



WHAT CAN TREE SWALLOWS TEACH US ABOUT BIOLOGY?

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Tree swallows are North American birds that can help us understand more about biology. We already know a lot about tree swallows because they are easy to work with. These birds are popular for scientists to study. We know a lot about bird health, migration, and nesting because of tree swallows. However, tree swallows are declining because of climate change, insect loss, and habitat destruction. You can help by becoming a community scientist! Tree swallows are fascinating birds that everyone can help conserve. And along the way, we can learn more about our world.

WHAT MAKES TREE SWALLOWS GREAT FOR SCIENCE?

Imagine you are at a lake and you see a beautiful blue-green bird flying over the water. The bird's feathers shine in the sun and its white

Figure 1

(A) An adult tree swallow shows off its beautiful blue-green feathers. (B) A mother tree swallow flying away from a baby swallow in a nest box. The mother swallow has a tracker on her back to follow her movements. The nest box also has an antenna and equipment to track birds' movements. (C) A close-up view of a tracker on a tree swallow, where it sits like a backpack. The tracker will fall off on its own over time. Other researchers attach trackers to birds' legs [photo credits: (A, B) Maren Vitousek; (C), Jennifer Uehling].



Figure 1

POPULATION

A group of individuals of the same species living in the same area.

MODEL ORGANISMS

Representative organisms that scientists study deeply to discover how nature works. Information from these models can be applied to general biology.

belly reflects the water. Its long wings flap up and down gracefully. This bird is a tree swallow (Figure 1). The scientific name for tree swallows is *Tachycineta bicolor*. They are small birds that live near water. They have blue-green-colored backs, white bellies, and pointed wings that help them fly. What you cannot see is how important these birds are for science! We can learn a lot about biology by studying tree swallows.

Tree swallows are easy to study, so we know a lot about them. One reason scientists like to study tree swallows is because they nest inside boxes (Figure 1B). This means that scientists can keep a close eye on their nests and babies. There are many study **populations** of tree swallows in the world that scientists have followed for many years [1]. Scientists have learned about how tree swallows live and respond to environmental changes because of this work. For example, scientists know about their nests, diets, and where they migrate. They also study how tree swallows respond to climate change.

Tree swallows can tell researchers much about the world. Organisms that scientists study to discover how nature works are often called **model organisms**. Model organisms are typically easy to find or research. Many model organisms are studied in the lab, like mice and plants. Tree swallows are special because they are model organisms that live in the wild. By learning a lot about these model organisms, we can understand a little more about many others.

WHAT CAN TREE SWALLOWS TELL US ABOUT THE WORLD?

Scientists know a lot about how wild tree swallows live and survive. When we learn something new about these birds, we can apply it to our understanding about how the world works.

MIGRATION

The seasonal movement of animals, like birds, from one region to another.

HORMONES

Chemicals that act like messengers to tell the body how to respond to the environment.

Movement and Migration

Each summer, tree swallows nest in North America. After baby swallows grow up and leave the nest, these birds fly to warmer areas for the winter. This is called **migration**. Some travel to the coasts of the southern United States, while others fly as far as Central America. During migration, tree swallows often fly with thousands of other swallows. High up in the sky, the big cloud of birds can look like a living tornado.

Scientists are trying to learn more about the paths that swallows take to move and migrate. To do this, researchers put tiny trackers on the birds ([Figure 1C](#)) [2]. From trackers, scientists have learned that tree swallows take different routes to their winter homes. The path they take depends on where the swallows breed.

Nests

Tree swallows build their nests in holes—often in tree trunks or branches, but also in nest boxes made by people. Nests are made from woven dry grass. The birds use feathers to line their nests, so chicks have a cozy place to grow up. If *you* put up a nest box, you may be able to attract a family of tree swallows ([Figure 1B](#))!

Scientists frequently use nest boxes to study how tree swallows grow. For example, some scientists want to see if the way the nests are built changes how the baby swallows grow up. Scientists found that nests with more feathers cooled more slowly than nests that did not have as many feathers [3]. They also found that baby tree swallows grow larger in nests with more feathers, because feathers act like a blanket to keep chicks warm and healthy on chilly days [4].

