BRAIN ZOOMING

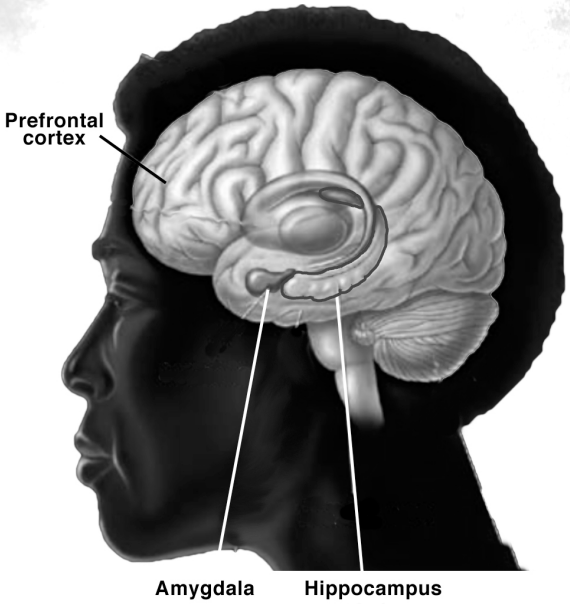
Zooming to New Connections: A Summary of Brain Growth in Adolescence

Neuroscience is the study of the brain, and this field has exploded with new information. Recent technology inventions enable scientists to take pictures of brains that are alive and growing. We now know that adolescents undergo profound brain growth and brain change far into their twenties. By then, the brain is "the most complicated three-pound mass of known matter in the universe."

Brain Power—Pruning Gray Matter and Growing White Matter

The gray matter of the brain represents the nerve cell bodies with the genetic DNA. There are over 100 billion of these cells. The cells on the right side of the brain have the DNA that controls the left side of the body, and the left brain controls the right side. Therefore, when an individual feels an itch on his right leg, the brain hemisphere on the opposite left side is recording that itch. During adolescence, the cells in this gray matter slim down. They are cast off just as an artist carves rock to make a sculpture, leaving rock crumbs behind. Nature carves the brain to eliminate cell connections that are seldom used, and nature strengthens connections that will assist one's thoughts and actions. This brain re-organization is called pruning. In adolescence, youth influence what stays and what goes, through their effort and choice of experiences.

The white matter is composed of long nerve trunks called axons, which are covered in white fat—hence the name.



The white fat, called myelin, helps electrical impulses travel very fast. One brain cell is connected to 1,000 to 5,000 other cells, creating a vast web of nerve connections that sends information to muscles, at 250 miles per second. The white matter grows increasingly dense in adolescence, in a back to front direction. There is a zone of reason and judgement, in the Prefrontal Cortex, and it develops last. Youth have an enormous window of opportunity to shape brain development in a positive or damaging direction. The brain grows in response to mental challenge, in the same way muscles respond to exercise.

Amygdala—The "Rock-and-Roll" Center

A brain area called the Amygdala (see the brain diagram) processes strong emotion such as danger and fear, or what people call emotions from the "gut". Music triggers this center too, and this explains why music and emotion are so hand-in-hand.

In adolescence, hormones in puberty excite the Amygdala to mature first. This fact is proven in scientific studies comparing youth responses to adults. When youth and adults are asked to identify emotions expressed on faces, magnetic imaging of brains shows that the Amygdala fires in youth, while the front of the brain (the prefrontal cortex) fires in adult brains. Adults have an advantage in this task

until the prefrontal cortex is mature, about the age of twenty-five.

There is good reason for this staging of brain growth. The Amygdala growth enhances the teenager's ability to connect feelings with memories of past situations that might be important. This time of intense emotion naturally triggers youth to seek personal identity and a way to define themselves in the world.

Brain Folds—Increase Information

Science proves teens shape their own development. Emotional learning, high-level thinking, and positive experiences builds complex brains. The brain's ruffled, folded surface increases its folds. This evolving pattern of folds and crevices reaches a peak by the late teens, and then the brain folds remains stable throughout adult life. These folds increase the flow of information. If folds were laid out end to end, they would equal the size of an open newspaper. Humans join cats, dogs, monkeys and dolphins in having these unique, folded brains. All other animals have primitive flat brains which provide less brain surface to support creativity of thought.

Protect that Dopamine!

Nerve cells talk to each other all the time, but they never actually touch. They meet in a space called a synapse. When an electrical impulse travels down the axon, it changes to a chemical impulse, crosses the synapse, and then converts back to an electrical impulse on the next axon. Special chemicals, carry the impulse across the synapse.

Reasoning cells in the Prefrontal Cortex, communicate by releasing the chemical Dopamine into synapses between cells. These Dopamine-rich cells grow rapidly in the teen years. They help the brain make decisions, and they coordinate using memory to make difficult choices. Dopamine cells also increase the capacity for impulse control. Drugs such as cocaine and amphetamine target dopamine cells and damage them. Ecstasy permanently destroys nerve cells and connections.

In summary, an adolescent has a brain full of promise. A writer of A. Nonny Mouse Writes Again! sums it up: "Ashes to ashes, dust to dust, oil those brains, before they rust."

- J. Prelutsky