

How Drugs Affect the Brain

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Director

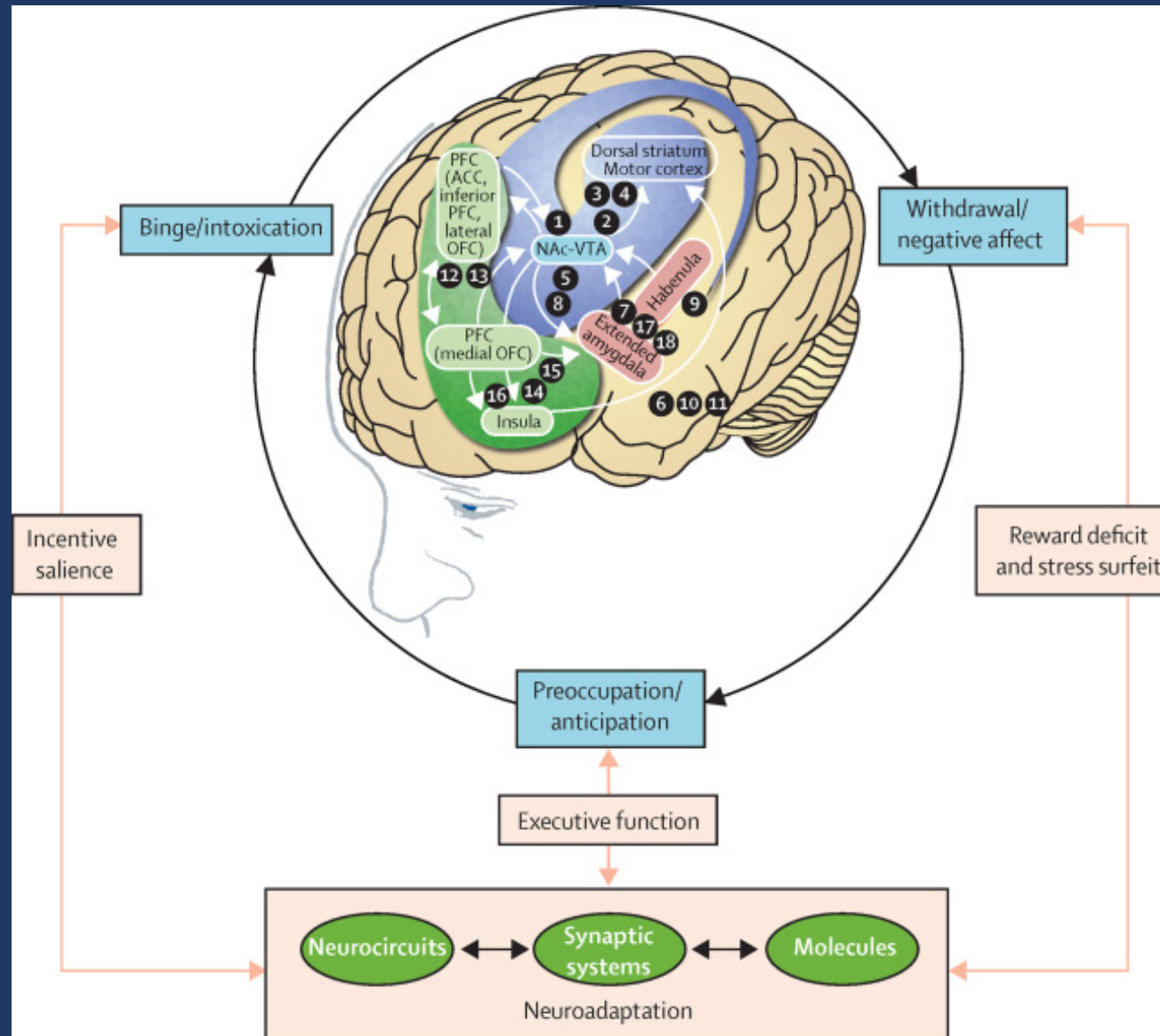


National Institute on Drug Abuse
National Institutes of Health

 @NIDAnews



Brain Circuits Involved in the Addiction Cycle



Koob and Volkow, Lancet Psychiatry 2016.

