

Sleep Deprivation Alters Food Odor Preference in *Drosophila*



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Background

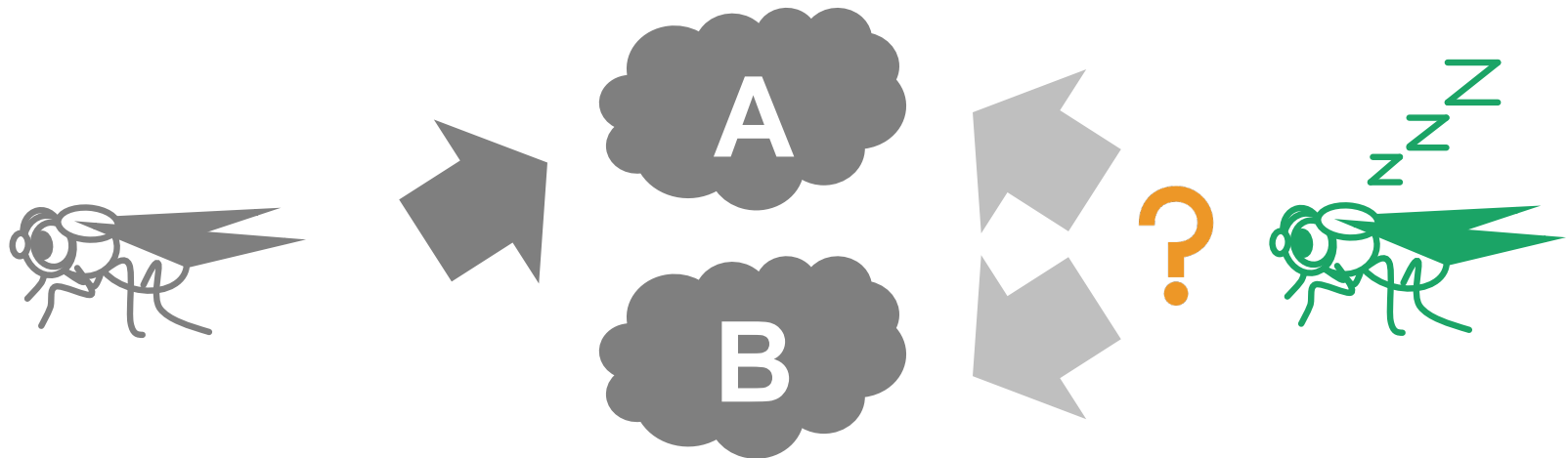
Function of Sleep

- **Maintenance of cognitive abilities** (Stickgold 2005 *Nature*)
 - **In *Drosophila*, Olfactory memory retention**
(classical conditioning paradigm) (Donlea 2019 *Curr Opin Neurobiol*, Li et al. 2009 *Sleep*)



