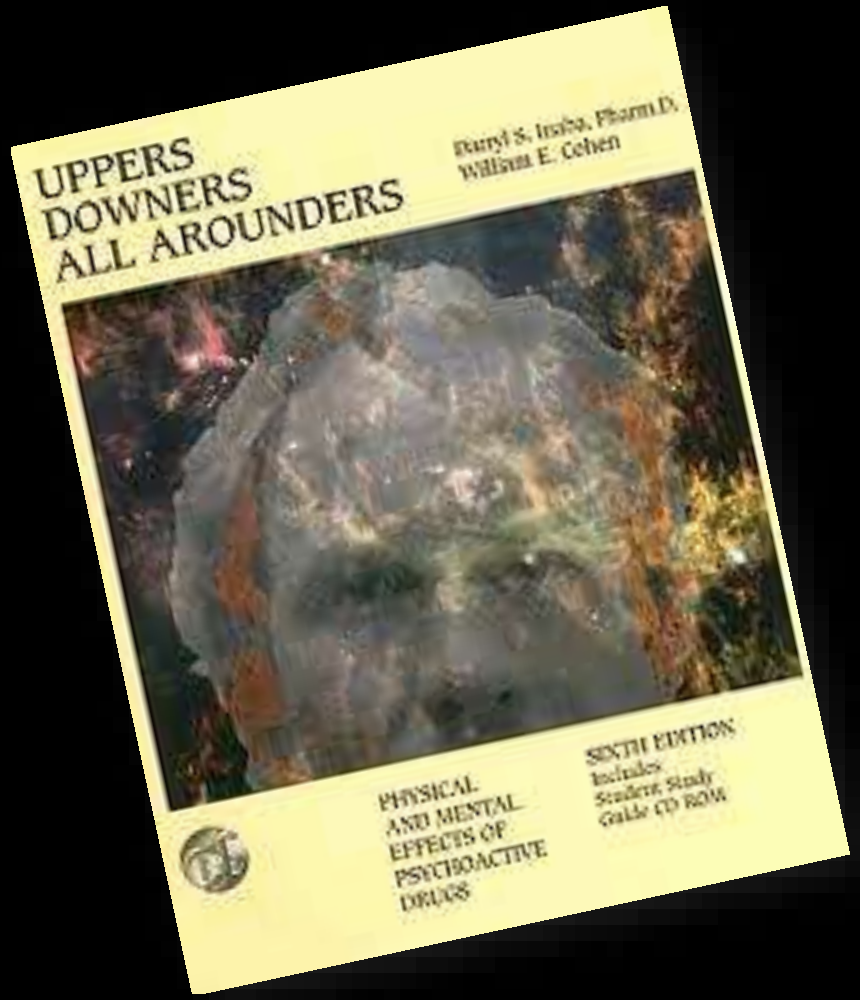
Pharmacology

ADDICTION, EPIDEMIOLOGY AND PHARMACOLOGY AND TEST PREP

Eric Martin, MAC, CADC III, CPS, CRM

ACCBO, Policy & Legislative Liaison,
ACCBO, Past-president & Director Emeritus, 1991-2008
Instructor; Oregon Child Welfare & University of Oregon
Governor's Advisory Board on Drugs & Violent Crime, 2004-2006
Governor's Council on Substance Abuse Programs, 2007-2009
Up in Smoke: Marijuana Education/Intervention Specialist
Consulting Editor; *NIDA Science to Practice Perspectives*
Certified NAADAC Case Presentation Examiner
ICRC Examination Proctor

Pharmacology Books to study for the Addiction & Prevention Exams

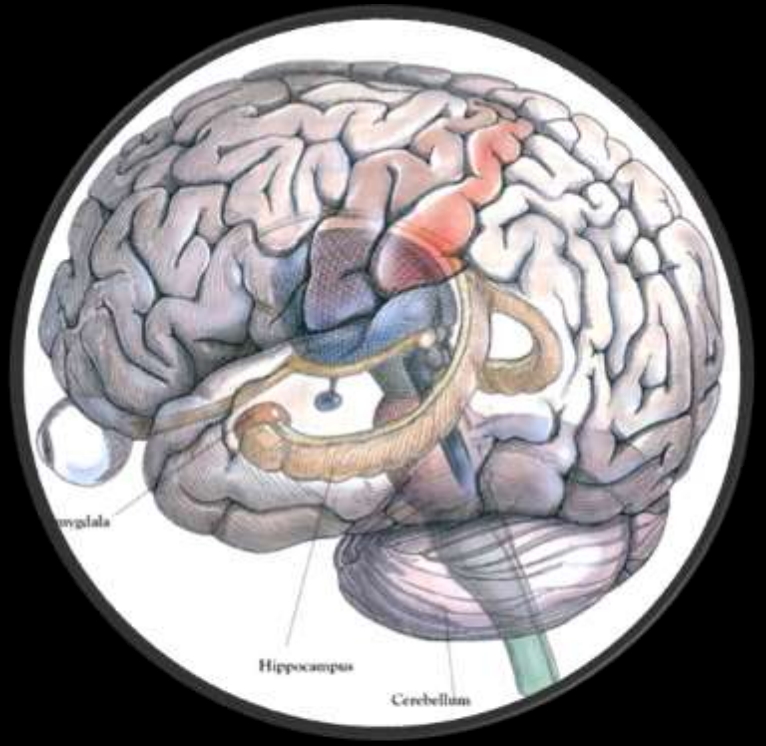


Before we start
let's talk about the
limitations of research
on this subject

Neuroimaging studies on kids have been difficult

Effects of Alcohol and Combined Marijuana and Alcohol Use During Adolescence on Hippocampal Volume and Asymmetry

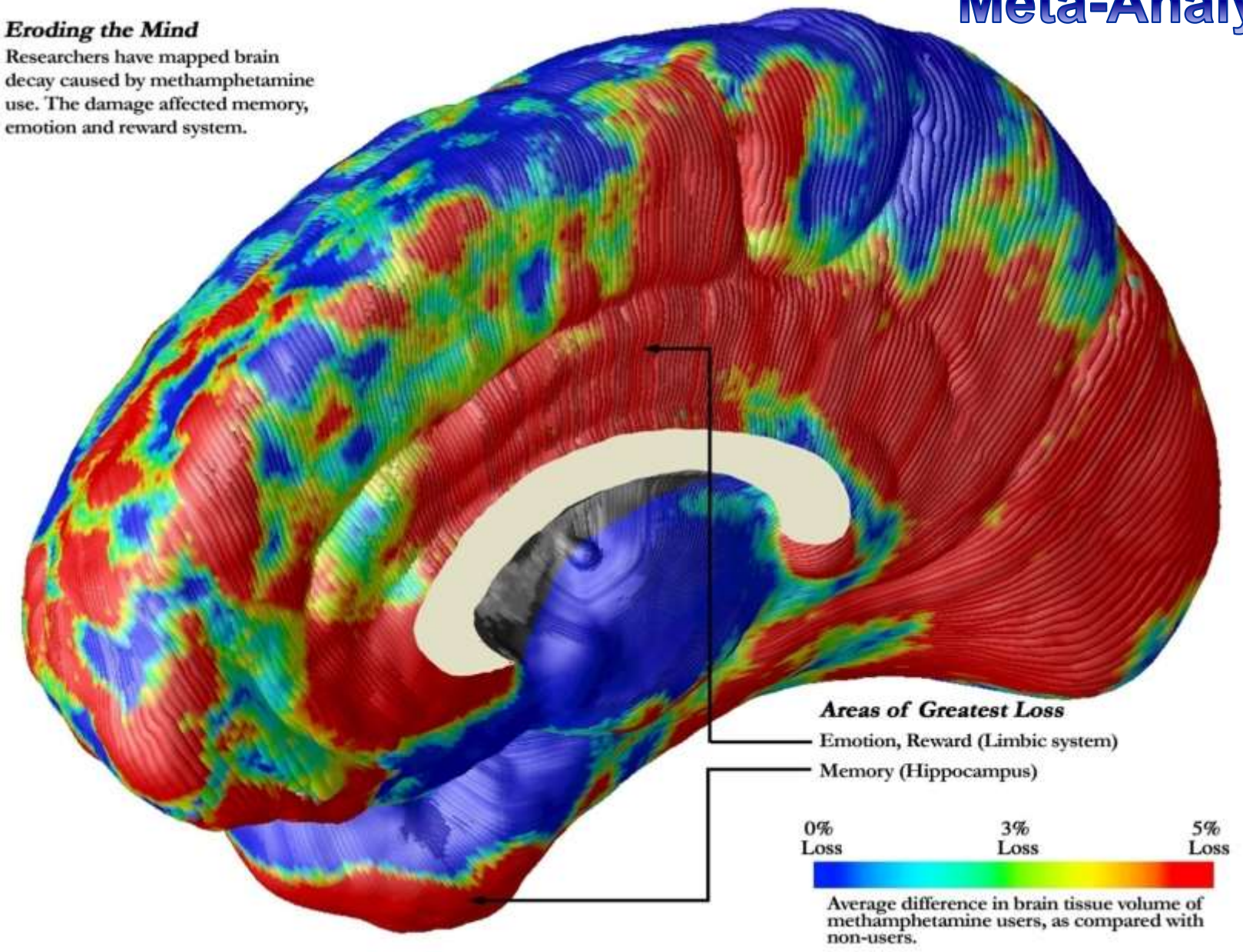
Krista Lisdahl Medina, Ph.D., Alecia D. Schweinsburg, M.A., Mairav Cohen-Zion, Ph.D., Bonnie J. Nagel, Ph.D., and Susan F. Tapert, Ph.D.



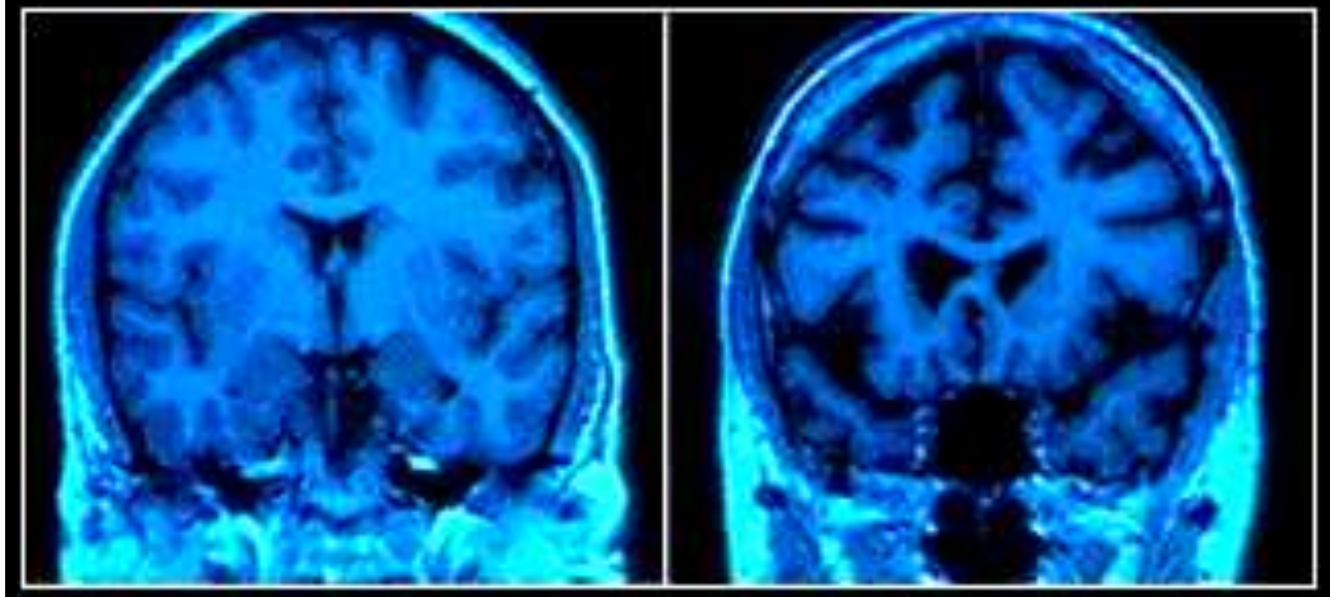
- Age 15–18
- Alcohol (*n*=16),
- Marijuana and alcohol (*n*=26),
- Demographically similar controls (*n*=21)
- Total (*n*=63)
- Extensive exclusionary criteria included prenatal toxic exposure, left handedness, and psychiatric and neurologic disorders. Substance use, cognitive, and anatomical measures were collected after at least 2 days of abstinence from all substances.

- Alcohol only kids hippocampal asymmetry, lower verbal learning scores
- MJ/alcohol no significant asymmetry, lower verbal learning scores

UCLA Methamphetamine Brain Tissue Loss Meta-Analysis



We already know heavy alcohol use, or abuse of alcohol damages the adult human brain.



Normal
43-year-old

Alcoholic
43-year-old

150 years ago Carl & Sergei saw a lot of fluid in the empty spaces, hence, “Wet Brain”

Wernicke-Korsakoff Syndrome

We've learned a lot about the toxic effects of drugs and alcohol on the brain.

And, we've learned a lot about adolescent development and adolescent brain development.

Now, we're beginning to learn about the effects of alcohol and other drugs on adolescent brain development.

https://abcdstudy.org/

ABOUT CONTACT EN ENGLISH

Adolescent Brain Cognitive Development

EDUCATORS FAMILIES SCIENTISTS STUDY SITES NEWS

ABCDstudy.org

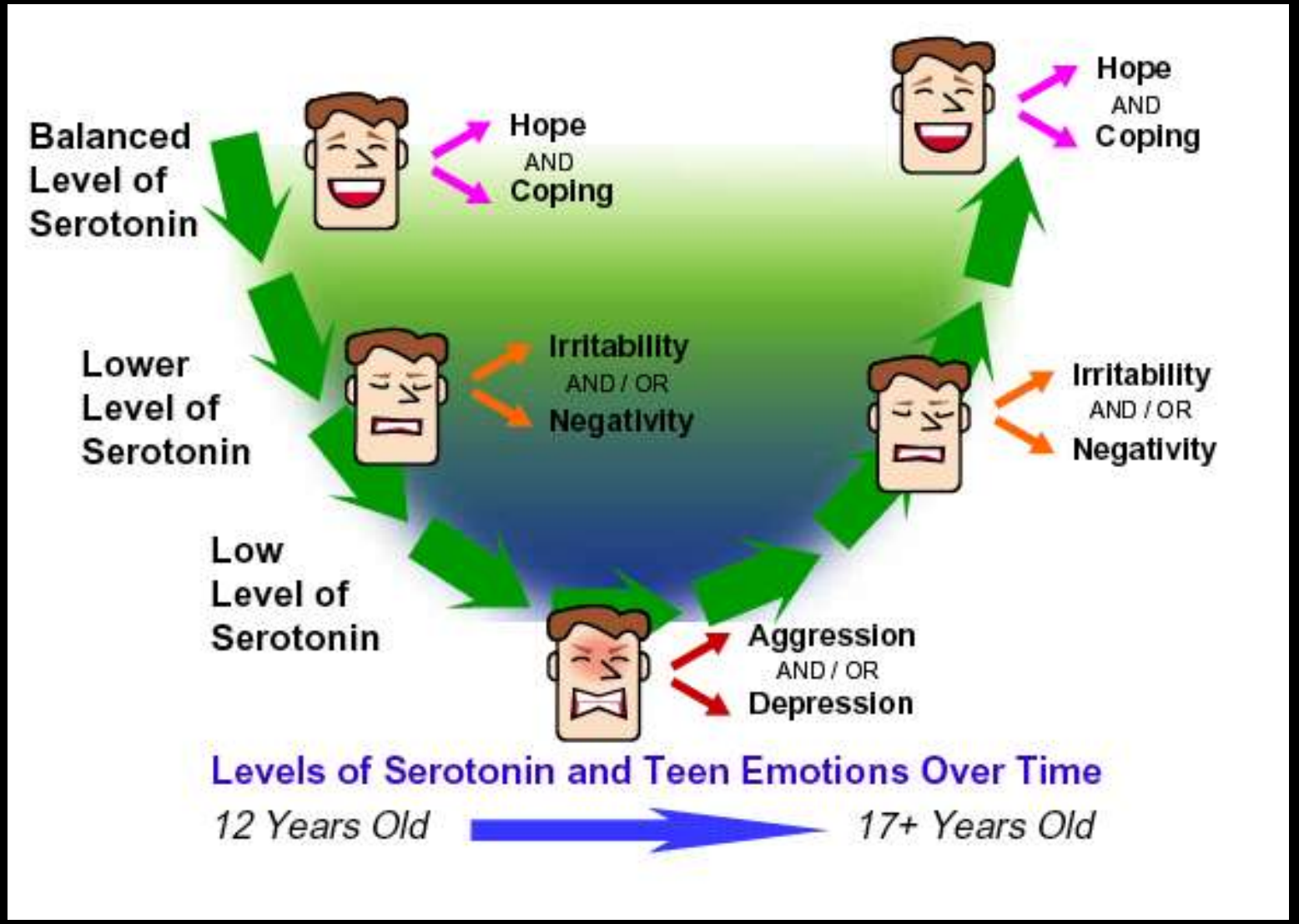
Huge study of teen brains could reveal roots of mental illness, impacts of drug use

Read More

Adolescent **B**rain **C**ognitive **D**evelopment

The ABCD Study is the largest long-term study of brain development and child health in the United States.

But there's still some mysteries that aren't understood. For example, neuroscientists have evidence of radical changes in brain chemistry during adolescent.



Stuff about Alcohol most people don't know: Muscle, Skin and Bone Effects

- Decreases fast twitch white fibers
  - White meat = velocity & speed
  - Dark meat= endurance
- 40% all Psoriasis patients have Alcohol misuse, abuse, or dependence
  - Nutritional deficiencies
- 50% bone mass disorders related to alcohol
  - More breaks, slower healing

WHY IS ADDICTION PHARMACOLOGY IMPORTANT?

A study of 7,700 current and former smokers showed that the most successful quitters were motivated by the following:

1. Having personal concerns about their health due to their smoking
2. Wanting to set a good example for their children

The least effective motivations for quitting were the following:

1. Concerns about the cost of cigarettes
2. The effect of smoking on others
3. Pressure from family or friends to quit smoking

Halpern, Michael and Kenneth Warner. Motivations for Smoking Cessation: A Comparison of Successful Quitters and Failures. Journal of Substance Abuse.

NCAC I vs. NCAC II

- **NCAC I**
  - Pharmacology: 35%
  - Counseling Practice: 35%
  - Theories: 15%
  - Professional & Ethical Issues: 15%

75%

- **NCAC II**
  - Pharmacology: 25%
  - Counseling Practice: 25%
  - Theories: 25%
  - Professional & Ethical Issues: 25%

70%

- **MAC**
  - Pharmacology: 35%
  - Counseling Practice: 30%
  - Theories: 0%
  - Professional & Ethical Issues: 35%

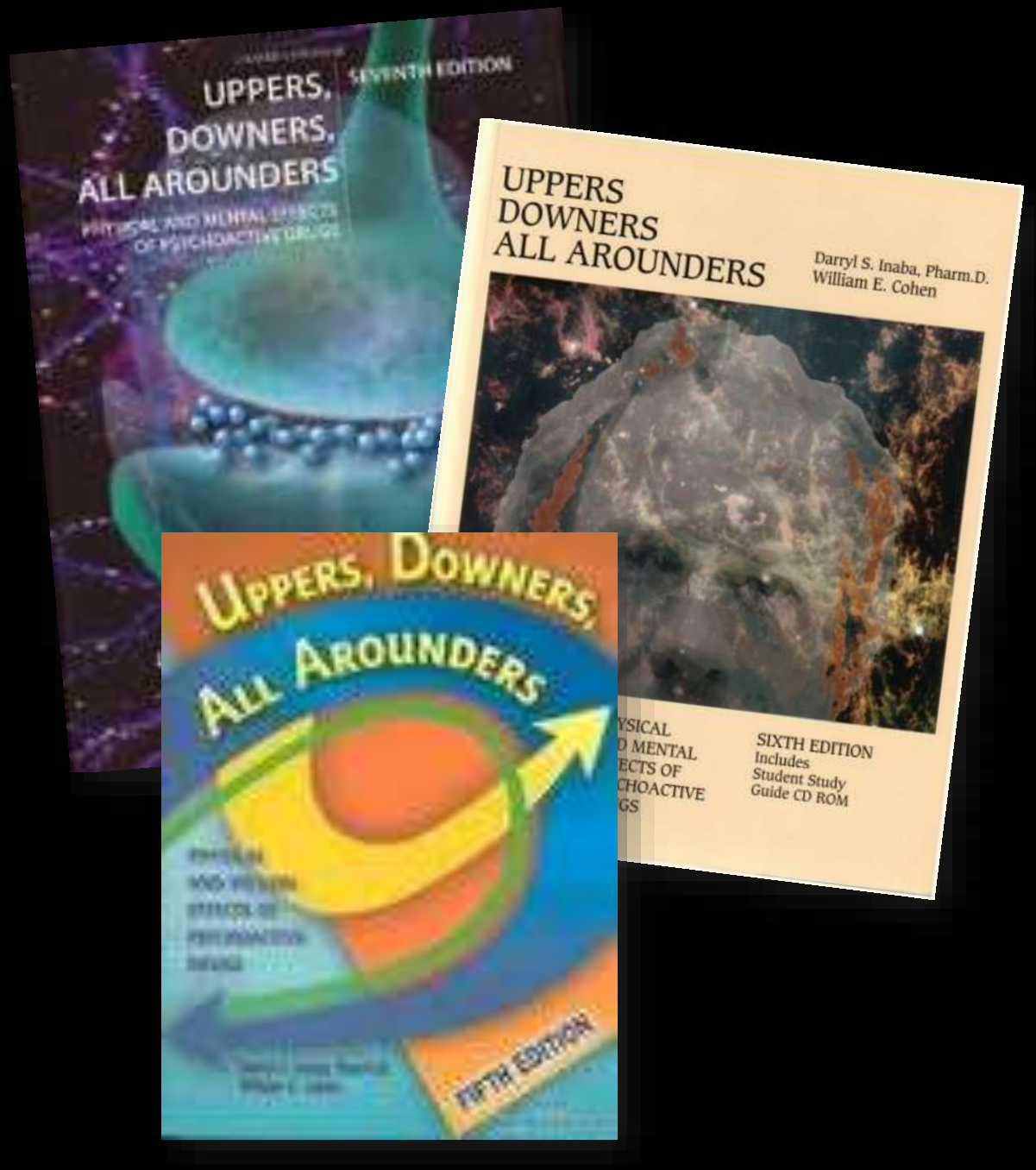
75%

Pass/Fail Rates

1. Fail area: Pharmacology
2. Fail area: Theories of Addiction Treatment and Counseling
3. Pass area: Professional & Ethical Issues
4. Highest pass area: Counseling Practice

- Get a good pharmacology book
- We recommend UDA by Darryl Inaba, Pharm.D., CADC III

- UDA
  - Covers entire body
  - Has chapters on treatment and prevention
  - Covers a variety of theories regarding addiction



Theories

- Traditional Counseling Theories
  - Freud
  - Adler
  - Jung
  - Rogers
  - Ellis
- Addiction Treatment Theory
  - Motivational Interviewing
  - 12 Step Facilitation
  - MAT
  - Relapse Prevention
  - MRT
  - Seeking Safety

Regs:

- CFR 42 PII / HIPAA
- Civil Rights
- Mandatory Reporting
- Fair Housing
- ADA
- Client Rights
- Informed Consent
- CMS Regs/OAR’s

MAT added to ADA & Fair Housing

- Individuals on MAT are protected by the Americans with Disabilities Act
- No discrimination
- Can’t refuse admission to treatment or publicly funded housing based on MAT, unless participation isn’t feasible.

Overview

- The Federal Organizations
- The Big Epidemiological Studies
- Trends
- “Invent a Drug”
- PH and Routes of Administration
- Neurons & Neurotransmitters
- Major Brain Parts & Body Organs
- Opiates & MAT
- Marijuana
- Meth/Cocaine
- Synthetic Drugs of Abuse
- Alcohol
- TEST PREP: 100 Multiple Choice Questions

The Big Joints to Remember

- CSAT: Center for Substance Abuse Treatment
  - How treatment is delivered kind of stuff – TIP's & TAP's – Evidence Based Practices & Addiction Treatment Best Practices
- SAMHSA: Substance Abuse and Mental Health Services Administration
  - Money stuff – federal block grants to the States
- CDC: Centers for Disease Control
  - Disease stuff, including Infectious disease through needle use stuff
- CSAP: Center for Substance Abuse Prevention
  - How prevention services are delivered type stuff – science based prevention activities
- NIDA: National Institute on Drug Abuse
  - Brain/drugs/medication research stuff, and research on EBP's
- NIAAA: National Institute on Alcoholism and Alcohol Abuse
  - Research on alcohol pharmacology and health consequences
  - *(NIDA & NIAAA may be merging in the next couple years)*

The Big Studies to remember

- MTF: Monitoring the Future
  - 8th, 10th, 12th
- NSDUH: National Survey on Drug Use and Health
  - annual survey of a cross section of U.S.
- DAWN: Drug Abuse Warning Network
  - Emergency Room Drug Mentions
- ADAM: Arrestee Drug Abuse Monitoring
  - Surveys of arrestees in jails in major cities
- CEWG: Community Epidemiological Work Groups
- TEDS: Treatment Episode Data Sets

Let's look at 6 years of outcome data (2006-2011)

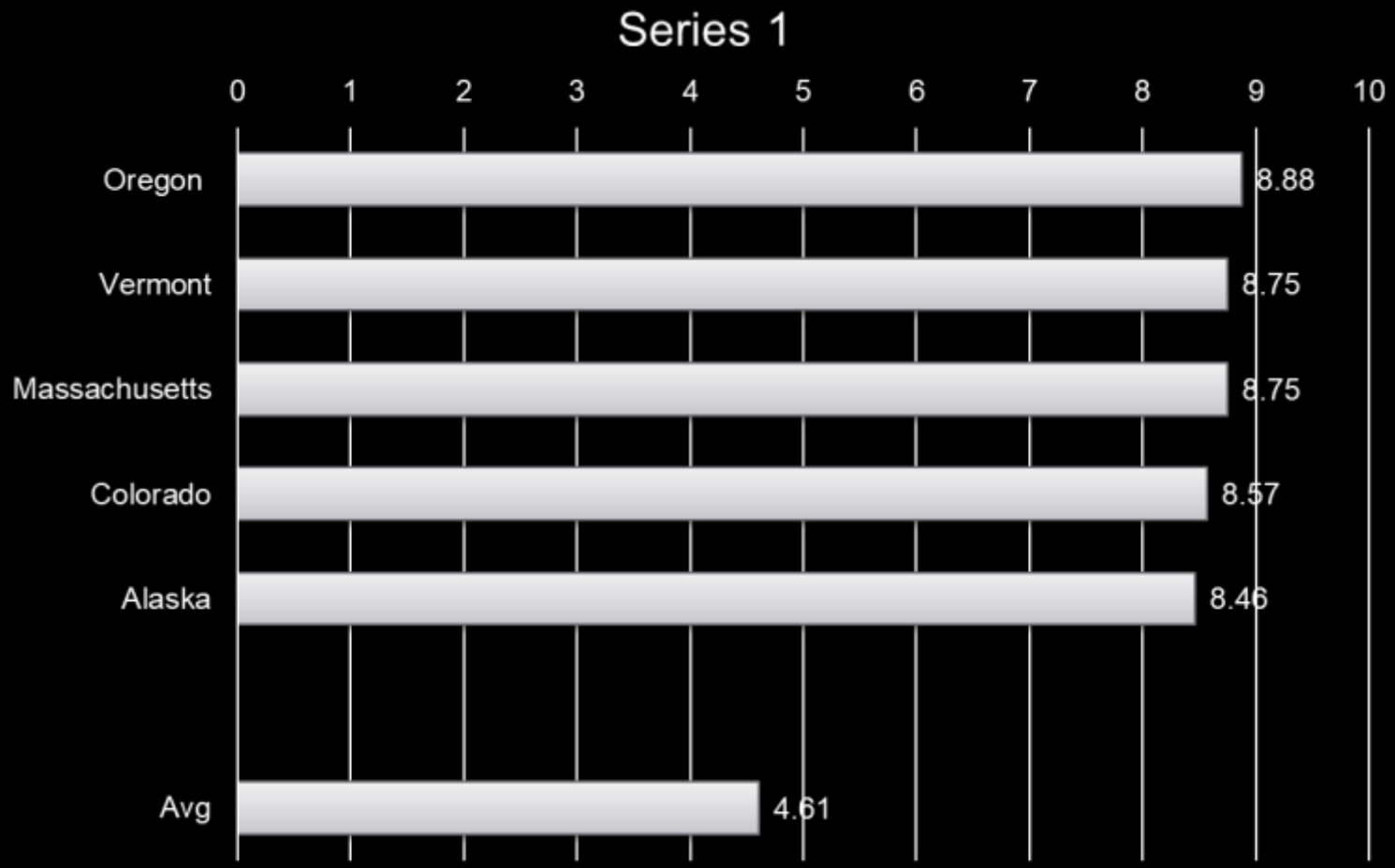
Most people go to abstinence-based treatment
2014: 7% of all discharges were from MAT

Needing but not Receiving Treatment in the Past Year, by Age Group and State: Percentages, *NSDUH Fall 2018 Report (2016-2017, n=135,000)*

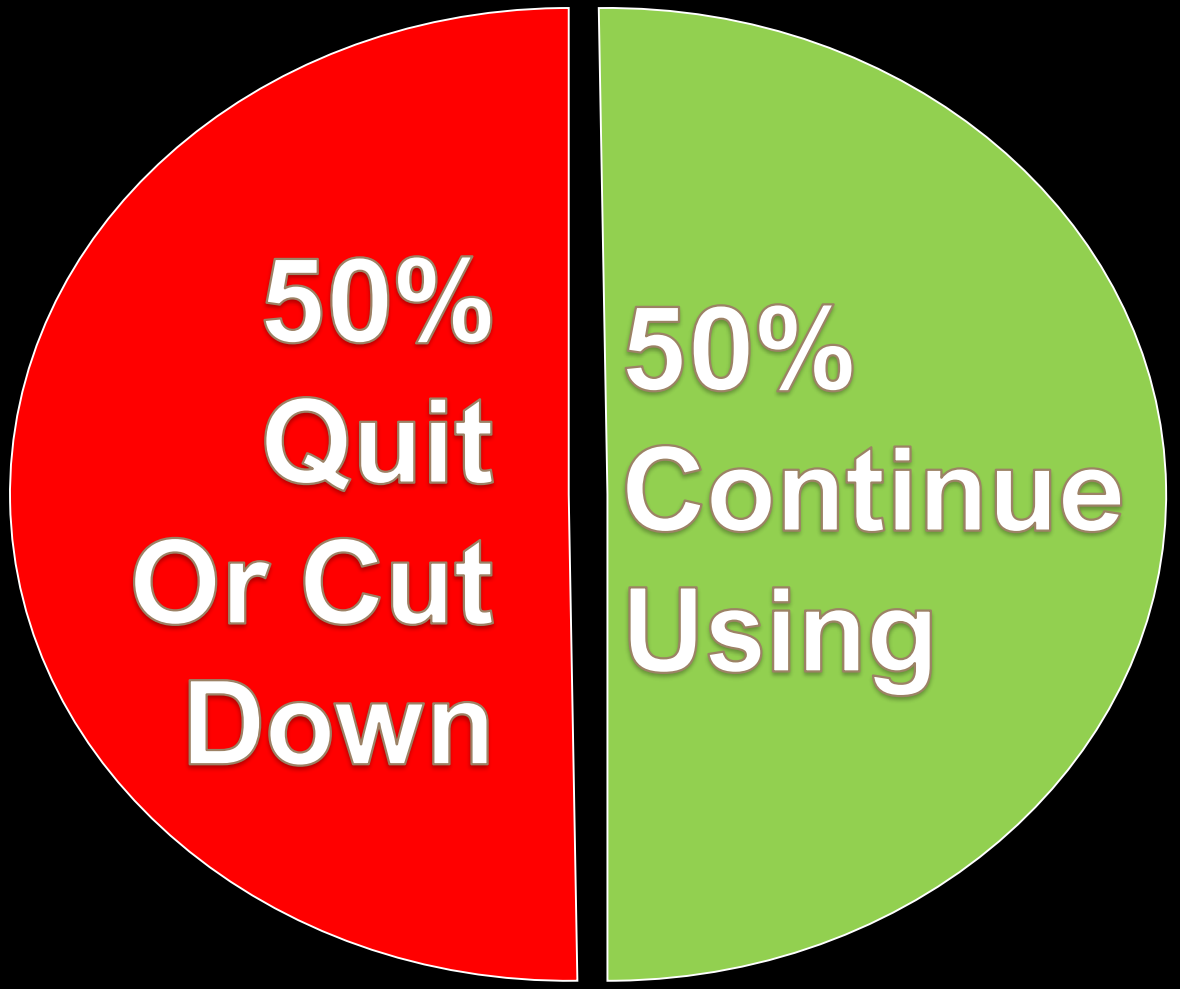
Oregon Ranks 50th

Needing but not Receiving Treatment past year

Among those 12 and older



Senate Bill 267

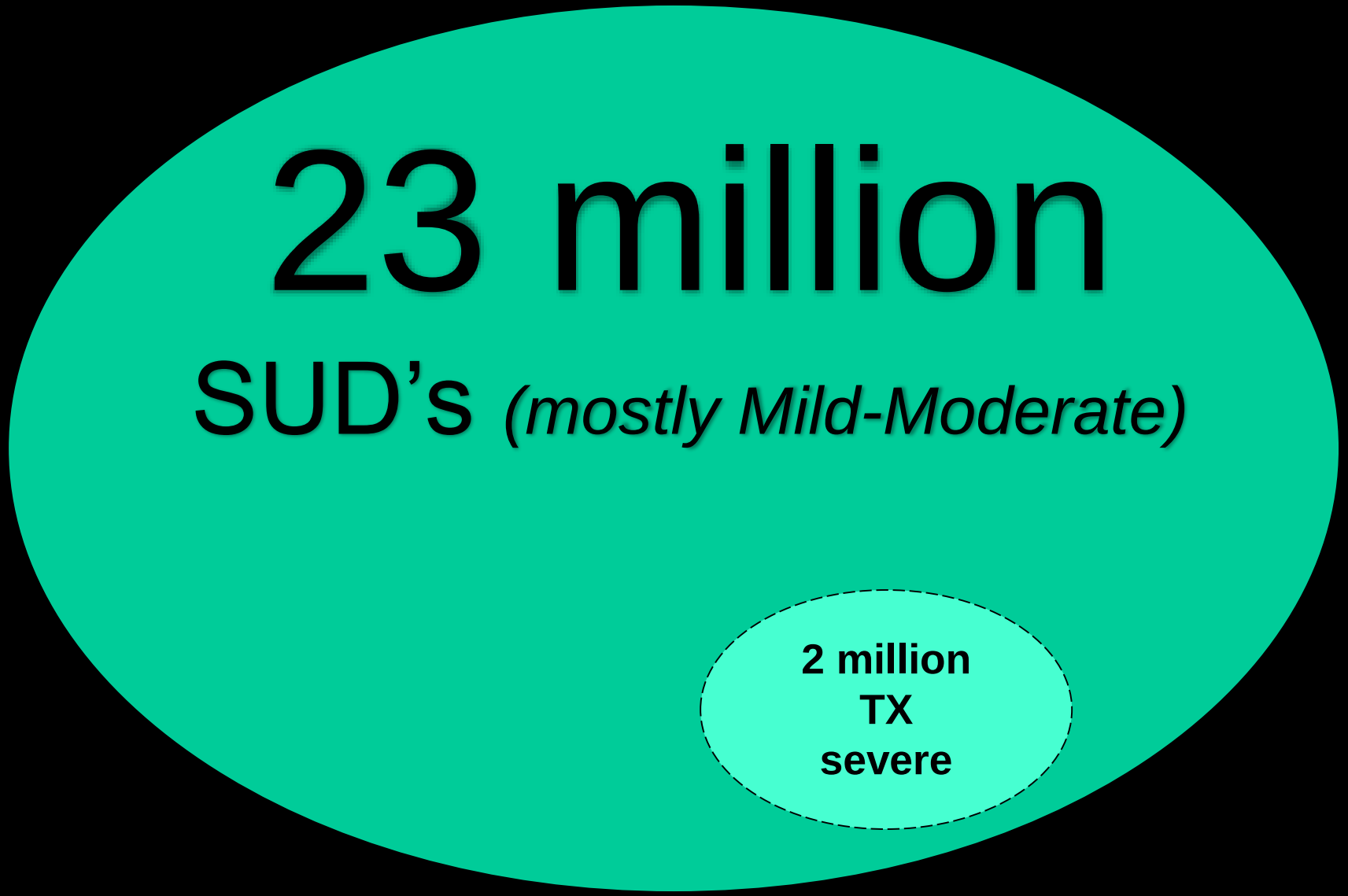


Quit Talk

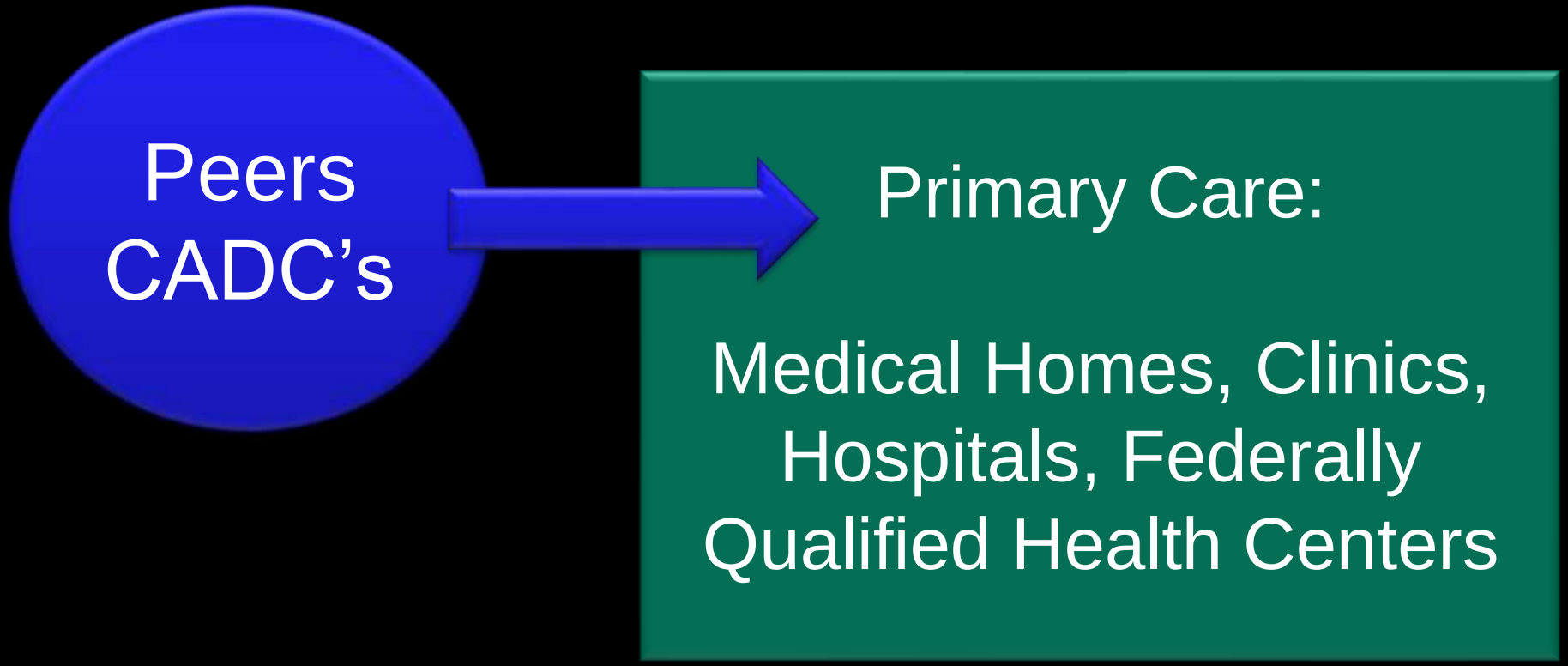
Ambivalence

Health Care Trends

NSDUH: Past Year Stats



Will this work?



"Let's intervene on people before they become addicted, before they get in trouble with the law."

Epidemiology

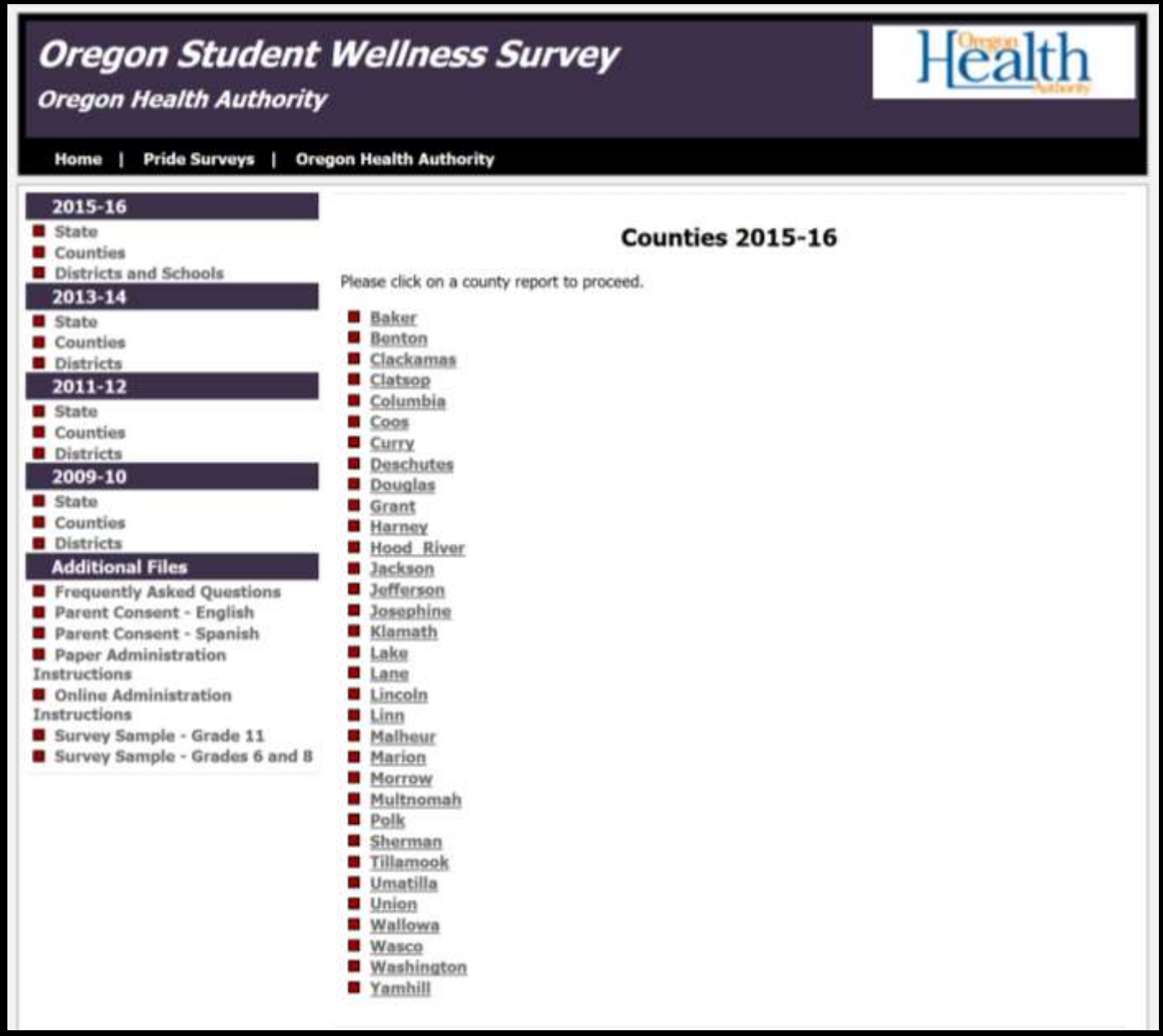
Epidemiology 101

- Surveys typically ask:
  - Have you ever used a particular drug?
  - Past month use?
  - Past week use?
  - Daily use?
  - Perception of risk or harm?
  - Other psych-social correlates
    - Criminal behavior
    - Mood – aggression
    - Drunk/drug driving
    - School behavior

- Scientific Analysis:
  - p values, confidence intervals, etc.
  - Heterogeneous, Homogeneous
  - Anomalous Data Compression
  - Comparisons
  - Regression Analysis used to identify correlation's, either “weak” or “strong”
  - Short-term, Longitudinal, Annual or Ongoing

Oregon studies you won't see on the national exam

- Oregon Healthy Teens (OHT)
- Oregon Student Wellness Survey (SWS)




UNITED NATIONS
Office on Drugs and Crime
GLOBAL ILLICIT
DRUG TRENDS


STATE OF OREGON
THE UNION
1859

Drug Trends

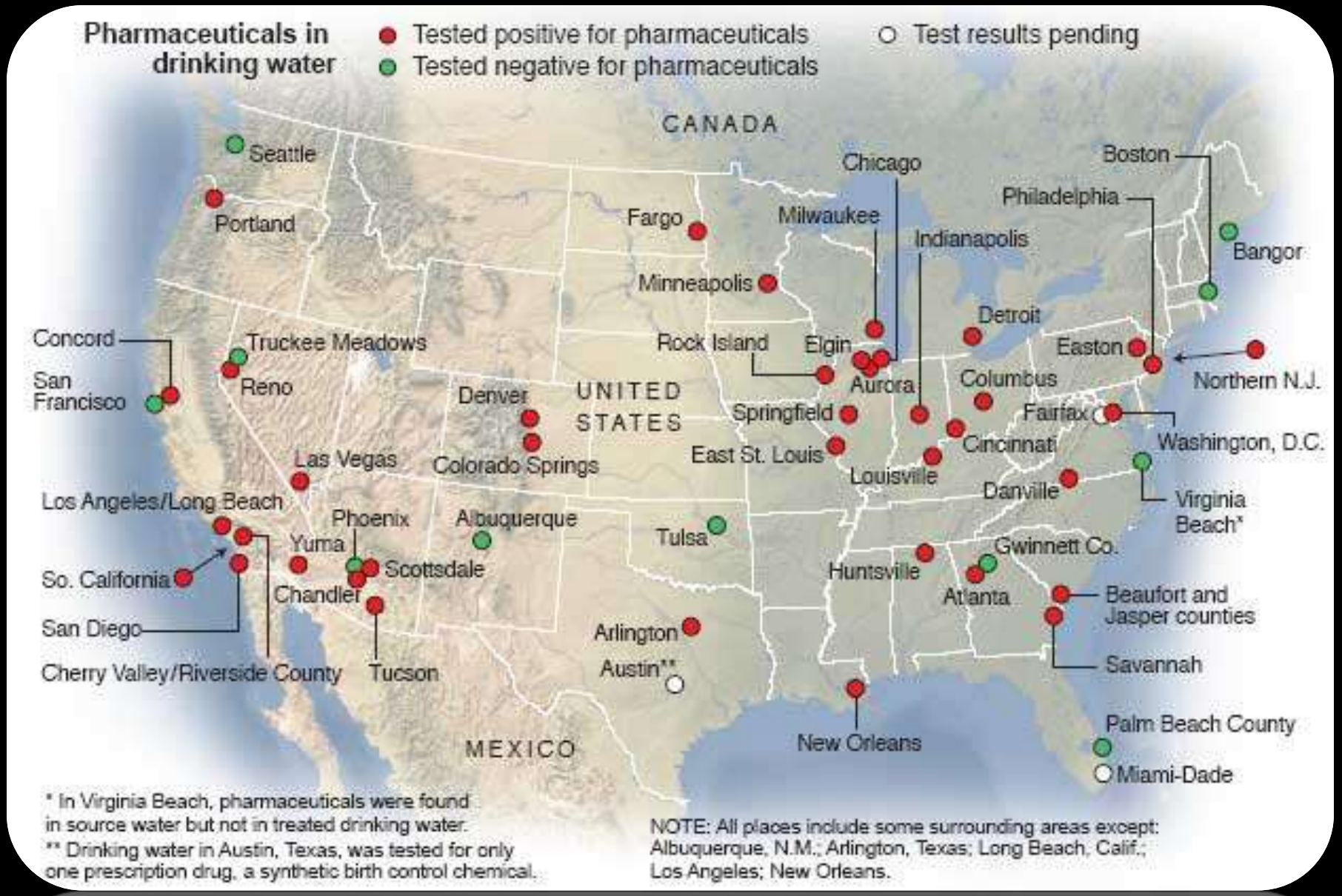
U.S. Consumption

- U.S. = less than 5% of world's population
- Consume 25% of the world's energy
- Consume over 50% of the world's illicit drugs.
- Consume about 60% of the world's Rx drugs
  - 99% of the world's hydrocodone
  - 85% of the world's oxycontin

