Neurobiology and Treatment of Addiction 2015

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Times are Changing

- Treatment is at a different day. Professionals must understand new trends and the science to deliver appropriate treatment in today's times.

NEUROSCIENCE

WHY IS IT IMPORTANT TO UNDERSTAND BASIC NEUROSCIENCE & NEUROGENESIS?

Neurogenesis

- **3 Possible Ways to Promote Neurogenesis -- and thus Healing -- In Our Brains**
- **1. Learn new things.** When put in plain cages, the brains of Dr. Gould's marmosets (another primate she works with) experienced decreased neurogenesis When the same animals were transferred to an "enriched" enclosure with things like hidden food and a variety of toys, their brains, "...underwent radical renovations at the cellular level," in less than four weeks.

  Learning a new language, hobby or new sport can help in regenerating brain functioning. Working puzzles, etc.

Neurogenesis

- **2. Anti-depressants-** There is evidence that anti-depressants actually work by promoting neurogenesis.
- **Exercise.** Yes, you've heard this before. But according to **article** in BioEd online, physical exercise promotes the generation of new neurons (neurogenesis).

Brain Structure New 3D MRI

Pill To Forget Bad Memories

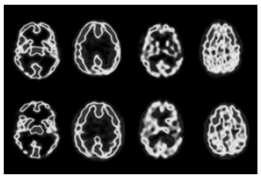
The Pill To Forget

- A drug which appears to erase painful memories has been developed by scientists.
- The astonishing treatment could help sufferers of post-traumatic stress disorder and those whose lives are plagued by hurtful recurrent memories.
- But some experts said the breakthrough raises disturbing ethical questions about what makes us human.
- They also warned it could have damaging psychological consequences, preventing those who take it from learning from their mistakes

The Pill to Forget

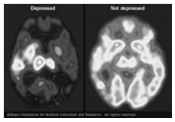
- 'It may perhaps be beneficial in some cases, but before eradicating memories, we must reflect on the effects that this will have on individuals, society and our sense of humanity.'
- Dutch researchers claim to have erased bad memories by using 'beta-blocker' drugs, which are usually prescribed to patients with heart disease

Rethinking Addiction



The New Age in Treatment

- The counseling side and the scientific side must work collaboratively to achieve the best in outcomes



Vaccines and Treatment

- **Are Vaccines the New Drug Addiction Treatment?**
- Vaccines are a popular focus in drug addiction treatment research. How wonderful would it be if avoiding drug addiction or breaking free from dependence was as simple as getting a shot?
- Diligently, scientists are testing different substances to try and make the dream a reality. Some vaccines will be released in the next year

Vaccines and Treatment

- **How Vaccines Work**
- Vaccines, for the most part, are preventative measures. They introduce a small amount of foreign cells into the body – not enough to overwhelm the patient, but enough to kick-start the immune system and give it an opportunity to develop the antibodies that create an immune response, according to the *New York Times*. The next time the foreign cells appear, the immune response will kick in and knock it out – theoretically.

Nasal Spray and Tx

THR (thyrotropin releasing hormone) works as a nasal spray to prevent suicides. TRH can help with depression, bi-polar disorders and suicidal urges. Nasal administration enters system quicker and more effectively than medications. Anti-depressants used as nasal spray in nanoparticle delivery. Army now testing and release is anticipated in 2015

Vaccines & Treatment

- Nicotine is a small molecule that upon inhalation into the lungs quickly passes into the bloodstream and subsequently reaches the brain by crossing the blood-brain barrier. Once in the brain, the nicotine binds to specific nicotine receptors resulting in the release of stimulants, such as dopamine, a chemical linked to pleasure and to addiction.
- NicVAX is designed to stimulate the immune system to produce antibodies that bind to nicotine in the bloodstream and prevent it from crossing the blood-brain barrier and entering the brain

Vaccines & Treatment

- With a reduced amount of nicotine reaching the brain, fewer stimulants are released and the pleasurable, positive-reinforcing effects of nicotine are diminished, thereby making it easier to quit smoking.
- Pre-clinical studies with NicVAX have shown that vaccination prevents nicotine from reaching the brain and blocks the effects of nicotine, including effects that can lead to addiction or can reinforce and maintain addiction, in animals.
- NicVAX, in combination with quit-counseling, has been clinically demonstrated effective.

