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INSIDE JEB

Real-world recreation makes a difference for brown anole lizards

Scientists like order, but the world is very often anything but organised. From differences in annual climate to the daily variations in temperature in incubating lizard nests, there is no such thing as a stable environment. And these fluctuations could have enormous impacts on developing cold-blooded (ectothermic) animals. The problem is that reproducing the real world in the laboratory can be expensive and difficult. However, Joshua Hall and Daniel Warner, from Auburn University, were undeterred by this challenge. Knowing that temperature can have a dramatic effect on the development of brown anole lizard (*Anolis sagrei*) embryos, the duo set up eggs developing in a series of different temperature scenarios to find out how the conditions affected the youngsters during development and after hatching.

Hall and Warner set up eight different temperature scenarios: two constant temperatures (21°C and 26°C, to mimic the average warmth in nests during the early and late nesting seasons); two perfect temperature cycles shaped like sine waves fluctuating around 21°C and 26°C; two more realistic slightly skewed daily repeating temperature cycles based on the average hourly temperatures in 22 nests over the early and late nesting seasons; and two naturally varying reproductions of the average temperature experienced by genuine eggs in nests over a 39 day period in spring and late summer nests. Then, the duo tracked the development of the embryos until they hatched and continued monitoring the youngsters as they grew up.

Comparing the effects of the temperature difference between the early spring and late summer nests, Hal and Warner could see it significantly affected the eggs' survival; the death rate of the cooler spring eggs was about three times that of the warmer late summer eggs. However, the fluctuating temperatures seemed to improve the chilly embryos' chances of survival, and when the duo checked the hatchlings, the repeatedly oscillating temperature had improved their endurance – they had a better chance of survival than the hatchlings that only experienced a constant temperature as embryos.

'Natural thermal fluctuations are important for successful development, and simpler approximations may poorly reflect natural systems', says Hall, adding that the benefits of replicating real-world scenarios in the lab could outweigh the costs of the technical challenges. However, he warns that the impact of recreating natural situations may not always be instantly apparent, 'but rather, manifest later', he says.

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Hall, J. M. and Warner, D. A. (2020). Ecologically relevant thermal fluctuations enhance offspring fitness: biological and methodological implications for studies of thermal developmental plasticity. *J. Exp. Biol.* **223**, jeb231902. doi:10.1242/jeb.231902

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