PHYSIOLOGICAL, BEHAVIORAL, HEALTH-SPAN, AND LIFE-SPAN SERVICES ARE OFFERED USING THE DROSOPHILA MODELS BY COMPARATIVE ORGANISMAL ENERGETIC CORE

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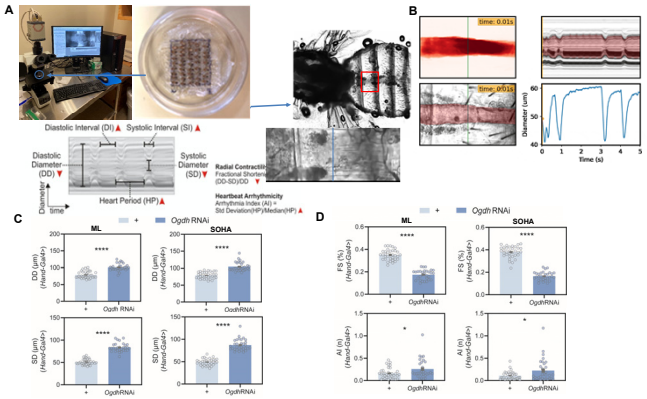
Introduction

Health-span and Life-span Parameters

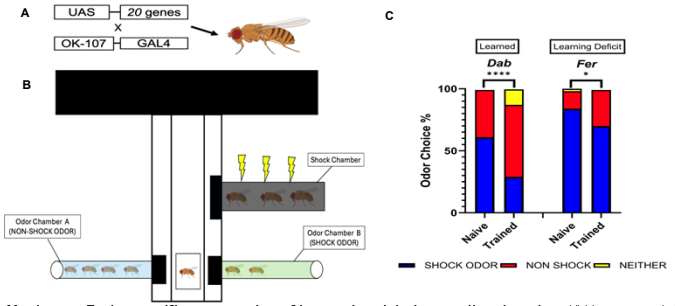
- Cardiac Physiological Changes with Aging & Metabolism
- Locomotor Alteration with Aging & Metabolism
- Aging & Metabolism related Muscle Performance
- Circadian Activity and Sleep-Related Variations with Aging & Metabolism
- Memory Impairments Related to Declines in Aging & Metabolism
- Gut Integrity Related Changes with Aging & Metabolism
- Lifespan (viability)
- Machine Learning-Based and New Imaging-Based Methodologies
- Interventions: Time-restricted Feeding and Exercise

Cardiac Physiology



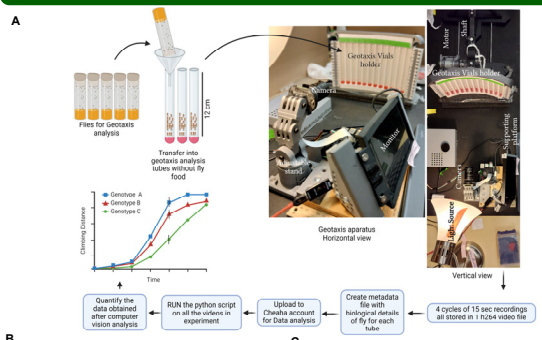
Comparative analysis of heart physiology using Semi-Optical Heart Analysis (SOHA) and Machine Learning (ML). A-B) Outline of SOHA[1] and M[2] and comparative analyses of cardiac parameters for the wild-type and *Ogdh* knock-down[2].

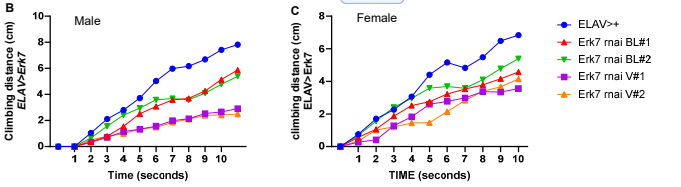
Memory Impairment



Mushroom Body -specific suppression of insomnia-related gene alters learning. (A) Experimental scheme depicting genetic crossing with a mushroom body-specific driver. (B) Experimental scheme of olfaction T maze. (C) Odor choice % from 3-week-old female *Drosophila* with mushroom body-specific knockdown of and insomnia-related genes.

