

Addiction as a Disease

ASAM Definition

- According to the American Society of Addiction Medicine, addiction is “a primary chronic neurobiologic disease, with genetic, psychosocial, and environmental factors influencing the development and manifestations
- Addiction is characterized by: (Four “C”s)
 - Impaired control over drug use
 - Compulsive use
 - Continued use despite harm
 - Craving

Seikel, SE, Methadone treatment in pregnancy...That can't be right, can it?, Northeast Florida Medicine, 2012; 63.

Definition of Addiction

- Addiction is an intense desire use a drug with an impaired ability to control the urges to take that drug, even at the expense of serious adverse consequences.
- Often addiction is stigmatized as a bad “choice” that is made voluntarily by the addicted person.
- Multiple studies and research show that repeated drug use leads to long-lasting changes in the brain that undermine voluntary control.
- There are environmental, genetic, and developmental factors that contribute to addiction.

Addiction is a Disease?

- Recent imaging studies have revealed an underlying disruption to brain regions that important for the normal processes of motivation, reward, and inhibitory control of addicted individuals
- The abnormal behavior with addiction is a chronic disease of the brain associated with dysfunction of brain tissue, just like cardiac insufficiency is a disease of the heart and abnormal blood circulation is a result of dysfunction of myocardial tissue
- Drug experimentation and recreational use are volitional, but after addiction develops, control is markedly disrupted
- Imaging studies consistently show specific abnormalities in the brain function of the addicted.

Volkow and et al., Dopamine in drug abuse and addiction: results of imaging studies and treatment implications, Archives of Neurology, 2007;64

Similarities to other Chronic Diseases

- The adaptations in the brain that result from chronic exposure are long lasting, and therefore addiction should be viewed as a chronic disease
- Long-term treatment will be required for most cases, just as for other chronic diseases (hypertension, diabetes, asthma)
- Perspective on relapse...discontinuation of treatment as for other chronic diseases, is likely to result in relapse. Relapse is not a failure of treatment, but due to lack of compliance or tolerance to an effective treatment
- Rates of relapse and recovery in the treatment of drug addiction are equivalent to other medical diseases.

McLellan et al., Drug dependence, a chronic medical illness: implications for treatment, insurance, and outcomes evaluation. JAMA, 2000;284.

Understanding Addiction

- Addiction is Brain Disease affecting 10 to 15% of the population
- Working in MAT, one can experience a transformation of a woman whose brain is being run by a limbic system in overdrive, to one with intact executive function and a prefrontal cortex that could override a thought of using
- Addiction is a brain disease...not a moral failing

Seikel, SE, Methadone treatment in pregnancy...That can't be right, can it?, Northeast Florida Medicine, 2012; 63.

Hypofrontality

- Nora Volkow's work at NIDA shows evidence of a limbic system that has significantly increased activity of PET images
- The prefrontal cortex in patients with addictive disorders has diminished cellular activity
- In neuroimaging, this is called "hypofrontality".
- Scientists could predict relapse in cocaine addicts by "how dark", or the degree of hypofrontality, in these patients.

Volkow et al., Long-term frontal brain metabolic changes in cocaine abusers,
Synapse, 1992:11

