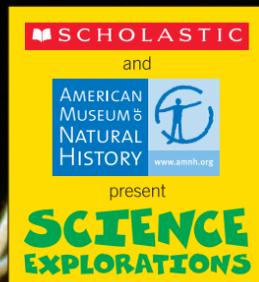


TWILIGHT Zone

Follow a scientist as she searches the skies to investigate one of nighttime's fliers—bats

BY BRITT
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LONG NOSED BAT, MERLIN TUTTLE/PHOTO RESEARCHERS, INC.; SIMMONS, ROBERT VOSS

FRUIT FEAST: Lesser long-nosed bats frequently feed on saguaro cactus fruit.

BAT CATCHER: Nancy Simmons, a scientist at AMNH, displays a bat caught in the rain forest.



The sun is setting in the rain forest of French Guiana (gee-AH-nah), a country in northern South America. Nancy Simmons, a zoologist at the American Museum of Natural History (AMNH) in New York, hikes along a trail through the trees. She spreads out a large net and strings it between two poles like a volleyball net. She lodges the poles into the ground. Then, she waits.

As evening falls, some of the forest's night fliers—bats—emerge from their sleeping roosts. As they swoop past Simmons—THWAP!—a few of the bats collide with her net and get snarled in its threads. Simmons works through the night, carefully untangling the bats. She examines each one before setting it aside in a cotton bag. At the end of the night, she decides which bats to release and which to take to her camp for further study.

By setting up nets all around a small patch of rain forest, Simmons has captured 78 different species of bats. That's the highest number of bat species ever found in one place.

But French Guiana isn't the only region of the world teeming with bats. The animals are found on every continent except Antarctica. Bats account for nearly one fifth of all of Earth's species of *mammals* (see *Nuts & Bolts*, p. 11).

With so many bats flying in skies all over the world, scientists are trying to learn how each of the different

species is related to the others. Follow along as Simmons shares her quest to construct a bat family tree.

What are some of the challenges of studying bats?

Bats are *nocturnal* (active at night). So when most people are going to bed, we are going to work. Besides having to stay up all night, it's difficult to study animals that fly in dark skies because you can't easily watch them. That's why we use nets to catch them.

Once you have captured a bat, what do you study?

I am a *morphologist*. That means that I study *anatomy*, or the body form of organisms. This ranges from what the bat looks like on the outside to what it looks like on the inside. For instance, I study color patterns on the bat's fur as well as the form of the bat's skull and the shape of its teeth.

What do these characteristics tell you?

You can learn a tremendous amount about how an animal lives by studying its anatomy. For instance, bats that eat insects need to puncture the insect's hard outer skeleton. So these bats tend to have sharp pointy teeth. A bat that eats fruit, on the other hand, needs to crush the fruit to squeeze out its juices. So fruit-eating



SO PRIMITIVE: These fossil remains are of the oldest known bat, *Icaronycteris index*.



ON THE FLY: Many insect-eating bats snatch up their prey, such as moths, while flying.



MINI FLIER: A bumblebee bat weighs only about as much as a dime.



Nuts & Bolts

Bats are *vertebrates*, or animals with a backbone, and *tetrapods*, or four-legged animals. Bats are also *mammals*. They are warm-blooded, have skin covered in hair or fur, and their young feed on their mother's milk.

Bats are distinct from other mammals. They are the only mammals that can fly. Bats also have long life spans for species of their size. A small bat may live to about 30 years, while a similar-size mouse would live one year. And unlike many other small mammals, which give birth to large litters, bats usually have only one or two offspring at a time.



WIDE WINGS: The world's largest flying fox can be found in the Philippines.



GOTCHA! Simmons uses nets with several horizontal panels to catch bats.

FOSSIL: PHOTO BY DENIS FINNIN. © AMERICAN MUSEUM OF NATURAL HISTORY; BAT AND MOTH: MICHAEL DUBRAN/WILDEN PICTURES; NETS: COURTESY OF NANCY SIMMONS; BUMBLEBEE BAT: MERLIN D. TUTTLE/PHOTO RESEARCHERS, INC.; FLYING FOX: ROLAND SEIRE/PETER ARNOLD

times. For example, millions of years ago, a group of insect-eating bats with pointy teeth may have started to eat fruit. As a result, over generations, the teeth of these bats would have become broader and less pointy. At the same time, a group of unrelated bats also may have changed their diet from insects to fruit. These bats may have evolved broader teeth, too. So while these two groups of animals aren't closely related, they now share a similar tooth structure.

Sorting out these patterns of similarities is part of what makes it hard to distinguish the true relationships among bats.

How are you hoping to sort out the relationships?

We are gathering information on the *traits* (inherited features) of all of

the world's bat species. In addition to studying anatomy and behavior, we are now using data from the bats' *DNA*, the molecule that carries hereditary information. We have found that each species shows slight differences in its DNA. Those variations give us additional data to find links between different bat species. By compiling this information, we hope to build a more complete bat family tree.

Why is it important to gather this information?

Learning more about bats will help us protect them. Many species of bats are *endangered* (in danger of dying out) because humans are destroying the *habitats* in which they live. By studying bats we can determine which bat species are at risk and find out how to help them survive.

bats tend to have broader, less pointy teeth—more like a human's.

Are there many kinds of bats?

There are more than 1,100 different bat species. There are large bats called flying foxes with wingspans of up to 1.8 meters (6 feet). These bats mainly eat fruit. Some city parks in Sydney, Australia, for example, are full of flying foxes.

The world's smallest bat is the bumblebee bat from Thailand. It is smaller than your little finger and its wingspan is just 8 centimeters (3 inches). These are *insectivorous* bats; they eat tiny flying insects. And there are all kinds of bats in between.

Has there always been so much diversity among bats?

The oldest records of bats are *fossils* (traces of ancient organisms)

from the early Eocene period—about 52 million years ago. These fossils show that ancient bats were similar to the bats that we see today. And we have found the fossil remains of many different bat species, suggesting that bats were quite diverse at that time.

WEB EXTRA

To discover more about bats and their adaptations, tour the interactive "Science Explorations" Web site. Be sure to take part in the live question and answer session with bat specialist Nancy Simmons. Visit: www.scholastic.com/bats

How are these different bats related?

That's one of the big mysteries that we are trying to solve. Most scientists now recognize 18 or 19 bat *families*. Bats are grouped into these families based on a variety of shared features, including anatomy and behavior. For instance, bats in one family may have similar teeth, skull form, and wing shape, as well as eat the same type of food. But scientists have not yet agreed on how these families are related. That's because there are so many features to match up, and the

variation within and among different families is complicated.

Why is it so complicated?

Most of the features that we study seem to have developed independently in different bat species at different

Check it Out:

Golden-capped fruit bats and many of their relatives can be seen in the American Museum of Natural History's Hall of Biodiversity. This permanent exhibition is devoted to a pressing environmental issue of our time: the need to protect and preserve our planet's biodiversity, or the variety and interdependence of Earth's life forms. The Museum has been researching and celebrating the natural world for more than 135 years and has more than 30 million objects in its extensive research collection. The Museum's 200 scientists travel around the world on 100 field expeditions each year, studying everything from leeches to woolly mammoths to the universe.

To learn more, ask your teacher, or visit www.amnh.org.

Why is it so important to protect bats?

Bats play a critical role in many environments. One of the important things bats do is they eat certain insects that are agricultural pests. For example, each night bats in parts of the U.S. eat thousands of tons of corn ear worms. These insects feed on food crops. If the big bat colonies in these parts of the country were wiped out, it could have devastating effects on our agriculture. ❁