



The effect of the oxytocin hormone in cocaine addicted rats suffering from abstinence syndrome

Juan Alberto Padilla

University of Puerto Rico University High School

Advisor: David Ojeda

Carmen S. Maldonado – Vlaar, Ph D

University of Puerto Rico- Rio Piedras

Department of Biology

1

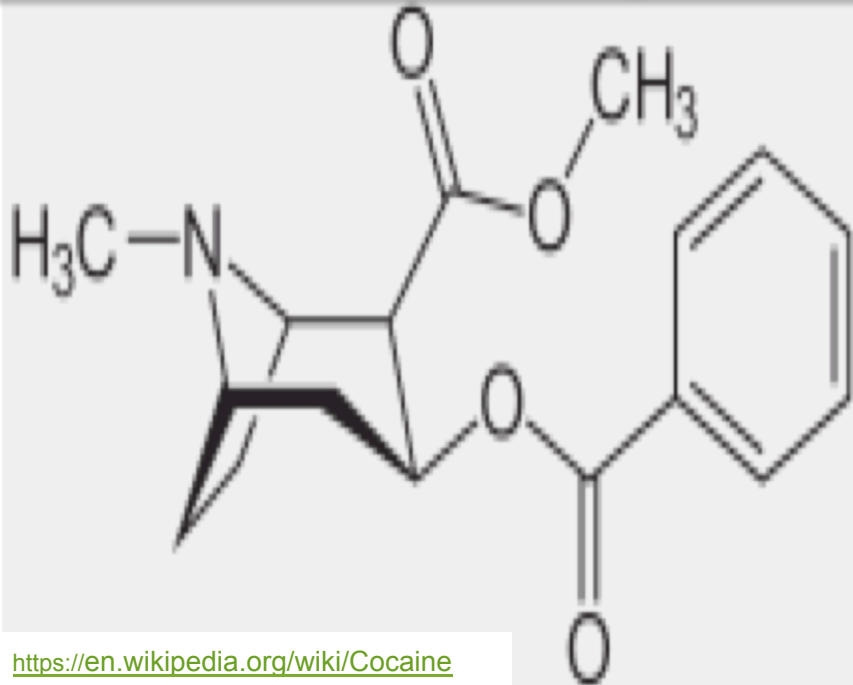


Background

- Rehabilitation from drug addiction is a very difficult process.
- Withdrawal syndrome forces the patient who is in the process of rehabilitation to go through extreme anxiety that causes them to quit the treatments.
- Studies suggest that the hormone oxytocin, which is associated with a **sense of calmness**, is a potential facilitator in the rehabilitation process.
- **Oxytocin** is known as the *love* hormone because, of the calming effects attributed to it, which helps humans make bonds.
- **The present study aims to test the calming effects of oxytocin in rats addicted to cocaine.**

