It has already been mentioned that the brain is divided into 5 Lobes (frontal, parietal, occipital, temporal and the hidden insula)
We also know that **sensory cortex** is divided into primary, secondary and association areas. (The primary area: receives the sensation, the secondary area does the processing and relates the sensation to past experience and the association area does further processing for multi-system or multi-sensation processing). Therefore the sensation moves from primary to secondary to association.

**Note:**
The primary visual cortex is found at the occipital lobe at brodmann area #17
The primary auditory cortex is found at the temporal lobe below the lateral sulcus occupying brodmann areas 41 and 42
That's for the sensory cortex.

For the **motor cortex**, we have a primary motor cortex (at the precentral gyrus: brodmann area #4) and a secondary motor cortex (at brodmann areas 6 and 8). Processing of information in case of complex and skilled movements takes place in the secondary motor cortex first and then goes to the primary motor cortex which sends the motor order for the muscle to do its action.
Therefore, unlike the sensory cortex, processing takes place first, especially during complex skilled movements which require the person to imagine the action to be done.
The main output pathways for the motor cortex are the corticospinal tracts. Corticospinal tracts fibres are: 50-60% from the primary motor cortex, 30% from the secondary motor cortex, and about 10% from sensory cortex and other areas.
So, unlike expected, the primary motor area isn't the only output source for motor action through the corticospinal tracts; there is a big contribution from the secondary motor cortex.
**#**Why is that? Why would we have part of the fibers of secondary motor cortex (which is responsible for the processing) directly pass to the corticospinal tract without passing to the primary motor cortex and leave from there?
- Well, reasonably, that would be for rapid action. Usually for actions involving
simple skilled movements that a person does regularly and usually involving only one hand (for example: holding a pen).
Yet, complex skillful movements requiring both hands usually go from the secondary motor cortex (premotor cortex) to the primary motor cortex and then down through the corticospinal tracts. As these actions would be quite too complex for the order to be sent directly from the secondary motor cortex area (which cannot permit a wide range of actions on muscles like the primary motor area).
**##** An experiment that has been done to prove the function of the secondary motor cortex (processing and coordination of motor action) was the following:
-A hole in a table has been made, and a piece of raisin has been made to fit perfectly and get stuck in the hole. A monkey under experiment with a normal functioning secondary cortex would squeeze one finger into the hole and put his other hand beneath the hole to set the raisin free.
Yet, a monkey with a damaged secondary motor cortex, would insert both his fingers from both sides of the hole in the table squeezing the raisin.
 >>> loss of coordination

**Note:** the secondary motor cortex (premotor area) also contains the frontal eye field.

**Disorders in sensory cortex:**
- Damage of the primary sensory cortex would lead to loss of sensation.
- Damage of the secondary motor area or parts of the primitive association areas won't lead to loss of sensation, rather would lead to non-understanding (unable to process) of that sensation. This would lead to **Agonsia.
-**Agnosia is a general term for being unable to understand or interpret a sensation

Examples:
- Olfactory agnosia: damaged secondary sensory area of olfaction. The person would be able to smell, yet he won't be able to differentiate between smells.
-Visual agnosia: Seeing but not knowing what you are exactly seeing.
There are subcategories for visual agnosia, including color agnosia (cant differentiate between colors), object agnosia (can't differentiate between objects)
-hearing agnosia

**Disorders in motor cortex:**
-Damage of primary cortex would lead to paralysis
-Damage of secondary cortex won't lead to paralysis and there would still be control over all muscles of the body, yet there would be loss of ability to do complex movements (like playing a guitar for example). This is called **Apraxia**.
\*The person would be able to tell you the steps which need to be done to do this complex action, yet he can't apply it\*
In severe damage to the secondary motor area, the person might lose the ability of doing simple tasks like brushing their teeth and changing their clothes.

**\*note**: person would still be able to walk, since walking is under the coordination of basal ganglia and the cerebellum

**Association cortex:**- The association area (all areas other than the motor areas and the primary and secondary sensory areas) is mainly located at the prefrontal cortex, temporal lobe, parietal lobe.

#Prefrontal cortex
 is responsible for planning of actions, personality and Deep feelings. (These three functions are interconnected, as the personality is determined by the way actions and deep feelings are controlled)

#Temporal lobe
>>At the superior part of the temporal lobe at the junction with the parietal lobe is an area that is responsible for language and the memory of words.
>>large part of the inferior surface of the occipito- temporal area is important for the interpretation and processing of vision
(for example: recognition if an object is a triangle or a circle; if it was a circle, then we further analyze if it's a ball or a person's head; if it's a person's head, then we further analyze if it's the head of someone we know or not, and so on..)
-A small part at the medial occipito-temporal gyrus is responsible for the recognition of faces. Lesion in that area would lead to a disorder known as **prospagnosia** (note that it has the word agnosia).
In this disorder the person won't be able to differentiate between faces. Yet he would be able to recognize the person from his voice if he was talking to him but not from his face. (face isn't enough for recognition)
\*\* There must be a lesion on both the right and the left sides of the brain of this area to get prospagnosia.
-There are other areas of the visual association areas that are responsible for the recognition of different more specific objects (EX: area for recognition of animals, area of recognition of trees, area of recognition of houses...etc)
As we move from the occipital part of the visual association area to the temporal part, specificity of recognition increases until we reach these areas mentioned above that are highly specific to different objects.

# Parietal lobe
The anterior area of the parietal lobe makes the primary sensory cortex. The superior and the posterior areas are part of the association centre.
It's responsible about: Time, sequence, attention and space.

-`The posterior parietal area is the area responsible for attention.
It was discovered by a scientist by chance while he was experimenting on the visual processing area (which is near this area).
(For example a hungry person would selectively target his vision to the place of interest and that would be where food is)
\* During tasks that require attention, the posterior parietal area would be active (can be seen on functional MRI)
\*It has been discovered that when attending (giving attention) to the left visual field, the right posterior parietal area is activated, while attending on the right visual field would cause the activation of both the right and the left posterior parietal areas. Therefore, a lesion/stroke at the left posterior parietal area can be compensated by the right side, but a lesion in the right side can't be compensated and would cause the person to lose attention on anything on the left visual field.

- Losing attention to anything on left side due to damage of right posterior parietal area >>> **Neglect syndrome**
In this syndrome, it's like the person sees only the right side of the visual field. If the person was asked to draw something, he would draw only the right half of it. It might reach to an extent that the person would shave only the right side of his beard!

**##**There are three ways by which we can know the function of each area in the cortex:
1- Damage/stroke/ lesion of a specific area in the cortex, with a consecutive loss of a specific function. (This function that has been lost is the function of that area)
\*EX: people who get a stroke in face recognition area, develop prospagosia.

2- Function MRI (shows the activity of the brain by showing the blood supply and the oxygen consumption).
 The person is made to do a specific action inside the MRI machine and the area with high blood supply and excessive oxygen consumption proves the activity of that area.
\*EX: under functional MRI, putting a picture of a person's face in front of the patient would cause the increase in activity of the face recognition area of the cortex)

3- By electrically stimulating an area in the cortex using an electrode, and then seeing the activity that would arise from that stimulation (usually experimented on animals)

**بالتوفيق :)**