Question1

**Does sleep deprivation alter
preferences of food-related odors
in *Drosophila melanogaster* adults?**



Method overview

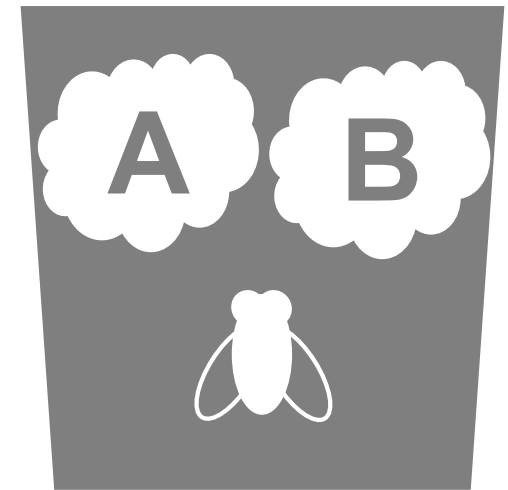
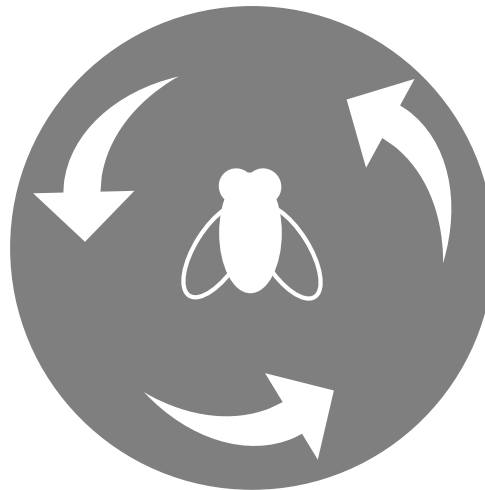
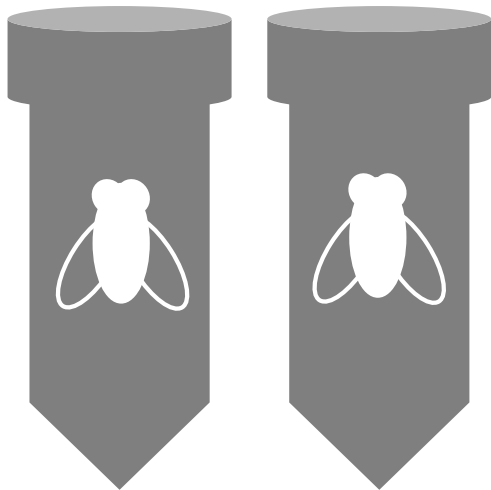
Culture



**Sleep
deprivation**

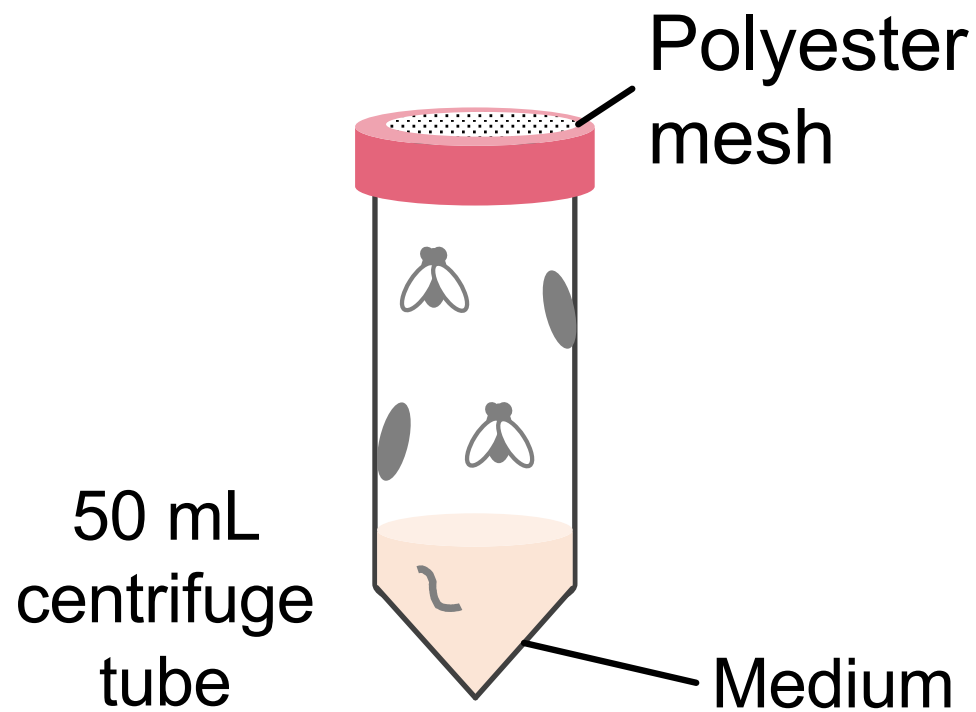
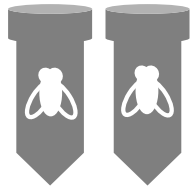


