



Effects of Drugs on the Brain and Behavior in Adolescents

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Today

- What would you like to get out of this discussion?
- What do you think drugs do to someone's brain?



Effects of Substances on Brain and Body

- Why talk about effects in the body?
 - To see that consumers are not bad people just continuously making poor choices, rather they have physically altered brain function
- We are programmed to seek out pleasurable activities.
 - Body rewards us for life-sustaining activities, teaching us to do them again



Effects of Substances on Brain and Body

- Most drugs of abuse hijack this reward system by flooding the circuit with dopamine.
 - Affects brain regions that regulate movement, emotion, cognition, motivation, and feelings of pleasure

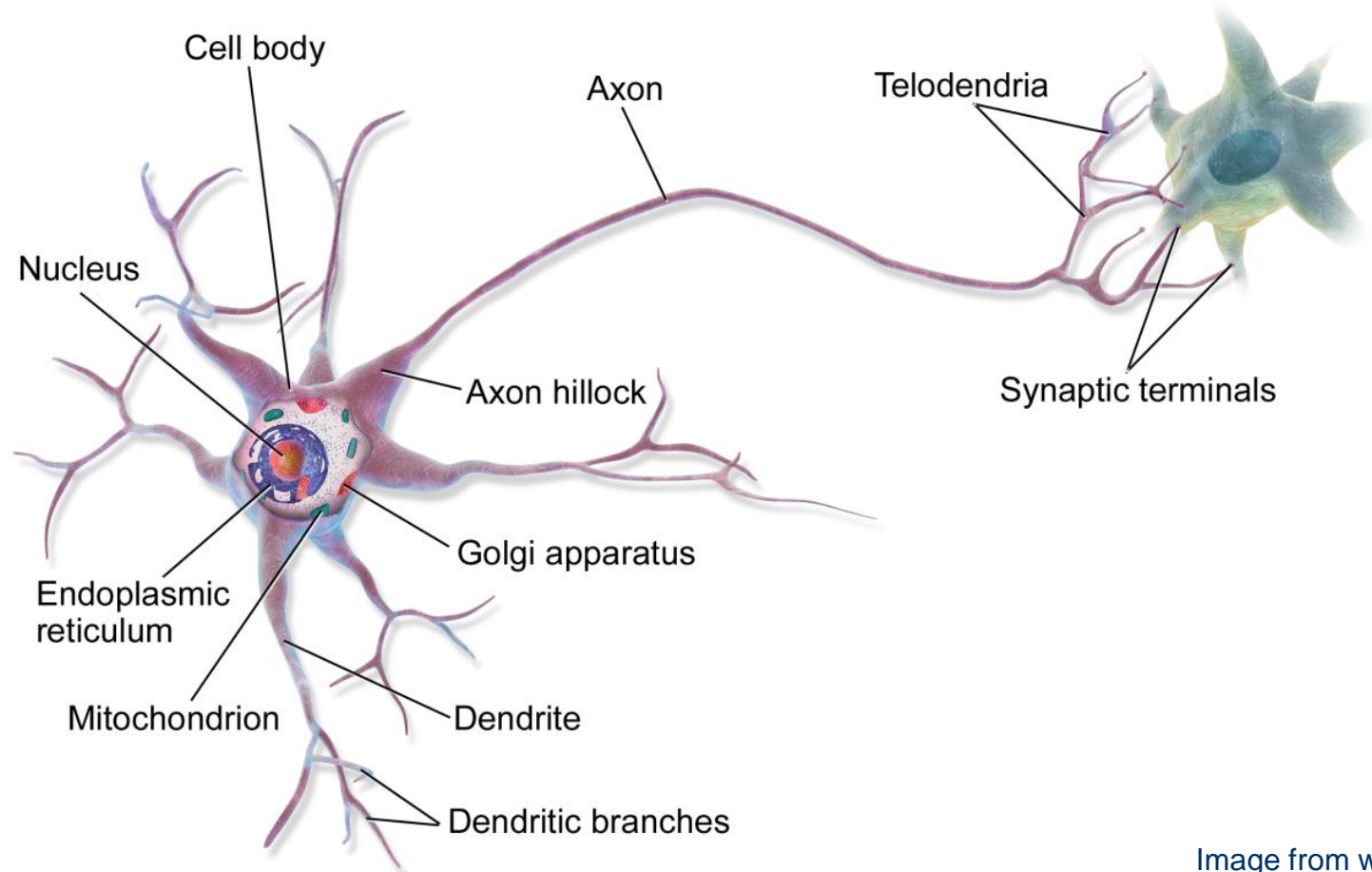


The Adolescent Brain

- The brain has all of its gray matter by age 12.
 - Cell bodies, neurons, nerve fibers, support cells, etc.
- Not fully wired and pruned until around age 25 (neuromaturation).
 - Adding connections and taking away others to make brain processing more efficient
 - Particularly in the prefrontal cortex
 - Females “done” before males



