SUCCESSFUL TREATMENT OF METHAMPHETAMINE ADDICTION

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NEUROBIOLOGICAL DEFICITS

• A broad cingulate and limbic deficit in gray-matter concentration appears prominently in the right hemisphere.

• MA abusers had a 7.8% deficit in hippocampal volume, and individual volumes were correlated with memory performance on a word-recall task, in that subjects with smaller hippocampi performed poorly.

• A prominent white matter hypertrophy (i.e., a 7.0% increase in white-matter volume in the temporal regions that surround the hippocampus. These changes are remarkable, because they show that chronic MA abuse is associated with a pattern of abnormal brain structure that is comparable with or greater than MRI deficits in early dementia and schizophrenia.
NEUROBIOLOGICAL DEFICITS

• MA users often exhibit performance deficits on tests of verbal memory, as well as tests of perceptual motor speed and executive functions such as inhibition, problem solving, abstract thinking, and tasks that require mental flexibility.

• MA induces an unusual type of neurodegeneration in which axonal arbors of dopamine neurons are destroyed but cell bodies are not lost. MA also may be especially neurotoxic to limbic structures that underlie memory and recall, because there are strong serotonergic projections from the raphe nuclei to the hippocampus which are severely atrophied.

• Our study participants were in their thirties, 15 years younger than the age when white-matter volume is usually greatest. MA-induced gray-matter losses with white-matter gains somewhat resemble an exaggerated pattern of normal aging.

Figure 1. Brain areas affected by methamphetamine neurotoxicity

- Frontal cortex
- Striatum
- Hippocampus

Legend:
- **Cell death**
- **Cell death and damage to dopamine nerve terminals**
METHAMPHETAMINE TOXICITY

• **INCREASED LEVELS OF NOREPINEPHRINE AND DOPAMINE**
  – Hyperarousal
  – Pleasure
  – Paranoia

• **INCREASED LEVELS OF SEROTONIN**
  – Reduced Hunger
  – Insomnia
METHAMPHETAMINE CRASH

- REDUCED LEVELS OF NOREPINEPHRINE AND DOPAMINE
  - Dysphoria
  - Depression
  - Anhedonia

- REDUCED LEVELS OF SEROTONIN
  - Mood swings
  - Sleep disturbances
METHAMPHETAMINE WITHDRAWAL

• Duration from several days to two weeks
• Symptoms include:
  – Decreased motor function
  – Irregular sleeping patterns
  – Vivid dreams
  – Suicidal ideation
  – An inability to feel happy (anhedonia)
METHAMPHETAMINE WITHDRAWAL

- Overeating/increased appetite
  - May experience craving for sweets and other drugs with low amphetamine craving after the crash and for the first days
- Depression and/or mood swings
- Meth induced psychosis
- Involuntary spasms and twitches
  - Some people who use meth may experience eye twitching and muscle spasms around the eyes. Eyes will twitch uncontrollably several times per minute throughout the day. Many times, eye twitching resolves on its own.
SLOW NEUROTRANSMITTER RETURN TO BASE (Volkow, N.D. et al., Journal of Neuroscience, 21(23), pp. 9414-9418, December 1, 2001)
“TWEAKING” ON METH (“tweak out”)

• Tweaking occurs when the meth addict can’t create the high any longer. The body and mind won’t react to smoking any more meth, and he enters a state that is almost psychotic. Tired from not sleeping for days, but is in a hungry rage to get back to a state he remembers but can’t reach. Meth addicts are called “tweakers” because they become unpredictable during the tweaking phase.
“TWEAKING” ON METH (“tweak out”)

- The drug user will exhibit symptoms like shaking, high blood pressure, paranoia, aggressive and psychotic behavior. Many drug users become addicted to the high feeling they get during the tweaking process, regardless of the fact that severe tweaking can lead to cardiac arrest and other life threatening issues if the drug is used long enough or in enough quantity.

- OVERDOSE
  - They can experience hallucinations and think bugs are crawling beneath their skin. They can hurt themselves and others. If you see a tweaker up close, you might notice that his eyes are darting rapidly around and he is almost shaking even though he is trying to stand still.

http://www.methamphetamineaddiction.com/5-things-meth-tweakers-do/
**STIMULANT PSYCHOSIS**

- Chronic methamphetamine use causes neuroadaptive/pathological changes in the brain, including numerous cognitive deficits plus mood, thought and behavioral disorders, the worst of which is psychosis.


- *When compared with schizophrenic patients, those with methamphetamine-induced psychosis present a higher prevalence of visual and tactile hallucinations but less cognitive disorganization, blunted affect and motor retardation.*
STIMULANT PSYCHOSIS

• Because of the high toxicity of meth, the debilitating effects often persist after extended periods of abstinence. As a result, *the cognitive deficits (which are not easy to detect in abstinence) affect how individuals respond to treatment, which is a highly didactic and educational experience.* Therefore, *treatment modalities and interventions must be tailored to address the individuals’ unique cognitive and emotional deficits and co-occurring psychiatric and medical disorders.*

STIMULANT PSYCHOSIS

• MIMICS PARANOID SCHIZOPHRENIA AND THE DELUSIONS RESEMBLE DELUSIONAL (PARANOID) DISORDER TYPES
  – Erotomanic Type
  – Jealous Type
  – Persecutory Type
  – Somatic Type
  – Grandiose Type

• METH INDUCED PSYCHOTIC SYMPTOMS INCLUDE:
  – Hallucinations (auditory, visual, olfactory, tactile, or gustatory)
  – Delusions (grandeur, persecution, jealous, somatic)
  – Obsessive behavior
STIMULANT PSYCHOSIS

• TRANSIENT PSYCHOTIC REACTION
  – 4.0-fold higher risk of psychotic symptoms for 1 to 15 days of use versus none in the prior month
  – 11.2-fold higher risk of psychotic symptoms for 16 or more days of use versus abstinence in the past month
  – Frequent cannabis and/or alcohol use (16 days of use in the past month) further increased the odds of psychotic symptoms

STIMULANT PSYCHOSIS

- Psychotic symptoms and syndromes are frequently experienced among individuals who use methamphetamine, with recent estimates of up to approximately 40% of users affected.

