CSB/EEB JOINT SEMINAR

Sleeping through the apocalypse: how temporal activity patterns shape speciation and extinction across species

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Many of the mechanisms that regulate the phase, duration, and structure of sleep are conserved, yet paradoxically, sleep displays remarkable variation both across and within species. Animals can have different chronotypes (‘early-birds’/‘night-owls’) or spend variable amounts of time asleep (2-18 hrs/day). Species can shift the phase of their activity (nocturnal/diurnal), restrict activity to specific periods (dawn/dusk), or lose rhythmicity entirely. We use multiple fish models to study the genomic, cellular, and evolutionary mechanisms of sleep. Using in lab animal tracking, we have recently identified incredible variation in sleep timing and duration across > 60 species of African cichlid fish from Lake Tanganyika. The diversity observed in these cichlids (10 my of evolution) is equivalent to that seen across all animals, suggesting that temporal niche partitioning may have contributed to their incredible evolutionary success. Genome-wide association analysis of sleep-related behaviours and functional comparisons between cichlid species have identified potential molecular and genetic mechanisms underlying the evolution of nocturnality/diurnality and sleep. In parallel, using meta-analysis of the literature I have assembled a database of the diel activity patterns of nearly 4000 species of fish. Ancestral reconstructions and comparisons with other vertebrate lineages suggest that fish have undergone twice as many transitions between nocturnal and diurnal activity patterns compared to tetrapods. Bursts in transitions in all vertebrate lineages were observed following large-scale extinction events, suggesting that ancestral nocturnality and frequent transitions to diurnality helped vertebrates survive these events. Together, these results suggest that the evolution of temporal activity patterns can impact speciation and survival across evolutionary time scales.

SEPTEMBER 10. 2024
10.AM - ESC B149

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