The Limbic System
Theory Of Addiction
And
The Pre Frontal Cortex
The Limbic System Theory of Addiction

The brain controls every aspect of a human being. From breathing to blinking, it runs the show. Most of how it operates, however, is on an automatic and unconscious level. There are three primal instincts buried deep within man’s subconscious brain; also known as the reptilian brain.

• To Eat- (to sustain life)
• To Reproduce- (to spread his seed, to continue his DNA
• To Kill- (to protect himself and what is his)

These instincts are inherit in our nature and locked in our DNA. They are known as our “survival instincts”. When addiction occurs, however, it supersedes these instincts and becomes the primary survival mechanism. The brain actually goes through a physiological change and once an addict becomes an addict, he cannot go back to being a non-addict.

A good example of this transformation is:
When a cucumber enters a barrel of brine and is submerged for a period of time, it becomes a pickle.
Once it becomes a pickle, it cannot go back to being a cucumber. So it is with the addict and the disease of addiction.
There are four very distinctive “Characteristics of Addiction”

1. There is a profound recurring urge (idea) to repeat the experience.

2. The urge becomes greater than any other urge (it becomes the primary urge).

3. It is automatic (requires no “trigger”).

4. It is incurable (irreversible-chronic), (once a pickle, always a pickle).
Diagram of the “Limbic System Theory of Addiction”

VITAL CENTER
CNS
RESPIRATORY
BLINK
REFLEXIVE
AUTOMATIC
SEMI-VOLUNTARY
UNCONSCIOUS

Limbic System

Seat of Emotion & Memory
Anger/Fear
Pleasure/Ecstasy
Sexual Orgasm

Drug and/or Behavior Reward Center
Payoff Orgasm-relief-Pleasure
Spiritual Awakening Experience

Orgasm
Cosmic Consciousness

Limbic System is Portal to Higher Areas of Consciousness
**Amygdala**- Involved in signaling the cortex of motivationally significant stimuli such as those related to reward and fear in addition to social functions such as mating. Trigger center.

**Hippocampus**- Required for the formation of long-term memories.

**Cingulate Cortex**- Autonomic functions regulating heart rate, blood pressure and cognitive processing.

**Septal nuclei**- The septal nuclei receive reciprocal connections from the hippocampus, amygdala, hypothalamus, midbrain, habenula, cingulate gyrus, and thalamus. The septal nuclei plays an important role in reward and reinforcement.

**Hypothalamus**- Regulates the autonomic nervous system. Affects and regulates blood pressure, heart rate, hunger, thirst, sexual arousal, and the sleep/wake cycle.
The Limbic System controls mood and attitude...

Functions associated with the Limbic System:

sets the emotional tone of the mind

filters external events through internal states (emotional coloring)

tags events as internally important

stores highly charged emotional memories

modulates motivation

controls appetite and sleep cycles

promotes bonding

directly processes the sense of smell

modulates libido
Problems associated with the Limbic System:

- moodiness, irritability, clinical depression
- increased negative thinking
- perceive events in a negative way
- decreased motivation
- flood of negative emotions
- appetite and sleep problems
- decreased or increased sexual responsiveness
- social isolation
The PFC is one of the most significant areas of the brain, especially to an addict. This is the most evolved system of the brain. The PFC has domain over a number of different brain functions. The five (5) major areas of the PFC that may become severely damaged by drug and alcohol abuse/addiction are:
1. **Behavior**- (controlling one’s actions) – having the ability to think or feel a certain way and acting with appropriate behavior.

2. **Development of an individual, or social, conscience**- (self-aware, insight) – knowing when something is not right and acting accordingly.

3. **Decision making**- (think before you act) - gathering of information before acting, the skill of making an informed decision.

4. **Impulse control**- thinking things through instead of immediately acting on a feeling or thought.

