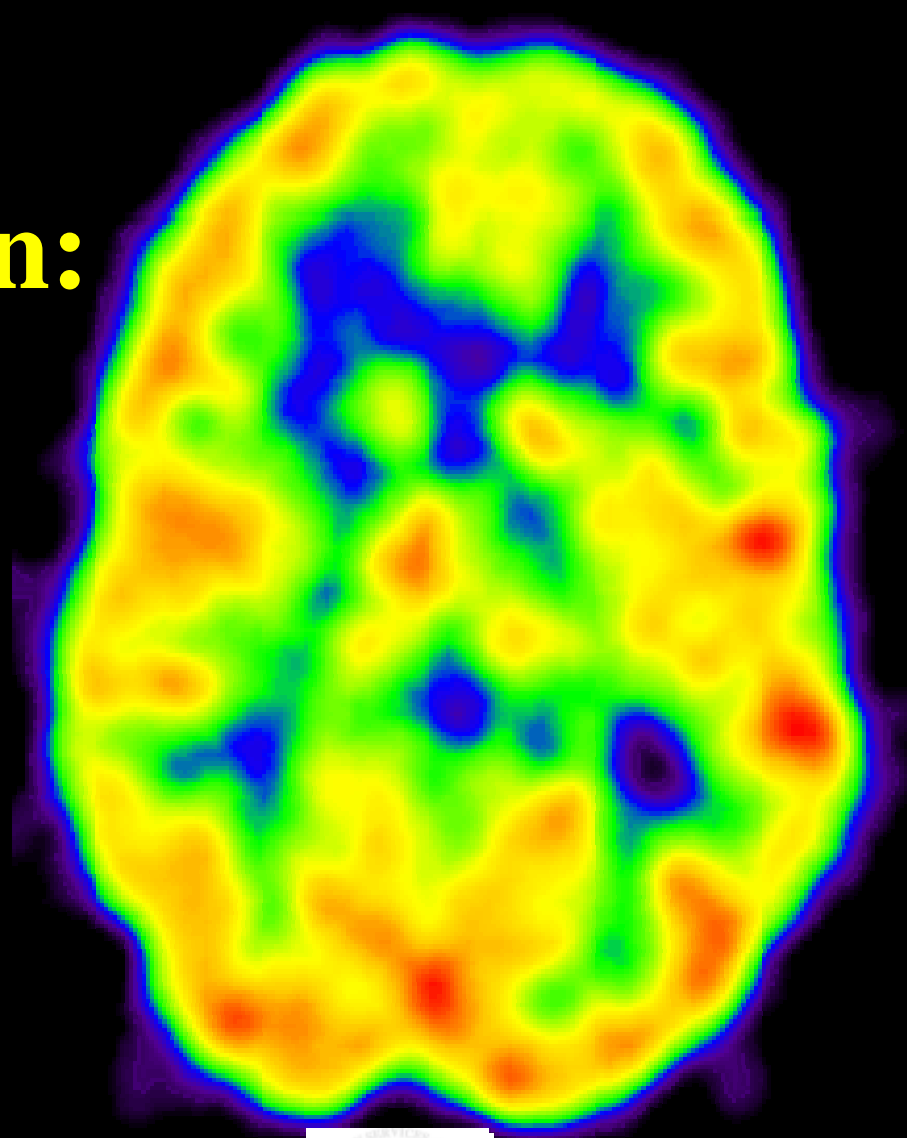
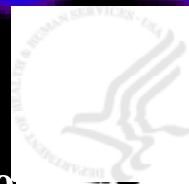


Drugs and the Brain: *Implications for Preventing and Treating Addiction*



Nora D. Volkow, M.D.
Director
National Institute on Drug Abuse






Addiction



Medical

NEUROTOXICITY
OBESITY
AIDS
CANCER
MENTAL ILLNESS

DRUGS



Economic

HEALTH CARE
COSTS
PRODUCTIVITY
LOSS
ACCIDENTS



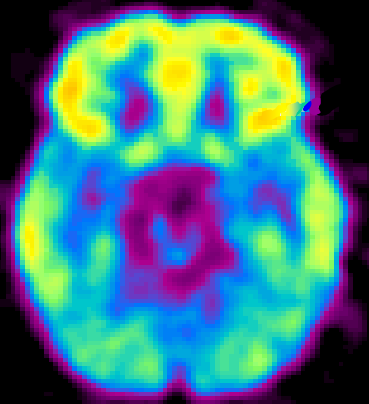
Social

HOMELESSNESS
CRIME
VIOLENCE

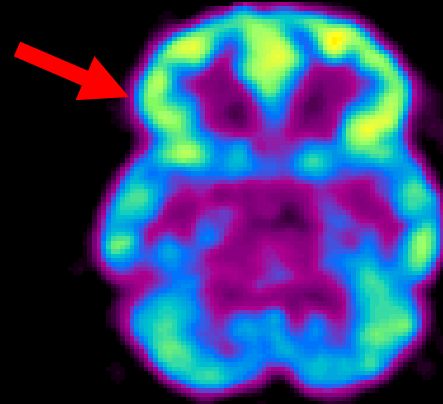
ADDICTION IS A DISEASE OF THE BRAIN

as other diseases it affects the tissue function

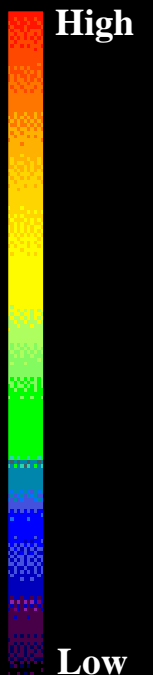
Decreased Brain Metabolism in *Drug Abuse Patient*