NPR, August 2008, J. Califano, Whitehouse Office of National Drug Control Policy, International Narcotics Control Board 2008

46 million in U.S. have drugs in drinking water

Testing shows traces of drugs in water greater than previously reported

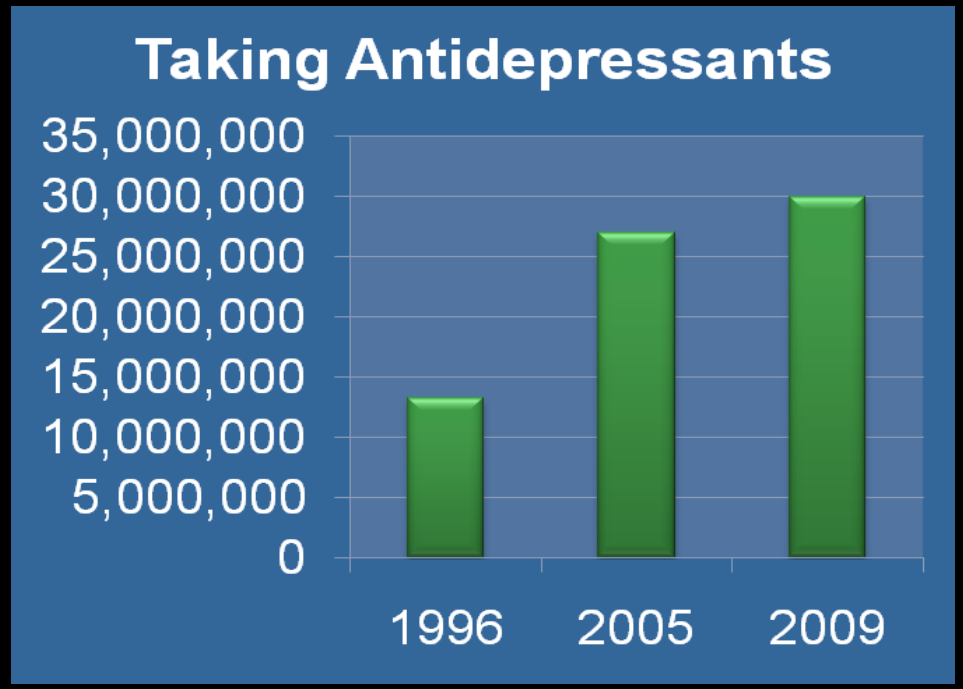


Study: Native Oregon oysters in Netarts, Coos bays contain low levels of pharmaceuticals, chemicals

NETARTS, OREGON -- May 22, 2013 -- Olympia oysters grow on Pacific oyster shells. For thousands of years, Olympia oysters -- the only variety native to the West Coast -- filled bays and backwaters, feeding people and filtering water, which improved habitat for the growth and survival of other fish. Then the Gold Rush came, along with rich miners ravenous for the tangy delicacies. From Alaska to Baja, they were nearly wiped out by overharvesting. As recently as last year a study dubbed them "functionally extinct." But a project to restore the species to Netarts Bay is seeing such great results there might one day be a commercial market for them again, plus great environmental benefits. Motoya Nakamura/The Oregonian *(Motoya Nakamura)*

By Andrew Theen | The Oregonian/OregonLive

Print

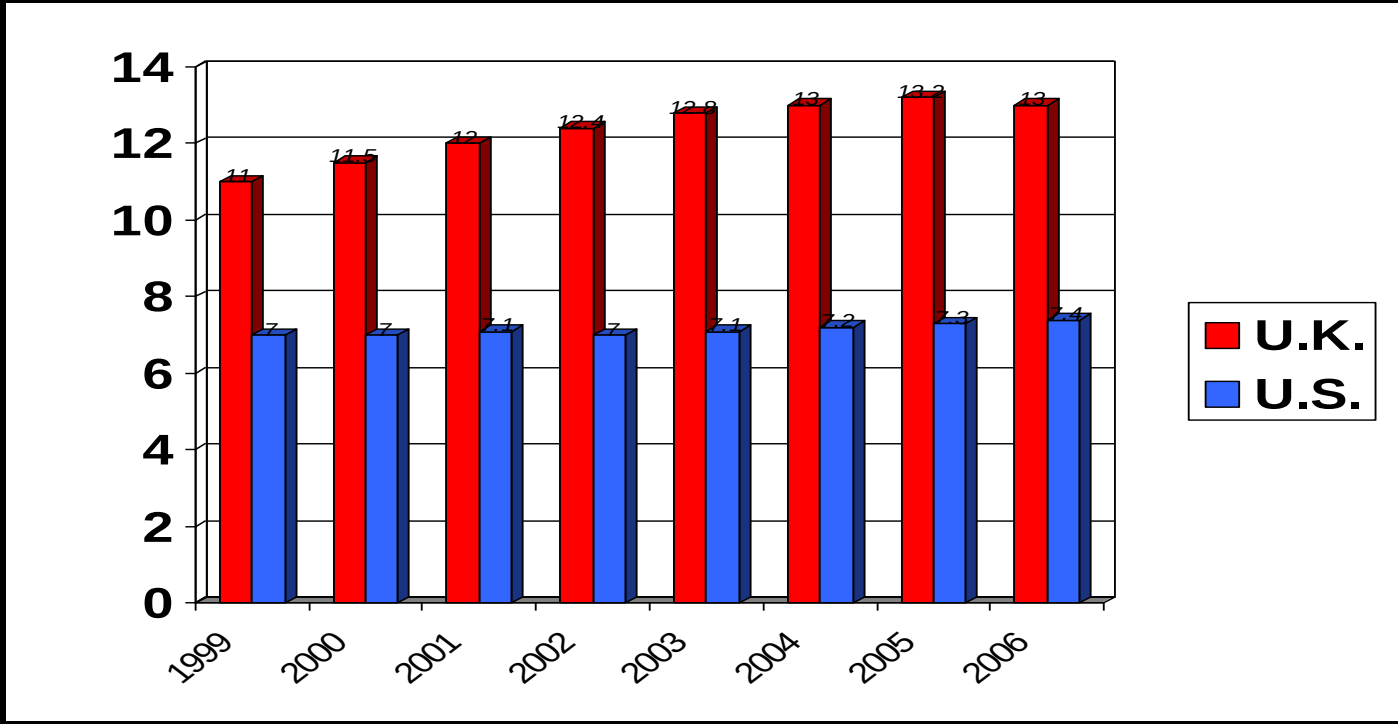


- Irving Kirsch, University of Connecticut
- Freedom of Information Act
- Meta-analytic Study
- SSRI work no better than placebo
- Only people to show improvement – 15% of people with most severe depressive symptoms
- 85% no better and possibly worse than placebo

People often say,
"Europeans teach their children to
drink responsibly from an early age."

U.S. vs. U.K. Annual Alcohol death rate per 100,000
U.S. has more DUII deaths than the U.K.
However, the U.K. has significantly more alcohol related health disorders (Cirrhosis, Pancreatitis, Ascites, etc,).

United Kingdom alcohol death rate per 100,000 is nearly double that of the United States.



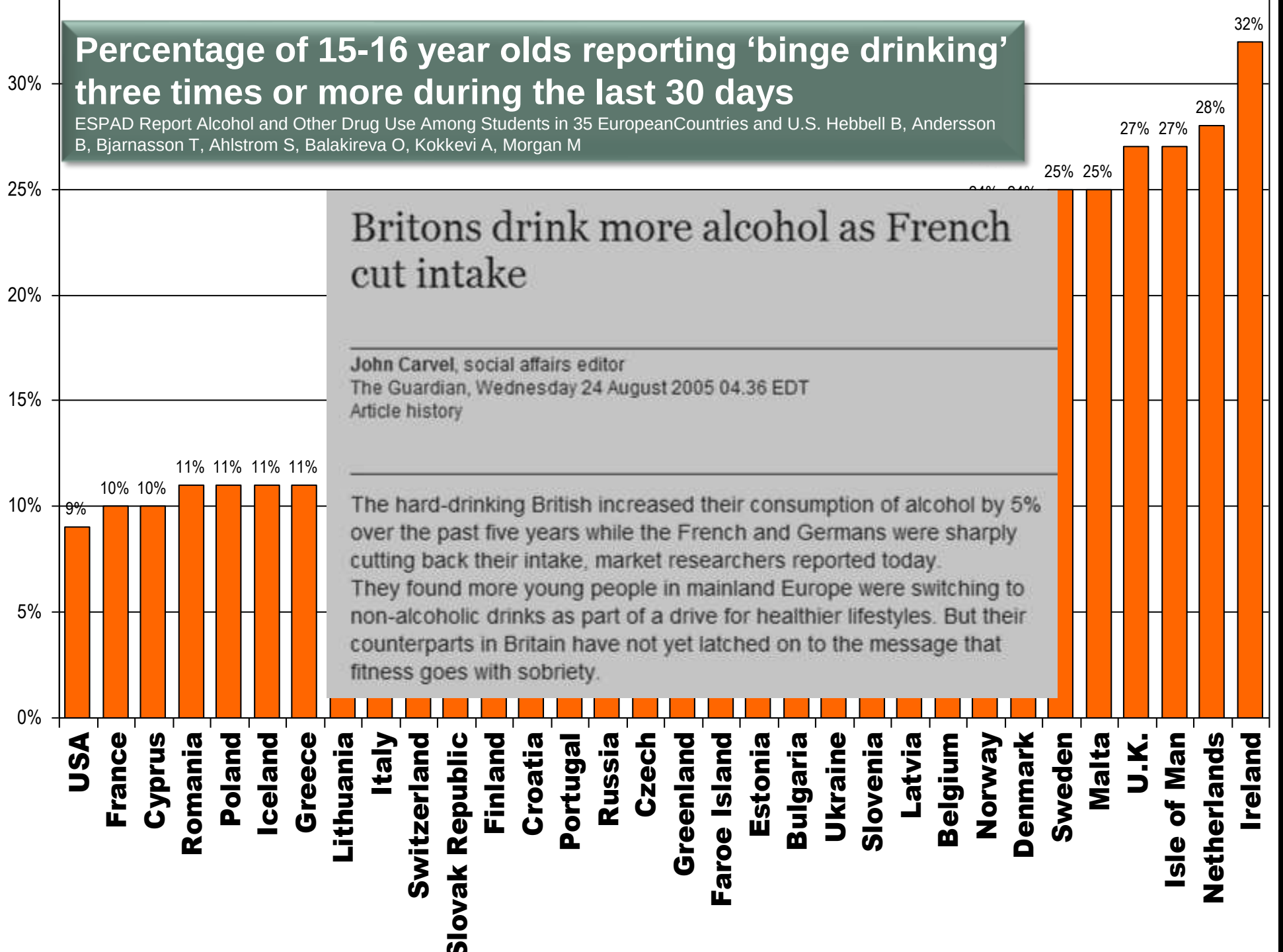
U.K. Office of National Statistics, published January 27, 2011

CDC, National Vital Statistics Report, Volume 57, Number 14, published April 17, 2009

"Globally, the highest rates of morbidity and mortality due to alcohol occur within the WHO European Region."

Percentage of 15-16 year olds reporting ‘binge drinking’ three times or more during the last 30 days

ESPAD Report Alcohol and Other Drug Use Among Students in 35 EuropeanCountries and U.S. Hebbell B, Andersson B, Bjarnasson T, Ahlstrom S, Balakireva O, Kokkevi A, Morgan M



Britons drink more alcohol as French cut intake

John Carvel, social affairs editor
The Guardian, Wednesday 24 August 2005 04.36 EDT
Article history

The hard-drinking British increased their consumption of alcohol by 5% over the past five years while the French and Germans were sharply cutting back their intake, market researchers reported today.
They found more young people in mainland Europe were switching to non-alcoholic drinks as part of a drive for healthier lifestyles. But their counterparts in Britain have not yet latched on to the message that fitness goes with sobriety.

French Anti-smoking Campaign causing huge uproar!

SAMHSA's NSDUH Fall 2017 Report

SAMHSA's National Survey on Drug Use and Health is an annual survey of 67,500 U.S. residents. This report of contains data collected 2016-2017.

Substance Use Disorder in the Past Year, by Age Group and State: Percentages, *NSDUH Fall 2018 Report (2016-2017, n=135,000)*

Oregon Ranks 2nd

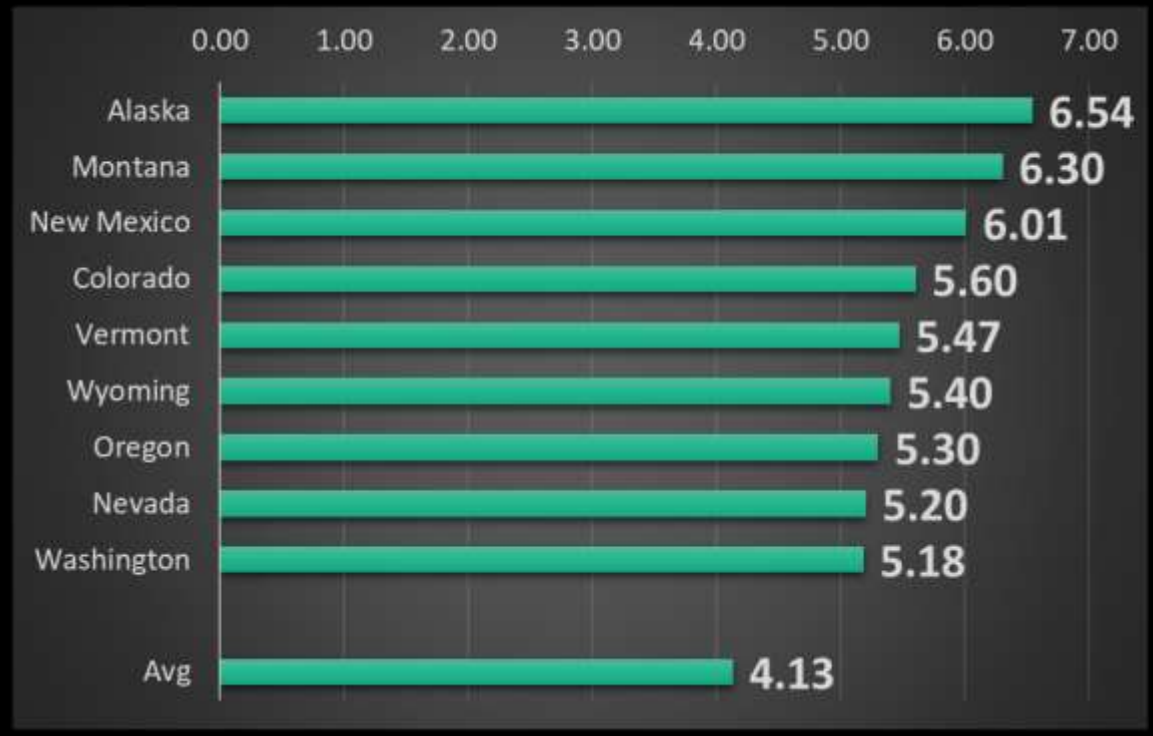
SUD past year
Among those 12 and older

Substance Use Disorder in the Past Year, by Age Group and State: Percentages, *NSDUH Fall 2018 Report (2016-2017, n=135,000)*

Teens

Oregon Ranks 7th

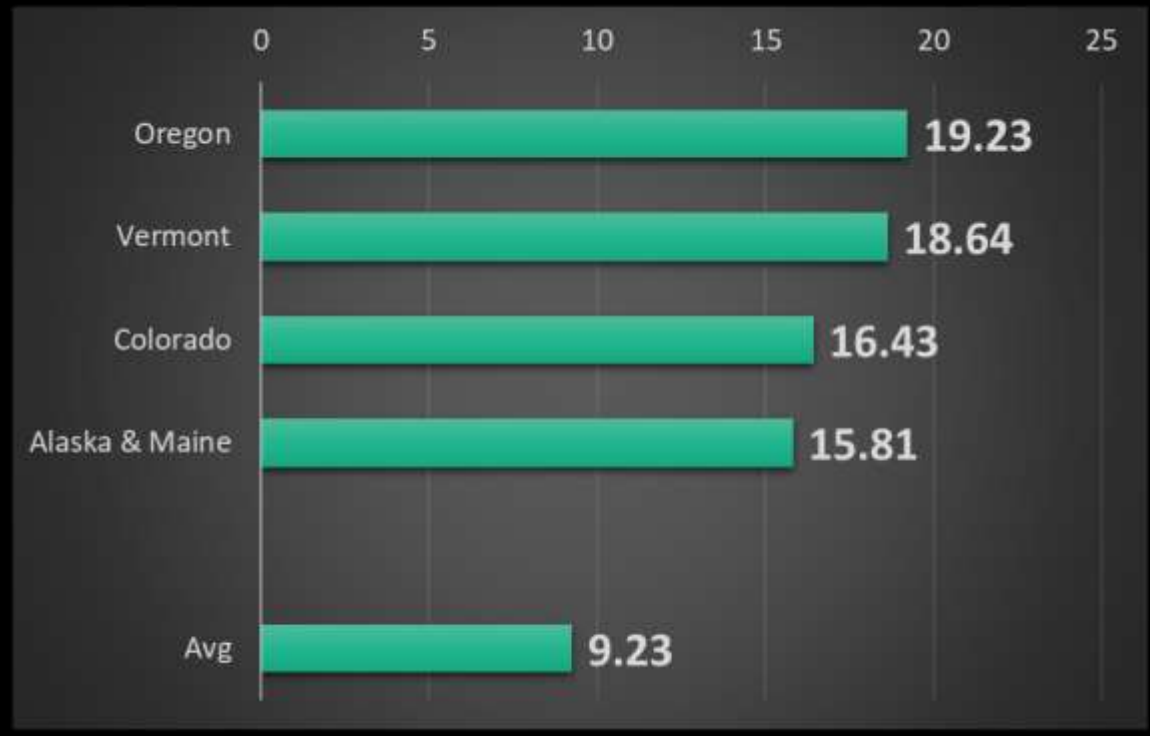
SUD past year
Among teens
12 -17



Marijuana Use in the Past Month, by Age Group and State: Percentages,
NSDUH Fall 2018 Report (2016-2017, n=135,000)

Oregon Ranks 1st

MJ use past month
Among those
12 and older

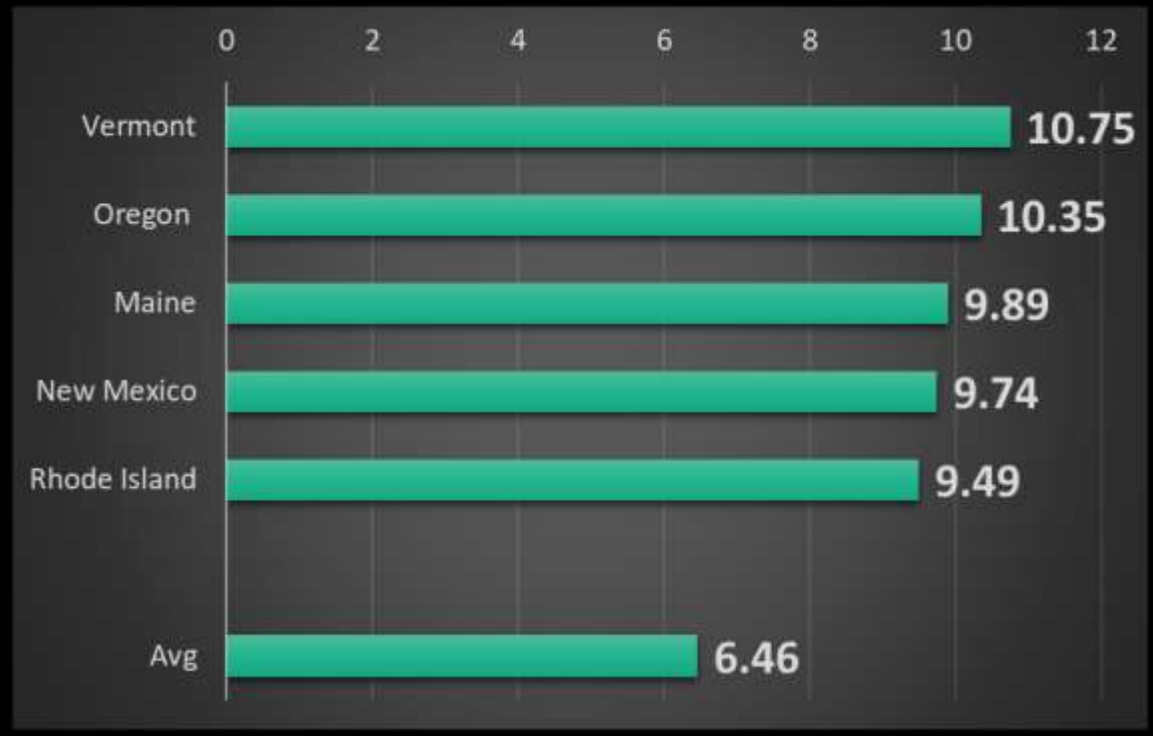


Marijuana Use in the Past Month, by Age Group and State: Percentages,
NSDUH Fall 2018 Report (2016-2017, n=135,000)

Teens

Oregon Ranks 2nd

MJ use past month
Among teens
12-17



Illicit Drug Use Other Than Marijuana in the Past Month, by Age Group and State, *NSDUH Fall 2018 Report (2016-2017, n=135,000)*

Oregon Ranks 2nd

Illicit drugs other than MJ past Mo.
Among those 12 and older

Illicit Drug Use Other Than Marijuana in the Past Month, by Age Group and State, *NSDUH Fall 2018 Report (2016-2017, n=135,000)*

Teens

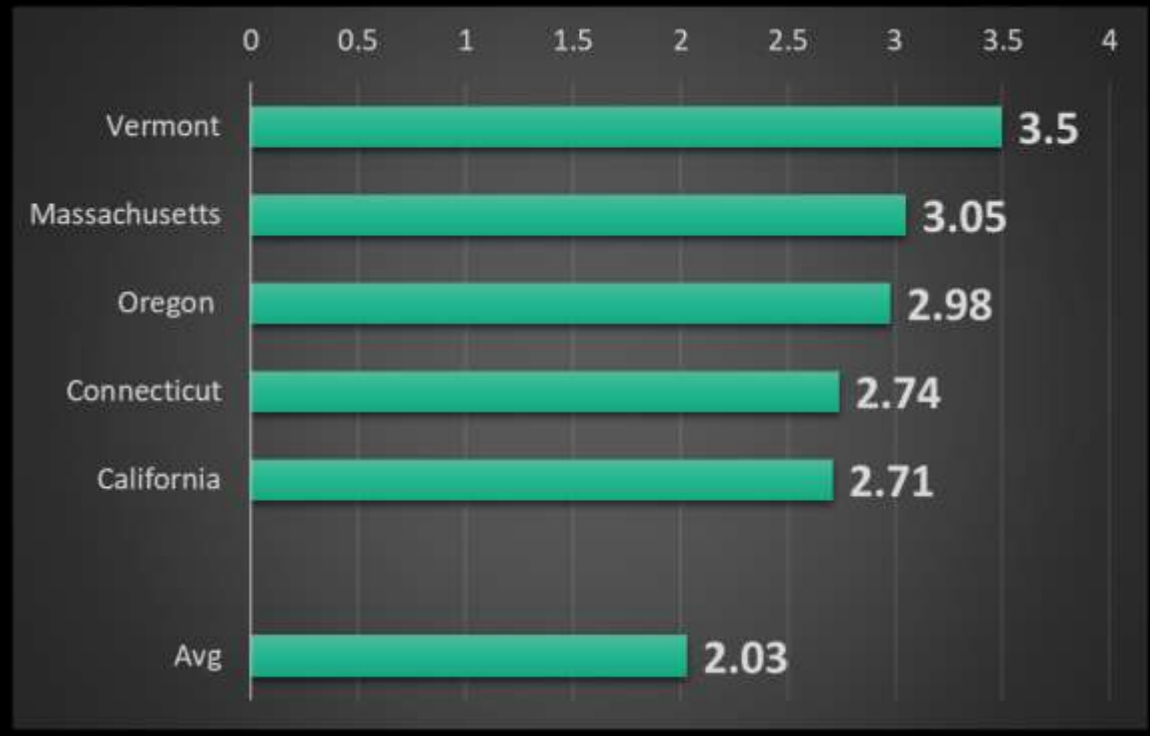
Oregon Ranks 3rd

Illicit drugs other than MJ past Mo.
Among teens 12-17

Cocaine Use in the Past Year, by Age Group and State: Percentages, *NSDUH Fall 2018 Report (2016-2017, n=135,000)*

Oregon Ranks 3rd

Cocaine past year
Among those 12 and older

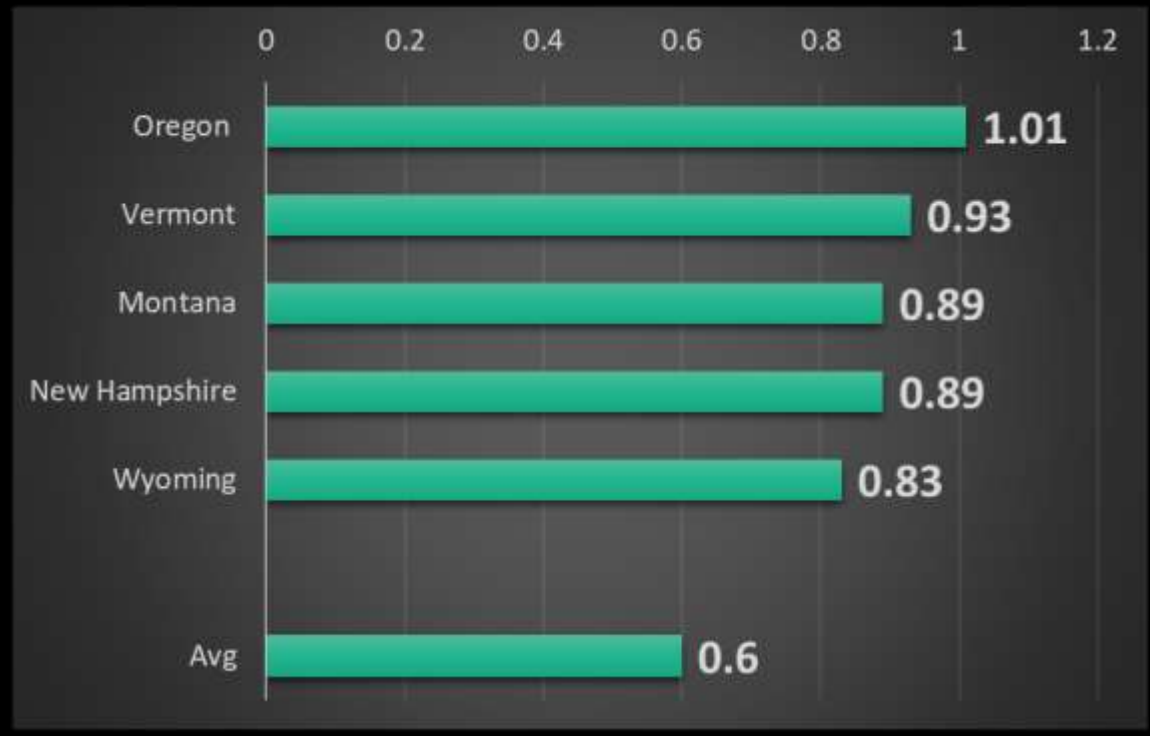


Cocaine Use in the Past Year, by Age Group and State: Percentages, *NSDUH Fall 2018 Report (2016-2017, n=135,000)*

Teens

Oregon Ranks 1st

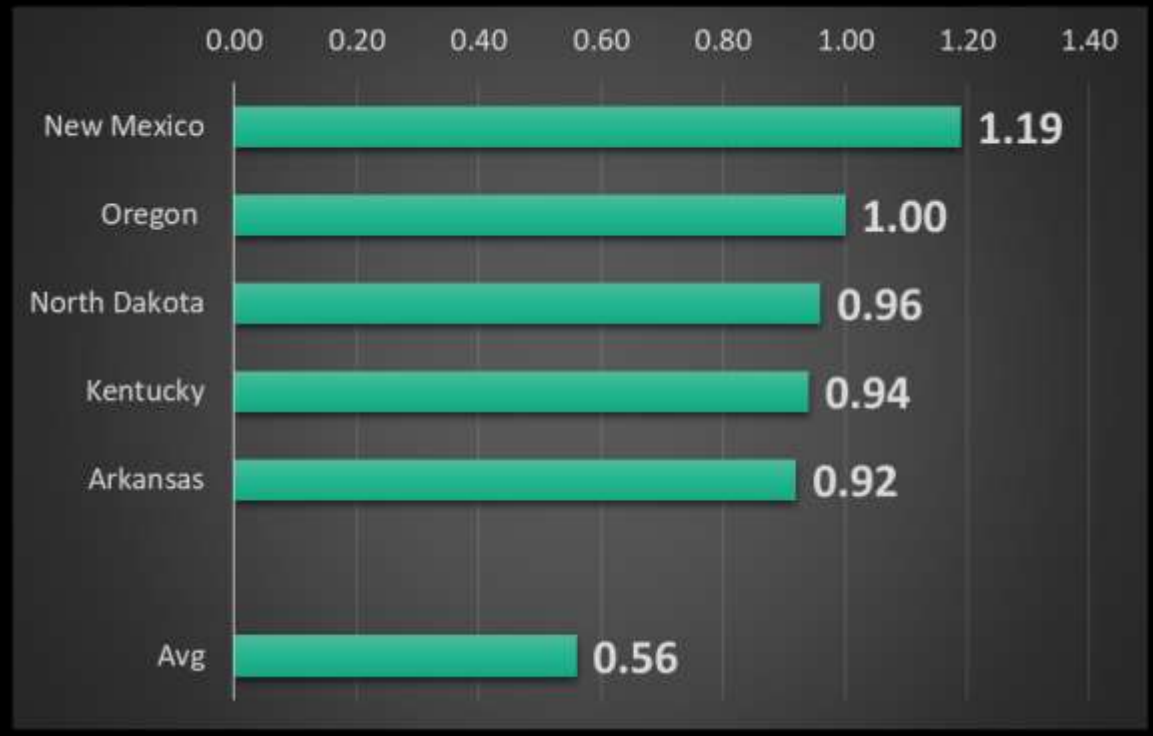
Cocaine past year
Among teens
12-17



Methamphetamine Use in the Past Year, by Age Group and State: Percentages, *NSDUH Fall 2018 Report (2016-2017, n=135,000)*

Oregon Ranks 2nd

Meth past year
Among those 12 and older

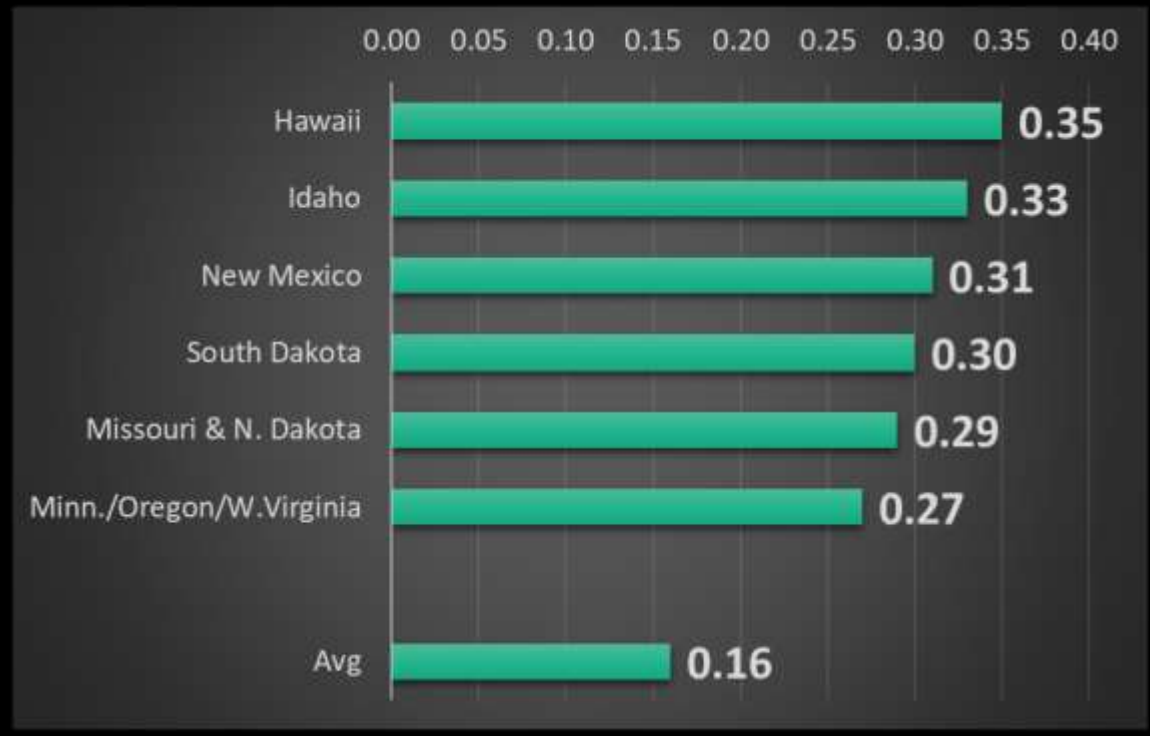


Methamphetamine Use in the Past Year, by Age Group and State: Percentages, *NSDUH Fall 2018 Report (2016-2017, n=135,000)*

Teens

Oregon Ranks 7th

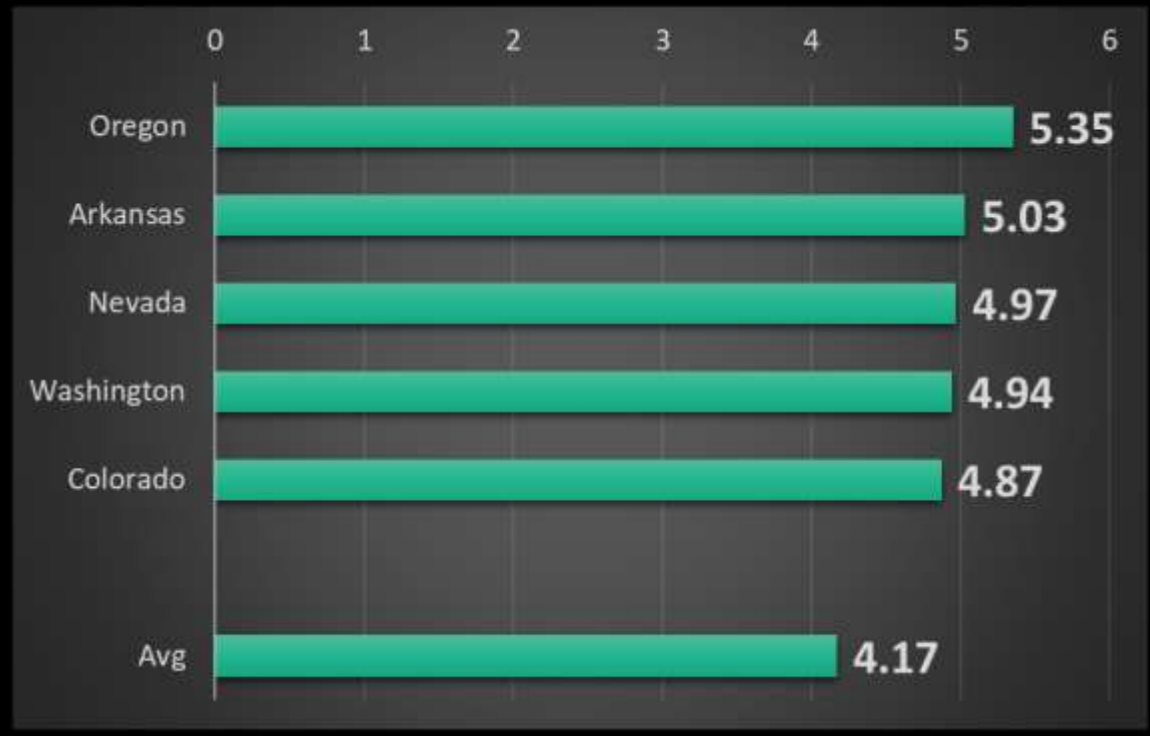
Meth past year
Among teens
12-17



Pain Reliever Misuse in the Past Year, by Age Group and State: Percentages, *NSDUH Fall 2018 Report (2016-2017, n=135,000)*

Oregon Ranks 1st

Pain Rx past year
Among those 12 and older



Pain Reliever Misuse in the Past Year, by Age Group and State: Percentages, *NSDUH Fall 2018 Report (2016-2017, n=135,000)*

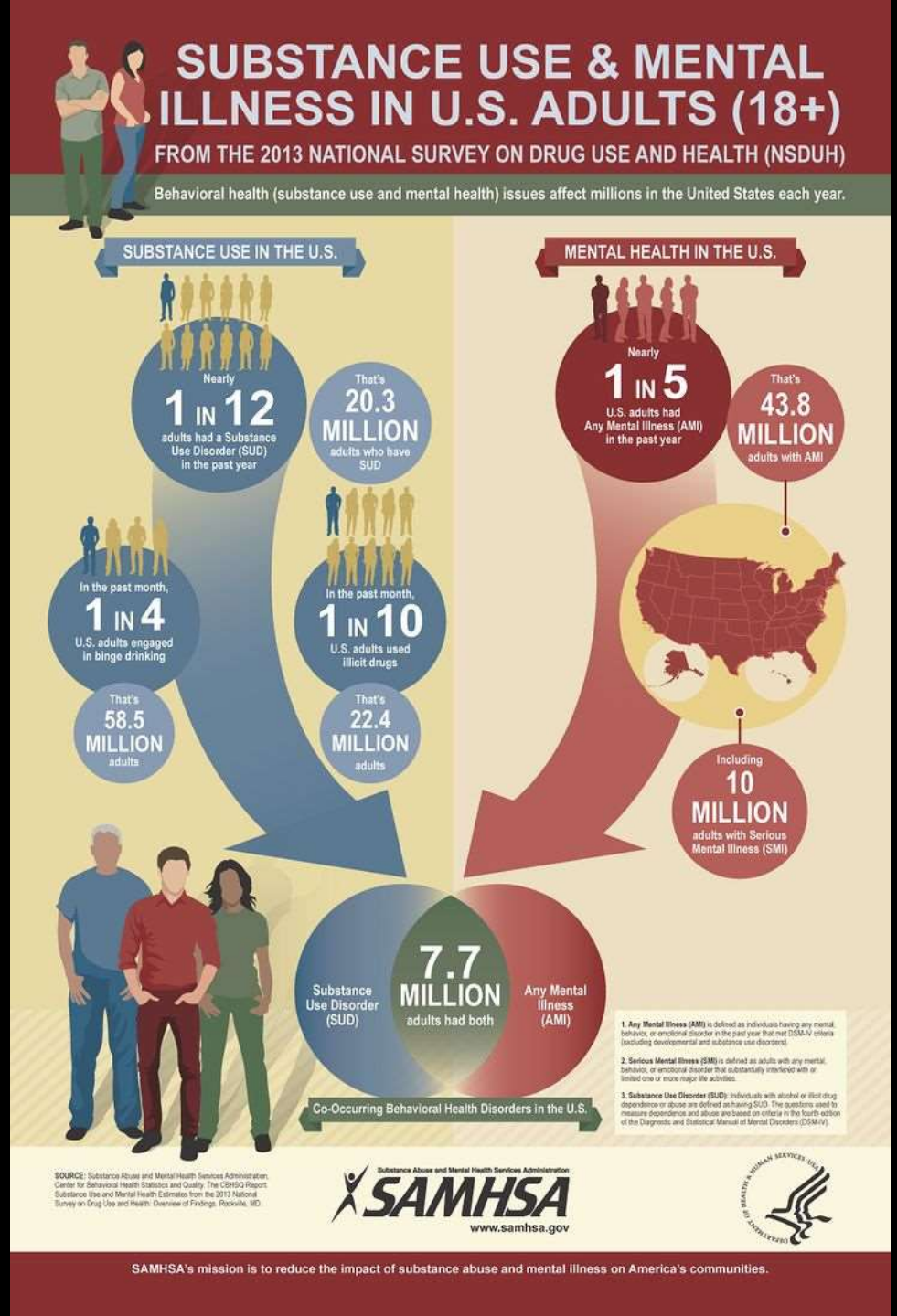
Teens

Oregon Ranks 7th

Pain Rx past year
Among teens
12-17

SAMHSA-NSDUH

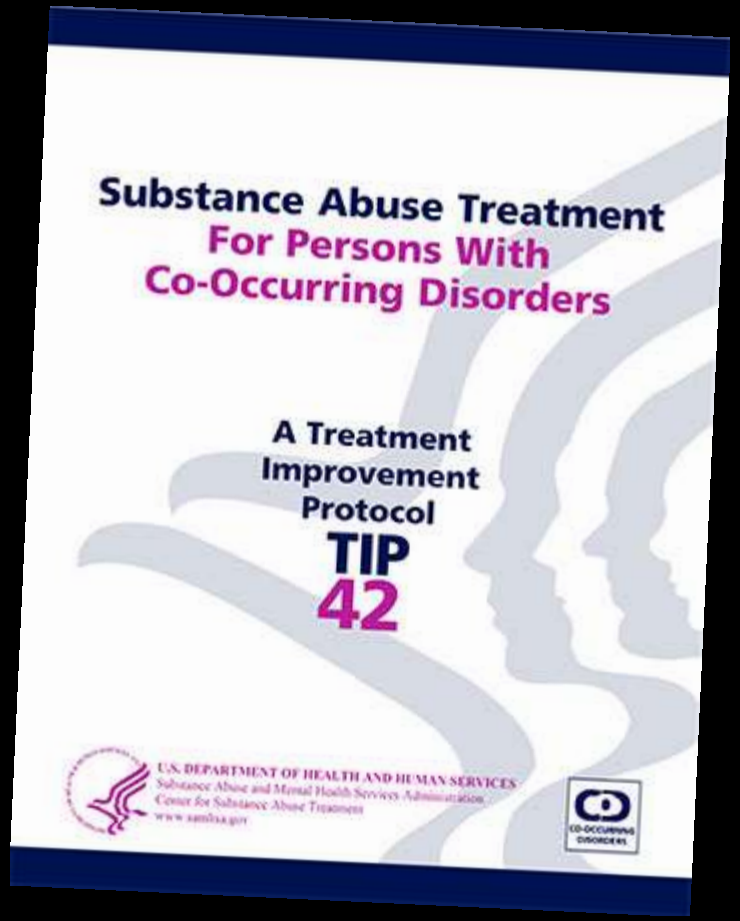
- Studied 1,008,000 people over 14 years.
- 37% of those with a substance use disorder have a “co-occurring mental illness.”
- 17.5% of those with a “mental illness have a co-occurring substance use disorder.”



Homeless Advocates go Berserk over Business Association Billboard

Other prevalence studies

- Top disorders for SUD clients: Depression & Anxiety
- Surveys of treatments staff: 60-90% of SUD clients have co-occurring disorders
- Studies separating mental health disorders and substance induced disorders, show rates of approx. 20% for non-substance induced disorders.



Example: Brown, Irwin, Schukitt

- **Study of patients in detox:**
  - 40% were diagnosed with anxiety disorder
  - 4 week follow-up after detox in treatment: 12%
  - 12 week follow-up post detox and treatment: 5%

Schukitt: study of 3,000 clients

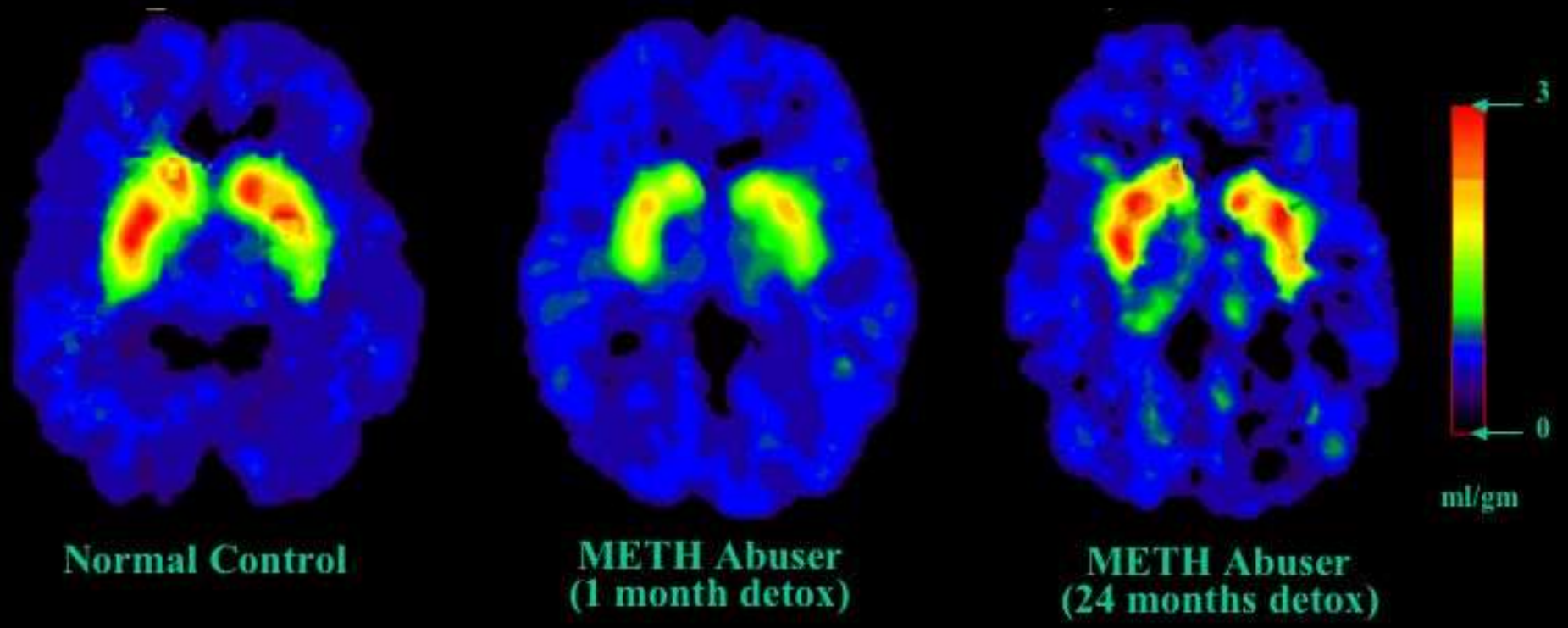
- 41% were diagnosed with MDD while in addiction treatment
- Post addiction treatment evaluation showed: 15% MDD

Many people have substance-induced mental health symptoms, like "substance induced psychosis." But, they don't actually have schizophrenia or bipolar disorders.

Substance-induced symptoms can last for days, weeks, months or several years.

- Acute withdrawal
- Protracted withdrawal
- Sub-acute withdrawal
- Post-acute withdrawal

Figure 3. Partial Recovery of Brain Dopamine Transporters in Methamphetamine (METH) Abuser After Protracted Abstinence

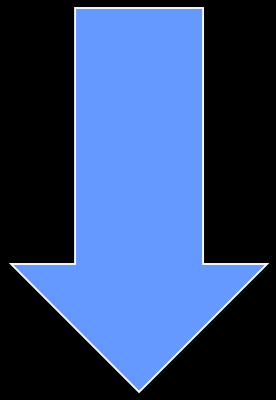


Source: Volkow, ND et al., Journal of Neuroscience 21, 9414-9418, 2001.

Withdrawal is the opposite of the drug!

