

Adolescent Brain Development:  
Implications for Understanding Youth

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New scientific discoveries have put a much different perspective on our understanding of adolescent behavior. Research now suggests that the human brain is still maturing during the adolescent years, with significant changes continuing into the early 20s. The developing brain of the teenage years may help explain why adolescents and young adults sometimes make decisions that seem to be quite risky and may lead to safety or health concerns (Spear, 2002). And it may add insights into unique vulnerabilities and opportunities associated with youth.

**WORK IN PROGRESS**

Advanced technologies in brain imaging have provided windows to the developing brain. Based on the pioneering work of Jay Giedd and colleagues at the National Institute of Mental Health (Giedd, 2004), evidence is accumulating that the brain is not fully formed at the end of childhood as earlier thought. The juvenile brain is still maturing in the teenage years and reasoning and judgment are developing well into the early to mid 20s.

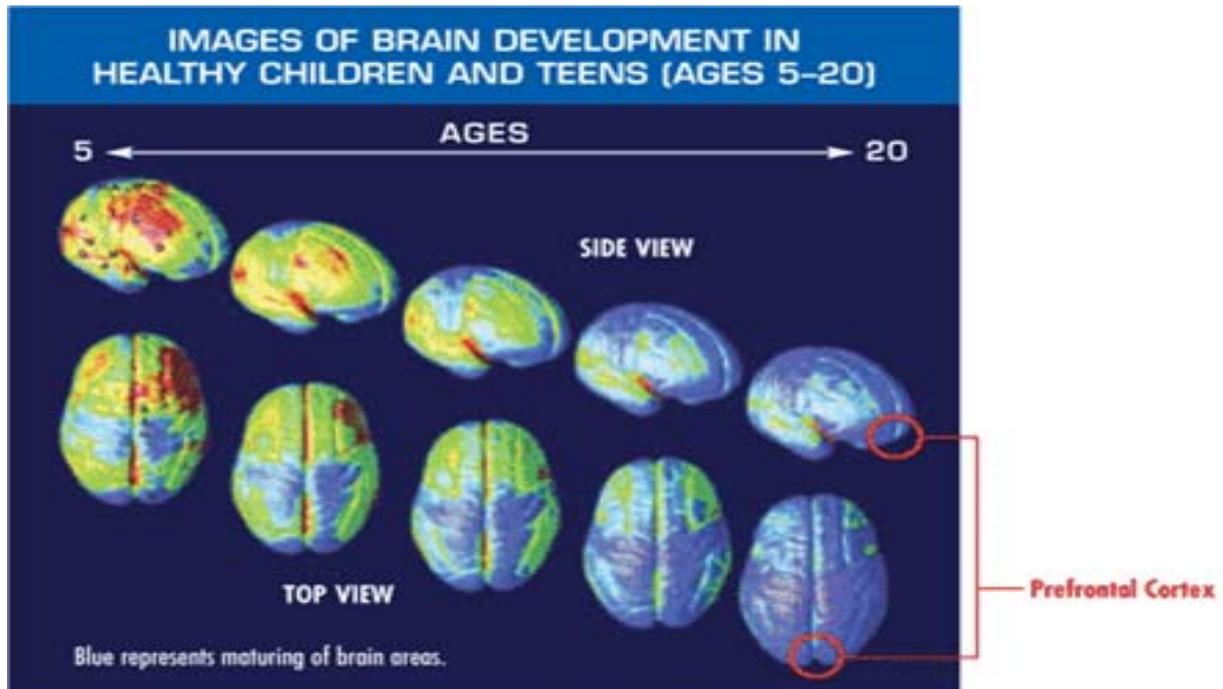
During childhood, the brain grows an excessive number of connections between brain cells. At about year 11 or 12, a young person begins to lose or “prune back” a substantial fraction of these connections. This loss is healthy in the long run and is a vital part of growing up. The pruning process clears out unneeded wiring to make way for more efficient and faster

information-processing as we become adults. And it promotes building the long chains of nerve cells that are required for the more demanding problem-solving of adulthood.