Neurobiology of Addiction





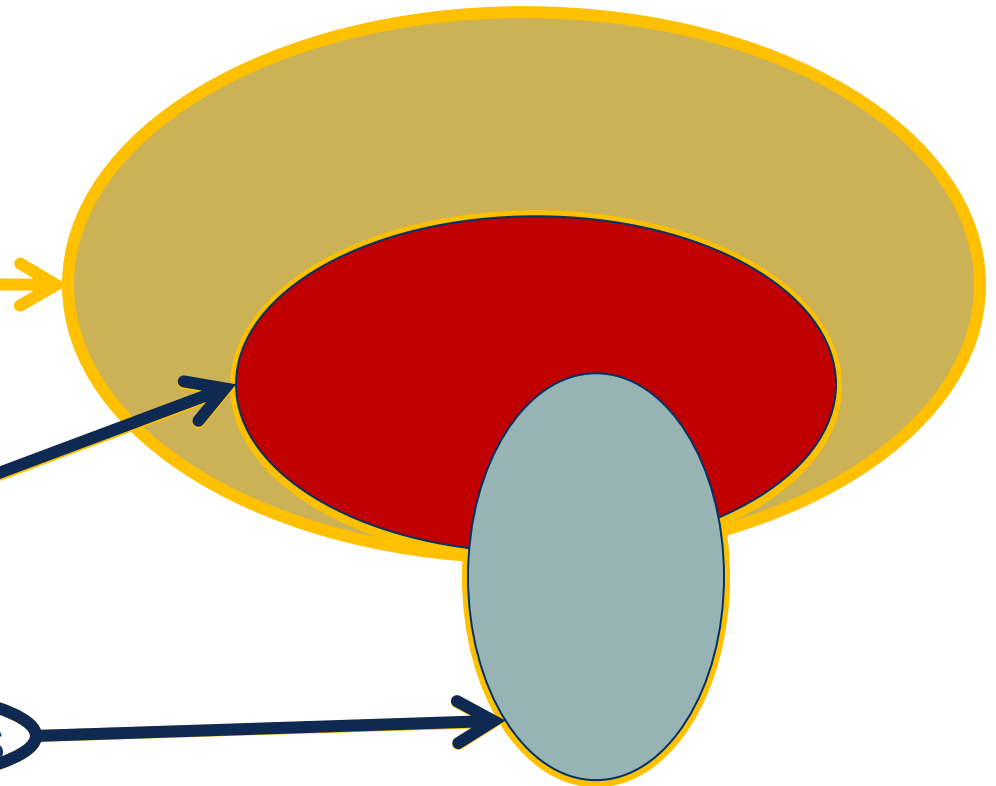
Neurobiology of Addiction

- A simple look at brain functioning

- Executive functioning

- Emotional processing

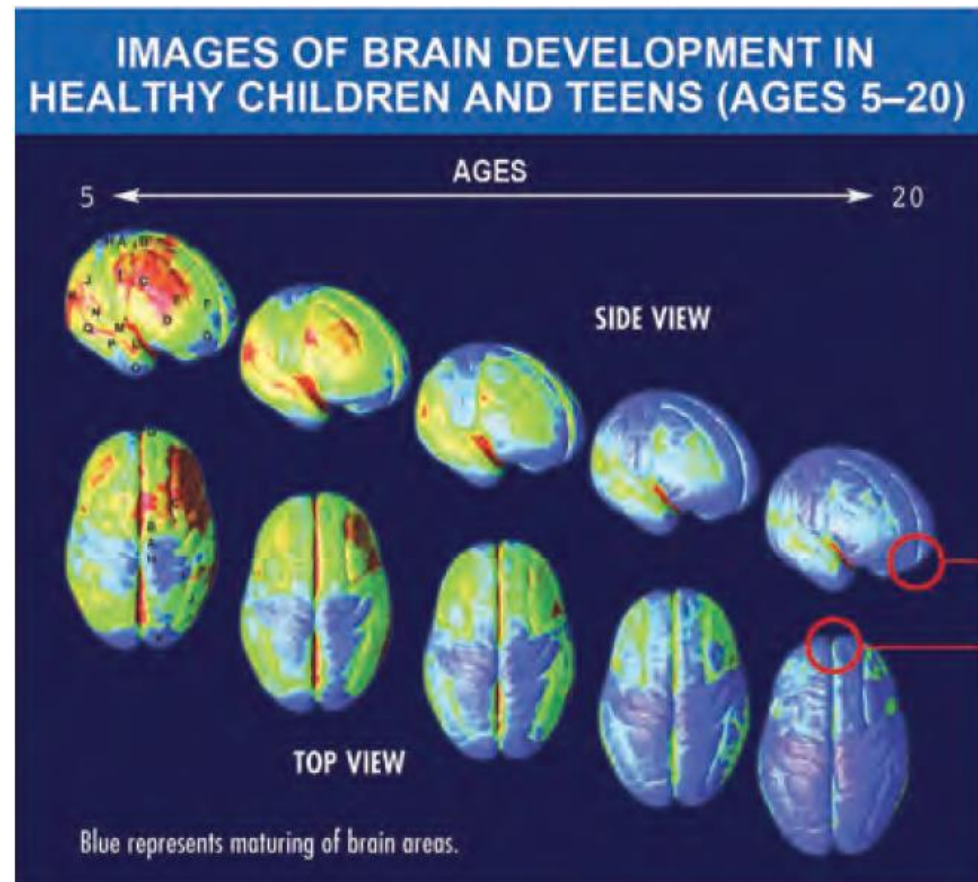
- Basic life functions





SUD in Adolescents

- Important to understand adolescence developmentally
- “A car with a fully functioning gas pedal ... but weak brakes”

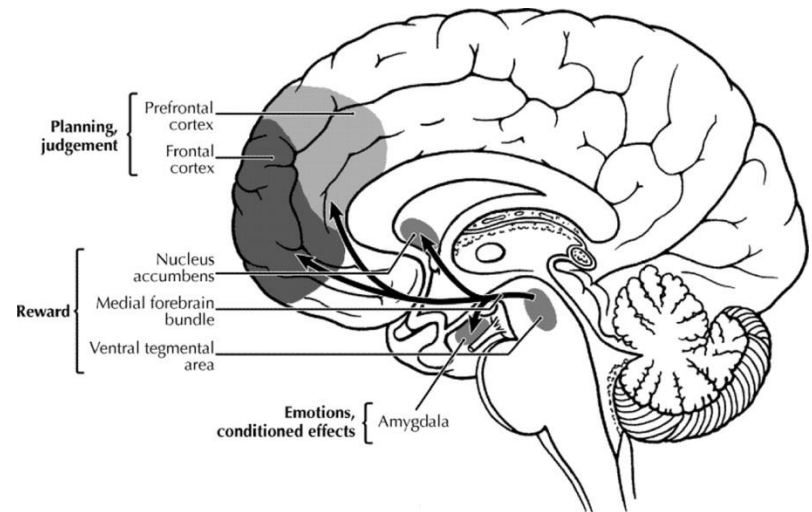




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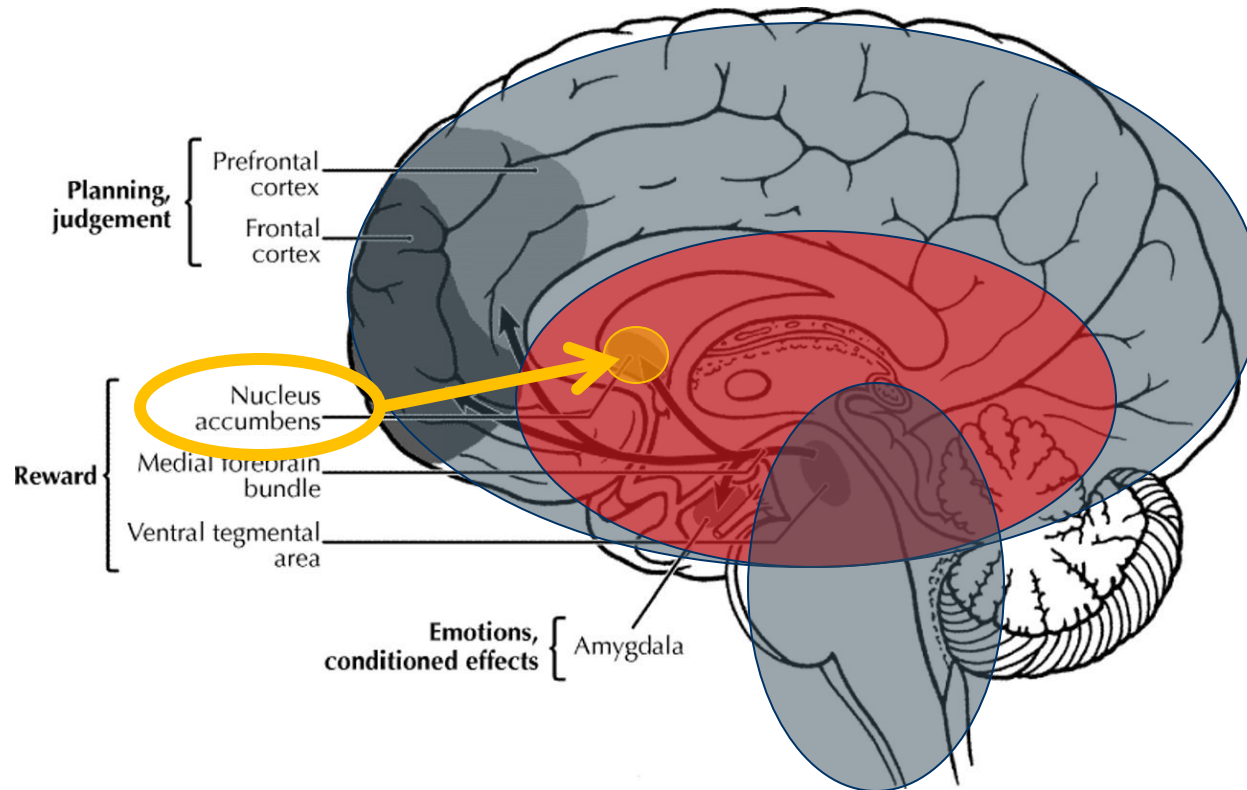
Nucleus accumbens

- Has a significant role in the processing of:
 - Motivation
 - Pleasure
 - Reward
 - Reinforcement learning
- Plays a role in dopamine release