Cocaine

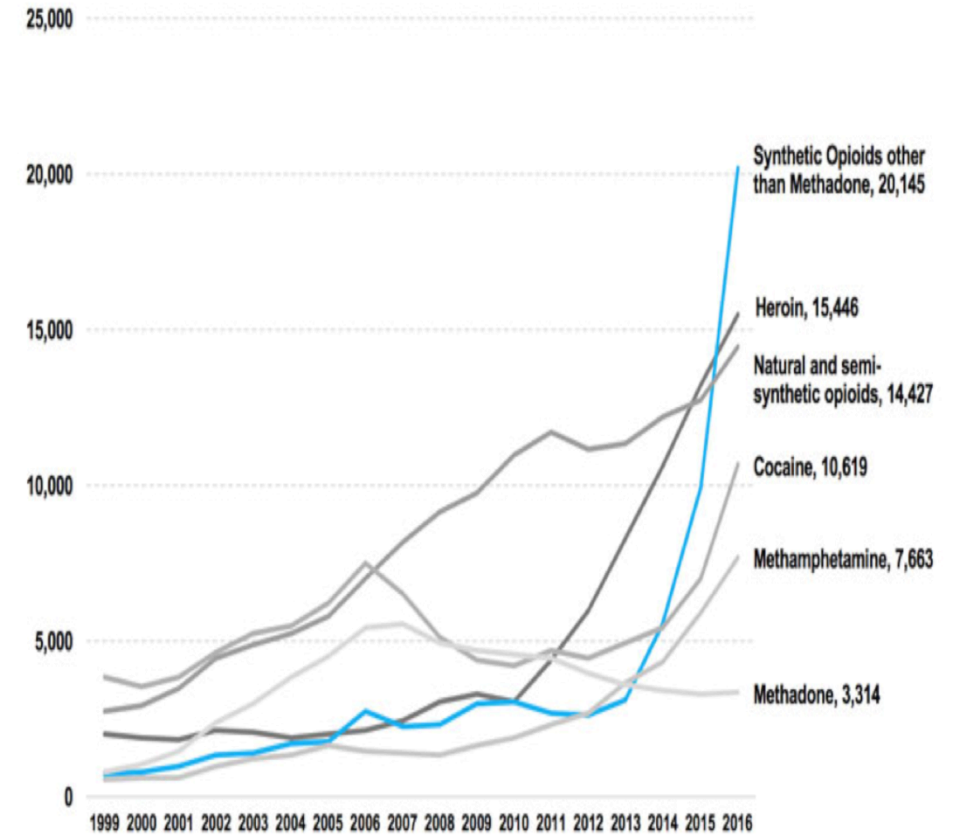
Cocaine chemical composition



<https://en.wikipedia.org/wiki/Cocaine>



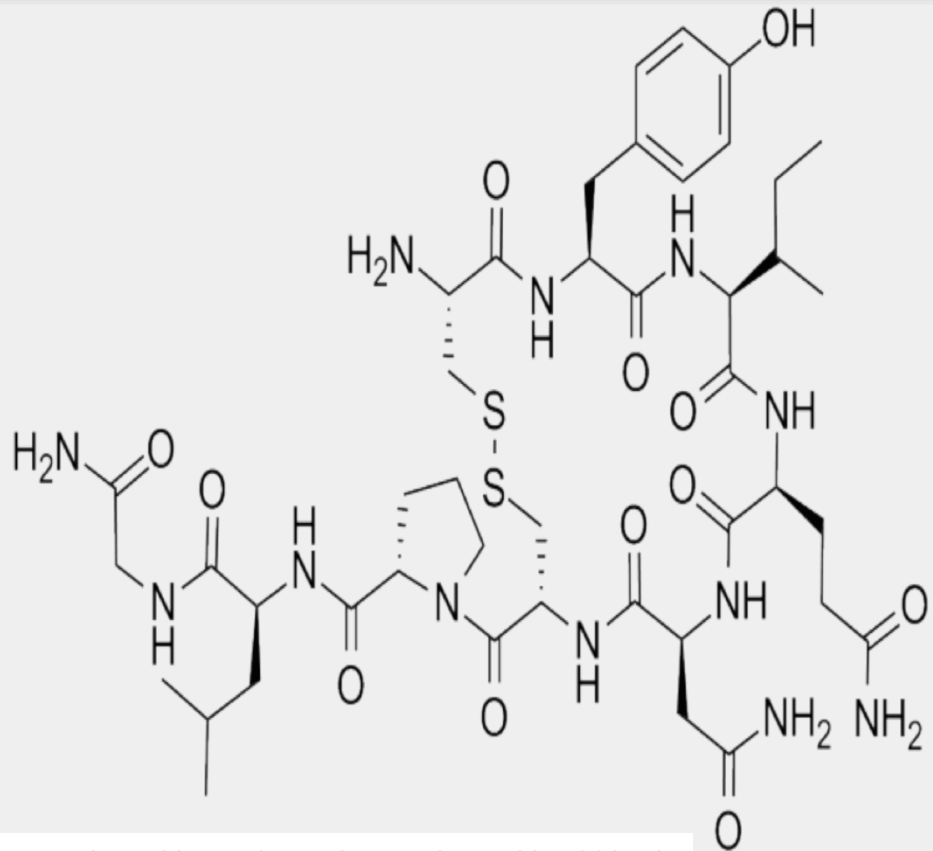
Drugs Involved in U.S. Overdose Deaths, 2000 to 2016



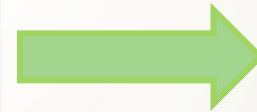
<https://www.drugabuse.gov/related-topics/trends-statistics/overdose-death-rates>

Oxytocin

Oxytocin chemical composition



<https://www.polypeptide.com/oxytocin-generic-peptides-21.html>



<https://www.healthguidance.org/entry/14120/1/breastfeeding-how-to-produce-more-milk.html>

Variables

Independent

- ***Levels of Anxiety***

Dependent

- ***Oxytocin Treatment***

Groups



METHODOLOGY

**Habituation
Phase**

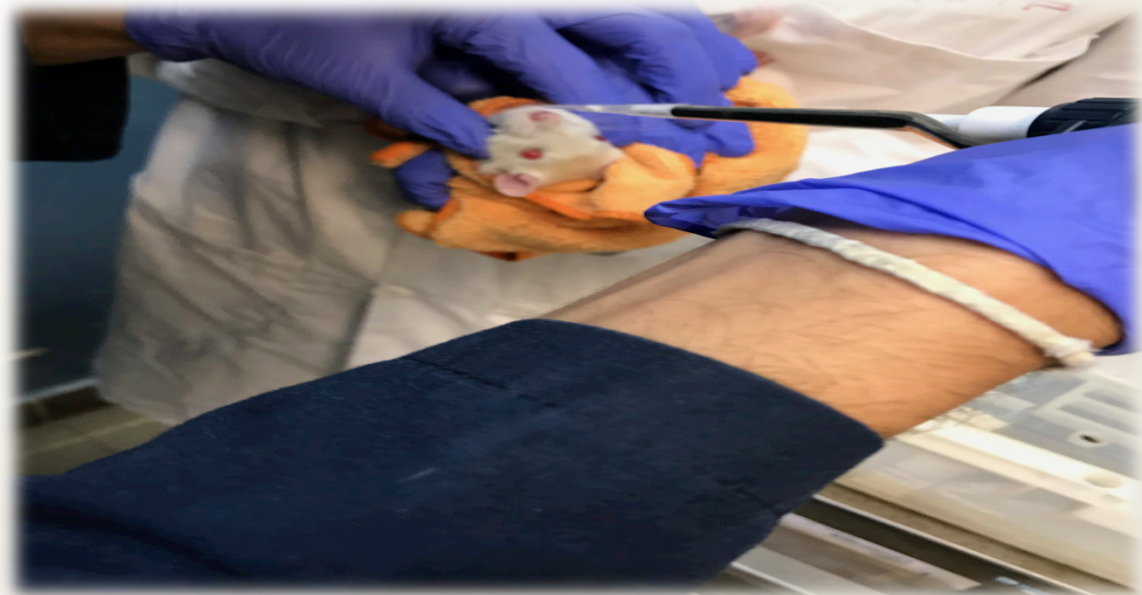
```
graph TD; A[Habituation Phase] --> B[Cocaine Treatment]; B --> C[Treatment];
```

**Cocaine
Treatment**

Treatment

Research Question

Can intranasal administration of the oxytocin in rats, during abstinence of cocaine treatment decrease withdrawal elicited anxiety and thus the craving of the drug?



