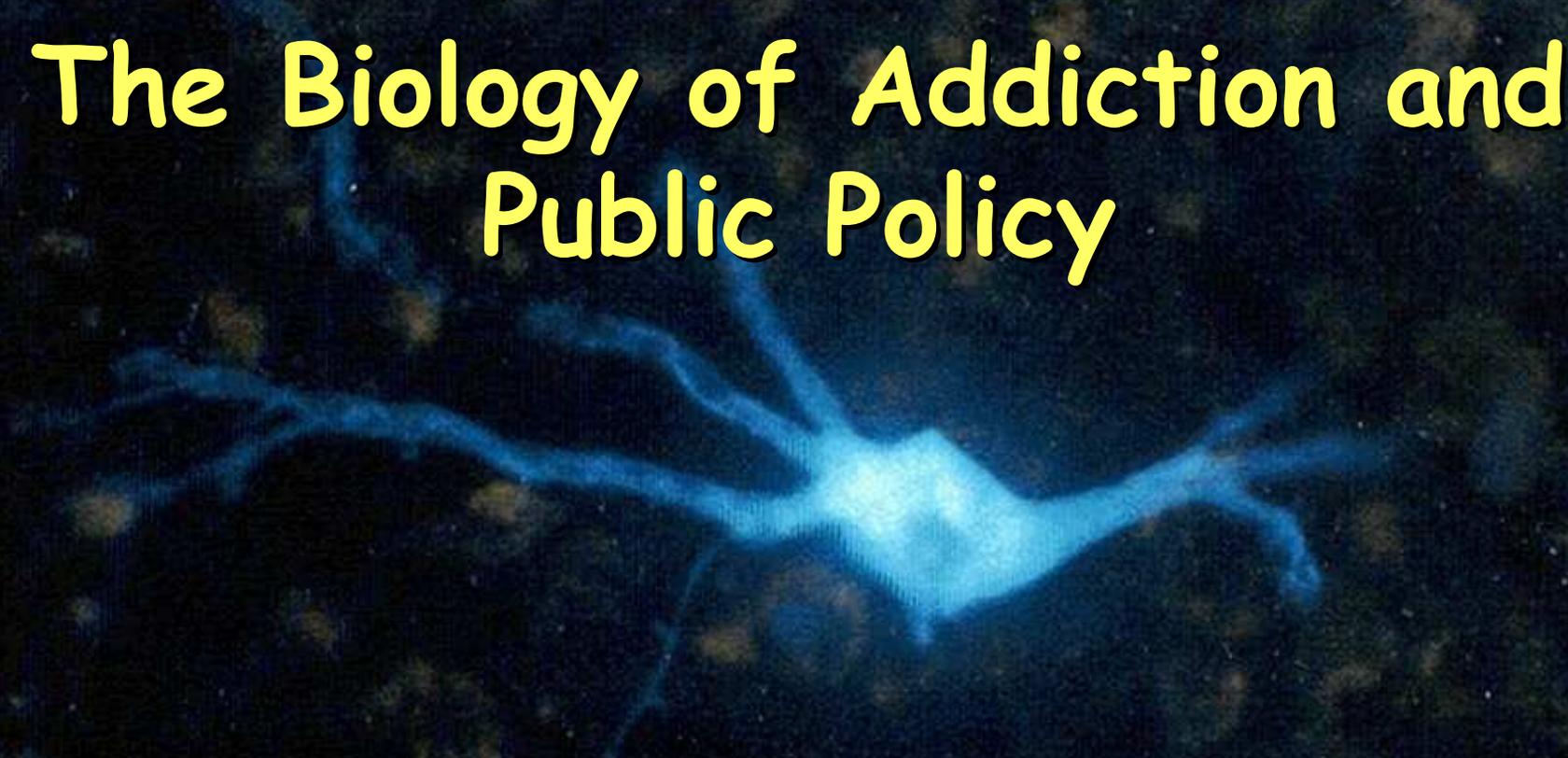


The Biology of Addiction and Public Policy



David P. Friedman, Ph.D.
Director
Addiction Studies Program

WAKE FOREST
UNIVERSITY

SCHOOL of MEDICINE
THE BOWMAN GRAY CAMPUS

A Long-held View

Drug Addiction is a Disease
of Moral Fiber



What the Scientists Say

- It depends
 - ◆ Policy makers want simple answers, scientists only have complex analyses
- We need more research
 - ◆ into the biological basis of moral fiber
- But, who has time to wait?

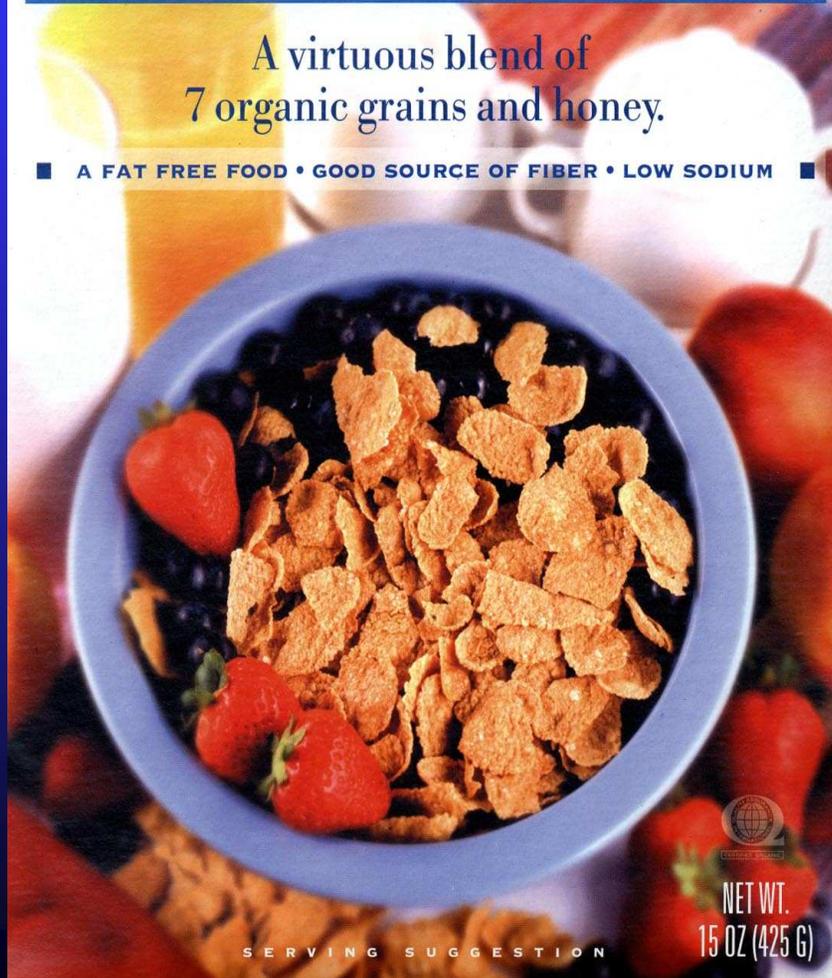


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Organic Moral Fiber Cereal

A virtuous blend of
7 organic grains and honey.

■ A FAT FREE FOOD • GOOD SOURCE OF FIBER • LOW SODIUM ■



NET WT.
15 OZ (425 G)

SERVING SUGGESTION

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Why How We Think About Addiction Matters

		Perspective	
		Drug addiction is a moral failing	Drug addiction is a brain disorder
Outcomes	Jail	✓	
	Treatment		✓

