


High-Potency Marijuana and Adolescent Brain Formation




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Synaptogenesis: the formation of synapses between neurons in the nervous system



Apoptosis: the controlled pruning of cells as a normal part of growth to allow specialization



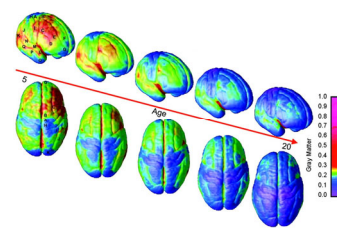
Myelination: the formation of sheaths around pathways to increase efficiency in transmission.

Human Brain Formation

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Right lateral and top views of the dynamic sequence of GM maturation over the cortical surface

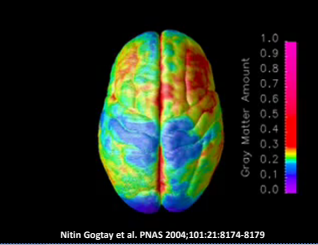


Nitin Gogtay et al. PNAS 2004;101:21:8174-8179

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Why is Marijuana So Much Worse for Adolescents? Their Brains Aren't Formed.



Gray Matter Amount
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0

Video of Adolescent Brain Formation

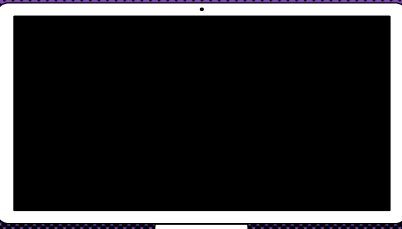
Ages 5 to 20

Nitin Gogtay et al. PNAS 2004;101:21:8174-8179

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HOW DOES THE BRAIN DEVELOP?



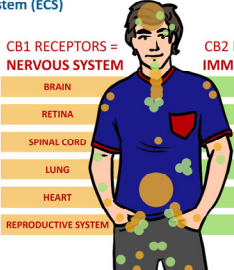
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The Endocannabinoid System (ECS)

STRESS RESPONSE
INFLAMMATION
MEMORY
MOOD
ENERGY BALANCE
IMMUNE FUNCTION
APPETITE & MORE

CB1 RECEPTORS = NERVOUS SYSTEM

CB2 RECEPTORS = IMMUNE SYSTEM



BRAIN
RETINA
SPINAL CORD
LUNG
HEART
REPRODUCTIVE SYSTEM


DIGESTION
LIVER
BONES
SPLEEN
COLON
PANCREAS

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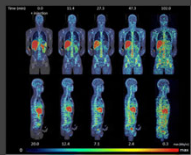
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CANNABINOID RECEPTORS ARE ALSO LOCATED THROUGHOUT THE BODY

Whole Body Distribution of CB1 Receptors (2, 25, and 100 min after injection): Nervous system



PET images of [11C]-NEA0 (CB2 radioligand): Immune system

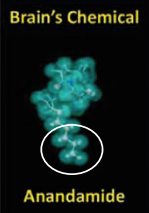


Terry et al., Eur J Nucl Med Mol Imaging. 2010

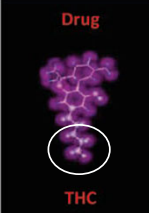
Ahmad et al., Mol Imaging Biol. 2013 A

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The THC and Anandamide molecules are so similar, THC can “trick” the brain and bind to the CB1 receptors and block normal neurological function.



Brain's Chemical
Anandamide



Drug
THC

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THC vs. Anandamide

THC produces an exaggerated high.	Anandamide produces a “runners high.”
THC can bind to the receptors for several days.	Anandamide breaks down in minutes.

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The Endocannabinoid System

Receptors = Locks
Neurotransmitters = Keys
Multiple keys can activate the same lock

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Science Timeline

THC was identified as the primary active cannabinoid that caused the "high"

1964

1988

1992

Anandamide, the natural chemical that binds to the receptors was identified, so it was labeled an "endocannabinoid" which unfortunately gave people the mistaken impression cannabis was made to fit in our bodies naturally.

Cannabinoid receptors were identified as the sites in the brain and body where THC acts

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Regions of the Brain Containing CB1 Receptors Impacted During Adolescent Brain Formation

Brain Part	Function	THC Impact
1. Prefrontal cortex	Executive function and higher reasoning	Increases impulsiveness and reduces judgment
2. Nucleus accumbens	The reward circuit releases dopamine	Overabundance can contribute to hallucinations
3. Amygdala	Emotions, fear, anxiety	Increases paranoia, panic
4. Hippocampus	Learning new information	Impairs memory
5. Orbitofrontal cortex	Motivation and drive	Decreases desire to do things
6. Basal ganglia	Planning and starting movement	Slows reaction time
7. Cerebellum	Motor skills, balance	Impairs coordination
8. Hypothalamus	Eating, sex drive	Increases appetite
9. Neocortex	Feeling and movement	Alters sensations

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WHAT AREAS OF YOUR BRAIN ARE IMPACTED BY THC?

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Association of Cannabis Use During Adolescence With Neurodevelopment

– JAMA Psychiatry. Published online June 16, 2021

• Images from 799 participants at 14 years old and then again at 19 years old.

• Change in cortical thickness in millimeters at varying levels of lifetime cannabis use.

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MULTIPLE STUDIES SHOW ALTERED BRAIN STRUCTURE AND FUNCTION IN YOUTH WHO REGULARLY USE CANNABIS

Early (<18y) Cannabis Use Decreases Axonal Fiber Connectivity

Axonal paths with reduced connectivity (measured with diffusion-weighted MRI) in cannabis users (n=59) than in controls (N=33).

Source: Zalesky et al Brain 2012

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HYPOFRONTALITY

Active marijuana use can reduce the activity in several Frontal Lobe regions.

This is called **HYPOFRONTALITY**.

It can arrest youth brain development and impair problem solving, judgment, decision making, working memory, organization, planning, and prioritization.

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HEALTHY BRAIN vs. MARIJUANA USER'S BRAIN

HEALTHY BRAIN

MARIJUANA USER'S BRAIN

Healthy Brain vs. Marijuana Brain

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The Adolescent Biological Imperative


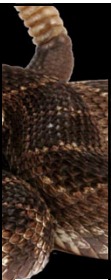
- It's in a teenager's nature to be impulsive.
- Their brains don't fully develop until mid-20s, so they can't make sound judgments.
- Young people are driven to take risks and explore the world.
- They want to break away from their parents and become independent.
- This can lead to destructive behaviors as drug and alcohol use, reckless risk-taking, and other dangerous conduct.
- We must teach them to treat their brains as their best friends.

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Teach a Healthy Fear of Marijuana

What did you teach your children about rattlesnakes?

STAY AWAY, because it can bite you!



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Share	Join and share our Facebook posts: facebook.com/groups/JohnnysAmbassadors
Show Up	Join us for the 2nd Annual #StopDabbing Walk on Sunday, September 18, 2022: StopDabbingWalk.com
Speak Out	Get involved: JohnnysAmbassadors.org/join
Support	We gratefully accept donations: johnnysambassadors.org/donate



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"If Johnny hadn't started using marijuana, I know he would still be alive today."
By Laura Stack, MBA, CSP, CPAE



Available on Amazon and anywhere books are sold:

The Dangerous Truth About Today's Marijuana: Johnny Stack's Life and Death Story

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Scan This QR Code To Go To Our LinkTree For a Complete List of Free Educational Resources!

Questions? Email me at
Laura@JohnnysAmbassadors.org



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