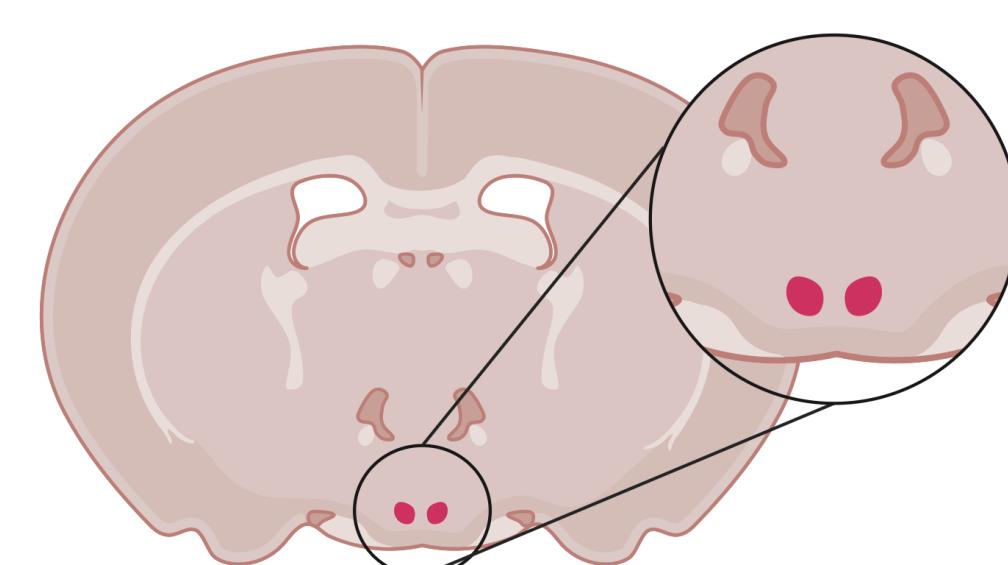


Acute Stress Decreases Glutamate Transmission in the Female Rat Dorsomedial Hypothalamus

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BACKGROUND

Stress response mechanisms have not adapted to our high stress society and landscape of high calorie, highly palatable foods¹. Women are particularly vulnerable to **disordered eating** behaviours when **stressed**², for which the neurophysiological basis is unclear. Yet, female research subjects remain underrepresented.