The pruning process appears to follow the principle of “use-it-or-lose-it,” according to experts. Thus, neural connections or circuitry that gets exercised as we grow up are retained, while the connections that are not activated or used, get pruned away. If you learned a musical instrument while growing up, the neural connections involved in music playing will be strong and resistant to pruning. Dr. Giedd refers to this process in this way: “Ineffective or weak connections are pruned in much the same way a gardener would prune a tree or bush, giving the plant the desired shape.”

Another feature of the pruning process is that it tends to occur from the back of the brain to the front, which means that the front regions do not become fully mature until around the age of 25. In this region of the brain is the prefrontal cortex, the part of the brain that is responsible for high-level reasoning and decision making, and enables a person to delay gratification and to control impulses. It is primarily responsible for how much priority to give incoming messages like “Do this now” versus “Wait! What about the consequences?” Because the regions of the brain that regulate emotions, or the “Do this now” regions, are predominantly located behind the front of the brain and have progressed more with the pruning process, it is difficult for the “Wait” part of the brain to exert much influence. Or as some experts have put it: the adolescent brain has an “accelerator” that is more developed than the “brakes.”

## Maturation Occurs from Back to Front of the Brain



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## IMPLICATIONS FOR UNDERSTANDING BEHAVIOR AND DECISION MAKING

Scientists caution against suggestions of definitive linkages between brain development and adolescent behavior, but there is a growing sentiment among experts that when teenagers are feeling high emotion or intense peer pressure, conditions are ripe for the still-maturing circuitry in the front part of brain to be overwhelmed, resulting in decisions that lack judgment (Reyna & Farley, 2006). Adolescents may be prone to make decisions that

- are more impulsive,
- focus on and overestimate short-term payoffs and underplay longer-term consequences,
- fail to consider alternative courses of action,
- reflect a high degree of risk, and
- are vulnerable to peer pressure.

This does not mean that teenagers always make decisions and behave in ways that lead to harmful consequences. The teenage brain is quite capable of demonstrating plenty of mental ability, and adolescents are capable of rational decisions, keeping in mind individual differences. But the teenager, with less than optimal neurologically-based control mechanisms, is more likely to act impulsively and with gut instinct when confronted with situations perceived to offer high rewards, without fully appreciating the immediate consequences of their actions.

## **IMPLICATIONS**

There are several implications as to how this new science may impact higher education for young people.

- Brain development may conflict with less than optimal decision making by the adolescent when it comes to several choices related to a post-secondary education, including whether or not to pursue a higher education, what type of institution to attend, reasons for choosing a particular school, and the field of study in which to major.
- For many youth who are experiencing independence from parents for the first time in their life, the post-secondary experience presents numerous unfamiliar and tempting situations that may challenge the still-maturing brain, which in turn may contribute to unhealthy behaviors, such as binge drinking, drug use, and unprotected sex.
- This new science places importance on educating youth about the skill of using the “thinking breaks” when faced with risky situations, including skills in avoiding situations that are likely to elicit temptation or that require behavioral inhibition, and how to engage cognitive processes that promote “on second thought.”

- This emerging information provides opportunities to encourage youth to capitalize on the assets of the developing brain, such as its propensity to be attracted to novelty and to risk-taking, which in turn can promote personal growth, learning and self-efficacy.
- How curriculum and instruction can be shaped to accommodate the post-secondary student who is still undergoing the later stages of brain development is an area in need of further discussion and research.

## **SUMMARY**

Adolescence is a time when a young person forges a sense of self, experiments with independence and seeks new experiences. This developmental period is also likely to be the years when we observe behaviors that reflect how social pressures and thrill-seeking can override common sense. The juvenile brain responds more quickly and more intensively to excitement and arousal, which likely contributes to the adolescent's vulnerability to negative influences, including peer pressure. Channeling this exuberance toward healthy and growth-enriching experiences, and shaping the learning experience to accommodate brain maturation, are important tasks for educators.

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### **SUGGESTED READINGS**

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