



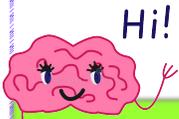
ANATOMY

SHEET NO. Dr.Maha – lecture 1

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CORRECTOR :

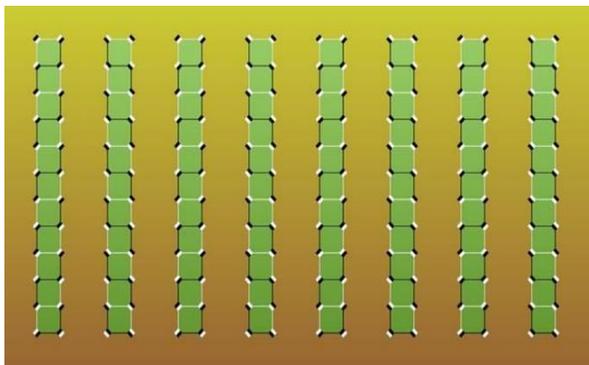
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Interesting facts about the human brain:

- ✓ The human brain weighs 3 pounds.
- ✓ It comprises 60% of fat and is one of the fattest organs in the human body.
- ✓ Human brain has the capacity to generate approximately 23 watts of power when awake.
- ✓ Of the total blood and oxygen that is produced in our body, the brain gets 20% of it.
- ✓ When the blood supply to the brain stops, it is almost after 8-10 seconds that the brain starts losing the consciousness.
- ✓ The brain is capable of surviving for 5 to 6 minutes only if it doesn't get oxygen after which it dies.
- ✓ The blood vessels that are present in the brain are almost 100,000 miles in length.
- ✓ There are 100 billion neurons present in the brain.
- ✓ In early pregnancy, the neurons develop at an alarming rate of 250,000 per minute.
- ✓ As we grow older, we are unable to remember new things. According to the researchers in the US it is because the brain is unable to filter and remove old memories which prevent it from absorbing new ideas.

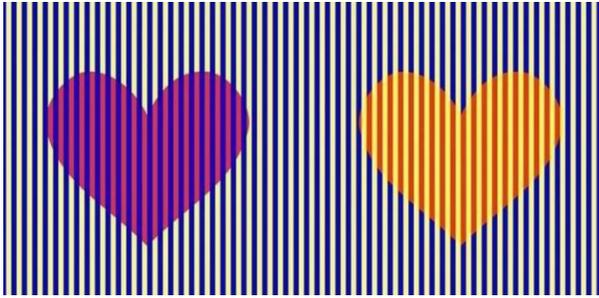
What do you see?



Look at these green lines and move your head, are they moving?

Now focus on one of them and cover the rest, still moving?

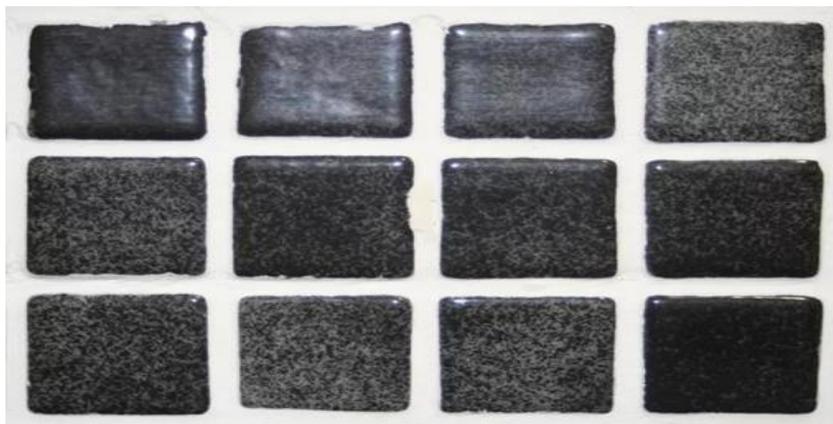
So, they are not moving at all!



Both hearts have the same colour, just focus on the background colour not the lines!



When you first look at this picture, you might see a young lady or an old one; however, if you concentrate you should be able to see both of them.



If you focused on one square and rapidly shifted your eyes between the rest, you are supposed to see a core of dots moving (shifting between white and grey); some scientists explained this in relation to psychiatry.

Sometimes we see things that are not really exist, this **Hermann Gird** illusion is a great example for what we are talking about.



is this shoe a grey and sea green shoe or is it a white and pink one?

