Circadian Evolution in Action: How Latitude Shapes the Genetic and Behavioral Divergence of Drosophila

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The circadian rhythm is a 24-hour biological clock that regulates physiological and behavioral cycles in response to environmental light cues. While previous studies on circadian rhythms in Drosophila melanogaster have focused mainly on strains from North America, little is known about the influence of latitude on circadian traits in populations from the equator and the Southern Hemisphere. Therefore, this study focuses on whether Drosophila strains exhibit distinct circadian characteristics from different latitudes. I compared equatorial and mid-to-high latitude strains under constant darkness (DD) to assess rhythm stability, period length, and activity levels. The results reveal that equatorial strains maintain a stable circadian rhythm under DD, resembling their behavior in a 12:12 light-dark cycle (LD 12:12). In contrast, mid-to-high latitude strains from both hemispheres displayed disrupted rhythms, diverging from stable patterns under normal light conditions. Furthermore, strain-specific differences in locomotor activity and rhythm strength were observed. Genetic analysis identified multiple single nucleotide polymorphisms (SNPs) in the regulatory regions of key circadian genes per and tim, suggesting a potential genetic basis for latitude-dependent variations in biological clock function. These findings provide new insights into how environmental selection pressures drive the evolution of biological clocks and raise the possibility that circadian divergence may play a role in the early stages of reproductive isolation and speciation.

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