



Fantastic FUR

FUR—AND THE HAIR
THAT MAKES IT UP—
HELPS ANIMALS SURVIVE
IN AMAZING WAYS.

BY CHRIS NISKANEN

You may have touched it on your dog or cat and felt its softness and warmth.

You may have seen it on black bears, white-tailed deer, and other animals. And you've probably combed it on your head and seen it drop on the floor when your barber cuts it.

You guessed it! We are talking about hair. When it grows thickly all over animals, it is called fur. Hair and fur can do amazing things.

When humans want to stay warm, we put on a jacket that is made with down feathers or wool. When we want to protect ourselves from thorns or dirt, we wear heavy pants or gloves made from leather.

But with other animals, hair and fur is an outer covering that does it all.

Fur provides warmth against the snow, protection from other animal bites, and camouflage to help animals catch prey or avoid becoming prey themselves. Special types of hair even act as a super-sensitive detection system to help animals find their way in woods and water.

Let's learn more about what makes hair and fur so fantastic.



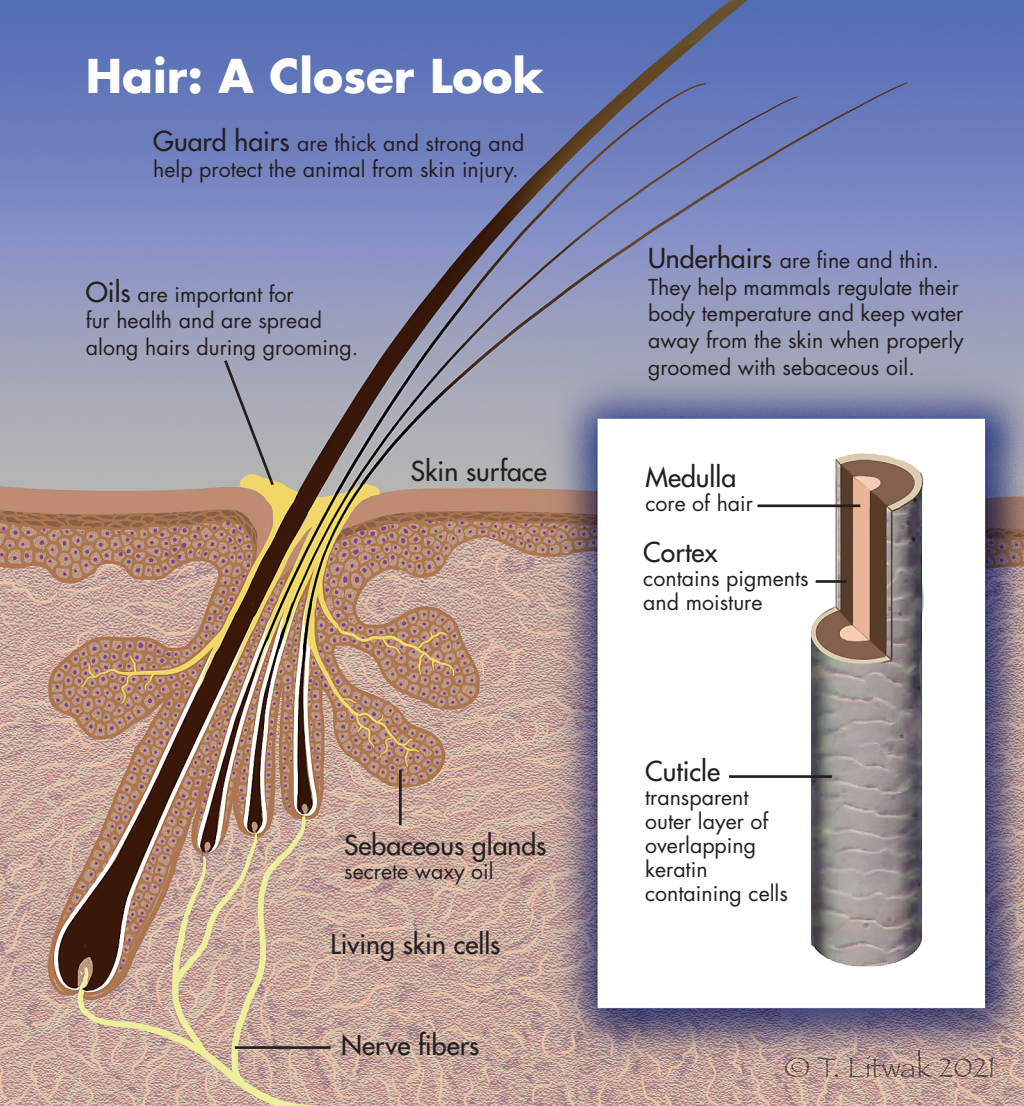
TOP LEFT: COURTESY OF THE A.D. OTHER PHOTOS: BILL MARCHEL.