Vaccines & Treatment

- A group of scientists are working on a vaccine that could reduce addiction to one of the world's most notorious narcotics: HEROIN.
- Researchers at the country's National Institute of Psychiatry say they have successfully tested the vaccine on mice and are preparing to test it on humans.
- The vaccine, which has been patented in the US, makes the body resistant to the effects of heroin, so users would no longer get a rush of pleasure when they smoked or injected it

Vaccines and Treatment

- **Cocaine vaccine could make drug addiction a distant memory**
- The first ever vaccine for drug addiction has just been created. By combining a cocaine-like molecule with part of the common cold virus, you get a vaccine that turns the immune system against cocaine, keeping it away from the brain.

Vaccines and Treatment

Cocaine Vaccine

The vaccine was created by taking just the part of the cold virus that alerts the body's immune system to its presence, and then researchers connected the signaling mechanism to a more stable version of the cocaine molecule.

Vaccine against Alcoholism will be tested on Humans in 2013

- A vaccine targeting an enzyme that metabolizes alcohol is being developed by researchers. It could be trialed on humans and may prove as preventative against alcoholism
- US researchers in October found out a genetic variation known as CYP2EI that works against alcoholism and 10-20% of people possessing this genetic condition start feeling high after having few glasses of alcohol.
- The gene is prevalent in the brain and is believed to contain an enzyme that metabolizes alcohol

New Science in Alcohol

Brain Hacking

- In the chilling not so distant future there will be capability to hack the brain and extract information. Using an EEG connected with designed software. This is attached to the scalp and scientist have been able to tap regions of the brain to gain information around sensitive information stored in your brain.

Ondansetron

Digital Pills

- FDA approved pill attachment that can be used to transmit information as to whether someone has taken their pills timely. Can be used for people that have problems with remembering meds or who have been medication resistant. Bi-polar disorders etc.

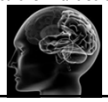
FDA Approved

Digital Meds

- The chip works by being imbedded into a pill. Ingest it at the same time that you take your medication and it will go to work inside you, recording the time you took your dose. It transmits that information through your skin to a stick-on patch, which in turn sends the data to a mobile phone application and any other devices you authorize.

Brain Mapping

- Scientist have identified an area of the brain called the caudate that is responsible for constant and repetitive and precise replay of events. Individuals with total life recall have been studied to show differing areas of their brain. (Mary Lou Henner.) They have identified 9 areas of the brain responsible for memory encoding and retrieval. Can be helpful in TX of OCD and other similar disorders.



Vaccines for Meth

- **MethBlocker™** as it is administered as a quantum vaccine daily x 3 consecutive days and then every 10 days for 2 months at any age before age 14 to provide a LIFETIME immunity to developing dysfunctional behavior that leads to meth addiction.
- Any hidden dysfunctional tendencies and/or genetic predispositions are erased by **MethBlocker's™** programs that continue to run daily for that person's lifetime. And QuantumMAN™ provides a lifetime guarantee of satisfaction with this quantum vaccine.

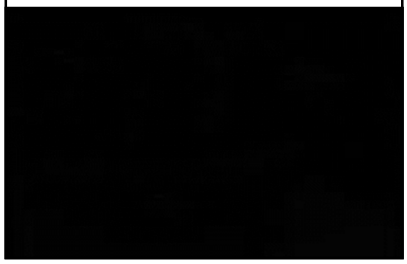
Brain Chemistry to Stop Addiction

- The discovery of a molecular "addiction switch" in the mammalian brain has the potential to control the addiction process in drug addicts, say University of Toronto researchers.
- A study published Jan. 18 in the online edition of Nature Neuroscience finds that a region of the brain called the VTA contains receptors that, when exposed to a certain enzyme, can control the switch from an addicted to non-addicted state and back again. This goes against previous ideas that viewed drug addiction as a permanent change in the brain.