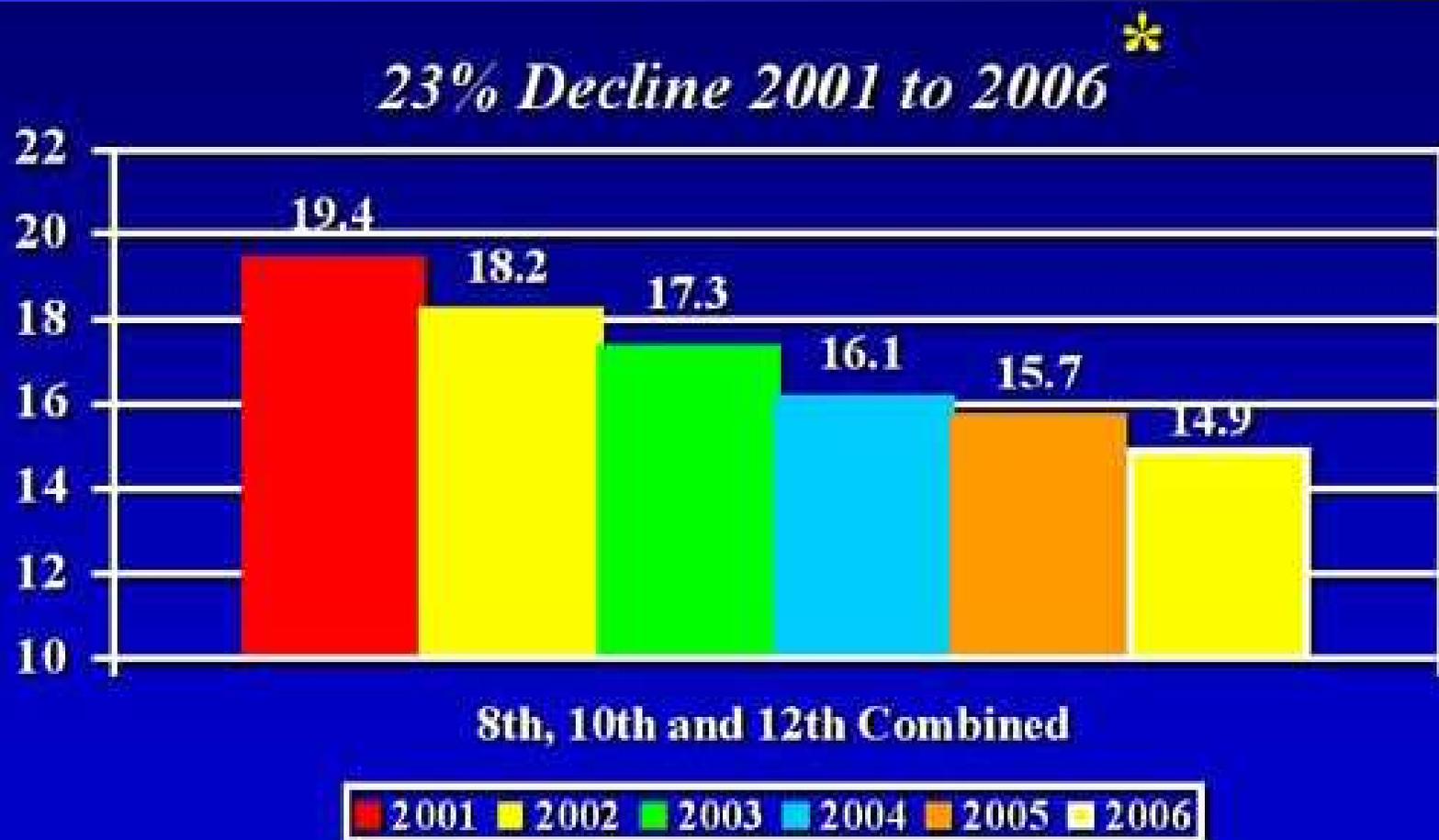


Cut to the Chase

- Drug Addiction is a brain disorder
 - The brain itself is changed by long-term drug abuse
- Addiction is a disease that begins in adolescence
- Addiction is a chronic condition that needs ongoing treatment and care
- Genetic factors are important
- Environmental factors are important



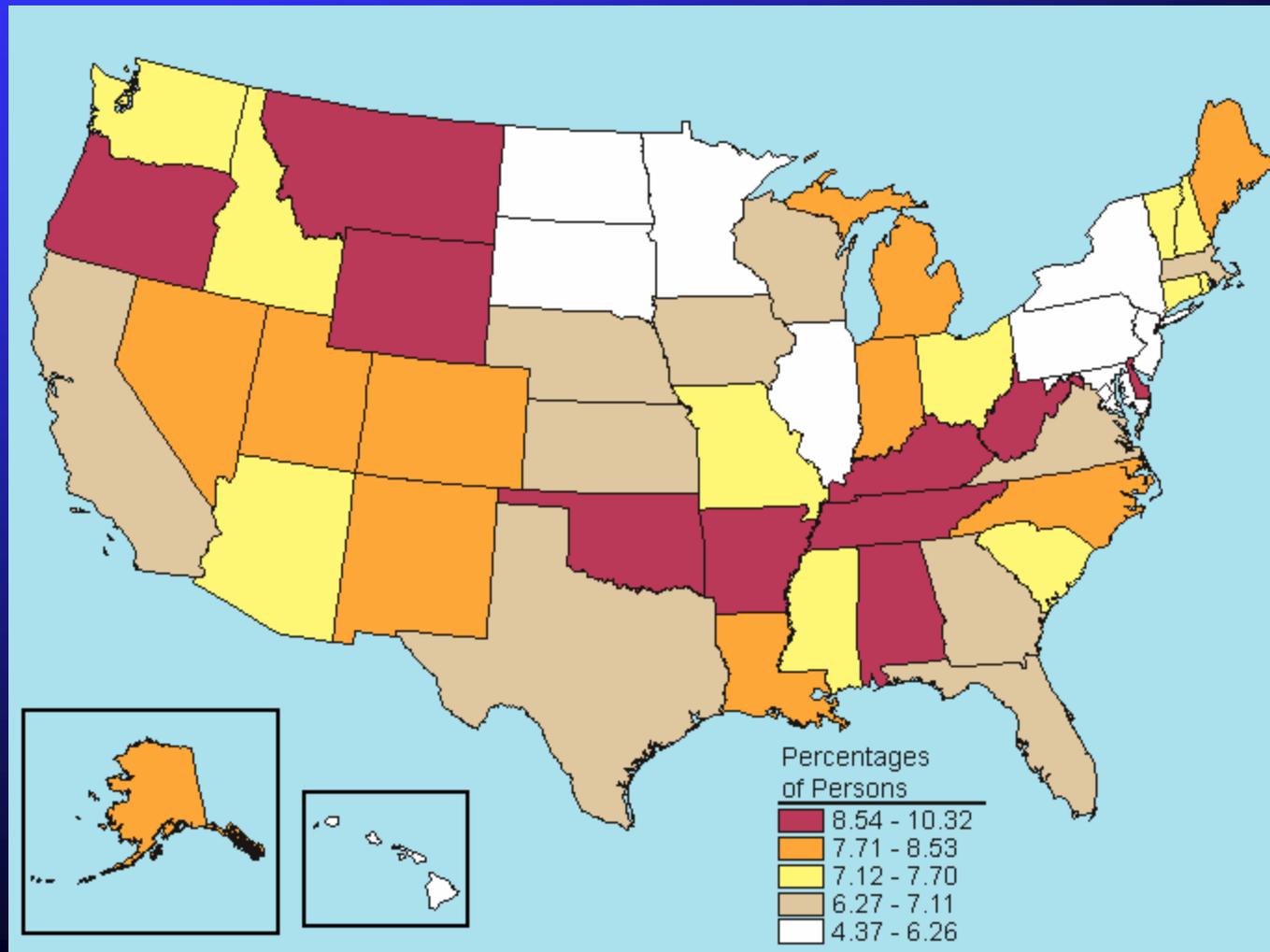
Percent of Students Reporting Past Month Drug Use Has Decreased



* P = .001

Source: University of Michigan, 2006 Monitoring the Future Study

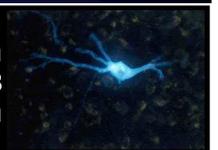
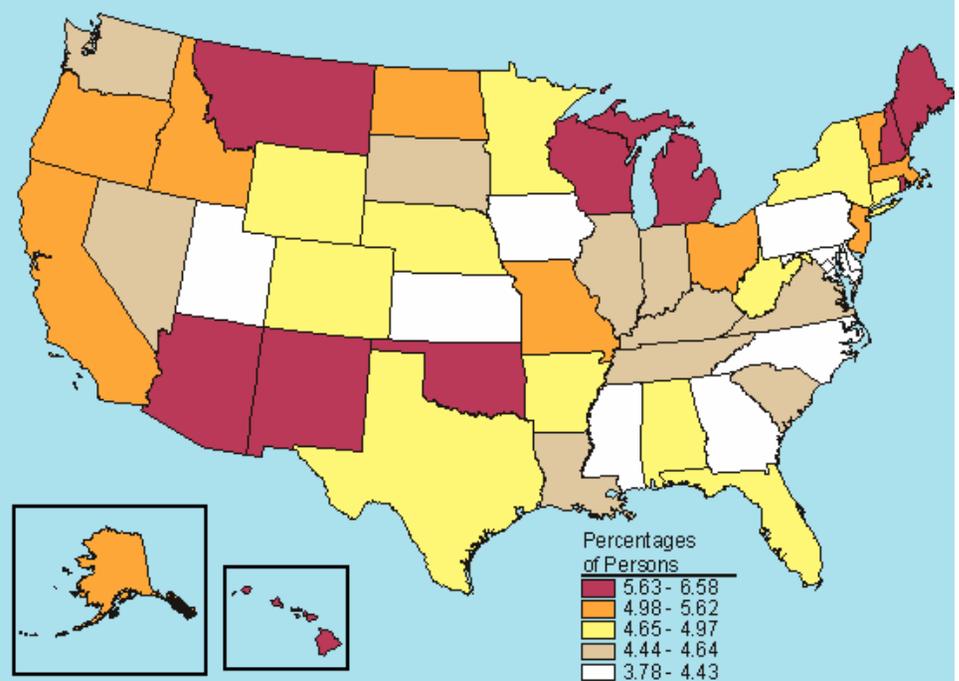
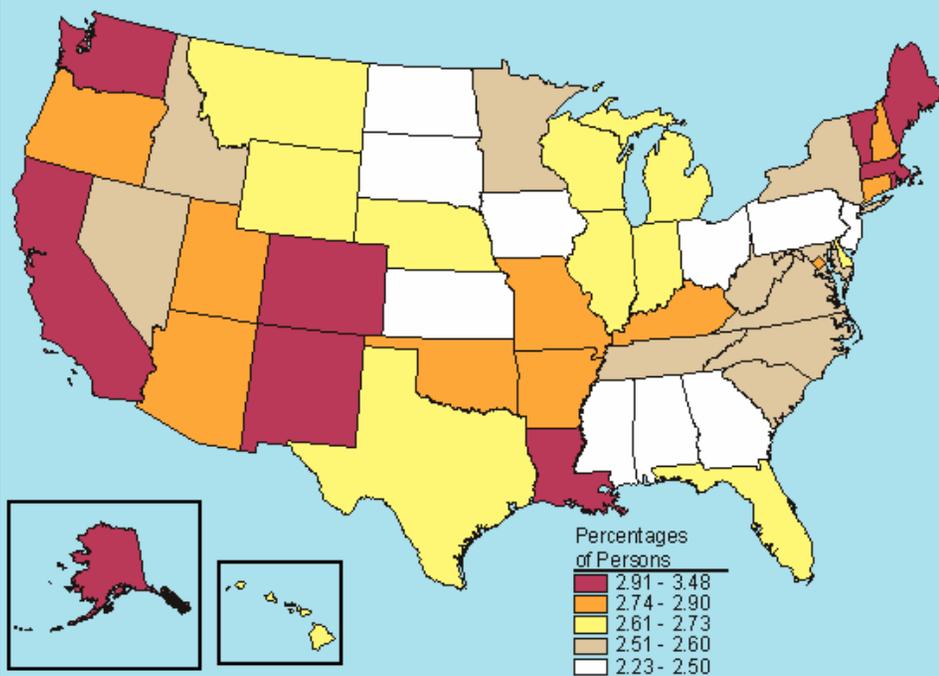
Past Month Use of Pain Relievers



