Hunger-sensing hypothalamic neurons drive food consumption despite environmental threat

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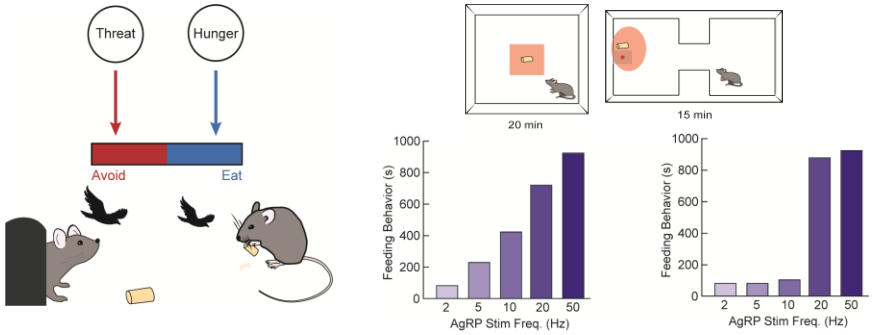
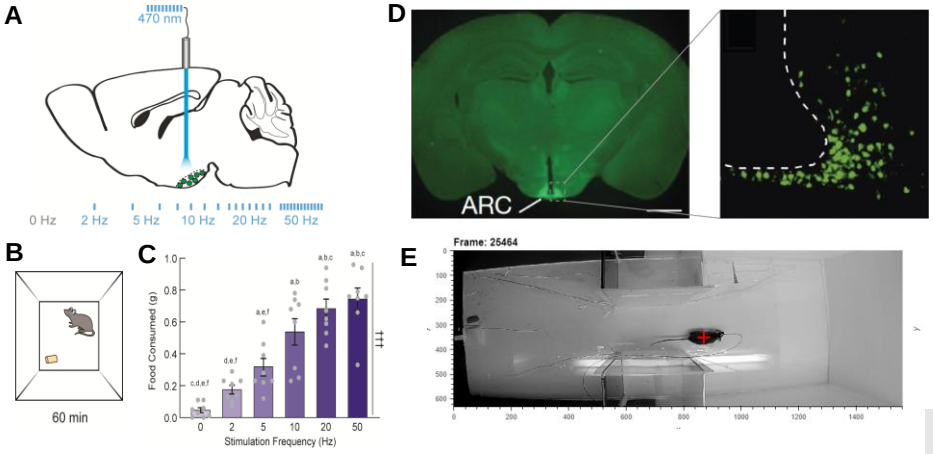
Behavior under competing motivations



How are survival behaviors prioritized when faced with competing motivations?

Hypothesized results: Progressively stimulating hunger-sensing neurons will either result in a gradual increase in feeding behavior despite threat, or there will be an all-or-nothing threshold at which hunger fully overcomes competing threat.

Optogenetically activating "hunger" neurons and analyzing mouse behavior



(**A**) Optogenetic strategy for Agouti-related peptide (AgRP)-expressing neuron stimulation: a Cre-dependent channelrhodopsin is expressed in AgRP neurons (green) in the arcuate nucleus and a fiber optic is implanted over the AgRP neurons. Blue light is pulsed through the fiber optic to stimulate AgRP neurons at variable frequencies. (**B**) Feeding assay: Mice receive AgRP stimulation for 60 min in a chamber with free access to food. (**C**) Food consumption in the feeding assay across stimulation frequencies. †††Repeated measures one-way ANOVA, $p < 0.001$. [a-f]Holm-Sidak multiple comparisons, $p < 0.05$ comparison to 0 Hz (a) through 50 Hz (f). (**D**) Channelrhodopsin expression in AgRP neurons (Betley et al. (2013) & Betley et al. (2015)

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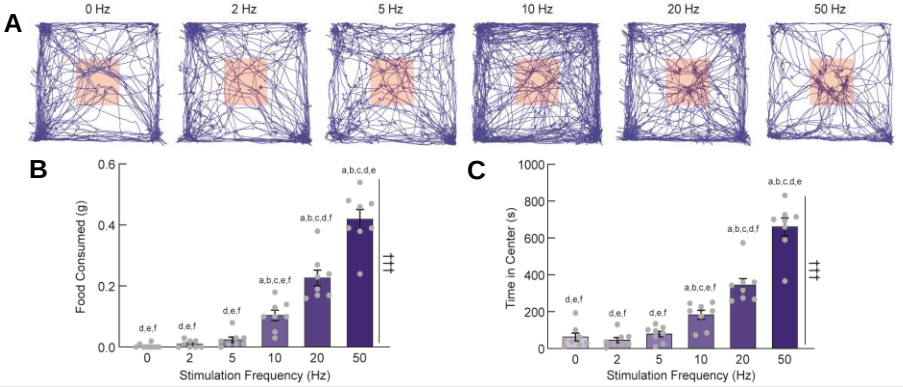
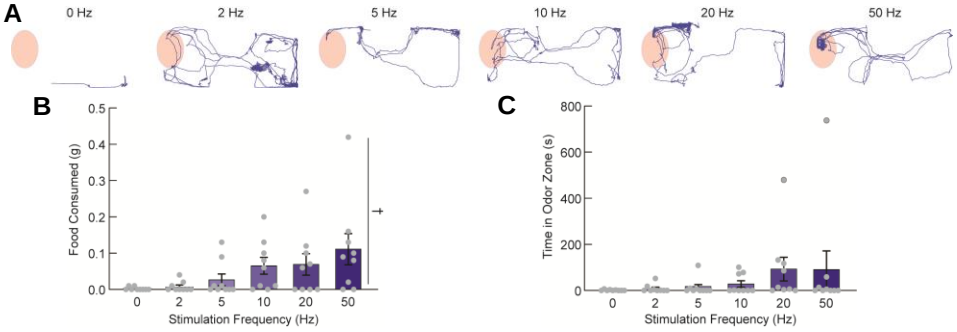
Open field assay



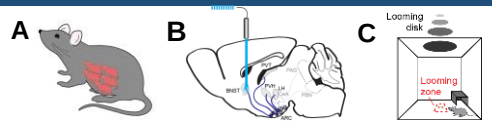
Open field assay: mice are placed in a large open chamber in which food is taped to the center. Food consumption and time inthe center (red area) are quantified. (**A**) Behavior trajectories across stimulation frequencies for a representative mouse. (**B-C**) Food consumption (**B**) and time in center (**C**) across stimulation frequencies. †††Repeated measures one-way ANOVA, $p < 0.001$. [a-f]Holm-Sidak multiple comparisons, $p < 0.05$ comparison to 0 Hz (a) through 50 Hz (f).

Predator odor assay



Predator odor assay: mice are placed in a large two-chamber apparatus in which food is glued directly adjacent to the predator odor trimethylthiazoline (TMT). Food consumption and time spent in the odor zone (red area) are quantified. (**A**) Behavior trajectories across stimulation frequencies for a representative mouse. (**B-C**) Food consumption (**B**) and time in odor zone (**C**) across stimulation frequencies. †Repeated measures one-way ANOVA, $p < 0.05$

Future directions



Future directions will test (**A**) the impact of pregnancy and adolescence on the prioritization of hunger and fear, (**B**) the role of individual AgRP axonal projections in driving these behaviors, and (**C**) will utilize a visual threat stimulus to test if these processes hold across multiple modalities of threat.