In a new study, addiction researchers of the Institute of Psychopharmacology (Scientific Director: Professor Rainer Spanagel) and of the Clinic for Addictive Behavior and Addiction Medicine (Medical Director: Professor Falk Kiefer) at the CIMH found elevated concentrations of the neurotransmitter dopamine in brain regions of alcoholics who had been abstinent for a longer period of time. The results of the study has been published in the Proceedings of the National Academy of Sciences (PNAS).

In alcoholism, periods of binge drinking frequently alternate with periods during which affected people try to stay sober. This phase often ends in relapse into drinking which only increases the addiction. Many changes occur in the brain during these cycles. Here, dopamine is especially important, as it modulates glutamatergic transmission in reward centers in the brain. When occasional alcohol consumption develops into an addiction the binding sites through which dopamine exerts its effects are also changed.

These alterations were the focus of Natalie Hirth and her colleagues who compared brain samples of alcoholics with those of people who consumed little or no alcohol throughout their lives. By analyzing different dopamine-binding molecules the scientists found indications for a hyperdopaminergic state in brain regions of alcoholics that are important for the control of rewarded behaviors. Additional experiments using alcohol dependent rats confirmed their findings and provided further, more detailed insights. The researchers could show that during acute withdrawal the amount of dopamine is markedly decreased. But when the animals did not receive alcohol for a prolonged period of time the dopamine increased well above normal values, which also resulted in hyperactivity in these rats.

On the basis of these findings, Hirth and colleagues believe that dopamine is decreased during acute withdrawal and then strongly increases when alcoholics succeed in staying abstinent for a longer period of time. “These findings could explain the initial decrease in motivation and the subdued mood during early withdrawal, as well as the symptoms of restlessness and perturbed impulse control which are often seen in addicts during prolonged abstinence”, adds Professor Kiefer, Director of the Clinic for Addictive Behavior and Addiction Medicine at the CIMH.

Based on the findings, new behavioral experiments can now be designed to better understand the connection between elevated dopamine and a relapse into alcohol dependence. In the end, the goal is finding ways to completely prevent relapse, and thereby to help the patients to conquer their addiction once and for all.

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