What is Substance Use & Addiction?

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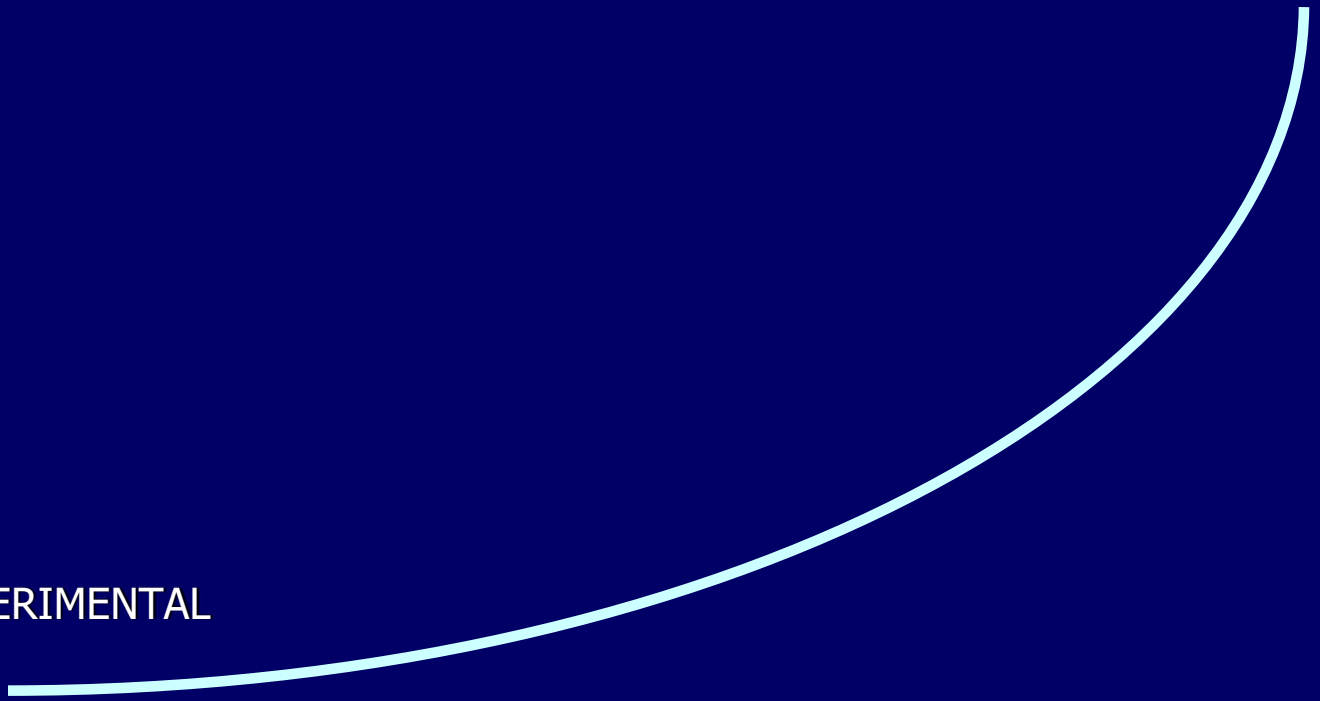
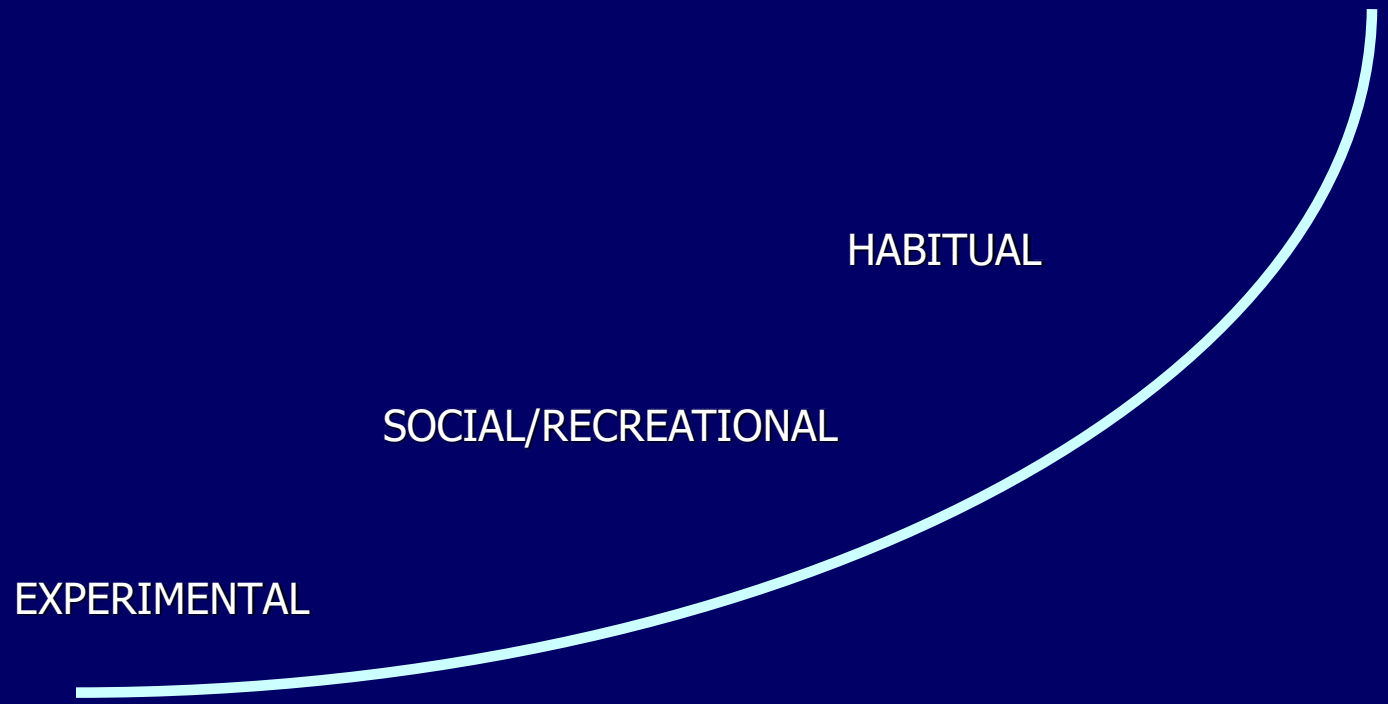
1. Stages of Using
2. What is Addiction
3. How fast Someone gets Addicted
4. What causes Addiction
5. Why there is Addiction

Continuum of Use & Addiction



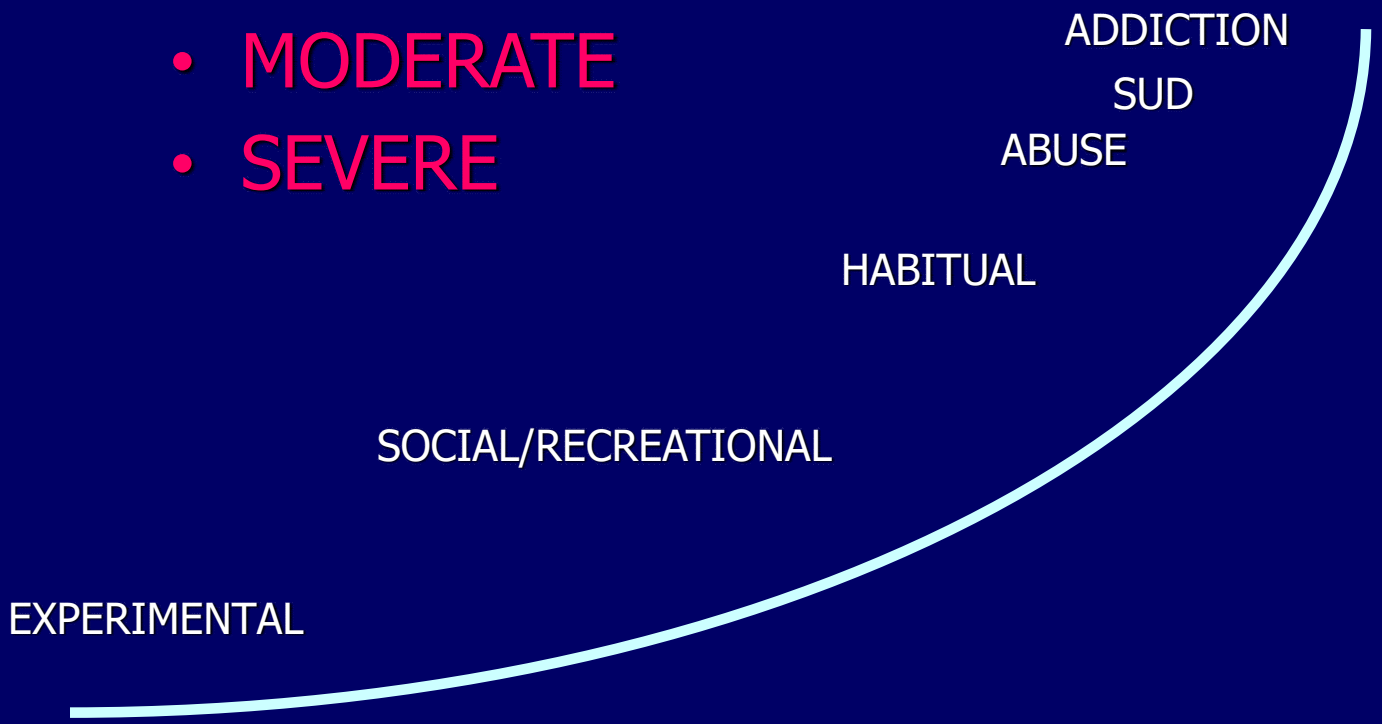
Continuum of Use & Addiction

Continuum of Use & Addiction



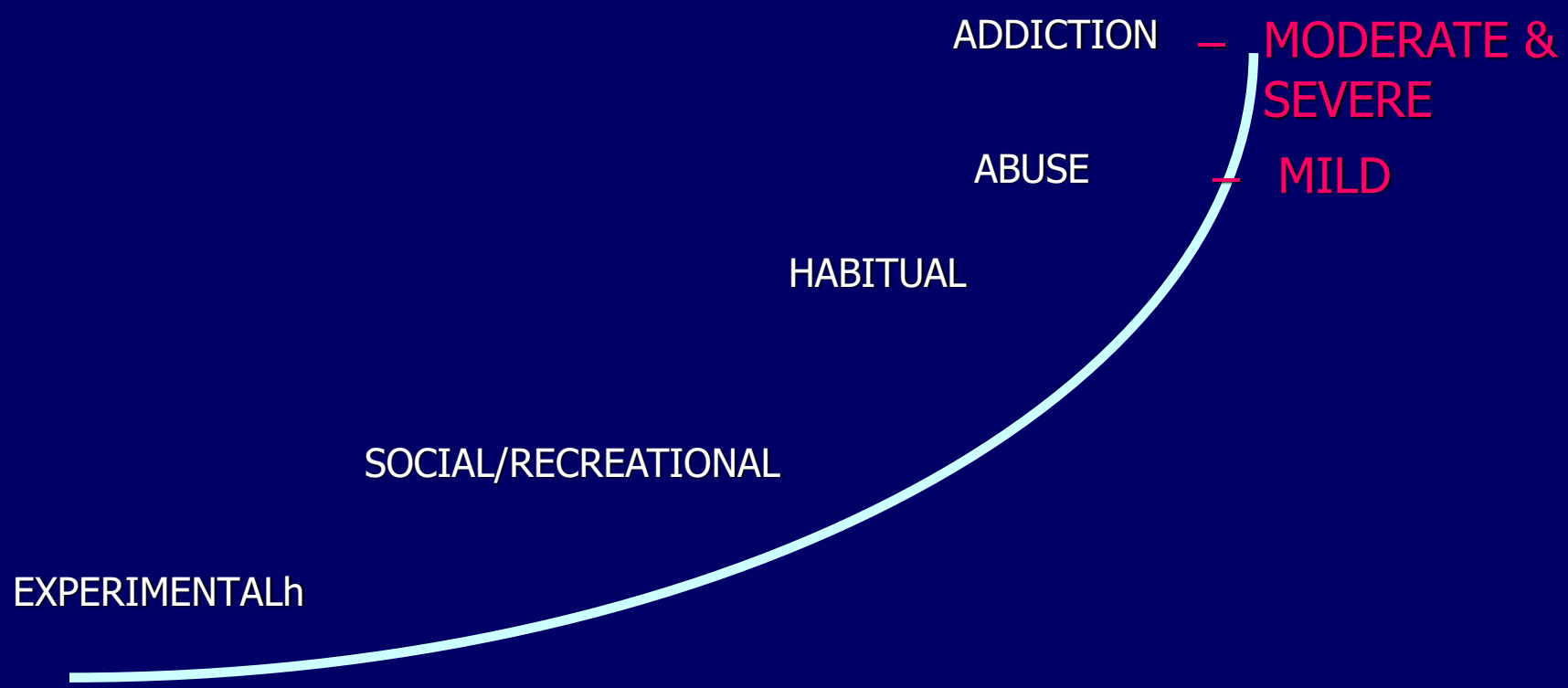
Continuum of Use & Addiction

- MILD
- MODERATE
- SEVERE



Substance Use Disorder

Continuum of Use & Addiction



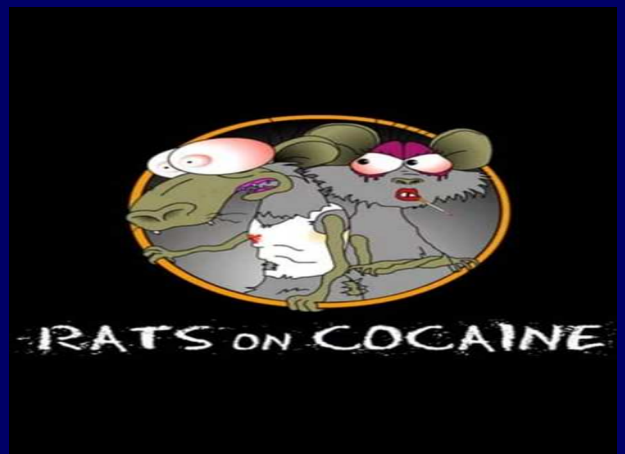
SUD - Mild

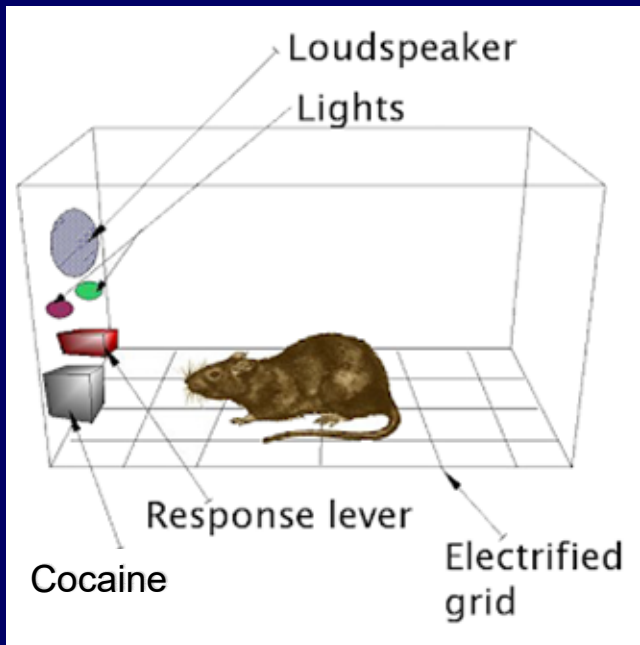
Substance Abuse

Continuing to use alcohol or other drugs despite

Problems!!