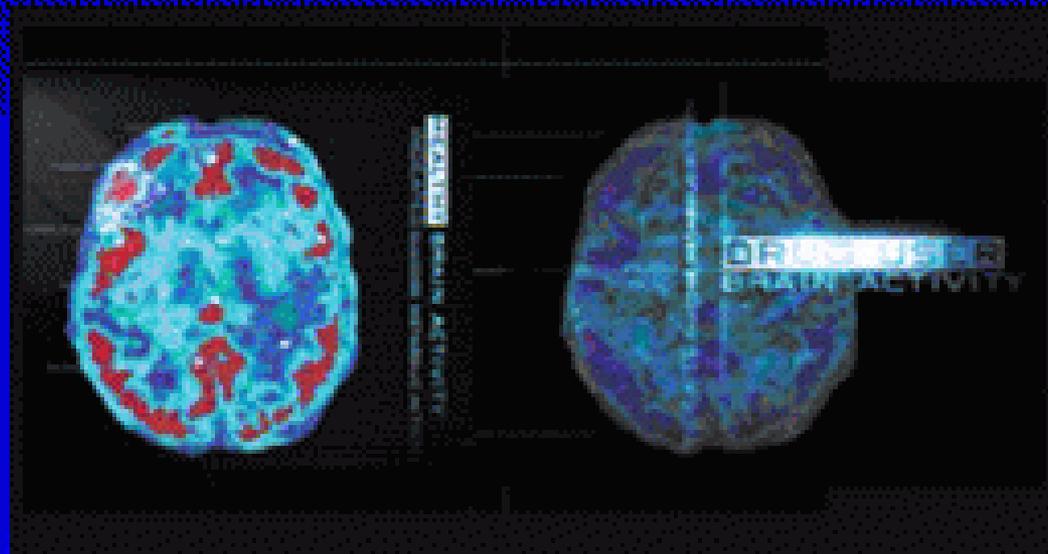
The Process of Addiction

- When the mu opiate receptor is chronically activated over a period of time, it results in structural changes in the brain – altered gene expression.
- Once there is new gene expression, new metabolic pathways are activated from new enzymes and the brain has changed, most likely permanently
- In NA, there is the saying “once an addict, always an addict” and...”you can’t change a pickle back into a cucumber”.

Kreek, MJ, Methadone-related opioid agonist pharmacology of heroin addiction. History, recent molecular and neurochemical research and future in mainstream medicine. *Annals of New York Academic Science*, 2000;909.

What is Addiction?

