

## Heat Triggers Sex Change in Lizards by "Turning Off" Key Gene

James Owen  
for [National Geographic News](#)

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Too much sun may mean sexual inequality for an Australian desert lizard, with higher temperatures changing males into females while still in the egg.

The reptilian sex reversal was discovered by Australian researchers who say the finding shows that determination of sex in animals isn't nearly as clear-cut as most scientists thought.



Central bearded dragon lizards usually develop into males or females depending on the sex chromosomes they inherit. But the study team found that turning up the heat during incubation caused unborn lizards to switch sex inside their eggs.

It had previously been assumed that an animal's gender could be determined either by genes or by temperature as an embryo develops but not by both.

In the case of the central bearded dragon, it appears that temperature can override genes that trigger male development.

The study is reported in the current issue of the journal *Science*.

### Heat Deactivates Sex Gene

Eggs incubated at higher than normal temperatures of 93.2 to 98.6 degrees Fahrenheit (34 to 37 degrees Celsius) produced a strong bias toward female hatchlings, which outnumbered males by about 16 to 1.

The researchers linked this gender bias to a sex-determining gene that was deactivated when the lizards' nests became unusually warm.

This process results in female offspring, because the key gene is on the so-called Z sex chromosome, of which male lizards have two and females only one.

Deactivation of the gene therefore turns a male (ZZ) into a female (WZ).

The findings could revolutionize thinking about how sex is determined in animals, said the research team, led by Alexander E. Quinn of the Institute for Applied Ecology at the University of Canberra.

"The important implication of this is that there is probably a whole continuum of reptiles with varying degrees of interaction between sex genes and temperature," Quinn said in an email.

Until now animals were assumed to use one mechanism or the other, with reptiles such as crocodiles, turtles, and tortoises relying on temperature, and mammals, birds, and most amphibians depending on genes.

### "Theory in Tatters'

A dual system for determining sex has also been suggested for another Australian lizard, the three-lined skink, by a team led by Rick Shine, professor of evolutionary biology at the University of Sydney.

Shine said that the new findings "verify a remarkable phenomenon."

"The evidence that nest temperatures can override sex chromosomes is absolutely clear-cut," he commented.

"The work is exciting because it suggests that a long-held dogma in this research field—that in any given population, sex is determined by a single process—is now in tatters.

"The factors that determine an animal's sex are truly basic to its biology, and it's becoming increasingly clear that we don't really understand what those factors are, at least in some major groups of animals.

"I suspect that future studies will show that many kinds of animals have far more complex sex-determining systems than we currently imagine," he added.

Quinn, the lead researcher of the new study, said a better understanding of such systems may benefit humans, leading to the discovery of sex-development genes that lie behind genetic disorders.

Reptiles like the central bearded dragon might be able to switch between genes and temperature as sex determiners in order to adapt to changing environmental conditions, he suggested.

(Read related story: ["Virgin Birth Expected at Christmas—By Komodo Dragon"](#) [December 22, 2006].)

But there are fears that global warming may heavily skew sex ratios in some reptiles, causing population crashes that could potentially lead to extinctions.

(Read related story: ["Warming May Drive Gender-Bending Reptiles Extinct, Scientists Say"](#) [November 10, 2006].)

"The concern now is that the current rate of climate warming could be too rapid for these species to adapt," Quinn said.

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