

Effect of Drugs and Alcohol on the Adolescent Brain

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Adolescence: The Search for New Experiences

- Adolescence is a time of new experiences, growth, exploration
- Drug and alcohol exposure starts in adolescence for most
 - Cigarettes/Nicotine
 - Alcohol
 - Marijuana
 - Other Drugs (Prescription Medications, Opioids)

Facts About Adolescent Drug Use

- Each day roughly 3,000 teens smoke their first cigarette.
- National Survey on Drug Use and Health
 - Illicit drug in the past month
 - 4% of 12- to 13-year-olds
 - 11% of 14- to 15-year-olds
 - 20% of 16- to 17-year-olds
 - 23% of 18- to 20-year-olds.
 - 64% of patients entering treatment for drug abuse started abusing drugs at age 20 or younger
 - A third of high school students who try smoking eventually become daily smokers

(SAMHSA, 2002)

Facts About Adolescent Drug Use

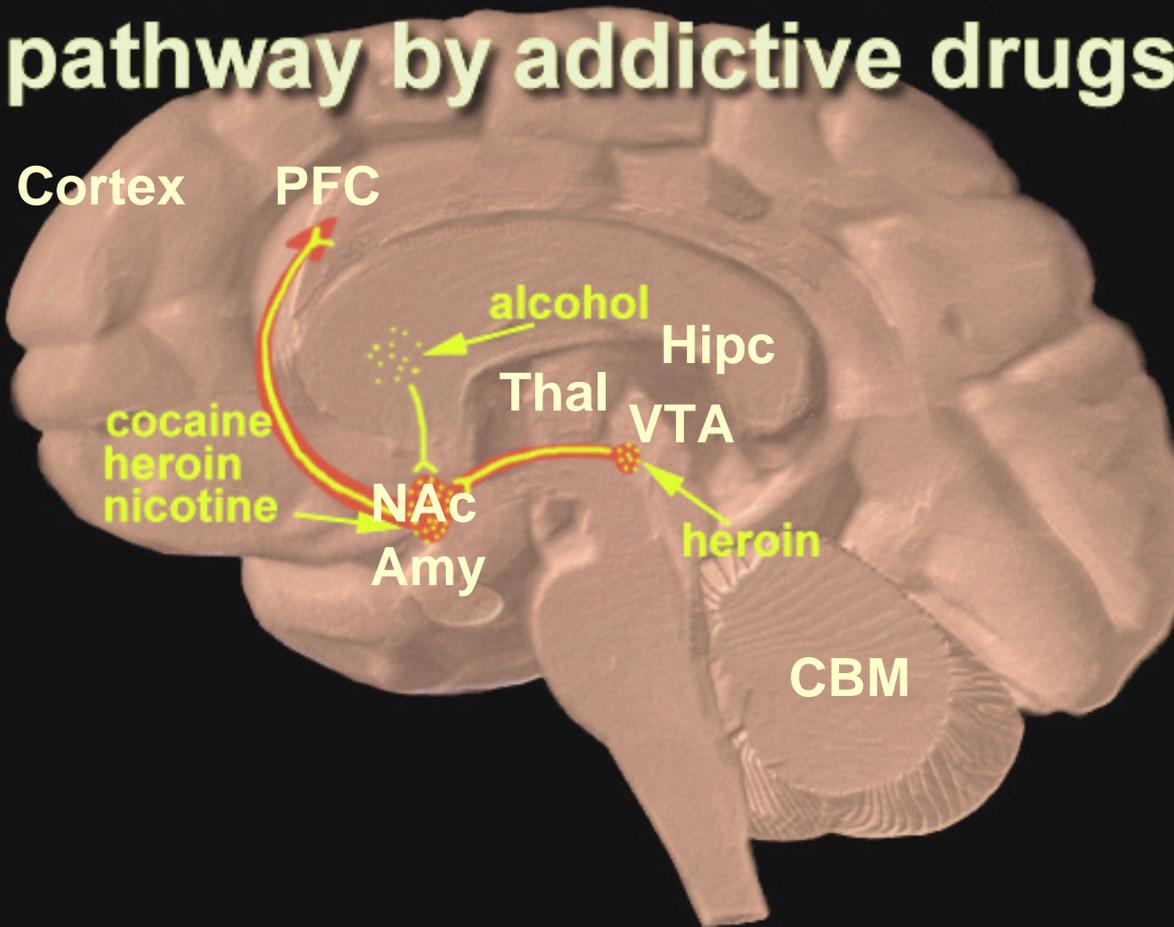
- Misuse of prescription drugs second now only to marijuana as most prevalent drug problem in U.S.
 - Rates of Non-medical Use of Pain Relievers (Past Year)
 - 18-25 y.o.: 11.8%
 - 12-17 y.o.: 7.5%
 - >26 y.o.: 3.1%
 - Risk of abuse or dependence greater for those who initiated use before age 16
 - » (SAMHSA, 2006)