Brain Chemistry to Stop Addiction

- "Our findings suggest that instead of a permanent alteration in the brain, there's actually a switch that goes on between two separate systems (one that mediates the brain's response to drugs while not yet addicted and the other that mediates response once addicted)
- "They also suggest we may be able to manipulate that switch pharmacologically to take drug addicts back to a non-addicted state in a relatively short period of time so they do not crave the drug."

Psychogenitics and Treatment



DNA and Treatment

- Patients are given a cheek swab for testing and based on their particular DNA the test determines which medication will be most appropropriate.
- IT will provide indicators for best for use, use with caution and not recommended.

NEUROSCIENCE & ADDICTION

- Understanding the brain will be critical in future treatment of addiction and mental health disorders.

Your Amazing Brain

- Receives information – within a fraction of a second, too minuscule to measure
- Acts on the external universe – allows you to cry, walk, play a musical instrument
- Utilizes language – one of your most advanced functions
- Possesses emotions – creates your affective universe

CEREBELLUM

- SERVES AS THE REFLEX CENTER AND INTEGRATING THE SKELETAL MUSCLE MOVEMENTS
- WITH ALCOHOL LOSS OF MUSCLE COORDINATION LOSS OF BALANCE.

MIDBRAIN

- HOUSES THE CENTERS WHICH CONTROL VISUAL AND AUDITORY REFLEX AS WELL AS HEAD MOVEMENT.
- CREATE VISUAL AND AUDITORY HALLUCINATIONS.
- Changes will affect MH & SUD

THALAMUS

- FUNCTIONS AS THE CENTRAL RELAY STATION OF THE BRAIN WHERE ALL INCOMING SENSORY IMPULSES EXCEPT FOR SMELL IS LOCATED.
- RESPONSIBLE FOR INTERPRETING SENSATIONS AS EITHER PAINFUL OR PLEASURABLE AND BODY TEMPERATURE

HYPOTHALMUS

- IT CONTROLS HEART RATE, BLOOD PRESSURE, WATER, BALANCE, HUNGER, BODY WEIGHT, MOVEMENTS, SEXUAL BEHAVIOR
- REGULATES EMOTIONS AND BEHAVIOR
- Changes here would affect what?

LIMBIC SYSTEM

- IT REGULATES EMOTIONS, FEAR, ANGER, PLEASURE AND SORROW. IT HAS SIGNIFICANT EFFECT ON BEHAVIOR ESPECIALLY THAT OF SURVIVAL
- PLEASURE PART OF THE BRAIN

TEMPORAL LOBES

- SENSORY AREAS RESPONSIBLE FOR HEARING, MEMORY OF VISUAL SCENES, MUSIC, AND OTHER COMPLEX SENSORY IMPULSES.

The Forebrain
The Limbic System

- **The Amygdala**

Responsible for evaluating sensory information

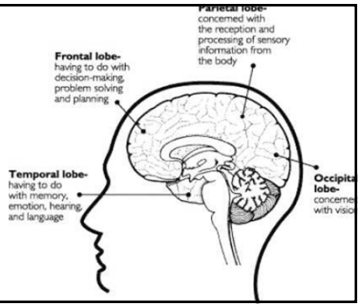
It determines its **emotional** importance remembering pleasurable events

It makes the decision to approach or to withdraw, issues with attachment

Its initial response may be overridden by the appraisal of the cerebral cortex Pleasure of Memory.

- **The Hippocampus**

The gate way to memory



BRAIN DOMINANCE

- ARE YOU RIGHT BRAINED OR LEFT BRAINED?

Lateralization

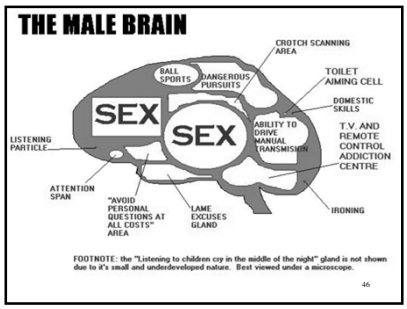
Left Hemisphere
- Verbal competence
- Speaking, reading, thinking,reasoning
- Processes info in sequence
- One piece of data at a time
- logical

