

Methamphetamine and the Brain: New Knowledge; New Treatments

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Pacific Southwest Technology Transfer Center (SAMHSA)
International Network of Treatment and Rehabilitation Resource Centres (UNODC)

Methamphetamine

The Drug

Forms of Methamphetamine



Methamphetamine Powder

IDU Description: Beige/yellowy/off-white powder



Base / Paste Methamphetamine

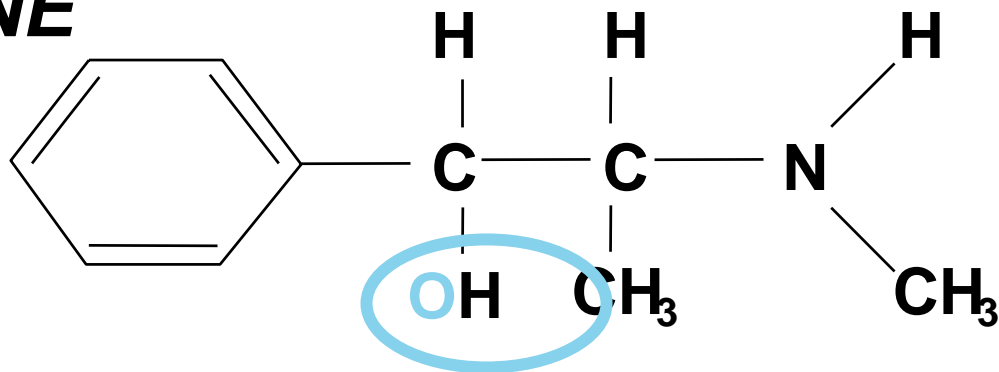
IDU Description: 'Oily', 'gunky', 'gluggy' gel, moist, waxy



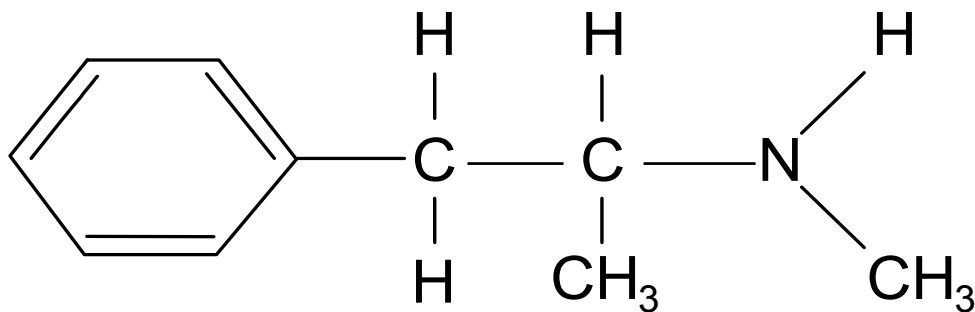
Crystalline Methamphetamine

IDU Description: White/clear crystals/rocks; 'crushed glass' / 'rock salt'

EPHEDRINE



METHAMPHETAMINE



Methamphetamine

The US Epidemic

Scope of the Methamphetamine Problem Worldwide

- According to surveys and estimates by WHO and UNODC, methamphetamine is the most widely used illicit drug in the world except for cannabis.
- World wide it is estimated there are over 26 million regular users of amphetamine/methamphetamine, as compared to approximately 16 million heroin users and 14 million cocaine users

The Methamphetamine Epidemic: Admissions/100,000: 1992-2003

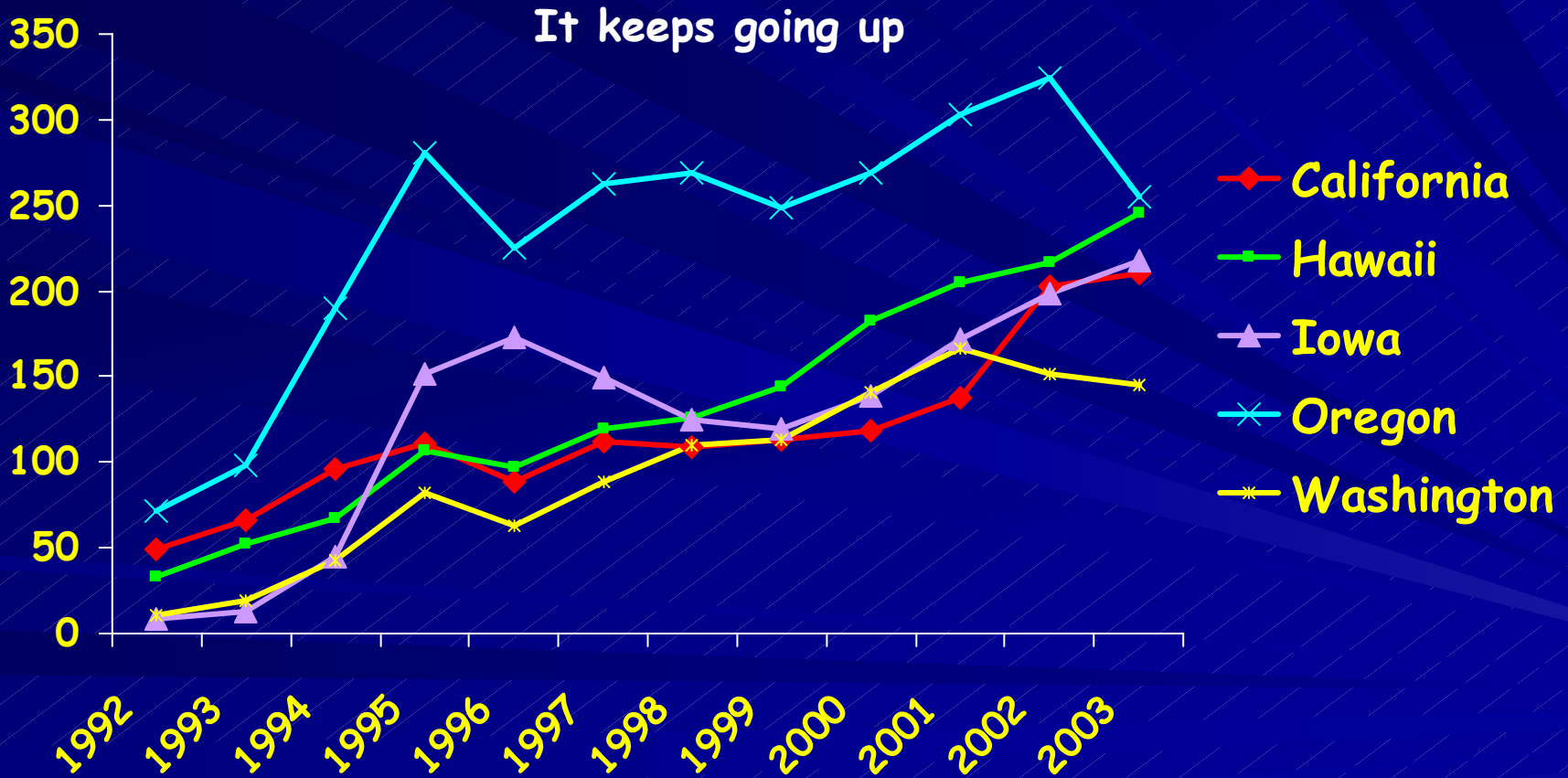
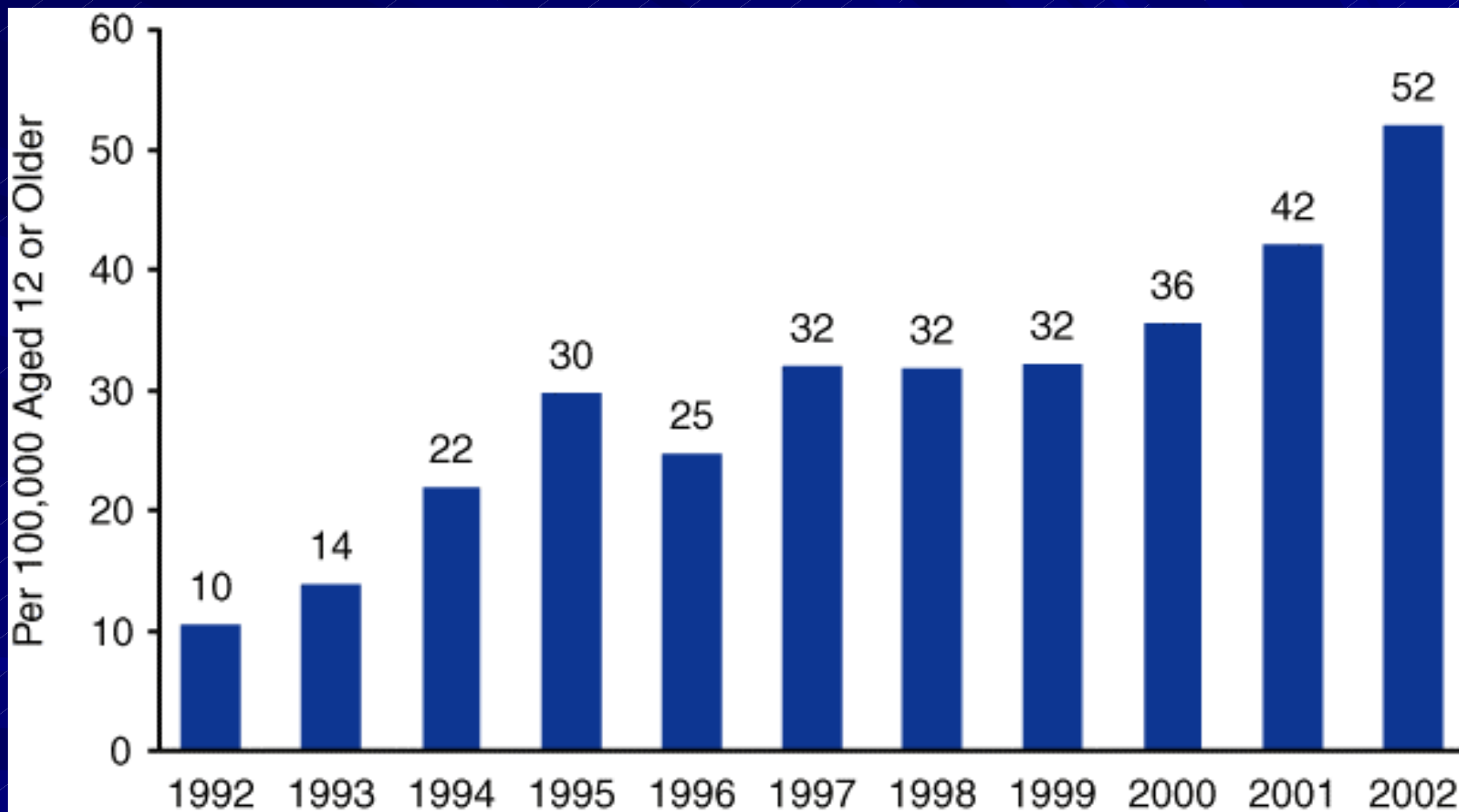
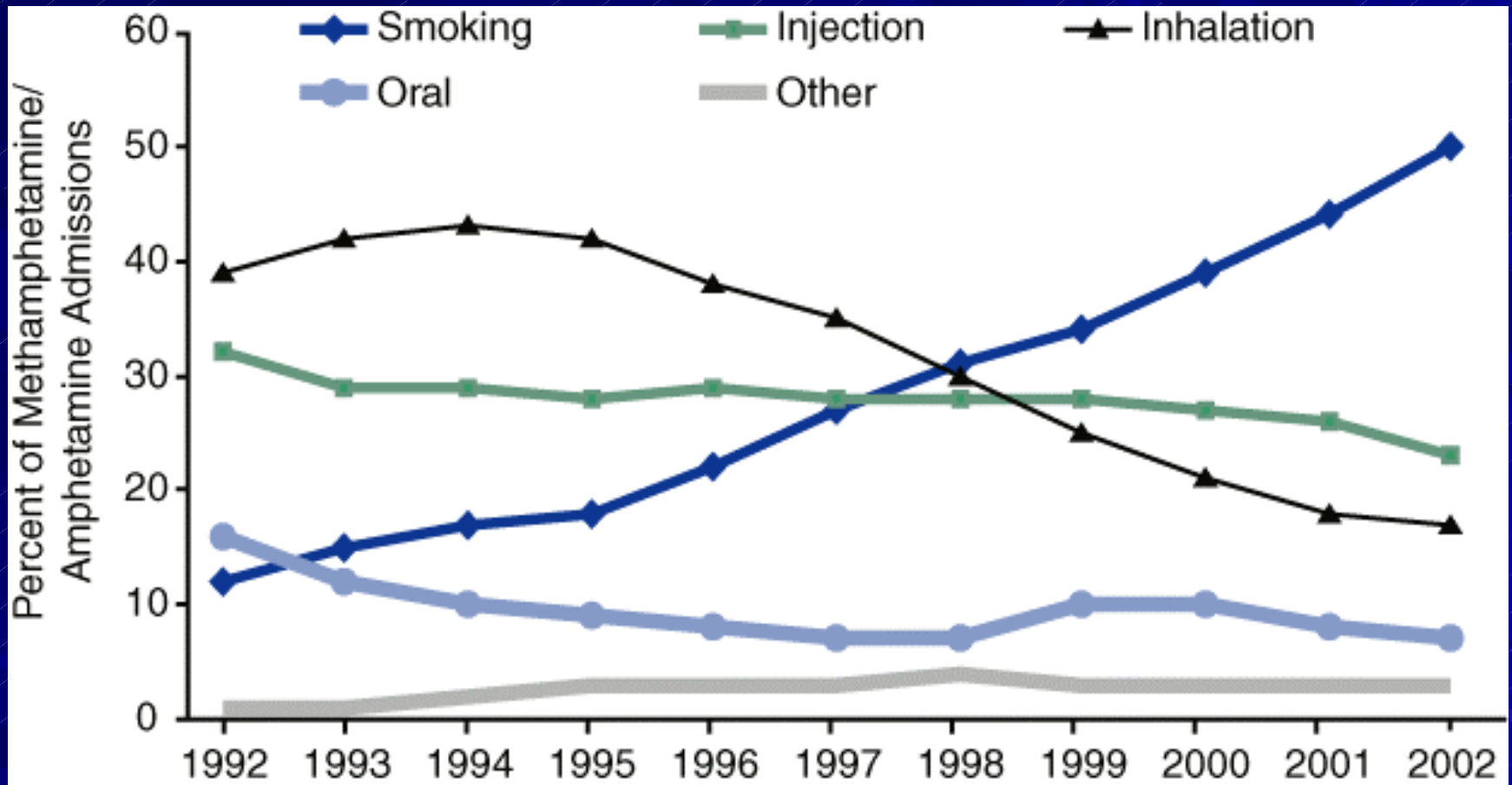


Figure 1. Methamphetamine/Amphetamine Treatment Admission Rate per 100,000 Population Aged 12 or Older: 1992-2002



Source: 2002 SAMHSA Treatment Episode Data Set (TEDS).