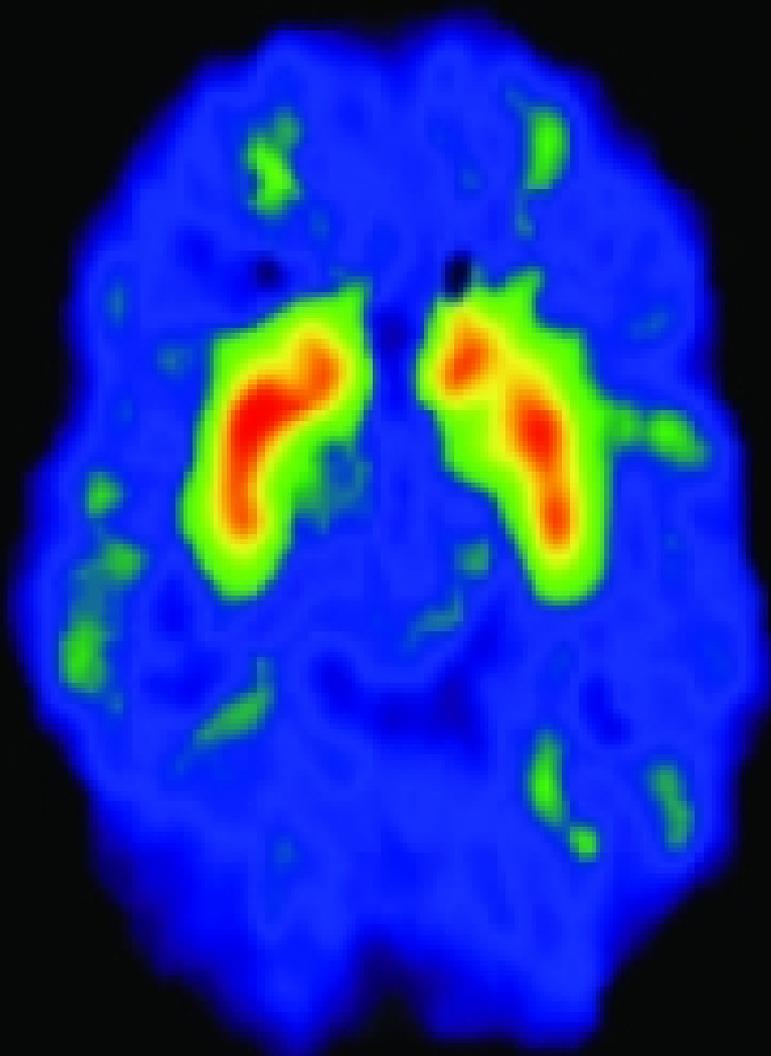
Addiction is A Brain Disease



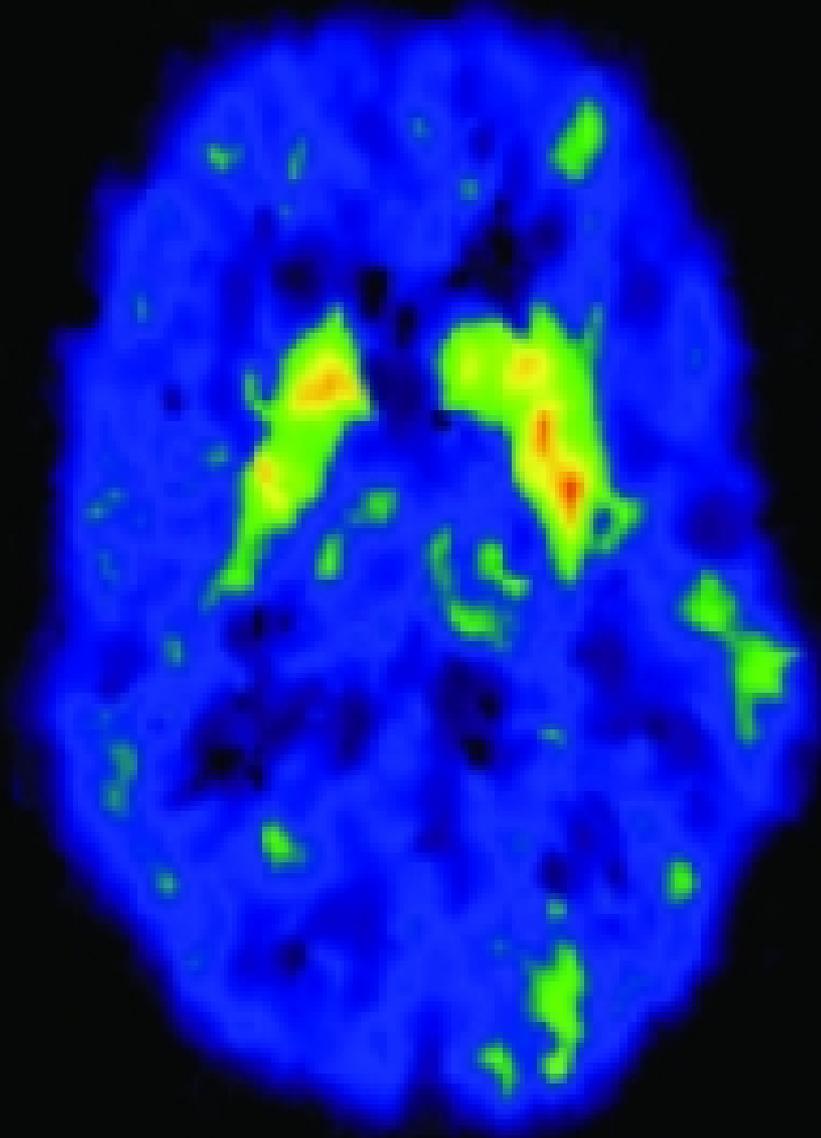
- Characterized by:
 - Compulsive Behavior
 - Continued abuse of drugs despite negative consequences
 - Persistent changes in the brain's structure and function

The Effects of Drugs on the Brain

Just as we turn down the volume on a radio that is too loud, the brain adjusts to the overwhelming surges in dopamine (and other neurotransmitters) by producing less dopamine or by reducing the number of receptors that can receive signals. As a result, dopamine's impact on the reward circuit of a drug abuser's brain can become abnormally low, and the ability to experience any pleasure is reduced. This is why the abuser eventually feels flat, lifeless, and depressed, and is unable to enjoy things that previously brought them pleasure. Now, they need to take drugs just to try and bring their dopamine function back up to normal. And, they must take larger amounts of the drug than they first did to create the dopamine high - an effect known as tolerance.



Healthy Control



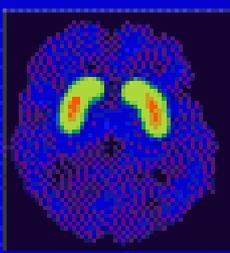
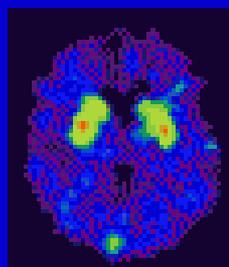
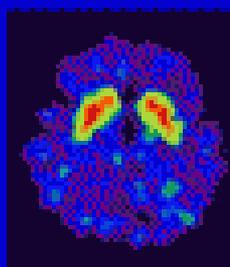
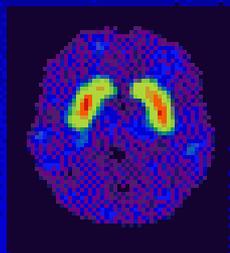
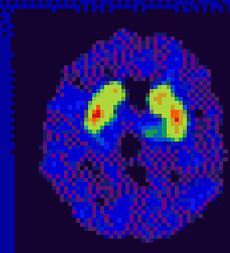
Drug Abuser

Description of Brain Changes

- Positron emission tomography (PET) images show similar changes in brain dopamine receptors resulting from addiction to different substances. Dopamine D₂ receptors are one of five types of receptors that bind dopamine in the brain. The brain images on the left are those of controls, while those on the right are from individuals addicted to cocaine, methamphetamine, alcohol, or heroin.

Functionally...

