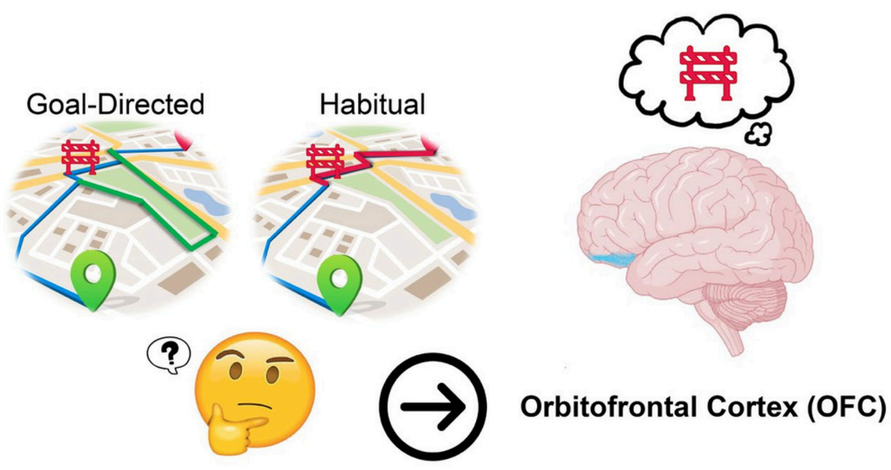
Sophie Yount

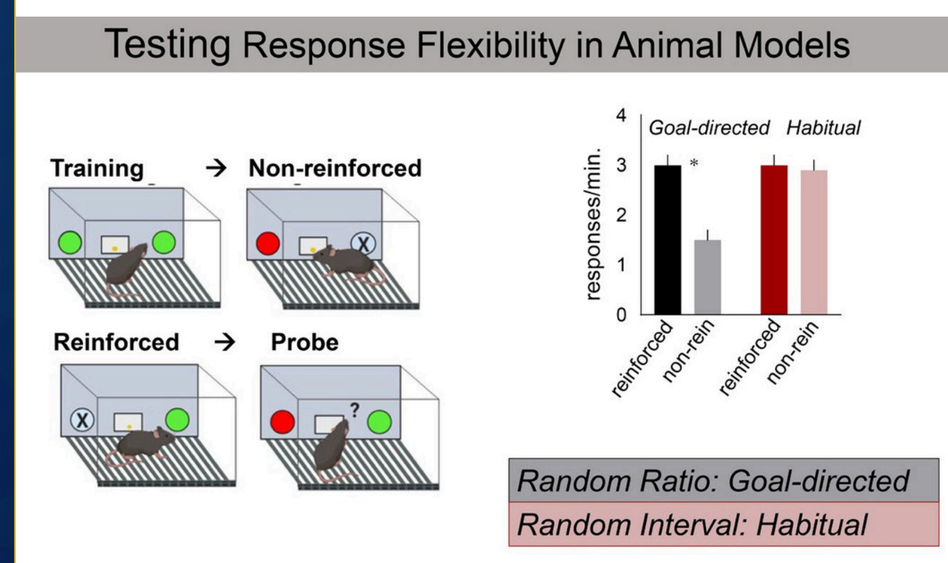
Ph.D. Student, Molecular and Systems Pharmacology
Third Year ARCS Scholar
Bazzel/Lundeen Award

EMORY UNIVERSITY

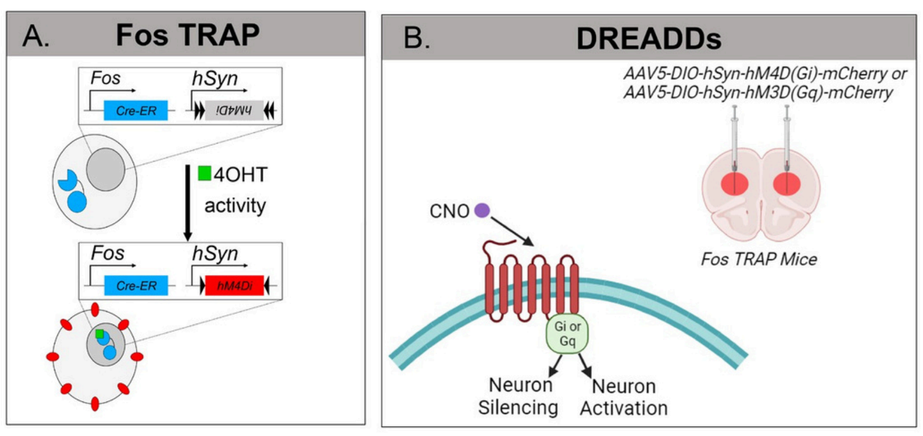
Functionally defining orbitofrontal cortex memory traces