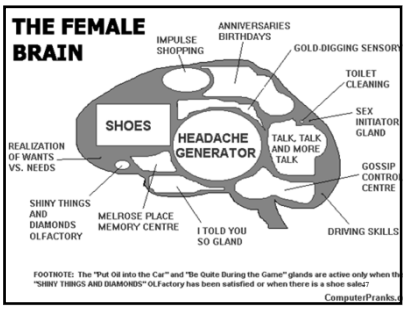
Right Hemisphere
- Nonverbal areas
- Comprehension, spatial relationships, drawing, music, emotion
- Processes info. As a whole
- Intuitive

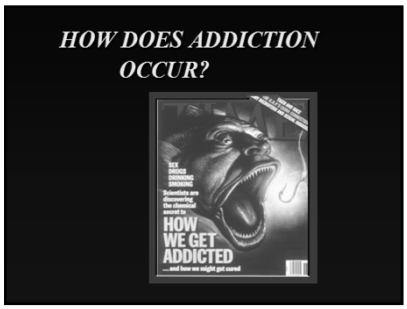
Emotion and Lateralization

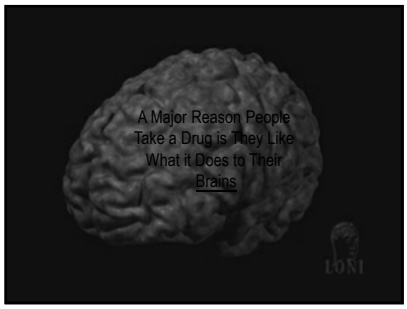
Left Hemisphere
- Important for the expression of positive emotion
- Damage to the L.H. leads to loss of the capacity of joy.
- Activation in the L.H. leads to tendencies to approach other people.

Right Hemisphere
- Important for the expression of negative emotion
- Damage to the R.H. may make people euphoric.
- Activation in the R.H. leads to tendencies to withdraw from people.









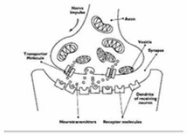
Brain Exercise

I cdnuolt blveiee taht I cluod aulaclty uesdnatnrd waht I was rdanieg The phaonmneal pweor of the hmuan mnid Aoccdrnig to a rscheearch at Cmabrigde Uinervtisy, it deosn't mttaer in waht oredr the ltteers in a wrod are, the olny iprmoatnt tihng is taht the frist and lsat ltteer be in the rghit pclae. The rset can be a taotl mses and you can sitll raed it wouthit a porbelm. Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe. Amzanig huh? yaeh and I awlyas thought slpeling was ipmorantt !

2012 ADDICTION SOLUTIONS

BRAIN CHEMISTRY

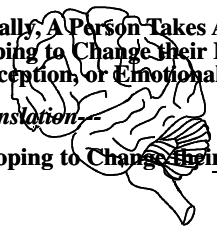
- DRUG USE NOT ONLY CHANGES BRAIN CHEMSTRY IN FUNDAMENTAL WAYS IT IS THE ONLY DRUG THAT EFFECTS ALL OF THE BRAIN NEUROTRANSMITTERS.



Initially, A Person Takes A Drug Hoping to Change their Mood, Perception, or Emotional State

Translation---

…Hoping to Change their *Brain*



Alan Leshner NIDA

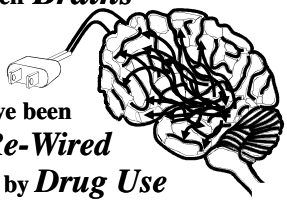
But Then…

After A Person Uses Drugs For A While, Why Can't They Just Stop?

