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Lecture Series Environment & Biodiversity

Why some cichlids are more diverse than others – the roles of mutation, demography, and ecology

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NLW-Faculty, Room 424, 2nd floor

Research focus:

Evolutionary Biology





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Abstract

African cichlid fishes exhibit remarkable diversity in morphology, ecology, behavior, and life-history traits. At the molecular level, it is genetic diversity that forms the foundation of this biodiversity. But what determines genetic diversity? Key factors include mutation, recombination, population size, and selection – yet, how these are shaped by ecology, life history, and demographic processes remains poorly understood. As the most direct source of new variation, germline mutations are critical drivers of evolution, though their role has been challenging to study. Here, by generating a comprehensive dataset of de novo mutation rate estimates derived from parent-offspring sequencing data, we show that cichlid mutation rates vary substantially among closely related species and have a positive relationship with genetic diversity. However, mutation rates alone cannot fully explain diversity patterns – other factors play equally important roles. Demographic instability, rather than stable population sizes, leads to higher genetic diversity. Ecological characteristics such as habitat depth or trophic level, along with life-history traits related to parental investment, further shape genomic variation. Understanding how these factors interact will reveal the molecular mechanisms underlying adaptive radiations and provide crucial insights for conserving biodiversity in a changing world.

