Is FLORATRYP Addicting?

Introduction:

Medical Report

Ray is at the medical clinic because he is feeling horrible. He is experiencing a variety of symptoms such as irregular heartbeats, headaches, nausea, and vomiting. He is having trouble sleeping. He also has been feeling very depressed and nervous.

He has experienced some of these symptoms in the past but they disappeared when he used "FLORATRYP", a mixture of over-the-counter and herbal medications. He tells the doctor that he has been using FLORATRYP for about a year.

Over the past few months Ray's use of FLORATRYP has increased from once a day to five or more times each day. He likes using FLORATRYP because it makes him feel happy and confident. "I only take it when I'm feeling low or stressed out. A little FLORATRYP and everything's better."

Ray has not been able to use FLORATRYP for the past few days because he ran out of money. He was recently fired from his part-time job because he skipped work a lot – especially after late nights of doing FLORATRYP with friends.

Ray explains that he doesn't think his symptoms are caused by FLORATRYP abuse. "Lots of people use FLORATRYP. It's not illegal. It's not addictive. What's wrong with feeling good?"

Drug addiction defined as "uncontrollable, compulsive drug seeking and use, even in the face of negative health and social consequences."
Scientists from the National Institute on Drug Abuse

1. Based on the information in the Medical Report, do you think that the Ray is addicted to FLORATRYP? Support your answer by listing <u>three</u> evidences from the Medical Report.

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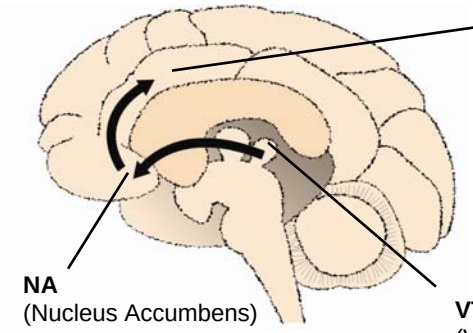
The Brain Reward Pathway

The brain contains a **reward pathway** (also called a "pleasure-reward pathway") that causes animals to associate certain activities with pleasure or reward.

When an animal does something that is pleasurable (such as eating, sexual activity, or taking addictive drugs), nerve signals travel through the reward pathway and cause a sensation of pleasure. This pleasure sensation is a reward that causes the animal to learn to do this action again and again.

The arrows on diagrams below show the **reward pathway** in a human brain and a rat brain.

Human Brain

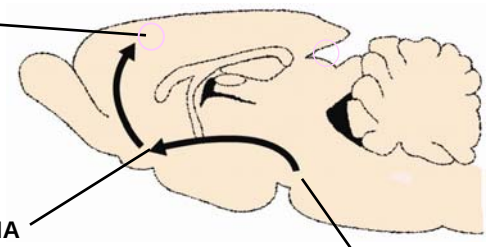


PFC
(Prefrontal Cortex)

NA
(Nucleus Accumbens)

VTA
(Ventral Tegmental Area)

Rat Brain



NA
(Nucleus Accumbens)

VTA
(Ventral Tegmental Area)

Dopamine is a chemical signal molecule in the brain reward pathway. Scientists know that a pleasurable or addictive activity will cause the amount of dopamine to increase in the reward regions of the brain.

Normal pleasurable actions result in <u>small</u> increases of dopamine in the reward regions of the brain. All known addictive drugs result in <u>large</u> increases of dopamine in the reward regions of the brain.

1. What is the function of the reward pathway of the brain?

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2. What chemical signal molecule is used to send messages within the reward pathway?

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3. Predict which would result in the largest increase in the dopamine level in the reward regions of the brain - eating or taking an addictive drug.

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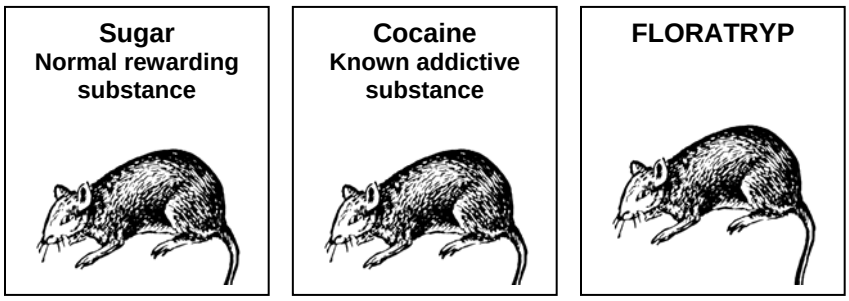
Part 1: Is FLORATRYP like other addictive drugs?

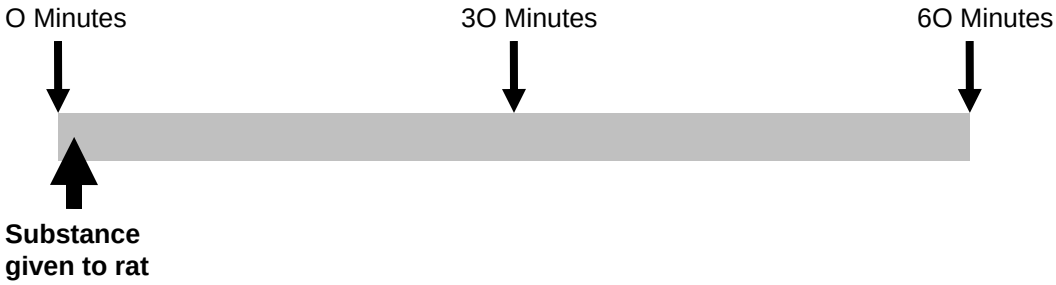
You work for a company that conducts tests to determine if "designer drugs" should be classified as addictive drugs. You have been asked to conduct animal tests to compare the levels of dopamine in samples of brain fluid collected from three rats.

