Could Climate Change Alter Lizard Learning?

by Elsa Youngsteadt on 10 January 2012, 7:02 PM | 0 Comments

The temperature of a nest can affect a hatchling lizard's size, speed, and sex. Now, the reptiles can add smarts to the list. Researchers have found that lizards incubated in warmer environments may learn faster than others. The results are preliminary, but they suggest that a hotter climate could give some lizards a cognitive edge, potentially helping them escape predators.

ENLARGE IMAGE

Smarty? Young lizards hatched from warm nests are quick to zero in on good hiding places.

Credit: Melanie Elphick

Among the species poised to sharpen up is the three-lined skink (*Bassiana duperreyi*), a small, bug-eating lizard native to southeast Australia. The female skinks lay clusters of eggs under sunny rocks and logs, and their nests are heating up. University of Sydney herpetologist Richard Shine and his colleagues found that between 1997 and 2006, the lizards' nest temperatures increased by about 1.5°C—despite females' tendency to dig deeper nests and lay eggs earlier in the spring.

Lizard moms might do well to accept the climbing temperatures—at least for now. Nests at the hot end of normal are more likely to produce fast-running hatchlings with an even sex ratio. (Cooler nests have more males, which are hardier in the cold—but an equal ratio could lead to more baby lizards overall.) Joshua Amiel, a Ph.D. student in Shine's lab, wondered if the warmer embryos' brains might develop differently, too. He collected wild females and nestled their eggs in individual glass dishes of sand and vermiculite (a common potting mix ingredient). Half went to a warm chamber with an average temperature of 22°C, the others to an incubator averaging 16°C, until they hatched.

When the skinks were a few weeks old and smaller than your pinkie finger, Amiel gave them a simple learning test. Each lizard was placed in a 24°C cage with two hiding places—overturned plastic flower-pot trays with entry holes cut in the sides. But one was a decoy, its opening blocked with Plexiglas. Clever lizards, after bumping the window a few times, should give up on the fake hiding place and go to only the good one, Amiel reasoned.

He tested each lizard 16 times over 4 days, touching its tail with a paintbrush to spook it into hiding. Amiel logged an "error" every time a lizard bumped its nose on the Plexiglas window and logged a successful "escape" if it found the real hiding place in 30 seconds.

Lizards from warm nests and cool nests started out making a "relatively equal" number of errors, Amiel says. But the warm-incubated lizards improved, making on average one or two more escapes during the second 2 days than they had during the first 2 days. Cool-incubated lizards showed no such gains, Amiel and Shine report online today in *Biology Letters*. If the same effect plays out in nature, hatchlings from warm nests may have a better chance of escaping predators, be they cats or kookaburras.

Incubation temperature changes so much about a lizard's development that "it makes sense" for it to affect learning ability, too, says Barry Sinervo, a herpetologist at the University of California, Santa Cruz. But, he adds, each species probably has an optimum incubation temperature above which its brain power declines again—so any benefit that lizards get from climate change is likely to be temporary and patchy.

Gordon Burghardt, who studies reptile behavior at the University of Tennessee, Knoxville, agrees that the study is "important" for linking learning with climate. But he's cautious about the results, in part because the experiments weren't blinded: Amiel knew which lizards came from warm and cold nests, and he knew which hiding place was

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the good one. Without blinding, Burghardt says, unconscious biases or even inadvertent behavioral cues from the experimenter can be "really problematic."

Amiel acknowledges that the study is preliminary, but he says he's eager to follow up with a new round of experiments and several cognitive tasks. "We've got a whole bunch of eggs that are just about to hatch now," Amiel says.

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