Dopamine D2 Receptors are Decreased by Addiction



Control

Addicted

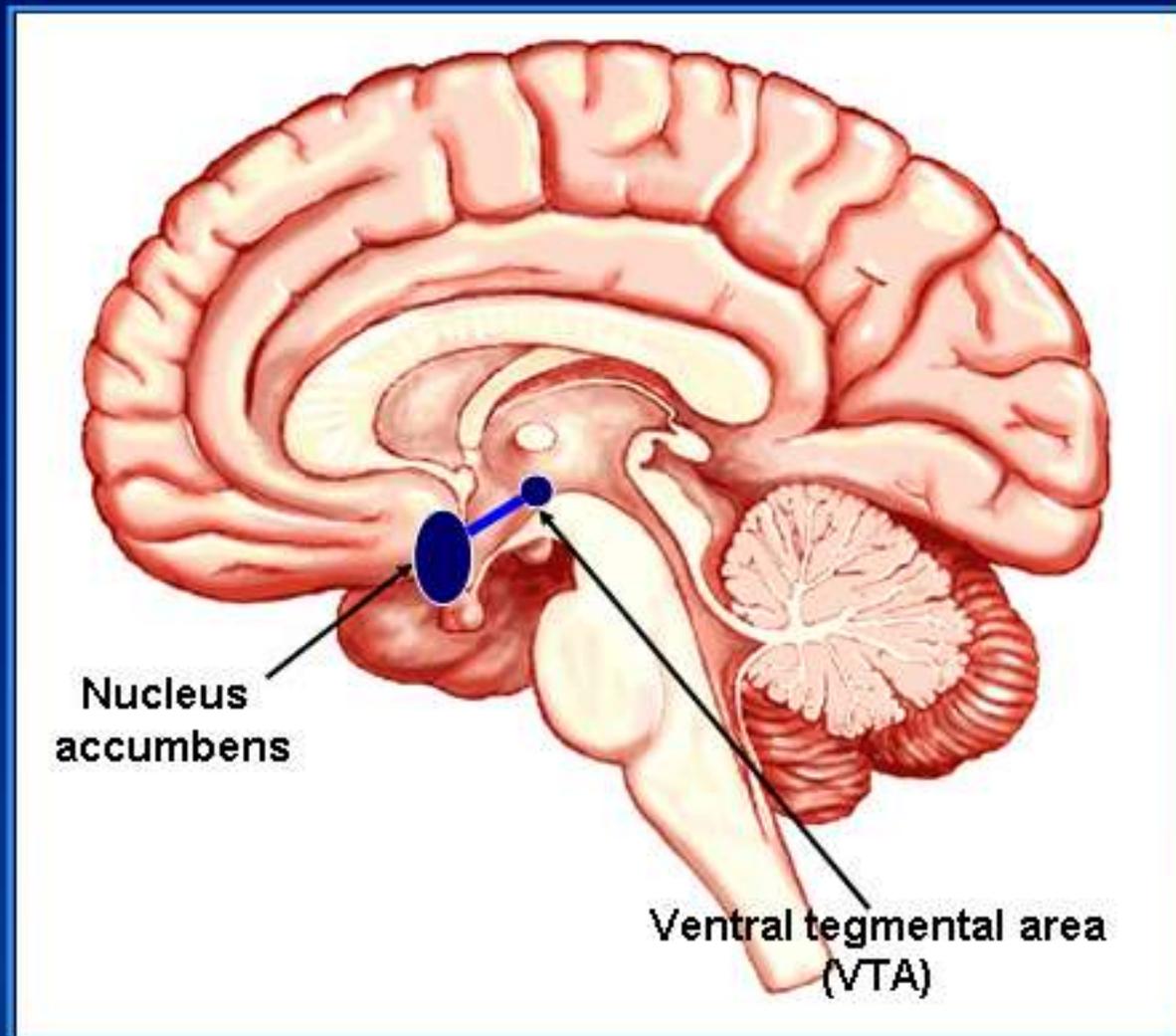


DA D2 Receptor Availability

Description of Brain Changes

- The striatum (which contains the reward and motor circuitry) shows up as bright red and yellow in the controls (in the left column), indicating numerous D2 receptors. Conversely, the brains of addicted individuals (in the right column) show a less intense signal, indicating lower levels of D2 receptors. This reduction likely stems from repeated over-stimulation of the dopamine receptors. Brain adaptations such as this contribute to the compulsion to abuse drugs.

Brain Reward Pathways



- The VTA-nucleus accumbens pathway is activated by all drugs of dependence including alcohol

- This pathway is important not only in drug dependence, but also in essential physiological behaviors such as eating, drinking, sleeping, and sex