Addiction Involves *Multiple Factors*

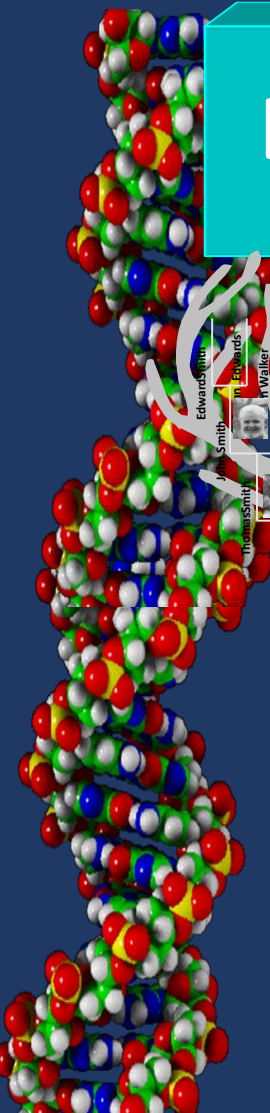
Biology/Genes

Environment

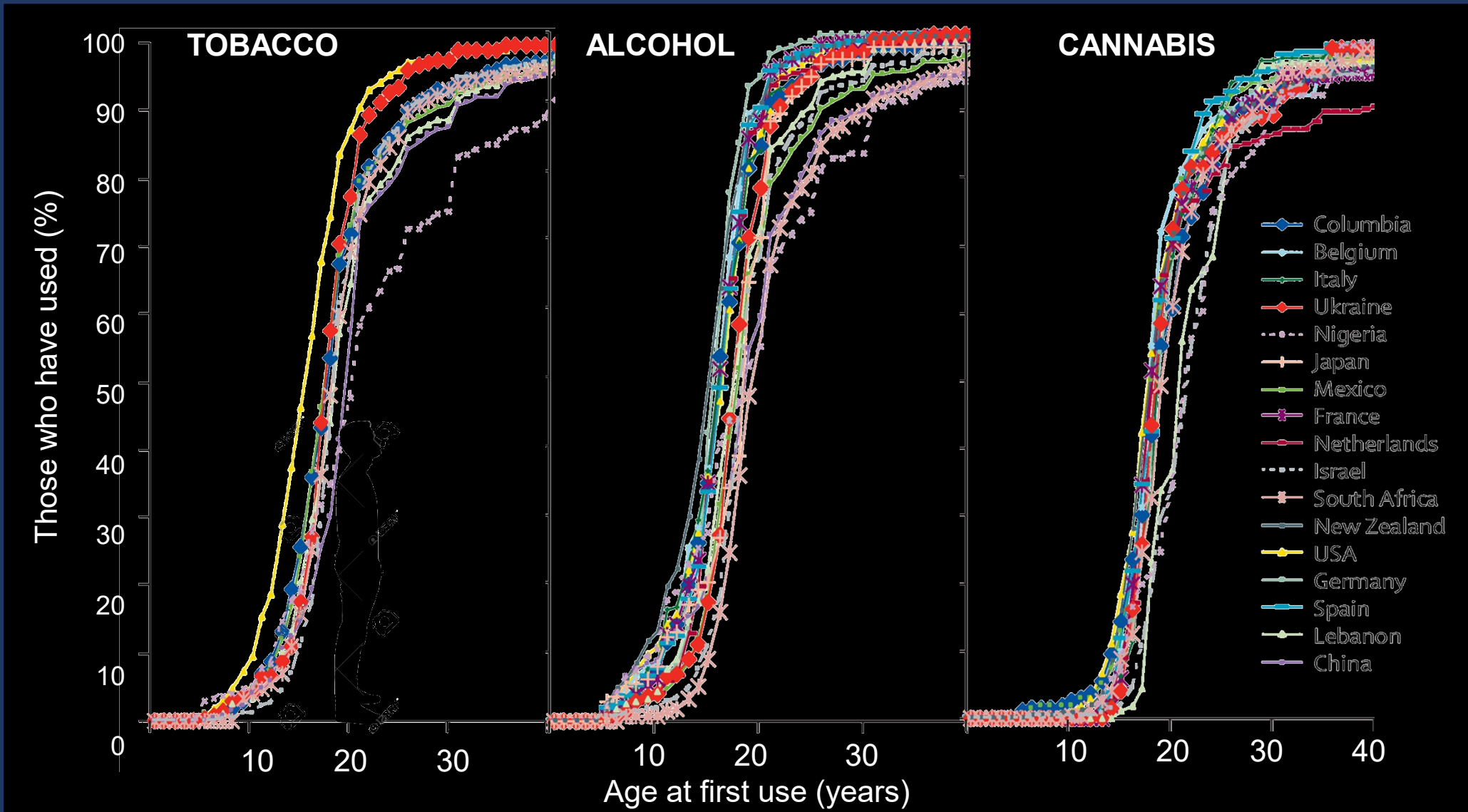
DRUG

Brain Mechanisms

Addiction

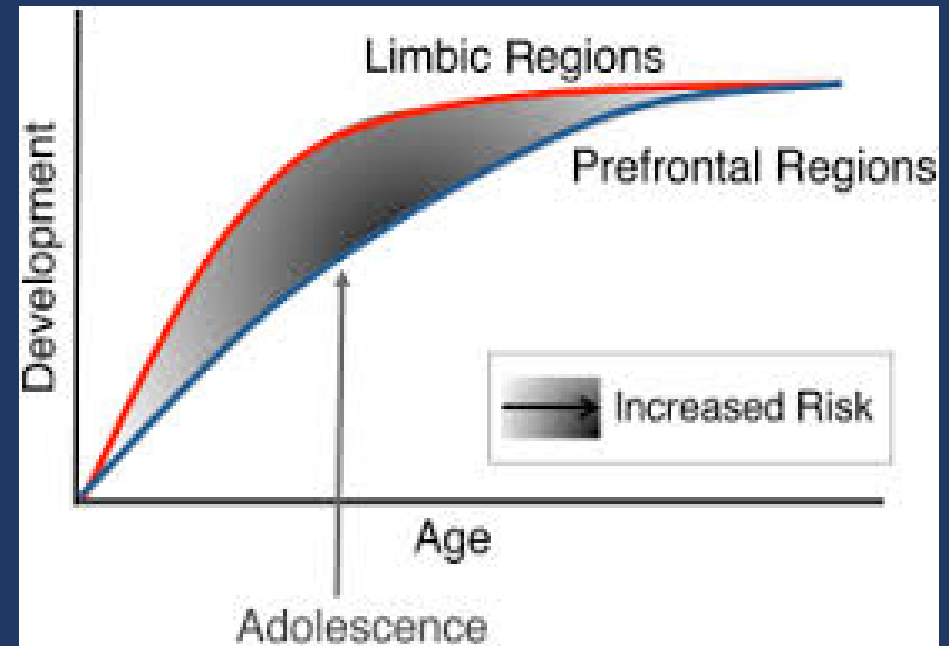
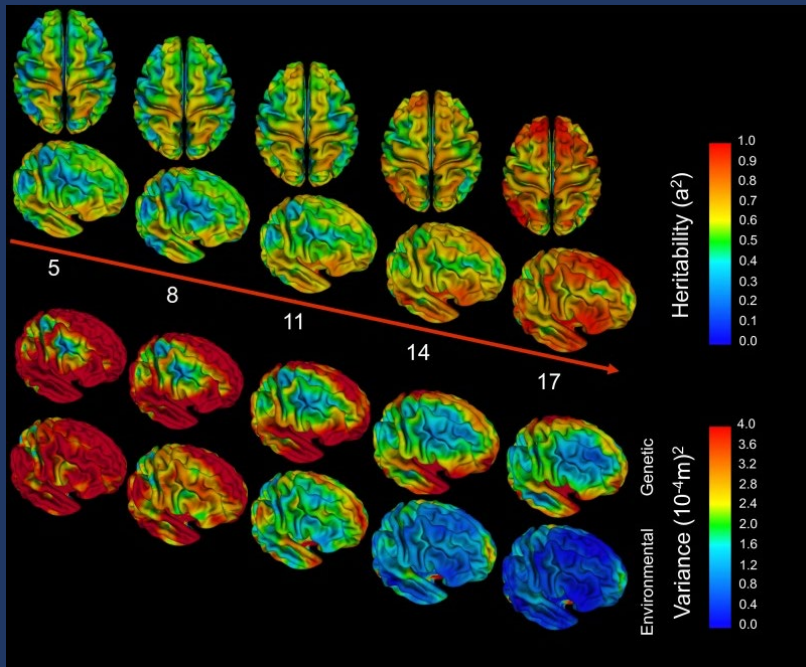


Adolescence is the *period of greater vulnerability* for drug use and addiction



Degenhardt, JAMA Psychiatry 2016.

Role Of **Genetics** On Brain Development



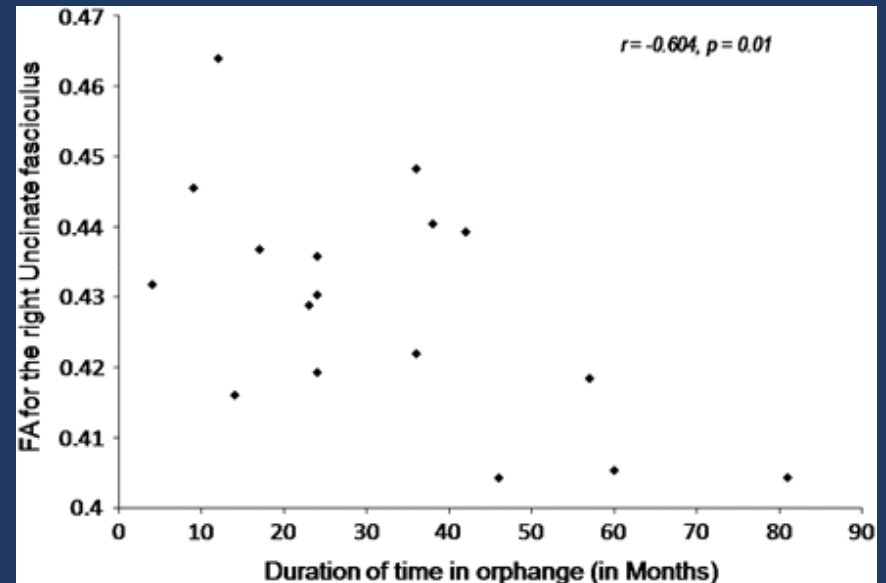
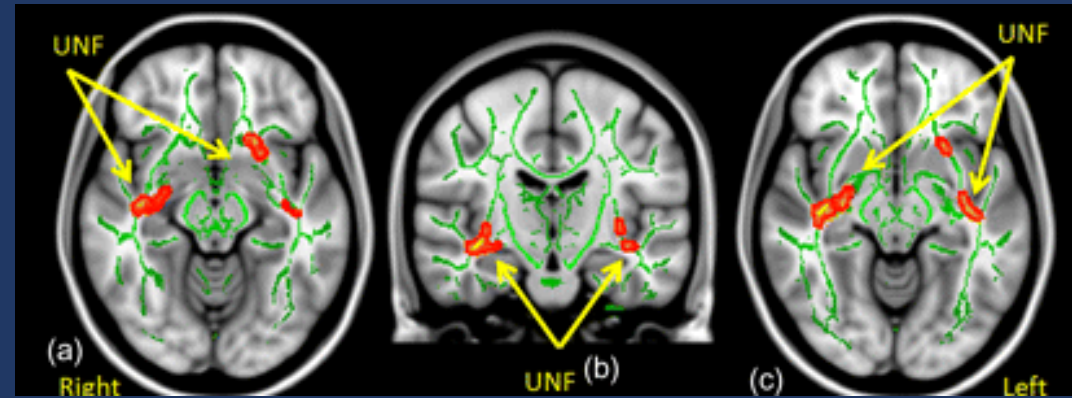
- Highest heritability in evolutionarily novel regions (temporal poles, inferior parietal lobes, and superior and dorsolateral frontal cortices)
- Heritability increased through late childhood and adolescence.