10% - abuse/addicted

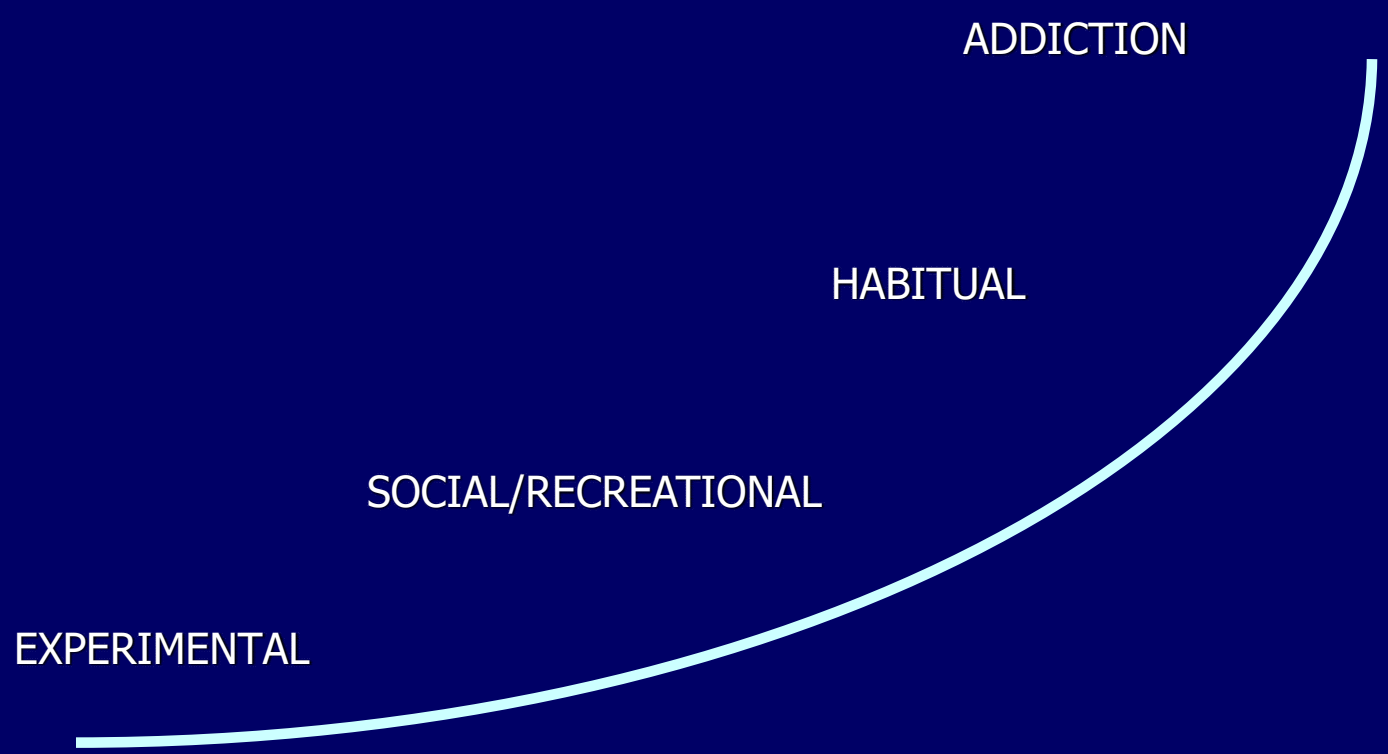




Addiction

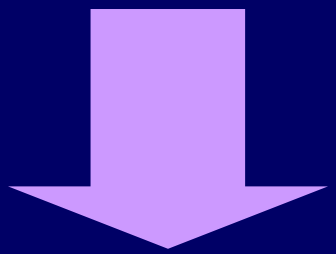
2. Problems with control.

Continuum of Use & Addiction



Addiction

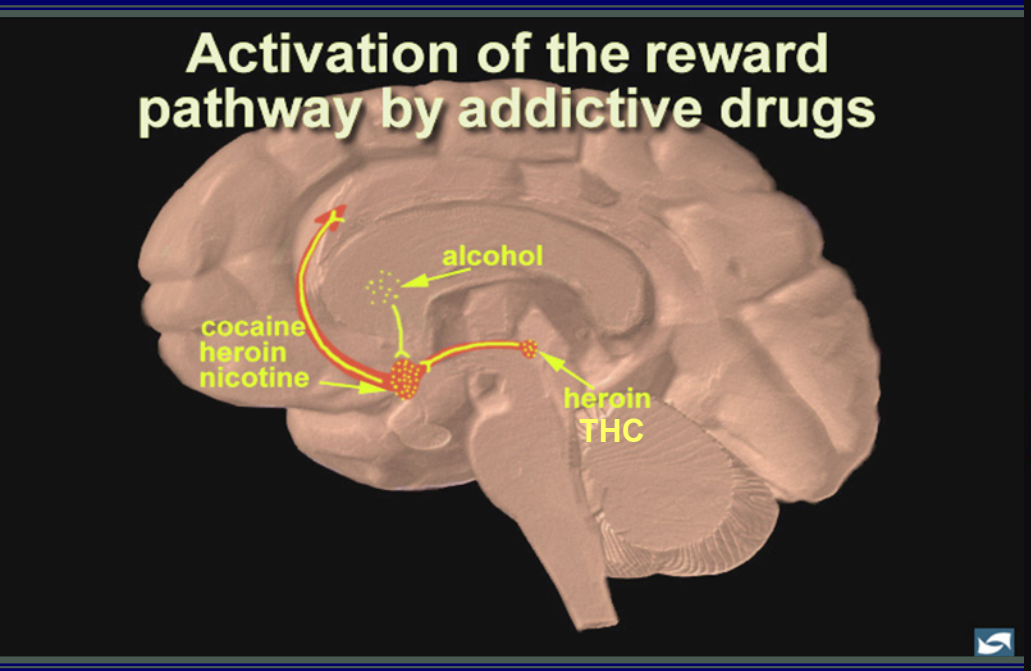
2. Problems with control.

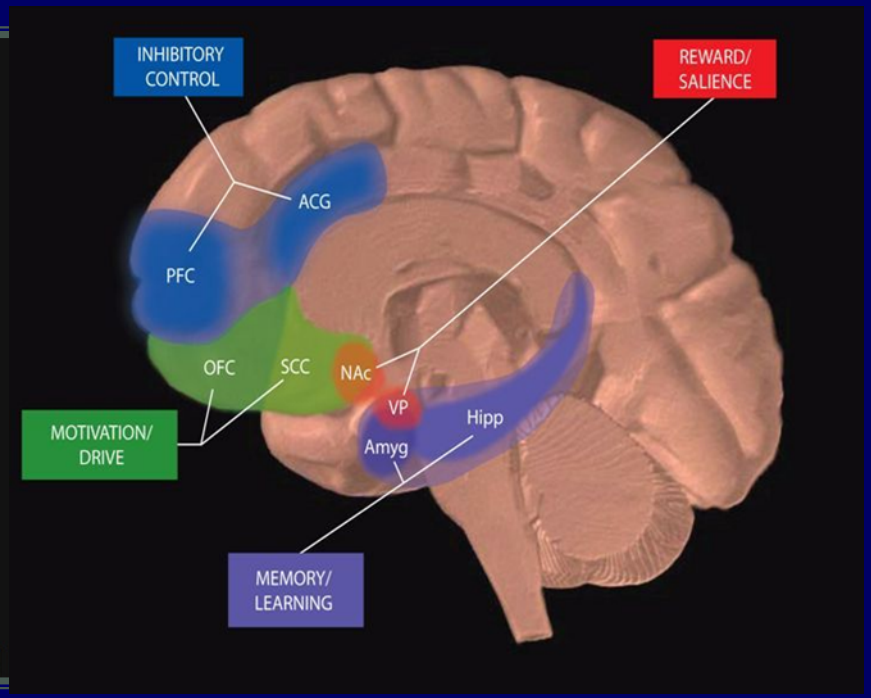


Loss of Control

Addiction

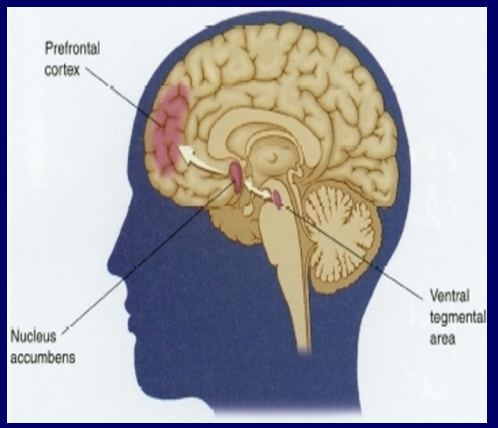
3. Preoccupation with drugs and alcohol Hijacks the Brain





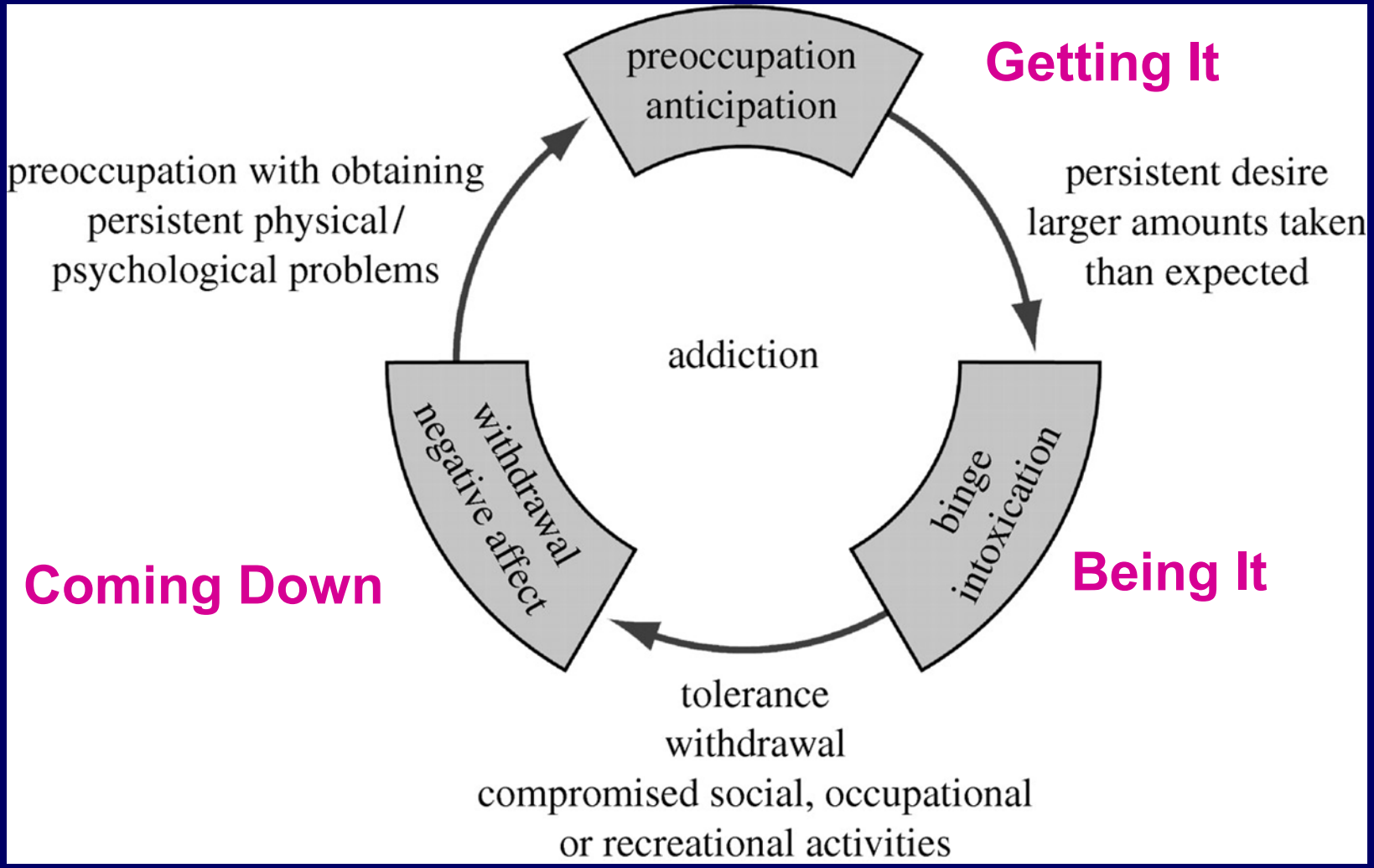
Addiction

3. Preoccupation with drugs and alcohol



Obsession & Compulsion

Getting It, Being It and Coming Down



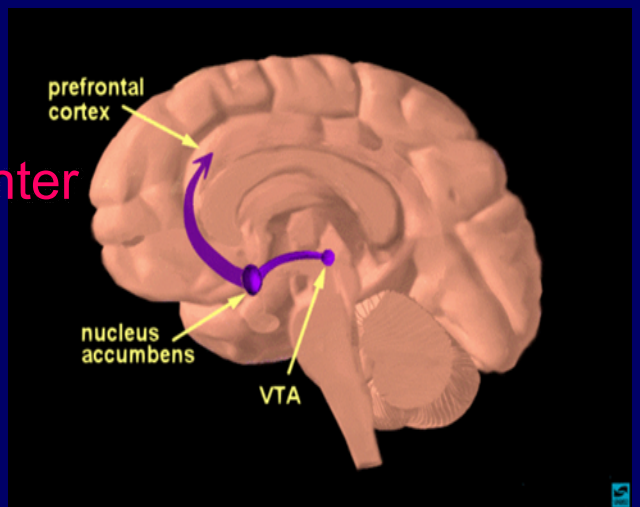
Koob G F , and Le Moal M Phil. Trans. R. Soc. B 2008;363:3113-3123

Reward, Pleasure, Pain & Addiction

Three C's...

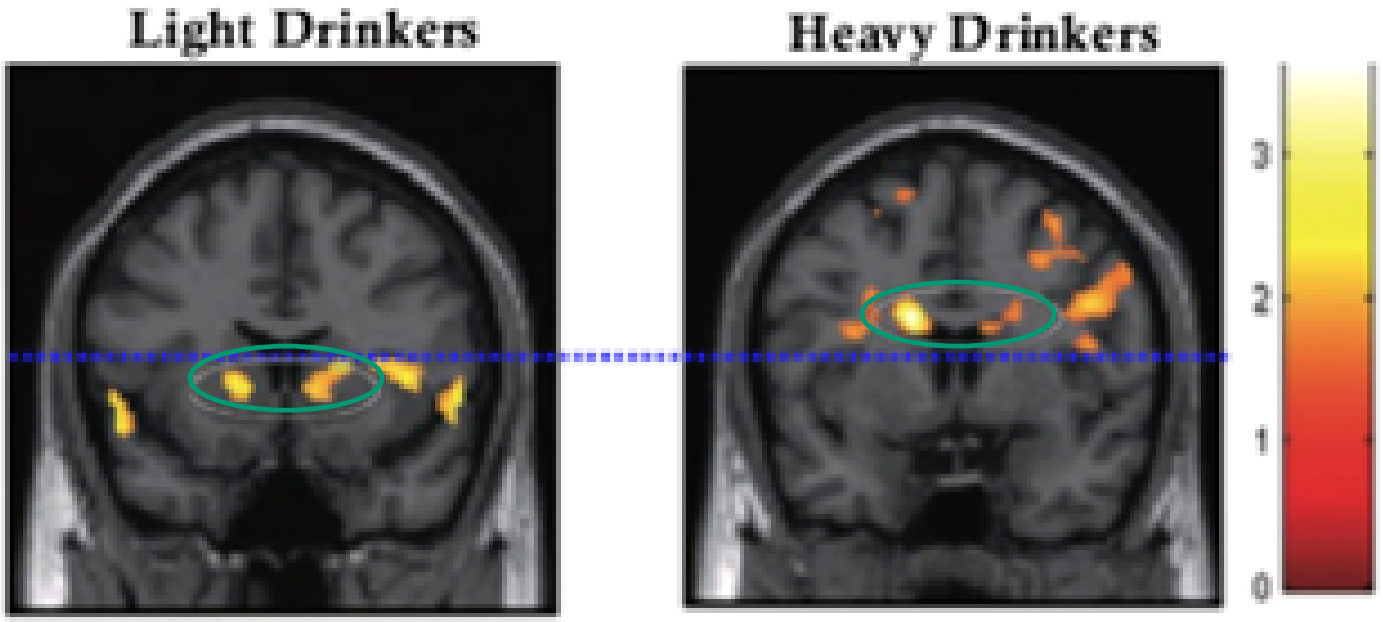
- Despite *C*onsequences/Problems
- Problems with *C*ontrol
- *C*ompulsion/Preoccupation