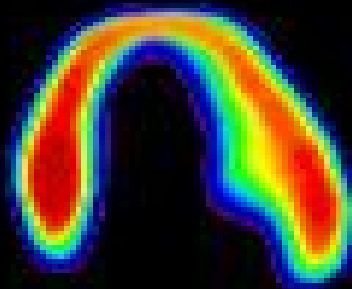
Control



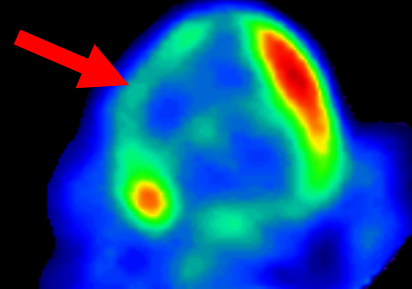
Cocaine Abuser



Decreased Heart Metabolism in *Heart Disease Patient*



Healthy Heart

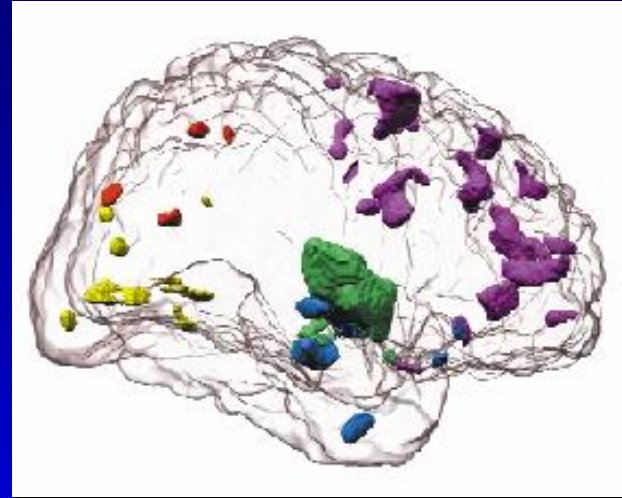
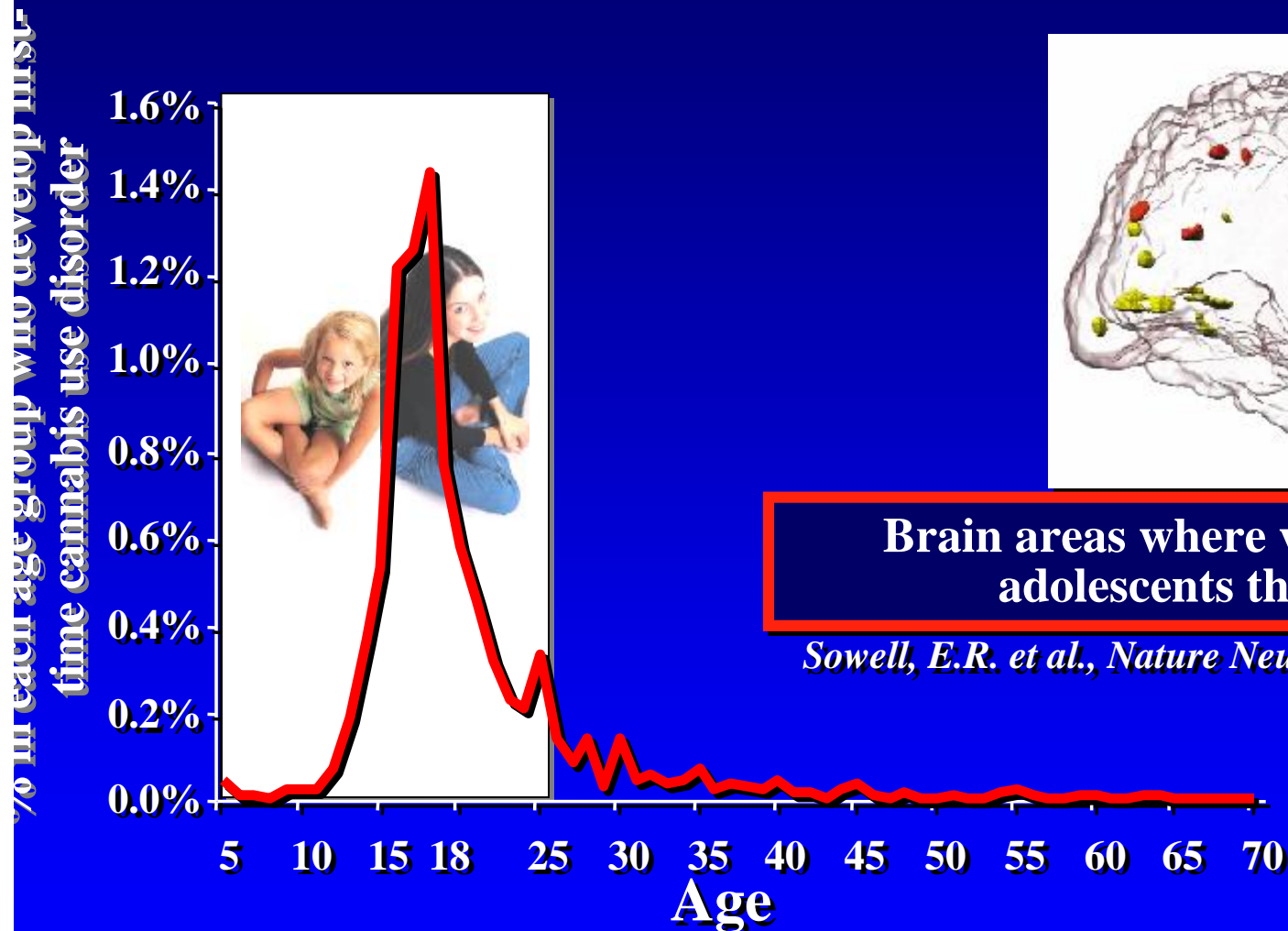


Diseased Heart

Sources: From the laboratories of Drs. N. Volkow and H. Schelbert

ADDICTION IS A DEVELOPMENTAL DISEASE

It starts in adolescence and childhood



Brain areas where volumes are smaller in adolescents than young adults.

Sowell, E.R. et al., Nature Neuroscience, 2: 859-861, 1999

Age at cannabis use disorder as per DSM IV

NIAAA National Epidemiologic Survey on Alcohol and Related Conditions, 2003.