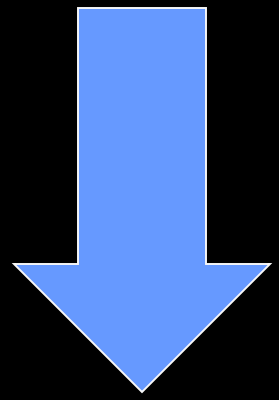
- Anxiety & Depression are the top two diagnoses of clients with substance use disorders
- Simultaneously, anxiety & depression are the top two detox symptoms. Withdrawal is the opposite of the drug.
  - Downers = anxiety
  - Uppers = depression

Uppers



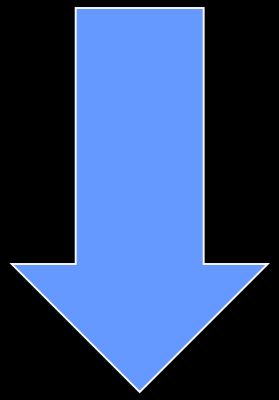
Depression, anhedonia, sadness, dysphoria, lethargy, sleeping, increased appetite, attention problems (focus)

Downers



Anxiety, nervousness, sleeping problems, weight loss, irritability, attention problems (focus)

Opioids



Physical pain, chronic aching, malcontent, hyperemotionality, whining, complaining labile mood/affect, inexplicable tears, “borderline.”

Let’s break up into groups.

Invent a Drug!

Then, “invent a drug” come up with a catchy name so people will buy it !!

List 2 primary major effects of the drug

and how the drug is consumed

CELL PERMEABILITY

- Molecules are either **ACIDIC** or **BASIC**
- Body fluids that drug molecules go into are also either **ACIDIC** or **BASIC**
  - **ACID = Ph less than 7**
  - **BASIC = Ph more than 7**
- **In addition, molecules are either FAT SOLUBLE or WATER SOLUBLE**
- **FAT soluble molecules penetrate cell membrane easily**
- **WATER soluble molecules have difficulty penetrating**
  - **Cell membrane is fatty; fat "slides" through**

CELL PERMEABILITY

- Which body fluids do drugs go into?
- Which is ACIDIC and which is BASIC?

ACID drug into ACID fluid becomes FAT SOLUBLE

BASE drug into BASE fluid becomes FAT SOLUBLE

QUICK!

ACID drug into a BASE fluid becomes WATER SOLUBLE and will not get into cell quickly. The same if they are reversed.

IF THE Ph's ARE THE SAME, THE DRUG ENTERS MORE QUICKLY!!

CELL PERMEABILITY

Routes of Administration

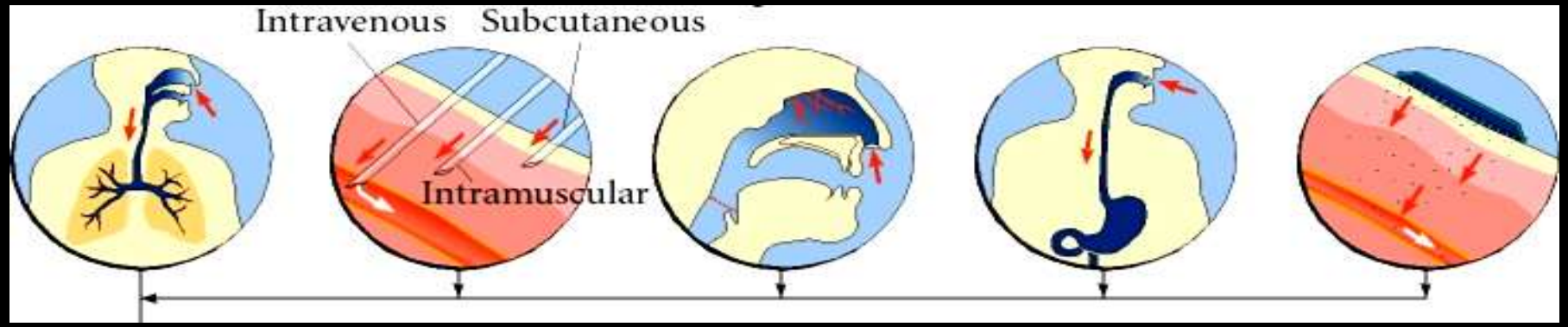
How Drugs Get Into the Body

Main Points

1. **The way a drug enters the body influences its effects.**
2. **Once a drug is in the system, certain *predictable rules* govern its behavior.**
3. **Many factors influence how rapidly drugs are *metabolized* and *excreted*.**

- There are FIVE ways that any drug can enter the body.
- They operate on a continuum from FASTEST to SLOWEST.
- All methods bypass the digestive tract (PARENTERAL) except for oral ingestion (ENTERAL).

Inhaling | Injecting | Mucosal | Oral | Transdermal

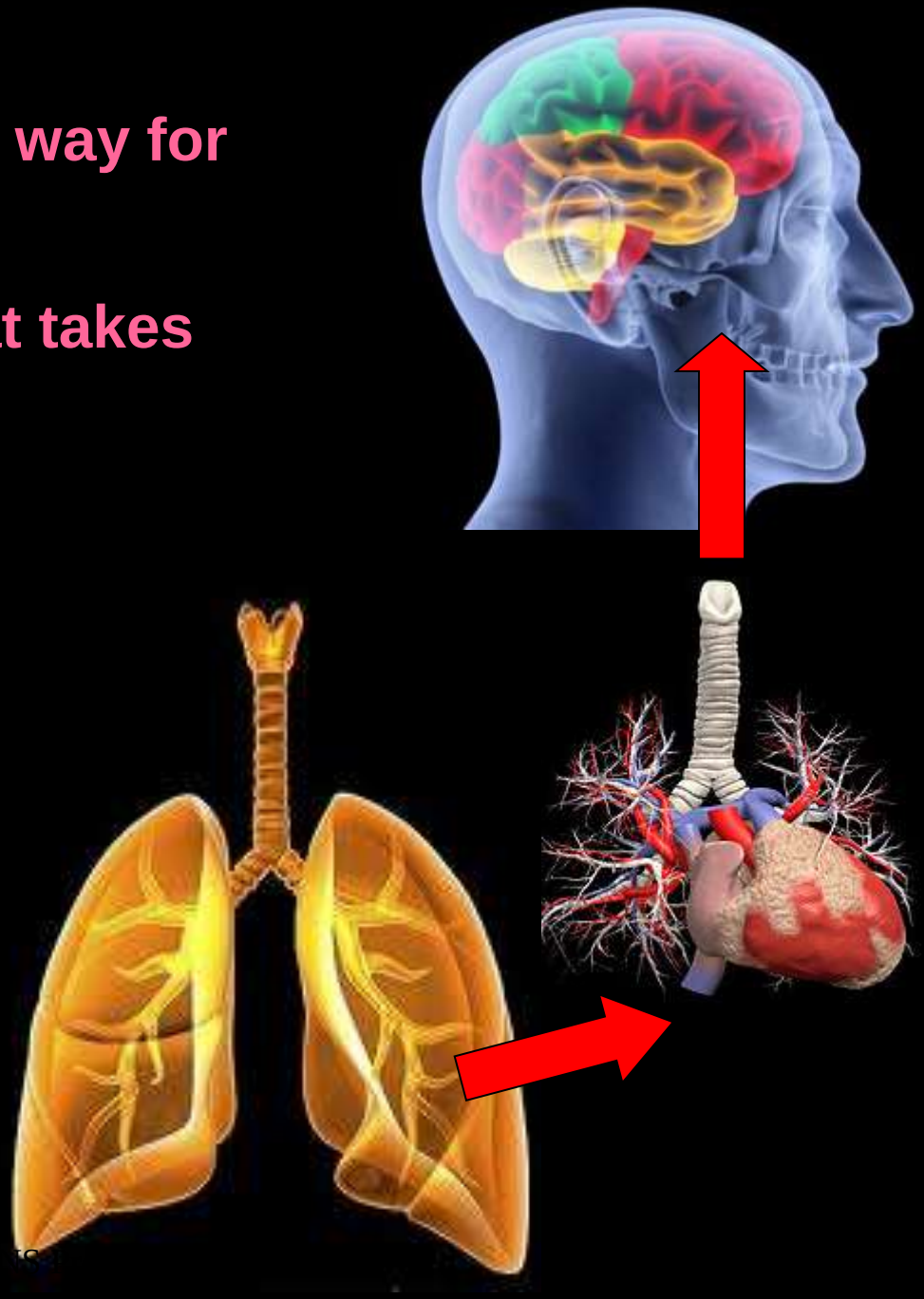


FAST → SLOW

Inhalation is the quickest way for a drug to reach the brain.

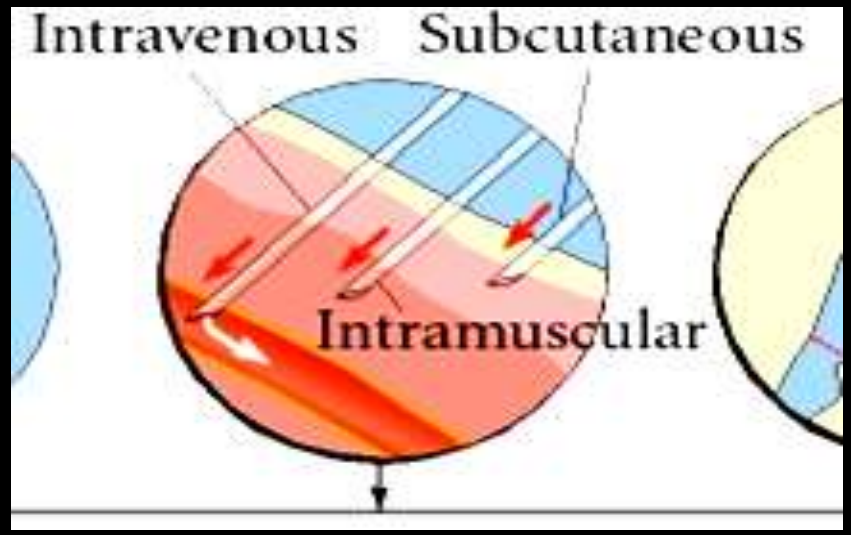
It is a three-step process that takes 7 seconds.

Most addictive route of administration.



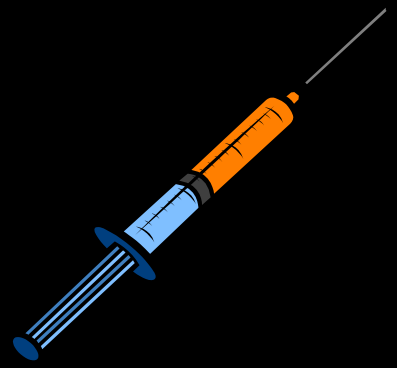
Injection is the second quickest way for a drug to reach the brain.

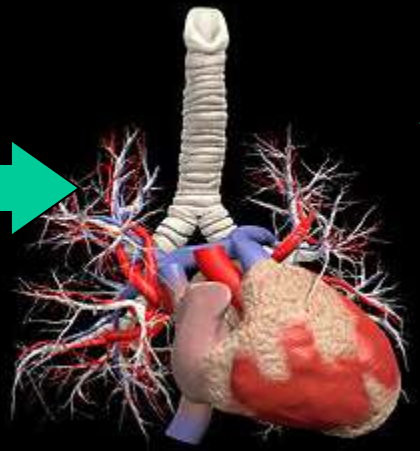
There are **three methods** of injection.

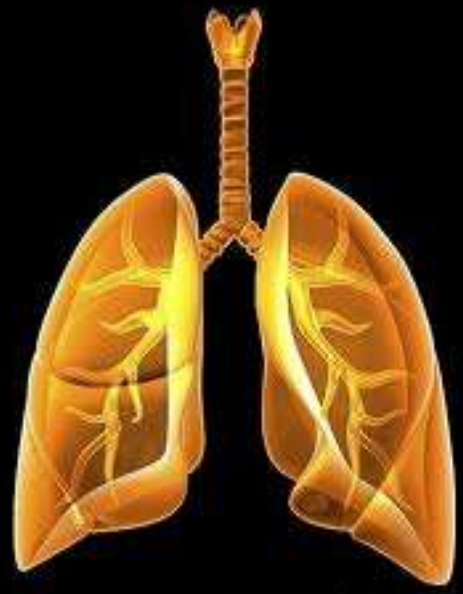


- **Intravenous (IV)** 15 to 30 seconds
- **Intramuscular (IM)** 3 to 5 minutes
- **Subcutaneous** 3 to 5 minutes

Injection is a four-step process.



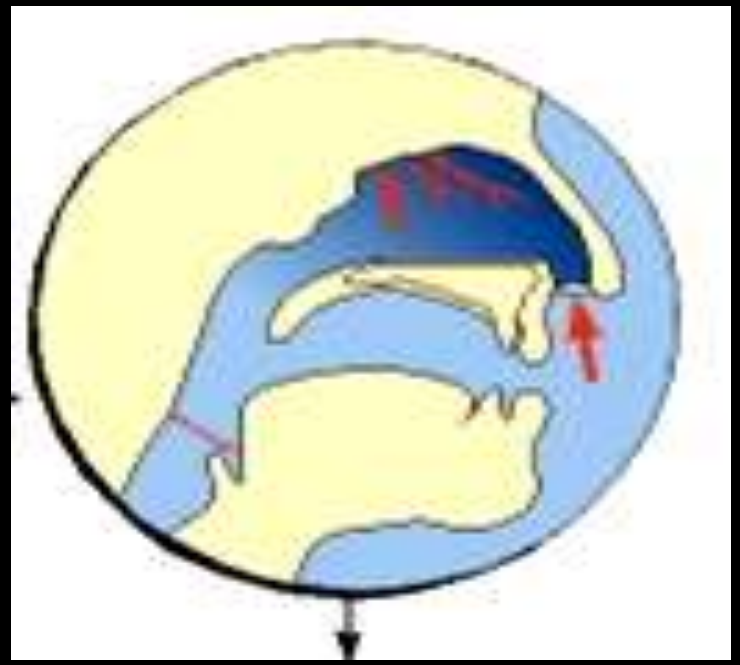




Needle use carries many risks.

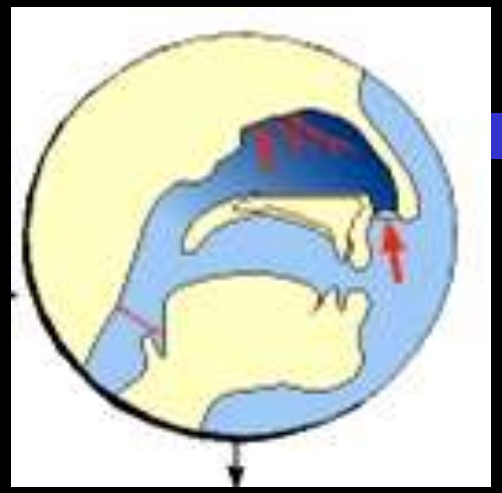
- ✓ Abscesses
- ✓ Septicemia
  - *cotton fever (50's-70's)*
- ✓ Hepatitis B & C
- ✓ Endocarditis
- ✓ Embolism *(micro)*
- ✓ HIV & AIDS
- ✓ Flesh eating bacteria

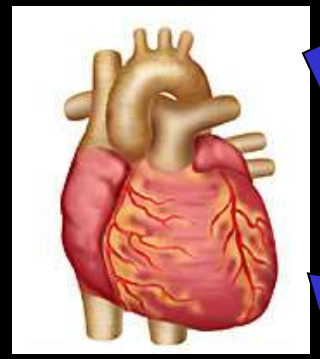
Snorting (insufflation) or mucosal administration gives 3 – 5 minutes until the effect.

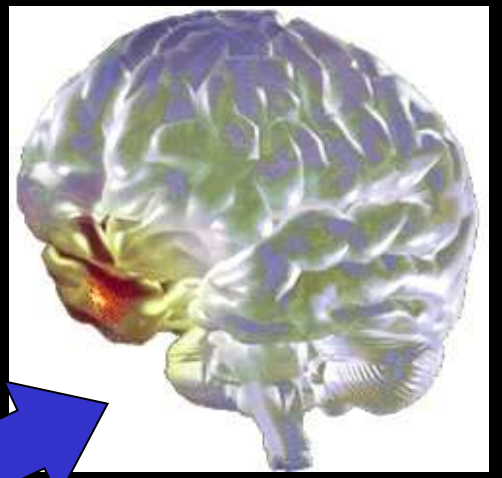


- **Snorting**
- **Suppository**
- **Eye dropper**
- ***Mucous membrane is highly permeable***

Like Injection, **mucosal absorption** is a four-step process.



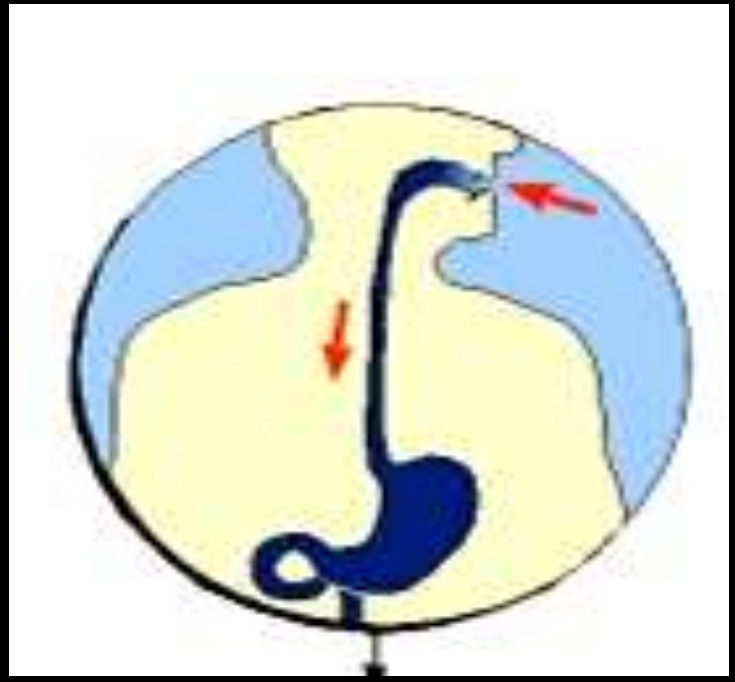




The BUCCAL method involves placing a drug in the mouth for direct absorption.

- **Tobacco**
- **Betel Nut**
- **Khat**
- **Sublingual Drugs**

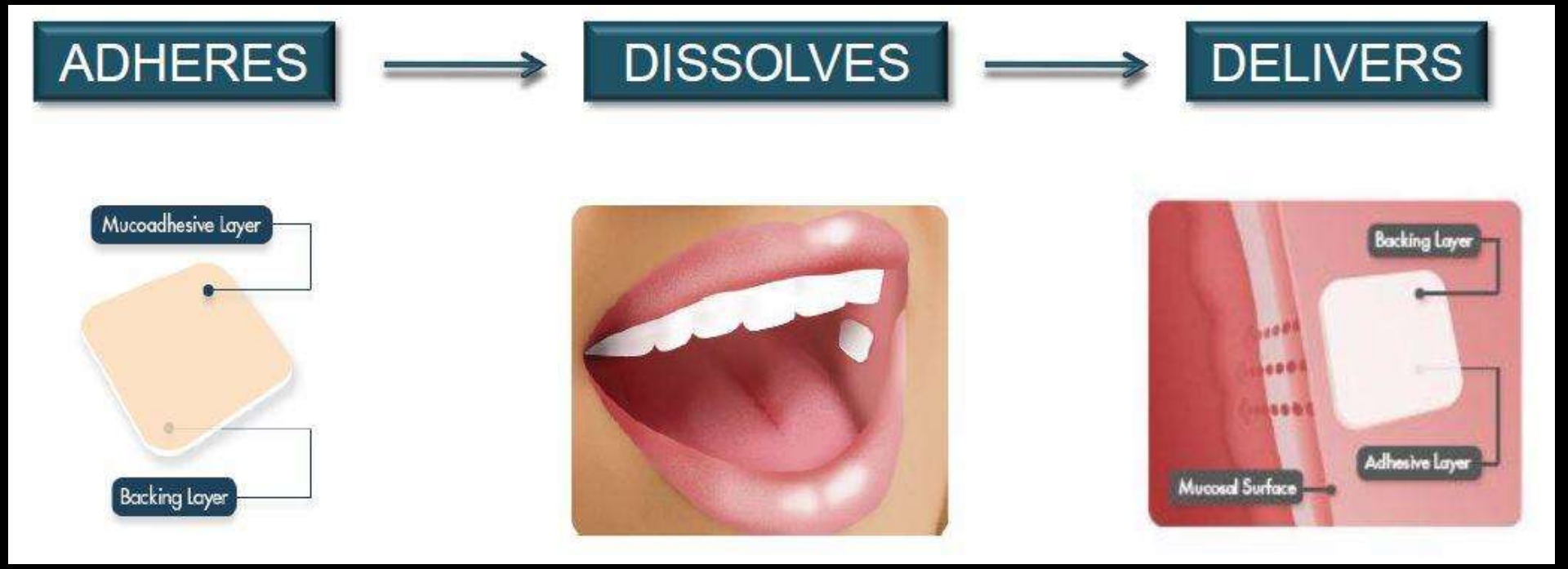
Oral use (ingesting) can take up to 20 - 30 minutes for absorption.



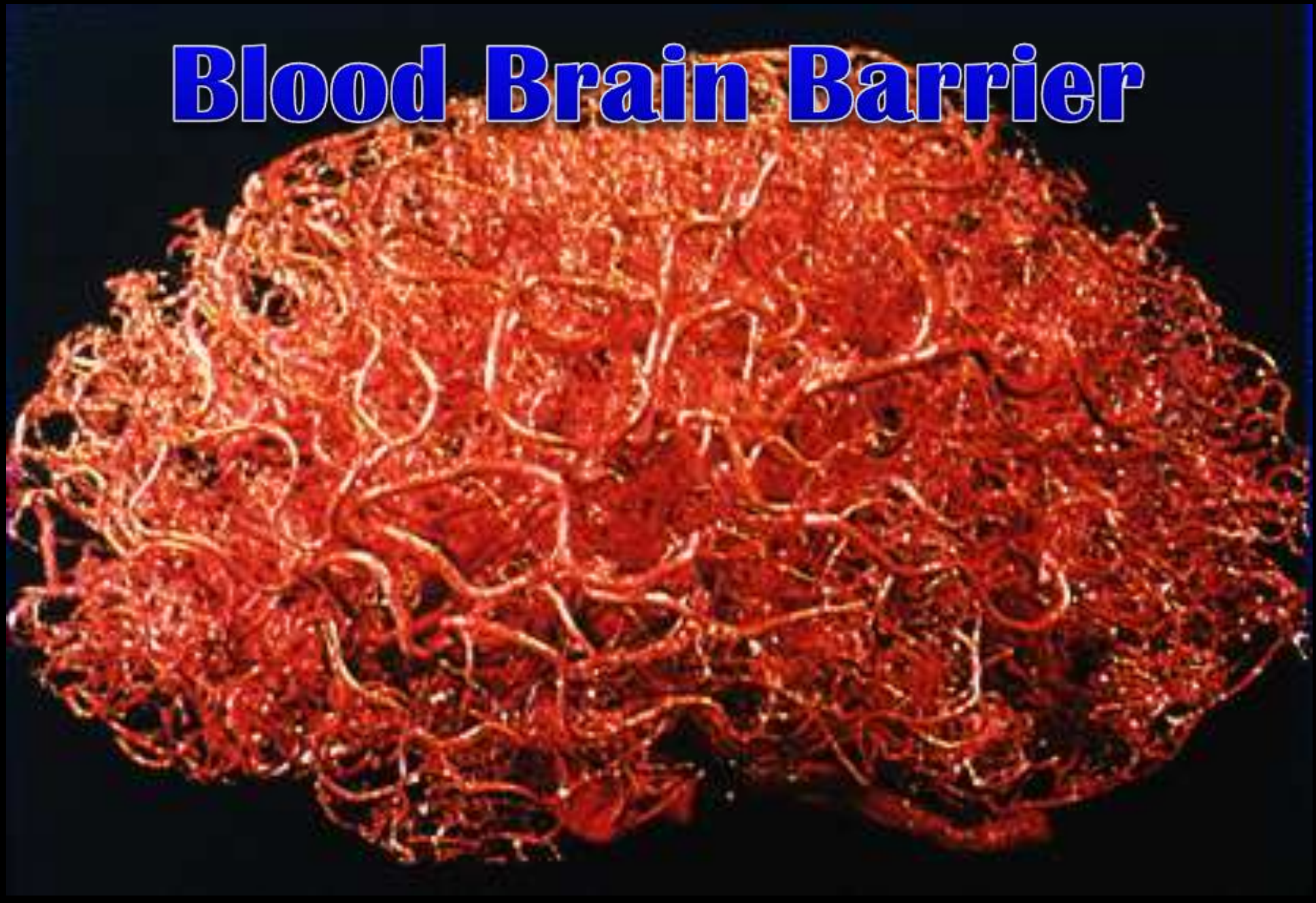
- Safe and slow
- Amount easily variable
- Easy retrieval
- Dilution possible

Contact or Transdermal: 1 to 2 days

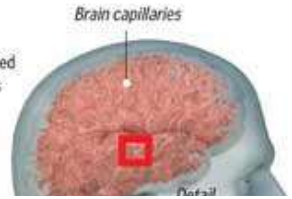
Is this a Transdermal Patch or Mucosal Patch



Blood Brain Barrier



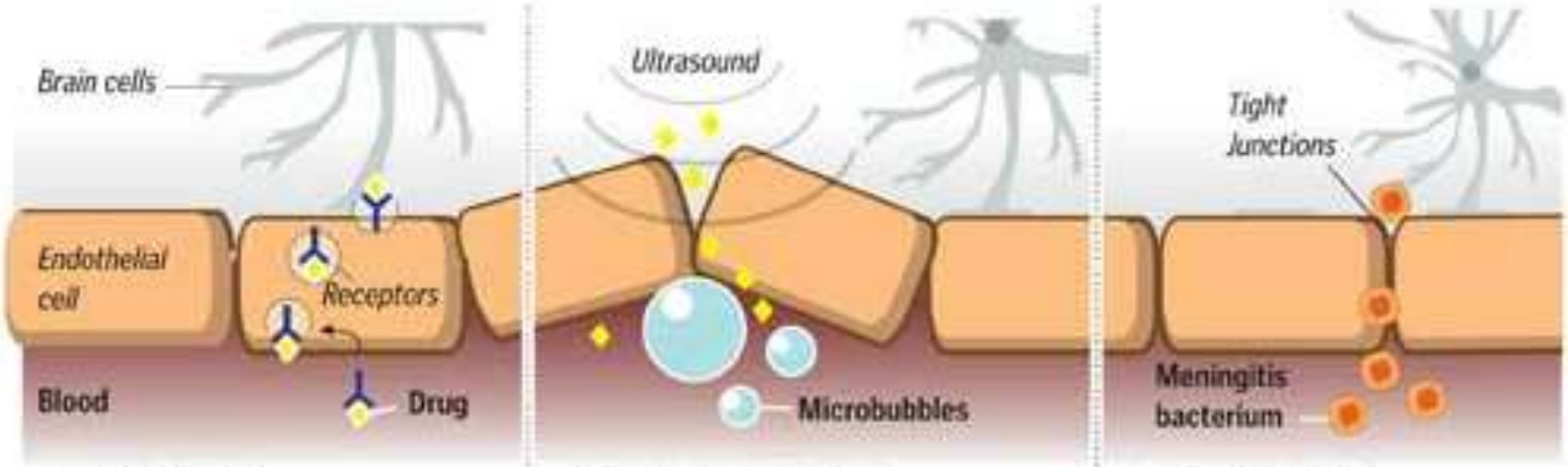
THE BRAIN'S FIRST LINE OF DEFENSE



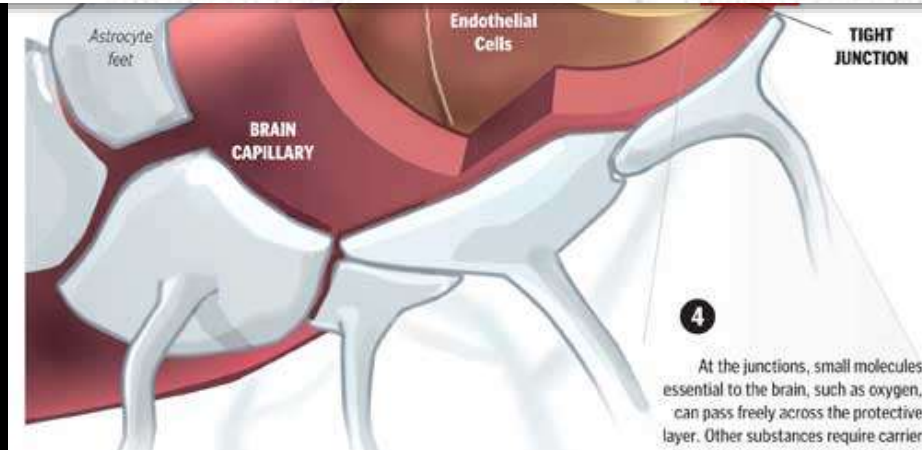
1 The brain is permeated by tiny blood vessels called **capillaries**. The capillaries are lined with special cells that prevent

BREACHING THE BARRIER

The same mechanism that keeps harmful substances out also bars many drugs that could be used to treat brain diseases. Several scientific teams are developing ways to get medicines to cross the barrier. Some of their strategies:



TROJAN HORSES **ULTRASONIC DISRUPTION** **MENINGITIS KEY**

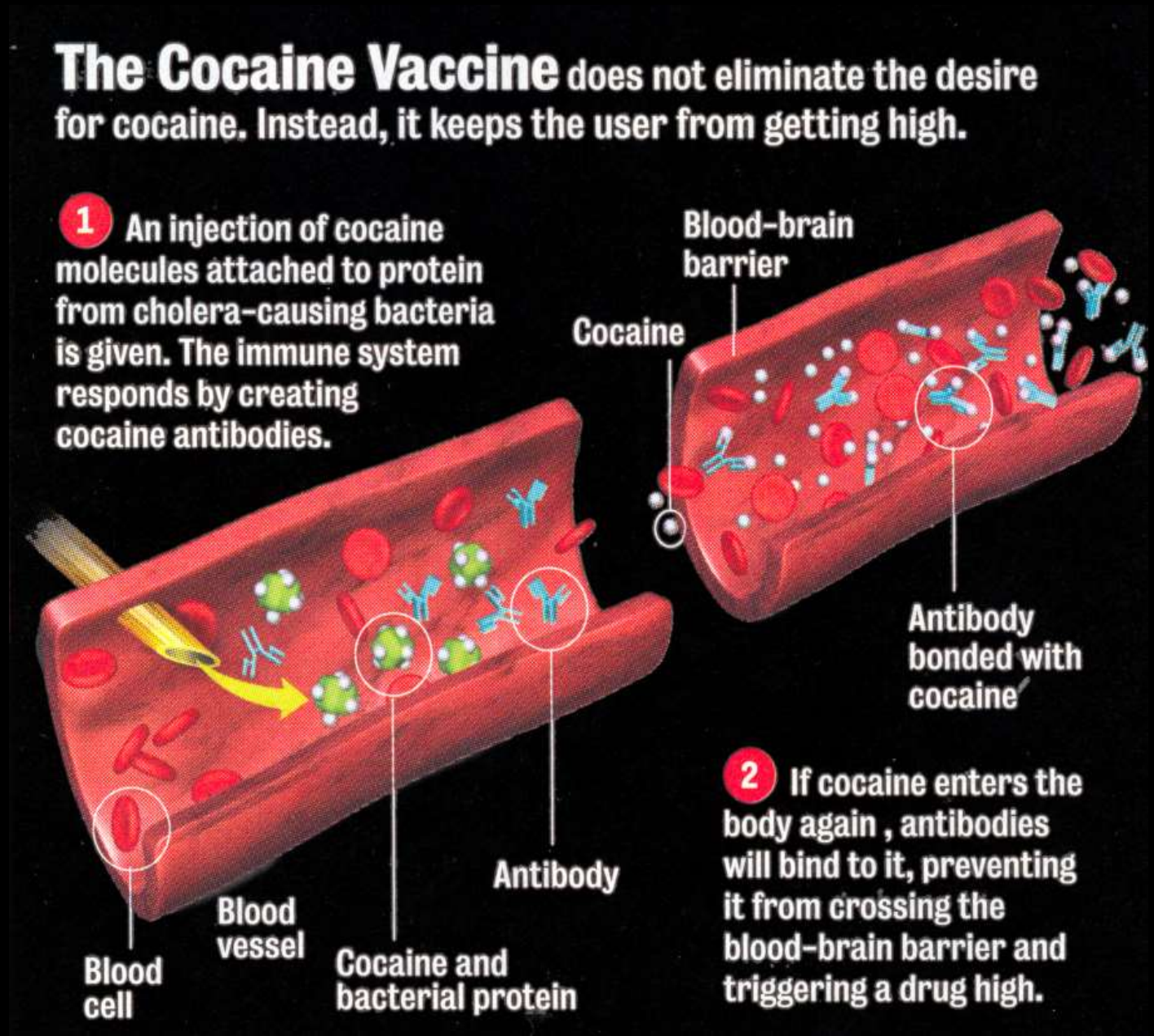


4 At the junctions, small molecules essential to the brain, such as oxygen, can pass freely across the protective layer. Other substances require carrier

Factors affecting *transport & distribution*

- **Blood - Brain Barrier**
  - Endothilial cells protect
  - Psychoactive drugs cross
  - Antibiotics do not cross

- **Placental Barrier**
  - Many substances cross
  - Teratogens
  - (Placental *sieve*)



Invent A Drug!!

- **Is this drug more acidic or basic and what is the route of administration of the drug?**

Brain Cells

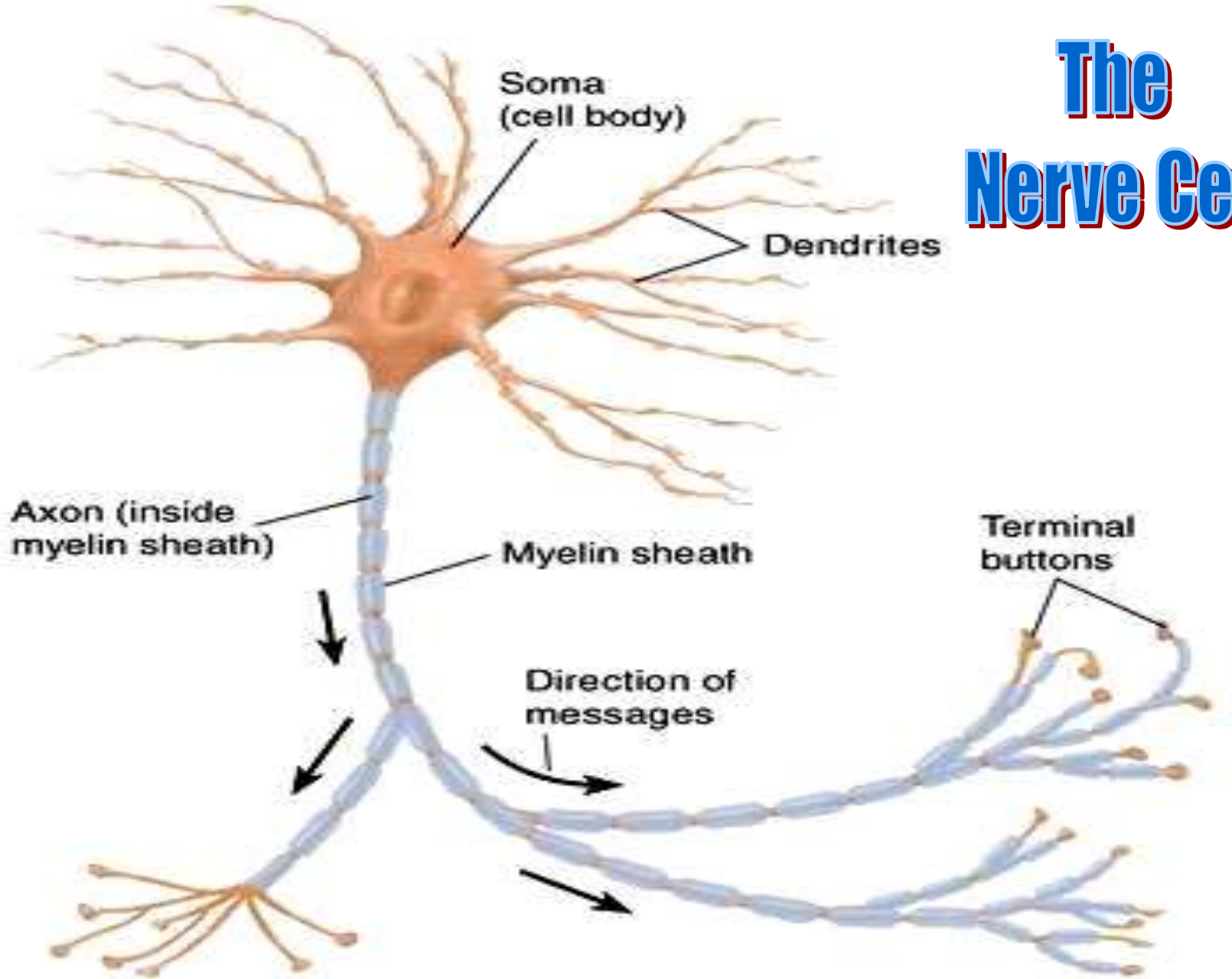
Neurons

Nerve Cells or Neurons or brain cells

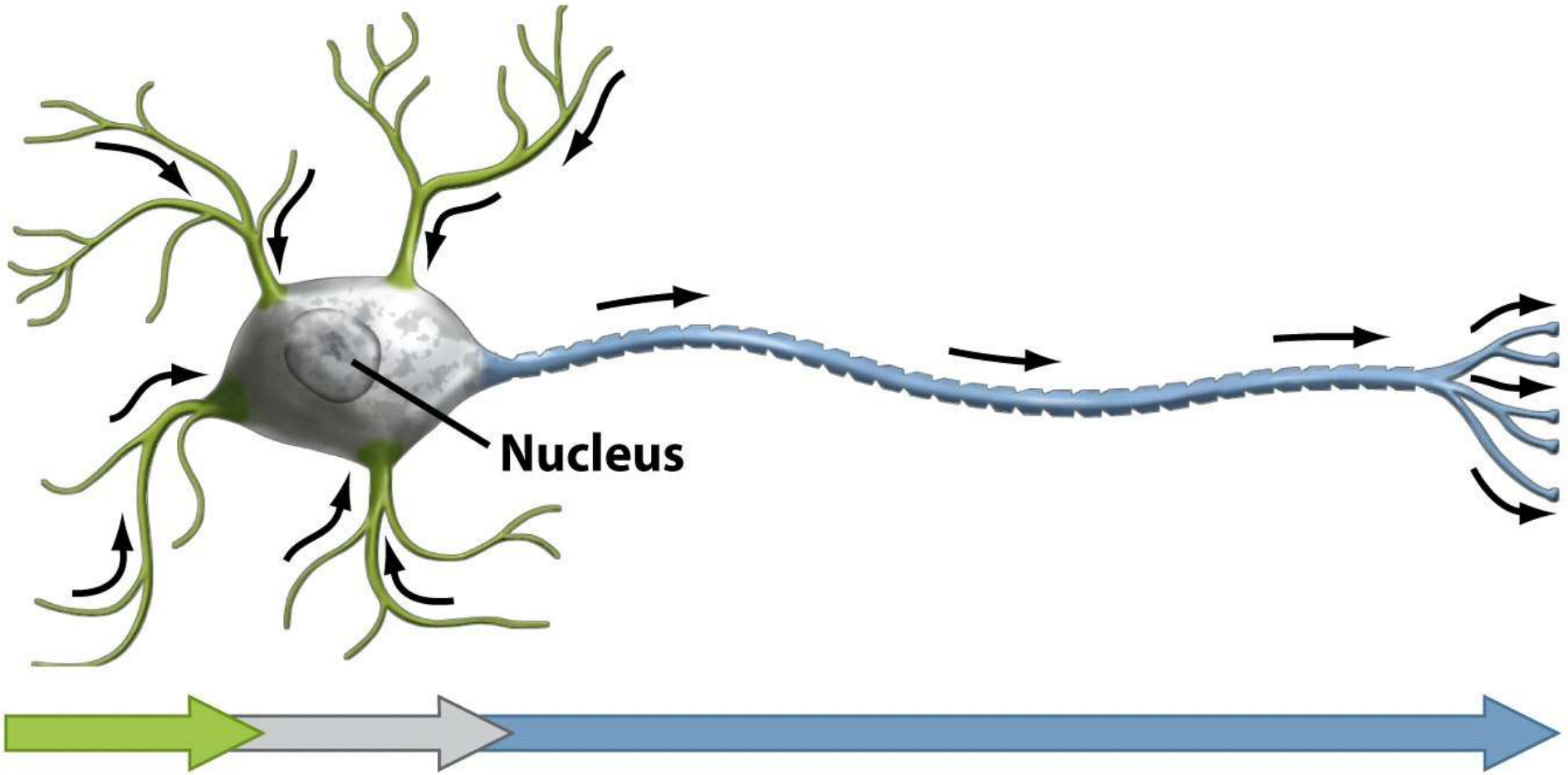
Damage to neurons

- ➢DNA damage in nucleus
- ➢Damage to vesicle sacs
- ➢Damage to uptake pumps
- ➢Damage to receptor sites
- ➢Down regulation

The Nerve Cell



Information flow through neurons



Dendrites
Collect electrical signals

Cell body
Integrates incoming signals and generates outgoing signal to axon

Axon
Passes electrical signals to dendrites of another cell or to an effector cell

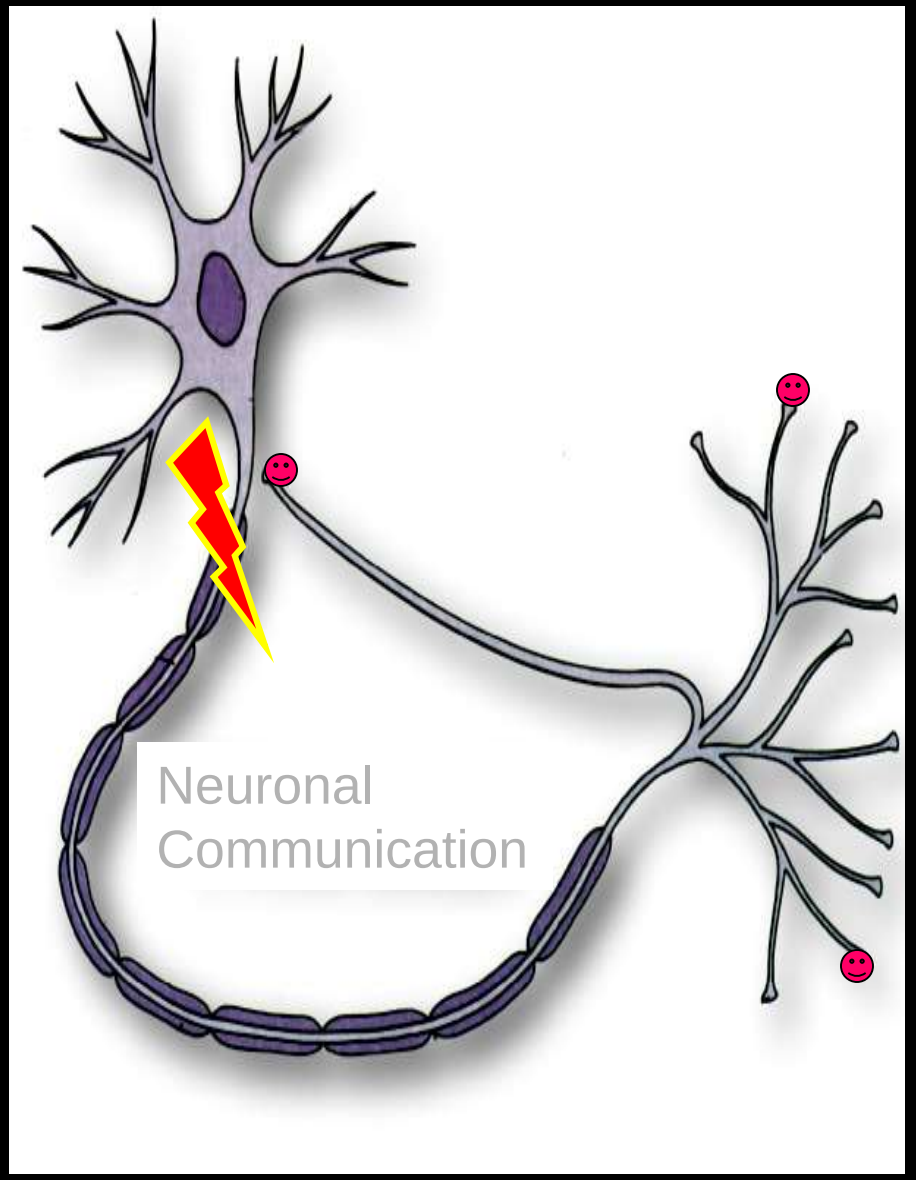
What actually happens in nerve cell communication?