5. **Focus**- being able to stay with a project or task, the ability to get the job done.
Functions of the Prefrontal Cortex

- Attention Span
- Perseverance
- Planning
- Judgment
- Impulse Control
- Organization
- Self-Monitoring and Supervision
- Problem Solving
- Critical Thinking
- Forward Thinking
- Learning from Experience and Mistakes
- Ability to Feel and Express Emotions
- Influences the Limbic System
- Empathy
- Internal Supervision
PROBLEMS ASSOCIATED WITH THE PREFRONTAL CORTEX

• SHORT ATTENTION SPAN
• DISTRACTIBILITY
• LACK OF PERSEVERANCE
• IMPULSE CONTROL PROBLEMS
• HYPERACTIVITY
• CHRONIC LATENESS, POOR TIME MANAGEMENT
• POOR ORGANIZATION AND PLANNING
• PROCRASTINATION
• UNAVAILABILITY OF EMOTIONS
• MISPERCEPTIONS
• POOR JUDGEMENT
• TROUBLE LEARNING FROM EXPERIENCE
• SHORT TERM MEMORY PROBLEMS
• SOCIAL AND TEST ANXIETY
• LYING
• MISPERCEPTIONS
There are many pathways in the brain, however, one pathway important to understanding the effects of drugs on the brain, is the reward pathway. When the brain is activated by a reward stimulus (e.g., food, water, sex), information travels from the VTA to the Nucleus accumbens and then up to the prefrontal cortex.
The Nucleus Accumbens is a collection of neurons within the forebrain. It is thought to play an important role in reward, laughter, pleasure, addiction and fear. This is the area of the brain that drives people to action.

What is the VTA? The “ventral tegmental area” is considered to be part of the pleasure system, or reward circuit, one of the major sources of incentive and behavioral motivation. Activities that produce pleasure tend to activate the “ventral tegmentum”, and psycostimulant drugs (such as Cocaine) directly target this area.
Neurotransmitters are naturally occurring chemicals in the brain that are used to relay, amplify and modulate signals and transfer information between a neuron and another cell. This is how nerve cells communicate with one another. Neurotransmitters underlie every thought and emotion as well as memory and learning.

There are more than 50 known neurotransmitters, however, only several of them are directly associated with addiction. Different drugs affect different neurotransmitters.
Some examples of neurotransmitter action:

- **Acetylcholine** - voluntary movement of the skeletal system, mental acuity, memory and learning.
- **Norepinephrine** - wakefulness or arousal, attention span and confidence.
- **Epinephrine** - similar to nor-epinephrine. Large amounts of it are produced and are released by the adrenal glands. Also called adrenaline. Energy.
- **Dopamine** - voluntary movement and motivation, "wanting", pleasure, associated with addiction and love, the reward pathway.
- **Serotonin** - memory, emotion, wakefulness, sleep, mood (depression), sexual activity and temperature regulation.
- **Glutamate** – Plays a major role in cognition, motor function, and sensory function.
- **GABA** – It controls impulses, muscle relaxation, and arousal and generally slows down the brain. It is one of the brains most frequently used neurotransmitters.
- **Glycine** - spinal reflexes and motor behavior.
- **Enkephalins, endorphins and dynorphins** - sensory transmission, especially pain, emotional and physical stress.
- **Histamine** - involved in the sleep/wake cycle and inflammatory response.
Dopamine Pathways

