Researchers studying how singing bats communicate

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Bats are the most vocal mammals other than humans, and understanding how they communicate during their nocturnal outings could lead to better treatments for human speech disorders, say researchers at Texas A&M University.

Thousands of bats native to Central Texas fly overhead each night singing songs of complex syllables – but at frequencies too high for humans to hear.

Texas A&M researcher Michael Smotherman is trying to understand how Mexican Freetail bats organize syllables into songs and how their communication is linked to the brain. “If we can identify those areas in a bat brain [responsible for communication], we can learn more about how a normal [human] brain generates and orchestrates complex communication sequences,” Smotherman says. “And by understanding how that works, we can then come up with testable hypotheses about what might be going on in speech disorders.”

The researchers in Smotherman’s lab are studying two aspects of bat communication. In behavioral studies, they examine sex differences and seasonal variations in communication, and in physiology studies they try to locate the parts of the bat brain active during communication.

Mexican Freetail bats sing mostly in ultrasonic frequencies that are right above the upper limit of human hearing. Humans can sometimes hear little bits of bat songs, however, when parts of syllables drop low enough.

Bats communicate at such high frequencies because of their ability to echolocate, which means they project sound and use the echoes to determine the direction and distance of objects. As the frequency of the bat's sound gets higher, it can detect a more detailed picture of its surroundings.

Smotherman says Mexican Freetail bats use between 15 and 20 syllables to create calls. Every male bat has its own unique courtship song. The pattern of all courtship songs is similar, but each male bat uses a different syllable in its distinctive song. Bats also use sophisticated vocal communication to draw territorial borders, define social status, repel intruders, instruct offspring and recognize each other.

"No other mammals besides humans are able to use such complex vocal sequences to communicate," Smotherman says.

The songs bats sing are similar to bird songs. Scientists have understood the link between bird songs and the bird brain for years, but "the architecture of a bird brain is very different from that of a mammal brain," Smotherman explains, "so it is difficult to apply knowledge about bird communication to human speech."

The brains of all mammals are organized in basically the same way, so a bat brain has many of the same structures as a human brain. This makes it easier to infer things about human speech from studying bat communication. The researchers' first goal is to locate the part of the bat brain responsible for singing. "The bat brain has to have some higher vocal center that's responsible for organizing these [vocal] sequences and patterns, and we just don't know where it is yet," Smotherman says. "So we're using molecular techniques to identify which regions of the brain are most active during singing."

Smotherman and his team maintain about 75 bats in their lab. They

usually collect the bats from schools and churches that report bats in their buildings. “[By doing this,] we don’t have to feel like we’re taking them out of the wild,” Smotherman says. He adds that the bats are not aggressive and are a “fantastic bat for the lab because they are quite friendly.”

Smotherman hopes that over the next decade, the group can apply its research to knowledge of human speech and help shed light on language disorders. “The fact that human speech is so unique has really constrained research in this area,” Smotherman says. “Compared to other areas of neuroscience, we’re way behind in understanding even the most basic issues of how [speech] works.”

Source: Texas A&M University