1. Neurotransmitters are manufactured from precursor materials inside the nerve cell.
2. An electrical impulse travels down axon (bumping along myelin sheath)
3. NT's are released across the synapse to the next (post-synaptic) neuron
4. NT's are either:

   A) Reabsorbed (Reuptake)

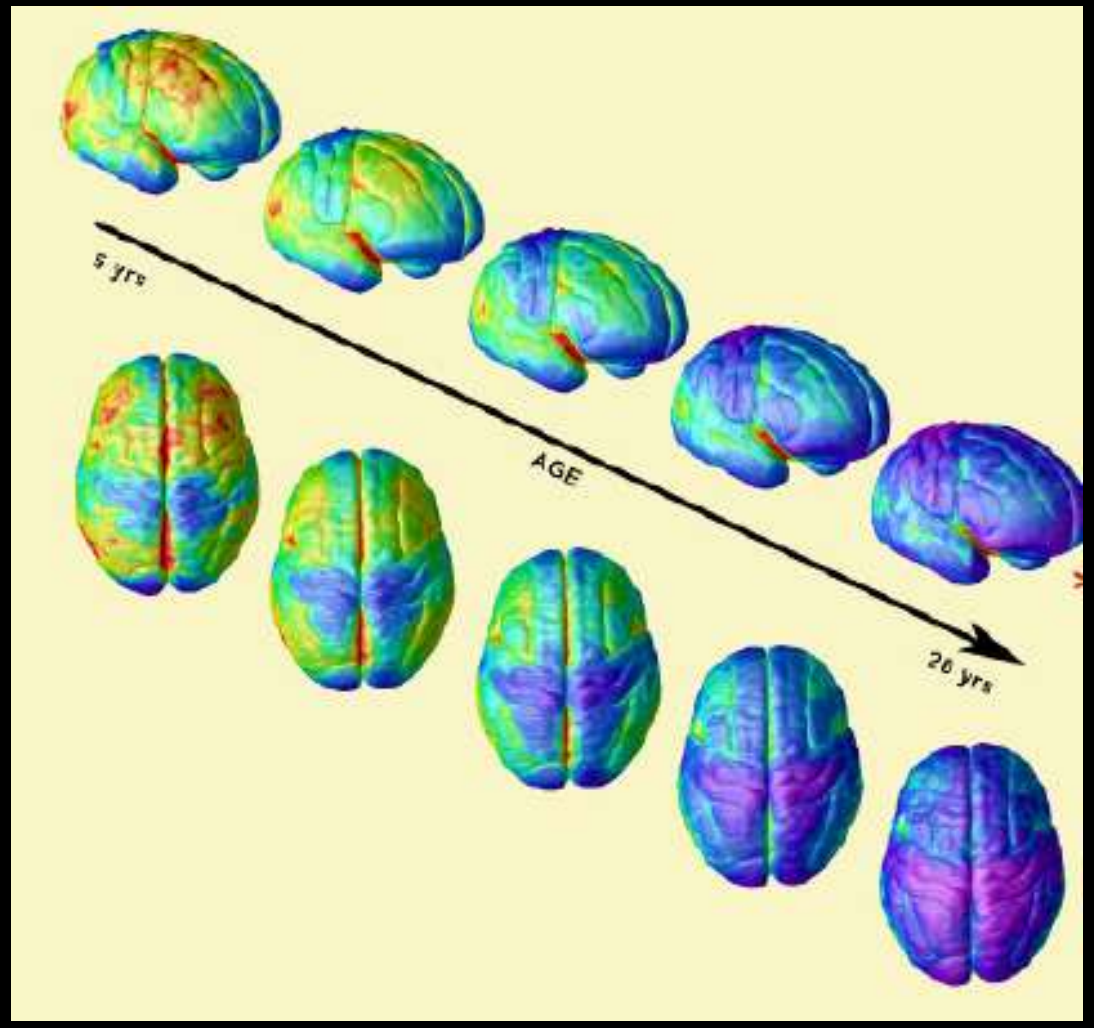
   B) Biodegraded by MAO

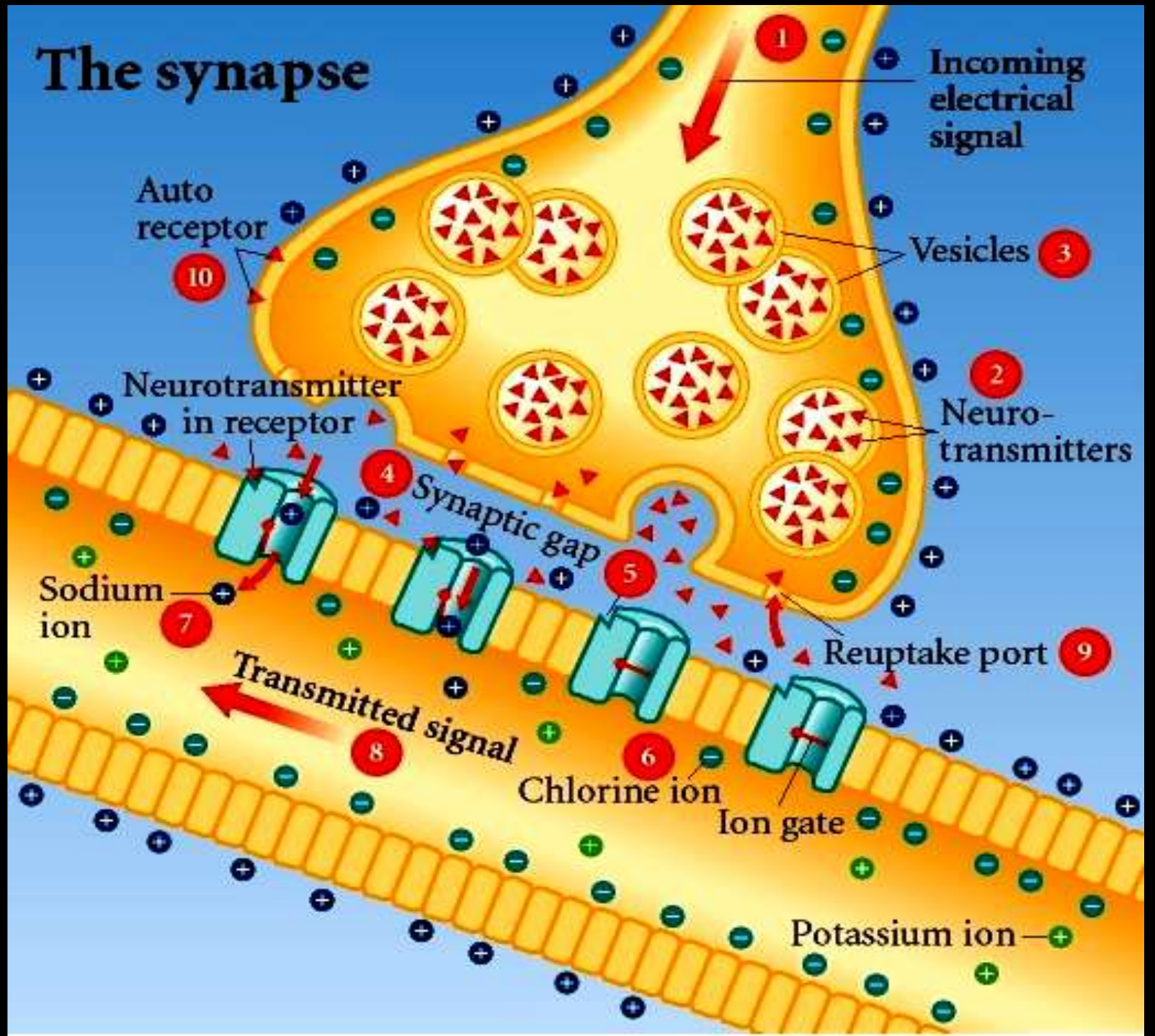
   C) Attached to auto-receptor (Feedback Loop)



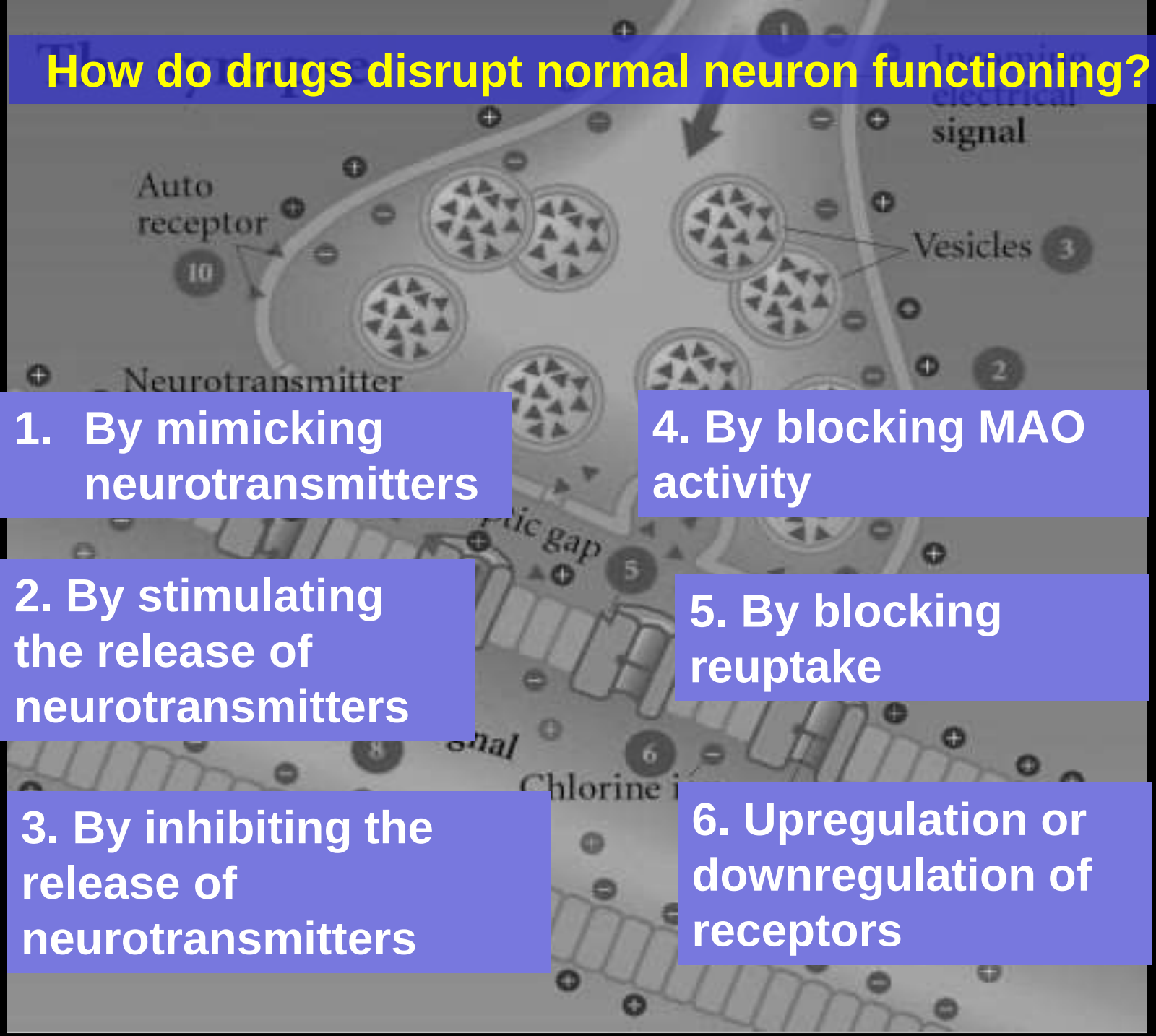
5 years of age to 20 years of age

- Grey matter ratio drops
  - Slower waves
- White matter ratio increases
  - Lightening hop
- Pruning & Myelenation




The synapse
1
Incoming electrical signal
Auto receptor
10
Vesicles
3
2
Neuro-transmitters
Neurotransmitter in receptor
4
Synaptic gap
5
Sodium ion
7
Reuptake port
9
Transmitted signal
8
6
Chlorine ion
Ion gate
Potassium ion

How do drugs disrupt normal neuron functioning?



1. By mimicking neurotransmitters

2. By stimulating the release of neurotransmitters

3. By inhibiting the release of neurotransmitters

4. By blocking MAO activity

5. By blocking reuptake

6. Upregulation or downregulation of receptors

Neurotransmitters

- **Messenger molecules**
- **Lock and key**
- **Determine how we think, feel, get high, suffer, etc.**

Acetylcholine

- First NT ever discovered
- Active at nerve-muscle junctions
- Affects mental acuity and memory
- Affects learning
- Imbalance implicated in Alzheimer's disease

Anandamide

- Discovered 1995
- “Bliss”
- Found in limbic system (Emotion, learning, memory)
- Inhibitory (G-protein inhibitor)
- Has STRONG affinity for receptor sites which accommodate THC
- Chemically similar to THC

Endorphins

- (Endorphin, Enkephalin, Beta-endorphin)
- Act on Opiate receptors to deaden pain
- Trigger Reward and Pleasure Center
- Molecularly similar to opiate drugs

GABA (Gamma amino butyric acid)

- Inhibitory
- Involved in approximately one third of synapses in brain
- Affects impulses
- Relaxes muscles
- Main natural “downer” in brain

DOPAMINE

- A CATECHOLAMINE
- Regulates fine motor activity
- Regulates emotional stability
- Controls satiation
- Rich in the Reward/Pleasure Center
- Too little = Parkinson’s
- Too much = Schizophrenia-like effects

Norepinephrine & Epinephrine
NE and E

- CATECHOLAMINES
- Act as stimulants upon demand from body
- Affect motivation, hunger
- Affect attention span
- Affect confidence and alertness

Serotonin (5-HT)

- Helps control mood stability
- ***Previously*** thought to reduce depression and anxiety
- Decreases appetite
- Can decrease libido
- SSRI’s work by allowing Serotonin to remain in synaptic gap for a longer period of time.

Substance “P”

- Conveys pain impulses
- Located in sensory neurons
- Allows pain to travel from site of injury to brain
- Blocked by opiates, enkephalins
- Foods with capsicum trigger local Substance P response (Example?)

Invent A Drug!!

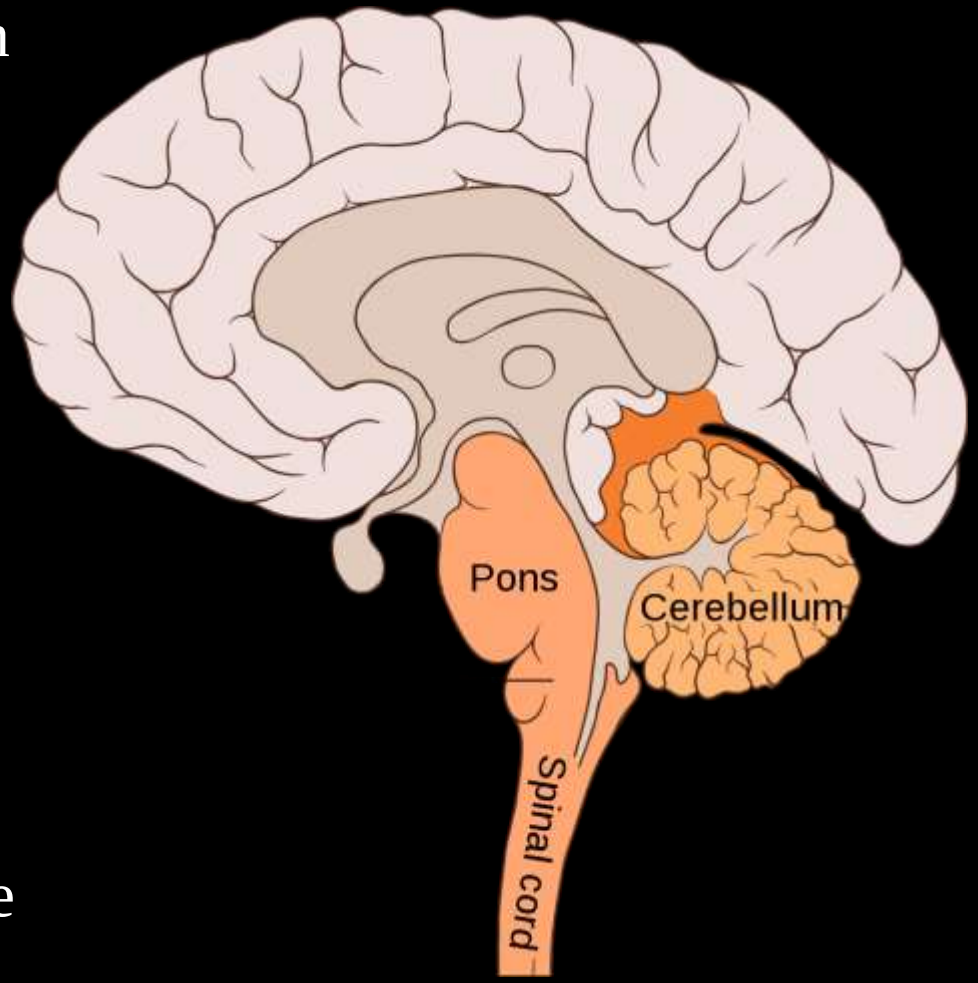
- Which neurotransmitters are involved in the effects?
- How? Decreased, increased, or mimicked? Down regulation? Up regulation?

Cerebellum

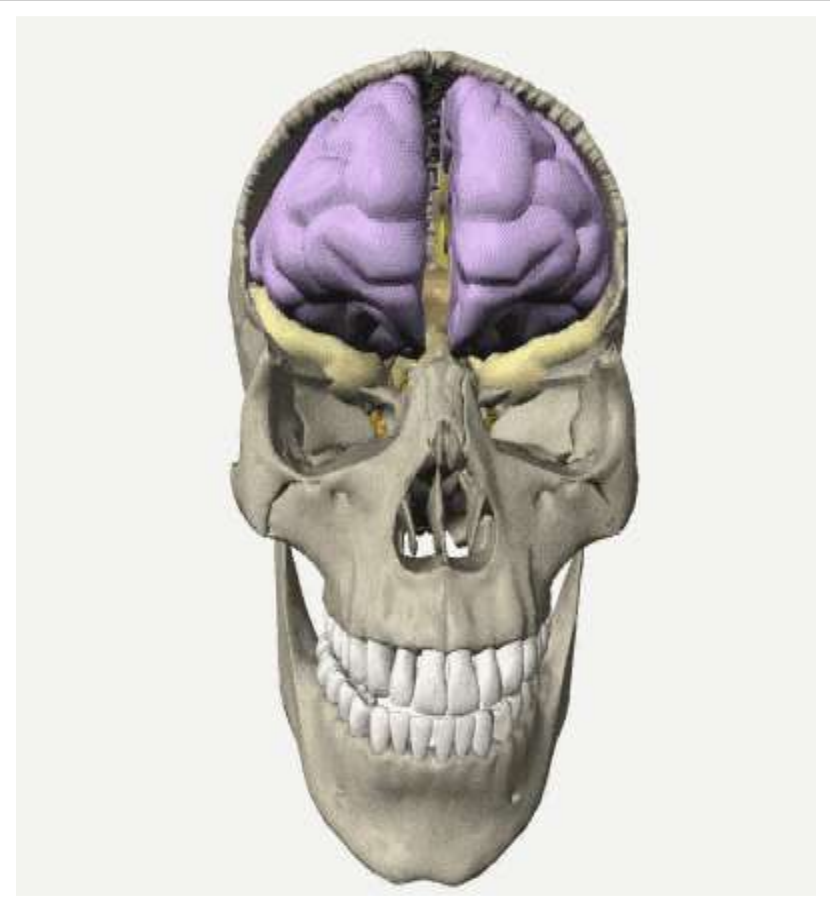
- Regulates motor behavior.
- Contains more neurons than the rest of the brain combined.
- Neurogenesis has been confirmed.

Brain Stem

- Controls breathing, heart rate, and blood pressure.
- coordinates with the motor cortex to contribute to fine movements of limbs and the face.



The Brain



Cerebellum:

Muscle movement and coordination

Problems: imbalance,

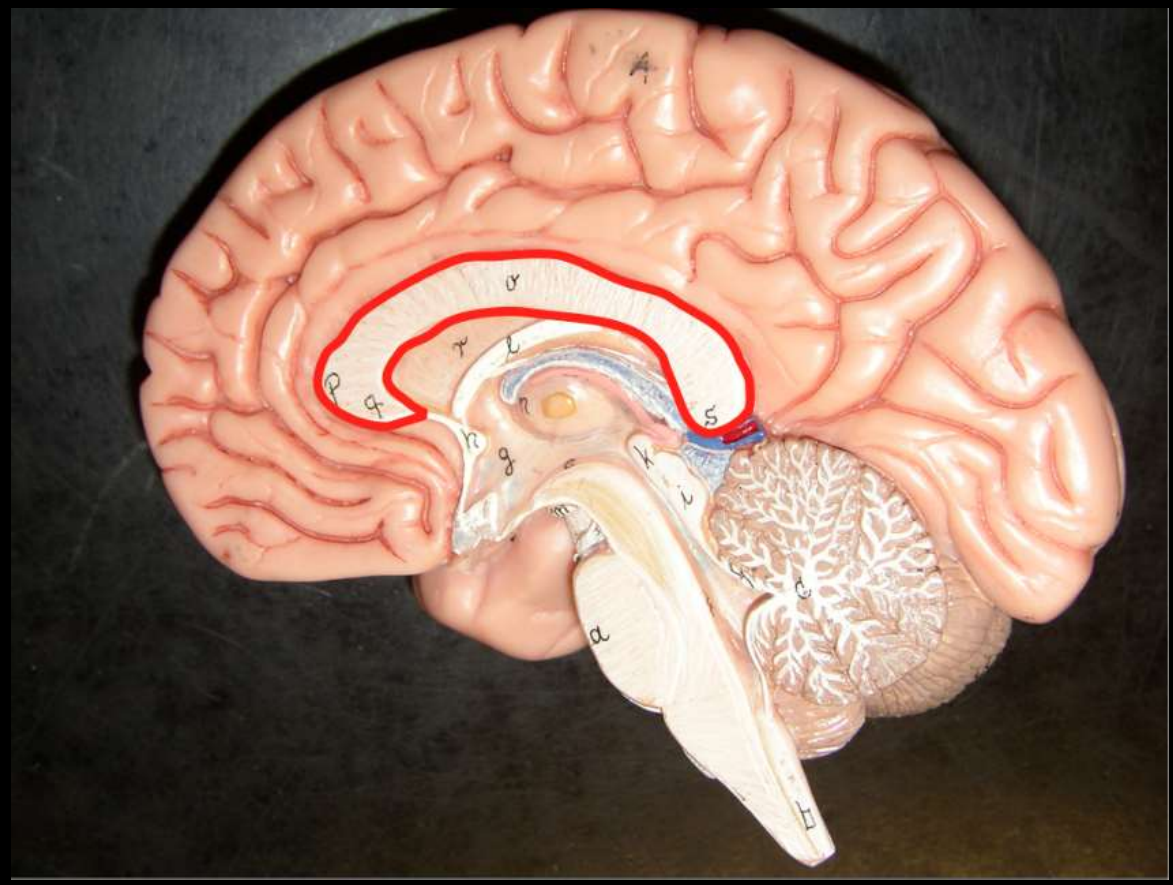
Loss of coordination,

Ataxia

What drugs could cause Balance and Coordination problems in the Cerebellum?

- Alcohol
- Cocaine
- Oxycontin
- Nicotine
- Ecstasy
- Opium
- Marijuana
- Heroin
- Methamphetamine
- Mushrooms
- Caffeine
- LSD
- Nitrous Oxide
- Butane
- Vicodin
- Hashish
- Airplane Glue
- Robitussin
- GHB
- Phenobarbital
- Valium
- Xanex
- Viagra
- Salvia

- Corpus Callosum
- Large bundle of fibers connecting the right and left hemispheres of the brain
- Each hemisphere controls movement in the opposite (contralateral) side of the body.

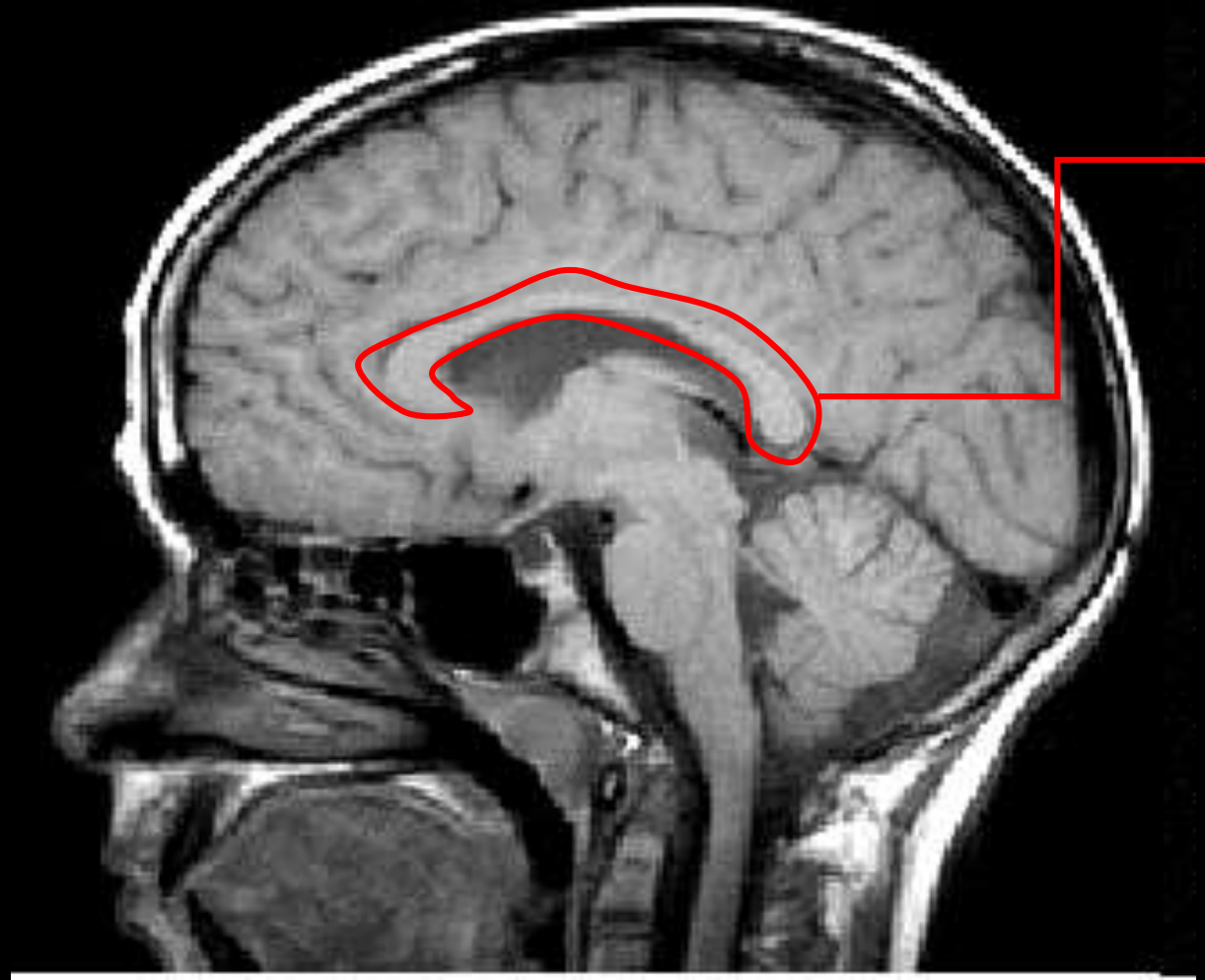


The Brain

Left: speech, calculation and logical thought, etc.

Right: creativity, music, etc.

MRI – Normal Corpus Collosum



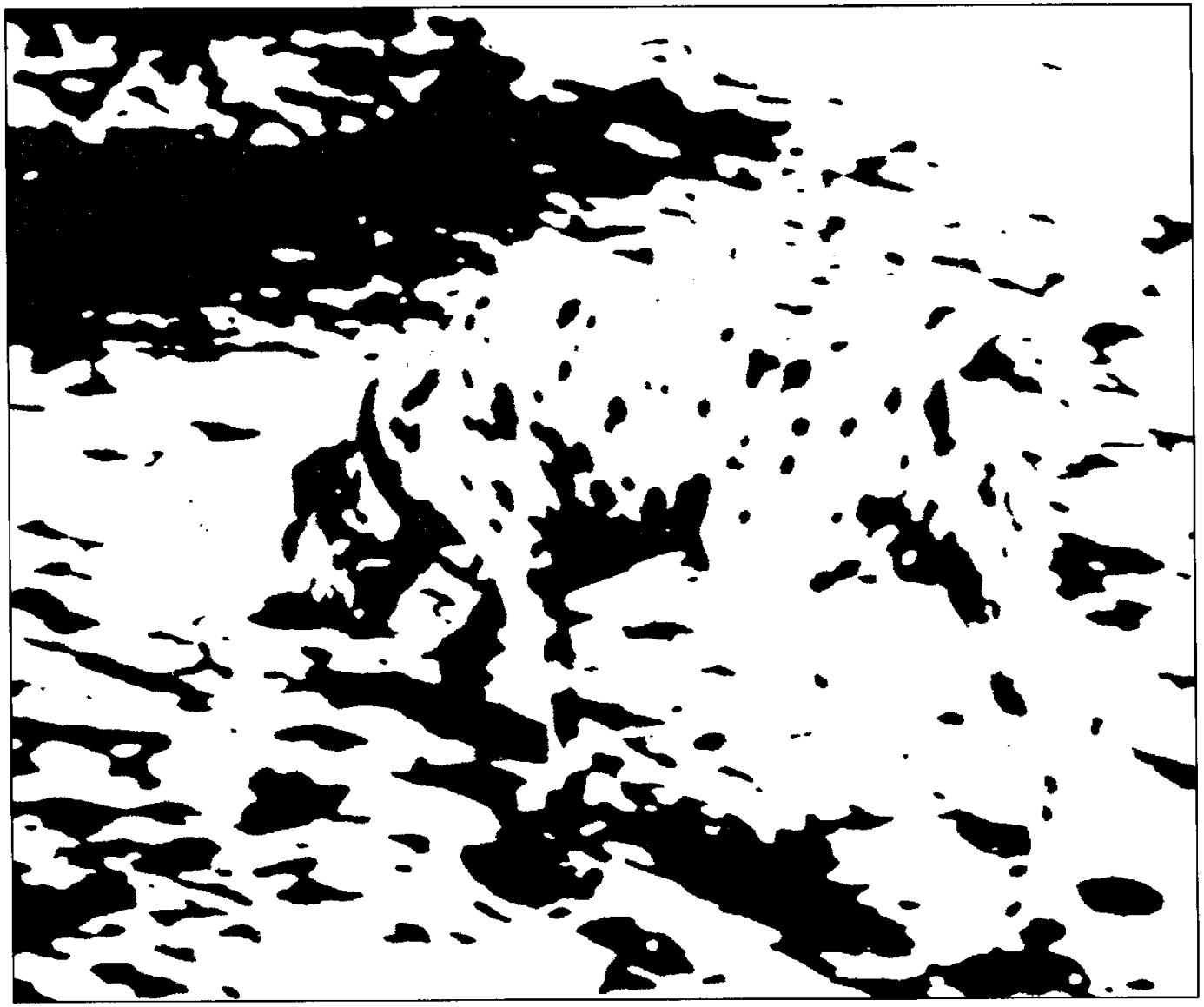
Corpus Collosum:

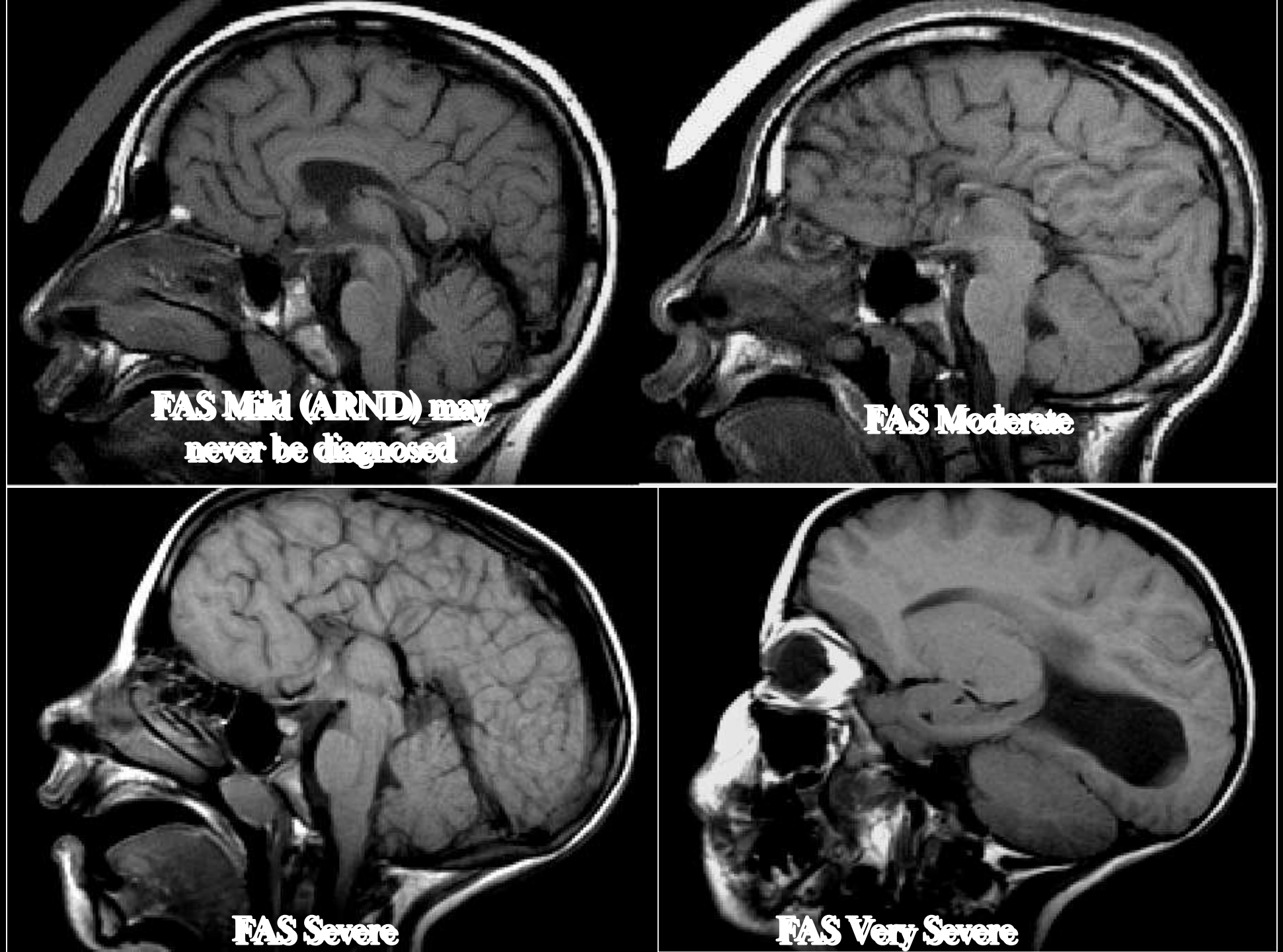
Fibrous tract that connects the right and left hemisphere

Left: Analytic

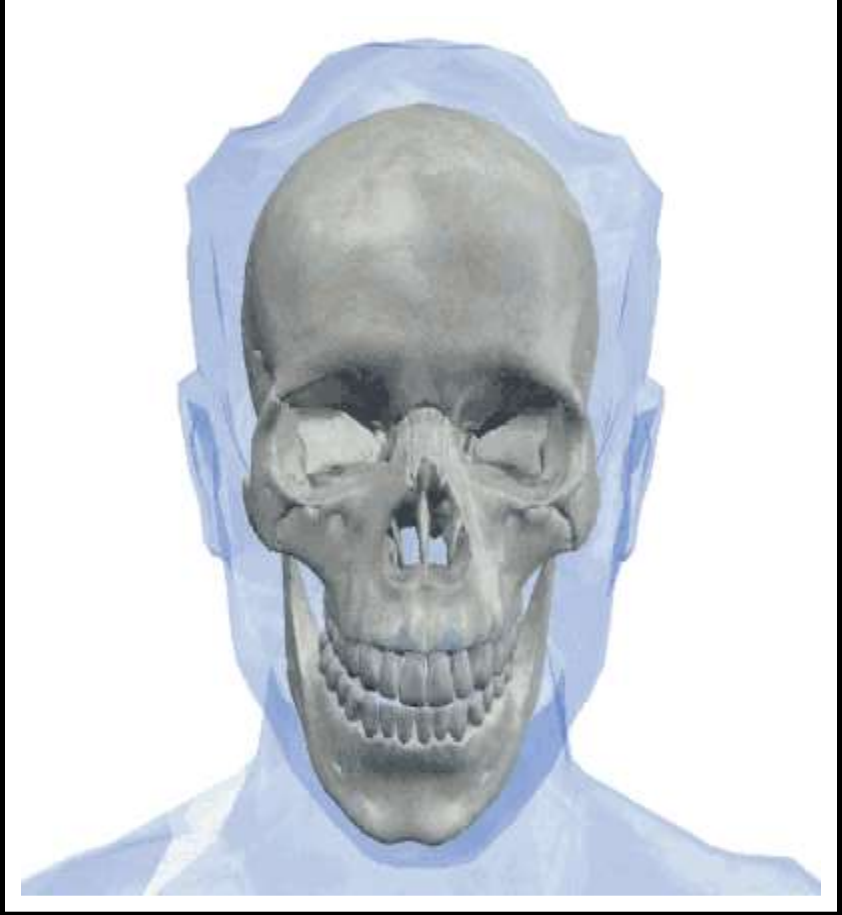
Right: Creative

The left part of your brain allows you to see the lines and blobs, the right side of your brain lets you see the ….




FAS Mild (ARND) may never be diagnosed
FAS Moderate
FAS Severe
FAS Very Severe

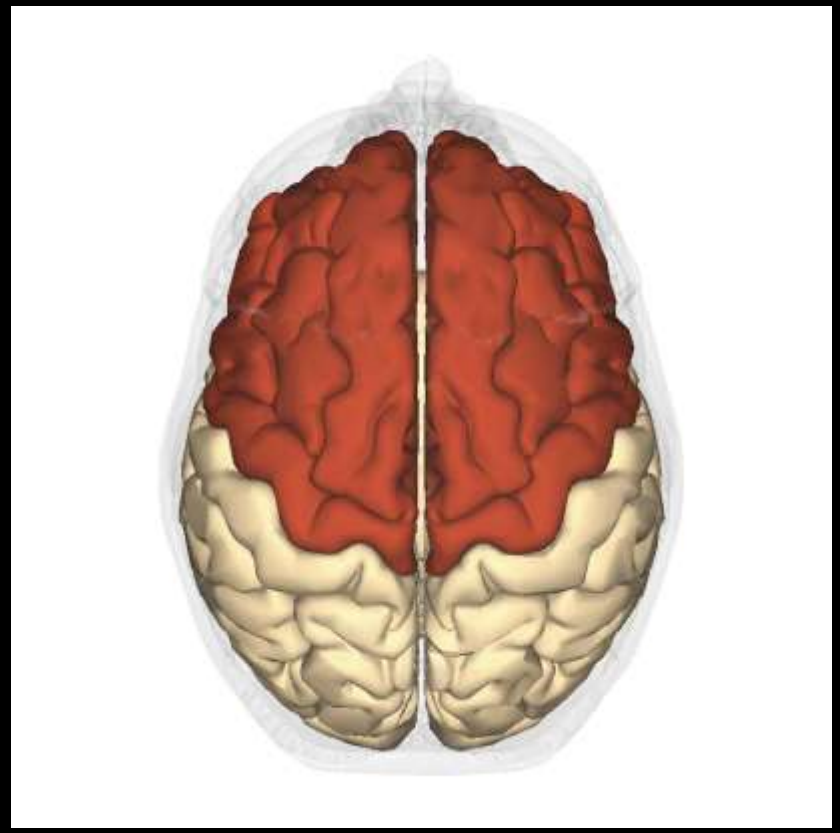
The Brain



Frontal Lobes	Problems: Impaired judgment and comprehension
Parietal Lobes	Problems: Proprioperception Time space
Temporal Lobes	Problems: Impaired auditory processing and recall
Occipital Lobes	Problems: Impaired visual processing and recall

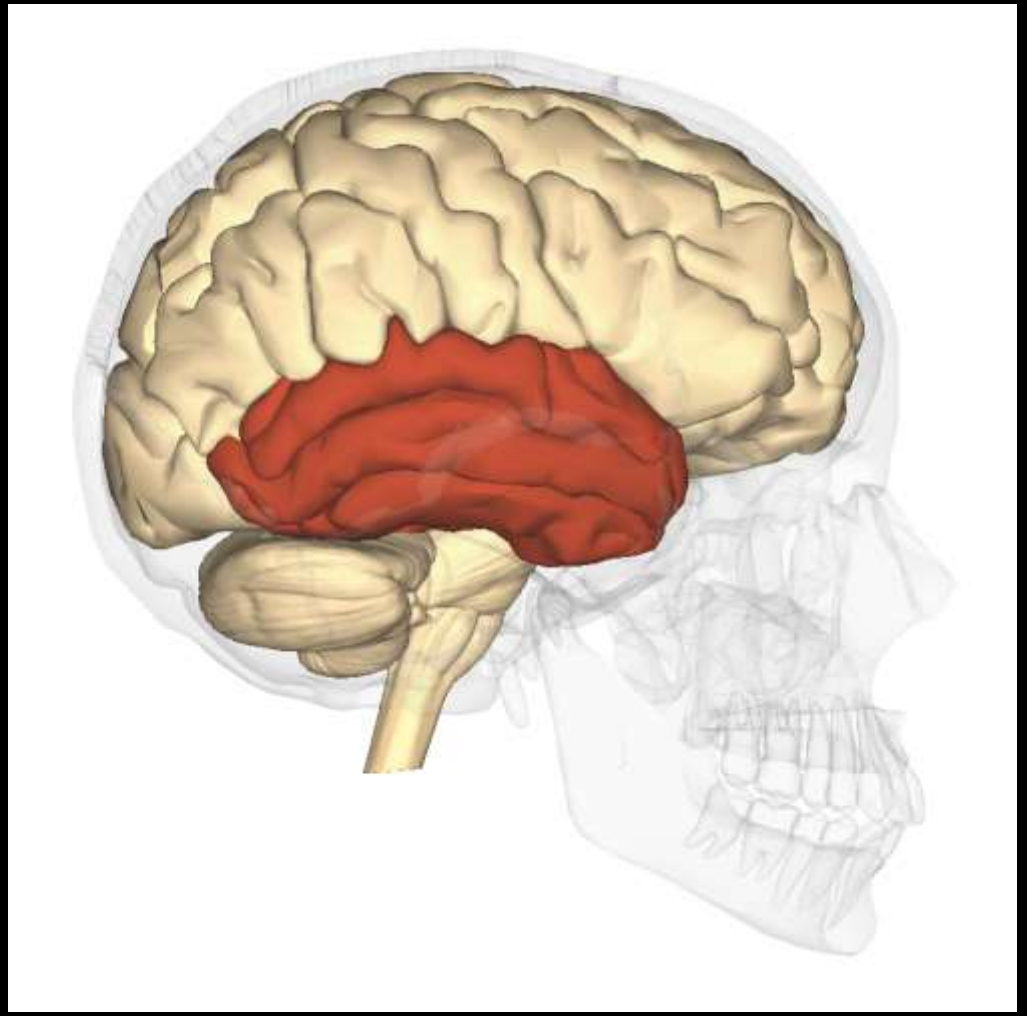
Frontal Lobe

- Executive Functions
- Judgement
- Empathy (mirror neurons)
- Impulse Control



Temporal Lobe

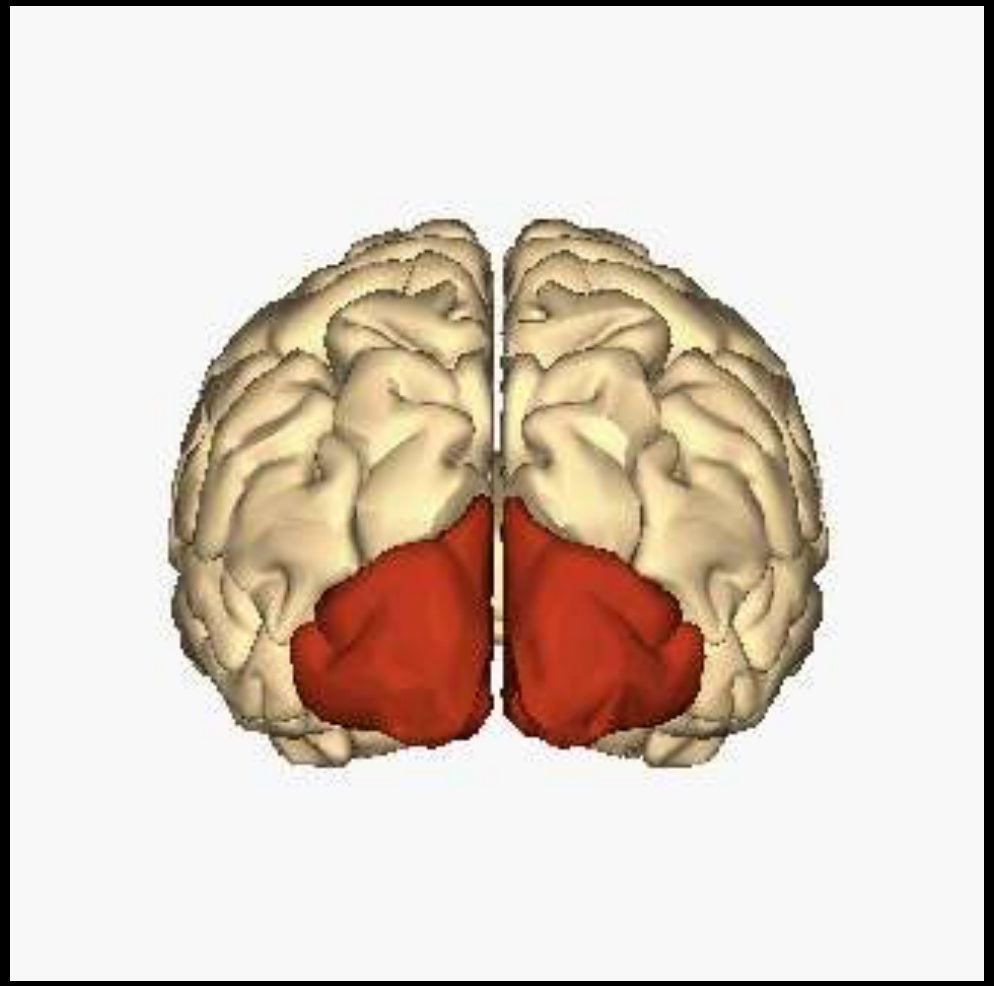
- The temporal lobes contain a large number of substructures, whose functions include:
- Auditory Processing
- Language
- Perception, face recognition, object recognition, memory acquisition, and emotional reactions.



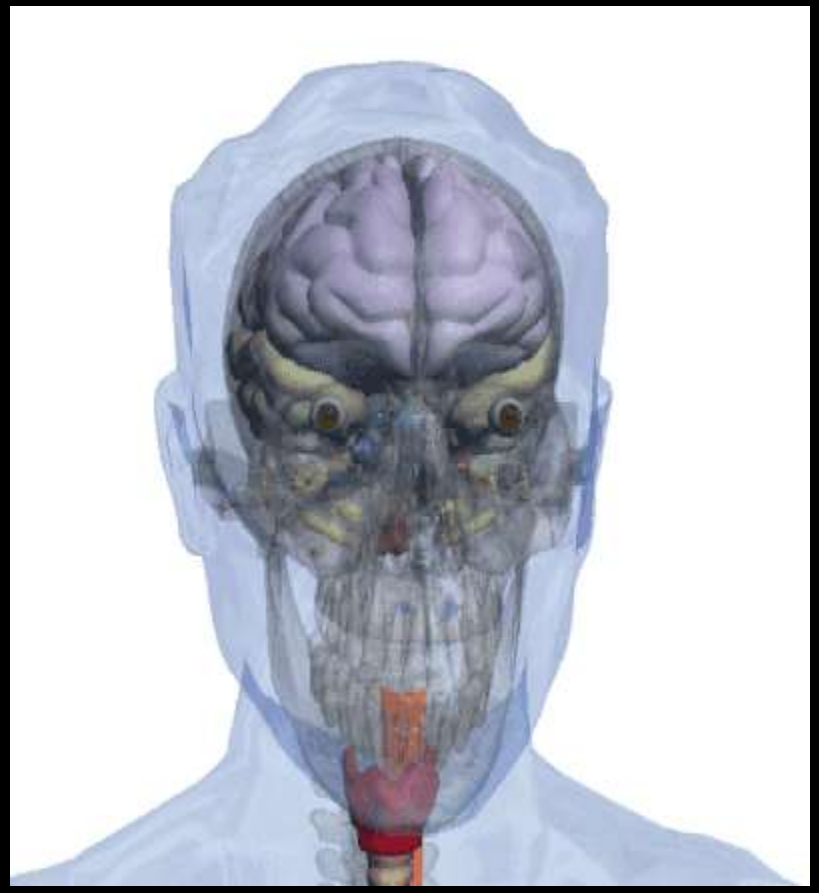
- Parietal Lobe
- plays an important role in integrating information from different senses to build a coherent picture of the world.

Occipital Lobe

- Visual area of the brain. It receives projections from the retina (via the thalamus) from where different groups of neurons separately encode different visual information such as color, orientation, and motion.



