The role of lactate in boosting memory
18 August 2014, by Anne-Muriel Brouet

In 2011, research published in the journal Cell by EPFL's Laboratory of Neuroenergetics and Cellular Dynamics in collaboration with a U.S. team unveiled the critical role of lactate. "In vivo, when the transfer of lactate from astrocytes to neurons is blocked, we found that the memorization process was also blocked," explains EPFL professor Pierre Magistretti, head of the lab. "We thus knew that it was an essential fuel for that process."

Focusing their attention on the molecular mechanism, the scientists discovered that lactate provides more than just energy. It acts as a moderator of one type of glutamate receptor (NMDA receptors), the nervous system's primary neurotransmitter. This glutamate receptor is involved in the memorization process, and the research demonstrates that lactate gives them what amounts to a turbo-boost. "Glutamate lets you drive in first gear; with lactate, you can shift into fourth and travel at 100 km/h," says Magistretti.

Palliating cognitive deficits

The scientists did their initial research in vitro. They exposed mice neurons to various substances and measured their effect on the expression of genes involved in memory. Glucose and pyruvate (another glucose derivative) didn't have any effect. A lactate supplement, on the other hand, triggered the expression of four genes involved in cerebral plasticity that are essential to memorization.

They followed this work with in vivo studies, which confirmed their results. They administered lactate into the brains of living mice, and then extracted the tissues and measured gene expression. Once again, the expression of genes involved in cerebral plasticity increased significantly.

Could we take lactate supplements and develop encyclopedic memory? Magistretti’s lab has just received a grant to study the effects of artificial lactate supplementation. "We have identified a series of molecules that can make astrocytes produce more lactate. Now the idea is to see in vivo..."
if we can mitigate cognitive deficits and memory disorders." In addition, since conditions such as depression are often accompanied by cognitive problems, "lactate could also have an antidepressant effect," says Magistretti, who also conducts research at the National Center for Competence in Research Synapsy, dedicated to the understanding of the synaptic basis of psychiatric disease.


Provided by Ecole Polytechnique Federale de Lausanne