Optogenetic Modulation of Octopamine Neurons in Anesthetic Vulnerability in *Drosophila melanogaster*

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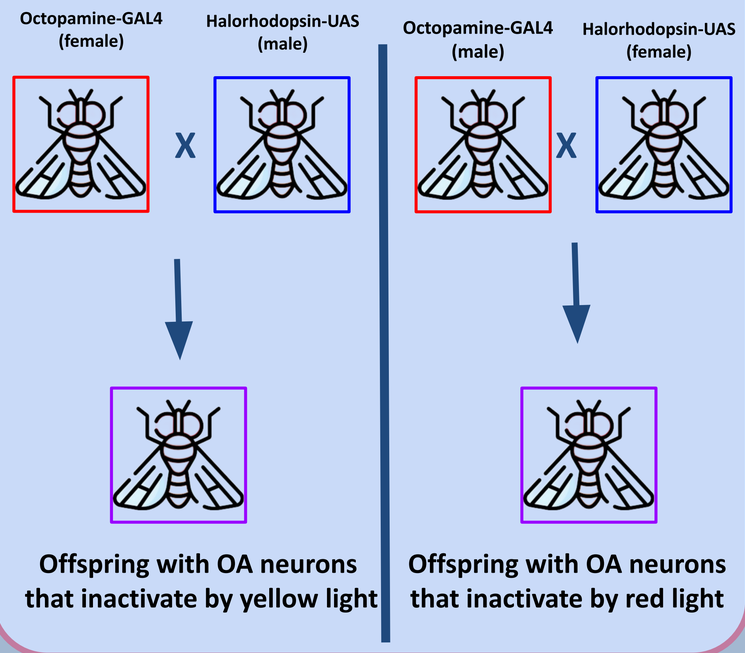
Introduction

- Role of neurotransmitters in anesthetic usage remains largely unexplored, posing a significant risk of overlooking critical factors in human anesthetic administration
- This study aimed to determine the effect of acute activation and deactivation of octopamine (OA) neurons on anesthetic vulnerability in fruit flies with the GAL4/UAS system (genetic tool to drive chosen gene expression)
- **Key terms**:
  - **Octopamine**: neurotransmitter in fruit flies, equivalent of fight or flight in humans (norepinephrine)
  - **Channelrhodopsin**: facilitate neurotransmitter activation, are light-gated by wavelengths of approximately 700 nanometers (red light), Sodium ion channel
  - **Halorhodopsin**: enable neurotransmitter deactivation, are light-gated by wavelengths of approximately 578 nanometers (yellow light), Chloride ion channel

