Blind as bats: Echolocation study reveals key evolutionary trade-offs with other senses

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Big eared townsend bat (Corynorhinus townsendii) Credit: Public Domain

Among the most fascinating evolutionary adaptations has been the development of echolocation in bats. But to develop their unique sonar system for exploring caves in the dark, what evolutionary tradeoffs occurred between their other senses like smell, vision and hearing, i.e. to be blind as a bat?

There are two kinds of bats, Old World fruit bats and echolocating bats. Old World fruit bats have no laryngeal echolocating ability, and navigate largely by vision with excellent eyesight, whereas echolocating bats rely solely on echolocation for navigation.

Now, using whole genome sequencing technology, a research team led by Dong Dong et al. performed a new comparative study of two sophisticated echolocating bats - the great leaf-nosed bat (*Hipposideros armiger*) and Chinese rufous horseshoe bat (*Rhinolophus sinicus*), named for their protuberances on their noses. When navigating, they are sensitive enough to distinguish their ultrasonic calls from the Doppler shifted echoes (think of the sound of a passing train). Their results confirm evolutionary trade-offs at work—showing an extensive contraction of smell (olfactory) receptor gene repertoires and loss of a dozen vision-related genes in the echolocating bats.

In addition, they re-sequenced the whole genome of 20 great leaf-nosed bats from four major distributed locations in China, and measured their genetic diversity and patterns of evolution. They found evidences of genetic adaptations in the great leaf-nosed bats that are associated with high altitudes, and overall, provided a useful powerful new resource for the research on the evolution of bats.

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