

Adolescent Brain Development

It has been known for years that adolescence is a time of stress and turmoil. There has also been reference to some of the behaviors that “typical teens” exhibit in the arts. For instance, in Shakespeare’s Romeo and Juliet, the short courtship and wild passion they exhibit for each other, and the ultimately fatal extremes that they are willing to go to for one another represent a couple of areas that are not fully developed in the adolescent brain.

To explore this topic in more detail, it is important to first define adolescence. Adolescence is typically viewed as the time between puberty and adulthood. Ronald E. Dahl, M. D., noted doctor of Psychiatry and Pediatrics, states it is the “awkward period between sexual maturation and the attainment of adult roles and responsibilities.” It typically begins with puberty and ends when a certain set of social roles have been accomplished. It is also important to recognize that adolescence is beginning at a younger age than in earlier times. Puberty, on average, used to begin around age 16 and now begins around age 12. In addition to puberty beginning earlier, people are waiting longer to marry, which defined the role of adulthood in traditional times. So, if one accepts marriage as the outlier and with sexual maturation happening earlier, the time of adolescence is much longer than the average two years it used to be and spans from about age 12 or 13 to about age 26, which is the average age of marriage for females at current, and age 27 for males.

While researchers used to believe that the brain was, basically fully developed by the end of early childhood and that no new growth took place, it has become evident that is not the case at all. In fact, during the teenage years, the brain undergoes much growth and development, similar to that during the first years of life. Through the science of Magnetic Resonance Imaging (MRI), researchers are able to track which parts of children’s brains are changing, how the areas of the brain that they use compare to the areas of brain used by adults for the same task and what part of the brain is being accessed during specific tasks.

Specifically, there are three parts of the human brain that appear to continue developing and maturing throughout the teenage years and contribute to the seemingly erratic behavior during these years: the nucleus accumbens, the amygdala which is just behind the forehead and the prefrontal cortex located in the frontal lobe. The nucleus accumbens plays a part in regulating the amount of work done to receive reward. If this is relatively immature then it is logical that

activities which require little work with high reward or pleasure are preferable. This would include activities such as video games, risky sporting activities like skateboarding and even substance use. The amygdala is the pleasure center of the brain and is also responsible for integrating emotions into reacting to stimuli. So far, it is thought that this immature structure plays out in two ways. One is that adolescents tend to overreact to situations rather than react in a calm, controlled fashion and the other is the likelihood for youth to see facial expressions that exhibit fear, neutrality or inquisitiveness as expressions of anger. This can lead to miscommunication when conversing with a teen. One of the last structures in the brain to mature, which can last into the mid-20's, is the prefrontal cortex. This is the area of the brain that controls complex thought processing ranging from making judgments to controlling impulses, foreseeing consequences and setting goals and plans. This could be the scientific reasoning for some teens being poor at the age old adage "think before you speak," as they are not yet fully wired to do so.

There is some exciting news coming out of this research for adolescents. While scientists used to think brains were hard-wired by the age of three while under the control of parents and other adults, there is now a place for the teen to be an active participant in shaping his or her own finished product. What happens during this period of development is that the brain undergoes a time much like that in the first 18 months of life, where it produces increasing amounts of gray matter; the thinking part of the brain. Whatever the teen is engaging in during this time is likely to be reinforced and hardwired once the brain moves to the next phase in development. This is called pruning and is nicely explained in [Adolescent Brain Development](#), May 2002, at www.actforyouth.net. To briefly define, it is when the brain begins surrounding these connections it creates and uses most often with a white matter called a myelin sheath. This will act as a protector and a conductor of the information being passed from cell to cell. Dr. Jay Giedd, a neuroscientist at the National Institute of Mental Health and a prominent researcher in adolescent brain development says, "If a teen is doing music or sports or academics, those are the cells that will be hardwired. If they're lying on the couch or playing videogames or watching MTV, those are the cells and connections that are going to survive."

The question then becomes, "How can we help these young adults who are seemingly plagued by poor decision-making, recklessness and emotional outbursts?" First of all, it is important to note that just because researchers are learning more and more about the structure of the brain; it doesn't smoothly translate to knowing the underlying functions of those structures. It is hypothesis at this point that if a brain structure is immature, then the purposes it serves will also be immature. However, a few generalizations can be made from the research that has been secured. We know that it is important to provide healthy role modeling for teens, and to involve them in learning about their own limitations and brain development during these critical years, especially if it means a lifetime of consequences from the choices made. Also, it may be advantageous to involve educators, especially if it is determined that certain subjects are learned best during particular stages in brain development. As the field develops even further, it may

include involving policy makers in advocating for the adolescent and young adult. For instance, consider these many disparities among current policy: driving age is 16 years old, voting and most adult decisions can begin at age 18, yet one cannot legally drink alcohol until the age of 21 or rent a car until the age of 25, but one can be tried as an adult for murder at the age of 14.

For additional information please visit:

www.pbs.org

www.actforyouth.net

www.nimh.nih.gov

www.wccf.org

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Reference:

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