

ARC (Activity Recording CAFE): A High-Throughput Behavioral Phenomic Assessment Using Machine Vision

Evaluating Phenomics in *Drosophila melanogaster*

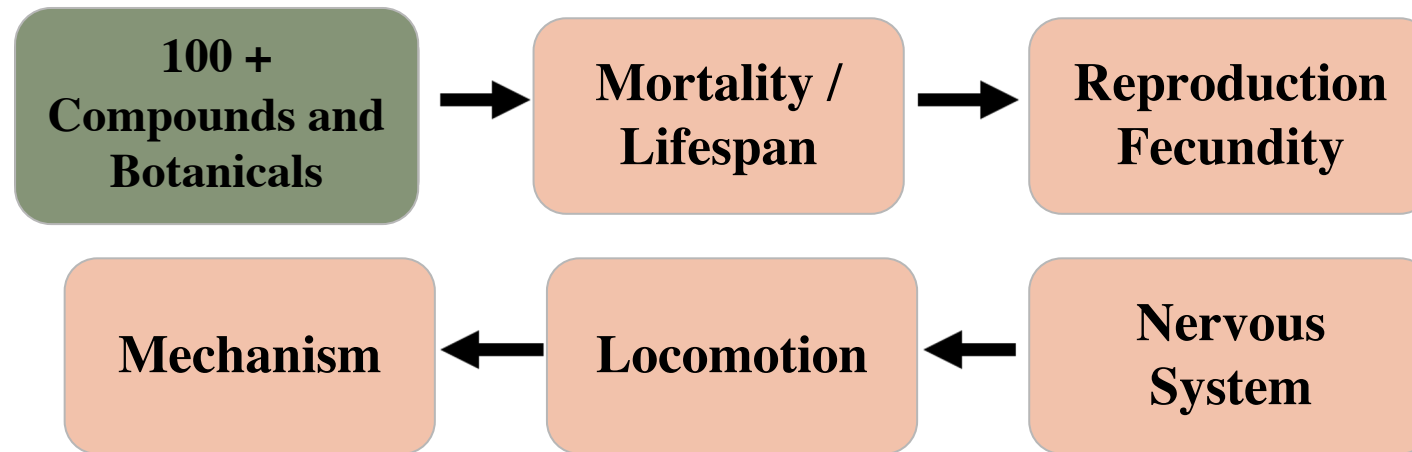
Jafari Lab:

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and Dr. Mahtab Jafari*



Screening Lifespan and Healthspan Algorithm

2005-present



Rhodiola rosea

Curcumin



Rosa damascena

Cinnamon

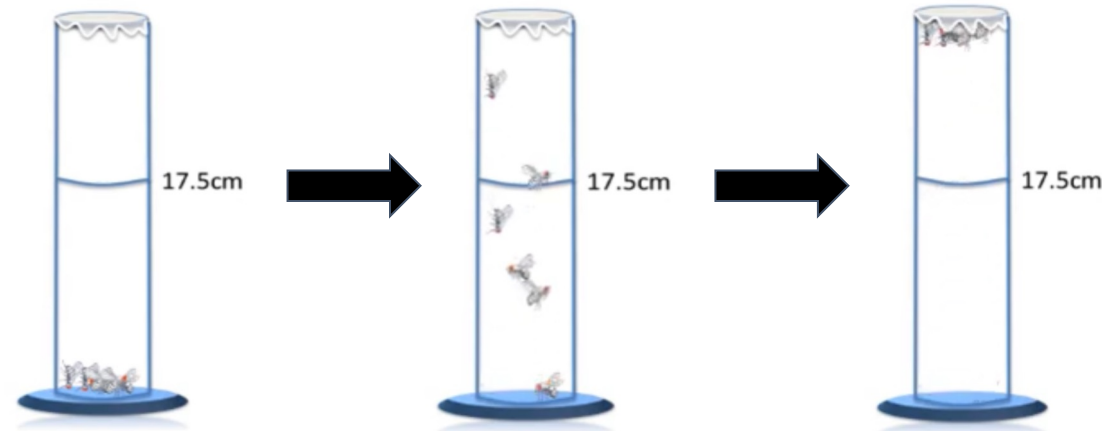


Angelica keiskei

Challenges with Phenomic Assays

Labor Intensive and Not High Throughput

