



Alan Alda in
SCIENTIFIC AMERICAN FRONTIERS

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Calls of the Wild



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■ A New Way to Hear

In a lab at Cornell University dedicated to understanding the sounds bugs make and how they use them, researchers have discovered an unusual hearing system - one that could one day help the hard of hearing screen out background noise.



This ping-pong treadmill tells scientists how accurately this fly can hear.

In "A New Way to Hear," Alan meets [Ron Hoy](#) who is studying how the parasitic fly *Ormia ochracea* is able to use sound to locate crickets, its host species. When the female *Ormia* fly hears a chirping cricket, she quickly homes in on the insect, lands nearby and lays hundreds of larvae who burrow into and feed off the cricket's body, killing it from the inside out.

What puzzled scientists is not the remarkable interrelationship between the two species, but how the flies could even hear the cricket at all. There are two known ways of directional hearing. One way is to detect the how much time elapses between when the sound arrives at each ear. The other is to detect a difference in loudness of the sound as it arrives at each ear. Both of these methods require two ears that either are some distance apart, or blocked by some relatively large structure, like a head.



Hoy and Miles are modeling more useful hearing aids on this fly's tiny ear.

But the flies are seemingly too tiny to be able to hear in either of these ways. To determine that the flies are in fact using their hearing - and not some other means - to find crickets, the researchers designed an ingenious contraption. The scientist harness a fly, then place it on a trackball treadmill that will indicate and record the direction of the fly's intended movement.

Then, the researchers play recorded cricket chirps from different angles. Incredibly, the fly can respond to changes in the direction of the cricket chirps as small as 2 degrees - about the same accuracy as human hearing.

So how can *Ormia* hear crickets, when more than 99% of fly species cannot? It turns out their special ears, which they wear on their chests under their heads, consist of membranes that are not only able to pivot around the center, but flap like bird wings.

It's a mechanical trick that amplifies the infinitesimal difference in the time the sound arrives at the two ears. Simple, but one human engineers had not thought of before. Now, inspired by the remarkable ear of *Ormia* engineers are working to design a better hearing aid. On a tiny silicon chip, Ron Miles has already constructed a microphone that responds to sound just like *Ormia's* ears do - by pitching and flapping. It should allow a human wearer not to locate crickets, but "tune in" to the speaker right in front of them. That's a big advantage over most hearing aids, which simply amplify all ambient sounds. It's another example of how all science - even just asking how - can have important and unimagined applications.

For more on this topic, see the web feature:

[FRONTIERS Profile: Damian Elias](#)

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