- Although transient in a large proportion of users, acute symptoms can include agitation, violence, and delusions, and may require management in an inpatient psychiatric or other crisis intervention setting.

- In a subset of individuals, psychosis can recur and persist and may be difficult to distinguish from a primary psychotic disorder such as schizophrenia.
FIVE STAGES OF METHAMPHETAMINE RECOVERY

• **STAGE ONE: CRASH AND ACUTE ABSTINENCE SYNDROME (HOURS–15 DAYS)**
  - Withdrawal usually lasts from 1 to 2 weeks, but it can last upwards of 4 weeks—and, in some extreme cases, longer. Also known as the “sleep, eat, and drink” stage, your body and brain are in healing overdrive.

• **STAGE TWO: THE HONEYMOON (DAYS 16–45)**
  - Acute withdrawal is over and your body has made those immediately needed repairs. You are feeling physically and emotionally much stronger. Unfortunately, this upswing can lead to overconfidence and you might find yourself minimizing your past meth problem.
FIVE STAGES OF METHAMPHETAMINE RECOVERY

THE HONEYMOON

OVERCONFIDENCE
DIFFICULTY CONCENTRATING
CONTINUED MEMORY PROBLEMS
MOOD SWINGS (INTENSE FEELINGS)
LOSE ABILITY TO PRIORITIZE
USE OF MOOD ALTERING SUBSTANCE(S)
FIVE STAGES OF METHAMPHETAMINE RECOVERY

• **STAGE THREE: THE WALL (6 Weeks – 4 Months)**
  - A seemingly insurmountable Wall of depression, boredom, and despair—it begins about 45 days into sobriety and it continues through month 4
  - The Wall is often where people will relapse. You so want the feelings of boredom and loneliness to pass, crystal meth seems like the solution again.

• **POST-ACUTE WITHDRAWAL**

• **STAGE FOUR: ADJUSTMENT (Months 4 – 6)**
  - The next stage is called “Adjustment” because that’s what characterizes this time period—adjusting, physically, socially, and emotionally, to life without crystal. You get relief from the overwhelming cravings and begin to find life interesting again.
FIVE STAGES OF METHAMPHETAMINE RECOVERY

THE WALL

ANHEDONIA
ANGER
DEPRESSION (Need we go further!)
MOODS SWINGS
ISOLATION
CRAVINGS
IRRITABILITY
FIVE STAGES OF METHAMPHETAMINE RECOVERY

• STAGE FIVE: ONGOING RECOVERY: Ongoing Recovery (Months 6 – 12)
  – RECOVERY IS ALWAYS WHATS GOING ON

• The time frames and stages are flexible and individually variable. For example, a life stressor such as loss of job or family discord can take someone in the Adjustment stage and put them back against the Wall.
PHARMACOLOGICAL TREATMENT

• There are currently no medications that counteract the specific effects of methamphetamine or that prolong abstinence from and reduce the abuse of methamphetamine by an individual addicted to the drug.

• Trial studies have been performed with many medications believed to possibly enhance long-term recovery success. However, more studies will be needed to confirm drug efficacy in the treatment of meth addiction

• SEE APPENDIX: PHARMACOLOGICAL TREATMENT
PSYCHOLOGICAL TREATMENT

HABILITATION OR REHABILITATION

STAGES OF RECOVERY

RECOVERY CAPITAL

CONFOUNDING VARIABLES (HISTORY OF TRAUMA OR NONENRICHED ENVIRONMENTAL UPBRINGING)
PSYCHOLOGICAL TREATMENT

• The most effective treatments for methamphetamine addiction at this point are behavioral therapies, such as cognitive-behavioral and contingency-management interventions.

• Motivational Incentives for Enhancing Drug Abuse Recovery (MIEDAR), an incentive based method for promoting cocaine and methamphetamine abstinence, has demonstrated efficacy in methamphetamine abusers through NIDA’s National Drug Abuse Clinical Trials Network.
MOTIVATIONAL INCENTIVES FOR ENHANCED DRUG ABUSE RECOVERY

• The study will determine if motivational incentives along with standard care therapy is more effective than standard therapy alone for the treatment of patients using cocaine or methamphetamine and entering a substance abuse treatment program (Stitzer, et. al. MOTIVATIONAL INCENTIVES FOR ENHANCED DRUG ABUSE RECOVERY: METHADONE CLINICS. NIDA-CTN-0007, December 6, 2000).

• The study utilizes a two group random assignment design. Thus, interested and eligible participant volunteers will be assigned to receive usual care or usual care supplemented by a motivational incentive program.
MOTIVATIONAL INCENTIVES FOR ENHANCED DRUG ABUSE RECOVERY

• *Those subjects in the motivational incentive group will be given the opportunity to receive tangible incentives twice weekly based on drug-free urine test results.* Each time a participant tests negative they will be able to make recovery picks from the abstinence bowl. Some picks will result in no incentive award. Some picks will result in receipt of a “small” incentive such as a soda, candy bar or toiletry item. Yet other picks may result in receipt of a larger incentive such as a radio or gift certificate to a local restaurant, grocery or retail store.
MOTIVATIONAL INCENTIVES FOR ENHANCED DRUG ABUSE RECOVERY