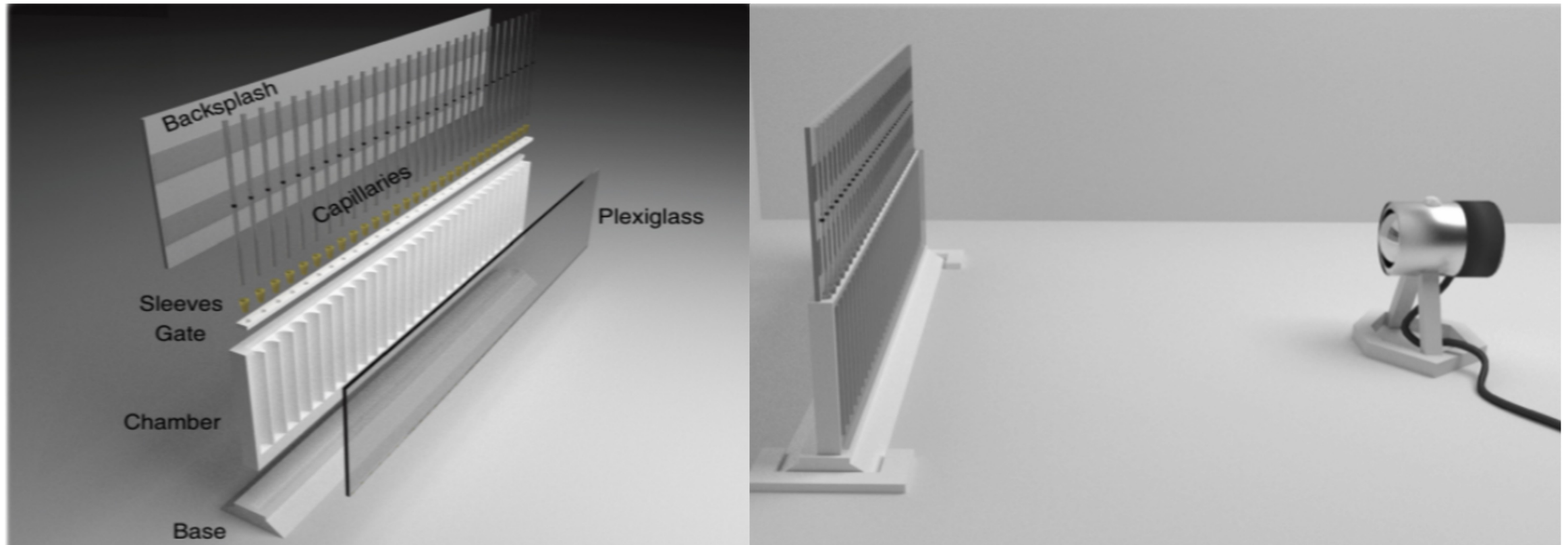
Locomotion Assay



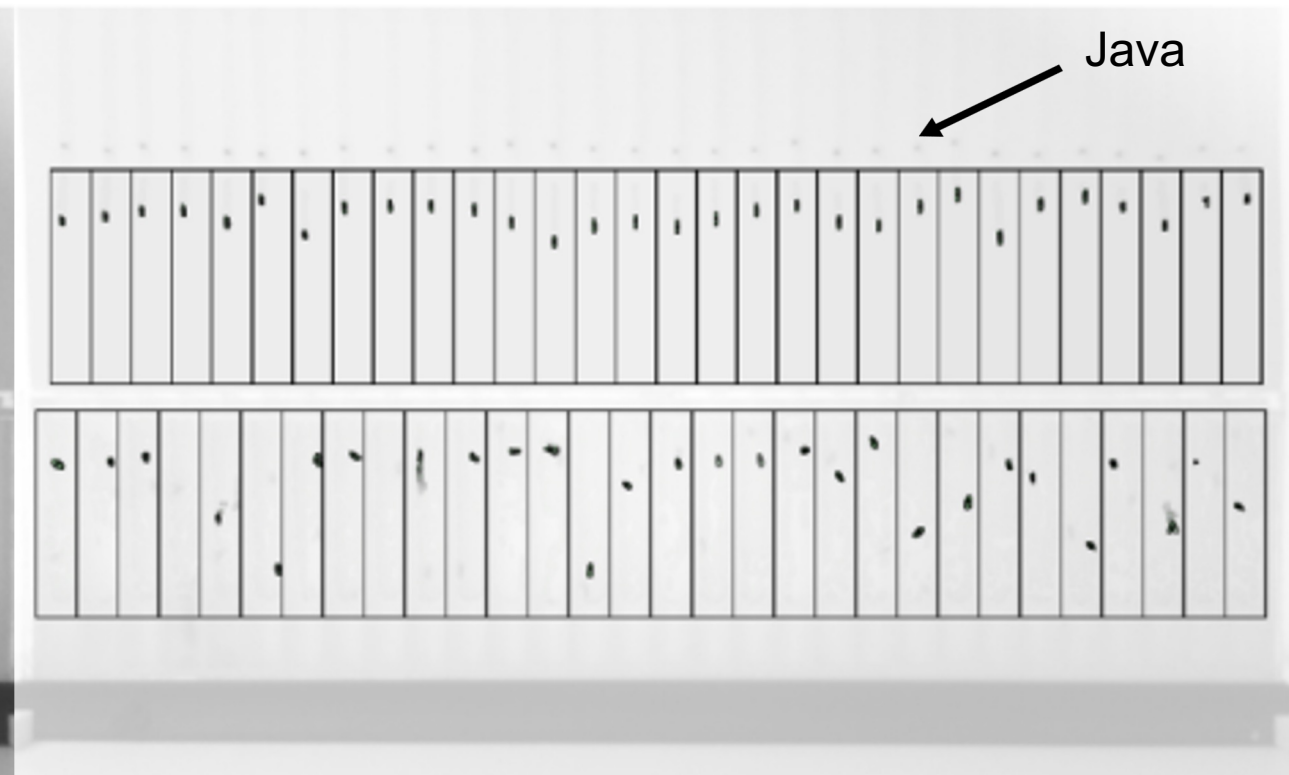
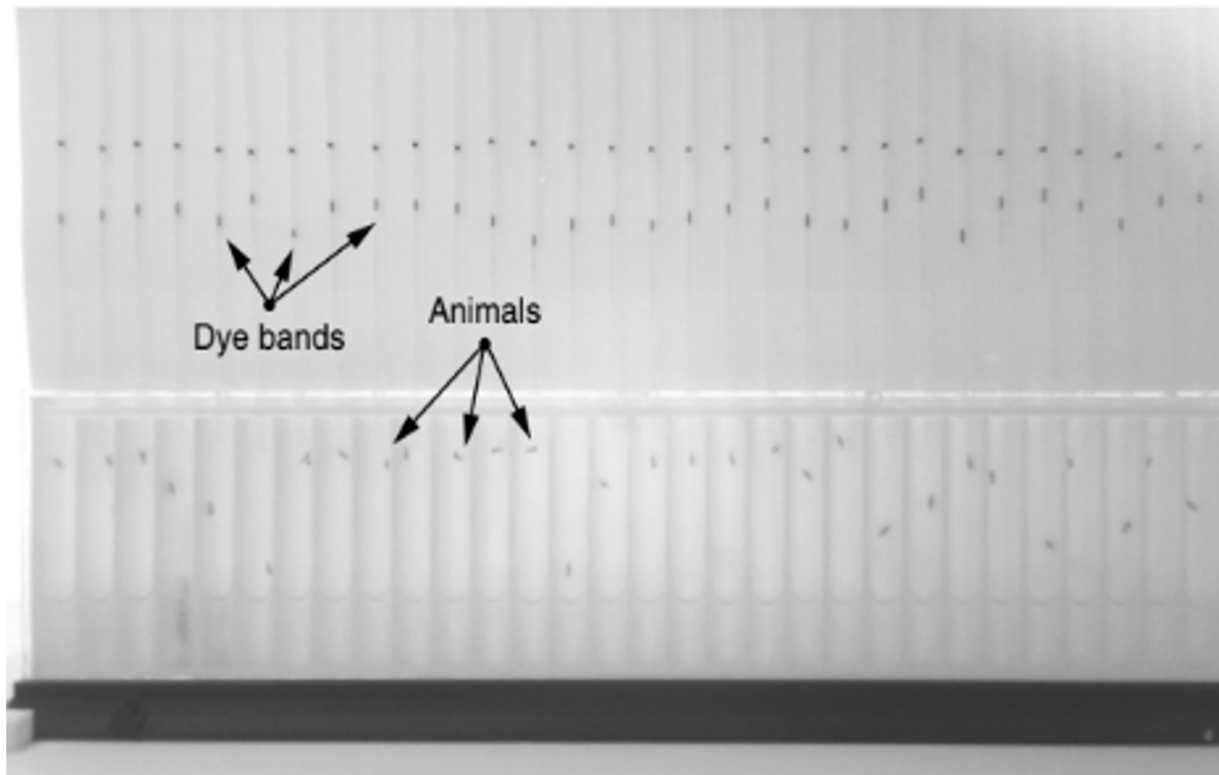
ARC: Automated System

