

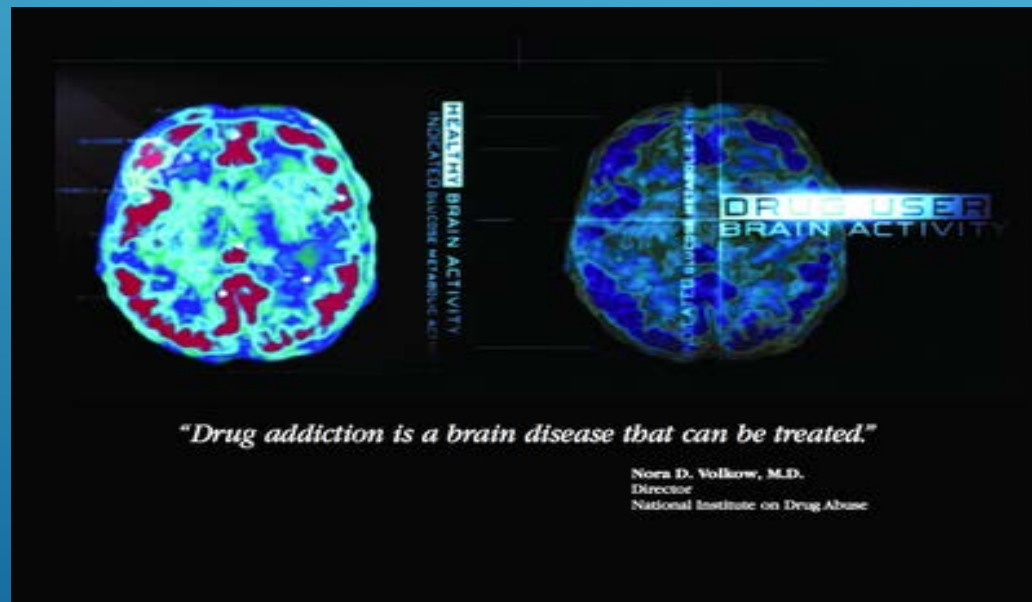
COGNITIVE REHABILITATION AS A CRUCIAL TOOL IN INCREASING THE EFFECTIVENESS OF TREATMENT IN SUBSTANCE ABUSE DISORDERS

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“Drug addiction is a **brain disease** that can be treated.”

- Nora D. Volkow, Director, National Institute on Drug Addiction



COGITO ERGO SUM

- **Cognition** is the mental action or process of acquiring knowledge and understanding through thought, experience and the senses
- **Addiction** can be defined as a chronic, relapsing brain disease characterized by compulsive drug-seeking and use, despite harmful consequences (NIDA)
- **Cognitive impairment (CI)**, according to NIDA, is “when a person has trouble remembering, learning new things, concentrating or making decisions that affect their everyday life”
- **Neurocognition** is the action of cognitive functions and their associations with brain areas and neural pathways



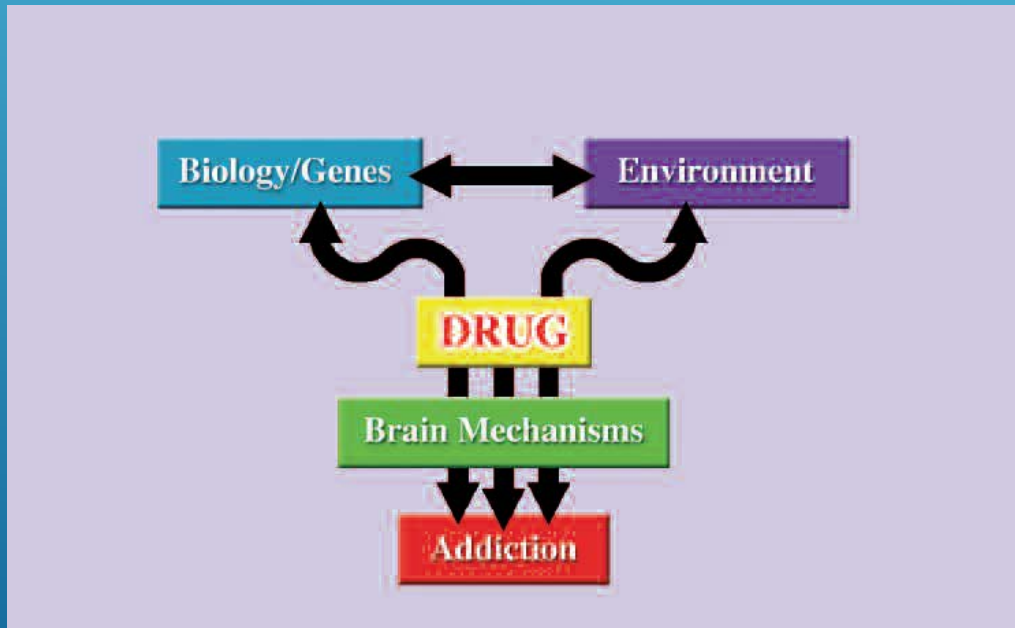
ADDICTION – MORAL FAILING? WEAKNESS?



