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RESEARCH NEWS STORY

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Unlocking the Genetic Basis of Animal Behavior Using Fruit Flies

A comprehensive dataset captures individual and group behaviors across genetically diverse strains of flies for decoding animals' behavioral patterns

Understanding how genes influence complex behaviors remains one of biology's most fascinating challenges. Now, however, in a recent study, researchers from Japan compiled a comprehensive dataset documenting the behaviors of over 30,000 fruit flies across 105 genetically distinct strains. This valuable resource captures individual and group behaviors under various conditions, providing unparalleled insights into the genetic foundations of behavior that could ultimately enable a better understanding of human health conditions and ecology.

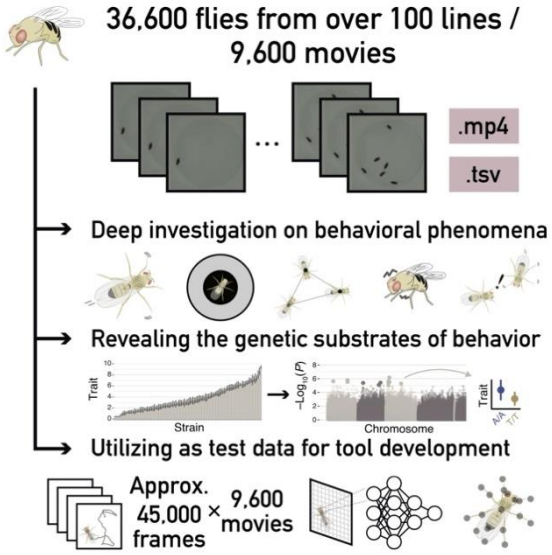

Image title: Researchers from Japan create a large behavioral dataset for fruit flies
Image caption: The study provides a comprehensive behavioral dataset of *Drosophila melanogaster*, categorized by genetic background, sex, and social context (isolated or in groups). Beyond enabling detailed analyses of behavioral mechanisms and genetic factors underlying locomotion, fear responses, and social interactions, this dataset provides a unique opportunity to examine individual behavioral variability within genetically identical flies, as well as to develop tracking tools.
Image credit: Assistant Professor Daiki Sato from Chiba University, Japan.
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Years of research in the field of genetics have offered interesting insights spanning the origins and development of heredity and traits, offering valuable information on its influence on every aspect of life, right from eye color to susceptibility to certain diseases. But how do our genes influence the way we act, react to threats, and interact with others? Despite the recent advances in genetics, understanding the genetic foundations of behavior remains one of biology's most fascinating challenges. Scientists have long turned to simpler organisms to help answer these questions, with the humble fruit fly emerging as an ideal candidate. These tiny insects share many genes with humans that are linked to various diseases, making them valuable models for understanding the relationship between genetics and behavior. Moreover, their short lifespan, ability to reproduce quickly, and produce numerous offsprings also allows researchers to conduct large-scale studies in a cost-effective manner.

However, creating meaningful connections between genes and behavior requires extensive, high-quality data, as this data needs to capture a wide range of behavioral patterns under various conditions. Against this backdrop, a research team led by Assistant Professor Daiki Sato, along with Mr. Takahira Okuyama and Associate Professor Yuma Takahashi from Chiba University, Japan, has now compiled an unprecedented behavioral dataset of *Drosophila melanogaster*. Their study, published in Volume 12 of *Scientific Data* on March 7, 2025, documents the behaviors of over 30,000 individual *D. melanogaster,* commonly known as fruit fly, across 105 genetically distinct strains, including 104 wild-type strains and one visually impaired mutant.

The research team meticulously recorded the flies' movements during 15-minute sessions in a confined space. The sessions included periods of normalcy and simulated threats in the form of looming stimuli—expanding dark circles that mimic approaching predators. Notably, the experiments were conducted with both isolated flies and flies in groups, allowing researchers to examine not only individual behaviors but also social interactions. In a particularly innovative approach, the team created mixed groups with flies from different genetic strains to investigate how genetic diversity might affect group dynamics.

Using sophisticated tracking software, the researchers quantified various behavioral metrics, including movement speed, time spent in the center of the arena (an indicator of boldness), distance to nearest neighbors (a measure of sociality and locomotor activity), and freezing duration (an indicator of the fear response) after exposure to threats. The resulting dataset provides a comprehensive catalog of behavioral responses categorized by genetic background, sex, and social context. Elaborating further, Dr. Sato says, "*By documenting the variation in behaviors across different genetic and environmental contexts, we can expand our understanding of how genes, social environment, and individuality shape animal behavior*."

What makes this dataset especially valuable is its ability to support genome-wide association studies, which can help identify specific genetic variations associated with particular behavioral traits. Additionally, the inclusion of genetically identical flies enables researchers to examine behavioral variations arising from the same genetic background, also offering insights into the influence of non-genetic factors on behavior.

Worth noting, the implications of this research extend far beyond the domain of fruit flies. The methodology and findings used in this study could potentially inform studies of more

complex animals, including humans, and contribute to our understanding of mental health conditions with known or suspected genetic components. This publicly available dataset also offers a valuable resource for the scientific community, enabling further analyses and discoveries across disciplines. As Dr. Sato notes, "*Our dataset not only holds the potential for discovering and functionally analyzing causative genes involved in diverse behavioral patterns, but it can also drive the development of image analysis and tracking software*."

By bridging the gap between genetics and behavior, efforts could pave the way for research that ultimately leads to the development of mental health treatments, as well as a deeper understanding of how our genes influence our identity and behavior.

About Assistant Professor Daiki Sato
Dr. Daiki Sato is an Assistant Professor at the Graduate School of Science at Chiba University, Japan. His research focuses on evolutionary genomics and the genetics and molecular and ecological mechanisms behind emergent properties of collective behavior.

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Reference:
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Authors: Daiki X. Sato[1,2], Takahira Okuyama[3], and Yuma Takahashi[2]
Affiliations: [1]Institute for Advanced Academic Research, Chiba University
[2]Graduate School of Science, Chiba University
[3]Graduate School of Science and Engineering, Chiba University
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Contact: Daiki Sato
Graduate School of Science, Chiba University
Email: daiki.sato12@gmail.com

Public Relations Office, Chiba University
Address: 1-33 Yayoi, Inage, Chiba 263-8522 JAPAN
Email: koho-press@chiba-u.jp
Tel: +81-43-290-2018