**Preference
experiment**



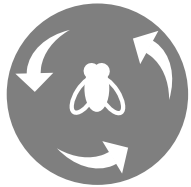
Materials

Insect rearing

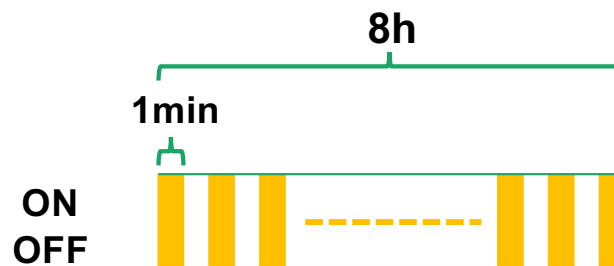
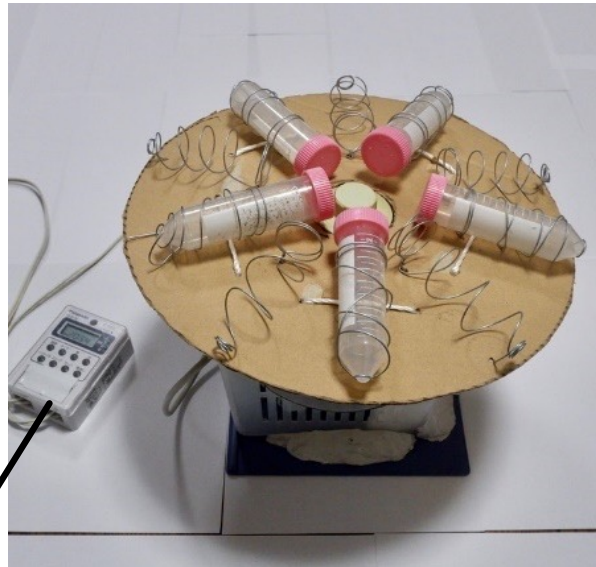