Frontal cortex

Serotonin Pathways

Striatum

Substantia nigra

Functions
- Mood
- Memory processing
- Sleep
- Cognition

Nucleus accumbens

VTA

Hippocampus

Raphe nucleus

Functions
- Reward (motivation)
- Pleasure, euphoria
- Motor function (fine tuning)
- Compulsion
- Perseveration
<table>
<thead>
<tr>
<th>Drug</th>
<th>Neurotransmitters Directly Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>GABA (gamma-aminobutyric acid), met-enkephalin, serotonin</td>
</tr>
<tr>
<td>Benzodiazepines</td>
<td>GABA, glycine</td>
</tr>
<tr>
<td>Marijuana</td>
<td>Anandamide, arachidonylglycerol (2AG), acetylcholine, dynorphin</td>
</tr>
<tr>
<td>Heroin</td>
<td>Endorphin, enkephalin, dopamine</td>
</tr>
<tr>
<td>LSD</td>
<td>Acetylcholine, dopamine, serotonin</td>
</tr>
<tr>
<td>Nicotine</td>
<td>Epinephrine, endorphin, acetylcholine</td>
</tr>
<tr>
<td>Cocaine and amphetamines</td>
<td>Dopamine, epinephrine, norepinephrine, serotonin, acetylcholine</td>
</tr>
<tr>
<td>MDA, MDMA</td>
<td>Serotonin, dopamine, epinephrine, norepinephrine</td>
</tr>
<tr>
<td>PCP</td>
<td>Dopamine, acetylcholine, alpha-endopsychosin</td>
</tr>
</tbody>
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FIGURE 4.4 | Cocaine in the Brain

TRANSMITTING NEURON

Vesicles containing dopamine

Dopamine transporter functioning normally

SYNAPSE

Dopamine transporter blocked by cocaine

Dopamine receptors

Cocaine

RECEIVING NEURON
We truly live in exciting times.

The field of addiction studies has been greatly enhanced by technological advances and we continue to learn more about how addiction affects the brain on a daily basis. A great deal of this research has been done by Dr. Daniel Amen of The Amen Clinics.

Dr. Amen helped to pioneer the use of brain SPECT imaging in psychiatry and continues to provide us with a better understanding of how our brain functions with his innovative techniques and his ongoing research. SPECT imaging; actually takes a picture of the brain and shows the areas of activity, or in some cases, inactivity. This gives us a better idea of what we can expect when treating certain individuals and allows us the ability to provide more specialized care.

SPECT is an acronym for:

Single
Photon
Emission
Computerized
Tomography
What is, Single Photon Emission Computerized Tomography?

SPECT is a sophisticated nuclear medicine study that looks directly at cerebral blood flow and indirectly at brain activity (or metabolism). In this study, a radioactive isotope is bound to a substance that is readily taken up by the cells in the brain.

A small amount of this compound is injected into the patient's vein where it runs throughout the blood stream and is taken up by certain receptor sites in the brain.

The patient then lies on a table for 14-16 minutes while a SPECT "gamma" camera rotates slowly around his head. The camera has special crystals that detect where the compound (signaled by the radioisotope acting like a beacon of light) has gone.

A supercomputer then reconstructs 3-D images of brain activity levels. The elegant brain snapshots that result offer a sophisticated blood flow/metabolism brain map.

With these maps, physicians have been able to identify certain patterns of brain activity that correlate with psychiatric and neurological illnesses.
The brain SPECT studies of today, with their higher resolution, can see into the deeper areas of the brain with far greater clarity and show what CAT scans and MRIs cannot - how the brain actually functions.
This is a surface view of what a healthy brain looks like.
These brain scans reflect substance abuse from as little as 3 years, to a prolonged use of over 20 years.
WHICH BRAIN WOULD YOU RATHER HAVE?
O.K., here’s the good news. If you stop using, your brain will get better.

This is your brain while in active addiction, abusing drugs and alcohol.

This is your brain after one (1) year of being drug and alcohol free.
Paranoid Schizophrenia

NO MEDICATION

WITH PROPER MEDICATION
PMS is real not imagined!!!!!

So is depression!!!
This presentation was developed to peak your interest in an area that will be valuable to you regardless of your educational goal or personal situation. Knowing how the brain functions will serve you well. Knowing how to use this information, will transform the way you think, and quite possibly, transform your life.

“We know that knowledge is power. What we must learn is: practical application is the key to success.” (Quote by: Drew Williams)

For more information on brain systems, SPECT scans or just the brain in general, do yourself a favor and visit: www.amenclinics.com