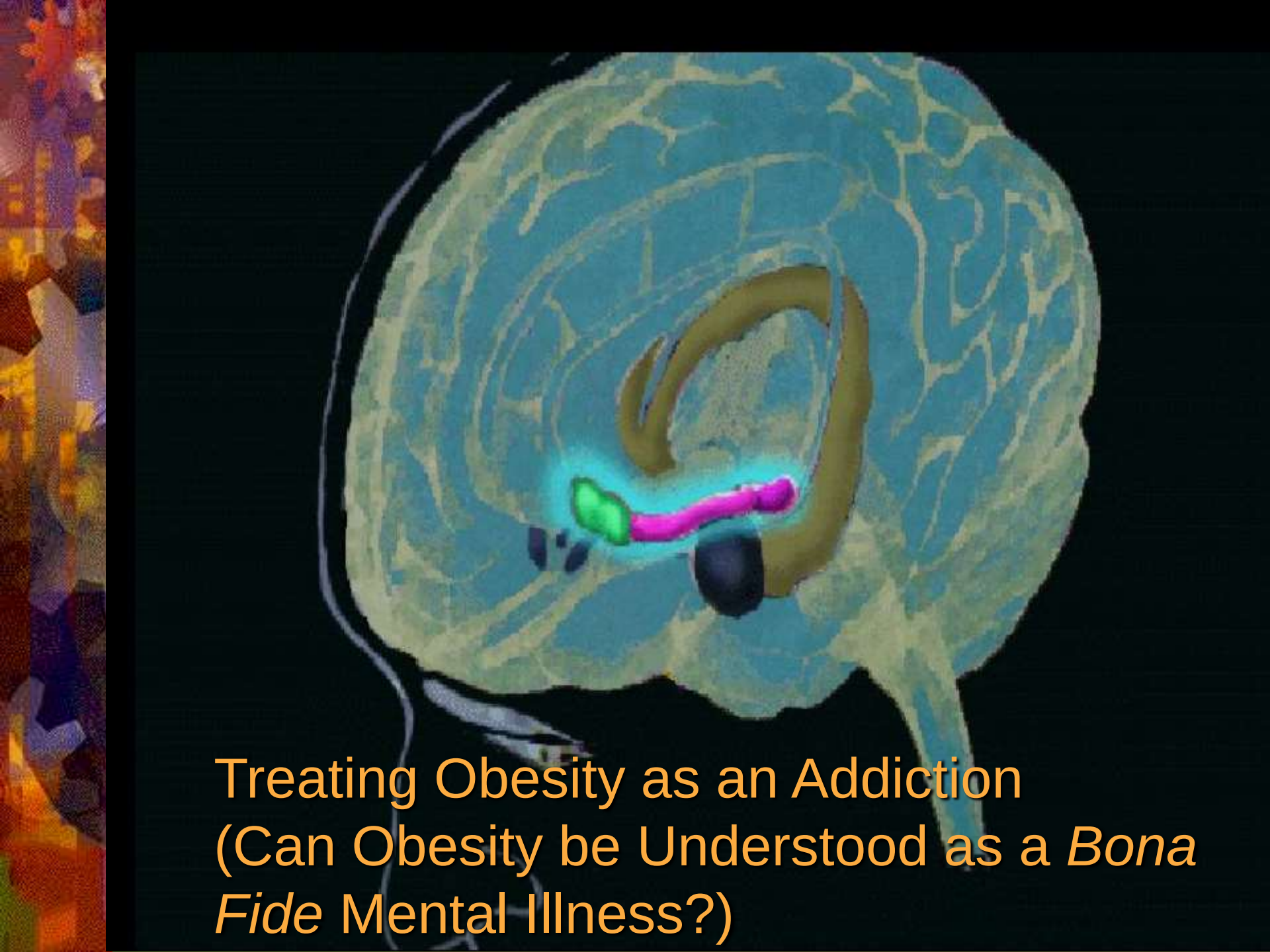


Treating Obesity as an Addiction (Can Obesity be Understood as a *Bona Fide* Mental Illness?)

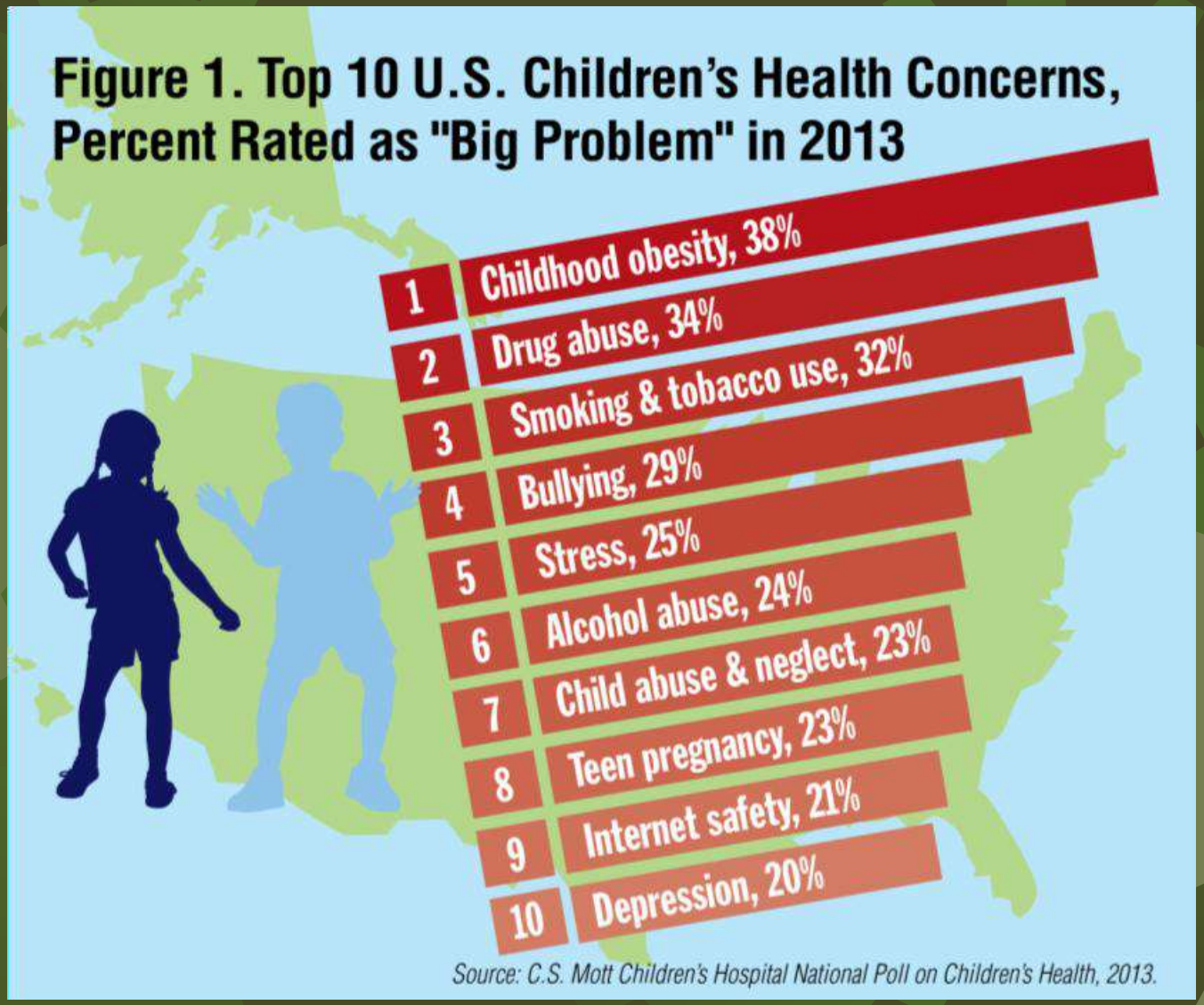
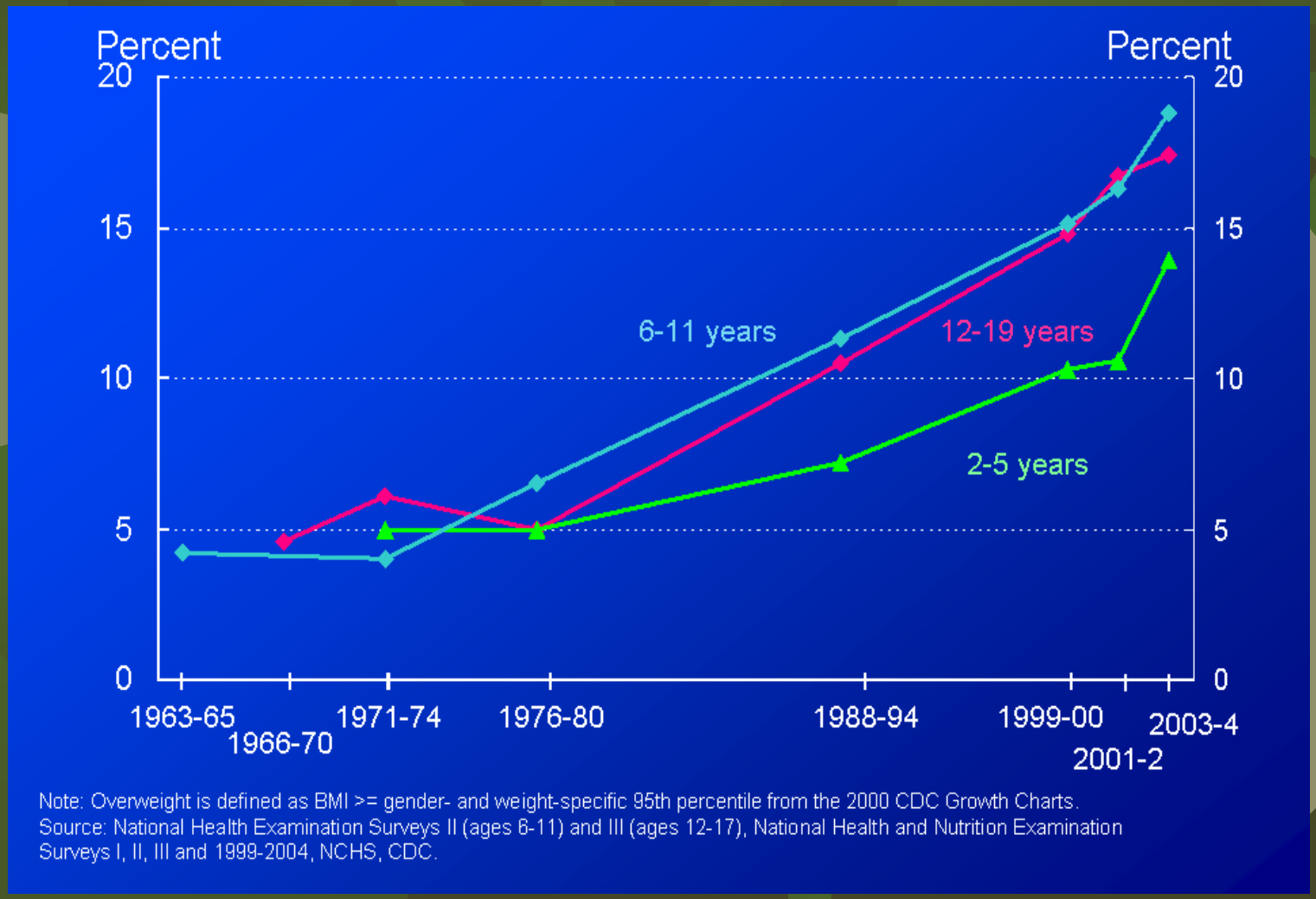


Figure 1. Top 10 U.S. Children's Health Concerns, Percent Rated as "Big Problem" in 2013
1 Childhood obesity, 38%
2 Drug abuse, 34%
3 Smoking & tobacco use, 32%
4 Bullying, 29%
5 Stress, 25%
6 Alcohol abuse, 24%
7 Child abuse & neglect, 23%
8 Teen pregnancy, 23%
9 Internet safety, 21%
10 Depression, 20%
Source: C.S. Mott Children's Hospital National Poll on Children's Health, 2013.

