# Characterizing Neurogenesis-Mediated Forgetting in the Water Maze Paradigm

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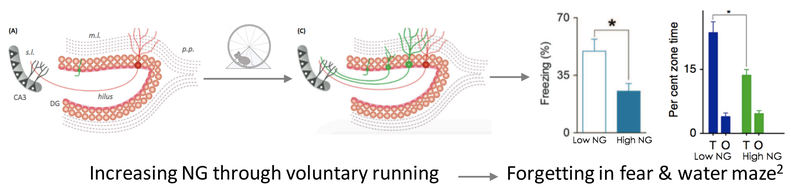
## Introduction

### Background

- **Increasing neurogenesis (NG),** the continuous generation of new neurons, by voluntary running **accelerates forgetting** in mice[1].
- **Infantile amnesia**, the forgetting of episodic memories from infantile stage, has been shown to be associated with **heightened neurogenesis** at early stages of development[1].
- However, the behavioral outcomes of increased NG reported in previous studies were one-dimensional and inconclusive. Thus, the current study aims to address the **lack of behavioral investigation** in mice with increased neurogenesis.

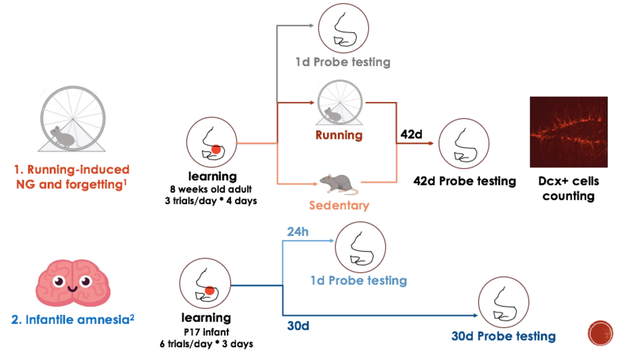



Increasing NG through voluntary running ⟶ Forgetting in fear & water maze[2]

### Goals

1. To thoroughly characterize the **behavioral forgetting** associated with **running-induced increase in NG** using the water maze paradigm
2. To examine behavioral forgetting in **infantile amnesia (IA)** to establish the **behavioral footprints of memory loss** associated with elevated NG

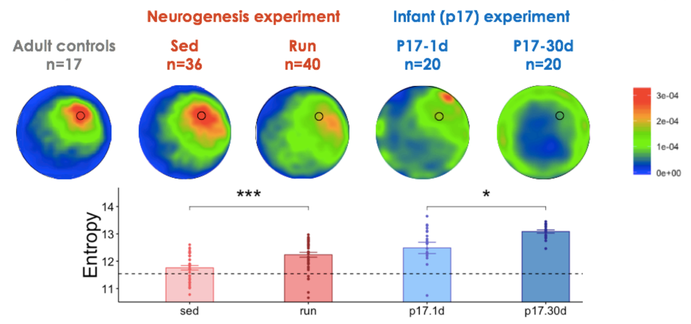
## Methods




## Results

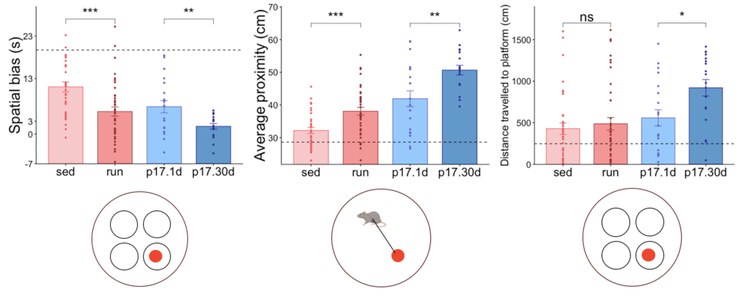
### Entropy

- The **swimming trace** of runners is **more distributed** than sedentary mice; the swimming trace of infant mice becomes more distributed after a 30-day delay



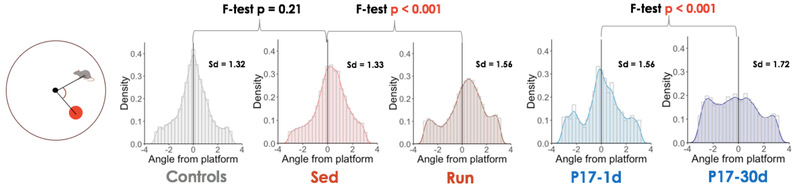

### Traditional Measures

- Runners perform worse than sedentary mice on traditional measures except distance travelled to platform; infant mice perform worse after a 30-day delay




### Angle Distribution

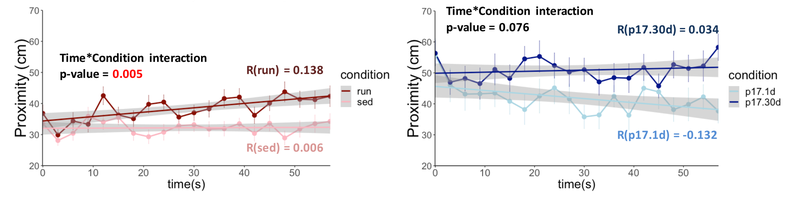
- Sedentary mice **swim within a smaller angle from the platform** than runners; infant mice swim at a larger angle from the platform after a 30-day delay




## Results

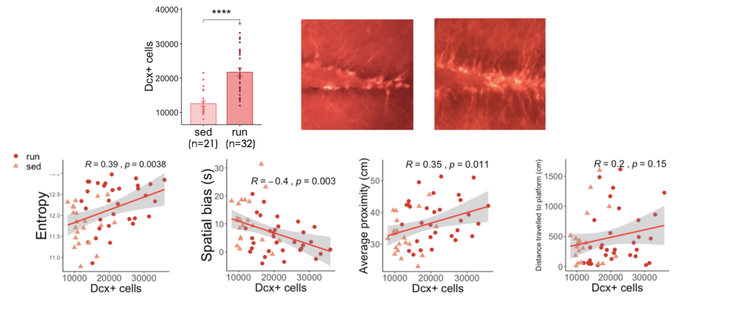
### Proximity vs. Time

- Runners **swim further away from the platform** than sedentary mice; infant mice swim further away from the platform after a 30-day delay




### Neurogenesis and behavior

- Running resulted in a **two-fold increase** in the number of Dcx+ cells in the dentate gyrus; the number of Dcx+ cells is **correlated with worse memory performance** except distance travelled to platform




## Conclusion

1. Increased NG results in **behavioral forgetting** in water maze
2. Increased NG results in **similar behavioral changes** as infantile amnesia
3. The level of NG is **correlated** with behavioral measures of forgetting

Taken together, our data demonstrate that hippocampal NG plays a crucial role in pruning memory precision in a quantitative manner. Increasing hippocampal NG through voluntary running results in behavioral forgetting similar to that observed in infantile amnesia.

### References

1. Akers, Katherine G., et al. "Hippocampal neurogenesis regulates forgetting during adulthood and infancy." *Science*
2. Guskjolen, Axel., et al. "Age-dependent changes in spatial memory retention and flexibility in mice." *Neurobiology of learning and memory*

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