

# Study reveals baby monkeys may be affected for life if separated from their mothers

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(PhysOrg.com) -- A new study by scientists in China has found that baby rhesus macaques stressed by being separated from their mothers remained anxious and had poor social skills even three years after separation. The babies had to be separated from their mothers at birth for a variety of reasons, such as the mother lacking breast milk or being too inexperienced to care for the infant safely. Some of the babies were taken into care because they were too weak or at risk of failing to survive in cold, rainy conditions.

The researchers compared 22 [rhesus macaques](#) reared by their mothers and 13 reared in incubators for a month and then paired with another age-matched monkey that had been separated from its mother. At around seven months old, all the monkeys (peer-raised and mother-raised) were

moved to mixed-sex [social groups](#) without adults, in connected indoor/outdoor enclosures.

After being returned to living a normal life with other monkeys, the young peer-raised monkeys continued to have problems after 1.5 years, and even three years after returning to normal life. They responded to stress more slowly than monkeys raised by their mothers, were prone to depression, moved less, sucked their own fingers and toes, and showed other signs of [anxiety](#). The researchers also found that their baseline levels of cortisol—the hormone in humans and monkeys that helps the body to cope with stress—in their hair were lower than normal. Blood samples showed blood cortisol was slower to reach a peak in response to stress than in mother-reared infants.

The research, carried out by Xiaoli Fenga and Lina Wang of the State Key Laboratory of Brain and Cognitive Science at the University of Hong Kong, and their colleagues, is the first study that suggests changes in the brains of the baby [monkeys](#), caused by the sustained release of cortisol during the stress of separation, could lead to poor development of some areas of the brain such as the hippocampus, and that these changes may not be reversed by a return to a normal social life.

Studies on humans have also found that adversity early in life, such as abuse or mistreatment in childhood, can lead to long-term problems such as [depression](#) and abnormal behavior patterns.

The results of the study could have implications for humans, and could find application for the treatment of people suffering as a result of adversity or trauma early in life. The authors suggest the rhesus macaque is a good animal model to study the effects of early adversity in humans. The paper was published in the *Proceedings of the National Academy of Sciences* this week.

**More information:** Maternal separation produces lasting changes in cortisol and behavior in rhesus monkeys, *PNAS*, Published online before print August 15, 2011, [doi: 10.1073/pnas.1010943108](https://doi.org/10.1073/pnas.1010943108)

## **Abstract**

Maternal separation (MS), which can lead to hypothalamic pituitary adrenal axis dysfunction and behavioral abnormalities in rhesus monkeys, is frequently used to model early adversity. Whether this deleterious effect on monkeys is reversible by later experience is unknown. In this study, we assessed the basal hair cortisol in rhesus monkeys after 1.5 and 3 y of normal social life following an early separation. These results showed that peer-reared monkeys had significantly lower basal hair cortisol levels than the mother-reared monkeys at both years examined. The plasma cortisol was assessed in the monkeys after 1.5 y of normal social life, and the results indicated that the peak in the peer-reared cortisol response to acute stressors was substantially delayed. In addition, after 3 y of normal social life, abnormal behavioral patterns were identified in the peer-reared monkeys. They showed decreases in locomotion and initiated sitting together, as well as increases in stereotypical behaviors compared with the mother-reared monkeys. These results demonstrate that the deleterious effects of MS on rhesus monkeys cannot be compensated by a later normal social life, suggesting that the effects of MS are long-lasting and that the maternal-separated rhesus monkeys are a good animal model to study early adversity and to investigate the development of psychiatric disorders induced by exposure to early adversity.

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