

# Sex Differences of $\mu$ -Opioid Receptor Expression in the Dorsal and Ventral Subcoeruleus Nuclei

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## Overview

- Male rats show greater expression of MOR in the Locus Coeruleus
- MOR plays a role in modulating the stress response by inhibiting NE activity thereby decreasing stress-levels back to baseline
- Women are more likely to suffer from stress and anxiety related mental health disorders

**Hypothesis:** Male mice will show increased amount of  $\mu$ -opioid receptors in the SubCV and SubCD regions in comparison to female mice.

**Objective:** To identify possible sex differences in MOR expression in the SubCD/SubCV regions of the NE system

**Justification:** Sex differences are noted in the rat LC, but are not widely studied in the SubCD/CV which can have implications for neuropharmacological treatments of stress-related mental health disorders.

## Methods

Mice brains were engineered to express green fluorescent protein (eGFP) in all NE neurons.



Figure 1. Schematic representation of Cre-negative, DBH-Flpo driver mice. Animals express Flp recombinase in any cell that expressed DBH. Therefore, all NE neurons express eGFP.

Immunohistochemistry methods were employed using primary and secondary antibodies to mark eGFP expression via Alexa 488 and MOR expression via Alexa 568.



Figure 2. Schematic of primary and secondary antibodies used for eGFP and our GOI (MOR)

Antibody	Name	ID, Manufacturer	Dilution
Primary Antibodies	Chicken anti-GFP	AB13970, Abcam	1:10000
	Rabbit anti-MOR	AB217766, Abcam	1:500
Secondary Antibodies	Goat anti-chicken Alexa Fluor 488	AB325653, ThermoFisher Scientific	1:1000
	Goat anti-rabbit Alexa Fluor 568	AB175471, Abcam	1:1000

