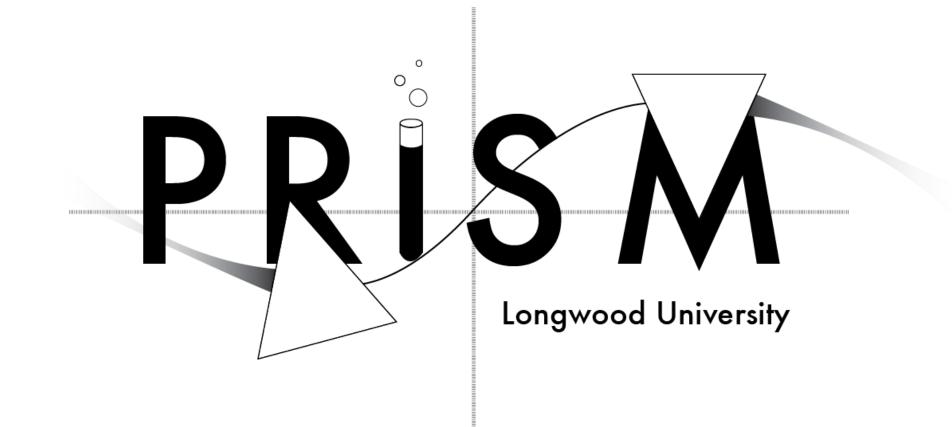


# **Epigenetically Heritable Effects of Maternal Behavior in Rats**

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#### Research Questions

- 1. Maternal behavior in rats is epigenetically heritable from one generation to the next. What are other neurobiological consequences of maternal behavior?
- 2. Can environmental enrichment mitigate the effects of bad maternal behavior?

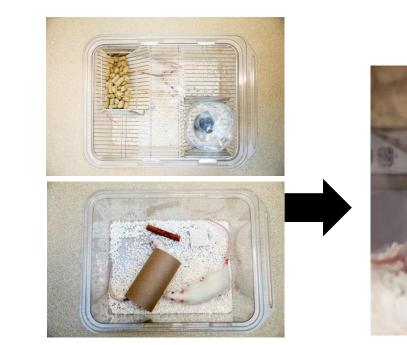
## Background

- Epigenetics is the study of how cells control gene activity without changing the DNA sequence<sup>1</sup>
- There is robust literature detailing how maternal behavior in rats is epigenetically heritable<sup>2</sup>
- Good moms raise relaxed pups that become Good moms
- Bad moms raise anxious pups that become Bad moms
- Anxiety has been shown to negatively effect learning and memory in rats<sup>3</sup>
- Early environmental enrichment has been demonstrated to reduce anxiety in adult rats<sup>4</sup>

## Hypotheses

- . We hypothesize that the epigenetic effects of maternal behavior have transgenerational, epigenetic neurobiological consequences. These include anxiety, boldness, resiliency, spatial memory, and nonspatial memory.
- We also hypothesize that enriched environments will improve rat performance regardless of parental behavior.

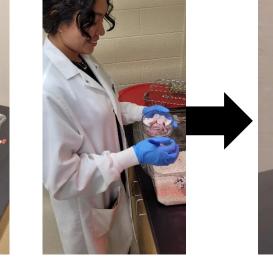
# Methods in Brief – Click on the QR Code for More Videos and Details



Rats Housed **Under Standard** or Enriched Conditions

Mother rats deliver and raise pups in home cage for 6-9 days





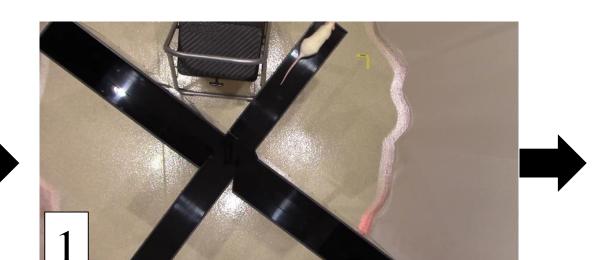
pups and moved into the testing room. We mark pups to ID