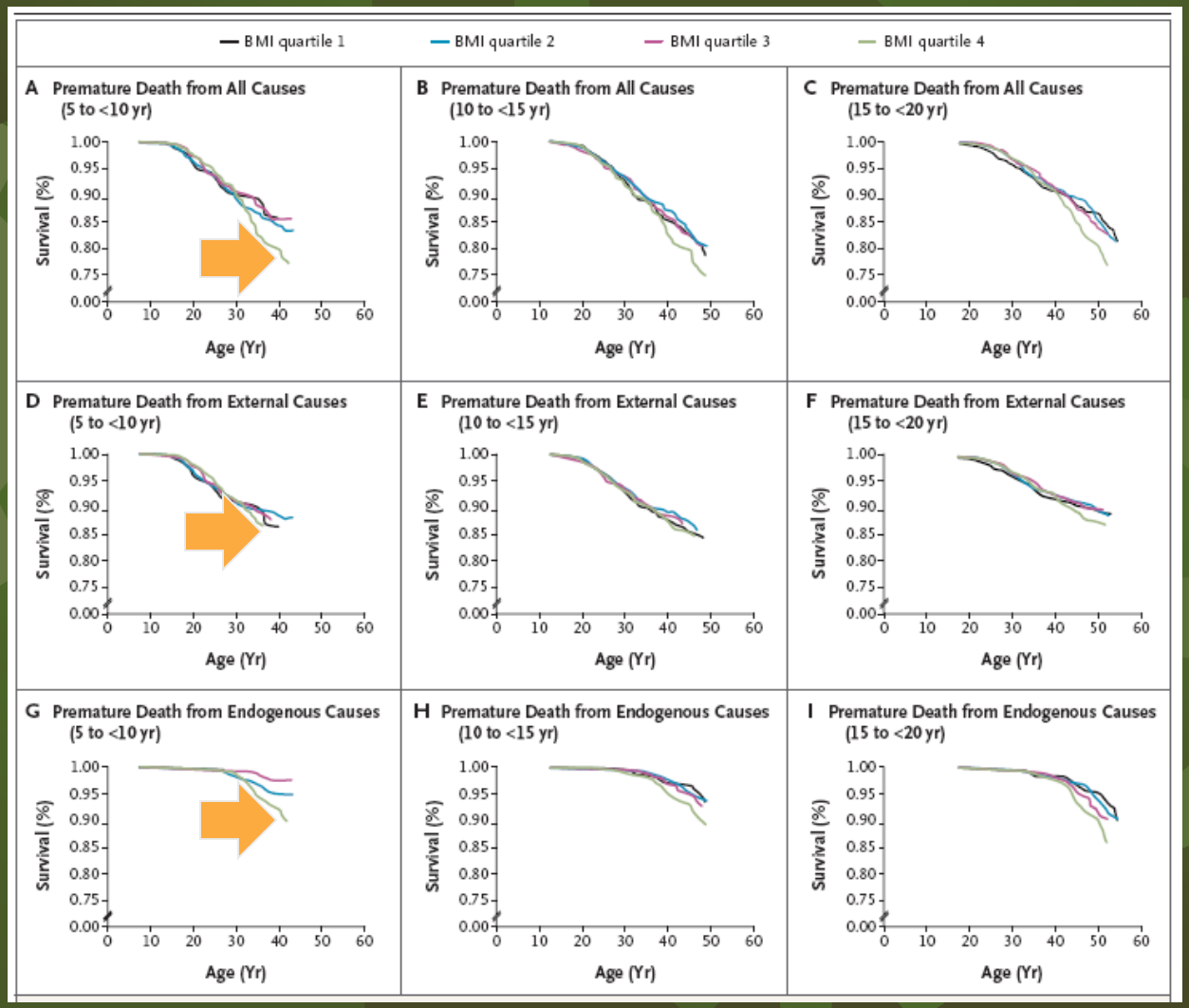
Source of the Problem: Trends in Child and Adolescent Obesity



Childhood Obesity has Reached Epidemic Proportions in United States

- Child obesity rates have tripled over last 30 years
- Childhood obesity may cause irreversible biologic changes in hormonal pathways, fat cells, and the brain affecting both hunger and metabolism
- Consequently, 30-40% of children may eventually develop DM II
- Obese parents increase risk of obesity in offspring through "perinatal programming" e.g. maternal hyperglycemia during pregnancy strongly predicts BMI in offspring
- Decline in life expectancy due to associated illnesses (Diabetes, CVS complications) likely for the first time in history

Rates of Premature Death from All, External, and Endogenous Causes



Franks et al., N. Engl. J. Med. 2010 Feb 11;362(6):485-493.

Type II Diabetes Mellitus: Threat to Worldwide Public Health

- 15% of all healthcare costs in U.S.
- Minimum estimate of 150 million cases of diabetes worldwide
- Prevalence expanding at 50% per decade due to obesity in the developed world
- >50% new cases by 2010 will be in China and India due to "Americanized" diets
- WHO predicts 2050 prevalence of 300 M
- Efficacies of current treatment approaches (postprandial glucose, lipids, hypertension) are being questioned

The NEW ENGLAND JOURNAL of MEDICINE

EDITORIAL

Navigating the Choices for Diabetes Prevention

David M. Nathan, M.D.

"The global epidemic of type 2 diabetes has prompted a large number of clinical trials aimed at reducing its incidence. Not surprisingly, addressing the ***underlying lifestyle behaviors — overeating and inactivity — that result in obesity***, the primary cause of the epidemic, has had a major and consistent effect in reducing the cumulative incidence of diabetes."

Diabetes Heart Treatments May Cause Harm

March 14, 2010, NY Times

ORIGINAL ARTICLE **Effect of Nateglinide on the Incidence of Diabetes and Cardiovascular Events**

The NAVIGATOR Study Group

ORIGINAL ARTICLE **Effect of Valsartan on the Incidence of Diabetes and Cardiovascular Events**

The NAVIGATOR Study Group

EDITORIAL **Navigating the Choices for Diabetes Prevention**

D.M. Nathan

ORIGINAL ARTICLE **Effects of Combination Lipid Therapy in Type 2 Diabetes Mellitus**

The ACCORD Study Group

ORIGINAL ARTICLE **Effects of Intensive Blood-Pressure Control in Type 2 Diabetes Mellitus**

The ACCORD Study Group

EDITORIAL **ACCORD and Risk-Factor Control in Type 2 Diabetes**

P.M. Nilsson

Published Online in NEJM

Attributed Causality Influences Treatment of Obesity

- Treatment is mostly influenced by widely-held attributions within society concerning responsibility for causation of the problem and for its solution
- Thus, obese individuals can be considered as either:
  - Patients (innocent victims of physiology/genetics/"fast" food who need a "medical/surgical" "cure")
  - Causal agents (weak, guilty, draining limited medical resources with little hope of real benefit—"psychiatry")
- Neither is true
  - Paradigm shift from acute to chronic "management" not "cure"
  - Treatment of obesity cannot be done well by medicine, surgery, or psychiatry alone; generalists integrated with specialists as needed
- Would treatment of obesity based on shared pathogenesis with alcohol/drug addiction (unitary neurobiological model) be beneficial to patients?

A ***biopsychosocial disorder***, management of which should benefit from an ***integrated pharmacopsychosocial approach***

Bariatric Surgeries per Year in United States (1995-2005)

Lifetime Course of Addiction: Pathogenesis and Treatment of Obesity

Antecedents/Socio-cultural Context/Consequences
Occasional/Regular/Compulsive

Brain Effects of Food/Feeding Behavior

Vulnerable Individual

- Biologic
- Psychologic
- Social

Neuroadaptation
Dependence
(Loss of control)
(Over-eating)

Complications

- Social
- Neuropsychiatric
- Medical (Obesity)

Pharmacopsychosocial Treatment
Focus on Addictive Over-Eating Rather than Complications

Addiction

"A small number of drugs and chemical agents can come to control human behavior."

Hyman et al., 2006

‘Behavioral’ Addictions: Fundamental Drives Gone ‘Awry’

- Obesity ⟷ Nutrition
- Sex ⟷ Reproduction
- Gambling ⟷ Exploration

‘…as far as the brain is concerned, a reward’s a reward, regardless of whether it comes from a chemical or an experience.’

Constance Holden, Science (2001)

A Broader Contemporary View of Addiction

"A small number of drugs and chemical agents [brain chemicals produced as a result of performance of selected behaviors] can come to control human behavior."

Hyman et al., 2006 revised

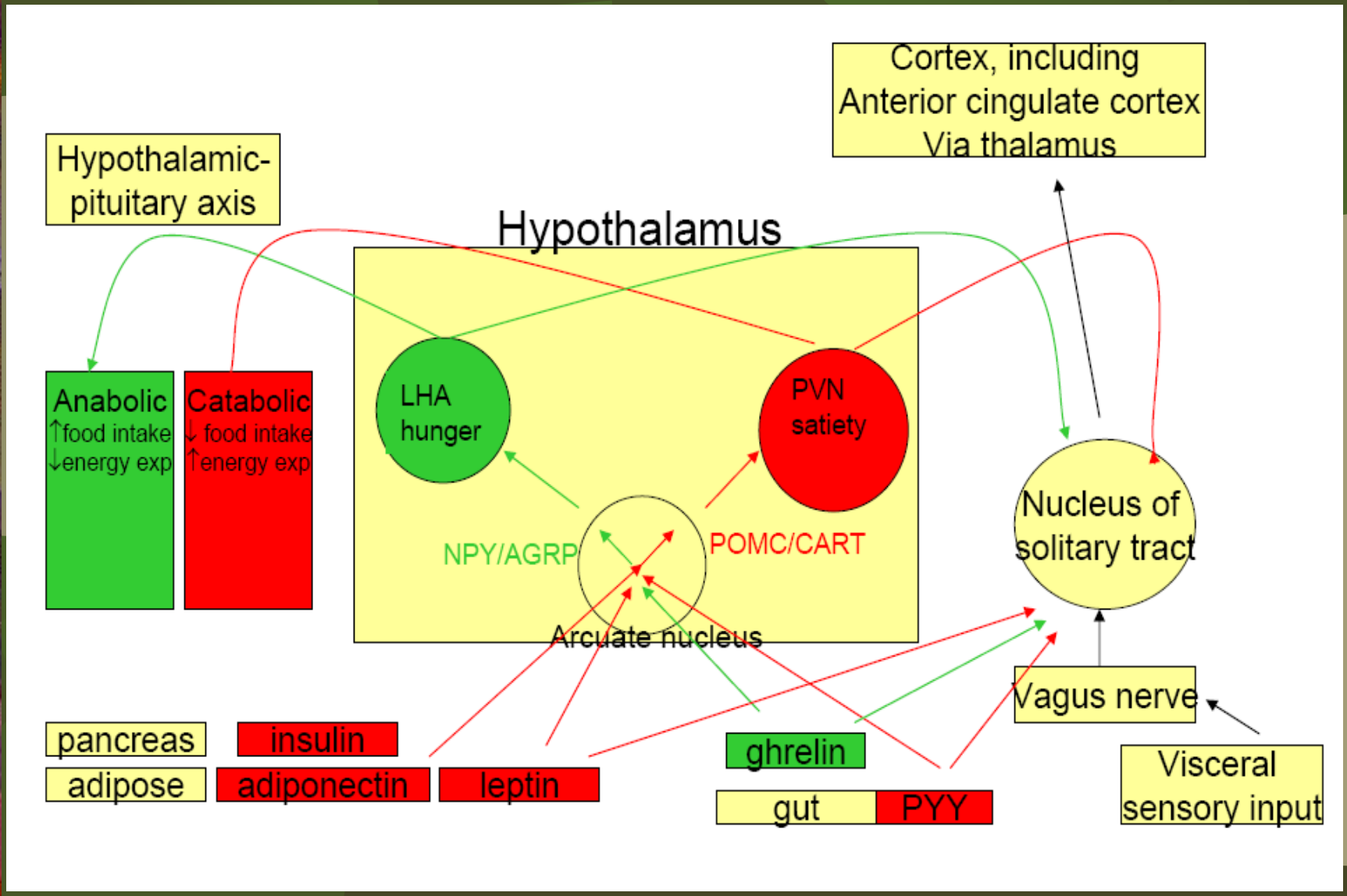
A Broader Contemporary View of Addiction Applicable to Obesity

"Brain chemicals produced as a result of hunger or eating can come to control human behavior."