Pleasure Center



Striatum Activity in Heavy Drinkers

- fMRI scan of light and heavy drinkers looking at alcohol



- Light drinkers showed increased activity in nucleus accumbens
- Heavy drinkers showed increased activity in dorsal striatum

Vollstädt-Klein 2010

4th Hallmark of Addiction:

Cognitive Distortions

Thinking Problems

Most Notably:

D

DENIAL

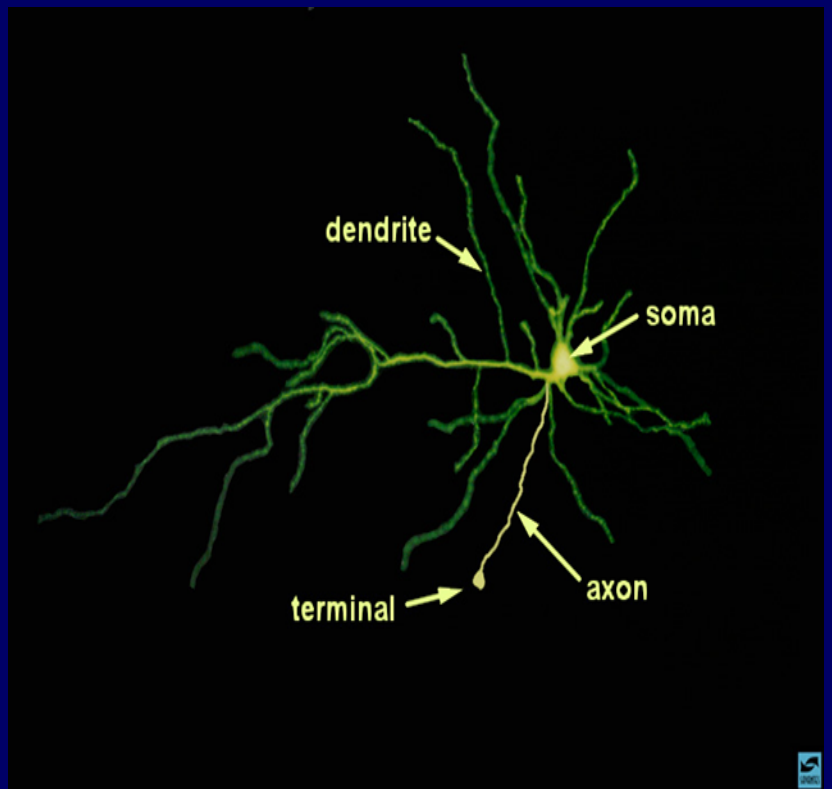
2 Levels of Denial:

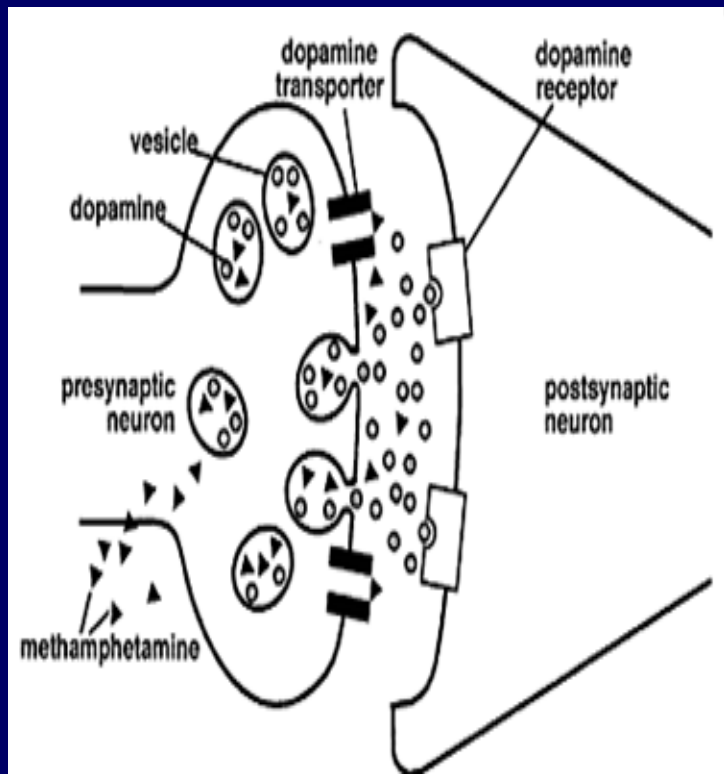
1. Neurological
   &
2. Psychological

Neurological Denial

- One reason we use:
  - To shut down our brain.
- Use a lot over time this becomes:
  - Brain atrophy

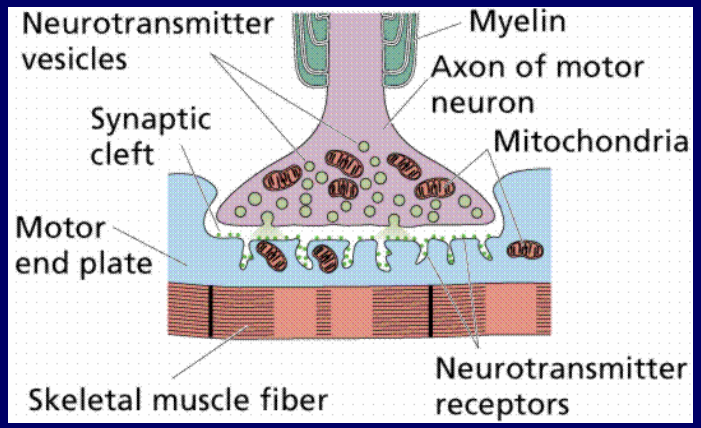
Drugs copy natural brain chemicals.





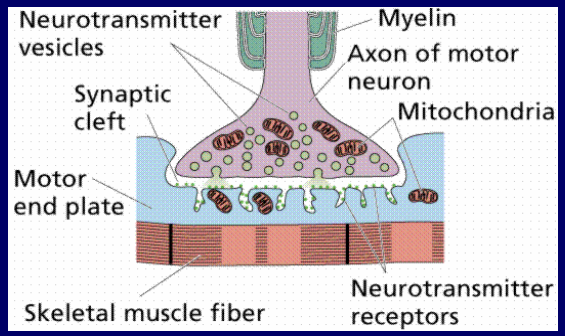
The Downside:

- For every action there is an equal and opposite reaction.



The Downside:

- We're not built to feel - That good,
- That easily,
- That often!
  - What goes up, must come down . . .

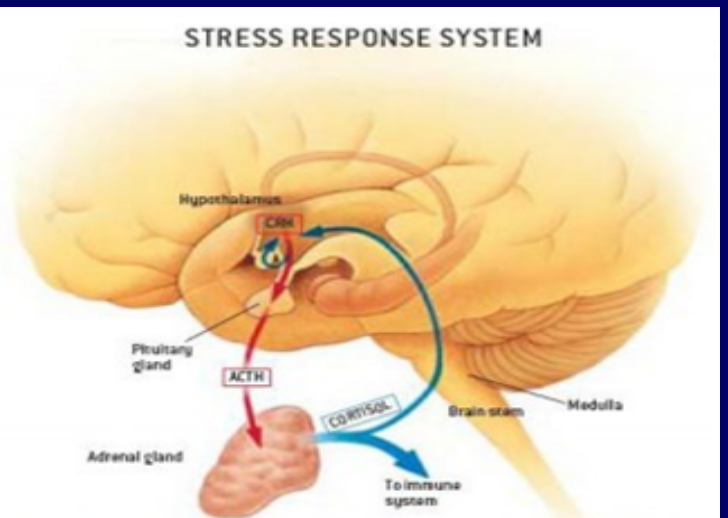


The Dark Side

The Dark Side

The Brain's Anti-Reward System

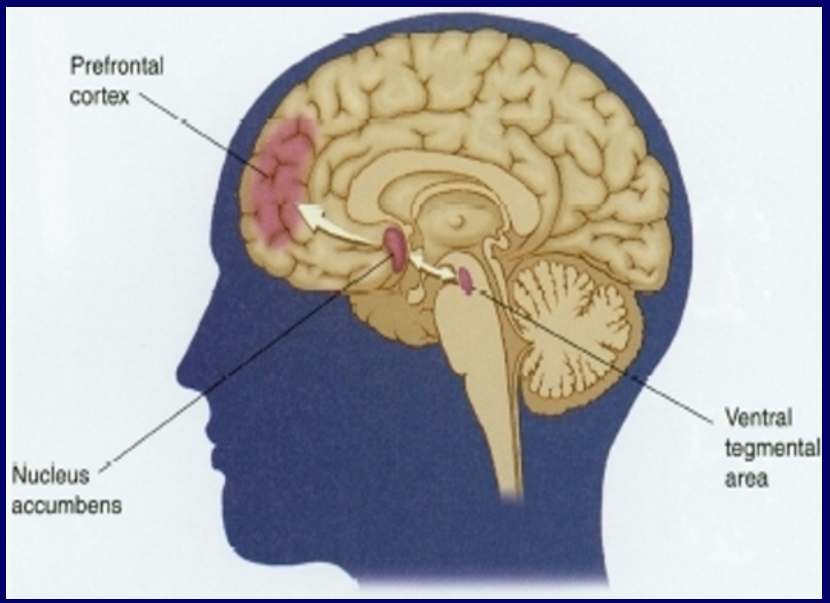
Increased Stress due to increased HPA axis functioning
And Decreased dopamine production from BDNF



NATURE NEUROSCIENCE, VOL. 8 NUMBER 11 , 11/05 *The Journal of Neuroscience* (Impact Factor: 6.91). 06/2014; 34(23):7899-7909. DOI: 10.1523/JNEUROSCI.3776-13.2014
Vargas-Perez, Hector, et al. "BDNF Signaling in the VTA Links the Drug-Dependent State to Drug Withdrawal Aversions." *The Journal of Neuroscience* 34.23 (2014): 7899-7909.

The Downside: For every action there is an = and opposite reaction.

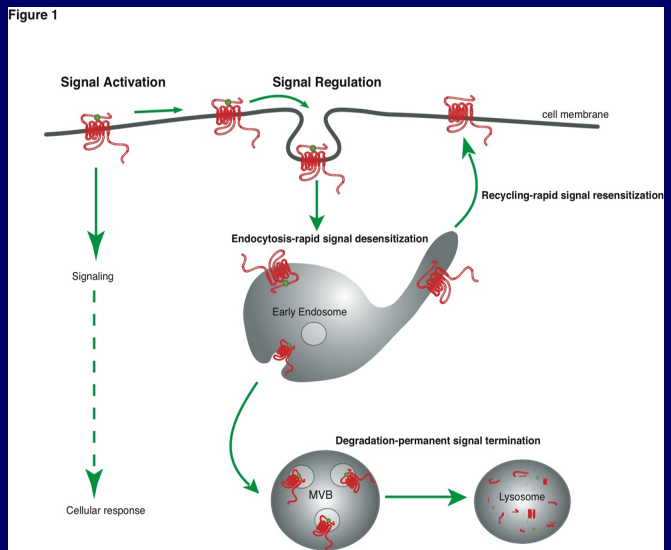
- Decreased Reward Functioning
  - To Drugs & Natural Rewards
- The Desire, the Craving Is Still There: "Feed me!" "I need to get high!"

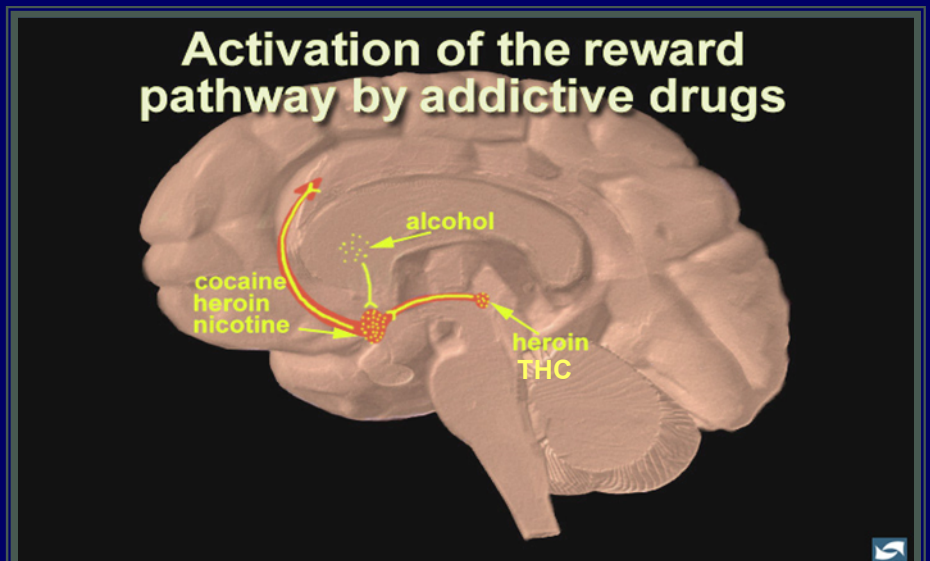


The Downside: For every action there is an = and opposite reaction.

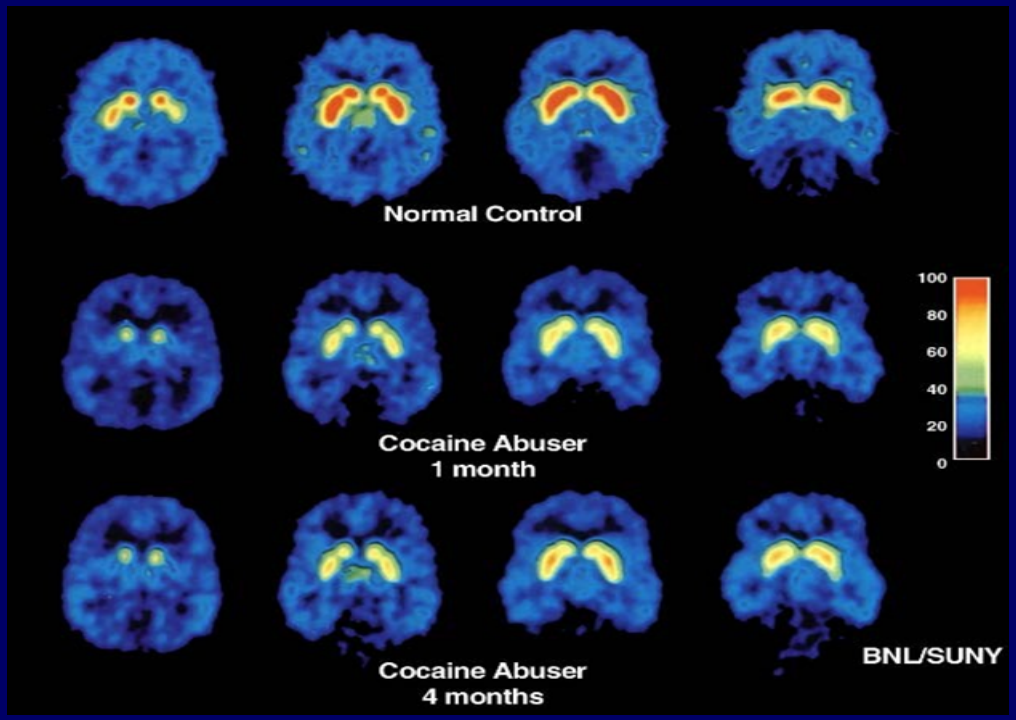
- **The Development of Tolerance:**

- **Receptor Site Down-Regulation**
- **Dopamine Deficiency Syndrome [& specific NT Deficiency Drug Activates]**