Social and Emotional Deprivation Increases Risk For SUD and Mental Illnesses



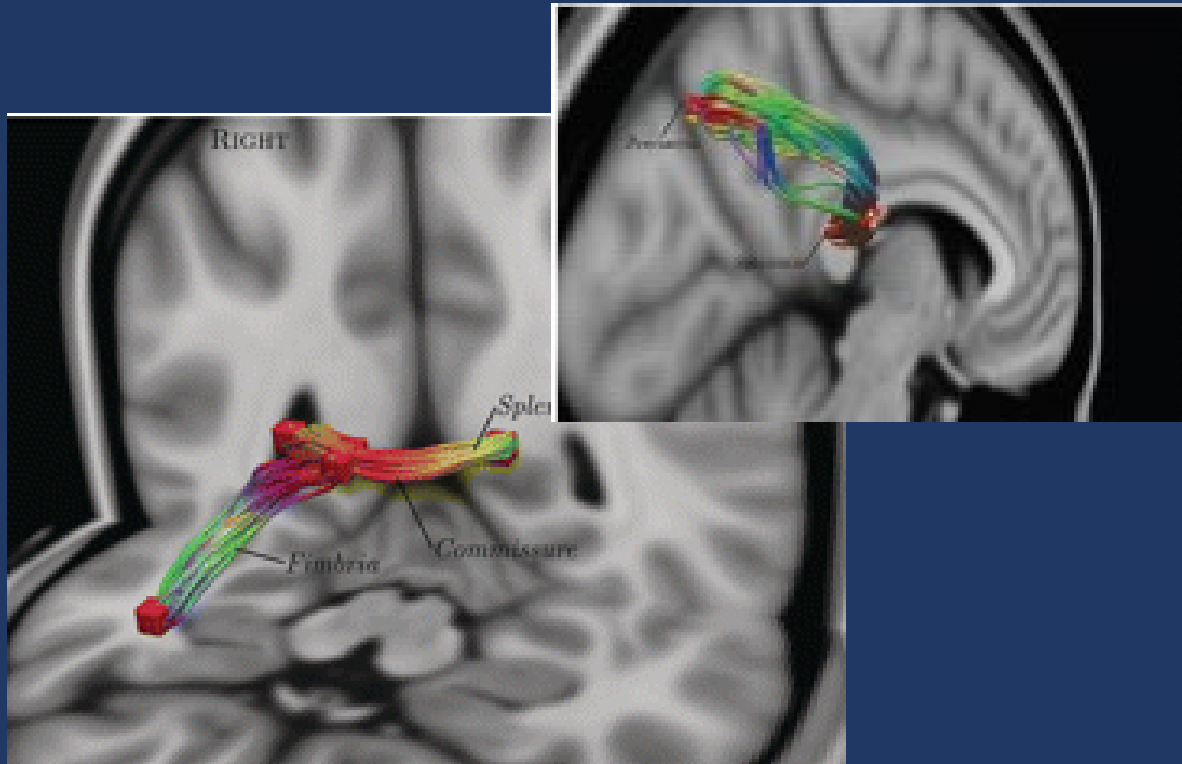
Decreases in connectivity were proportional to time in orphanage

Decreases in brain connectivity with social neglect in childhood



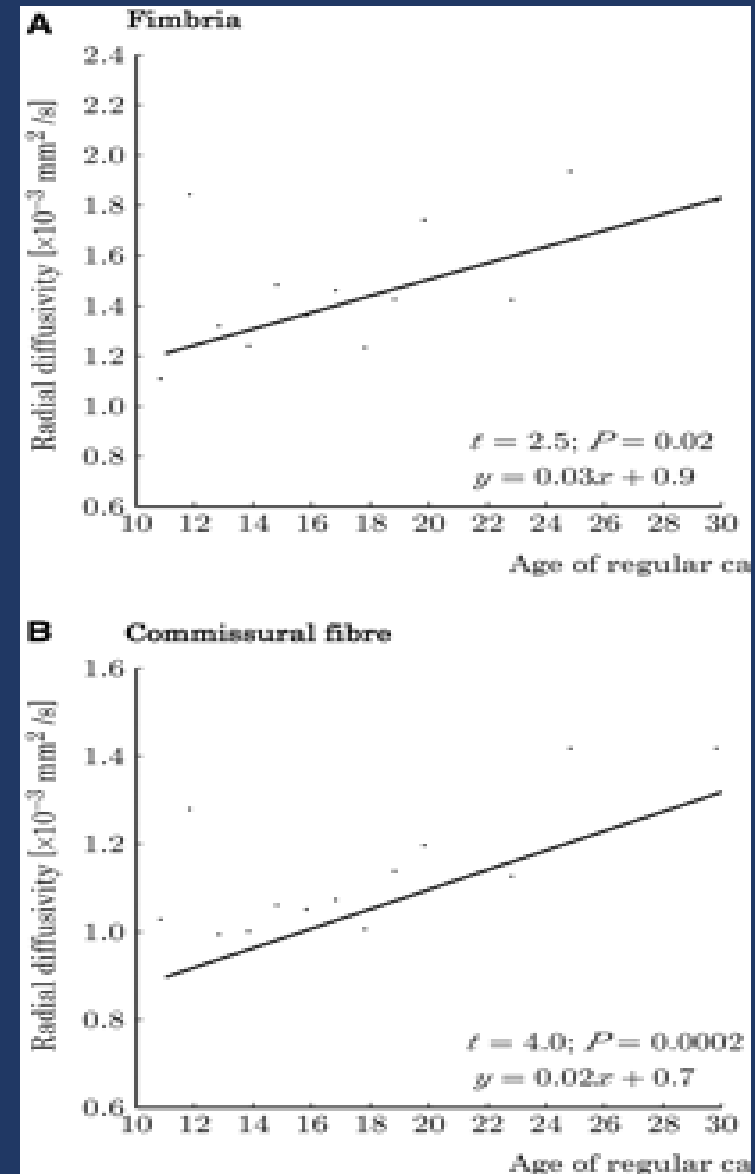
Early Drug Use Can *Modify Brain Development*