Neurobiology of Addiction



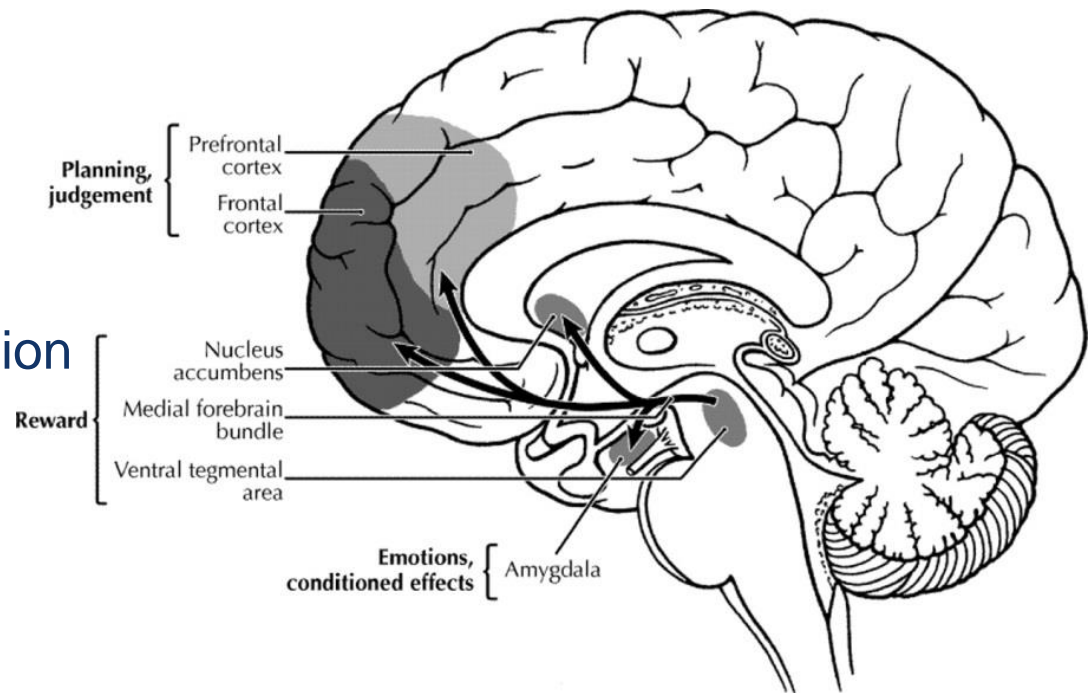


Neurobiology of Addiction

Anterior cingulate cortex

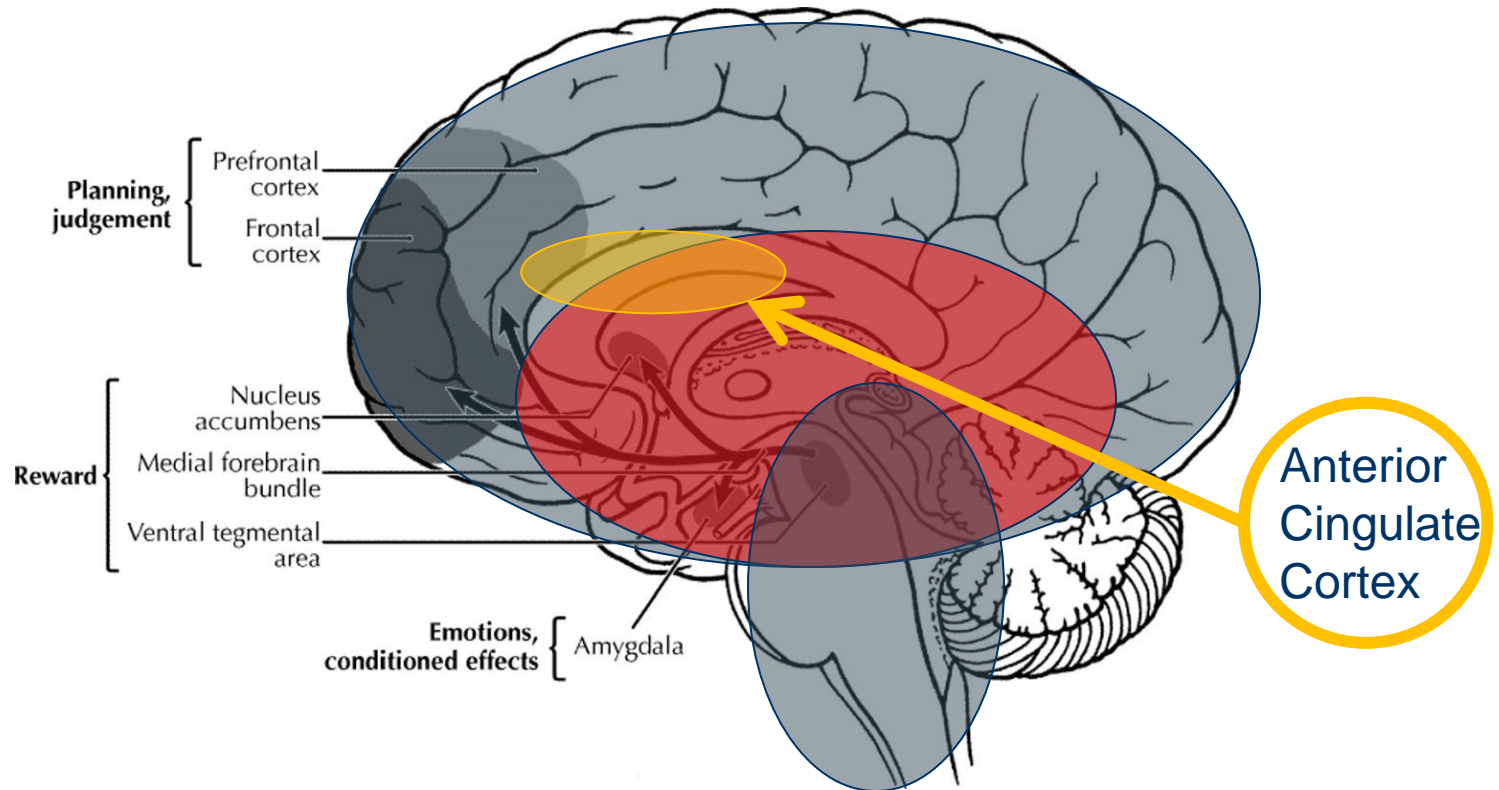
Involved in rational cognitive functions

- Reward anticipation
- Decision-making
- Empathy
- Impulse control
- Emotion





Neurobiology of Addiction

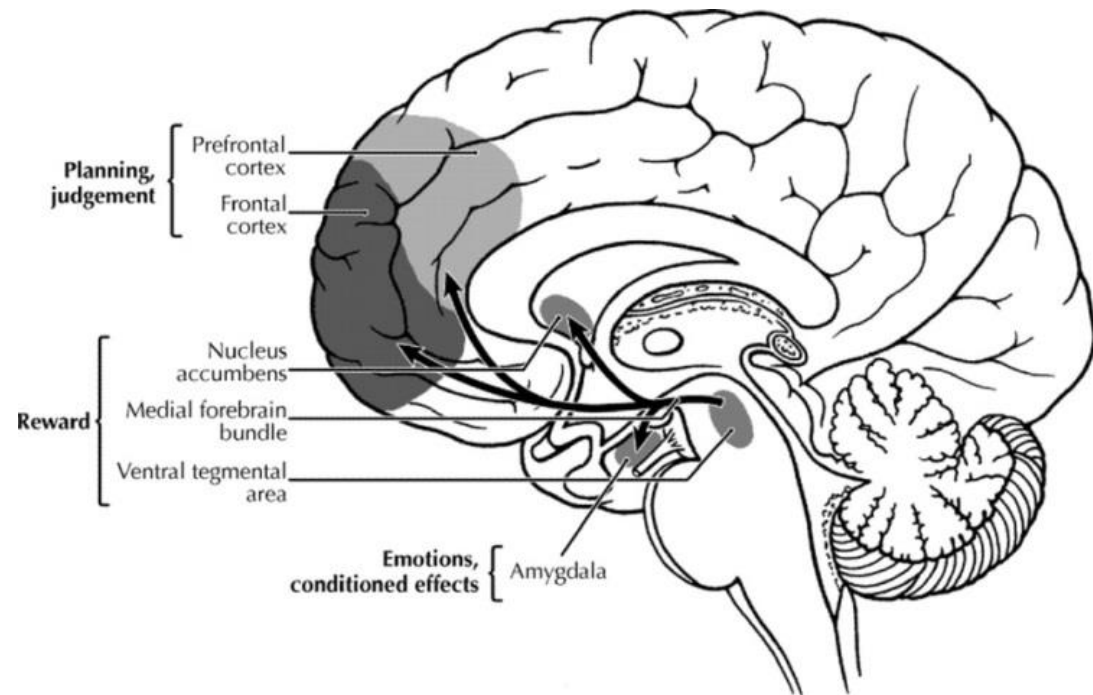




Neurobiology of Addiction

Amygdalae

- Vital in formation and storage of emotional learning and fear response
- Right amygdala in particular handles negative emotions