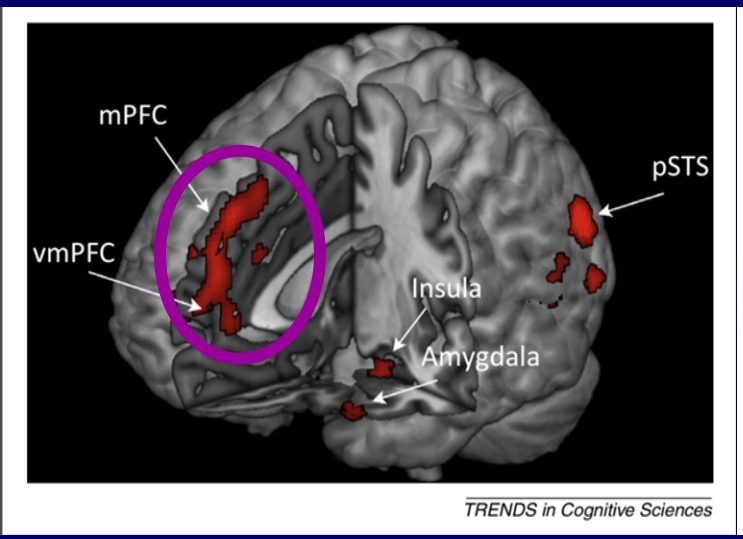
Tolerance = Less D2 Dopamine Receptors

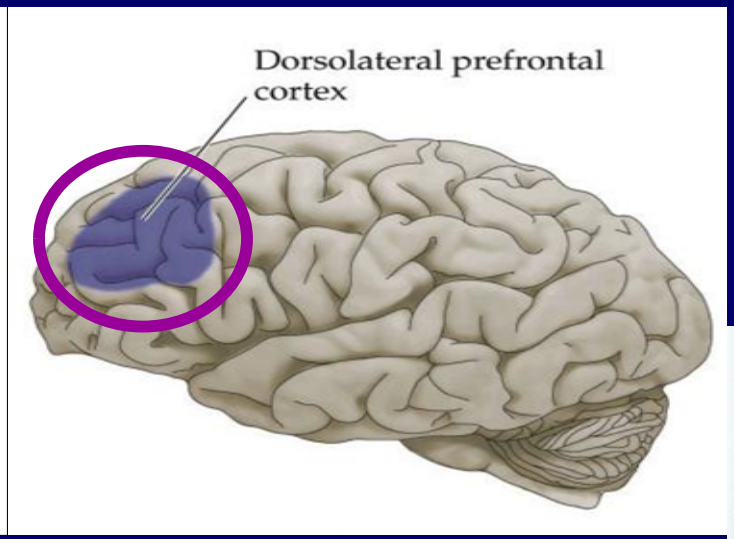


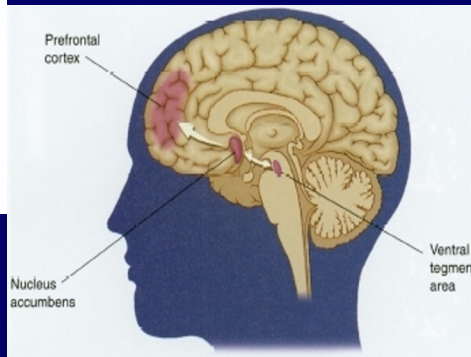
- Due to the chronic stimulation of dopamine in the nucleus accumbens, the neurons simply reduce the number of D2 dopamine receptors:
  - Less Brakes
  - Less, "It's not worth it . . ."
    - Continue despite problems/consequences.

Decreased D2 Indirect Pathway Leads To:

- Decreased Frontal Lobe Functioning =
  - Decreased Self-Control
  - Increased Stress-Sensitivity
  - Increased Sensitivity to Negative Feelings







The Brain on Drugs:From Reward to Addiction, Nora D. Volkow1,* and Marisela Morales1National Institute on Drug Abuse, National Institutes of Health, Bethesda, MD 20892, USA *Correspondence: nvolkow@nida.nih.gov
http://dx.doi.org/10.1016/j.cell.2015.07.046

The Downside: For every action there is an = and opposite reaction.

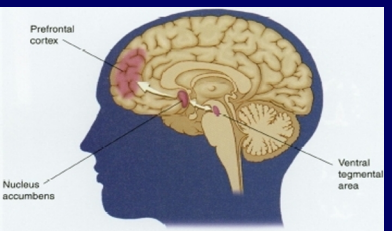
SUD - Mild

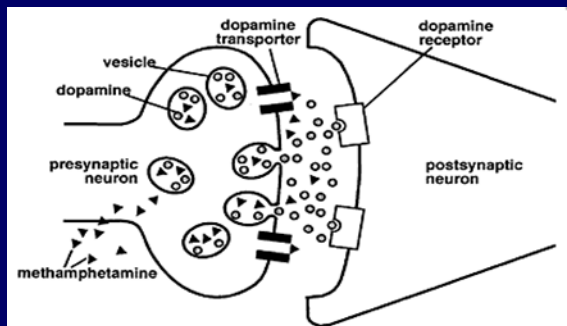
Substance Abuse

- Continuing to use alcohol or other drugs despite

8

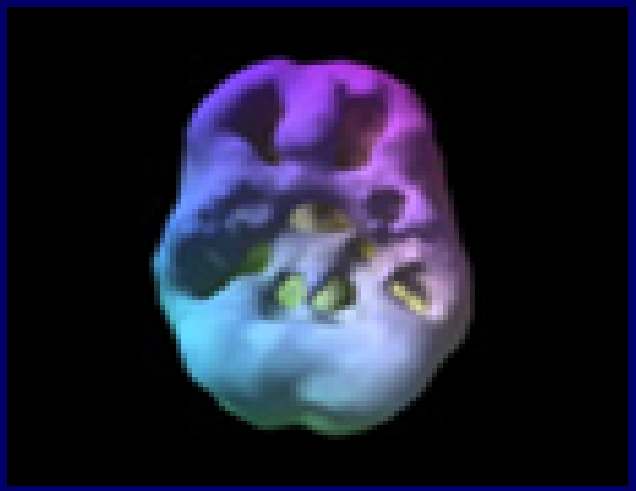
- Dopamine Deficiency Syndrome
- Low DA receptors leads to Punishment Resistant/Immediate Reward-Seeking



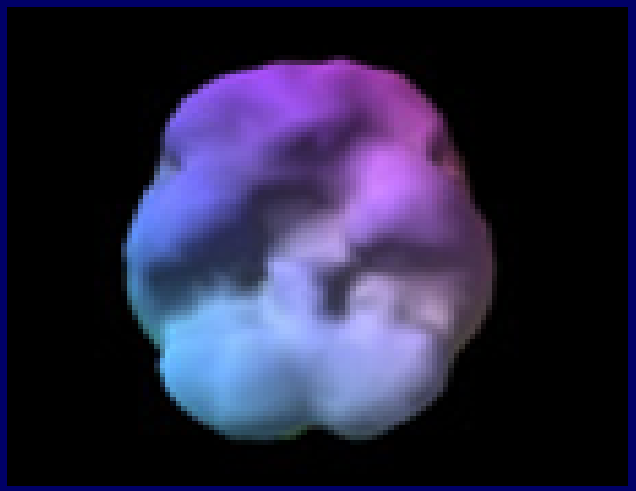


Impact of Addiction

- MARIJUANA:



16 y.o.
2 year history of daily abuse

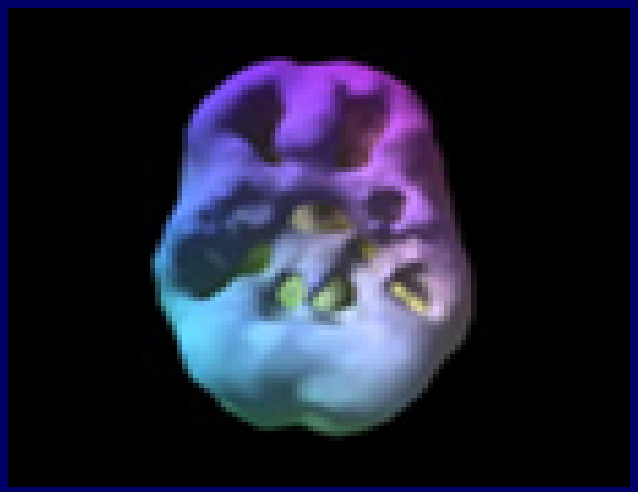


Normal

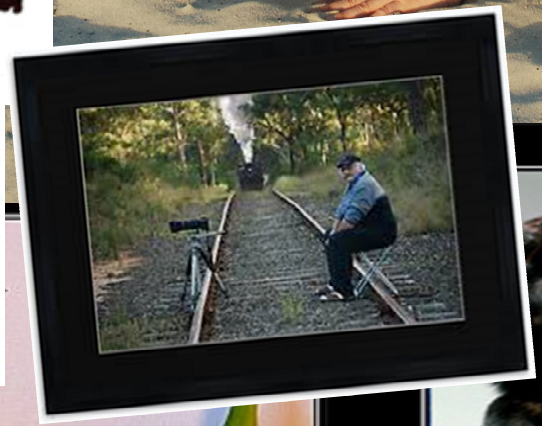
underside surface view of prefrontal and temporal lobe activity