Early (<18y) Long-Term Cannabis Use Decreases Connectivity



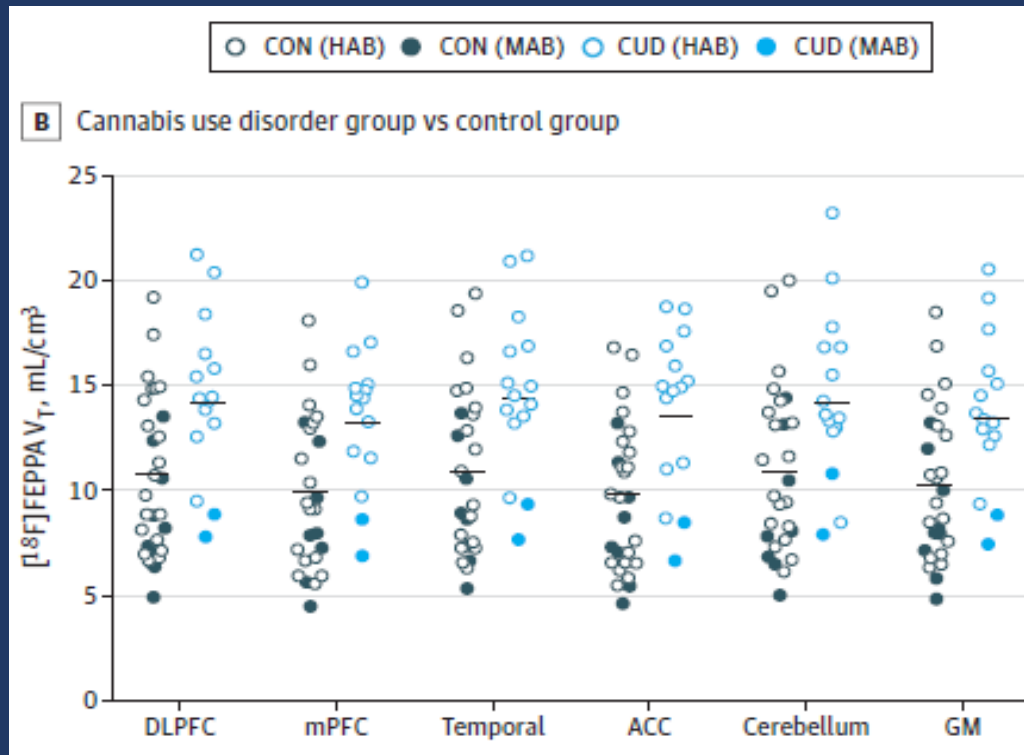
Reduced connectivity (measured with MRI) in cannabis users (n=59) compared to controls (N=33).

Zalesky et al Brain 2012.



Imaging of TSPO (Neuroinflammation Marker) in Long-term Cannabis Users

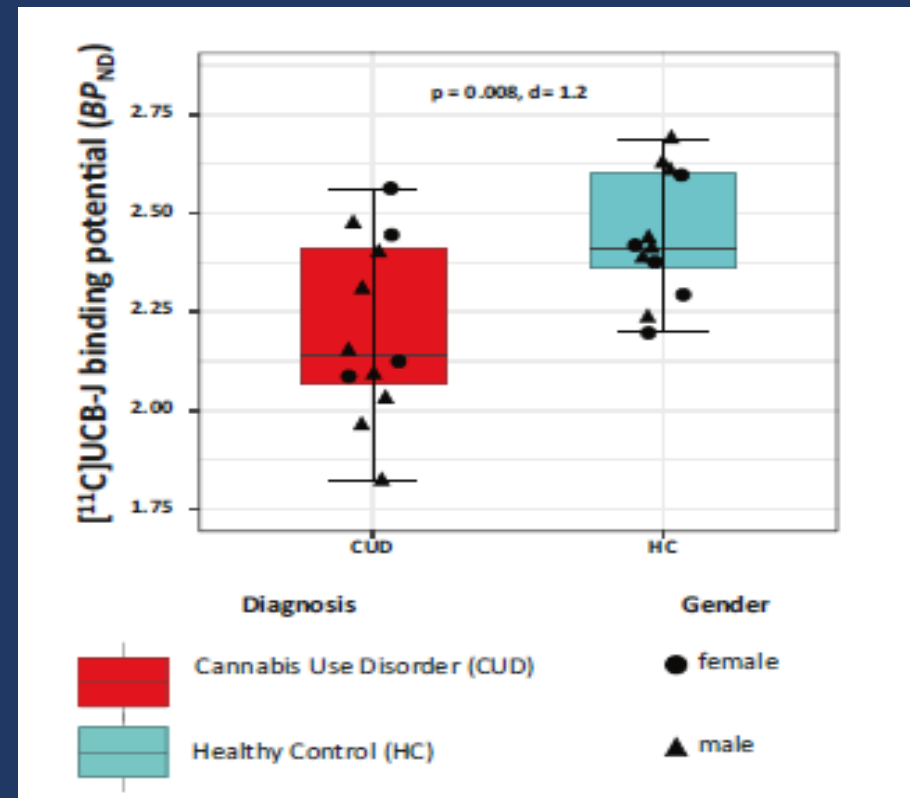
[18F]FEPPA Distribution Volume in
Cannabis Users



Da Silva T et al., *JAMA Psychiatry* 2019;
76(12):1306-1313.

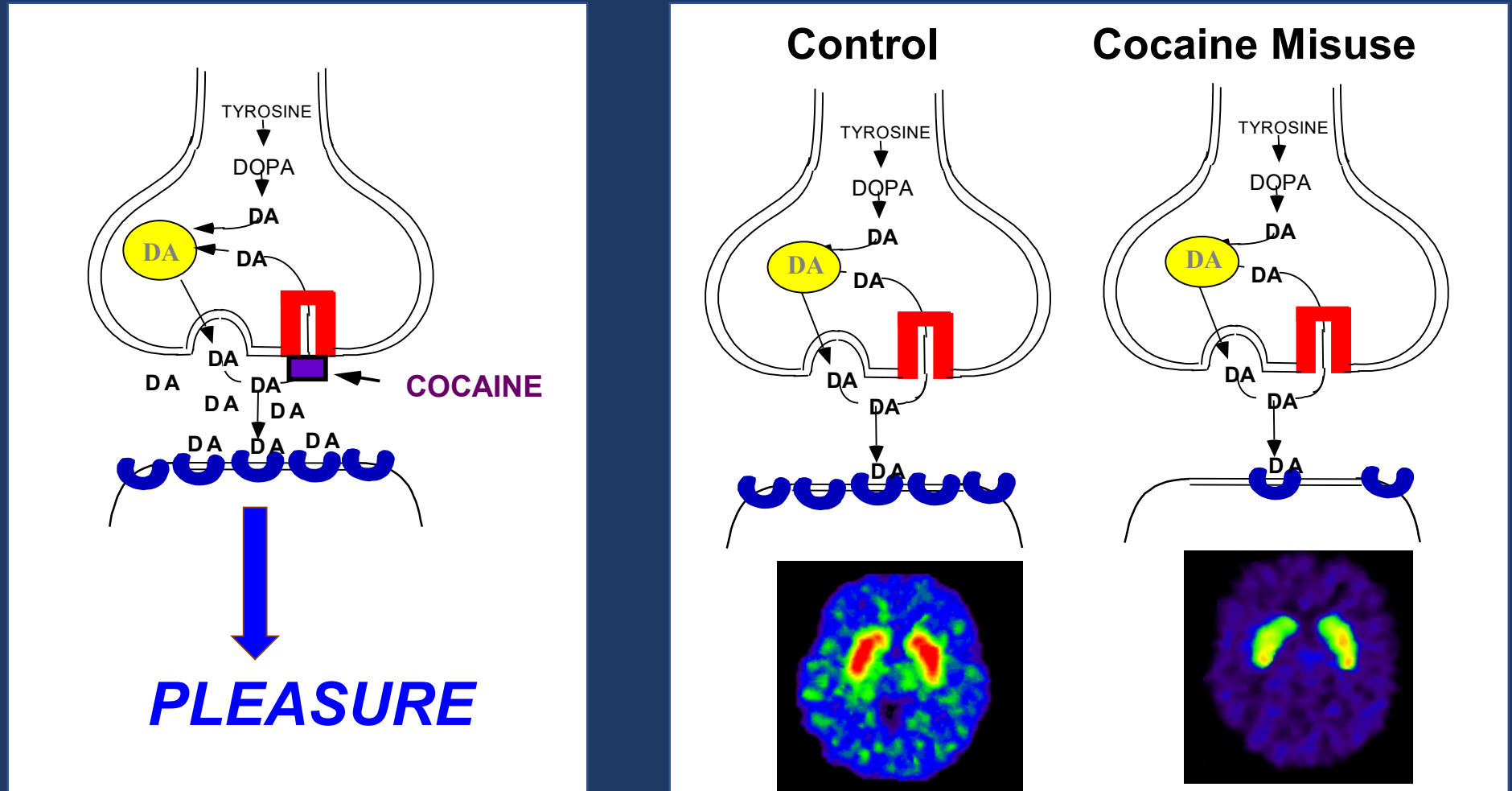
Lower Hippocampal Synaptic Density In Cannabis Use Disorder