Growing Up

When baby tree swallows hatch from their eggs, they are blind and have no feathers ([Figure 2](#)). So, tree swallow chicks depend on their parents for food and warmth. The chicks must grow up quickly so that they can migrate to warmer places for the winter. The environment that tree swallows grow up in can change how their bodies develop. Challenges like bad weather, predators, and limited food can affect their growth. For example, tree swallow chicks weigh less when they grow up in cold, wet conditions [5, 6].

Dealing with Challenges

When animals, including humans, face challenges, their bodies release chemicals called **hormones** that cause changes in the body. Have you ever gotten cold and started to shiver, and then tried to get warm? Hormones cause these reactions. On chilly days, hormones make animals, including humans and birds, shiver so they can make heat to stay warm. Hormones cause animals to change their behaviors when they face challenges like bad weather, predators, or lack of food.

Figure 2

Tree swallow chicks rest in a nest with many warm feathers provided by their parents, next to an unhatched egg (photo credit: Maren Vitousek).



Figure 2

Animals are facing more and more challenges these days. For example, climate change is leading to more extreme and variable weather. This can be a problem for wild animals, like swallows, that live outside. Recently, scientists investigated how tree swallows respond to challenges. For example, how do birds respond when the weather unexpectedly gets super hot or super cold? What happens with their hormones? Scientists discovered that, after tree swallows experience cold days for the first time, they release more hormones the next time it gets cold. This means that facing challenges like cold weather might prepare tree swallows to face future challenges [7].

Diet

Tree swallows mostly eat flying insects, like flies, dragonflies, and moths. Have you ever been bitten by a mosquito? Tree swallows love eating mosquitos. Mosquitoes are an example of insects that spend their early lives in the water. Insects that grow up in water are important for tree swallow health. These insects are especially good for baby tree swallows, because they help them grow up big and strong [8]. By studying what tree swallows eat, scientists can learn about what types of foods are healthiest for them. Using what they know about tree swallow models, scientists can learn a lot about the nutrition and diets of other animals. This information can help us learn what foods keep other animals, including us, healthy.

WHAT CAN WE DO TO HELP TREE SWALLOWS?

Since 1970, bird populations across North America have declined. There are now almost 3 billion fewer breeding birds than there were

before. Tree swallows and other insect eaters are some of the birds that have seen the greatest decline. Although tree swallows are not endangered, their populations have decreased by over 30% [9]. One of the major reasons for bird losses is human-caused climate change. Climate change can make weather more variable, which can make it harder for tree swallows to survive.

Some scientists think that insect-eating birds like tree swallows are not doing well because the insects they eat are declining. Recently, scientists found that we are in an “insect apocalypse”. The Earth is losing many insects every year because of climate change and other human impacts (for more information on insect loss, see [this article](#)). For example, dangerous chemicals sprayed on plants to protect food crops can poison insects. If birds eat insects poisoned by these chemicals, the birds can be harmed, too [10]. Since insects are declining, tree swallows might have a harder time finding food and staying healthy.

To help swallows and other birds, we must also try to help insects! For example, we can plant insect-friendly gardens, or support the conservation of natural areas. This will help the insects that tree swallows need to eat to survive. If the birds have good resources, they might be able to weather more storms.

CONSERVATION

Protection of species and natural areas/habitats from loss by preserving natural resources.

HABITATS

The natural home of an animal, plant or other organism.

Habitat Conservation

Conservation is the protection of species and natural habitats. We can conserve many birds and animals by taking care of their **habitats**. To help, you can preserve old trees with holes where tree swallows like to nest. You can also **build your own nest boxes**. Tree swallows like small, wooden nest boxes that are attached to a pole or tree and placed close to water. Building new nests can help tree swallow populations. It is also important to reduce waste and chemicals that hurt wildlife like swallows and insects. You could volunteer to clean up trash from local bird habitats. Teach your friends and family about the importance of natural habitats for wildlife.

Community Science: How Can YOU Contribute to Research?

There are many ways that you can help scientists learn about birds. You can find out about these projects through your local college, nature center, or museum, or online. For example, there phone apps that can help you identify bird species, [Merlin Bird ID](#). Other apps allow you to mark where animals are and how they move around (see [iNaturalist](#), for example). You can even help scientists learn more about tree swallows and other birds in your own backyard. Check out the table of resources for some ideas ([Table 1](#)).

