

Social Isolation's lifespan cascade: Linking early compensatory hyperactivity to late-life cognitive decline and Alzheimer's risk.

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Background

Apathy and **motivational deficits** are key symptoms of mood and neurodegenerative disorders, yet their developmental origins and behavioral markers remain unclear. *Drosophila melanogaster* provides a powerful comparative model to explore how early-life social experience shapes motivational traits. This study evaluated the effects of larval social isolation on feeding motivation and locomotor activity. Contrary to the initial hypothesis that isolation would reduce motivation, preliminary results indicate that socially isolated larvae and adults exhibit higher locomotor activity and increased feeding drive compared to socially reared controls. These findings challenge assumptions about social deprivation and motivation, suggesting **compensatory** or **hyperactive** behavioral responses.

Methods

Chilean study (Gierke, et. al., 2026) served as human reference framework. This data informed a comparative developmental model using *Drosophila melanogaster* designed to assess whether social isolation produces enduring behavioral effects across the life cycle. Social conditions were experimentally manipulated during early development, and feeding, locomotor, and exploratory behaviors were longitudinally assessed from larval stages through adulthood.

Results

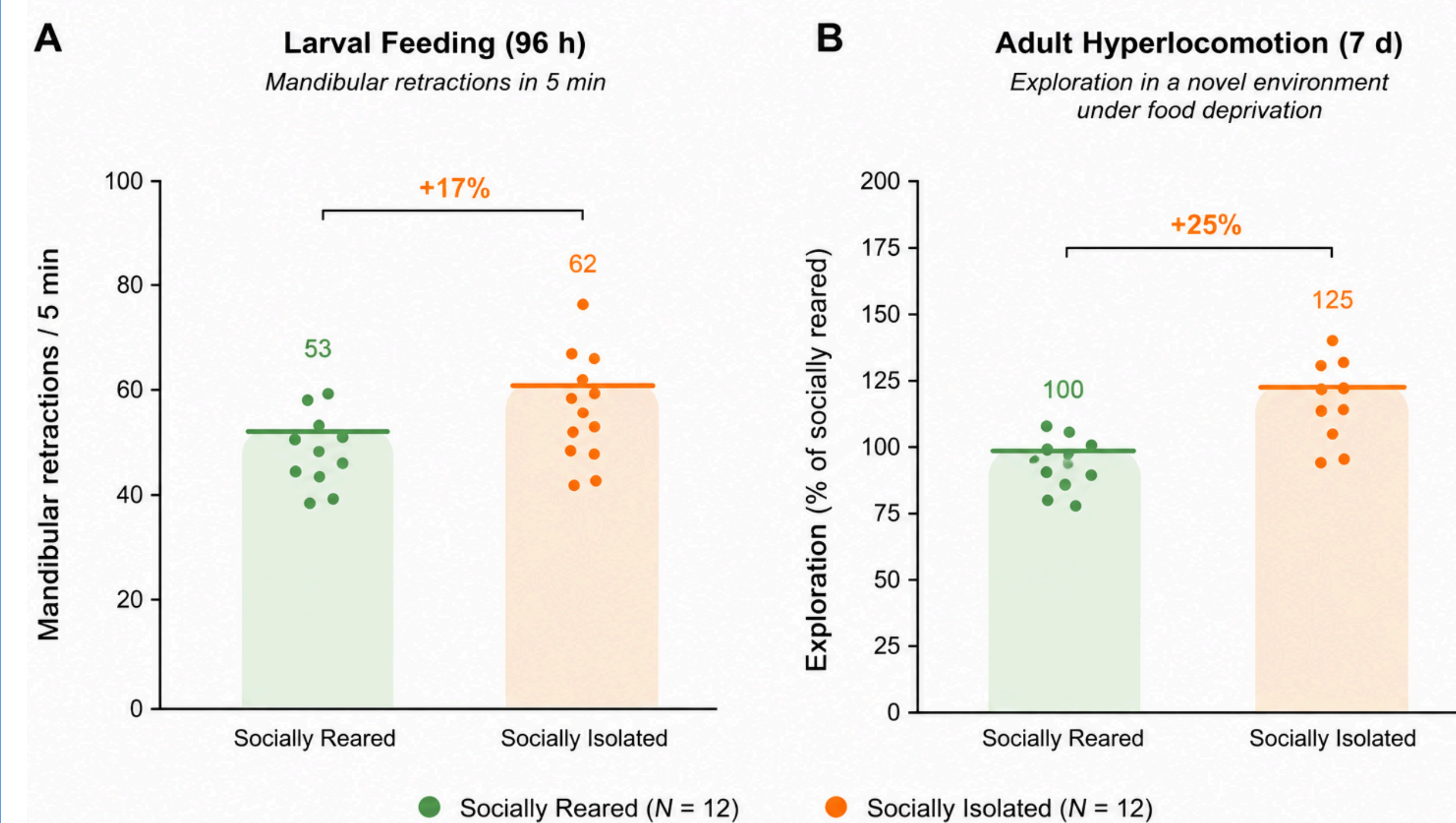
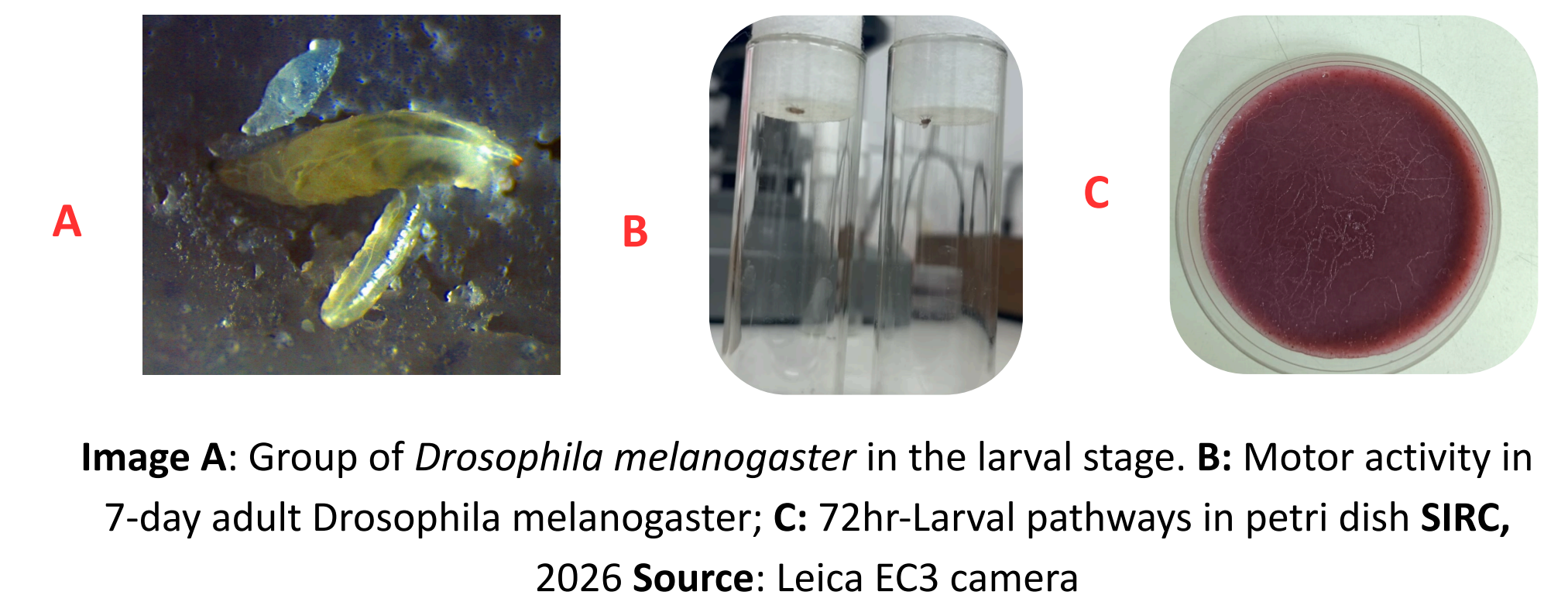


Figure 1. Early-life social isolation induces persistent motivational hyperactivity across development in *Drosophila melanogaster*. (A) Third-instar larvae (96 h) reared in isolation exhibited greater feeding activity than socially reared larvae, measured as mandibular retractions during a 5-minute feeding assay (62 vs. 53 retractions; +17%). (B) Seven-day-old adults previously reared in isolation displayed increased locomotor exploration under food deprivation in a novel environment (+25% relative to socially reared controls). Values are presented descriptively because only summary statistics were available.

Conclusions

Our findings identify **compensatory motivational hyperactivity** as a novel lifespan intermediate phenotype linking early social isolation to Alzheimer's disease vulnerability, providing a translational framework for the development of preventive strategies across the life course.



Early social isolation programs neural circuits and behavior across the lifespan, leading to **persistant hyperactivity** and **increase vulnerability to Alzheimer's disease**