Table 1. Primary and secondary antibodies sources and proper dilutions

## Results

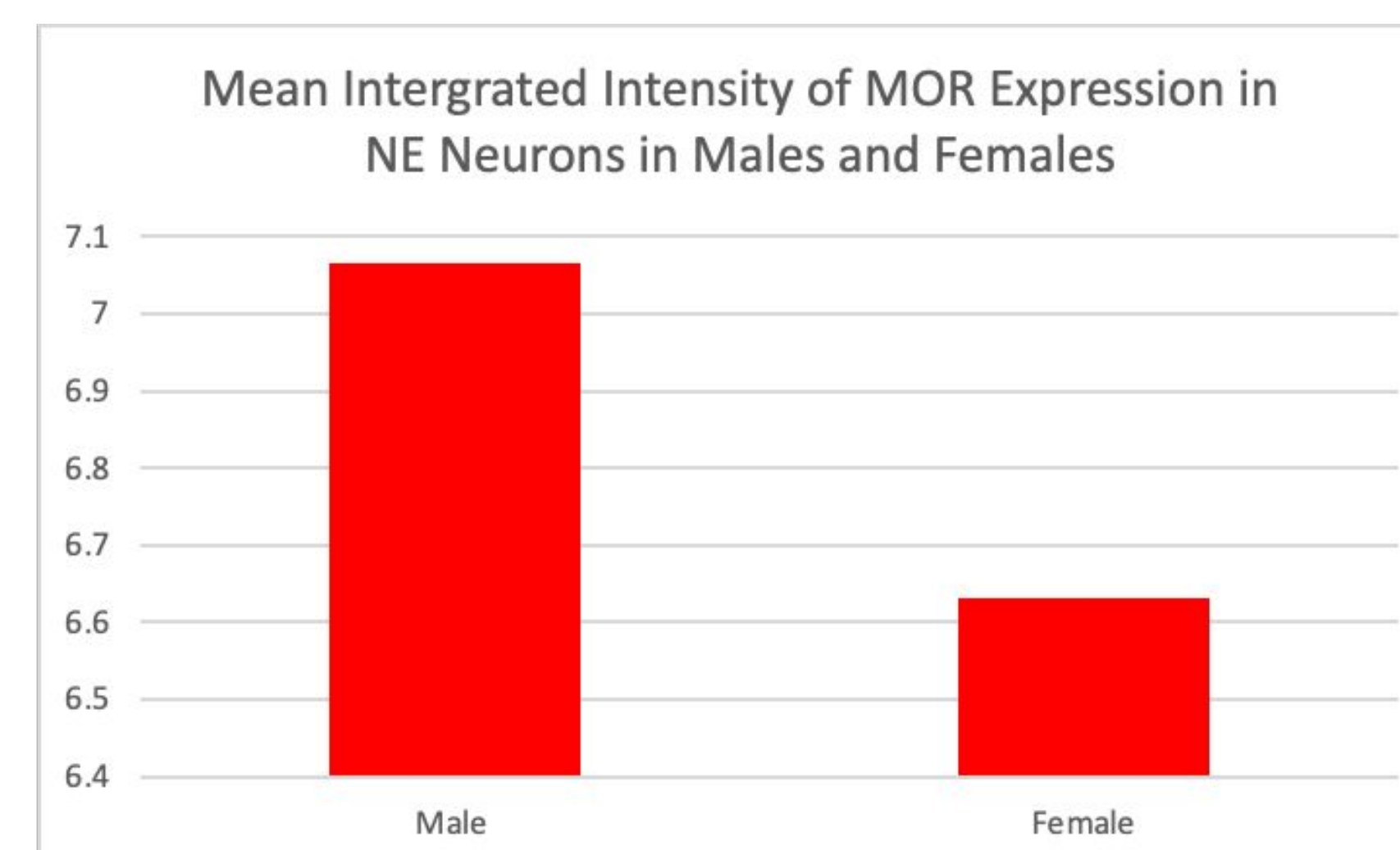


Figure 1. Mean integrated intensity of MOR expression in NE neurons of males and females

