

IN THE FIELD

An Evolutionary Embrace

Many plants and animals get along with serious give-and-take. Think about flowering plants. Unlike animals, they can't move to find a mate. So, most depend on insects, birds, or bats to carry their pollen from flower to flower. Without pollinators, flowering plants would struggle to reproduce. The pollinator's reward? Tasty nectar! When a bat nuzzles inside a flower to sip its nectar, pollen sticks to its fur. At the next flower that the bat visits, some of the pollen falls off. *Presto*—pollination!

Remarkable relationships—with remarkable results

Think about bats and the flowers they pollinate. The give-and-take can lock them in an evolutionary race. A flower might evolve a unique fragrance, color, or shape that attracts only a single species of bat. The change increases the chances the bat will transfer pollen to other flowers of the same species. For example, with time, a trumpet-shaped flower might evolve an even longer tube. This forces nectar bats to linger longer at each blossom and collect more pollen. But meanwhile—by chance—one species of bats evolve an even longer tongue . . . and the race is on!



Calliope hummingbird



Nectar bat



Hawk moth

▲ Birds, bats, and insects evolved to do a better job slurping flower nectar—and transferring pollen.

TECHNOLOGY

Nathan Muchhala

UNIVERSITY OF TORONTO
Biologist
ECOLOGY & EVOLUTIONARY BIOLOGY



▲ On a trip to Ecuador, Nathan stops to do one of the things he loves—sketching.

Nathan Muchhala always dreamed of becoming a jungle explorer. As a young boy, Nathan explored the woods behind his Milwaukee, Wisconsin home. There he caught snakes and salamanders. In school, Nathan loved biology—especially evolution. “It was cool that one theory can explain so much in nature,” Nathan says. In college, Nathan thought he would focus on reptiles or amphibians. Then a friend invited him to Ecuador, where Nathan helped his friend study bats in the Andean cloud forests. Aha! Nathan could fulfill his childhood dream. “That’s what pulled me in,” Nathan says. During the day,

Nathan surveyed the flowers that blossomed in the thick, humid forest. At night, he caught different species of nectar bats. Gradually, Nathan learned about the ways flowers and bats influenced each other. Some flower species evolved shapes that allowed them to transfer pollen to specific parts of a bat’s body. Why? He discovered it kept the bats from mixing their pollen while flitting from flower to flower. That’s not such a batty idea! Nathan also found a long bell-shaped flower—and a bat with a suspiciously long tongue. Did it pollinate the flower? Had they evolved together?

IN THE FIELD



▲ Yes, that's the nectar bat's super long tongue reaching for some nectar. Afterward the tongue curls back in to its storage space—the nectar bat's ribcage!

Late at night in Ecuador's Andes Mountains, Nathan Muchhala crouches in a screened-in tent, deep in the damp cloud forest. A captive bat flutters around Nathan's hand where he holds a glass tube filled with nectar. On an earlier expedition, Nathan spotted an extraordinarily long-tubed flower. Nathan suspects the tube-lipped nectar bat is its exclusive pollinator. Measuring its tongue could confirm his hypothesis.

"C'mon," he whispers. "Closer, closer." Under the light of Nathan's headlamp, the bat darts, hovers, and flicks its tongue deep into the slender tube. Success! Again and again, the bat feeds. Slowly, the nectar level drops until the bat's tongue can reach no deeper. Nathan measures the depth. It's 8.5 centimeters (3.3 inches)—the exact length of the flower!

TECHNOLOGY

Nathan did more research to confirm the bat really does pollinate the long-tubed flower. First, Nathan gently netted one of the bats. He then used tape to lift pollen off the bat's fur. Using a microscope, he examined the pollen grains. Did they match pollen samples taken directly from the flower? Yes!



INVENTION CONNECTION

A Tall Measure

Imagine you're a biologist. You want to find out the height of a giraffe without capturing and directly measuring it. You read how Nathan used a test tube of nectar to indirectly measure the length of a bat's tongue. You also know giraffes like to nibble leaves that grow high up on acacia trees. Discuss with a partner how you could apply that knowledge to *indirectly* measure the giraffe's height, and use Nathan's work for inspiration.

Oh, By the Way

Nathan's long-tongued bat turned out to be a new species, called *Anoura fistulata*. The bat's tongue stretches 1.5 times the length of its body! That's twice the length of any other nectar bat's tongue. So, it is the only bat able to pollinate the long-tubed flower called *Centropogon nigricans*. (below with *Anoura Fistulata*).

