



NEUROSCIENCE

The Effects of Toxic Stress During Pregnancy

**NATIONAL
SCIENTIFIC
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DEVELOPING
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A review of a recent study on the effects in adulthood of exposure to prenatal stress.

What did the study find? The study found that predictable, repeated, intense stress during pregnancy was more disruptive and caused long-term increases in anxiety-like behavior in the offspring when compared to the effects of milder and more random stressors. Not surprisingly, animals that displayed increased anxiety also had hyper-responsive stress hormone functions. The examination of male and female offspring separately found that females expressed greater disruption of behavioral and stress hormone functions, with far fewer changes seen in males. The authors also discovered a specific change in brain chemistry, found only in males, which may help explain why adult male offspring are more resistant to the long-term consequences of prenatal stress.

Why was the study done? Stress during pregnancy can have adverse influences on children after birth by altering the development of brain and endocrine systems that control behavior. It is thought that such changes also may have long-term consequences well into adult life. There are many kinds of stress, however, and not all are associated with lasting damage. Moreover, scientists have not determined differences in the degree to which certain individuals may be more or less vulnerable to stressful experiences before birth. This study was undertaken using an animal model in which different types of stress could be administered carefully and in a controlled setting. The scientists then measured the influence of these different kinds of stress during pregnancy on later neuroendocrine, behavioral, and brain functions.

How was the study conducted? Using a model in which rats were stressed during the last week of pregnancy, this study compared the long-term effects of a single, intense stressor that was administered three times daily on a predictable schedule, in contrast to different types of milder stressors that occurred once randomly during the day. Adult male and female offspring were then studied in three ways: (1) to determine levels of anxiety-like behavior on two different tasks; (2) to determine hormone responses to stress, measuring the classic stress hormones ACTH and cortisol; and (3) to determine whether the experience of prenatal stress causes changes in brain chemicals that influence the length of time of a stress response in adulthood.

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SCIENCE BRIEFS

summarize the findings and implications of a recent study in basic science or clinical research. Studies are selected for review based on their scientific merit and contributions to understanding early development. No single study is definitive, of course. Understanding of early development is based on many studies that, taken together, permit broad conclusions and human applications. Generalizing to human children the results of studies with animals, for example, must be done cautiously and confirmed by research with children and their families. The National Scientific Council rests its work on a rigorous discussion of the validity of many studies like these conducted over many years and using different methodologies and samples.

What do the findings mean? The authors note that their findings in the rat are consistent with the well-documented higher rate and severity of disorders of mood and emotional behaviors in women compared to men. Although the increased incidence of mood disorders in adult females has not been linked to prenatal experience in humans, this potential association may be worth examining in future research. The present study also shows that intense stress, even when predictable, may be more detrimental to the developing fetus than intermittent stress of lower intensity. This suggests that high levels of stress during pregnancy should be categorized as potentially “toxic”, indicating that they might have long-term consequences for human development that are similar to the adverse impacts of significant neglect or abuse in early childhood. ●

Study Title and Authors: Richardson, HN, Zorrilla, EP, Mandym, CD, Rivier, CL (2006). Exposure to repetitive versus varied stress during prenatal development generates two distinct anxiogenic and neuroendocrine profiles in adulthood. *Endocrinology* 147:2506-2517.