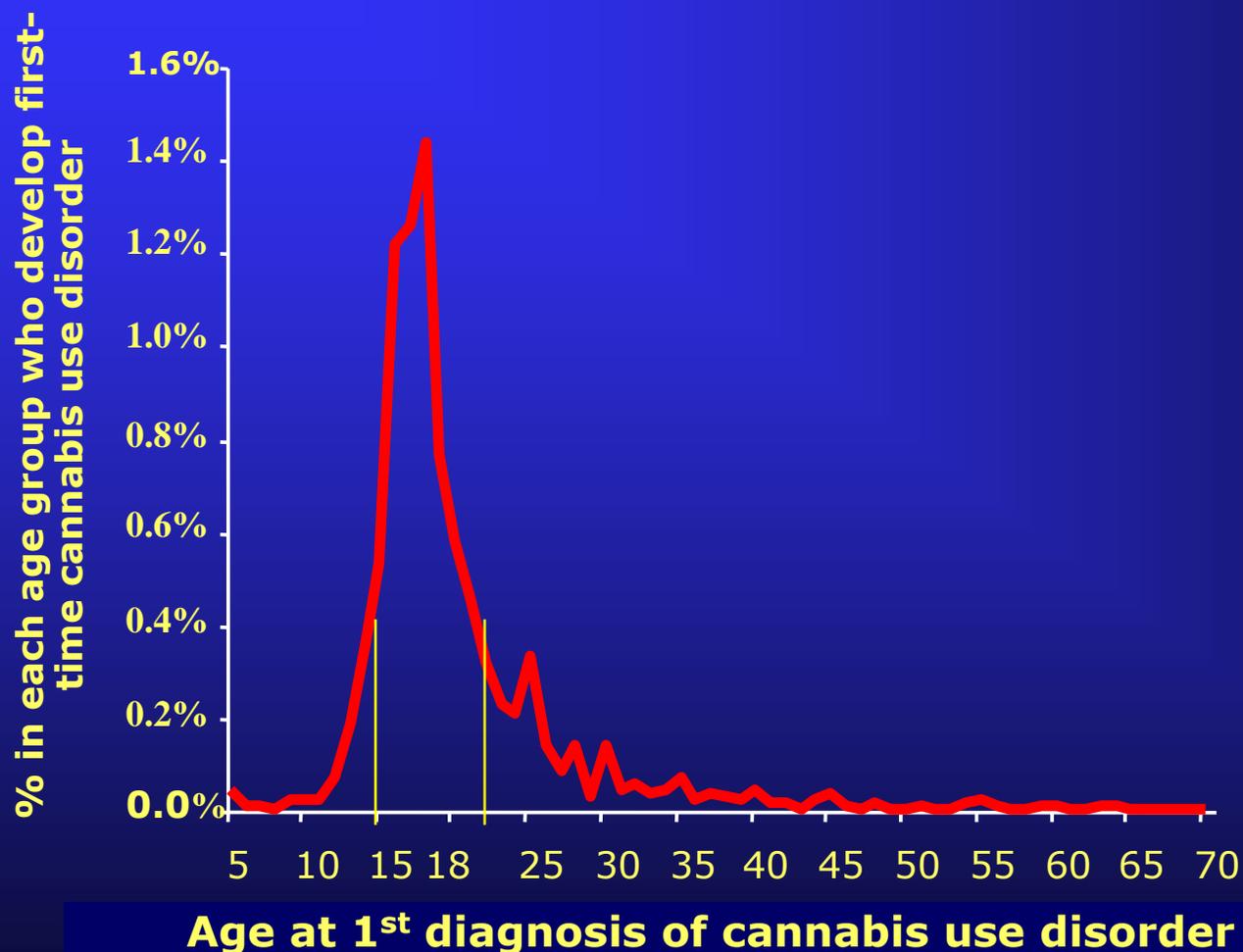
Needing Treatment and

Not Receiving It

Receiving It



Addiction is a Disease That Starts in Childhood & Adolescence

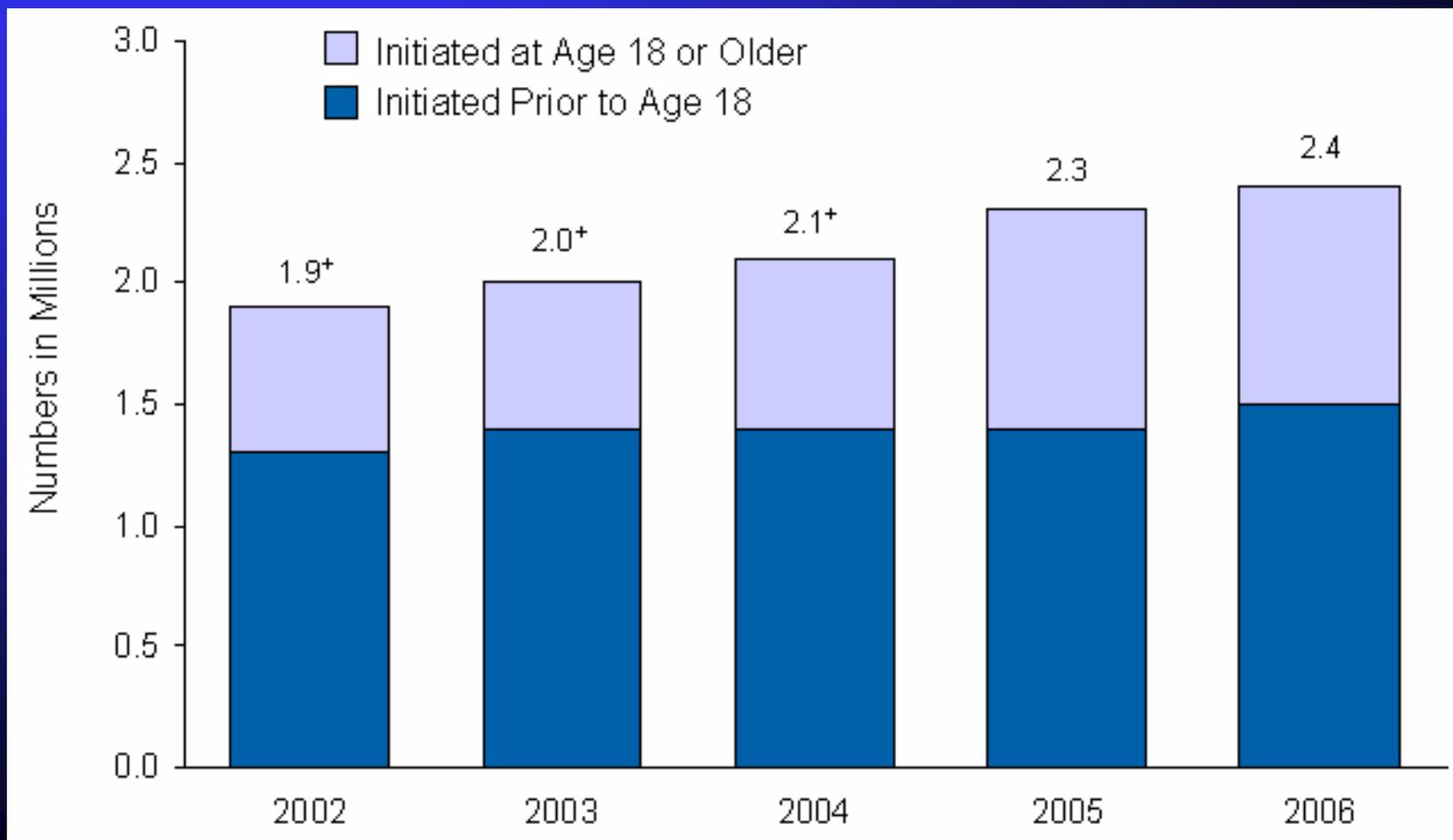


