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Unravelling Brain Disorders: Drosophila as a Genetic Tool in Neurodegeneration

Unravelling Brain Disorders: Drosophila as a Genetic Tool in Neurodegeneration

Neurodegenerative diseases are a diverse group of progressive, age-associated disorders characterized by improper functioning of neurons, ultimately leading to impaired cognition, movement, and survival. Disorders such as Alzheimer's disease, Parkinson's disease, Huntington's disease, are major public health challenges, yet effective therapies remain limited due to the complexity of their underlying mechanisms. Drosophila melanogaster has become a widely used model system for unravelling the genetic, molecular, and cellular basis of neurodegeneration. Its advantages include a well-mapped nervous system, highly conserved signalling pathways, rapid life cycle, and powerful genetic tools, which allow the creation of transgenic lines that mimic pathological features of human diseases. Studies in Drosophila have successfully replicated key disease phenotypes such as protein aggregation, mitochondrial dysfunction, oxidative stress, synaptic loss, and neuron death, thereby providing valuable platforms to understand pathogenic mechanisms. Moreover, large-scale genetic screens and pharmacological assays in flies have enabled the identification of modifier genes and candidate therapeutic compounds with translational potential. Research using Drosophila has also highlighted the importance of non-neuronal cells, such as glia, in influencing neuronal survival, further expanding our understanding of disease complexity. Collectively, insights gained from Drosophila melanogaster models continue to bridge the gap between basic molecular research and clinical applications, making the fruit fly an indispensable tool in advancing neurodegenerative disease research and therapeutic discovery.

Keywords

Neurodegenerative diseases, Drosophila melanogaster, Protein aggregation, Genetic screens, Therapeutic discovery

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