Primates vs cobras: How our last common ancestor built venom resistance

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Associate Professor Bryan Fry. Credit: University of Queensland

The last common ancestor of chimps, gorillas and humans developed an increased resistance toward cobra venom, according to University of Queensland-led research.

Scientists used animal-free testing techniques to show that African and Asian primates evolved resistance toward the venoms of large, daytime-active cobras and discovered that our last common ancestor with chimps and gorillas evolved even stronger resistance.

University of Queensland Ph.D. candidate Richard Harris said African and Asian primates developed venom resistance after a long evolutionary arms race.

"As primates from Africa gained the ability to walk upright and dispersed throughout Asia, they developed weapons to defend themselves against venomous snakes, this likely sparked an evolutionary arms race and evolving this venom resistance," Mr Harris said.

"This was just one of many evolutionary defenses—many primate groups appear to also have developed excellent eyesight, which is thought to have aided them in detecting and defending themselves against venomous snakes.

"But Madagascan Lemurs and Central and South American monkeys, which live in regions that haven't been colonized by or come in close contact with neurotoxic venomous snakes, didn't evolve this kind of resistance to snake venoms and have poorer eyesight.

"It's been long-theorized that snakes have strongly influenced primate evolution, but we now have additional biological evidence to support this theory."

The team studied various snake toxin interactions with synthetic nerve receptors, comparing those of primates from Africa and Asia with those from Madagascar—which doesn't have venomous snakes—and those from the Americas—where the cobra-related coral snakes are small, nocturnal and burrowing.

Team leader Associate Professor Bryan Fry said the study also revealed that in the last common ancestor of chimpanzees, gorillas, and humans, this resistance was sharply increased.

"Our movement down from the trees and more commonly on land meant more interactions with venomous snakes, thus driving the evolutionary selection of this increased resistance," Dr. Fry said.

"It is important to note that this resistance is not absolute—we are not immune to cobra venom, just much less likely to die than other primates.

"We have shown in other studies that resistance to snake venoms comes with what's known as a fitness disadvantage, whereby the receptors don't do their normal function as efficiently, so there is a fine balance to be struck where the gain has to outweigh the loss.

"In this case, partial resistance was enough to gain the evolutionary advantage, but without the fitness disadvantage being too taxing.

"We are increasingly recognizing the importance snakes have played in the evolution of primates, including the way our brain is structured, aspects of language and even tool use.

"This work reveals yet another piece in the puzzle of this complex arms race between snakes and primates."

More information: Richard J. Harris et al, Monkeying around with venom: an increased resistance to α-neurotoxins supports an evolutionary arms race between Afro-Asian primates and sympatric cobras, *BMC Biology* (2021). DOI: 10.1186/s12915-021-01195-x

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