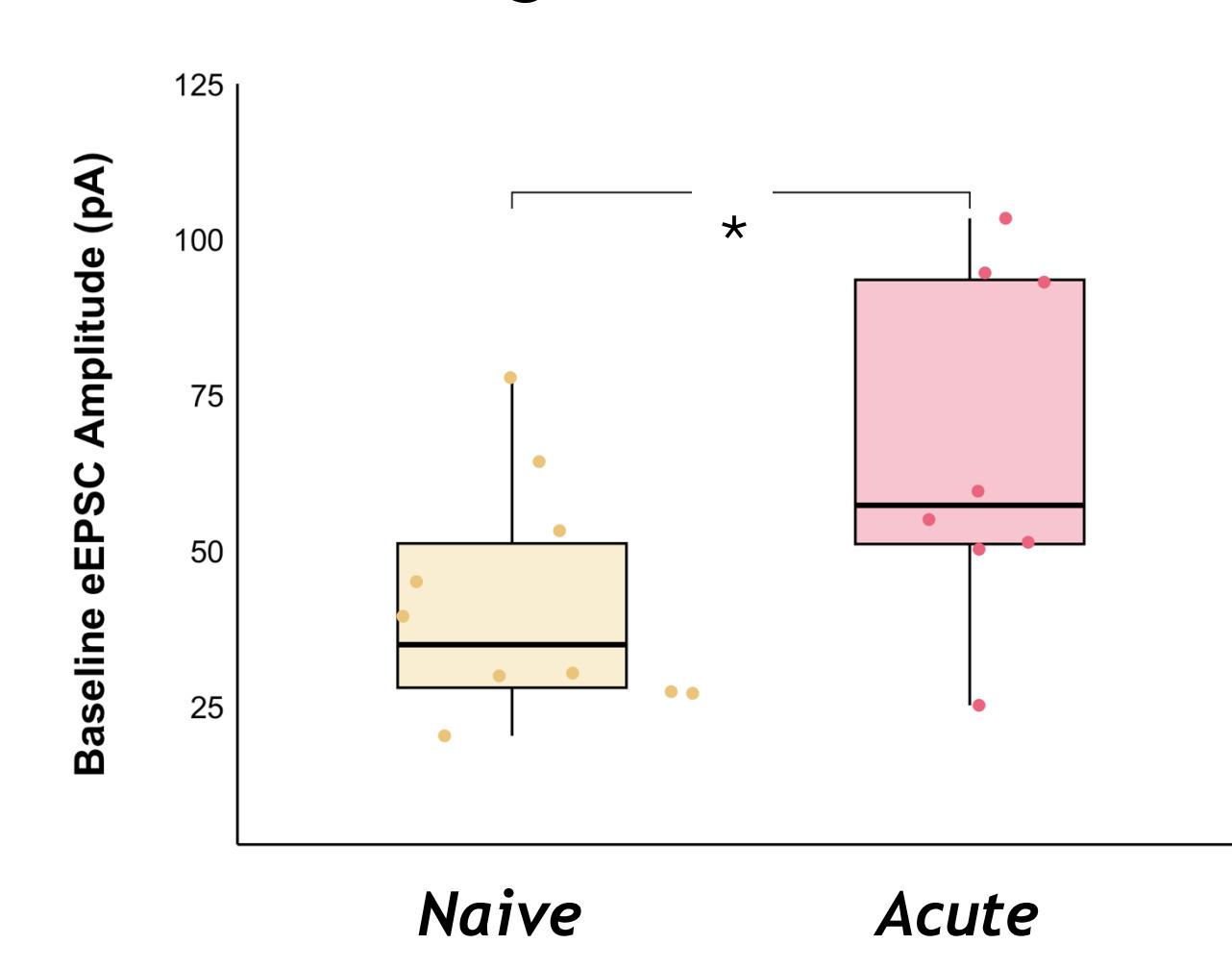


The **dorsomedial hypothalamus (DMH)** is a brain region involved in appetite and body weight regulation³, and the stress response⁴. Some DMH neurons increase appetite and have receptors for **stress hormones**⁵. How stress affects DMH neurons is unclear.

How **acute stress** in **females** affects glutamatergic transmission in the DMH is unknown.

