adolescent brains and marijuana use

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An introduction

NEUROPHYSIOLOGY & DEVELOPMENT
consequences?
Adolescence is a time of enormous opportunity and of enormous risk
Contentious Subject

- politics
- shoulds
- fear
- crime
Addiction issues?

- Caffeine
- Adderall
- Video games
- Facebook
- Gambling
- Food
IQ and learning?

- lack of sleep
- caffeine drinks
- poor diet
- stress & anxiety

Gateway drug?

Most cocaine users started with marijuana

Brain is changed → more likely to use other drugs

Young age + regular use

Genetic predisposition

Social milieu?

Hall, W. D. and Lynskey, M. Drug and Alcohol Review, (January 2005), 24, 39 – 48
“Neuroscience research has shown that while teenagers' feet may be done growing by the end of high school, their brains are not.”

Rachel Tompa – www.berkeley.edu
teenage brains are really different than...  

...8 year old brains...

...and adult brains.

MRI structural & physiological imaging

Longitudinal studies from 3 – 30 years old

development of the brain
what is marijuana?

- cannabis sativa plant
- leaves, stems, flowers
- delta-9-tetrahydrocannabinol = Δ⁹-THC
- main psychoactive ingredient
Δ⁹-THC is the main psychoactive ingredient

Δ⁹-THC activates cannabinoid1 (CB1) receptor in the brain.

CB1 is expressed at high levels in many brain areas

Two endogenous brain lipids have been identified as CB1 ligands
endocannabinoids – ligands for CB$_1$

- Anandamide (AEA)
- N-arachidonylethanolamine
- 2-arachidonoylglycerol (2-AG)
- Arachidonate-derived neuroactive lipids
what areas of the brain process marijuana?

- hypothalamus
- basal ganglia
- ventral striatum
- amygdala
- brainstem
- cortex
- hippocampus
- cerebellum
hormones

appetite

circadian rhythms

sexual behavior

hypothalamus

basal ganglia

ventral striatum

amygdala

brainstem

 cortex

hippocampus

cerebellum
motor controlled planning

initiation of actions

termination of actions

habit pathway

hypothalamus
basal ganglia
ventral striatum
amygdala
brainstem
hippocampus
cerebellum
cortex
prediction

reward

addiction?
anxiety
emotion
fear

hypothalamus
basal ganglia
ventral striatum
amygdala

cortex
hippocampus
cerebellum
brainstem
vomiting reflex

pain sensation

sympathetic nervous system reactions

hypothalamus
basal ganglia
ventral striatum
amygdala

brainstem
cortex
hippocampus
cerebellum
The brain contains several key structures including the hypothalamus, basal ganglia, ventral striatum, amygdala, cortex, hippocampus, cerebellum, and brainstem. These structures are involved in various functions:

- **Higher cognitive functions**
- **Sensation and perception**
- **Judgment and pleasure**
memory formation

learning: facts

sequences

places
The brain contains several areas that play crucial roles in motor control and learning, which increases the risk of car accidents with DUI. These areas include:

- Hypothalamus
- Basal ganglia
- Ventral striatum
- Amygdala
- Cerebellum
- Cortex
- Hippocampus
- Brainstem

Motor control and coordination are essential functions that are affected by these brain regions. Learning, especially in the context of driving, is also enhanced by these areas, leading to a higher risk of accidents when under the influence of alcohol.
“Neuroscience, the scientific study of the biology of the brain, has made great strides over the past decade in revealing that remarkable changes occur in the brain during the second decade of life.

Contrary to long-held ideas that the brain was mostly grown up – “fully cooked” – by the end of childhood, it is now clear that adolescence is a time of profound brain growth and change.”

Weinberger, Elvevag, & Giedd, 2005