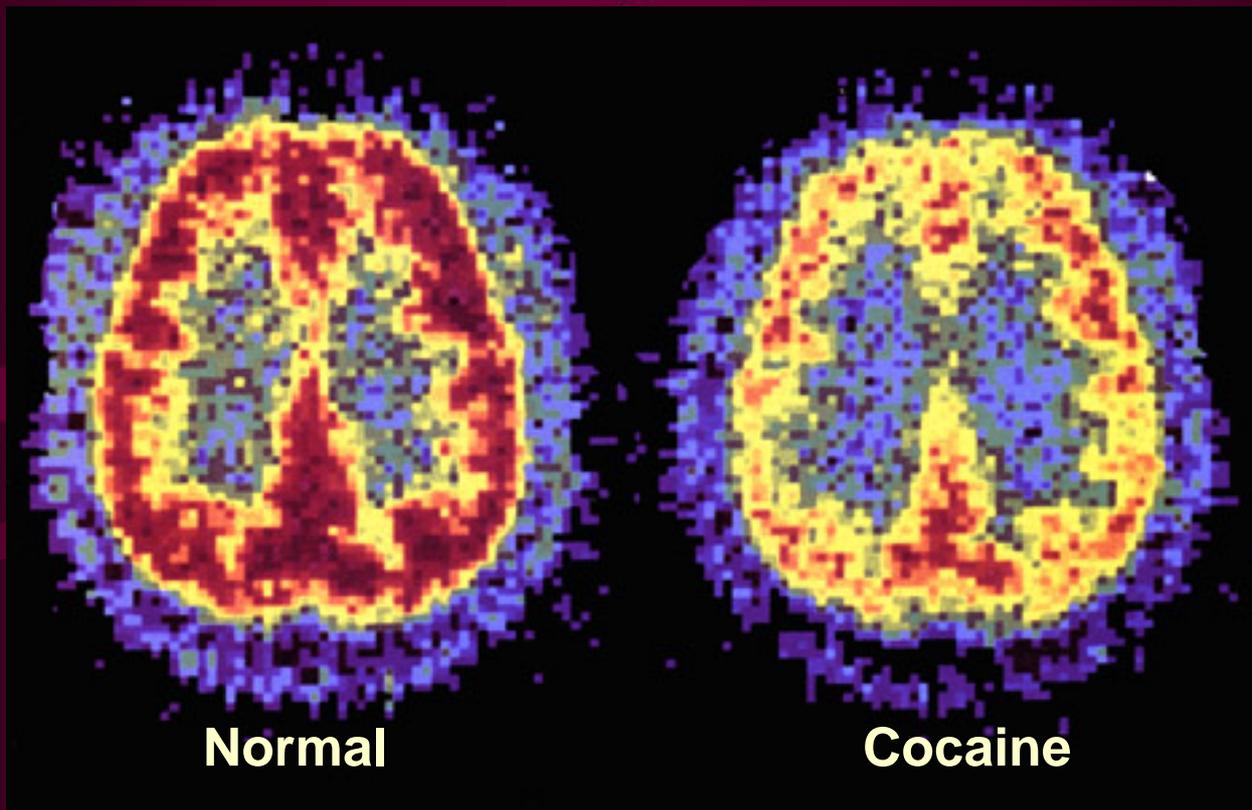
What does basic research tell us
about problems of adolescent
substance abuse?

Do Adolescents Have a Special Vulnerability to Substance Abuse?

- Adolescent brain is immature
- Human brain matures until about age 24
- Three structures maturing through adolescence are involved in drug/alcohol responses:
 - **Nucleus accumbens:** pleasure center where drugs/alcohol produce euphoria and pleasurable effects; modulates how much effort a particular reward is worth, adolescent NA selects for low effort, high excitement, e.g.: video games/substance use
 - **Amygdala:** controls emotional reaction to pleasurable and aversive experiences; in adolescents: responsible for explosive reactions rather than controlled responses
 - **Prefrontal cortex:** complex information processing; judgment, controls impulses, foreseeing consequences, making plans; in adolescents: poor judgment, impulsive behaviors

Activation of the reward pathway by addictive drugs





Normal

Cocaine

Are Adolescents More Vulnerable to Drug Abuse than Adults?

- Immature brain of adolescents associated with poor judgment, impulsivity, inability to contemplate consequences
- Greater feelings of social disinhibition with alcohol (less shyness in social settings reinforces use)
- Lower sensitivity to intoxicating effects of alcohol resulting in use of larger amounts
- Combination of these effects may contribute to initial decision to use and make experience rewarding enough to repeat
- May lead to substance use disorders-abuse and dependence

How do Drugs and Alcohol Affect Brain Development?

Drug Exposure:

- Exposure to nicotine in adolescence:
 - Associated with greater use of nicotine in adulthood
 - Greater stimulant response to cocaine administered to adults
- Adolescent exposure to nicotine may be associated with cognitive deficits in adulthood
- Adolescent animals respond differently than adults to tetrahydrocannabinol, the active chemical in marijuana (VYTP)

How do Drugs and Alcohol Affect Brain Development?

Alcohol Exposure

- Damage to frontal cortex: Cognitive deficits
- Damage to cerebellum: Coordination
- Smaller hippocampus: Damage to memory

Implications

Treatment:

- Understanding neurobiology leads to new targets for pharmacotherapy
- Psychotherapy can be targeted to level of brain maturation

Implications

Prevention:

- Age appropriate curriculum to educate about brain and its development; incorporate neurodevelopmental findings into educational materials
- Educate therapists to adjust therapeutic goals based on brain maturity-older adolescents can weigh pros/cons of unhealthy behaviors, younger adolescents need more concrete interventions
- Educational efforts with public advocates; delay of substance abuse; avoiding neurological damage by avoiding substance abuse in adolescence