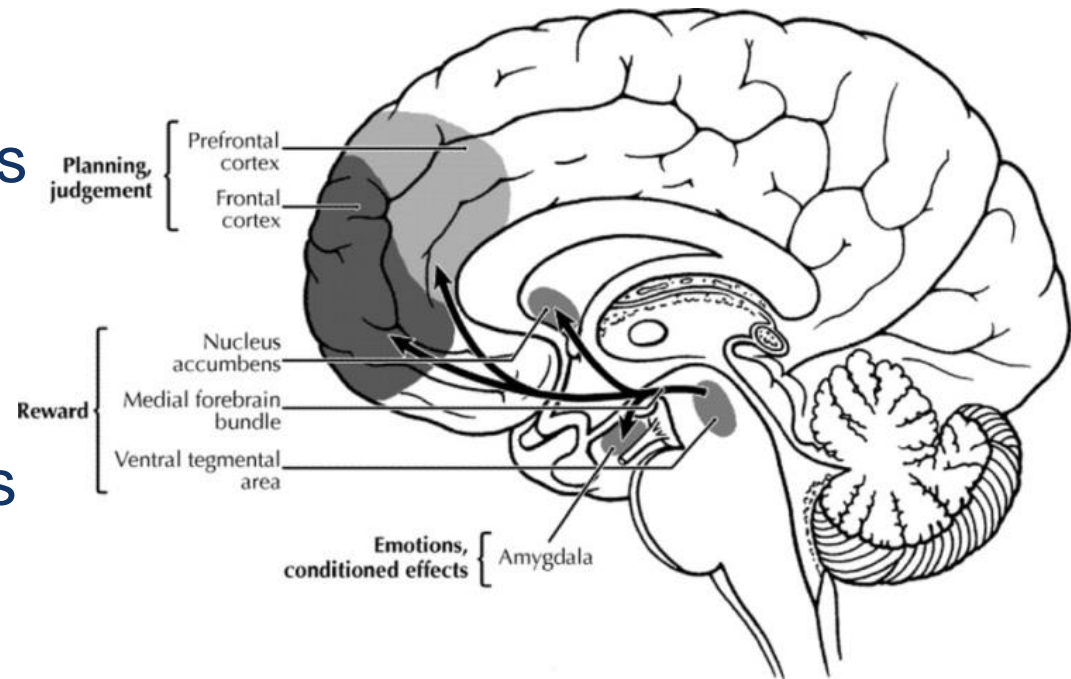




Neurobiology of Addiction

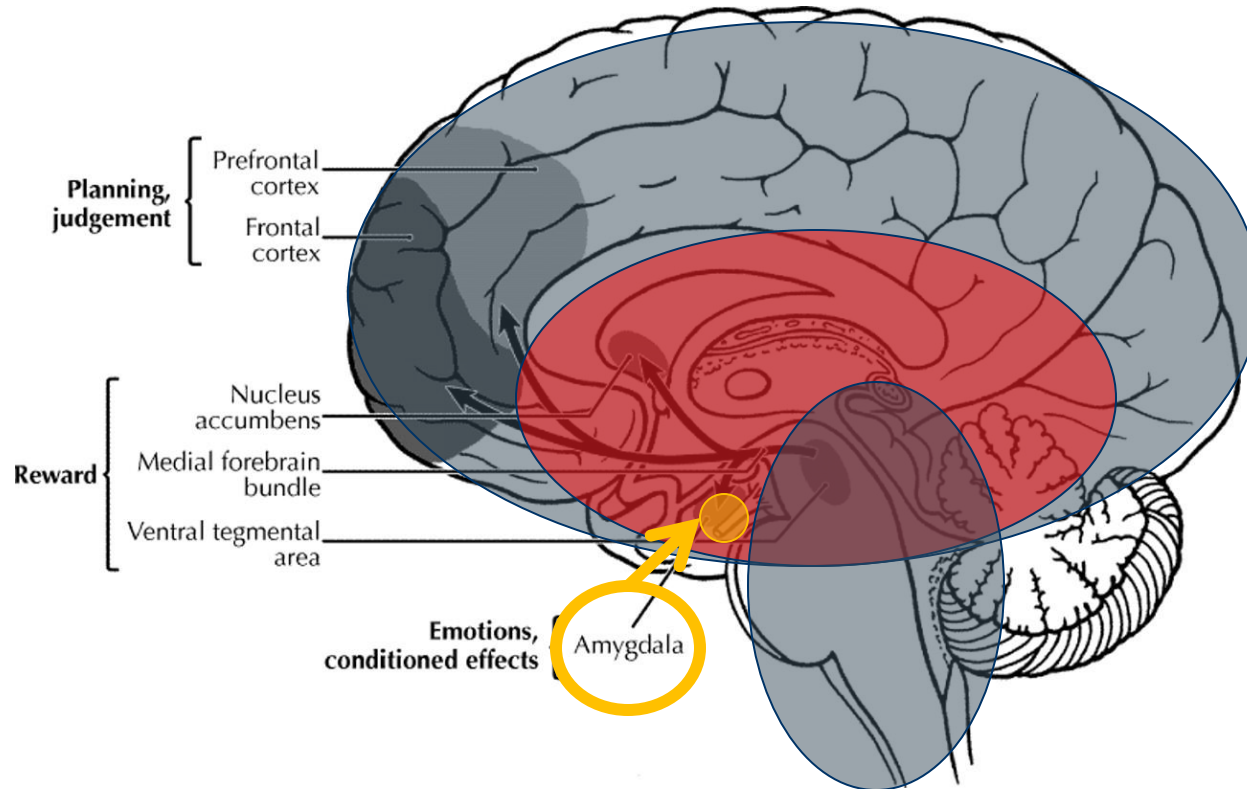
Amygdalae

- Left amygdala in particular processes pleasant and negative emotions, reward system.
- Each amygdala has a unique, specific function in how we perceive and process emotion.





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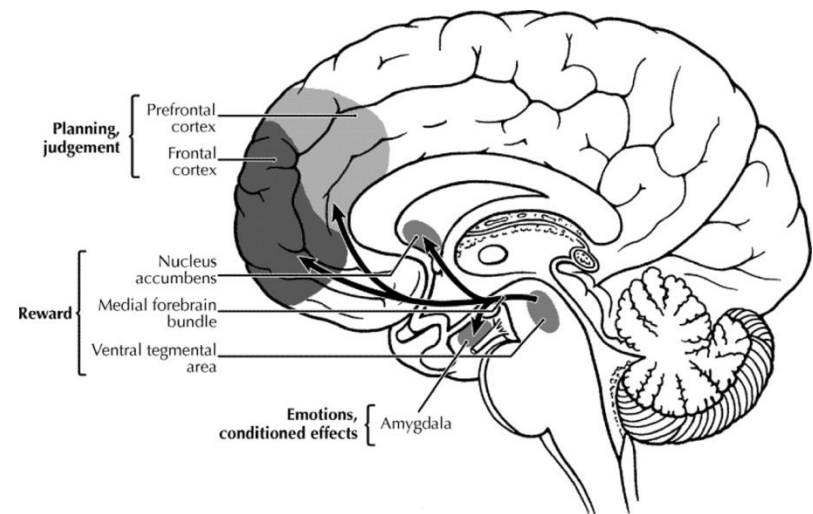




Neurobiology of Addiction

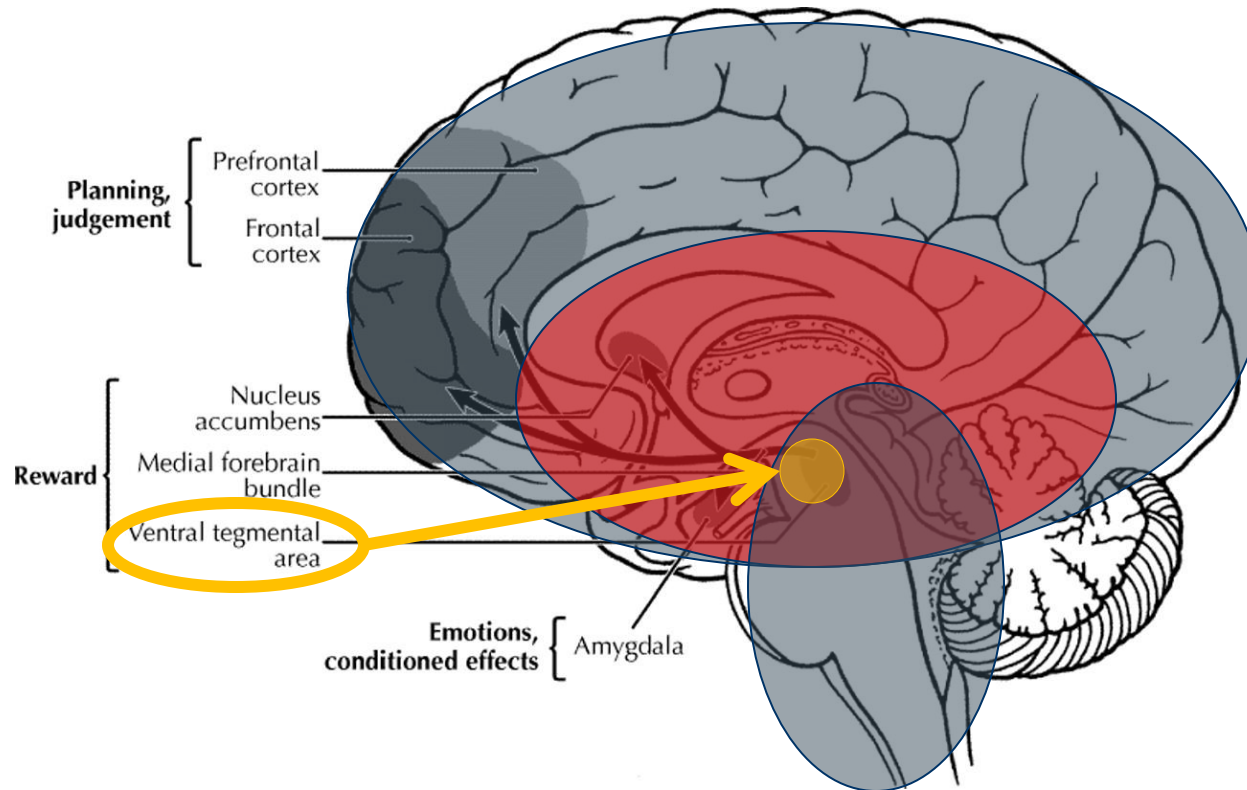
Ventral Tegmental Area (VTA)

- Origin of the dopaminergic cell bodies
- Widely implicated in the drug and natural reward circuitry of the brain