• RESULTS
  - RETENTION IN TREATMENT FOR THE 12 WEEK PROGRAM
    - Control group- 35%
    - Incentive Group- 50%
  - GROUP ATTENDANCE
    - Control group-52%
    - Incentive Group- 76%
MOTIVATIONAL INCENTIVES FOR ENHANCED DRUG ABUSE RECOVERY

- Use negative urine as objective evidence
- Collect urines frequently
- Test on-site (immediate feedback)
- Provide immediate rewards for negative UA
  - Vouchers or drawing for prizes
MOTIVATIONAL INCENTIVES FOR ENHANCED DRUG ABUSE RECOVERY

• Principle of alternative reinforcement:
  – Making abstinence today a more attractive option
• Points earned for cocaine negative urine results
  – Escalating schedule of point earnings
  – Trade in points for goods
  – $1000 available over 3 months

Steve Higgins
MOTIVATIONAL INCENTIVES FOR ENHANCED DRUG ABUSE RECOVERY (Higgins et al. Am. J. Psychiatry, 1993)

Cocaine negative urines

Percent of Subjects

Weeks of Treatment
MOTIVATIONAL INCENTIVES FOR ENHANCED DRUG ABUSE RECOVERY

• *Start with attendance incentive*  
  – to improve early engagement

• *Shift to abstinence*  
  – after attendance well established

• *Shift to life-style change goals*  
  – after abstinence well established
PSYCHOLOGICAL TREATMENT

• Cognitive-Behavioral strategies to promote abstinence and prevent relapse
  – Avoidance of “high risk” situations
  – Educating about “triggers” and “craving”
  – Reinforcing principles of verbal praise by therapist and peers
PSYCHOLOGICAL TREATMENT

HABILITATION or REHABILITATION?

STAGE OF CHANGE (INTERVENTION SPECIFIC)

RECOVERY CAPITAL

CONFOUNDING VARIABLES

• HISTORY OF TRAUMA
• NONENRICHED ENVIRONMENT
PSYCHOLOGICAL TREATMENT

• RELAPSE
  - *Reframe event, not a failure*
  - *What did you learn from the experience?*
  - *How can you use this information to improve your recovery program?*
  - *Repeated as indicator of need for more restrictive level of care*

• URINALYSIS
  - *What will the test results show?*
  - *Reevaluate the period surrounding the test*
  - *Give patient opportunity to explain*
  - *Don’t get into validity of test argument*
  - *May need to increase number of tests*
PSYCHOLOGICAL TREATMENT-ACCEPTANCE

COGNITIVE

AFFECTIVE

SPIRITUAL
TREATMENT MODEL

• DEVELOPING THE PREFRONTAL CORTEX (PFC)
  – EMOTIONAL DEVELOPMENT AND AFFECT CONTROL
  – COGNITIVE DEVELOPMENT AND TOP DOWN
    REGULATION (top of the brain over the bottom of the brain)
  – ATTACHMENT AND RELATIONSHIPS

• It takes longer for the methamphetamine addict’s PFC to come back “on line”

• In many instances (especially where there is a history of early life developmental trauma and/or early alcohol and drug use), a habilitation model is necessary
DEVELOPING THE PREFRONTAL CORTEX

• There are three areas that make up the prefrontal cortex (PFC) and its link to the limbic system
  – ORBITOFRONTAL CORTEX (VENTROMEDIAL PFC)
    – AFFECT CONTROL
    – WEIGHING DECISIONS
  – DORSOLATERAL PREFRONTAL CORTEX
    – EXECUTIVE FUNCTIONS
    – MORAL JUDGMENTS
  – ANTERIOR CINGULATE GYRUS
    – RELATIONAL
    – ATTENTION AND FOCUS
DEVELOPING THE PREFRONTAL CORTEX

• Research tells us...
  – We can impact the areas of relationships, affective control and cognitive abilities
  – RELATIONSHIPS (ATTACHMENT) = ANTERIOR CINGULATE CORTEX
  – AFFECTIVE CONTROL = ORBITOFRONTAL CORTEX
  – COGNITION = DORSOLATERAL PREFRONTAL CORTEX
Ventromedial prefrontal cortex

Orbitofrontal prefrontal cortex

Dorsolateral prefrontal cortex
Blue represents maturing of brain areas.
EMOTIONAL DEVELOPMENT

- The core features of emotional development include the ability to identify and understand one’s own feelings, to accurately read and comprehend emotional states in others, to manage strong emotions and their expression in a constructive manner, to regulate one’s own behavior, to develop empathy for others, and to establish and maintain relationships.
EMOTIONAL DEVELOPMENT

• Emotions can change how much control you have. *So, when you look at the medial and orbital surfaces of the frontal lobe, which some call the ‘social’ brain, the mean age of myelination of those connections between the limbic system and those frontal areas is about 32.*

DEVELOPING THE PREFRONTAL CORTEX

• AFFECTIVE CONTROL
  – Role play
    – How to manage potential relapse and craving situations
      – People, Places and Things (PPT) group
  – Other structured groups (“Drop the Rock” for example)
  – Anger management
    – How when I get angry I give up control to the person I claim is making me angry
  – Spiritual
    – Each day a patient reads from a chosen passage from a spiritual text (AA, NA, Bible, Koran, Bhagavad Gita, Tao, etc. purchased as library)
    – Utilizing the right hemisphere to be in the present and to appreciate beauty
# PEOPLE, PLACES AND THINGS WORKSHEET

<table>
<thead>
<tr>
<th>PEOPLE</th>
<th>CAN CHANGE</th>
<th>CANNOT CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLACES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THINGS</td>
<td></td>
<td></td>
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</tbody>
</table>
DEVELOPING THE PREFRONTAL CORTEX

• AFFECTIVE CONTROL
  – Introduction to meditation
    – Opportunity to experience various approaches to spending time in the right hemisphere
  – Develop a personalized SAFETY PLAN
    – Develop on a 3x5 index card
  – Qualifying-writing and reading your story-experience, hope and expectations
## DEVELOPING THE PREFRONTAL CORTEX