The Brain



Eyes transmit information to occipital lobe of the brain

Problems:

visual recall problems,

nystagmus

-vertical

-horizontal

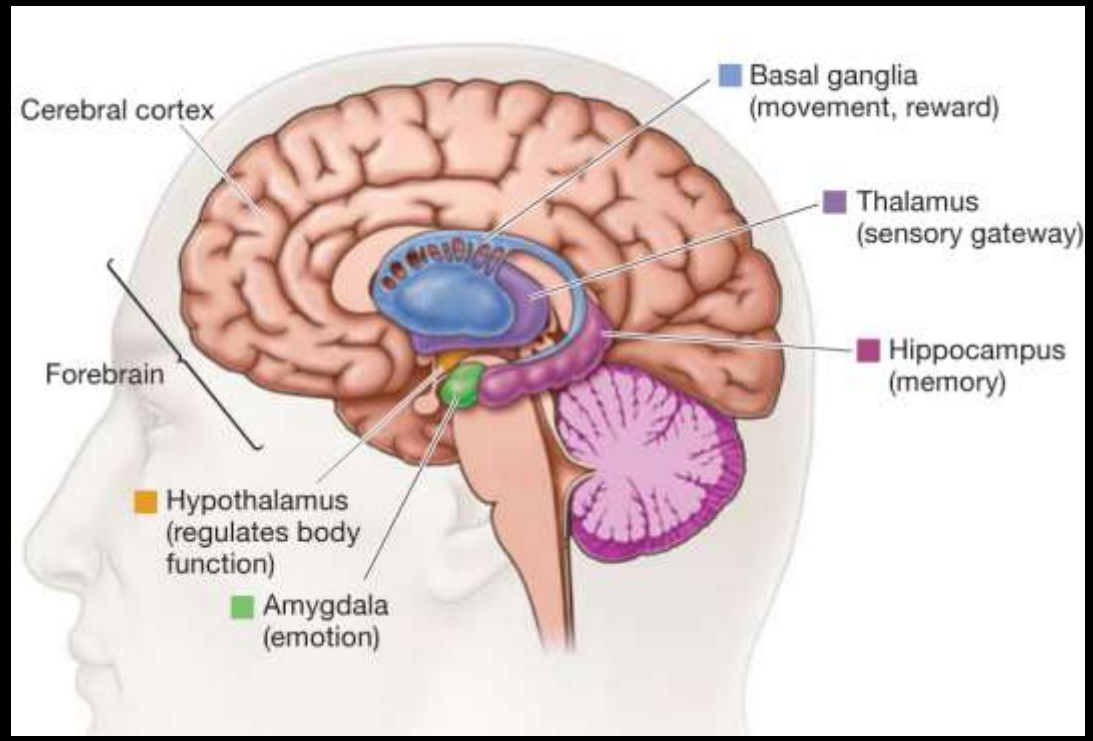
-convergence

Thalamus

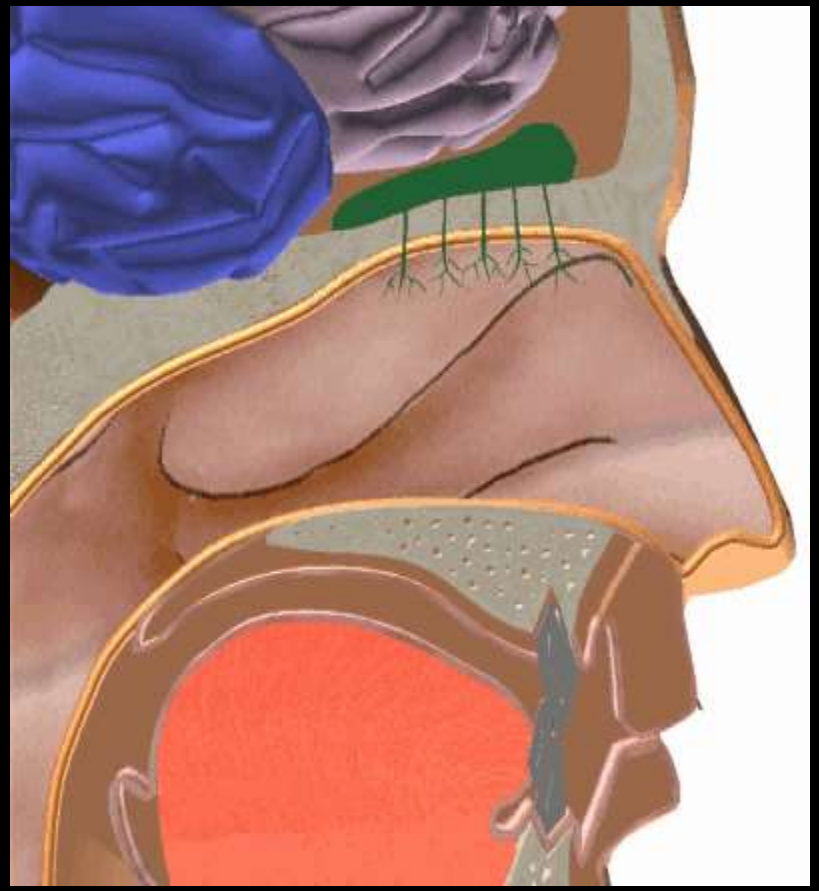
- Modulates 4 out 5 senses.
- Relays incoming stimuli

Basal Ganglia

- The basal ganglia are also involved in cognitive and emotional behaviors and play an important role in reward and reinforcement, addictive behaviors and habit formation.



Sinus



The Sinus:

Biologist estimate that 70-80% of taste is actually smell. The nose is made of many bones that are in plates. Damage to the sinus or sinus bones is virtually irreparable, e.g. Michael Jackson

Problems:

Powerful cues via sinus nerves that go directly into the brain (olfactory hallucinosis)

Damage to sinus and sinus bones from insufflation of drugs.

The Brain

Thalamus sorts incoming sensory stimuli

Problems: synesthisia

Hypothalamus regulates autonomic nervous system and hunger

Problems:

Sympathetic and Parasympathetic disruption

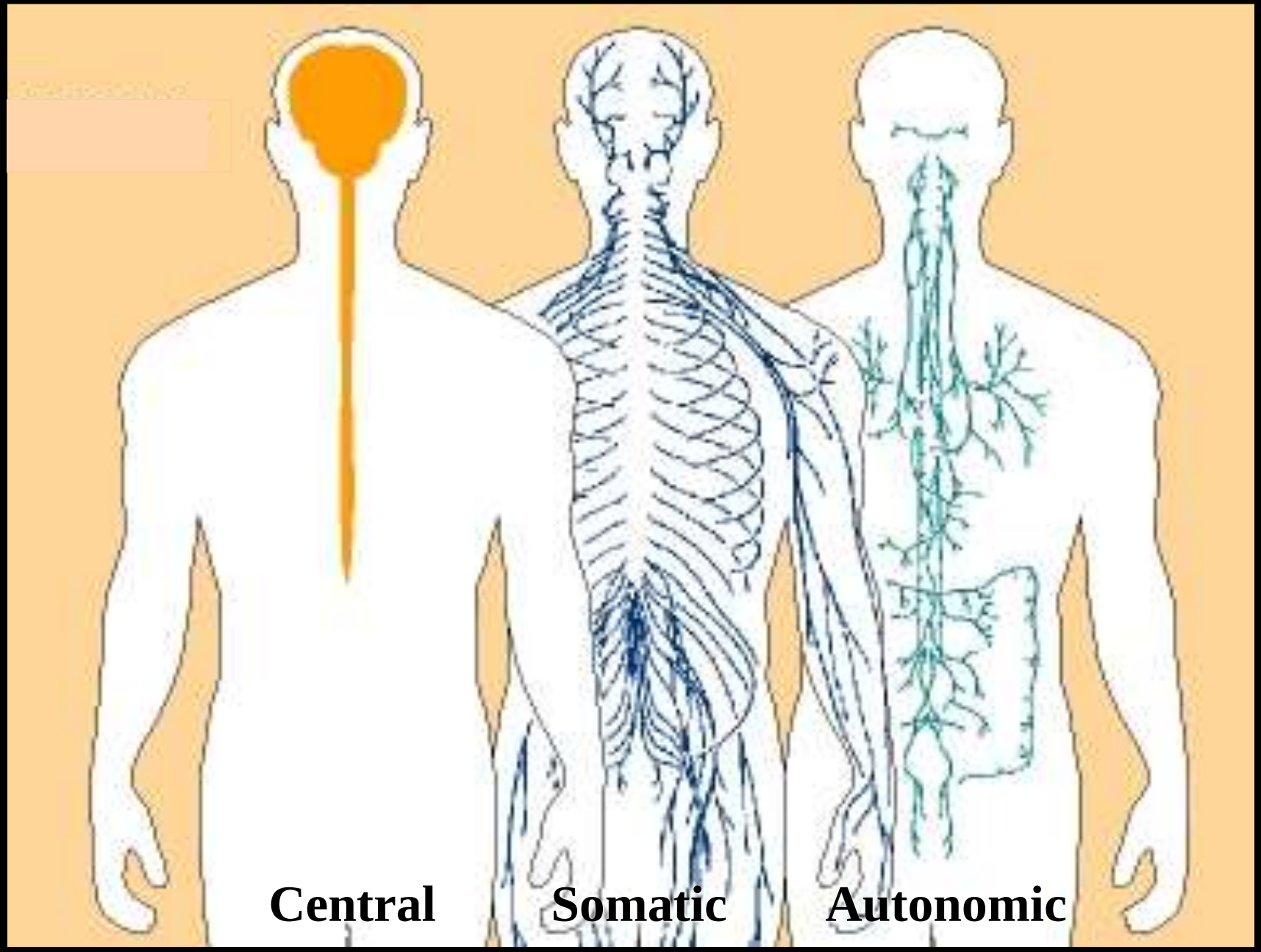
Corpus Collosum regulates information exchange between brain hemispheres.

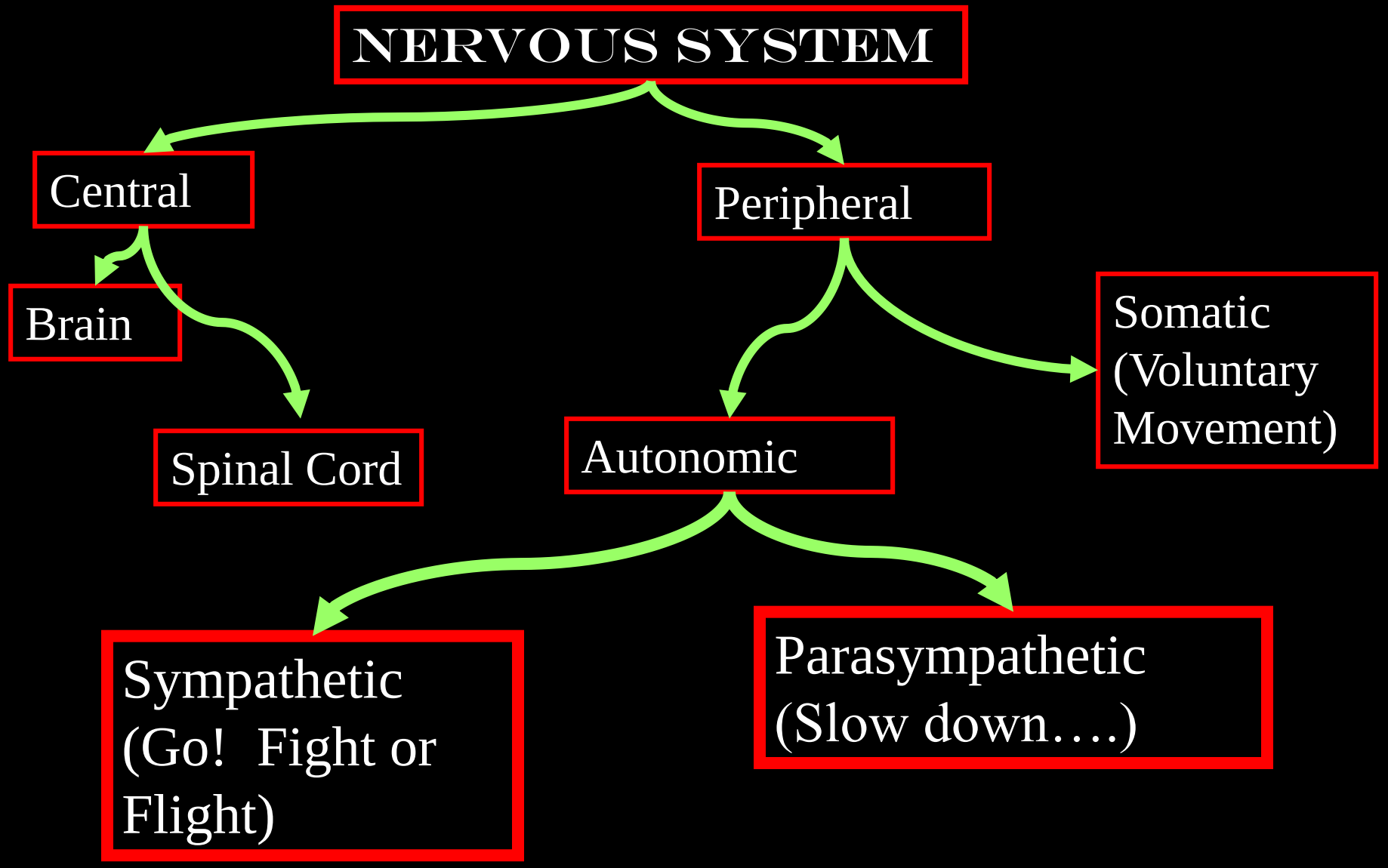
Problems:

Disruption in communication, most severe with FAS

What drugs could cause “Synesthisia” in the Thalamus?

- Alcohol
- Cocaine
- Oxycontin
- Nicotine
- Ecstasy
- Opium
- Marijuana
- Heroin
- Methamphetamine
- Mushrooms
- Caffeine
- LSD
- Nitrous Oxide
- Butane
- Vicodin
- Hashish
- Airplane Glue
- Robitussin
- GHB
- Phenobarbital
- Valium
- Xanex
- Viagra
- Salvia


Central
Somatic
Autonomic


NERVOUS SYSTEM
Central
Peripheral
Brain
Spinal Cord
Autonomic
Somatic (Voluntary Movement)
Sympathetic (Go! Fight or Flight)
Parasympathetic (Slow down….)

SYMPATHETIC

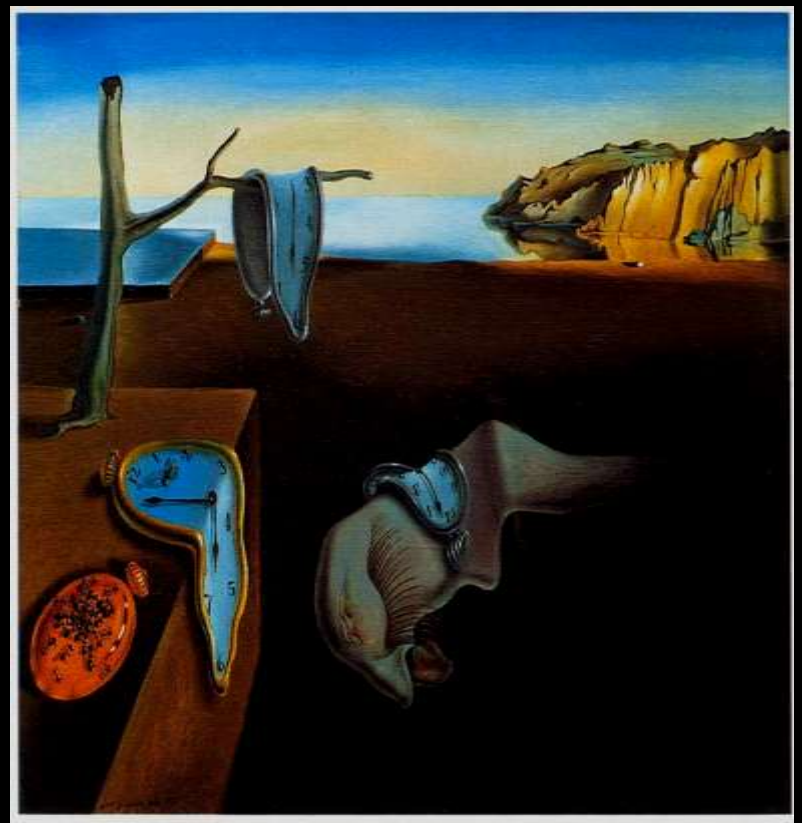
- Pupils dilate
- Muscles tense
- Hair stands on end
- Sweat glands secrete
- Salivary glands dry up
- Liver releases glucose (energy)
- Lungs and bronchial tubes dilate
- Heart rate, blood pressure increase
- Blood vessels contract on surface = pale skin

AUTOMATIC STRESSOR

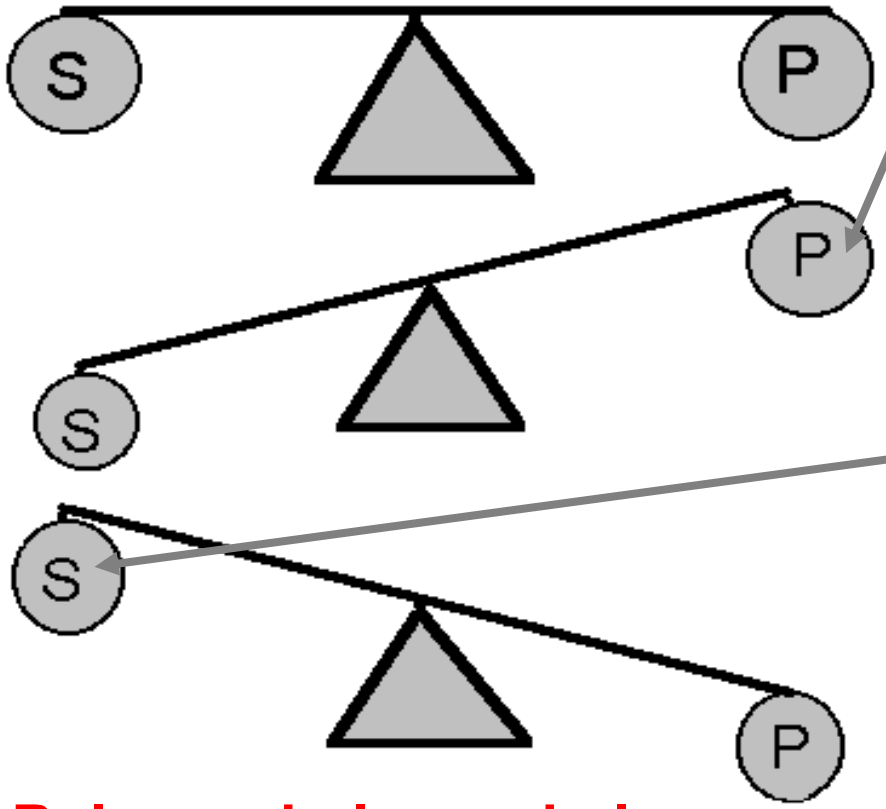
"FIGHT or FLIGHT"

- **<u>PARASYMPATHETIC</u>**
- **Heart rate and blood pressure decrease**
- **Sweat glands slow down secretion**
- **Pancreatic secretions normal**
- **Salivary secretion increases**
- **Breathing slow and normal**
- **Even blood distribution**
- **Pupils constrict**

- ***AUTOMATIC RELAXER***
- ***“TAKE IT EASY….”***



Example: DOWNERS



Balance, balance, balance...

Taking the downer activates parasympathetic nervous system and depresses sympathetic

Downer wears off (is metabolized) and sympathetic rebound effect occurs

What drugs activate either the sympathetic or parasympathetic nervous system and later have a large rebound effect by activation of the opposite system?

- Alcohol
- Cocaine
- Oxycontin
- Nicotine
- Ecstasy
- Opium
- Marijuana
- Heroin
- Methamphetamine
- Mushrooms
- Caffeine
- LSD
- Nitrous Oxide
- Butane
- Vicodin
- Hashish
- Airplane Glue
- Robitussin
- GHB
- Phenobarbital
- Valium
- Xanex
- Viagra
- Salvia

NIDA's Theory

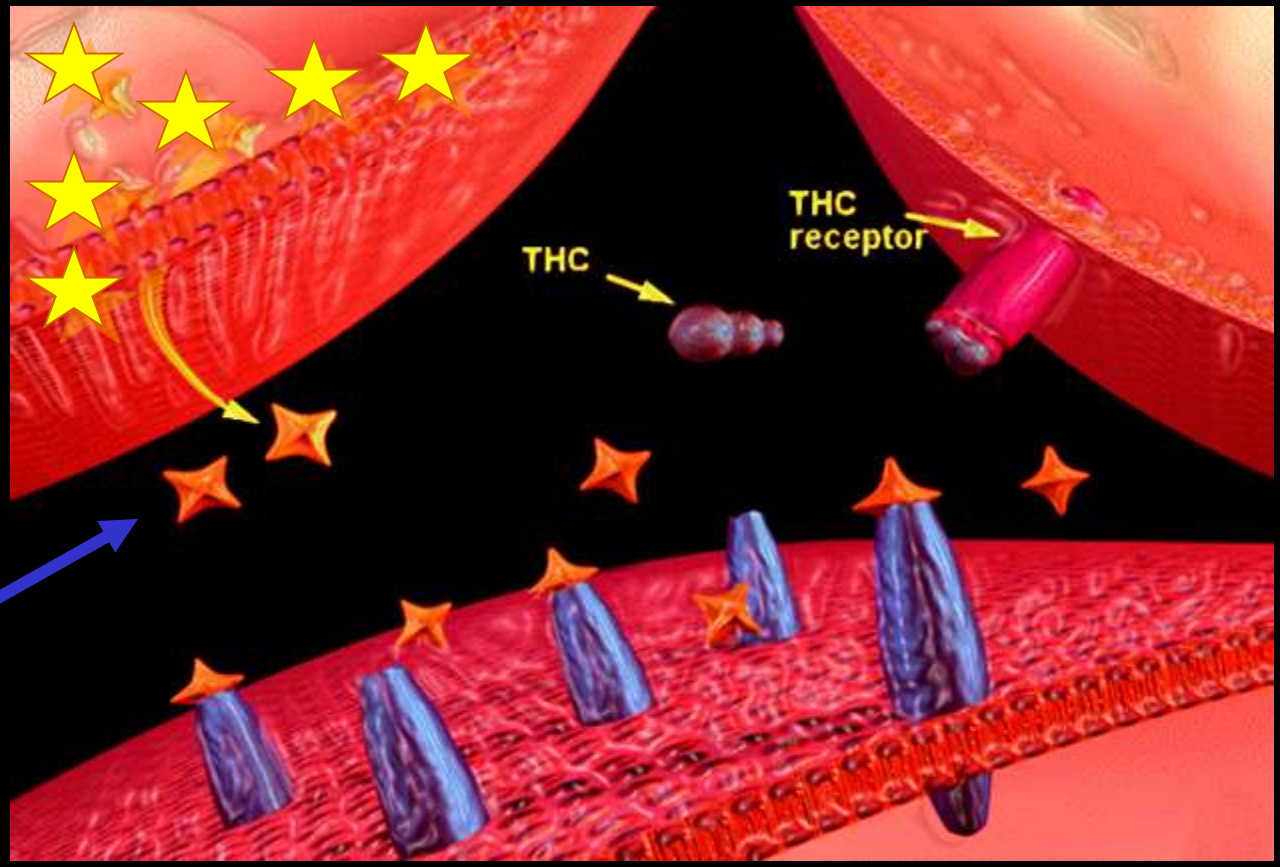
Part I: Pleasure & Reward Pathways

Drugs of Abuse are "Dopaminergic"

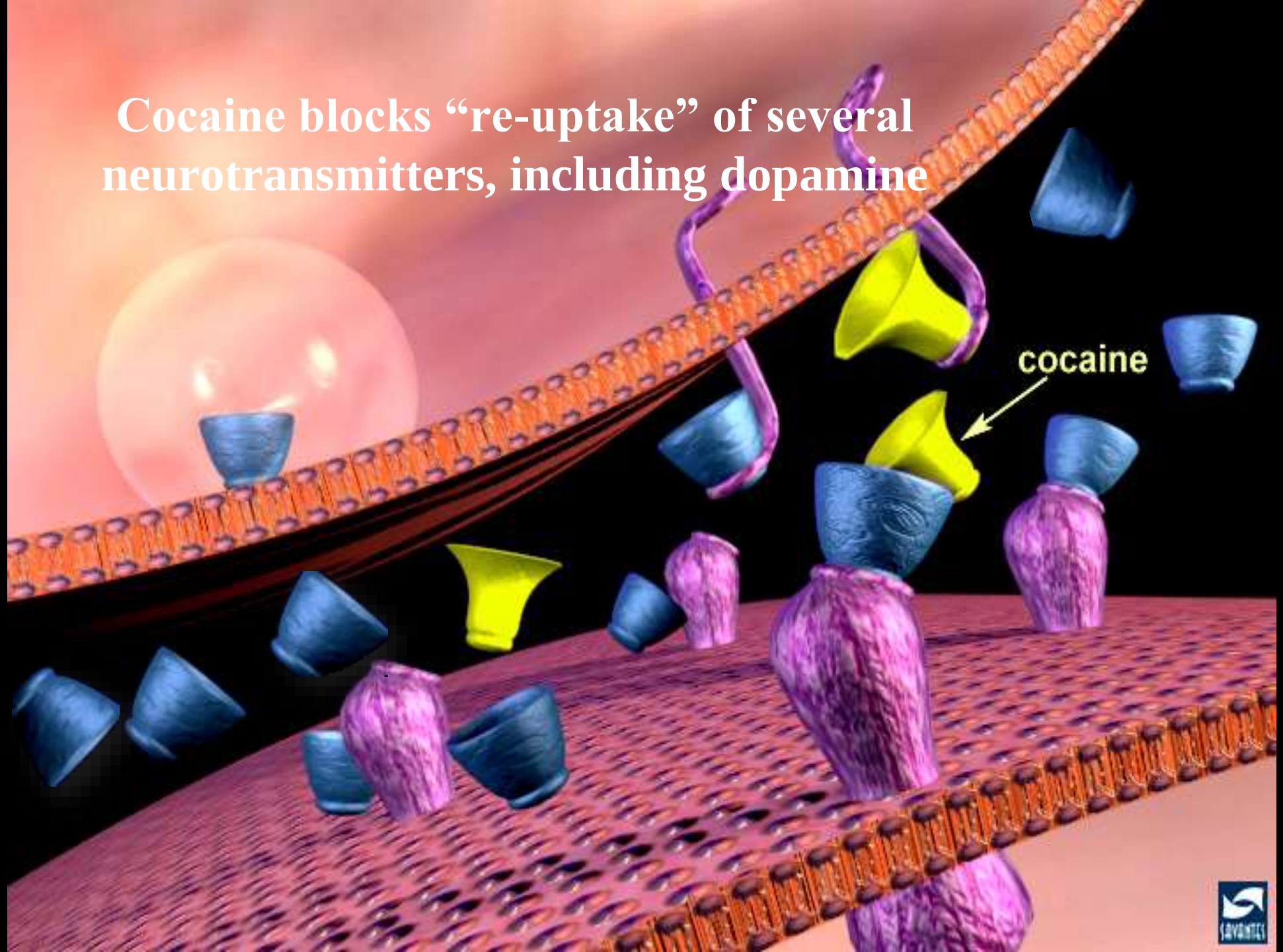
Or, in other words, they increase dopamine activity.

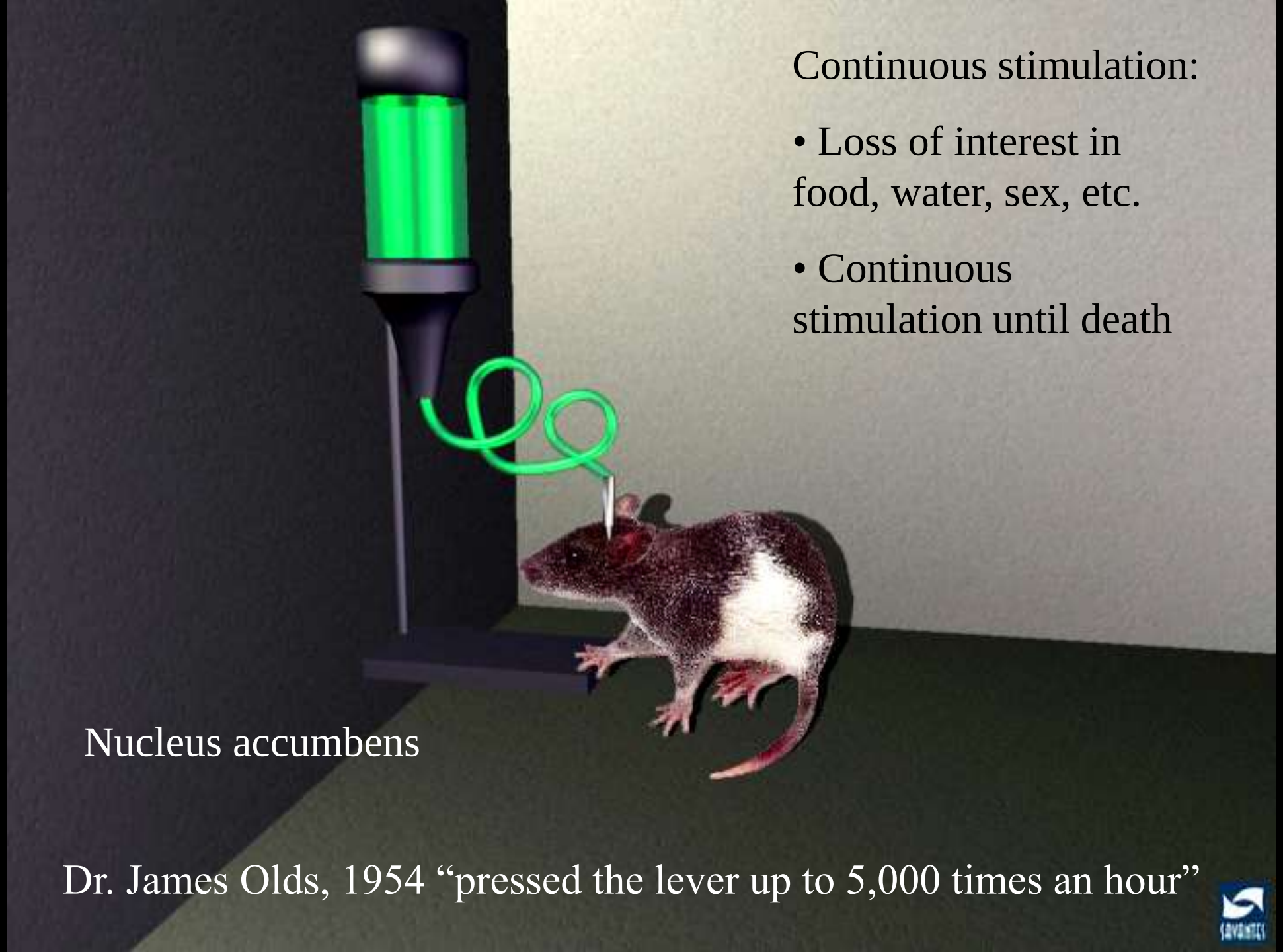
EXAMPLE:

THC connects with receptors and causes the release of dopamine



Cocaine blocks “re-uptake” of several neurotransmitters, including dopamine





Dr. James Olds, 1954 “pressed the lever up to 5,000 times an hour”

The one and only thing…

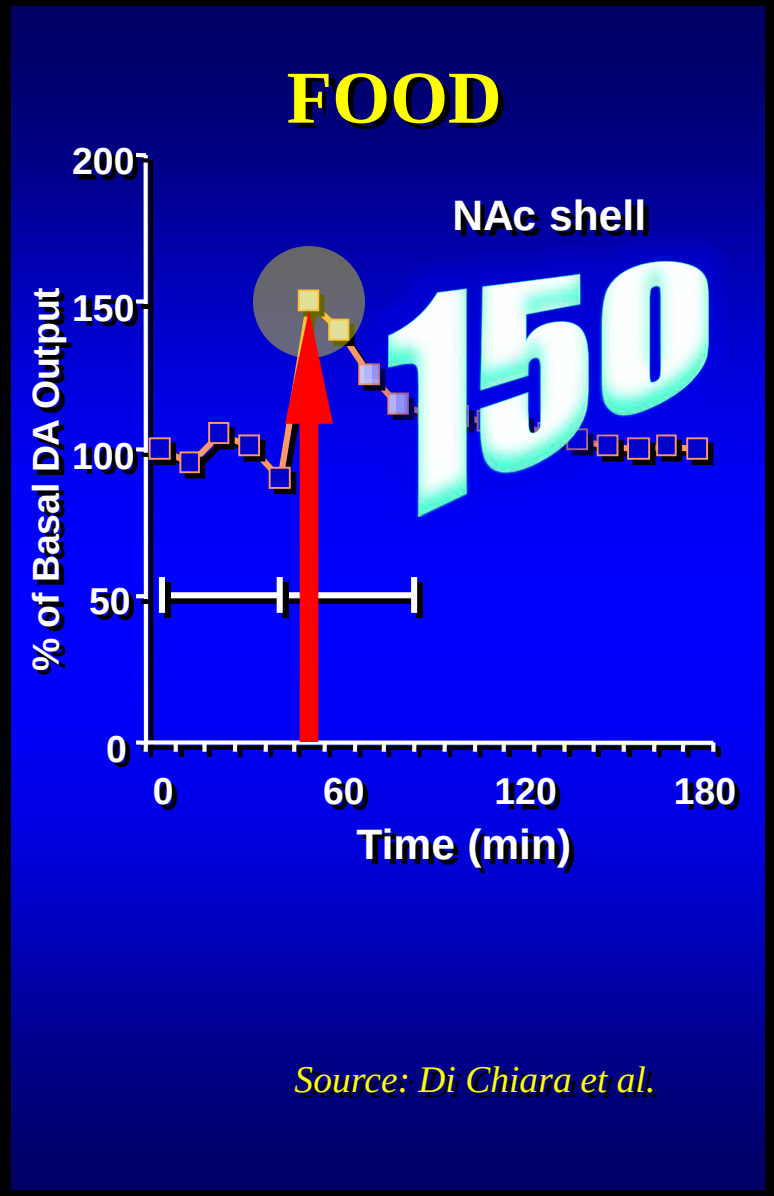
Marijuana
Alcohol
Heroin
Cocaine
Crack
Meth
Nicotine
Caffeine

www.nida.nih.gov

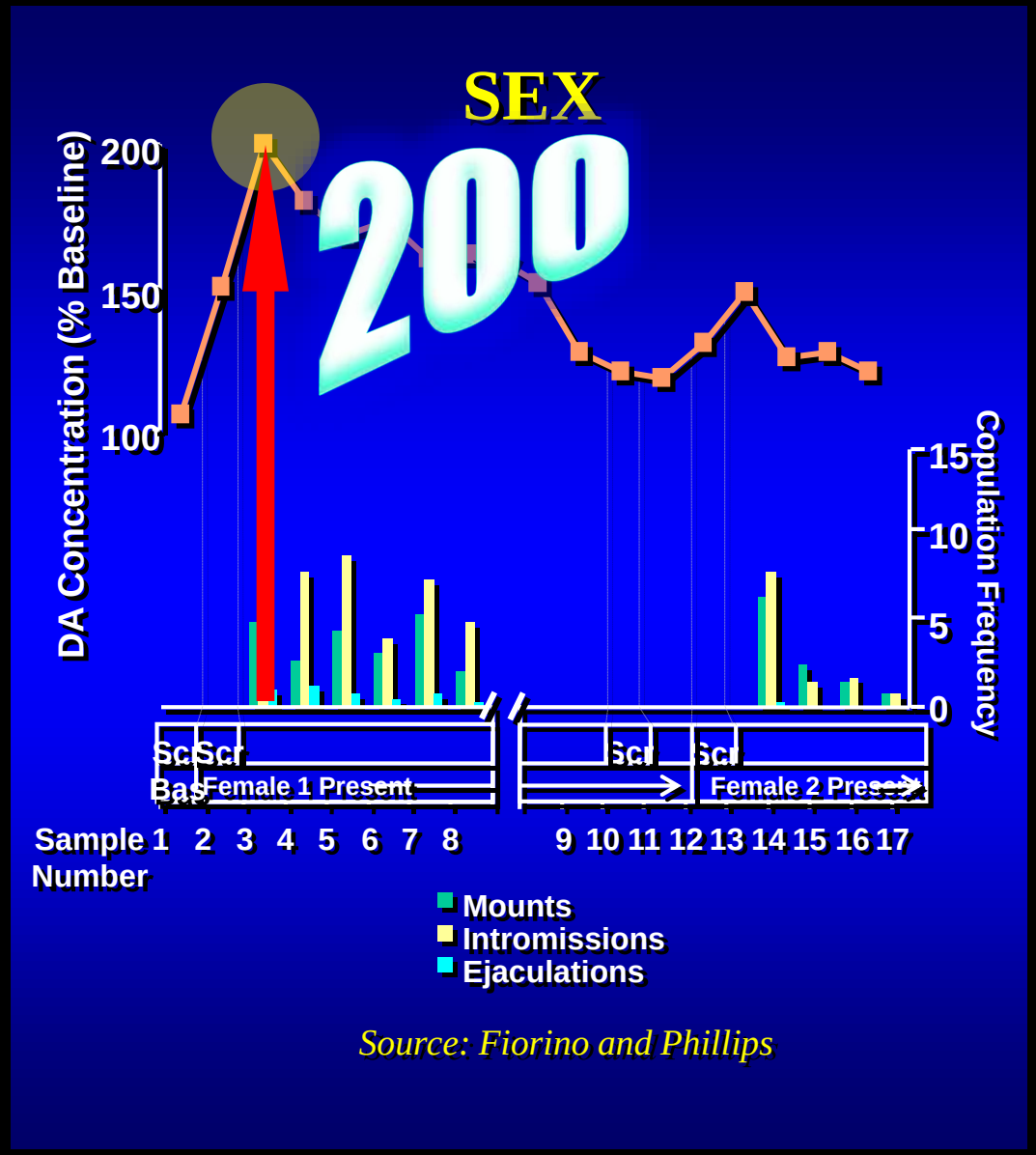
Drugs don't cause highs – they release highs

Dopamine part…	***Effect of drug…***
Marijuana High	Stoned, tired
Cocaine-Meth, etc. Rush	Wired, adrenaline, anxious, nervous
Alcohol Warm Fuzzy Glow	Drunk, reduce respiration, sedation
Opiates Warm Euphoria	Tired, Block pain, Narce'=Sleep

Natural Rewards Elevate Dopamine Levels

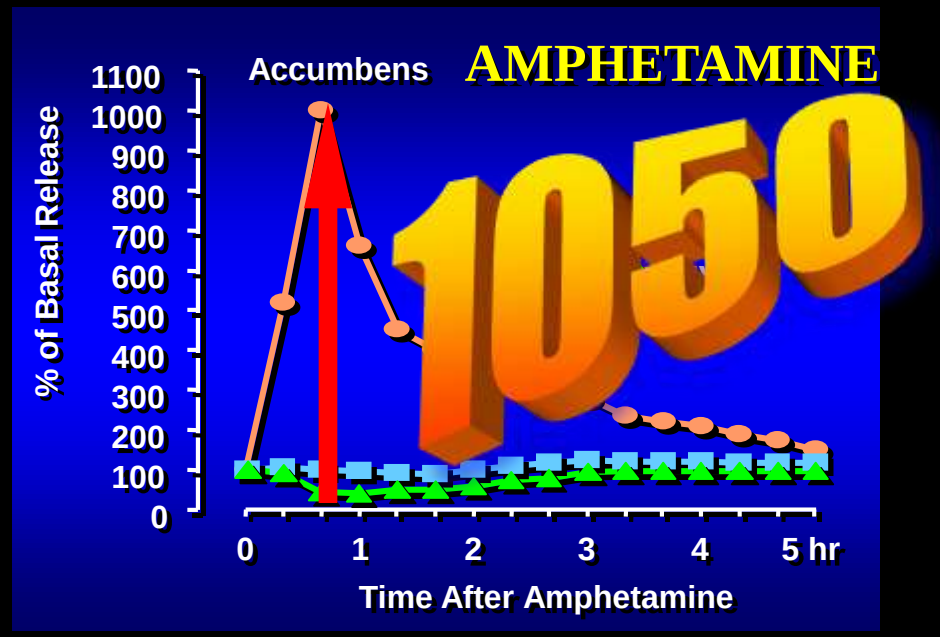


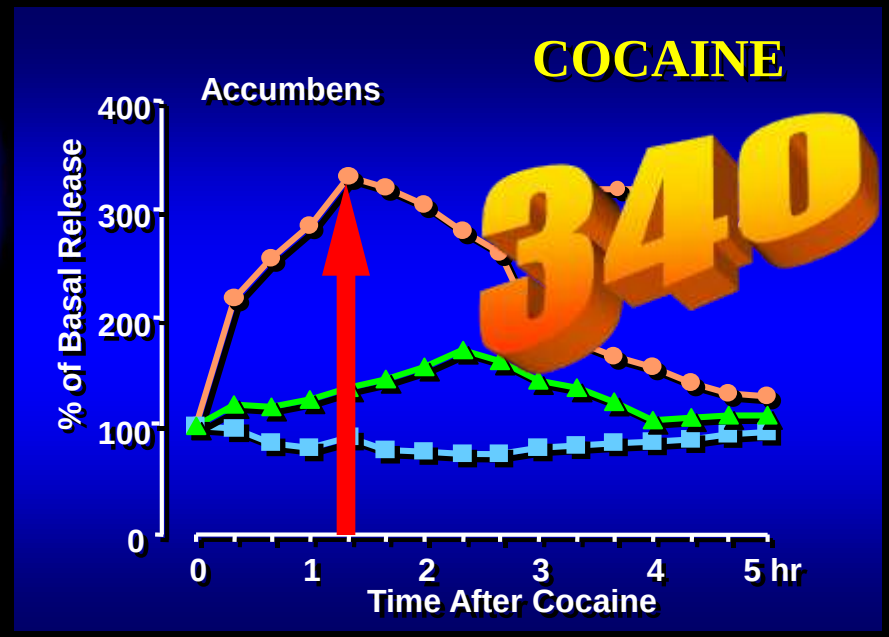
Source: Di Chiara et al.

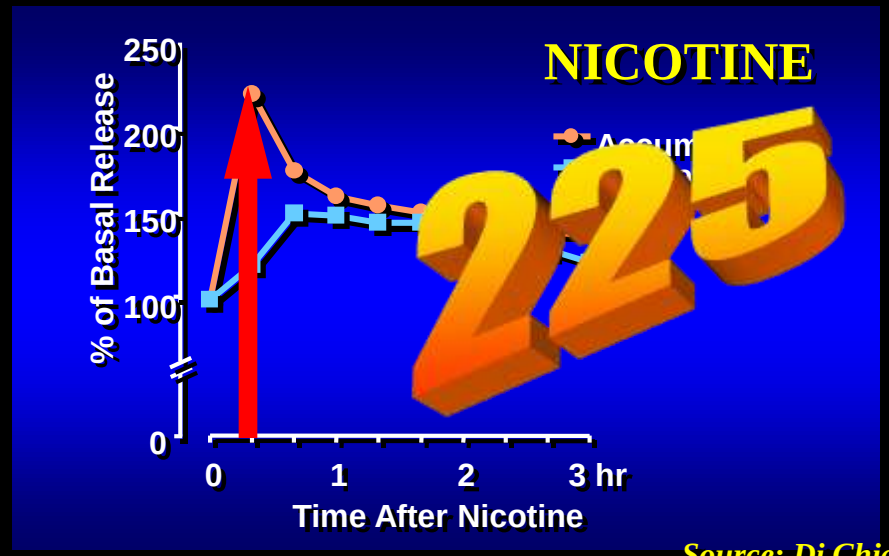


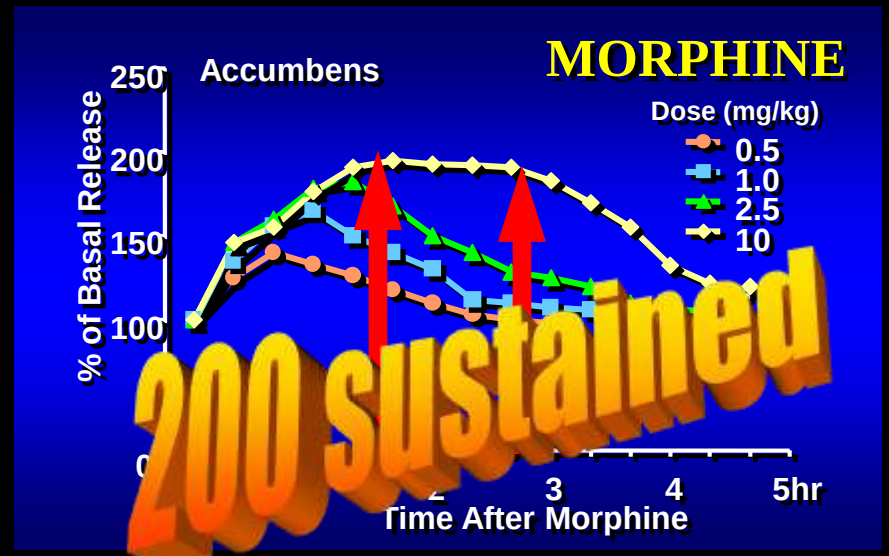
Source: Fiorino and Phillips

Effects of Drugs on Dopamine Levels









Source: Di Chiara and Imperato

Part I: Pleasure & Reward Pathways

Part 2: Dopamine Salience

Dopamine Salience

- Drug releases more dopamine than expected – salience
- Salience moves “new” behavior up on the chain of survival priorities

Survival Priorities:

Eat

Survive

Sex

Part I: Pleasure & Reward Pathways

Part 2: Dopamine Salience

Part 3: Hypofrontality

Go switch

Stop switch

Orbitofrontal Cortex

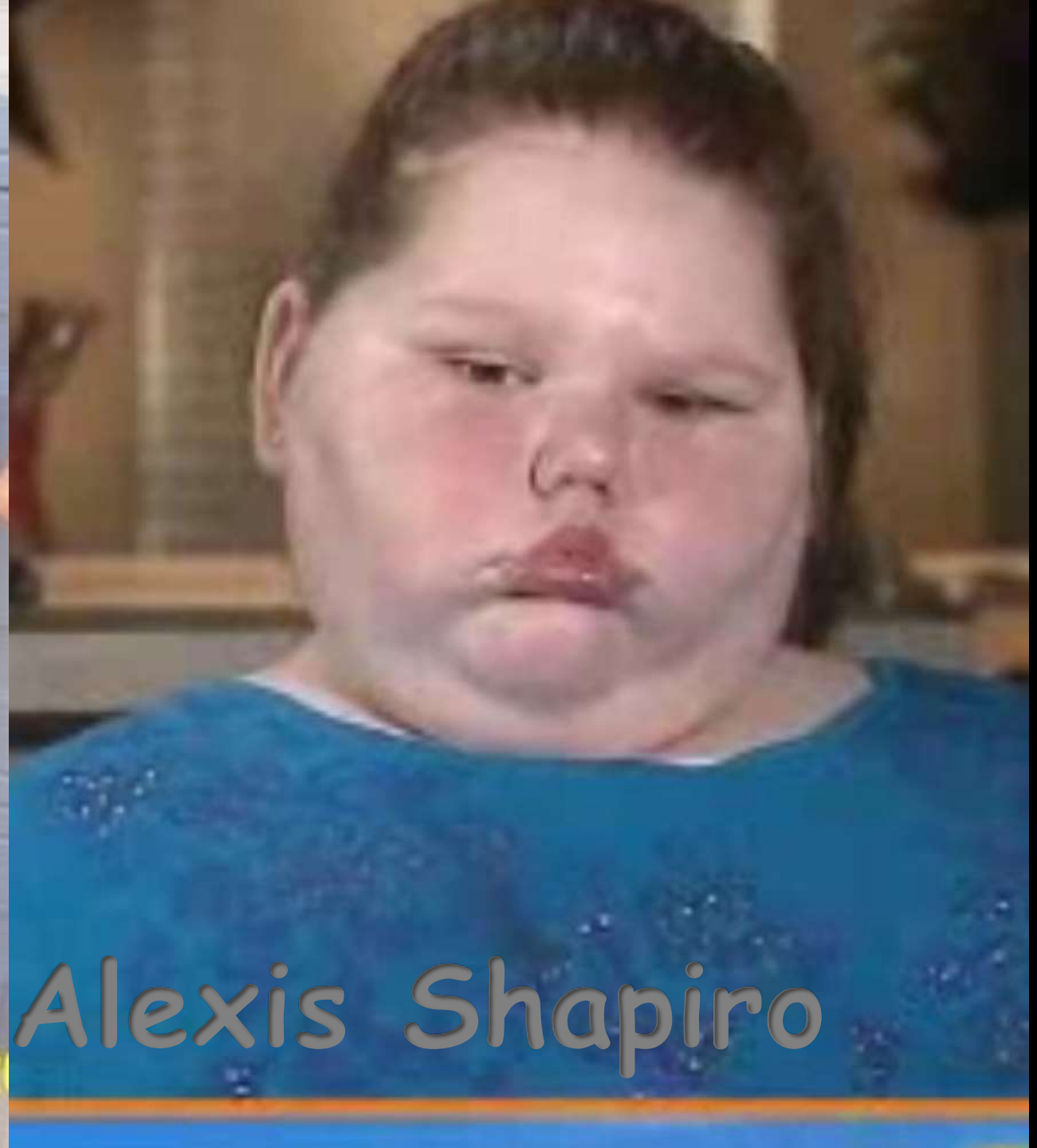
"endorphin/glutamate mediated stop switch"

Old Alcoholics Anonymous Saying…

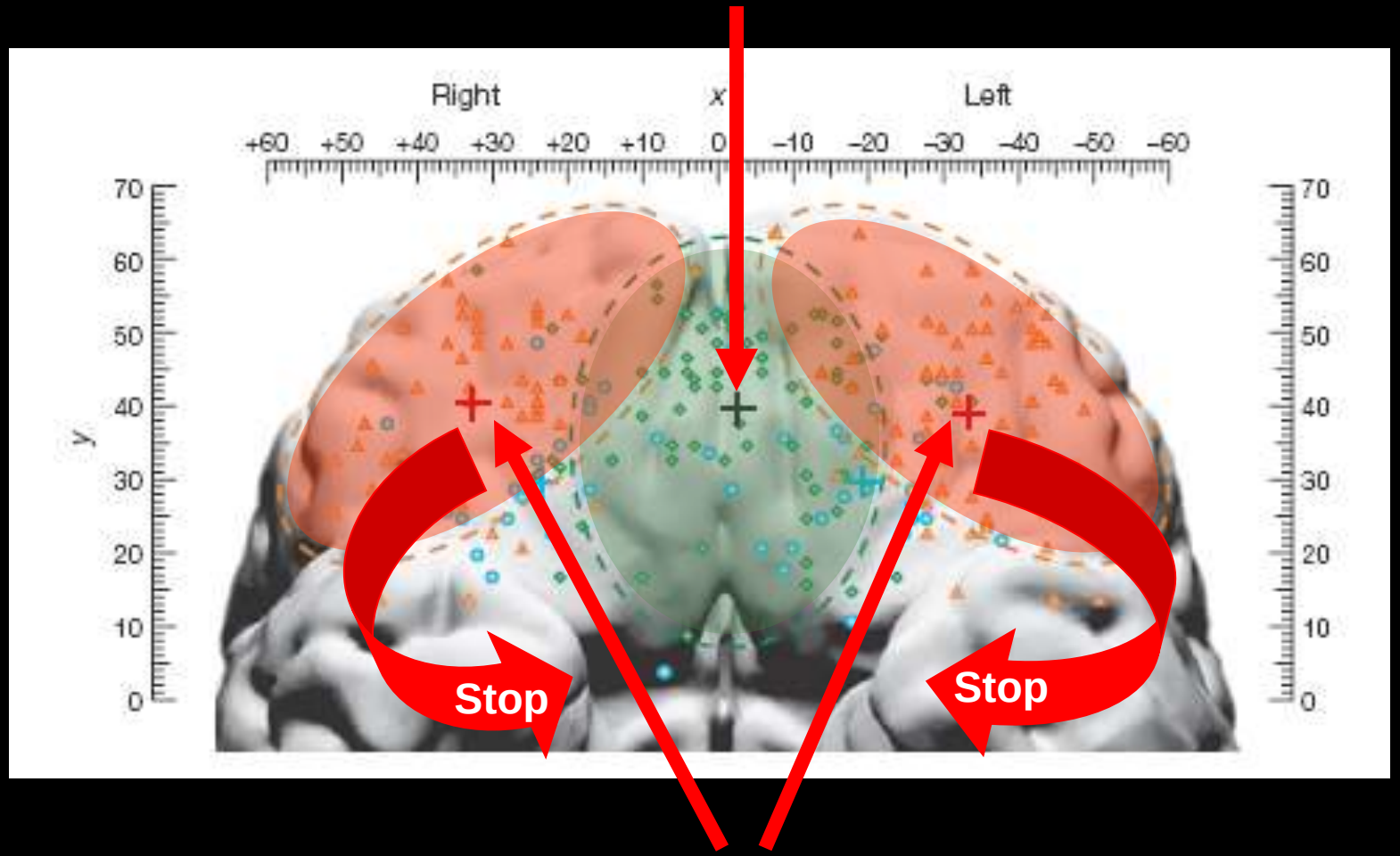
"I don't have a drinking problem … I have a stopping problem!"