The rats used in this experiment were given sugar, cocaine, or FLORATRYP.



The brain fluid samples were collected from the reward region of the brain at three times:

- 0 minutes (immediately before the substance was given to the rat)
- 30 minutes after the substance was given to the rat
- 60 minutes after the substance was given to the rat



You will be responsible for testing brain fluids samples collected from a rat that was given ONE of the substances (sugar, cocaine, or FLORATRYP). Other students in your class will be testing brain fluid samples collected from rats that were given the other substances.

1. Obtain three tubes (labeled 0, 30, and 60 min) from your teacher. These tubes contain brain fluid samples collected at different time points in the experiment.

2. Read the label on the three tubes. What substance was given to the rat that you are testing (sugar, cocaine, or FLORATRYP)?

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3. Prepare a Dopamine Indicator Solution by adding 1 mL of tap water to the tube labeled "Dopmaine Indicator" Put the cap on the tube, and shake gently for approximately 30 seconds.

4. Add 3 drops of "Dopamine Indicator" to each of the 3 tubes of brain fluid samples. Put the caps on the tubes, and shake gently for approximately 30 seconds.

5. Compare the color of the brain fluid samples with the "Color Chart for Dopamine Concentration" that is included in your lab kit. Record the estimated dopamine concentration in the data table below. *Note: 1 picogram is 1 trillionth of a gram.*

6. Share your results with others in your group and add their data to your table.

Data Table 1: Concentration of Dopamine in Rat Brain Fluid Samples

Substance Given	Time after being given substance	Concentration of dopamine (picograms/mL)
Sugar	**0 min**	
	30 min	
	60 min	
Cocaine (a drug that causes addiction)	**0 min**	
	30 min	
	60 min	
FLORATRYP	**0 min**	
	30 min	
	60 min	

7. What was the purpose of testing samples of brain fluid from rats that were given sugar?

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_____

8. What was the purpose of testing samples of brain fluid from rats that were given cocaine?

_____

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9. Compare the levels of dopamine after 30 minutes in the rat given FLORATRYP with the levels of dopamine in the rat given sugar.

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10. Compare the levels of dopamine in the rat given FLORATRYP with the levels of dopamine in the rat given cocaine.

- After 30 minutes:

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  _____

- After 60 minutes:

  _____

  _____

11. Do the results of your experiment support the hypothesis that FLORATRYP is an addictive drug? Support your answer with data collected in this experiment.

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12. Which substance (sugar, cocaine, or FLORATRYP) would you expect to have the most long-lasting effect? Support your answer with data collected in this experiment.

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13. Explain why drugs such as cocaine and FLORATRYP are more addictive than natural rewards (such as food or listening to music)?

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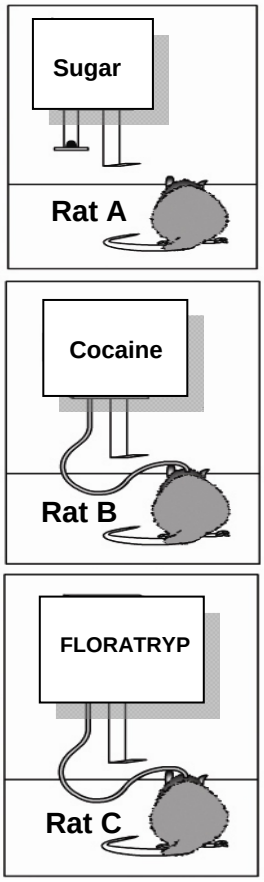
Part 2: Does FLORATRYP cause addictive behavior?

To be considered addictive, FLORATRYP must activate the reward center and produce the repetitive drug seeking behavior associated with addictive drugs.

In this activity, you will analyze the data collected by a researcher who studied the drug seeking behavior in rats.

For this experiment, rats were placed in individual cages with a lever they could press that delivered a reward.

- When Rat A rat pressed a sugar lever, a pellet of sugar was released.
- When Rat B pressed a cocaine lever, it received an injection of cocaine (an addictive drug) into the reward region of its brain.
- When Rat C pressed a FLORATRYP lever, it received an injection of FLORATRYP into the reward region of its brain.



Each day (for 6 days), the rats were placed in the appropriate cages and scientists observed and recorded the number of times the rats pressed the levers in 5 minutes.

The results of the experiment are presented in Data Table 2 on the next page.

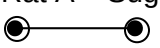
Data Table 2: Effect of Reward on Rat Lever Pressing Behavior

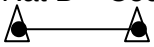
		Total number of lever presses during 5 minute observation					
	Lever	**Day 1**	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**
Rat A	**Sugar** (a natural reward)	1	3	4	5	7	8
Rat B	**Cocaine** (an addictive drug)	4	7	12	29	52	77
Rat C	FLORATRYP	3	8	14	20	47	70

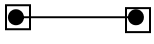
1. Summarize the data from the experiment by plotting the total number of times that the each of the rats pressed the levers versus days.

   - Label the vertical axis
   - Mark an appropriate scale on both of the axes.
   - Plot the data using the legend provided.

Legend:

Rat A – Sugar 

Rat B – Cocaine 

Rat C - FLORATRYP 

On the first day, the rats initially press a lever while they are exploring the cage. Whether the rat presses the sugar lever or the drug lever at first is usually random. Once the rats have learned that pressing a lever provides a pleasurable reward, they will repeat the lever pressing behavior more frequently.

2. Why does the number of lever presses for sugar increase?

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3. Compare the number of lever presses for FLORATRYP with the number of lever presses for sugar.

   _____

   _____

4. Compare the number of lever presses for FLORATRYP with the number of lever presses for cocaine.

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5. Does the data support the claim that FLORATRYP is an addictive drug? Support your answer using information from the graph.

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