



The more scientists discover about bats and echolocation, the more remarkable this biological sonar system seems to become.

Researchers recently reported that "superfast" vocal muscles allow bats to emit the incredibly rapid pulses of sound needed to obtain the very precise information that lets them capture fast-flying insects in the dark. Echolocating bats emit ultrasonic sounds into their path and analyze the echoes that come bouncing back. Shorter, faster calls produce a more precise picture.

Now Rolf M  ller, associate professor of mechanical engineering at Virginia Tech, says his team has demonstrated that bats maximize echolocation by changing the shape of their ears in half the time it takes to blink a human eye.

"Certain bats can deform the shapes of their ears in a way that changes the animal's ultrasonic hearing pattern," M  ller said in a news release from Virginia Tech. "Within just one-tenth of a second (100 milliseconds), these bats are able to change their outer-ear shapes from one extreme configuration to another ... in ways that would suit different acoustic-sensing tasks."

The study was reported in the journal *Physical Review Letters* by M  ller and graduate students Li Gao and Sreenath Balakrishnan, as well as Weikai He and Zhen Yan Shandong University in China.

The research involved horseshoe bats (of the genus *Rhinolophus*) in China. These bats use echolocation to maneuver swiftly through dense vegetation and identify insect prey under difficult conditions, the news release said.

Using techniques that included high-speed, stereo video and high-resolution tomography, the team was able to reconstruct the changing three-dimensional geometry of the outer ears as they deformed in these short time intervals. A bat's ears act as biosonar-receiving antennas and the shape-changing could improve reception.

After analyzing the changes, the researchers concluded that the different ear configurations could suit different hearing tasks performed by the animals. Hence, the ear deformation in horseshoe bats could be part of the animals' adaption for echolocation.

The project is part of a continuing collaboration between Shandong University and Virginia Tech, which began when M  ller opening of a new international laboratory at the Chinese facility in 2010. The lab focuses on bio-inspired engineering research. Muller says his goal is to bridge the gap between biology and engineering.

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