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Temporal niche choice in Drosophila melanogaster

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In a world characterized by regular fluctuations, biological systems have developed mechanisms to anticipate and respond to environmental changes to increase their fitness and survival. Circadian clocks consist of highly preserved molecular feedback loops allowing organisms to adapt their behavior to the 24 hours environmental light and temperature changes. Circadian clocks enable biological systems to restrict their activity to specific periods of the day, which is defined as temporal niche. Correct temporal niche choice is important for the fitness and survival of an organism, and it is regulated by an intricate interplay between the animal's circadian clock and environmental fluctuations.
As temporal organization is genetically determined, mutations in circadian clock genes can allow organisms to explore and to occupy different temporal niches, increasing the adaptation of a population to different environmental conditions. However, the molecular and cellular mechanisms that drive niche choice remain to be fully understood. Under non-stressful conditions, individuals show low inter-specific phenotypic variability, despite being genetically different. However, they may accumulate genetic mutations that are not phenotypically visible, called cryptic genetic variations. When a sudden environmental stressor occurs, cryptic genetic variations introduce new phenotypes that are then bottlenecked by natural selection to favor fitness and survival of the population. Heat shock protein 90 (HSP90) has been identified as a possible candidate to unveil the genetic potentials of biological systems. Previous studies (Hung et al., 2009) indicate that loss of HSP90 leads to increased behavioral variation in *Drosophila*, including multiple transitions from rhythmic to arrhythmic behavior. Here, we investigate
whether individuals can actively explore and choose temporal niches that support their own fitness, and the possible role of HSP90 in the molecular pathways leading to variable intraspecific temporal niche choices.

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