ADDICTION IS BIOLOGICAL, ENVIRONMENTAL & BEHAVIORAL

Risks for addiction include:

- Home environment of drug use or criminal behavior
- School environment of drug-using peers; poor academic performance
- Family history of addiction; genetic factors account for 40%-60% of vulnerability for drug use



ALCOHOL/DRUGS & BRAIN FUNCTIONING

Negative effects on a wide array of functions, including:

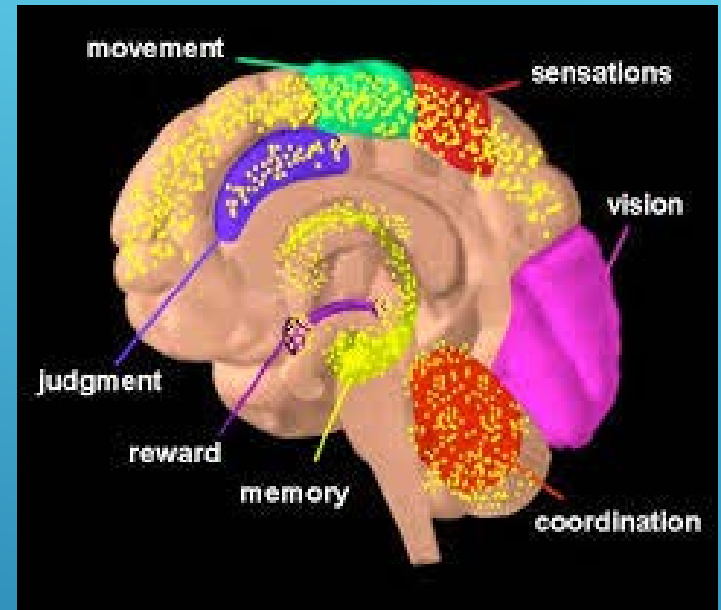
- Learning, memory and reasoning
- Attention
- Motor skills
- Time estimation, verbal fluency, pattern recognition
- Planning
- The ability to shift attention from one frame of reference to another

...and many more

Psychological effects:

- Wild mood swings
- Depression
- Anxiety
- Paranoia
- Violence
- Decrease in pleasure in everyday life

...and others



TRAUMATIC BRAIN INJURY (TBI)

Image of brain of veteran with TBI compared with a normal brain

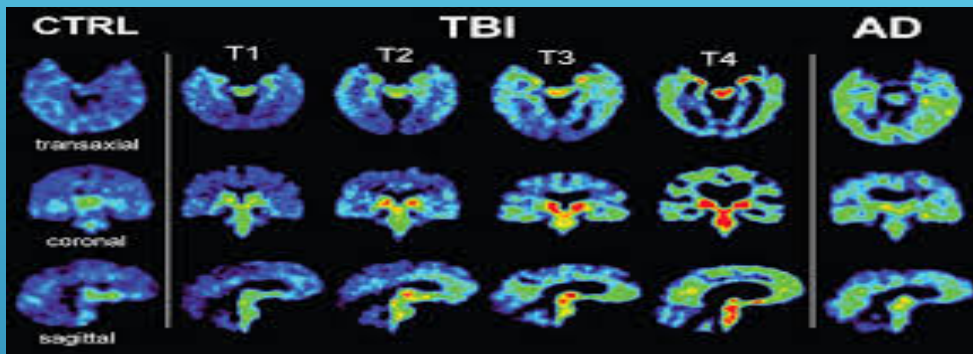
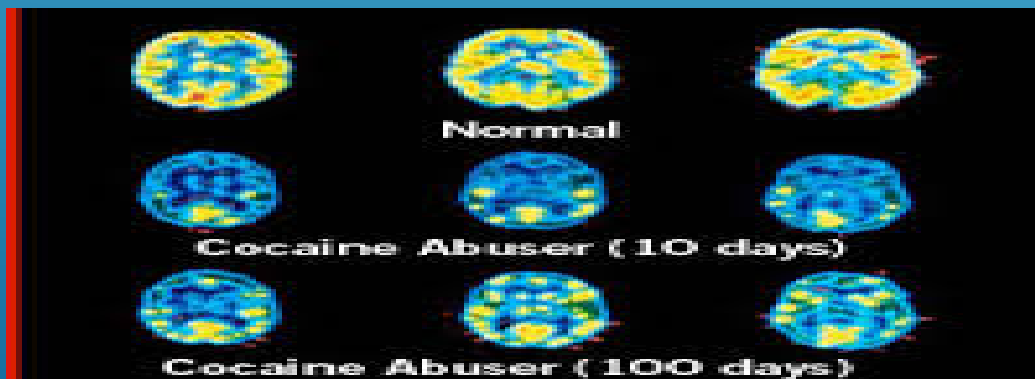