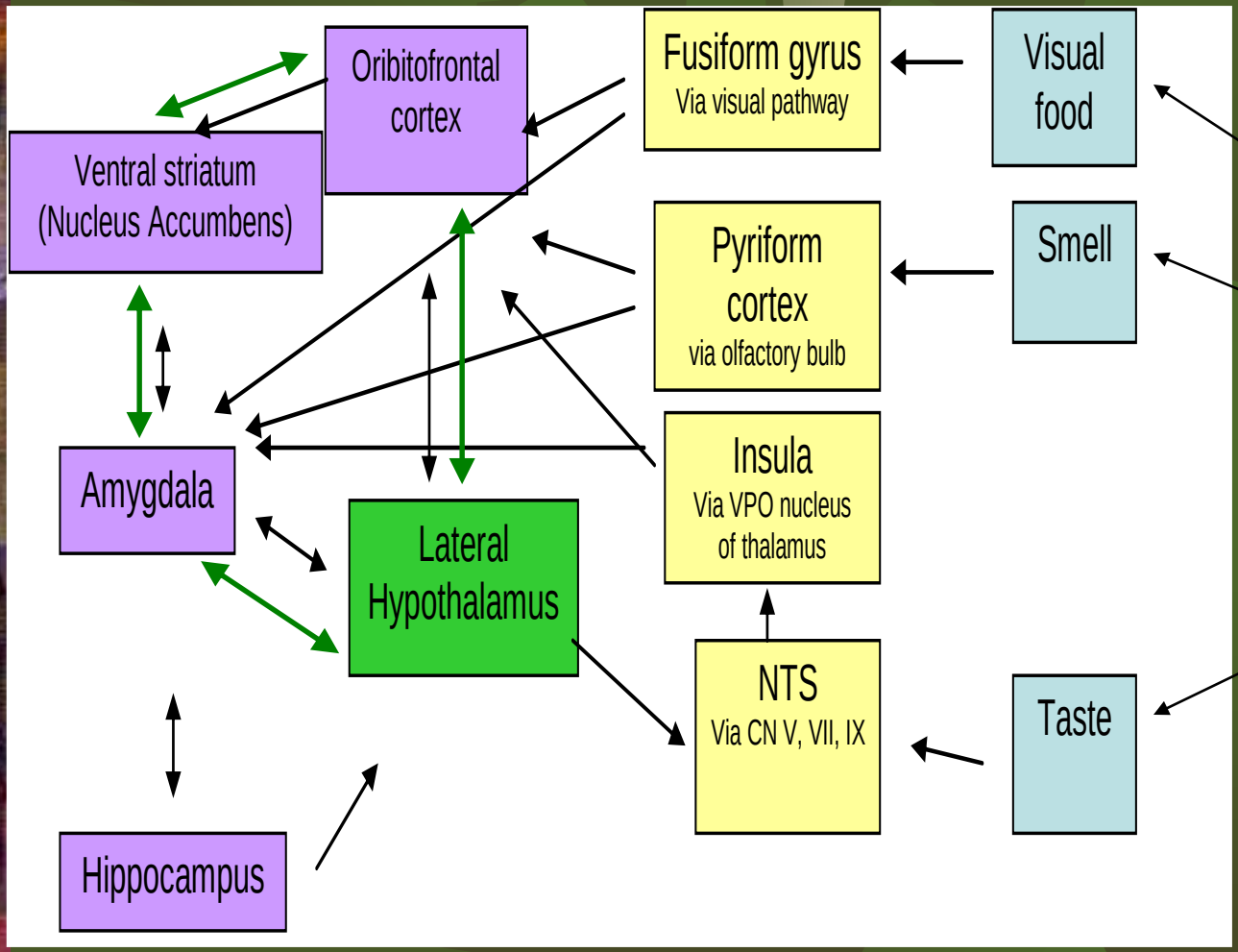
Hyman et al., 2006 revised

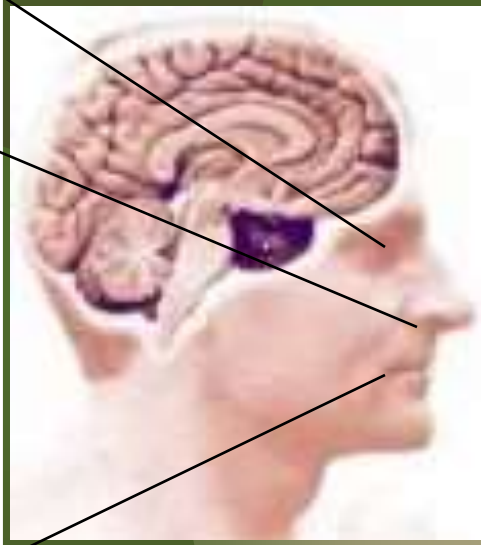
Neural/Metabolic Systems Regulate Food Intake to *Maintain* Body Weight

Regulation of Body Weight via Energy Homeostasis (Complications)



Reward System Activated by Environmental Stimuli (Over-Eating)

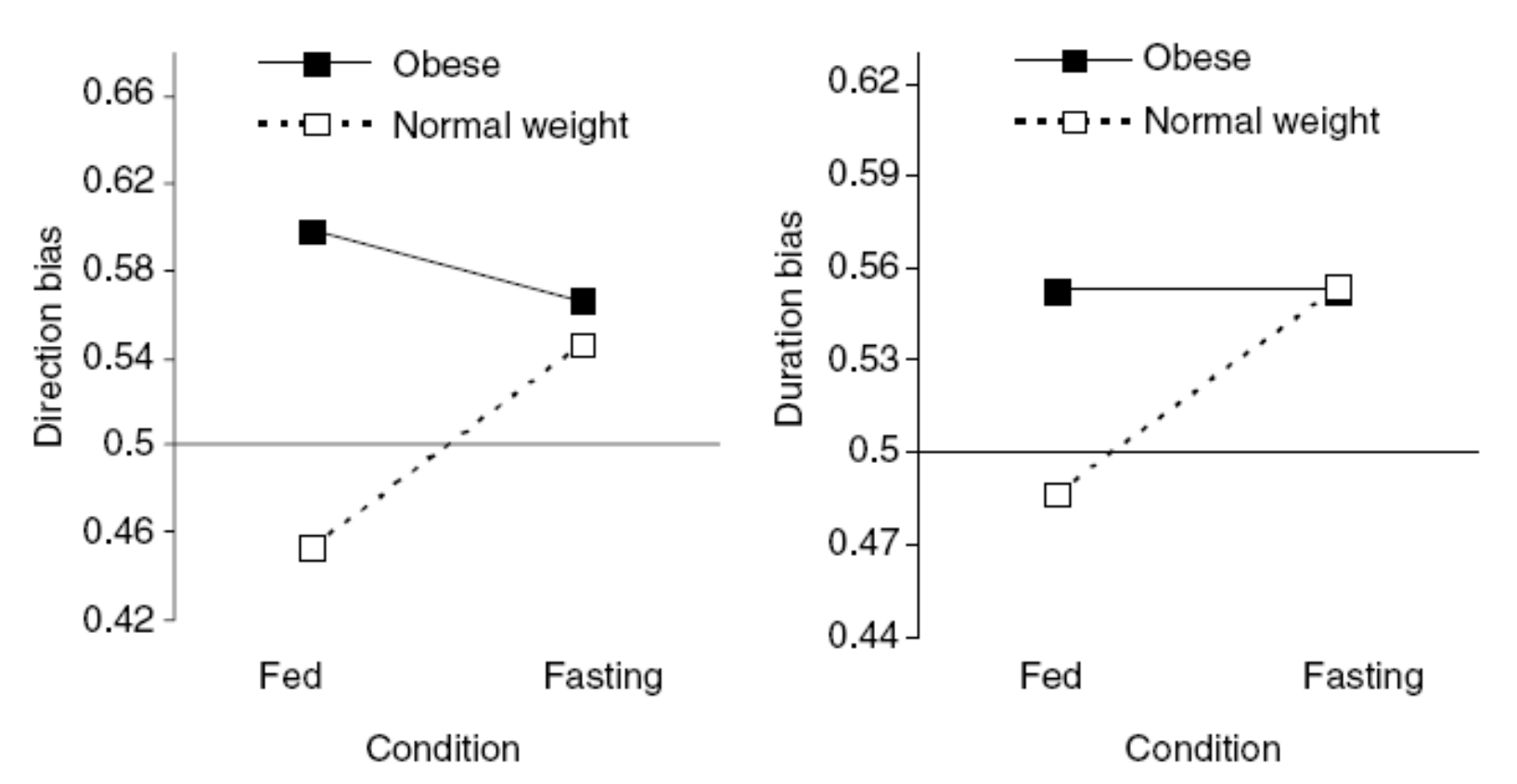




Obesity as Addictive Behavior: Altered Food Reward Circuits

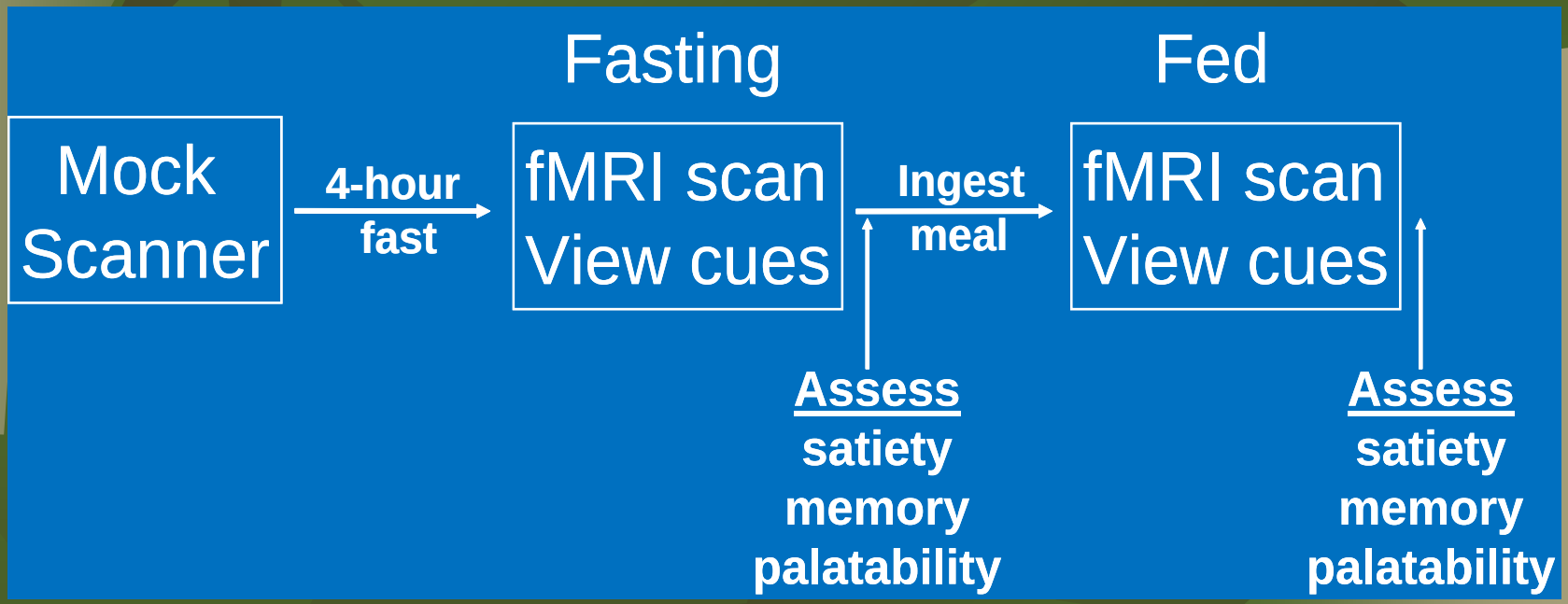
- Obesity has significant features of an addictive disorder: out-of-control behavior despite negative consequences
- Both food and abused drugs activate brain reward systems in similar ways: palatable foods, especially those high in sugar, trigger release of dopamine, endocannabinoids/ opioids in the mesolimbic system
- Exposure to drug- or food-related cues have been shown to induce craving (and activation of brain reward circuits) in drug addicts and obese individuals, respectively

Gaze Direction/Duration to Food Cues: Brain "Biasing" in Obesity?



