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Stress can affect future offspring

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Rats exposed to stress during early development inherit the effects of that stress to their offspring, largely expressed in behavior impairments but also characteristics of resilience, shows a new study from the University of Haifa, published in "Developmental Psychobiology". Providing environmental enrichment to the future mother rats had a remedial role on some of the negative effects. "The similarities between rats and humans raise the question of whether similar effects might transpire in humans."

The study found that stress experienced by young female rats can impair their future offspring, but can also improve resilience. The study also showed that providing the young stressed females with an enriched environment (often used to model therapy), can indeed ameliorate some of the effects. "The similarities between rats and humans raise the question of whether similar effects might transpire in humans; for example, exposure to war or natural disasters might have heritable effects," explains Prof. Micah Leshem who headed the study.

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The study, conducted by Prof. Leshem of the Department of Psychology at the University of Haifa along with Prof. Jay Schulkin of Georgetown University and postgraduate students Hiba Zaidan and Neta Kvetniy-Ferdman, set out to examine the cross-generational effects of early exposure to stress and enrichment. The researchers examined rats because of their resemblance to humans and their rapid rate of development and reproduction, which facilitates cross-generational studies.

The researchers studied 40 female rats weaned at 27 days of age. One group of these females – the control group - was then raised normally in individual cages; the second group was exposed to different stressors; the third was enriched; and the fourth group was both stressed and enriched. The matured rats were mated at 60 days, had normal pregnancies and births, and their offspring pups were divided into two groups – one raised normally, and the other raised in an enriched environment, so that the effect of "therapy" on the next generation could also be evaluated. The offspring groups were then evaluated with respect to social interaction, anxiety levels, ability to learn and capacity to cope with fear.

The study's main findings showed that the early treatment of the mothers impacted their offspring behavior. Stress to the mothers reduced social interaction in their offspring, but improved their ability to learn to avoid distress. Male offspring were also better at coping with fear. Some of these changes were mitigated by enrichment to the mothers, so that stressing the mothers and then providing them with a "therapeutic" (enriched) environment, prevented some, but not all, of the effects in the next generation. Providing enrichment to the offspring also offset some of the inherited effects.

According to the researchers, their study, with other evidence, "suggests

that evolution equipped the parent generation to sample its environment, and then, possibly via heritable epigenetic changes, to prepare the next generation to better cope with this environment," Prof. Leshem explains. "It is important to investigate whether stressful experiences at a young age affect the next generation, and whether therapeutic experiences can minimize the trans-generational effects in humans too. As our study shows that the inheritance of the effects of adversity can be modified by timely intervention, this may have important educational and therapeutic implications," he concludes.

Provided by University of Haifa