Early life stress has effects at the molecular level

12 November 2009, by Lin Edwards

Mouse pups that are just a day old. Image: Muhammad Mahdi Karim, via Wikipedia

(PhysOrg.com) -- A new study of mice suggests that stress and trauma in early life can have an impact on the genes and result in behavioral problems later in life.

Scientists from the Max Planck Institute of Psychiatry in Munich, Germany, looked at the long-term effects of stress mice suffered soon after their birth. The stress was produced by separating the mouse pups from their mothers for three hours a day for the first ten days of their lives. The separation did not affect their nutrition but would have made them feel abandoned. The pups were then followed through their lives.

The researchers found the stress caused the baby mice to produce hormones that altered their genes and affected their later behavior, making them less able to cope with stress later in life. The mice exposed to the stresses also had poorer memories than the control group.

The leader of the team, Dr Christopher Murgatroyd, told the BBC that the research for the first time showed in molecular detail how stress in early life could program behavior later on. The stress had caused the animals to produce high levels of stress hormones, and this in turn had led to epigenetic changes, meaning that the experience had changed the DNA of a gene coding for the stress hormone vasopressin, which is important in controlling mood and cognitive behaviors. The result of the genetic changes meant the brain developed more receptors for vasopressin.

In humans vasopressin is known to be involved in social connections such as parent/child bonding. In rodents, higher levels of vasopressin have also been shown to increase aggressive behavior.

The change in the vasopressin gene resulted in the mice being "programmed" to produce high levels of the stress hormone in their adult lives. The study was also able to prove that vasopressin was involved in the behavioral problems and poorer memories of the stressed mice, because when the adults were given a drug to block the vasopressin effects, their behavior became more normal.

The study in mice may have implications in human studies of how the effects of trauma in childhood can lead to problems in later life, such as depression. Until the present study, scientists have not understood the mechanism by which early stress could have far-reaching effects. An understanding of the molecular basis for the phenomenon could help scientists develop therapies for mental disturbances arising from early stress or trauma.

The paper was published on November 8 in the online version of the Nature Neuroscience journal.

More information: Dynamic DNA methylation programs persistent adverse effects of early-life stress, *Nature Neuroscience*, Published online: 8 November 2009; doi:10.1038/nn.2436