Either you see it green or pink, the original owner of the shoes confirmed that it's a white and pink shoe, but this doesn't mean you're wrong.

These different situations we reviewed are cases of optical illusion, which can be explained by different suggested theories.

In the case of the shoe for example 87% people voted that its grey & sea green, and 13% voted for pink & white. And as u know our brain is formed by right & left cerebral hemispheres... So, what scientists basically said is if you are more of a right-side brain person (your Rt. Side of the brain is dominant) you will see pink and white, and this means you are intelligent.

On the other hand, if you are more of a left-side brain (your Lt. hemisphere is dominant) you will see grey and sea green, and this means you have a creative mind.

- Optical illusions have nothing to do with color blindness; In color blindness person cannot differentiate some similar colors. Optical illusion is a manipulating trait our mind uses in a very joyful way. It is also attributed to the fact that we have two comprehension systems in our brains:
 - ✓ **Fast thinking system** (system 1): it is activated when you look without concentration (the first glance of examining something), it usually gives a false result, due to the rapid analysis, e.g., If you looked quickly on a mathematical problem, there is a high probability of concluding a wrong answer.
 - ✓ **Slow thinking system** (system 2): activated when concentrating; like what you try to do in an exam or while reading a novel. You should aim to run this system more often especially when making fateful life decisions.

The Nervous system is divided into:

- ❖ CNS → found within bones; **the skull**: brain [cerebrum, cerebellum, brain stem], **the vertebral canal**: spinal cord [8 cervical, 12 thoracic, 5 lumbar, 5 sacral, 1 coccygeal].

- ❖ PNS → consists of:
 - Autonomic nervous system: divided into sympathetic & parasympathetic nervous systems.
 - somatic nerves: including 31 pairs of spinal nerves connected to the spinal cord and 12 pairs of cranial nerves connected to the brain as the following:
 1. Arising from the brain: **CN I** (olfactory nerve) & **CN II** (optic nerve)
 2. Arising from the brain stem: **CN III – CN XII** in this way:
 - ✓ midbrain: **CN IV** (trochlear nerve)
 - ✓ midbrain – pontine junction: **CN III** (oculomotor nerve)
 - ✓ pons: **CN V** (trigeminal nerve)
 - ✓ pontine – medulla junction: **CN VI** (abducens nerve), **CN VII** (facial nerve), **CN VIII** (vestibulocochlear nerve)
 - ✓ medulla oblongata: **CN IX** (glossopharyngeal nerve), **CN X** (vagus nerve), **CN XI** (accessory nerve), **CN XII** (hypoglossal nerve)

Basic Histology of the nervous system

Starting with the functional unit of this tissue; **the Neuron**.

A neuron is formed of cell body & it's processes [dendrites + axon]. Thus, we have multiple types of neurons according to shape:

- Unipolar [pseudounipolar]: the dendrite & axon emerge from the same stem (point); e.g., The neurons of the dorsal root ganglia [the first order sensory neurons].



- Bipolar: the axon and single dendrite leave at opposite ends [distinct points] of a spindle shaped body.
- Multipolar: the most numerous neuronal cells as it makes many synapses; formed by one axon & multiple dendrites.



Functional Classification of Neurons:

- Afferent (sensory) neurons: convey information from tissues and organs into the central nervous system (CNS).
- Efferent (motor) neurons: transmit signals from the CNS to the effector organs (muscles & glands).
- Interneurons: the most abundant type of neurons connects neurons within specific regions of the CNS [e.g., between the dorsal root & ventral root in the spinal cord]. Most founded in the reflexes which act on an impulse before that impulse reaches the brain (e.g., withdrawal reflex).

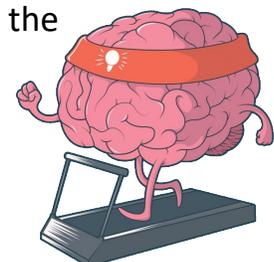
The Cell body of a neuron contains:

- ✓ Nucleus [large, rounded with prominent nucleolus].
- ✓ Cytoplasm [contains the usual organelles & neurofibrils (remember **NO** centrioles, that's why mature neurons can't divide, they are permanent cells)].

