Counting Endogenous Circadian Cycles to Determine Period of a Semilunar Rhythm in An Intertidal Insect

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Abstract

How the period of a biological rhythm is maintained during free-run, i.e., without environmental cues, has been a challenging question even after the molecular mechanisms of circadian rhythms has mostly been figured out. Here we report the first case supporting Frequency Demultiplication Hypothesis in which the longer circasemilunar rhythm of emergence of a marine midge is based on counting 15 endogenous circadian cycles. This rhythm is entrained by nightlight and is temperature compensated.

潮間帶是海洋生態系中環境變化最大的，但其中許多與日出日落或潮水漲落有關的卻是最有規律的變化，這提供了生物演化出內生周律的條件。生物的內生性近日周律、近潮汐周律、近半月、近月周律都經常在潮間帶顯現，其中近半月、近月周律提供了研究長時間周律的絕佳機會，是一般陸生實驗動物(如果蠅、大白鼠)所無法進行的，另方面近年周律雖然在哺乳類、鳥類上有相當研究，但因長周期耗費時間，進展相對緩慢。本研究以臺灣南部海邊出現的一種海生搖蚊(*Pontomyia oceana*)爲對象，在實驗室進行光、暗、夜光、日周期長短等處理，結果發現這種搖蚊族群在野外的半月羽化高峰是由每隻的內生性周律所控制，夜晚出現的弱光可校準(entrain)此半月周律，半月的計時機制是藉由計數~15 個內生性近日周期來達成(第一次在生物上的發現)，因此這機制不受溫度變化的影響。