### AFFECTIVE CONTROL
- The therapeutic relationship
- Cognitive-behavioral therapy
  - Functional Analysis of High-Risk Situations Record

<table>
<thead>
<tr>
<th>ANTECEDENT SITUATION</th>
<th>THOUGHTS</th>
<th>FEELINGS AND SENSATIONS</th>
<th>BEHAVIOR</th>
<th>CONSEQUENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO WAS I WITH?</td>
<td></td>
<td>WHAT SIGNALS DID I GET FROM MY BODY?</td>
<td>WHAT AND HOW MUCH DID I USE?</td>
<td>HOW DID OTHER PEOPLE REACT?</td>
</tr>
<tr>
<td>WHAT HAPPENED?</td>
<td></td>
<td></td>
<td></td>
<td>ANY OTHER CONSEQUENCES?</td>
</tr>
</tbody>
</table>
ADDICTION AND COGNITIVE FUNCTION

• Addiction is a disorder of altered cognition

• Addiction impacts…
  – LEARNING
  – MEMORY
  – ATTENTION
  – REASON
  – IMPULSE CONTROL

• Effects are particularly disruptive when exposed during brain development and in the co-occurring population
ADDITION AND COGNITIVE FUNCTION

• Drugs impact on cognition include the areas…
  – STRIATUM
  – PREFRONTAL CORTEX
  – AMYGDALA
  – HIPPOCAMPUS

• These regions underlie declarative memory—the memories that define an individual and generate and maintain a concept of self
ADDICTION AND COGNITIVE FUNCTION

• Cognitive deficits in chronic drug abuse
  – Withdrawal produces cognitive symptoms
  – Cocaine-deficits in cognitive flexibility
  – Amphetamine-deficits in attention and impulse control
  – Opioids-deficits in cognitive flexibility
  – Ethanol-deficits in working memory and attention
  – Cannabis-deficits in cognitive flexibility and attention
  – Nicotine-deficits in working memory and declarative learning
ADDICTION AND COGNITIVE FUNCTION

**ENRICHED ENVIRONMENT**
- Creates a surge of neurogenesis
- The cortex becomes thicker
- Synaptic connections become denser and dendrite branching more complex
  - Especially in the dendrite gyrus area of the hippocampus involved in learning and memory (Briones, et. al. (2004))
- Impacts behavior positively
- Novelty and Physical Exercise augment neurogenesis
DEVELOPING THE PREFRONTAL CORTEX

• EXECUTIVE FUNCTIONING
  – Write a job resume and have the group give feedback
  – Practice interviewing for a job
    – The interviewer will use a standard set of questions which
      the patient will answer in front of the group
    – Group feedback encouraged
  – Skills Development
    – Experimenting with several opportunities to develop an
      interest or hobby
      – Photography, cooking, painting, drawing using multiple
        mediums
DEVELOPING THE PREFRONTAL CORTEX

• EXECUTIVE FUNCTIONING
  − Jig saw puzzles, cross word puzzles, etc.
  − Certain computer games that are nonviolent but demand attention and delayed gratification such as SimCity
  − The puzzles and computer games can be competitive in nature leading to a discussion on winning and losing or maybe the losing team waits on the winning team at dinner, etc.
DEVELOPING THE PREFRONTAL CORTEX

EXECUTIVE FUNCTIONING
- Cognitive-behavioral therapy
- Thought Change Record

<table>
<thead>
<tr>
<th>EVENT OR SITUATION</th>
<th>AUTOMATIC THOUGHTS</th>
<th>EMOTIONS</th>
<th>LOGICAL THOUGHTS</th>
<th>OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual event</td>
<td>Write AT’s</td>
<td>Specify</td>
<td>ID thinking</td>
<td>Rate feeling 0-100</td>
</tr>
<tr>
<td>Thoughts Memories</td>
<td>Rate belief in AT</td>
<td>Feelings</td>
<td>distortion</td>
<td>Describe changes in</td>
</tr>
<tr>
<td></td>
<td>0-100</td>
<td>intensity</td>
<td>Write realistic</td>
<td>how you could</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>healthier thought</td>
<td>handle situation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rate belief 0-100</td>
<td></td>
</tr>
</tbody>
</table>
DEVELOPING THE PREFRONTAL CORTEX

• EXECUTIVE FUNCTIONING
  – EDUCATION
    – Why give an alcoholic or addict a 60 minute didactic or video?
    – A new format
      – 15-20 minute simple didactic
      – How to participate in treatment
      – 10 minute questionnaire
      – 30 minute discussion group
DEVELOPING THE PREFRONTAL CORTEX

<table>
<thead>
<tr>
<th>I THINK...........</th>
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</thead>
<tbody>
<tr>
<td>I FEEL.............</td>
</tr>
<tr>
<td>I LEARNED......</td>
</tr>
<tr>
<td>MY FUTURE BEHAVIOR WILL CHANGE...</td>
</tr>
</tbody>
</table>
Attachment refers the particular way in which you relate to other people. Your style of attachment was formed at the very beginning of your life, during your first two years. Once established, it is a style that stays with you and plays out today in how you relate in relationships and how you parent your children.
ATTACHMENT-EARLY ATTACHMENT PATTERNS

• Young children need to develop a relationship with at least one primary caregiver in order for their social and emotional development to occur normally.