Many actions, both big and small, are helpful for birds and useful for scientists. You can use the resources we provide as starting point, or you can talk to the people around you for creative ideas. There are so

Table 1

Resources that young community scientists can use to do science or learn about birds.

Action	Resource	Website
Collect data about bird nests	NestWatch	nestwatch.org
Count birds in your backyard	Great Backyard Bird Count	birdcount.org
Identify organisms in your area	Seek App	inaturalist.org
Learn more about birds	All About Birds	allaboutbirds.org

Table 1

many ways you can help! By protecting natural habitats and collecting information about swallows and other birds, you can help scientists continue to learn about the world through tree swallows.

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YOUNG REVIEWERS

BIOBUDDIES , AGE: 11–14

Fluent in the languages of genes, cells, and ecosystems, we are the BioBuddies (Avleen, Girik, Amtoj, Suvaathy, Japanhad, Kabir). But do not worry, we are equally adept at communicating in English! When we are not deciphering scientific enigmas, we are simplifying complex concepts for those new to the field, all with a touch of humor and a sprinkle of charisma. A team of science-savvy students, we are on a mission to unravel the mysteries of life on Earth and beyond in the extraterrestrial environment.





QUEEN ELIZABETH'S GRAMMAR SCHOOL, AGE: 12

We are a year 7 form and loved working with our science mentor to learn more about tree swallows.

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COLLEEN R. MILLER

My name is Colleen Miller. I have a Ph.D. in ecology from Cornell University. I research how light pollution, like streetlamps and city skyglow, affects animal behavior and ecology. I also have a master's degree in climate change ecology. I love to talk about conservation and birds with my community! *ccm246@cornell.edu



JENNIFER L. HOUTZ

My name is Jennifer Houtz, and I have a Ph.D. in ecology from Cornell University. I study the tiny bacteria that live inside bird guts. Gut bacteria can help birds digest food, fight diseases, and help the gut communicate with the brain. I love teaching students cool facts about birds, bacteria, and behavior!



NICOLE MEJIA

My name is Nicole Mejia, and I am a Ph.D. student at Cornell University. I am interested in how birds' bodies and genes are responding to climate change. I also enjoy hiking, reading, and trying new foods.



NATALIE J. MORRIS

My name is Natalie Morris and I am an undergraduate senior studying ecology and evolutionary biology at Cornell University. I am super interested in how climate change affects birds and their gut bacteria! In the future, I want to get a Ph.D. in ecology. When I am not studying, I love to ride horses, lift weights, and go hiking!



MONIQUE A. PIPKIN

My name is Monique Pipkin, and I am a Ford Foundation Predoctoral Fellow, Alfred P Sloan Foundation Scholar and Ph.D. Candidate at Cornell University. I study iridescent feathers. Iridescent feathers are feathers that change color depending on how you look at them! In tree swallows, feathers can look blue or green depending on how you look at them. I am trying to understand why iridescent feathers evolved and how iridescent feathers may help birds today. I also study how people learn about science through creating and experiencing art.



ANUSHA SHANKAR

My name is Anusha Shankar. I have a Ph.D. from Stony Brook University and was a postdoctoral fellow at Cornell University. I am now an assistant professor at the Tata Institute of Fundamental Research Hyderabad in India and am a National Geographic Explorer. I study hummingbirds and how they manage their time and their energy needs in various environments. I love salsa dancing, making art, reading fiction, and being outside.





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My name is Jennifer Uehling, and I am an assistant professor in the Department of Biology at West Chester University in Pennsylvania. I have my Ph.D. in ecology from Cornell University. I study why birds decide to eat certain foods and how what they eat affects them. I also like to run, watch baseball, and bake!



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My name is Jessie Williamson, and I am a National Science Foundation postdoctoral fellow at Cornell University and the Cornell Lab of Ornithology. I study migration, physiology, and genomics of giant hummingbirds and other mountain birds from the Andes Mountains of South America. When not doing science, you can find me outside birding or hiking.



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My name is Maren Vitousek, and I am a professor of ecology and evolutionary biology at Cornell University. I study tree swallows and how they cope with stress. I also like to hike, camp, and enjoy the natural world with my kids!