

Stressed snakes strike first

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A cottonmouth snake sits on the ground. Credit: Mark Herr, Penn State

Whether a wild cottonmouth snake will attempt to strike in an encounter depends on its baseline stress level, according to a team of scientists led by undergraduate researcher Mark Herr.

"Most people think a snake is more likely to strike after you have

handled or harassed it," said Tracy Langkilde, professor and department head of biology. "Our results show this is not true. We show that how stressed a snake gets when handled or harassed does not determine how likely it is to strike."

The researchers found that cottonmouths with high baseline levels of corticosterone, a hormone that is used to estimate the amount of stress an animal experiences, were more likely to strike during an encounter with a person than were cottonmouths with lower baseline levels of corticosterone. Surprisingly, an increase in corticosterone levels that occurred after a standardized stressful experience did not make the snakes more likely to strike.

Only eleven of the thirty-two snakes in the experiment struck after being held by snake tongs on their first encounter. After a short period of stressful confinement, just seven of the snakes attempted to strike when held by tongs. These results, recently published online in the journal, *General and Comparative Endocrinology*, suggest that cottonmouths are not as aggressive as popular lore suggests and that the level of aggression a cottonmouth displays during an encounter may often be exaggerated.

Based on this work, the researchers suggest that protecting the habitats of snakes so they do not routinely experience high stress may be an effective way to reduce the incidence of snakebite. If snakes are not stressed, they may be less likely to strike humans when encountered. These results may have implications in the developing world where snakebites from all species result in 25,000 to 125,000 deaths a year and up to 400,000 amputations annually.

Although stress is considered an important factor affecting behavior, the interaction between stress hormones and behavior in wild animals is not well understood. This motivated the researchers to design an experiment that could gain insight into how stress drives behavior in snakes in the

real world. The researchers selected the cottonmouth snake, a venomous pit viper endemic to the southeastern United States because it has a clear suite of anti-predator behaviors that are easy to measure. Anti-predator behaviors include flashing the white lining of mouth—which gives the snake its common name—vibrating the end of its tail, flicking its tongue, hissing, fleeing the scene and striking.

The research team included Herr, Langkilde and Sean Graham, a former post-doctoral researcher in the Langkilde lab who is now assistant professor at Sul Ross State University. Langkilde, an expert in animal behavior, Graham, an expert in stress physiology with previous experience studying cottonmouth snakes, and Herr combined their expertise to design the field experiment. Herr and Graham then set out to selected field sites in Alabama to collect data.

The team explored beaver marshes and cypress swamps in search of cottonmouth snakes to stage threatening encounters. In an encounter, Herr and Graham would stand one meter away from a snake and record any anti-predator behavior. After 15 seconds, Graham would grab the snake at mid-body with tongs and observe the snake for 15 seconds for any changes in behavior. After placing a clear plastic tube around the head of the snake to prevent it from striking, Herr would draw a blood sample from the tail. Blood samples were used to measure corticosterone levels. The snake was then placed in a 5-gallon bucket for 30 minutes to subject it to a stressful confined environment. The researchers then held the snake with tongs again, recorded its behavior, and took another blood sample to measure post-confinement corticosterone levels.

They found that confinement did raise corticosterone levels in the snakes, but that whether a given snake would strike during the subsequent encounter was not related to its post-confinement corticosterone level or to how much its corticosterone went up during the experiment. These results showed that a [snake](#)'s striking behavior was

related to its baseline level of corticosterone—its level of stress before the encounter—but not to its level of corticosterone after a short period of handling and confinement stress.

"These are some of the first results we know of that connect stress biology with anti-predator behavior in the wild," said Herr.

According to the researchers, the main limitation of this study is that the researchers only show a correlation between baseline corticosterone levels and behavior in cottonmouth snakes. In other words, the researchers did not demonstrate that high baseline stress levels cause a cottonmouth to strike. To answer this question and exclude other possible causes like genetics, they are planning an experiment to manipulate the [stress](#) levels of cottonmouths to understand the impact this factor has on snakes' [behavior](#).

Provided by Pennsylvania State University

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