Method

Centrifugal equipment

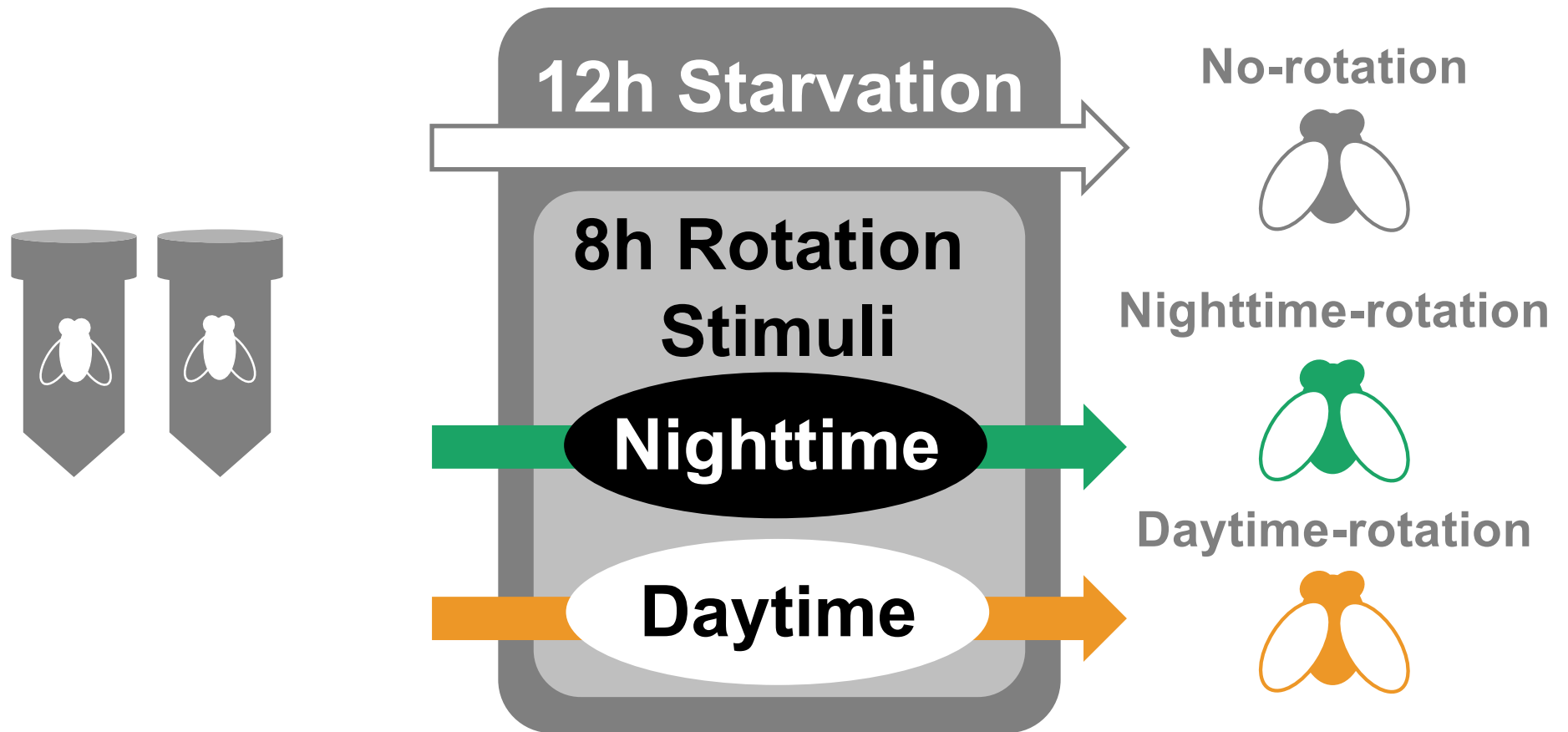


On/Off timer



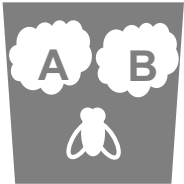
Method

Sleep deprivation

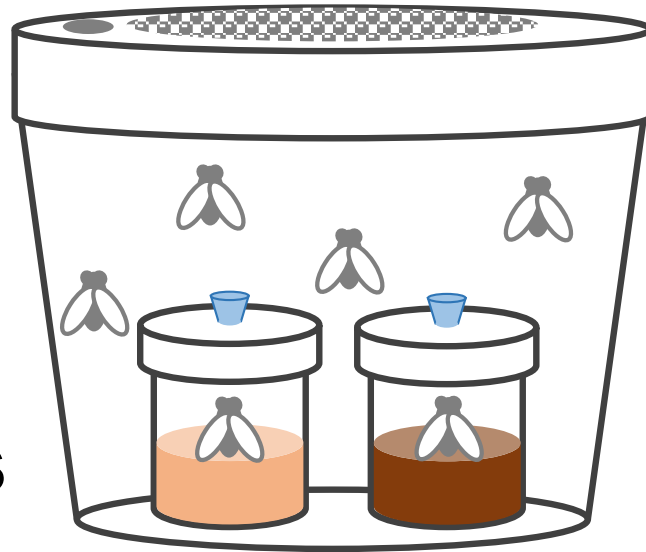


Method

Experiment box



50 flies



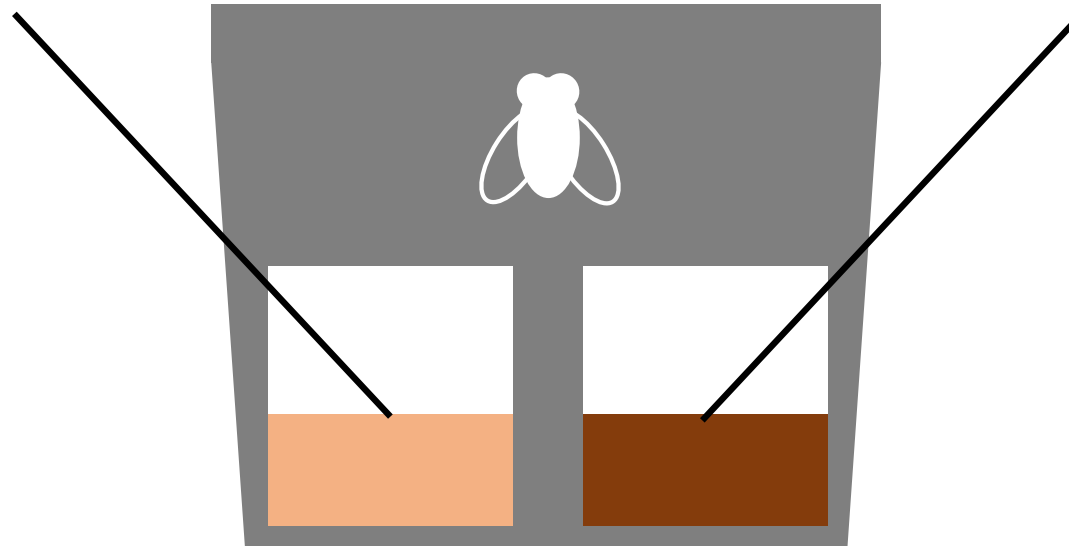
Exp. 1