Habituation Phase

Sprague Dawley rats were **seven days** in quarantine in a 12 hour day/night shift

Animal House



<http://www.pharmacyinstrumentsindia.com/animal-house.html>



<https://www.pinterest.com/pin/512003051381317848/>

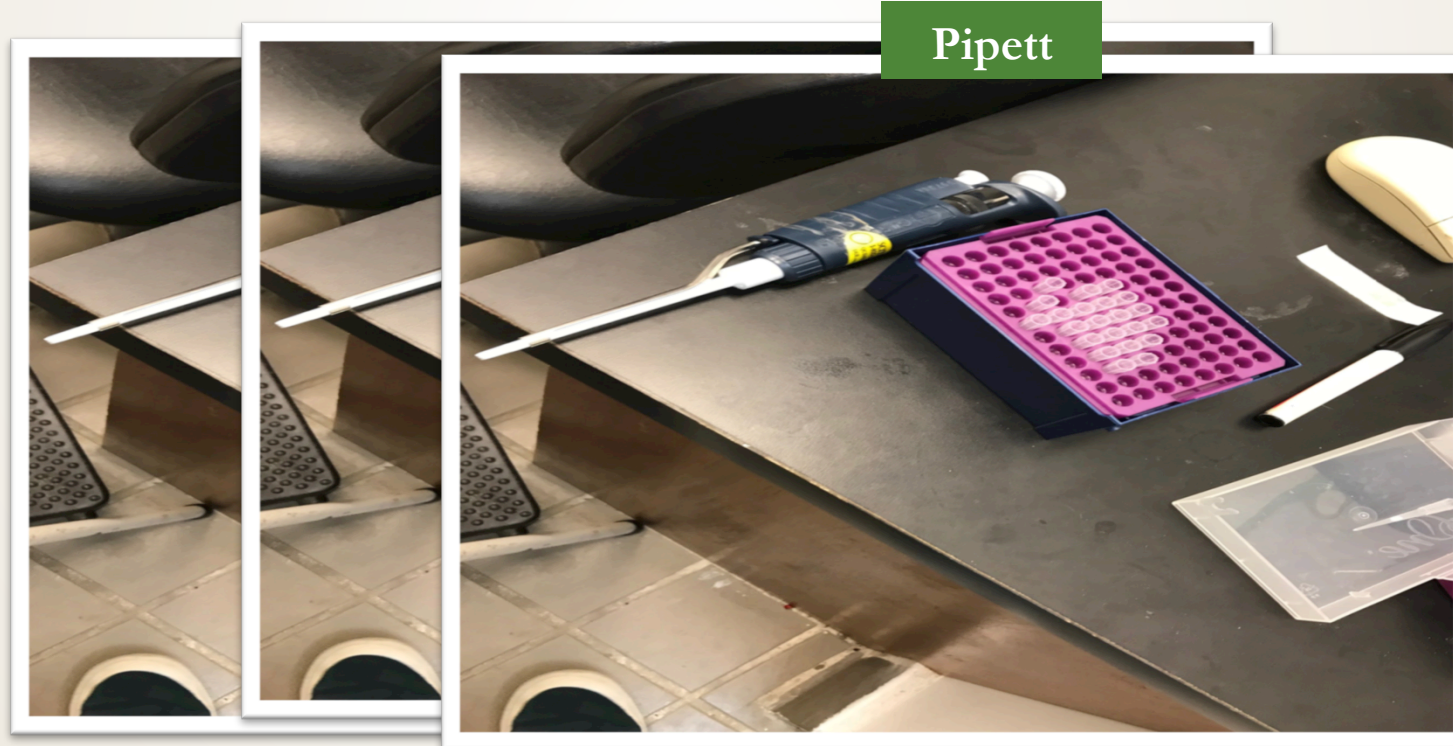
Habituation Phase

One week of handling to allow the subjects to **get comfortable** with the researchers.

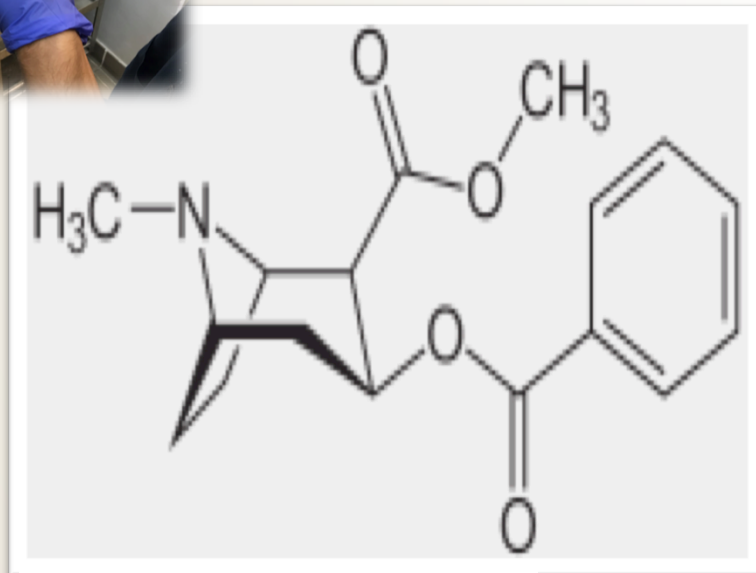


Habituation Phase

Three days of habituation exposure where all subjects were intranasally administered saline to habituate experimental procedures.