Because…

Alan Leshner NIDA

Their ***Brains***



have been

Re-Wired

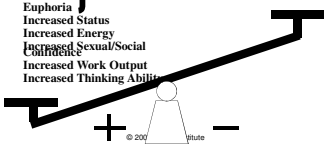
by ***Drug Use***

Cognitive Process During Addiction

Introductory Phase

Relief From
Depression
Anxiety
Loneliness
Insomnia
Euphoria
} AOD
Increased Status
Increased Energy
Increased Sexual/Social Confidence
Increased Work Output
Increased Thinking Ability

May Be Illegal
May Be Expensive
Hangover/Feeling Ill
May Miss Work



Conditioning Process During Addiction

Introductory Phase

Strength of Conditioned Connection

Triggers
•Parties
•Special Occasions

Mild

Responses
•Pleasant Thoughts about AOD
•No Physiological Response
•Infrequent U

Development of Obsessive Thinking

Introductory Phase

Development of Craving Response

Introductory Phase

Entering Using Site

Use of AODs

AOD Effects
Heart/Pulse Rate
Respiration
Adrenaline
Energy
Taste

2012 ADDICTION SOLUTIONS

Family Response to Increasing Addiction

INTRODUCTORY PHASE

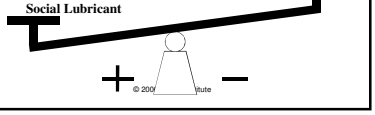
- Non-recognition
- Confusion regarding occasional atypical behaviors
- Admiration for abnormal accomplishments achieved through drug/alcohol use

Cognitive Process During Addiction

Abuse Phase

Depression Relief
Confidence Boost
Boredom Relief
Sexual Enhancement
Social Lubricant

Vocational Disruption
Relationship Concerns
Financial Problems
Beginnings of Physiological Dependence



Conditioning Process During Addiction

Abuse Phase

Strength of Conditioned Connection

Triggers
•Parties
•Friday Nights
•Friends
•Concerts
•Alcohol
•"Good Times"
•Sexual Situations

Moderate

Responses
•Thoughts of AOD
•Eager Anticipation of AOD Use
•Mild Physiological Arousal
•Cravings Occur as Use Approaches
•Occasional U

Development of Obsessive Thinking

Abuse Phase

Family Response to Increasing Addiction

ABUSE PHASE

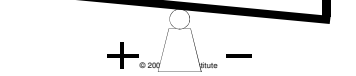
- Experimentation with solutions
- Extreme responses
- "Enabling"

Cognitive Process During Addiction

Dependence Phase

Social Currency
Occasional Euphoria
Relief From Lethargy
Relief From Stress

Nose Bleeds
Infections
Relationship Disruption
Family Distress
Impending Job Loss



Conditioning Process During Addiction

Dependence Phase

Strength of Conditioned Connection

Triggers		Responses
•Weekends •All Friends •Stress •Boredom •Anxiety •After Work •Loneliness	STRONG	•Continual Thoughts of AOD •Strong Physiological Arousal •Psychological Dependency •Strong Cravings •Frequent Use

Development of Obsessive Thinking

Dependence Phase

Development of Craving Response

Dependence Phase

Thinking of Using

Mild Physiological Response

- ↑ Heart Rate
- ↑ Breathing Rate
- ↑ Energy
- ↑ Adrenaline Effects

Entering Using Site

Powerful Physiological Response

- ↑ Heart Rate
- ↑ Breathing Rate
- ↑ Energy
- ↑ Adrenaline Effects

Use of AODs

AOD Effects

Heart
Blood Pressure
Energy

Family Response to Increasing Addiction

ADDICTION PHASE

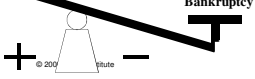
- Avoidance of problem
- Blaming the addicted
- Blaming selves
- Guilt and shame

Cognitive Process During Addiction

Disaster Phase

Relief From Fatigue
Relief From Stress
Relief From Depression

Weight Loss
Paranoia
Loss of Family
Seizures
Severe Depression
Unemployment
Bankruptcy



Conditioning Process During Addiction

Disaster Phase

Strength of Conditioned Connection

OVERPOWERING

Triggers		Responses
•Any Emotion •Day •Night •Work •Non-Work		•Obsessive Thoughts About AOD •Powerful Autonomic Response •Powerful Physiological Dependency •Automatic

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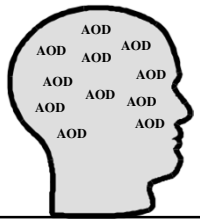
Development of Obsessive Thinking