Odor preference

ACV

vs

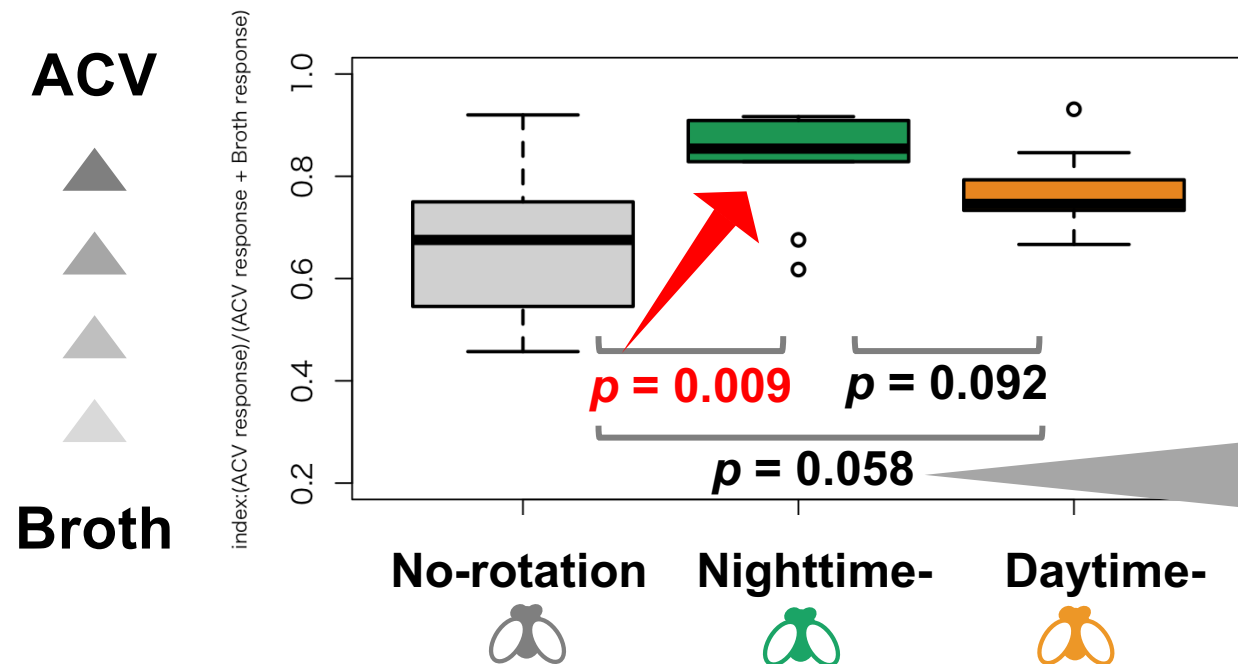
Broth



Result 1

Odor preference

Nighttime-rotated flies showed **increased preference for ACV to Broth**



No difference
between daytime- and
no –rotation flies

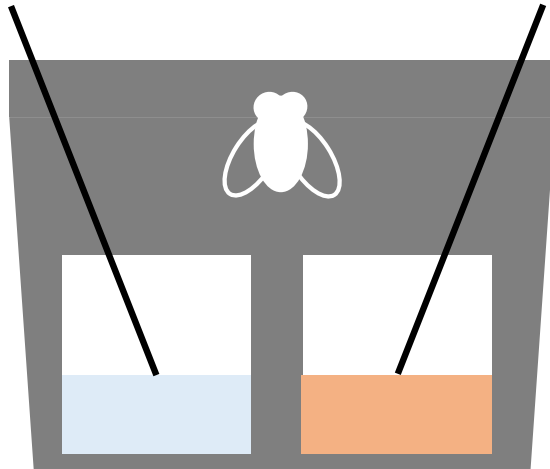


Effect of Rotation
