Fade To White

Evolution is happening before our eyes in a lizard community in a New Mexico desert.

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Another eye-scorching day has dawned at New Mexico's White Sands national Monument. Erica Rosenblum, squinting behind dark sunglasses, brandishes a fishing pole that has a tiny noose made from dental floss hanging from one end. Slowly, she scans the sandy desert, looking for lizards to lasso.

Is Rosenblum some kind of Wild West reptile rustler? No, just a scientist at work. Rosenblum, an evolutionary biologist from the University of California (Berkeley), is studying a remarkable transformation that has happened at White Sands.

White Sands wasn't always white. It was brown. But 6,000 years ago, a shift in geology turned it white. Now, the lizards at White Sands are changing to match. "At White Sands, we're seeing the process of evolution in action," she told *Current Science.*

CHANGE IN THE LANDSCAPE

Most desert landscapes are brown because their soils contain a mix of different minerals. At White Sands, the sand is gypsum, a pure white mineral. Gypsum is an *evaporate,* a mineral that crystallizes out of solution when salt water evaporates.

The gypsum at White Sands came from an ancient layer of gypsum rock in the surrounding mountains. During an unusually wet period 24,000 to 12,000 years ago, rain eroded the gypsum layer. The dissolved gypsum washed into a huge lake that had formed in the valley where White Sands is now.

When the wet period ended, the lake dried up, leaving the gypsum behind. By 6,000 years ago, the lake bed was mostly a vast plain of glistening white gypsum.

Little brown lizards had been living large in the brown desert around the lake. Their brown color afforded them some camouflage protection against predators. But a big change was heading the lizards' way.

Wind chewed at the exposed gypsum in the lake bed. Grain by dazzling grain, the gypsum piled up into sand dunes that spread into the surrounding desert. Like a creeping fog, the bright, white dunes slowly covered everything in their path-including the lizards brown landscape. The lizards adapted to that change by turning white, too.

LUCKY CHANGE

To investigate that adaptation, Rosenblum lassos lizards and checks them against a color chart. She also snips off the tail of each animal to collect samples of flesh. That may sound cruel, says Rosunblum, but lizards lose their tails naturally and then regrow them.

Once Rosenblum has enough samples, she hightails it back to her lab to study the lizards' *deoxyribonucleic acid (DNA).* DNA is a long molecule that exists in every cell and contains thousands of units called *genes* that determine the traits (behavior and appearance) of an individual. DNA is passed down from one generation to the next.

Rosenblum says the lizards' change in color began as an occasional random *mutation* in a few lizards. A mutation occurs when a gene in the DNA suddenly changes. In this case, the mutation altered the gene for color and made the mutant lizards lighter in appearance.

What a lucky change that mutation was! The light colored lizards were better hidden against the new white background and were more likely that the brown ones to survive and pass on their color. Over time, more white lizards hatched at White Sands.

"There is very strong *natural selection* happening there," says Hopi Hoekstra, a biologist at the University of California (San Diego). Natural selection is the process in which individuals that are better adapted to their environment survive and reproduce more successfully than less-well-adapted individuals. It is the mechanism of evolution.

SKIN-DEEP DIFFERENCE

To learn more about the lizards' evolution, Rosenblum has compared DNA from the white lizards with DNA from brown lizards living in a brown environment 30 kilometers (19 miles) away. She analyzed the mutations in each group. "The longer they white and dark lizards have been separated, the more difference we should see when we compare DNA from the to groups," she says.

But Rosenblum found that only the gene for color distinguishes the two sets of DNA. "There are no other consistent genetic differences between the two groups," says Rosenblum.

That single difference suggests two things: One, the white lizards did indeed evolve from the brown ones. . Two, the split occurred relatively recently-in the last few thousand years.

Rosenblum says the white lizards haven't evolved into a new species. But she has noticed that the white lizards display mating behavior more often when they're around other white lizards. Two closely related groups of organisms are considered separate species when they don't mate. "I can't predict the future," she says, "but the process of a new species forming has started."

EVOLVING TOGETHER

White Sands is a glittering example of how the evolution of landscape and species are tied."If the landscape wasn't there, the lizards couldn't adapt to it," says Rosenblum.

The New Mexico desert is not the only place where geologic change has spurred an evolutionary adaptation in an animal's coloring. Hoekstra has studied several black lava fields in Arizona and New Mexico where black mice have evolved from brown ones. "We're connecting genes to real changes in environments," she says.

Meanwhile, back at White Sands, other animals are following in the same evolutionary footprints taken by the lizards, says Rosenblum. Crickets, mice, and spiders are going white, too!