Effects of Tobacco, Alcohol and Drugs on the Developing Adolescent Brain

Risk-taking may be based in biology, but that does not diminish the possible unhealthy consequences of alcohol and other drugs and tobacco on the developing teen brain.

Recent brain research with magnetic resonance imaging suggests that alcohol impacts adolescents differently than it does adults. Young people are more vulnerable to the negative effects of alcohol on the hippocampus—the part of the brain that regulates working memory and learning. Consequently, heavy use of alcohol and other drugs during the teen years can result in lower scores on tests of memory and attention in one's early to mid-20s.

People who begin drinking before age 15 are four times more likely to become alcohol-dependent than those who wait until they are 21. Teens also tend to be less sensitive than adults to alcohol's sedative qualities. Sedation in response to alcohol is one of the ways the body protects itself, since it is impossible to keep drinking once asleep or passed out. Teenagers are able to stay awake longer with higher blood alcohol levels than older drinkers can. This biological difference allows teens to drink more, thereby exposing themselves to greater cognitive impairment and perhaps brain damage from alcohol poisoning.

There are also striking differences in the way nicotine affects adolescent and adult smokers. Nicotine results in cell damage and loss throughout the brain at any age, but in teenagers the damage is worse in the hippocampus, the mind's memory bank. Compared to adults, teen smokers experience more episodes of depression and cardiac irregularities, and are more apt to become quickly and persistently nicotine-dependent.

Drugs such as cocaine and amphetamines target dopamine receptor neurons in the brain, and damage to these neurons may affect adolescent brain development for life in the areas of impulse control and ability to experience reward.

Other effects of substance abuse in adolescents include delays in developing executive functions (judgment, planning and completing tasks, meeting goals) and overblown and immature emotional responses to situations.