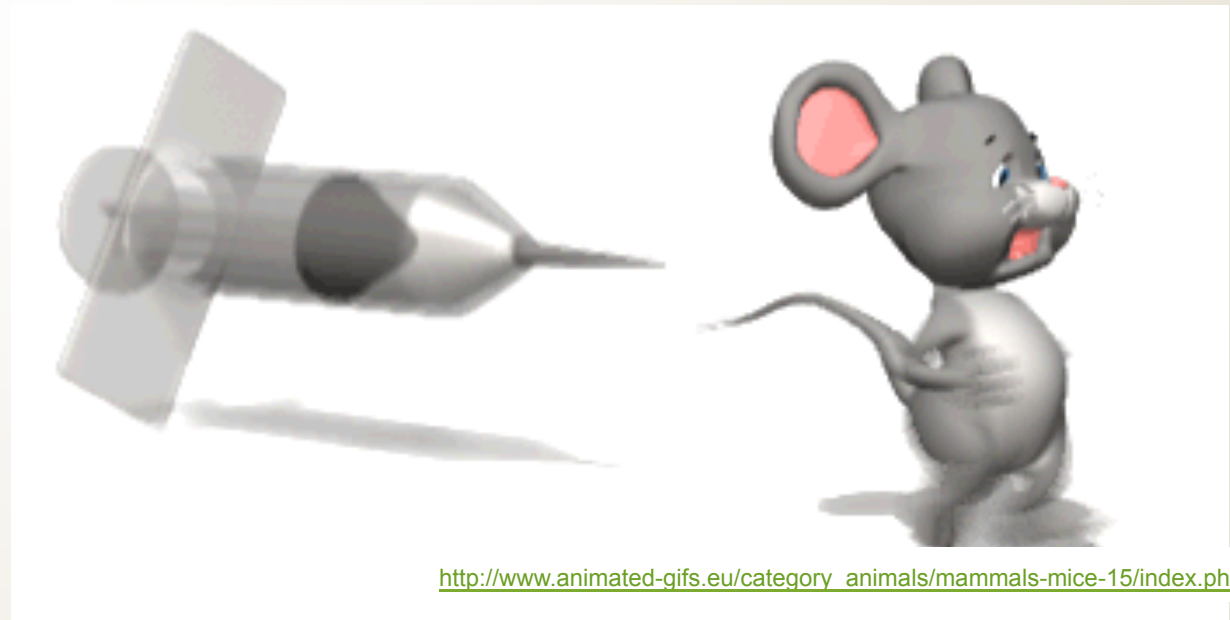


Cocaine Treatment Phase



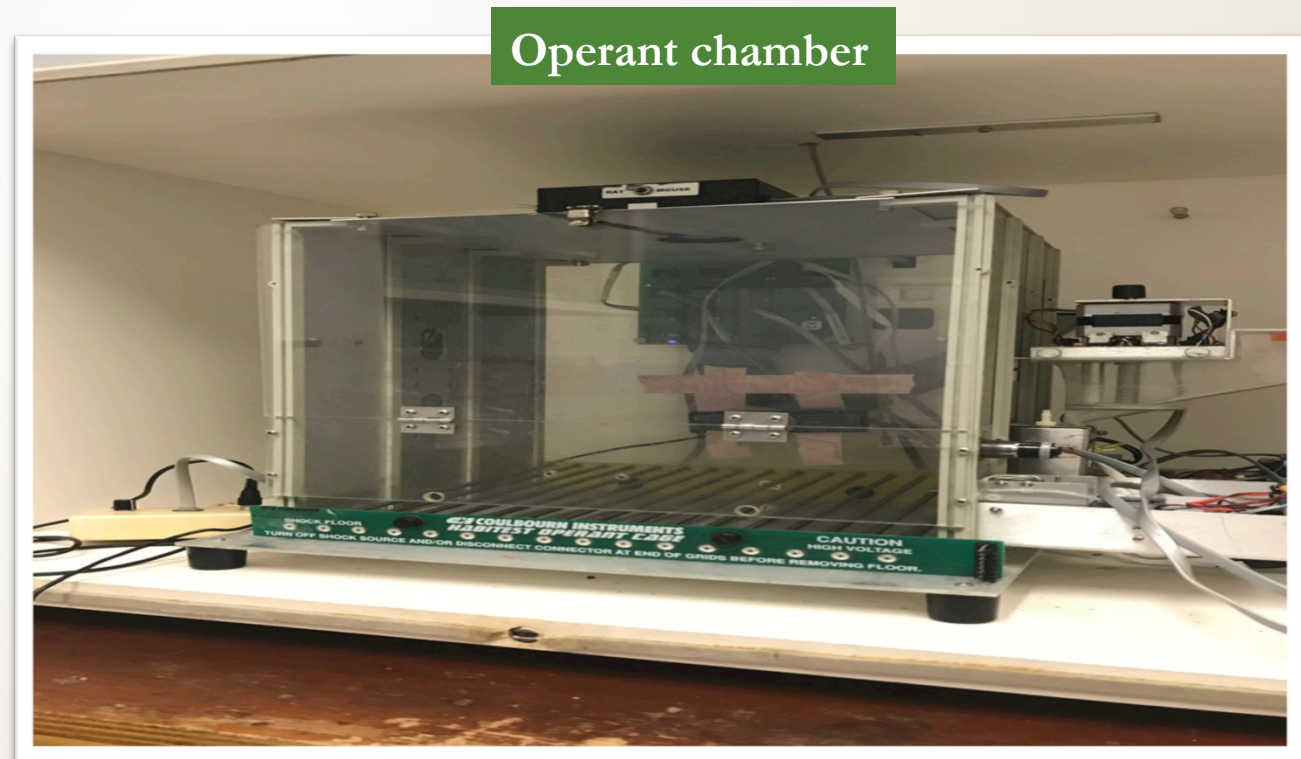
<https://en.wikipedia.org/wiki/Cocaine>

For **five consecutive** days all rats (n=6) were injected **10 milligrams/Kg** of cocaine diluted in sterile 0.9% saline Solution.