- ❖ **How does this system work?**
 - High-resolution machine vision tracks
 - *Drosophila* location and movement
 - food meniscus level
- ❖ **Advantages**
 - replicable and ↓ human error
 - measures multiple behaviors in one assay

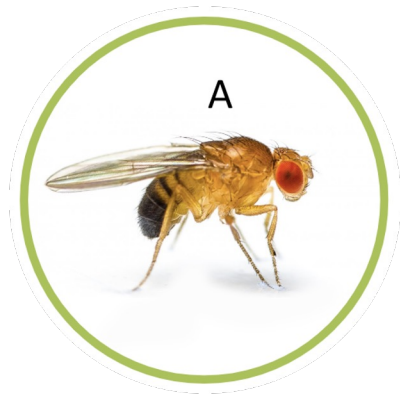
ARC Set-up



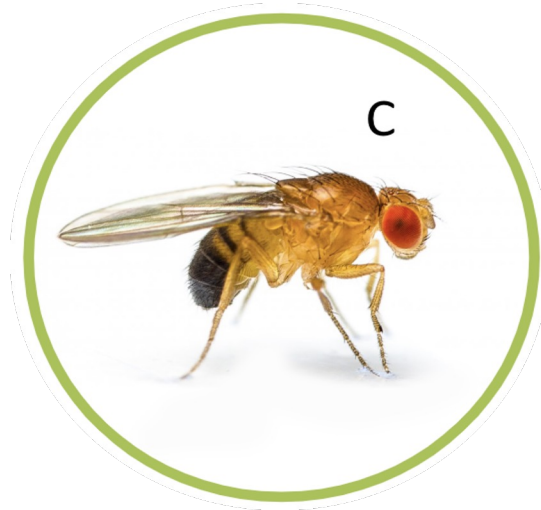
Live Data Collection



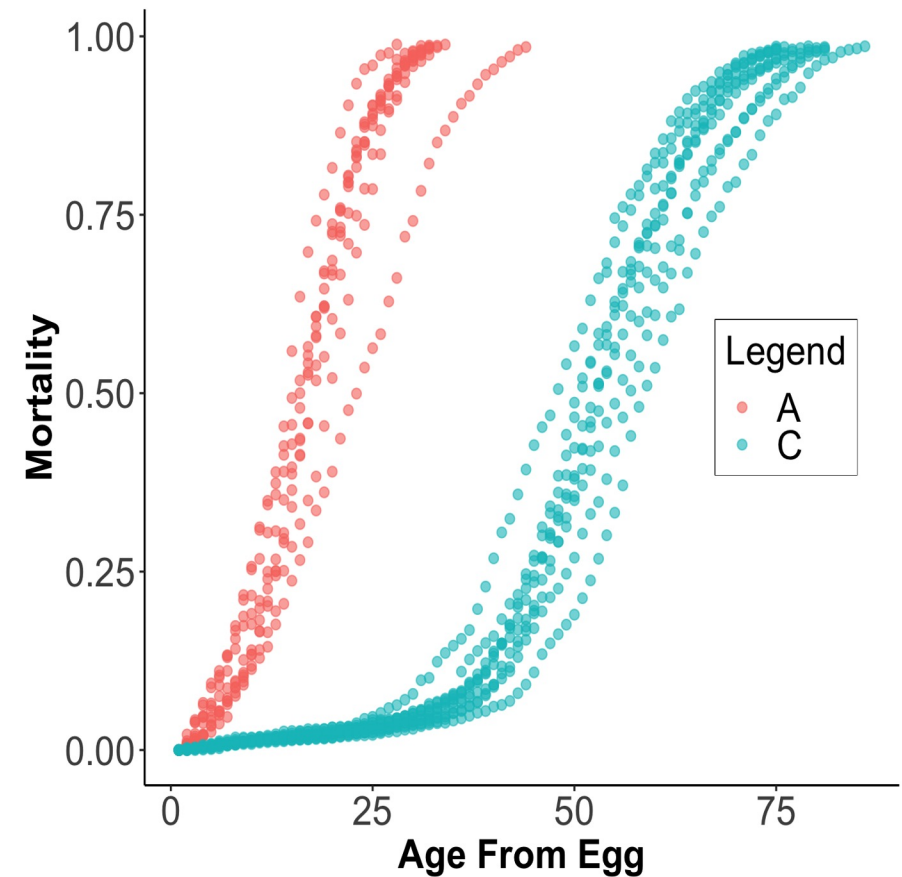
Drosophila Populations Tested



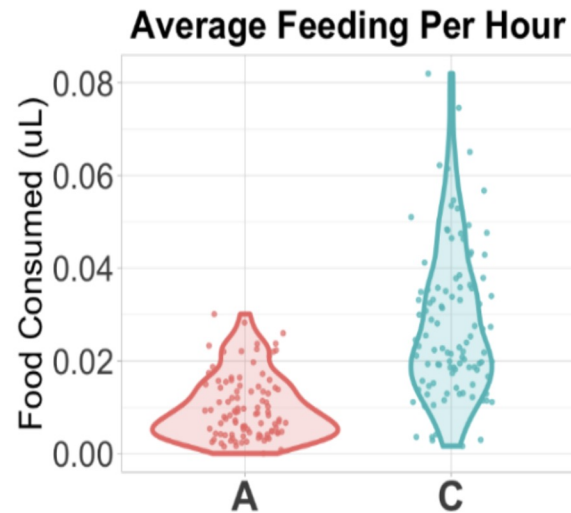
Mean Lifespan:
Short-lived
31 Days



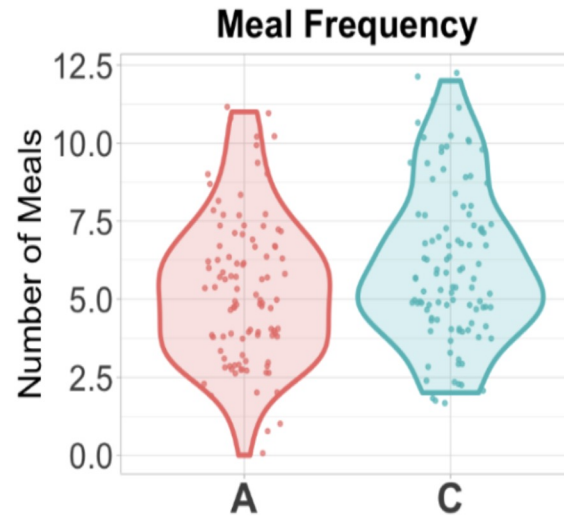
Mean Lifespan:
Long-lived
66 Days



Results: Proof of Concept

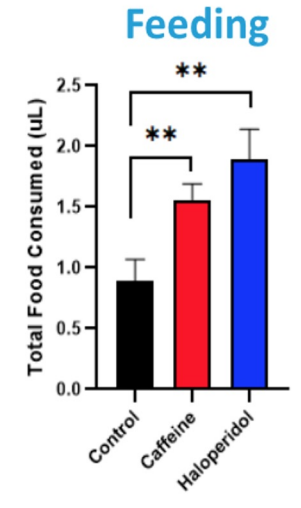
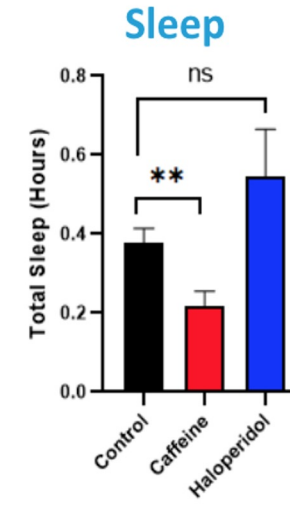
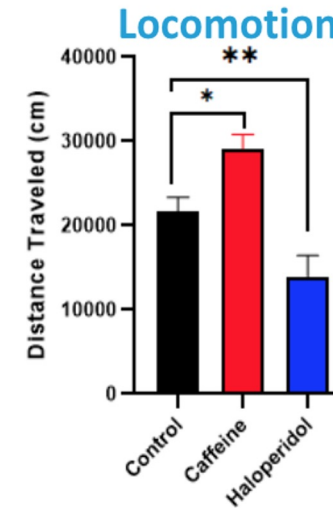


p-value= 0.013



p-value=0.194

Differences in feeding



Caffeine (a stimulant) and haloperidol (a sedative) induced differences in locomotion, sleep and feeding.

Takeaways & Future Direction

ARC can be used as a platform for pharmaceuticals and natural products phenomic screening in drug discovery.

Optimizing ARC

- Testing additional *Drosophila* populations
- Testing pharmaceuticals
- High throughput phenomics in multi-omics (phenomics, transcriptomics, and metabolomics) natural products drug discovery

Selected References

- Grant A. Rutledge, Howard J. Phang, Michael N. Le, Linsey Bui, Michael R. Rose, Laurence D. Mueller, and Mahtab Jafari. Diet and Botanical Supplementation: Combination Therapy for Healthspan Improvement?. *Rejuvenation Research*. Oct 2021. 331-344.
<http://doi.org/10.1089/rej.2020.2361>
- Molly K. Burke, Thomas T. Barter, Larry G. Cabral, James N. Kezos, Mark A. Phillips...Michael R. Rose. (2016), Rapid divergence and convergence of life-history in experimentally evolved *Drosophila melanogaster*, *Evolution*, 70 (9), 2085–2098.
- Murphy KR, Park JH, Huber R, Ja WW. Simultaneous measurement of sleep and feeding in individual *Drosophila*. *Nat Protoc*. 2017 Nov;12(11):2355-2366. doi: 10.1038/nprot.2017.096. Epub 2017 Oct 12. PMID: 29022943; PMCID: PMC5812262.

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