Genetically
engineered
to have
low impulse
control


08/26/2


Alexis Shapiro

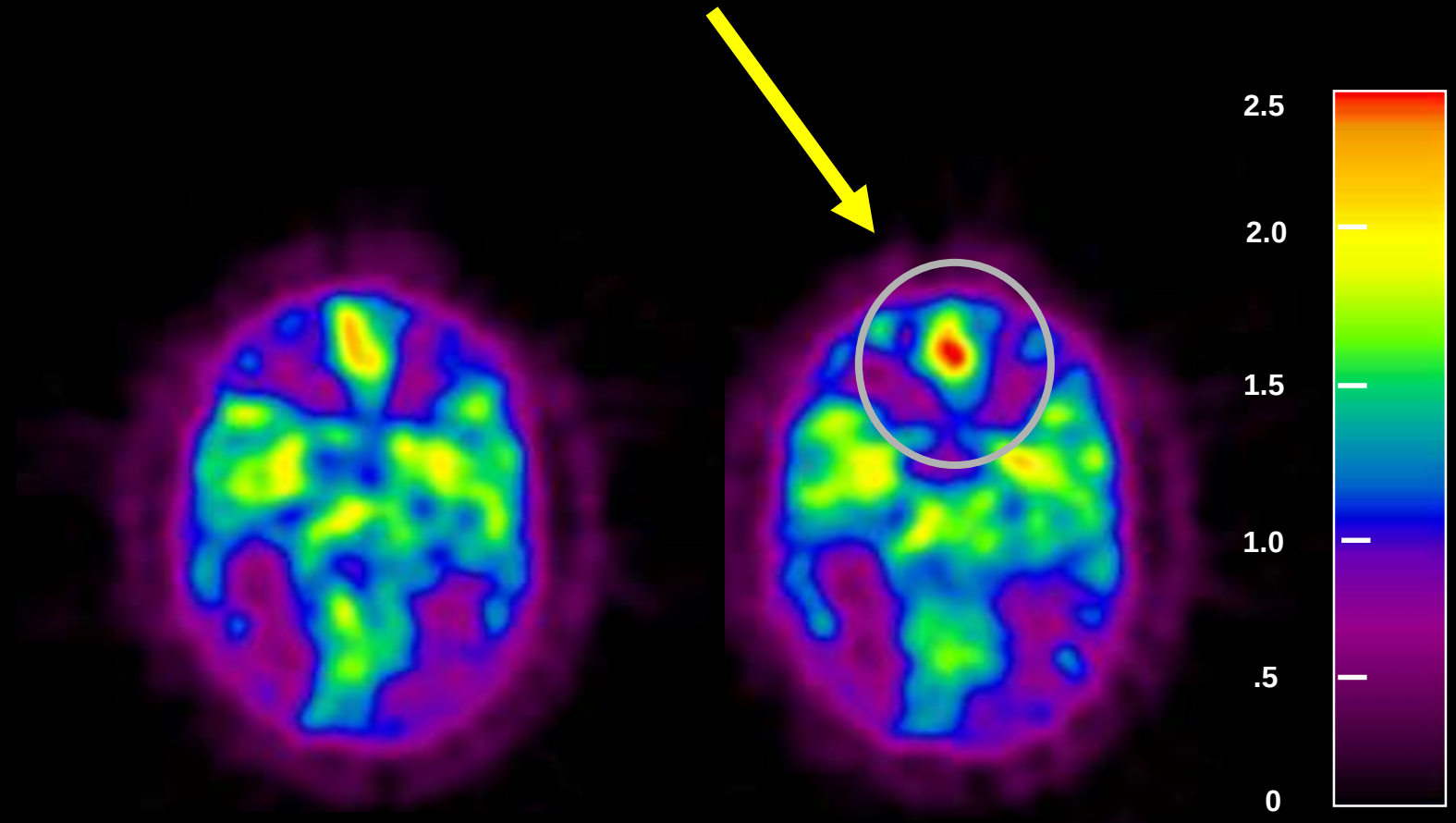
GREEN AREA: Medial OFC evaluates positive reinforcing rewards; food, drugs, sexual orgasms, etc.



ORANGE AREAS: Lateral OFC evaluates negative reinforcers (punishments); being overweight, coming down off drugs, hangovers, sexual regrets, STD's, other consequences, etc.

Meta-analysis of 267 OFC activation exams, Kringelbach, 2004.

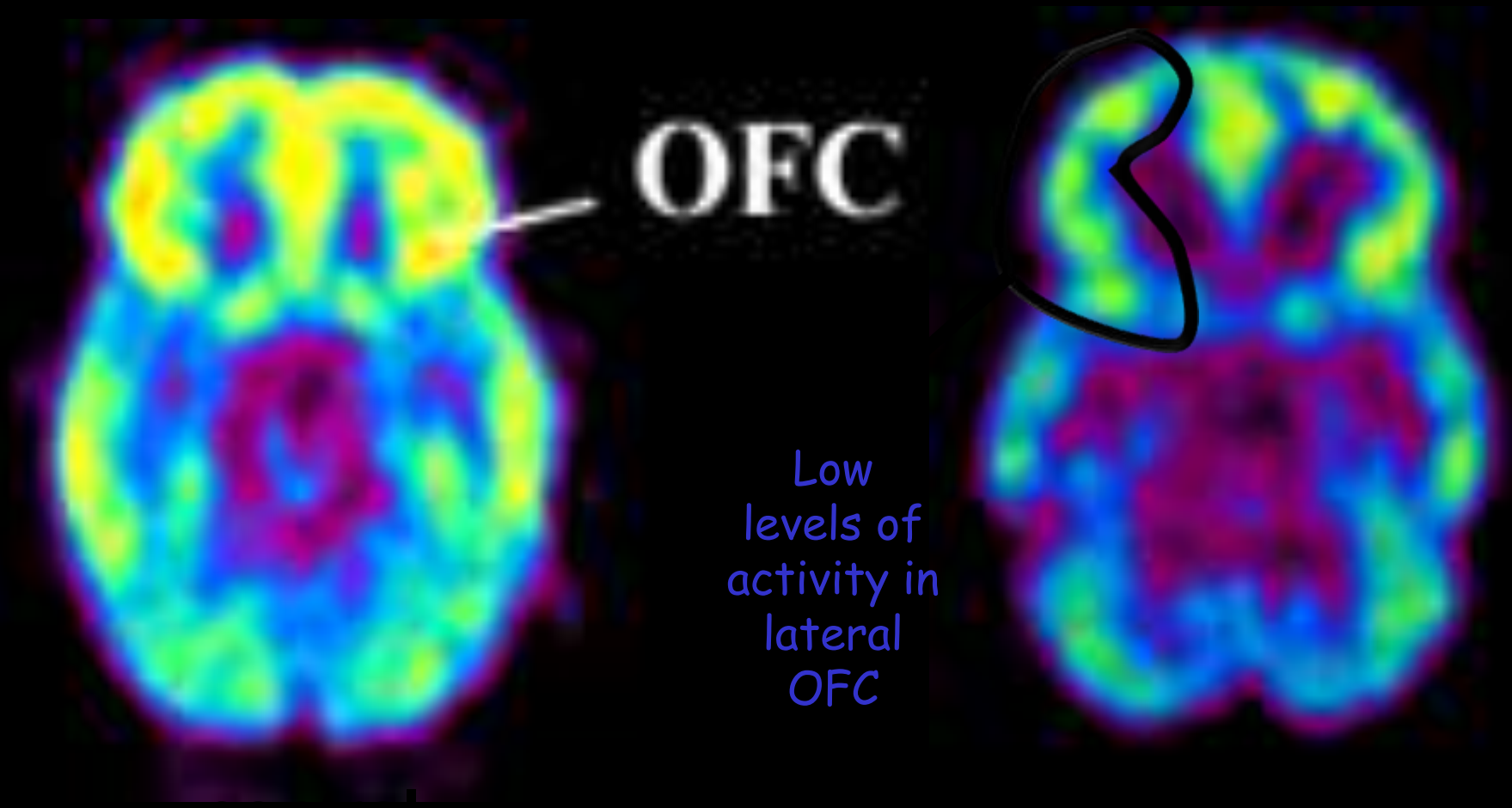
Medial OFC Activation

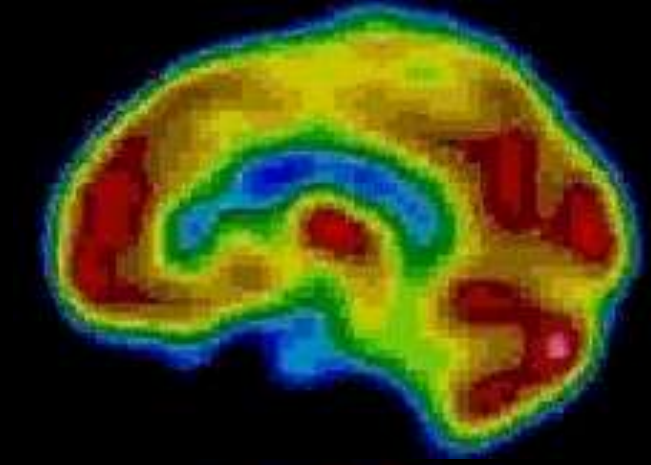


Nature Video

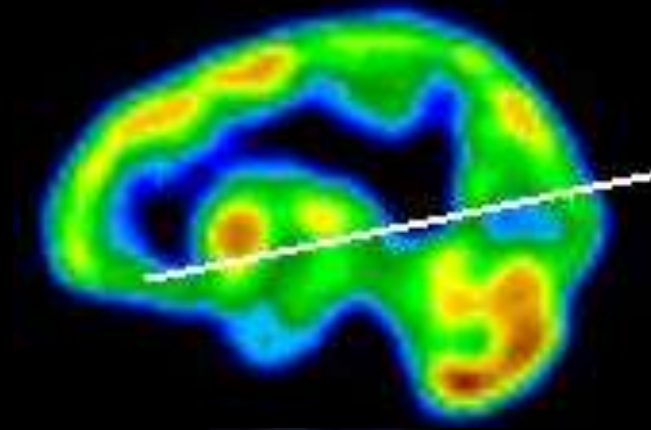
Cocaine Video

Decreases in Metabolism in Orbitofrontal Cortex (OFC)

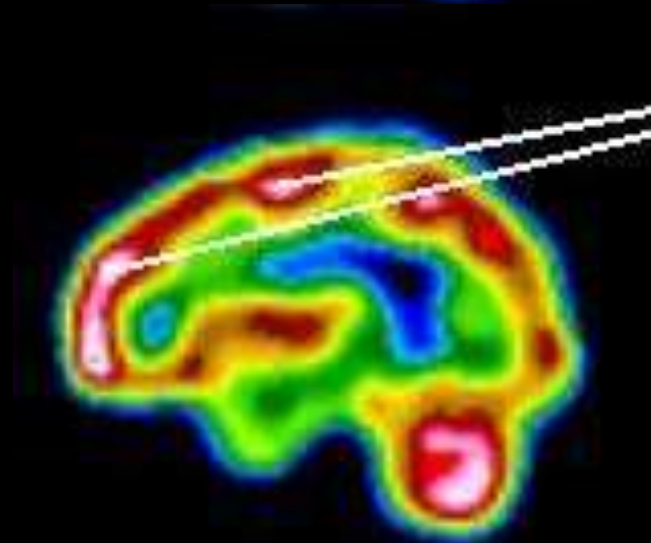




Normal



Frontal - Underactive
Orbital Frontal Cortex
(OFC)



Frontal Overactive

Dr. Robert G. Kohn

Want to learn more about the Orbitofrontal Cortex?

Anna Rose Childress, PhD

Brain scans often find underactive frontal lobe activity in addicts
Discussion: how does the information I just presented fit with what you already know about addiction substance abusing clients/offenders?

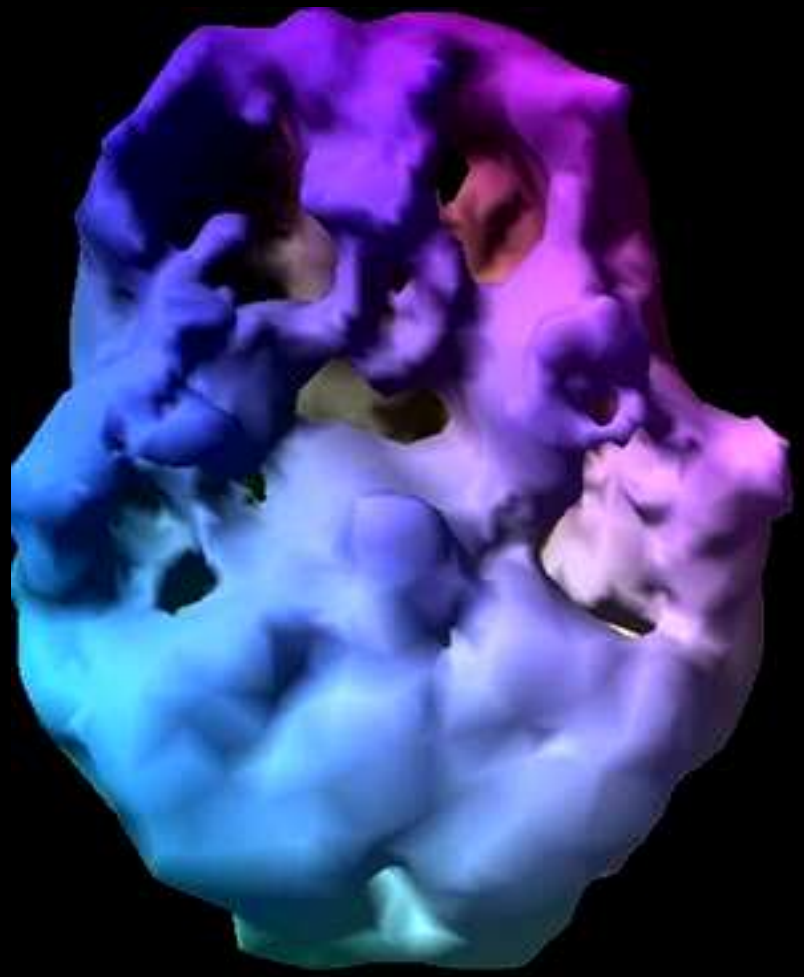
Orbitofrontal Cortex

-*Judgment*

-*Comprehension*

-*Impulse Control*

-*Empathy*



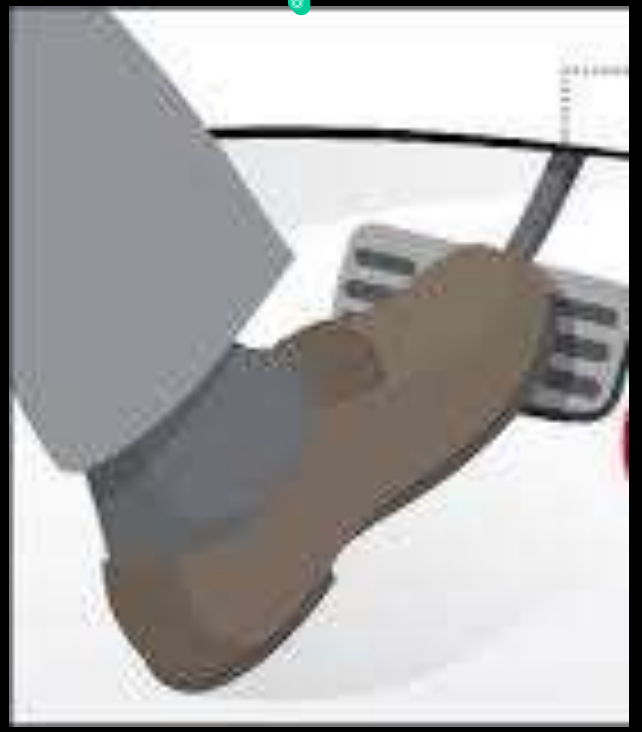
MTP Sx in Diagnostic Assessment

(n=450 daily marijuana users, multi-site)

DIAGNOSTIC CRITERIA	**%+**
Persistent desire or one or more unsuccessful attempts to cut down or control use.	**96%**

Desire to Abuse (emotional)

Desire not to abuse (control problem)



Accelerator Problems

Breaking Problems

PRIOR ATTEMPTS
TO QUIT OR CUT DOWN

=

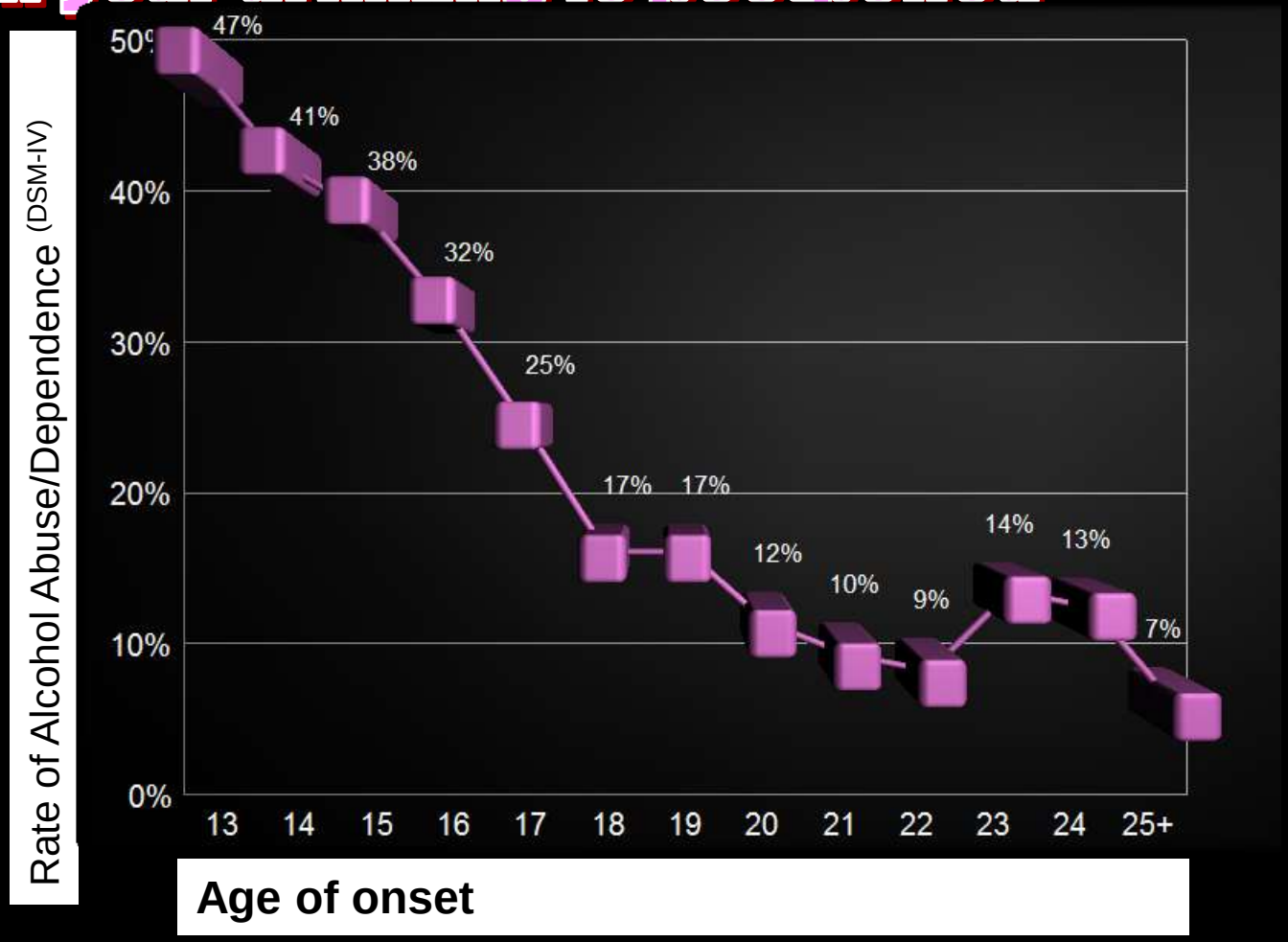
LOSS OF CONTROL
POWERLESSNESS

Risk of Alcohol Abuse/Dependence (DSM-IV) drops each year drinking is postponed

Rate of Alcohol Abuse/ Dependence Diagnosis by Age of Onset:

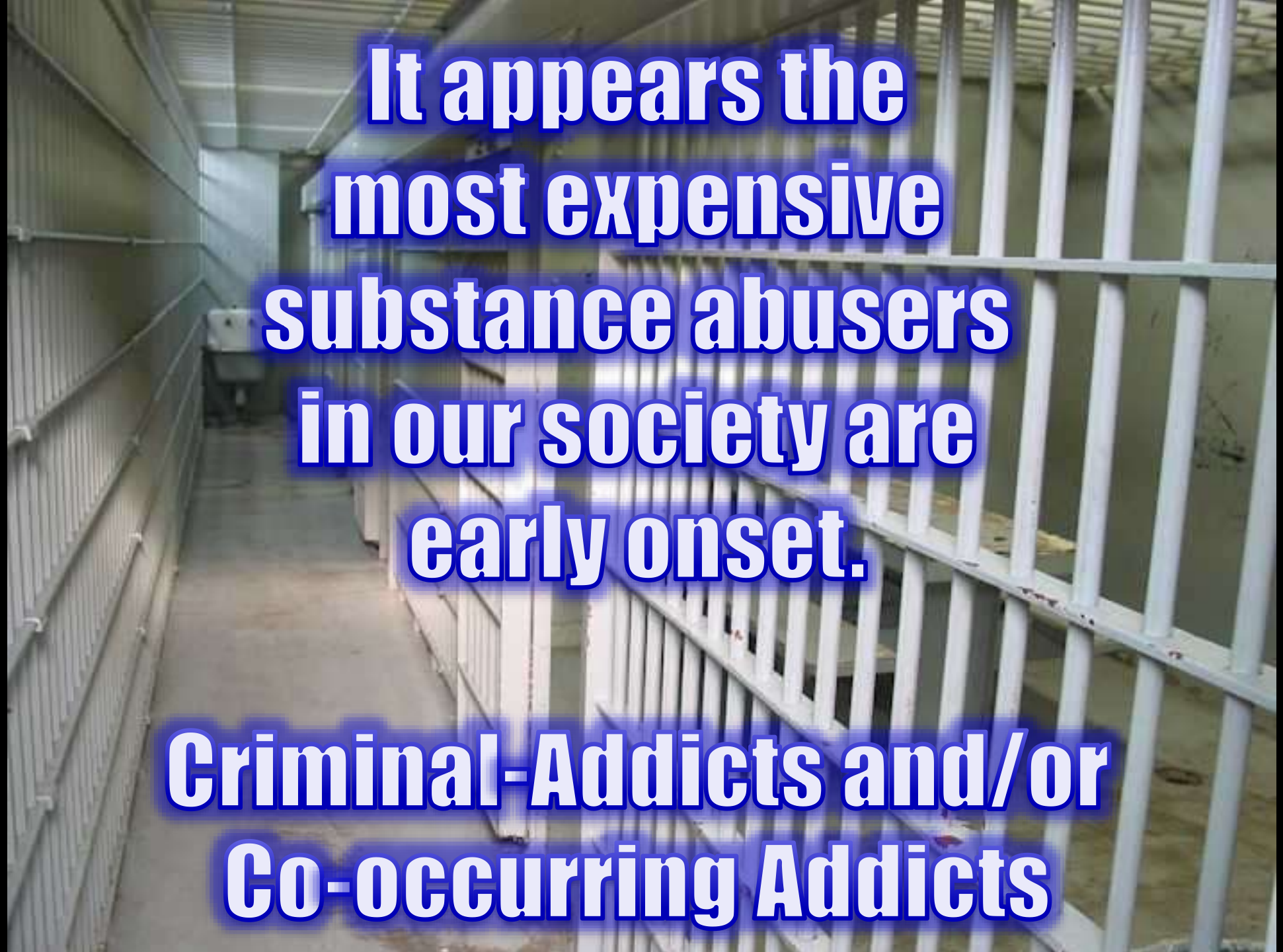
Nearly half of those who started drinking at age 13 were diagnosed

While only 6% of those who began drinking at 25 or older were diagnosed



Why are some people's orbitofrontal cortex's not workin' right?

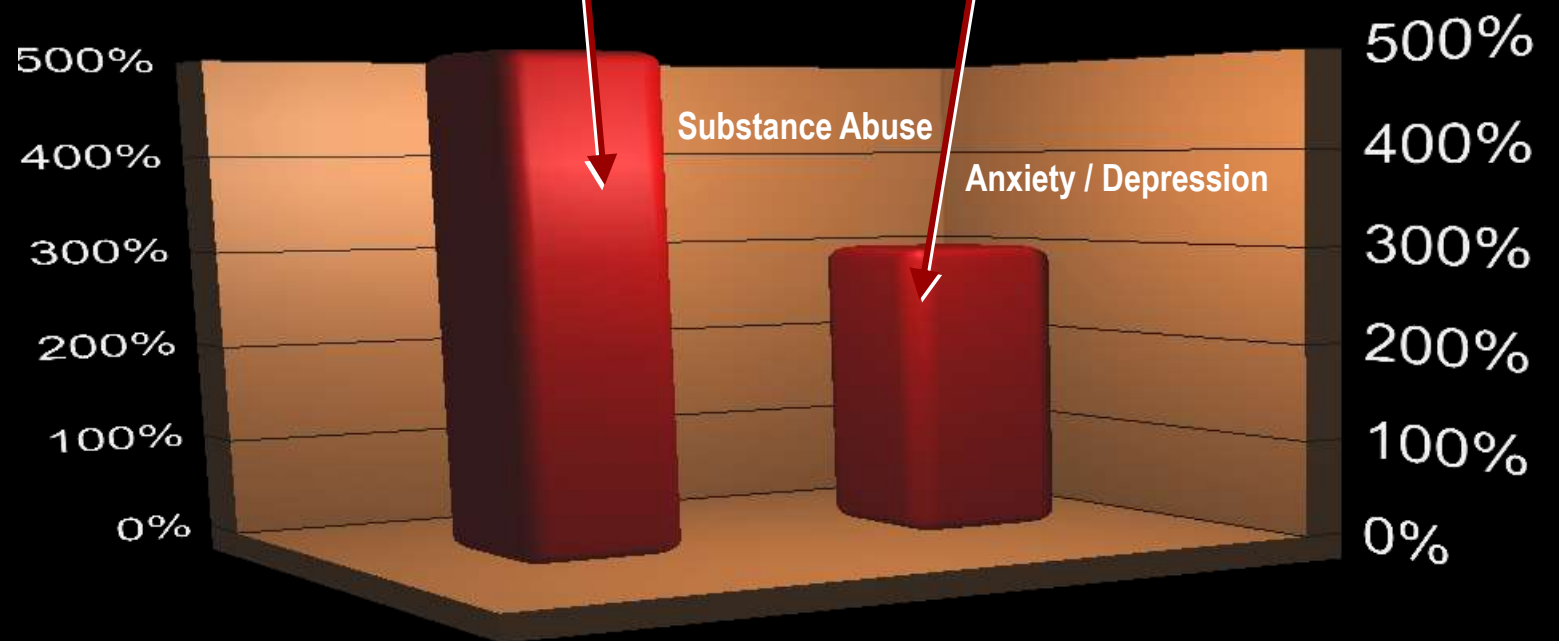

Nora Volkow, M.D.
NIDA Director
FOREIGN PRESS CENTER
WASHINGTON

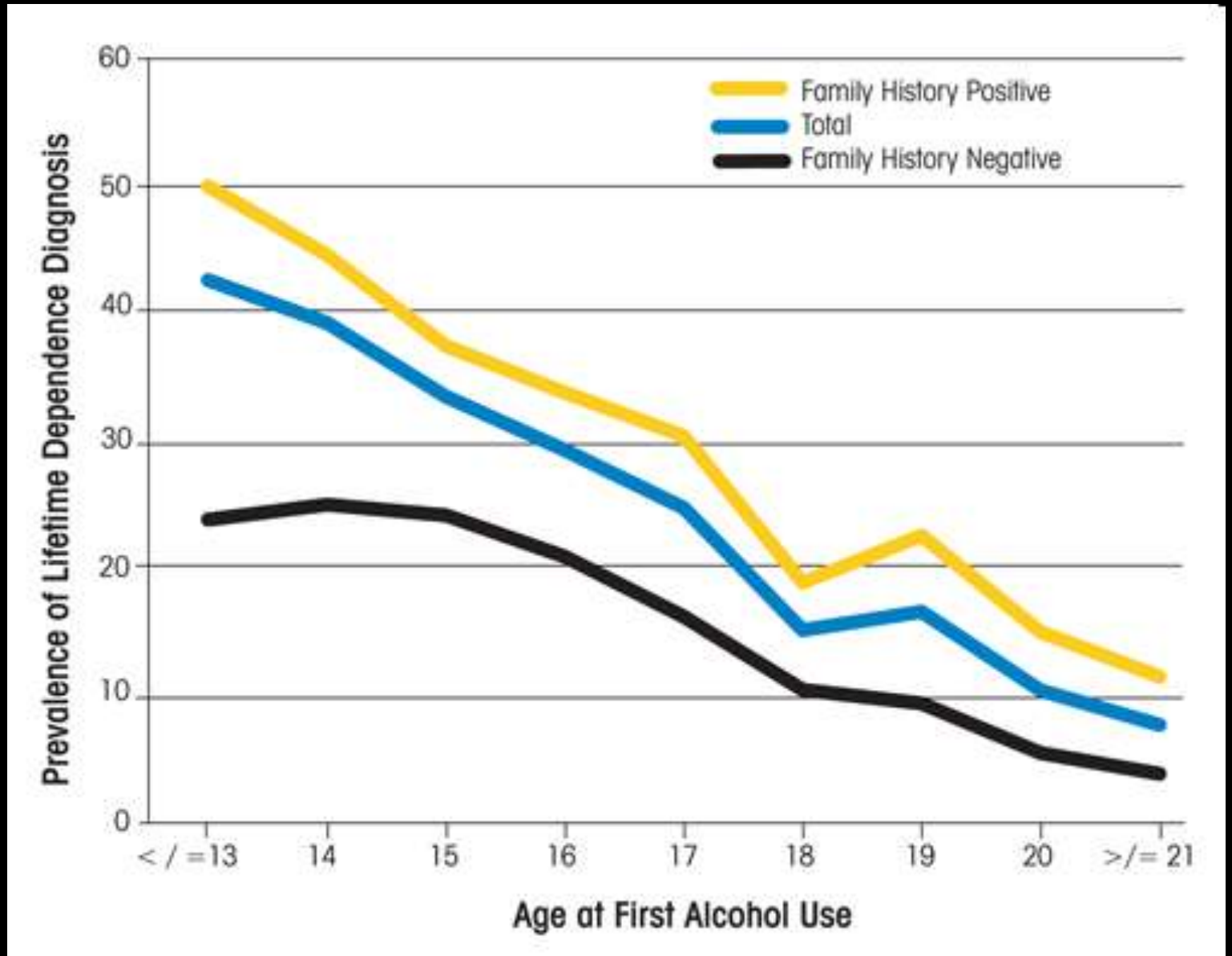

It appears the
most expensive
substance abusers
in our society are
early onset.
Criminal-Addicts and/or
Co-occurring Addicts

Large studies and small identical twin studies

Early onset substance using kids had up to 5 times higher rates of substance abuse/dependence

Up to 3 times higher rates of anxiety and depression

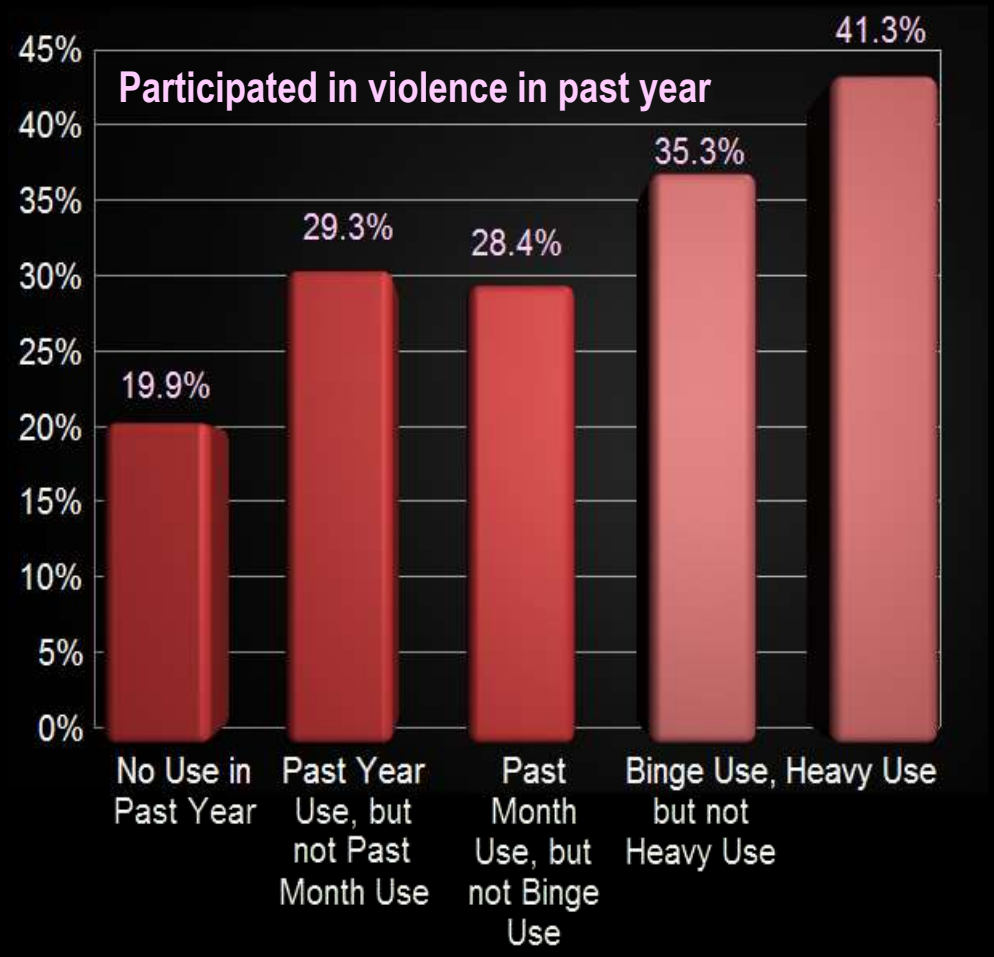



Family History Positive
Total
Family History Negative
Prevalence of Lifetime Dependence Diagnosis
60
50
40
30
20
10
0
< / =13
14
15
16
17
18
19
20
>/= 21
Age at First Alcohol Use

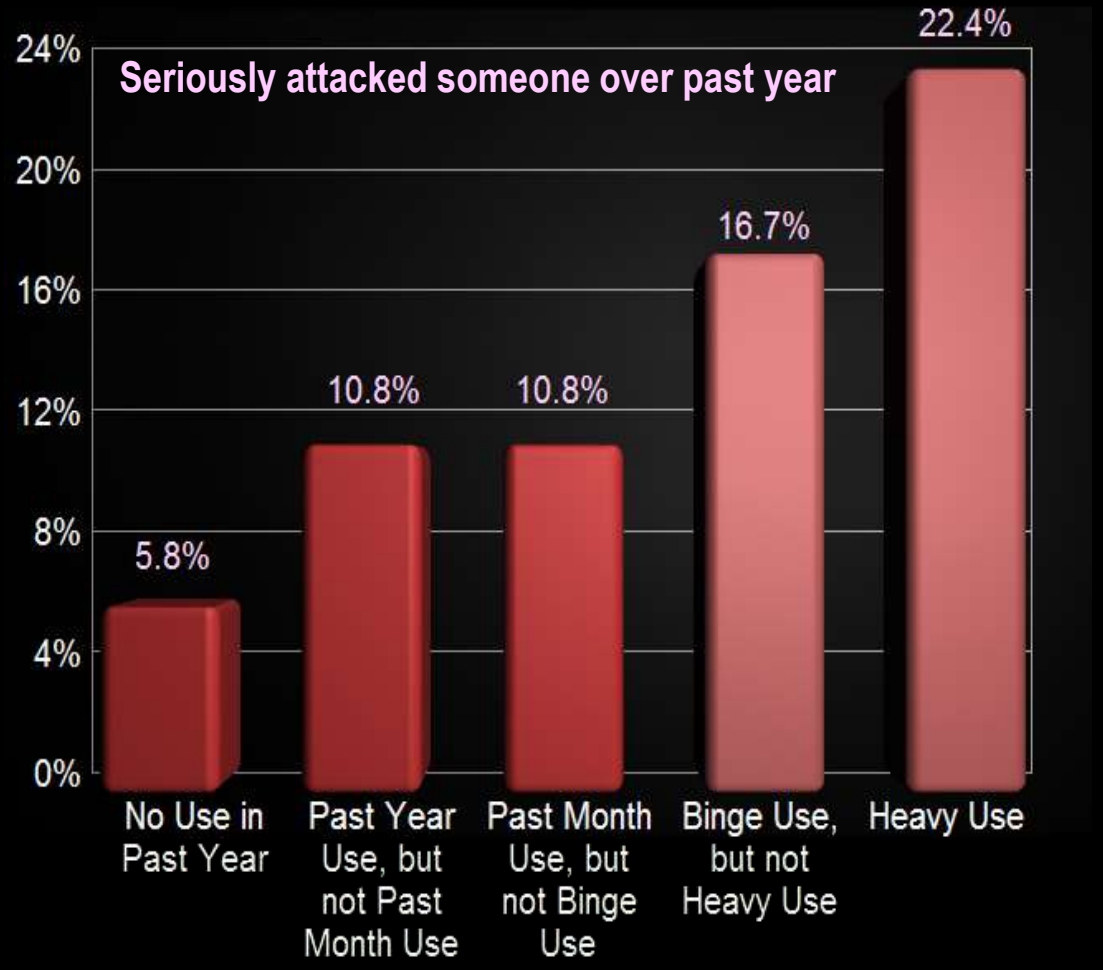
NIAAA Research

- "Our findings show that adolescents and young adults with alcohol-use disorders had a smaller prefrontal cortex and prefrontal cortex white-matter volumes compared with controls," said De Bellis.
- "It may be that the adolescent prefrontal cortex is more vulnerable than the adult brain to the negative effects of drinking," said De Bellis. "Or prefrontal-cortex maturation may be impeded by the neurotoxic effects of substances on the adolescent brain.

