

**ADOLESCENT BRAIN DEVELOPMENT**

Many have remarked that developmentally, two-year-olds and 12-year-olds have a lot in common: feistiness, moodiness, and a constant tension between their desire to grow up and the immaturity and impulsivity that characterize their thinking and behavior.

Since the early 1990s, brain research has produced mounting evidence that neurologically, there are remarkable similarities between toddlers and teenagers. The teenage brain, formerly thought to be stable and hard-wired once the sex hormones kicked in, is now known to be as dynamic and changing as the brain in early childhood. In fact, human brain development is not complete until the early to mid 20s and for some, especially males, closer to 30.

What are some of the characteristics of the teenage brain, and what are the implications of these qualities for learning, emotions, and behavior?

<b>Brain Development</b>	<b>Implications</b>
<p>Proliferation occurs, followed by pruning: As in the early years of life, there is exuberant growth of synapses, or connections among nerve cells, in the teenage brain. This is followed by a pruning process in which many of these connections are discarded, leading to a streamlined, more efficient neural network.</p>	<p>With neural connections still being formed, all kinds of cognitive and emotional processes are in flux. This can make it harder to prioritize and carry out multiple tasks or understand abstract ideas. Judgment, self-control, and emotional stability also are affected.</p>
<p>Different parts of the brain develop on different schedules. One of the last areas to mature, the prefrontal cortex, controls our capacities for decision-making, interpreting ambiguous information, deferring judgment, and resisting impulses. With their prefrontal cortexes still under construction, teenagers often process information by way of the limbic system, deep in the brain's interior, where "gut responses" and emotions are generated.</p>	<p>Teenagers' emotional responses tend to be intense and unmodulated, leading to mood swings, unpredictability, and explosiveness. One study found that teenagers had far greater difficulty than adults in accurately "reading" facial expressions and body language that expressed fear. This tendency to misread the intentions and moods of others can lead them to make poor behavioral choices.</p>

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<b>Brain Development</b>	<b>Implications</b>
<p>In girls and boys, sex hormones surge. This leads to a sort of flipping of switches that have been in place since before birth. Besides initiating the physical changes of puberty, these hormones change the brain's structure.</p>	<p>Interest in sex is ignited. Additionally, enlargement of part of the limbic system that generates fear and anger may lead to a rise in aggressiveness and irritability, so typical of teenagers.</p>
<p>In one of the last steps towards brain maturity, nerves are coated with white matter called myelin—fatty cells that spiral around shafts of nerves like a sheath around a knife. The myelin sheathing allows electrical impulses to travel down nerves faster and more efficiently. Nerves finish myelinating earlier in girls than in boys, some of whom do not finish the process until the age of 30.</p>	<p>Some of the nerves that are myelinated connect areas of the brain that govern emotion, judgment, and impulse control. Hence the greater maturation that becomes evident as young people enter their 20s. Later myelination for boys may explain why teenage girls often seem more emotionally mature than their male contemporaries.</p>

**What can we do?**

- Try to make sure teenagers get enough sleep. Teenagers need quality sleep, and plenty of it. As annoying as it may be when they sleep past noon on a weekend, that sleep may be supporting healthy brain development.
- Understand that teenagers experience the world differently. They may look grown up, but their developing brains mean they are immature in their perceptions and judgments.
- Teach them strategies for organization and time management. With their minds literally all over the place, teenagers have trouble focusing and prioritizing.
- Refrain from engaging a teenager who is in a rage or otherwise overcome by strong emotion. Say that when he or she has calmed down, then you can talk together.
- Be vigilant about teenagers' use of alcohol and other drugs. With so much brain development under way, teens run the risk of seriously derailing their intellectual and emotional development if they shut out the wealth of experience that is available to them in favor of being high.