

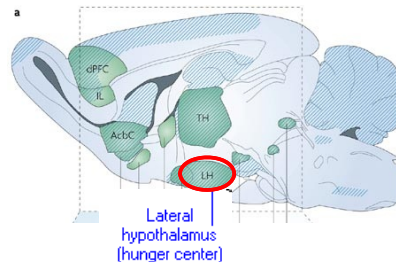
The Effects of Hypothalamic Injections of a Glutamate Receptor Agonist, NMDA, on Foraging in Satiated Rats

Brenton Mahaffey, Caroline Burdette, and Laura Arthur on behalf of students in Biology 250



Why the Lateral Hypothalamus (LH)?

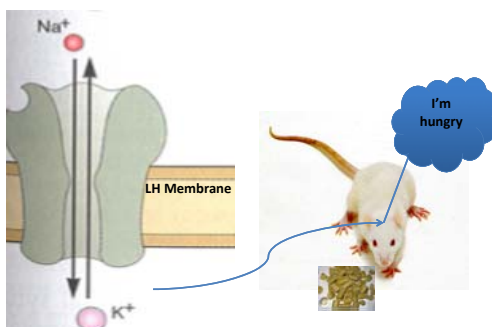
- Controls Feeding



Why Glutamate Receptors in the lateral hypothalamus (LH)?

G

N



What is the purpose of the experiment?

- Does injection of NMDA into the LH initiate **foraging behavior**?
- Does NMDA have effects on other behaviors?
 - Hyperactivity?



What Food do Rats Prefer while Foraging?

- Rats prefer sweetness of Froot loops
- Rat Chow has same amount of Calories per gram as Froot Loops
- Prefer under foraging conditions?



Who cares about understanding the neuronal mechanisms controlling feeding behavior?

- Weight disorders:
 - Obesity
 - 28% of Americans over 20 yrs of age
 - (WebMD.com)
 - Eating Disorders:
 - Anorexia nervosa
 - 5.1% of college-age women
 - (WebMD.com)



What is our hypothesis?

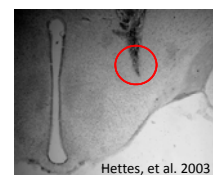
The unilateral LH injection of the glutamate receptor agonist, NMDA, in satiated rats will cause an **increase** in food intake of a more *palatable* food type while in foraging conditions.

In other words...

An injection of NMDA into the hunger-control center of the brain will cause rats that are not hungry to search for and eat foods that are "tasty".

How did we target the LH?

- Central microinjections via a tube inserted directly into the lateral hypothalamus
- Insert tube into LH
 - 15 CD-1GS rats
 - General anesthesia
 - Stereotaxic Surgery to target the LH
 - Uses a 3D coordinate system to find a desired location



Hettes, et al. 2003

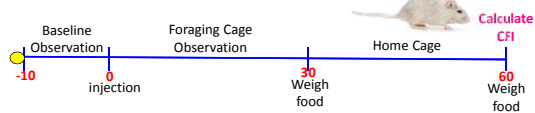
What did we inject into the LH?

Rat Chow	OR	Froot Loops
0.1 nmol NMDA	Low Dose NMDA	0.1 nmol NMDA
artificial Cerebral Spinal Fluid (aCSF)	CONTROL	artificial Cerebral Spinal Fluid (aCSF)
1.0 nmol NMDA	High Dose NMDA	1.0 nmol NMDA

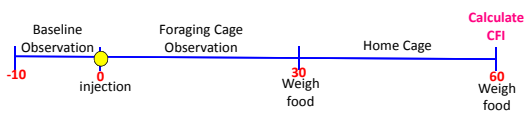
Each rat received 6 injections over 6 test days

How did we record behavior?

Time (min)	Eat	Drnk	Grm.	Loc.	Rear	Alert	Rest
-10					✓	✓	
-9			✓	✓			
-8					✓	✓	
-7							✓✓
-6			✓	✓			

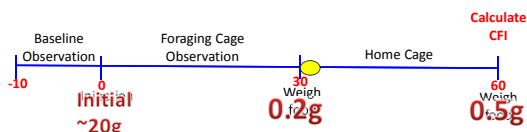
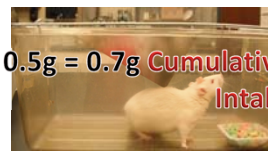