RESULTS

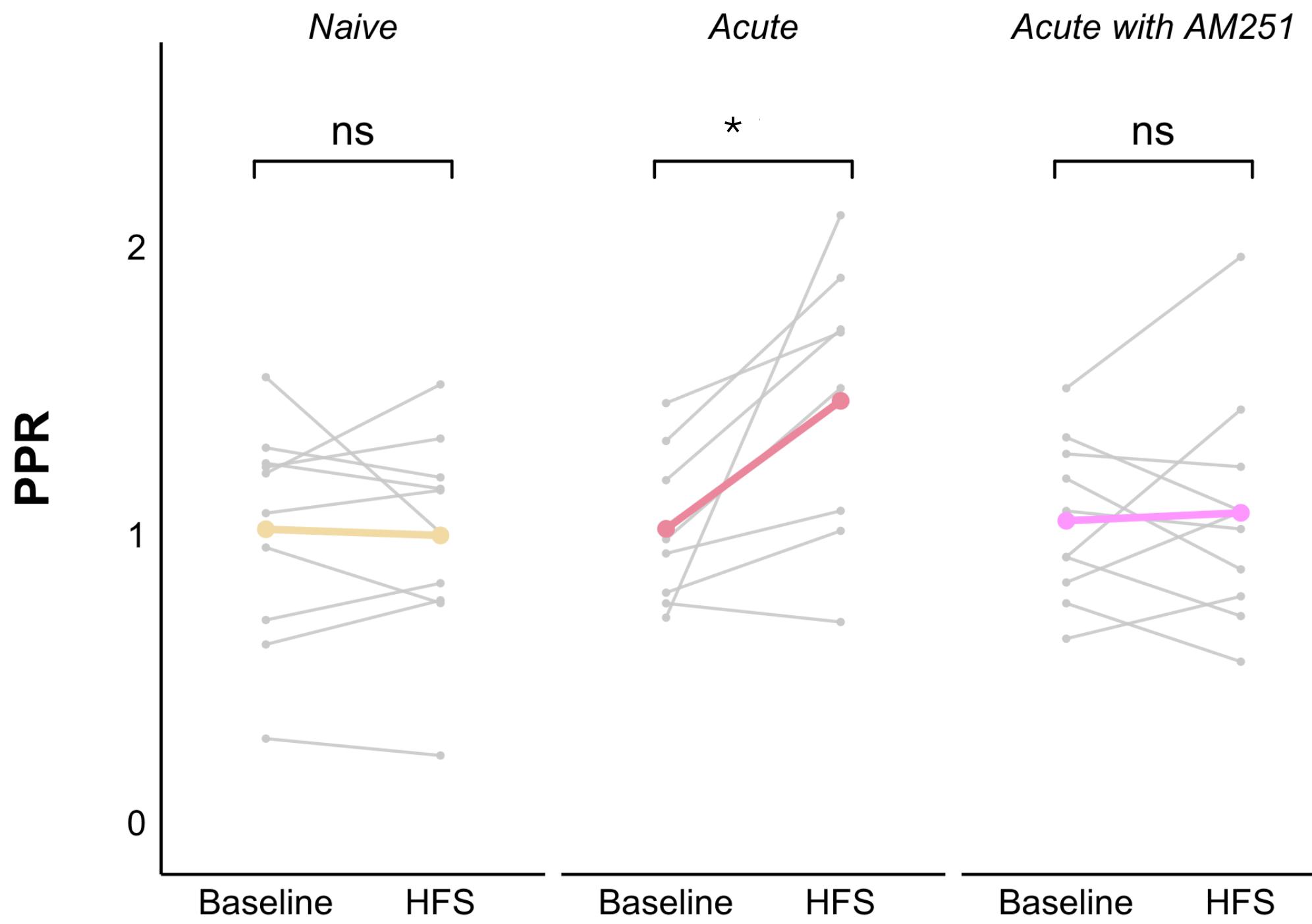
How does **acute stress** in **females** affect baseline glutamate transmission?



An unpaired *t*-test was used to compare between groups.
 $* = p\text{-value} < 0.05$

There is a significant increase in eEPSC amplitude.

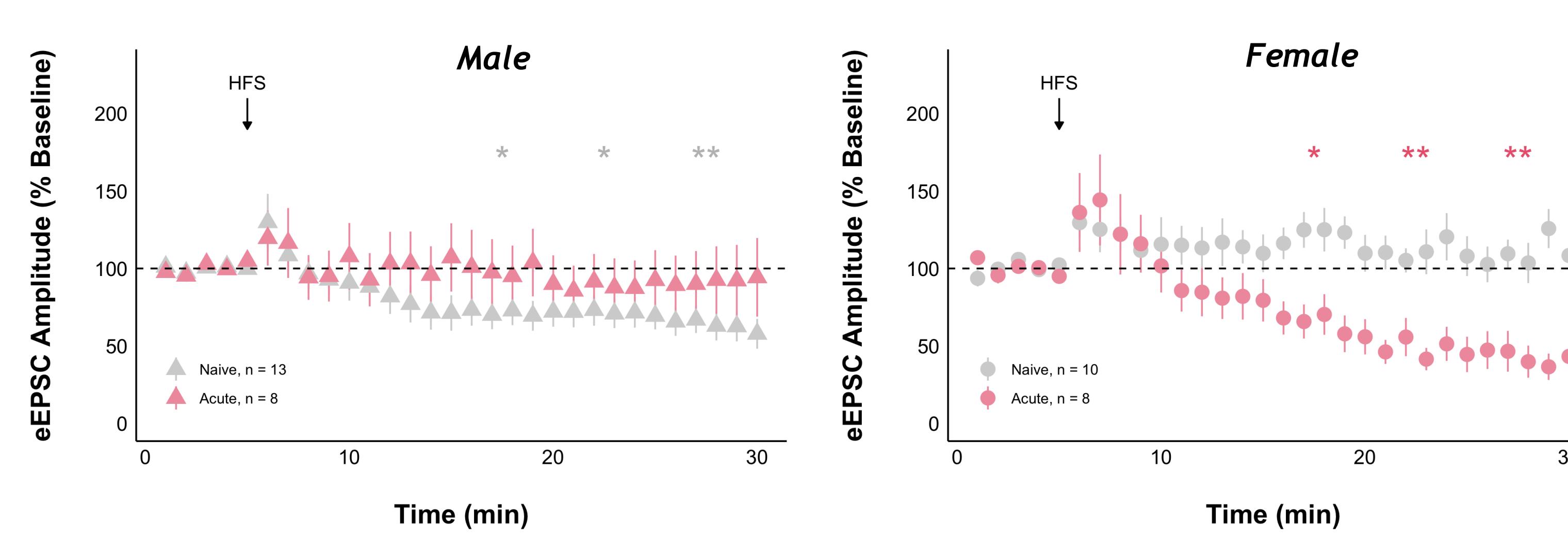
Is the depression due to a presynaptic decrease in glutamate onto DMH neurons during **acute stress**?