Image of brain damage over time (at 10 days & 100 days) in a cocaine user



EFFECTS OF SUBSTANCE USE ON COGNITION

Research has shown that there is a **correlation between substance use and specific neurocognitive deficits:**

- **Cocaine:** Deficits in cognitive flexibility (the brain's ability to switch from thinking about one concept to another)
- **Amphetamines:** Deficits in attention and impulse control
- **Opioids:** Deficits in cognitive flexibility
- **Alcohol:** Deficits in working memory and attention
- **Cannabis:** Deficits in cognitive flexibility (switching from one subject to another), attention, memory



MEET THE BRAIN!

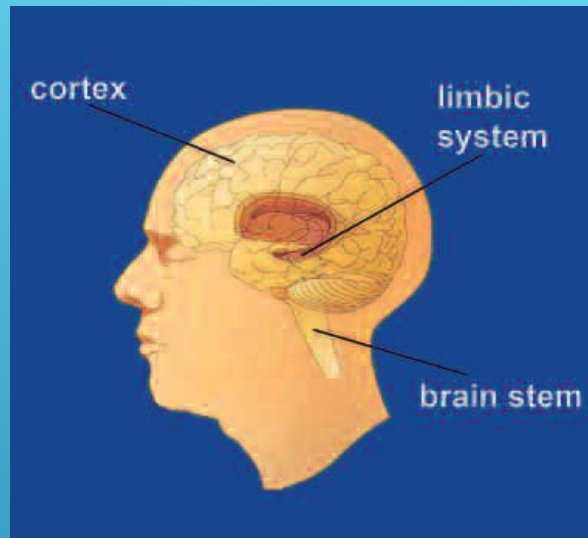
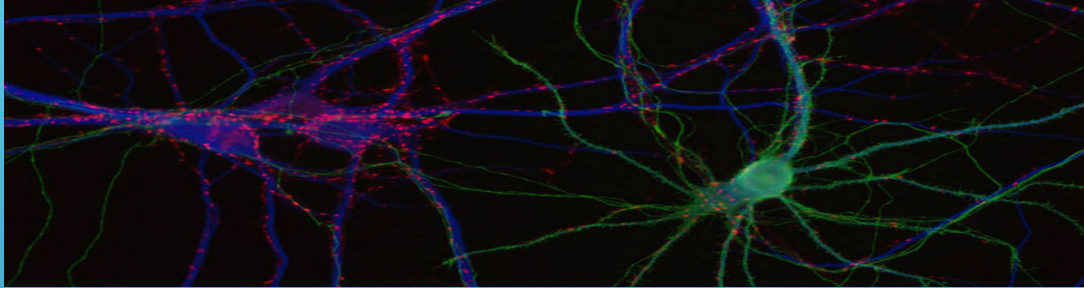


Figure courtesy of the National Institute on Drug Abuse

- **Brain stem:** Regulates life-sustaining process such as breathing, sleeping and heart rate.
- **Cerebral cortex:** Processes information from the senses; includes the frontal cortex, which controls thinking, planning, problem-solving, decision-making
- **Frontal cortex:** A part of the cerebral cortex, the so-called thinking center, which is responsible for thinking, planning, problem-solving and decision-making.
- **Limbic system:** Activated by drugs and alcohol; the “pleasure center” of the brain