[11C]UCB-J BPND in Cannabis
Use Disorder (CUD) and Healthy
Controls (HC)



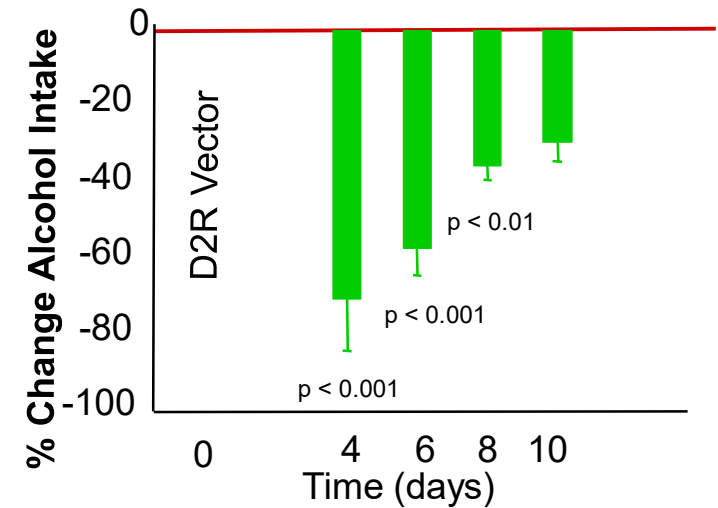
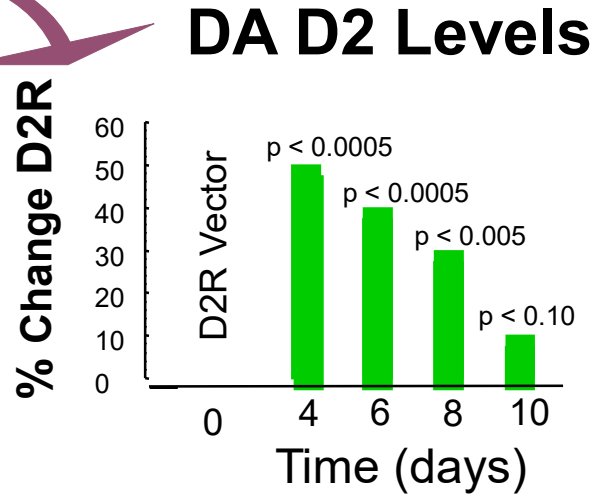
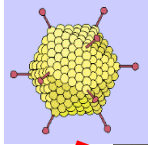
D'Souza, CD et al., *Molecular Psychiatry*,
online September 24 2020.

