

# Tip of the



## CSAP's Western Center for the Application of Prevention Technologies

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### Adolescent Brain Development

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*Most of the research on this topic has been conducted using nonhuman animal models. Yet to be determined is whether all of the differences observed in other animals map onto the human condition, although researchers certainly expect this to be the case. The following information is based on what we know from research with humans regarding adolescent brain development.*

The brain of the adolescent is unique and differs from that of younger individuals and adults in numerous regions, including those that are critical with respect to alcohol and other drugs. Particular sets of brain circuits are involved in the development of addictions and these are the same ones that are rapidly undergoing change during adolescence. A predisposition for alcohol use may be in part biologically determined by age-specific neural alterations that continue into late adolescence.

Magnetic Resonance Imaging (MRI) has shown that the teen brain is a work in progress. Until recently, most scientists believed that the major "wiring" of the brain was completed as early as age three and that the brain was fully mature by the age of 10 or 12. New findings show that the parts of the brain responsible for functions such as self control, judgment, emotions and organization undergo the greatest changes between puberty and adulthood. Both organizational and functional changes occur in the frontal lobe during adolescence. Frontal lobe gray matter reaches its peak at around age 11 or 12 and then decreases throughout adolescence. Researchers believe that the decrease in gray matter reflects two separate processes that result in fewer, but more efficient use of remaining brain cells.

The brain has heightened plasticity during adolescence. This is a double edged sword—it provides a unique opportunity to guide brain development in healthy ways, but it also appears to increase vulnerability to

disruptive effects of both acute and chronic substance use. Dr. Jay Giedd of NIMH reports that "brain maturation does not stop at age 10, but continues into the teen years and even into the 20s... Kids who 'exercise' their brains by learning to order their thoughts, understand abstract concepts and control their impulses are laying the neural foundations that will serve them for the rest of their lives."<sup>1</sup>

Adolescents react differently to the initial effects of alcohol. Additionally, research on 15- and 16-year-olds showed cognitive impairments in teen alcohol abusers, compared to their non-abusing peers, even weeks after they stop drinking. This suggests that the abuse of alcohol by teens may have long-term negative effects on the make up of their brains. This research also may provide an explanation for why adolescents often fail to heed adults' warnings about risks. Simply put, they may not be able to understand and accept arguments that seem logical and decisive to adults.

#### **The Adolescent Brain and Substance Abuse**

- The adolescent brain is a brain in transition.
- Frontal lobe gray matter reaches its peak around the age of 11 or 12 and then decreases throughout adolescence.
- The brain has heightened plasticity during adolescence.
- The sets of brain circuits rapidly undergoing change during adolescence are the same ones involved in the development of addictions.
- The parts of the brain responsible for functions such as self control, judgment, and emotions undergo the greatest changes between puberty and adulthood.
- The majority of serious health problems involving the control of behavior and emotions occur during adolescence.
- Mortality and morbidity increase by 300 percent during adolescence.
- Adolescents react differently than adults to the initial effects of alcohol.

#### **The following links are additional resources on adolescent brain development:**

- <http://www.nida.nih.gov/Curriculum/HSCurriculum.html>
- <http://www.nimh.nih.gov/publicat/teenbrain.cfm>
- [http://www.teens.drugabuse.gov/facts/facts\\_brain1.asp](http://www.teens.drugabuse.gov/facts/facts_brain1.asp)

For more information visit: <http://captus.samhsa.gov> or call (888) 734-7476. Funded by the U.S. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Center for Substance Abuse Prevention.

<sup>1</sup> Wallis, C., & Dell, K. (2004, May 10). What Makes Teens Tick. *Time*, 163, 56-65.