Cocaine Treatment Phase

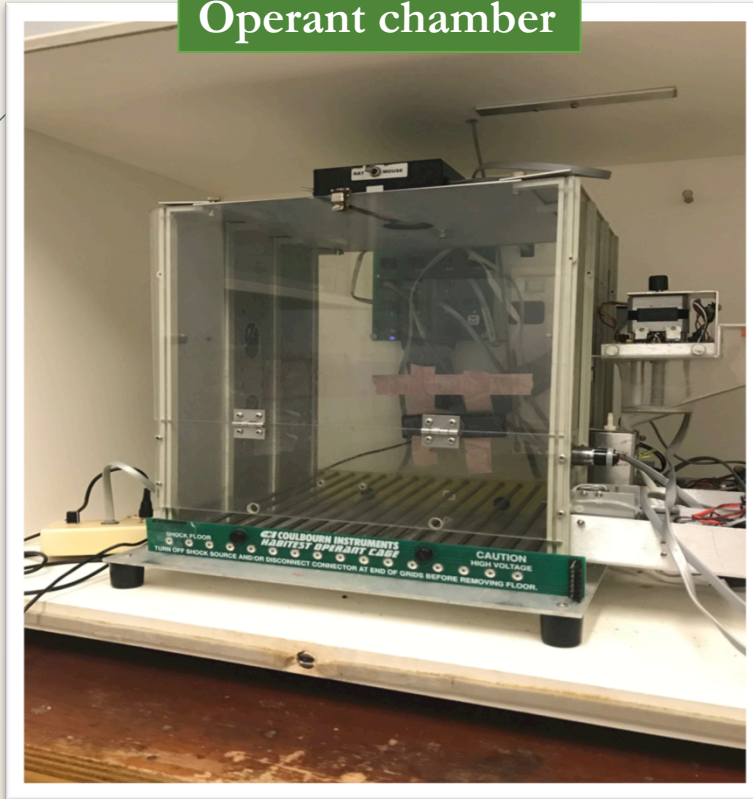
- Animals were placed in an operant chamber for **30 minutes**.
- Locomotor activity was monitored.



Treatment phase

All rats were then placed in the operant chamber for **thirty minutes**. Locomotor activity was recorded.

Operant chamber

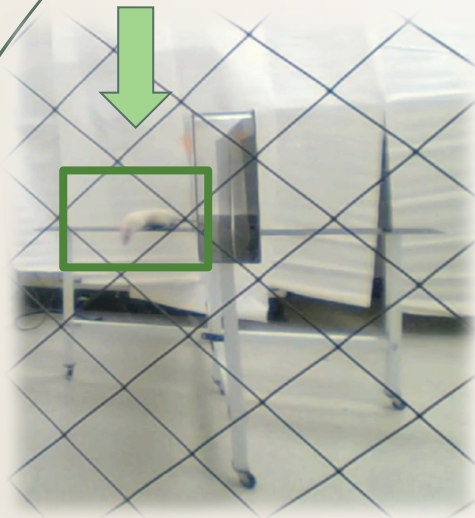


Treatment phase

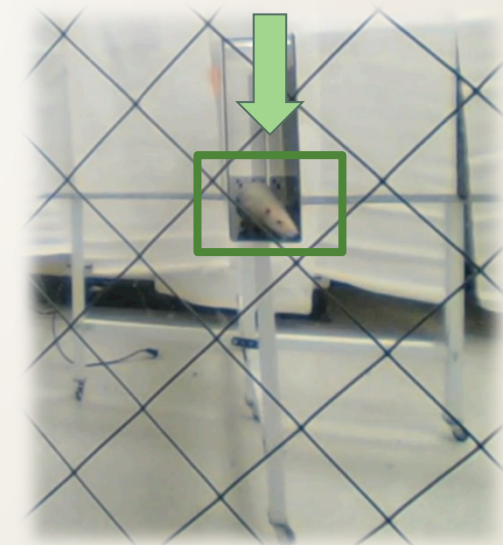
- Animals were exposed to the Elevated Plus Maze (EPM) test **for 5 minutes.**
- Behaviors were recorded.
- **Anxiety levels** were determined **by time in arms.**