Figure 2. Methamphetamine/Amphetamine Treatment Admissions, by Route of Administration: 1992-2002

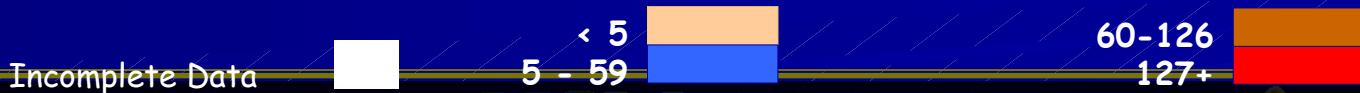
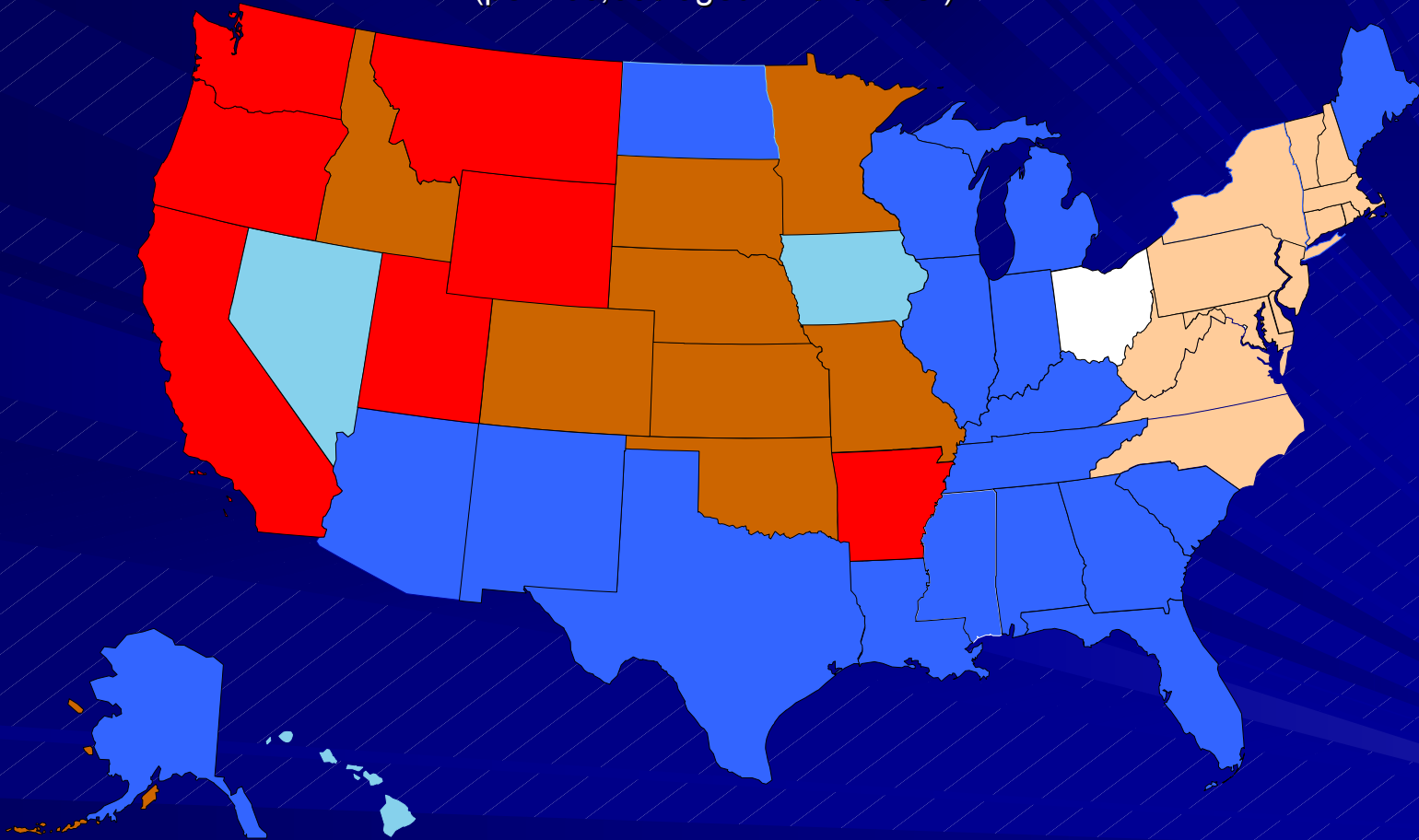


Source: 2002 SAMHSA Treatment Episode Data Set (TEDS).

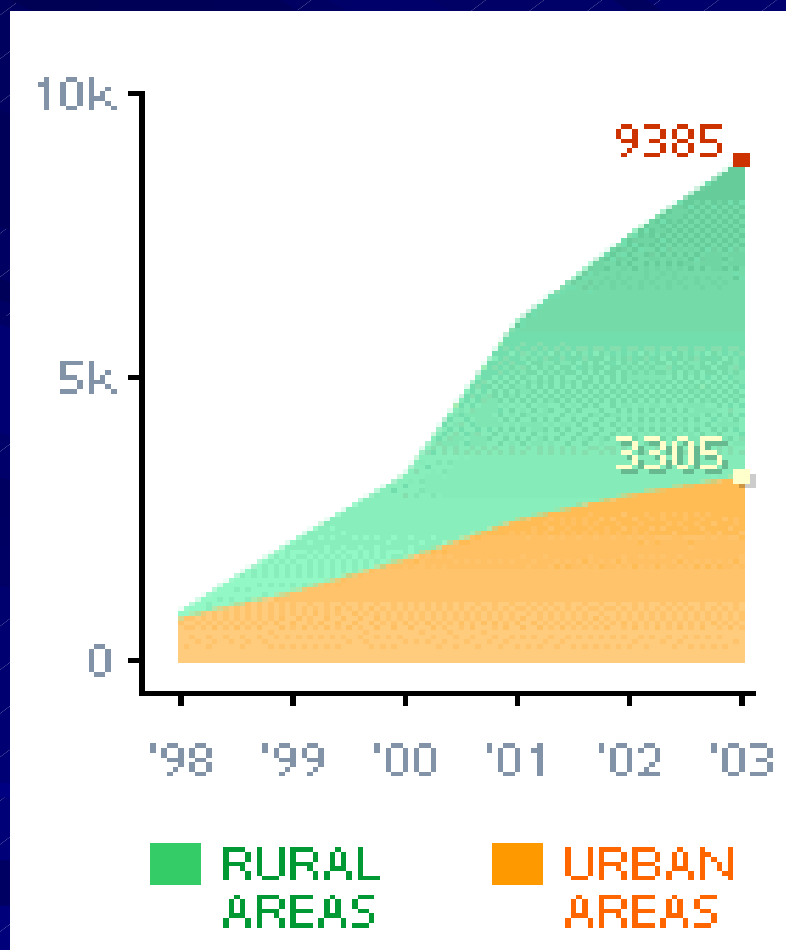
The Eastward Spread of Methamphetamine

Primary Amphetamine/Methamphetamine TEDS Admission Rates: 2003

(per 100,000 aged 12 and over)



Methamphetamine: A Growing Menace in Rural America



- In 1998, rural areas nationwide reported 949 methamphetamine labs.
- Last year, 9,385 were reported.
- This year, 4,589 rural labs had been reported as of July 26.

■ Source: El Paso Intelligence Center (EPIC), U.S. DEA

Methamphetamine

Medical/Psychiatric Effects and Consequences

Cardiovascular problems

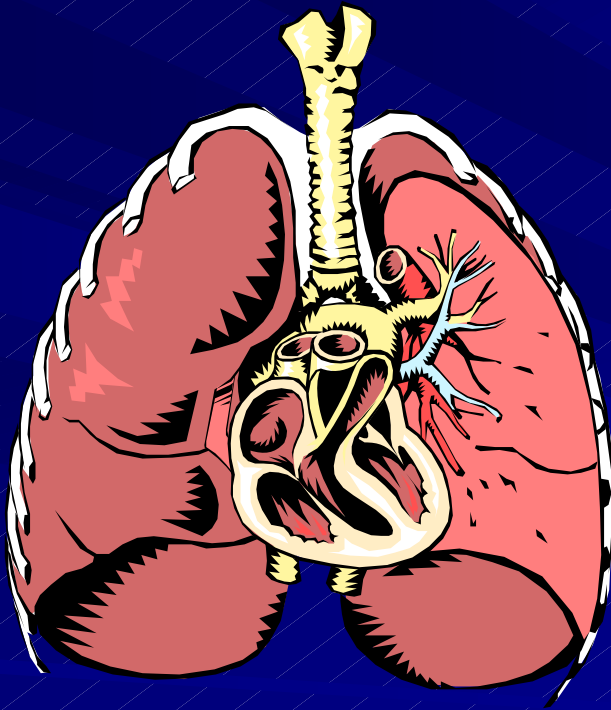
- ↑ Heart rate
- Palpitations
- Arrhythmia
- ↑ Blood pressure
- Chest Pain
 - Acute coronary syndrome
- Valve thickening

Neurological problems



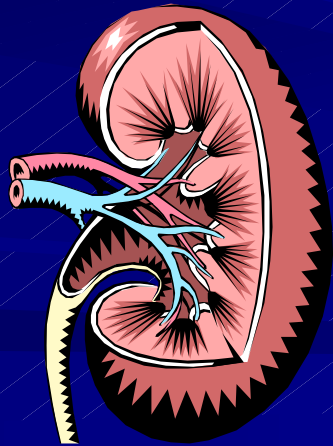
- Seizures
- Stroke
- Cerebral hemorrhage
- Cerebral vasculitis
- Mydriasis

Respiratory problems



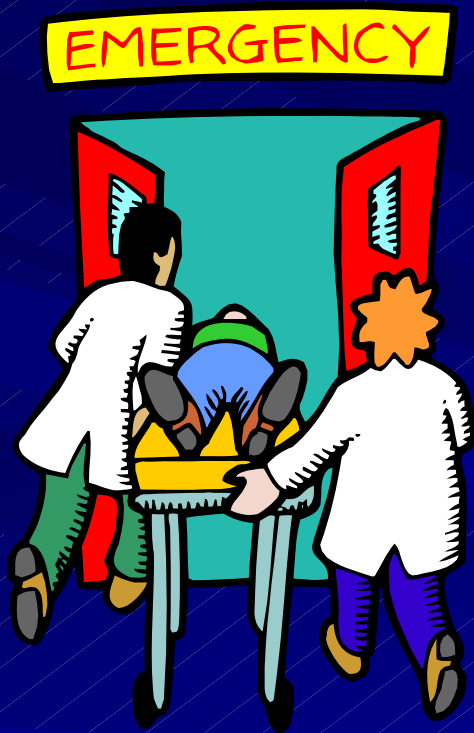
- Dyspnea
- Pulmonary hypertension
- Pleuritic chest pain

Other problems



- Eye ulcers
- Over-heating
- Rhabdomyolysis
- Obstetric complications
- Anorexia / weight loss
- Tooth wear, cavities
- “Speed bumps”

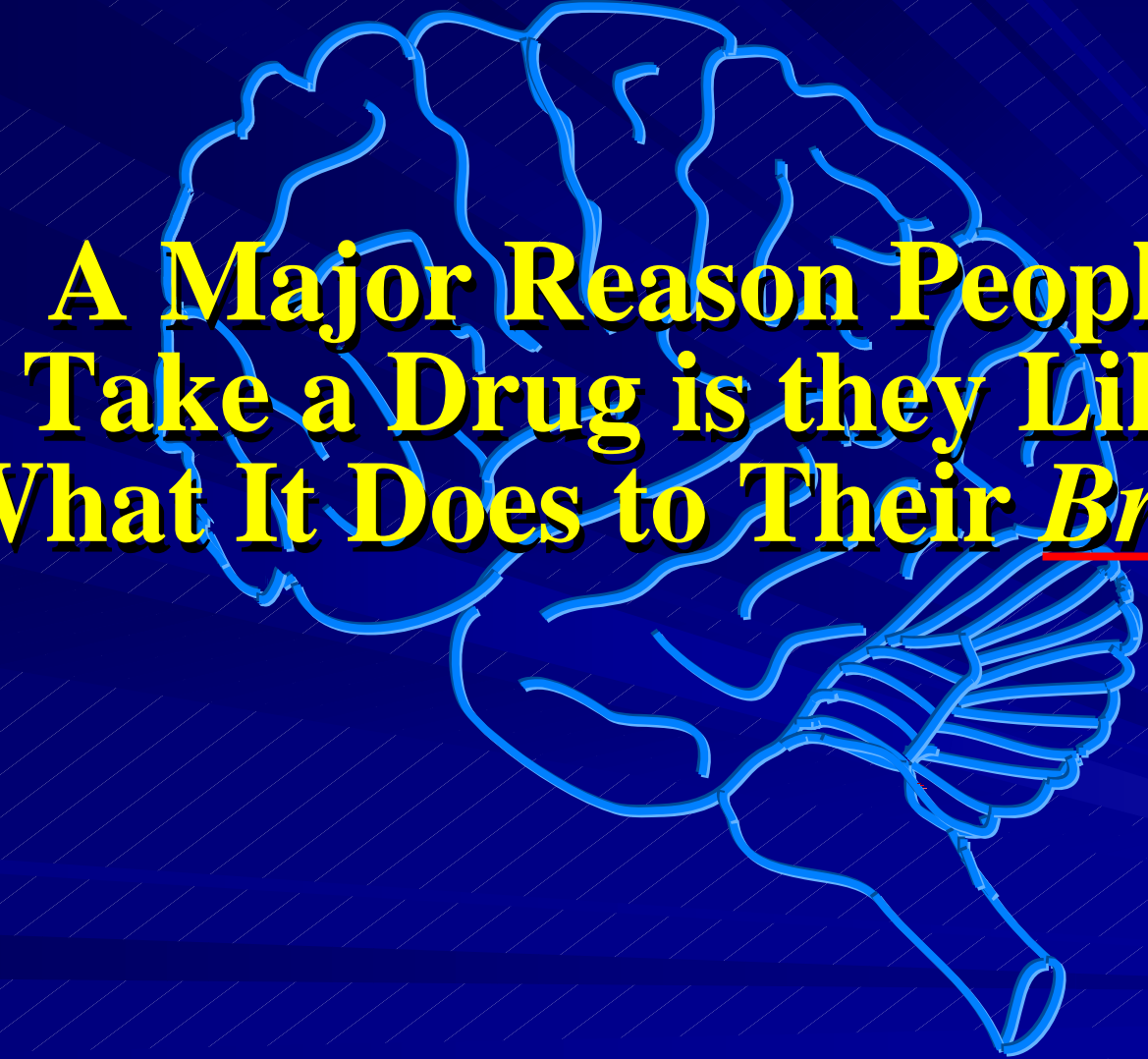
Trauma



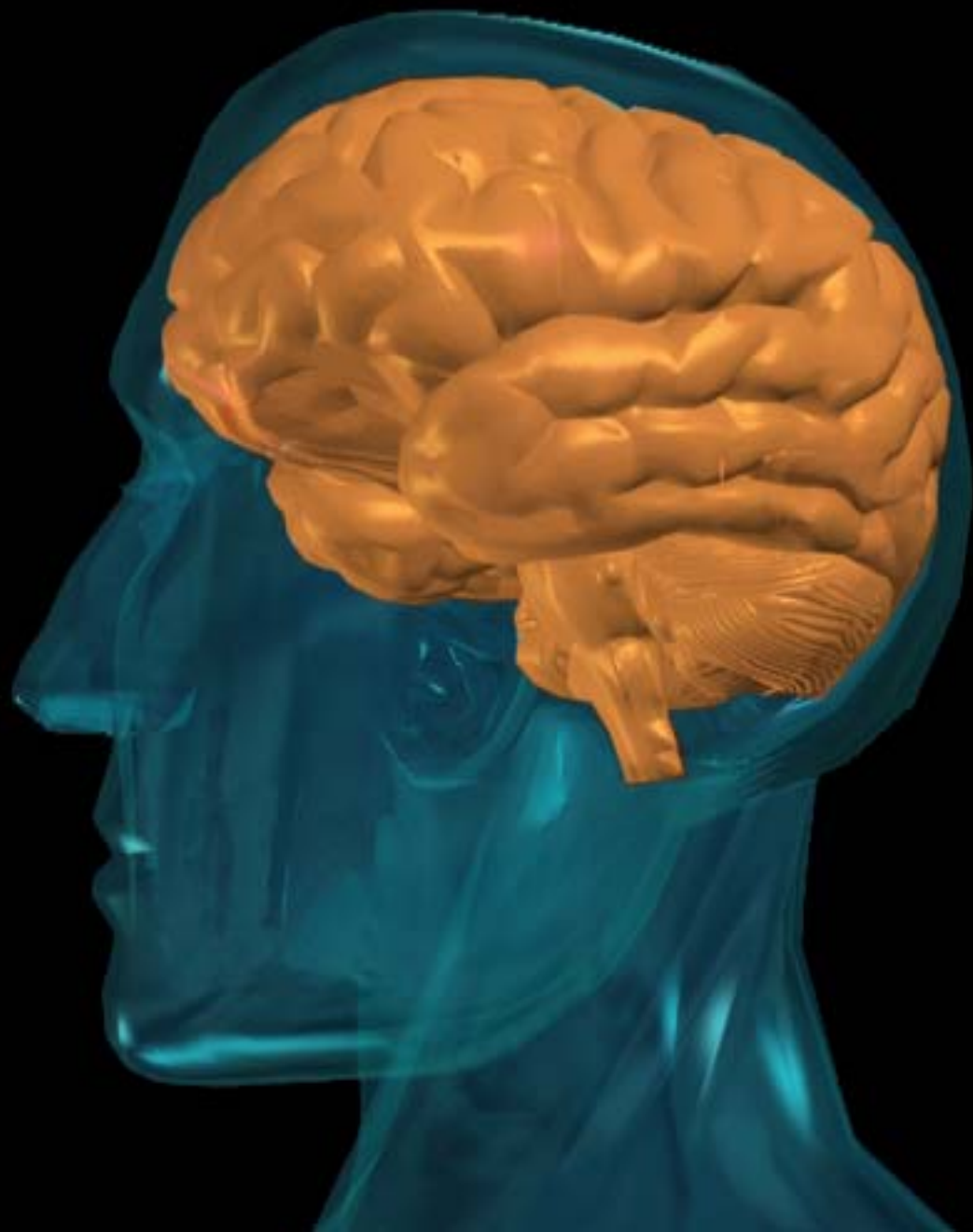
- Interpersonal trauma
 - Assault
 - Gunshot
 - Knife
- Motor Vehicles
- Suicide attempts