EH Castellanos et al, International Journal of Obesity (2009) 1–11

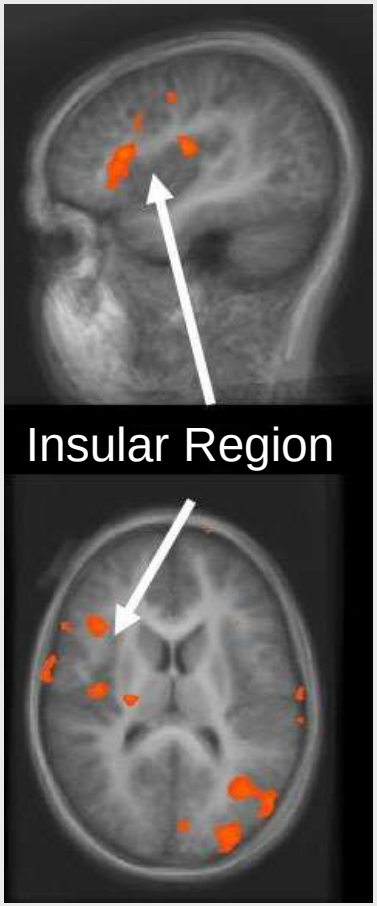
Experimental Design

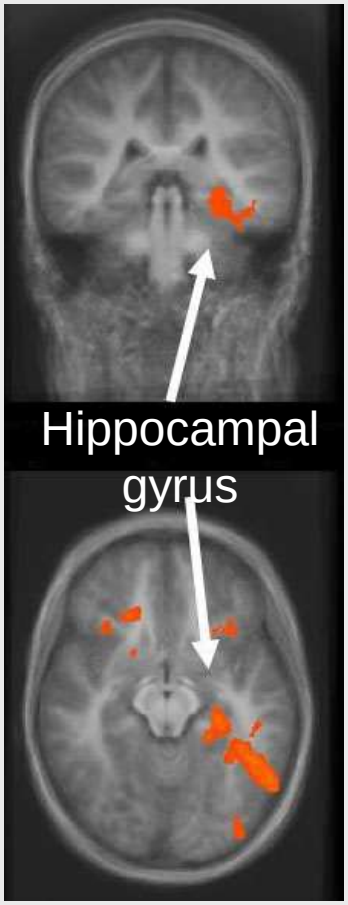


High Calorie Food

Greater Activation in Significant ROIs in Obese than Normal Weight Children

Anticipation of reward and sensory integration

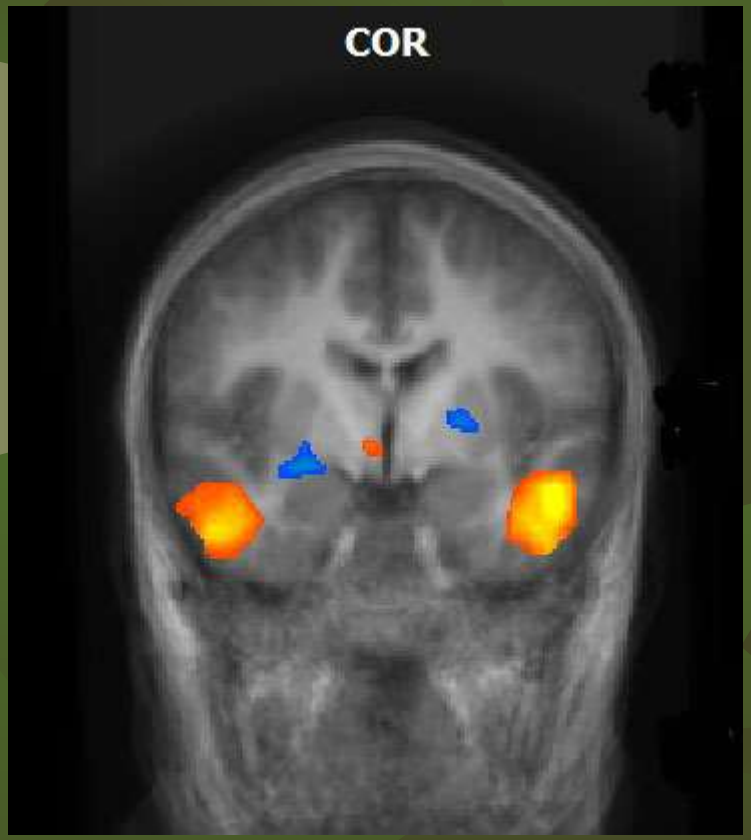




Memory processing

Nature Images

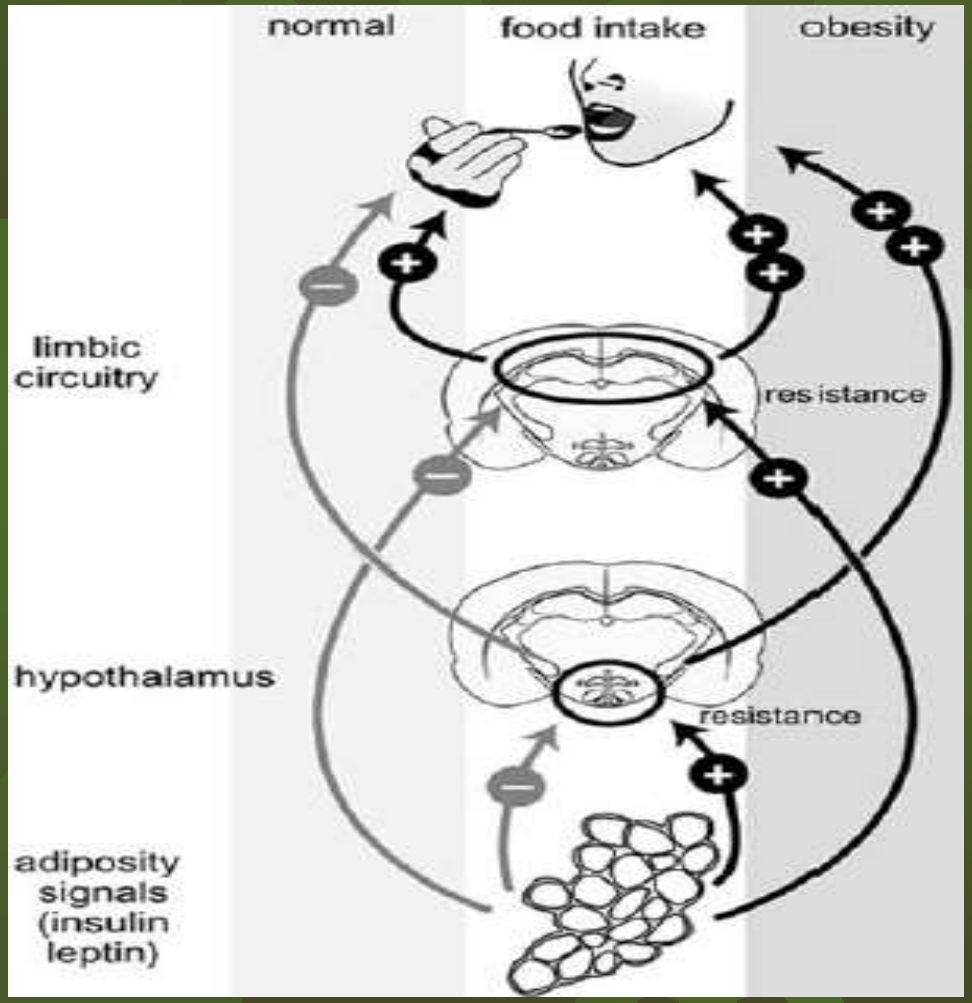
Response to Nature Images



(t = 3.30; p = 9.84E-4)

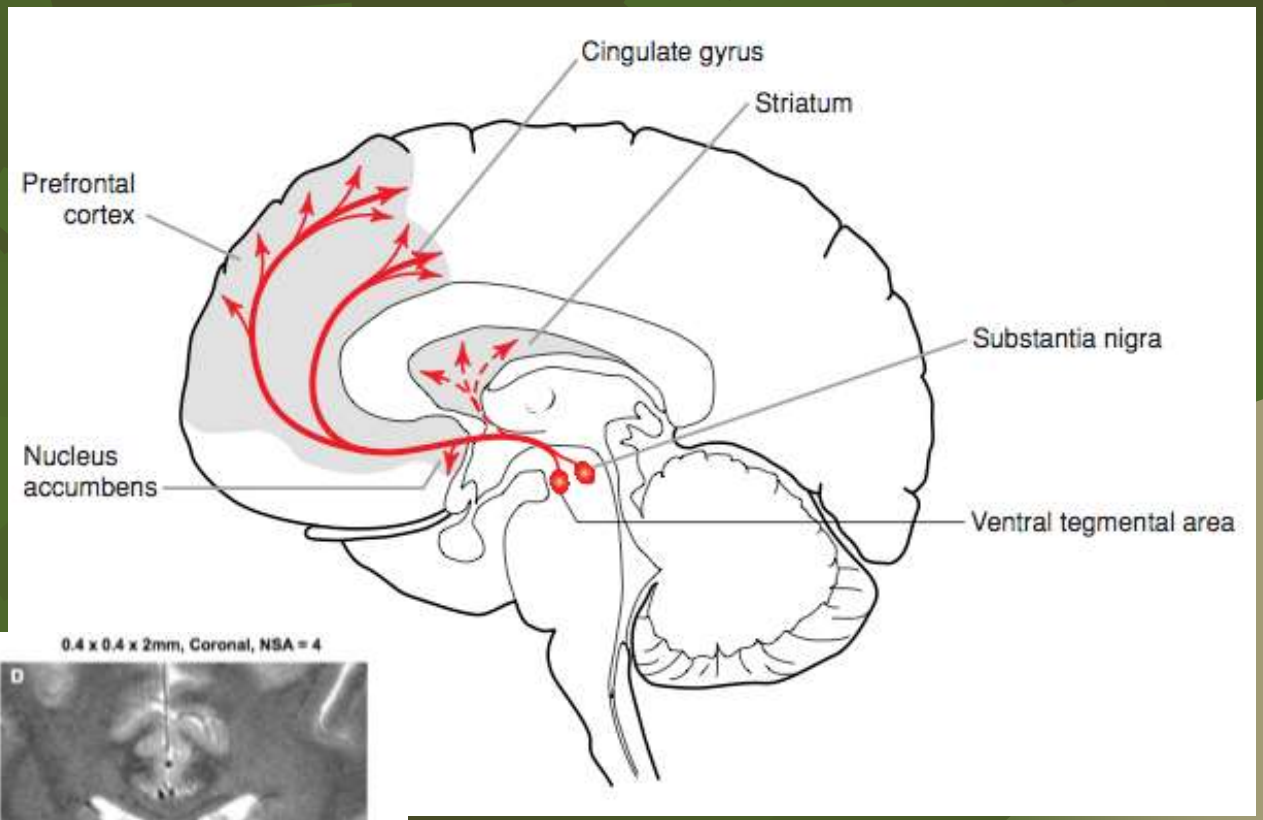
- Nature images produced greater activation in the lateral olfactory pathway and limbic system in obese children compared to normal weight children (both in fasting condition).
- This finding suggests that obese children may interact with the environment in a significantly different way than normal weight children.

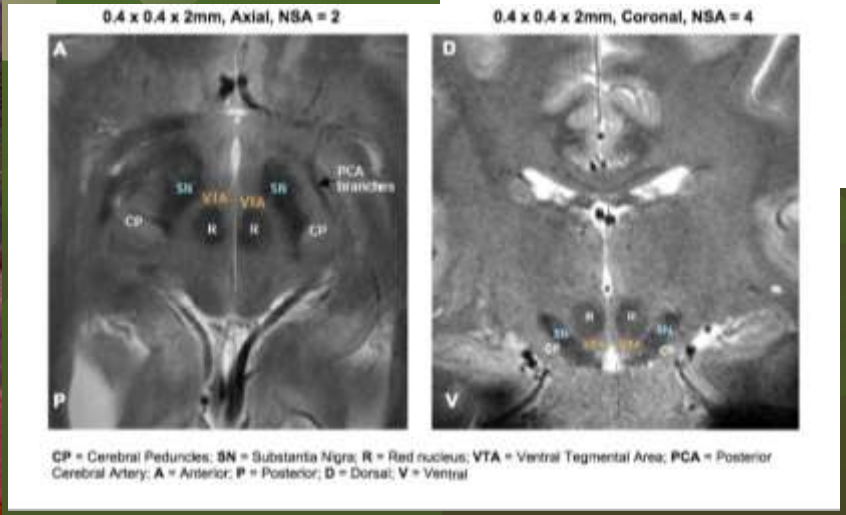
Reward Potentiates Food Intake and Development of Obesity



Niswender et al., Curr. Med. Chem.–Immun., Endoc. & Metab. Agents, 2004, 4, 91-104.