Open arms= less anxiety

Closed arms=more anxiety



Elevated Plus Maze



RESULTS -ANALYSIS

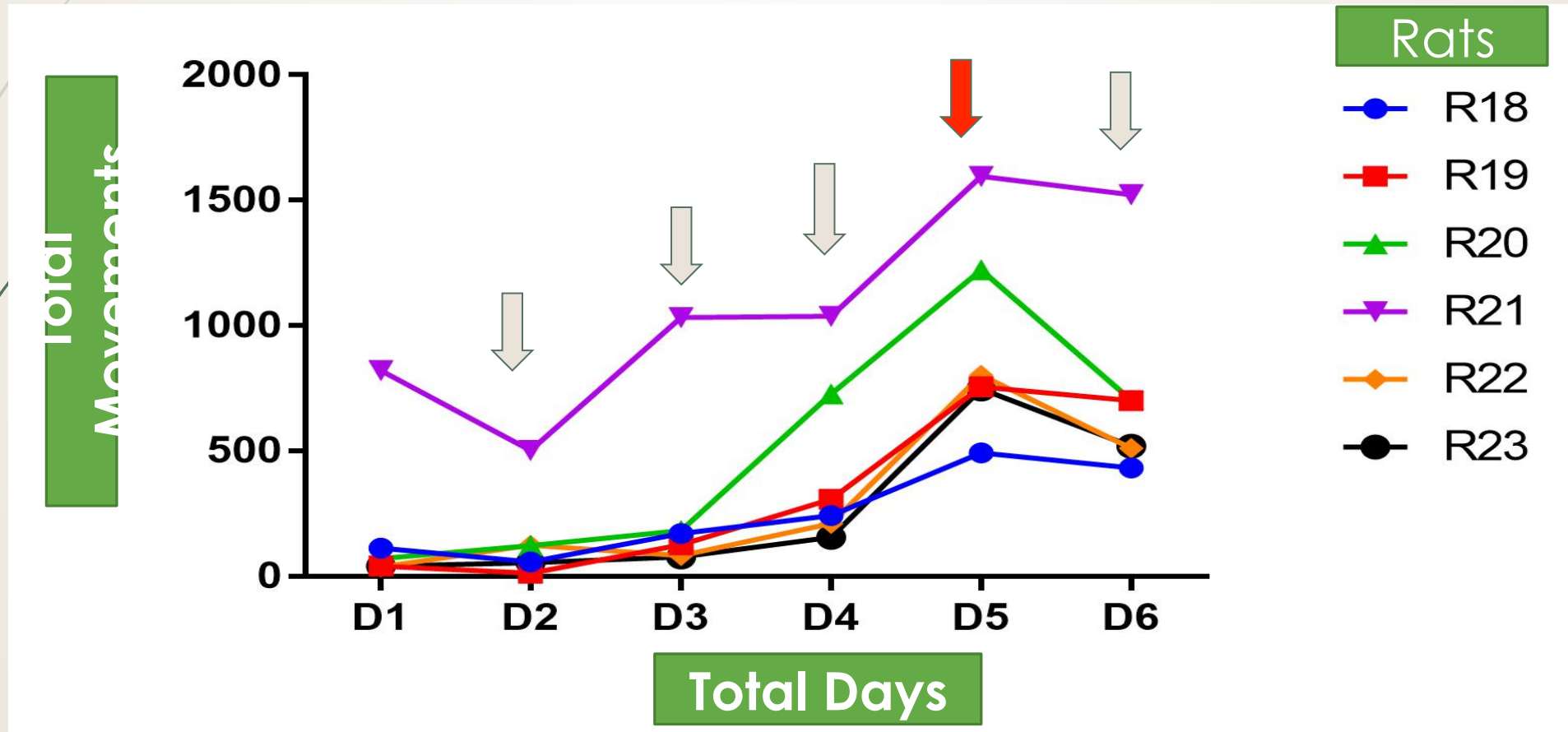
LOCOMOTION

ELEVATE PM TEST

ANXIETY LEVELS

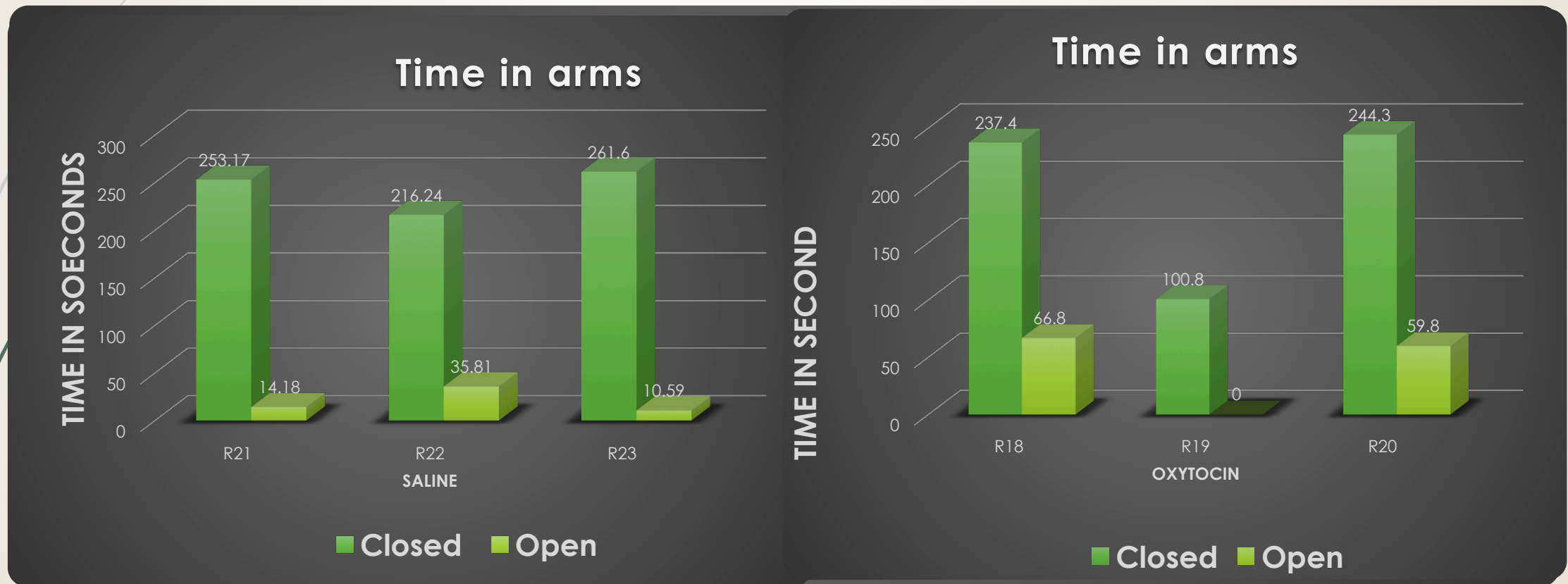
Locomotion

An increase in locomotor activity is found in animals on Day 4-6.



