Chapter highlights: Addiction (Ch 11)

The purpose of “chapter highlights” is to offer a framework in which to think about the specific information discussed in each *Brain Facts* chapter. These highlights draw upon information in the chapter and on the new Brain Facts web site (http://www.brainfacts.org) and occasionally, on our own knowledge of neuroscience that may not be discussed in *Brain Facts*. Questions for Brain Bee will come from *Brain Facts* (new 2012 publication) and entries from the new Brain Facts web site that have “brainfacts.org” in the URL. Some but not all relevant entries are cited below.

**Drug addiction** is a pathological desire for drugs, despite many adverse consequences. Drugs of abuse typically activate the *brain reward system* and also change a person’s brain circuits, making them more susceptible to addiction.

For more information about brain circuits involved in addiction, go to: http://www.brainfacts.org/diseases-disorders/addiction/articles/2011/addiction-and-brain-circuits/

- The brain regions that are changed by drugs are involved in *executive function* and *judgment*.
- These changes are short-term AND long-term.
- **Tolerance** and physiological **dependence** do not mean addiction, but are associated with addiction.
- To learn more about the dangerous cycle of drug addiction, and how genes and environment are involved, go to: http://www.brainfacts.org/diseases-disorders/addiction/articles/2010/reward-and-punishment/

**How do drugs of abuse work in the brain?**

**Nicotine** is the addicting substance in tobacco

- Acts through *acetylcholine nicotinic receptors*
  - Stimulates the adrenal glands, causing release of *epinephrine*
  - Stimulates the release of *dopamine* in reward areas of the brain

**Alcohol** contains the active ingredient *ethanol*

- Activates **gamma-aminobutyric acid (GABA)** receptors. GABA is an *inhibitory* neurotransmitter, so it makes sense that activation of GABA receptors can calm anxiety, delay reaction time, and impair muscle control
- Decreases **N-methyl-d-aspartate (NMDA)** receptor function

**Marijuana** contains the active ingredient **tetrahydrocannabinol (THC)**

- THC binds to *cannabinoid receptors*

**Opiates** (includes *heroin* and *morphine*)

- Activates **opioid receptors** by mimicking the body’s own, naturally occurring, opioid peptides
- Increase the release of *dopamine* in reward areas

**Psychostimulants** (includes *cocaine* and *amphetamine*)

- Block *dopamine transporter*, causing an accumulation of *dopamine* in synapses within the reward centers, such as the **nucleus accumbens**
**Club drugs** (includes ecstasy, GHB, roofies, and ketamine)

- MDMA (aka ecstasy) is a synthetic **amphetamine**, so it blocks the transporter on dopamine cells, increasing dopamine in the synapse
- Rohypnol (aka roofies), GHB, ketamine are **central nervous depressants**. In fact, a lot of researchers use ketamine as an anesthetic on research animals!

*You may have noticed that most of these drugs cause an increase in dopamine within reward centers of the brain. For a short film (noir) about dopamine, told from the viewpoint of a dopamine-producing cell in the brain’s reward center, the ventral tegmental area, go to:* [http://www.brainfacts.org/diseases-disorders/addiction/articles/2011/dopamine-and-addiction/](http://www.brainfacts.org/diseases-disorders/addiction/articles/2011/dopamine-and-addiction/)

**Myths associated with addiction** (for explanations of what really goes on, click on the following links!)

- Drinking alcoholic drinks always kills brain cells
- Drug use makes holes in your brain