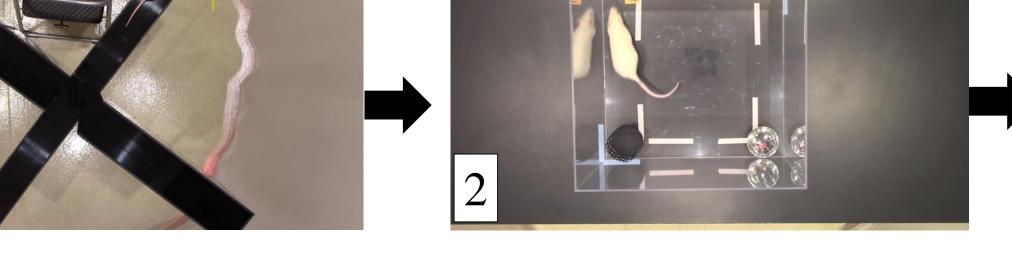
them in 3 different experimental ratios. Mother rats interact

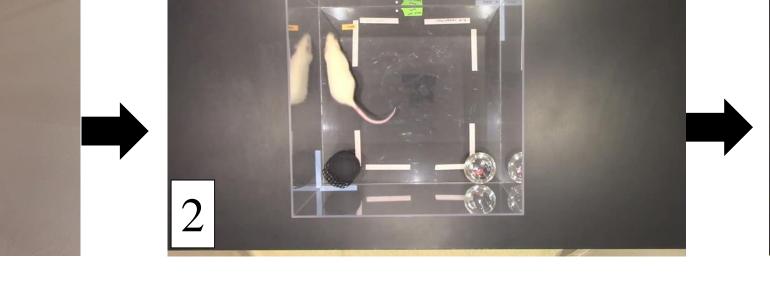
with litter of pups for 15 minutes; behavior video recorded.