Methods



Results

FIG 1: Control - Channel and Halo

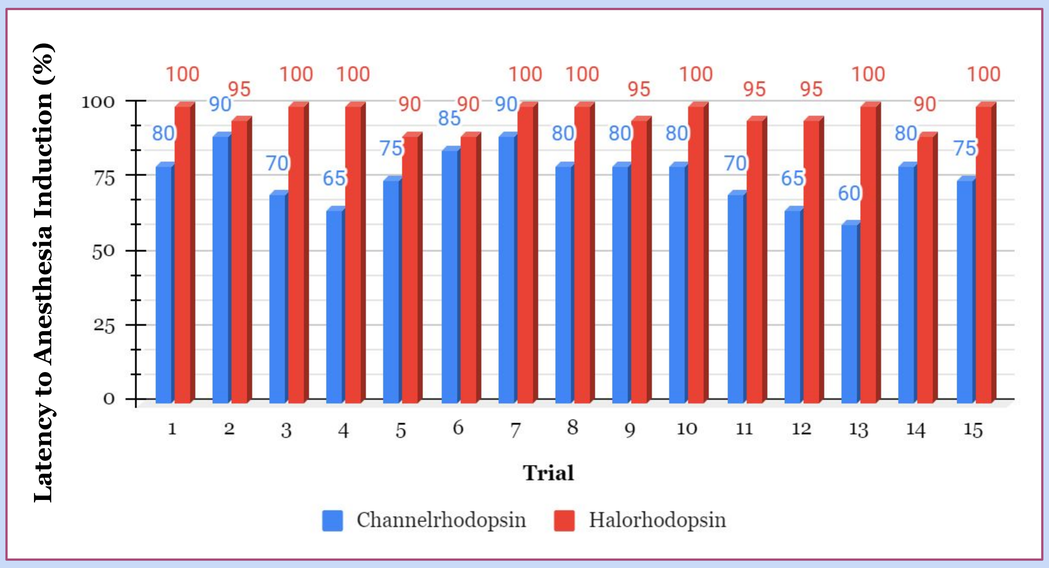


FIG 2: Experimental - Channelrhodopsin

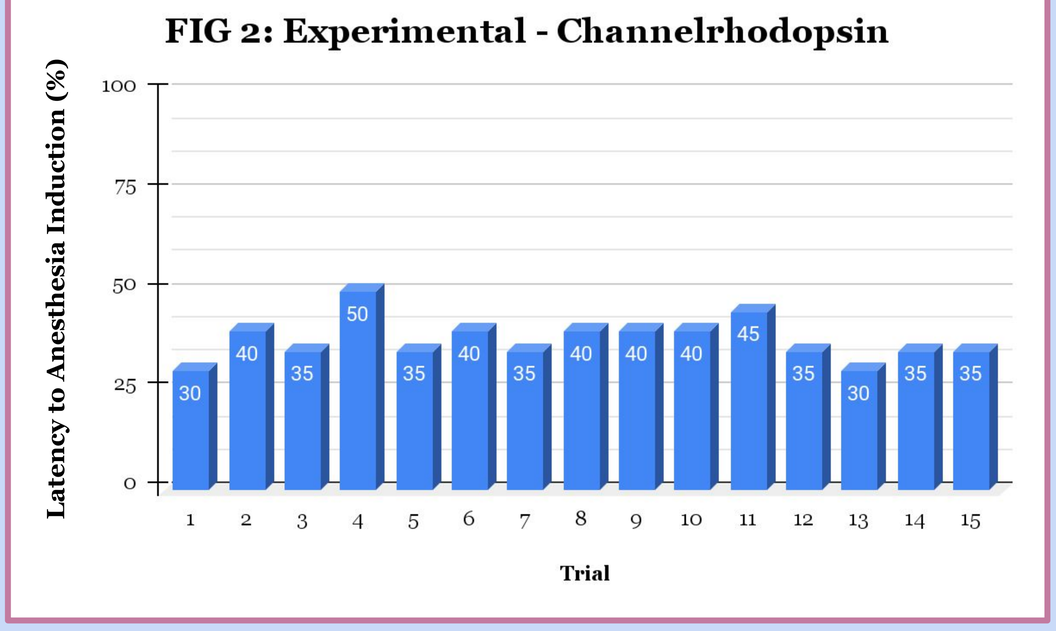


FIG 3: Experimental - Halorhodopsin

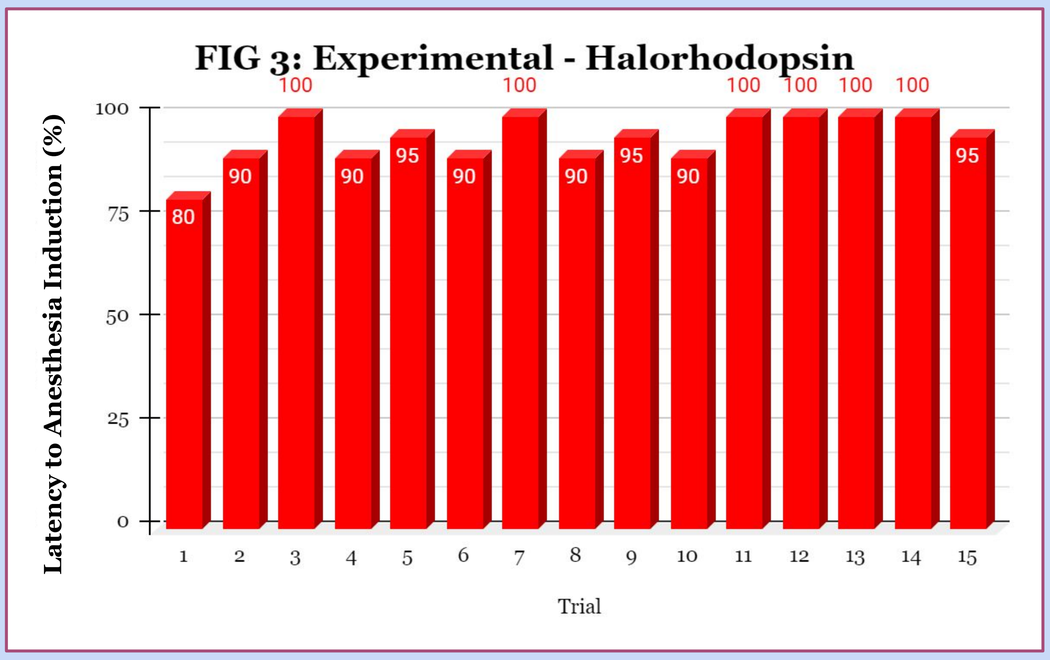
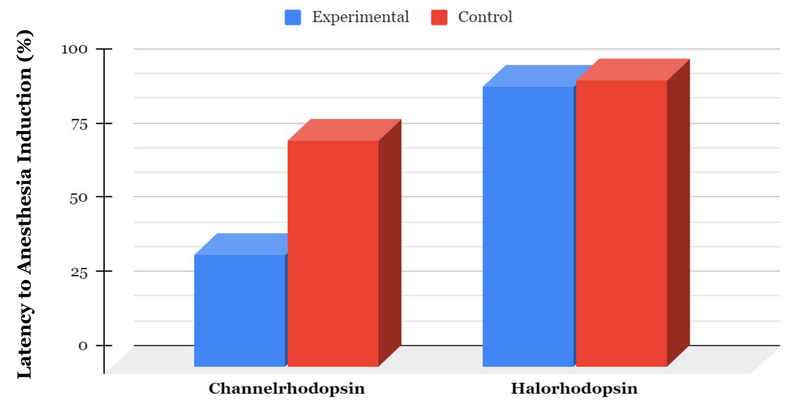


FIG 4 - Average Experimental vs. Average Control



Discussion/ Conclusions

- Acute activation of Octopamine was associated with less vulnerability to anesthetic and greater aversion
  - **p value < 0.0001** → statistically significant
- Acute deactivation of Octopamine did not present a significant effect on anesthetic vulnerability
  - **p value = 0.2201** → not statistically significant
- Findings highlight that Octopamine activation plays a significant role in anesthetic vulnerability
