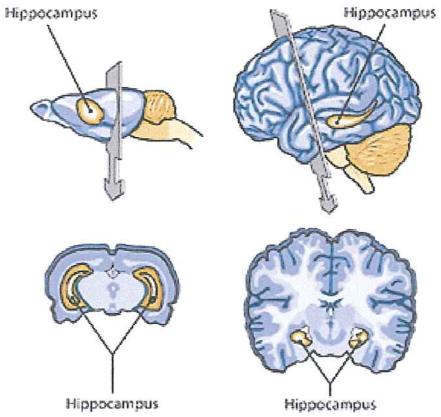
Adolescent Alcohol Use Affects Brain Structure and Function in Adulthood



Location of the hippocampus, an area of the brain that appears to be particularly vulnerable to alcohol's effects. It sits below the surface of the neocortex in the rat brain (left) and the human brain (right).

Source: Adapted from Hiller-Sturmhoefel, S., and Swartzwelder, H.S. Alcohol's effects on the adolescent brain —what can be learned from animal models. *Alcohol Research & Health* 28(4):213–221, 2004/2005.

Repeated exposure to alcohol during adolescence can cause structural and functional abnormalities in the brain that last into adulthood, according to a study published in June in the journal *Alcoholism: Clinical and Experimental Research*. Scientists have long known that human adolescence is a crucial time for brain growth and maturation, and have noted that chronic excessive alcohol use during adolescence is associated with memory problems and other cognitive deficits in adulthood. Thus, many have hypothesized that alcohol abuse, which is common during adolescence, might have long-term harmful effects on brain development and function.

To test this hypothesis, researchers, led by Drs. Mary-Louise Risher and Scott Swartzwelder of the Duke University and Durham Veterans Affairs Medical Centers, exposed adolescent rats to alcohol in a way that modeled the intermittent, high-dose alcohol use typically seen among adolescent humans. After the rats reached adulthood, the researchers used a variety of laboratory techniques to measure the rats' brain development and function.

Previously, the Duke researchers had reported that animals exposed to alcohol during adolescence grew up to be more vulnerable to memory disruption than animals that were not exposed to alcohol. However, they did not know how the hippocampus, a region of the brain associated with memory and learning, was affected. So in their new study, they focused on hippocampal area CA1, which plays an important role in learning and memory during both adolescence and adulthood.

The researchers found that, compared with control animals, brains of adult rats that had been exposed to alcohol during adolescence had a number of structural and neurochemical abnormalities in hippocampal area CA1. In particular, they found that a cellular mechanism known as long-term potentiation (LTP) was increased among the alcohol-exposed animals. Although LTP is the mechanism that helps strengthen connections between brain cells as they learn and remember new things, the researchers note that the increased LTP seen among alcohol-exposed animals is not a good thing, as excessive LTP would lead to poorer memory and slower learning, and can be toxic to brain cells. The researchers also found that dendritic spines, brain cell structures that are vital for cell-to-cell communication, appeared immature in the alcohol-exposed animals.

Taken together, the researchers say their findings demonstrate that the adolescent hippocampus is vulnerable to alcohol-induced damage, with pathological changes that impair memory-related brain function into adulthood.

Source:

Risher, M.L.; Fleming , R.L.; Risher, W.C.; Miller, K.M.; Klein, R.C.; Wills, T.; Acheson, S.K.; Moore, S.D.; Wilson, W.A.; Eroglu, C.; and Swartzwelder, H.S. Adolescent intermittent alcohol exposure: Persistence of structural and functional hippocampal abnormalities into adulthood. *Alcoholism: Clinical and Experimental Research* 39(6):989–997, 2015. PMID: 25916839

News From the Field

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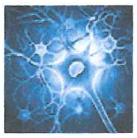

The Knock-In Mouse: NIAAA-Funded Study Identifies Gene Variant Linked to Compulsive Drinking
According to the results of a recent NIAAA-funded animal study, carrying a gene variant that affects the release of a specific brain protein may increase the risk of developing an alcohol use disorder.

Advancing Personalized Treatment of AUD
In a commentary published in April in the journal *Alcoholism: Clinical and Experimental Research*, Raye Litten, Ph.D., and other NIAAA scientists describe the evolution of our understanding of the heterogeneity of alcohol use disorder (AUD)

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