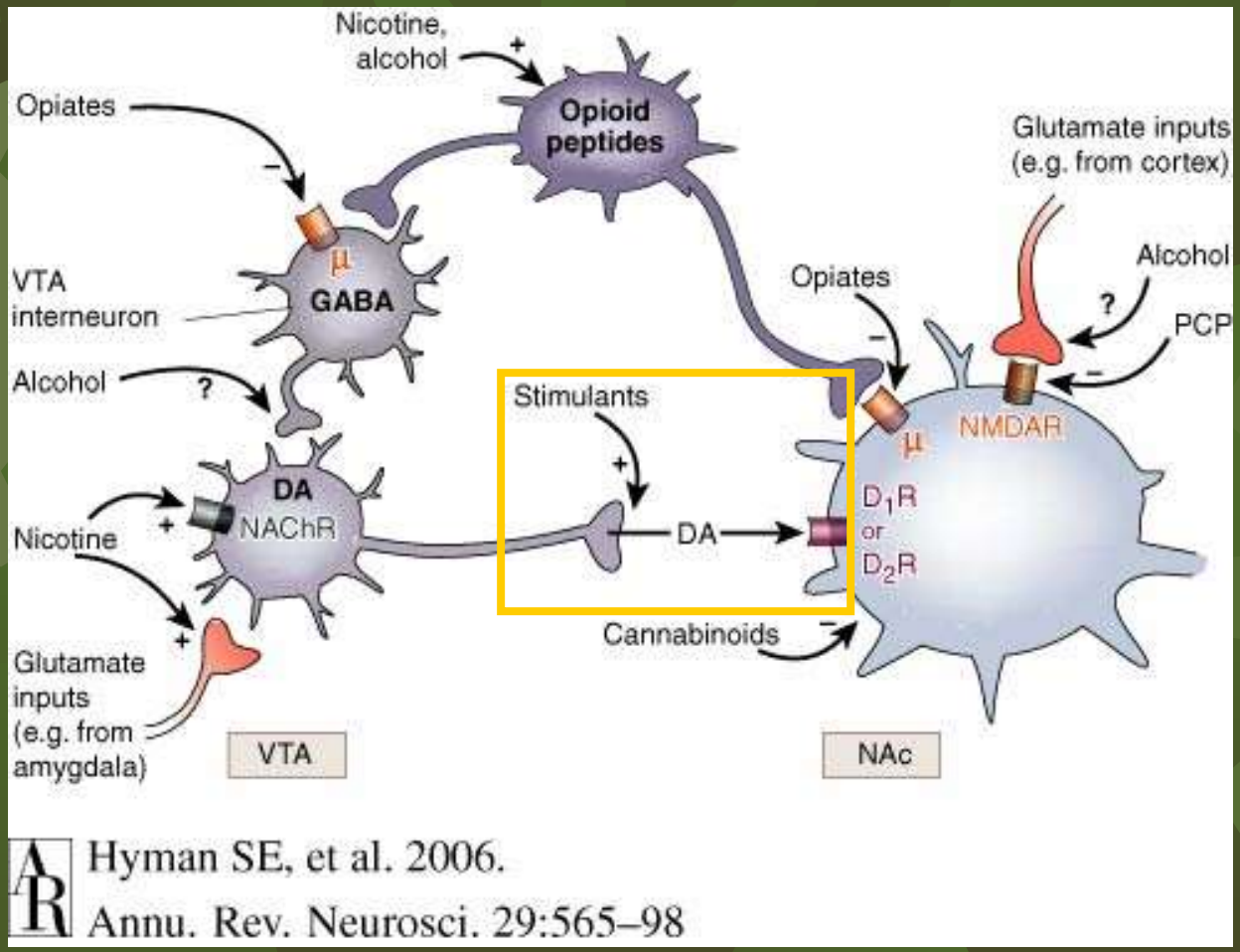
Central Role of Dopamine in Reward and Addiction



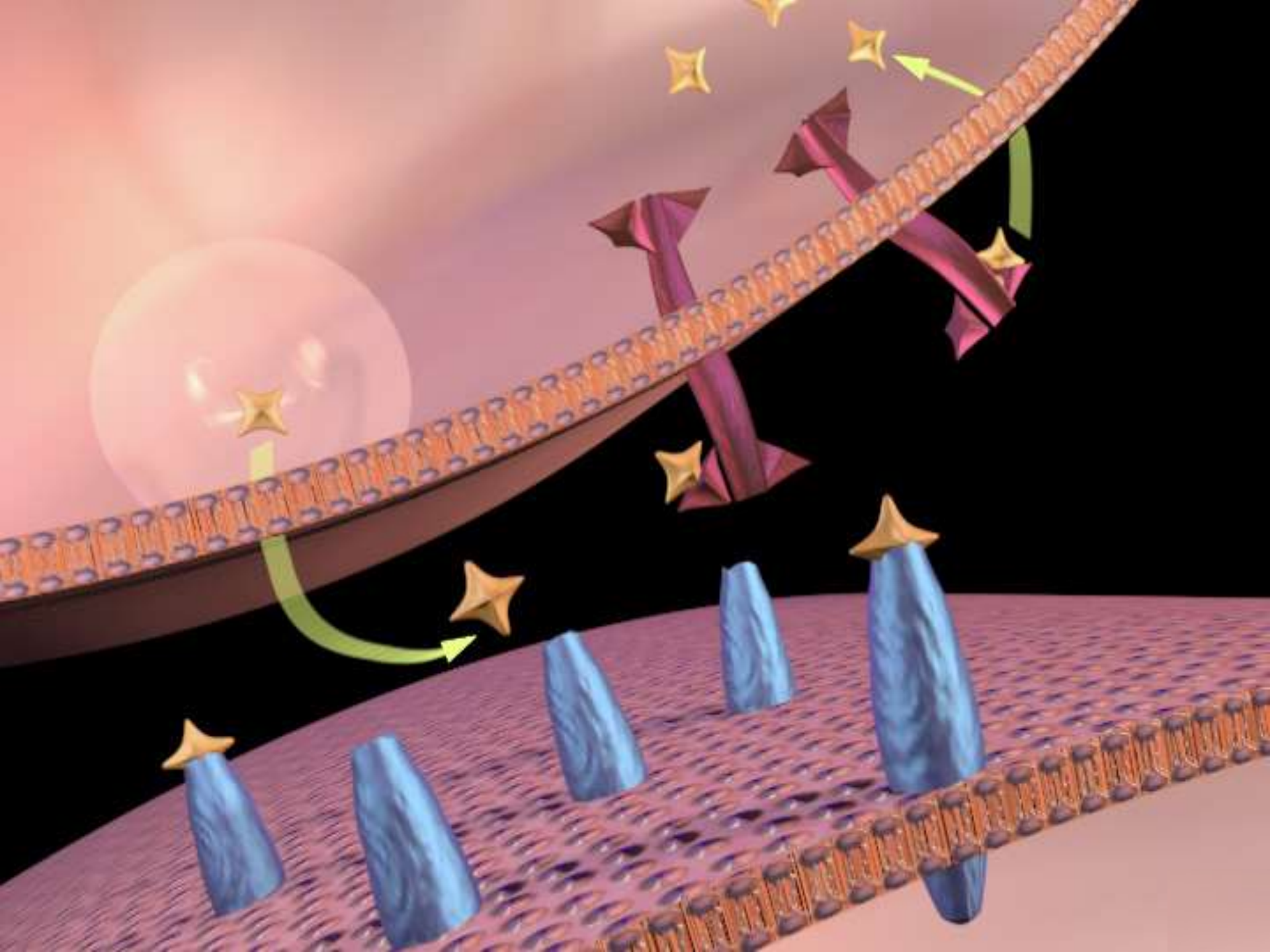


Hyman et al., Ann Rev Neurosci 2006

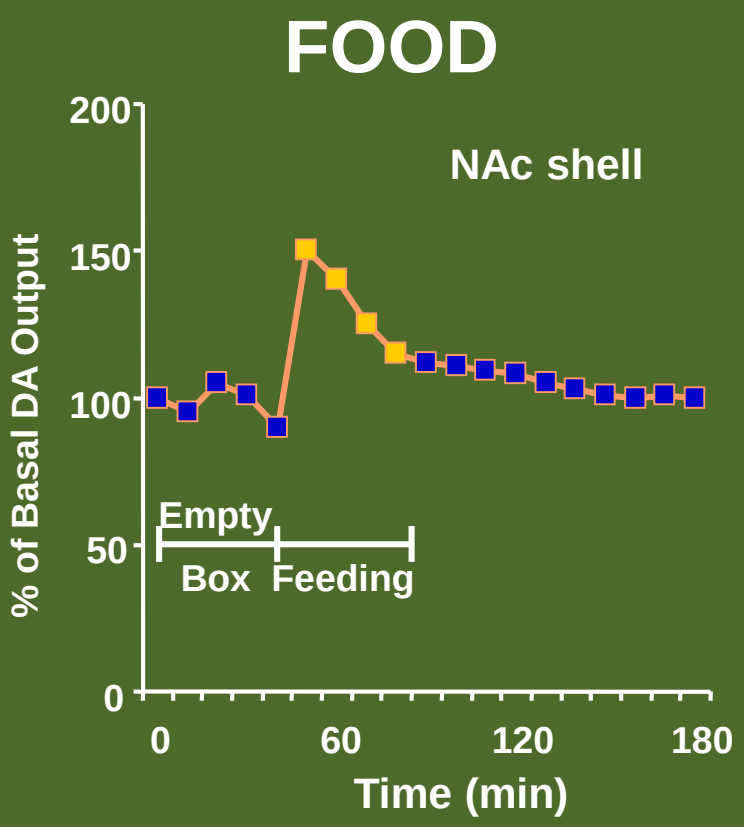
The Common Denominator: Dopamine in Nucleus Accumbens and VTA