A paired *t*-test was used to compare between baseline and post HFS. The PPR is calculated as the evoked current amplitude of peak 2/peak 1.

The PPR significantly increased, indicating a lower probability of glutamate release onto DMH neurons under **acute stress**, but there is no change in PPR when **eCB-CB1 receptors** are blocked under **acute stress**.

What about long term changes?



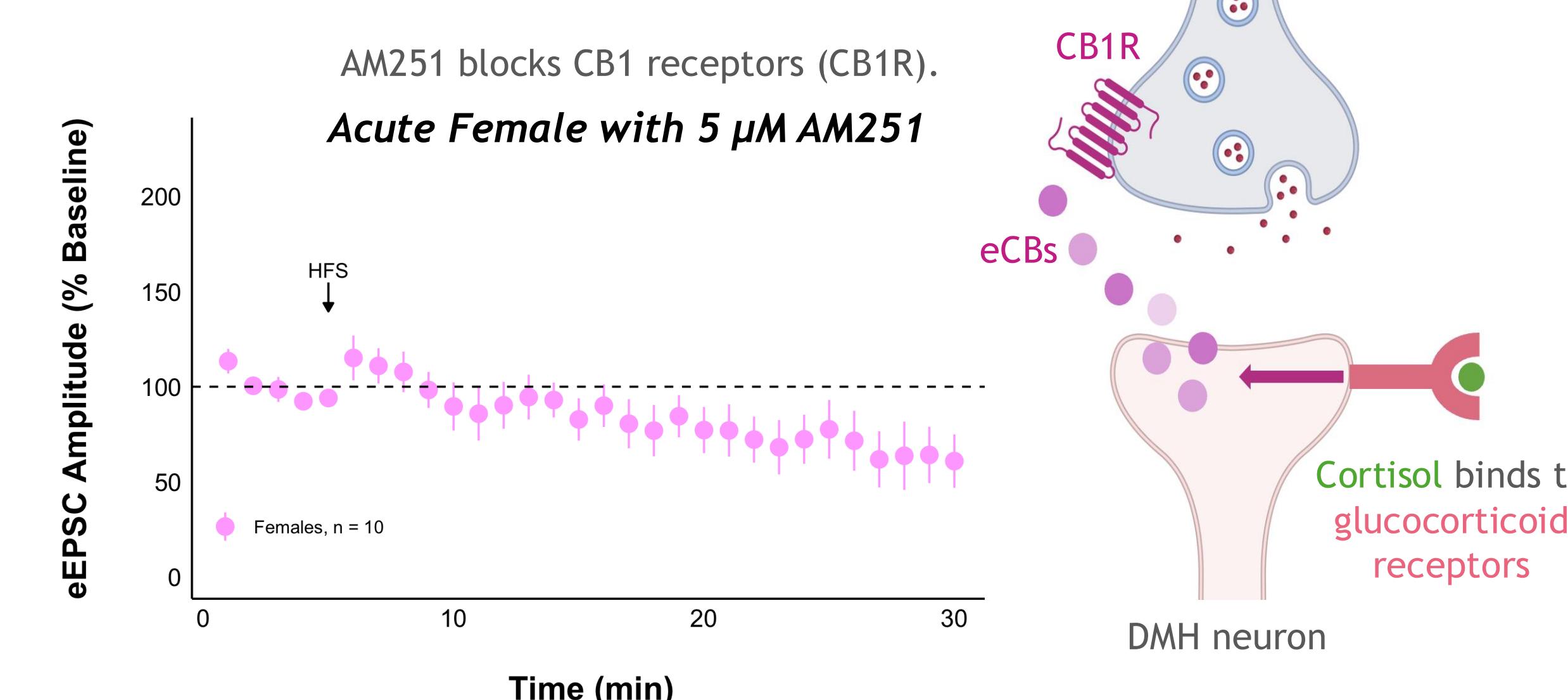
Naive female data collected by Lara Swart, male data collected by Sarah Wilson.