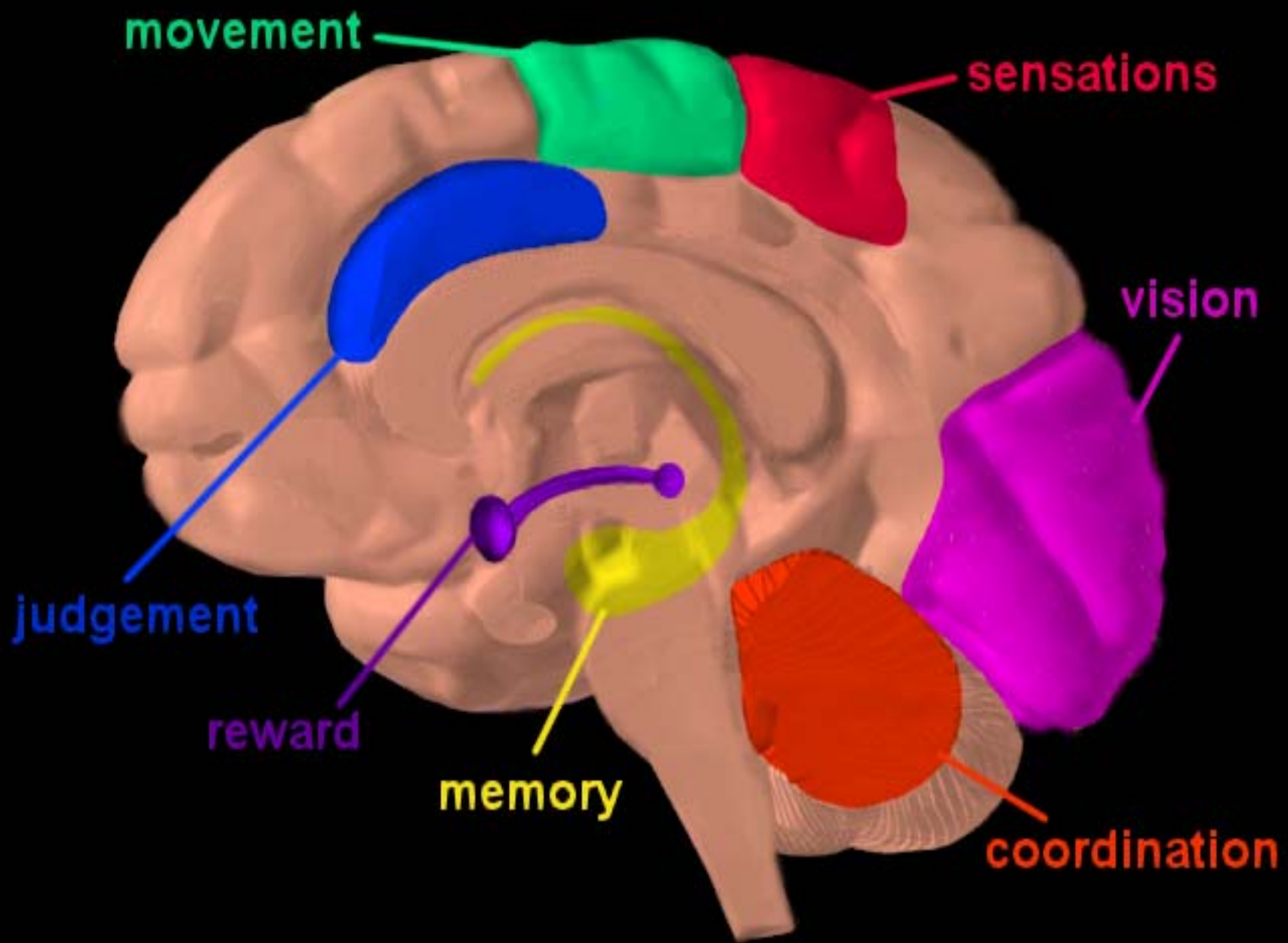
Methamphetamine

The Brain



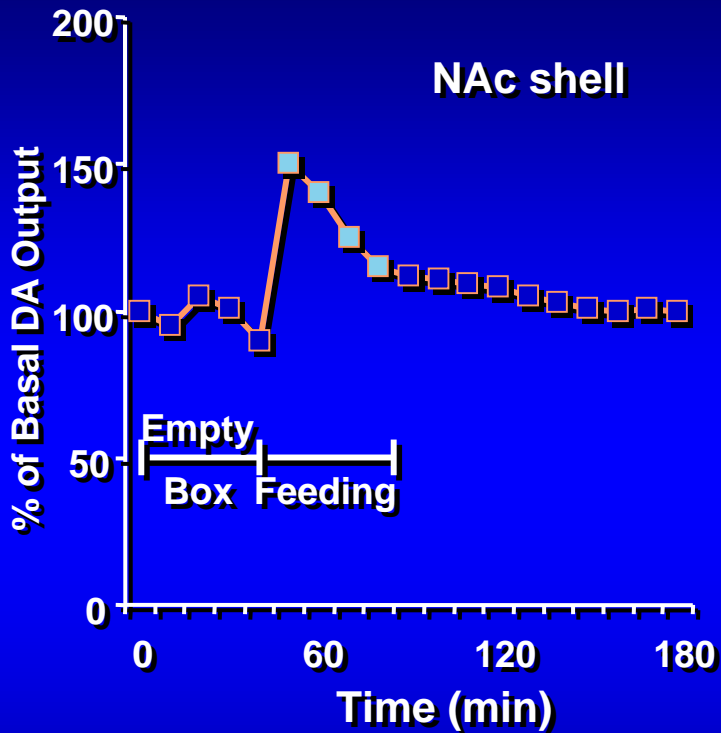
**A Major Reason People
Take a Drug is they Like
What It Does to Their Brains**





Natural Rewards Elevate Dopamine

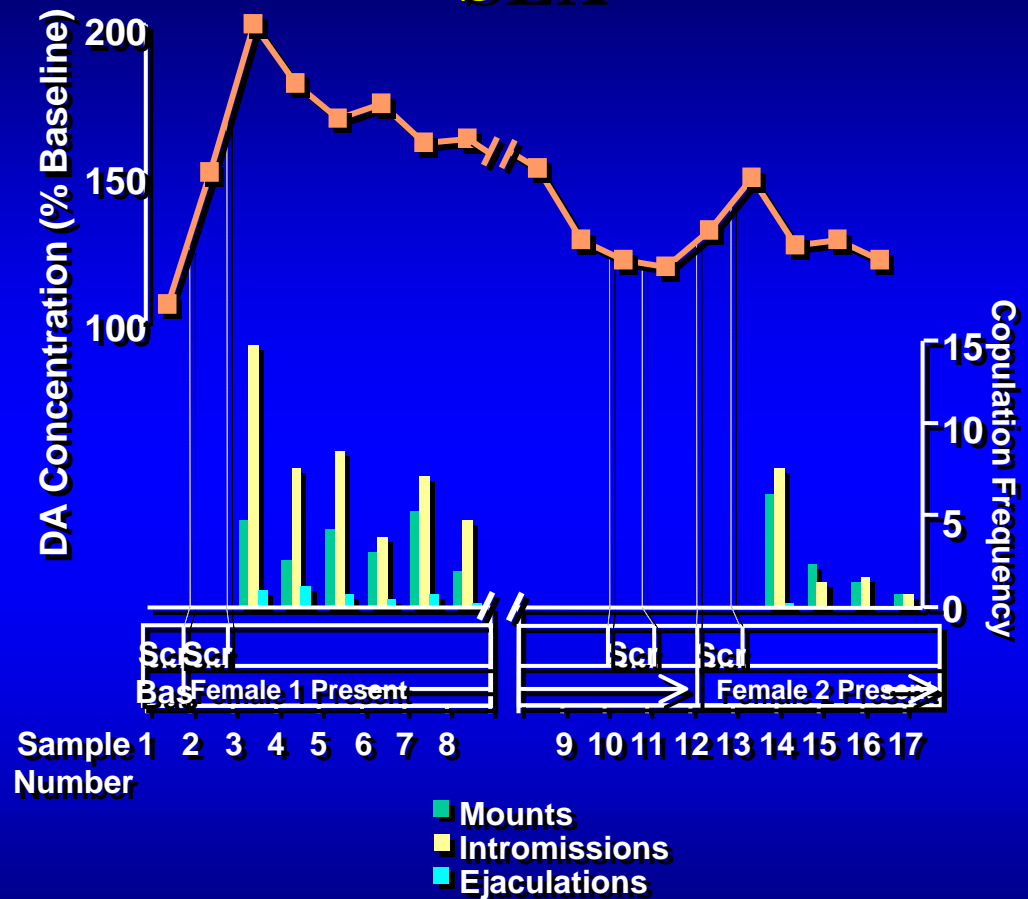
FOOD



Source: Di Chiara et al.