• During the first two years, how the parents or caregivers respond to their infants establishes the types of patterns of attachment their children form. These patterns will go on to guide the child’s feelings, thoughts and expectations as an adult in future relationships.
SECURE ATTACHMENT

• Ideally, from the time infants are six months to two years of age, they form an emotional attachment to an adult who is attuned to them, that is, who is sensitive and responsive in their interactions with them. It is vital that this attachment figure remain a consistent caregiver throughout this period in a child’s life. During the second year, children begin to use the adult as a secure base from which to explore the world and become more independent. A child in this type of relationship is securely attached.
# ATTACHMENT-EARLY ATTACHMENT PATTERNS

<table>
<thead>
<tr>
<th>Attachment Style</th>
<th>Parental Style</th>
<th>Resulting Adult Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secure</td>
<td>Aligned with the child; in tune with the child’s emotions</td>
<td>Able to create meaningful relationships; empathetic; able to set appropriate boundaries</td>
</tr>
<tr>
<td>Avoidant</td>
<td>Unavailable or rejecting</td>
<td>Avoids closeness or emotional connection; distant; critical; rigid; intolerant</td>
</tr>
<tr>
<td>Ambivalent</td>
<td>Inconsistent and sometimes intrusive parent communication</td>
<td>Anxious and insecure; controlling; blaming; erratic; unpredictable; sometimes charming</td>
</tr>
<tr>
<td>Disorganized</td>
<td>Ignored or didn’t see child’s needs; parental behavior was frightening/traumatizing</td>
<td>Chaotic; insensitive; explosive; abusive; untrusting even while craving security</td>
</tr>
<tr>
<td>Reactive</td>
<td>Extremely unattached or malfunctioning</td>
<td>Cannot establish positive relationships; often misdiagnosed</td>
</tr>
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</table>
DEVELOPING THE PREFRONTAL CORTEX

- **ENHANCING RELATIONAL ABILITIES**
  - *Group oriented program*
  - *Physical exercise*
  - *Ropes course*
  - *Alcoholics Anonymous, Narcotics Anonymous, Crystal Meth Anonymous, etc.*
  - *Sponsorship*
  - *Therapeutic Relationship*
  - *Ask, Admit and Take Action Test (See “Skill Set” in APENDIX)*
  - *Identification of personal attachment pattern and how this relates to the patients relationship history*
DEVELOPING THE PREFRONTAL CORTEX

• ENHANCING RELATIONAL ABILITIES
  – Music therapy
    – *Examine their interpretation of their favorite lyric of their favorite song and discuss in group*
    – *Have the group make their own instruments and write their own recovery song to be performed at community meeting or graduation*
  – Teach Active Listening Skills
DEVELOPING THE PREFRONTAL CORTEX

• ENHANCING RELATIONAL ABILITIES
  
  – Developing Emotional Intelligence
    
    – Emotional Intelligence (EQ or EI) can be defined as the ability to understand, manage, and effectively express one's own feelings, as well as engage and navigate successfully with those of others. *EI is absolutely essential in the formation, development, maintenance, and enhancement of close personal relationships.* Unlike IQ, which does not change significantly over a lifetime, our EQ can evolve and increase with our desire to learn and grow.
DEVELOPING THE PREFRONTAL CORTEX

• ENHANCING RELATIONAL ABILITIES

  – *Five keys to improve one's emotional intelligence:*
    - 1. The ability to deal with one's own negative emotions
    - 2. The ability to stay cool under pressure
    - 3. The ability to stay proactive, not reactive in the face of a difficult person
    - 4. The ability to be *assertive* and express difficult emotions when necessary
    - 5. The ability to express intimate emotions in close, personal relationships
DEVELOPING THE PREFRONTAL CORTEX
DEVELOPING THE PREFRONTAL CORTEX

THE NUCLEUS BASALIS IS...

NOVELTY

THE MODULATORY CONTROL CENTER FOR PLASTICITY
DEVELOPING THE PREFRONTAL CORTEX

YOU ARE NEUROPLASTICIANS!

WHAT ENHANCES PLASTICITY?
  • NOVELTY
  • THERAPEUTIC RELATIONSHIPS
  • PHYSICAL EXERCISE
  • MINDFULNESS
DEVELOPING THE PREFRONTAL CORTEX

• TRANSCRANIAL DIRECT CURRENT (tDCS) AND TRANSCRANIAL MAGNETIC STIMULATION (TMS)

- Differences between tDCS and TMS include presumed mechanisms of action, with TMS acting as neuro-stimulator and tDCS as neuro-modulator. Moreover, TMS has better spatial and temporal resolution, TMS protocols are better established, but tDCS has the advantage to be easier to use in double-blind or sham-controlled studies and easier to apply concurrently with behavioral tasks. Despite their differences, both TMS and tDCS can induce long-term after-effects on cortical excitability that may translate into behavioral impacts that can last for months. These long-term after-effects are believed to engage mechanisms of neural plasticity.
DEVELOPING THE PREFRONTAL CORTEX

• TRANSCRANIAL MAGNETIC STIMULATION
  
  - Stimulates the brain to produce serotonin and melatonin while reducing cortisol (the stress hormone) and calming the brain's Default Mode Network. The device is effective in treating the following types of insomnia:
    
    - Chronic Insomnia
    - Onset Insomnia
    - Comorbid Insomnia
    - Maintenance Insomnia: Difficulty staying asleep through the night (waking up often or waking up too early).
DEVELOPING THE PREFRONTAL CORTEX

• TRANSCRANIAL DIRECT CURRENT STIMULATION
  - It is known that tDCS can be an effective treatment for depression, therefore researchers undertook this study to investigate the optimal duration of the stimulation sessions.
  - Participants in the 30-minute group showed a significantly greater percentage improvement than those in the 20-minute group.
  - The 30-minute group had significantly greater improvement in mood and greater proportion of remitters compared [with] the 20-minute group.
DEVELOPING THE PREFRONTAL CORTEX

• TRANSCRANIAL DIRECT CURRENT STIMULATION
  - The 30-minute group was also superior to the 20-minute and sham groups in percentage of responders (89%, 68%, and 50%, respectively) and remitters (70%, 27%, and 35%, respectively).