NIAAA National Epidemiologic Survey on Alcohol and Related Conditions, 2003

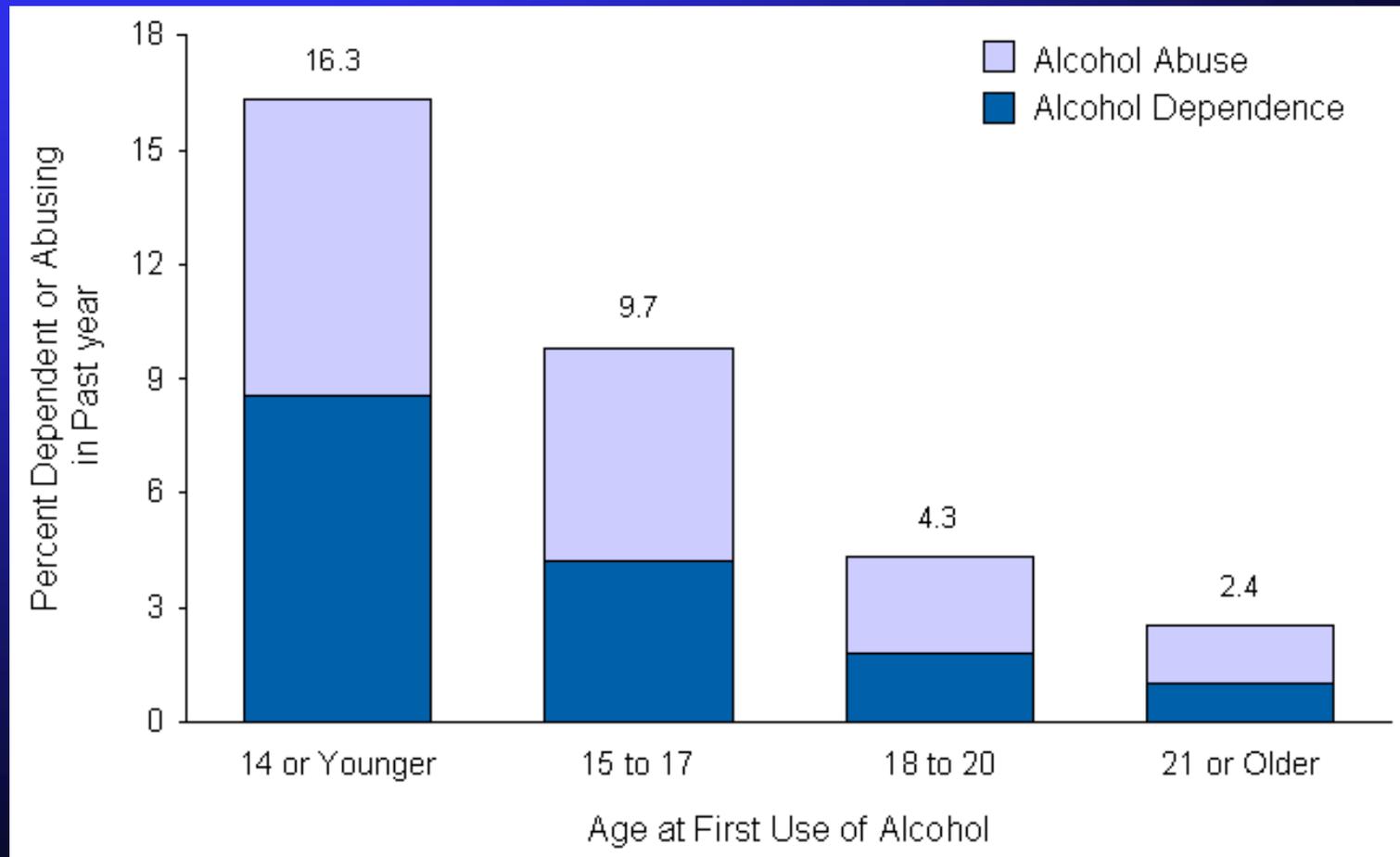
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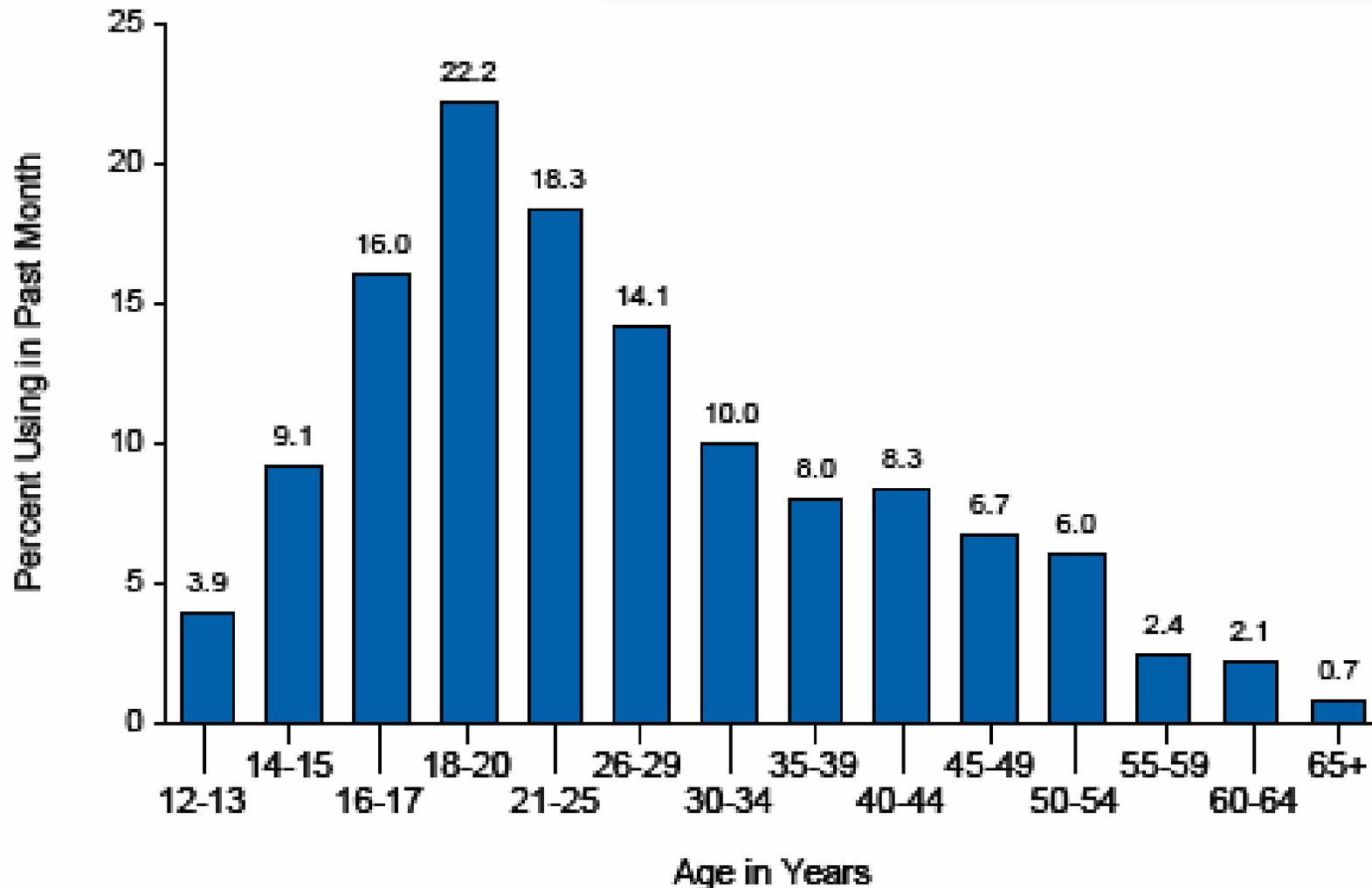
Tobacco Use Starts in Adolescence