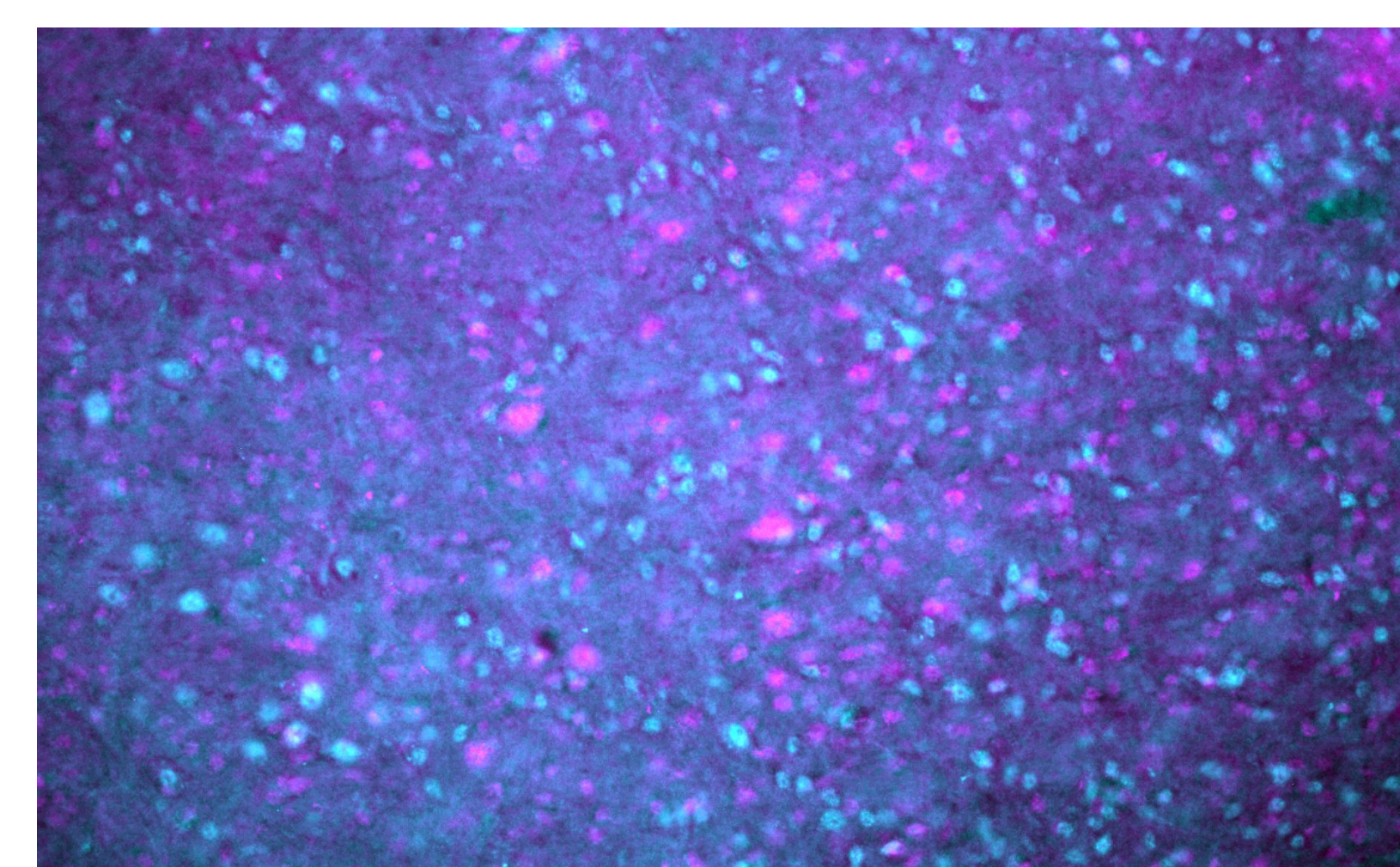


Figure 2. Overlaid male and female GOI expression

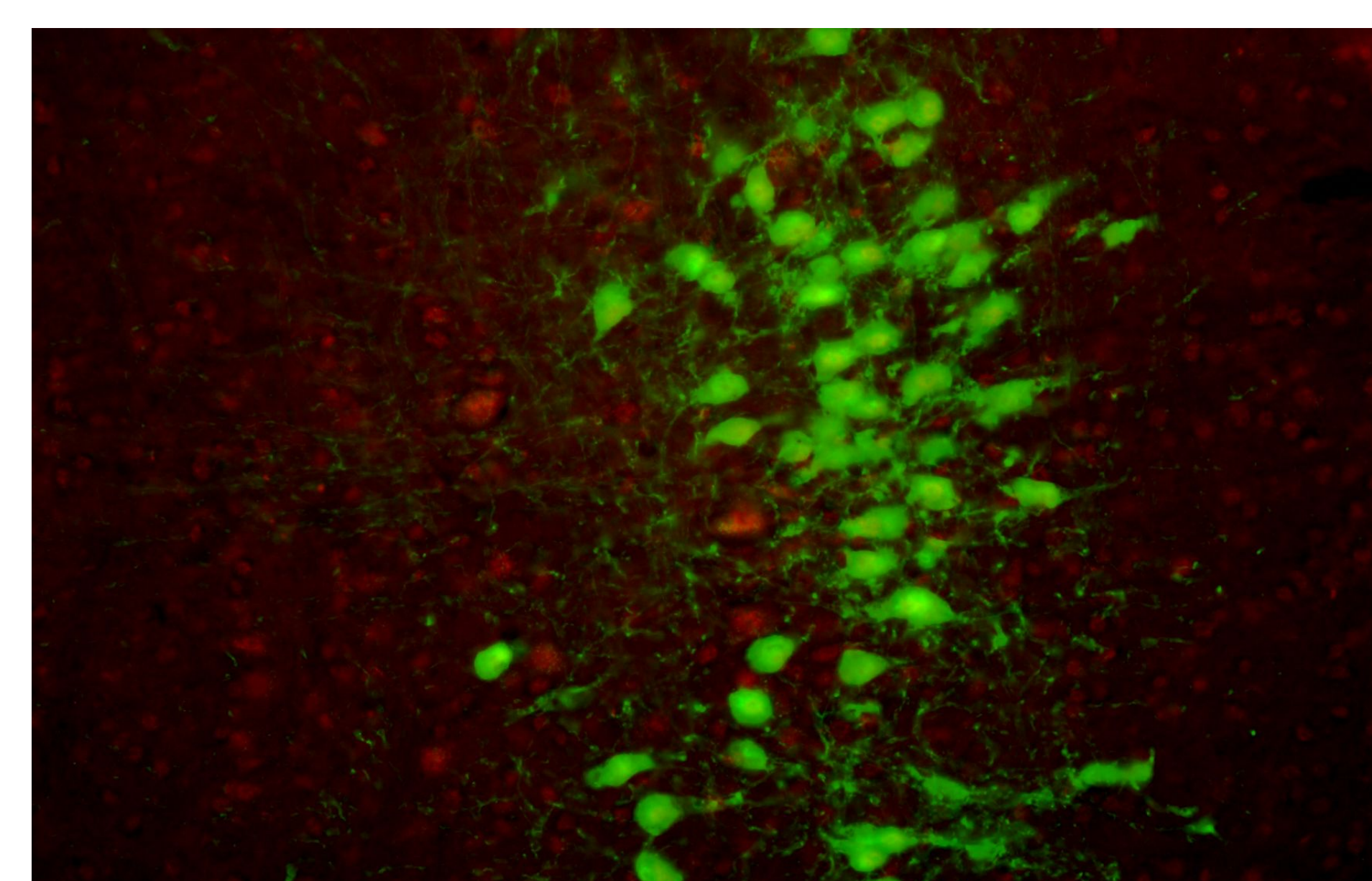


Figure 3. Overlaid GFP and MOR spectra

- Results indicated that males expressed a higher number of MOR receptors than females.

- As seen in figure 2, male expression of MOR wasn't drastically higher than female expression, but figure 1 shows us the mean integrated intensity of MOR expression, indicating a significant difference.

- Overall, our hypothesis proved to be correct, as females expressed lower amounts of MOR. This supports the idea that MOR expression affects the rate of psychiatric diseases.

## Controls

- Control mice were utilized who did not express the primary antibody, but did contain secondary antibody and thus were unable to bind to the GOI, but provided a reference any unexpected binding.

## Conclusion

- Our findings indicated that female mice expressed a significantly lower amount of MOR neurons, leading to the increase of neuropsychiatric disorders that are seen in women

## Limitations

- More tissue samples for female mice
- Limited research time and equipment leading to generalized results

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