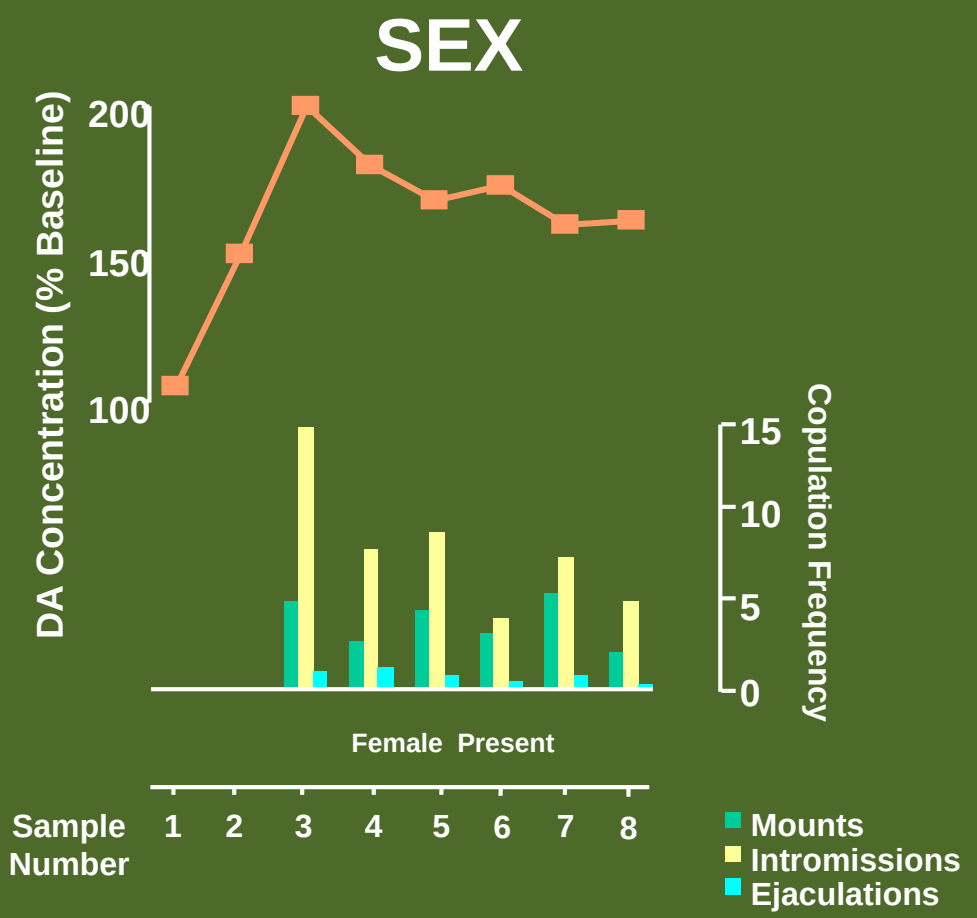


Hyman SE, et al. 2006.
Annu. Rev. Neurosci. 29:565–98



Natural Rewards Elevate Dopamine Levels in Shell of Nucleus Accumbens

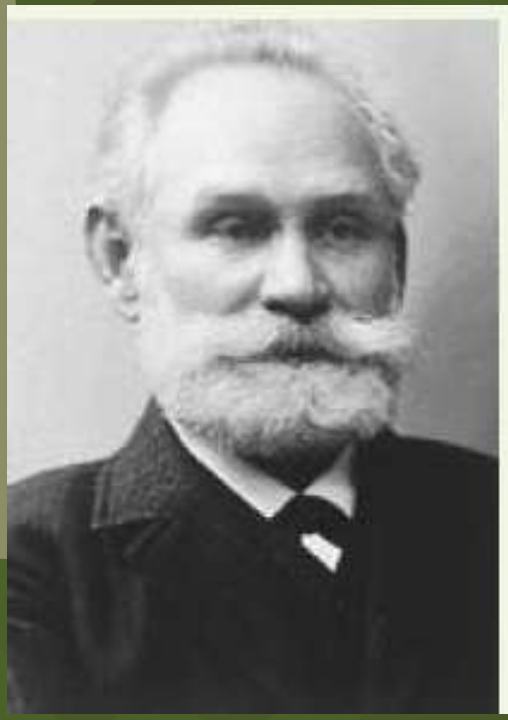


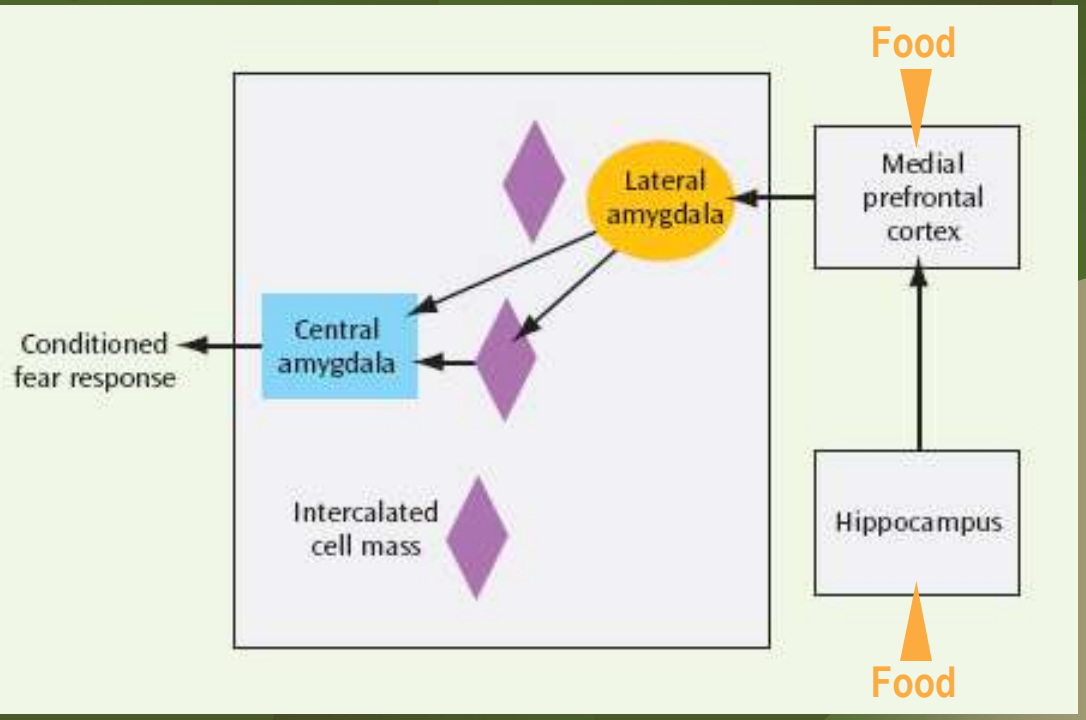


Di Chiara et al., Neuroscience, 1999.

Fiorino and Phillips, J. Neuroscience, 1997.

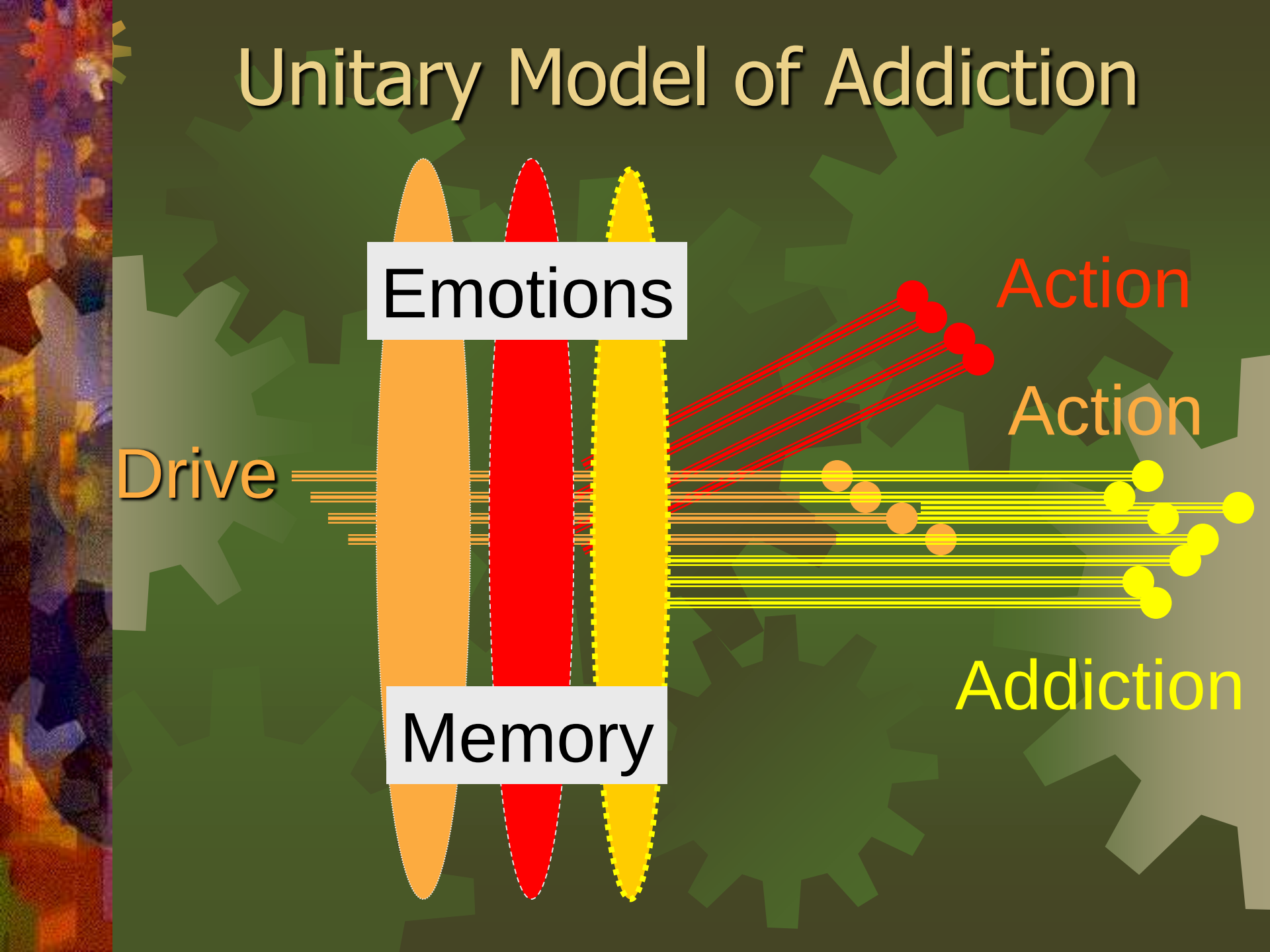
Pavlovian Classical Conditioning/ Extinction and Trauma/Addiction





Tamminga, *Am. J. Psychiatry* 163:961 (2006)

Unitary Model of Addiction



Addiction and Learning/Memory: Relevance to Obesity Treatment

- Addiction relies on some of the same neurobiological mechanisms as learning
- Cravings are triggered by memories, affective states, and situations associated with a behavior (hunger/over-eating)
- Both declarative and non-declarative memories are involved in responses to cravings (relapse to over-eating) and must be modified (diminished) in treatment

Complication of Over-Eating: Neuroadaptation to Food Signals

- Chronic intake of fat can disrupt normal adiposity signals leading to insulin and leptin resistance
- Enduring neuroadaptive changes in appetite/satiety may result
- Food tolerance, dependence, and withdrawal akin to neuroadaptive changes associated with drug addiction

Obesity: Loss of Control

- Food is consumed in larger amounts or over a longer period than intended
- Persistent desire or unsuccessful efforts to cut down or control over-eating

Obesity: Salience to Behavioral Repertoire

- A great deal of time is spent in activities necessary to obtain food, over-eat, or recover from effects of over-eating
- Important other social, occupational, or recreational activities are given up or reduced
- Over-eating is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by overweight

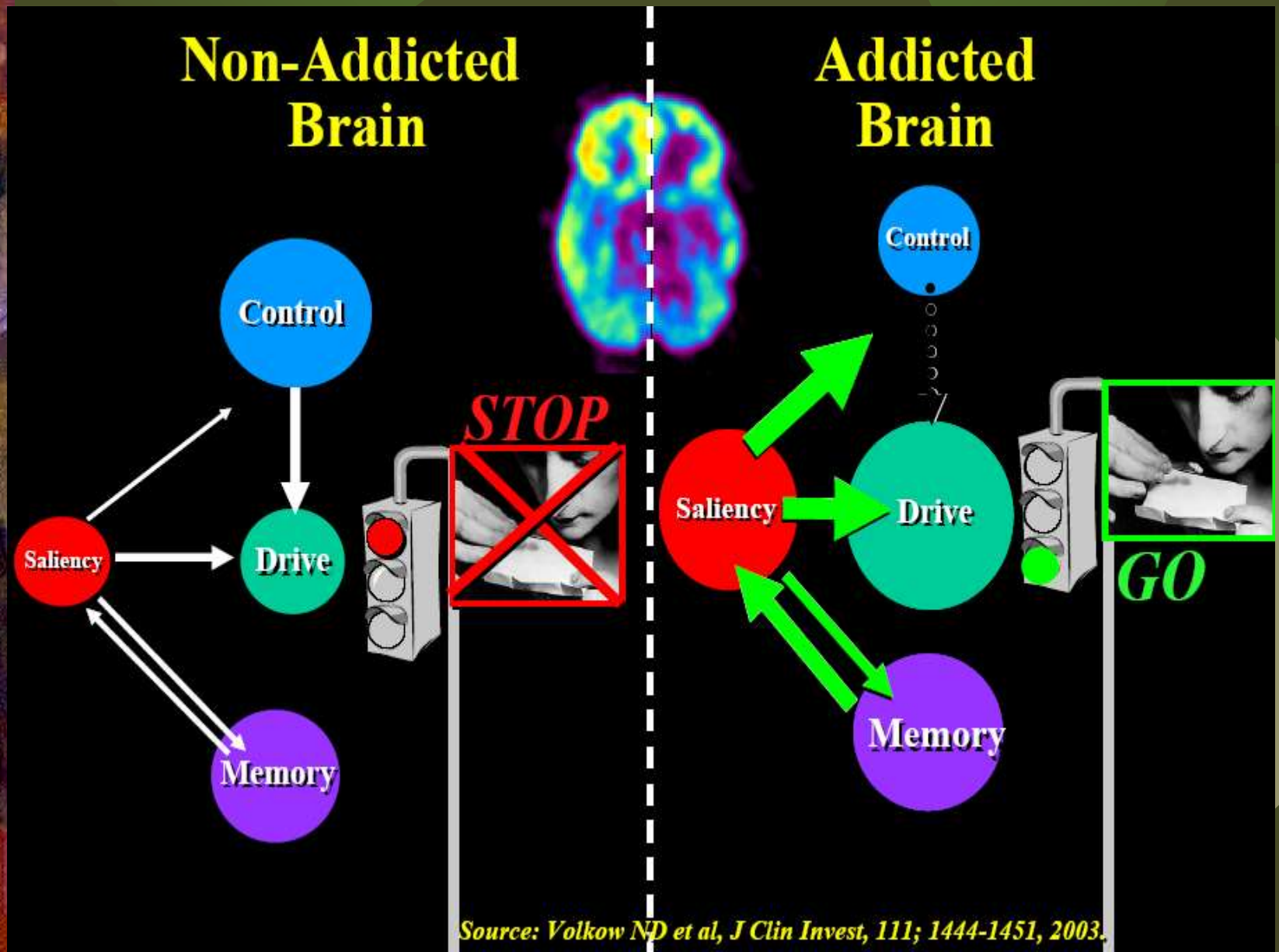
Obesity: Neuroadaptation

- Tolerance
  - need for increased amounts of the food to achieve satiety or desired effect
  - markedly diminished effect with continued intake of the same amount of food
- Withdrawal
  - characteristic dysphoria, lack of well-being
  - eating to relieve or avoid withdrawal symptoms