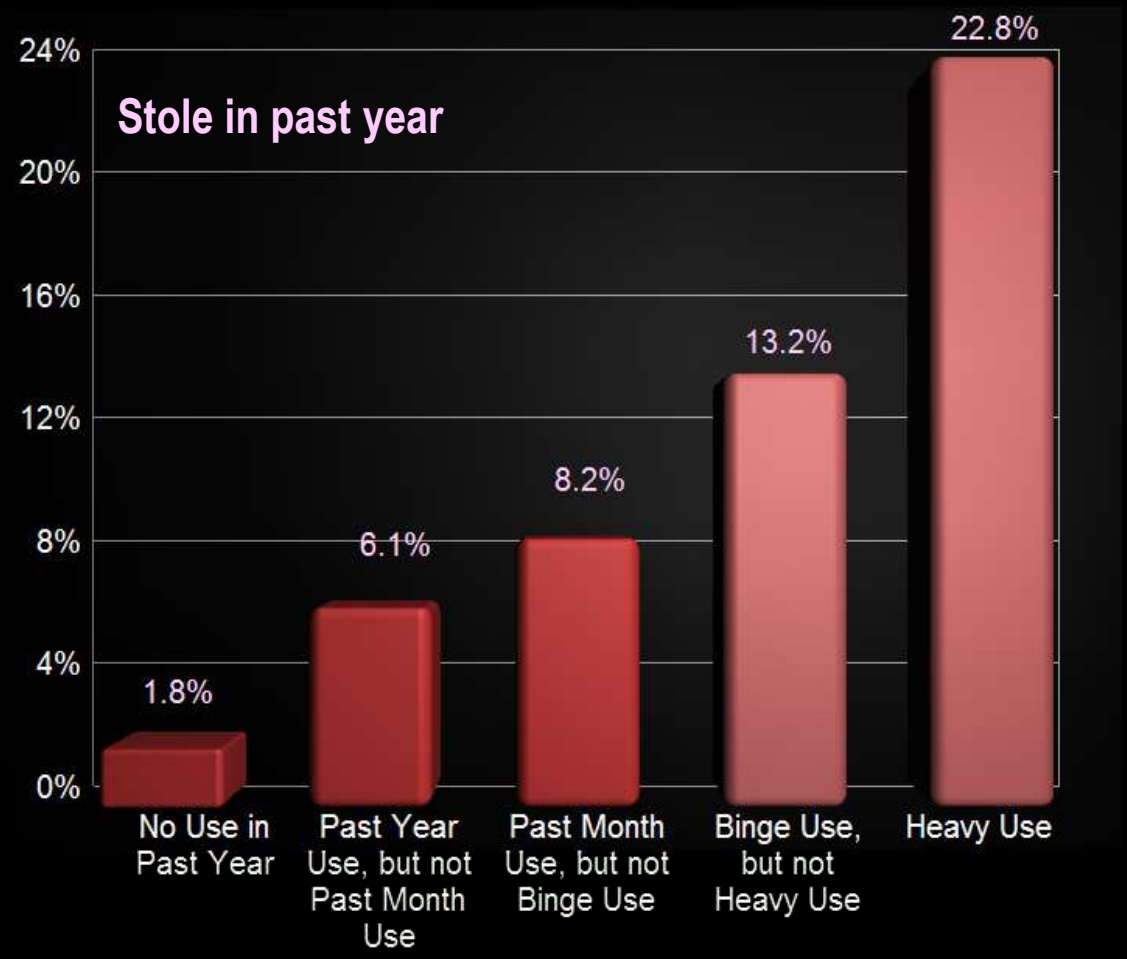
Heavy Alcohol using 12-17 year olds are twice as likely to participate in violence than kids who don't drink



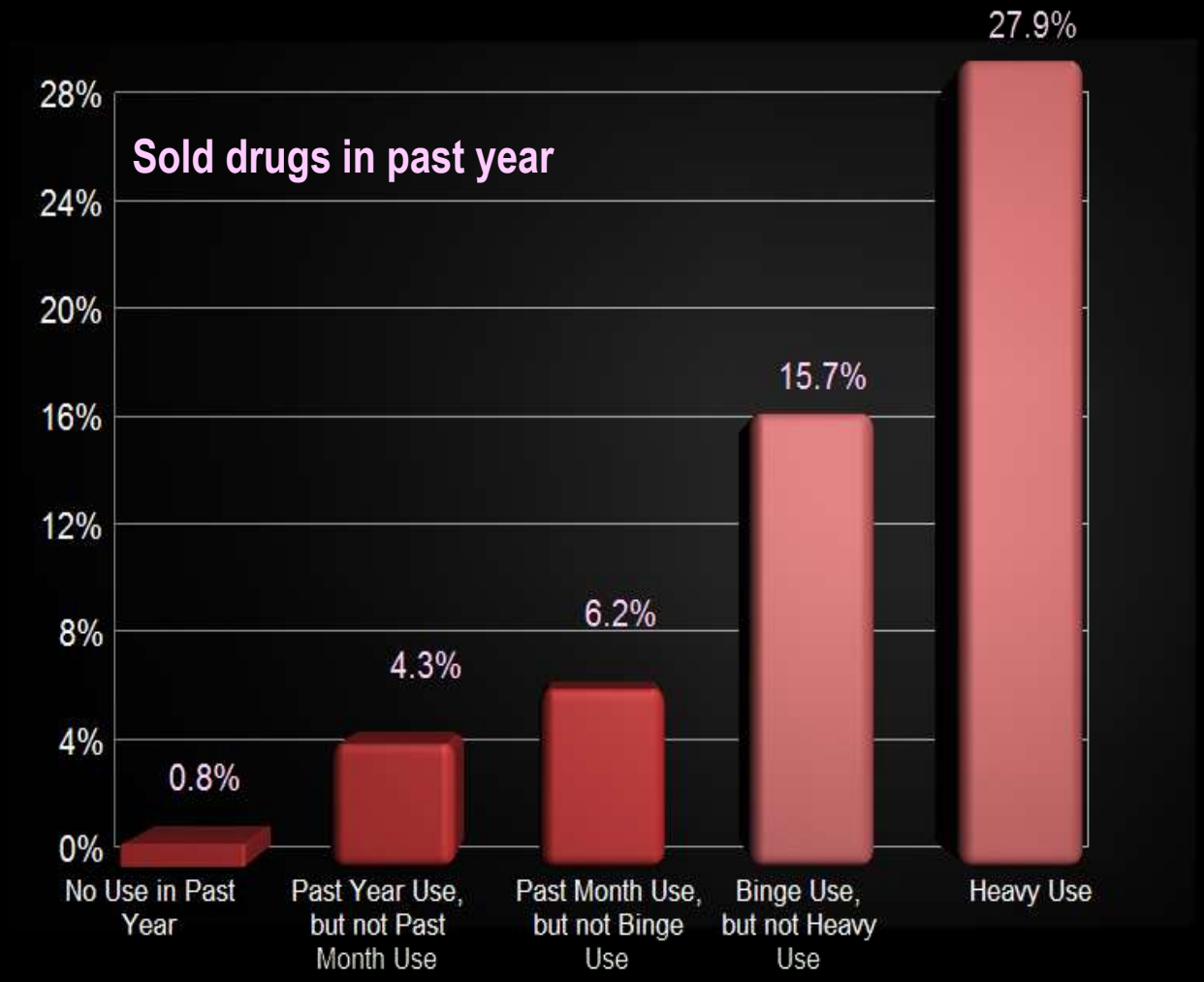
Heavy alcohol using 12-17 year olds are four times more likely to seriously attack others than kids who don't drink



Heavy alcohol using 12-17 year olds are 12 times more likely to steal than kids who don't drink



Heavy alcohol using 12-17 year olds are 34 times more likely to sell drugs than kids who don't drink



Heavy alcohol using 12-17 year olds are 5 times more likely to carry a handgun than kids who don't drink

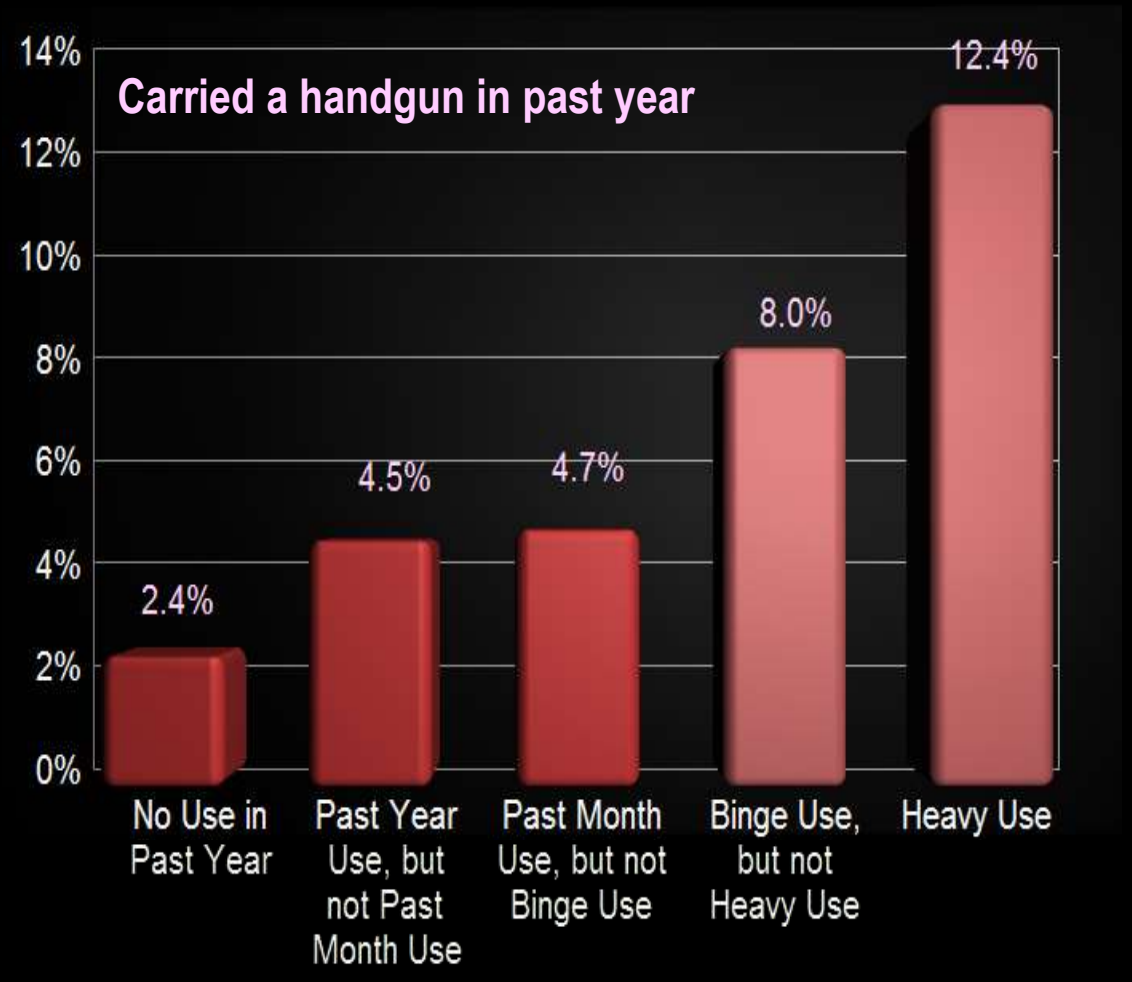
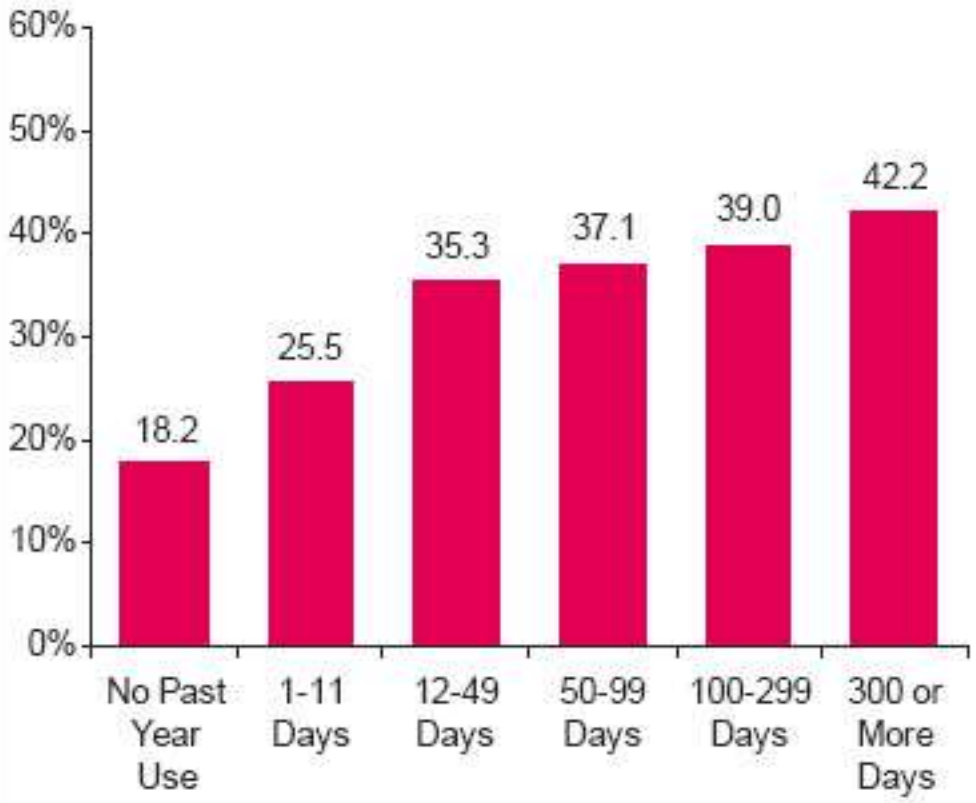
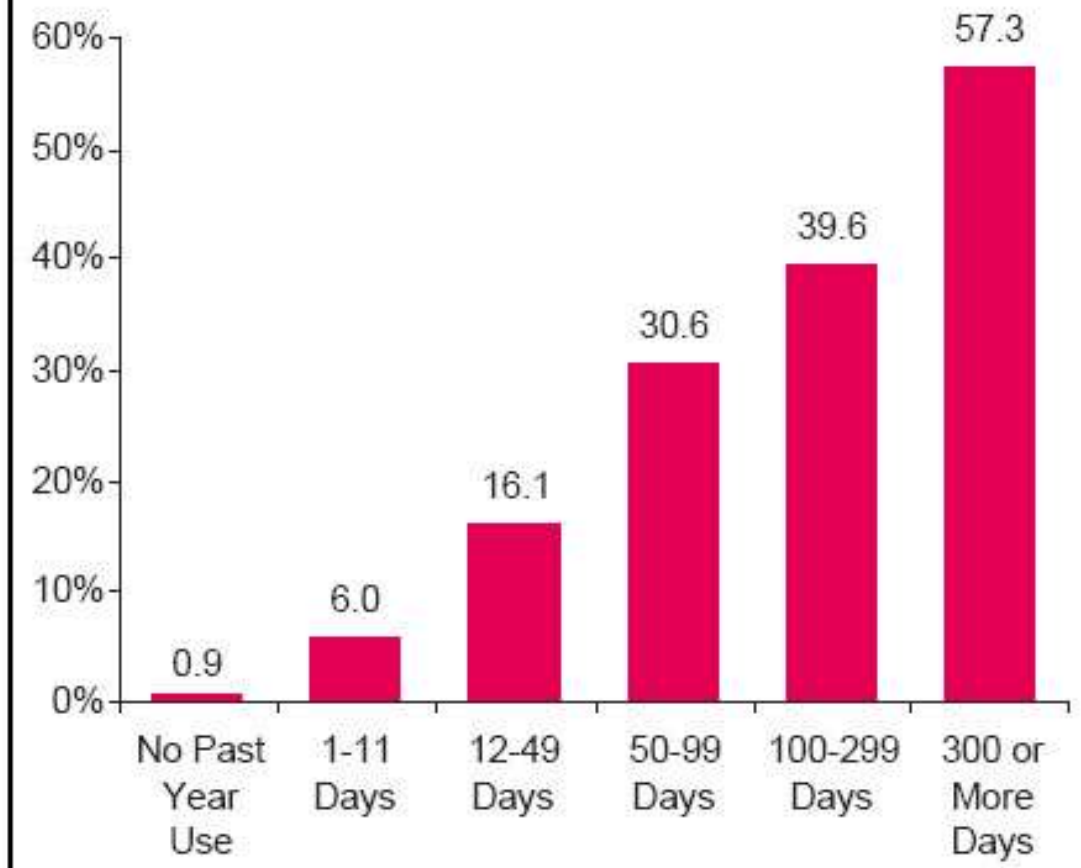


Figure 2. Percentages of Youths Aged 12 to 17 Who Took Part in Serious Fighting at School or Work in the Past Year, by Frequency of Past Year Marijuana Use: 2002



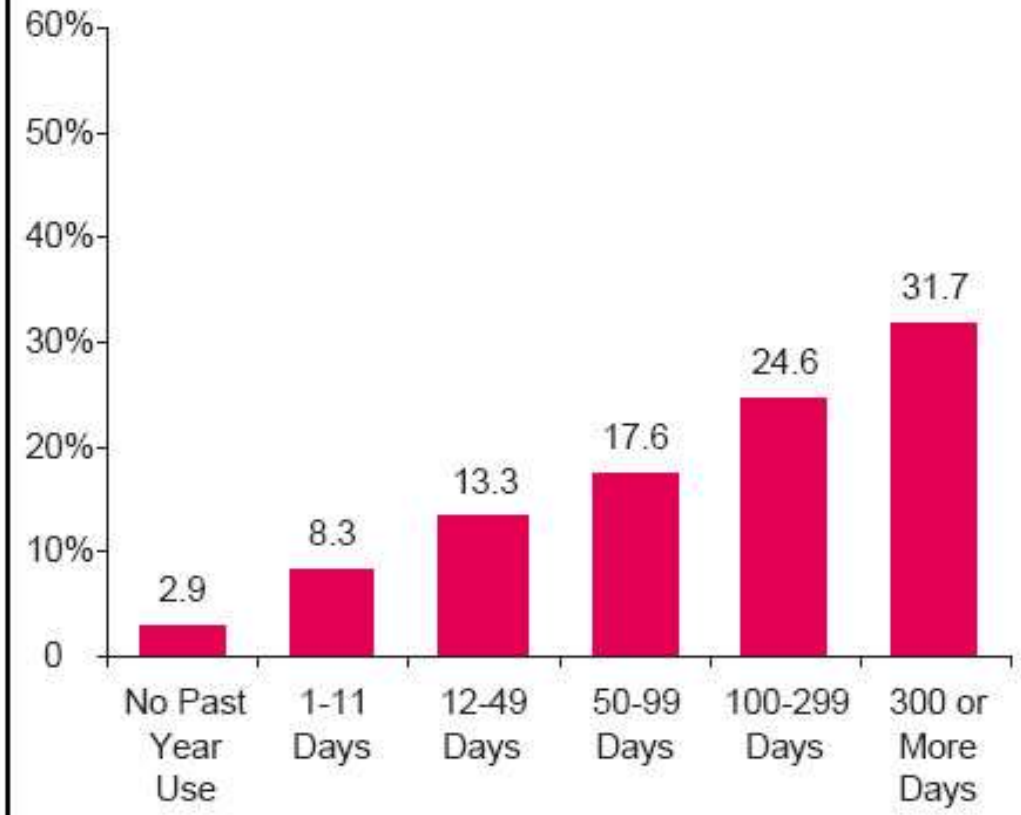
2.3 times more likely to be in a serious fight

Figure 3. Percentages of Youths Aged 12 to 17 Who Sold Illegal Drugs in the Past Year, by Frequency of Past Year Marijuana Use: 2002



63 times more likely to sell drugs

Figure 4. Percentages of Youths Aged 12 to 17 Who Stole or Tried to Steal Anything Worth More Than $50 in the Past Year, by Frequency of Past Year Marijuana Use: 2002



11 times more likely to steal

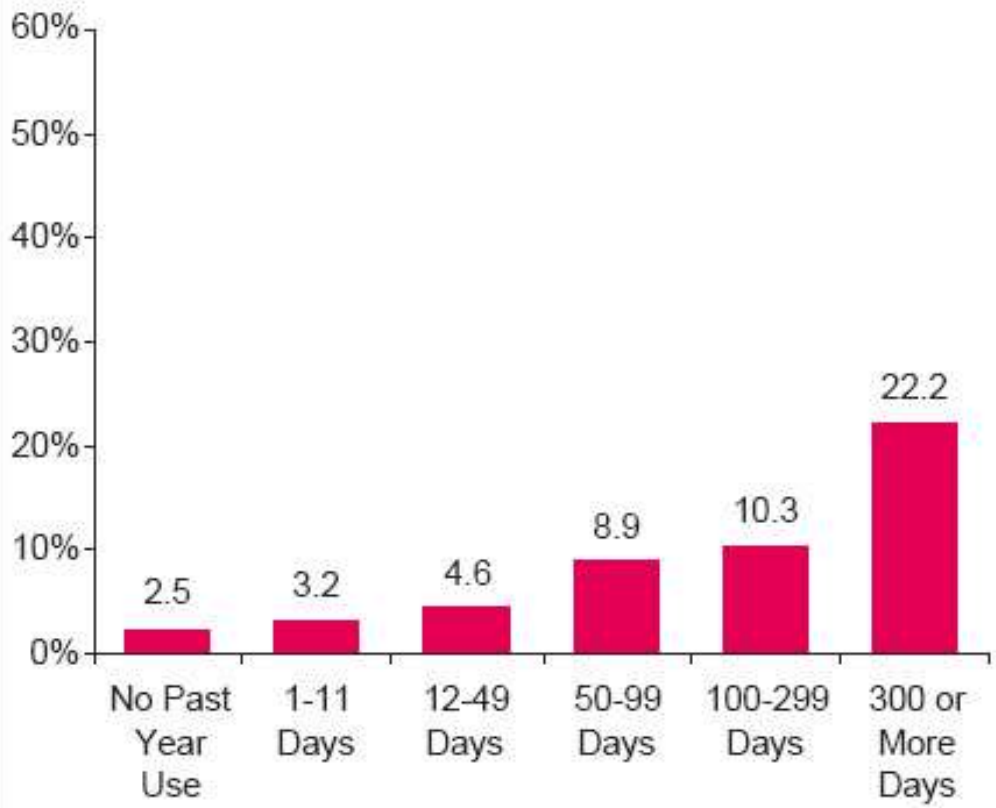
Figure 5. Percentages of Youths Aged 12 to 17 Who Attacked Someone With the Intent to Seriously Hurt Them in the Past Year, by Frequency of Past Year Marijuana Use: 2002

5.5 times more likely to attack with intent to harm

Figure 6. Percentages of Youths Aged 12 to 17 Who Took Part in a Group-Against-Group Fight in the Past Year, by Frequency of Past Year Marijuana Use: 2002

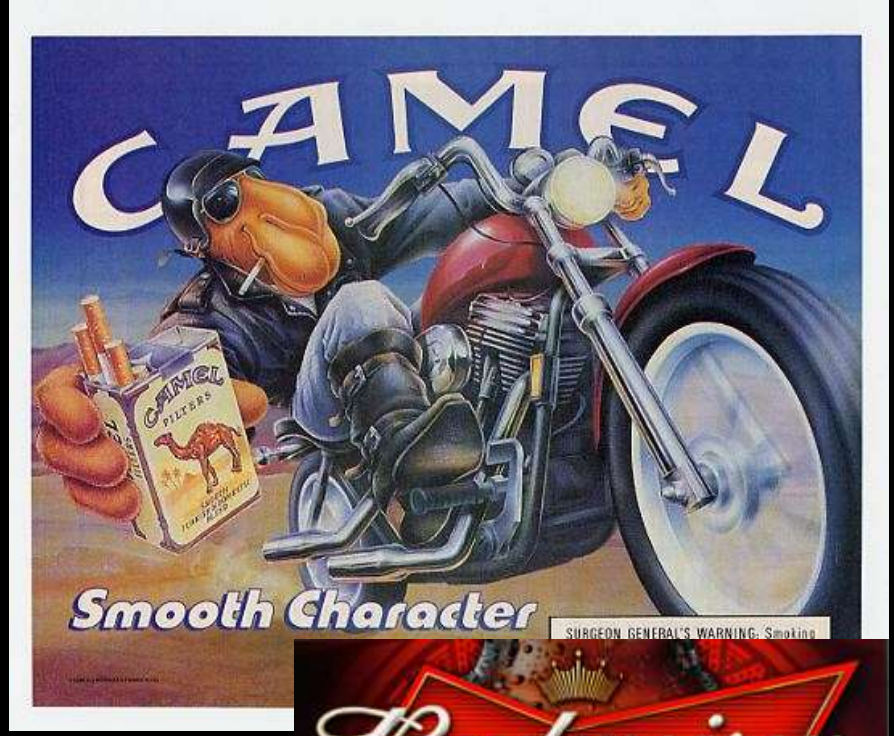
3 times more likely to participate in group violence

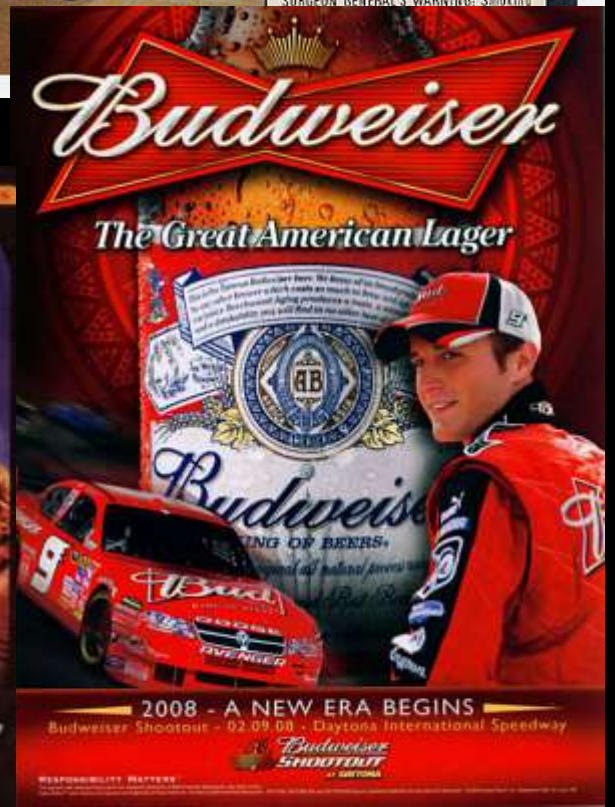
Figure 7. Percentages of Youths Aged 12 to 17 Who Carried a Handgun in the Past Year, by Frequency of Past Year Marijuana Use: 2002

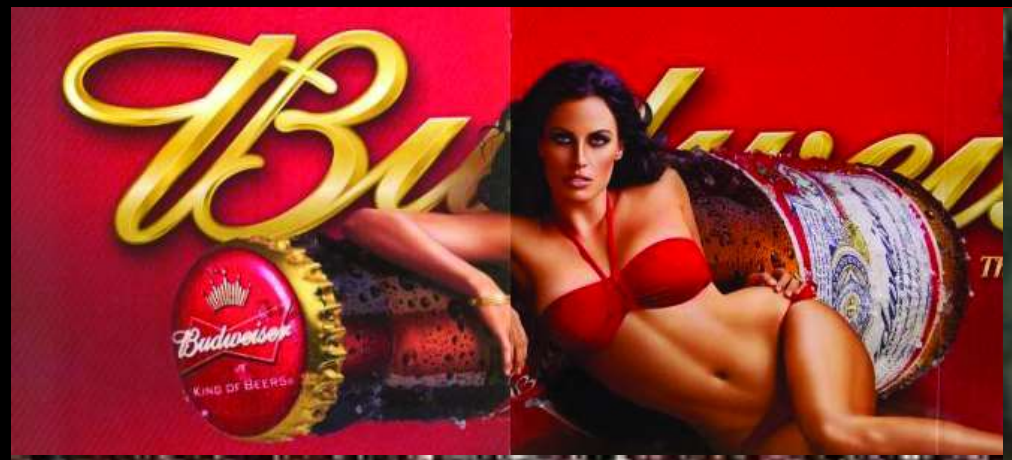


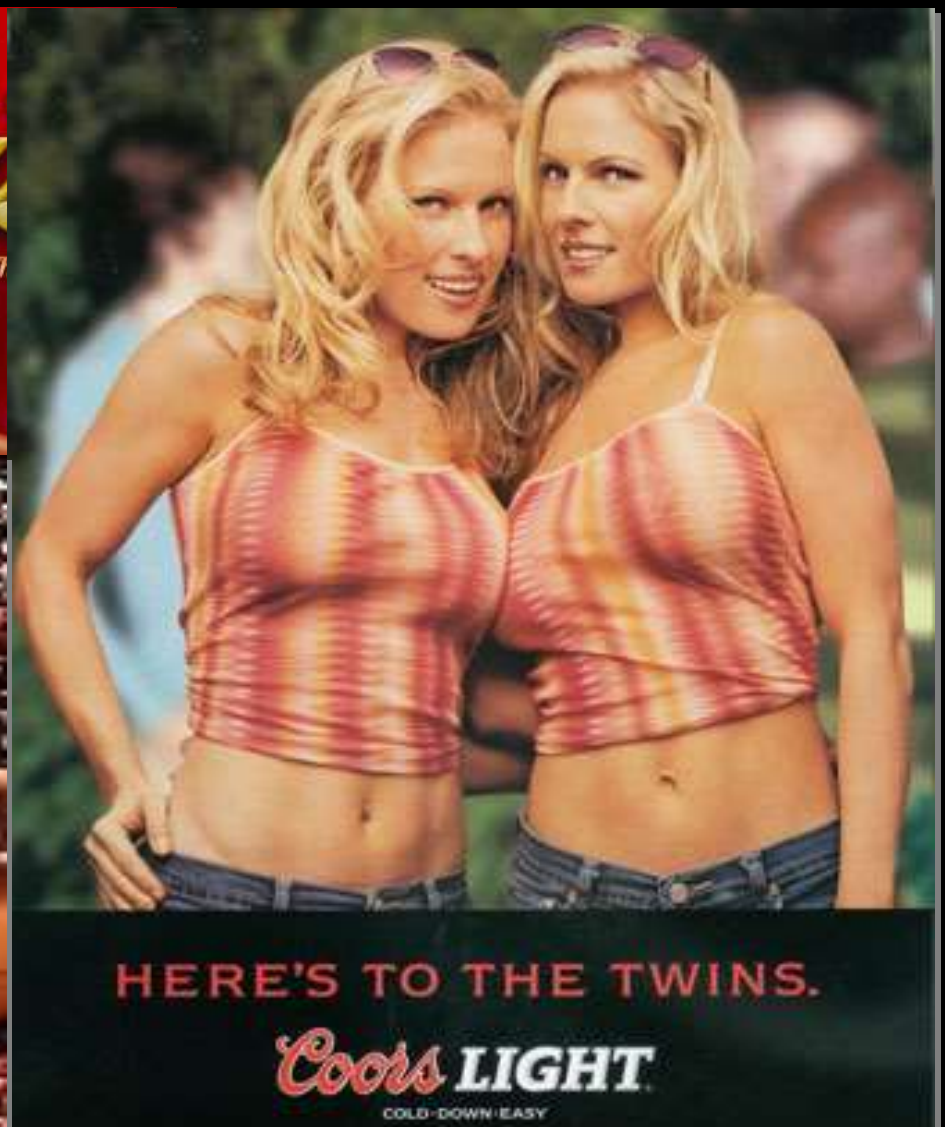
8.8 times more likely to carry a handgun

Alcohol & Tobacco companies target kids 13 and younger because they know about this research too

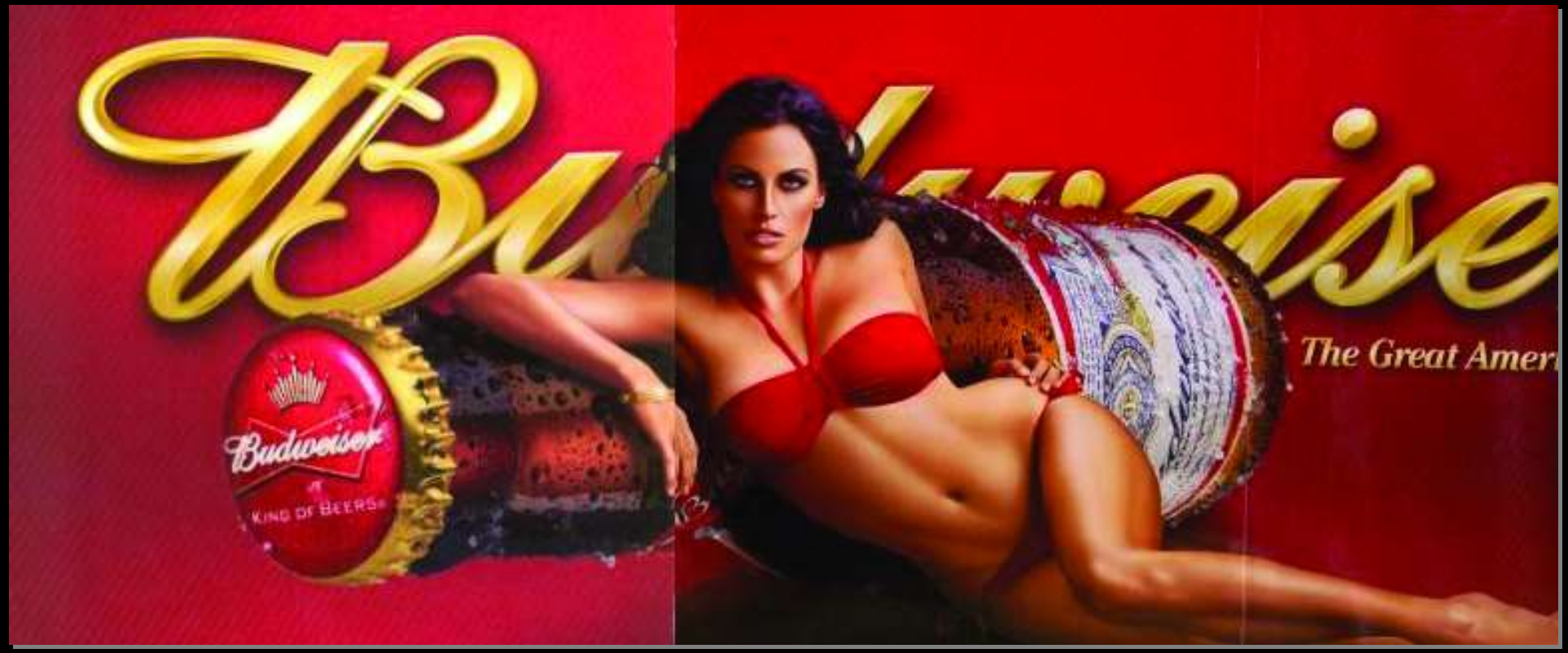





Budweiser
KING OF BEERS


HERE'S TO THE TWINS.
Coors LIGHT
COLD·DOWN·EASY

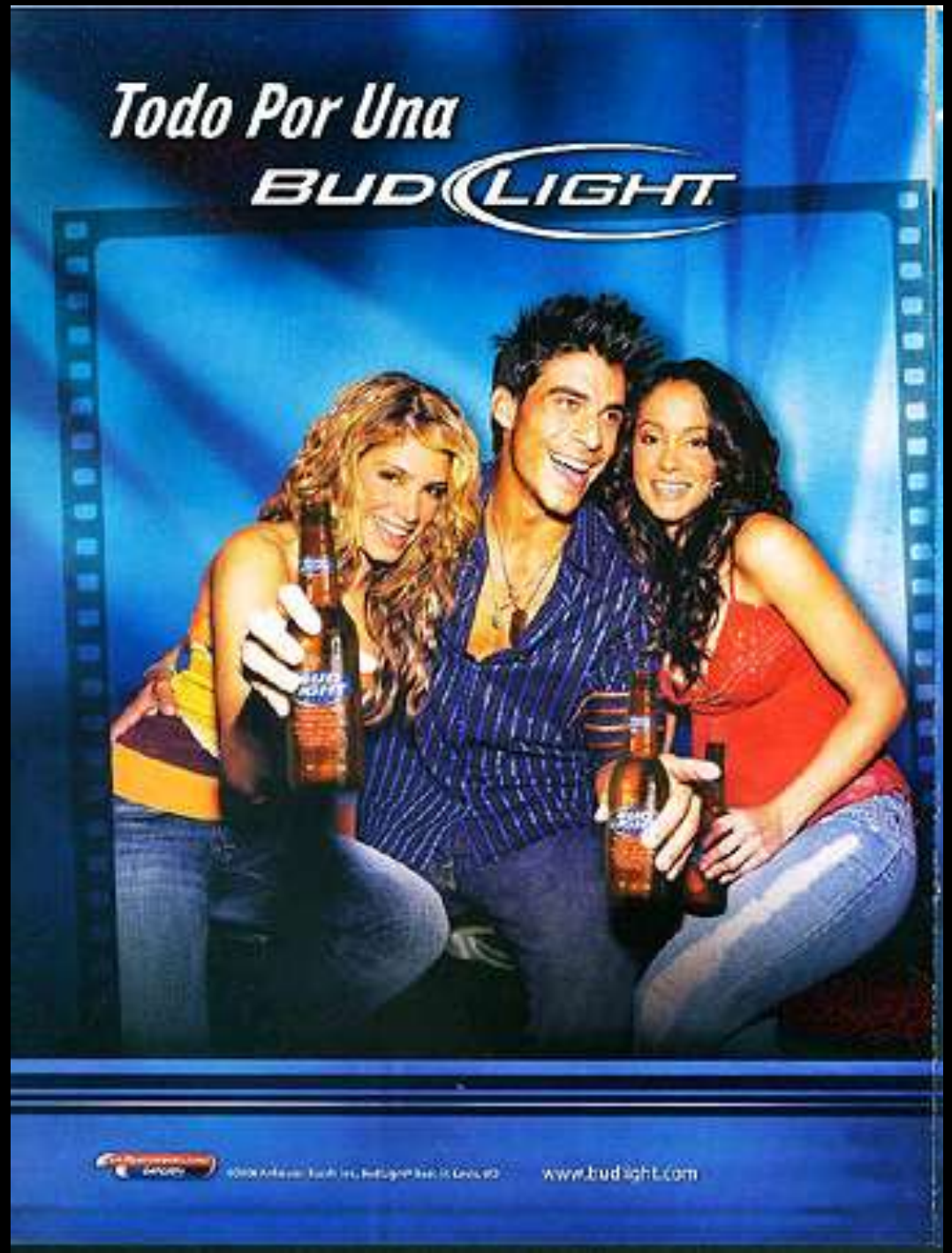
For decades the alcohol industry has objectified women to target young male drinkers

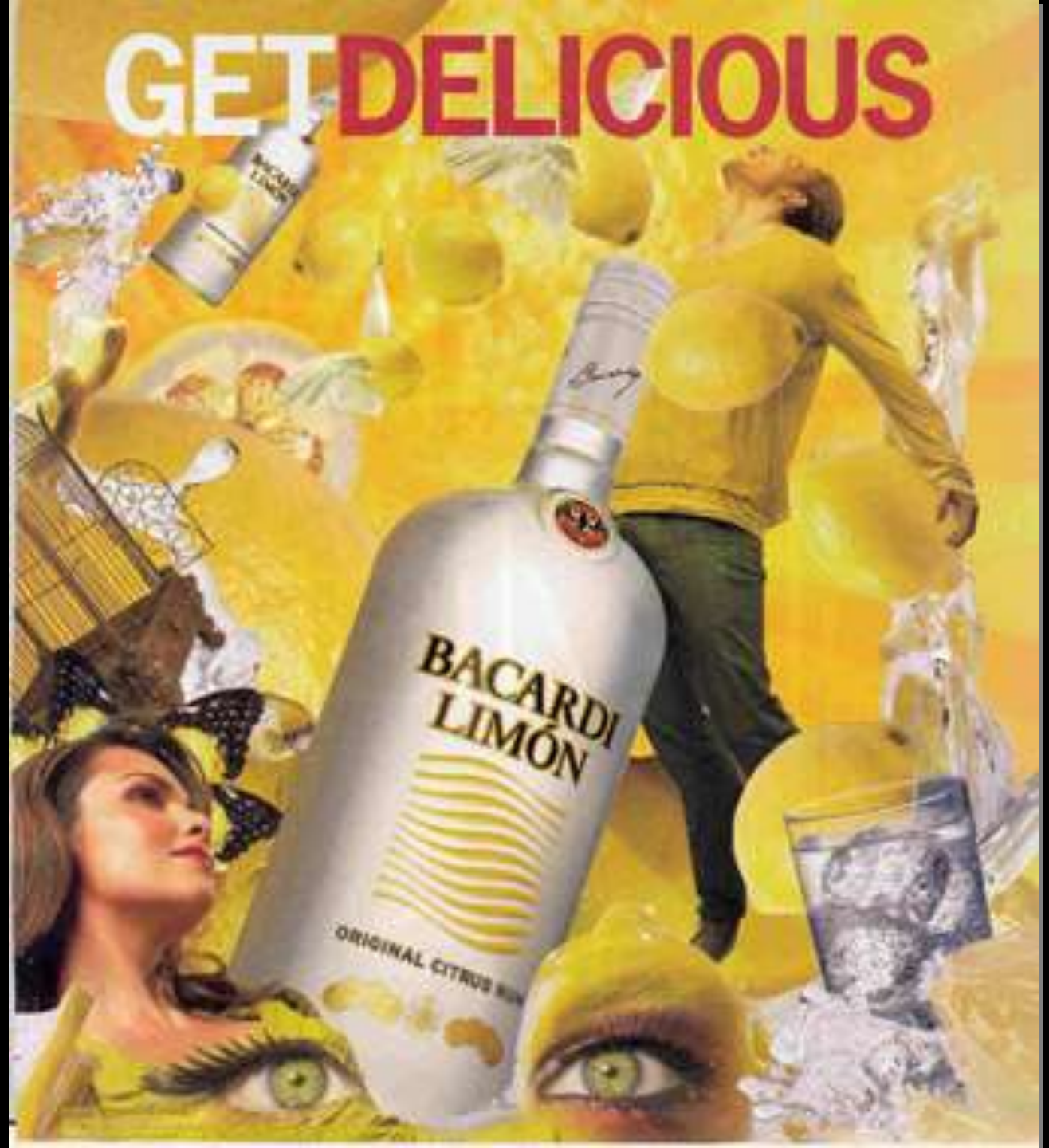


In recent years, they've presented ads suggestive of "multiple partners"

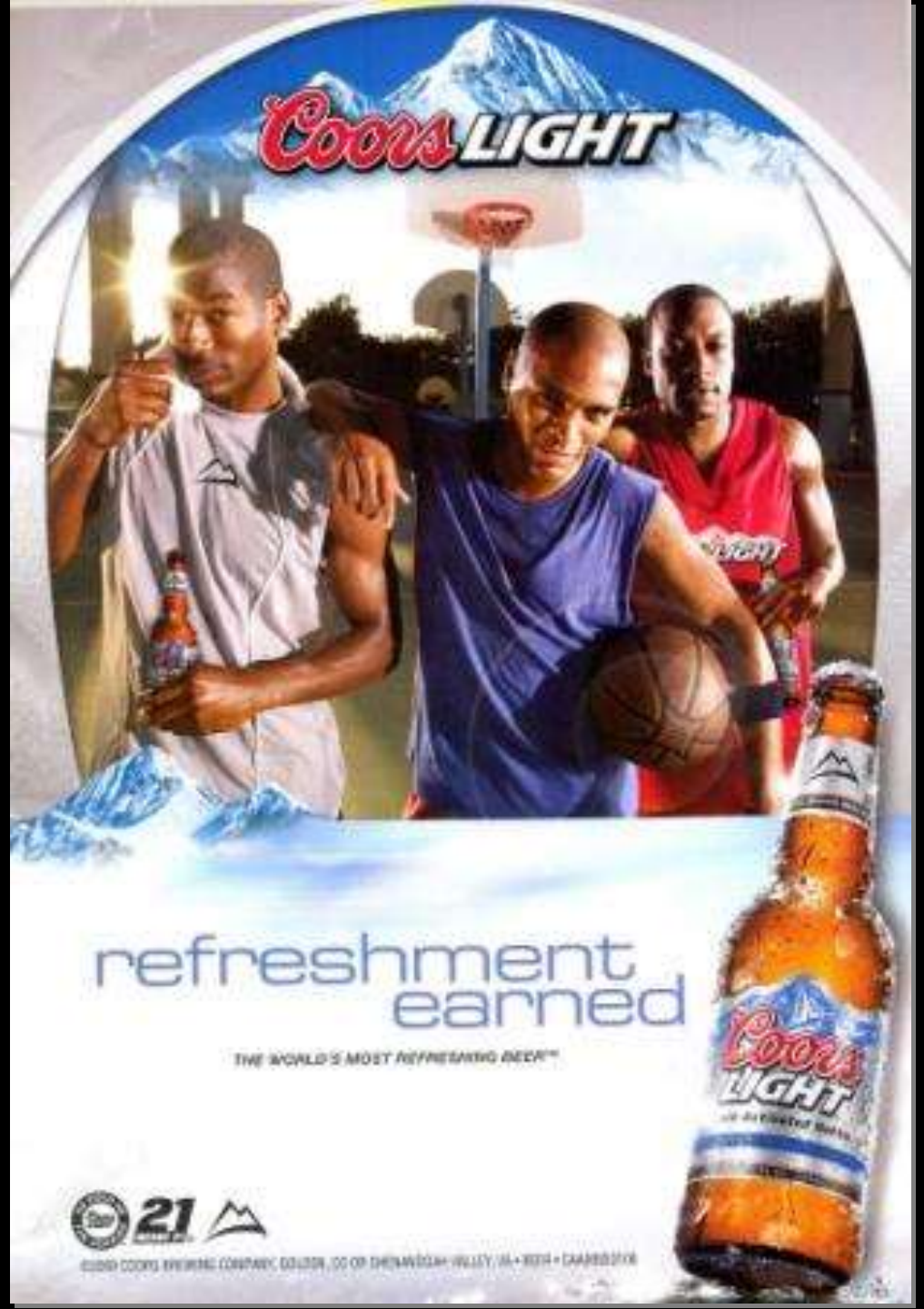
"BL" is obscured and looks more like "BI"

Todo Por Una
“All for one”





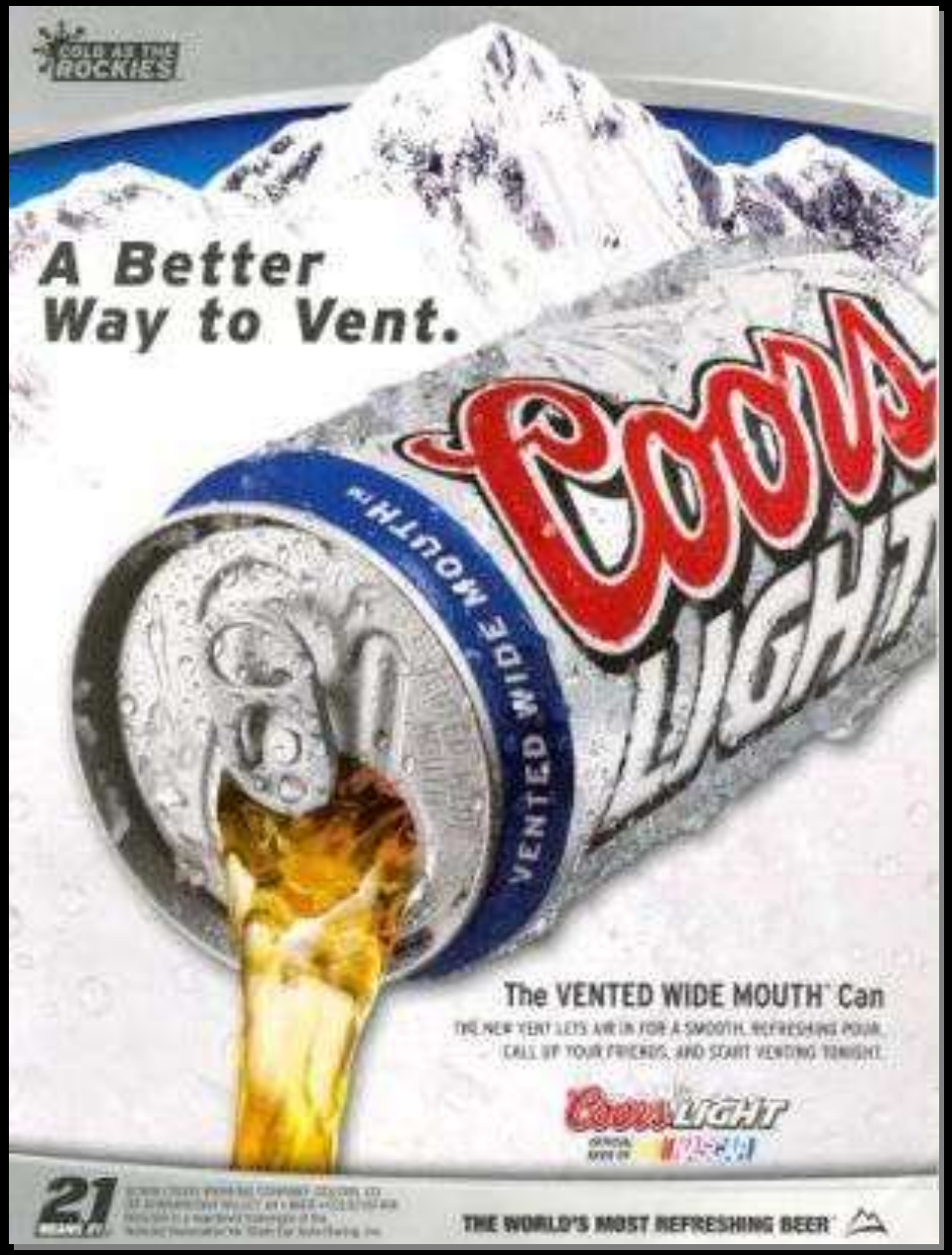
They've also attempted to objectify male anatomy



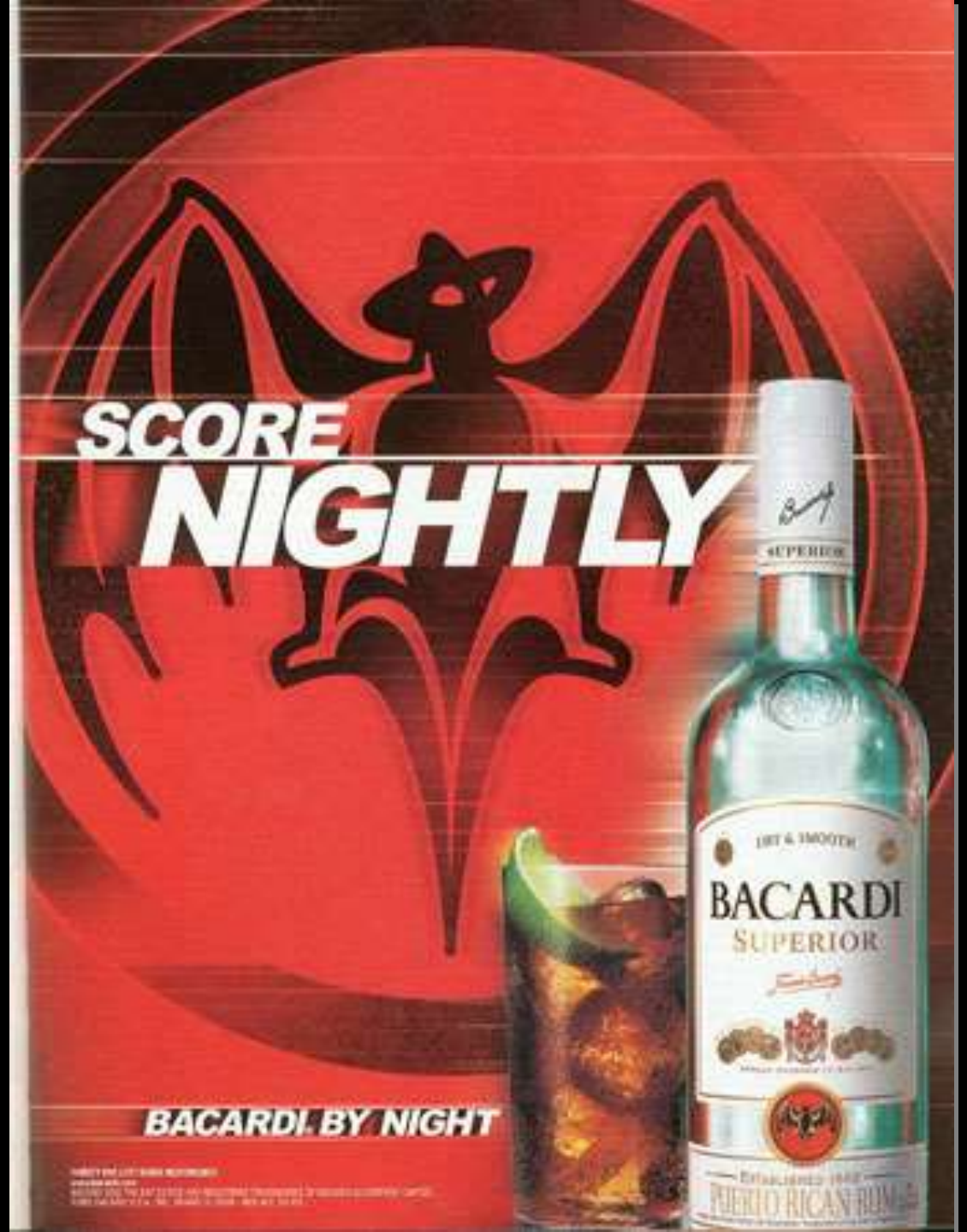
- **I've earned it!**

BREAK IT DOWN:

What is this ad actually saying?