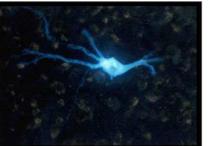
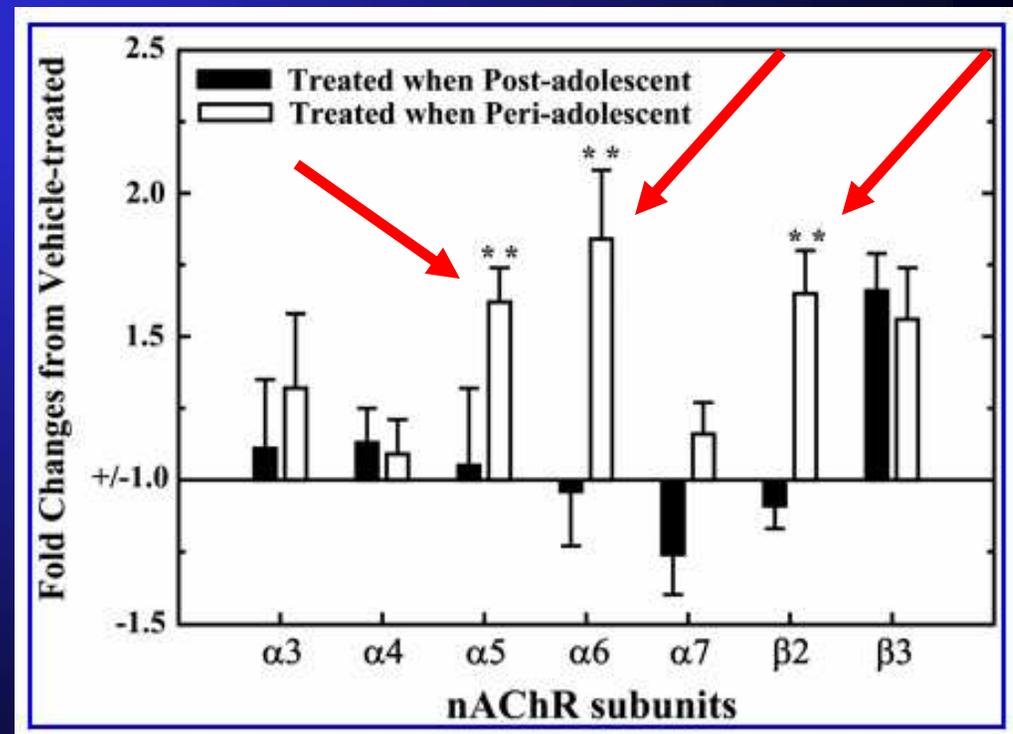
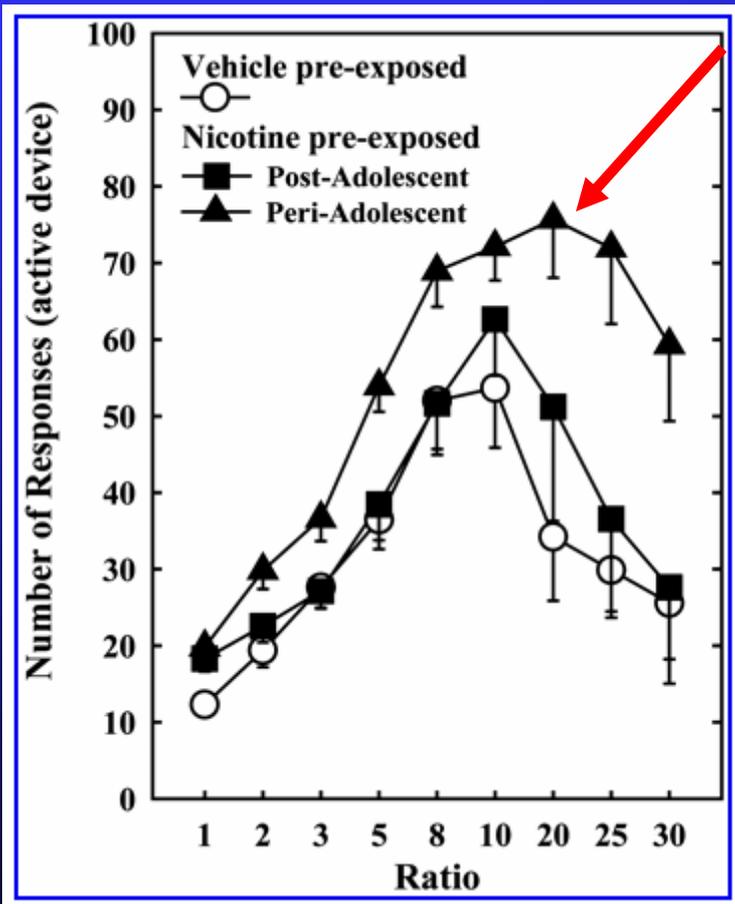
Earlier Onset of Drinking Increases Risks of Addiction



Past Month Drug Use



The Adolescent & Adult Brains Respond Differently to Drugs



What To Do?

- Prevention
- Prevention
- Prevention





Drug Use and Abuse

- Voluntary behaviors
- Does not necessarily have adverse consequences
- But, all drug addicts pass through a period of drug abuse





Drug Addiction: A Brain Disorder

- Loss of control of drug-taking behavior
 - ◆ Overwhelming compulsion to take drugs
 - ◆ Craving when drugs not available
- Addicts are:
 - ◆ Tolerant
 - ◆ physically dependent
 - ◆ psychologically dependent
- Addiction is a chronic, relapsing disorder
 - ◆ Relapse can occur long after drugs are gone from the body



Many Common Diseases Are Chronic, Relapsing Disorders

- Hypertension
- Adult Onset Diabetes
- Atherosclerosis
 - ◆ Begin with voluntary behaviors
 - ◆ Have genetic and environmental components
 - ◆ Result in biological changes
 - ◆ Medications can be useful treatments
 - ◆ Require lifestyle changes



Pain Patients Can Get Addicted But Most Don't

- They experience the acute effects
- They undergo the neuroadaptations

BUT

- Their behavioral contingencies are different
 - So what they learn is different



Psychological Dependence

- When drug-taking becomes central to life
 - replace other activities
- When a person considers drug-taking to be necessary for continued well being



Key Points About Addiction

- An addict's brain is different from a normal brain
- The differences are enduring



The Brain and Behavior: Operant Conditioning

- Any behavior that is reinforced (rewarded) tends to be repeated
- A specific neural circuit underlies reward
- The release of dopamine is an essential step
- Activation of the reward system teaches us to repeat the behavior that activated it