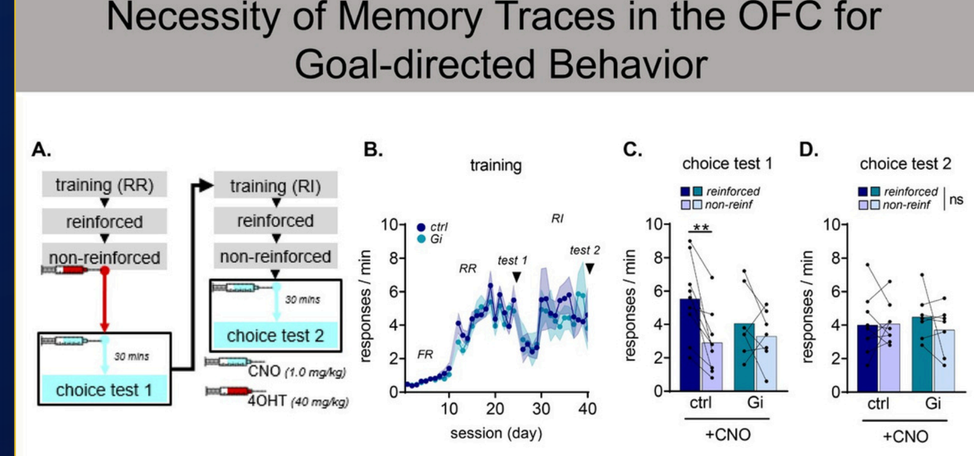
1. The orbitofrontal cortex (OFC) is a large frontal cortical brain region thought to build so-called "task spaces," a catalog of information necessary to develop strategies to obtain desired outcomes. As such, OFC activity is essential for goal-directed decision making (i.e., making a choice based on changes in outcome expectation).



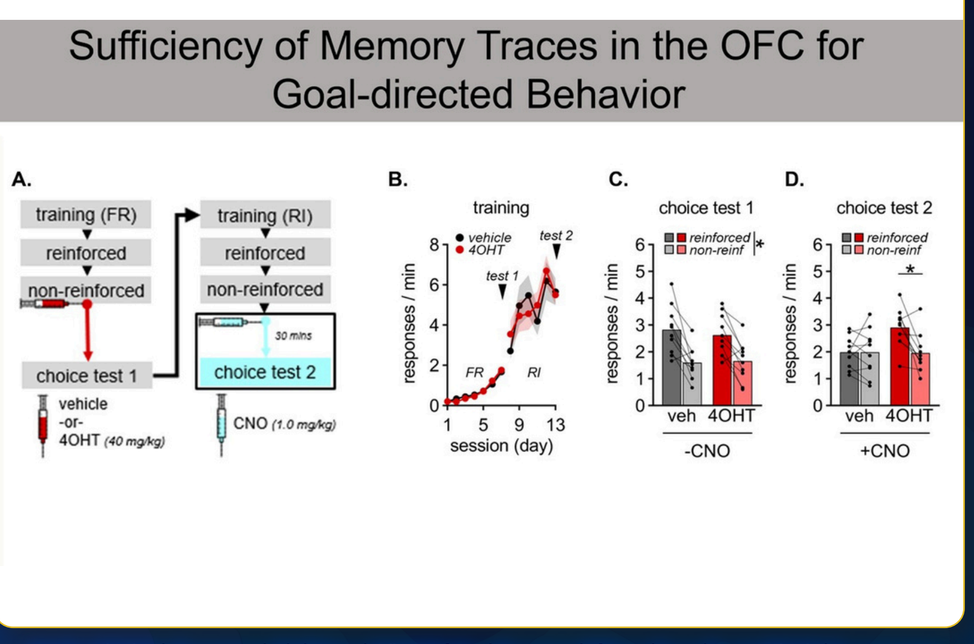
2. We can test goal-directed vs. habitual behavior in animal models using operant conditioning. Different schedules of reinforcement can drive goal-directed vs. habitual behavior. Ratio training induces goal-direct behavior, while interval training induces habitual behavior.