* = $p\text{-value} < 0.05$, ** = $p\text{-value} < 0.01$

Acute stress in **females** triggered a long-lasting depression in glutamate transmission compared to naïve, but not in **males**.

What causes the **female** depression?

Endocannabinoids (eCBs) can trigger a long-lasting decrease in glutamate release.

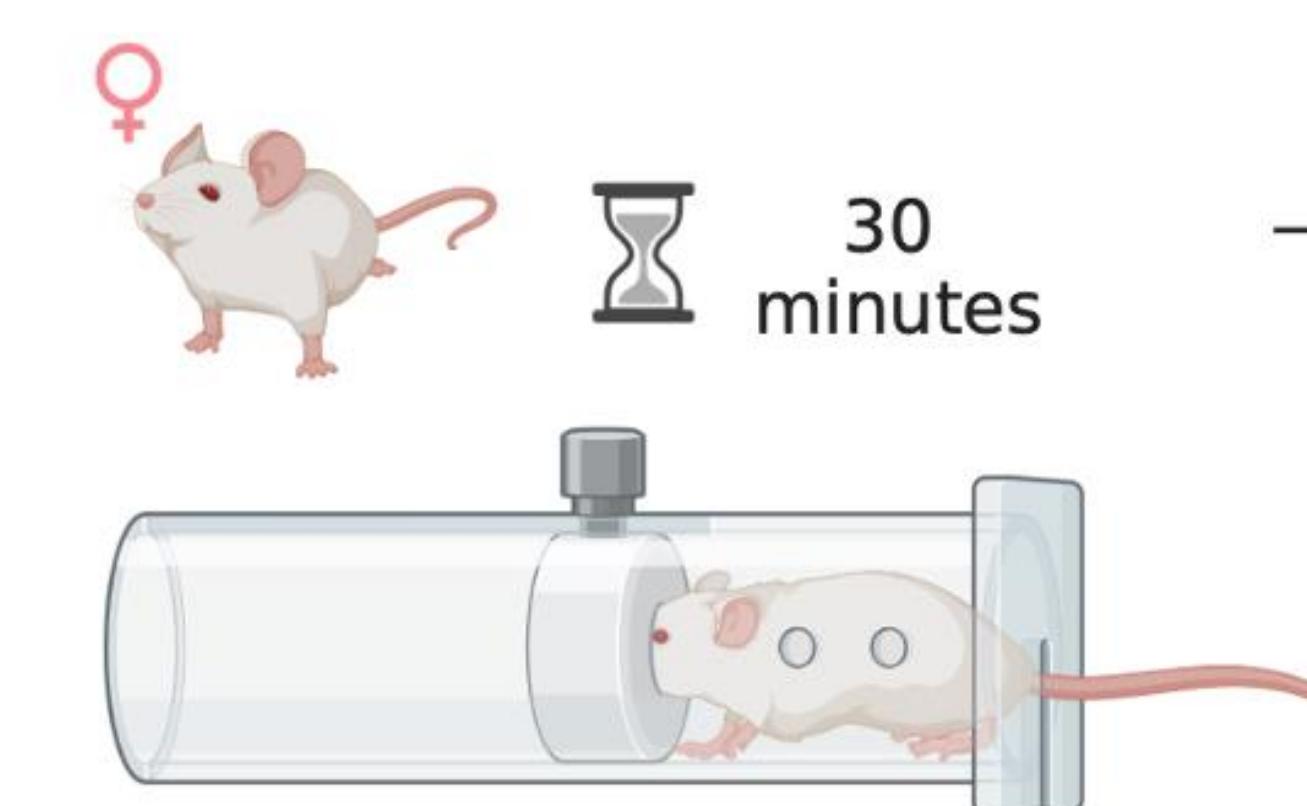


When **eCB-CB1 receptors** are blocked there is no longer a long-lasting decrease in glutamatergic current amplitude under **acute stress**.