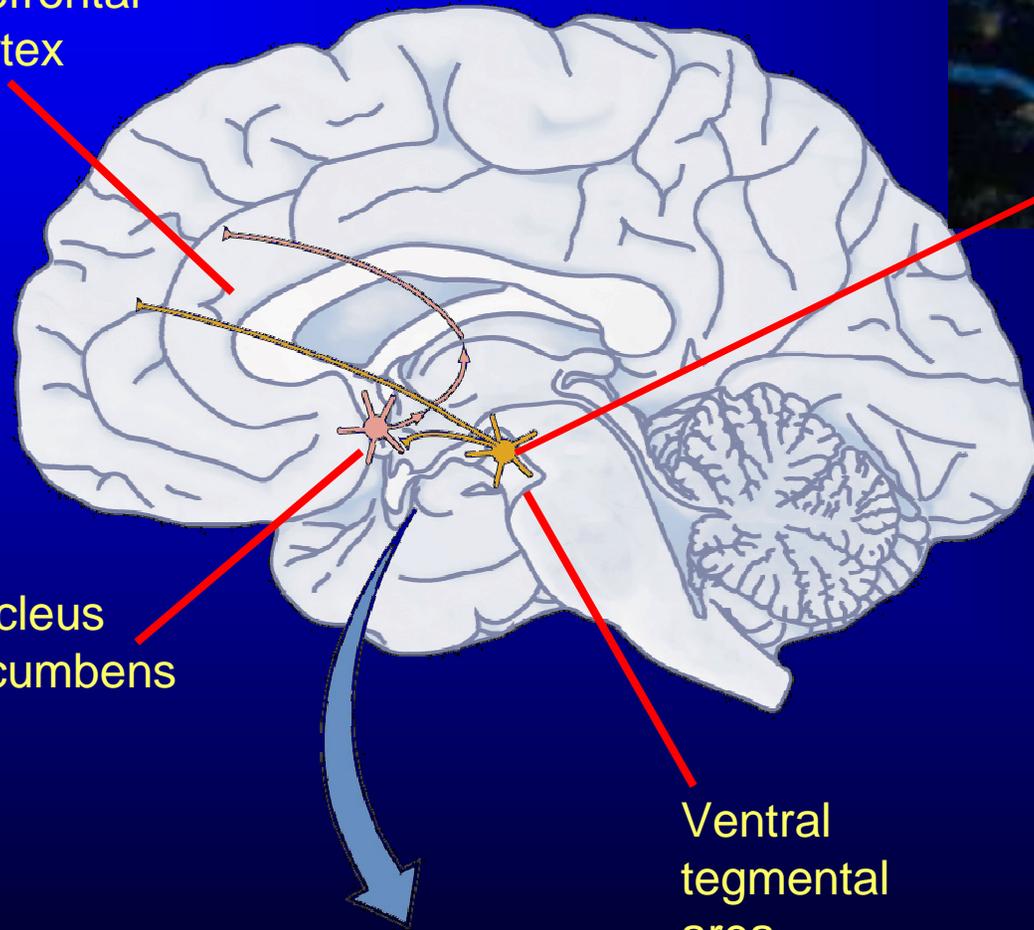


A Pathway for Reward

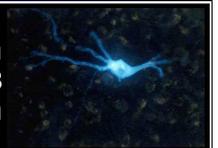
Prefrontal cortex

Nucleus accumbens

Ventral tegmental area



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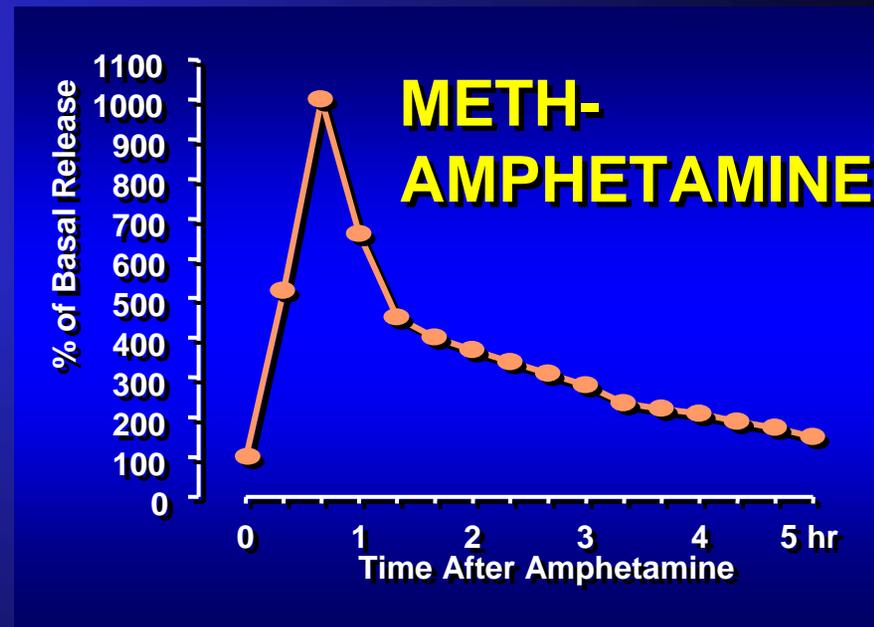
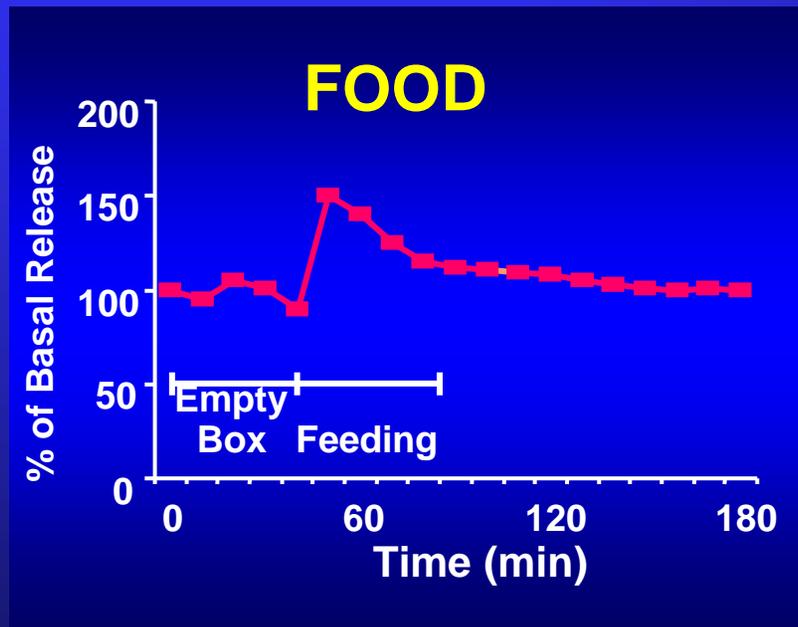
The Reward Pathway Helps us Get Things We Need to Survive



We Learn to Repeat Behaviors That Produce Reward



Pleasurable Events Increase the Release of Dopamine



But drugs do it best!



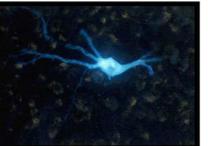
Cocaine Causes Enduring Changes in the Density of Dopamine Receptors



Cocaine
Naive

3 Days
Abstinence

227 Days
Abstinence



Drug Addiction Is Learned

- Explicit Memory
 - ✦ consciously recalled memories
- Implicit Memory
 - ✦ operant conditioning
 - ✦ classical conditioning

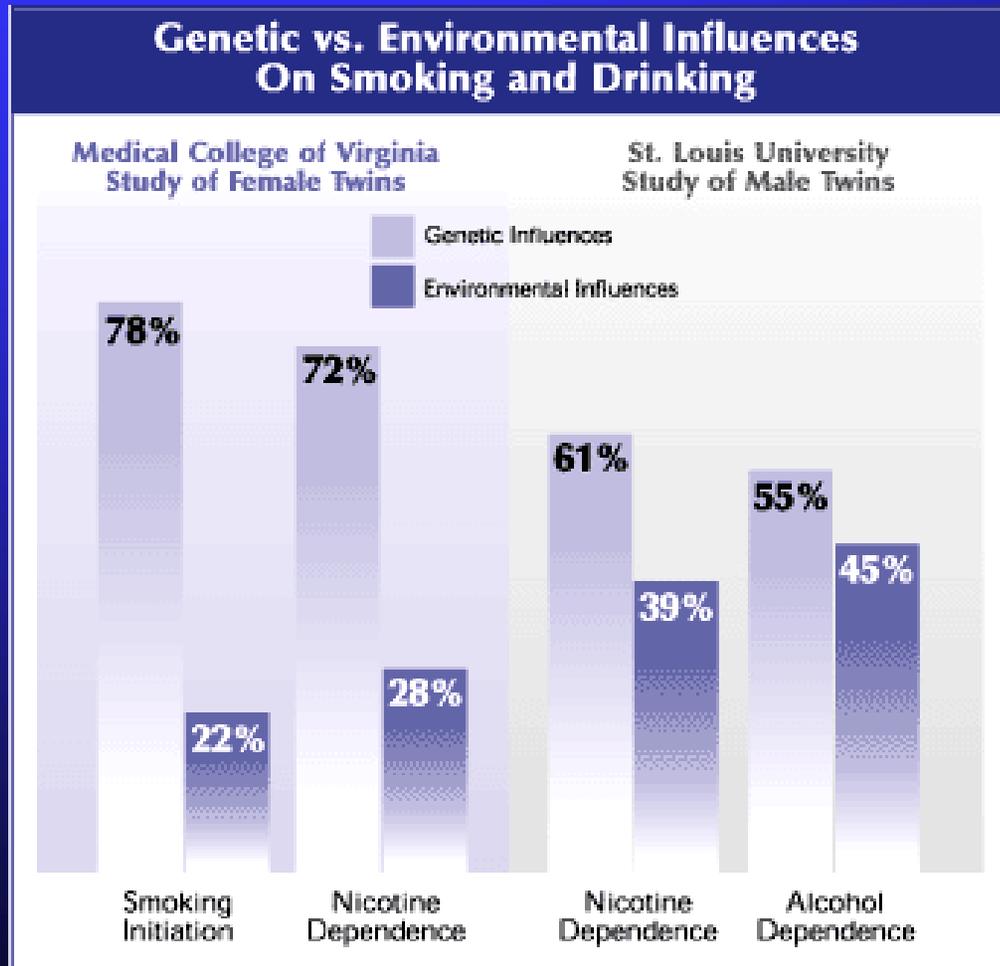


Classical Conditioning

- Association between two stimuli
- Learned by repetition
- Long lasting
- Very difficult to extinguish because of extensive over-learning



Genetic Factors Account For 50-80% Of The Risk For Addiction



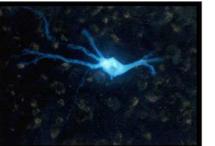
NIDA Notes, Vol. 15 No. 2 (2000)

- "Heritability"
 - ✦ Risk for addiction involves many factors



What Aspects of Addiction Might Be Genetically Modified

- Response to drug
- Risk of persistent use
- Becoming dependent
- Usage per day
- Ability to quit



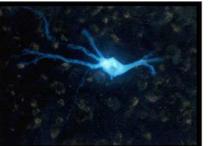
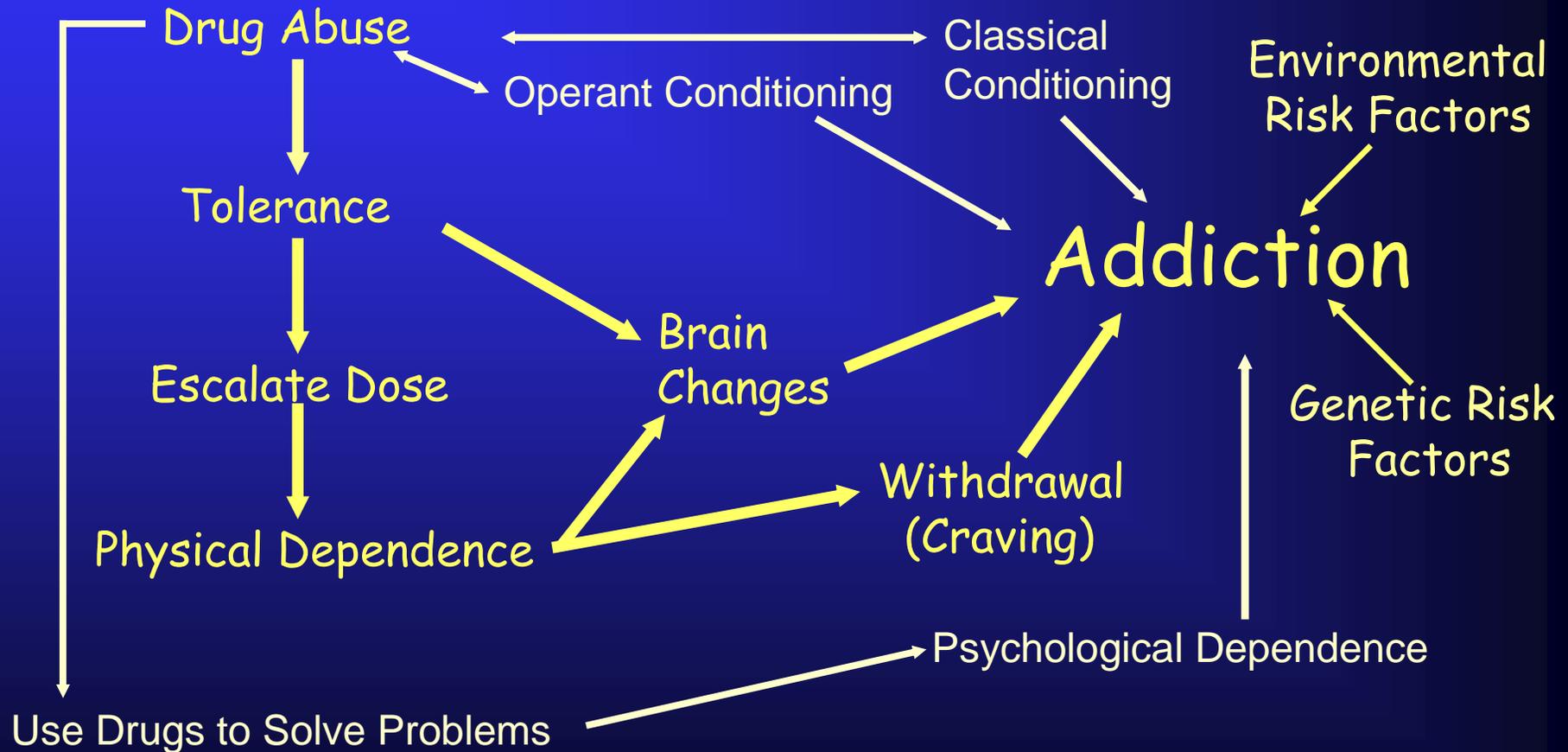


