

Investigating the Neuroanatomical and Behavioral Consequences of Motherhood

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Introduction

- **Behavioral Changes that Occur During Pregnancy**
- Throughout life, the female body undergoes multiple hormonal changes
- Many women will be pregnant during their lifetime
- Pregnancy causes many physical and hormonal changes that can change behavior
- Hormonal changes include significant increases in estrogen and progesterone
- Behavioral changes include enhanced social cognition and emotional processing
- “Mommy Brain”, characterized as memory deficits
- **Neurophysiological Changes that Occur During Pregnancy**
- Significant increases in progesterone during pregnancy cause the increase in GABA-A receptor proteins and a particular subunit (delta subunit) of the GABA-A receptor changes.
- GABA is the primary inhibitory neurotransmitter within the brain.
- Increased GABA receptor activation occurs in the hippocampus, critical for learning and memory
- The increase in inhibitory neural activity might be related to “Mommy Brain” symptoms
- Pregnancy caused a decrease in cortical volume in the human hippocampus that did not return to baseline volume through 2 years post-partum

Research Question:

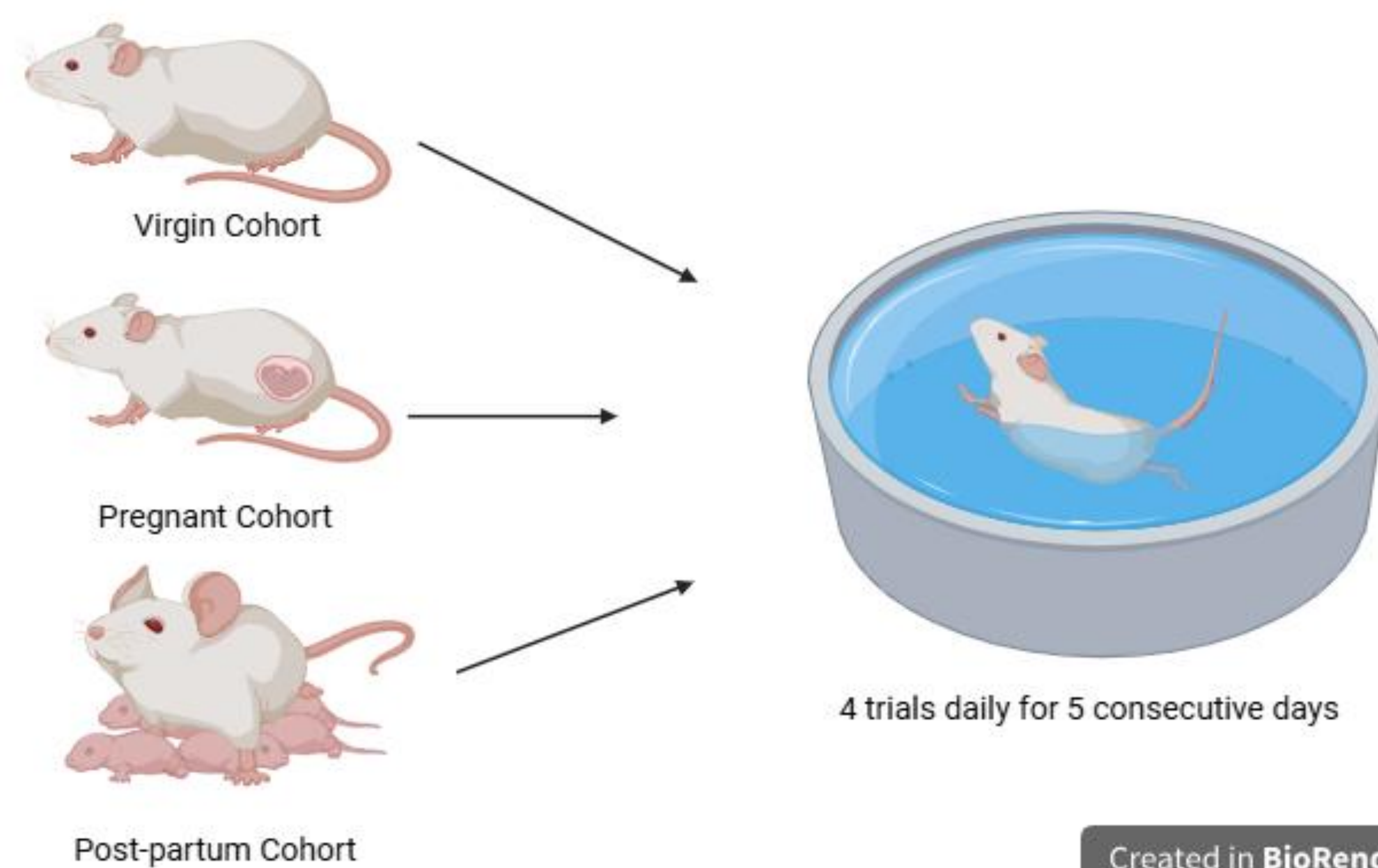
Does pregnancy impact memory and how does delta subunit concentration of GABA-A receptors change before, during, and after pregnancy?