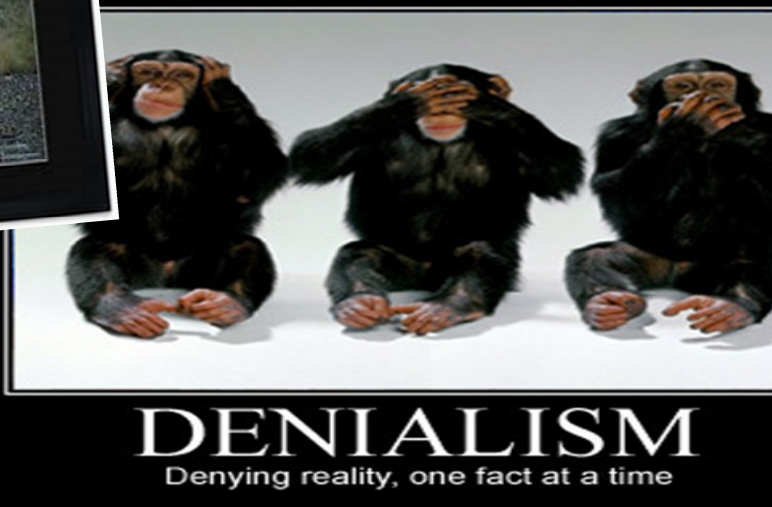
Neurological Denial

- Makes it difficult to connect the dots
- Neurogenic Denial

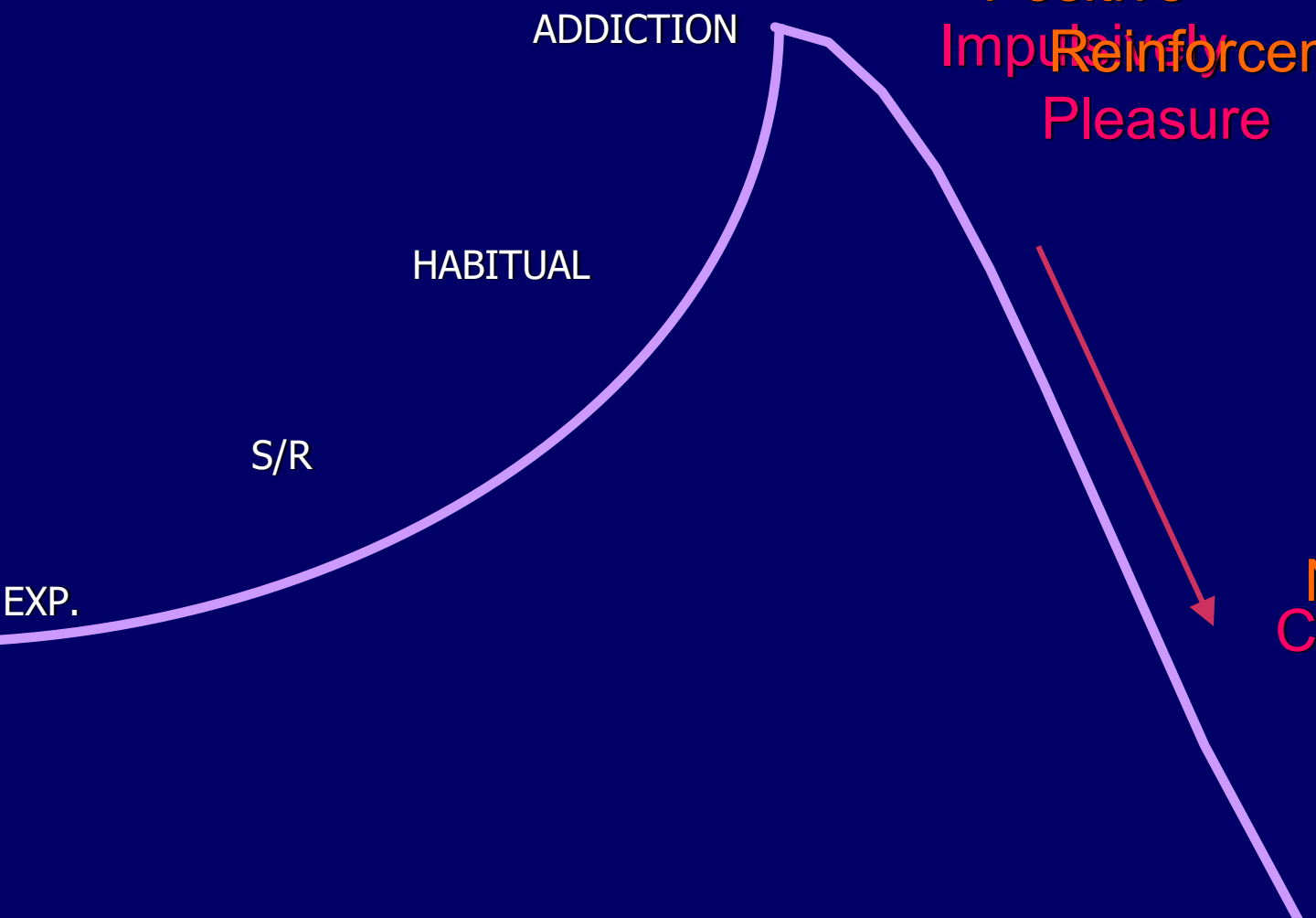


Neurogenic Denial

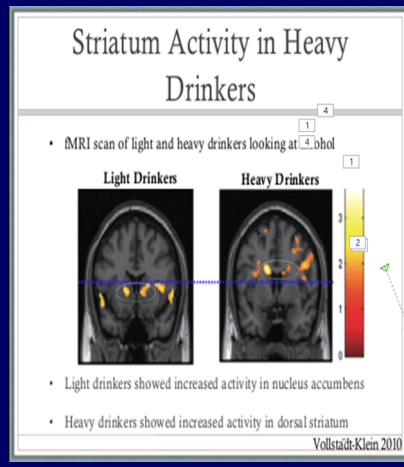




Continuum of Use & Addiction

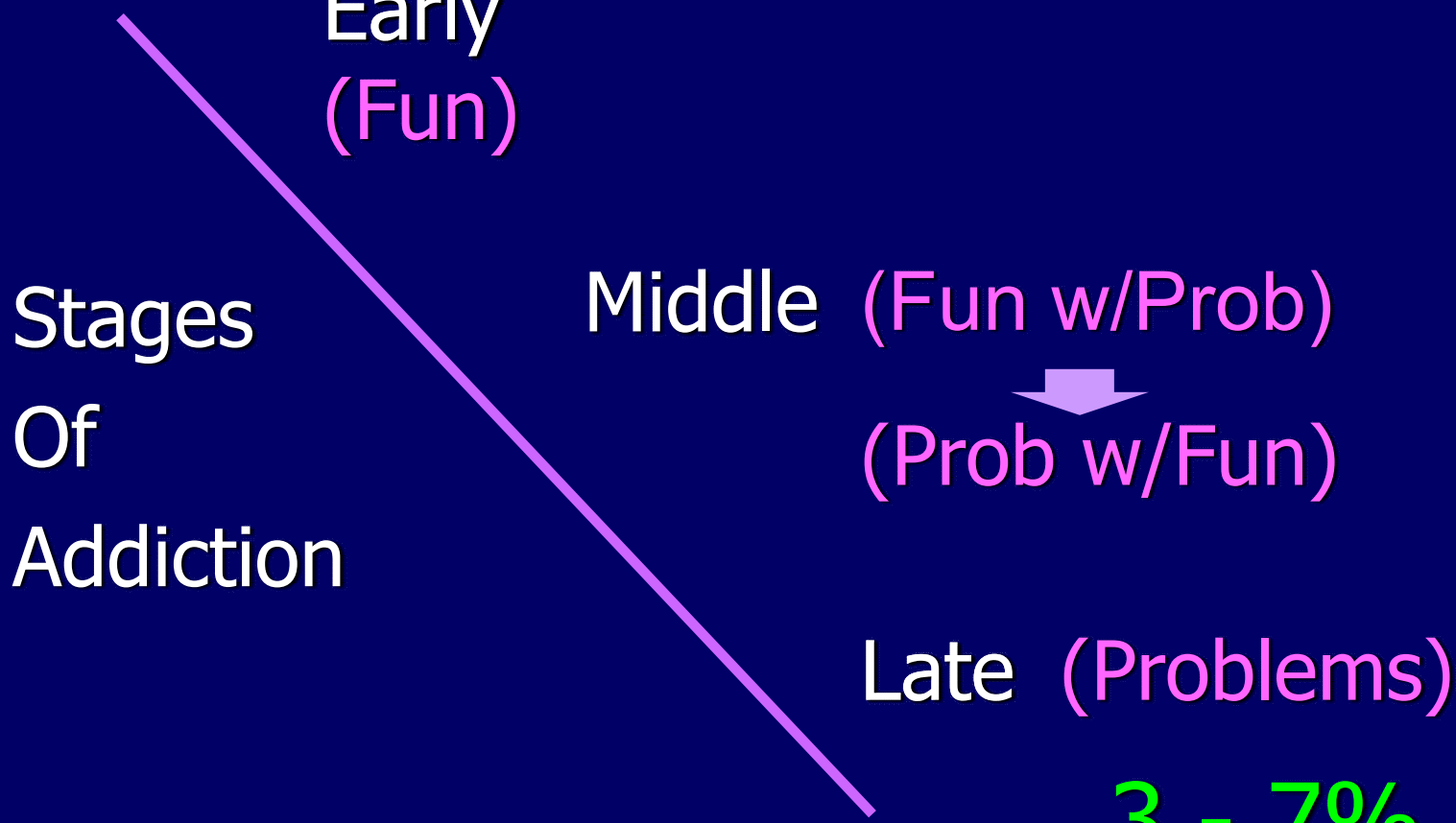


Positive Reinforcement
Impaired Pleasure

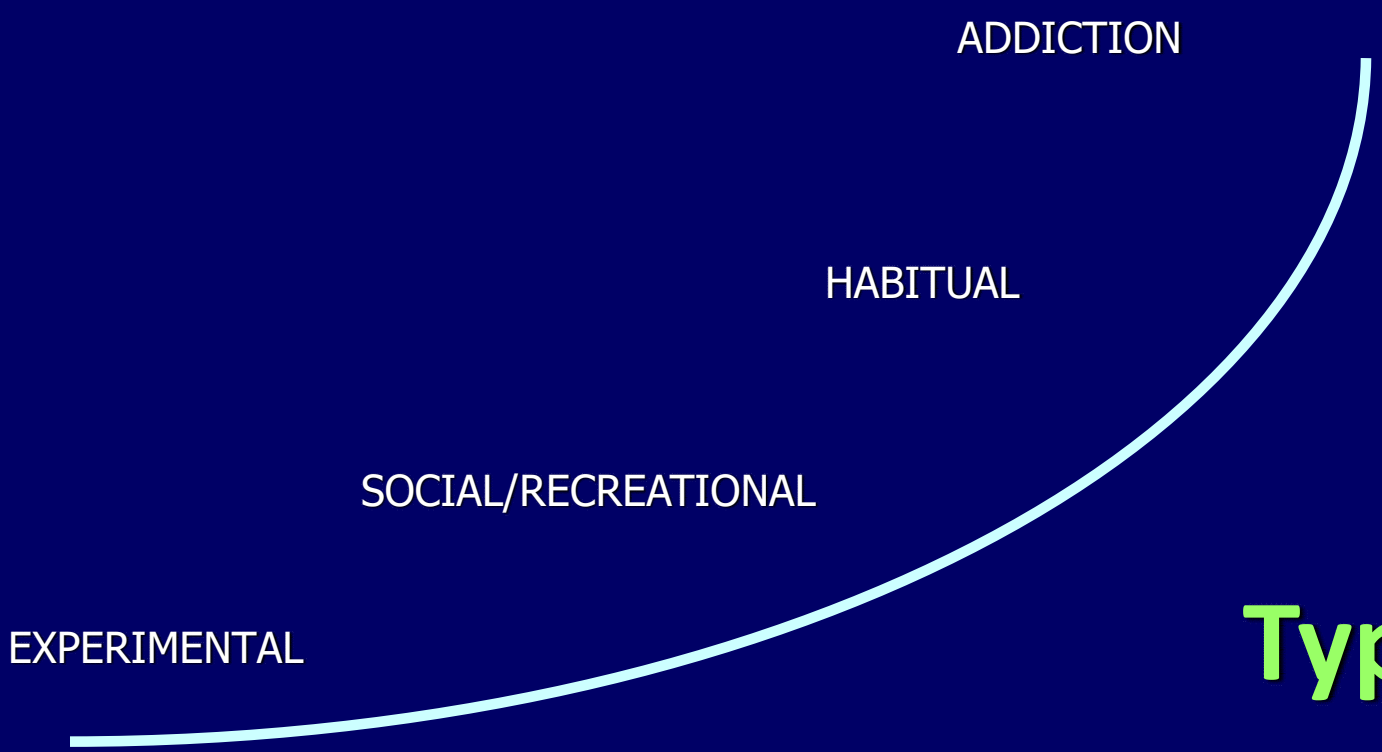


Negative Reinforcement
Compulsive Pain

Psychological Denial:



