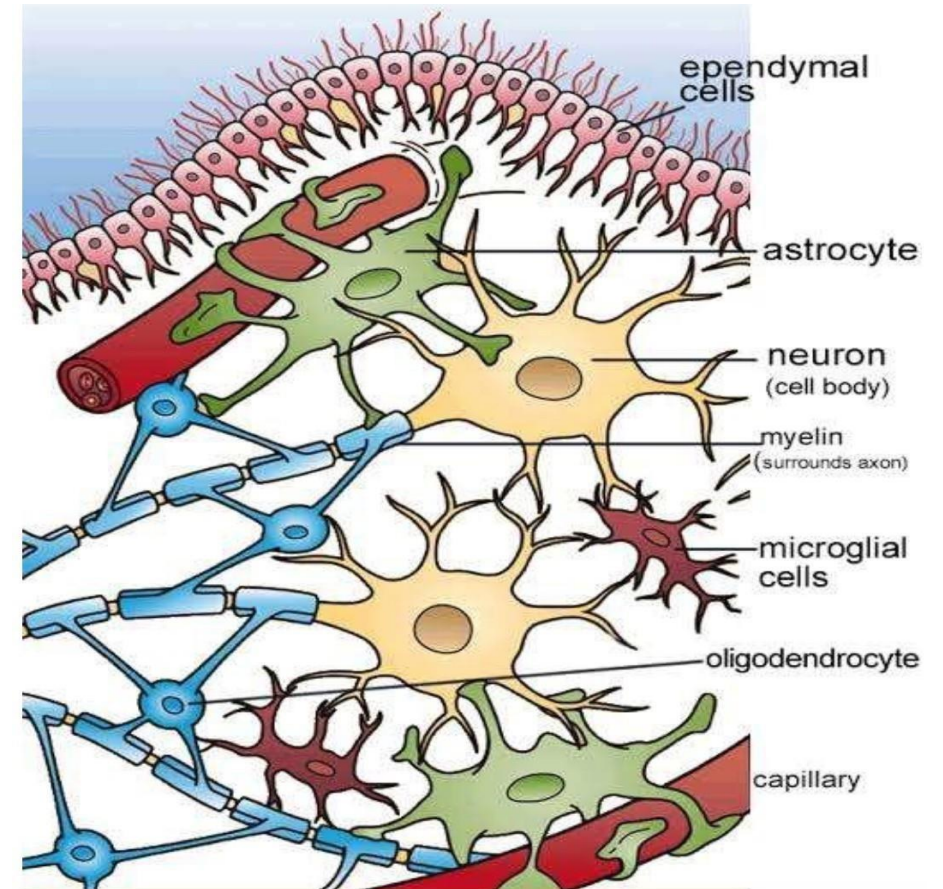
Development of Nervous Tissue

Nervous tissue primarily develops from the neural plate, which folds to form the neural tube. The neural crest, arising at the borders of the neural plate, gives rise to many components of the nervous system. However, one important exception is the microglial cells, which do not originate from the neural tube or neural crest, but rather from **mesoderm-derived monocytes**.

Types of Neuroglia

Neuroglia are classified into:

- Central Neuroglia - Located within the brain and spinal cord.
- Peripheral Neuroglia - Located outside the CNS, primarily in peripheral nerves.