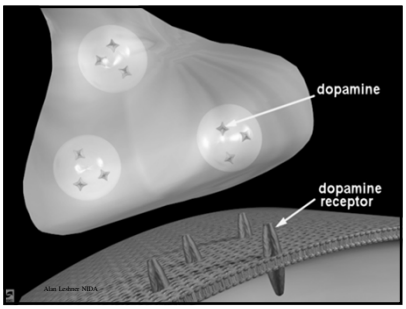
Disaster Phase

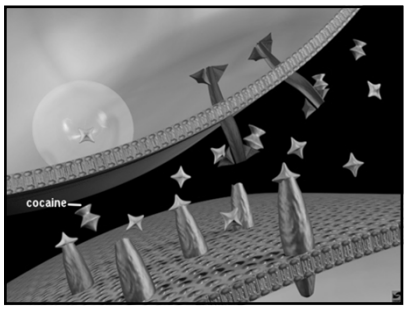


Family Response to Increasing Addiction

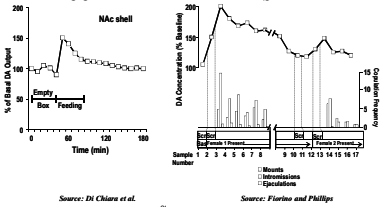
DISASTER PHASE

- Separation
- Internalization of bad feelings
- Resignation and hopelessness
- Establishment of unhealthy family rules



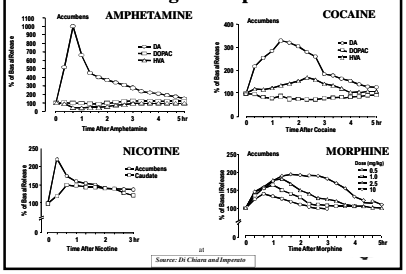


Natural Rewards Elevate Dopamine Levels



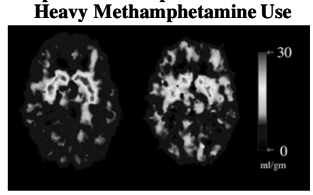
Source: Di Chiara et al. *Source: Fiorino and Phillips*

Effects of Drugs on Dopamine Levels

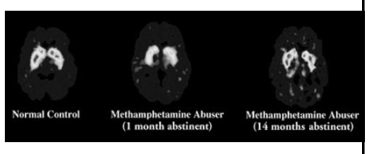


Source: Di Chiara and Imperato

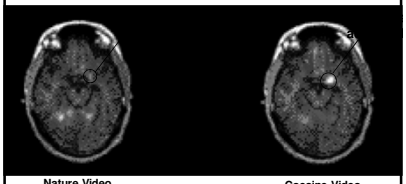
Dopamine Transporter Loss After Heavy Methamphetamine Use



Comparison Subject **METH Abuser 6 Months After Us**



The Memory of Drugs



Nature Video Cocaine Video

NEUROTRANSMITTERS

- NOREPINEPHRINE- STIMULANT, ANGER, FEAR, ANXIETY, FIGHT, FLIGHT - COCAINE, METH, RITALIN, ADDERALL
- SEROTONIN – DEPRESSANT, SLEEP, CALM PLEASURE- THC,ETOH,SSRI`S
- GABA – RELAXANT, STRESS REDUCTION, SEIZURE THRESHOLD – BENZOS, ETOH, BARBITURATES, ATAVAN, VALIUM
- ENDORPHINS – PAIN RELIEF, PLEASURE – OPIODS, ETOH, HYDROCODONE
- ACETYLCHOLINE- INVOLUNTARY ACTIONS, MEMORY MOTIVATION – NICOTINE, METH, THC
- ANANDAMIDE-MEMORY, NEW LEARNING, CALMNESS- METH
- GLUTAMATE- ORGANZATION OF BRAIN SIGNALING, MEMORY, PAIN - ETOH METH, OPIATES,
- DOPAMINE – PERCEPTION, MOVEMENT, PLEASURE – METH ,ETOH,COCAINE, ALL DRUGS, EATING, GAMBLING

Neurotransmitters

Serotonin

Sleep, appetite, sensory perception, temperature regulation, pain suppression, and mood

Dopamine

Voluntary movement, learning, memory, and emotion

Acetylcholine

Muscle action, cognitive functioning, memory, and emotion

Neurotransmitters

Norepinephrine

Increased heart rate and the slowing of intestinal activity during stress, learning, memory, dreaming, waking from sleep, and emotion

GABA

(gama-aminobutyic acid)

The major inhibitory neurotransmitter in the brain

Neurotransmitters

Cortisol

Cortisol is associated with stress. Increase in cortisol damages the brain and may be associated with posttraumatic stress.