Neurobiology of Addiction

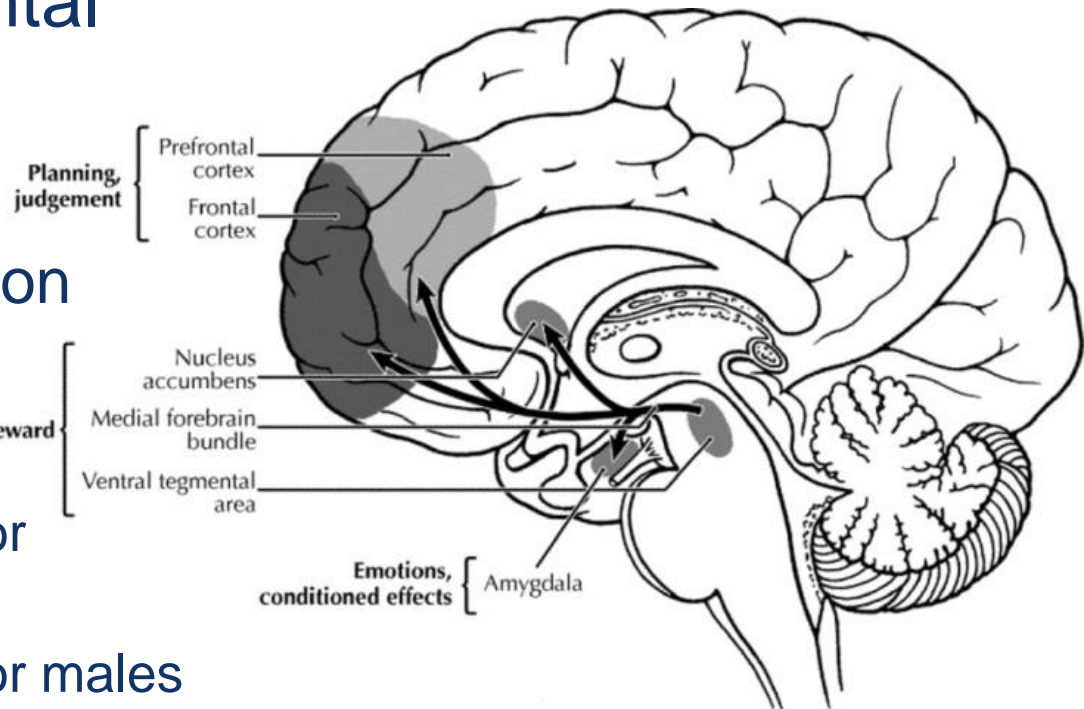




The Neurobiology of Addiction

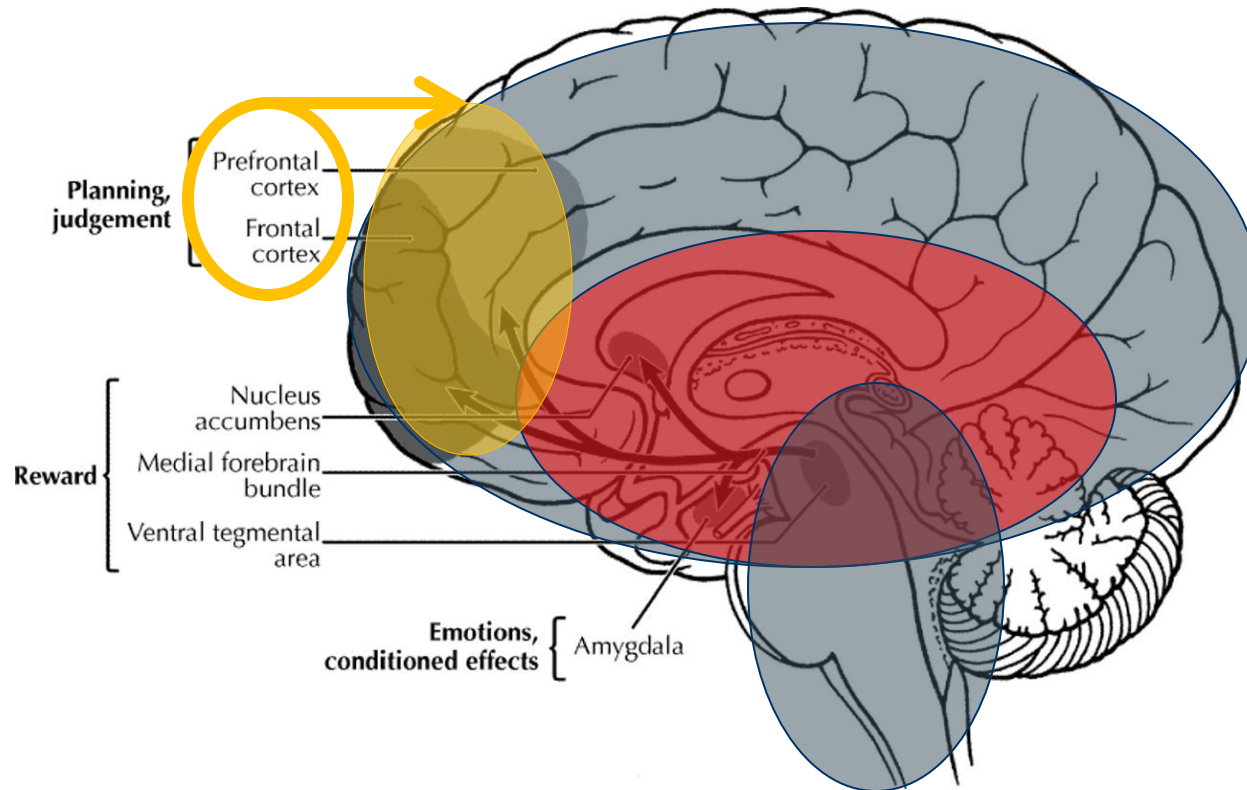
Frontal and pre-frontal cortex

- Impulse control
- Delay of gratification
- Still developing in adolescence
 - Into mid 20s for females
 - Into late 20s for males
- How is it affected by a SUD?