NEUROGLIA

Central Neuroglia

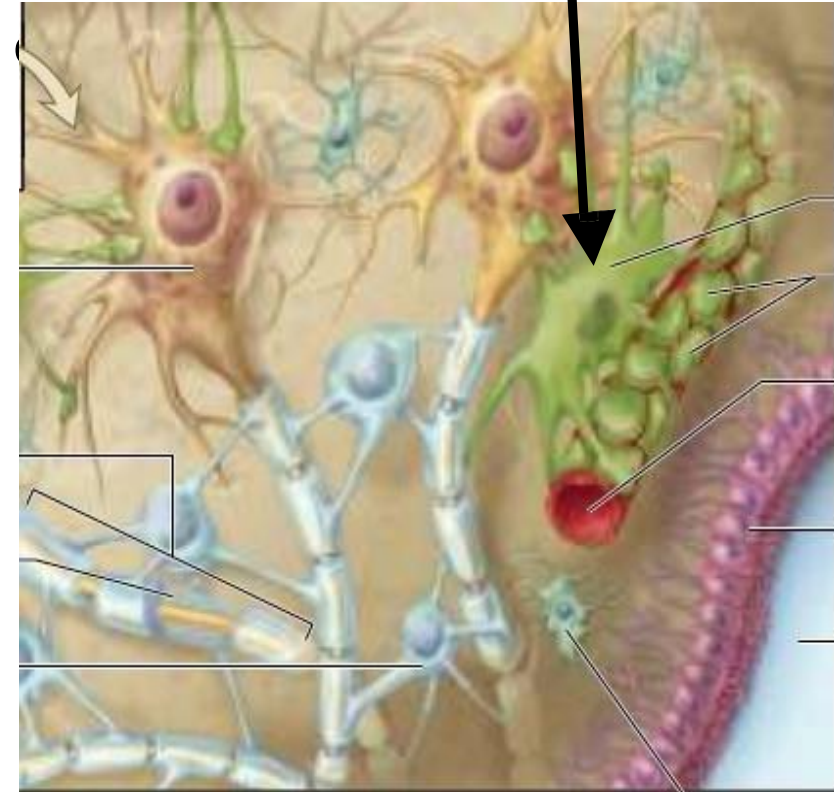
ASTROCYTES

- Have a large number of long radiating, branching processes
- Terminal processes of a single astrocyte associate with over a many synaptic sites.
- Astrocytes originate from neural tube cells.
- Most numerous glial cells of the brain.
- Most diverse structurally and functionally.
- Participate in blood-brain barrier. (This statement was deleted in the slides of the new recorded lecture)
- **Fibrous** astrocytes— white matter ----- long delicate processes
- **Protoplasmic** astrocytes— gray matter----- shorter processes.
- Communicate directly with one another via gap junctions.

Astrocytes

The most abundant glial cells, especially in **gray matter**. Extend processes that contact blood vessels and neurons, contributing to the blood-brain barrier (BBB). Involved in repair processes—they do not regenerate neurons but proliferate to fill spaces left by dead neurons

Predominant in the **Gray matter of the CNS**



Central Neuroglia

Oligodendrocytes

- Extend many processes--sheet-like and wraps repeatedly around a portion of a nearby CNS axon (myelin: electrical insulation—rapid transmission of impulses).
- Many oligodendrocytes for axon's full length
- Are the predominant glial cells in **white matter**.
- Appear as small cells with rounded, condensed nuclei and unstained cytoplasm.