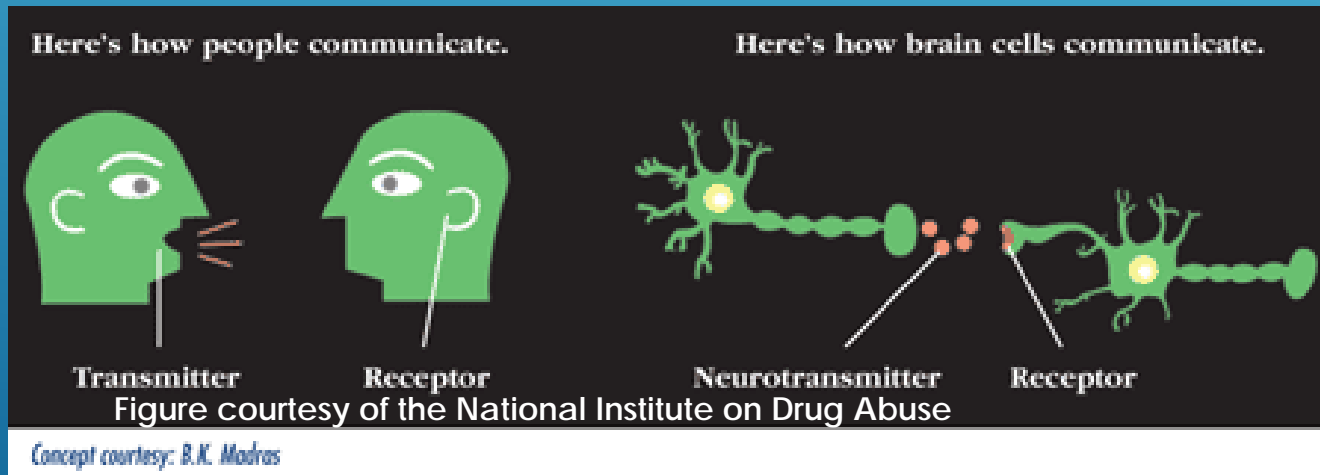
HOW THE BRAIN COMMUNICATES



- **Neuron-to-Neuron:** A nerve cell in the brain (a neuron) sends and receives messages via electrical and chemical signals, then “forwards it to other neurons”
- **Synapses:** Spaces between neurons over which messages are carried between neurons
- **Neurotransmitters (chemical messengers):** Carry messages between neurons
- **Receptors (chemical receivers):** The neurotransmitter attaches to these sites on neurons in “lock and key” fashion, then “forwards” the message
- **Transporters (the brain's chemical recyclers):** Located on the neuron that releases the neurotransmitter, they recycle neurotransmitters by bringing them back to the neuron that released them, shutting off the signal

SUMMARY OF A CEREBRAL CONVERSATION

To send a message, a brain cell (neuron) releases a chemical (neurotransmitter) into the space (synapse) between it and the next cell. The neurotransmitter crosses the synapse and attaches to proteins (receptors) on the receiving brain cell. This causes changes in the receiving cell—the message is delivered.



NEUROPLASTICITY

Neuroplasticity is defined as the inherent property of neural circuits to alter their structure, function, and connectivity in response to intrinsic (internal) or extrinsic (external) stimuli.

Common causes of neuroplastic changes include:

- Neurodegenerative conditions such as Alzheimer's disease
- Developmental disorders such as Attention Deficit Hyperactivity Disorder (ADD) and other neuropsychiatric disorders (schizophrenia, bipolar disorder, ADD, depression)
- Brain injuries from TBI, stroke and—Yes—**addiction!**

Cognitive rehabilitation in people with brain injury can result in:

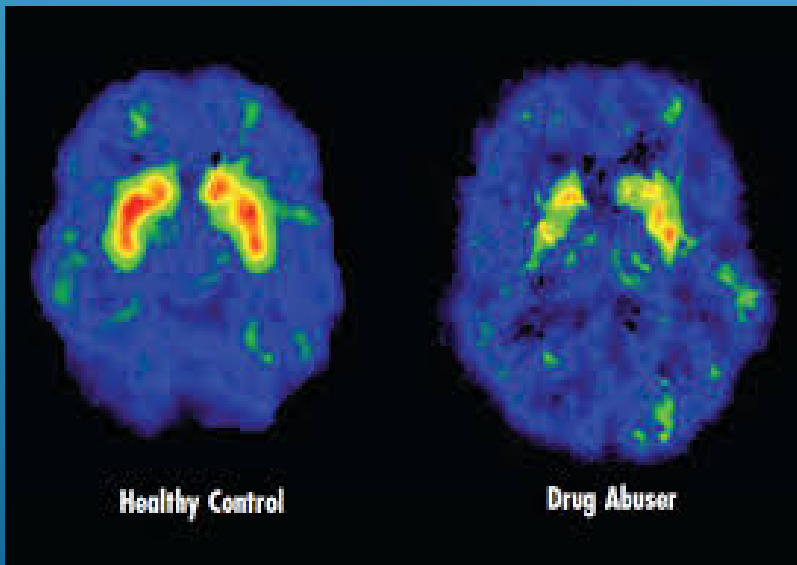
- Formation of new synaptic connections
- Strengthening of synaptic connections
- Development of projections from neurons on the undamaged side of the brain to areas where the nerves are malfunctioning
- Shifting in inter-hemispheric balance towards the uninjured hemisphere
- Changes in the area of the brain that controls motor skills



