Embargoed until Nov. 13, 3:30 p.m. EST
Press Room, Nov. 12–16: (202) 249-4080

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NATURE AND NURTURE WORK TOGETHER TO SHAPE THE BRAIN

New animal research finds life experiences influence brain development, behavior

Washington — Scientists presented new research today demonstrating the impact life experiences can have on genes and behavior. The studies examine how such environmental information can be transmitted from one generation to the next — a phenomenon known as epigenetics. This new knowledge could ultimately improve understanding of brain plasticity, the cognitive benefits of motherhood, and how a parent's exposure to drugs, alcohol, and stress can alter brain development and behavior in their offspring.

The findings were presented at Neuroscience 2011, the annual meeting of the Society for Neuroscience and the world's largest source of emerging news about brain science and health.

Today's new findings show that:

- Brain cell activation changes a protein involved in turning genes on and off, suggesting the protein may play a role in brain plasticity (Ian Maze, PhD, abstract 660.03, see attached summary).
- Prenatal exposure to amphetamines and alcohol produces abnormal numbers of chromosomes in fetal mouse brains. The findings suggest these abnormal counts may contribute to the developmental defects seen in children exposed to drugs and alcohol *in utero* (Jerold Chun, MD, PhD, abstract 166.04, see attached summary).
- Cocaine-induced changes in the brain may be inheritable. Sons of male rats exposed to cocaine are resistant to the rewarding effects of the drug (Chris Pierce, PhD, abstract 371.05, see attached summary).
- Motherhood protects female mice against some of the negative effects of stress (Tracey Shors, PhD, abstract 219.12, see attached summary).

Another recent finding discussed shows that:

- Mice conceived through breeding — but not those conceived through reproductive technologies — show anxiety-like and depressive-like behaviors similar to their fathers. The findings call into question how these behaviors are transmitted across generations (David Dietz, PhD, see attached speaker's summary).

"Research in the last few years has dramatically changed what we know about how behaviors are inherited," said press conference moderator Flora Vaccarino, MD, from Yale University, an expert on the developing brain. "Today's findings show how our genes and environment work together to influence brain development throughout a lifetime."

This research was supported by national funding agencies, such as the National Institutes of Health, as well as private and philanthropic organizations.

Related Presentation:

Presidential Special Lecture: Genes, the Environment, and Decisions: How Fixed Circuits Generate Flexible Behaviors
Monday, Nov. 14, 5:15–6:25 p.m., Hall D

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Abstract 219.12 Summary

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Motherhood Protects Female Rats from Negative Effects of Stress

Animal study finds effect lasts long after pups have grown up, separated from mother

Maternal experience may offer life-long protection against the negative effects of stress, according to new animal research. The research was presented at Neuroscience 2011, the annual meeting of the Society for Neuroscience and the world's largest source of emerging news about brain science and health.

In virgin female rats, it's known that stressful experiences diminish the ability to learn associations between events in the environment. This study found that the impairment does not occur in female rats that are either lactating or taking care of young, suggesting they are somehow immune to the negative consequences of stressful experiences.

To determine how long the protective benefits of maternal experience might last, Tracey Shors, PhD, and colleagues at Rutgers University, examined how a stressful experience affected female rats that had given birth to offspring at least once. Unlike virgin females, which did not learn after exposure to a stressful event, female mothers performed as well on a learning task as females that had not been exposed to the stressful event.

"In our study, learning after a stressful experience is altered for the better after motherhood, and apparently this effect remains long after the offspring have matured," said Shors.

Research was supported by the National Institute of Mental Health and National Science Foundation.

Scientific Presentation: Sunday, Nov. 13, 3:45-4 p.m., Washington Convention Center, Halls A–C

219.12, Once a Mother, Always a Mother: Maternal experience protects females from the negative effects of stress on learning throughout their lifetime.
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Dept. of Psychology & Ctr. for Collaborative Neurosci., Rutgers, The State Univ. of New Jersey, PISCATAWAY, NJ

TECHNICAL ABSTRACT: Women experience profound hormonal fluctuations throughout their reproductive lives. Pregnancy into motherhood/postpartum is one such transitional stage during which women and other female species are especially susceptible to disturbances in mood and/or cognition (Brummelte & Galea, 2010). Responses to stressful stimuli are also altered. Virgin female rats express a severe learning deficit in associative eyeblink conditioning after a stressful life event (Wood & Shors, 1998; Wood et al., 2001). Interestingly though, females that are lactating and/or caring for young learn as well as unstressed females (Leuner & Shors, 2006). The deficit in learning is nonetheless evident if the young are removed and lactation ceases. Thus, it seems as though the protective effect of motherhood relies on the presence of offspring and maternal behavior. These previous studies tested females during their first pregnancy. Here, we hypothesized that females that had been maternal at some time in their lives would learn well even after exposure to a stressful event. To test this hypothesis, we examined females that had at least one brood of young and expressed a normal estrus cycle. During diestrus, they were exposed to an acute stressful event that reliably impairs learning in virgin females. They were trained 24 h later with classical eyeblink conditioning. In contrast to the virgin females that did not learn after stressor exposure, those females that had been mothers performed as well as those that were not stressed ($p>0.05$). These data suggest that motherhood is protective. Maternal experience appears to impart a resistance to stress that is long-lasting and perhaps permanent.