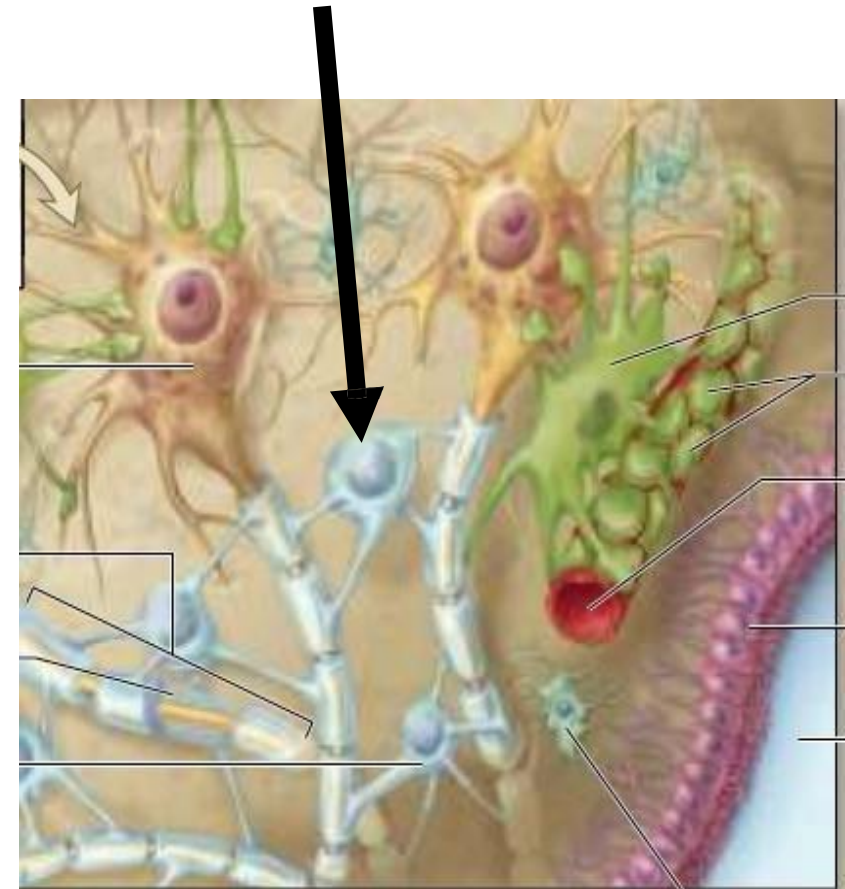
Oligodendrocytes

Form the myelin sheath in the central nervous system.

Each cell can myelinate multiple axons or multiple segments of different axons.

Functionally similar to Schwann cells in the peripheral nervous system, but unlike Schwann cells, they do not wrap their entire body around axons—only their processes do.

Derived from the neural tube.



CENTRAL NEUROGLIA

Ependymal Cells

Line the ventricles (spaces within the brain that are filled with cerebrospinal fluid (CSF)), of the brain and the central canal of the spinal cord. Possess long microvilli on their surfaces. Aid in the production and circulation of cerebrospinal fluid (CSF).