Dendrites	Axon
Multiple (for synapses btw neurons)	single
Carry impulses to the cell body (afferent fibers)	Carry impulses from the cell body to the effector organ (efferent fibers)
Wide base & tapering end	The same diameter in all parts
Give many branches	Give few collaterals
Contain neurofibril & Nissl granules	Contain neurofibril ONLY

The important thing is: more dendrites → more synapses → more integratory functions of the nervous system → improving the memory, IQ and the observation skills.

Exercise your brain so you can get more synapses!



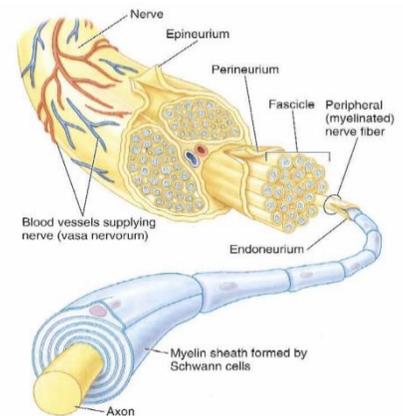
Nerve trunk

a nerve trunk is composed of several bundles of nerve fibers [fascicles], and these fascicles are formed from collections of several nerve fibers which might be sensory or motor.

The Nerve fiber is a nomenclature applied to the axons of all nerve cells & to the dendrites of the unipolar cells.

Be aware to the membranes surrounding each level:

- I. Epineurium is a large quantity of connective tissue surrounding the nerve trunk from the outside.
- II. Perineurium CT surrounds the fascicles separating them from each other.
- III. Endoneurium CT surrounds each single nerve fiber.



Nerve ganglia

A ganglion is a collection of nerve cells & nerve fibers surrounded by a CT capsule outside the CNS. It is found along the course of a nerve.

When having this collection inside the CNS we call it nucleus.

Types of nerve ganglia:

- ✓ Spinal ganglia: located near the spinal cord, e.g., Dorsal root ganglia is located near the dorsal horn.
- ✓ Autonomic ganglia: sympathetic & parasympathetic located around the autonomic nervous system e.g., the sympathetic chain around the vertebral column.
- ✓ Cranial ganglia: they are parasympathetic ganglia **ONLY**; related to the cranial nerves.

Important to know:

Basal ganglia: an old terminology used to emphasize the cell bodies [nuclei] inside the cerebral hemisphere [at its base] that controls the motor activity. Now we call it **BASAL NUCLEI**.

Glial cells

The other important cells in the nervous tissue are the Glial cells (supporting cells).

Type	Origin	Location	Main functions
oligodendrocyte	Neuronal tube	CNS	Myelin production, electrical insulation
Schwann cells	Neuronal tube	PNS	Myelin production, electrical insulation
Astrocyte star-shaped cells with multiple radiating processes that bind neurons to capillaries and to the pia mater. Astrocytes with few long processes are called fibrous astrocytes and are located in the white matter; protoplasmic astrocytes, with many short-branched processes, are found in the grey matter.	Neuronal tube	CNS	-structural support, repair processes. -contributes to the formation of BBB, metabolic exchanges
Ependymal cell	Neuronal tube	CNS	Lining cavities of the CNS [ventricles: spaces inside the brain that lighten its weight so we couldn't feel it, where the CSF flow].
Microglia	Bone marrow	CNS	Phagocytic cells: they phagocytose unwanted microbes/cells

There is an exam question from the above table



Myelin sheath

It is a thin layer of lipoprotein which is formed by Schwann cells outside the CNS & by oligodendrocytes inside the CNS. It's interrupted at nodes of Ranvier.

Thickly myelinated fibers transmit impulses faster as this layer has an insulator function **the more the myelination, the faster the impulse** it also has a nutritional role to the neuron.

It's also important for nerve regeneration after injury. when an incomplete cut of the nerve fiber takes place, it undergoes regeneration that depends on the:

- ✓ Severity of the injury.
- ✓ The state of the cell body (soma) → if it still intact and produces ribosomes then there will be regeneration **but** if it is severely injured the regeneration will be very minimal.

If we are in the CNS ,the oligodendrocyte will attach to the site of injury in the sheath & start the process of myelination rolling around the fiber [in the form of spiral circuits. Note that **One oligodendrocyte** can attach & fix **more than one** segment.

In the PNS it will be a Schwann cell who takes over the regeneration process. And **One Schwann cell** can ONLY fix **one segment**.

You just finished the sheet,



I will not give up until I reach

مَا زُفَعَلْنَا عَمَّا يَرَوُنَا!