**DRUGS OF ABUSE CAN
PRODUCE ADDICTION
BY HIJACKING
MOTIVATION AND
PLEASURE PATHWAYS
IN THE BRAIN**

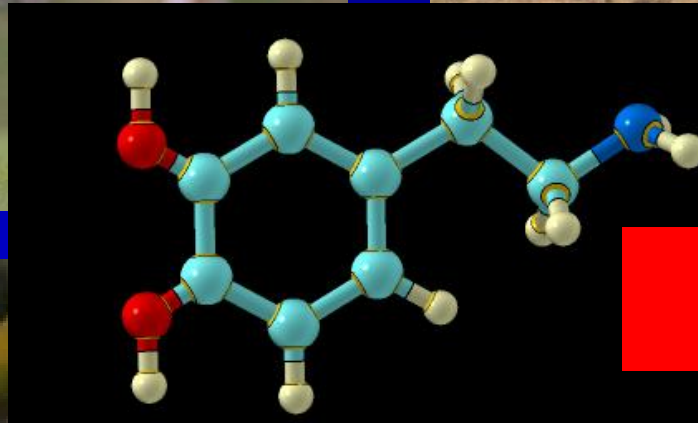




movement



motivation



Dopamine

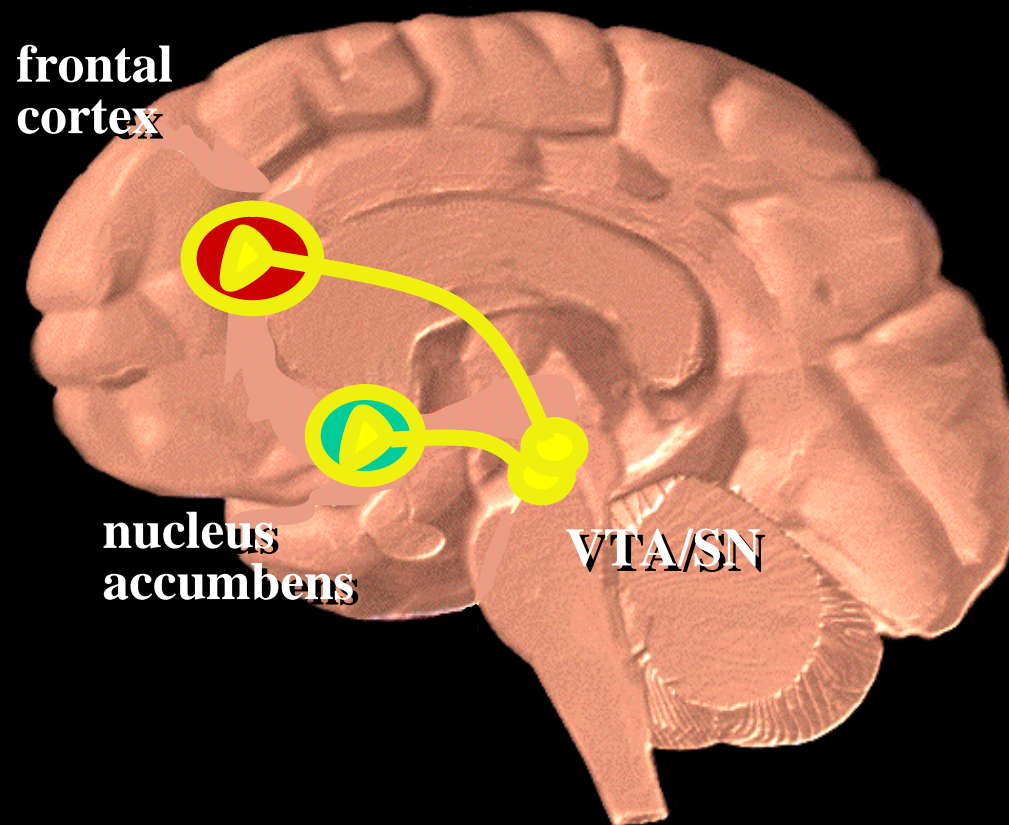


addiction

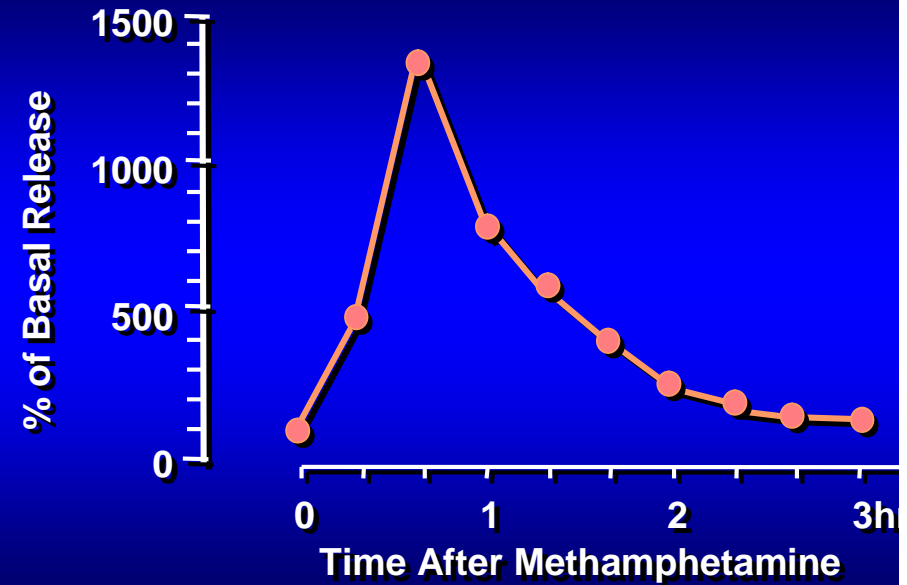


Reward & well-being

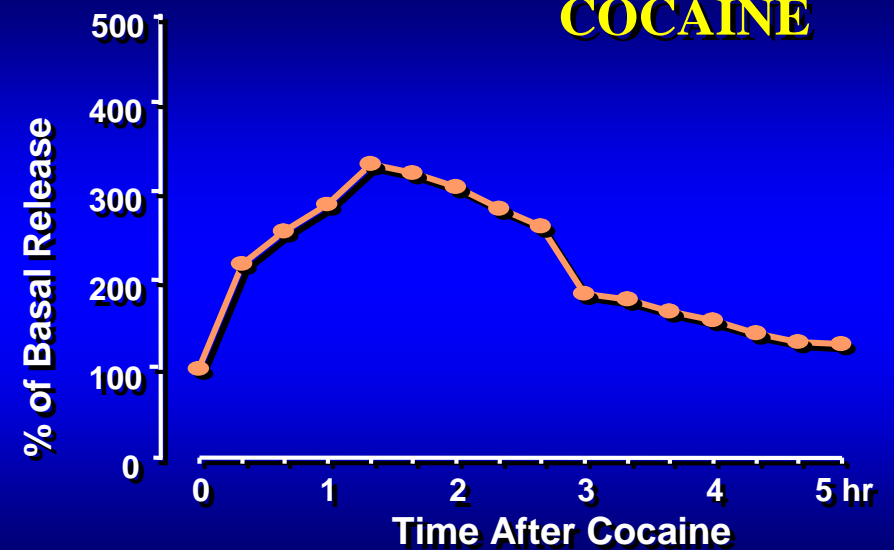
Dopamine Neurotransmission



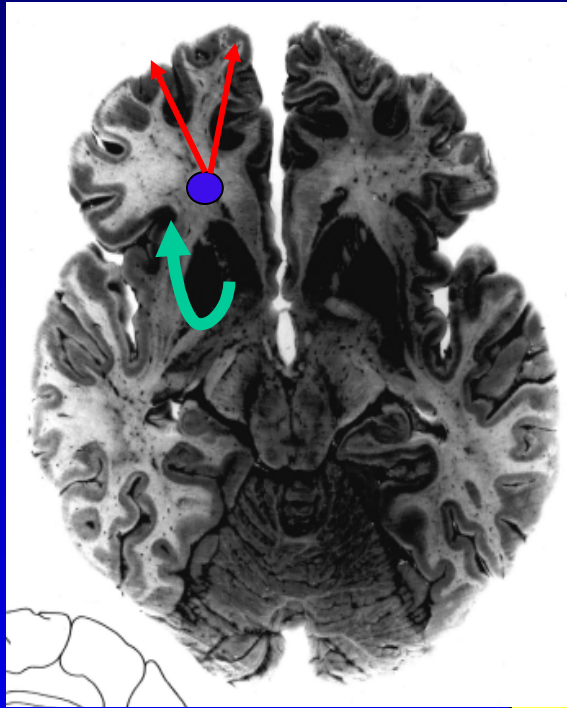
METHAMPHETAMINE



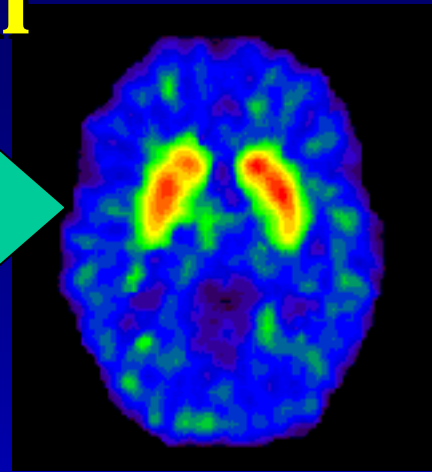