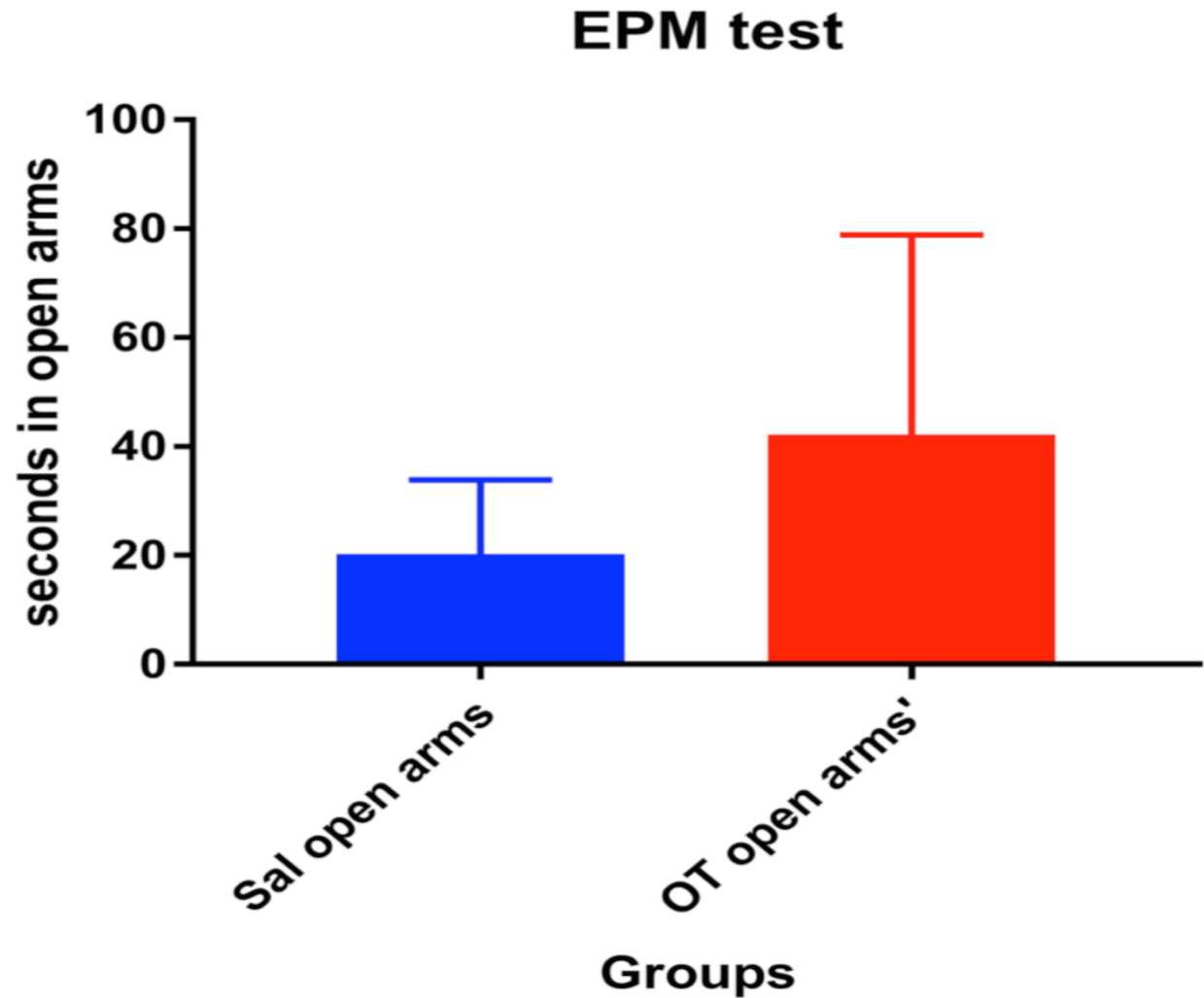
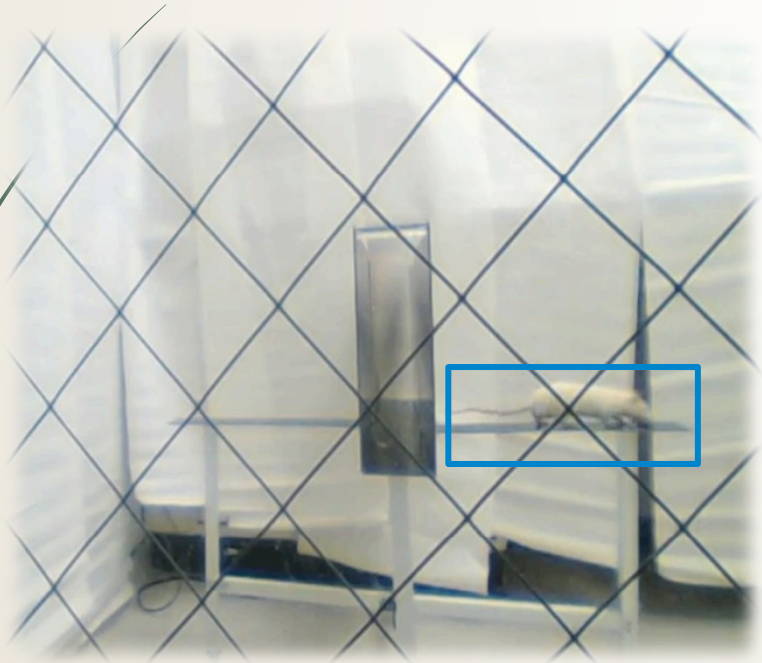
Elevated Plus Maze Test

Data shows evidence of different levels of anxiety between the groups.



Anxiety levels

Average on open arms:
group of oxytocin was
22 sec. more than
group of saline.