Levels

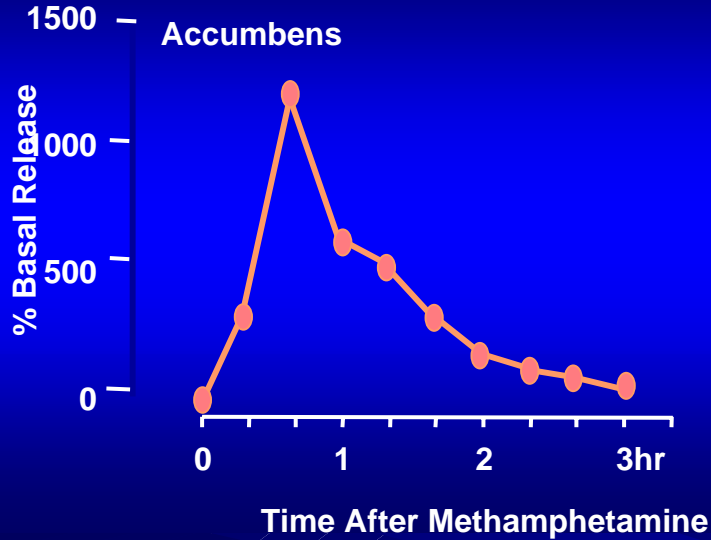
SEX



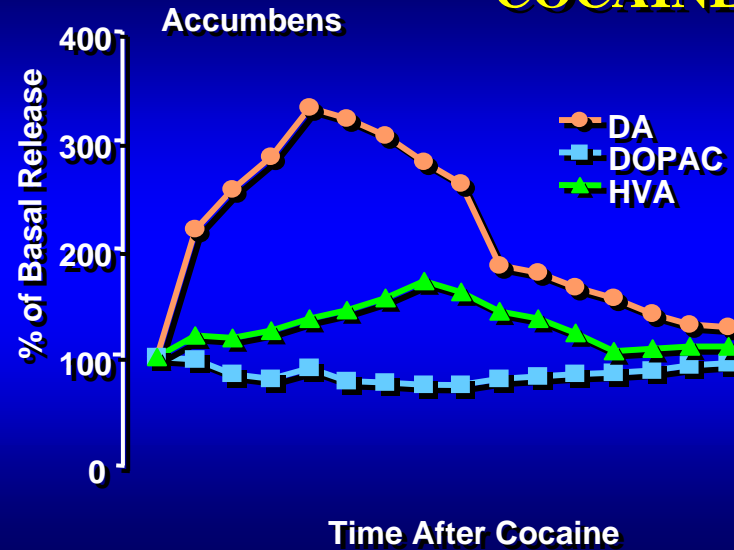
Source: Fiorino and Phillips

Effects of Drugs on Dopamine Release

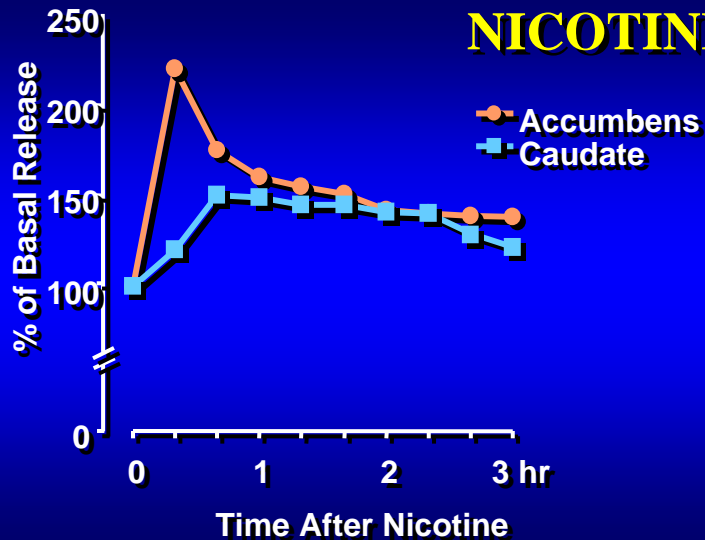
METHAMPHETAMINE



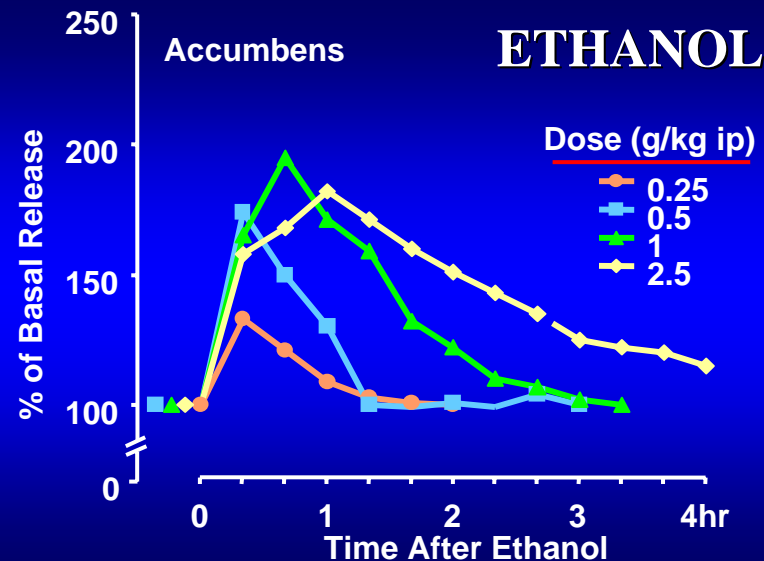
COCAINE



NICOTINE

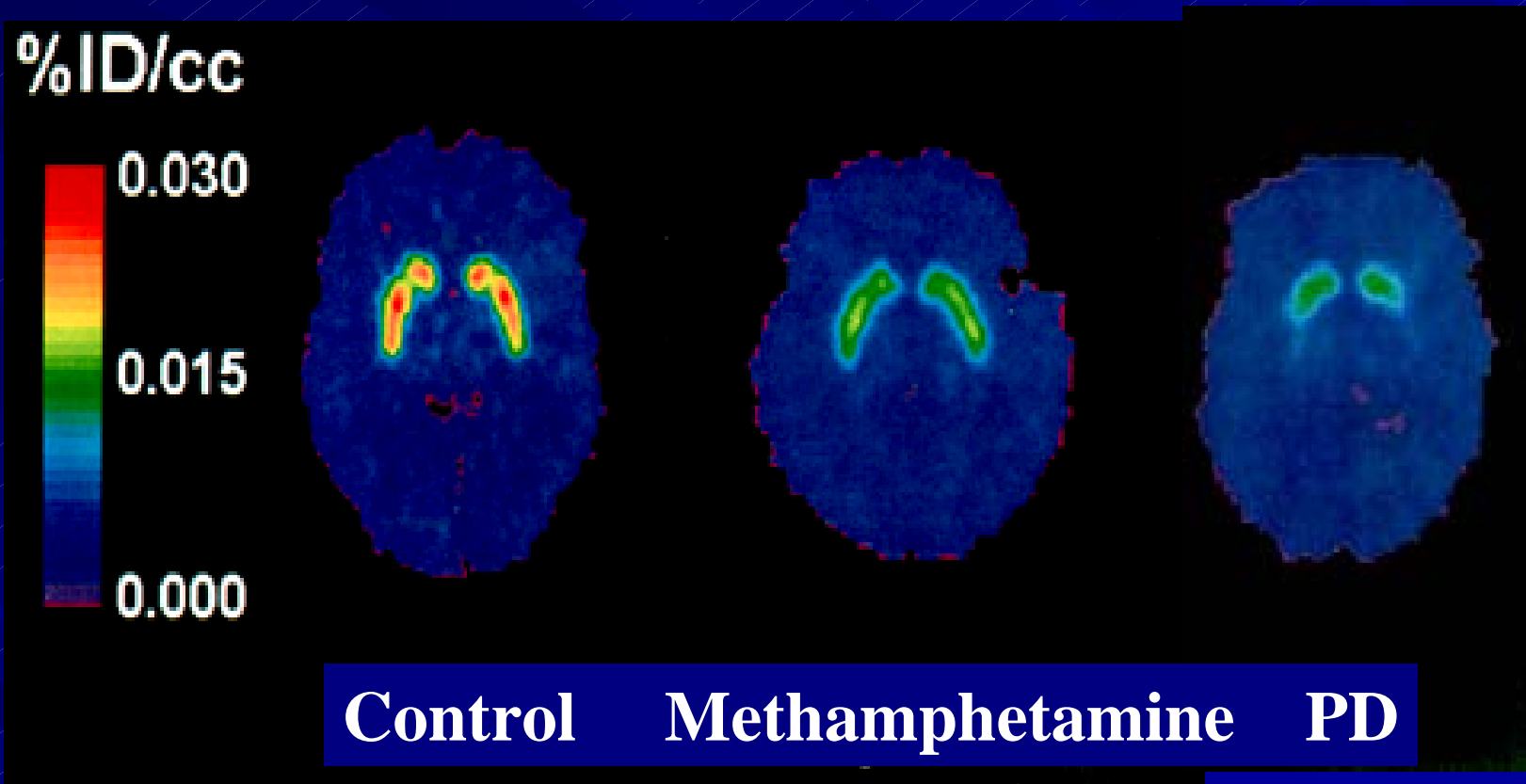


ETHANOL



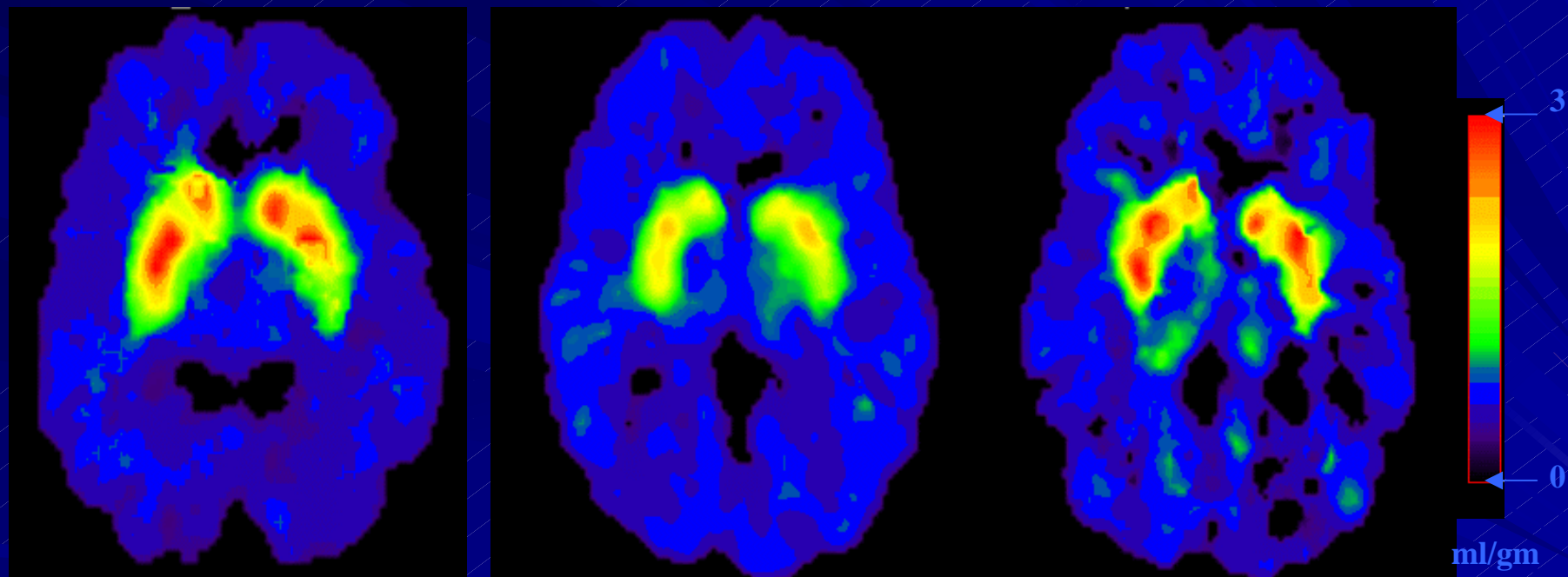
Prolonged Drug Use Changes the Brain In Fundamental and Long-Lasting Ways

Decreased dopamine transporter binding in METH users resembles that in Parkinson's Disease patients



Source: McCann U.D., et al., *Journal of Neuroscience*, 18, pp. 8417-8422, October 15, 1998.