COCAINE



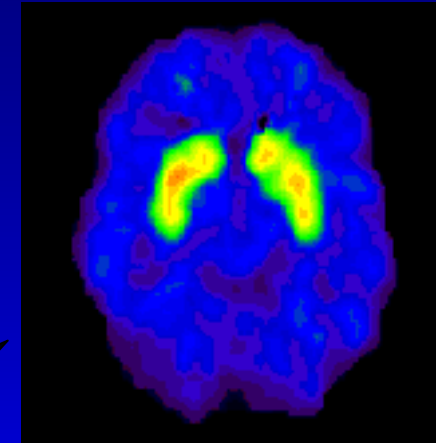
Brain Dopamine System



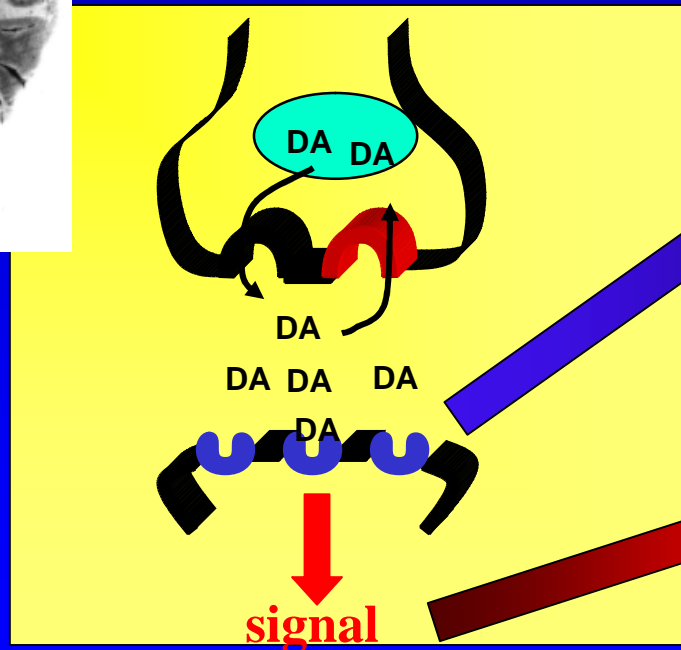
Anatomy



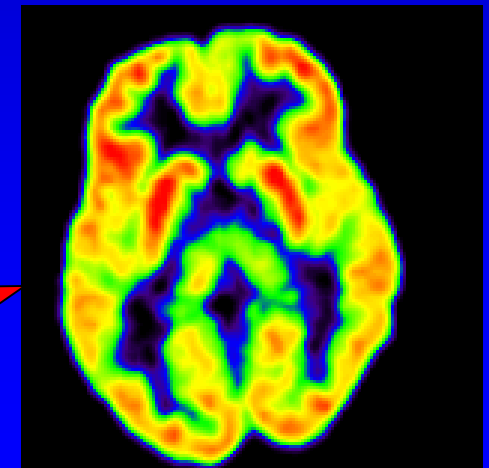
DA Transporters



DA Receptors

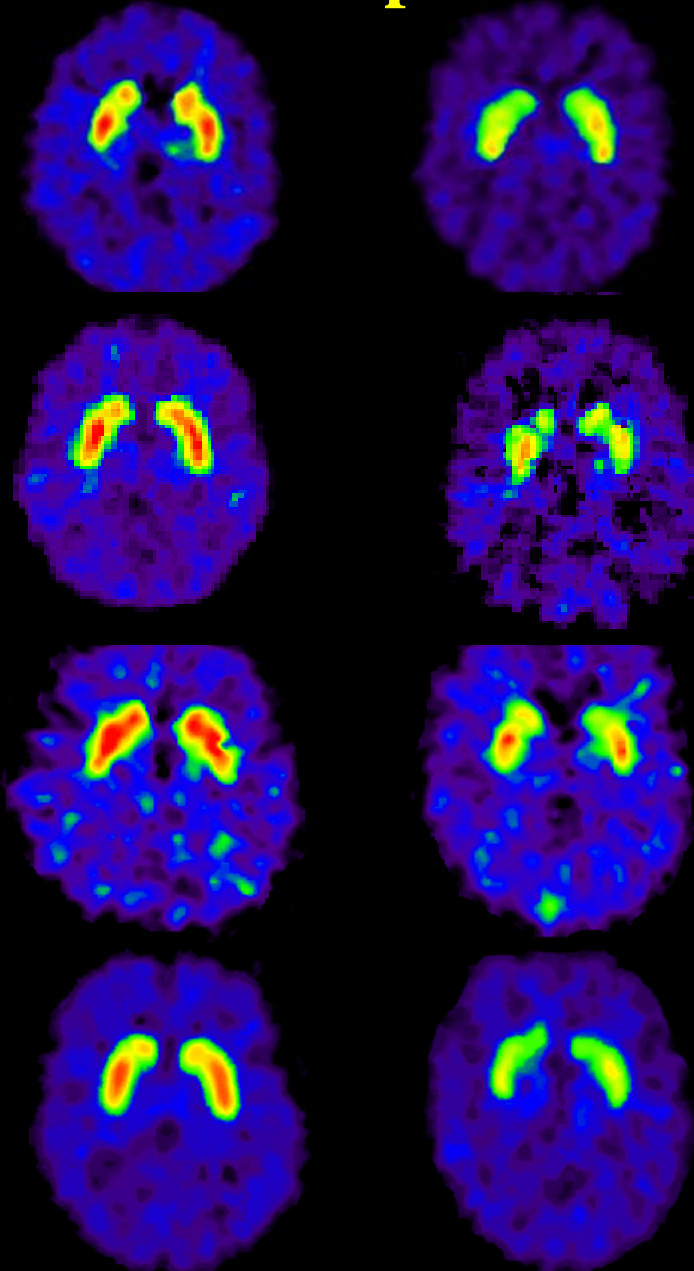


Dopamine Cell



Metabolism

Dopamine D2 Receptors are Lower in Addiction

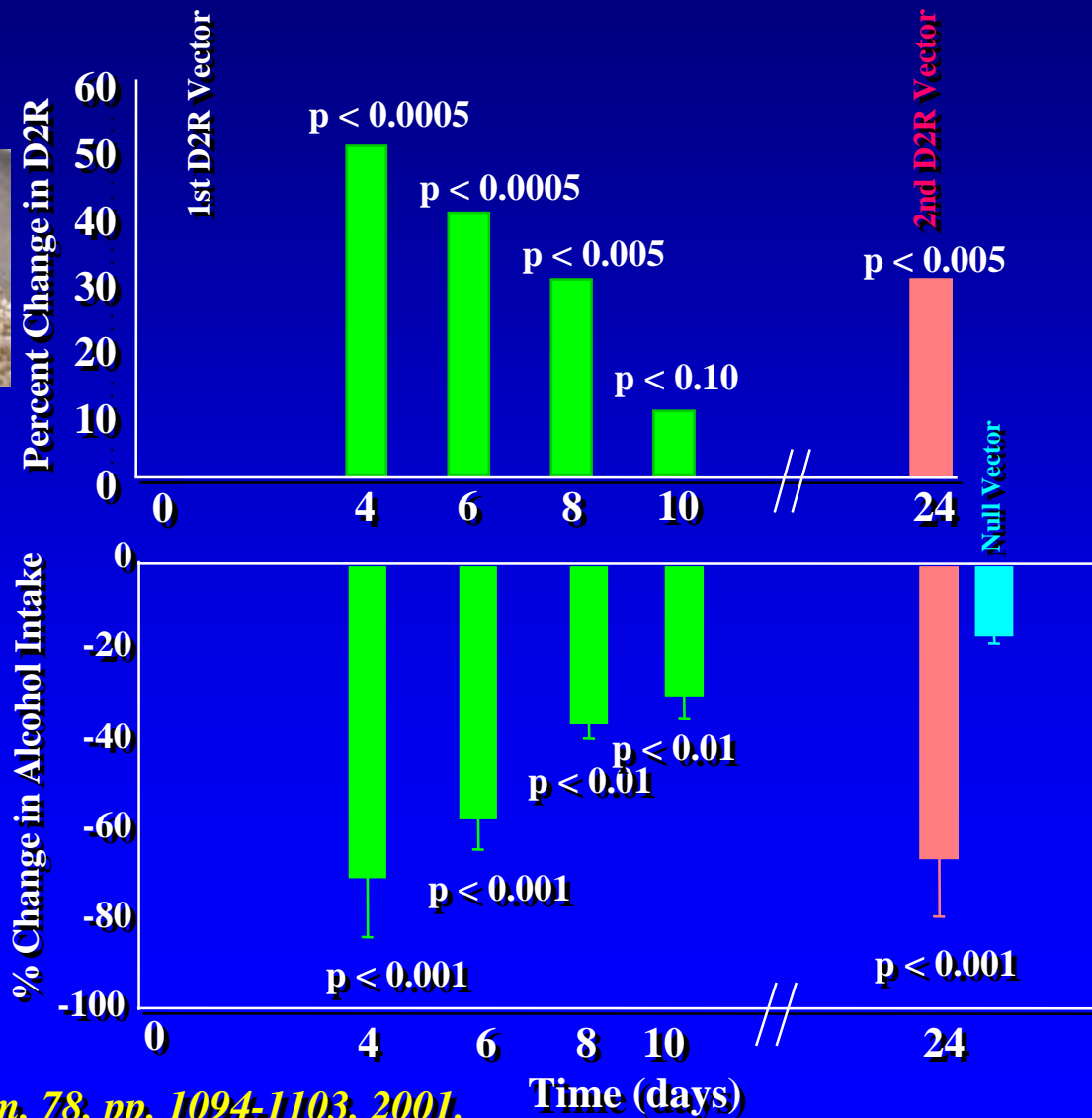
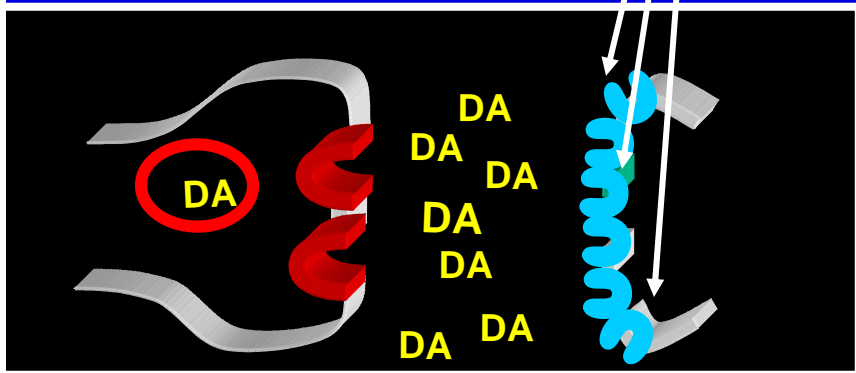
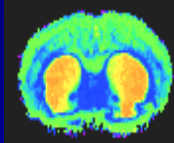