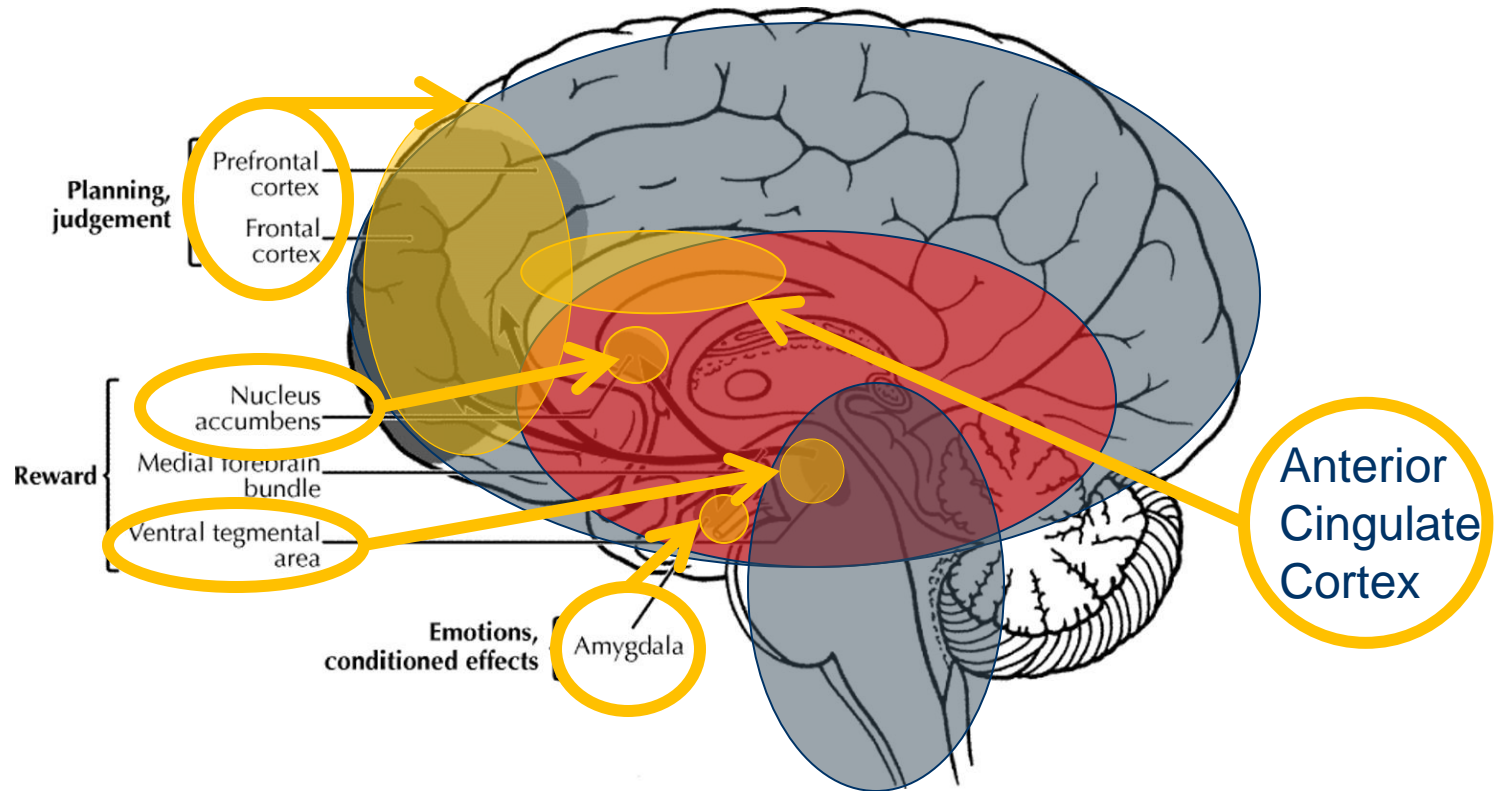


Neurobiology of Addiction





Neurobiology of Addiction





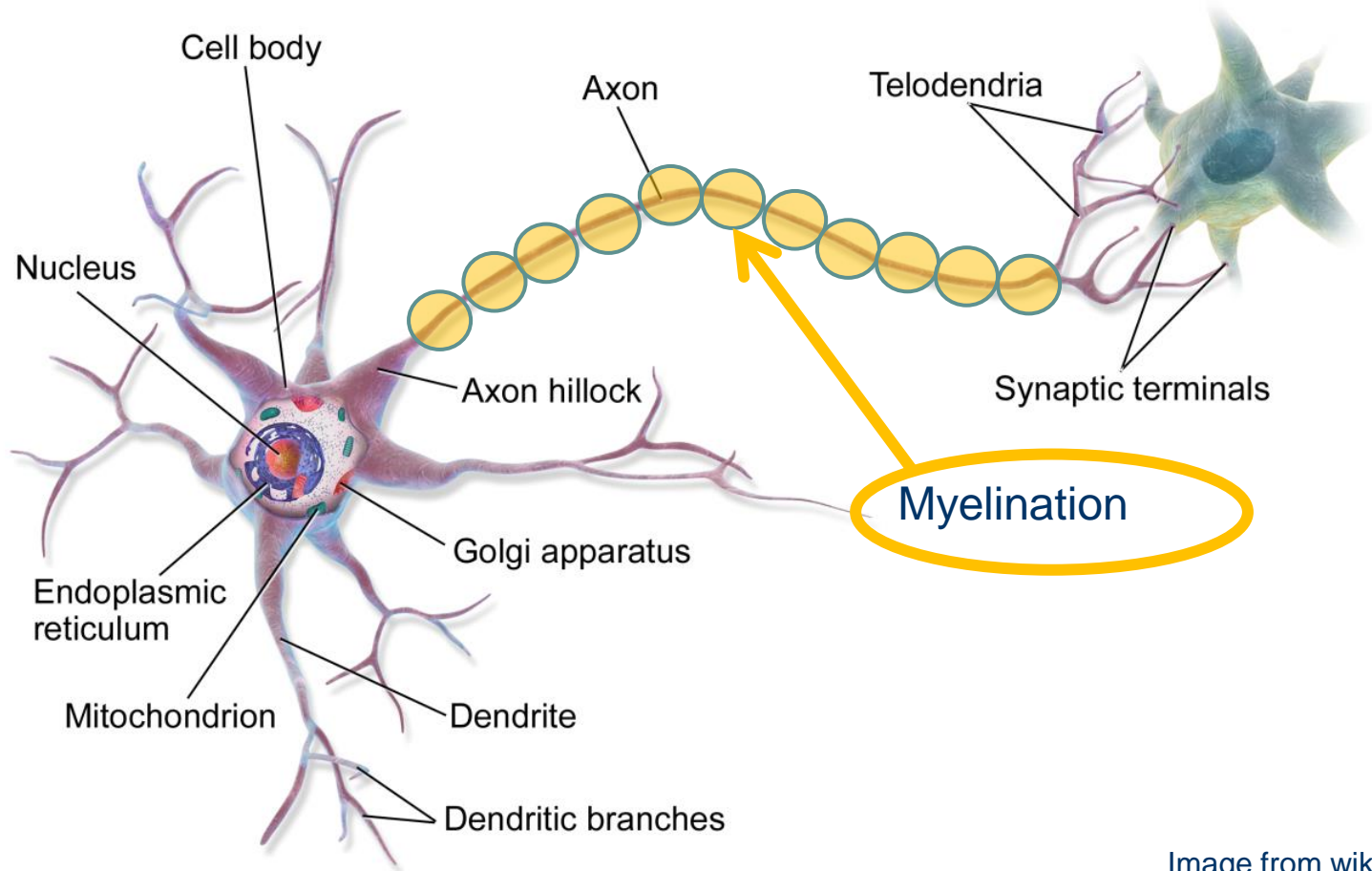
Effects of Substances on Brain/Body

I like to think of the brain as being lazy.

- Since pleasure reward system is over-functioning, brain feels that this is a more efficient way to get its “reward.”
 - Teaching it to want to do the same life-sustaining action over and over again
 - More dopamine than naturally rewarding activities such as eating and sex
 - Puts substance of choice as a priority over other “normal,” healthy, life-sustaining activities
- This is reinforced by a process called myelination.



Neurobiology of Addiction



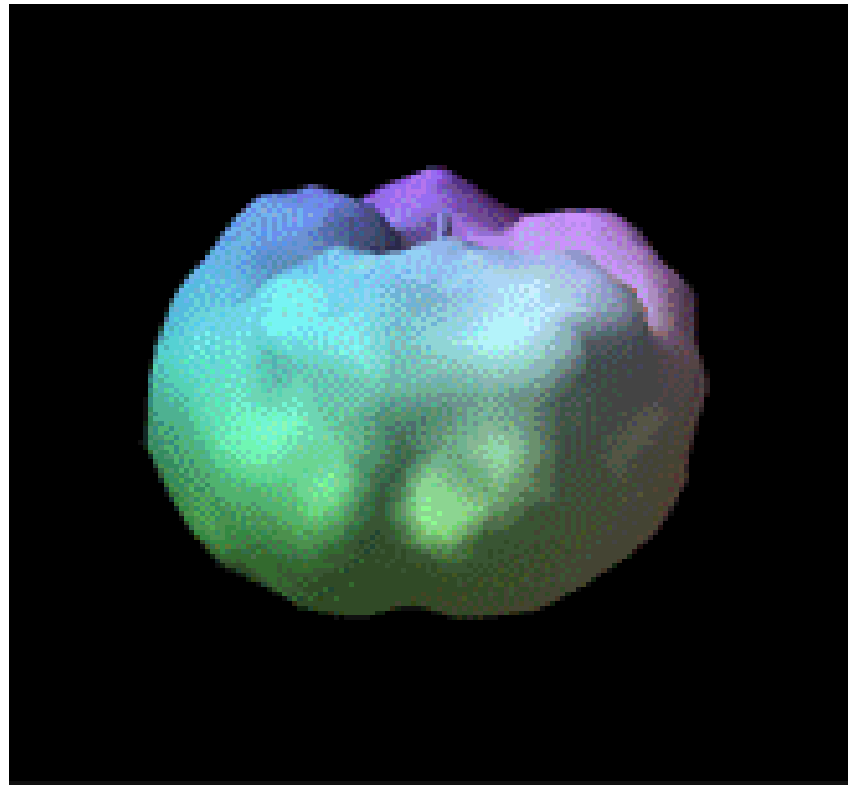


Epigenetics

- This can have effects on the genetic level.
 - No longer nature versus nurture, it is now how nature and nurture interact.
- Micro-evolutions can happen in one generation.
- May help explain the diathesis stress model and resilience.
 - Individuals have different thresholds that trigger gene expression.