Aldehyde Dehydrogenase (ALDH2)

- Enzyme involved in alcohol metabolism
- Variants of *ALDH2* affect sensitivity to alcohol
 - ✦ Variant1: Very active, found in most ethnic populations
 - ✦ Variant2: Inactive or low activity
 - ▶ “Alcohol flushing response” & increased hangover symptoms
 - ▶ Protective: reduced occurrence of alcoholism
 - ▶ Common in some Asian populations



A Complex Path to Addiction



Policy Implications of Neuroscience

- Addiction is a brain disorder and it matters
 - ◆ Enduring changes in brain
- Common substrate for all addictions
- Immature or damaged orbitofrontal cortex leads to poor decision making
- New medications come from research
- Paradigm shift about the nature of addiction
 - via teaching, textbooks, etc
- Identify risk factors
 - ◆ What do you do about them?
 - ▶ Adolescent onset of addiction
- Understanding operant conditioning tells us to prevent regular drug use



Treatment

Does It Work?



FDA Level Evidence Therapies

- Cognitive Behavioral Therapy
- Motivational Enhancement Therapy
- Community Reinforcement & Family Training
- Behavioral Couples Therapy
- Multi Systemic Family Therapy
- 12-Step Facilitation
- Individual Drug Counseling



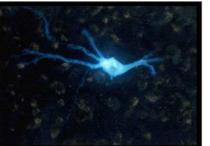
FDA Level Evidence Medications

- Alcohol
 - ✦ Disulfiram, naltrexone, acamprosate
- Opiates
 - ✦ Naltrexone, methadone, buprenorphine
- Cocaine
 - ✦ Disulfiram, topiramate
- Marijuana
 - ✦ Rimonoban



Why Do We Think Treatment Doesn't Work?

- Lindsay, Brittany, etc
- What are our expectations?

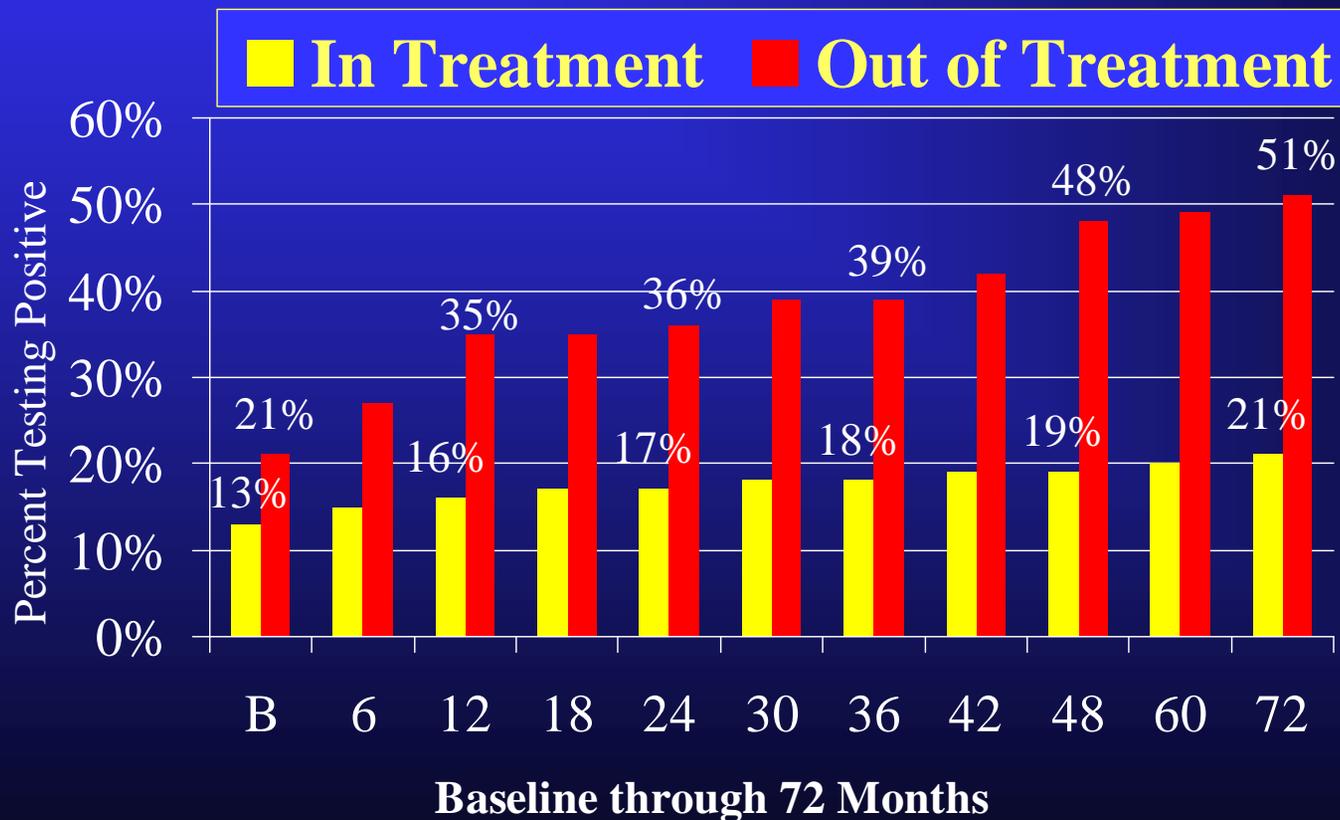


What The Public Expects

- Safe, complete detoxification
- Eliminate crime
- Reduced use of medical services
- Return to employment
- Eliminate family disruption