DA D2 Receptor Availability ↑



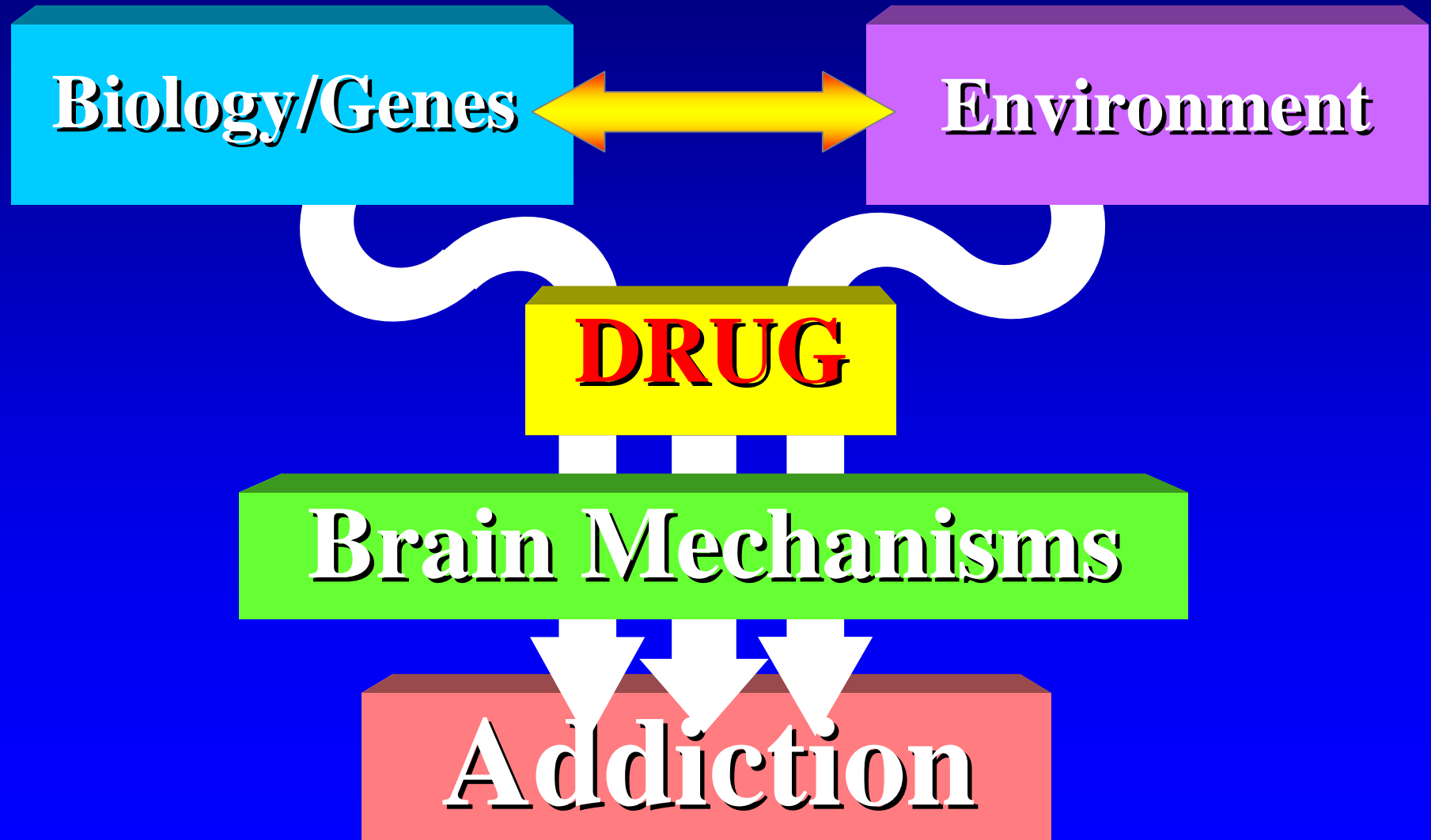
Effects of Tx with an Adenovirus Carrying a DA D2 Receptor Gene into NAc in DA D2 Receptors

Overexpression of DA D2 receptors reduces alcohol self-administration



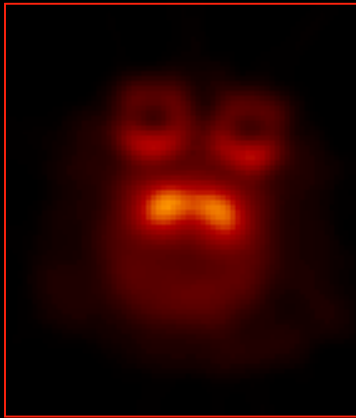
Source: Thanos, PK et al., J Neurochem, 78, pp. 1094-1103, 2001.

ADDICTION INVOLVES MULTIPLE FACTORS

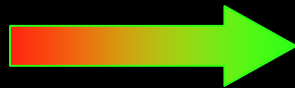


Effects of a Social Stressor on Brain DA D2 Receptors and Propensity to Administer Drugs

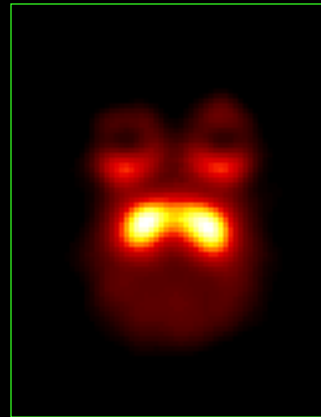
Individually Housed



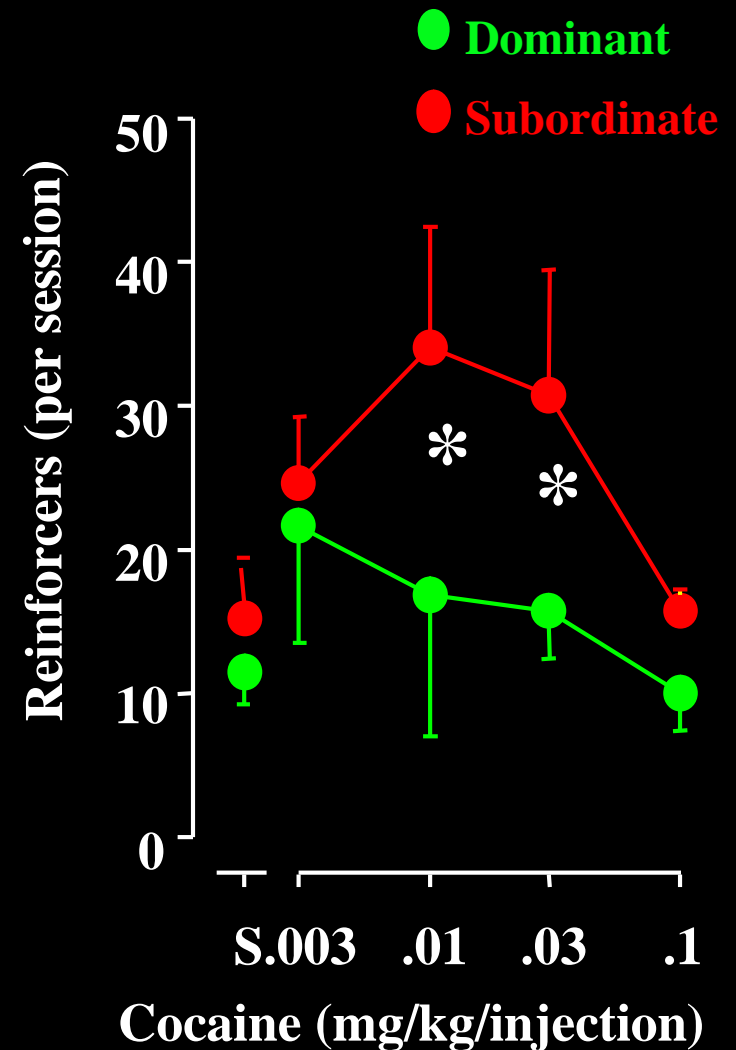
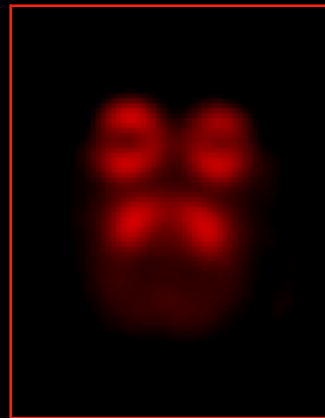
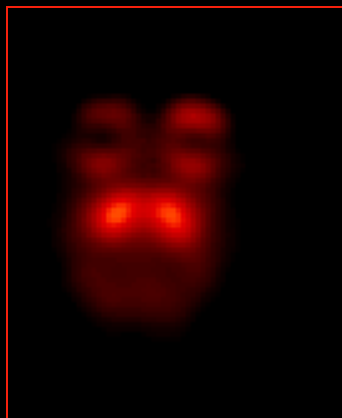
Becomes *Dominant*
No longer stressed