SPECT: Healthy Brain

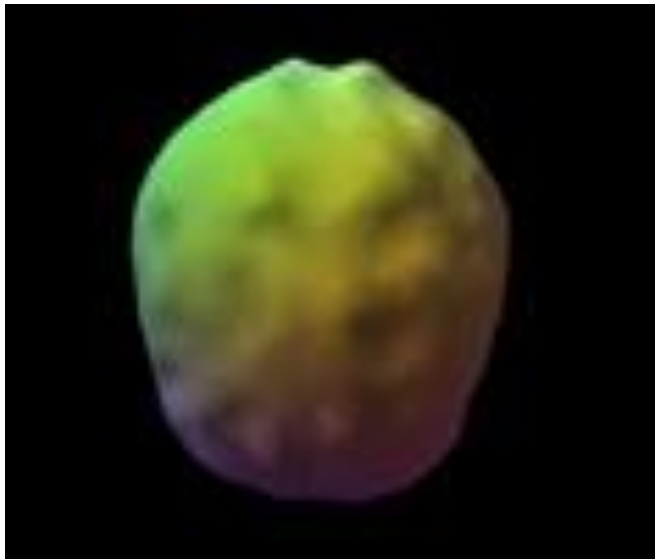


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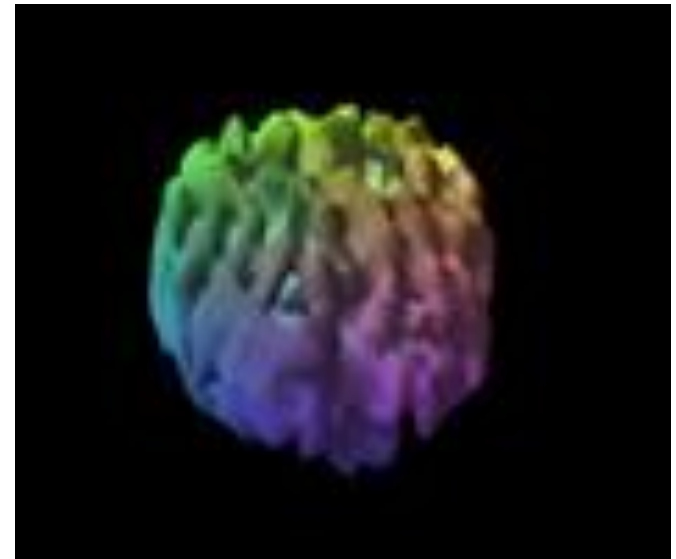


SPECT: Regular Heroin Use

Healthy brain



**39-year-old,
25 years regular use**

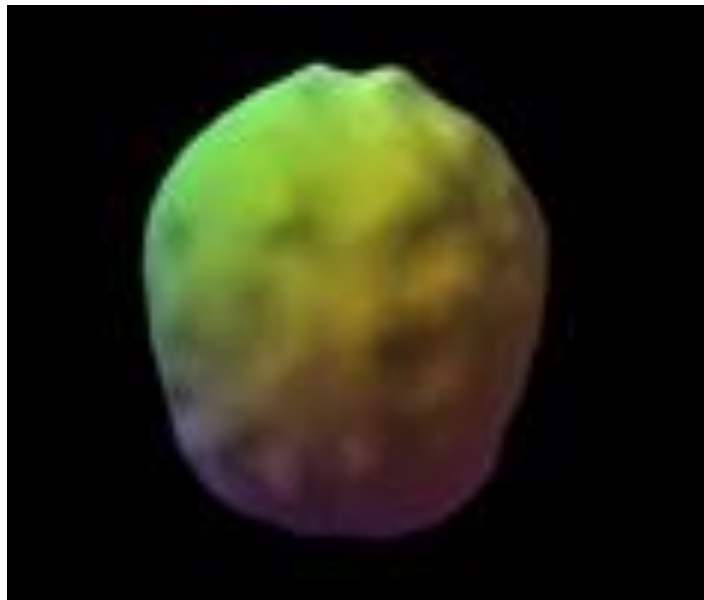


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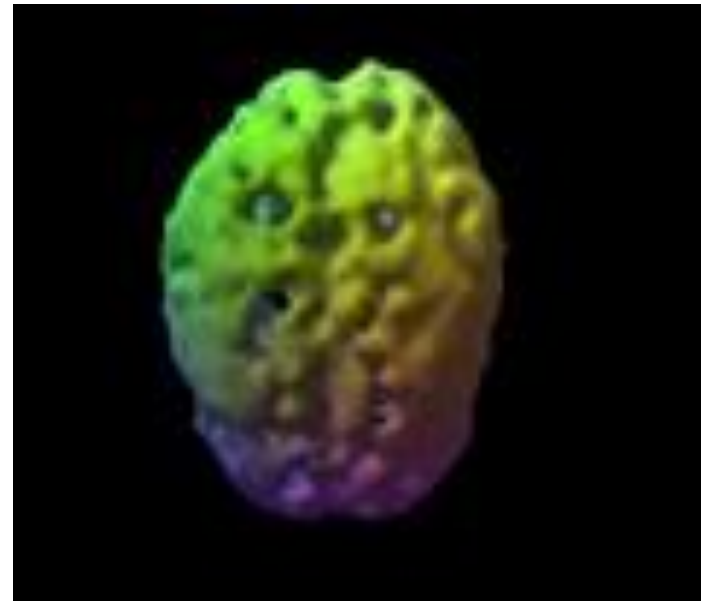


SPECT: Regular Cocaine Use

Healthy brain



**24-year-old,
2 years frequent use**

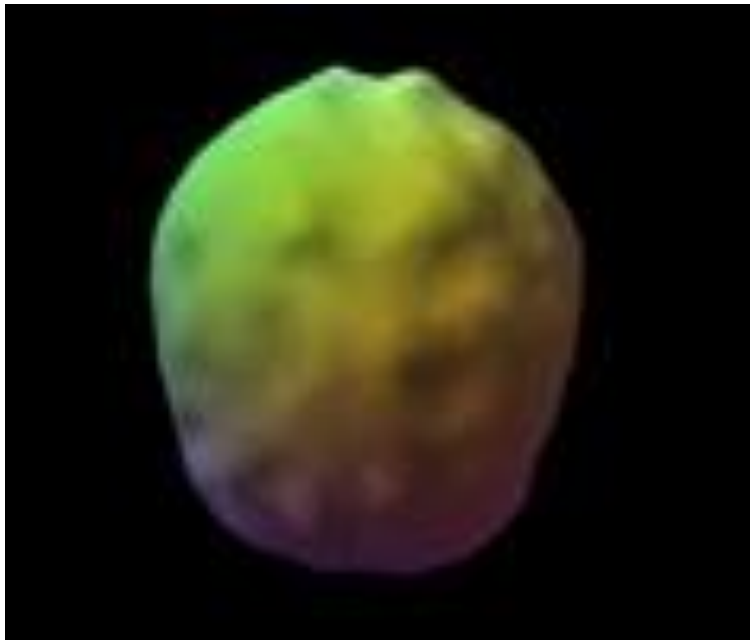


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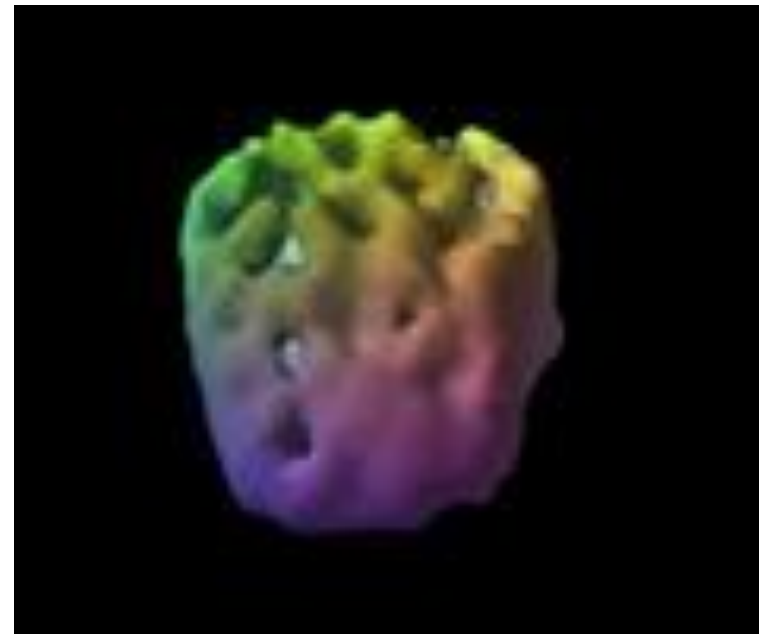