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

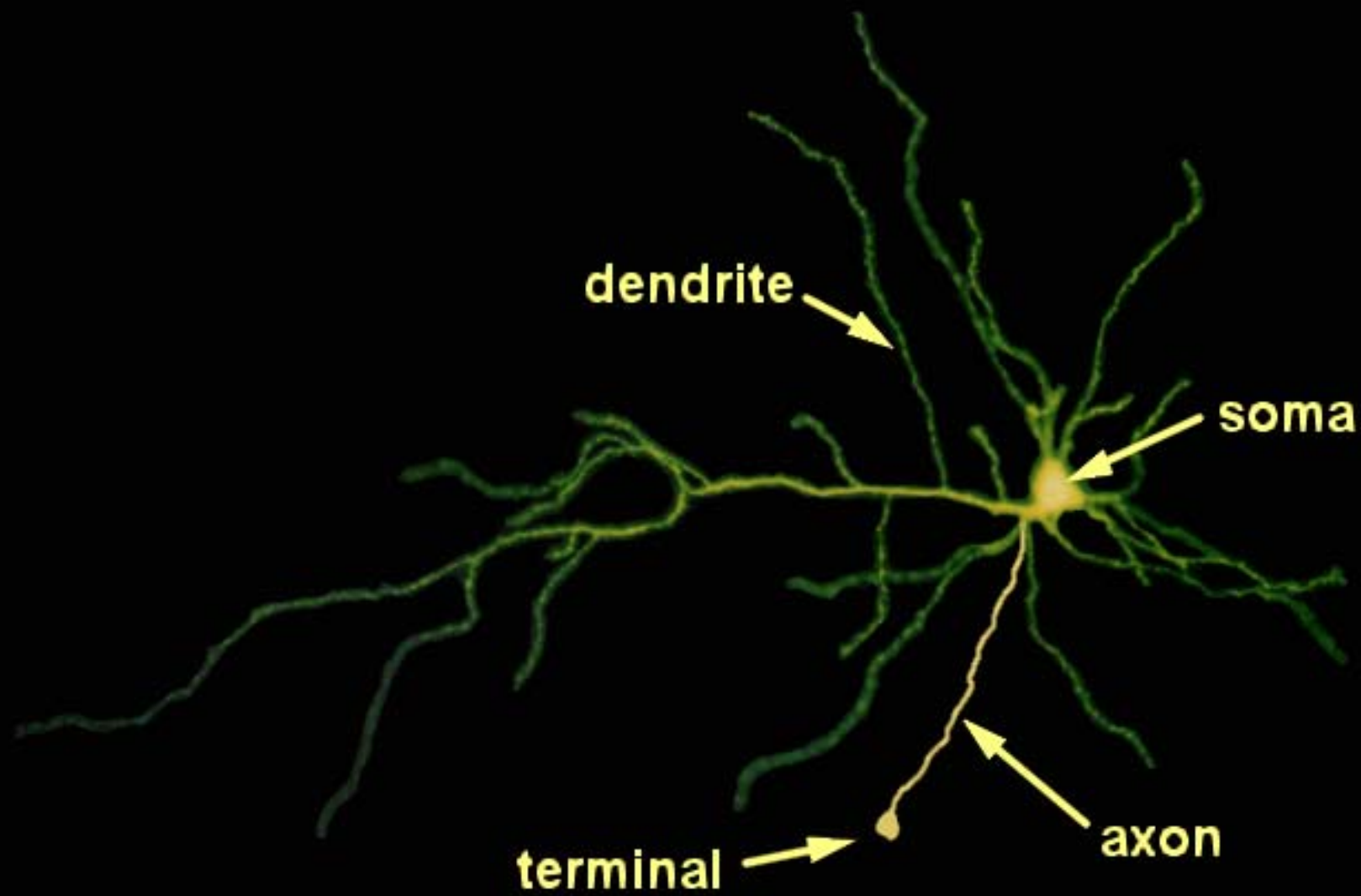


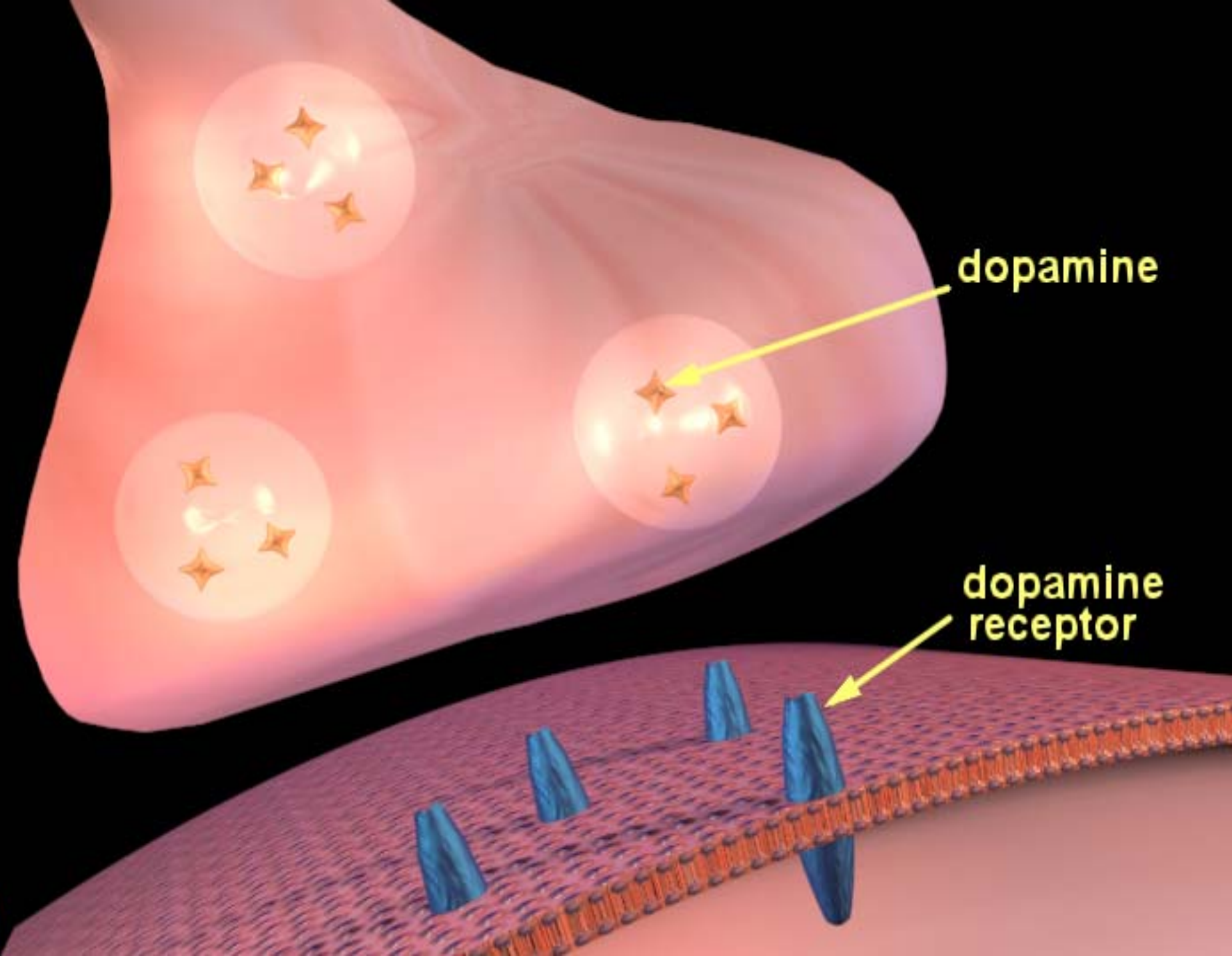
Normal Control

**METH Abuser
(1 month detox)**

**METH Abuser
(24 months detox)**

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

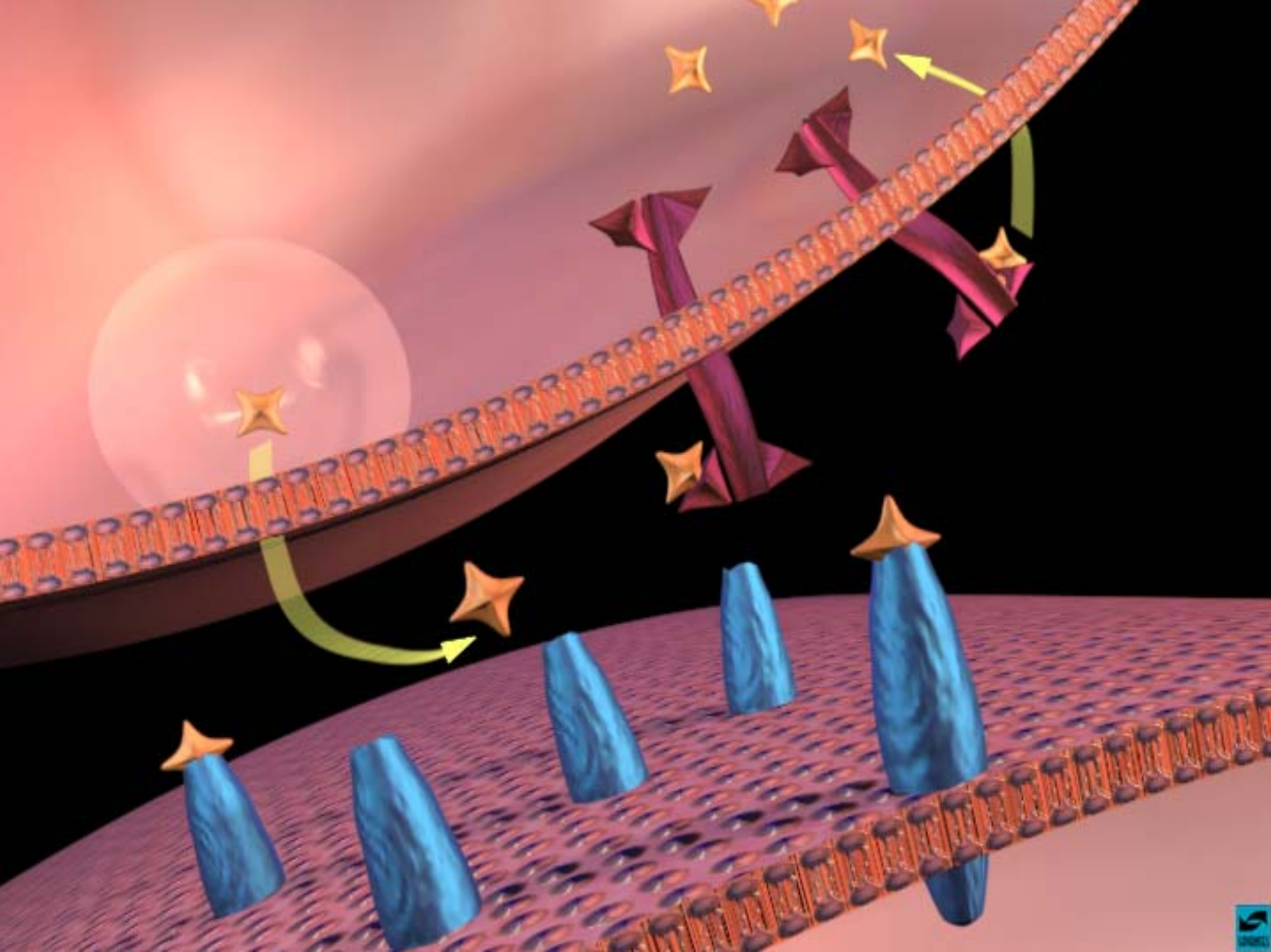


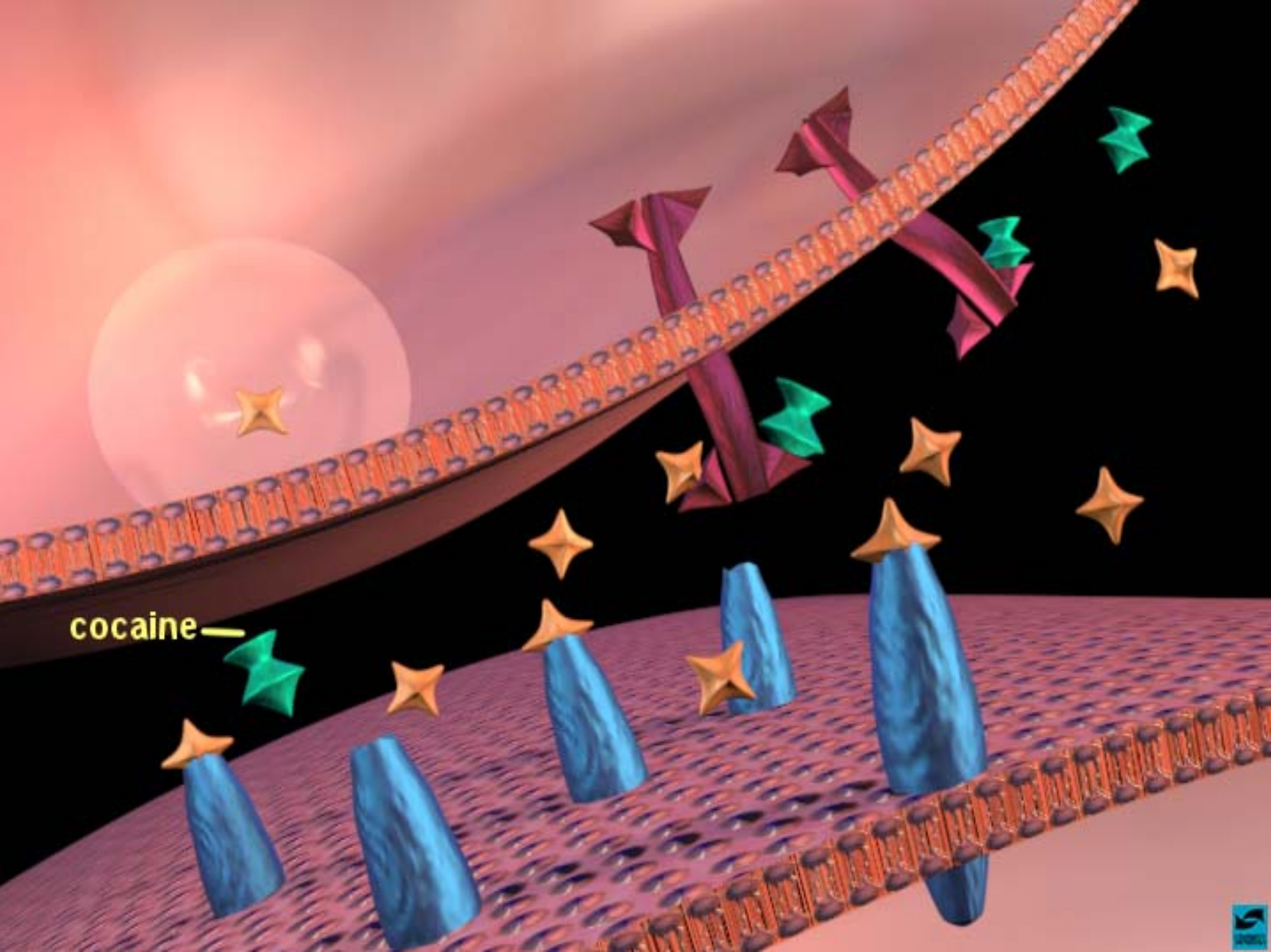


dopamine

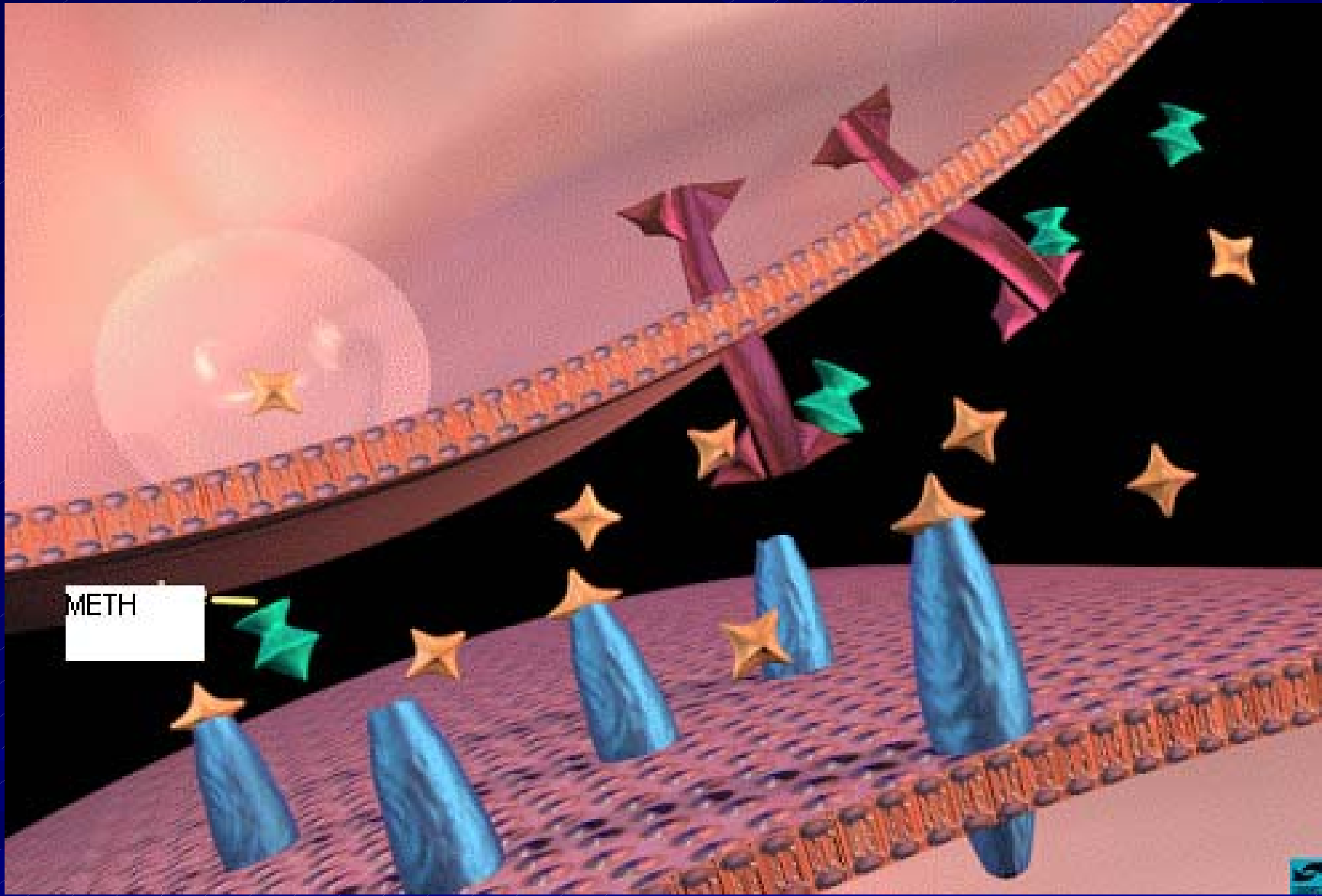
dopamine
receptor



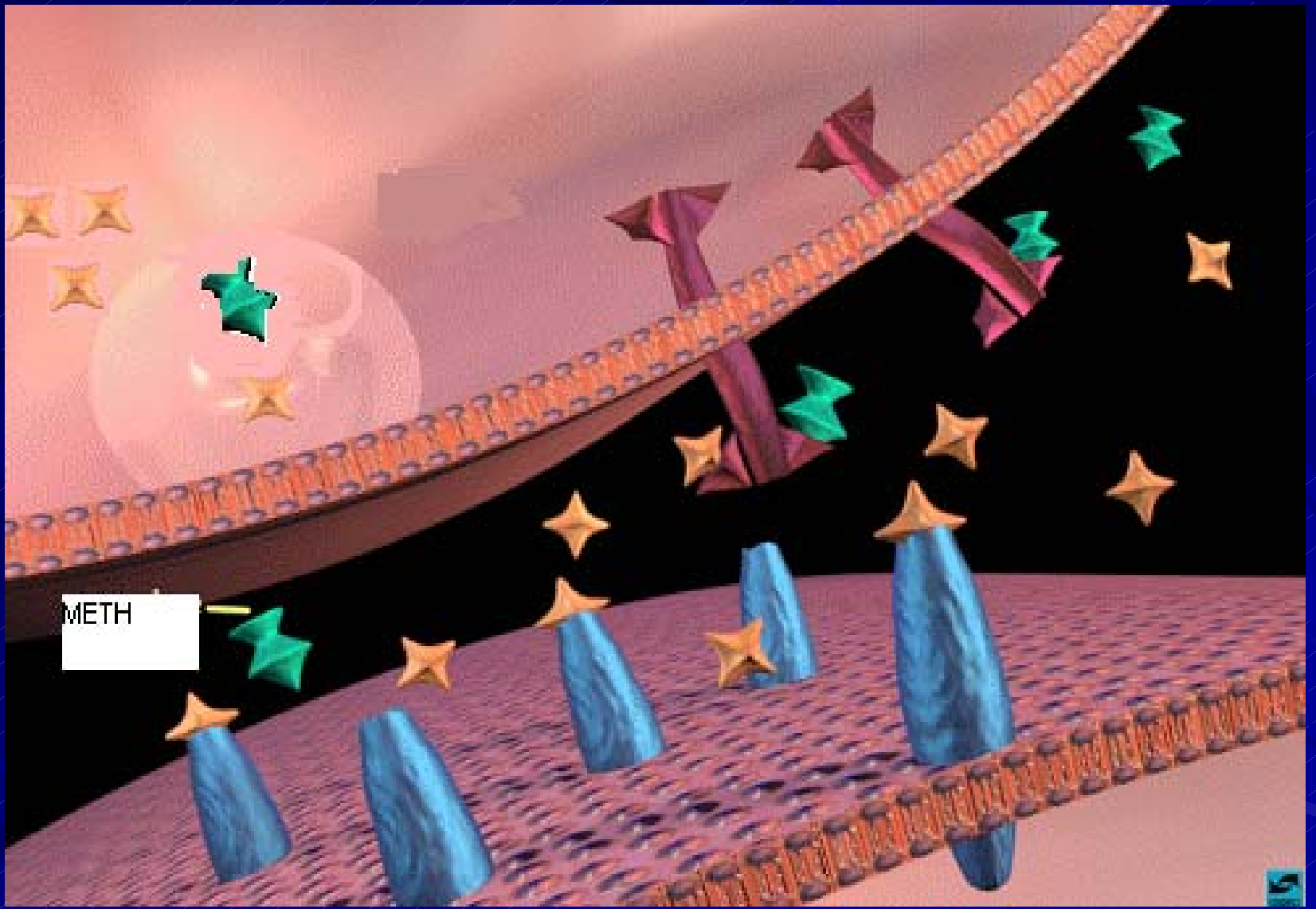




cocaine —

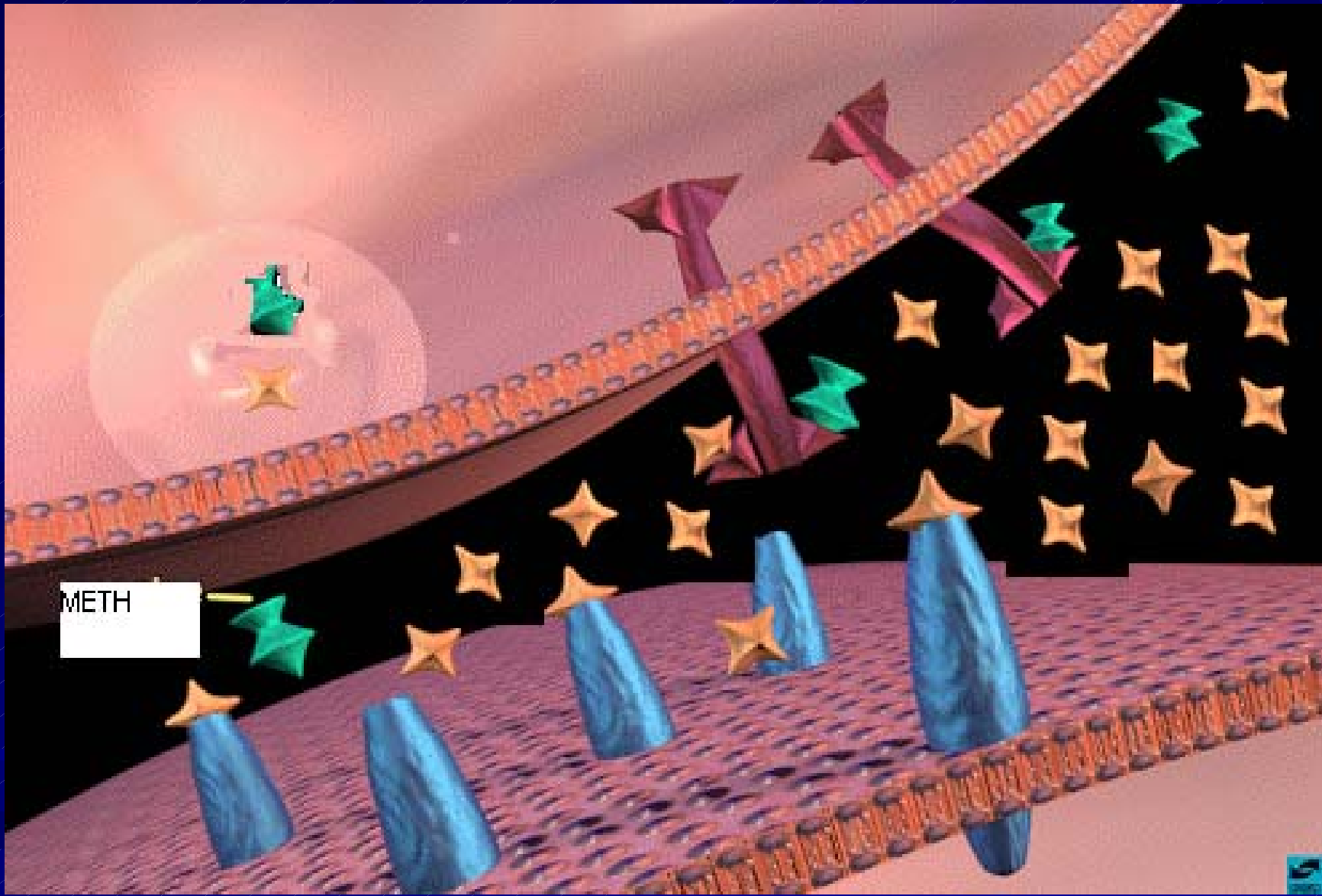


METH

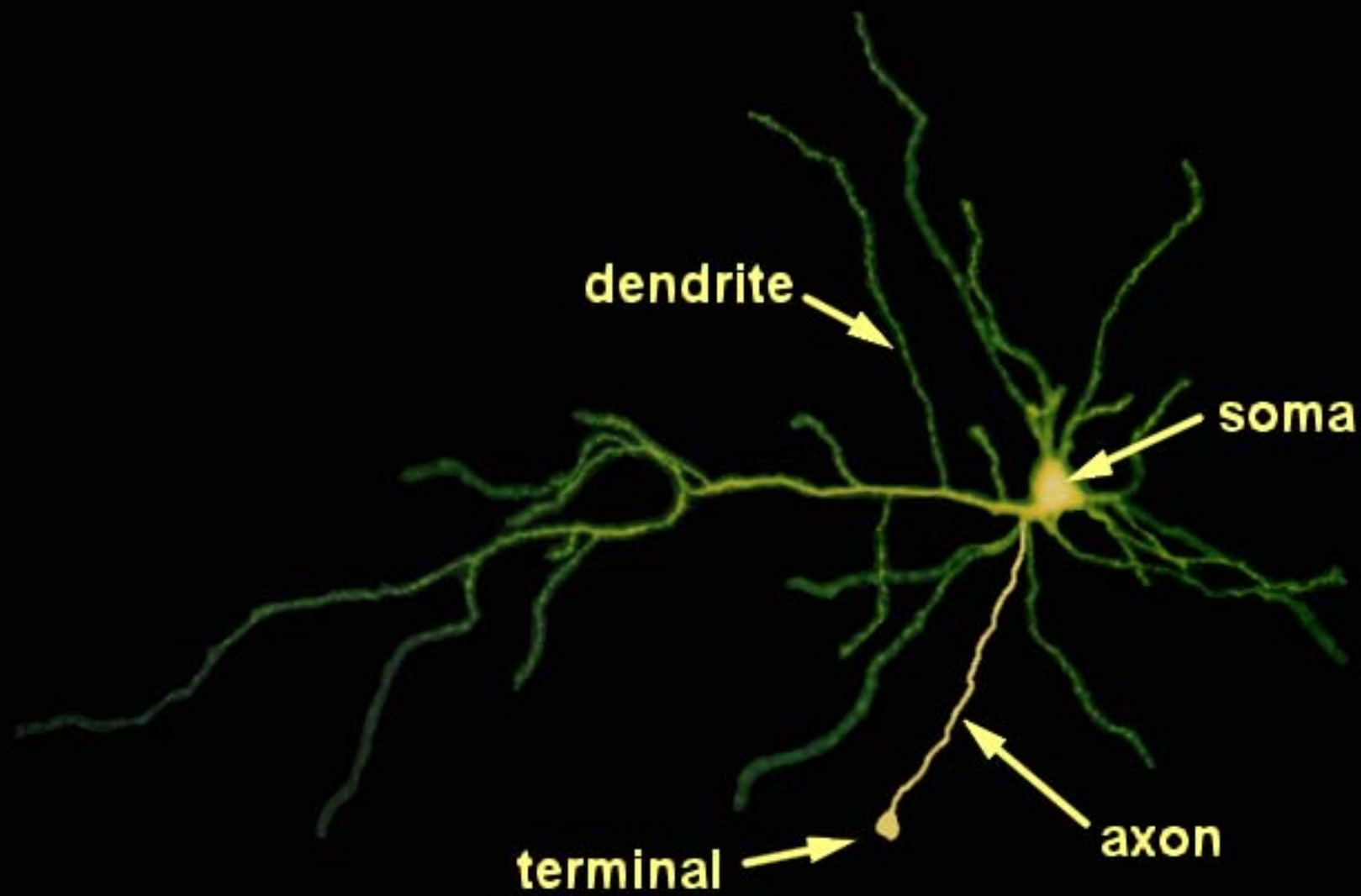