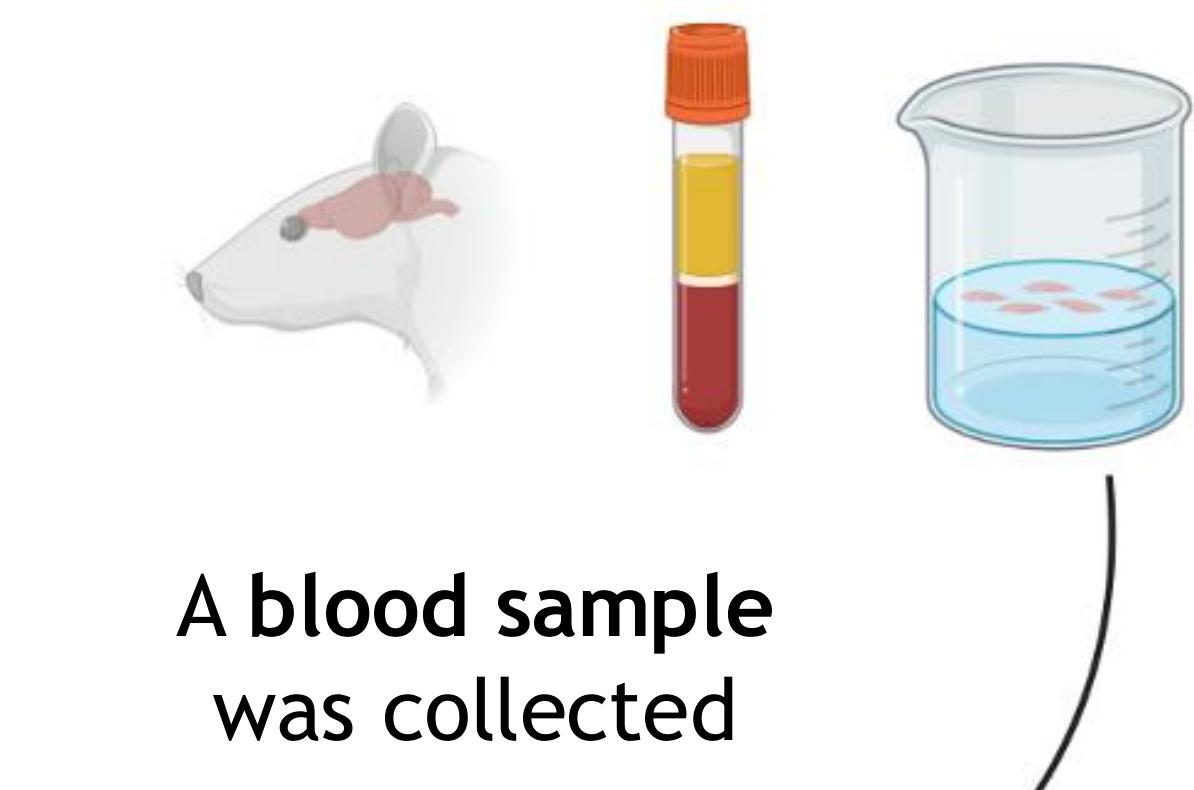
METHODS

Experiments were performed according to protocol #104140 approved by the Mount Allison University Animal Care Committee in accordance with the Canadian Council on Animal Care Guidelines