THE BRAIN ON DRUGS & ALCOHOL



Public service announcements have aimed to create dramatic images of our brains on drugs. This campaign from the 1970's was memorable, if not entirely scientific 😊

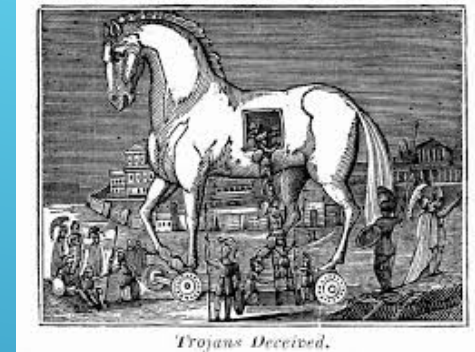


Advances in neuroimaging have yielded more sophisticated, but similarly jarring, images 😞

Decreased Dopamine Transporters in a Methamphetamine Addict

DRUGS & ALCOHOL **TRICK** THE BRAIN

- Marijuana & heroin: **"Trojan horse"** drugs that activate neurons because their chemical structure mimics that of a normal neurotransmitter
- Amphetamines & cocaine: Neurons release large amounts of neurotransmitters or prevent normal recycling of neurotransmitters; results in a very **amplified "message"** results
- Alcohol: **Increases dopamine** levels by directly raising the firing rate of isolated dopamine neurons rather than flooding the entire brain



THE PITFALLS OF PLEASURE ...

Dopamine: Neurotransmitter that regulates movement, emotion, motivation and feelings of pleasure

At normal levels, rewards natural behaviors (sex, eating) = **pleasure**

Overstimulation of the system with drugs/alcohol

↓
Euphoric effects

↓
Reinforces behavior of drug/alcohol use

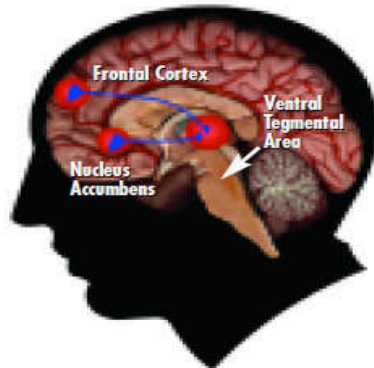
↓
Repetition of use → **ADDICTION**



... AND EUPHORIA

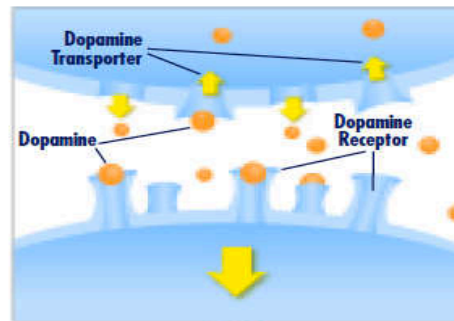
DRUGS OF ABUSE TARGET THE BRAIN'S PLEASURE CENTER

Brain reward (dopamine) pathways

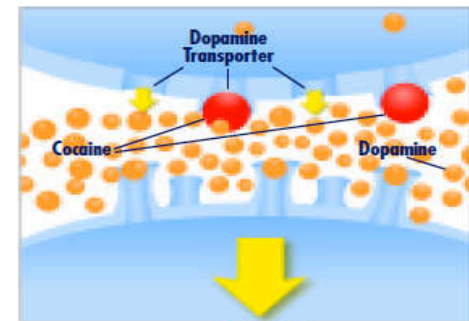


These brain circuits are important for natural rewards such as food, music, and sex.