itself was not shown

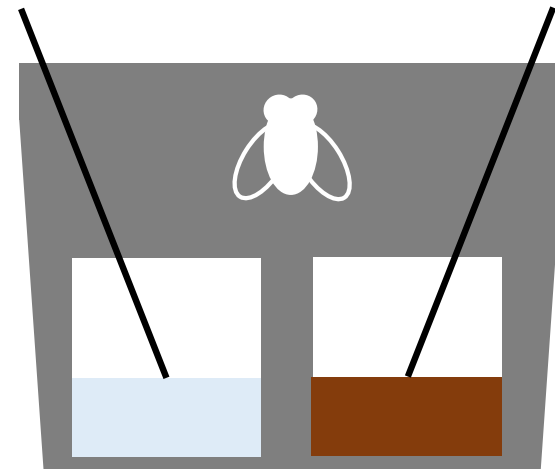
Exp.2

Response to a single odor

Water vs ACV



Water vs Broth



Result 2

Response to a single odor

Nighttime-rotated flies

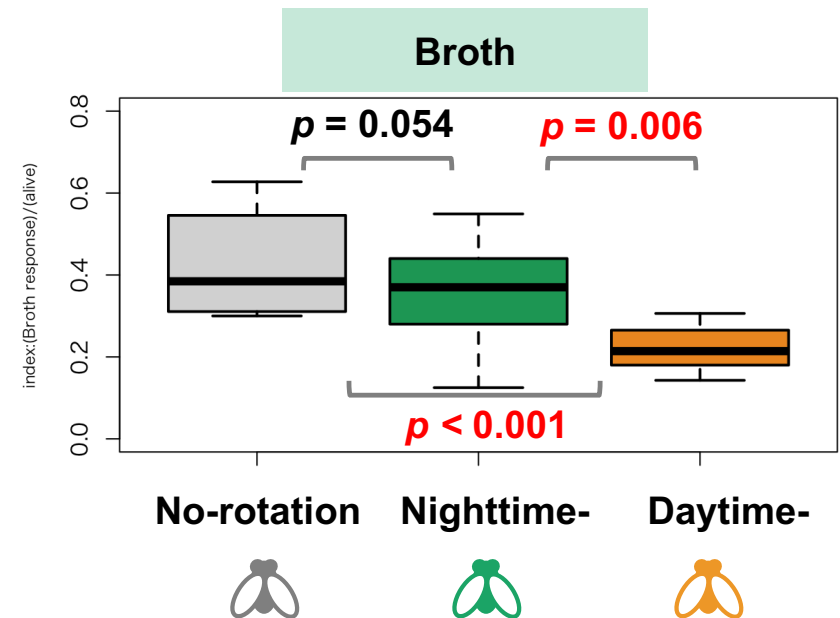
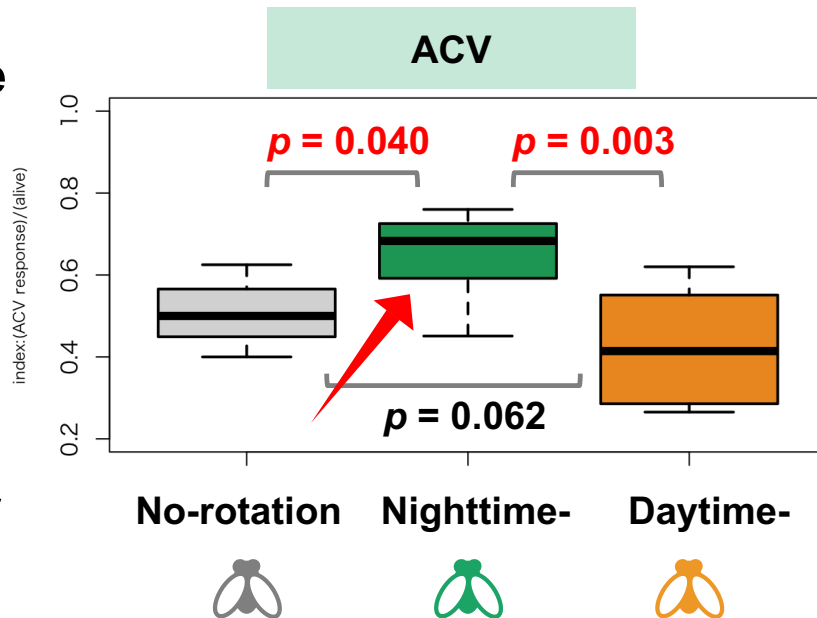
ACV: **Increase**

