

# Frog only has ears for sweetie

Rare species can tune out background

By Tim De Chant  
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With a twitch of a muscle, the Chinese concave-eared torrent frog brushes off the sounds of thundering rivers, focusing on the one thing that really matters: the siren song of the opposite sex.

The males of this rare species are the only animal known to be able to turn a deaf ear to distracting noises while enhancing the calls of its own kind, according to a study published Monday in the Proceedings of the National Academy of Science.

When the frog is calling for a mate, a piece of cartilage in its eustachian tubes—the canals that connect the ears with the mouth—largely blocks out distracting low-frequency sounds like rushing water. Scientists hope their discovery may lead to improved hearing aids.

“This probably is the only example we know of in the

animal kingdom with this unusual adaptation,” said Albert Feng, professor of molecular and integrative physiology at the University of Illinois at Urbana-Champaign and one of the study’s lead authors.

Before they made the accidental discovery, Feng and his colleagues were measuring how the frog’s unusually thin eardrum responded to sounds. Suddenly, the eardrum stopped vibrating.

“We were scratching our heads,” Feng said.

Shining a flashlight into its eustachian tubes, “we saw something, a dark shadow through this transparent eardrum,” he said. “We said, wow, what’s going on there?”

Previously, scientists thought frogs’ eustachian tubes were never closed off.

“It’s strange from top to bottom,” said Mark Bee, an assistant professor in ecology, evolution and behavior at the University of Minnesota who was not a part of the study. The study has “forced us to rethink everything” about frog hearing, he said.

The Chinese frog lives alongside fast-flowing rivers, with birds and insects shrieking over a cacophony of falling water and rushing rapids. The frogs try to shout over one another, too—the amphibian equivalent of the cocktail party problem.

Without its adaptation, a frog might not hear a mate.

“This frog produces a long 3- or 4-second call that consists of little pulses, you know: ‘dat dat dat dat dat,’” Bee said. The call is 10 percent sound and 90 percent silence, he added, and the adaptation may allow the caller to hear other frogs better in the gaps between the bursts.

The frogs have inspired Feng to ponder new hearing aids that could gracefully handle noisy environments.

Current hearing aids work well in quiet situations, said Bee, “but you put Grandma and her new hearing aid at the dinner table at Christmas with 15 other people all talking at the same time, and it doesn’t do her any good.”

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## How frogs tune out sound

**Chinese concave-eared torrent frog**

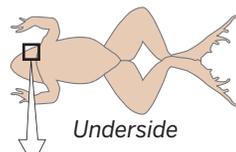
*Odorrana tormota*

**Length:** 1.2-2.2 inches

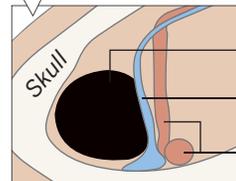
**Habitat:** In vegetation along mountain streams and waterfalls, and moist forests and shrubland

**Reproduction:** Eggs are laid in June.

**Origin:** Zhejiang and Anhui Provinces, China



Underside



### ELIMINATING BACKGROUND NOISE

In males, the eustachian tube opens and closes, protecting the inner ear from low-frequency sound.

### Normal function

Eustachian tube open, unprotected

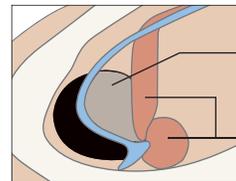
Cartilage horn (acts like a hinge)

Muscles not contracted

### Calling or swallowing

Cartilage horn pulls protective tissue over eustachian tube

Muscles contract



SOURCES: Proceedings of the National Academy of Science, Amphibiaweb.org, Naturwissenschaften; photo courtesy of Albert S. Feng, University of Illinois

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