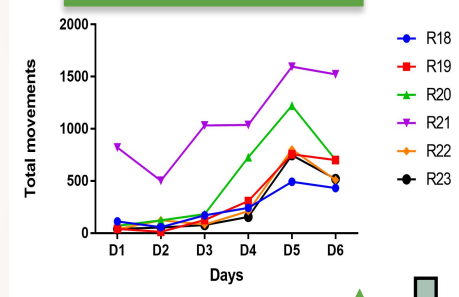
t Test proved to be not statistically significant.

Cocaine

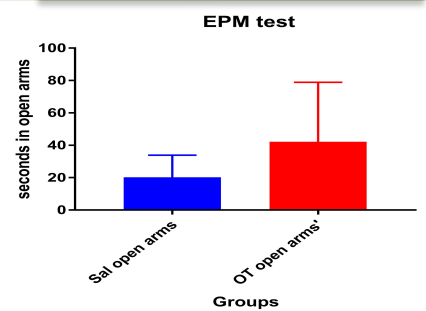
The diagram illustrates the experimental setup for cocaine administration. It includes the chemical structure of cocaine (CN1[C@H]2CC[C@@H]1[C@@H](C(=O)OC)c3ccc(O)cc3), an illustration of a syringe, and a photograph of a white rat being held by a person wearing blue gloves. An arrow points from the rat to a photograph of an operant chamber.



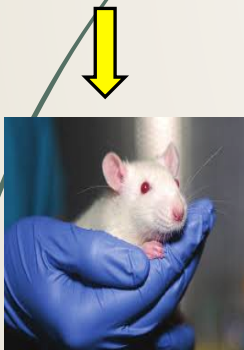
Locomotion



Anxiety Levels



Oxytocin



n=3

Saline



n=3



We suggest that oxytocin does have a calming effect on cocaine addicted rats

This tendency proved to be not statistically significant

There was a tendency for oxytocin treated rats to explore more

Conclusions

- Oxytocin treatment **did not affect locomotor** activity of cocaine treated animals on day 6.
- Oxytocin made experimental animals **less anxious** when compared to controls in the EPM, although it did not reach statistical significance in the t-test.

Future Experiments

- Incorporate more animals in to each group.
- Add another dose of Oxytocin.
- Effect of Oxytocin in BDNF proteins in brain of Cocaine addicted rats.
- Test how addictive Oxytocin could be.
- Study the effect of Oxytocin with other hormones and chemicals such as Tetrahydrocannabinoid or Serotonin.

What I learned ?

- The body works and how truly amazing the human brain truly is and the horrible effects of a great many deal of drugs.
- To handle rodents.
- An actual laboratory works.
- To inject rats.
- To extract a rodent brain without damaging it.
- To analyze data.
- To communicate with scientists.

Acknowledgements

- University of Puerto Rico-Rio Piedras, Department of Biology
- Dr. Carmen S. Maldonado Vlaar (PI)
- Dr. Wickensonn Norze (Graduate student)
- David Ojeda (undergraduate research student-NeuroID program)
- Sol Fonseca (undergraduate research student-NeuroID program)
- Dr. Keyla Soto, Science teacher, University High School (UHS)
- NIH-BP-ENDURE NeuroID Program

Bibliography

- Abuso de drogas en adolescentes y jóvenes y vulnerabilidad familiar.* (2013) (1st ed., p. 7). Peru. Retrieved from https://www.unodc.org/documents/peruandecuador/Publicaciones/Publicaciones2014/LIBRO_ADOLESCENTES_SPAs_UNODC-CEDRO.pdf
- Commonly Abused Drugs Charts.* (2016). *Drugabuse.gov*. Retrieved 28 February 2017, from <https://www.drugabuse.gov/drugs-abuse/commonly-abused-drugs-charts#cocaine>
- Definición de Síndrome de Abstinencia.* (2017). *Definición ABC*. Retrieved 28 February 2017, from <http://www.definicionabc.com/salud/sindrome-de-abstinencia.php>
- González Llona, I., Tumuluru, S., González-Torres, M., & Gaviria, M. (2015). Cocaína: una revisión de la adicción y el tratamiento. *Revista De La Asociación Española De Neuropsiquiatría*, 35(127), 555-571. <http://dx.doi.org/10.4321/s0211-57352015000300008>
- Kabilan, A. (2014). Pharmacological Role of Oxytocin – A Short Review. *Journal Of Pharmaceutical Sciences And Research*, 6(4), 220-223. Retrieved from <http://www.jpsr.pharmainfo.in/Documents/Volumes/vol6issue04/jpsr06041413.pdf>
- L. Kovács, G., Sarnyai, Z., & Szabó, G. (1998). OXYTOCIN AND ADDICTION: A REVIEW. *Psychoneuroendocrinology*, 23(8) 945-962. [http://dx.doi.org/10.1016/s0306-4530\(98\)00064-x](http://dx.doi.org/10.1016/s0306-4530(98)00064-x)

Bibliography cont.

McGregor, I. & Bowen, M. (2012). Breaking the loop: Oxytocin as a potential treatment for drug addiction. *Hormones And Behavior*, 61(3), 331-339. <http://dx.doi.org/10.1016/j.yhbeh.2011.12.001>

Shen, H. (2015). *Neuroscience: The hard science of oxytocin*. *Nature*. Retrieved 26 February 2017, from <http://www.nature.com/news/neuroscience-the-hard-science-of-oxytocin-1.17813>

Maldonado, C. (2014). *Anxiolytic effects of oxytocin in cue-induced cocaine seeking behavior in rats*. Springer. 1-13.



???

**THANK YOU
FOR
your
ATTENTION!**

<https://www.gimaze.com/@AtwQvT0w/0nitedu>

**Does anyone have any
questions ?**

28



Juan Alberto Padilla
University of Puerto Rico University High School