Sex Differences in Tyrosine Hydroxylase Expression in Norepinephrine Neurons in A2 Region

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Introduction

Intro:

- Noradrenergic neurons in Parkinson's Disease (PD) might have a link to sex differences.
- The study examines the expression of tyrosine hydroxylase (TH) in the A2 region of the pons in male and female rats.
- The study aims to provide insight into the differential development of PD and contribute to a better understanding of its underlying pathology.

Hypothesis: It's expected to see decreased expression of GFP and TH in the A2 region of the pons in male mice compared to female mice.

Methods

Procedure:

- Triple transgenic mice were used to examine the location of tyrosine hydroxylase (TH) expression compared to noradrenergic neurons.
- The brain tissue was collected via dissection, fixed, and cryoprotected.
- The study utilized double immunofluorescence labeling, including goat anti-chicken alexa 488 and goat anti-rabbit alexa 568 to label norepinephrine neurons and TH respectively (Figure 2).
- The intensity of the TH+ expression was measured using ImageJ and statistical analysis was performed on the data to compare the signal/area values between male and female mice models.

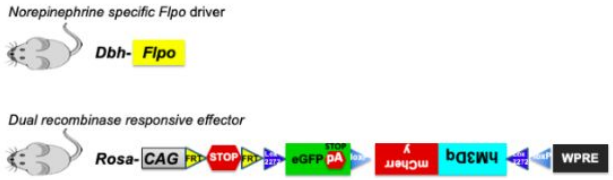

Figure 1: Schematic diagram of the norepinephrine expression using a Flpo driver for Dbh and the dual recombinase responsive effector.

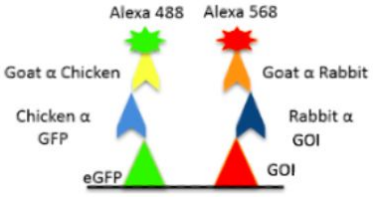

Figure 2: Dual primary antibody and secondary antibody procedure that allows for expression of eGFP and TH.

Control:

- A negative control was used to compare TH expression levels in the experimental group to low levels of TH expression in controls.
- The primary antibody was omitted in the control group for the TH gene of interest.

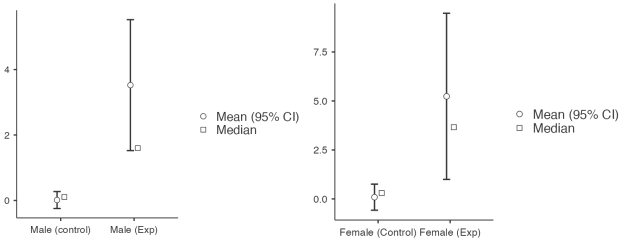

Figure 3: Control group comparisons for TH expression levels.

Results

- No statistical significance was found between the levels of expression of TH in the A2 region of the pons in male and female mice.
- The hypothesis is not supported since there was a p-value of 0.102 when the alpha level was set to 0.05

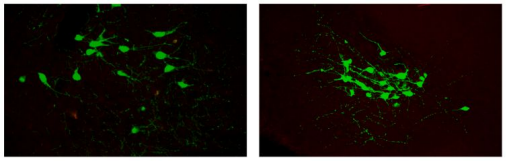

Figure 4: Merged Photos of eGFP and TH in female (right) and male (left).

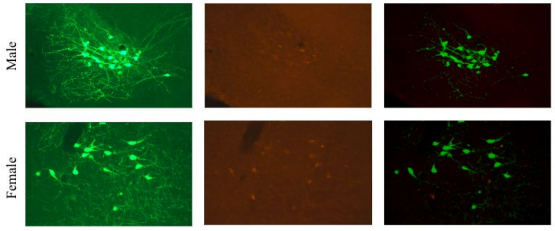

Figure 5: Immunofluorescence of eGFP and TH expression in A2 region of mice.

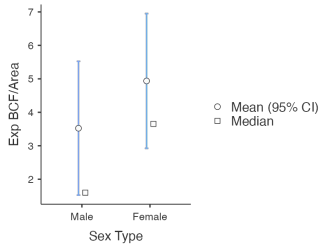

Figure 6: Statistical Analysis results for TH expression in norepinephrine neurons.

Conclusion

Discussion:

- This study used immunohistochemical analysis to investigate sex differences in TH expression in the A2 region of mice.
- The results showed that females did not have significantly higher TH expression compared to males.
- The findings suggest there is no significant sexual dimorphism in TH expression that may be related to the increased incidence of Parkinson's Disease in males.

Limitations:

- This study was conducted using mice, and further research is required to investigate whether the findings can be extrapolated to humans.
- The study utilized a small sample size (n=2) making the results of this experiment less reliable when compared to the population of interest.

Future Directions:

- Further research should focus on investigating the impact of norepinephrine systems on Parkinson's Disease in both male and female populations.
- Specifically, studies could investigate whether lower TH expression in areas other than the A2 region of the pons serve as a starting point for investigating the disproportionate representation of Parkinson's disease in the male population.
- Future research should be conducted to determine the extent to which norepinephrine plays a protective role in Parkinson's disease.