Drugs of abuse increase dopamine



FOOD

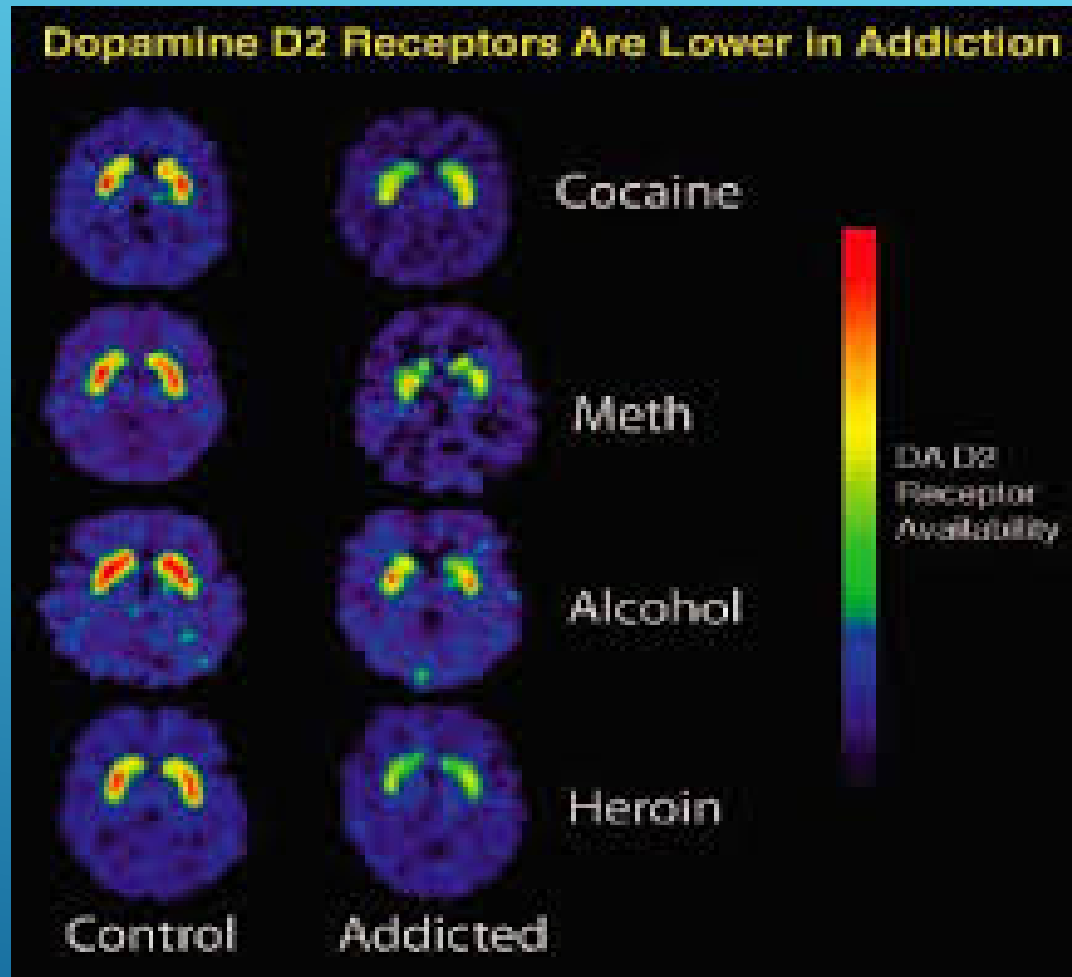


COCAINE

Typically, dopamine increases in response to natural rewards such as food. When cocaine is taken, dopamine increases are exaggerated, and communication is altered.



BYE-BYE HIGH: DOPAMINE IN THE USER BRAIN DECREASES



SUBSTANCE USE AND COGNITIVE DEFICITS

Studies have shown a variety of effects on cognition according to substance used:

- **Cocaine:** Deficits in cognitive flexibility (the brain's ability to transition from thinking about one concept to thinking about another concept)
- **Marijuana:** Memory loss, decreased IQ
- **Amphetamines:** Affect attention and impulse control
- **Opioids:** Deficits in cognitive flexibility
- **Alcohol:** Decreased function of working memory and attention
- **Cannabis:** Affects cognitive flexibility and attention



RECOVERY MANAGEMENT



PILLARS OF EFFECTIVE RECOVERY MANAGEMENT

- Develop an effective line of communication between patient and treatment staff
- Psychotherapy, especially cognitive behavioral therapy (CBT)
- Developing a treatment plan tailored to the patient's unique psychological and drug profile, and cognitive deficits
- Structure a cognitive rehabilitation plan based on the patient's deficits
- Monitoring patient's response to medications
- Frequently administering tools based on patient feedback
- Observing and documenting patient symptoms
- Adjusting medications and psychotherapy based on staff observations and patient feedback
- Acknowledge that treatment may involve setbacks, and make adjustments as needed



MEDICATIONS FOR ADDICTION

Medications help to re-establish normal brain chemistry and function, and can decrease cravings. Treat **all** addictions concurrently; often there is more than one.