METH

5



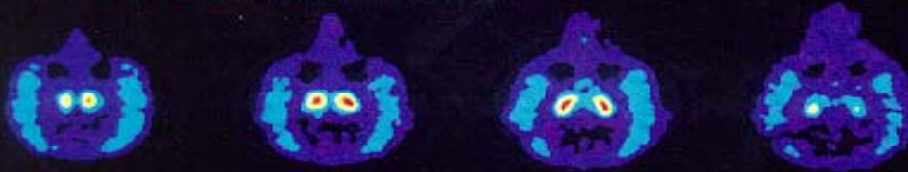
METH



**Prolonged Drug Use Changes
the Brain In Fundamental
and Long-Lasting Ways**

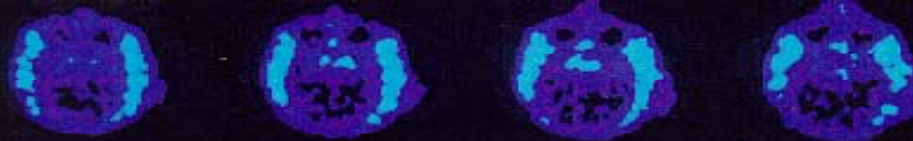
Striatal FDOPA Activity

Pre-Amphetamine/Control

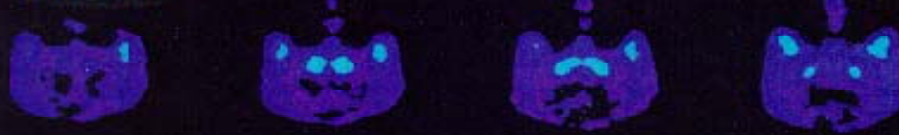


Post-Chronic Amphetamine (10 days)

4 weeks



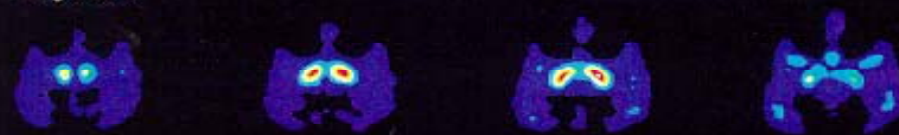
6 months



1 year



2 years

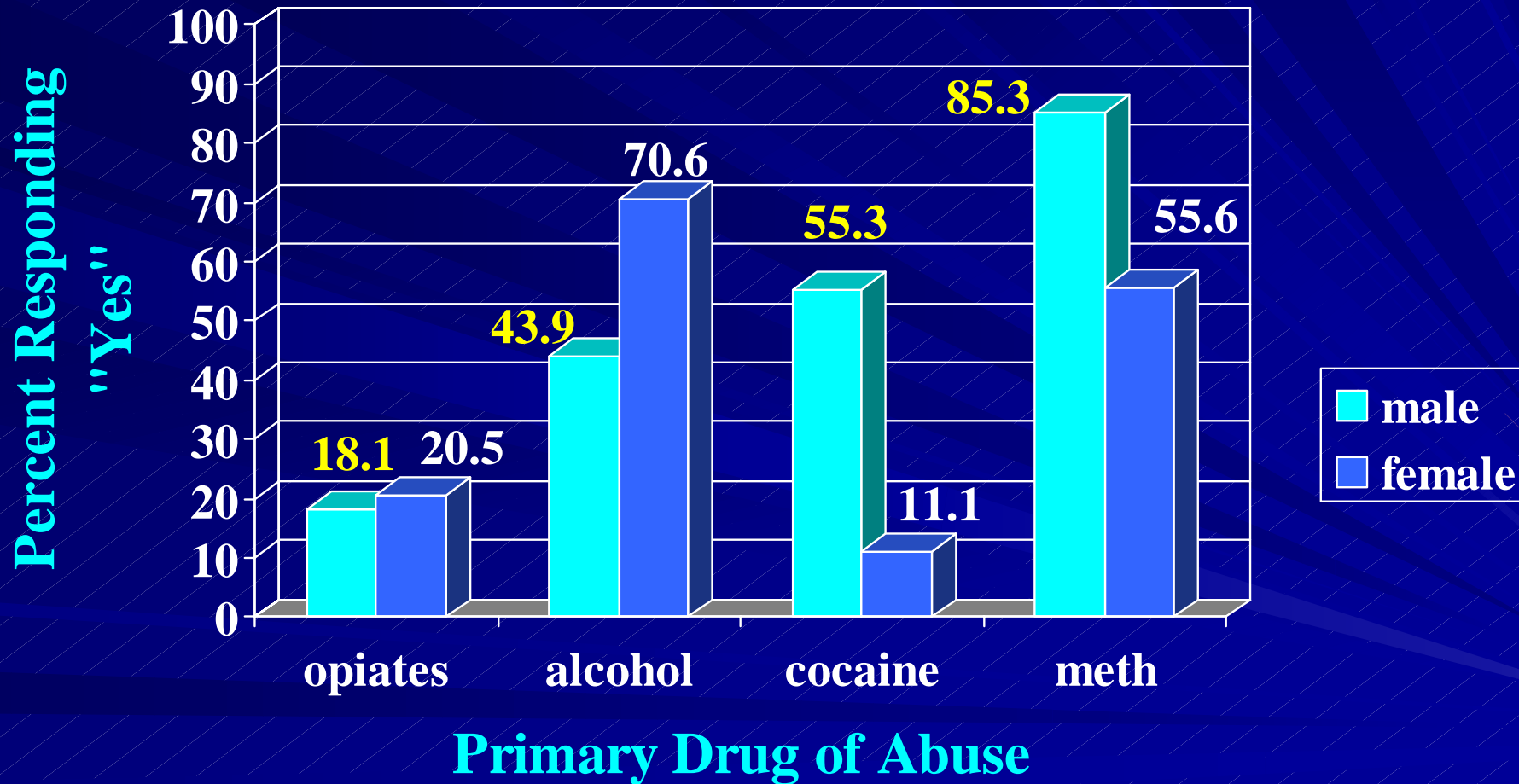


Superior



Inferior

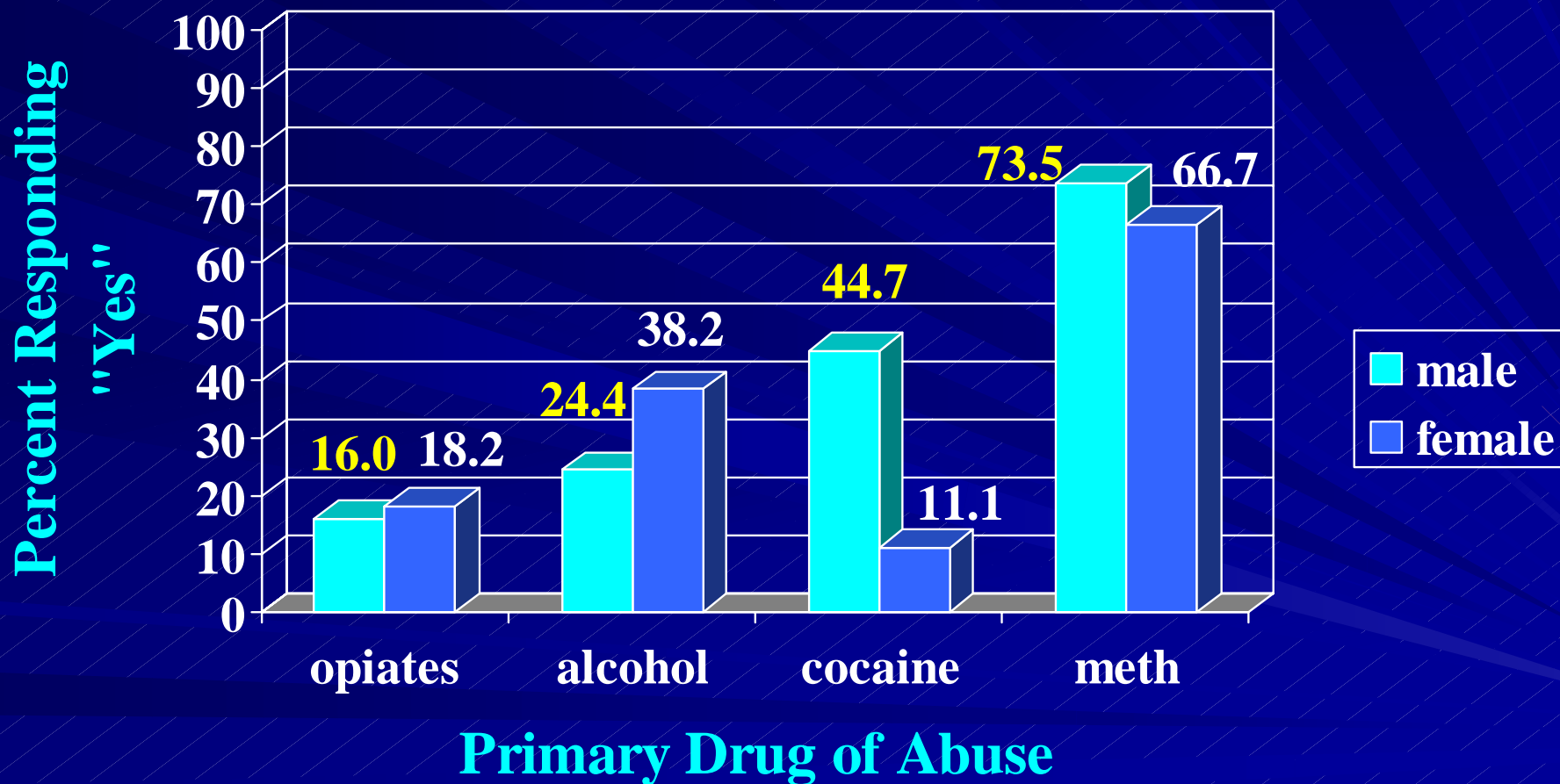
My sexual *drive* is increased by the use of ...