Group Housed

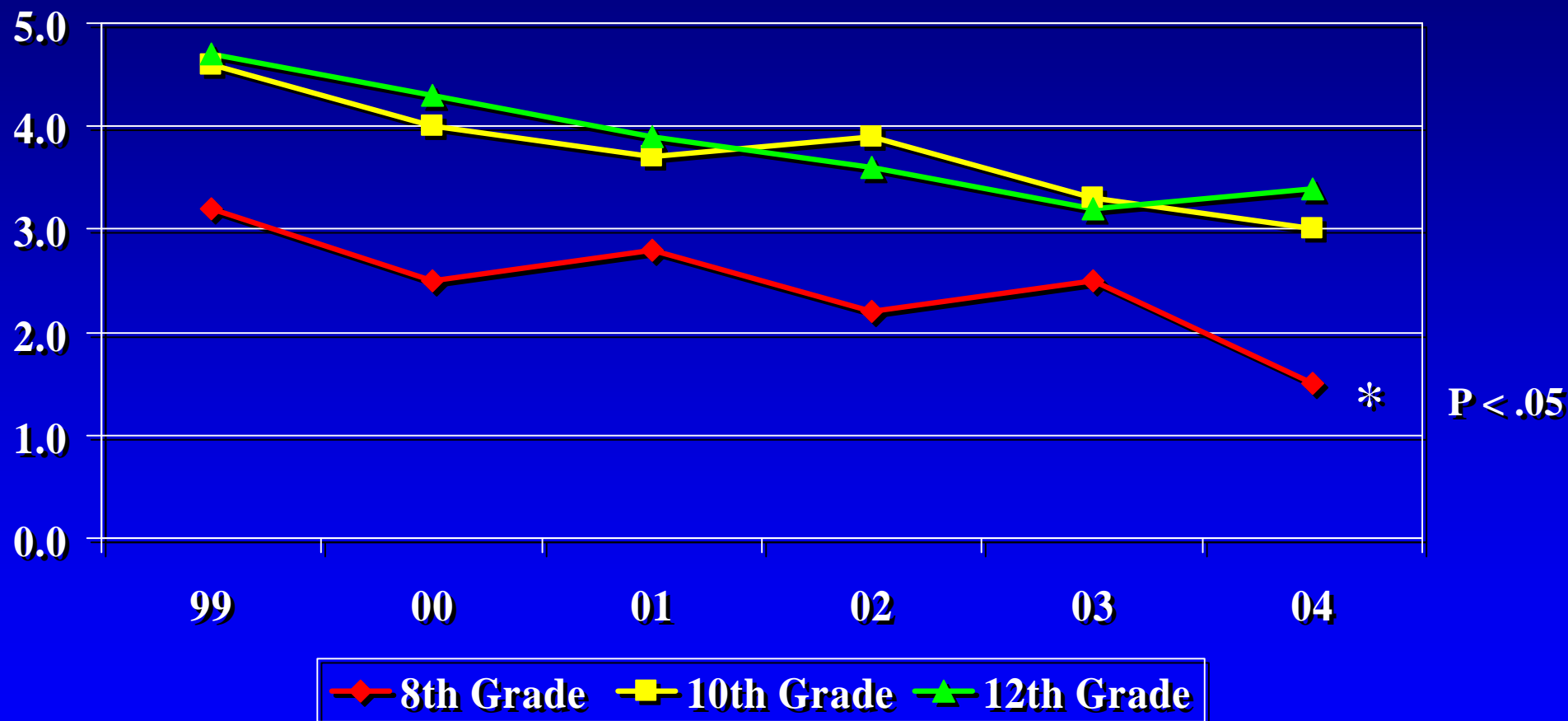


Becomes *Subordinate*
Stress remains



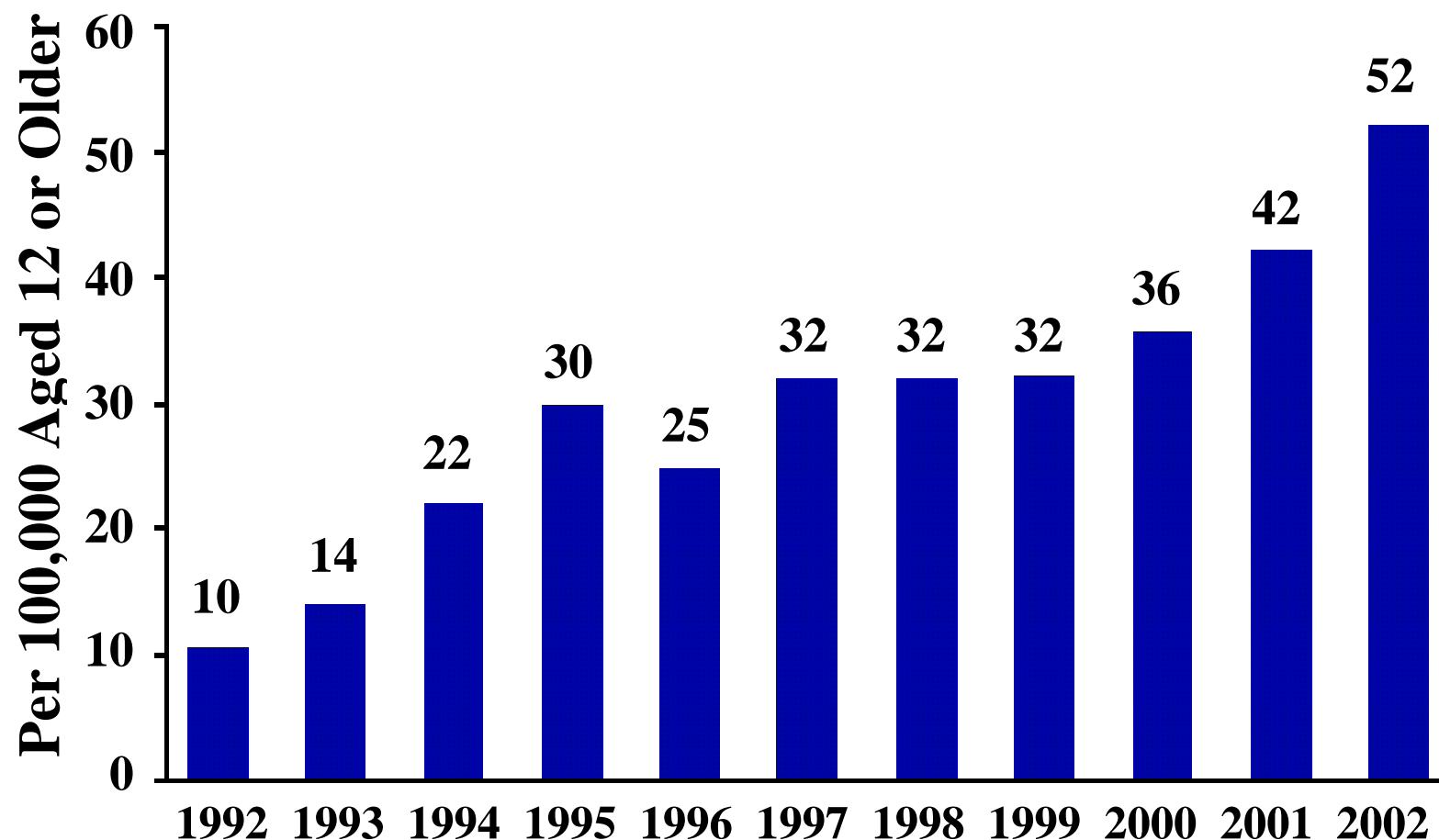
Morgan, D. et al. *Nature Neuroscience*, 5: 169-174, 2002.

According to the Monitoring the Future Study... Methamphetamine is not Increasing



**Percent of Students Reporting Use of
Methamphetamine in Past Year, by Grade**

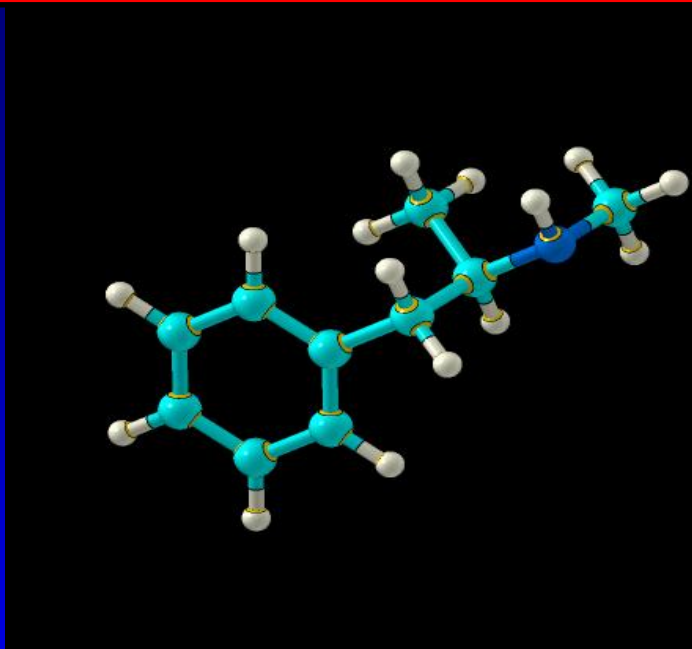
Methamphetamine Treatment Admissions Have Been Increasing