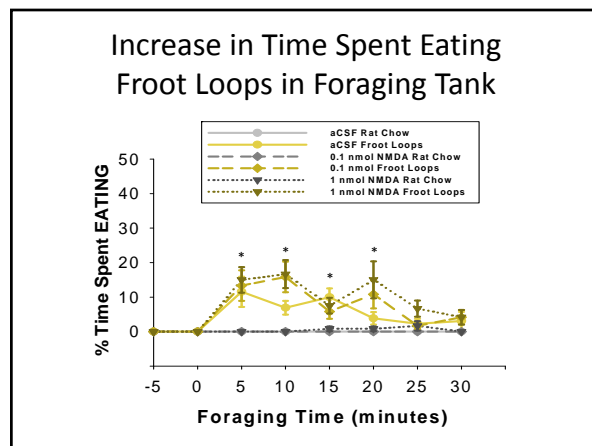
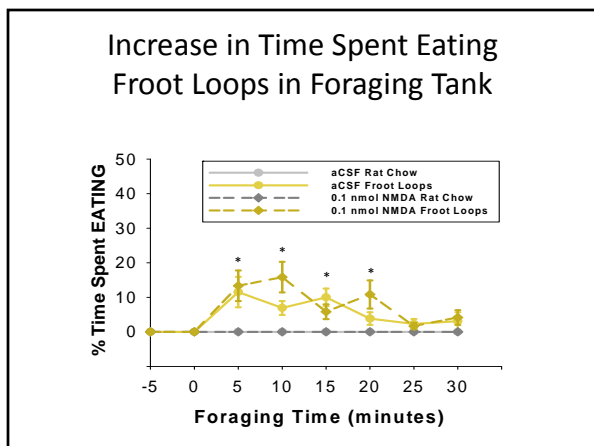
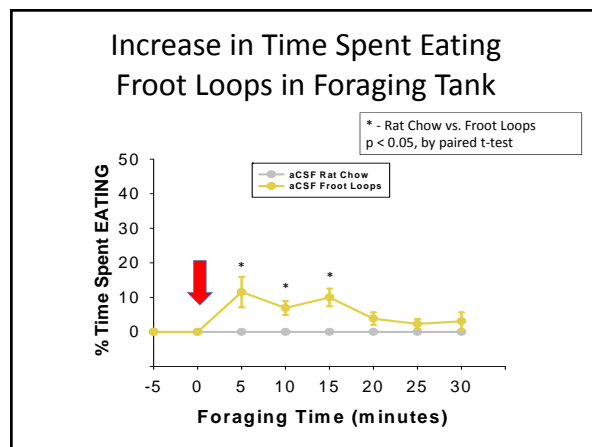
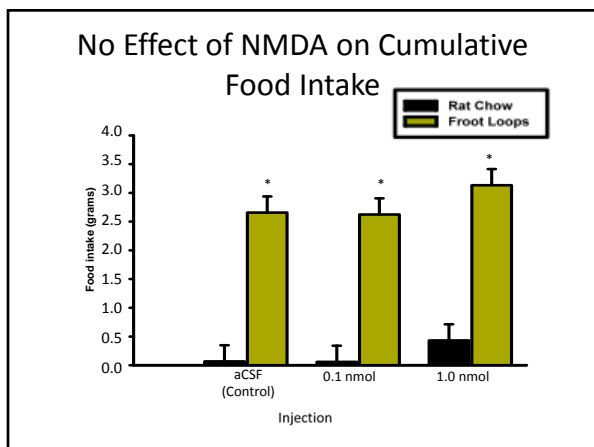
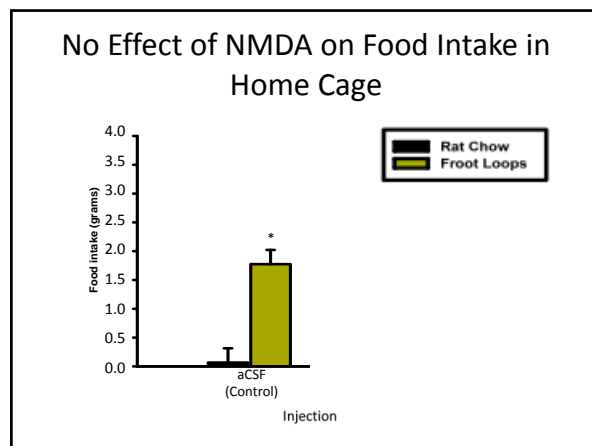
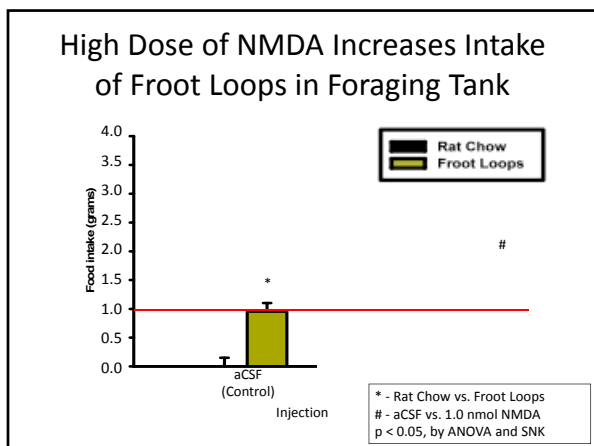
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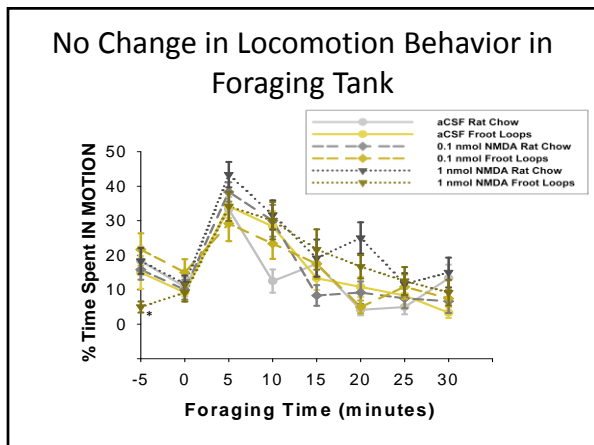
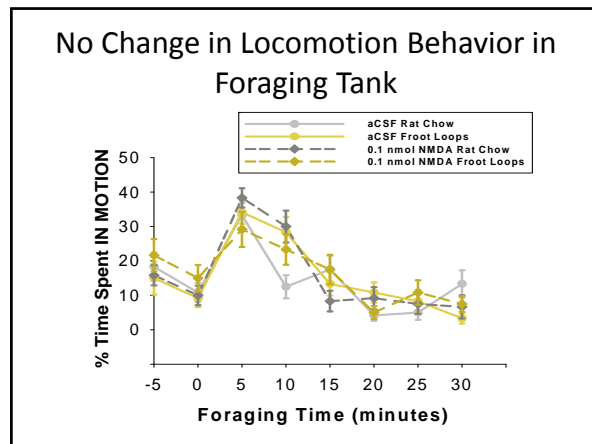
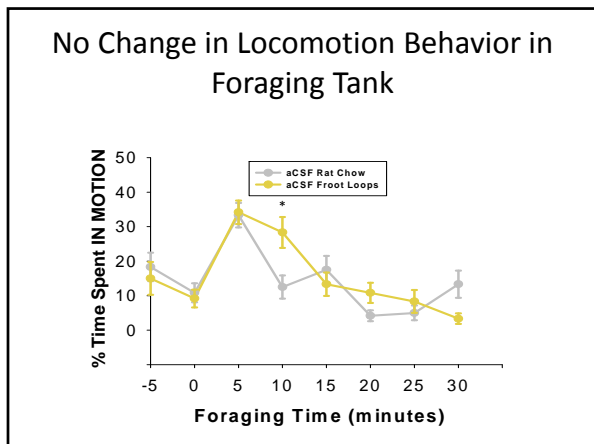


How did we measure food intake?

$$0.2g + 0.5g = 0.7g \text{ Cumulative Food Intake}$$







- ### Summary
- Regardless of NMDA dose, Froot Loops were preferred in the Foraging Tank and the Home Cage
 - A high dose of NMDA induces an increase in Froot Loop intake in the Foraging Tank
 - No significant increase in food intake in the home cage

Conclusion

- We successfully targeted the Lateral Hypothalamus
- NMDA bound to the receptor to initiate foraging behavior
- Activation of glutamate receptors in the LH is selective for foraging behavior

The diagram shows a cross-section of a cell membrane labeled 'LH Membrane'. A red circle with the letter 'N' represents the NMDA receptor. An arrow points upwards from the membrane, labeled 'Na+', indicating sodium ion entry. Another arrow points downwards from the membrane, labeled 'K+', indicating potassium ion exit.