Hypotheses:

- **Learning tasks:** the pregnant rats will perform the worst, the postpartum group will perform slightly better, and the virgins will perform the best.
- **Cellular changes:** pregnant rats will have higher level of delta subunit concentration of the GABA-A receptor than postpartum > virgin

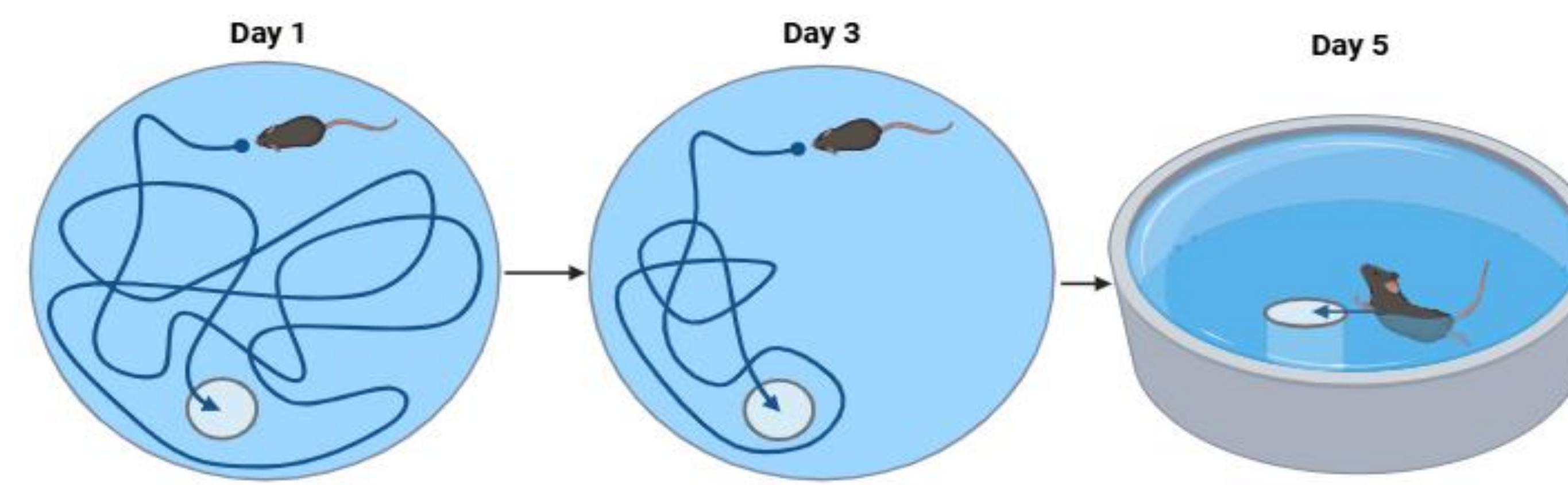
Methods

Morris Water Maze



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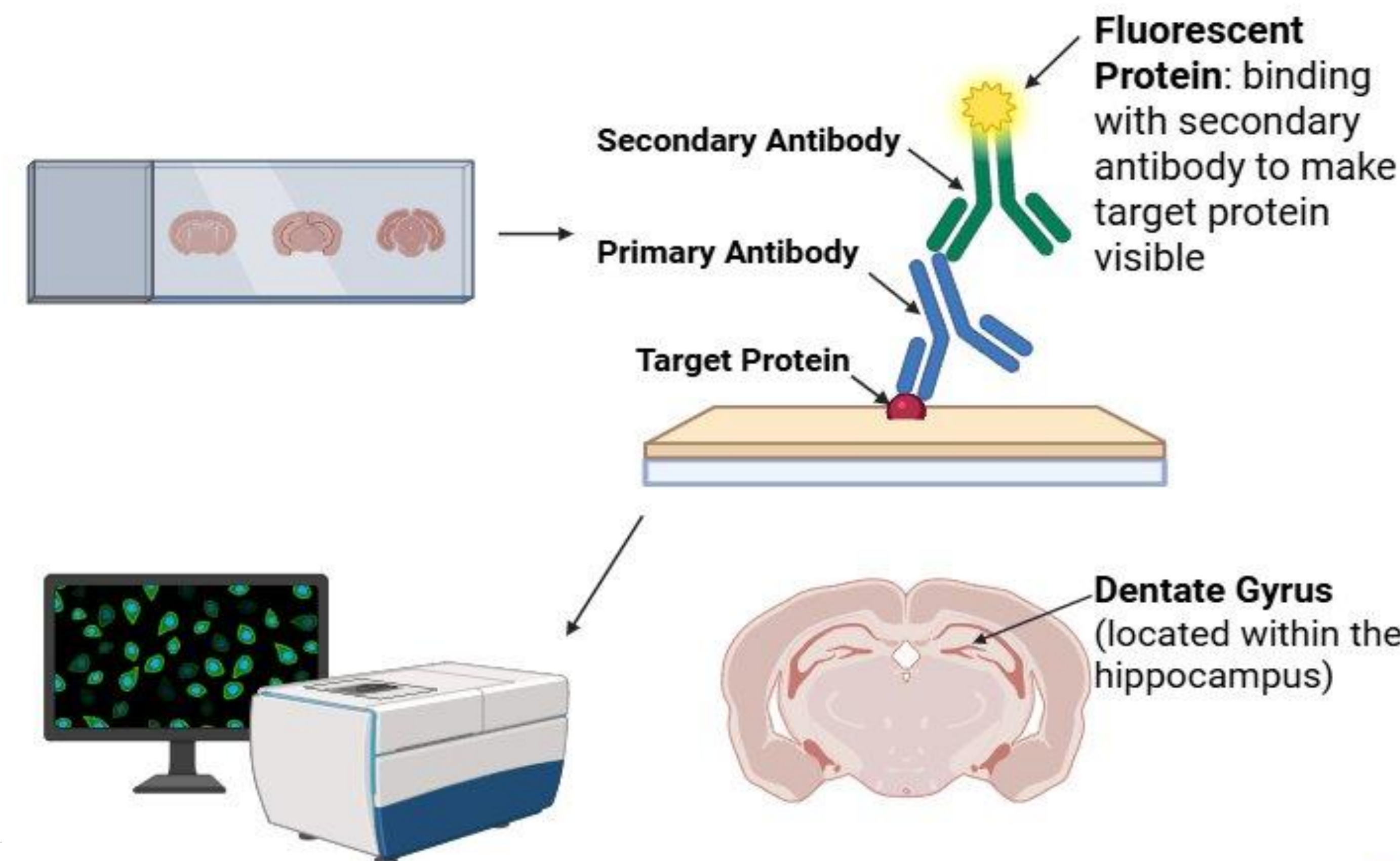
Methods Cont.



Rats were observed during behavioral testing and memory was measured based on decreased latency to the platform over trials and days.