DEVELOPING THE PREFRONTAL CORTEX

TRANSCRANIAL DIRECT CURRENT STIMULATION

- Cranioelectrotherapy stimulation (CES), also called transcranial direct current stimulation (tDCS) or microcurrent electrical stimulation, is based on the application of extremely weak electrical current to the head and neck to treat anxiety, depressed mood, insomnia and substance abuse. The mechanism of action may involve stimulation of endorphin release and induction of frequency changes in the frequency of brain waves that, in turn, reduce the severity of emotional and cognitive symptoms.
DEVELOPING THE PREFRONTAL CORTEX

• TRANSCRANIAL DIRECT CURRENT STIMULATION

- *Used to lessen symptoms of alcohol and drug withdrawal. The postulated mechanism of action involves stimulation of release of endorphins, enkephalins, and other endogenous opioid peptides*

- Findings of a sham-controlled study (60 subjects) on hospitalized alcohol or polysubstance abusers suggested that daily 30-minute CES treatments significantly improved cognitive functioning and reduced measures of stress and anxiety during the acute phases of withdrawal in this population. In a 7-year prospective study of CES in the treatment of alcohol, drug, and nicotine addiction, acute and chronic withdrawal symptoms were diminished, normal sleep patterns were restored more rapidly, and more patients remained addiction-free following regular CES treatments compared to conventional psychopharmacological management.
DEVELOPING THE PREFRONTAL CORTEX

• TRANSCRANIAL DIRECT CURRENT STIMULATION

- Individuals with substance abuse problems generally exhibit increased impulsivity and risk-taking behavior when compared to controls, due to deficits in top-down cognitive control. Bilateral stimulation of the DLPFC was shown to elicit a significant decrease in ambiguous risk-taking behavior in healthy human subjects and a decrease in impulsivity on a non-ambiguous risk task. The principal target for such studies is the DLFPC, modulation of this area results in a decrease in nicotine, cocaine and also food craving, and neuroimaging studies show that the activity in this area is significantly associated with drug craving (alcohol, cocaine, nicotine, heroin).
DEVELOPING THE PREFRONTAL CORTEX

• TRANSCRANIAL DIRECT CURRENT STIMULATION
  
  - This means that these interventions may result in lower drug-seeking behavior. Moreover, there are some studies showing that drug craving is correlated to the level of impulsivity and that when there is a cue associated with a drug such as images of the drug or people-using drug, this creates a response in the mesolimbic pathways generating an increase in DLPFC activity that, in part, may be responsible for the drug-seeking behavior. ‘It would follow that if the activity of DLPFC is modulated externally by tDCS, this might block this cascade of events due to the competition with the input coming from tDCS that can ultimately decrease the signal to noise in the neural system associated with reward.
APPENDIX

• SLEEP
• ATTACHMENT
• PHARMACOLOGICAL TREATMENT
SLEEP

• Sleep deprivation disrupts brain cells’ ability to communicate with each other

• This leads to temporary mental lapses that affect memory and visual perception

• Interferes with the neurons ability to encode information and translate visual input into conscious thought

• Tied to heightened risk of depression, obesity, diabetes, heart attacks and stroke
SLEEP

• Consider using the program called Conquering Insomnia which can be found at CBTforINSOMNIA.com or teach basic sleep hygiene

• Evidence-based program developed by Dr. Greg Jacob at Harvard Medical School and funded by a NIH grant

• In a study conducted at Harvard was found to be more effective than Ambien
SLEEP

• INSOMNIA
  - 5 session interactive program
    - SESSION 1: BASIC FACTS ABOUT SLEEP
    - SESSION 2: SLEEP SCHEDULING AND STIMULUS CONTROL
    - SESSION 3: COGNITIVE RESTRUCTURING AND SLEEP MEDICATION TAPERING TECHNIQUES
    - SESSION 4: DAYTIME RELAXATION TECHNIQUES
    - SESSION 5: BEDTIME RELAXATION TECHNIQUES
SLEEP

- The journal SLEEP demonstrated online CBT program for insomnia effective for improving sleep in 80% of patients.

- *The interactive version in a study by NIH showed it was comparable to the results garnered from face-to-face CBT.*

- Wake time after sleep onset was reduced from over an hour to less than 30 minutes per night.

- Sleep onset latency decreased from over 30 minutes to less than 20 minutes per night.

- **Total sleep time increased about an hour**
SLEEP HYGIENE

• Go to bed and get up at the same times each day.
  ■ Use natural light (that comes through a window) to remind yourself of when it’s time to be asleep and awake. This can help you set a healthy sleep–wake cycle.
  ■ Exercise regularly.
  ■ If you take naps, keep them short and before 5 p.m.
  ■ Don’t eat or drink too much when it is close to bedtime.
SLEEP HYGIENE

- Avoid caffeine (in coffee, tea, chocolate, cola, and some pain relievers) and nicotine for several hours before bedtime.
- Wind down before going to bed (e.g., take a warm bath, do light reading, practice relaxation exercises).
- Keep the bedroom a relaxing place—avoid working or paying bills in bed.
- Sleep in a dark, quiet room that isn’t too hot or too cold.
- Don’t lie in bed awake. If you can’t fall asleep within 20 minutes get up.
SLEEP

• PHARMACOTHERAPY
  – **Melatonin** - a metabolite of serotonin is a hormone secreted by the pineal gland; plays a role in maintenance of sleep-wake cycle (suprachiasmatic nucleus)
  – **Valerian** (could damage the liver)
  – **Tryptophan** - precursor amino acid to serotonin
  – **Antidepressants** - Trazodone is a popular choice although not backed by formal clinical studies
  – **Quetiapine** (Seroquel) and gabapentin (mixed results)
SLEEP