Repeated Drug Use *Modifies Brain Chemistry & Function*

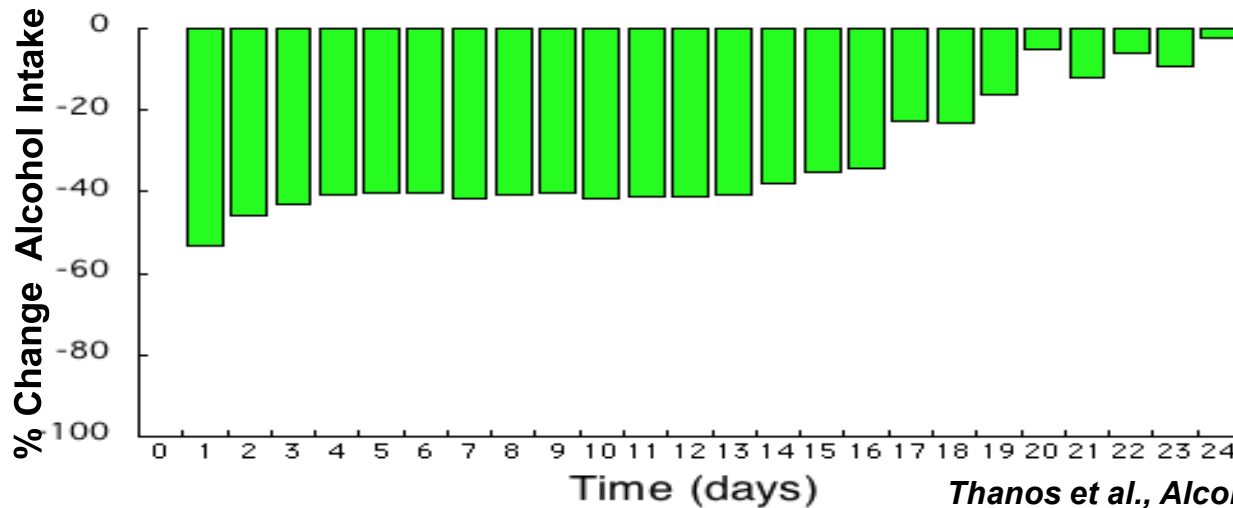


*Acutely, Drugs Increase Dopamine but
Repeated Use Decreases it*

Dopamine Receptor Over-Expression in Alcohol-Preferring Rats



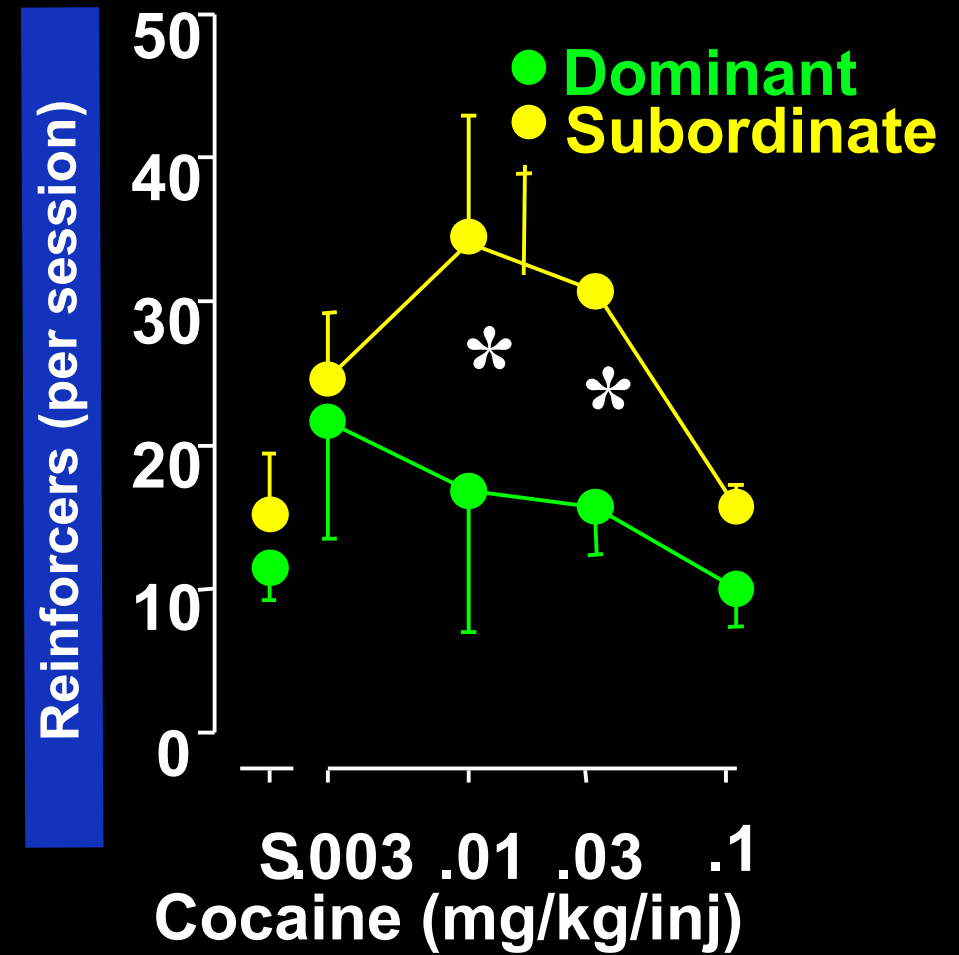
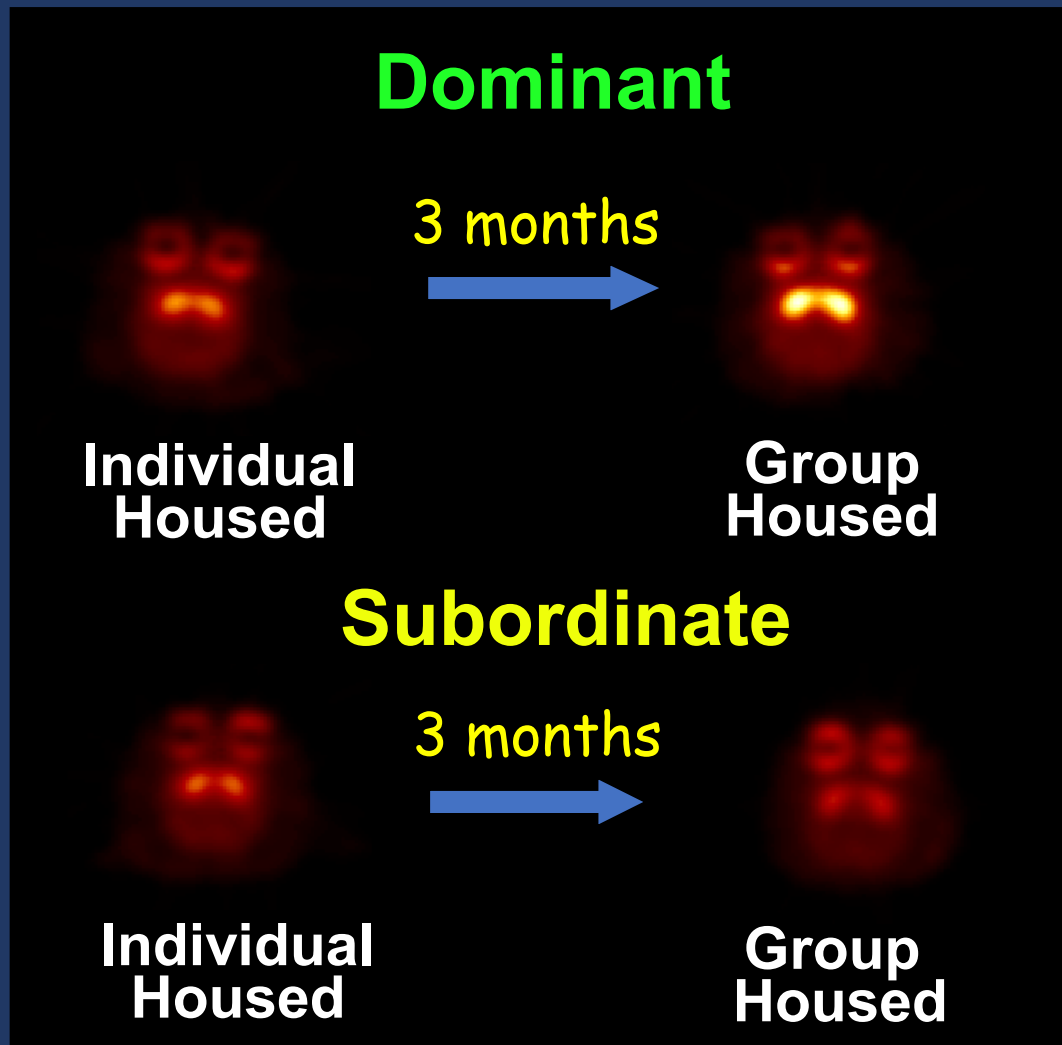
Thanos, PK et al., J Neurochem, 2001.



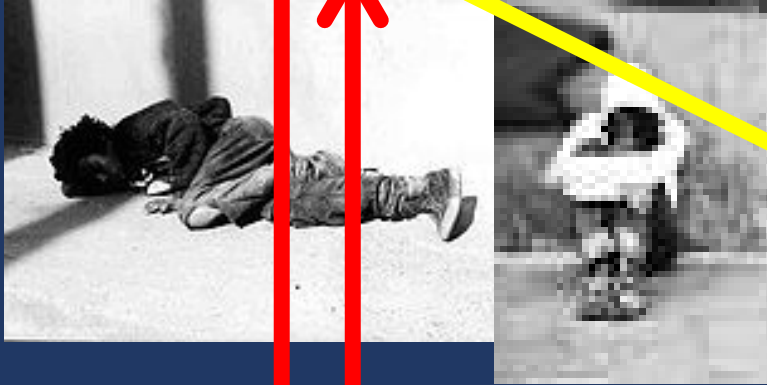
Thanos et al., Alcohol Clin Exp Res. 2004.

Over-expression of D2 receptors in rats markedly reduces alcohol intake

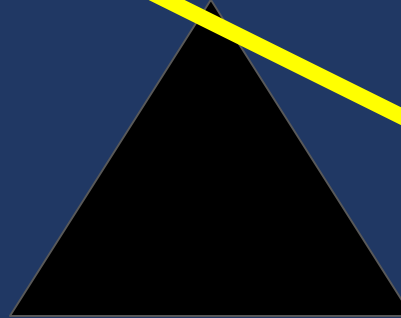
Social Rank & Vulnerability to Drug Use



RISK



Early Aggressive Behavior
Poor Social Skills
Lack of Parental Supervision
Substance Use
Drug Availability
Poverty