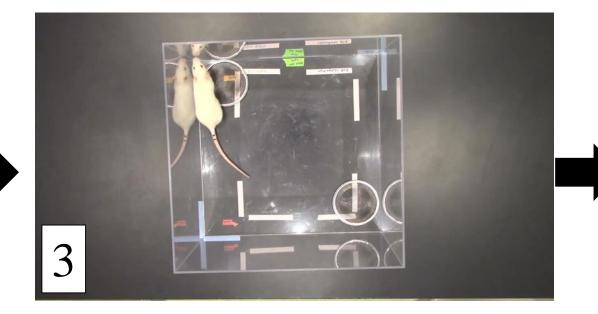


Behavior coded for maternal and nonparental behaviors

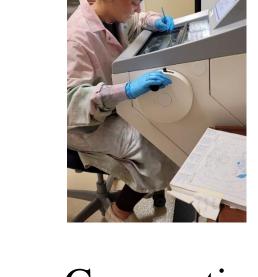










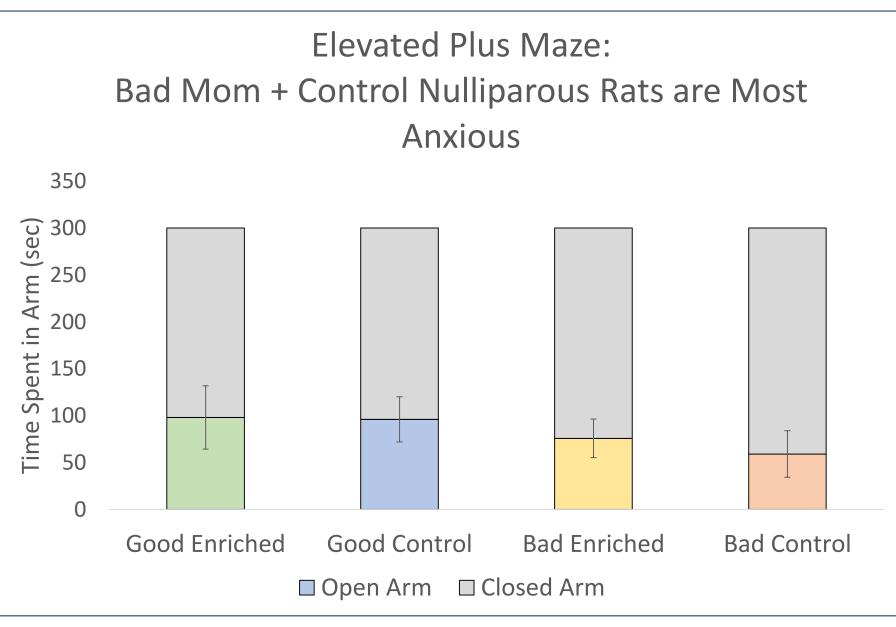


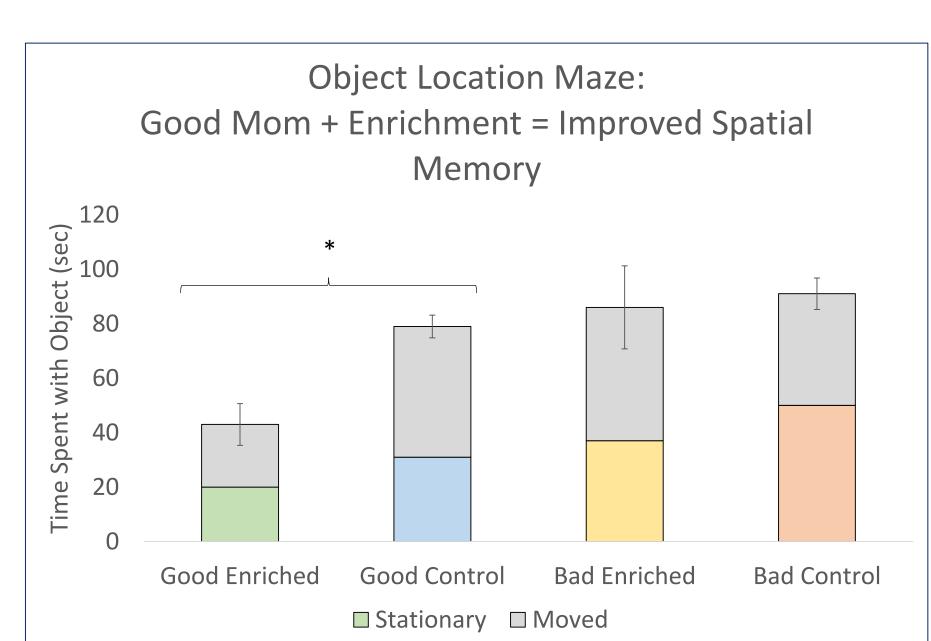
Measure rats – mothers and offspring as adolescents, virgin adults, and as moms themselves - on several other behavioral tasks, including Elevated Plus Maze (1; Anxiety/Boldness), Novel Object Preference Test (2; Non-spatial memory), Object Location Maze (3; Spatial Memory), and Forced Swim Test (4; Resiliency/Coping Strategies) For more information on each test, click the QR Code!

