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Risky behavior by teens can be explained in part by how their brains change

By Arthur Allen September 1, 2014

Teenagers can do the craziest things. They drive at high speeds. They stand around outside loud parties and smoke weed in front of cops. They guzzle liquor. They insult their parents — or lie to them — and feel no remorse, because, of course, their parents are idiots.

It is easy to blame peer pressure or willfulness, but scientific studies suggest that at least some of this out-there behavior has a physiological tie-in: Brain mapping technologies show that the average teenager's brain looks slightly different from an adult's. The biggest differences lie in the prefrontal cortex — a part of the brain associated with reasoning — and in the networks of brain cells that link the cortex to regions of the brain that are less about reasoning and thinking and more about emotion.

Using such tools as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET), scientists have peered into teen brains and found that typically, until a person hits his early to mid-20s, his prefrontal cortex is still rapidly changing. So are the cell endings and chemical connections that link the cortex to parts of the brain associated with gut impulses.

When people are around 15 or 16 years old, many brain cells in the cortex die off while others are created, and new connections form among them. A lot of the basic cognitive abilities — advanced reasoning, abstract thinking, self-consciousness — rapidly expand during this time period, says Laurence Steinberg, a Temple University psychology professor. "The connections within the brain don't fully branch out until age 22 or so. The kinds of capabilities that connectivity contributes to — emotion regulation and impulse control — probably plateau in the early to mid-20s."

Research that Steinberg and colleagues published in January showed that when adolescents are in the presence of peers, what is known as the reward circuitry in the brain is more activated than when adults are with their peers. These electrical signals impel us to seek pleasurable things, and it's only natural that such feelings should be more

intense in teens, Steinberg says. “Adolescence is when you start to mate, and from an evolutionary point of view it’s adaptive to do this outside the family, with people close to you in age. So it should be part of our inheritance to feel good when you’re around people your age,” he says.

These circuits — which include dopamine-containing neurons in the prefrontal cortex and deeper areas of the brain, such as the nucleus accumbens and amygdala — may provide a hormonal jolt that causes some teens to embrace risky behaviors, according to researchers. Racing cars to the point of crashing into a tree isn’t going to win you a mate, but if you survive, you may impress your peers.

Susceptible as they are to social feedback, praise and rejection — more so than adults, according to research by Steinberg and others — teens often do what peers want them to do, or what they think peers want them to do, rather than what we might say is rational, Steinberg said.

Risk-taking isn’t all bad

Yet as difficult as this risk-
taking, peer-driven, reward-
seeking behavior can be for parents and other adults to deal with or merely observe, it’s important to see the positives, and to realize that youthful foolishness usually doesn’t last forever, says Silver Spring-based neuropsychologist William Stixrud.

He finds it helpful to point adults to the scan images that show that teenage brains are physically different from theirs and to the research showing that brains change over time.

That science has found physical differences between teen and adult brain structures and activity means something to his patients — and their anxious parents, Stixrud says.

He finds it “enormously useful” to be able to explain to teenagers that it’s their “sensitive and reactive amygdala” that causes them to feel things more strongly than others do but also makes it harder to live in their own skins.

All brain functions are immensely complicated, but the amygdala plays an important role in emotional memory, and this area of the brain seems to show more activity in teenagers than in adults, according to research by Dutch scientists at Leiden University and others. For Stixrud, an overactive amydgala helps explain why teens’ feelings of aggression, fear and depression may be more intense than those of adults.

When research comparing prefrontal cortices of adults and teens first came out in the 1990s, his colleagues interpreted it to mean “we need to keep them on a short leash, because they aren’t fully developed,” Stixrud said. More recently, he said, he and other professionals have tended to focus on the power and adaptability of the teen brain.

The brain development that can make teens and young adults take scary risks also motivates them to go out on their own, seek new experiences and sometimes create new things.

Genes and environment

Some neurologists worry that too much can be made of scans of the brain's complex structures and functions.

Neurological images "are powerful, but images are not causes" of behavior, says Tomas Paus, a professor of psychology and psychiatry at the University of Toronto, who has authored research papers with Steinberg but is more skeptical of overarching interpretations. "The causes are in our genes and our environment. The image is just a manifestation of those causes."

Paus has examined thousands of images of the teen and adult brains in his work, which is focused on alterations in the coatings of brain cells. He sees differences between the two age groups, but he cautions that they are subtle. So subtle, he says, that it can be difficult to say whether it is aging or experience that causes the changes.

"If you have [the scans of] a given 20 individuals, teens or adults, and compare them with another 20, you'll find it very difficult to classify the teens and adults," Paus says. "I don't think there are quantitative differences. It's a continuum, and one that is influenced by our experiences," and not just age.

"A 17-year-old has different experiences than a 40-year-old," he adds. "It's not only the brain that changes our experience; experience changes the brain."

Consider the case of Brian Blacklow, who became a Stixrud patient at age 12, after he started cutting class at Westland Middle School in Chevy Chase and spent most of his time roaming Washington, grabbing magazines from bookstores, reading Kerouac novels and watching planes land at Reagan National Airport.

Eventually he dropped out of a Connecticut boarding school and hoboed down to Florida with his girlfriend. They spent the next few years living rough in Florida. For several months they were homeless.

Perhaps only a teenager would be foolish enough to do what Blacklow did. Yet he now says the experiences informed his whole life.

Blacklow, now 37, eventually went to college and is now a master educator in some of the District's roughest schools. Blacklow says he has empathy with students and teachers that he would lack if his path had taken him directly from Chevy Chase to an elite college, like many of his peers.

"Those experiences molded me," he said. "They made me who I am and they hold value for me. How much of that was

immaturity related to the prefrontal cortex and how much is just arrogance and foolishness, I just don't know."

Stixrud points to patients such as Blacklow — and what we know of teen brain scans — when seeking to reassure parents that children who are struggling when they are 14 or 16 or 19 or 22 won't necessarily be struggling at 25 or 28.

"They will have a very different brain," he says. "That is arguably the most useful thing I can do for families in lowering levels of anxiety and fearfulness about the future, and helping kids and parents understand each other."

For teens and parents living through these years, "be patient" may the wisest words. Science tells us that by age 24 the teenage brain has mostly morphed into an adult version.

Of course, adults sometimes do crazy things, too.

Allen is the author of "The Fantastic Laboratory of Dr. Weigl: How Two Brave Scientists Battled Typhus and Sabotaged the Nazis."