Individual
Family
Peer
School
Community

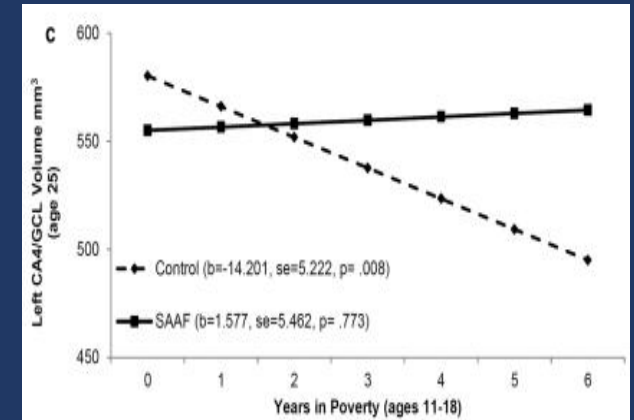
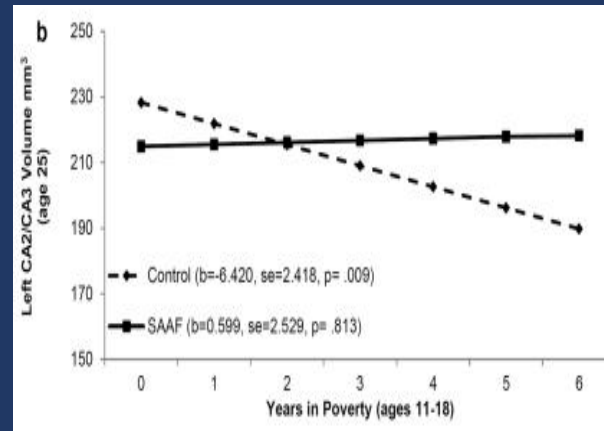
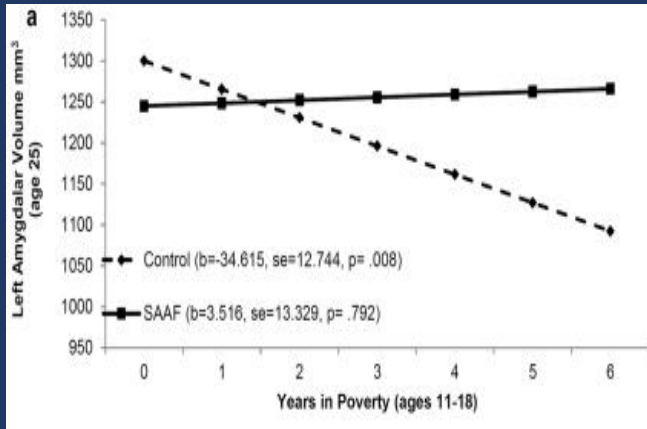
PROTECTION



Self Control
Parental Monitoring & Support
Positive Relationships
Academic Competence
Anti-Drug Use Policies
Strong Neighborhood

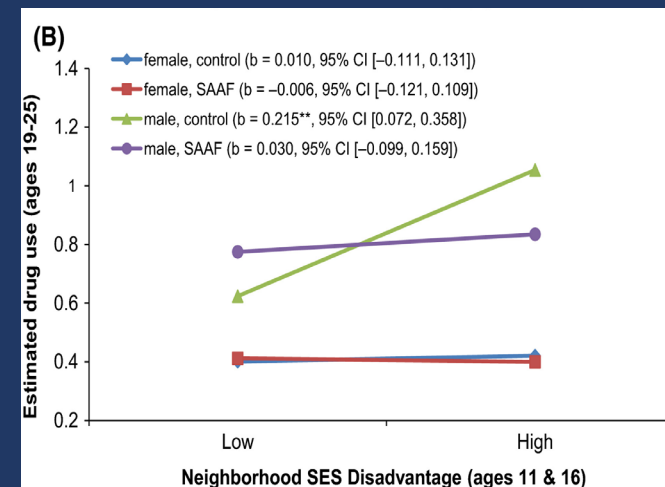
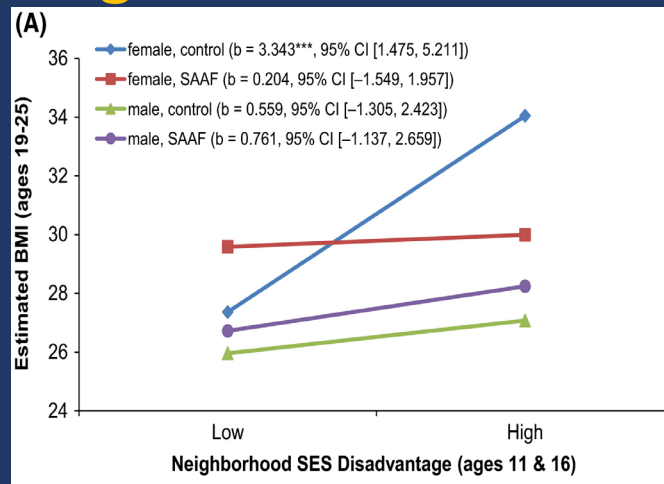
Protective Effects of a Supportive Parenting Intervention (SAAF n=59) on Poverty's Effects on Brain Development (Control n=57)

Strong African American Families (SAAF)



Brody GH et al. *JAMA Pediatr.* 2017;171(1):46-52.

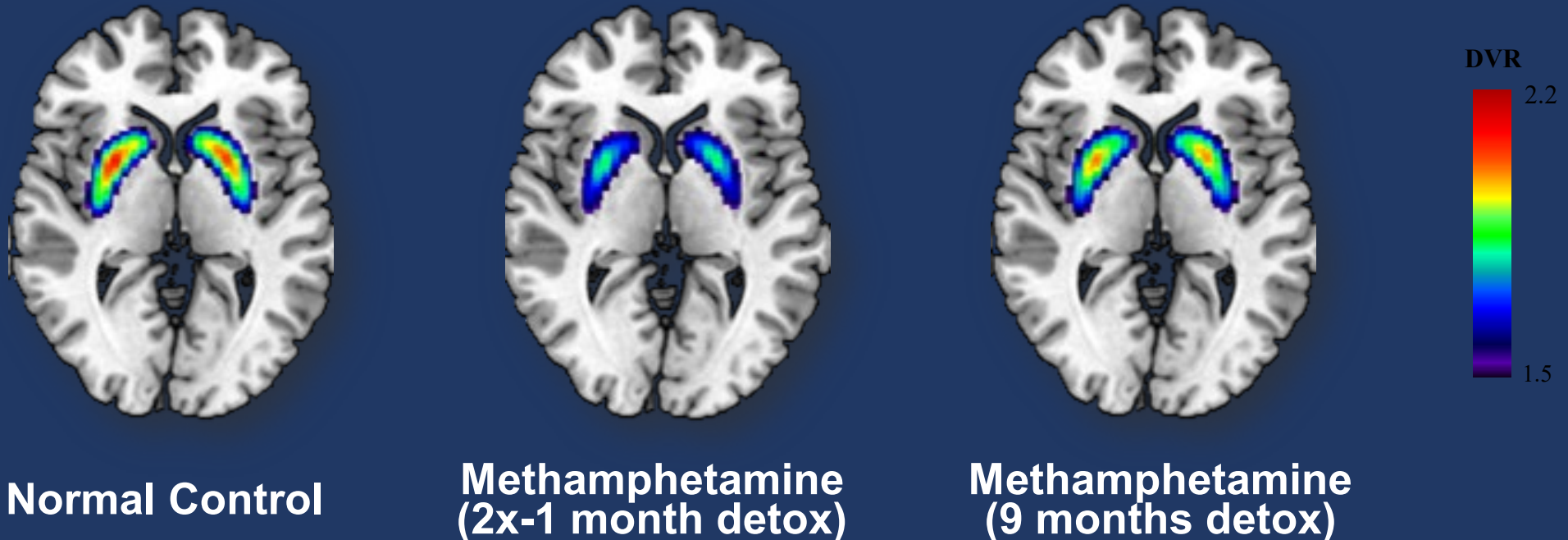
Preventive Parenting Intervention (SAAF n=290) During Childhood and Young Black Adults' Unhealthy Behaviors (Control n=219)



Brody GH et al., *J Child Psychology Psychiatry.* 2019 60(1):63-71.

Drug Use Can be *Treated*

Recovery of Brain Dopamine Transporters After Protracted Abstinence following Methamphetamine Misuse



Intersection Between Opioid Crisis and COVID-19



Overdoses Grew Dramatically During COVID Pandemic

Overdoses increased up to 42% per month during the pandemic, as compared to the same months in 2019.

