GLOBAL HEALTH

Vaccinating bats could be good for people. But how do you vaccinate a bat?

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Bats such as this greater horseshoe bat can harbor dangerous viruses. Researchers present new evidence that it might be possible to immunize the winged mammals to protect them — and us — from potentially lethal diseases.
Hesperornithoides/Getty Images

Here's a question you might never have asked yourself: How do you vaccinate a bat?

You can't simply ask your local vet. Nor will the bats line up outside of a clinic on their own.

But a group of Chinese researchers thinks they may have an answer, one that could prove to become a new way to stop the spillover of diseases that cross from animals — like bats — into people.

"Bats carry a lot of very deadly pathogens like Ebola virus, Nipah, Hendra, coronavirus, and also rabies virus," says Alina Zheng, a virologist at the Chinese Academy of Sciences. "People are finding more and more bat-borne viruses."

When such viruses are transmitted to humans, the results are often fatal — so there's a lot of interest in trying to prevent spillover in the first place.

In some parts of the world, this has led to the organized culling of bats. "But when people kill the bats, basically they have more contact with the bat," says Zheng. "There are more chance[s] to get infected."

And wiping out bats can have other ramifications. These flying mammals play critical roles in the environment by pollinating plants and controlling insect pests. And they're already threatened by habitat loss and their own diseases.

Now, in a paper published in the journal Science Advances, Zheng and his colleagues offer evidence for a different solution to the problem of spillover — vaccinating the bats themselves against these dangerous viruses. "We not only protect the human but also protect the animals," says Zheng.

They used a couple of techniques to immunize the bats, including using vaccine-carrying mosquitoes!

"The advantage is if we immunize the population, the transmission of the virus will be decreased or eventually eliminated," he adds.

The approach is still in early stages, but comes as an exciting development for people battling these diseases.

The skeeter strategy

Zheng explains that the challenge with the approach was how to vaccinate the bats.

In a study a few years back, for instance, researchers applied a topical vaccine to the fur of bats so they could lick it off one another. Zheng says it worked in the lab, but "it's not easy to scale up in the real world. You have to catch a lot of bats and then release them."

So instead, Zheng and his colleagues opted to enlist a squadron of tiny syringes on wings — mosquitoes. "We want to turn the mosquito into a vaccination tool," Zheng says. In particular, they feed mosquitoes blood laced with genetically engineered vaccines against one of two deadly viruses — Nipah and rabies. Those vaccines then showed up in the mosquito bodies and their salivary glands.

To see if a mammal would pick up the vaccine from the mosquito, his team conducted some of their experiments on mice and other rodents. But the big tests came with actual bats. One of the first steps involved catching insect-eating bats from the suburbs of Beijing. "I like to do some exploration in the cave," says Zheng.

In the lab, the researchers exposed the animals to the special insects in one of two ways: Either the mosquitoes bit the bats or the bats ate the mosquitoes.

A few weeks later, when the researchers drew blood from the bats, they found antibodies. Zheng says that means the animals had mounted an immune response to the virus matching the vaccine they'd been exposed to.

The researchers then infected the bats that had developed antibodies against rabies with the actual rabies virus. Such an infection would have normally been a death sentence. But for these bats, "most of them survived," says Zheng.

One day, he imagines releasing these altered mosquitoes into caves where they might vaccinate wild bats. He considers using a steady current of air at the entrance to trap the insects inside while allowing the bats to come and go freely. He hopes that after a period of time, most of the bats would become vaccinated.

Drink up

Zheng acknowledges that the mosquito approach wouldn't work everywhere. "The real world is complicated," he explains, making it hard to release the modified insects in all environments. So the researchers came up with a Plan B: saline solution that contained an oral rabies vaccine, which the bats in their lab readily slurped up. "So when the bat drink[s] the water, they will get vaccinated," says Zheng.

This too protected the animals from subsequent infection with rabies. "Yeah, it really worked," he says. "I'm pretty excited with these result[s]."

"This is an amazing study," says Aungkul Moon, a veterinarian and infectious disease specialist at icddr,b, a health research institute in Dhaka, Bangladesh. He wasn't involved in the experiments.

Islam acknowledges that if the approach is successful in the wild, it could be a real boon for countries like Bangladesh that wrestle with bat-borne viruses. "They have [a] promising way of developing vaccines [for] different animals," he adds, "but I think there's still work to be done before large-scale applications" — like exploring how long immunity lasts in the bats and how feasible it would be for different countries to set up an ongoing bat vaccination campaign.

As for Zheng, he and his team are already planning future studies and looking for international collaborators to help make this batty idea a reality.

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