• PHARMACOTHERAPY
  - Many over-the-counter sleep medications contain antihistamines that cause sedation. They are not recommended as a long-term treatment for insomnia because they negatively affect the natural sleep cycle and have side effects such as morning grogginess, daytime sleepiness, and impaired alertness and judgment. Furthermore, evidence supporting their long-term effectiveness is insufficient.
SLEEP

• PHARMACOTHERAPY

- Ramelteon (sleep-onset insomnia, works like melatonin) and doxepin are the only unscheduled prescription medications approved by the U.S. Food and Drug Administration (FDA) for the treatment of insomnia. Ramelteon decreases the amount of time it takes to fall asleep. Doxepin, originally FDA approved as an antidepressant, has been approved for treating insomnia typified by problems staying asleep. These medications may be suitable for treating insomnia in patients in recovery, because they do not appear to have potential for abuse.
SLEEP

• PHARMACOTHERAPY

- *Gabapentin, an anticonvulsant with sedative properties,* also has evidence of efficacy for treating insomnia. It has been found to be more effective in promoting sleep than lorazepam (an anxiolytic commonly prescribed to treat insomnia) among people withdrawing from alcohol. It has also been found to be more effective than trazodone in promoting sleep among those in early recovery. *Acamprosate, a medication used to maintain alcohol abstinence, may also improve sleep during withdrawal from alcohol.*
SLEEP

• Transcranial Electrical Stimulators
  – *Stimulates the brain to produce serotonin and melatonin while reducing cortisol* (the stress hormone) and calming the brain's Default Mode Network. The device is effective in treating the following types of insomnia:
    – Chronic Insomnia
    – Onset Insomnia
    – Comorbid Insomnia
    – Maintenance Insomnia: Difficulty staying asleep through the night (waking up often or waking up too early).
ATTACHMENT-EARLY ATTACHMENT PATTERNS

• Young children need to develop a relationship with at least one primary caregiver in order for their social and emotional development to occur normally

• During the first two years, how the parents or caregivers respond to their infants establishes the types of patterns of attachment their children form. These patterns will go on to guide the child’s feelings, thoughts and expectations as an adult in future relationships.
ATTACHMENT-EARLY ATTACHMENT PATTERNS

- Secure Attachment
- Avoidant Attachment
- Ambivalent/Anxious Attachment
- Disorganized Attachment
SECURE ATTACHMENT

• Ideally, from the time infants are six months to two years of age, they form an emotional attachment to an adult who is attuned to them, that is, who is sensitive and responsive in their interactions with them. It is vital that this attachment figure remain a consistent caregiver throughout this period in a child’s life. During the second year, children begin to use the adult as a secure base from which to explore the world and become more independent. A child in this type of relationship is securely attached.
AVOIDANT ATTACHMENT

• There are adults who are emotionally unavailable and, as a result, they are insensitive to and unaware of the needs of their children. They have little or no response when a child is hurting or distressed. These parents discourage crying and encourage independence. Often their children quickly develop into “little adults” who take care of themselves. These children pull away from needing anything from anyone else and are self-contained. They have formed an *avoidant* attachment with a misattuned parent.
AVOIDANT ATTACHMENT

• Do not feel the need for love and reassurance
• This lowers the need for intimacy
• Reluctant to trust and rely on another
• *Fear intimacy*
AMBIVALENT/ANXIOUS ATTACHMENT

Some adults are inconsistently attuned to their children. At times their responses are appropriate and nurturing but at other times they are intrusive and insensitive. Children with this kind of parenting are confused and insecure, not knowing what type of treatment to expect. They often feel suspicious and distrustful of their parent but at the same time they act clingy and desperate. These children have an ambivalent/anxious attachment with their unpredictable parent.
AMBIVALENT/ANXIOUS ATTACHMENT

• Need for love and reassurance but *fear rejection*

• Project their own flirtatiousness and sexual interest onto another based upon hope he/she will reciprocate
DISORGANIZED ATTACHMENT

• When a parent or caregiver is abusive to a child, the child experiences the physical and emotional cruelty and frightening behavior as being life-threatening. This child is caught in a terrible dilemma: her survival instincts are telling her to flee to safety but safety is the very person who is terrifying her. The attachment figure is the source of the child’s distress. In these situations, children typically disassociate from their selves. They detach from what is happening to them and what they are experiencing is blocked from their consciousness. Children in this conflicted state have *disorganized attachments* with their fearsome parental figures.
PHARMACOLOGICAL TREATMENT

• There are currently no medications that counteract the specific effects of methamphetamine or that prolong abstinence from and reduce the abuse of methamphetamine by an individual addicted to the drug.

• Trial studies have been performed with many medications believed to possibly enhance long-term recovery success. However, more studies will be needed to confirm drug efficacy in the treatment of meth addiction.
PHARMACOLOGICAL TREATMENT

• Bupropion. This drug may reduce meth use in light meth users only.

• Modafinil. This drug shows mixed results. One study has suggested that this drug – when combined with cognitive-behavioral therapy – may help reduce meth use. Other studies have not shown a lot of promise for this drug.

• Naltrexone. More than one study have suggested that this drug has potential for reducing use and increasing abstinence of methamphetamine.

• Mirtazapine. One study found that mirtazapine – alongside cognitive-behavioral therapy – was associated with significant reductions in meth use among a sample of men who have sex with men (MSM).

• Topiramate. One study found topiramate to reduce overall meth use. Total abstinence from meth was not observed in conjunction with taking topiramate, however.
PHARMACOLOGICAL TREATMENT

• A range of medications have been tested for reducing meth cravings, many of which showed no success in reducing meth cravings. Some of the medications that have shown more promise, however, include:

• **Rivastigmine.** Studies have suggested this drug might help reduce meth users’ desire for meth.