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Immunohistochemistry



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Results

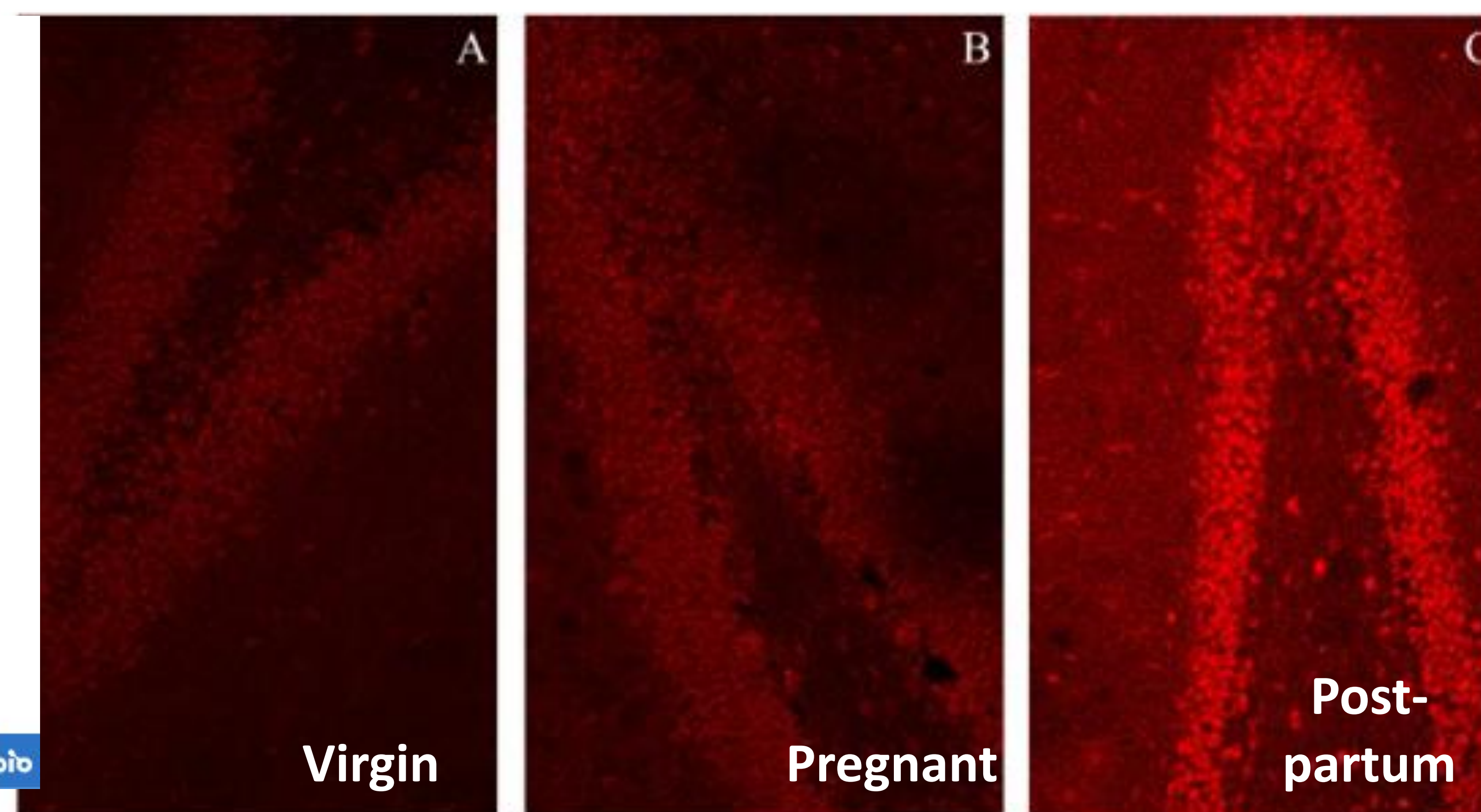


Figure 4 Representative images of the dentate gyrus with fluorescence illuminating the delta subunit. A. Virgin rat. B. Pregnant rat. C. Postpartum rat.

Results Cont.