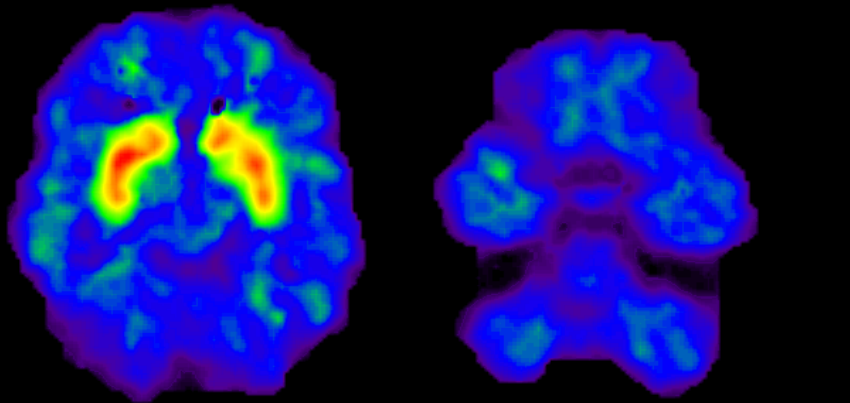
**Methamphetamine/Amphetamine Treatment
Admission Rate : 1992 -2002**
2002 SAMHSA Treatment Episode Data Set

Concerns with Methamphetamine

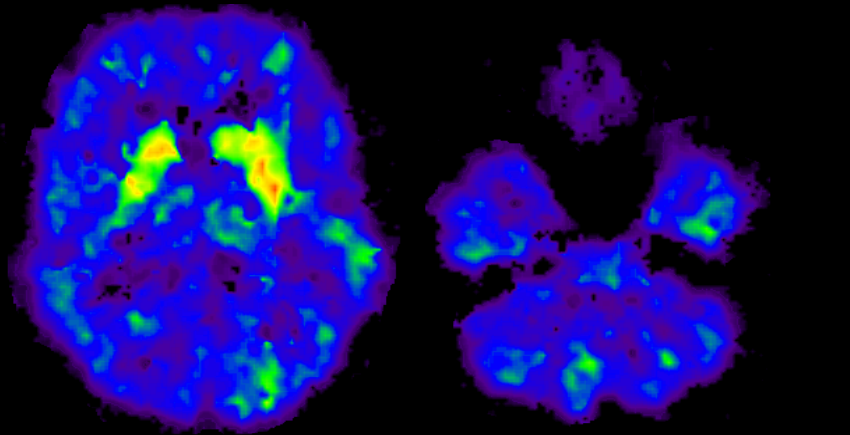
- | **Neurotoxic** in animal models of drug self administration
- | Highly **addictive**
- | Intoxication associated with behaviors that **increase risks for infection with HIV and HCV**
- | Can be **easily manufactured** by small clandestine laboratories



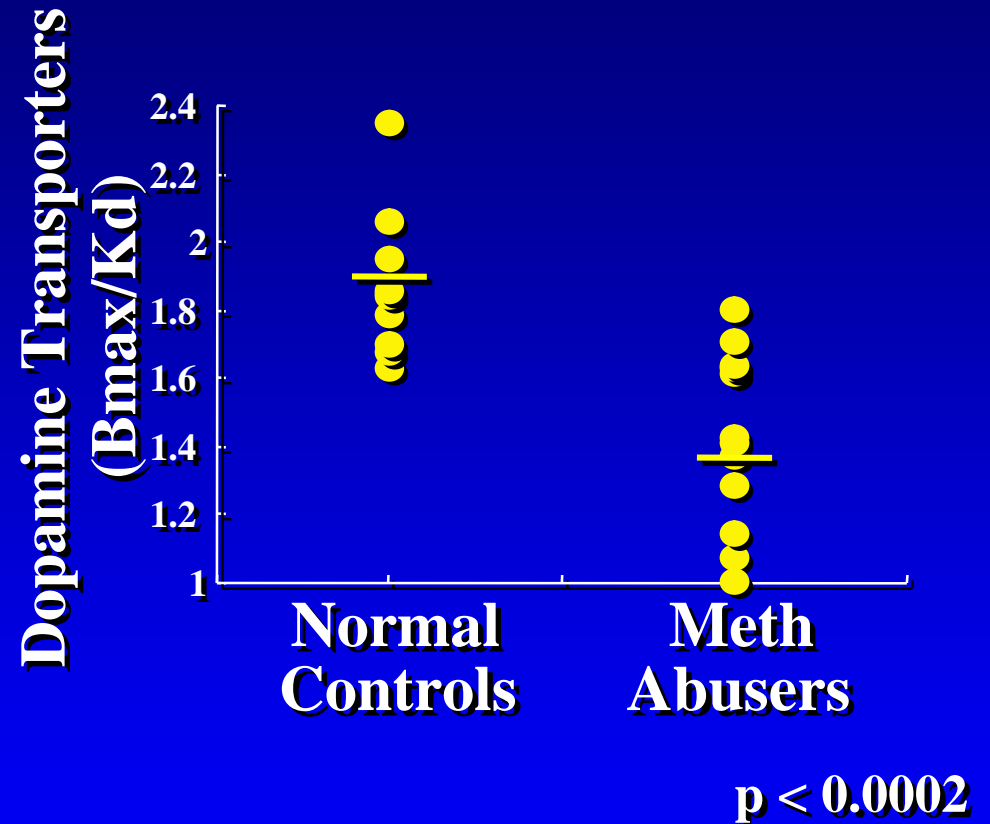
Dopamine Transporters in Methamphetamine Abusers



Normal Control

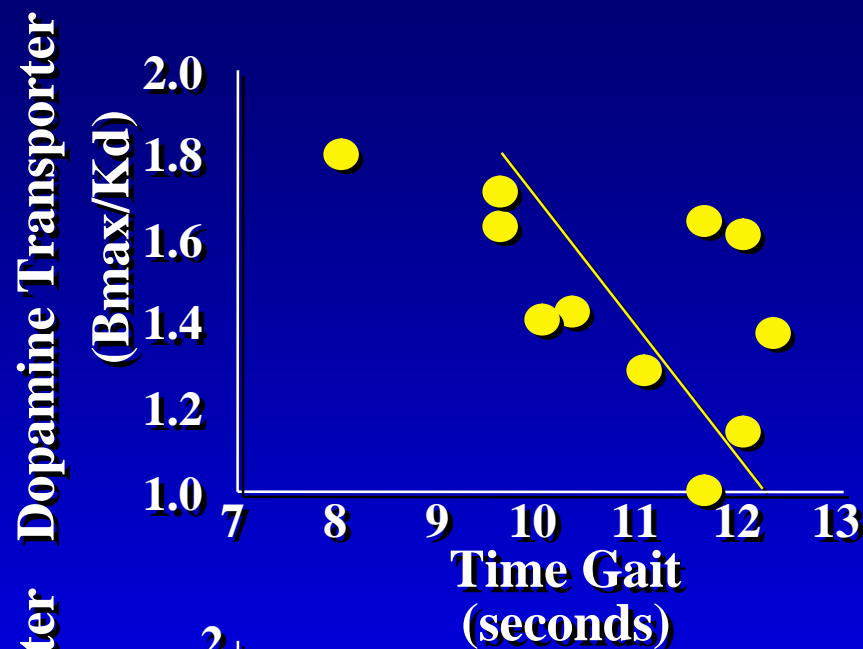


Methamphetamine Abuser



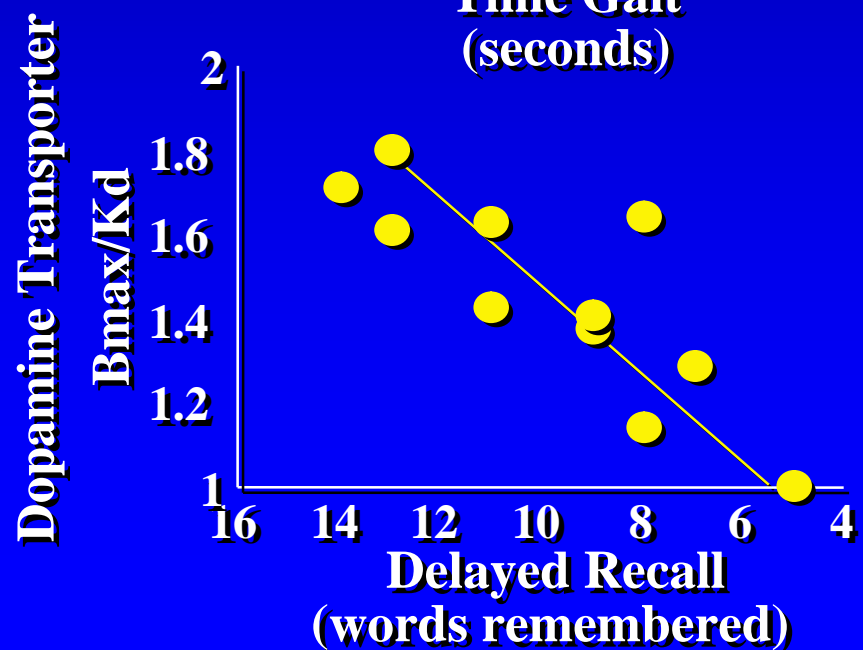
- **Methamphetamine abusers have significant reductions in dopamine transporters**

