What is the Biological Basis of Drug Addiction?

Deep inside our brain the limbic system teaches us to repeat behaviors that help us survive. This system releases dopamine, a brain chemical that rewards us with good feelings when we eat to quell hunger, drink to satisfy thirst, or have sex to perpetuate our species.

Addictive drugs act on this system. Instead of teaching us survival behaviors, drugs teach us to repeat drug-taking and threaten our survival. They can do this because they have a much more powerful effect on dopamine release than food or drink, like a lightning bolt, for example, instead of a match.

This animal experiment illustrates the point. The lower graph measures the reward response of food by charting the release of dopamine in the brain. Dopamine increases after eating from a normal level of 100 to 150 in less than a minute and returns to baseline a few minutes later.

In contrast, amphetamine (upper graph) releases 10 times the amount of dopamine and lasts for several hours.

When people learn the lesson that drugs teach and repeatedly use drugs, tolerance develops. This means they must take more of the drug more often to experience the initial effect.

If use continues, physical dependence develops. When people try to stop using drugs, they experience withdrawal. The only thing that relieves their discomfort is to take more drugs.

At some point psychological dependence develops. People no longer feel pleasure but must compulsively use drugs just to feel normal. All addictive drugs act on the brain's limbic system to produce addiction.

Scientists define addiction as the compulsive use of a drug despite negative health and life consequences.