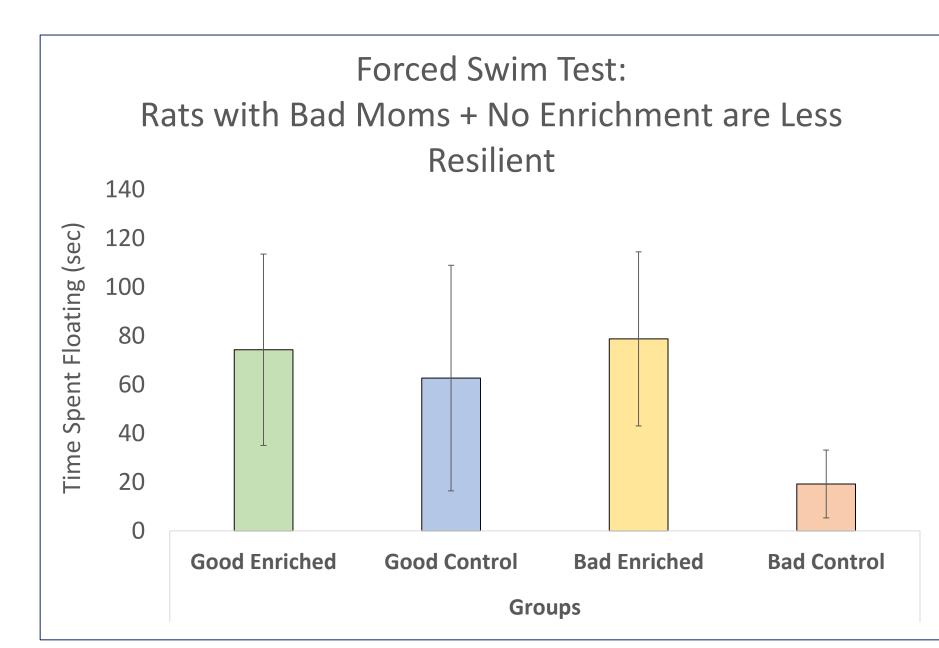


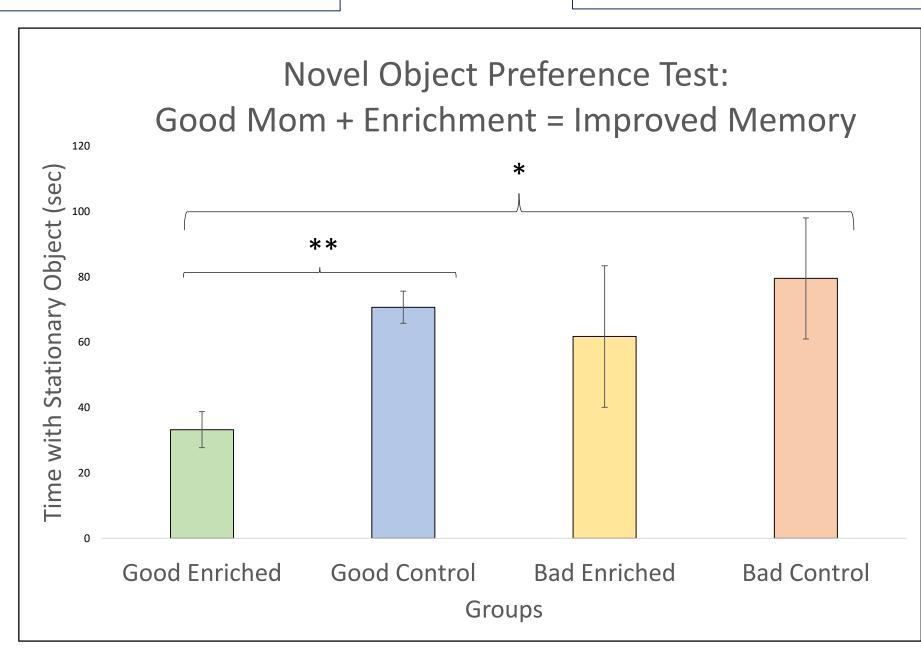
Cryosection perfused maternal brain tissue @ 40 microns for neuron analyses

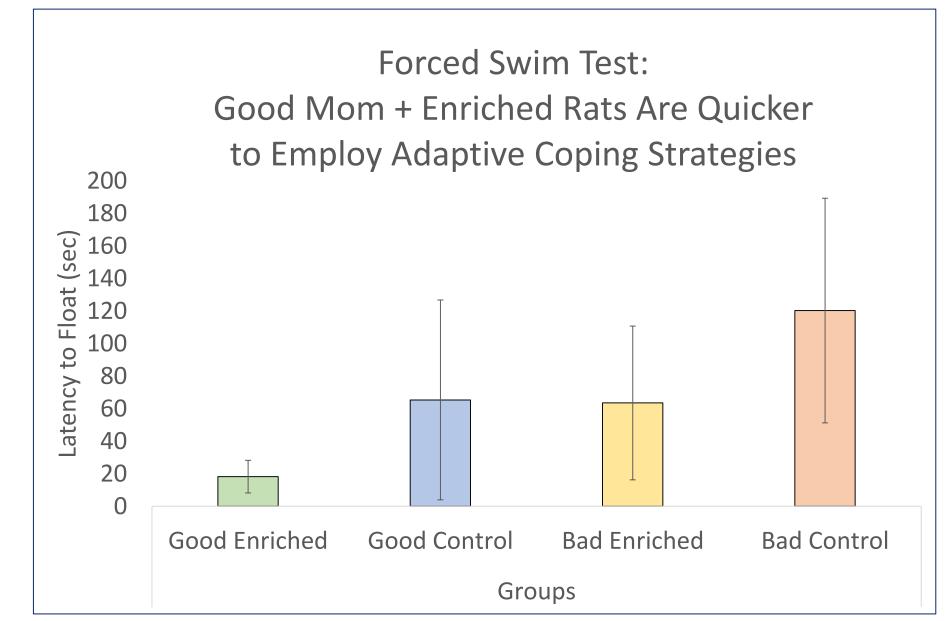
#### Work in Progress! Results to Date











## Applying the Science: Childhood Resiliency

- Children's psychopathology risk and behavior can be influenced by parental characteristics<sup>5</sup>
- Having a 'bad' household or 'bad' parents can have severe neurological and psychological consequences<sup>6,7</sup>
- Types of enrichment for kids are numerous and varied, including virtually all sensory/motor stimulation<sup>7</sup>
  - Meet minimal needs, such as sleep and access to healthful foods
  - Social interactions such as play dates and group sports/activities
- 3. Early childhood education and good schools throughout adolescence<sup>8</sup>
- Our preliminary findings offer evidence that enriching environments may help children overcome negative childhood experiences.

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