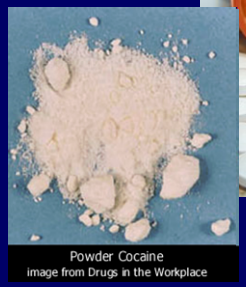
Continuum of Use & Addiction



Type of Drug

3 Types of Drugs of Abuse

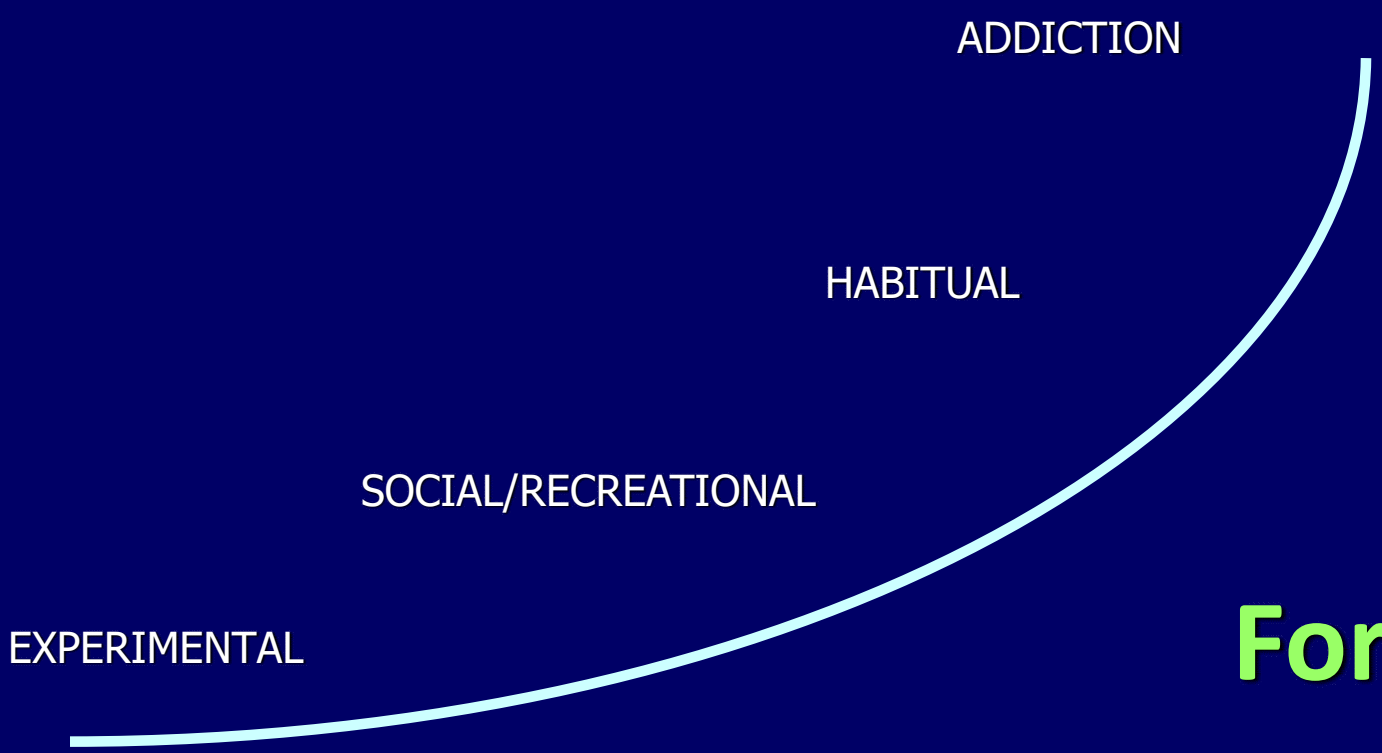
1 **Uppers**



2 **Downers**

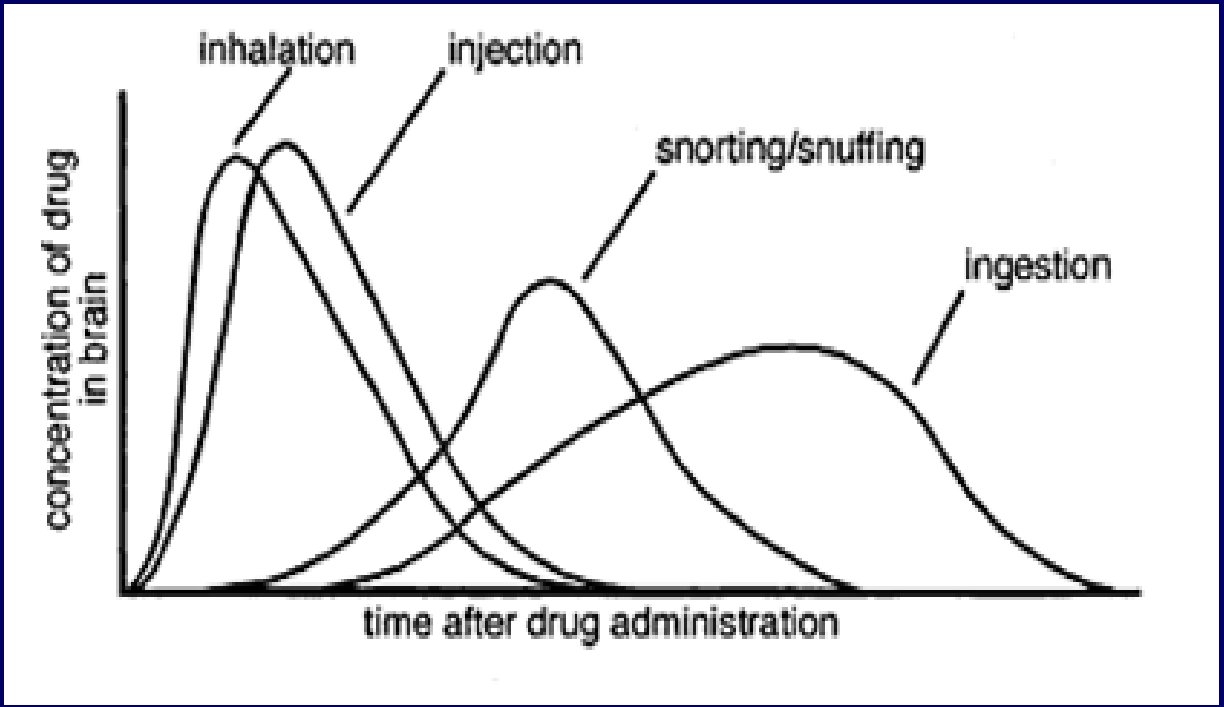
2 **All Arounders – Hallucinogins**

Development of Addiction

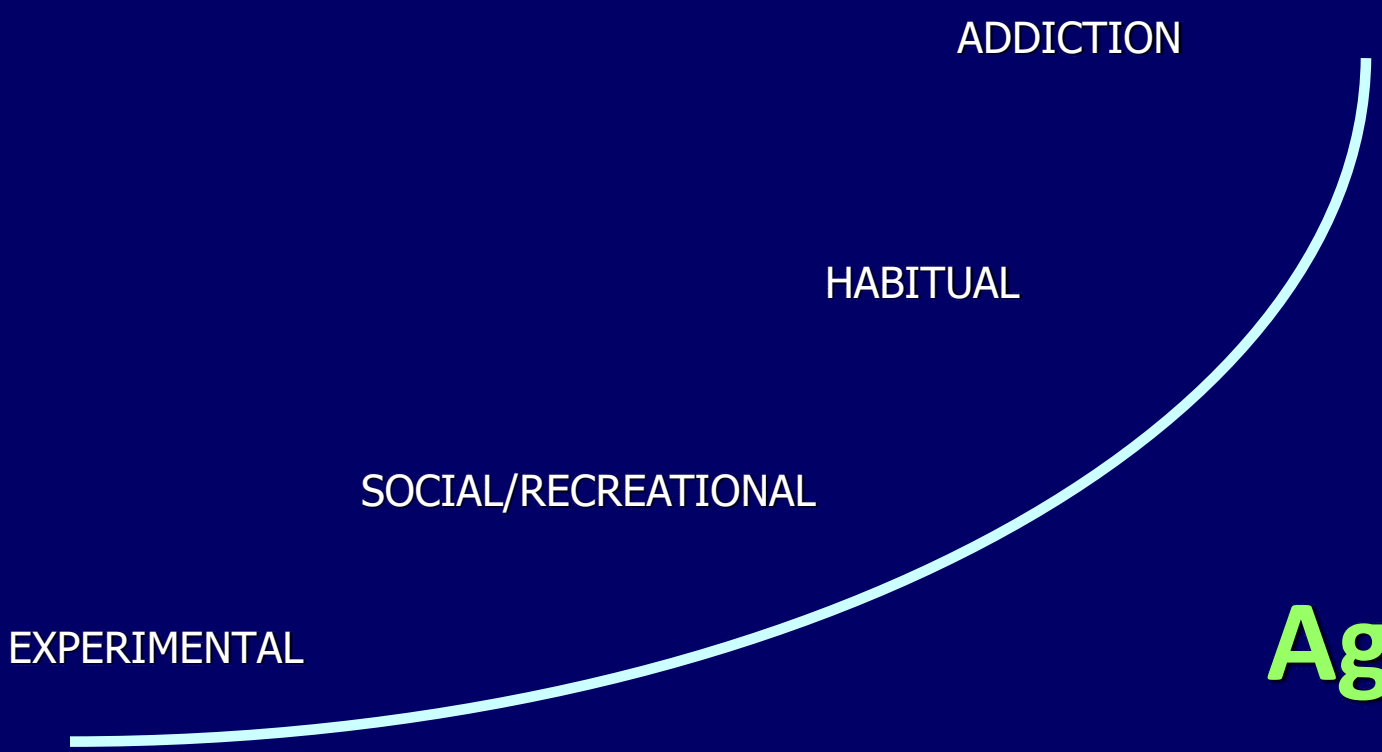


Form of the Drug

Form of the Drug

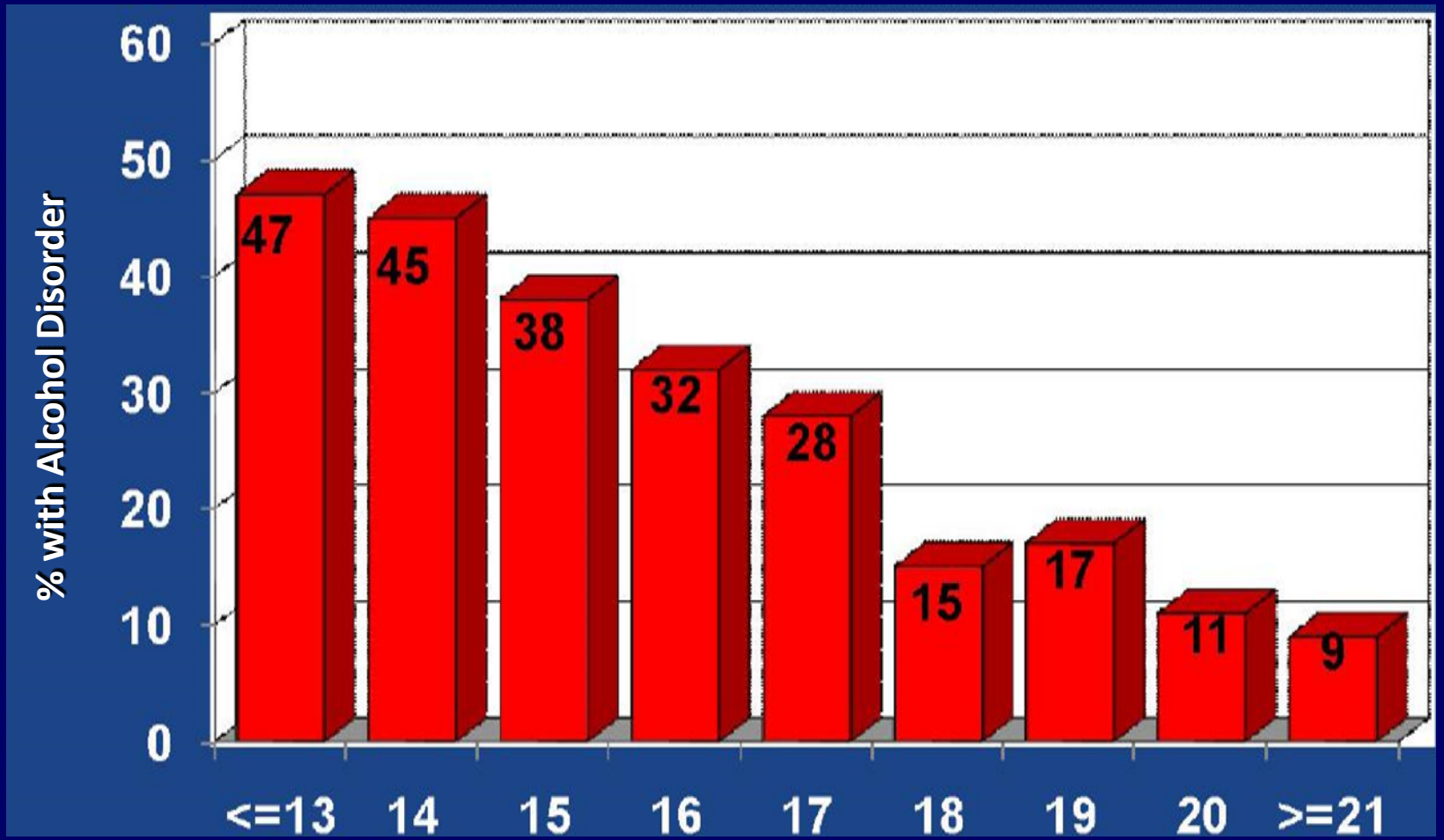


Development of Addiction



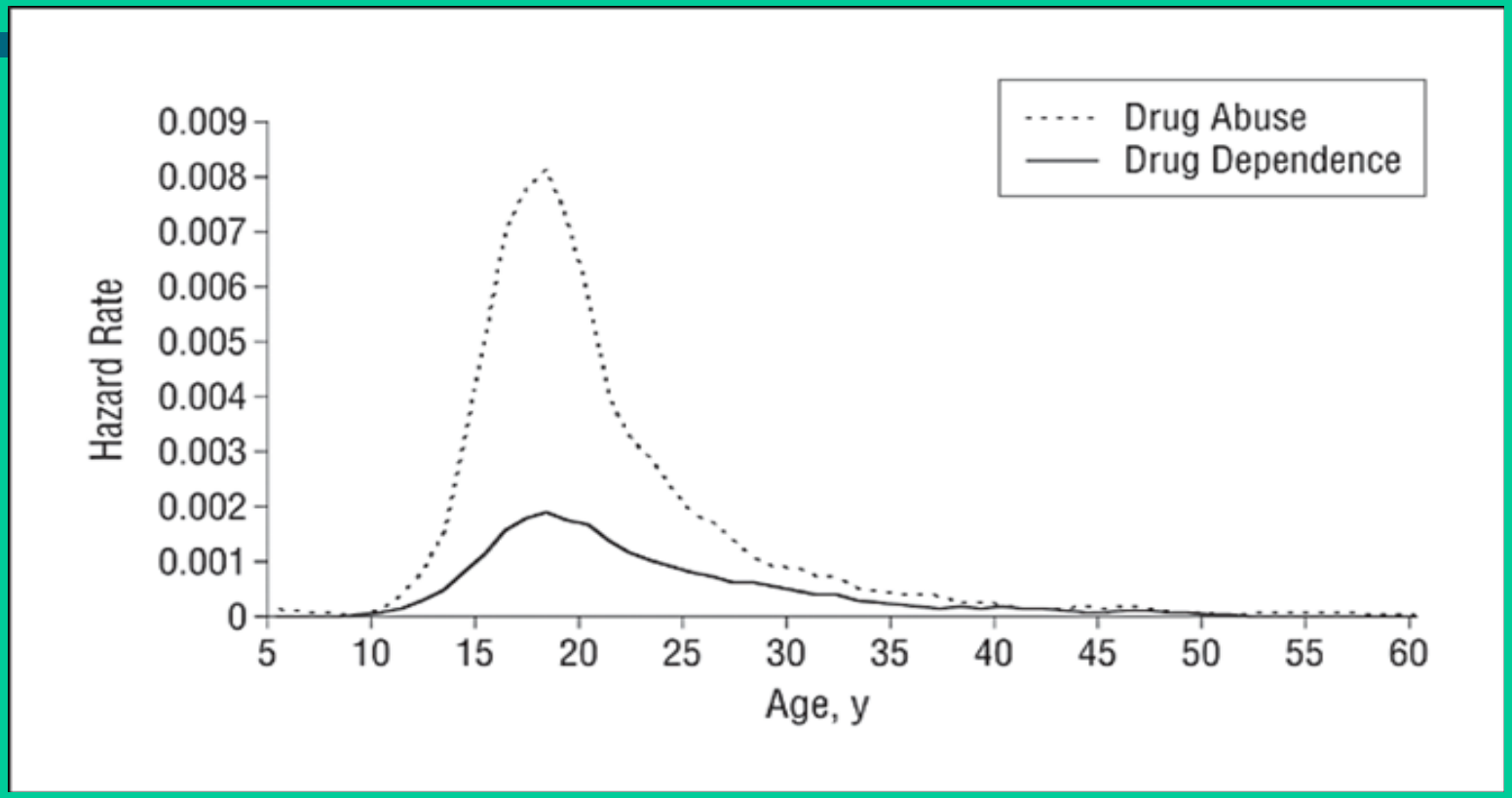
Age of Onset

Percentage of U.S. Adults 18 & Older Dependent on Alcohol, by Age of Drinking Onset



Source: Hingson RW, Heeren T, Winter MR. Age at drinking onset and alcohol dependence. *Arch Pediatr Adolesc Med.* 2006;160:739-746.

Drug Dependence Onset



Hazard rates for age at onset of DSM-IV drug abuse and dependence

Compton, W. M. et al. Arch Gen Psychiatry 2007;64:566-576.

ARCHIVES OF GENERAL PSYCHIATRY

Addiction Onset

- >90% of adults with current substance use disorders started using before 18
- 1/2 of those began before 15 (Cermak, 2009)

Direction of Growth

- Growth begins at the back and moves to the front of the brain.

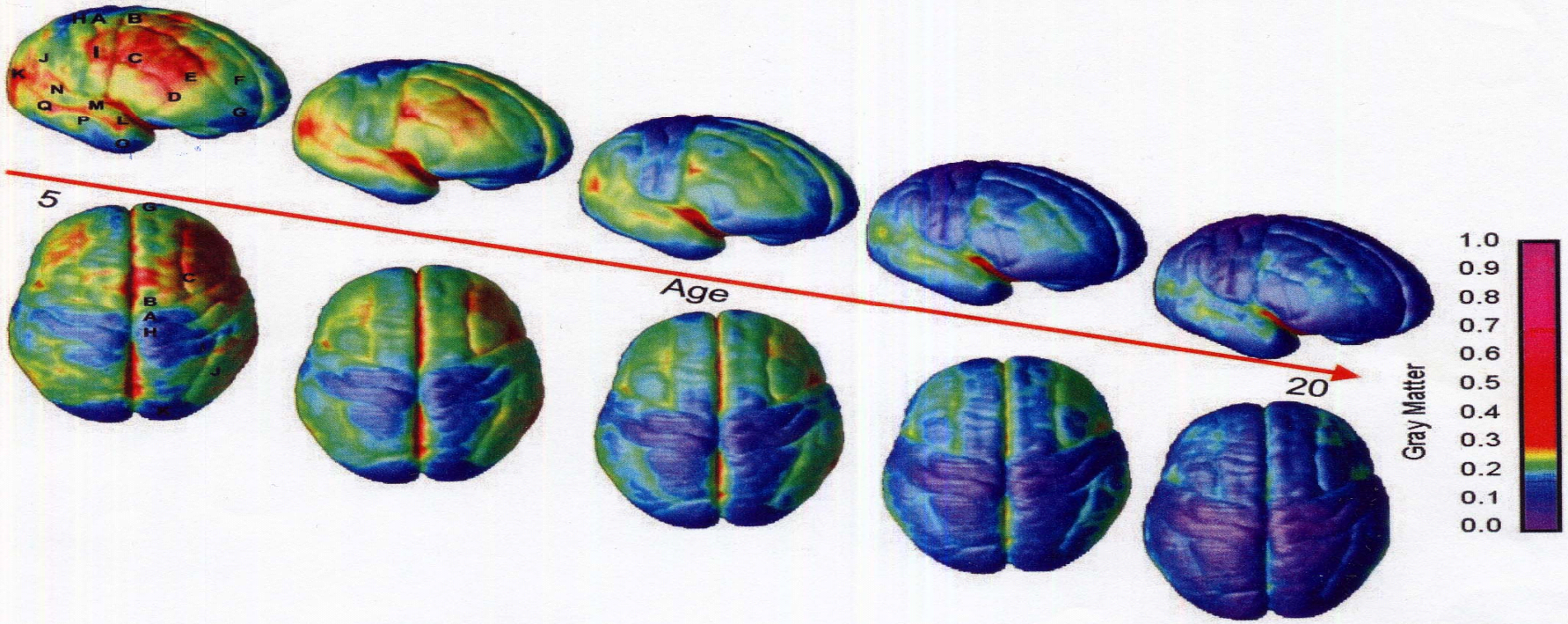
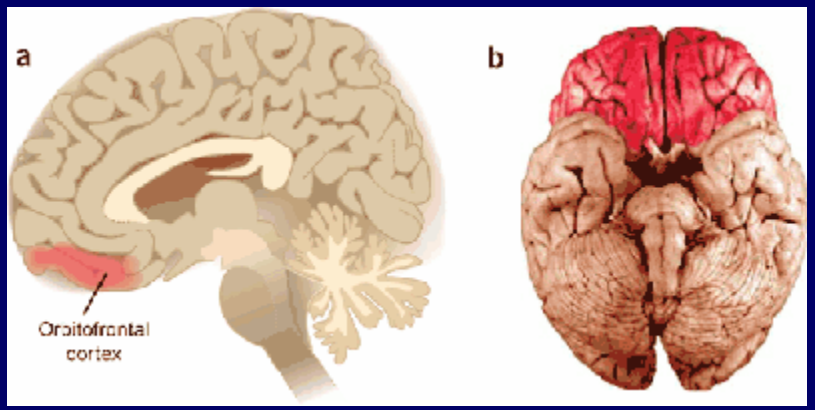


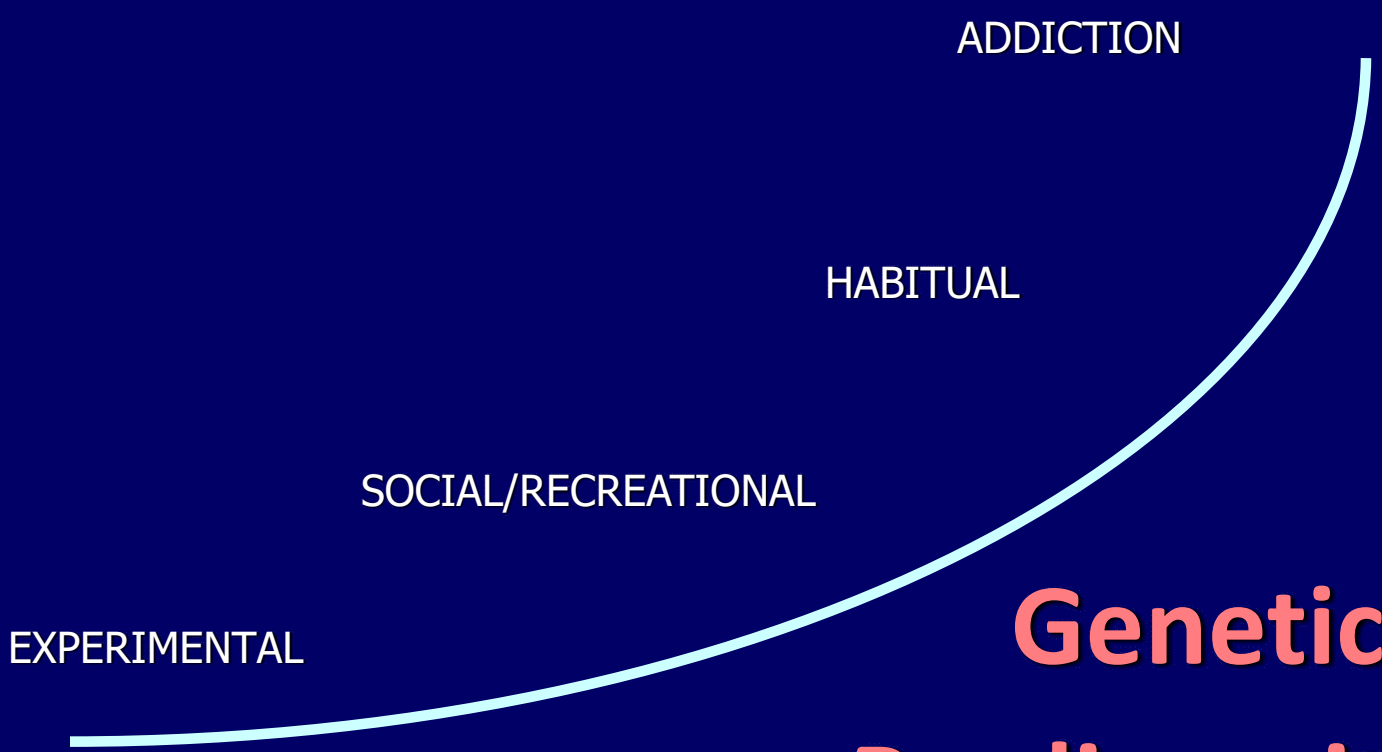
Fig. 3. Right lateral and top views of the dynamic sequence of GM maturation over the cortical surface. The side bar shows a color representation in units of GM volume. The initial frames depict regions of interest in the cortex as described for Fig. 1. This sequence is available in Movies 1–4 in the supporting information.