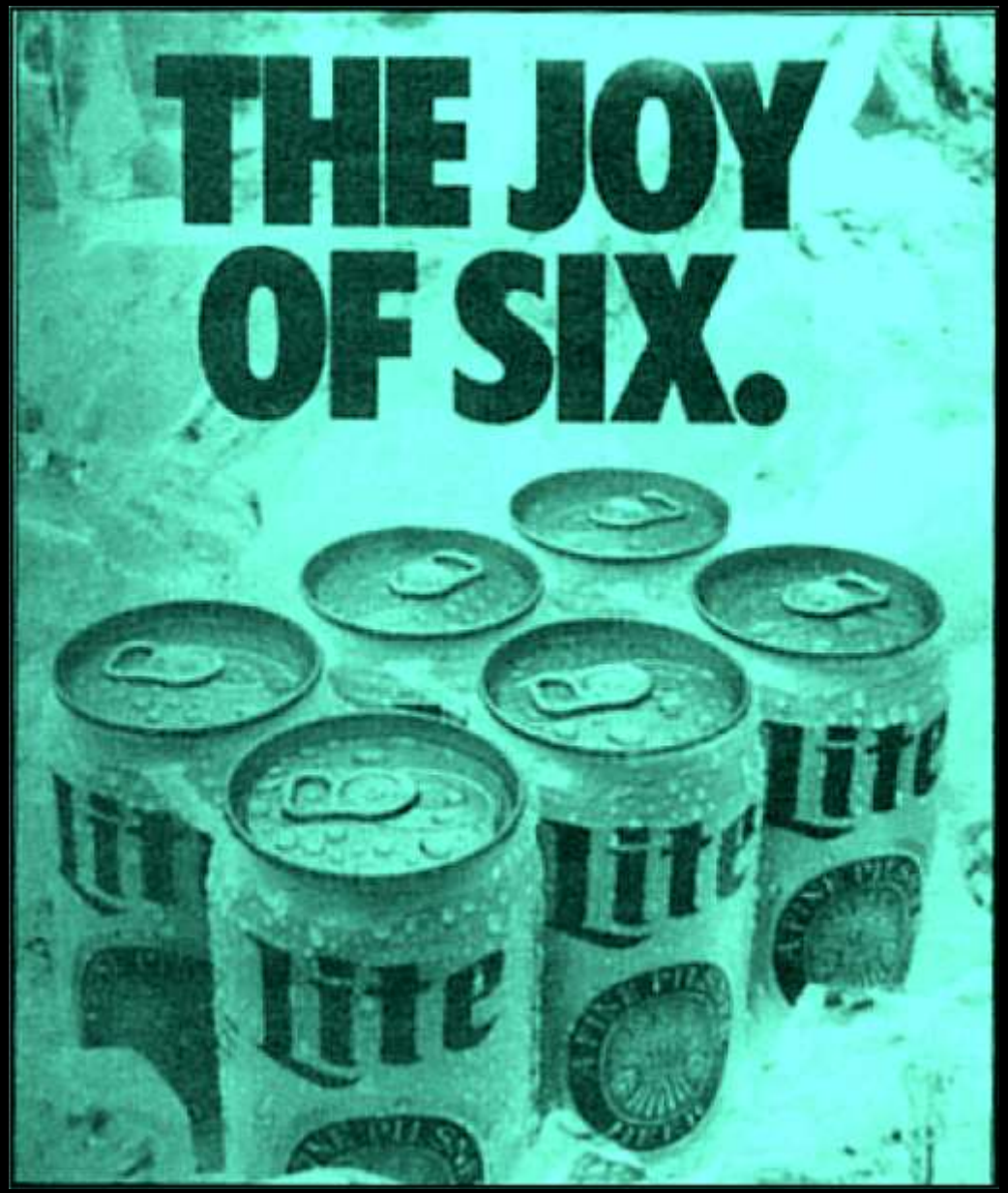



TAKE IT INTO
OVERTIME
BACARDI BY NIGHT
BACARDI
SUPERIOR
PUERTO RICAN RUM


SCORE
NIGHTLY
BACARDI
SUPERIOR
BACARDI BY NIGHT

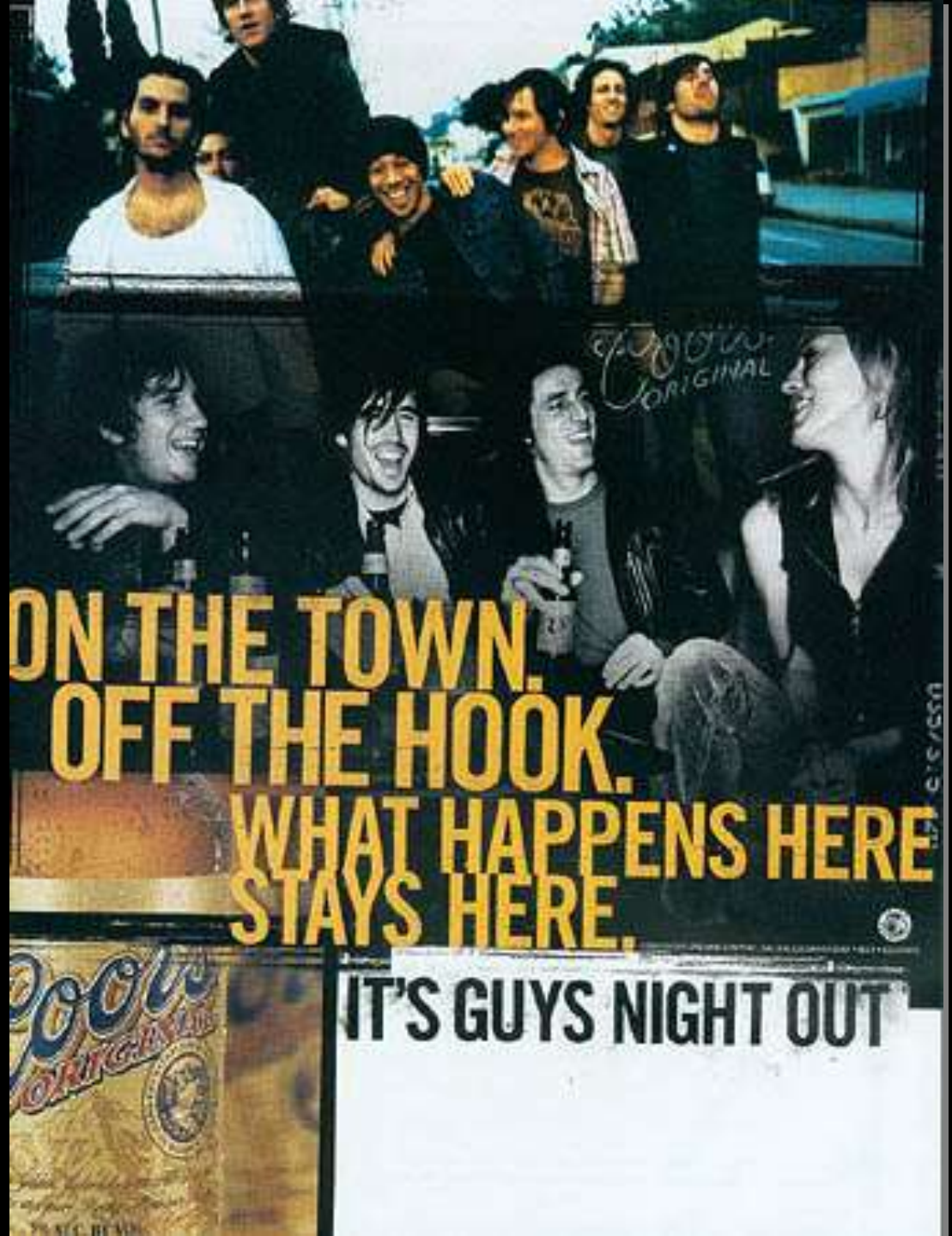
BREAK IT DOWN:

What is this ad actually saying?



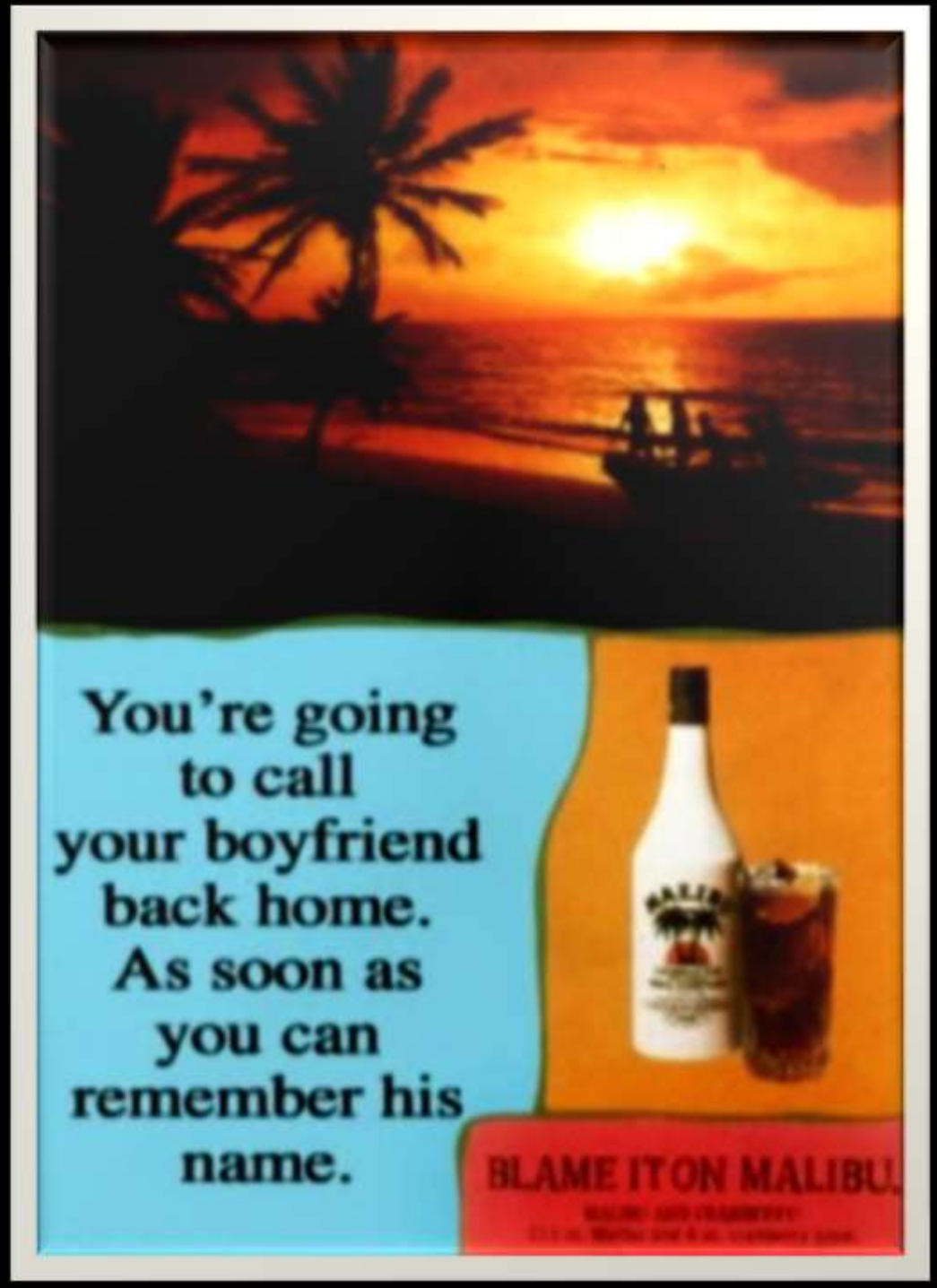
BREAK IT DOWN:

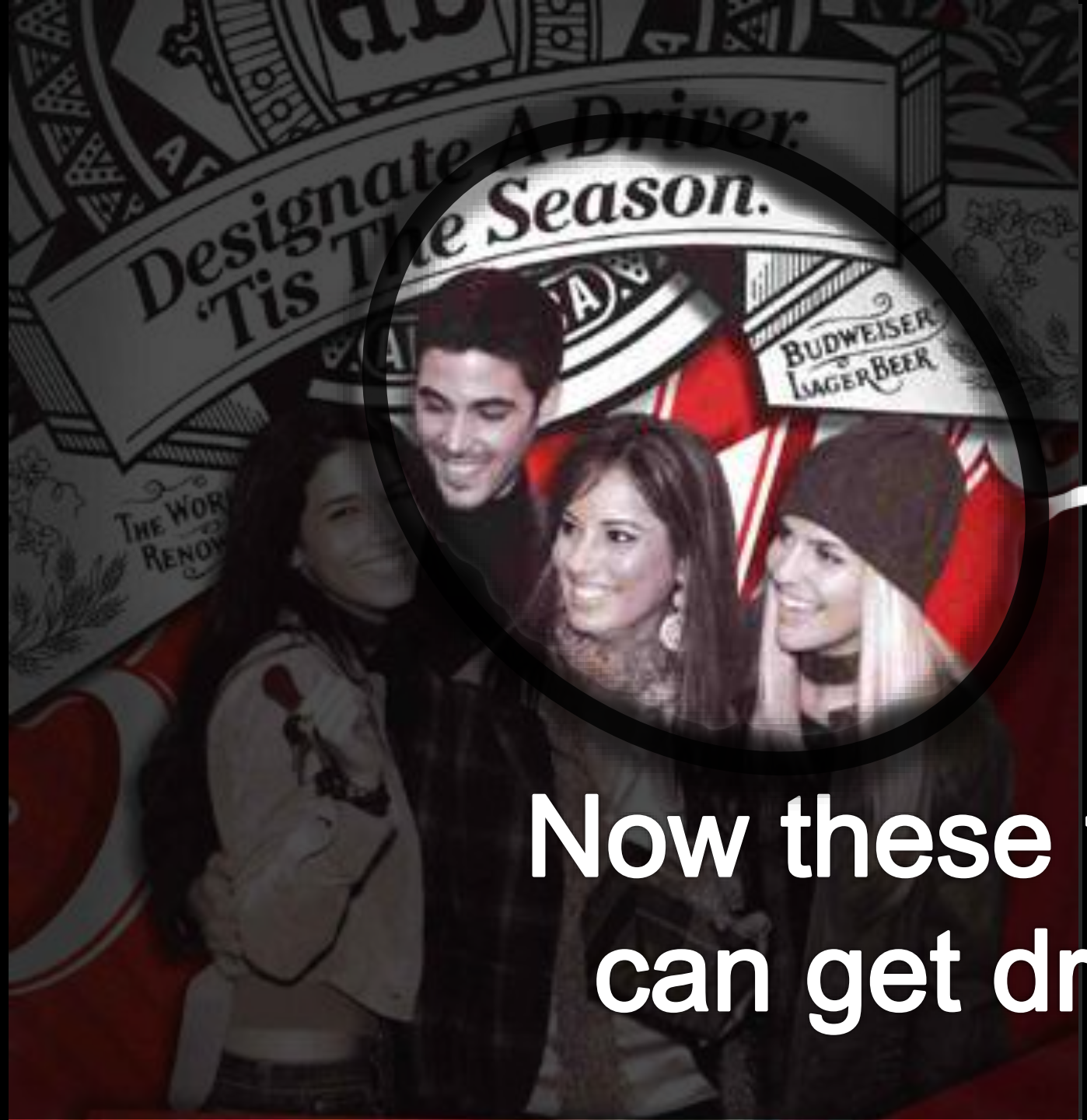
What is this ad actually saying?



BREAK IT DOWN:

What is this ad actually saying?

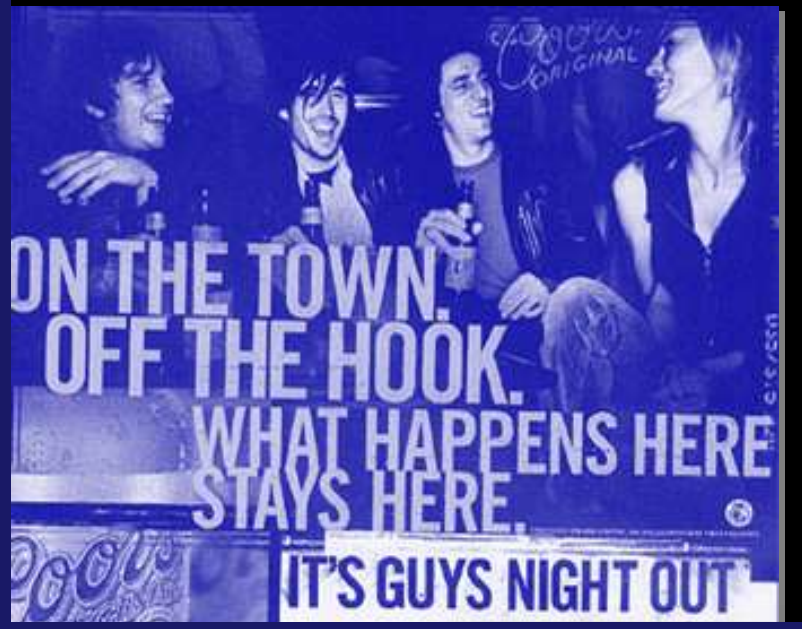




Now these three
can get drunk

- Alcohol Ads tell us:
  - Drink to medicate your feelings
  - Drink faster
  - Drink more/longer than intended
  - Drink every night
  - Surreptitious drinking/behavior
  - Drink to blackout
  - It's OK to get drunk just don't drive
  - Blame others for drinking problems

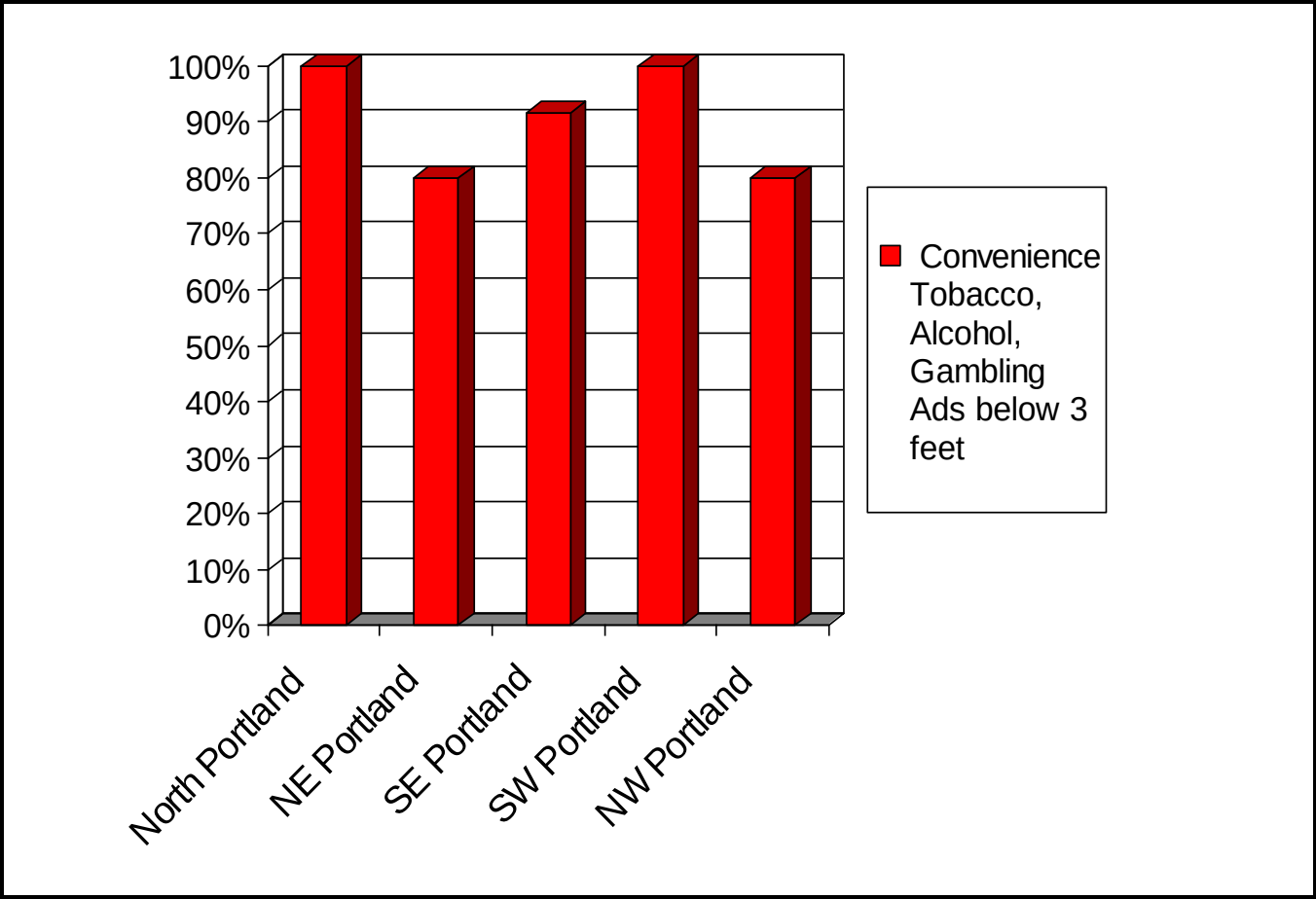
= Symptoms of Alcoholism



Percentage of Convenience Stores with Alcohol, Tobacco and/or Gambling Advertisements below 3 Feet

(n=62)

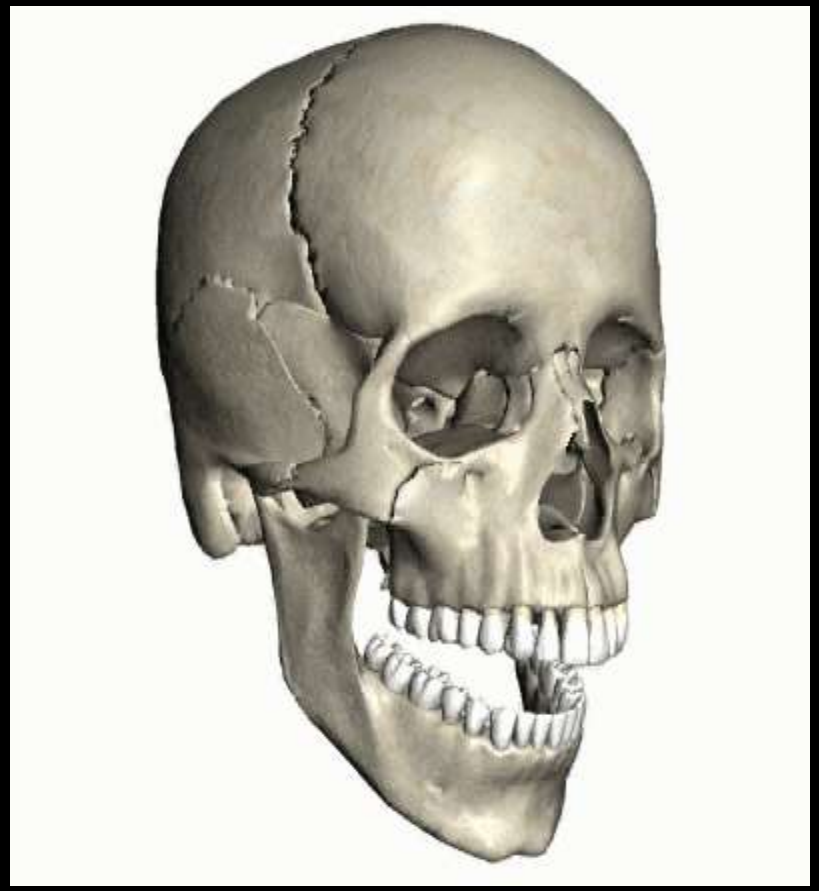
- City wide **91.5%** of convenience outlets (chain, non-chain, & gas) showed alcohol, tobacco, and/or gambling advertisements below 3 feet



This Portland area study is looking at the percentage of retail outlets with Tobacco and Alcohol ads below 3 feet and ads near candy. Additionally, this study is looking at the prevalence of Gambling advertisements and products below 3 feet.

23.6% of Oregon youth report playing scratch tickets (AMH, 2006).

Teeth



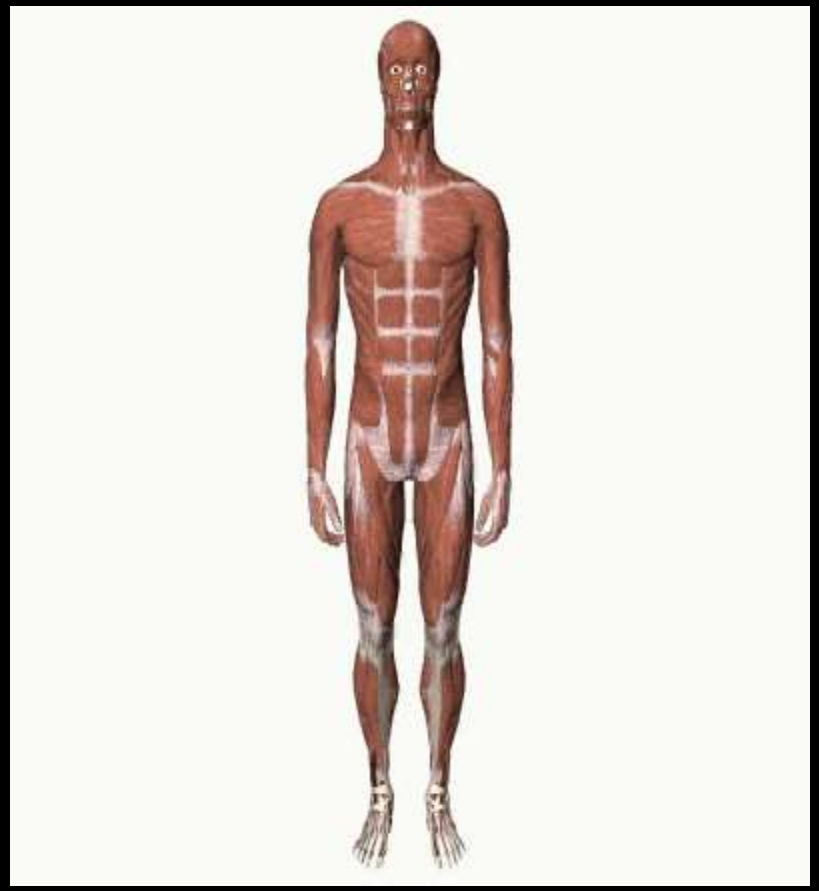
The Teeth

Problems:

Constriction of blood vessels in the mouth reduce flow of white blood cells causing an increase in bacterial growth.

Some drugs cause “grinding of the teeth” (bruxism)

Skeletal Musculature



Skeletal Musculature

over 300+

Problems:

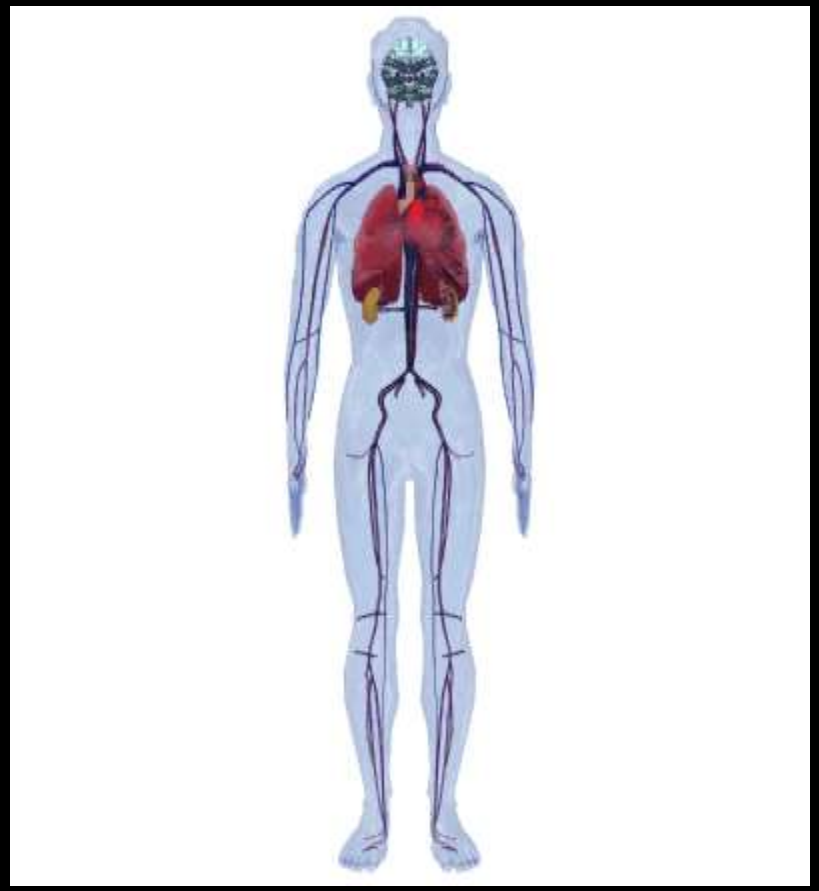
Impaired coordination

Atrophy

Rhabdomiolysis

Loss of fast twitch white muscle tissue

Cardivascular



Cardiovascular system

Problems:

High blood pressure = withdrawal off downers

High blood pressure, tachycardia, heart attack on stimulant drugs.

Sedation of heart rate and respiration on sedatives.

Endocarditis

Blood

Red blood cells carry oxygen

White blood cells fight off disease

Platelets help heal injuries

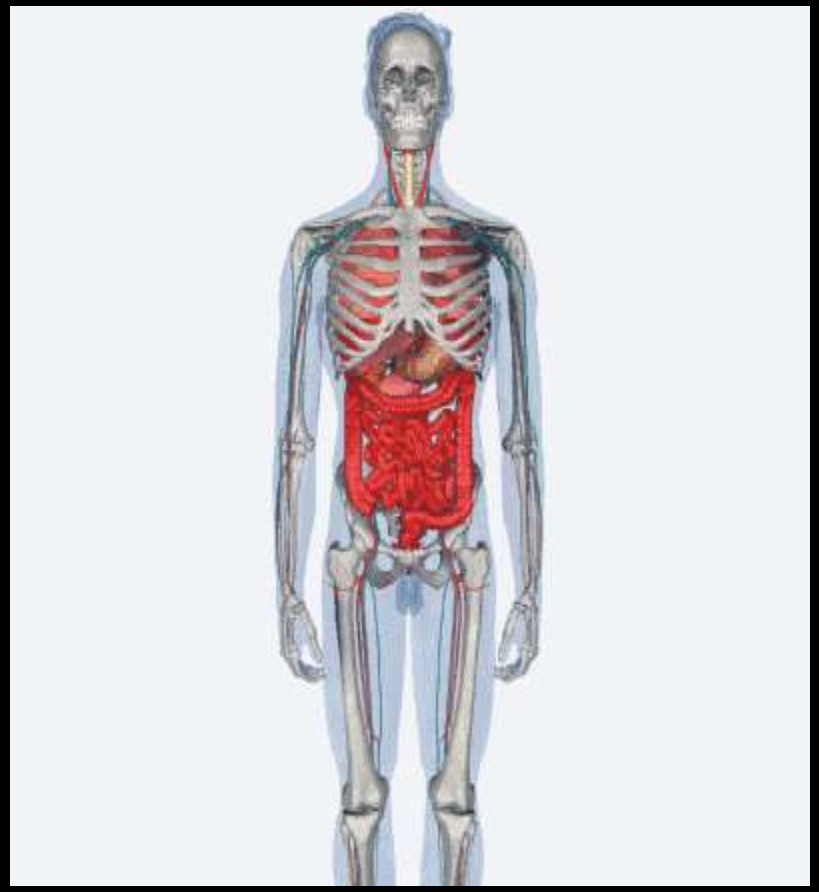
Problems:

Impaired development of red blood cells (diameter)

Chromosome damage to white blood cells

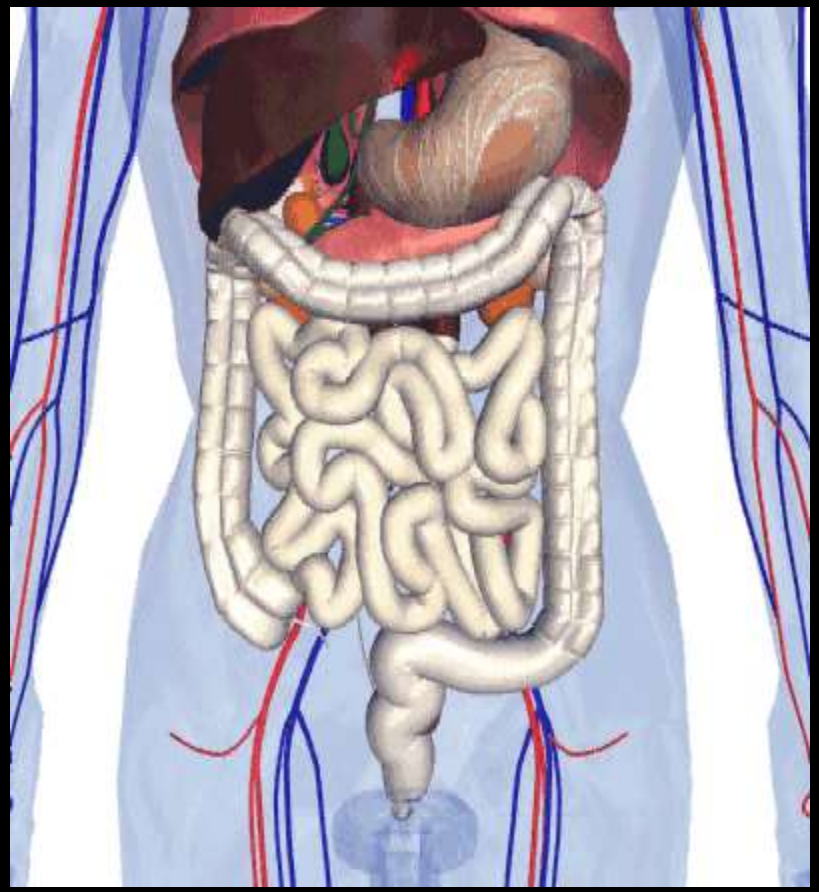
Impaired healing

Digestive Tract



Mouth	Problems: Cancer, sores
Esophagus	Cancer, varices
Stomach	Cancer, ulcers
Small intestine	Ulcers
Large intestine	Ulcers
Colon	Cancer, ulcers

Kidneys



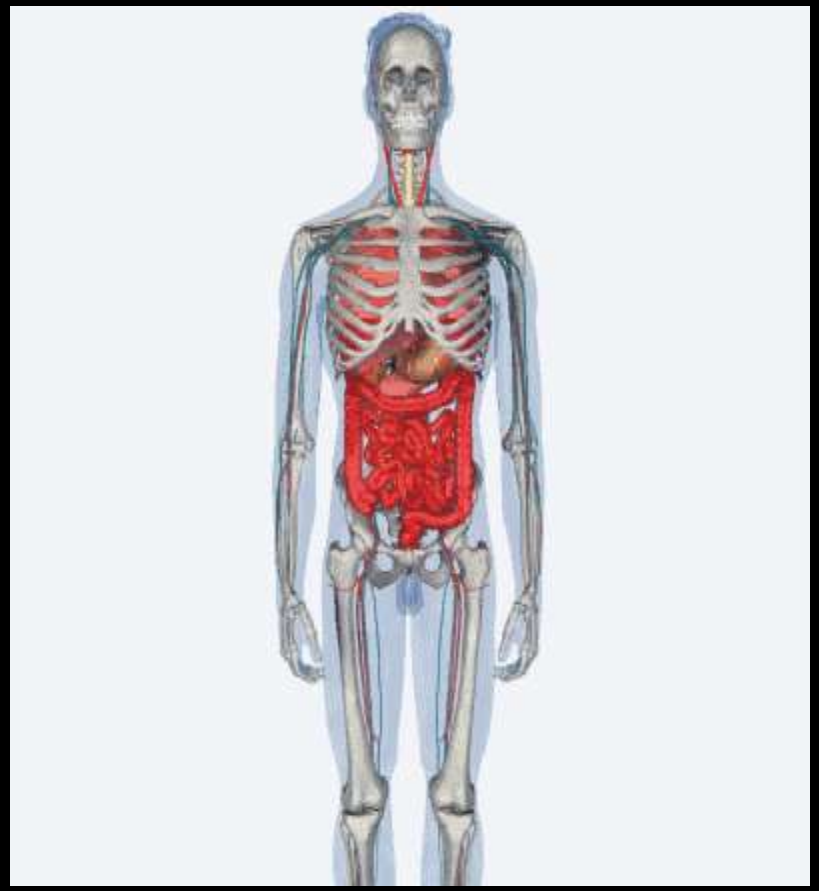
Kidneys filter the blood and produce urine. Filtering occurs through basic law of diffusion.

Problems:

Rhabdomiolysis

Tubular Necrosis

Pancreas

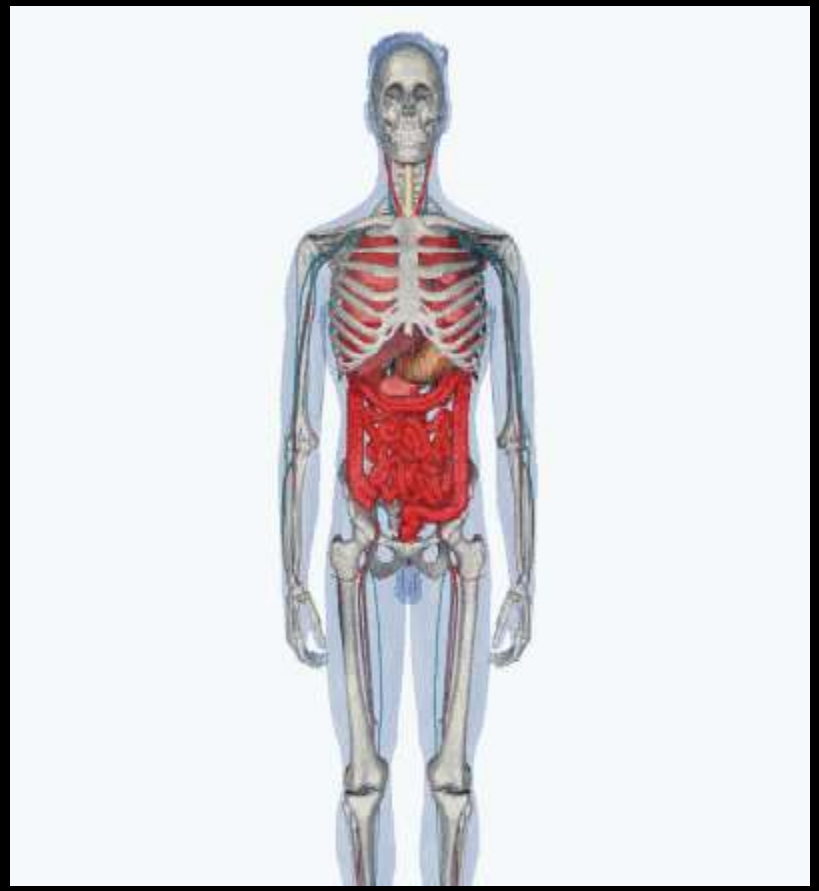


Pancreas creates insulin and digestive juices

Alcoholic Diabetes

Pancreatitis

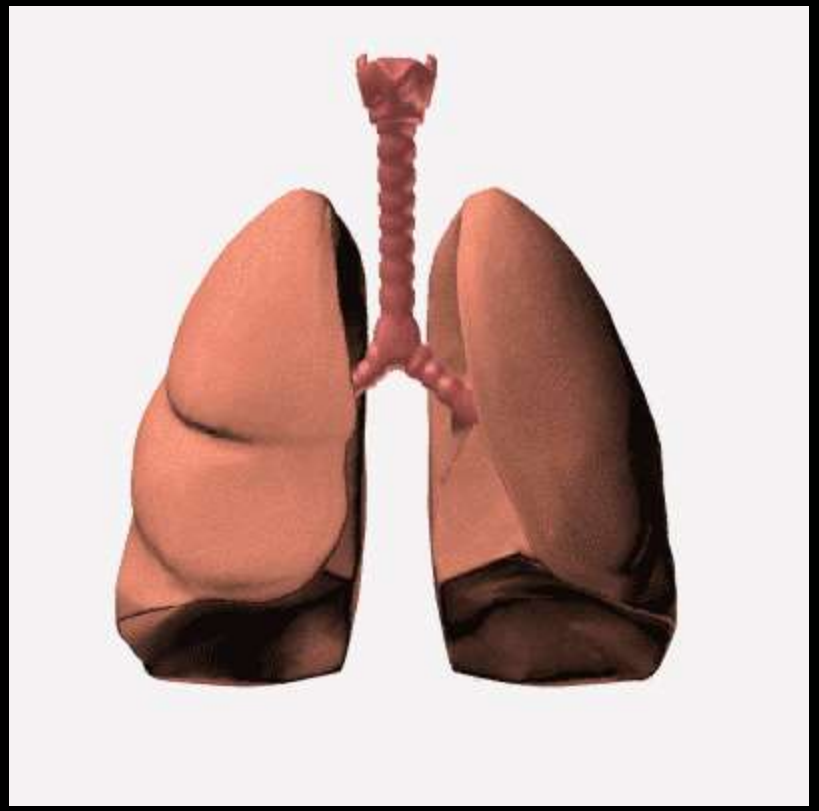
Adrenal glands



Adrenals produce adrenalin

Adrenal sensitivity

Lungs



Lungs

Exchange oxygen and carbon dioxide via the alveolar sacs

Problems:

Destruction of Cilia

Emphysema

Cancer

Metabolism

Most drugs undergo changes inside the body.

This is biotransformation or METABOLISM.

- **Generally a liver function**
  - ***If action becomes more efficient, tolerance results***

- **Generally a drug changes to a less harmful substance, or sometimes a psychoactive substance.**
  - **GHB**
  - **Tramadol**
  - **MDMA**
  - **Marijuana**

Kratom vs. Krypton Kratom

- Natural Kratom
- Native to Thailand
- Mitryna Speciosa
- Delta opioid agonist

- “Krypton Kratom” is a mixture of Kratom, caffeine and a synthetic opioid, O-desmethyltramadol.
- O-desmethyltramadol is the psychoactive metabolite in Tramadol (Ultram)
- O-desmethyltramadol is a mu-receptor agonist.
- Combined with natural Kratom users achieve both mu and delta receptor activation

Eventually, a drug has to leave the body.

Usually via the kidneys in urine, but there are other methods:

Lungs

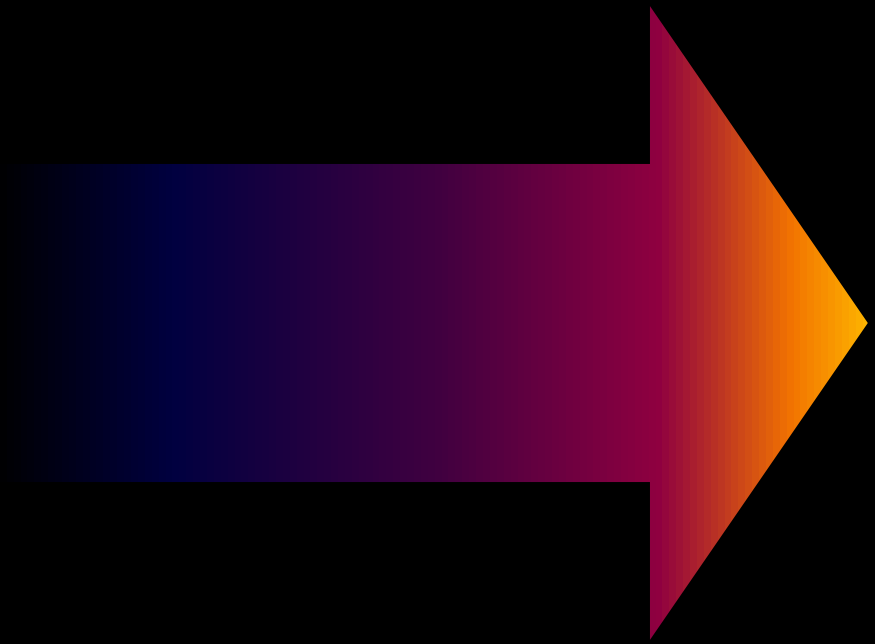
Excrete gases
E.g. alcohol, anesthetics

Perspiration

Small amounts

Tears and Saliva

Small amounts



HALF-LIFE

HALF-LIFE

HALF-LIFE

HALF-LIFE

HALF-LIFE

*Amount of time required for plasma level concentration to decrease by **50%***

DRUG A (4 Hour Half-Life):

	HOUR	Amt. In Plasma
10,000	0	10,000
units	4	5,000
	8	2,500
	12	1,250
	16	625
	20	312.5
	24	156.2

- ***4** half-lives to eliminate 90%*
- ***6** half-lives to eliminate 98%*

156.2

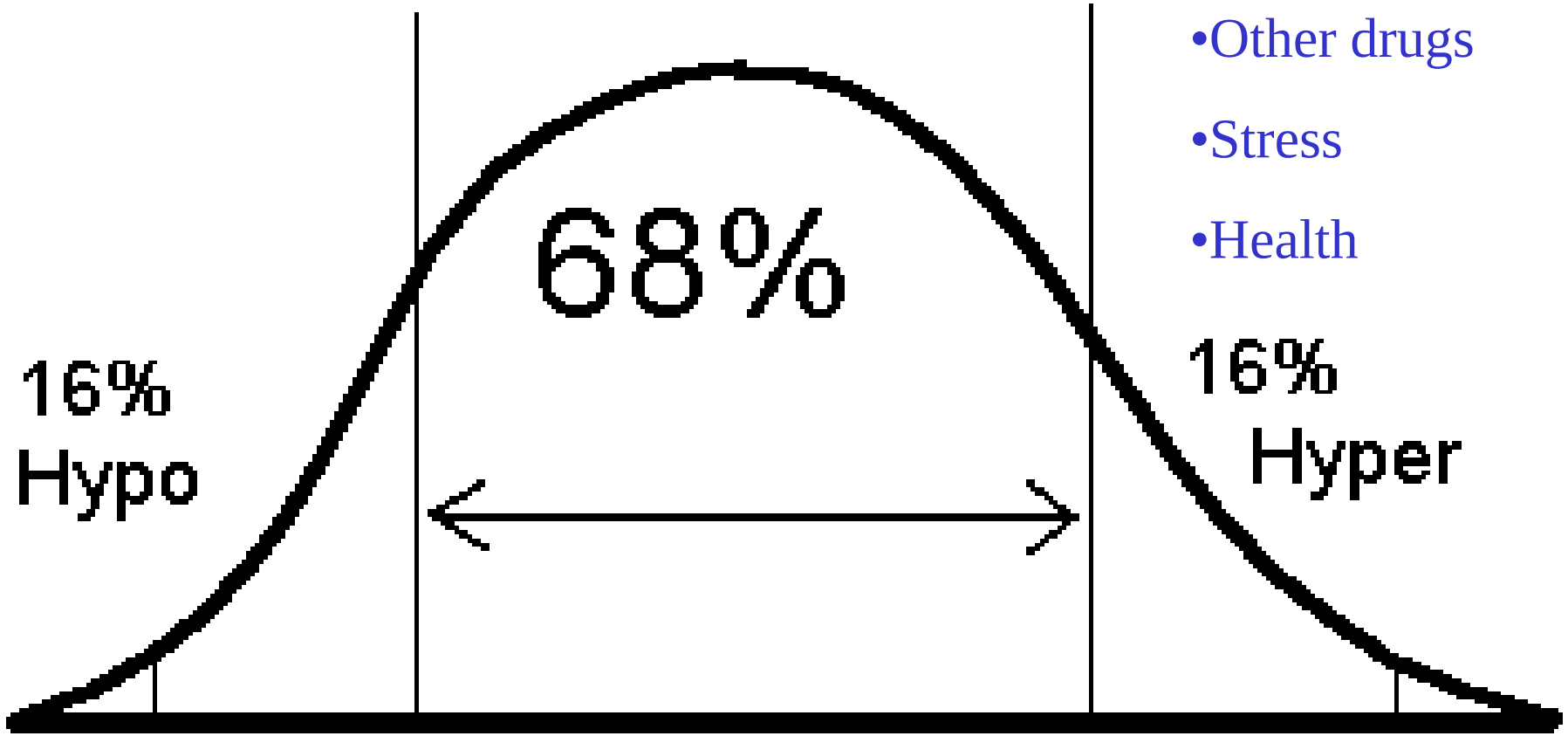
10,000

10,156.2

WHEN IN DOUBT...

Individual Variabilty

- Age
- Weight
- Genetics
- Other drugs
- Stress
- Health



The Normal Curve

DRUG INTERACTIONS

- **+++ *Additive:*** 2 + 2 = 4

Varies with different drugs at different dose levels *(Example?)*

- **xxx *Synergistic:*** 2 + 2 = 8, or 10, or…

Also called ***potentiating;*** varies with different drug combinations *(Example?)*

- **+/- *Antagonistic:*** 2 + 2 = 3

Effect-specific; *not* necessarily an antidote

Invent A Drug!!

- What parts of the brain and body might be effected by your drug?
- Are there any long term consequences to the use of the drug?