Biotechnologies in a genetic model organism to unveil biological processes underlying premature aging

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Aging is a gradual decline in cellular function and overall performance of an organism over time. As aging progresses, cellular damage accumulates, leading to diminished physical and mental capacities, as well as an increased susceptibility to diseases. Studies have shown that environmental pollutants can affect cellular markers of aging and contribute to the high incidence of age-related diseases. We utilized Drosophila melanogaster as a model organism to examine the effects of the environmental contaminant cadmium, which was introduced through the diet, on processes related to aging. The treated flies demonstrated a significant decline in learning and memory abilities over time, suggesting accelerated aging. Furthermore, specific molecular markers associated with aging, including transposable elements and genes related to memory and stress, were found to be deregulated in the brains of the flies. This indicates a premature loss of transcriptional and/or post-transcriptional regulation. These findings, along with the analysis of neuronal cell organization, provide a foundation for understanding how environmental stressors contribute to age-related degeneration.