Brain matures faster due to childhood stress

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Stress in early childhood leads to faster maturation of certain brain regions during adolescence. In contrast, stress experienced later in life leads to slower maturation of the adolescent brain. This is the outcome of a long-term study conducted by researchers of Radboud University in which 37 subjects have been monitored for almost 20 years. The findings will be published in *Scientific Reports* on 15 June.

In 1998, the group—which then comprised 129 one-year-olds and their parents—was tested for the first time. Over the past 20 years, researchers studied, inter alia, their play sessions and interactions with parents, friends and classmates. The children were also subjected to MRI scans. This wealth of data has enabled Karin Roelofs, Professor of Experimental Psychopathology, her Ph.D. student Anna Tyborowska and other colleagues of Radboud University to investigate how stress in various life stages affected the adolescent brain of these children.

More specifically, they looked at the effects on cerebral maturation. During adolescence, our brain experiences a natural pruning process in which previously made connections between brain cells are refined, allowing the creation of more useful and efficient networks.

More pruning due to early life stress

The researchers investigated two types of stressors—negative life events and negative influences from the social environment—in two life stages of their subjects: early childhood (0-5 years) and adolescence (14-17 years). They related these stress levels to the maturation of the prefrontal cortex, amygdala and hippocampus. These brain regions play an important role in functioning in social and emotional situations and are

known to be sensitive to stress.

Stress due to negative experiences during childhood , such as illness or divorce, appears to be related to faster maturation of the prefrontal cortex and amygdala in adolescence. However, stress resulting from a negative social environment during adolescence, such as low peer esteem at school, is connected to slower maturation of the brain area hippocampus and another part of the prefrontal cortex. "Unfortunately, in this study we can't say with certainty that stress causes these effects. However, based on animal studies we can hypothesize that these mechanisms are indeed causal," Anna Tyborowska says.

Loss of flexibility

"The fact that early childhood stress accelerates the maturation process during adolescence is consistent with theories of evolutionary biology," says Tyborowska. "From an evolutionary perspective, it is useful to mature faster if you grow up in a stressful environment. However, it also prevents the brain from adjusting to the current environment in a flexible way. In other words, the brain become "mature" too soon." The researchers were surprised to find, however, that social stress later in life seems to lead to slower maturation during adolescence. Tyborowska: "What makes this interesting is that a stronger effect of stress on the brain also increases the risk of developing antisocial personality traits."

Tyborowska is now conducting the eleventh round of measurements, with the subjects now being in their twenties. "Now that we know that stress affects the maturation of brain regions that also play a role in the control of emotions, we can investigate how this development continues later in life."

Longitudinal study from Nijmegen

The Nijmegen Longitudinal Study was initiated in 1998. This study aims to investigate how the development and functioning of children at various ages is influenced by their interactions with parents and peers and how this relates to their disposition and personality. Several research groups have access to the data collected from the subjects (at present about 100). Other research topics include mother-child relationships, bullying and risk behaviour. This long-term study is one of the few worldwide in which so many measurements are taken over such a long period.

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