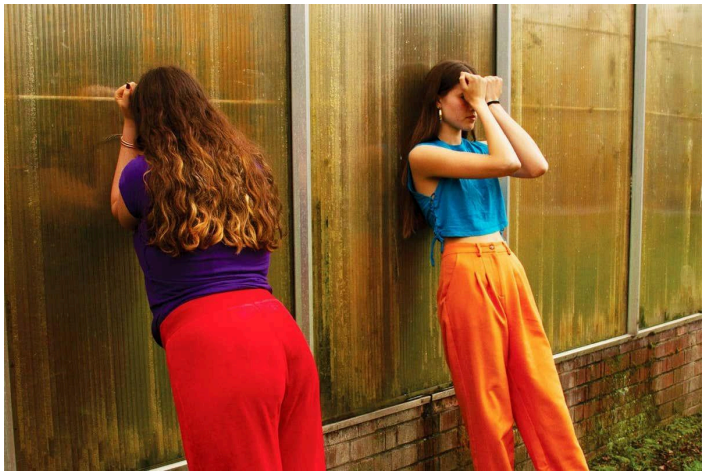
The hidden evolutionary advantages of the teenage brain

Recent research suggests teenagers' brains are particularly suited to coping with volatility and new experiences, including socialising and venturing to unknown places

By Thomas Leslie on February 20, 2024



There are hidden evolutionary benefits of the teenage brain. Kerry Woolman/Millennium

TEENAGERS, eh, what are they like? They have a reputation for being difficult, reckless and self-absorbed, but surely these negative stereotypes can't be the whole story. Most other animals fly the nest soon after puberty, and none, including our closest primate relatives, has the prolonged adolescence that we do. Why would humans have evolved this peculiar life stage? A closer look at the teenage brain suggests it brings a hidden evolutionary advantage.

The past two decades of research has emphasised that the cerebral cortex, the brain region central to higher processing and cognitive control, continues to develop until our early to mid-20s. By contrast, regions that are sensitive to rewards – including an area called the ventral striatum – are firing on all cylinders by our mid-teens. This has bolstered the narrative that the adolescent brain is noisy and imbalanced, with its overactive reward system causing erratic, sub-optimal decision-making. Early assessments of adolescent cognitive performance seemed to support this. "Sometimes adolescents would do a task well and other times they would not. It was messy," says Eveline Crone at Leiden University in the Netherlands. However, more recent studies have found that adolescents can be extraordinarily capable – they just need the right kind of task to showcase their skills.

In 2022, for example, Linda Wilbrecht at the University of California, Berkeley, and her colleagues presented 291 volunteers aged between 8 and 30 years old with a computer game in which they had to guess which of two boxes contained a gold coin. First, it would mostly appear in one box. Then, after a random number of guesses, it would start appearing mostly in the other box, before switching again. To do well at the game, participants had to assess the best point at which to shift their guesses from one box to the other. Far from making poor decisions, adolescents aced the test, uncovering more coins than older or younger participants. Teens show a similar aptitude in simulations of foraging tasks, where participants choose between exploiting one plot of land or exploring potentially greener pastures.



The adolescent brain is much more socially adaptive than we thought. Drazen Zigic/Shutterstock

“We tend to see these instances where adolescents outperform adults under conditions that are more uncertain or volatile,” says Wilbrecht. In such circumstances, adolescents seem more disposed to try new options, which may provide them with information about how to perform well in the future. Parallel behaviours in other species, including our closest primate relatives, suggest this has an evolutionary explanation. As animals make the transition to adulthood and independence, they must learn new skills, travel from their birth site and encounter novel environments. During this uncertain period, it pays dividends to explore your options, with animals that do so having a greater chance of passing their genes to the next generation.

Curiously, more optimal behaviour under such conditions may be linked with greater activity in the reward centres of the brain, which had previously been thought of as dysfunctional in adolescents. Research in Rhesus macaques, for example, has implicated activity in the ventral striatum and amygdala, two components of the brain’s reward system, as key to deciding whether to explore new territory during foraging tasks. Activity in the ventral striatum is also associated with better learning in adolescents than children, because the reward signals feed back to the cerebral cortex, strengthening or pruning neural pathways to optimise behaviour. “The adolescent brain is built to explore, discover and connect,” says Wilbrecht. “I mean connect in a literal way, because the neurons are reaching out and forming new connections. And we need [feedback from] experience for the brain to be informed about which connections to keep.”

Perhaps surprisingly, this optimisation of the adolescent brain extends to social experience, too. In the past few years, it has become clear that the ventral striatum is highly active when working with other people, and adolescents have even greater activity during collaborative tasks than adults and children do. “These social situations rely on that same neural network that is so sensitive in adolescents,” says Crone. “So it now seems that the function of the developing adolescent brain is much more socially adaptive than we initially thought.”