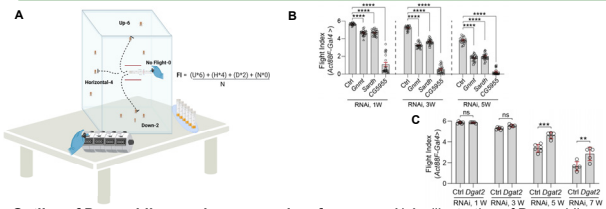
Locomotor Performance (Geotaxis)





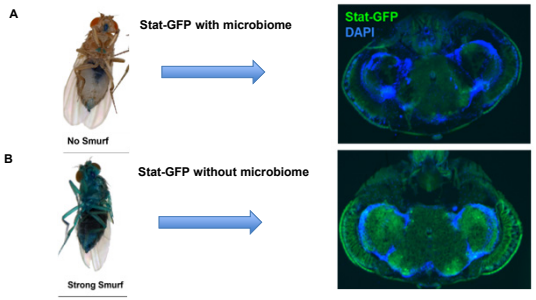
Integrated Device Design and Machine Learning-Based Behavioral Analysis. A) The camera connected to a Raspberry Pi records the experiment using a Python script followed by python analysis processes video frames for fly detection. B-C) Pan neuronal knockdown of the *Erk7* gene alters motor performance in 3 weeks male and female.

Muscle Performance (Flight)



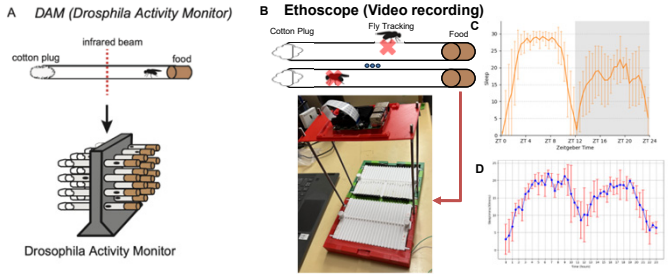
Outline of Drosophila muscle assay and performance. A) An illustration of Drosophila muscle performance. B-C) Muscle performance is represented with Flight index for genes associated with muscle metabolic regulation and delaying muscle aging[3-4].

Gut Integrity (Smurf Assay)



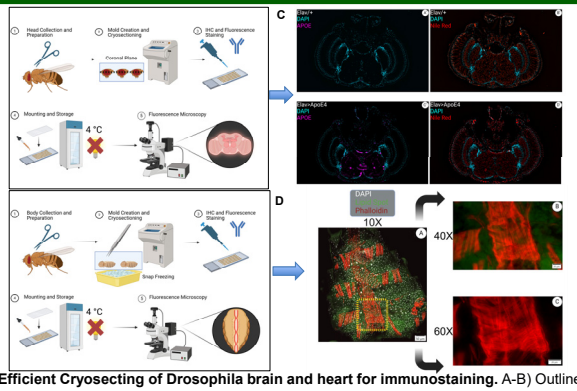
Removing of microbiome leads to compromised gut integrity and enhanced inflammation. A) An image of Drosophila expressing Stat-GFP showed gut integrity (no smurf) and an image of the fly brain section. B) An image of the same fly after removing the microbiome (axenic fly), which showed compromised gut integrity and enhanced inflammation in the brain.

Sleep and Circadian Activity



One-click analysis of DAM and Ethoscope data using Machine Learning. A-B) An illustration of Drosophila Sleep/Activity using DAM and Ethoscope. C-D) 30 min Sleep bin of wild-type flies using machine learning (unpublished data).

Development of New Technologies



Efficient Cryosecting of Drosophila brain and heart for immunostaining. A-B) Outline of the step for brain and heart cryostaining procedure and staining. C-D) Representative brain and heart images[5-6].

Conclusions

- We offer services using Drosophila models of cardiac, muscle, neuronal, and circadian rhythms-related research during aging, including environmental and genetic factors that affect aging.
- The automated Devices enable high-throughput, standardized data collection with minimal human error.

References

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6. Watson et al. JOVE 2024 (Accepted)

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