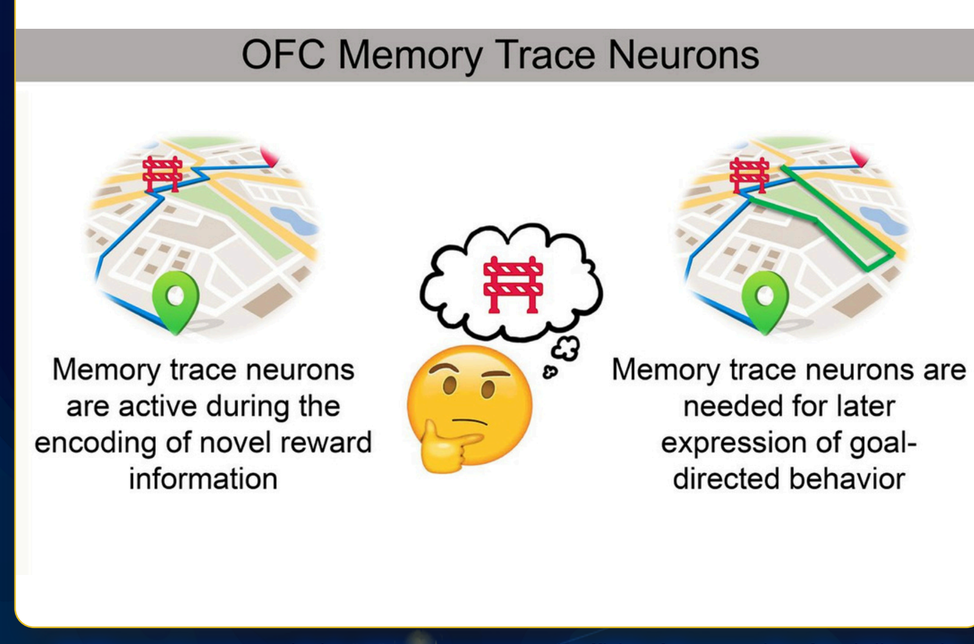
3. We used Fos-Targeted Recombination in Active Populations (TRAP) mutant mice to gain genetic access to neuron ensembles active following instrumental response training schedules that induce either goal-directed behavior. Designer Receptors exclusively activated by Designer Drugs (DREADDs) can be used to control neuron activity. Gi DREADDs silence neurons, while Gq DREADDs activate neurons. Using Fos TRAP mice and DREADDs technology, we can insert controls into neuron populations that are active after distinct experiences to manipulate them at later time points.



4. Fos TRAP mice were administered 4OHT after the non-reinforced session to TRAP the neurons that are encoding new response reward contingencies. Later inhibition of this neuron population disrupts goal-directed behavior but does not affect habitual behavior.



5. Fos TRAP mice were administered 4OHT after the non-reinforced session to TRAP the neurons that are encoding new response reward contingencies. Later stimulation of this neuron population promotes goal-directed behavior despite training to induce habitual behavior.



6. Memory trace neurons in the OFC are necessary and sufficient for expression of goal-directed behavior. Functionally defining OFC neuron populations will advance our understanding of the region's contribution to goal-directed action and improve future efforts to mitigate harmful habitual behaviors.

I would like to thank my advisor, Shannon L. Gourley, and the entire Gourley Lab for their continued support. This work was also supported by the Molecular and Systems Pharmacology Graduate Program, NIH MH117103, NIH training grant T32-GM008602, NSF GRFP Grant No. (1937971), and the Emory Primate Center (NIH P51 011132).

Scholar Awards Celebration
November 15, 2023

SCHOLAR AWARDS CELEBRATION ARCS FOUNDATION ATLANTA

Igniting Innovation in Georgia