

Adolescent impatience increases as testosterone levels rise

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In a series of studies conducted at the Max Planck Institute for Human Development, researchers have examined risky and impulsive decision behavior in adolescence. A study recently published in the journal

Psychoneuroendocrinology is the first to investigate the influence of testosterone on adolescents' decisions.

Patience isn't their strongest suit: Adolescents often want immediate results, even when it would pay to wait. Researchers at the Max Planck Institute for Human Development and the University of California, Berkeley, attribute this impatience to the surge in testosterone levels during puberty. In a recently published study, they have investigated the role that hormones play in adolescents' impulsive decisions. Because boys are more impulsive than girls, the researchers focused on boys aged between 11 and 14 years.

Sensitivity to immediate rewards

To gauge the pubertal status of the participants, the researchers collected morning saliva samples from 72 adolescents and determined their [testosterone levels](#). Participants then completed a choice task that gauged their impulsivity: They had to make a total of 80 choices between two hypothetical amounts of money available either soon or further in the future. Specifically, they had to choose between a smaller sooner reward and a larger later reward.

The results showed that most of the adolescents were more likely to choose immediate rewards. On average, about two-thirds of the participants opted for the smaller sum of money that was available sooner. The researchers think that sensitivity to immediate rewards is associated with the effects of testosterone on certain reward-related regions of the brain, such as the striatum. Chronological age cannot explain this sensitivity. It is only with increasing age that the timing of the reward becomes less important. "Our study shows that puberty—measured in terms of physical and hormonal maturity—needs to be properly accounted for in developmental psychological studies. Developmental differences are often not in line with [chronological age](#),"

says lead author Corinna Laube of the Max Planck Institute for Human Development in Berlin.

Control network in the brain matures more slowly

The results are another step toward understanding adolescents' impulsive decisions and complement the findings of a previous study conducted at the Max Planck Institute for Human Development. According to that study, teenage impulsivity is attributable to an imbalance in the maturation of the subcortical affective brain network, the cortical cognitive control network, and the connections between the two. The affective network—especially the striatum—which is involved in the anticipation and valuation of rewards, matures earlier than the control network and its connections. With increasing age, the connection with the control network strengthens, and young people learn to be patient and wait for future rewards. A follow-up study is now being conducted to investigate the function of testosterone within these networks: To what extent does [testosterone](#) influence the imbalance in the maturation of different brain regions and thus explain young people's susceptibility to making [impulsive decisions](#)?

"Impulsivity is part of growing up and healthy [development](#). By being impulsive teenagers learn new skills that they need to live independent lives. But their impulsive behavior can also cause them harm," says co-author Wouter van den Bos of the Max Planck Institute for Human Development. Our findings indicate that it may be advisable to [reward adolescents](#)' good behavior in the short term, instead of promising rewards at some time in the distant future.

More information: Corinna Laube et al. Dissociable effects of age and testosterone on adolescent impatience, *Psychoneuroendocrinology* (2017). [DOI: 10.1016/j.psyneuen.2017.03.012](https://doi.org/10.1016/j.psyneuen.2017.03.012)

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