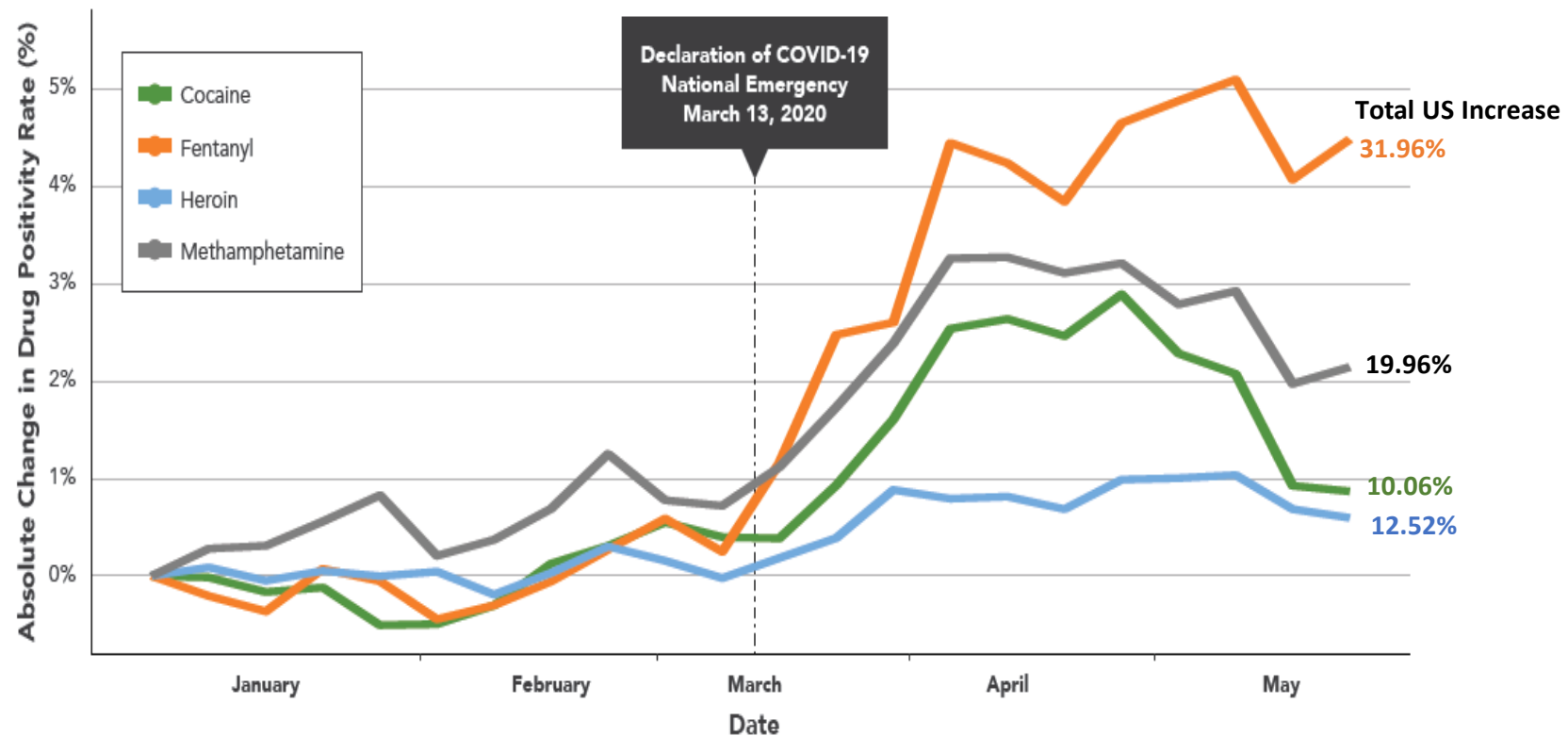


Note: Percent growth references the 1,201 agencies reporting to ODMAP by January

Source:  **ODMAP**
OVERDOSE DETECTION
MAPPING APPLICATION PROGRAM

ALYSSA FOWERS/THE WASHINGTON POST

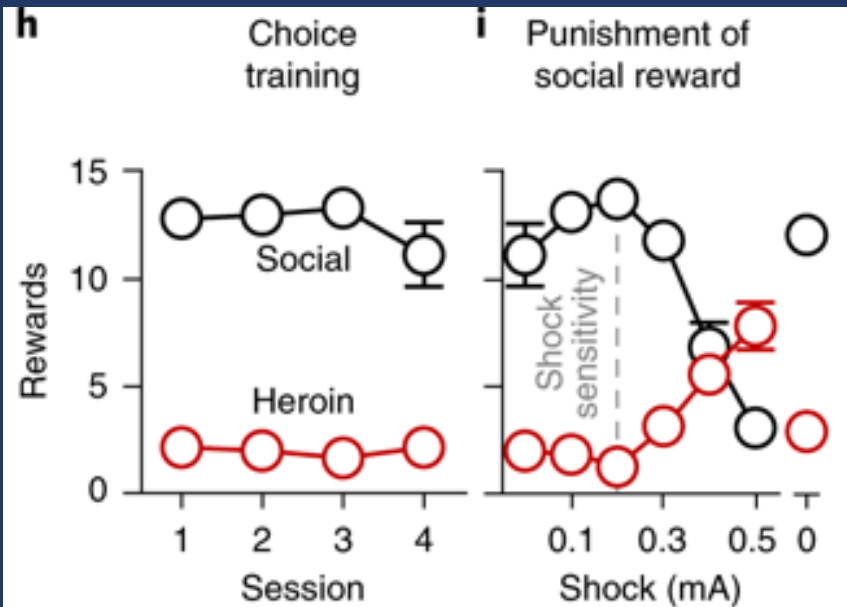
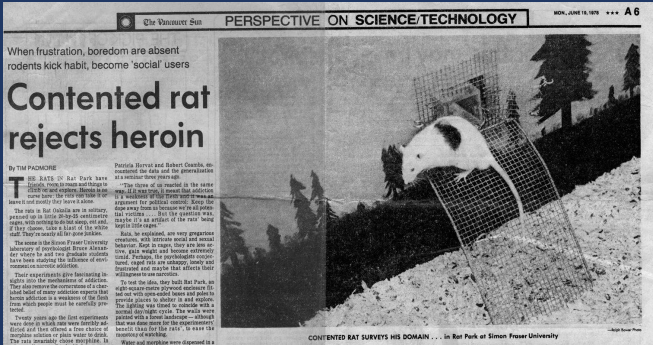
Drug Use Increase During COVID



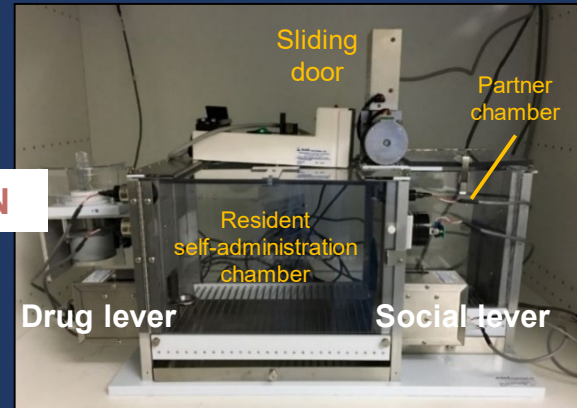
Millennium Health Signals Report™ COVID-19 Special Edition:
Significant Changes in Drug Use During the Pandemic Volume 2.1 Published July 2020

Total Study Population Change in Unadjusted Positivity Rate for Cocaine, Fentanyl, Heroin and Methamphetamine

Social Interaction Favored over Heroin Unless Social Interaction is Punished



HEROIN



Veniro et al., Nature Neuroscience 2018

