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Analysis of the effects of drugs and alcohol on neuronal stem cell differentiation.

Drug and alcohol abuse lead to neuronal cell loss and altered CNS plasticity that effects one's ability to understand and learn new information, as well as restructure pathways important in abstinence based recovery processes. Plasticity relies, in part, on stem cells in several regions of the adult brain that expand, migrate, differentiate and establish new neurons and supportive glial cells. Previous studies suggest that drugs of abuse, including alcohol, methamphetamine and opioids reduce the number of stem cells and affect migration and differentiation processes. Our study examined differentiation of E14 rat neuronal stem cell differentiation after drug insult. In this study, differentiated neuronal stem cells were exposed to single doses of alcohol, methamphetamine, and DAMGO (opioid agonist) to recreate the effects of adult substance abuse. We examined cells, after 5 days, to determine differentiation processes and cell numbers. Synaptogyrin-1 antibody was used to determine neuronal connectivity, and Glutamine Receptor Type 1 antibody was used to determine glutamate neurotransmission. Cells were also stained for synaptic vesicle expression. We show substantial cell loss with alterations in vesicle packaging and synaptic cleft formation.