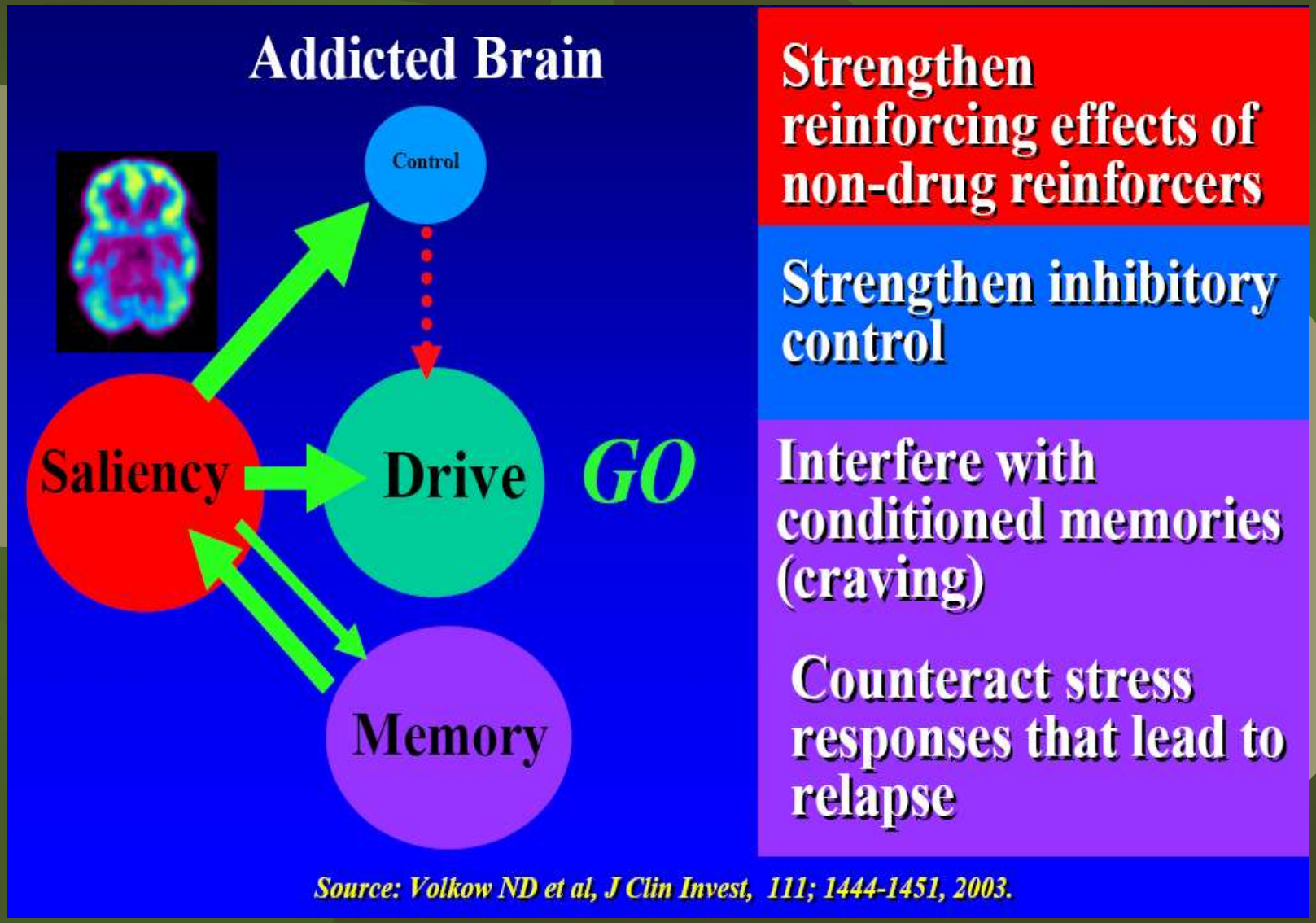
Addiction Model: Treatment of Obesity

- Primary focus on over-eating
- Clinical evaluation must consider psychiatric and medical antecedants and complications
- Recognition of presence of withdrawal symptoms
- Inpatient, outpatient, residential, aftercare
- Psychotherapies (social or milieu, insight-oriented, behavioral, individual, and group)
- Introduce/encourage participation in mutual-support groups, e.g. OA (modeled on AA)
- Chronic (life-long) illness with expected relapses

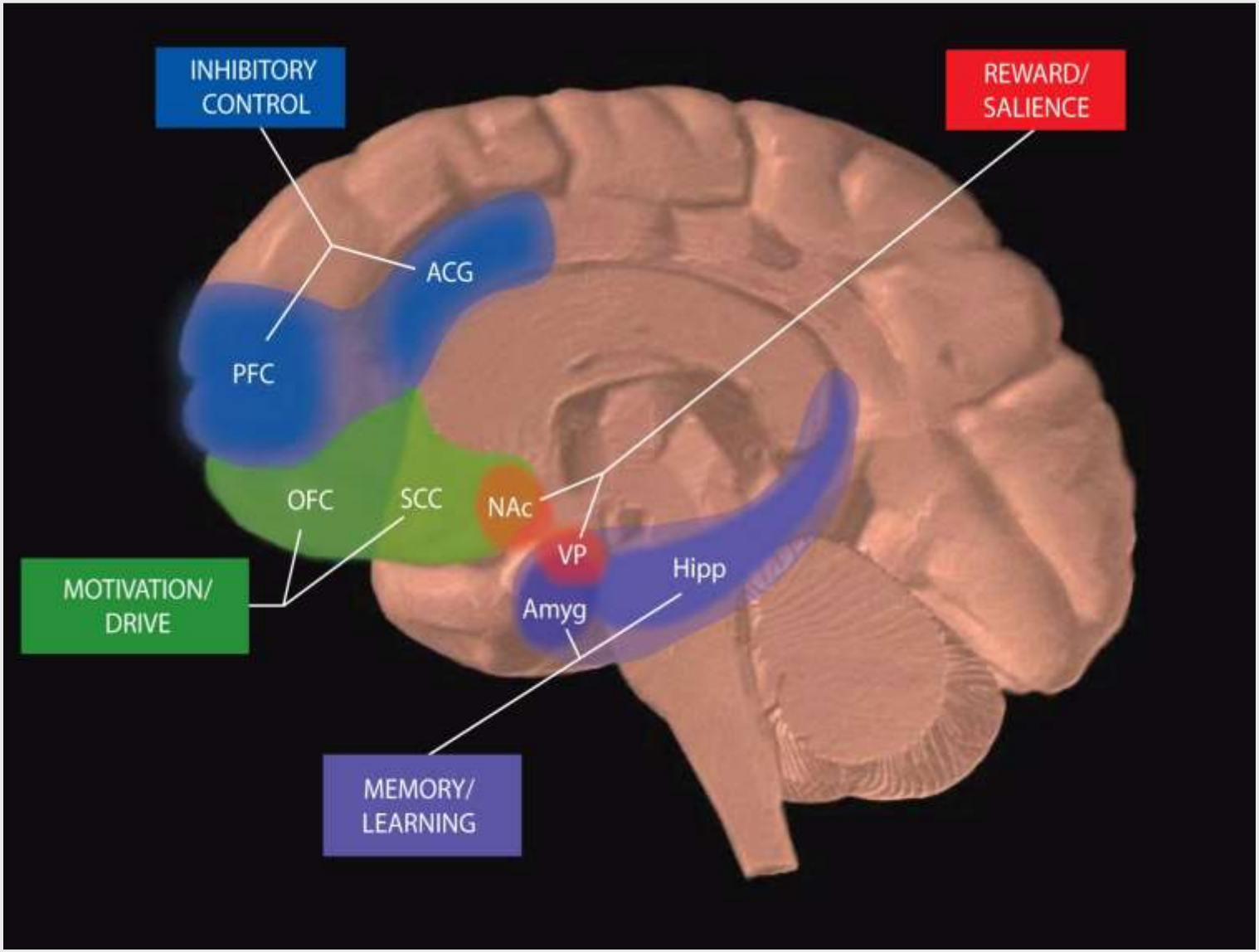
Addiction Changes Brain Circuits: Augmented Response to Triggers



