HEADS UP
REAL NEWS ABOUT DRUGS AND YOUR BODY

Mapping the Brain

How technology is shaping what we know about the brain

Fact: Through 85 billion neurons* (nerve cells) traveling up to 270 miles per hour, your brain controls every move you make and every thought you think.

How do we know this? The answer is found through neuroscience, the study of the nervous system, including the brain. Scientists study the brain with three very complex tools: MRI, fMRI, and PET.

Using these tools, neuroscientists have learned which areas of the brain control thoughts, movements, and feelings. Every day they learn more about what can hurt the brain, like injury or using harmful drugs. They also learn what can protect the brain, like physical activity and learning new skills.

Read on to learn more about how these tools work and what they are teaching us about ourselves.

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

The Future of Brain Research: The ABCD Study

In 2016, neuroscientists will begin the ABCD Study, a landmark study of teen brain development. Neuroscientists with the ABCD Study will use MRI and fMRI to map the brains of 10,000 9-10-year-olds for 10 years. They will also use surveys and games to measure behaviors, like sleep, sports activity, stress, and using drugs. The scientists will look at how teens’ lives affect their brains and how teens’ brains affect their lives. This is information that can help future generations live better, healthier lives.

1 Adolescent Brain and Cognitive Development Study
**Structural MRI**

**WHAT IT SHOWS**
Gives a detailed picture of the size and shape of tissues, organs, and bones. It also shows if there is injury or disease.

**HOW IT WORKS**
A person lies in an MRI machine which surrounds them in a magnetic field while sending out radio waves. Because hydrogen atoms in water are magnetic, this causes differences in how the different areas of the body respond based on the amount of water in organs, muscle, and bones. A computer measures the release of energy from the radio waves and then creates a picture.

**SOMETHING WE’VE LEARNED**
MRI scans show that people who have used harmful drugs for a long time have a smaller prefrontal cortex than non-drug users. This is the brain area that controls decision making.

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**Functional MRI (fMRI)**

**WHAT IT SHOWS**
Shows the brain areas being used when a person is doing something.

**HOW IT WORKS**
A person lies in an MRI machine while doing something, like laughing, looking at an image, or solving a puzzle. Oxygen levels increase in the areas of the brain a person is using. A computer analyzes oxygen changes to map brain function.

**SOMETHING WE’VE LEARNED**
Scientists have done studies of teens playing games to earn rewards. They report there is higher activity in the areas of the brain that control motivation and pleasure compared with those that control thoughtful decision making. This shows that teens may focus more on the rewards and less on drawbacks of decisions. Thinking like this could increase a person’s risk for using drugs.

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**PET**

**WHAT IT SHOWS**
Shows the brain and body at the cellular level.

**HOW IT WORKS**
Radioactive chemicals, called radiotracers, are injected into the body. Each radiotracer is designed to go to different parts of the body. The PET machine uses color to show the location of the radiotracers.

**SOMETHING WE’VE LEARNED**
When the brain chemical dopamine locks into its brain receptors, a person feels pleasure. PET scans have shown that heavy use of harmful drugs can reduce the number of dopamine receptors. Fewer receptors means less dopamine activity. This finding helps explain why people addicted to drugs experience less pleasure from everyday activities and crave drugs to feel normal.

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**More Info:** For additional facts about the brain, visit [scholastic.com/headsup](http://scholastic.com/headsup) and [teens.drugabuse.gov](http://teens.drugabuse.gov).