(Rawson et al., 2002)

My sexual *pleasure* is enhanced by the use of

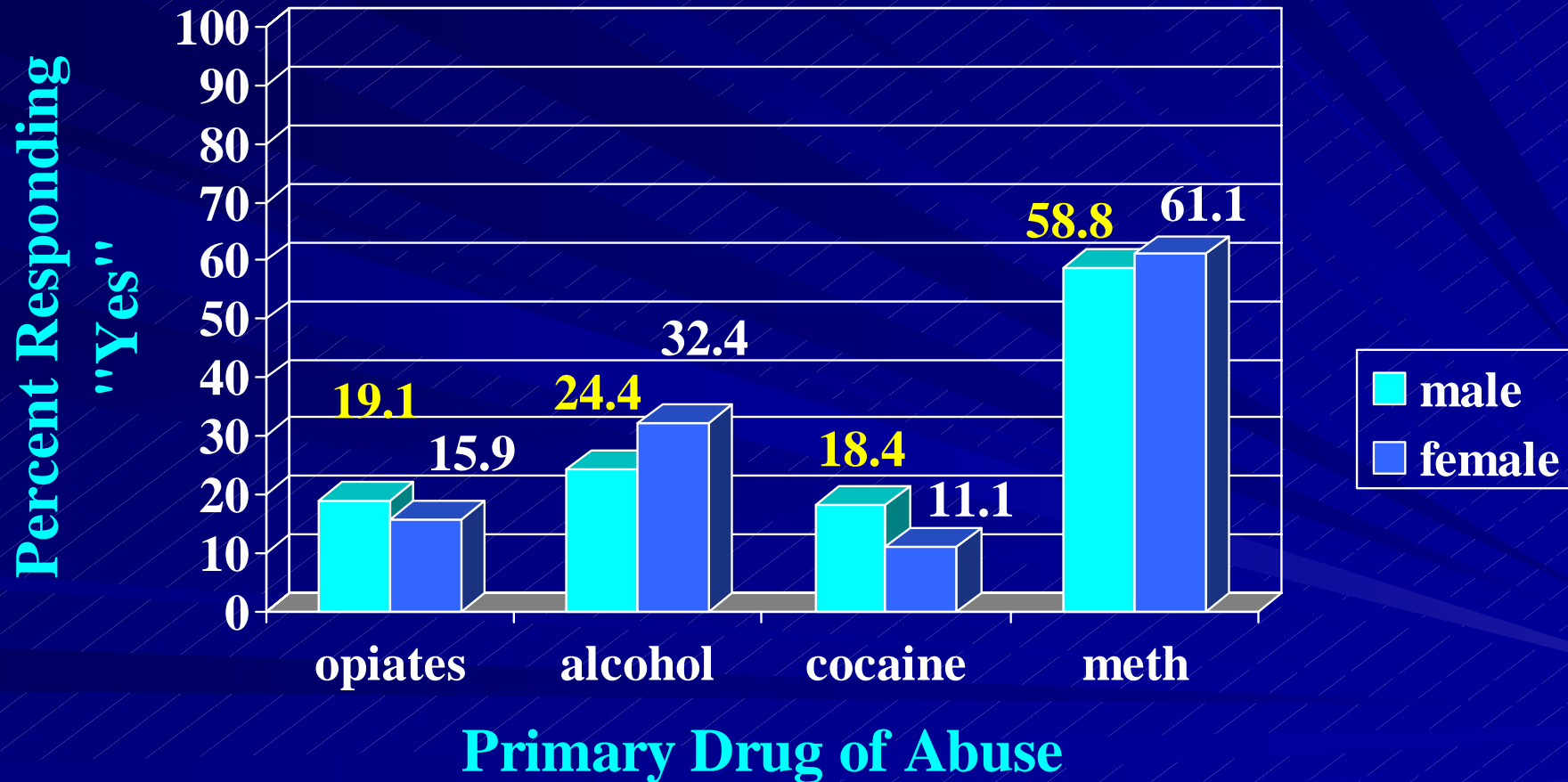
...



(Rawson et al., 2002)

My sexual performance is improved by the use of

...



(Rawson et al., 2002)

Methamphetamine

Treatment

MA Treatment Issues

- Acute MA Overdose
- Acute MA Psychosis
- MA “Withdrawal”
- Initiating MA Abstinence
- MA Relapse Prevention
- Protracted Cognitive Impairment and Symptoms of Paranoia

MA “Withdrawal”

- Depression
- Fatigue
- Anxiety
- Anergia
- Paranoia
- Cognitive Impairment
- Agitation
- Confusion

■ Duration: 2 Days - 2 Weeks

Medications

- Currently, there are no medications that can quickly and safely reverse life threatening MA overdose.
- There are no medications that can reliably reduce paranoia and psychotic symptoms, that contribute to episodes of dangerous and violent behavior associated with MA use.

Bupropion: An efficacious pharmacotherapy?

- Newton et al 2005 Bupropion reduces craving and reinforcing effects of meth
- Elkashef (recently completed) Bupropion reduces meth use in an outpatient trial, with particularly strong effect with less severe users.

Special treatment consideration should be made for the following groups of individuals:

- Female MA users (higher rates of depression; very high rates of previous and present sexual and physical abuse; responsibilities for children).
- Injection MA users (very high rates of psychiatric symptoms; severe withdrawal syndromes; high rates of hepatitis).
- MA users who take MA daily or in very high doses.
- Homeless, chronically mentally ill and/or individuals with high levels of psychiatric symptoms at admission.
- Individuals under the age of 21.
- Gay men (at very high risk for HIV and hepatitis).

Treatments for Stimulant-use Disorders with Empirical Support

- Motivational Interviewing
- Cognitive-Behavioral Therapy (CBT)
- Community Reinforcement Approach
- Contingency Management
- 12 Step Facilitation
- Matrix Model
- Brief Interventions

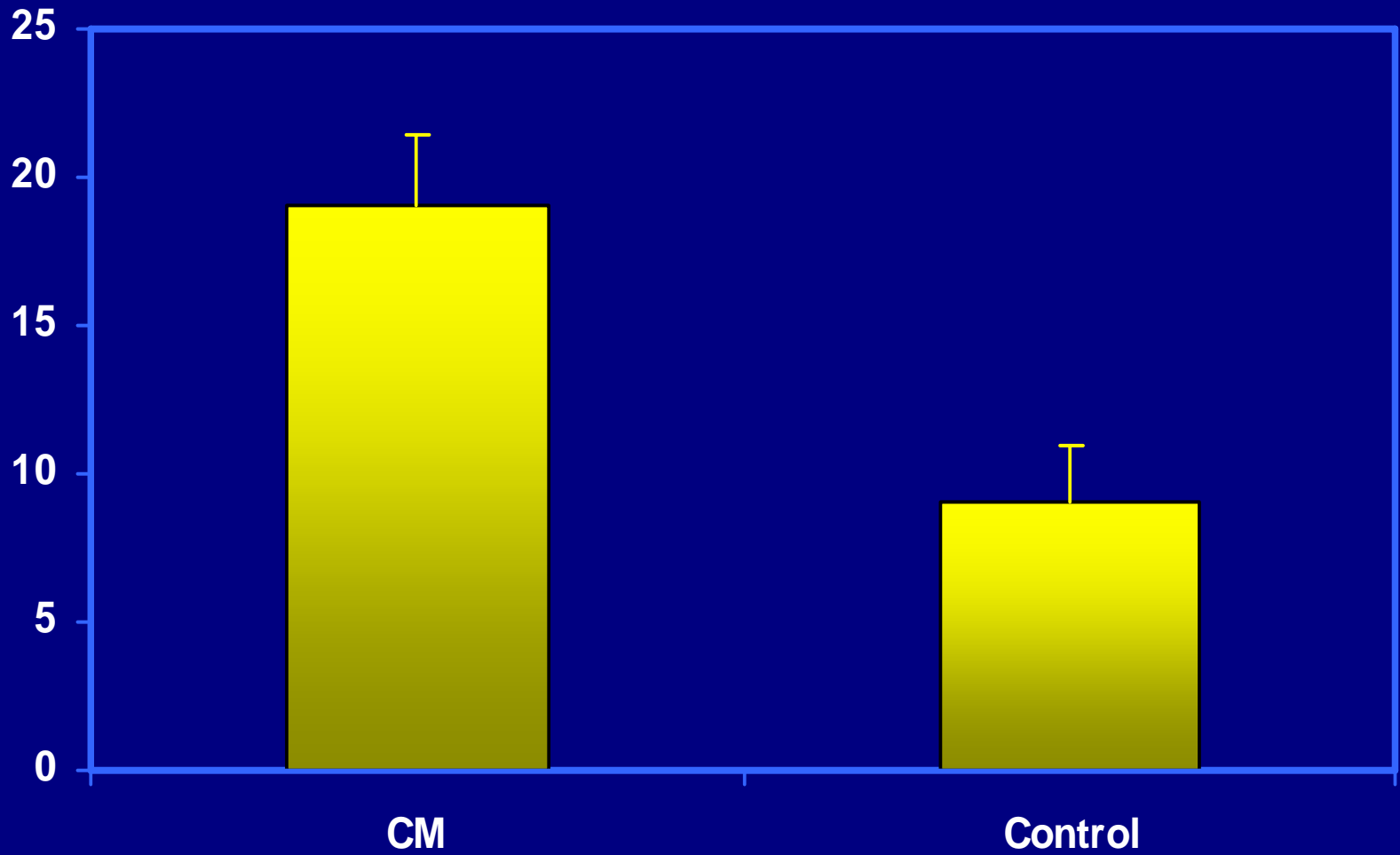
Methamphetamine Treatment: Controlled Clinical Trials

Contingency Management Matrix Model

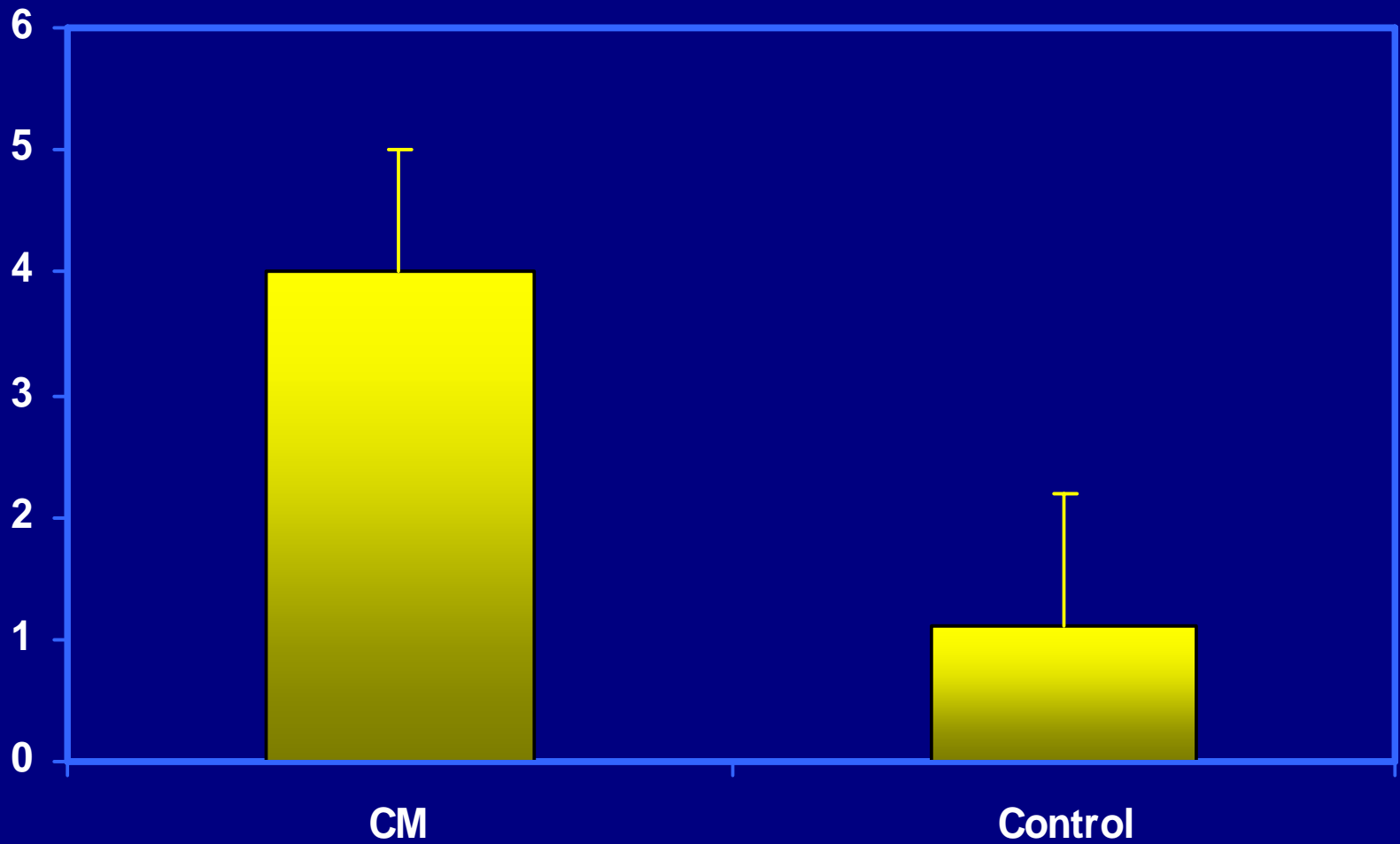
Contingency Management

- A technique employing the systematic delivery of positive reinforcement for desired behaviors. In the treatment of methamphetamine dependence, vouchers or prizes can be “earned” for submission of methamphetamine-free urine samples.

