Drug Abuse and Addiction: What the Research Says

Donald R. Vereen, M.D., M.P.H.
Director
Community-Based Public Health
School of Public Health
University of Michigan
Former Medical Officer and Special Assistant
National Institutes of Health
Former “Deputy Drug Czar”
White House Office of National Drug Control Policy

National Library of Medicine
Drug Abuse is a Preventable Behavior
ADDICTION IS A DEVELOPMENTAL DISEASE
starts in adolescence and childhood

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


Age at cannabis use disorder as per DSM IV

NIAAA National Epidemiologic Survey on Alcohol and Related Conditions, 2003
Drugs of Abuse Engage Systems in the Motivation and Pleasure Pathways of the Brain
Dopamine Pathways

Principal “Pleasure” System of the Brain

Effects of Drugs on Dopamine Levels

- **AMPHETAMINE**
  - Nucleus accumbens
  - Dopamine (DA) levels increase and then decline over time.

- **COCAINE**
  - Nucleus accumbens
  - Dopamine (DA) levels increase and then decline over time.

Natural Rewards Elevate Dopamine Levels

- **FOOD**
  - NAc shell
  - Dopamine (DA) levels increase after feeding.

- **SEX**
  - Dopamine (DA) levels increase after female presentation.

**Source:** Di Chiara and Imperato

**Source:** Di Chiara et al., Fiorino and Phillips
Brain Dopamine System

Anatomy

Dopamine Cell

DA Transporters

DA Receptors

Metabolism

Brain Dopamine System

Anatomy

Dopamine Cell

DA Transporters

DA Receptors

Metabolism
Drug Addiction is a Treatable Brain Disease
Dopamine D2 Receptors are Lower in Addiction

Reward Circuits
Non-Drug Abuser

Drug Abuser

Control
Addicted
Different Brain Circuitry Involved in Drug Reward and Drug Persistence Behavior

Reward – Limbic Subcircuit

Blockade in these regions blocks relapse or reinstatement

Drug Seeking Behavior – Motor Subcircuit

Circuits Involved In Drug Abuse and Addiction

Inhibitory Control
Motivation/Drive
Reward
Memory/Learning

All of These Must Be Considered In Developing Strategies to Most Effectively Treat Addiction
ADDICTION IS A DISEASE OF THE BRAIN
like other diseases, it affects tissue function

Decreased Brain Metabolism in *Drug Abuse Patient*

- Control
- Cocaine Abuser

Decreased Heart Metabolism in *Heart Disease Patient*

- Healthy Heart
- Diseased Heart

Sources: From the laboratories of Drs. N. Volkow and H. Schelbert
Dopamine Transporters in Methamphetamine Abusers

Methamphetamine abusers have significant reductions in dopamine transporters.

Dopamine Transporters (Bmax/Kd)

- Normal Controls
- Meth Abusers

p < 0.0002

Methamphetamine abusers have significant reductions in dopamine transporters.
As we grow older we lose dopamine transporters in our brain; methamphetamine accelerates this loss.
Chronic use of some of these drugs may alter the way the brain functions, making persons particularly susceptible to mental illness.
Research Tells Us That **STRESS** Can Be A Major Factor In the *Initiation of Drug Use*…

And One of the Most Powerful Triggers for *Relapse* In Recovering Addicts…
Effect of Cocaine Abuse on Dopamine D2 Receptors

normal subject

cocaine abuser (1 month post)

cocaine abuser (4 months post)
The Majority of People Who Need Treatment for Drug Abuse Problems *Don’t* Receive It!

Nearly half of individuals with a past year substance use disorder also had a mental disorder.

Mental disorders found to be most prevalent included affective disorders, anxiety disorders, personality disorders, and psychotic disorders.
DRUG ABUSE AND ADDICTION INVOLVE MULTIPLE AND INTERACTIVE FACTORS

Biology/Genes

Environment

Brain Mechanisms

Addiction