

Environmental epigenetic effects of social isolation and their transgenerational transmission in *Drosophila melanogaster*

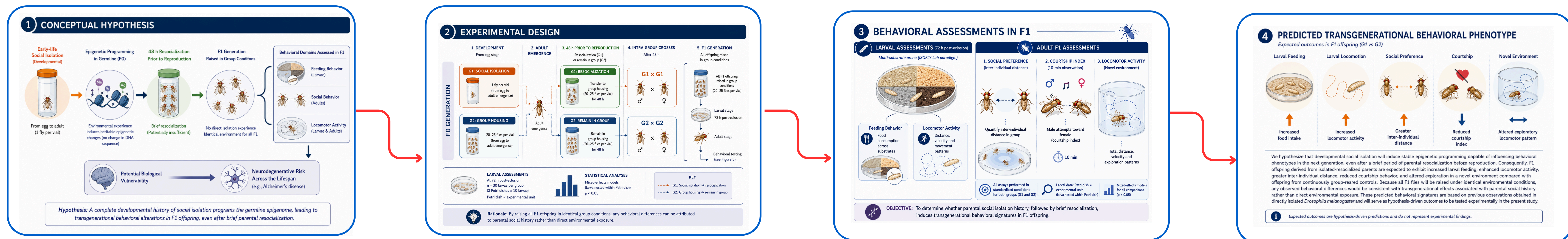
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Background

Developmental social isolation is a powerful environmental stressor capable of inducing persistent behavioral and biological alterations. Whether these effects can be transmitted across generations after parental resocialization remains unknown. This study proposes a transgenerational *Drosophila melanogaster* model to investigate epigenetically mediated behavioral inheritance.

Methods



Expected Results



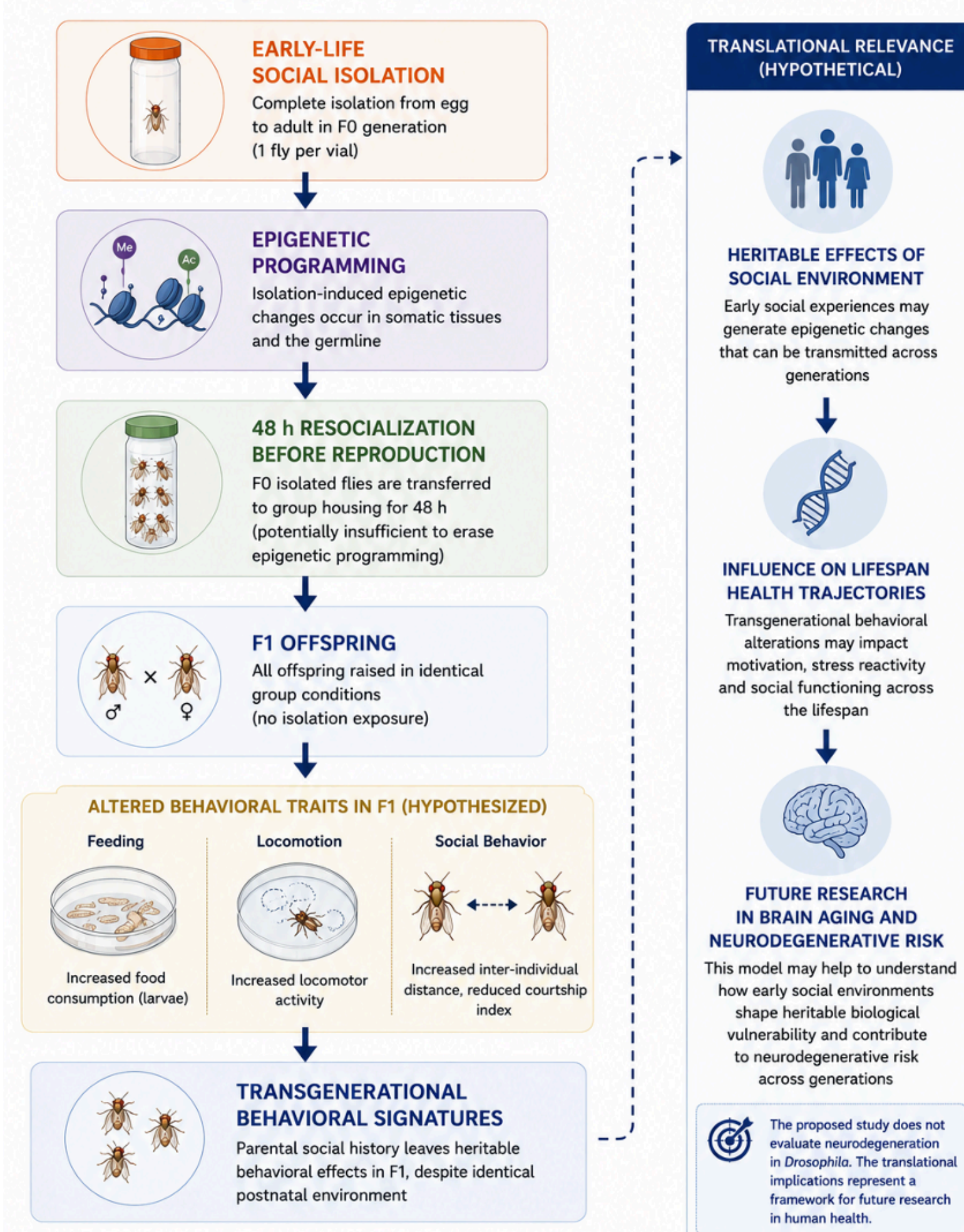
We anticipate that F1 larvae derived from socially isolated-resocialized F0 parents (G1) will exhibit **altered feeding behavior** and **locomotor activity** compared to F1 larvae from group-reared controls (G2), despite both cohorts being raised under identical social conditions. We expect F1-G1 larvae to show **hyperphagia** and **compensatory hyperlocomotion** relative to F1-G2 controls — a pattern that, if confirmed, would suggest **transgenerational transmission** of isolation-induced motivational dysregulation.



At the adult stage, F1-G1 flies are expected to exhibit **increased inter-individual distance**, **reduced courtship index**, and **altered locomotor activity** in novel environments compared to F1-G2 flies, indicating **persistent alterations** in **social preference** and **motivational state** across development.

5 BIOLOGICAL MODEL

From early-life social isolation to transgenerational behavioral signatures in *Drosophila*



Traslational Relevance

If transgenerational behavioral signatures are confirmed in *Drosophila melanogaster*, the model may provide a **framework** for understanding how **early social environments** generate **heritable biological effects** across generations. These mechanisms could inform future research on social determinants of brain health and neurodegenerative risk.

Future Directions

- Molecular epigenetic profiling
- Additional generations (F2/F3)
- Translation to mammalian models

Figure design note: Illustrations were created with AI-assisted graphic design based on the authors' original scientific concepts. All study content, data interpretation, and conclusions are solely the work of the authors

