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Stress and nerve cells survival in rats; finding may open widow for depression treatment

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A single, socially stressful situation can kill off new nerve cells in the brain region that processes learning, memory, and emotion, and possibly contribute to depression, new animal research shows.

Researchers found that in young rats, the stress of encountering aggressive, older rats did not stop the generation of new nerve cells—the first step in the process of neurogenesis. But stress did prevent the cells, located in the hippocampus, from surviving, leaving fewer new neurons for processing feelings and emotions. The hippocampus is one of two regions of the brain that continues to develop new nerve cells throughout life, in both rats and humans. The reduction of neurogenesis could be one cause of depression, says senior author Daniel Peterson, PhD, of the Rosalind Franklin University of Medicine and Science, near Chicago. His team reports their findings in the March 14 issue of *The Journal of Neuroscience*.

"This is strong evidence that the effects of social stress on neurogenesis occur after a delay of 24 hours or more, providing a possible time window for treatment after acute episodes of stress," says Henriette van Praag, PhD, of the Salk Institute for Biological Studies.

When Peterson and his research team put a young rat in a cage with two older rats for 20 minutes, the resident rats quickly pinned down and, in many cases, bit the intruder. The team reported that intruder rats were fearful and acted depressed around the bigger, more mature animals and had stress hormone levels six times as high as young rats that didn't

experience a stressful encounter.

Examining the rats' brains under a microscope, the scientists discovered that even with high levels of stress hormones, the young, stressed rats generated as many new cells as their unstressed counterparts. Previous research had led some to think that hormone levels played a role in blocking the generation of new cells or caused them to die early on. But a week after the encounter, the team found that only a third of the cells generated under stress had survived. Long-term survival of nerve cells was also compromised: When Peterson's team marked newborn cells in the hippocampus, subjected rats to stress a week later, then examined brain tissue at the end of a month, they counted a third fewer fully developed nerve cells.

"The next step is to understand how stress reduced this survival," says Peterson. "We want to determine if anti-depressant medications might be able to keep these vulnerable new neurons alive."

Source: Society for Neuroscience

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