- **Opioid addiction:** Use methadone (Dolophine[®], Methadose[®]), Buprenorphine (Suboxone[®], Subutex[®], Probuphine[®]) and naltrexone (Vivitrol[®]); these agents act on the same targets in the brain as heroin and morphine
- **Alcohol addiction:**
 - Naltrexone: Reduces cravings and relapse
 - Acamprosate (Campral[®]): May reduce insomnia, anxiety, restlessness and dysphoria (generally feeling unwell or unhappy)
 - Disulfiram (Antabuse[®]): Interferes with the breakdown of alcohol & produces unpleasant side-effects if alcohol is consumed (flushing, nausea and irregular heartbeat)

There are currently **no drugs** approved for **marijuana** or **methamphetamine** addiction



TREATING PATIENTS WITH DUAL-DIAGNOSIS

- Approximately one-third of patients with alcohol addiction and one-half of patients with drug addiction have a **dual-diagnosis** (co-existing conditions), meaning they have both a substance use disorder and a psychiatric condition
- DD can be a mild or severe combination of disorders and symptoms
- Risk factors for DD:
 - Lower socioeconomic status
 - Military veterans
 - Patients with other general, non-substance related medical illnesses



THE CHICKEN OR THE EGG?



In patients with dual-diagnosis, it is hard to tell which happens first—the substance use or the psychiatric disturbance. We know that substance use causes neurocognitive changes, which can lead to brain disturbances and psychiatric disorders.

We also know that psychiatric conditions, especially untreated, can lead to substance use for self-medicating purposes.

Regardless of which comes first, substance use worsens mental health conditions!

PATIENTS WITH DD: SYMPTOMS

- Withdrawal from friends and family
- Sudden changes in behavior
- Using substances under dangerous conditions
- Engaging in risky behaviors when drunk or high
- Loss of control over use of substances
- Doing things one wouldn't normally do to maintain the habit
- Developing tolerance and withdrawal symptoms
- Feeling like the drug is needed to be able to function



PATIENTS WITH DD: **WARNING SIGNS AND TREATMENT**

- Extreme mood changes
- Confused thinking or problems concentrating
- Avoiding friends and social activities
- Thoughts of suicide

Focus of treatment:

- Varies according to the specific mental illness and substance use disorders in the patient
- Intense medical and mental health treatment for several days
- Cognitive rehabilitation



EARLY SIGNS OF RELAPSE

Early signs of relapse may include anxiety, dysphoria (feeling sad or hopeless), insomnia and poor concentration

Focus of Treatment:

- Intensive CBT
- Monitoring of early signs, develop preventative strategies
- Interventions for stress management
- Crisis problem-solving
- Increased supportive therapy
- Targeted medication changes and short-term medication increases



RECOVERY MANAGEMENT: **ALL PATIENTS**

- Close monitoring of patients' symptoms
- Alleviating physical symptoms and mental distress during detoxification and after will:
 - Help patients focus on and understand their treatment goals
 - Facilitate communication with the medical team
 - Aid in preventing relapse, and motivate them to complete the treatment plan.



MONITORING COGNITIVE STATUS & PHYSICAL SYMPTOMS

- **The Clinical Institute Withdrawal Assessment of Alcohol Scale, Revised (CIWA-Ar):** Clinician-administered tool, assesses nausea and vomiting, tactile and auditory disturbances, tremor, visual disturbances, paroxysmal (sudden/extreme) sweating, headache/head fullness, anxiety, and agitation; provides medication adjustment guidelines
- **The AWARE Questionnaire (Advance WArning of RElapse):** A 37-item self-report questionnaire completed by patient; predictor of relapse, measures warning signs so treatment plans can be adjusted, prevention interventions initiated
- **Patient Health Questionnaire-9 (PHQ-9):** Tool establishes level of depression, and improvement or decline in depressive symptoms
- **Generalized Anxiety Disorder-7 or (GAD-7):** Screens for anxiety, and can be used to establish a diagnosis for, and severity of, generalized anxiety disorder
- **Brief Social Phobia Scale (BSPS):** Uses 3 subscales—fear, avoidance, and physiological arousal—to assess common presenting problems such as depression, anxiety disorders, and phobias



COGNITIVE REHABILITATION THERAPY (CRT)

Definition of CRT is: Achieving functional changes by:

1. Reinforcing, strengthening, or reestablishing previously learned patterns of behavior
2. Establishing new patterns of cognitive activity or compensatory mechanisms for impaired neurological systems



GOALS OF CRT

CRT is directed at achieving functional changes by:

- Reinforcing, strengthening or establishing previously learned treatment-focused patterns of behavior
- Establishing new patterns of cognitive activity or mechanisms to compensate for impaired neurological systems
- Helping individuals to make the most of his/her abilities, and increase self-reliance and self-confidence by providing training, resources, information and adaptive strategies



BENEFITS OF CRT

- Enhancing the patient's functional competence in real world situations by direct retraining, and providing compensatory strategies and cognitive tools
- Helping individuals to make the most of his/her abilities, and increasing self-reliance and self-confidence through training, resources, information and adaptive strategies
- Involving patients in experiences that require them to interact, analyze, question, reflect and connect via what they have learned