• **Nicotine.** Nicotine administration during meth withdrawal has shown to reduce meth-seeking behavior in some individuals.
PHARMACOLOGICAL TREATMENT

• Out of the medications that have been studied so far, it appears that two of those drugs may show some promise in reducing both meth use as well as meth cravings:

• Bupropion (including Wellbutrin). Available in several trade name formulations (including Wellbutrin and Zyban), bupropion is currently FDA-approved for major depression, seasonal affective disorder and smoking cessation. Bupropion may be one of the most publicized medications in aiding methamphetamine addiction. Bupropion's mechanism of action is not completely understood, but it is believed to weakly inhibit uptake of norepinephrine and dopamine. This action results in increased amounts of norepinephrine and dopamine available in the body. As mentioned earlier, dopamine is one of the body’s primary “pleasure chemicals,” while norepinephrine is one of the body’s primary “fight or flight” chemicals. Bupropion’s efficacy in this capacity is reported to be pronounced only in light meth users.
PHARMACOLOGICAL TREATMENT

• **Naltrexone.** Naltrexone is currently FDA-approved for treating both alcohol and opioid drug dependence. It works as an opioid receptor antagonist – meaning that it competes with and blocks other drugs that would normally have an effect on opioid receptors. **Naltrexone is believed to have some potential for helping with meth addiction by blocking meth-induced dopamine.** More studies are still needed to evaluate naltrexone’s efficacy and role in treating meth addiction.
The National Institute of Drug Abuse (NIDA) established the Methamphetamine Clinical Trials Group (MCTG) to conduct studies of medications for methamphetamine.

- **Paxil** (Paroxetine or Pexeva)
  - **What it does:** An antidepressant, Paxil was found to decrease methamphetamine craving.
  - **How it works:** Paxil contains the compound ondansetron that can block the effects of methamphetamine withdrawal.
  - **Side effects:** Headaches, dizziness, weakness, nausea, constipation and heartburn. For a more complete list of side effects visit this NIH page.
  - **Research:** In one study the antidepressant paroxetine (Paxil) was found to decrease methamphetamine craving compared to placebo.

PHARMACOLOGICAL TREATMENT

- **Modafinil** (Provigil®)
  
  - **What it does:** May be effective in treating sleep disorders and methamphetamine withdrawal symptoms and improving cognitive function
  
  - **How it works:** This central nervous system stimulant is chemically and pharmacologically dissimilar to other stimulants such as the amphetamines. The dopamine- and glutamate-enhancing actions of modafinil may help reduce withdrawal severity. The stimulant properties of modafinil may also ease the disturbed sleep patterns, poor concentration and low energy levels characteristic of methamphetamine withdrawal. It is well tolerated and has low abuse liability.

  - **Side effects:** Headache, dizziness, drowsiness, nausea, constipation and heartburn. For a more complete list of side effects visit this NIH page.

  - **Research:** Modafinil is an important drug being studied which appears to improve cognitive functioning and may also complement behavioral counseling for methamphetamine abuse. [drugabuse.gov/publications/drugfacts/methamphetamine](http://drugabuse.gov/publications/drugfacts/methamphetamine)

PHARMACOLOGICAL TREATMENT

- **Mirtazapine** (Remeron)
  - **What it does:** An antidepressant that was found to decrease methamphetamine use
  - **How it works:** Mirtazapine helps release several brain chemicals including norepinephrine, serotonin and dopamine that are involved in mood.
  - **Side effects:** drowsiness, dizziness, anxiousness, confusion, increased weight and appetite
  
  For a more complete list of side effects visit this NIH page.

- **Research:** In a small 12-week study of 60 patients, the addition of mirtazapine to substance use counseling decreased methamphetamine use among active users, despite low to moderate medication adherence. Colfax NC, et al. Mirtazapine to reduce methamphetamine use: a randomized controlled trial. Arch Gen Psychiatry. 2011;68(11):1168-1175.
PHARMACOLOGICAL TREATMENT

• **Dopamine agonist treatment**: Medications based on activation of the same receptors targeted by an addictive drug are effective in treating other addictions, such as the use of methadone or buprenorphine to treat opioid use disorder and the use of nicotine replacement to assist smoking cessation. Since methamphetamine targets the dopamine system, some stimulant medications that activate dopamine receptors (agonists) and that are often used to treat attention-deficit hyperactivity disorder (ADHD) are being investigated as potential medications to treat methamphetamine use disorder.
PHARMACOLOGICAL TREATMENT

• **The opioid system:** The euphoric effects of addictive drugs likely involve the opioid system. Candidate medications in this category include the opioid antagonist naltrexone (currently being studied in combination with the antidepressant bupropion) and the opioid partial agonist buprenorphine.

• **GABA and glutamate systems:** Several medications targeting disruptions in the *balance of excitation and inhibition* (mediated by the neurotransmitters GABA and glutamate) are being investigated to treat methamphetamine use disorder.
PHARMACOLOGICAL TREATMENT

• The following targets and strategies have shown promise in animal or human studies related to methamphetamine use disorder:

  – **The neuroimmune system**: Chronic methamphetamine use is associated with activation of microglia, cells that mediate inflammation in the central nervous system. Drugs like ibudilast and minocycline are being studied for their capacity to inhibit activation of microglia.

  – **Cognitive enhancement**: Chronic methamphetamine use is also associated with cognitive problems, such as impaired decision-making and impaired behavioral inhibition. Several drugs are under investigation for their potential to improve cognition in people who use methamphetamine.


PHARMACOLOGICAL TREATMENT

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  - **The neuroimmune system**: Chronic methamphetamine use is associated with activation of microglia, cells that mediate inflammation in the central nervous system. Drugs like ibudilast and minocycline are being studied for their capacity to inhibit activation of microglia.
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