SPECT: Regular Alcohol Use

Healthy brain



Long-term use

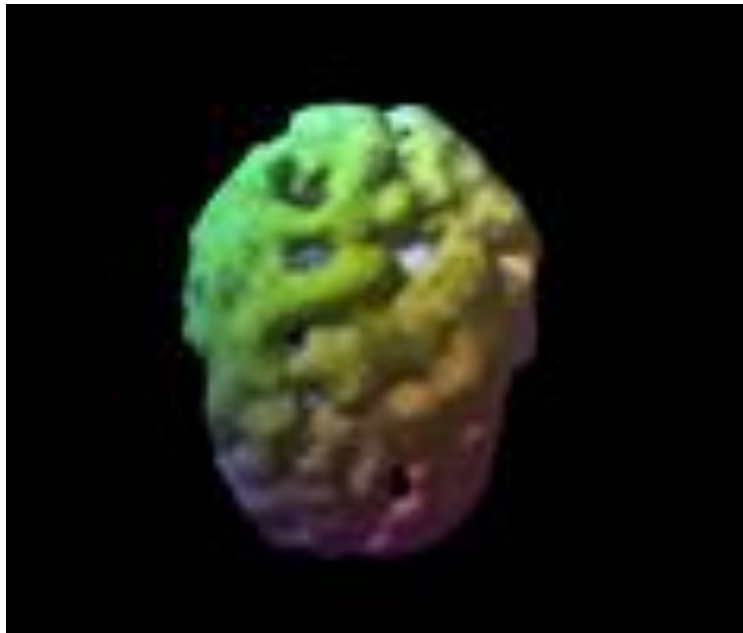


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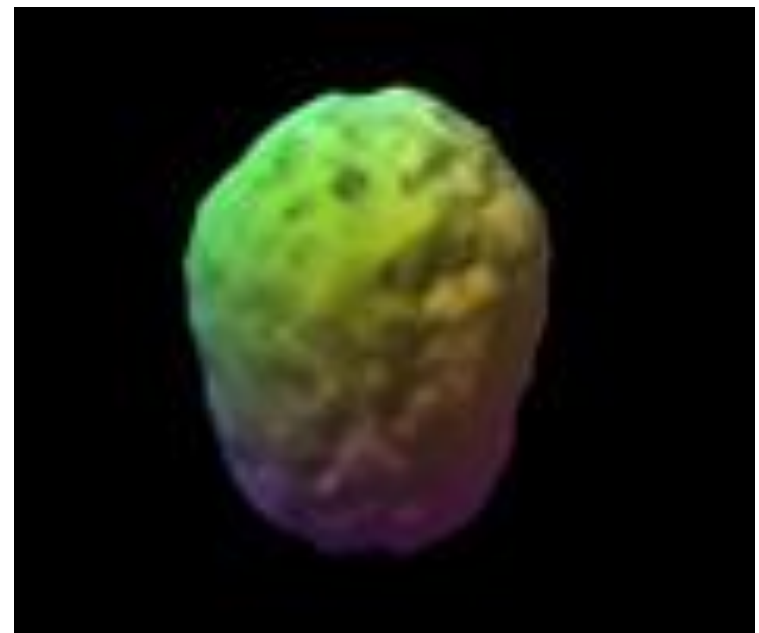


SPECT – Recovery

During substance abuse



One year drug- and alcohol-free



From amenclinics.com



Gateway Drugs

- Do they exist?
 - Causation versus correlation
- Cross tolerance
 - When someone who is tolerant to the effects of a certain drug also develops a tolerance to another drug



Focused Discussion: Alcohol

- Powdered Alcohol
 - “Palcohol”
 - Currently in the process for federal approval
 - Available in other countries already
 - Needs to stay in a sealed container otherwise ethanol evaporates
 - 58% alcohol by weight (until diluted in liquid)
 - Easier to abuse
 - Can be snorted



Focused Discussion: Marijuana

- Tetrahydrocannabinol (THC) is the active agent
 - Psychoactive, responsible for the “high”
- Volume, shape, and density of gray matter changes
 - Study of 40 college students at Northwestern (20 marijuana users)
 - Increase of volume of grey matter in nucleus accumbens and amygdala
 - Change of shape and density in nucleus accumbens



Focused Discussion: Marijuana

- Marijuana users are more likely to use harder drugs than non-marijuana users
- Many of those who do use harder drugs, use marijuana first
- However:
 - 107 million marijuana users in the U.S.
 - 37 million have used cocaine
 - 4 million have use heroin



Focused Discussion: Marijuana

- American Journal of Psychiatry: correlation of use of marijuana and hard drugs is more likely due to individual tendencies and environmental circumstances
- The Institute of Medicine: the fact marijuana is illegal makes this correlation stronger
- What does this mean?
 - Focus on preventing environmental and behavioral risk factors
 - This is better than demonizing one particular drug



Focused Discussion

Synthetics



Synthetic Marijuana

- Name is not accurate
 - Dried plant material, synthetic drugs sprayed on
 - Highs are unpredictable because of constantly varying chemical compounds
 - Can precipitate psychosis
 - Both acute symptoms and potential long-term issues depending on predisposition
 - Other side effects can include heart issues and seizure



Synthetic Marijuana Symptoms

- Nausea
- Hypertension (high blood pressure)
- Tachycardia (rapid heart rate)
- Myocardial infarction (heart attack)
- Blurred vision
- Agitation
- Vomiting
- Hallucinations
- Psychoses
- Seizures
- Convulsions
- Panic attacks



Focused Discussion

Opiates and Opioids



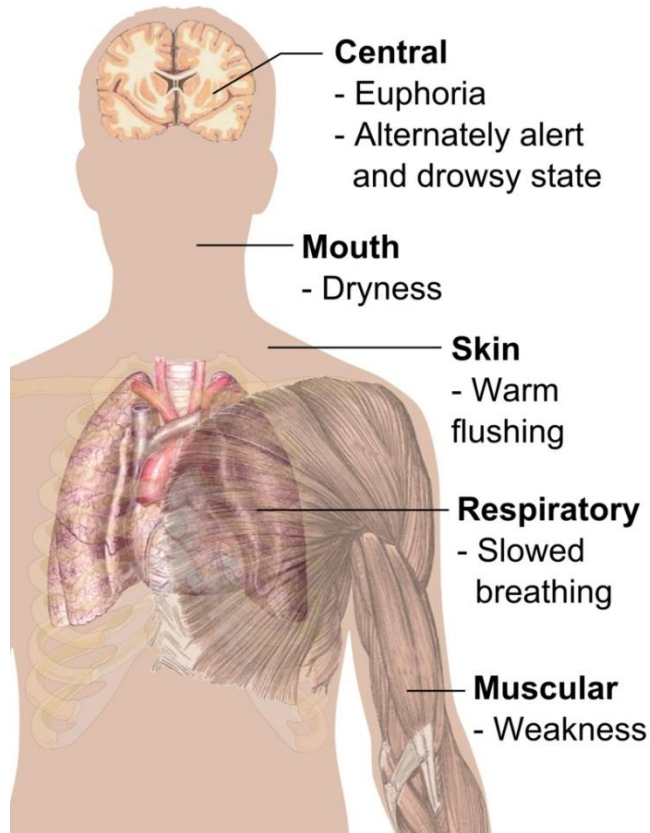
Heroin

- An opioid, binds to opioid receptors in the brain
 - Many of these receptors are in areas that are involved in the perception of pain and reward
 - Also located in the brain stem
- Is a depressant
 - Depressing brain stem functions, including breathing, can cause hypoxia (lack of oxygen to the brain).
 - This can have short- and long-term effects

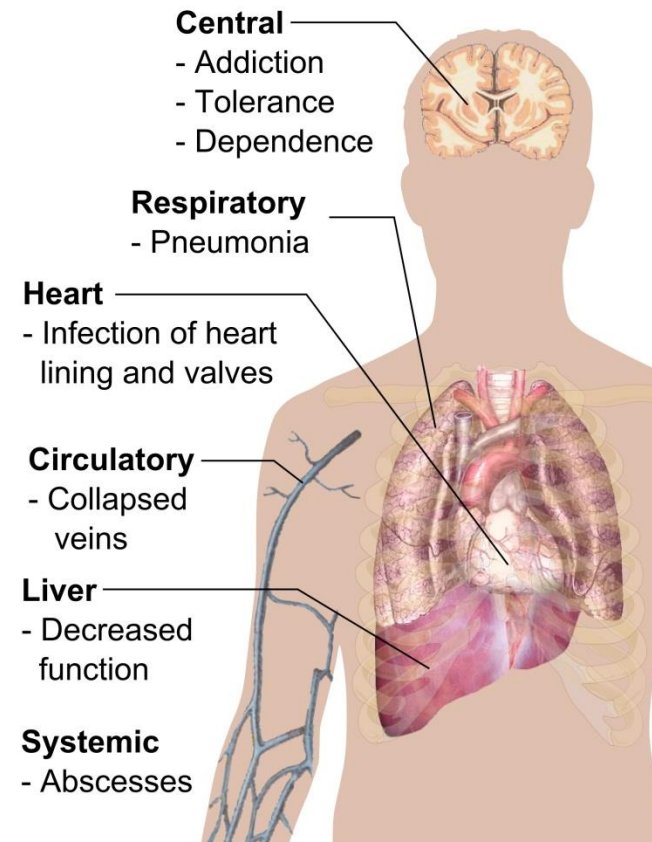


Heroin

Short-term effects of Heroin



Long-term effects of Heroin





Extra Information Right in Your Backyard

A great amount of research on this happening at UW-Milwaukee

- Dr. Krista Lisdahl at the BraIN Lab.
- BraIN Lab focuses on the brain and cognitive consequences of chronic drug use during adolescence and young adulthood.



Contact Information

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