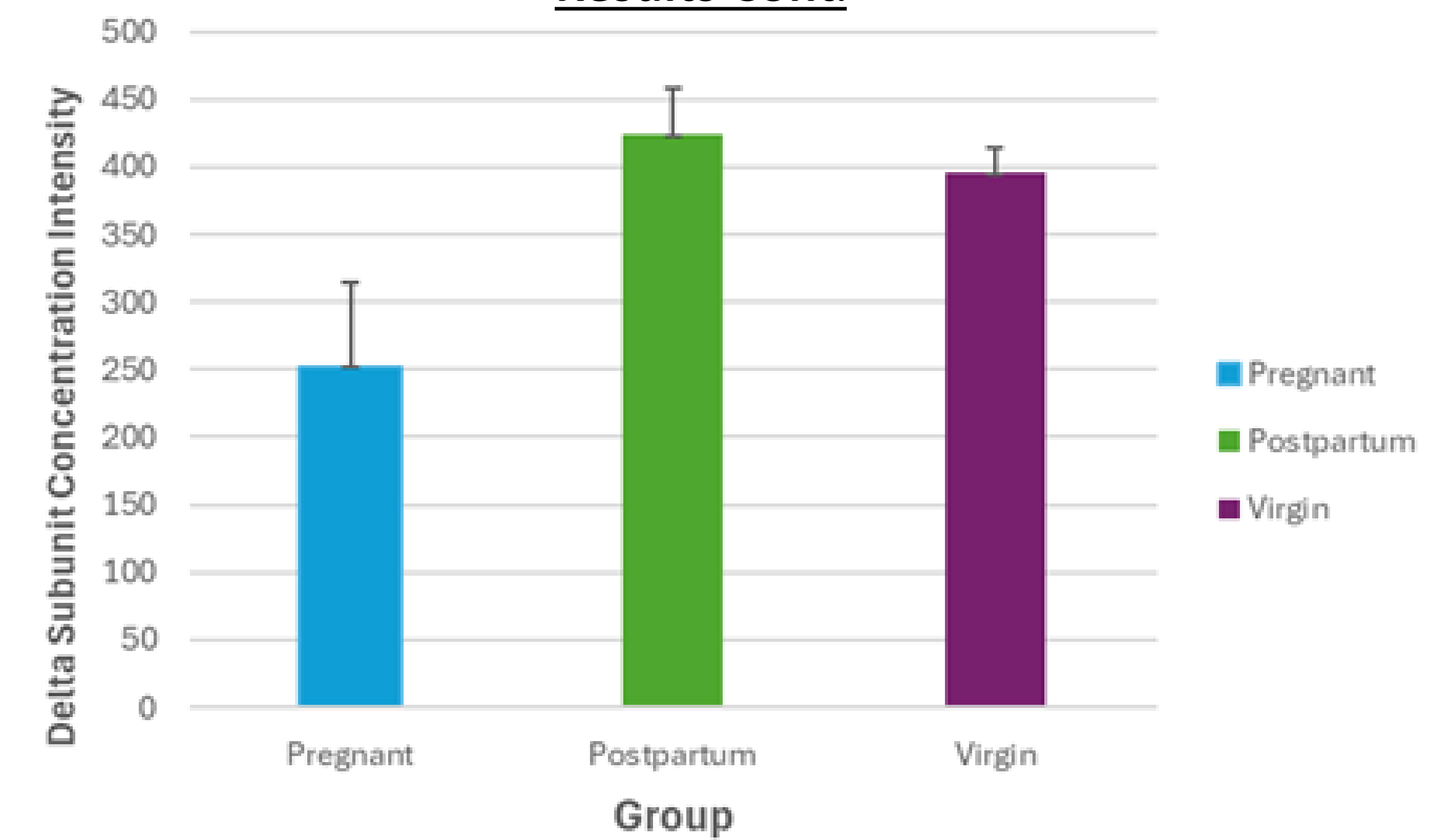


Figure 3 The concentration of the delta subunit measured through brightness intensity for virgin, postpartum, and pregnant brain sections, sourced from the dentate gyrus ($p=0.332$). Error bars indicate SEM.