  - Highlights importance of considering additional factors in human anesthetic administration, such as norepinephrine levels and arousal states
  - Understanding the influence of octopamine on anesthetic susceptibility in Drosophila could inform better anesthetic management and personalized approaches in clinical settings, potentially improving patient outcomes

Visuals

Image 1: Attempted Dissection

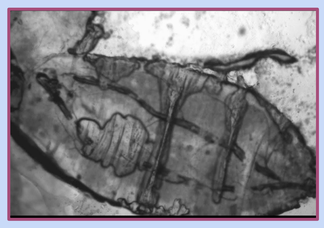


Image 2: Pupa under Leica Microscope

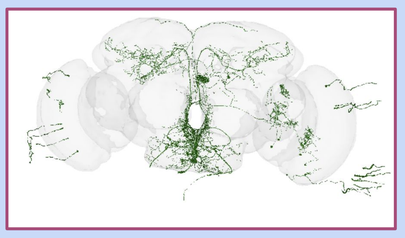


Image 3: Octopamine Diagram

Acknowledgements

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References

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2. Claßen G, Scholz H. Octopamine Shifts the Behavioral Response From Indecision to Approach or Aversion in Drosophila melanogaster. Front Behav Neurosci. 2018 Jul 3;12:131. doi: 10.3389/fnbeh.2018.00131. PMID: 30018540; PMCID: PMC6037846.