Dopamine Transporters in Methamphetamine Abusers



Motor Task

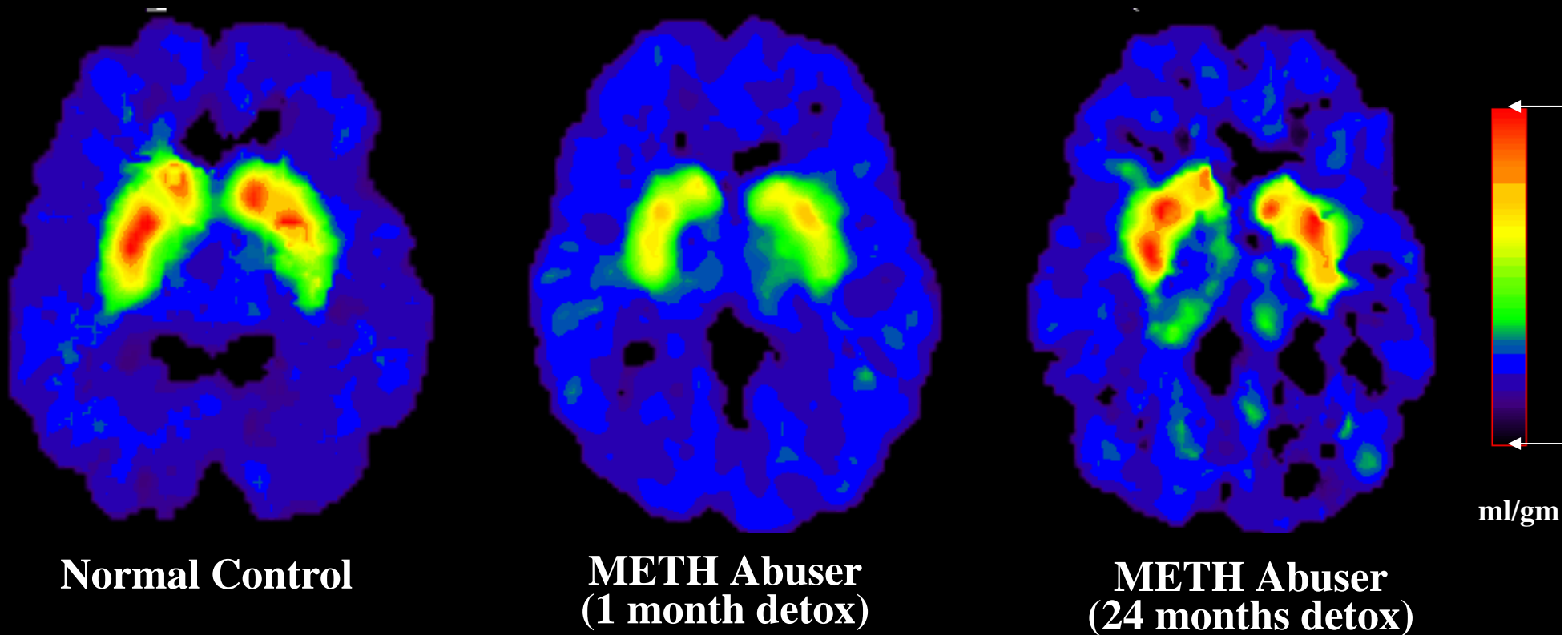
Loss is associated with slowing of motor reactions.



Memory Task

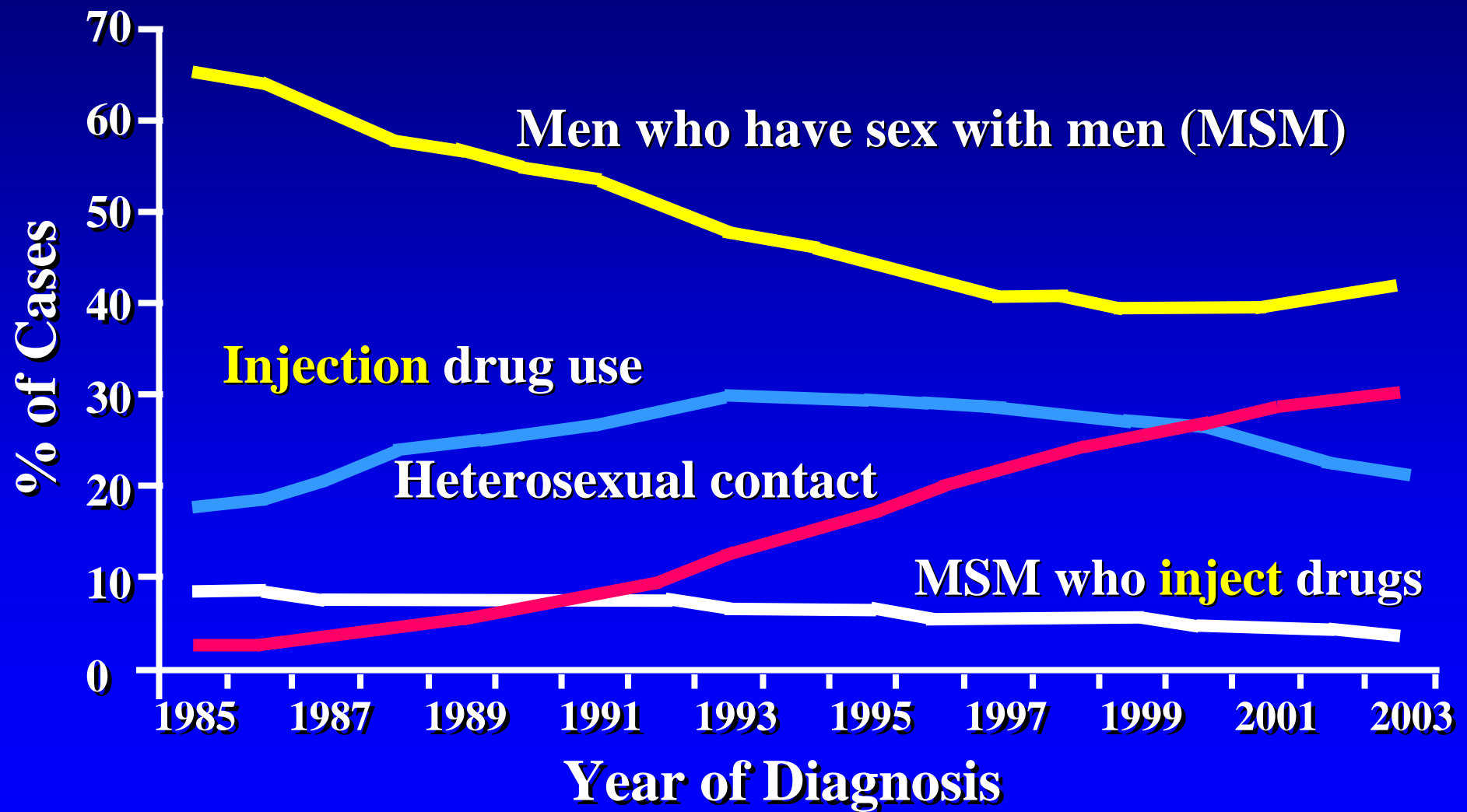
Loss is associated with memory impairment.

Partial Recovery of Brain Dopamine Transporters in Methamphetamine (METH) Abuser After Protracted Abstinence



Source: Volkow, ND et al., Journal of Neuroscience 21, 9414-9418, 2001.

Proportions of AIDS Cases in Adults and Adolescents by Exposure in the USA



Source: Centers for Disease Control and Prevention (CDC)

Methamphetamine in the HIV Epidemic

- **METH has been shown to alter immune function**
- **Risky sexual behavior that occurs during METH intoxication increases the risk of HIV infection**
- **Physiological changes resulting from METH use may increase infectivity (e.g., erosion of normal protective epithelial layer)**

Aggressive Action Is Needed To Stop METH Use & Its Serious Consequences

- We Need to **Make the Public Aware** of the Drug's **Toxic** and **Addictive** Properties
- And to **Develop Treatments** that will counteract neuroadaptations that underlie the addictive process and reverse METH's neurotoxic effects



The Partnership Between



and



Is working to develop...

A Latin American Epidemiology Work Group that would parallel the US Community Epidemiology Work Group (CEWG)

A program offering small research grants to students carrying out their post-graduate thesis work at Latin American Universities

