Examining Brain Function

by Sophia Tutorial

WHAT'S COVERED

This tutorial will focus on the brain as the central part of the nervous system by focusing on:

1. Brain Overview
2. Neuroplasticity
3. Localization of Function
4. Ongoing Research
   a. Electrical Stimulation of the Brain (ESB)
   b. Electroencephalograph (EEG)

1. Brain Overview

The brain is responsible for everything that makes up a person's thoughts, feelings, perceptions, language, and behaviors. It allows for the full range of the human experience.

Through various types of studies, psychologists have determined that certain areas and structures of the brain relate to certain behaviors or mental processes. This is what is called **localization of functions**, meaning that specific areas lead to certain functions. This is common in most people.

However, the brain is so complex that ongoing research is necessary. For instance, one area of the brain is aligned to vision, but the one specific neuron that leads to that one function of vision is unknown. That level of complexity is too difficult to fully understand at this time, but much progress has been made.

TERM TO KNOW

Localization of Function
The idea that specific areas and structures of the brain relate to certain behaviors or mental processes

2. Neuroplasticity

The brain adapts to different situations and different responses from the environment. This is called neuroplasticity, which is the ability of the brain to change in response to the environment or to different kinds

of events that occur in life.

DID YOU KNOW

The brain is constantly growing and developing and making new connections within the neurons throughout our entire lifespan time, and especially when we're younger.

IN CONTEXT

Suppose a stroke victim has damage to a specific area of the brain. Because of the localization of function, there are impairments with movement and speech.

However, because of neuroplasticity and the ability of the brain to adapt, this individual regains some of the functions over time. How is this possible?

The area surrounding the damaged parts of the brain began to take on some of those different functions because the brain has changed in order to adapt, and has learned to compensate for the damaged areas.

Some stroke victims may not completely regain all of their function, but they might regain some of it over time.

3. Localization of Function

Localization of function has been studied in brain damaged patients. The loss of certain abilities has been studied to determine which area(s) of the brain caused the damage.

EXAMPLE People who have lost speech have been examined and found to have a certain area of the brain that was damaged. This was later determined to be called the Broca's area, which is related to the production of speech itself.

Phineas Gage is a famous psychological subject, who had a tamping rod shot through the frontal lobe of his brain and survived.

There was damage to a specific part of his brain and it severely affected his mood and personality. He essentially became a different person. Localization of function was studied, and psychologists began to understand that part of the brain is related to personality and mood.

Studies are also conducted on postmortem patients (after death) that had reported certain kinds of problems when they were alive.

> EXAMPLE If someone had trouble producing speech, then they can donate their brains to research, to be examined. Researchers can study the areas of the brain that may have received some damage, which in turn caused the speech problems.

4. Ongoing Research

To further study localization of function of the brain, healthy patients are examined and researched as well.

4a. Electrical Stimulation of the Brain (ESB)

Neurons communicate through electrical impulses, so providing **electrical stimulation of the brain (ESB)** can activate specific parts and show the results and the different functions of those specific parts of the brain.

A psychologist may surgically implant an electrode, which is a device that produces an electrical stimulation, in a certain area of the brain, then measure those responses. Using electrodes on certain parts of the brain can elicit:

- Physical movements
- Aggression
- Memories
- Altered speech
- Crying

Powerful magnets produce the same kinds of results. Transcranial magnetic stimulation (TMS) is relatively new. This allows researchers to measure the electrical activity of the brain to see which areas are active. Since this can be conducted through the head, it's an alternative to surgery.

TERM TO KNOW

Electrical Stimulation of the Brain (ESB)
Providing electrical shocks directly to certain parts of brain to activate them and measuring responses

4b. Electroencephalograph (EEG)

An **electroencephalograph (EEG)** is a device placed on a person's head that can amplify and measure electrical responses of the brain to show which specific areas are being activated.

> EXAMPLE When a person performs a certain kind of activity such as reading, the EEG can identify which specific area of the brain is activated. Various behaviors can be done to show how certain areas of the brain produce thoughts or behaviors. Damaged areas can also be identified and can help establish treatment.

TERM TO KNOW

Electroencephalograph (EEG)
A device placed on a person’s head that can amplify and measure the brain’s electrical activity

SUMMARY

Today we discussed an **overview of the brain**, exploring the usefulness and methods utilized in localizing brain function. The brain is responsible for everything that makes up a person's thoughts, feelings, perceptions, language, and behaviors. **Neuroplasticity** is how the brain adapts to different situations and responses from the environment, and **localization of function** means that certain areas of the brain are responsible for specific behaviors and mental processes. **Ongoing research** can involve the use of electrical stimulation of the brain (ESB) or an electroencephalograph (EEG), to measure electrical responses of the brain.

Good luck!

Source: This work is adapted from Sophia author Erick Taggart.

TERMS TO KNOW

Electrical Stimulation of the Brain (ESB)
Providing electrical shocks directly to certain parts of brain to activate them and measuring responses.

Electroencephalograph (EEG)
A device placed on a person’s head that can amplify and measure the brain’s electrical activity.

Localization of Function
The idea that specific areas and structures of the brain relate to certain behaviors or mental processes.