Ependymal cells

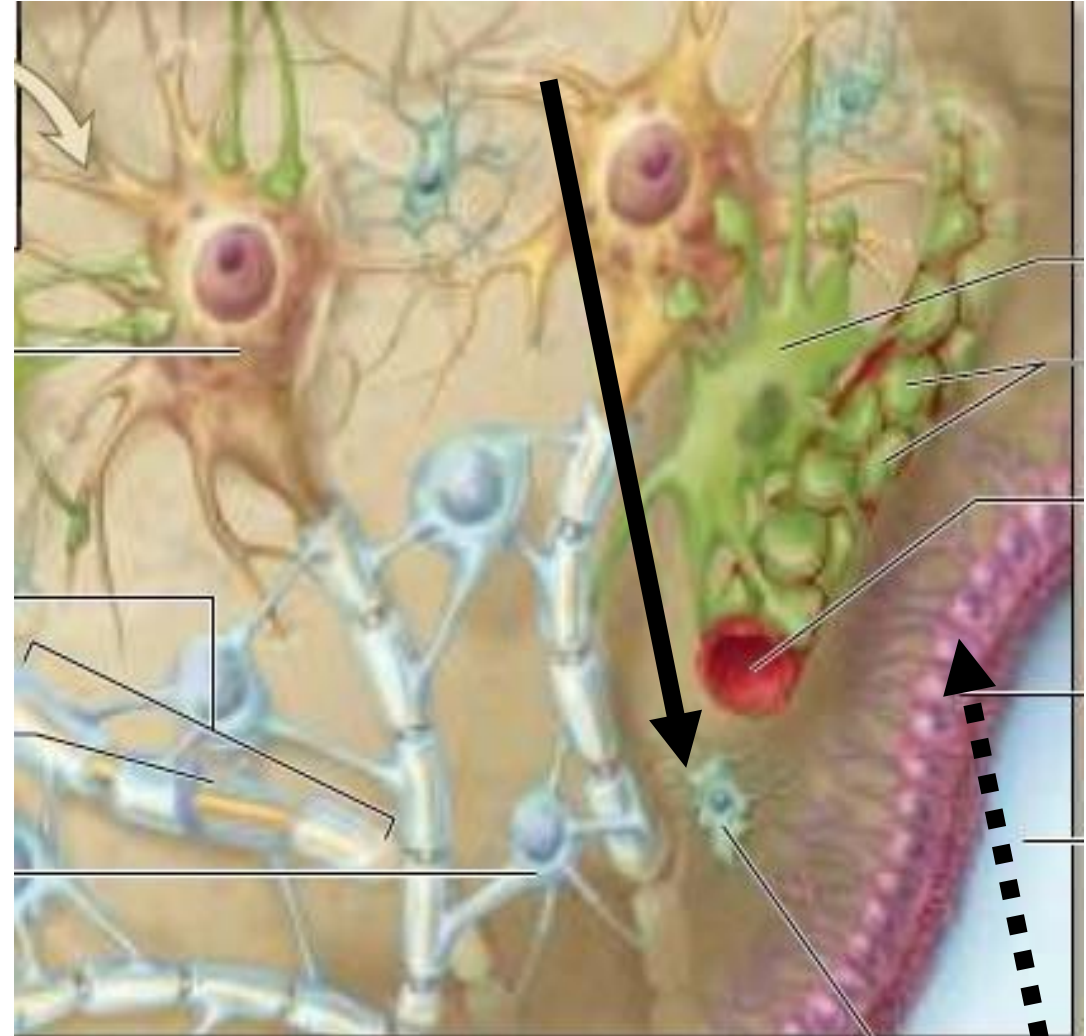
- Columnar or cuboidal cells that line the ventricles of the brain and the central canal of the spinal cord.
- Aid in CSF production and circulation

Microglia

Microglial Cells

The immune cells of the CNS, functioning as macrophages. Involved in phagocytosis, clearing debris, and pruning unnecessary synapses and processes. Derived from monocytes of **mesodermal origin**, making them the only CNS glial cells not derived from the neural tube.

- Less numerous
- Throughout gray and white matter
- Microglia migrate to remove damaged or effete synapses.
- Constitute the major mechanism of immune defense in the CNS. Remove any microbial invaders and secreting a number of immunoregulatory cytokines
- Originate from circulating blood monocytes.