TESTING FOR COGNITIVE IMPAIRMENT

- **The Neuropsychological Assessment Battery-Screening Module (NAB-SM):** A 45-minute battery of tests with known sensitivity to the mild-to-moderate cognitive deficits observed in patients with substance use
- **The Montreal Cognitive Assessment (MoCA):** A 10-minute screening instrument for cognitive impairment; allows for identifying patients with low cognitive performance
- **The Allen Cognitive Level Screen (ACLS):** Screening assessment of functional cognition; provides a quick estimate of an individual's learning and problem-solving abilities during visual motor tasks
- **The Routine Task Inventory-Expanded (RTI-E) Test:** 25 Activities of Daily Living and Instrumental Activities of Daily Living measures 4 subscales (physical, community, communication, work)
- **Neuroimaging tests (MRI and CT):** Provide information about areas of the brain compromised to focus CRT



2 TYPES OF COGNITIVE REHABILITATION THERAPY

- **Restorative CRT:** Focuses on improving and normalizing targeted impaired cognitive functions; treatments “exercise” weakened areas of the brain; aim is to restore function
- **Compensatory CRT:** Treatments are aimed at providing alternative strategies for performing activities of daily living

TREATMENT:

Currently, there are **no** FDA-approved treatments for CRT

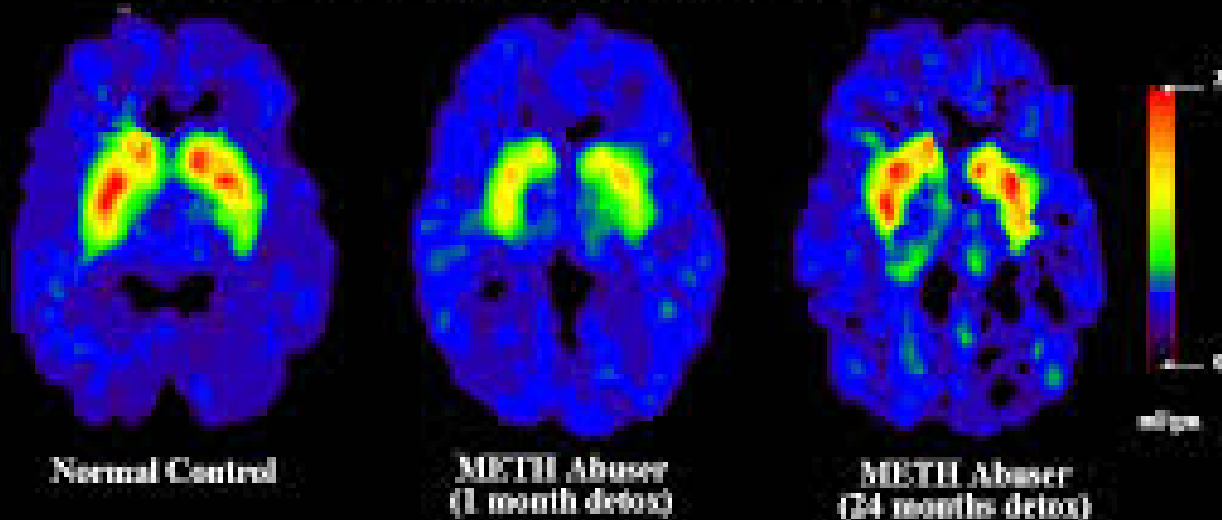
- **NECOREDA** (Neurocognitive Rehabilitation for Disease of Addiction) to improve neurocognitive impairments
- **Scientific Brain Training™** and the **PRO CR-Psychiatry Program**
- Online modules and cell phone apps for brain training
- Flashcards, word lists, mazes, puzzles
- Dietary changes focused on healthful, low-fat regimens
- Exercise such as weight-training and yoga



REHABILITATION WORKS!

4. ADDICTION CAN BE TREATED

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



Source: Volkow, ND et al., *Journal of Neuroscience* 21, 9434-9438, 2001.

IN CLOSING

Cognitive rehabilitation therapy is not meant to replace medical treatments or certain types of psychotherapy, but rather to complement their effects. Indeed, all three types of treatment—CRT, medication therapy and psychotherapeutics—are complimentary and address different aspects of addiction. Psychoactive drugs impact brain receptors, psychotherapy impacts the patient's image of him/herself and his/her environment, and cognitive rehabilitation impacts the processing of information. These different therapeutic approaches can be combined and work synergistically. In short, cognition is enhanced by training a patient's deficient functions, or by developing functions that have been preserved with compensational mechanisms.





*“Hope” is the thing with feathers
That perches in the soul
And sings the tune without the words
And never stops at all,*

- Emily Dickinson



Thank You!

