

# Memory enhanced by sports-cheat drug

September 9 2008

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A drug used to increase blood production in both medical treatments and athletic doping scandals seems also to improve memory in those using it. New research published in the open access journal *BMC Biology* shows that the memory enhancing effects of erythropoietin (EPO) are not related to its effects on blood production but due to direct influences on neurons in the brain. The findings may prove useful in the treatment of diseases affecting brain function, such as schizophrenia, multiple sclerosis, and Alzheimer's.

Patients given EPO to treat chronic kidney failure had been observed to have improved cognition after starting the drug. "These effects of EPO were thought to result from the blood-boosting effects of the drug", explains Hannelore Ehrenreich at the Max Planck Institute, "but the finding of receptors for EPO on nerve cells in the brain suggests that some other mechanism might be involved."

To investigate the mechanisms of EPO-enhanced cognition, the researchers injected mice with EPO every other day for three weeks (11 doses) to test the effects of long-term exposure. After the treatment period, mice given EPO had better memory in some situations than did mice that had been given a placebo instead. The improvement in memory lasted up to three weeks from the last EPO dose and outlasted increased blood-cell production, but had disappeared by four weeks. Mice given three doses saw no benefit with respect to memory improvement.

"Young mice systematically treated with EPO for three weeks have

improved memory, similar to the dramatic improvements observed in endurance and muscular performance athletes who use EPO to boost performance", says Ehrenreich. The specific memory improvements were associated with the hippocampus, a structure in the brain involved in learning and memory, among other functions.

The researchers did a series of experiments on hippocampal tissue taken from the mice and found that EPO directly affected the neurons in this structure. "EPO had pronounced effects on short-term and long-term plasticity in the hippocampus as well as on synaptic transmission", the researchers report. "Treatment with EPO seems to increase the number of inhibitory circuits, which actually increases the efficiency of transmission of excitatory nerve impulses in specific neurons, resulting in greater short-term and long-term plasticity in memory pathways in the hippocampus."

These findings begin to shed light on the mechanisms of improvements in cognition seen in patients with schizophrenia and multiple sclerosis as a result of treatment with this drug. As well as working to refine these findings, further studies might also investigate the effects of EPO on other brain regions that might be associated with improvements in motor functions in multiple sclerosis, and investigate the potential of using EPO or targeting the networks involved in EPO-generated neuronal plasticity in the treatment of neurodegenerative diseases.

Source: BioMed Central

Citation: Memory enhanced by sports-cheat drug (2008, September 9) retrieved 25 April 2024 from <https://medicalxpress.com/news/2008-09-memory-sports-cheat-drug.html>

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