

# What Makes Caffeine Addictive

Gabrielle Shackelford, Alexia Hamm, Jessica Pierce  
Advised by Dr. John Moran

Choose  Ohio First

## What is Caffeine?

Caffeine, also known chemically as trimethylxanthine, is a cardiac stimulant that has both positive and negative effects in the body. This project's focus is on what aspect of caffeine creates an addictive quality in the human body. By looking at both the negative and positive effects one can compare its qualities to those of other addictive chemicals in common drugs.

## What are the Addictive Qualities?

- Caffeine is a cardiac stimulant
- known chemically as trimethylxanthine
- Caffeine gives you a “boost of energy”
  - Sleepiness is caused by adenosine buildups in the brain
    - Adenosine binds with receptors
    - This slows down nerve cell activity which causes drowsiness
- Caffeine binds to the receptors so that the cells cannot sense the adenosine
  - Therefore, the nerve cell activity does not slow down, so you do not get tired
  - The cells actually speed up
- Since there is more cell activity occurring, the pituitary gland begins the assume that there is an emergency occurring
  - This signals the adrenal glands to release adrenaline
  - The liver then releases sugar into the bloodstream for a little boost of energy
- Dopamine levels also increase with caffeine
  - This is similar to the way that amphetamines increase dopamine levels
- Dopamine is a neurotransmitter that activates the pleasure center
- When caffeine wears off, the body become fatigued and depressed

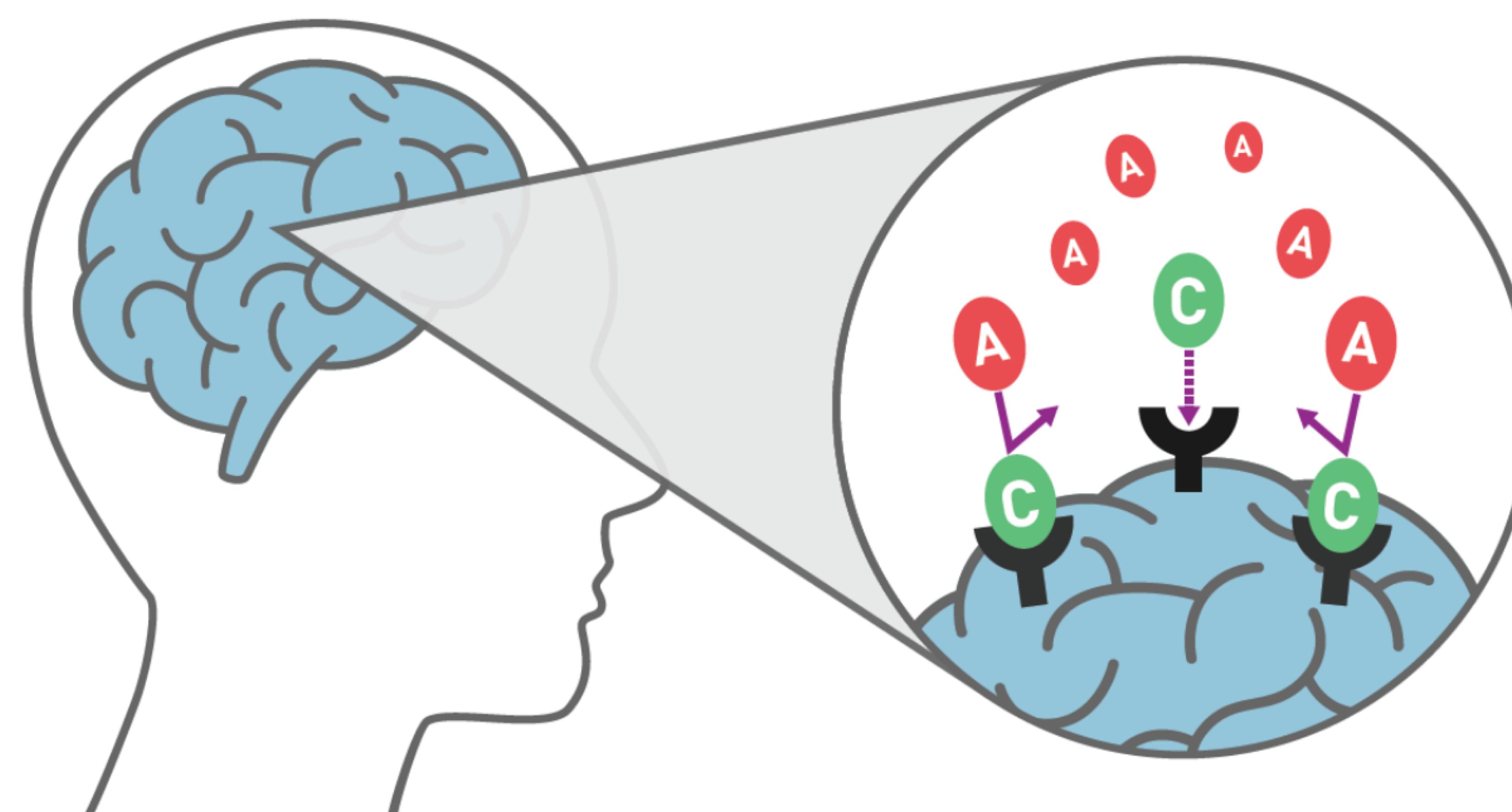


Figure 2. Diagram of caffeine in the brain.