Compared to No Treatment



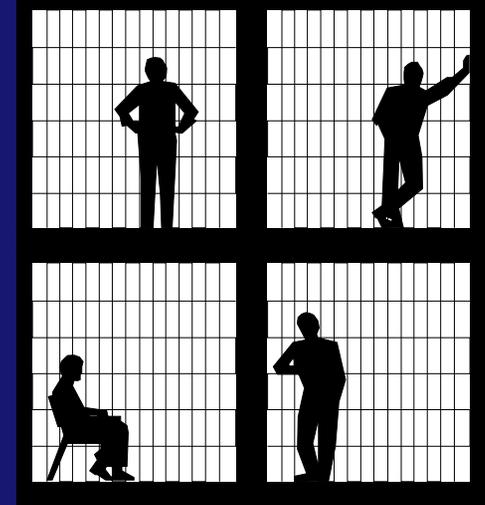
Compared to Prison

Criminal Recidivism in 3 Years

- 68% re-arrested
- 47% convicted
- 50% re-incarcerated

Relapse to Drug Abuse in 3 Years

- 95% relapse

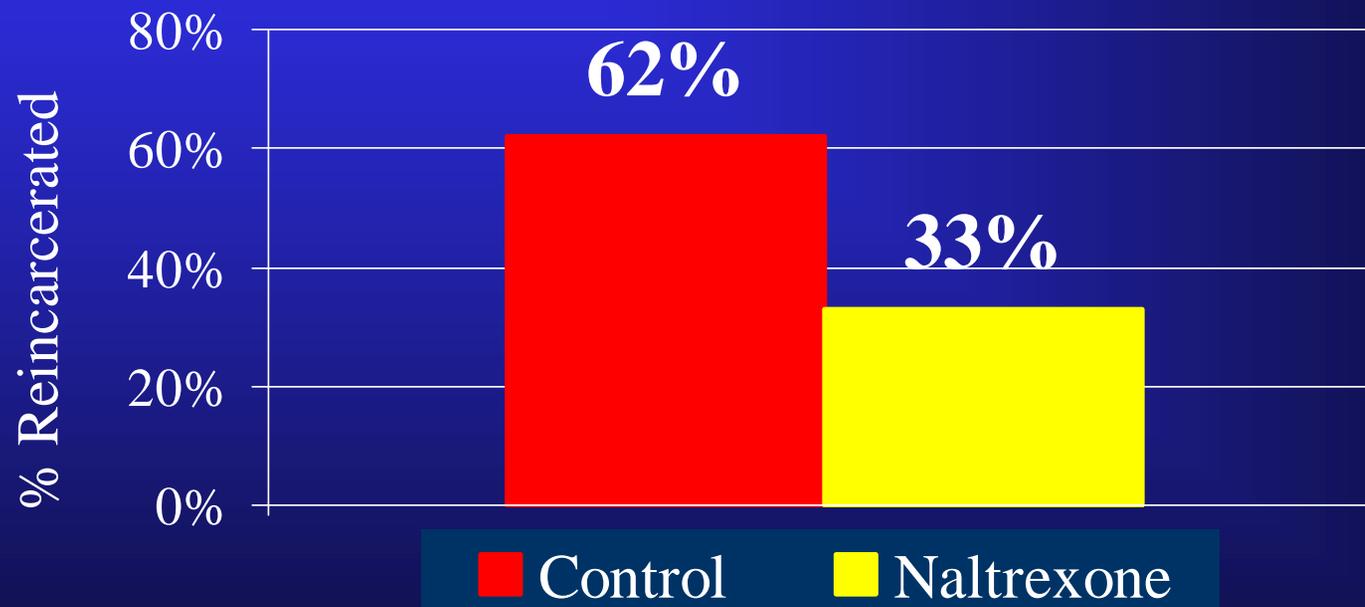


Drug Courts

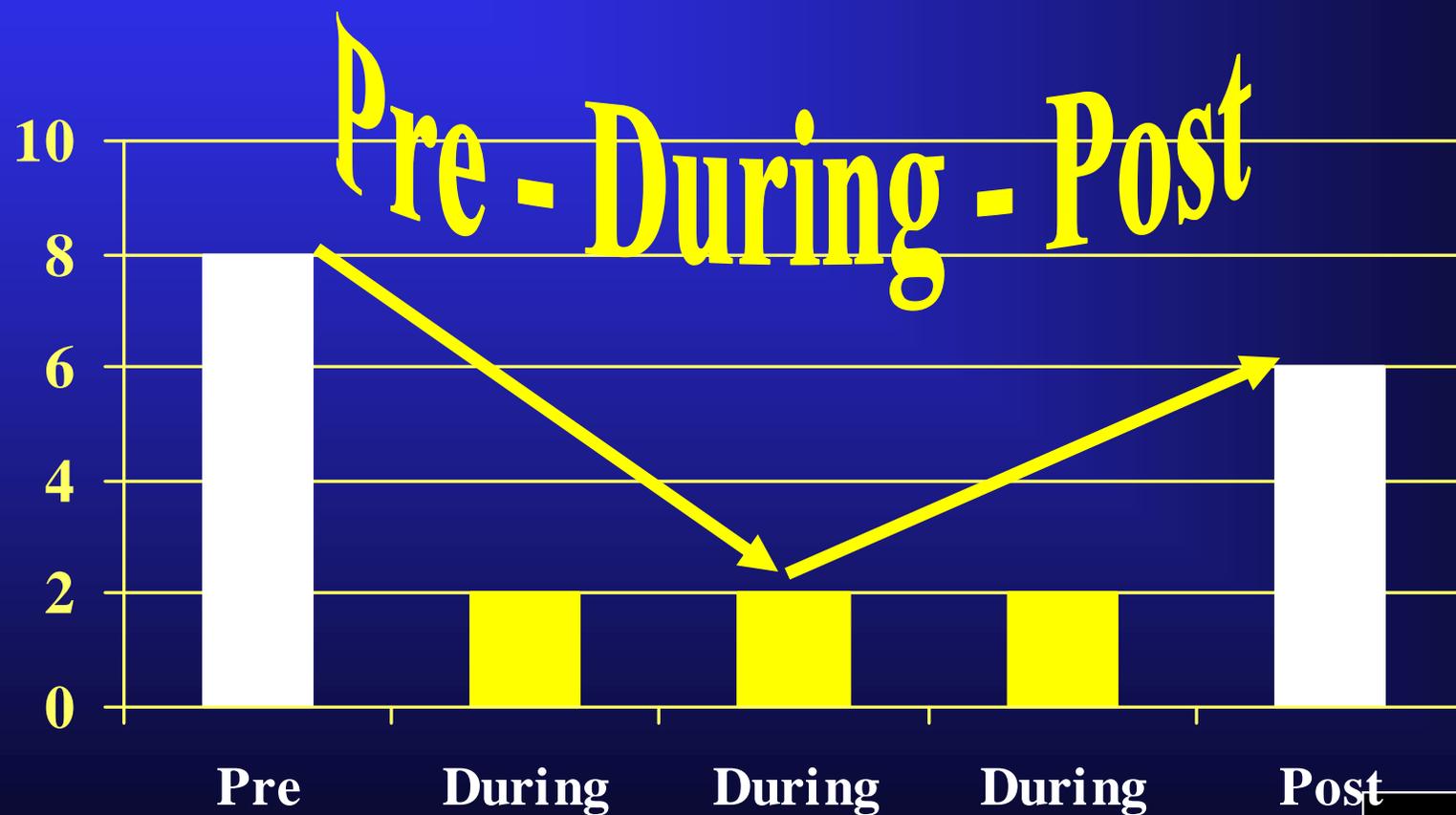
- 60% complete 12 months of treatment
- 50% graduate
- Reduced recidivism and drug use
- Serves about 5% of eligible population



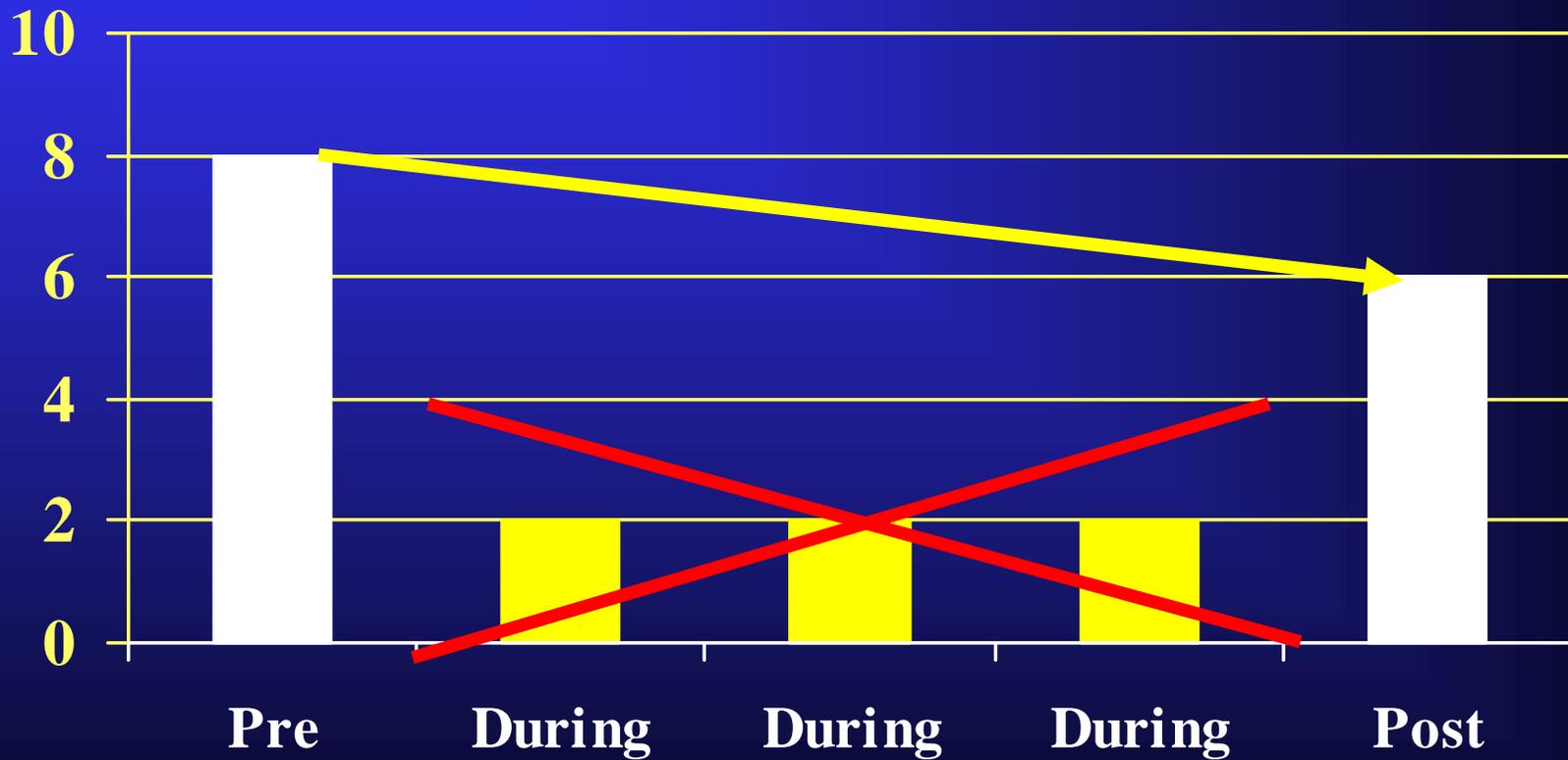
Compared to Intensive Supervision, Treatment Enhances Success in Probation



Evaluating Treatment for Hypertension



Evaluating Addiction Treatment



Lesson Learned From Other Chronic Illnesses

- Most patients do not respond to first medication/treatment
- Most patients do not adhere to treatment/behavioral change
- Treatment effects don't last long after treatment stops
- Repeating acute care episodes is not a treatment plan



A Comprehensive Care Model: The New Gold Standard

