

# **No venom resistance in snake-eating birds: 'They just don't need it'**

February 15 2022, by Amber Verhaar

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Muzaffar Ali Khan in the field with an adder in his hands. Credit: Leiden University

To eat or get eaten. It describes the evolutionary race of snakes versus the mammals and birds that prey on these snakes. Muzaffar Ali Khan devoted his Ph.D. to investigating the molecular mechanisms play of the evolutionary arms race, and has his promotion 16 February. What makes mammals and birds successful in their snake hunting?

"I grew up in Pakistan, a part of the world where some farmers keep peacocks. Peacocks are famous for their ability to attack and kill snakes," Khan says. "I wanted to know more about animals that are capable of killing dangerous snakes and know how they do it." Under the supervision of Michael Richardson at the Institute of Biology Leiden (IBL), Khan analyzed the molecular resistance against cobra venom and found considerable differences in resistance between animals groups.

## **Genetic resistance in mammals differs**

Khan looked at several mammals that eat snakes, such as the Asian mongoose, the European hedgehog, and the honey badger. He determined that only mammals that shared territory with snakes have evolved some form of resistance. The resistance made [snake](#) venom less potent, by making the toxins unable to bind to its target in the [mammal](#) body.

Even more interesting, the changes Khan found in the DNA were not the same in all animals. Khan: "That means that different animals evolved the resistance in their own way, without a [common ancestor](#) that already

was resistant in the first place. It shows that it is essential for some mammals to have protection against cobra venom. If they didn't, the snakes won and killed them."

## **No genetic resistance in birds**

With this in mind, Khan also looked at several [birds](#) of prey and other snake-eating birds. Hawks, eagles, the secretary bird, and peacocks, the red-legged seriema among others, were investigated. But when Khan analyzed their DNA, he was amazed. None of these snake-eaters were even slightly resistant, in genetic terms, to snake venom. "That finding was fascinating. What makes these birds able to kill snakes?"

Khan and supervisor Richardson do have a theory. "Some birds attack snakes with impunity, even though they have no resistance," Richardson says. "It seems that the resistance is redundant: There is no selection pressure for it. Birds have feathers, scaly legs, excellent vision, are very intelligent, and are very agile. The snakes don't stand a chance against all these adaptations, so birds just don't need to be resistant."

## **A race of life and death**

Khan adds: "They kill snakes with their speed and know how to distract the snake. They open their wings to divert the snakes' attention and then try to peck the back of the neck, away from the fangs. It is like an action movie. It is a race of life and death."

## **Treatment for snake bites**

Both researchers hope to continue their study on differences in resistance to [snake venom](#). "For example, we also found that snakes that live in the same territory as other snake species, often have evolved some

form of molecular [resistance](#) against each other," Khan explains. "We want to understand the genetic variation between animal groups. Every year, thousands of people worldwide die from snake bites, especially in Asia and Africa. One day, we hope to use our knowledge to develop a genetic treatment. That can potentially save the lives of a lot of people."

Provided by Leiden University

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