## How Does it Compare?

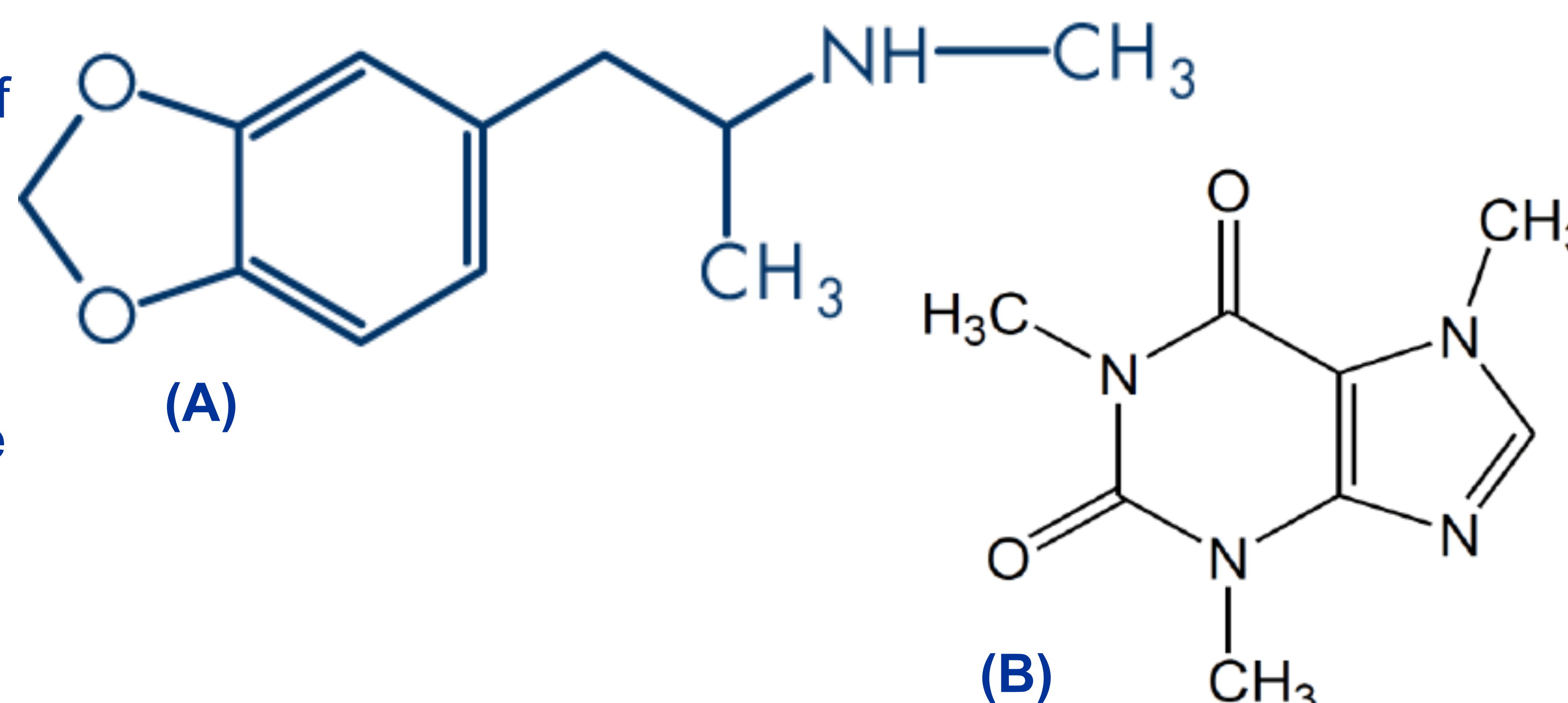
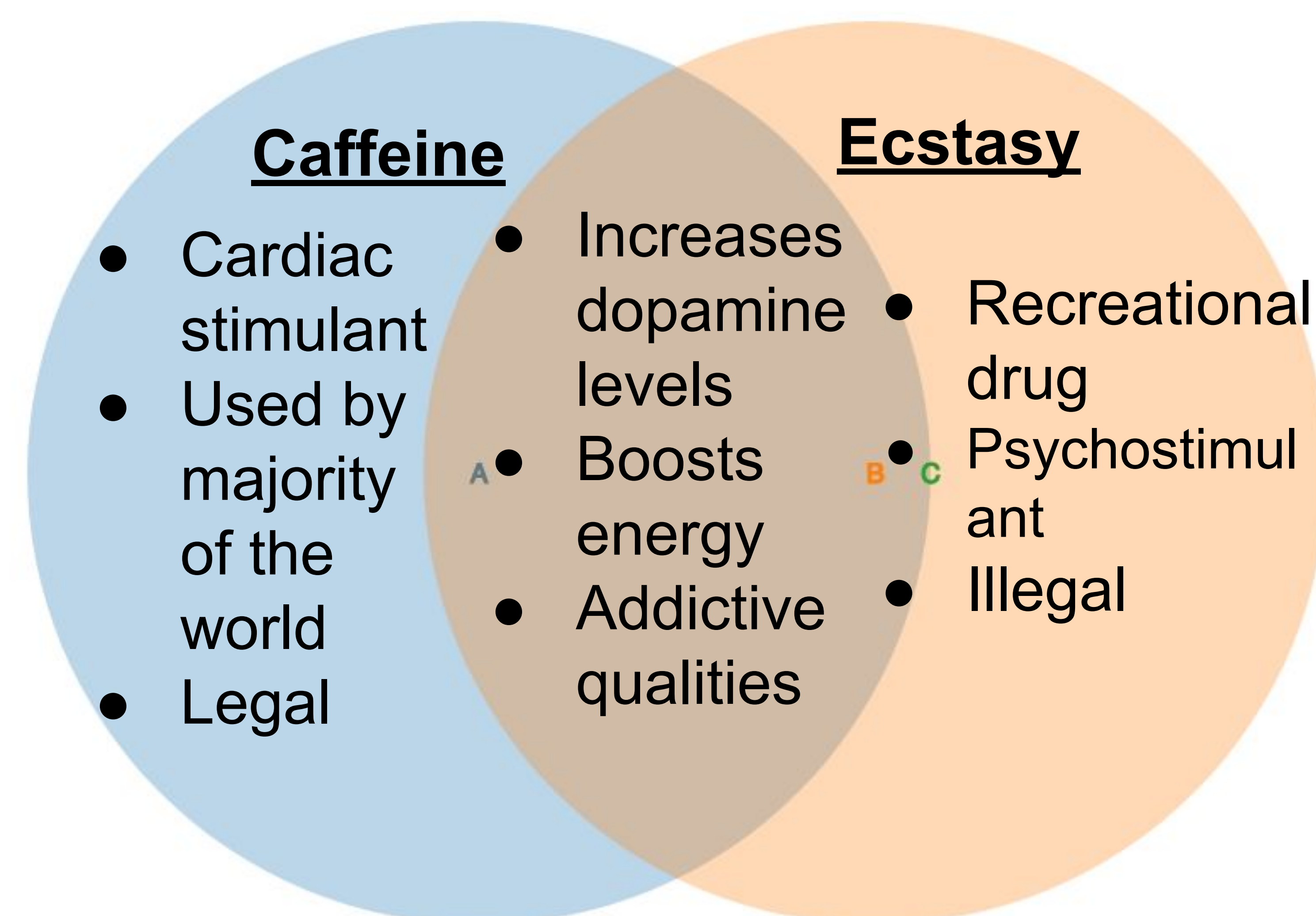