Broth: **No or negative effect**

Single
Odor



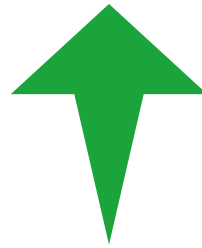
Water



Conclusion1

Does sleep deprivation alter preferences of food-related odors in *Drosophila melanogaster* adults?

Sleep has a role in food odor preference and their actual foraging behavior



changes:

ACV  Broth

ACV  Broth 

Question2

Why the preference of food-related odors changes?

Background

Drosophila prefers odor of rearing environment
(Jaenike 1983)

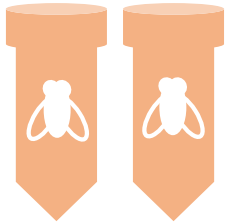
**Sleep-deprived flies prefer
an odor of rearing environment?**



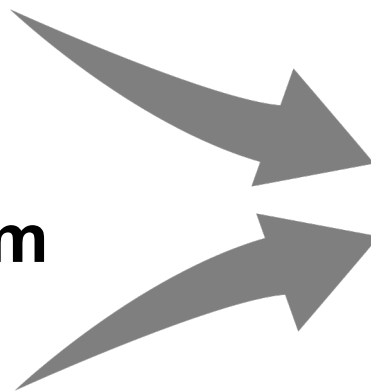
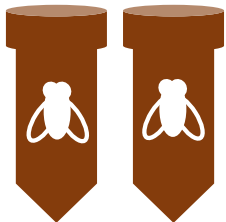
Exp.3