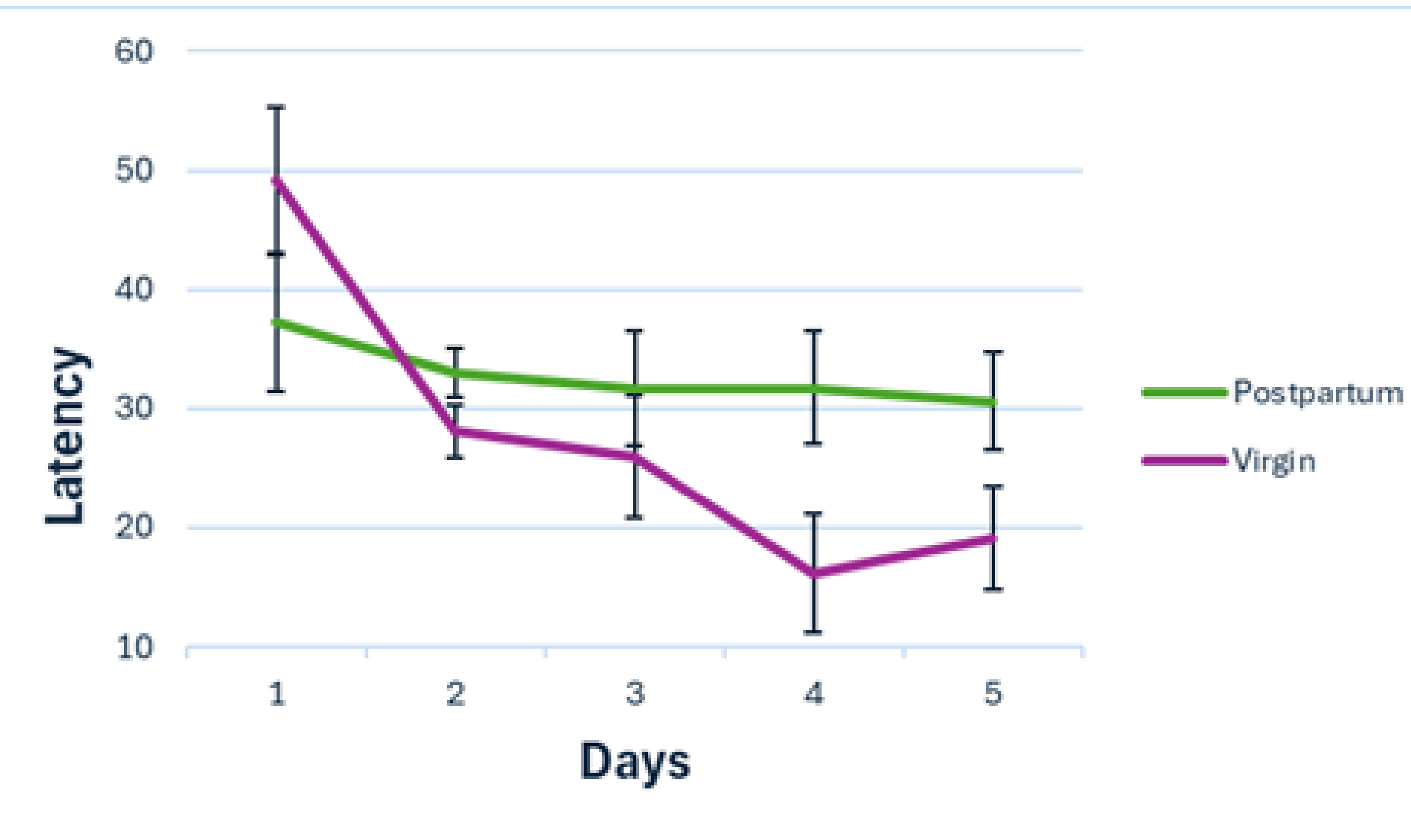


Figure 2 Latency to platform in MWM over five days of testing for postpartum and virgin Sprague-Dawley female rats. There was a significant interaction effect of learning over days, $p=0.035$. Error bars indicate standard error of the mean (SEM)

Conclusions and Future Directions

- The Postpartum group did not learn. This rodent model for “Mommy Brain” supports anecdotal evidence that motherhood impairs memory.
- There was no significant difference in delta subunit concentration between the three groups which is inconsistent with existing literature that demonstrated that the delta subunit concentration during pregnancy was significantly higher compared to virgin and postpartum rats
- Although this study did not find a significant difference in delta subunit expression of GABA-A receptors within the dentate gyrus, more research can be conducted to observe the activity of these receptors prior to conception, during pregnancy and postpartum using electrophysiology

References

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Acknowledgements

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