Pharmacopsychosocial Approaches for Relapse Prevention

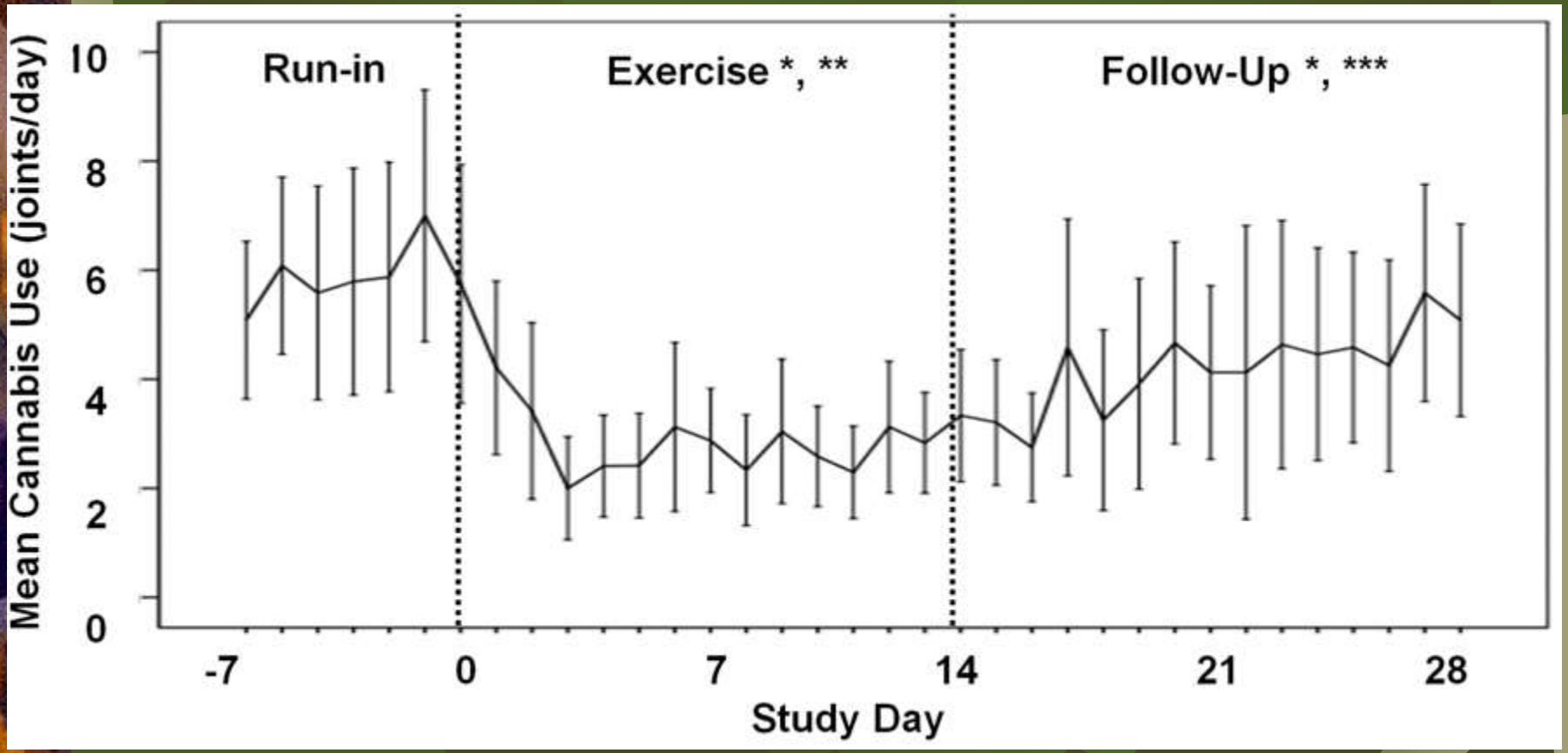


Circuits Involved In Drug Abuse and Addiction



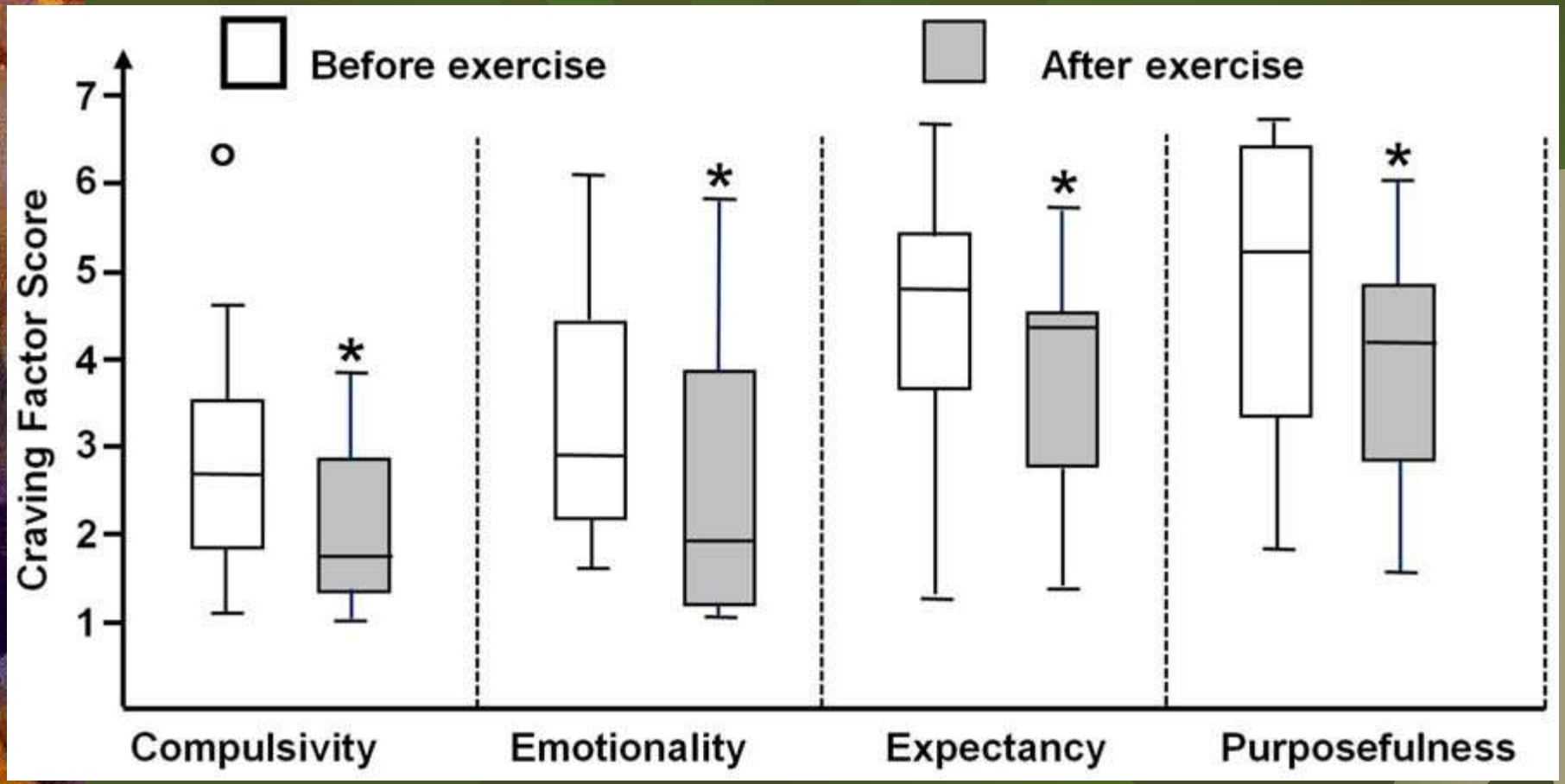
All of these must be considered in developing strategies to effectively treat addiction (to food?)

Effects of Exercise on Cannabis Use in Non-Treatment Seeking Individuals



Buchowski et al, PLoS ONE 6(3): e17465. doi:10.1371/journal.pone.0017465

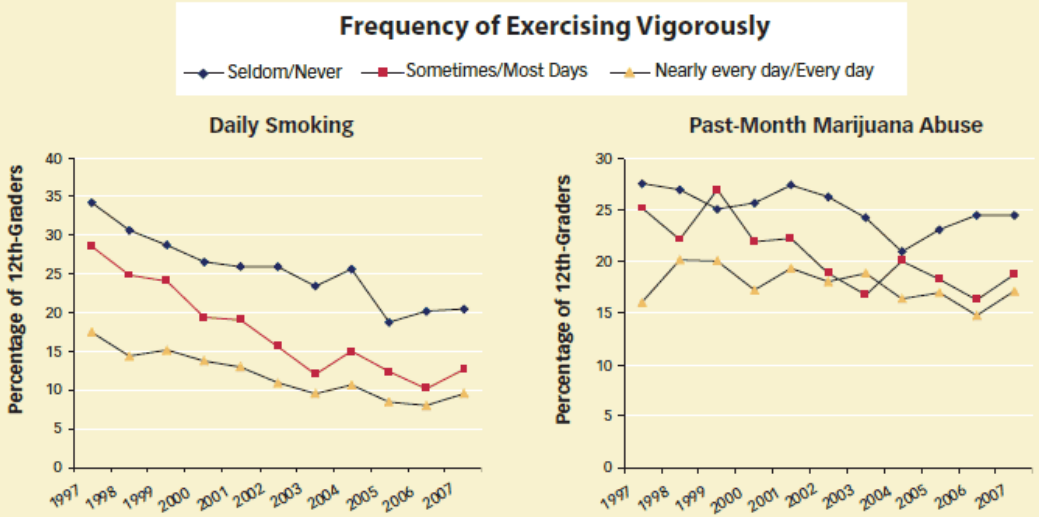
Cannabis Craving During Exercise Sessions



Buchowski et al, PLoS ONE 6(3): e17465. doi:10.1371/journal.pone.0017465

WHAT THE NUMBERS SAY

Lower Rates of Cigarette and Marijuana Smoking Among Exercising Teens



Teens who exercise regularly are less likely than less active peers to have smoked cigarettes daily or to have abused marijuana during the past month. This pattern has persisted over the past decade, according to an annual survey of the nation's high school students.

Source: An analysis of repeated cross-sectional data from the Monitoring the Future Survey, by Dr. Lloyd Johnston, University of Michigan.

Medications Used in Treatment of Addiction/Obesity

- Craving/Relapse (1° only)
  - disulfiram, naltrexone, acamprosate, topiramate*, oxcarbazepine
  - methadone*, buprenorphine, LAAM
  - bupropion, nicotine replacement, varenicline*
  - rimonabant*
- Antidepressants (2° only)
  - fluoxetine, sertraline, paroxetine, etc
- Mood stabilizers (1° and 2°)
  - valproate*, carbamazepine, oxcarbazepine, lithium*, etc
- Antipsychotics (1° and perhaps 2°)
  - haloperidol, risperidone, olanzapine*, etc
- Anxiety/Insomnia/Pain: BE VERY CAREFUL!

* *Significant effect on body weight noted clinically*

Major Goal of Treatment: Diminish and Manage Relapses

- Reduce stimuli which might reinstate active addiction (to food?):
  - Stress
  - Environmental cues
  - Re-exposure to drugs

Nonpharmacologic Treatments for Substance Abuse (Over-Eating)

- Education
- 12-Step support program facilitation (eg, AA, NA, CA)
- Enhancement of coping strategies
- Relaxation training
- Family therapy
- Lifestyle change (avoiding drug use trigger situations)
- Psychotherapy (usually cognitive, relational, or supportive, in a group or individual setting)
- Vocational and physical rehabilitation
- Recreational therapy
- Sexual education
- Health and nutritional counseling
- Spiritual growth
- Aftercare

Original Article |

ONLINE FIRST

Substance Use Following Bariatric Weight Loss Surgery ONLINE FIRST

Alexis Conason, PsyD; Julio Teixeira, MD; Chia-Hao Hsu, PhD; Lauren Puma, MS; Danielle Knafo, PhD; Allan Geliebter, PhD

[+] Author Affiliations

Arch Surg. 2012;():1-6. doi:10.1001/2013.jamasurg.265.

Published online October 2012

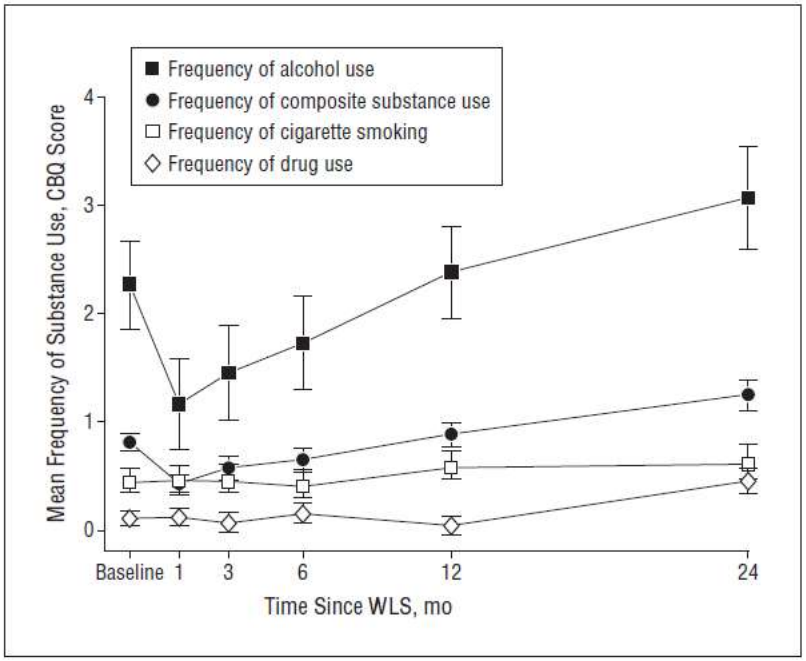


Figure 1. Estimated mean frequency of substance use by category for bariatric weight loss surgery (WLS) based on Compulsive Behaviors Questionnaire (CBQ) scores of 155 participants. The values represent mean values, and the error bars indicate SEM.

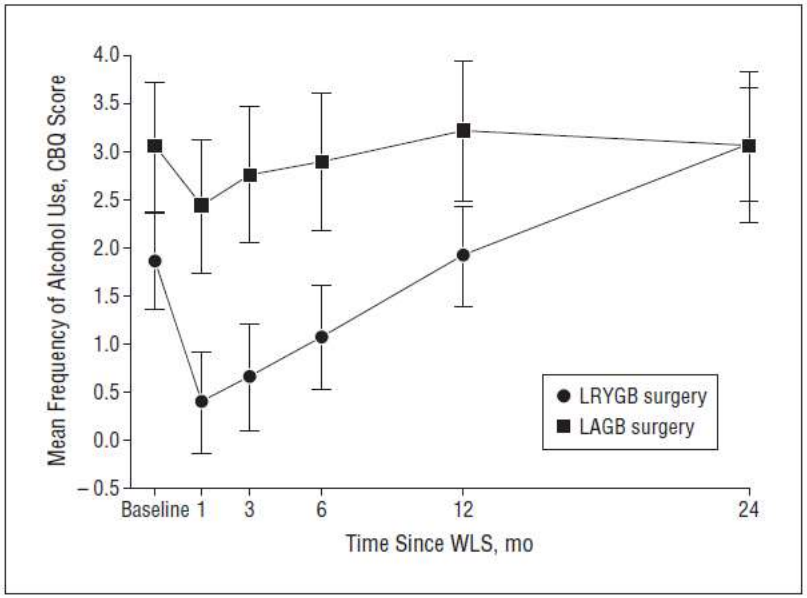


Figure 2. Estimated mean frequency of alcohol use for laparoscopic Roux-en-Y gastric bypass (LRYGB) surgery and laparoscopic adjustable gastric band (LAGB) surgery based on Compulsive Behaviors Questionnaire (CBQ) scores of 155 participants. The values represent mean values, and the error bars indicate SEM.