GABA

Abnormal GABA levels have between implicated in sleep and eating disorders and in compulsive disorders.

Glutamate

Glutamate, serotonin, and high levels of dopamine have been associated with schizophrenia

BRAIN DEVELOPMENT

- RECENT RESEARCH HAVE GIVEN SCIENTIST AN ESTIMATE OF BRAIN CHEMISTRY DEVELOPMENT:

- AGE 11-18 50% COMPLETE
- AGE 18 – 21 75% COMPLETE
- AGE 22- 32 – 100% COMPLETE
- AGE 44 – 59 75% COMPLETE
- AGE 60 – 50% COMPLETE

Brain Development 0 to 5 yrs

- Excess neurons are pruned in first 18 mo but brain keeps growing. Brain cells become more adapt at communicating and babies learn to talk
- Initial ISSUES:
- Autism 4 x more prevelant in boys
- Epilepsy 10% will have seizure in lifetime
- ADHD Effects 3x more boys than girls
- 5% of school ages have ADHD

Brain Development Ages 5 to 10

- Dramatic growth in the temporal and parietal lobes, brain regions crucial to language and understanding prime time for learning languages and music
- Initial Issues:
- Depression -Given year 10% of population mostly women will experience a depressive episode 10% of children ages 6 to 12 have symptoms of depression typical of those at onset in mid 20;s
- Anti Social Behavior- From bullying to lying more prevalent in boys who inflict more physical harm
- Dyslexia – revealed when child learns to read and write
- Anxiety Disorders – pre syptoms begin
- ADHD – issues become more apparent

Brain Development Ages 10 to 13

- Just before puberty the brains grey matter thickens especially in frontal lobe the seat of planning, impulse control and reasoning. Growth triggered by sex hormones.
- Initial Issues:
- Obsessive Compulsive Disorder – Caused by abnormally functioning brain circuitry, neurotransmitters and hormones become involved
- Eating Disorders – more common in girls
- Conduct Disorders – Disregard for norms and rules, affects 6 to 16% of boys and 9% of girls under age 18.

Brain Development Ages 13 to 20

- The brain begins to shrink losing about 2% of it weight and volume Abnormally high loss of gray matter may lead to onset of schizophrenia.

- Initial Issues:
- Panic Disorders – Affects 2.4 million ages 18 to 54 More common in women.
- Social phobias – Fears being watched or embarrased or being around others.
- Peak suicide years – leading cause of death among young people 15 to 24 white males are at greatest risk

Brain Development Ages 20 to 30

- By late 20s information processing begins to slow down. Memory centers in the hippocampus and frontal lobes seem most affected, degree of this change may impact symptoms in late 60's such as alzheimers disease.

- Initial Issues:
- Postpartum depression – 10% of new mothers
- Schizophrenia – affects 1% of population
- Bi-polar disorder – about 2.3 million are bi-polar

Brain Development Ages 30 to 60

- Learning and memory and other complex mental processes become more difficult and reacting to stimuli takes longer. Plagues and tangles may form in certain brain regions.
- Initial Issues:
- Menopause – sudden mood swings, inability to cope, memory lapses
- Onset of Alzeheimer's
- Huntington Disease – more than 250, 000 are at risk of inheriting it

What are the goals of brain imaging?

Figure out how drugs act.

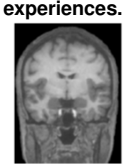
What are the acute effects?

Characterize addiction.

What's wrong in the brain? What circuits?

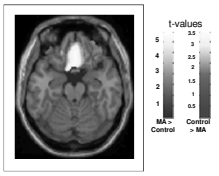
Advance treatment.
Provide a rational basis to design medicines or cognitive-behavioral therapies.

