Neurotransmitters Made Easy: Chemistry and Addiction

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Key Point #1
Thinking and mood are controlled by brain chemicals (neurotransmitters)
Two Functions

- **Excitatory** - Increase excitability of a nerve cell
- **Inhibitory** - Slows down activity

Key Point #2

We are born with genetically determined receptor sensitivity

Taken from Fred Von Stieff, MD. 2012. Brain in Balance, Ghost River Images
Serotonin
5-hydroxytryptamine (5-HT)

- Well-being
- Calm mood
- Self-regulation
  - Sleep, appetite, libido
- Social bonding
- Empathy

Glutamate

- Excites other neurons
- Opposed by GABA
- Associative learning
- Associative memory
**GABA**

- gamma-aminobutyric acid
  - Slows activity of other neurons
  - Opposes glutamate
  - Allows calming from fear created in the amygdala

**Dopamine (DA)**

- Pleasure
  - Food, water, sex
- Reinforcement
- Motor control

**Norepinephrine/ noradrenaline -(NE)**

- Warning/vigilance
- Alarm
- Fight – flight – fright
- Decreases nerve pain
Acetylcholine (Ach)
- Sympathetic nervous system
- Memory (rote)
- Attention
- Peripheral nerves, internal organs, and muscle/nerve connection

Nicotine
- Increases alertness and energy
- Speeds nerve transmission “volume control”
- Profile changes from stimulant to sedative/pain killer with increasing dosages

Endocannabinoid
- Movement
- Cognition
- Memory
- Pain perception
- Appetite

Opiate
- Analgesia
- Sedation
- Decrease rate of body functions

Endorphin & Enkephalin
- Endogenous morphine
- Reduce pain
- Euphoria & well-being
- Transmission of pain impulses

Factors Affecting Neurotransmitter Systems
- Diet
- Body states (fatigue, hunger, illness)
- Events
- Thoughts
- Drugs/medicines
- Hormones
Key Point #2

We are born with genetically determined receptor sensitivity
(Temperament vs. Personality)
Parkinson’s Disease

Eight Neurotransmitter Systems

29 primary subtypes

83 variations

Associated Mental Disorders

- Serotonin: Depression
- GABA: Anxiety disorder
- Glutamate: OCD/PTSD
- Dopamine: Psychosis
- Acetylcholine: Alzheimer’s disease
- Endocannabinoid: Amotivational syndrome
- Opiate: Chronic pain disorder
Predisposition for Addiction

- Serotonin deficiency
- B57 rats

Alcoholic Family Tree 1

Drugs Affecting Serotonin

- Ecstasy
- MDMA
- LSD
- Cocaine

Well-being
Calm mood
Self-regulation
Sleep, appetite, libido
Social bonding
Empathy

Drugs Affecting GABA

- Alcohol
- Benzodiazepines
- Barbiturates

Slows activity of other neurons
Opposes glutamate
Allows calming from fear created in the amygdala

Drugs Affecting Glutamate

- Phencyclidine (PCP)
- Ketamine
- Dextromethorphan (DMT)

Excites other neurons
Opposed by GABA
Associative learning
Associative memory
### Drugs Affecting Dopamine
- Pleasure
- Reinforcement
- Motor initiation

- Cocaine
- Amphetamine
- Methamphetamine

### Drugs Affecting Norepinephrine
- Warning/vigilance
- Alarm
- Fight – flight - fright
- Decreases nerve pain

- Cocaine
- Methamphetamine

### Drugs Affecting Acetylcholine
- Sympathetic nervous system
- Memory (rote)
- Attention
- Peripheral nerves and Internal organs

- Nicotine

### Drugs Affecting Endocannabinoid
- Movement
- Cognition
- Memory
- Pain control
- Appetite

- Tetrahydrocannabinol (THC)

### Drugs Affecting Opiate
- Analgesia
- Sedation
- Decrease rate of body functions

- Morphine
- Hydrocodone
- Oxycode
- Heroin
- Codeine
- Methadone
- Fentanyl
- Tramadol

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A person’s drug of choice is the one that lines up best with the receptors.
Key Point #3

Drug use is motivated by “correcting deficits” and Feeling better
Key Point #4

Affecting any one system affects many other systems
Key Point #5

Tolerance is the down-regulation of neurons trying to “right” the drug-created imbalance.
Key Point #6
Withdrawal is the up-regulation process of undoing tolerance

Key Point #7
Treatment Involves attention to neurotransmitter systems
Change neurotransmitter balance

• Diet
• Wellness (sleep, exercise, relaxation)
• Environment
• Thoughts
• Medication

Two Types

• Amino acid – from food
  - Glutamate, GABA

• Biogenic – made in the brain
  - Dopamine, serotonin, norepinephrine, endorphin

Medications for Serotonin

Selective serotonin uptake inhibitors (SSRIs)
  - Prozac, Paxil, Celexa, Lexapro

Monoamines oxidase inhibitor (MAOI)
  - Parnate, Nardil, Marplan
• Abilify
• Wellbutrin
• Haldol
• Gabapentin
• Tramadol

Schizophrenia

Haldol
**Opiate**

Partial agonists
- Buprenorphine Suboxone, Subutex

Full agonist
- Methadone

Antagonist
- Naltrexone, ReVia, Vivitrol
Points to Remember

1. Thinking and mood are controlled by brain chemicals
2. We are born with genetically determined receptor sensitivity
3. Drug use is motivated by “correcting deficits”
4. Affecting any one system affects many other systems

5. Tolerance is the down-regulation of neurons trying to “right” the drug-created imbalance
6. Withdrawal is the up-regulation process of undoing tolerance
7. Treatment involves attention to neurotransmitter systems

References