PreFrontal Cortex

- The "STOP" part of the brain
  - Impulse Control-The Brain's Police



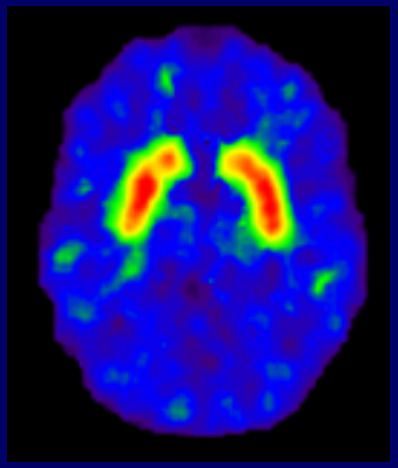
Development of Addiction



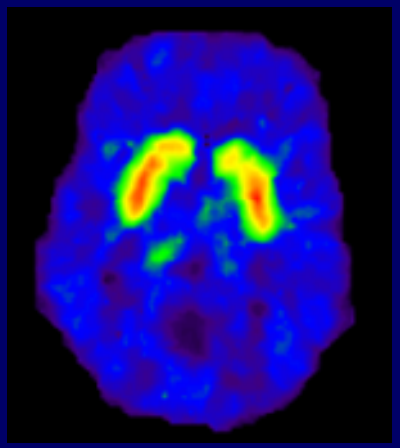
Genetic Predisposition

DA Receptors and the Response to Methylphenidate (MP)

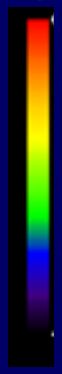
High DA receptor



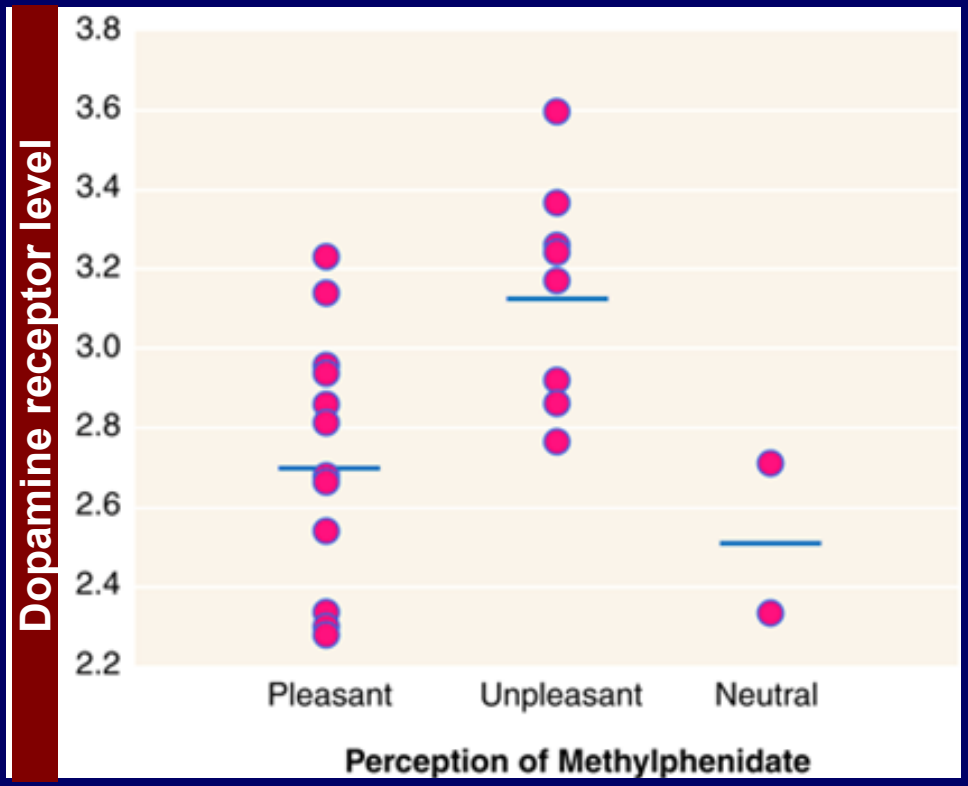
Low DA receptor



high



low



As a group, subjects with low receptor levels found MP pleasant while those with high levels found MP unpleasant

Adapted from Volkow et al., Am. J. Psychiatry, 1999.

Formula for Development of Addiction:

AD = G + E + LB

USE

TO FEEL GOOD:
Have Fun!

TO FEEL BETTER:
(Self-Medicate or
Medicate Wx)

TO DO BETTER:

USE

TO FEEL GOOD [TYPE II]
And/or
TO FEEL BETTER [TYPE I]:

AD = G + E + LB

Formula for Development of Addiction:

AD = G + E + LB

10 = 10

= 9 + 2

USE

TO FEEL BETTER:
(Self-Medicate)

Categories of Adverse Childhood Experiences

Abuse, by Category:

- Emotional (by parents – put downs, insults, etc.,)
- Physical (by parents – hit, physically hurt, etc.,)
- Sexual (anyone)

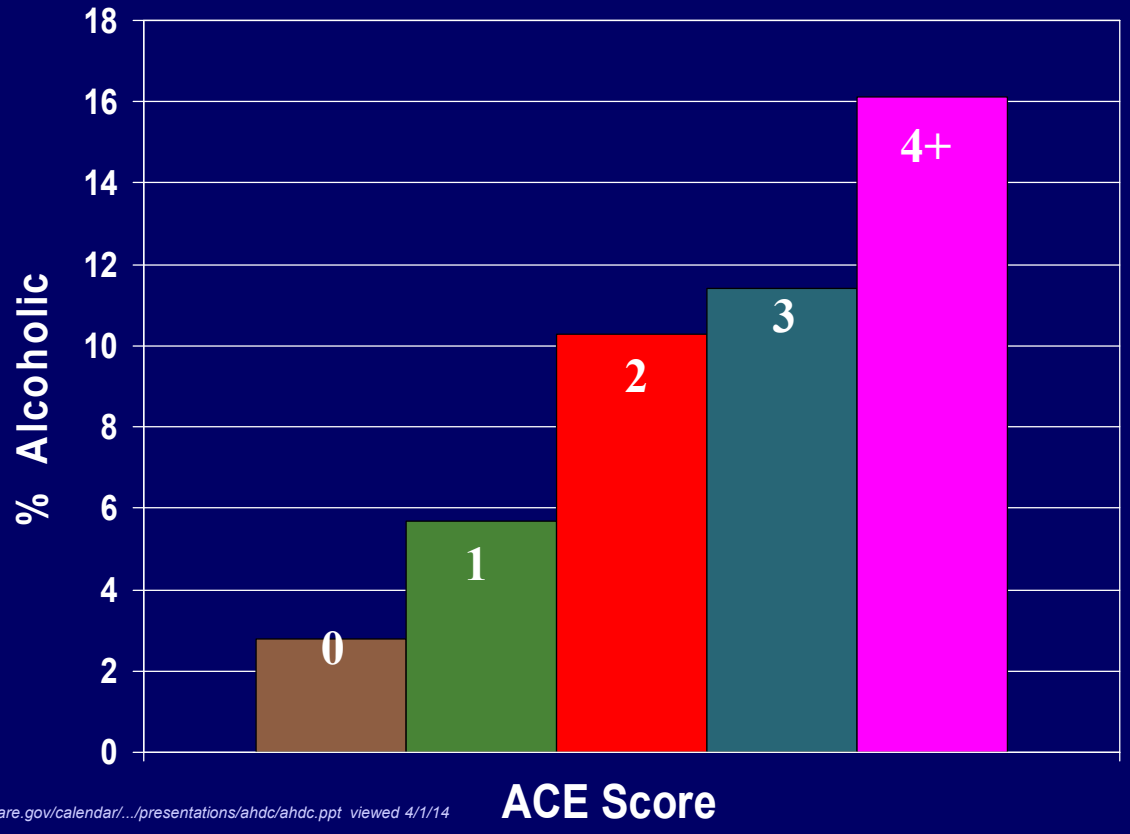
Neglect:

- Physical (hungry, no one to take care or you, etc.,) or Emotional

Household Dysfunction, by Category

- Substance Abuse in family
- Mental Illness in family
- Domestic Violence
- Imprisoned Household Member
- Loss of parent, separation or divorce

Childhood Experiences vs. Adult Alcoholism



https://www.childwelfare.gov/calendar/.../presentations/ahdc/ahdc.ppt viewed 4/1/14
www.acestudy.org

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ACE Score and Drug Abuse

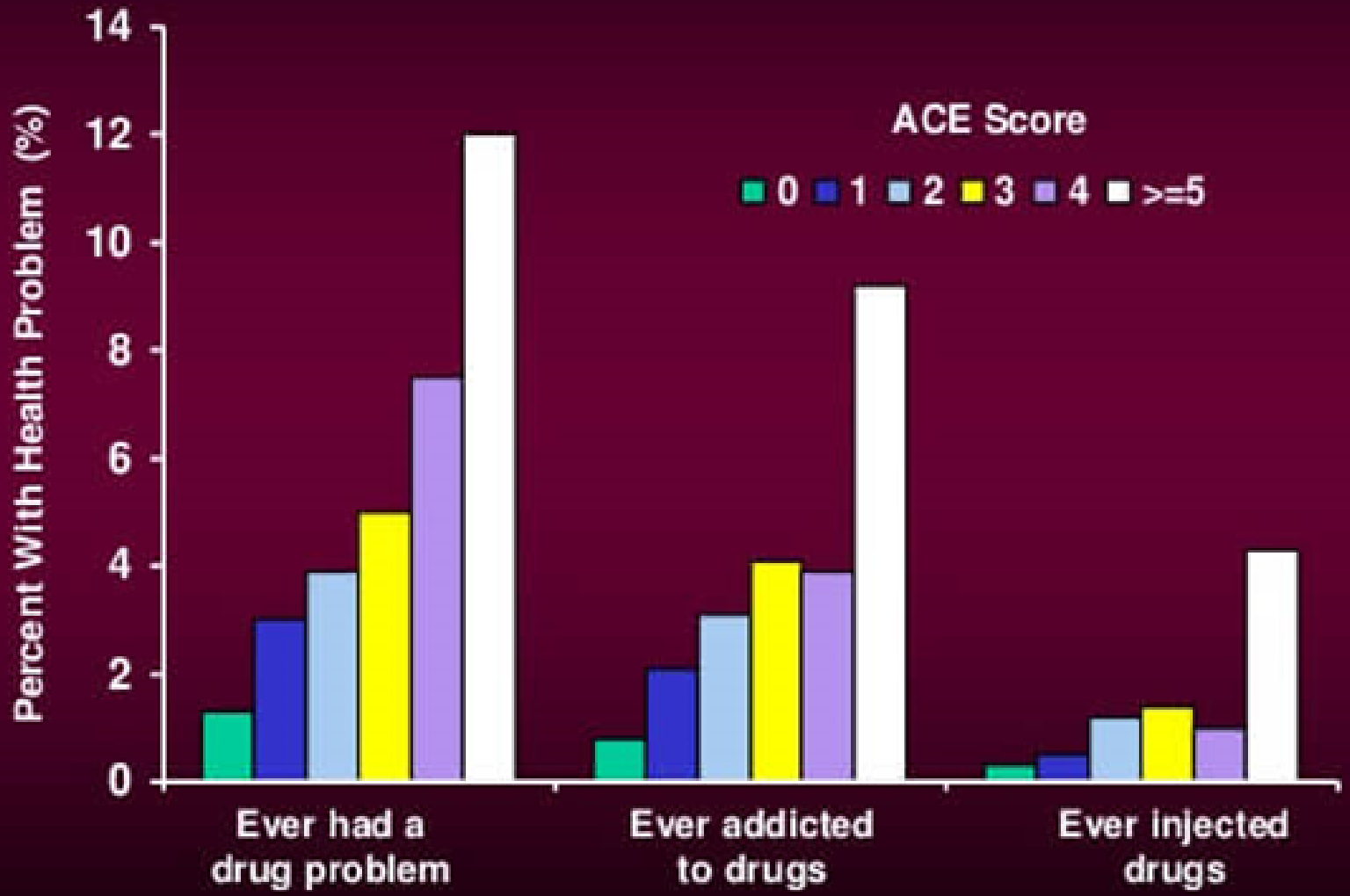


Photo Courtesy of Robert F. Anda, MD, MS, Slide 18

Formula for Development of Addiction:

AD = G + E + LB

10 = 10

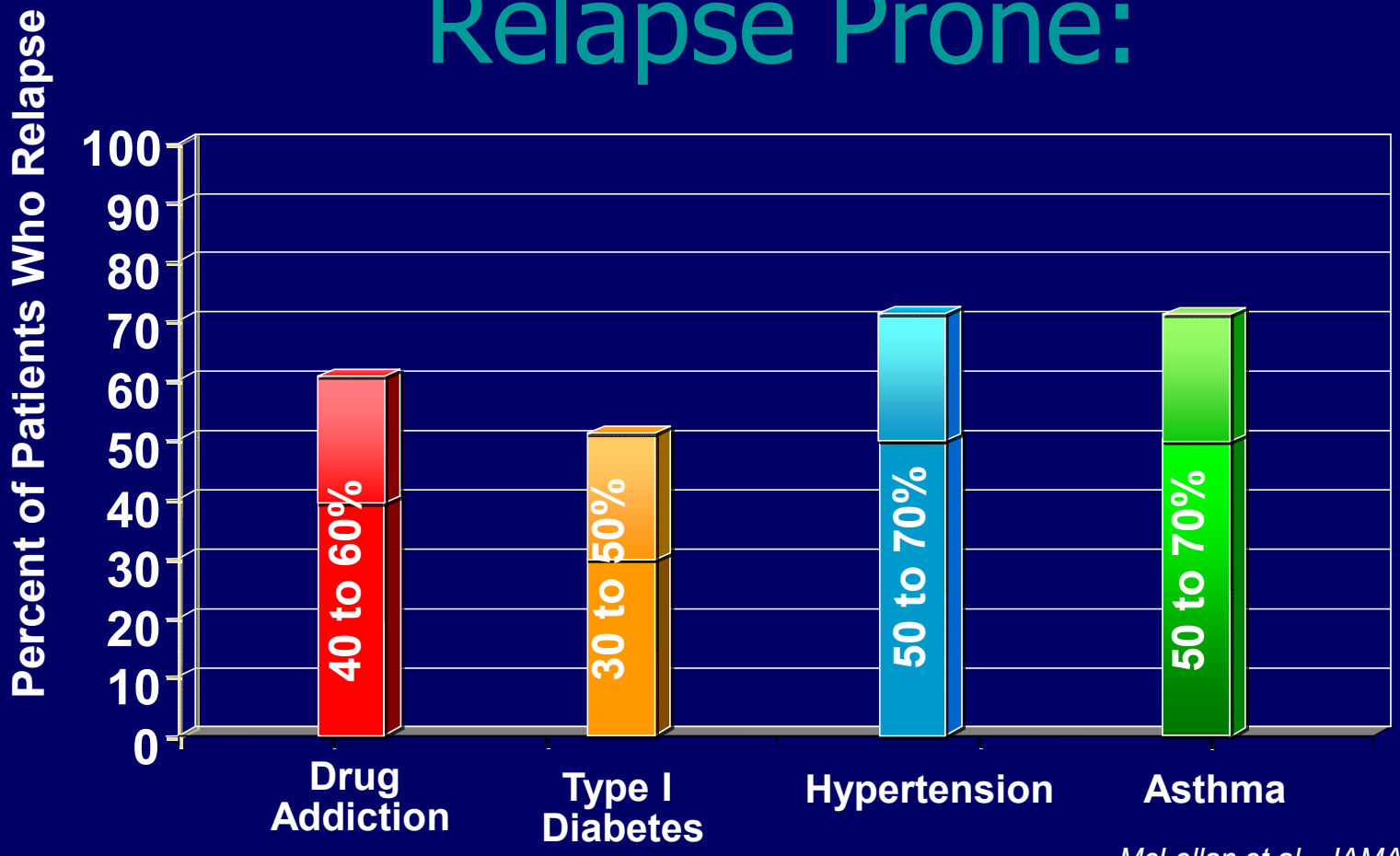
= 9 + 2

= 5 + 2 + 3

= 3 + 2 + 3 + 2

ADDICTION: CHRONIC, PROGRESSIVE BRAIN ILLNESS

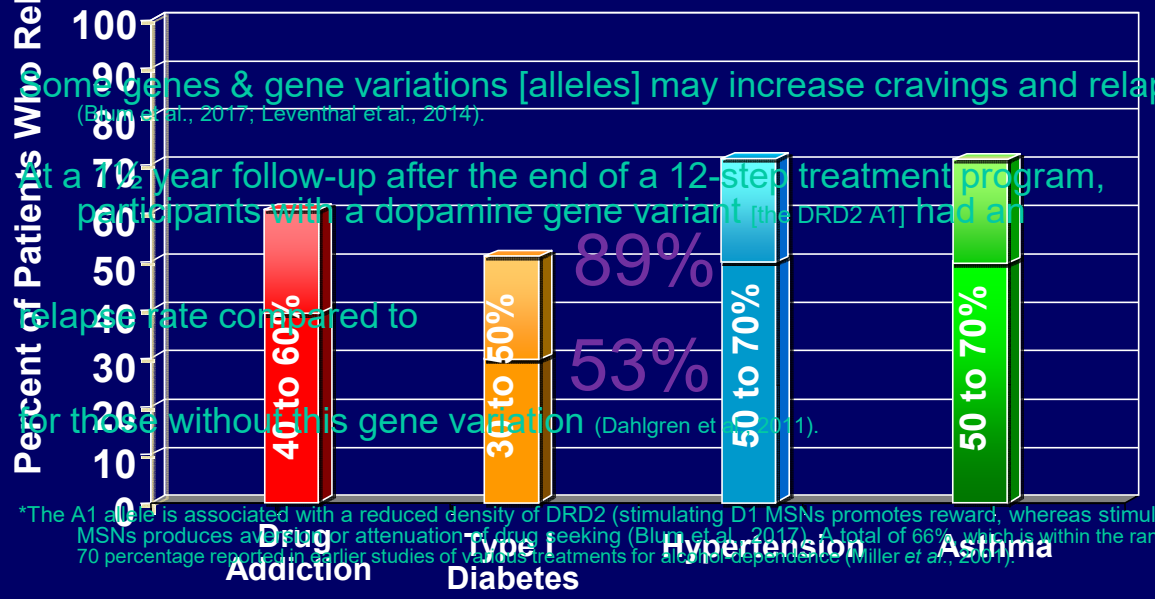
Relapse Prone:



McLellan et al., JAMA, 2000.