Young, **female** Sprague-Dawley rats were exposed to a single restraint stress



They were anesthetized, euthanized, and their brains were quickly removed

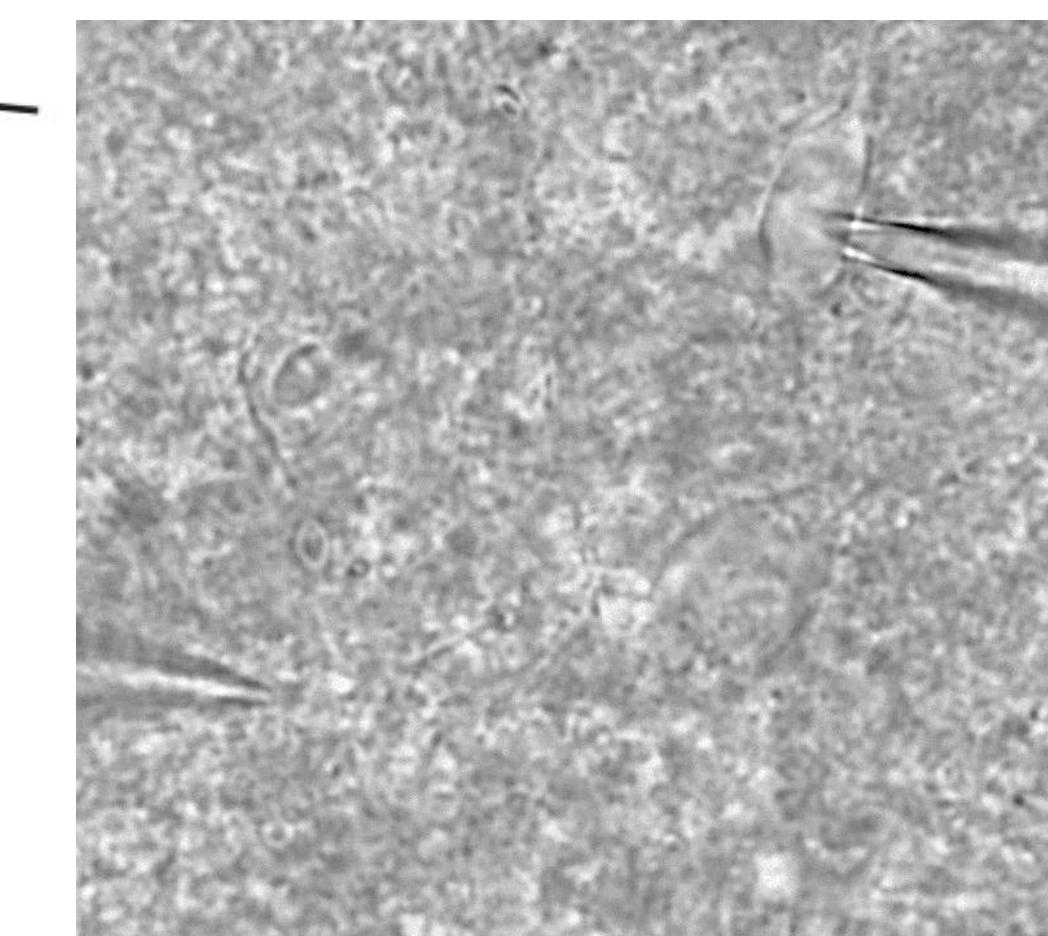


A blood sample was collected

250 μ m coronal brain slices containing the DMH were kept alive in oxygenated artificial cerebrospinal fluid kept at 32.5 °C

50 μ M picrotoxin was applied to observe glutamate synapses

Recording electrode inserted into DMH neurons, and a stimulating electrode into surrounding tissue to evoke excitatory postsynaptic currents (eEPSC) at 0.2 Hz



Living neurons were recorded from before and after high frequency stimulation (HFS) to observe long-lasting changes

HFS Protocol: 100 Hz for 4 seconds, twice, 20 seconds apart

Data analysis was performed using patchclampplotteR by Christelinda Laureijs⁶

CONCLUSIONS

- There are sex differences in glutamate transmission in the rat DMH.
- Females** who are **acutely stressed** have more glutamate transmission onto DMH.
- There is a long-lasting decrease in glutamate current amplitude and probability of presynaptic glutamate release under **acute stress**.
- The decreases in eEPSC amplitude and presynaptic glutamate release during **acute stress** are **no longer significant** when **endocannabinoid-CB1 receptors** are blocked.

FUTURE DIRECTIONS

Future work aims to determine:

- The effect of chronic (repeated) stress (**work in progress**) on the **female** rat DMH.
- How corticosterone is involved in the change in glutamate transmission under **acute stress**.
- The effect of stress on neuronal excitability.

ACKNOWLEDGMENTS

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