

***In vivo* and *ex vivo* tracking the cocaine's mechanism of action in the medial part of the Central Amygdala**

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Addiction is a big social problem in the whole Europe. According to the statistical data of European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) intake of drugs-of-abuses is increasing every year. Such tendency is observed also in the usage of so-called “hard drugs”, which are extremely addictive. Treatment costs of addicted people consume large part of public health funds. Moreover, addiction is a tragedy to addicts and their families. It is important to point that addiction is not a case of weakness, as some people might claim. It is a chronic, relapsing brain disease characterised in the revision ICD-10 by International Statistical Classification of Diseases and Related Health Problems. Drugs-of-abuse usage causes long-lasting changes in addicts' brains, which are severe obstacles on their way to healthiness. It is important that even single exposure to such substances cause long-lasting changes in the physiology of the brain.

Mechanisms involved in the addiction formation are similar to physiological processes underlying memory formation. They both cause neuroplasticity, characterized by for example changes on connections between neurons (synapses) in specific brain regions. Addictive substances engage regions called the reward system. This brain system is involved in processing emotions of positive valence. Such feelings are a result of for example eating sweet food or taking drugs-of-abuse. Both of them cause increased production of the “happiness hormone”, the dopamine.

Cocaine has a special ability in stimulating the reward system of the brain. It causes not only release of the dopamine but it also pharmacologically blocks its reuptake from synapses. This is accompanied with euphoria sensation, which is a reason why people so willingly use cocaine again. Unfortunately, increased dopamine level long-lastingly plastic changes in neurons in the reward system. This is a neuronal base of the addiction, which affect the processing by the brain also other pleasant stimuli.

The goal of our studies is to find exactly what is the neuroplastic modifications after cocaine usage and how it affects the activity of the brain. We are performing our studies on mice, as they have similar brain architecture as human brain does. We are studying an important part of the reward system of the brain – the amygdala, where we found neuronal populations sensitive to the dopamine. We are comparing effects of two substances causing positive experiences: sucrose and cocaine. Cocaine additionally is highly addictive due to its pharmacological properties.

We are expecting to broad our knowledge about molecular bases of addiction and effects of the drugs-of-abuse usage on the brain activity. We hope that such knowledge will help in bringing back the physiological brain activity of addicts.