Response to an odor of rearing environment

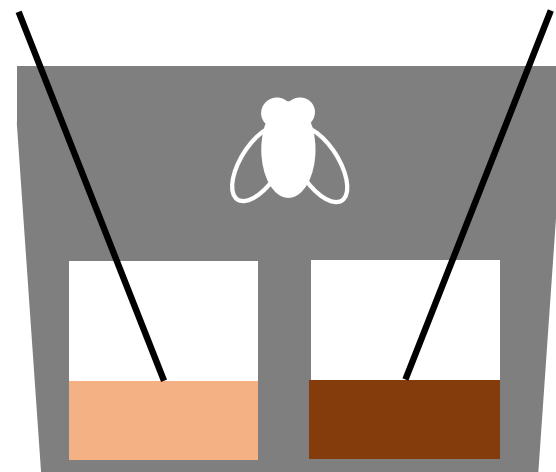
ACV 20% medium



Broth 10% medium



ACV vs Broth



Exp.3

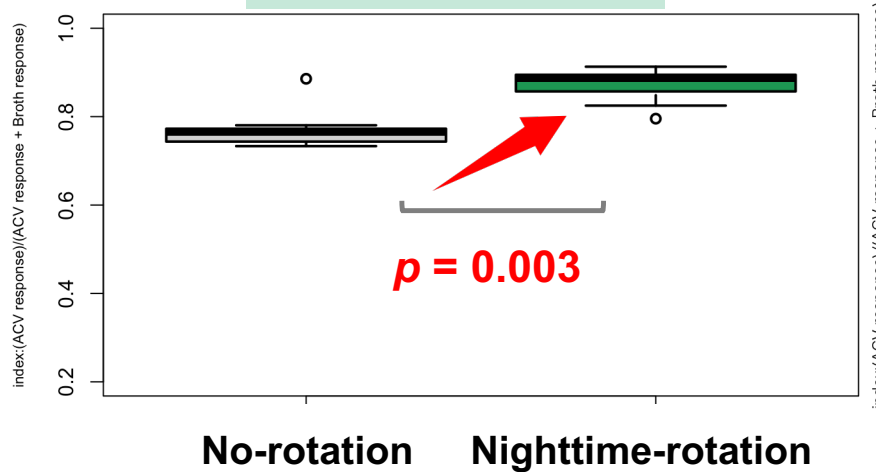
Response to an odor of rearing environment

Nighttime-rotated flies

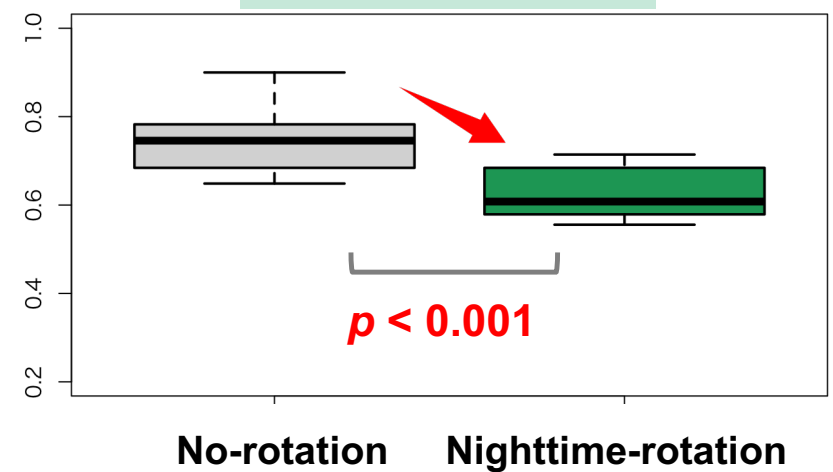
ACV-medium-flies ► **Increased response to ACV**
Broth-medium-flies ► **Increased response to Broth**

ACV

ACV-medium-flies



Broth-medium-flies



Broth

Conclusion2

Why the preference of food-related odors changes?

ACV-medium-flies : ACV



Broth-medium-flies : Broth



Sleep-deprived flies preferred odors of rearing environment!

In a sleep-disturbed state,
Flies may try to stay in the adult environment to avoid the risk.

Thank you for watching !

Future challenge

Neural basis of the preference for the novel odors in *Drosophila*

- Memory deficits concerning novel objects and events are early symptoms of Alzheimer's disease (Lee et al. 2003 *Eur. J. Neurosci.* 18:1660–1670).
- The symptoms can be accelerated by sleep loss through the accumulation of amyloid- β peptide (A β) in the patient's brain (Ju et al. 2014 *Nat. Rev. Neurol.* 10:115–119; Tabuchi et al. 2015 *Curr. Biol.* 25:702–712).
- Sleep enhancement reversed memory impairment by abnormal processing of A β in *Drosophila* and humans (Dissel et al. 2017 *Neurobiol. Sleep Circadian Rhythm.* 2:15–26).

⇒ Understanding of the the neural bases of the current study can provide a useful approach for human neural disease researches.

Future challenge

1. Quantitative evaluation of the sleep deprivation
2. The role of sleep in host selection behavior of *Drosophila*
3. Neural basis of the preference for the novel odors in *Drosophila*
 - Sleep enhancement reversed memory impairment by abnormal processing of Amyloid β peptide in *Drosophila* and humans (Dissel et al. 2017 *Neurobiol. Sleep Circadian Rhythm.* 2:15–26).
4. Relationships to other stressors and factors of other daily habits