The anterior cingulate and insular cortices participate in emotional experiences.



The amygdala links perception with emotion and memory.

Prefrontal Cortex Dysfunction in Stimulant Abusers



Serotonin

When a person is depressed, their serotonin level is low, which causes several changes to the body:

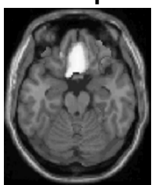
1. Pain Threshold Lowered: A depressed person feels more pain from no apparent source.
(back pain is very common amongst sufferers)

2. Sleep Disturbance: A depressed persons day runs on an average of 22 hours, not 24. And there are many spikes in temperature throughout the night which causes a person to wake many times, resulting in not getting any REM sleep.

Depression and Substance Use

- Common symptoms with both depression and substance use.
- Mood changes
- Anhedonia
- Irritability
- Insomnia
- Sleep patterns change
- Concentration difficulty

Anti-Social Personality Pre-frontal Cortex not fully developed



Bi-Polar Affective Disorder

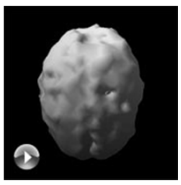
What Causes Mania?

- The neurotransmitters: Norepinephrine, dopamine, and serotonin, have been studied since the 1960s as factors in mania and depression.
- For example, during a manic episode, clients with bipolar disorder have a significantly higher Norepinephrine and epinephrine levels than a depressed or euthymic (normal mood) person.
- Norepinephrine and epinephrine are responsible for "fight or flight" responses.

Neurobiological Changes in Response to Traumatic Stress

- Limbic System -- Hippocampus and Amygdala (Affect and Memory, judgement, prioritizing information
- Neurotransmitters and Peptides (Numbing and Depression,
- Changes in Hormonal System (HPA axis) (Arousal, Desire

Addiction & Trauma



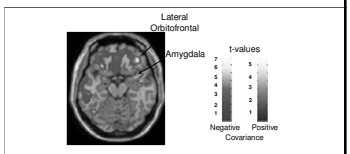
Reframing the "problem" of Personality Disorders

- One way to understand personality disorders is that the person coped in the best way they knew how, in response to difficult circumstances, and at that past time (typically during childhood), it helped them to survive. (i.e., ADAPTIVE)

Anxiety in MA Abusers

Amygdala Activity

Changes in Norepinephrine



103

The brain images below show how alcohol may harm teen mental function. Compared with a young non-drinker, a 15-year-old with an alcohol problem showed poor brain activity during a memory task. This finding is noted by the lack of pink and red coloring.

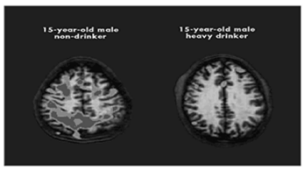
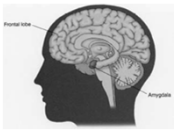


Image from Susan Tapert, PhD, University of California, San Diego.

104

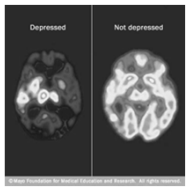
Emotions



Adolescents use the **Amydala** (fight or flight response) rather than the **Frontal Cortex** (used by older adults) to read emotions

Adolescents often misread facial expressions. Adults see fear adolescents may see anger or shock

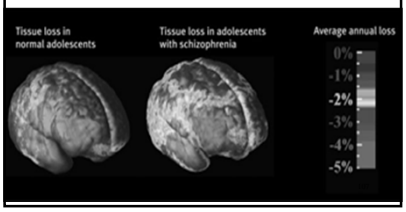
PET scan of brain for depression



A PET scan can compare brain activity during periods of depression (left) with normal brain activity (right). An increase of blue and green colors, along with decreased white and yellow areas, shows decreased brain activity due to depression.

Schizophrenia

- Brain scans of teens with schizophrenia show brain lesions in thalamus and frontal cortex



Conclusion

- Neuroscience can help in the future of medications, and treatment.
- All professionals working in addiction must be aware of the advances to provide appropriate and up to date treatment.
- Questions or Comments ?

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