Figure 2. Chemical structure of MDMA (A) and Caffeine (B)

## What Can be Concluded?

Caffeine is a widely used stimulant, which affects the body in various ways. By blocking receptors in the brain and increasing levels of dopamine, caffeine creates an energetic effect that the body craves continually. Caffeine can be compared to ecstasy, a highly addictive street drug that produces amplified versions of the effects caffeine creates. The way these drugs interact with the body confirms that caffeine is addictive.

## Future work:

Looking at how caffeine affects different diseases

- Neurodegenerative diseases
- Parkinson's
- Multiple sclerosis
- Depression
- ADHD and ADD
- Comparing energy drinks to coffee
- Monster
- Studying the effects in kids
- What are the long term effects?
- How easy is it for children to become addicted to caffeine?

## References

**Studies and Research on Caffeine Content of Various Products** by: Maria Poroach-Seritan, Cristina Beatrice Michitiuc, and Mihaela Jarcău Retrieved from <http://proxy.ulib.csuohio.edu:2094/ehost/detail/detail?vid=3&sid=ee81463c-cc05-4d16-950d-f544682f7fb3%40sessionmgr4006&bdata=JnNpdGU9ZWVhc3QtbGI2ZQ%3d%3d#AN=128404155&db=a9h>

HSDB: CAFFEINE retrieved from <https://toxnet.nlm.nih.gov/cgi-bin/sis/search2/r?dbs=hsdb:@term+@rn+58-08-2>  
NIDA. Retrieved from <https://www.drugabuse.gov/publications/drugfacts/understanding-drug-use-addiction>  
Neurochemical and Neurotoxic Effects of MDMA (Ecstasy) and Caffeine After Chronic Combined Administration in Mice retrieved from <http://proxy.ulib.csuohio.edu:2083/ehost/pdfviewer/pdfviewer?vid=9&sid=d2d22671-2325-4ccb-b691-71da1c50920e%40sessionmgr102>

## Acknowledgments

Thanks to our faculty advisor Dr. John Moran and the Choose Ohio First program for their support throughout this project.