

SIDEBAR: THE TEENAGE BRAIN

By Dr. Steven Krugman

October 19, 2011

One of the promising aspects of contemporary neuroscience lies in its potential to illuminate issues in development and learning on the one hand, and issues related to psychopathology on the other, and bring a pragmatic focus to bear. In fact, the English Board of Education convened a national conference in 2009 to examine how the new neuroscience might impact public education.

I've been particularly fascinated by a set of findings regarding neurobiological developments that precede adolescence that may be implicated in many of the issues that parents, educators, and therapists encounter during the teenage years.

Puberty is, of course, a well-known passage marked, among other things, by the surging of testosterone and estrogens, the triggering of secondary sex characteristics, a preoccupation with sexuality, and the capacity to procreate. Most of the challenges teenagers present have typically been written off to "hormones," self-centeredness, invulnerability, and a preoccupation with things sexual.

NIMH neuroscientist Jay Geidd, beginning in 1991, scanned the growing brains of 1800 children on into adolescence. He (and others) found that brain growth spikes prior to puberty and continues into mid to late 20's, This growth is of several kinds. There is a burst of new neuronal (gray matter) connections that apparently support the new learning that adolescence requires. Gradually, these new connections are either put to use, mapping new challenges, or they fade with disuse (a process known as pruning, according to the "use it or lose" principle). Along with this burst of gray matter, the process of mylenization proceeds to connect sub-cortical (e.g., limbic regions) to frontal areas. Myelin, a white fatty tissue, coats axons and speeds up neural transmission by 100x. This process makes the brain more and more efficient. It also integrates cortical and sub-cortical, front and back areas, bringing about more sophisticated frontal control over fight-flight-freeze responses. By 25, most young adults have achieved good inhibitory control over their impulsivity and emotional reactivity. They can delay and consider consequences, make

deliberate moral and strategic choices. At 15, the connections are too immature to hold back adolescent impulses. Emotional intensity and reactivity hijack the system, and behavior is underway without much consideration of risk or consequence. Other researchers have also discovered that testosterone (in boys and girls) increases the size of the amygdala and probably contributes to the heightened sensitivity and emotional reactivity so common among adolescents.

It's not hard to think about teen rudeness, disobedience, and defiance in terms of the heightened emotionality, the limited inhibitory restraint, and the intense need to separate emotionally in preparation for living a more independent life. There is evidence from several experiments that adolescents tend to be emotion driven, with little cortical oversight, often misreading emotional signals.

For parents these findings contain several important implications. For one, don't blame your teen for their biology, expecting them to behave like adults when their neurology isn't there yet. This is even more so when teens are first confronting biologically driven issues that include anxiety and eating disorders, depression, and vulnerability to substance abuse, and schizophrenia. For another, it is clear that teens need parents to function as their "auxiliary frontal lobes." They need more help with judgment, consequences, and planning than they may like or we may think. (They may be large but they're not grown.) Finally, their limbic system is over-active and not well integrated. Dealing effectively with an adolescent requires that the adult stay in charge, find a way to self soothe, and calm down. An emotionally volatile parent only makes the teens job tougher. We have to help them think about their situations, their lives, and other people. We want to encourage mentalizing. They can only do that if they can get to calm, feel safely connected to their parents, and get some perspective.

There are many ways in which neuroscience findings about the developing brain can help us in our effort to support young people trying to come to terms with who they are, and what their struggle is. Thinking about adolescence in a way that gives parents, teachers, and counselors both greater perspective as well as tools to help with emotion regulation and clearer thinking, is one powerful contribution of neuroscience to parenting, teaching, and counseling.