ADDICTION: CHRONIC, PROGRESSIVE BRAIN ILLNESS

Genetic Basis for Relapse:



- Some genes & gene variations [alleles] may increase cravings and relapses (Blum et al., 2017; Leventhal et al., 2014).
- At a 1½ year follow-up after the end of a 12-step treatment program, participants with a dopamine gene variant [the DRD2 A1] had an relapse rate compared to for those without this gene variation (Dahlgren et al., 2011).

*The A1 allele is associated with a reduced density of DRD2 (stimulating D1 MSNs promotes reward, whereas stimulating D2 MSNs produces aversion or attenuation of drug seeking (Blum, et al., 2017). A total of 66%, which is within the range of 65–70 percentage reported in earlier studies of various treatments for alcohol dependence (Miller *et al.*, 2001).

Formula for Development of Addiction:

Formula for Recovery:

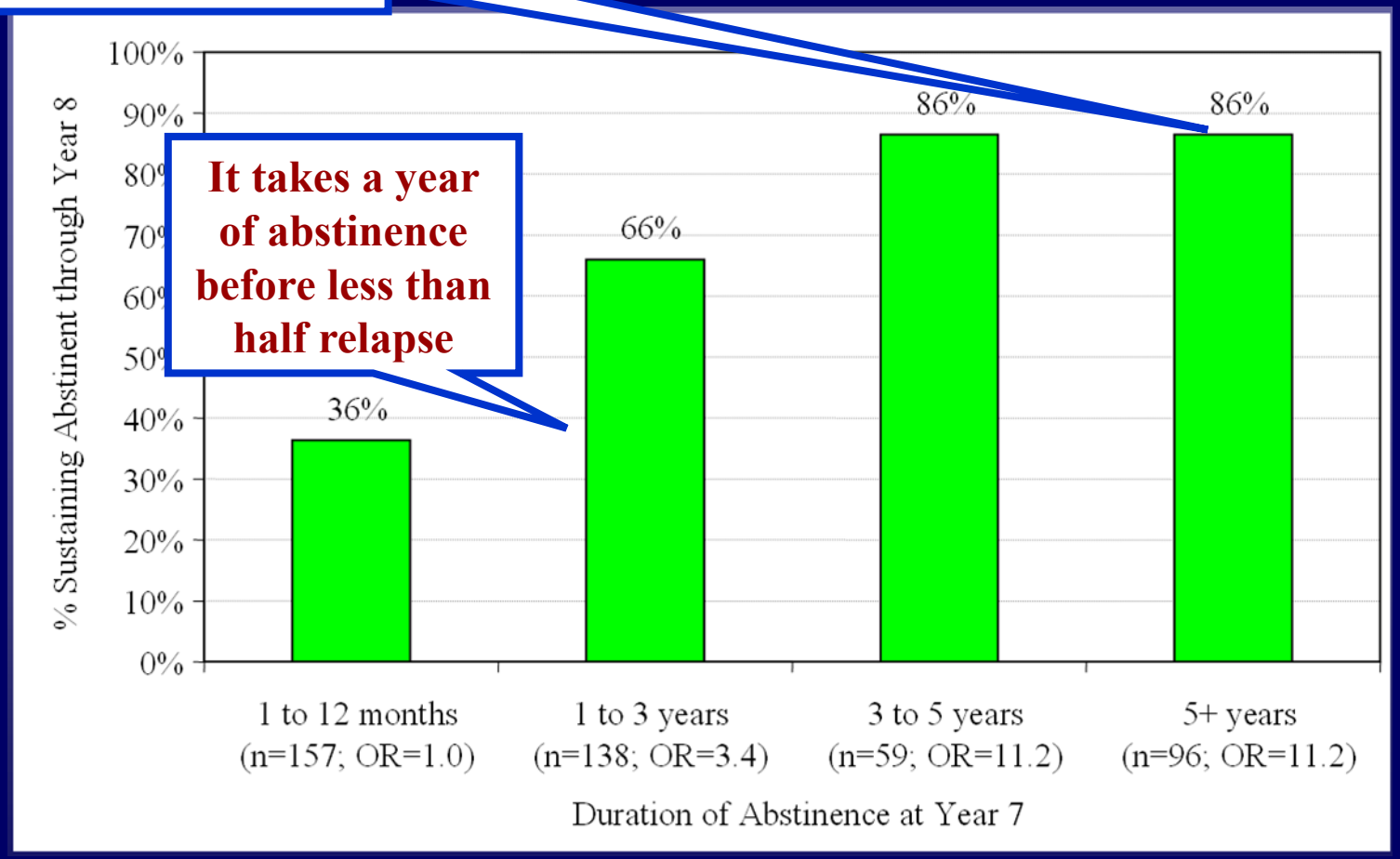
RAD = G + E + LB

Neuroplasticity Epigenetics

Each individual, including both ourselves and our children, cannot be blamed for the cards they are dealt, yet we all must assume full responsibility for playing those cards as well as possible. (T. Cermak)

Extended Abstinence is Predictive of Sustained Recovery

After 5 years – if you are sober, you probably will stay that way.



Dennis et al, Eval Rev, 2007

Abstinence vs. Recovery

2.8x more likely to be sober @ 2 yrs. If:

1. Have a sponsor
2. Do service work
3. Read literature.
4. Call other members for help

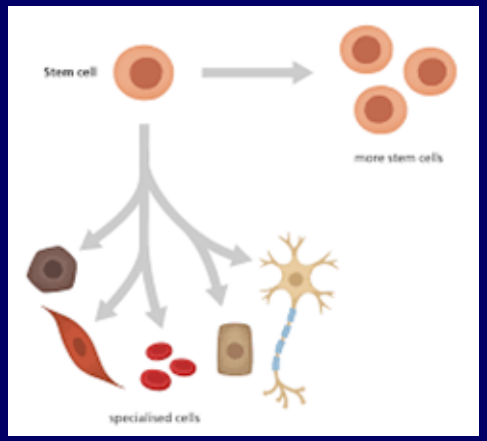
Add SLE [Oxford House]:

5.6x

Majer, L Jason, D Aase, J Droege, J Ferrari (2013). Categorical 12-step involvement and continuous abstinence at 2 years. Journal of Substance Abuse Treatment 44 (1), 46-51

90

Early AA Thinkers Were Intuitive Neuroscientists




PROCRASTINATORS ANONYMOUS
TONIGHTS MEETING POSTPONED. TO BE RESCHEDULED EVENTUALLY
© Original Artist

Reward-based Learning & Recovery

- Recovery is:

Rewiring your brain.

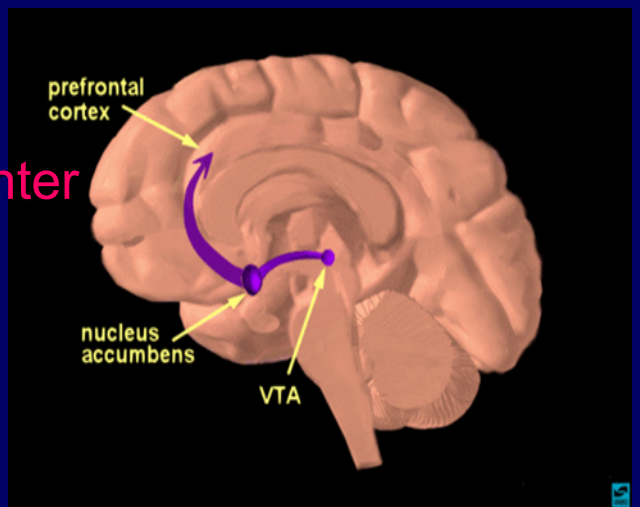
- The Craving Mind: From Cigarettes to Smartphones to Love—Why We Get Hooked and How We Can Break Bad Habits Judson Brewer and Jon Kabat-Zinn Ph.D.

Reward-based Learning & Recovery

Drugs & Alcohol over-stimulate the brain.

This causes Down - Regulation

Pleasure Center

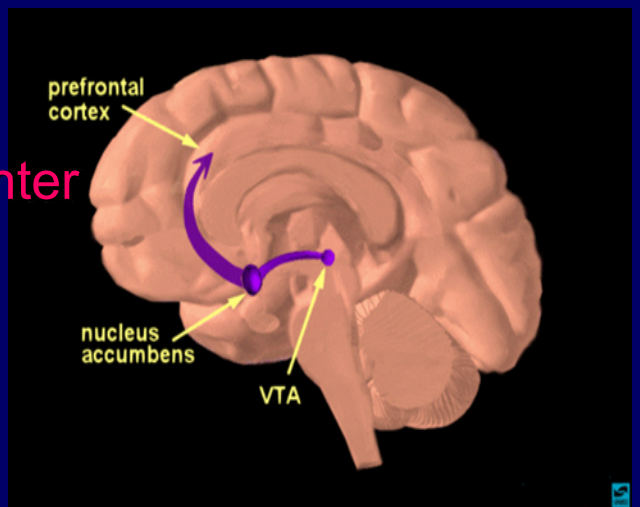


The Secret Sauce

Thinking of, or doing something, that makes you feel happy:

Feeling grateful, noticing a tree, listening to music, . . .

Pleasure Center

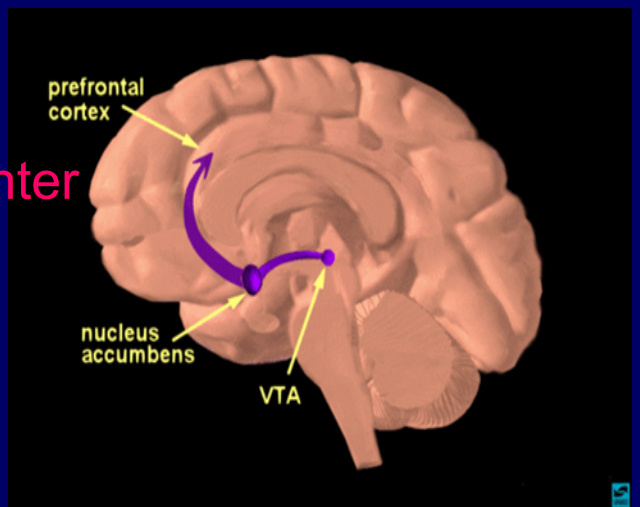


The Secret Sauce

This Causes Up-Regulation of the D2R and other receptors.

This is Rewiring the Brain! This is Recovery!

Pleasure Center



EVOLUTION & ADDICTION

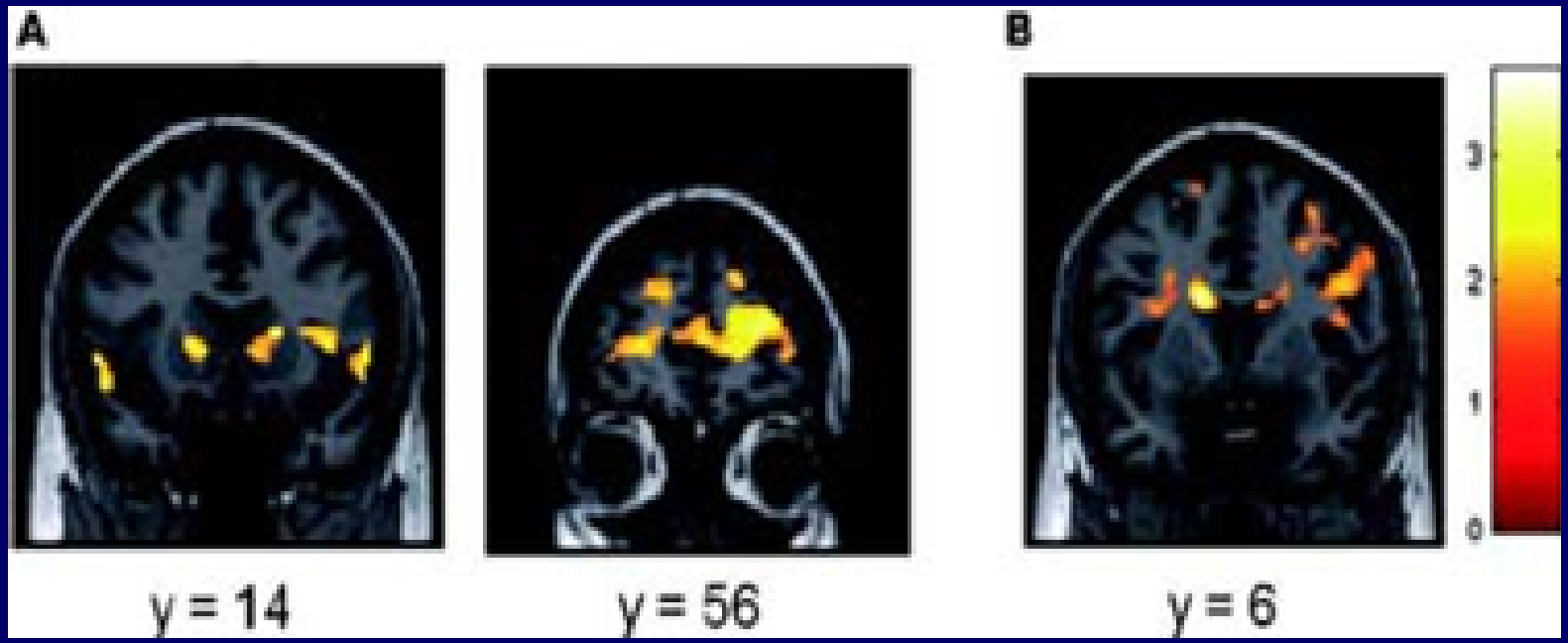
2%

8 - 10%

N Engl J Med 2016;374:363-71.
DOI: 10.1056/NEJMra1511480

The End!

Dean.Blumberg@kp.org


A
B
y = 14
y = 56
y = 6
3
2
1
0

Frontal lobe

- The brain's chief executive.

- The human frontal lobe comprises:

30%

Frontal lobe

- Dogs?

7%

Frontal lobe

- Cats?

3%