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Growth Hormone is Made in the Brain, Report Scientists

Scientists have found that growth hormone, a substance that is used for body growth, is produced in the brain, according to an article published in this week's Proceedings of the National Academy of Sciences.

The research team -- whose members work at three institutions -- found that growth hormone is produced within the hippocampus, a structure deep inside the brain that is involved in memory and emotion.

The scientists also found that more growth hormone is produced in females than in males, and more in adults. More growth hormone was also produced in response to estrogen. The study has implications for menopausal women using estrogen replacement therapy and for athletes taking growth hormone and anabolic steroids to increase muscle mass.

The scientists suspect that reasoning and mood may also be affected by these differences in the amount of growth hormone in the brain.

"Growth hormone has been associated with growth of muscles and bones, and the production of it was believed to lie mainly in the pituitary gland," said co-author Ken S. Kosik, co-director of the Neuroscience Research Institute at the University of California, Santa Barbara. "No one had thought too much about what growth hormone might be doing in the brain. Hormones in the brain may not be obvious

compared to what they are doing in the rest of the body."

The authors previously found that hippocampal growth hormone increases with learning. The current study shows that the production of growth hormone is very different in males versus females.

"Males and females look different, we act different, so of course our brains are different," said Tracey J. Shors, co-author and a professor of psychology at the Center for Collaborative Neuroscience at Rutgers: the State University of New Jersey. "There are remarkable differences. People used to think of females as a male with hormones. That's just not the case."

The authors found that growth hormone in the brain is increased with stress, especially in males. The effect in females depended on how much estrogen they had at the time.

"One interesting interpretation of these results is that exposure to a stressful event increases growth hormone expression in males -- but the increase in females may be dependent on their levels of estrogen at the time," said first author Christine P. Donahue. Donahue, formerly a postdoctoral fellow of Ken Kosik, is an instructor in the Department of Neurology at Harvard Medical School.

The authors suggest that because growth hormone in the body is associated with growth of the body, it may also cause growth in the brain. Females have more dendritic spines (parts of neurons) in the hippocampus than do males. This is especially true when estrogen levels are high and when growth hormone levels are high. They also produce more new neurons in the hippocampus during this time.

"Sex differences in the brain is an area of research that has exploded in recent years," said Shors. "Sex hormones, like estrogen, have a tremendous effect on the growth and architecture of the brain. Several studies in our lab and in others have shown that males learn differently than females. It is possible that sex differences in these hormones are somehow involved."

This study was supported by the National Institute of Mental Health. The article, "Growth hormone is produced within the hippocampus where it responds to age, sex and stress," is published in the on-line edition of the Proceedings of the National Academy of Sciences the week of March 27.

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