Peripheral Neuroglia

Schwann cells

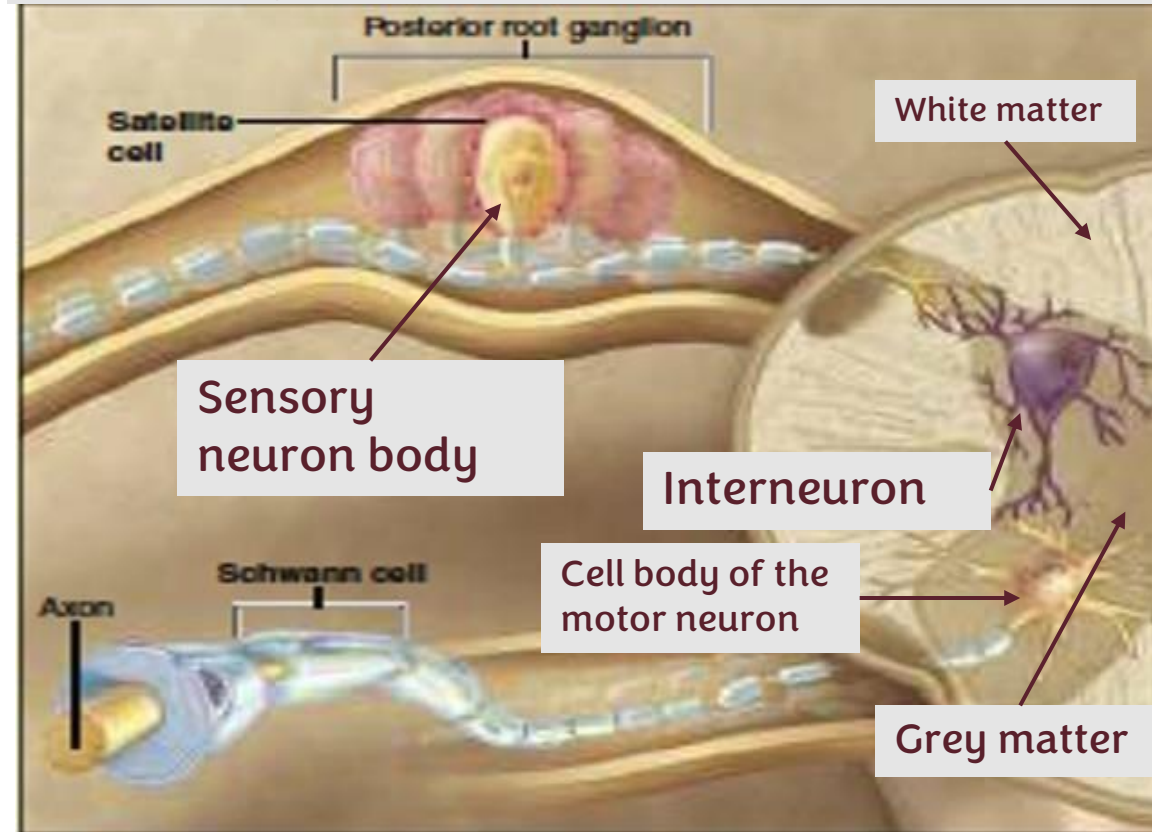
One Schwann cell will wrap itself (with its cytoplasm and nucleus) around one segment in one axon

- Are found only in the PNS
- Differentiate from precursors in the neural crest.
- Are the counterparts to oligodendrocytes of the CNS,
- Having trophic interactions with axons and most importantly forming their myelin sheathes.
- Forms myelin around a portion of **only one axon**.

Satellite cells of ganglia

- Derived from the embryonic neural crest.
- Form a thin glial layer around neuronal cell body in the ganglia.

The sensory cell body is located outside the spinal cord while the motor cell body is located inside it.



This diagram shows the roots of the spinal cord. (Focus on the dorsal root ganglion)

NEUROGLIA (REQUIRED)

Important to study the summary

Glial Cell Type	Origin	Location	Main Functions
Oligodendrocyte	Neural tube	CNS	Myelin production, electrical insulation
Astrocyte	Neural tube	CNS	Structural and metabolic support of neurons, especially at synapses; repair processes
Ependymal cell	Neural tube	Line ventricles and central canal of CNS	Aid production and movement of CSF
Microglia	Bone marrow (monocytes)	CNS	Defense and immune-related activities
Schwann cell	Neural crest	Peripheral nerves	Myelin production, electrical insulation
Satellite cells (of ganglia)	Neural crest	Peripheral ganglia	Structural and metabolic support for neuronal cell bodies

Quiz!!

<https://forms.gle/ye8cgcfUqy1uHjhU6>

Good luck!!

For any feedback, scan the code or click on it



Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			

Additional Resources:

رسالة من الفريق العلمي:

اللهم ارزقنا عملاً صالحاً ترضى به عنا، ونوراً في القلب، وبركة في العمر، وتوفيقاً في الدنيا والآخرة. اللهم إني أسألك خير المسألة وخير الدعاء وخير النجاح وخير العلم والعمل، ربنا آتنا في الدنيا حسنة وفي الآخرة حسنة وقنا عذاب النار