MAPPING THE BRAIN

How technology is shaping what we know about the brain

Your brain has an estimated 85 billion neurons (nerve cells) that send signals with speeds of up to 270 miles per hour. Through neurons, your brain controls every move you make and every thought you think.

We know this, and much more, from advancements in neuroscience—the study of the nervous system, including the brain. Neuroscientists use brain-imaging tools—MRI, fMRI, and PET—to study the brain's structures and functions.

With these technologies, neuroscientists have mapped out which brain regions control different bodily functions. They've identified the brain areas that control critical thinking, movement, and breathing, as well as feelings like pleasure, sadness, and fear. They've also learned what happens to the brain as we age, as well as the effects of injury and of using drugs.

But there is still a lot to figure out. Read on to learn how these technologies work and how they are helping to teach us about ourselves, now and in the future.

The Future of Brain Research: The ABCD Study

We know the brain changes a lot during adolescence. But does sleeplessness or stress affect brain development? Does playing sports? Are there lasting changes to the brain that result from vaping e-cigarettes?

To answer these questions and many more, neuroscientists will begin a study in 2016 that researches 10,000 9- to 10-year-olds for a period of 10 years. The researchers will use MRI and fMRI to track brain structure and function in the participants, as well as surveys and games to track the participants' behaviors. In the largest study of its kind, scientists will be able to look for patterns in how teens' lives affect their brains, and how teens' brains affect their lives. This information can be used to help future generations live better, healthier lives.

The prefix neuro- signals a word related to the brain, nerves, or the nervous system—such as neuron (a nerve cell).

Structural MRI

**WHAT IT SHOWS**

A detailed image of the structure (size and shape) of tissues, organs, and bones. Also shows the presence of disease.

**HOW IT WORKS**

A person lies in an MRI machine, which surrounds the body with a magnetic field and emits radio waves. Hydrogen atoms in the water of tissues and bones absorb and then release the energy from the radio waves. A computer maps and measures these changes to create an image.

**WHAT IT SHOWS**

Changes in the size of tissues (such as from diseases like cancer that cause tumors) can increase the amount of water in different parts of the body, which can be detected by MRI scans.

**SOMETHING WE'VE LEARNED**

MRI scans of the brain have shown that people who have been using drugs for a long time have a smaller prefrontal cortex than people who have not been using drugs. The prefrontal cortex is the area where decision making occurs.

**PET** Positron Emission Tomography

**WHAT IT SHOWS**

The brain and body at the cellular level.

**HOW IT WORKS**

PET scans use radioactive chemicals, called radiotracers, that are injected into the body. The radiotracers go to different areas depending on the chemical that is used. The PET machine detects the radiotracers and computer programs use colors to show their location.

**SOMETHING WE'VE LEARNED**

PET scans have shown that using drugs reduces the number of dopamine receptors in the brain. Fewer receptors indicates less dopamine activity in the brain. This finding helps explain why people addicted to drugs experience less pleasure from everyday activities. They begin to crave the drug to get their dopamine activity back up to normal.

To view images for the rest of the brain, visit scholastic.com/headsup and teens.drugabuse.gov.

*Adolescent Brain and Cognitive Development Study

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More Info: For additional facts about the brain, visit scholastic.com/headsup and teens.drugabuse.gov.