

# Unit 3- The Brain


1/23/2019

## Module 12

**UNIT III**  
**Biological Bases of Behavior**

**MODULES**

- 1) Biological Psychology and Neurotransmission
- 2) The Nervous and Endocrine Systems
- 3) Mapping the Brain, and Other Brain Structures
- 4) The Cerebral Cortex
- 5) Brain Hemisphere Organization and the Biology of Consciousness
- 6) Behavior Genetics: Predicting Individual Differences
- 7) Evolutionary Psychology: Understanding Human Nature



### Learning Targets

#### Module 12

#### The Cerebral Cortex

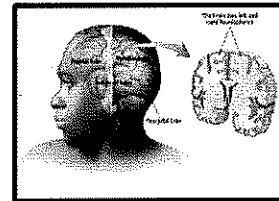
- 12-1 Describe the four lobes that make up the cerebral cortex and explain the functions of the motor cortex, somatosensory cortex, and association areas.
- 12-2 Analyze the notion that we really use only 10 percent of our brain.
- 12-3 Discuss how the brain adjusts to new experiences.
- 12-4 Discuss the brain's ability to reorganize itself after damage, and explain neurogenesis.

### What is the cerebral cortex?

The intricate fabric of interconnected neural cells covering the cerebral hemispheres; the body's ultimate control and information-processing center.

It is divided into four regions called *lobes*.

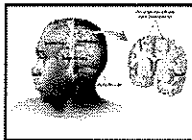
### What four lobes make up the cerebral cortex?



- frontal lobe, parietal lobe, temporal lobe and occipital lobe
- located in both right and left hemispheres

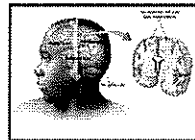
### What are the functions of the frontal and parietal lobes?

#### frontal lobes



Involved in speaking, motor movements, judgment and decision-making.

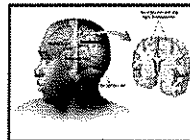
#### parietal lobes



Receives and processes sensory input for touch and body position.

### What are the functions of the temporal and occipital lobes?

#### temporal lobes



Each lobe receives auditory information, primarily from opposite ear.


#### occipital lobes



Each lobe receives visual information, primarily from opposite visual field.

**What are the functions of the motor and somatosensory cortex?**


motor cortex      somatosensory cortex



controls voluntary movements      registers information from the skin senses and body movement

**What are the functions of the auditory and visual cortex?**

auditory cortex      visual cortex



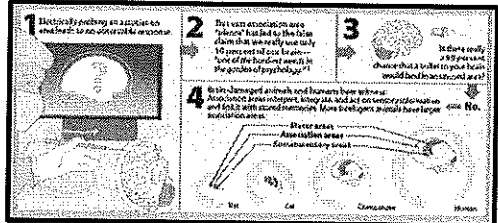
receives information from the ears      receives information from the eyes

**1. What Would You Answer?**

**Damage to which of the following areas could interfere with the ability to plan for the future?**

A. frontal lobes  
B. temporal lobes  
C. parietal lobes  
D. occipital lobes  
E. somatosensory cortex

**Do we really use only 10% of our brain?**



**What are the association areas?**

Most of the brain's cortex which integrates information involved in learning, remembering, thinking, and other higher-level functions.

Attention is shifted, planning occurs.

Not specifically devoted to motor or sensory cortex functions.


**Let's look at the research on association areas...**

The *prefrontal cortex* in the forward part of the frontal lobes enables judgment, planning, and processing of new memories  
(de la Vega et al., 2016).


People with damaged frontal lobes may have high intelligence test scores and great cake-baking skills. Yet they would not be able to plan ahead to *begin* baking a cake for a birthday party  
(Huey et al., 2006).

And if they did begin to bake, they might forget the recipe.  
(MacPherson et al., 2016).

### The case of Phineas Gage



The Phineas Gage Case, 1848. From "Phineas Gage" by John A. H. Murray, 1850. Digitized by Google.



A tamping iron accident damaged neural tracks in his frontal lobe.

His frontal lobes could no longer filter emotional reactions from the limbic system.

### What are Broca's and Wernicke's areas?

Broca's area	Wernicke's area
language center located in the left frontal lobe	language center located in the left temporal lobe
involved in expressive language	involved in receptive language

### How does our brain adjust to new experiences?

**plasticity:** the brain's ability to change, especially during childhood, by reorganizing after damage or by building new pathways based on experience

### Let's consider London taxi drivers...

Taxi driver trainees spend 2-4 years memorizing all of the routes through London.

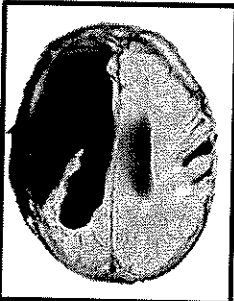
Eleanor Maguire, an Irish neuroscientist, with her peers, showed increased size in portions of the hippocampus in this population.

The brain changes in response to experience.

(Maguire et al., 2000, 2006)


### How does plasticity work?

In this image, most of the right hemisphere of a young girl's brain has been removed due to chronic seizures that threatened her life.



### How does plasticity work? Cont.

Due to the cross-wiring of the brain, she should not have been able to move the left side of her body. Yet, her left hemisphere compensated by putting other areas to work.



## 2. What Would You Answer?

The ability of our brain to adapt to damage, where one area may take over the function of the damaged area, is due to

- A. lesioning.
- B. positron emission training.
- C. Broca's area.
- D. Wernicke's area.
- E. Plasticity.



## What is neurogenesis?

Although the brain often attempts self-repair by reorganizing existing tissue, it sometimes attempts to mend itself through **neurogenesis**—producing new neurons.

## Learning Target 12-1 Review



Describe the four lobes that make up the cerebral cortex and explain the functions of the motor cortex, somatosensory cortex and association areas.

- The **cerebral cortex** has two hemispheres and four lobes: **frontal**, **parietal**, **occipital**, and **temporal**
- **motor cortex**: controls voluntary movements
- **somatosensory cortex**: registers and processes body touch and movement sensations
- **association areas**: integrate information involved in learning, remembering, thinking, and other higher-level functions.

## Learning Target 12-2 Review



Analyze the notion that we really use only 10 percent of our brain.

- The unresponsiveness of our **association areas** to electrical probing led to the false claim that we only use 10 percent of our brain.
- In reality, these vast brain areas are responsible for interpreting, integrating, and acting on sensory information and linking it with stored memories.

## Learning Target 12-3 Review



Discuss how the brain adjusts to new experiences.

- **Plasticity** enables our brain to adjust to new experiences. While this is a lifelong ability, plasticity is greatest in childhood.
- With practice, our brain develops unique patterns that reflect our life experiences.

## Learning Target 12-4 Review



Discuss the brain's ability to reorganize itself after damage, and explain neurogenesis.

- While brain and spinal cord neurons usually do not regenerate, some neural tissue can **reorganize** in response to damage.
- Sometimes mends itself by forming new neurons, a process known as **neurogenesis**.