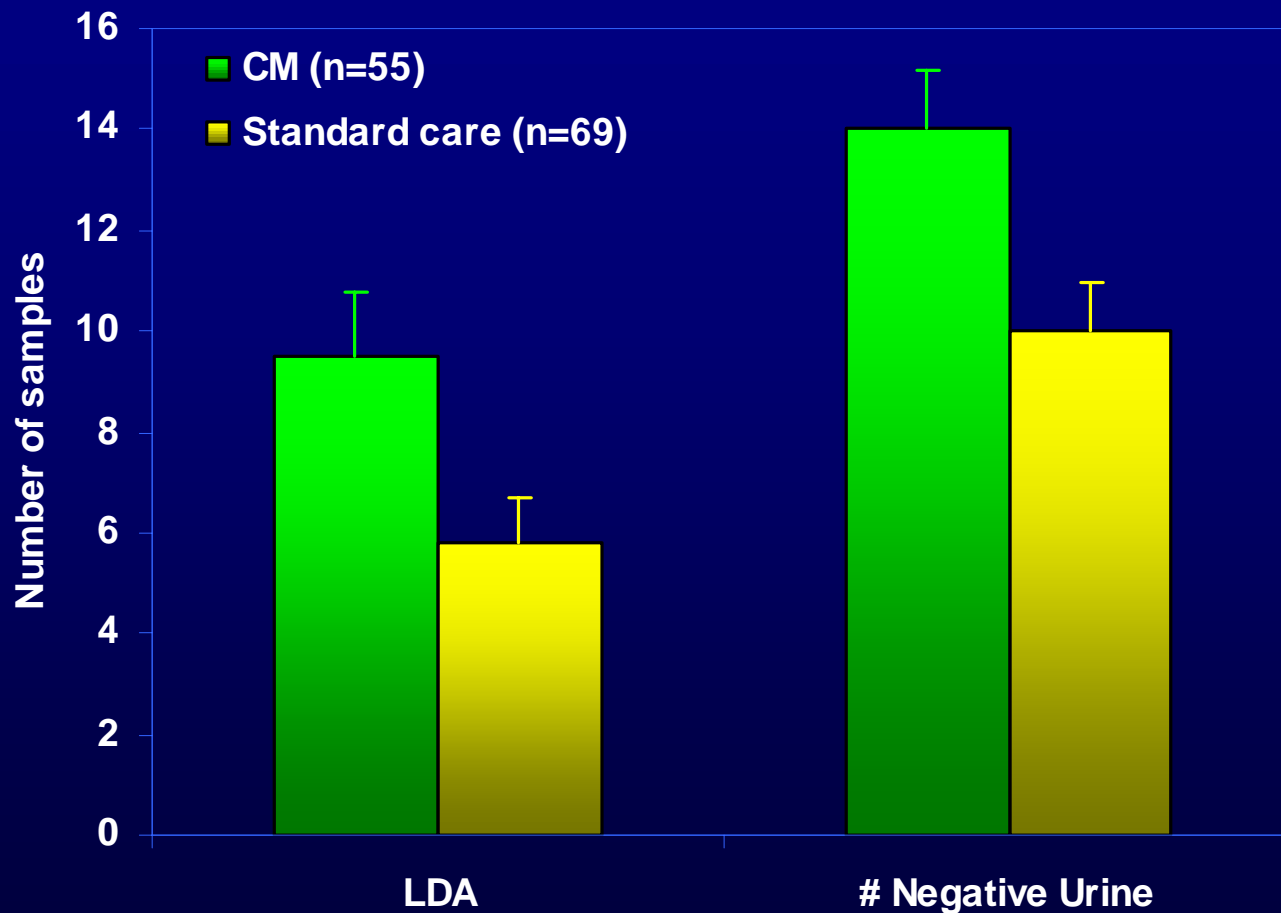
Mean number of abstinences



Mean weeks of consecutive abstinence



Methamphetamine Outcomes from CTN 006



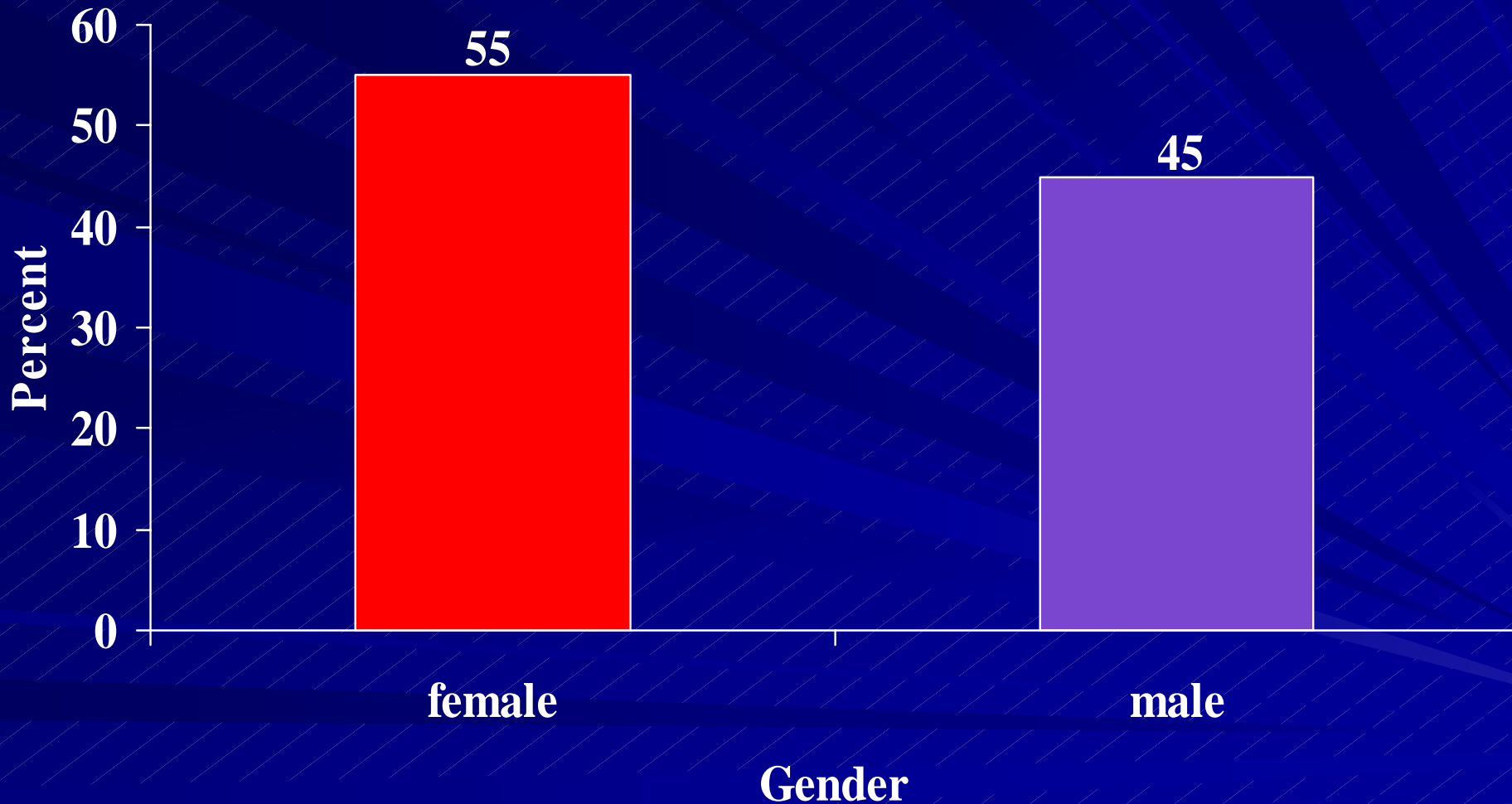
The Methamphetamine Treatment Project



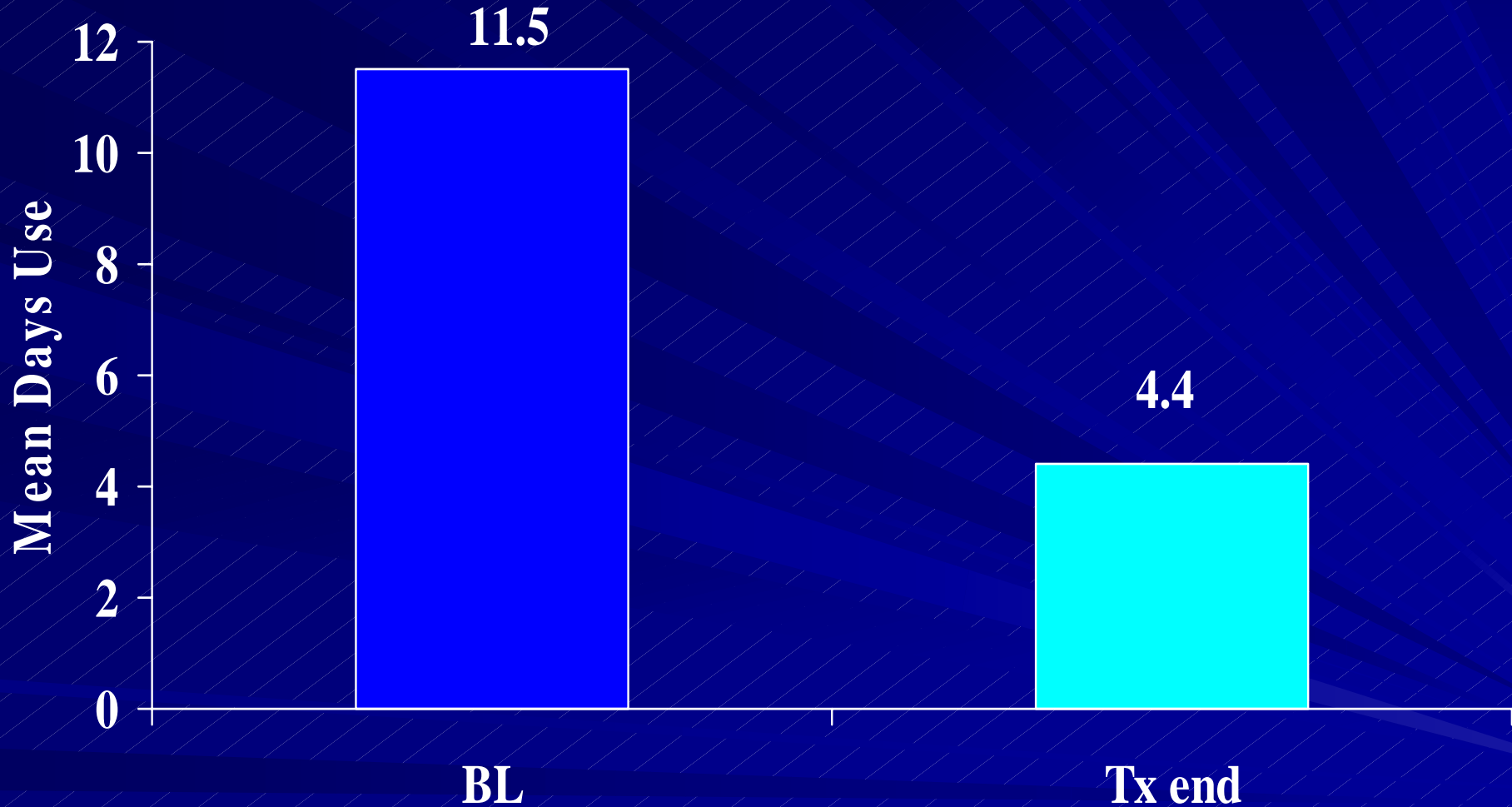
Baseline Demographics

Participants Served (n)	1016
Age (mean)	32.8 years
Education (mean)	12.2 years
Methamphetamine Use (mean)	7.5 years
Marijuana Use (mean)	7.2 years
Alcohol Use (mean)	7.6 years

Gender Distribution of Participants

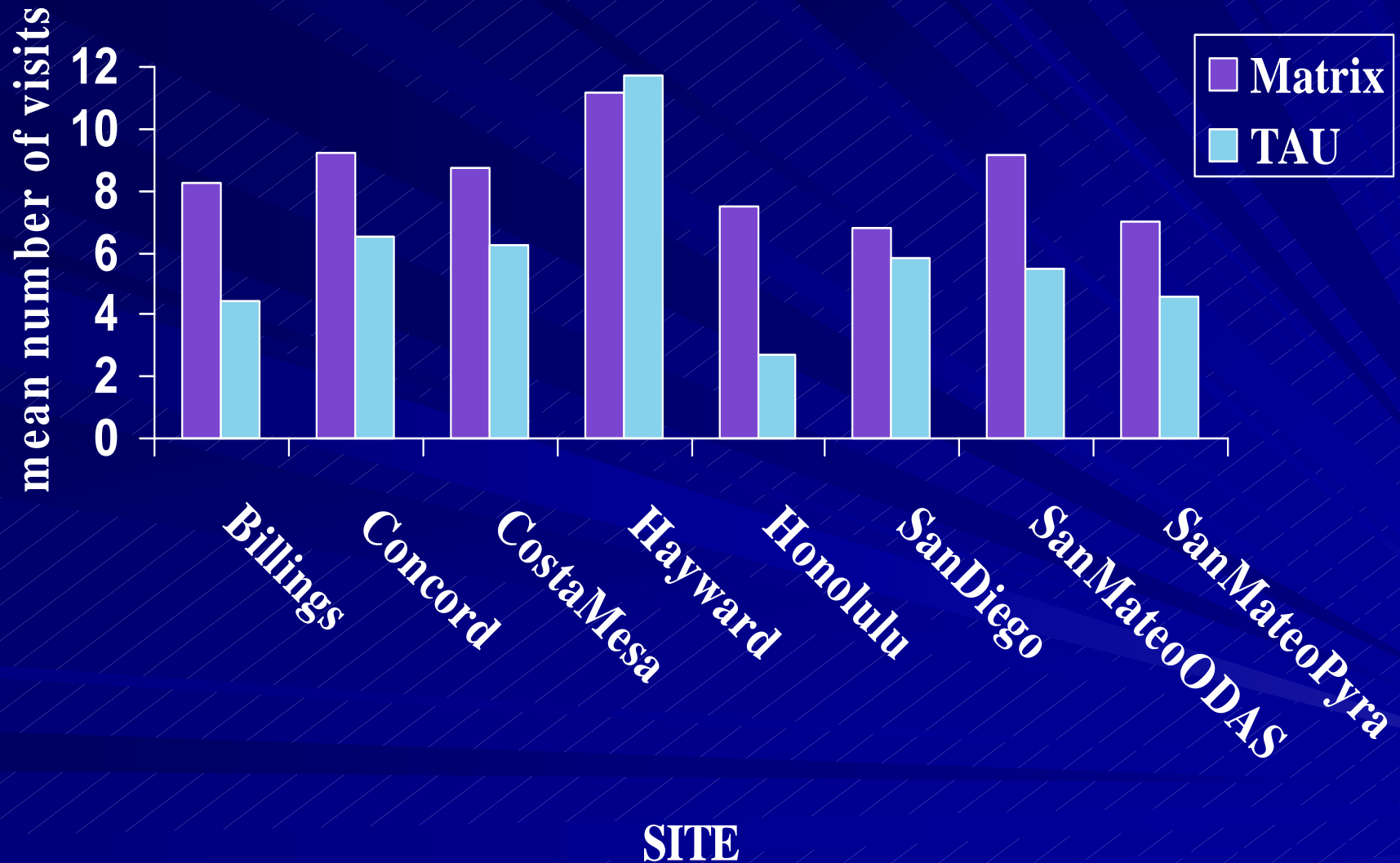


Days of Methamphetamine Use in Past 30 (ASI)

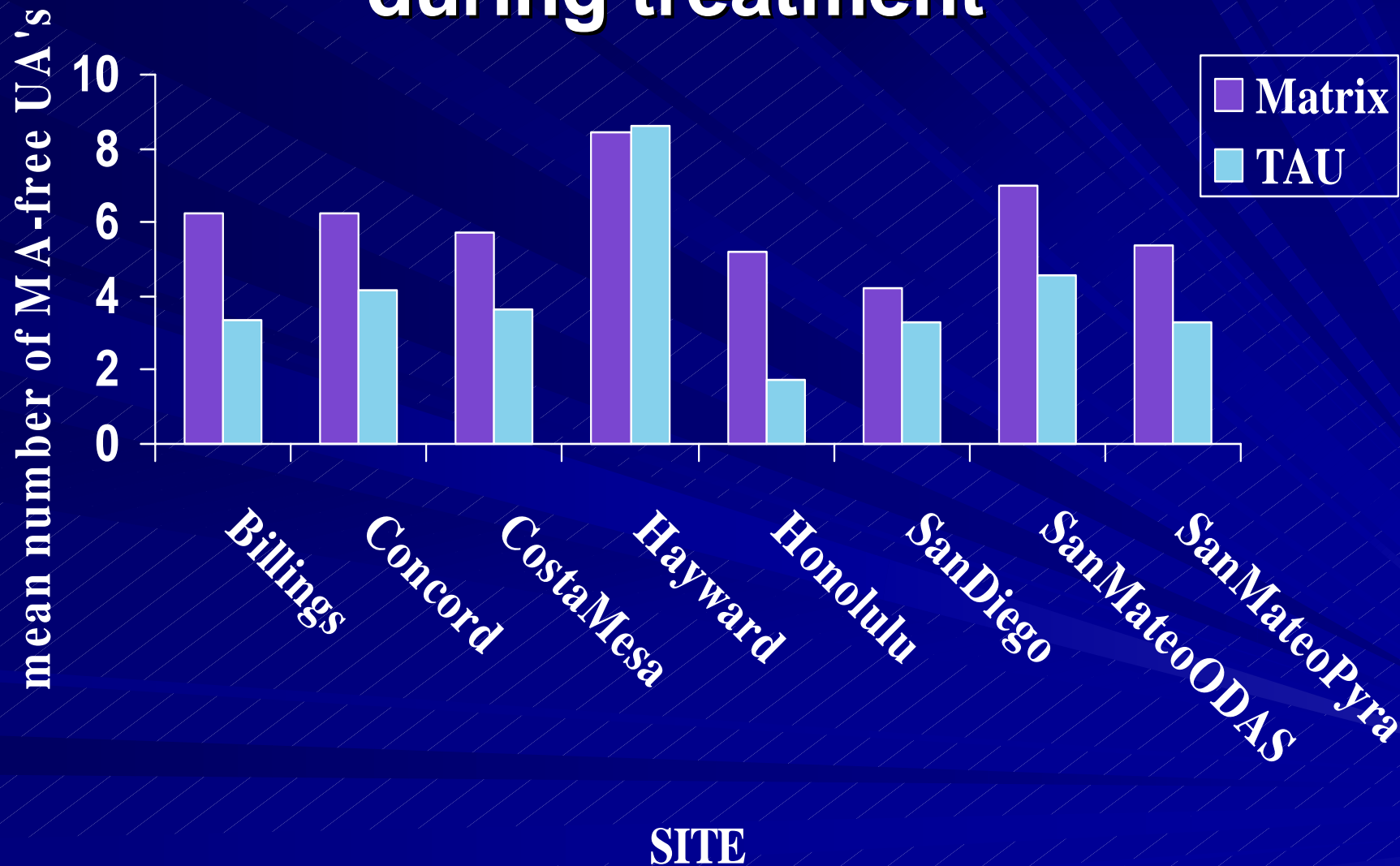


Possible is 0-30, range = 20-90

Mean Number of Weeks in Treatment



Mean Number of UA's that were MA-free during treatment



Urinalysis Results

- Results of Ua Tests at Discharge, 6 months and 12 Months post admission **

- Matrix Group

- TAU Group

D/C: 66% MA-free

65% MA-free

6 Ms: 69% MA-free

67% MA-free

12 Ms: 59% MA-free

55% MA-free

**Over 80% follow up rate in both groups at all points

Treatment of MA-Use Disorders

- No medications currently are available with evidence of efficacy
- Two approaches, Contingency Management and Matrix Model have data to support efficacy
- MA users appear to respond to other psychosocial treatments in a manner comparable to other categories of drug users.
- MA users are responsive to treatment