Hair: A Closer Look

Guard hairs are thick and strong and help protect the animal from skin injury.

Oils are important for fur health and are spread along hairs during grooming.

Underhairs are fine and thin. They help mammals regulate their body temperature and keep water away from the skin when properly groomed with sebaceous oil.



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TAINA LITWAK

It's a Mammal Thing

Hair and fur are made from the same material, called *keratin*. While humans grow hair on specific parts of their bodies, many mammals have fur all over their bodies. Even sea mammals like

whales and dolphins have hair.

Hair and fur are one thing that makes mammals, including humans, different from other animals. Other differences are that mammals are warm-blooded

and produce milk for their young.

Hair and fur do many things, so it's not surprising individual hairs have multiple parts. They have a dead and dry upper part—the part you see and touch—and a living part that grows out of a depression in the skin.

Hair grows from a layer of living, thick skin, but it doesn't stay the same forever. On animals, hair and fur is constantly changing and growing, helping animals stay alive.

A New Coat

You probably notice that pets shed their hair. This is called *molting*, and it's how many mammals lose old hair and replace it with new hair.

Molting is especially important to mammals living in cold climates because they can replace old and damaged fur with new fur that provides more insulation against the cold.

"A new fur coat in the summertime helps keep mammals cool, while a new fur coat in the wintertime helps keep mammals warm," says Blane Klemek, a regional wildlife manager for the Minnesota Department of Natural Resources. This is called *thermoregulation*.

There are two main types of hair: underfur and guard hairs. The guard hairs are the long, coarse hairs that give mammals color. Guard hairs also help mammals shed water and protect their skin from abrasions.

Underfur is fine, dense hair that provides insulation. When you brush your dog or cat, the soft and fluffy fur in your brush is underfur. Mammals shed both their underfur and guard hairs.

Fur for Warmth

Sea mammals like whales have very few hairs, but very thick layers of fat to survive in cold water. Land mammals like bears have a layer of fat, but also thick fur to keep them warm. Minnesota's black bears grow extra thick and long hair to protect them during the coldest winter months.

Klemek says white-tailed deer grow short hair for their summer coats to keep them cooler and longer hair in the winter for warmth. Their winter hair is also hollow and filled with air, which helps keep deer warm and dry.

Semi-aquatic mammals that live on land and water, like beavers and river otters, have very dense and specialized fur to keep them warm when they dive underwater.

When beavers and river otters dive, their dense underfur traps air bubbles, a process called *entrainment*. Those bubbles provide an additional barrier to the cold because air doesn't conduct as much heat as water.

Beavers and river otters also have oil glands near their tails that they rub with their feet. Then they "comb" the oil throughout their hair to keep water out.



BILL MARCHEL

This Minnesota weasel's brown fur turns white in winter—except for its tail tip—to blend into the landscape.

Nature's Camo

Fur color can help protect mammals. Snowshoe hares and weasels turn from brown to white in winter in order to blend into the snowy landscape and avoid predators. They're the only Minnesota mammals to do this.

Even while the rest of their fur coat turns white, short- and long-tailed weasels have black tips on their tails, which adds another layer of protection.

Raptors such as hawks and owls can be fooled by the black tip, says John Erb, a wildlife biologist at the Minnesota Department of Natural Resources. "A raptor would be most likely to aim for the moving black spot and the weasel would escape," says Erb.

Ever wonder why skunks have a white stripe against black fur? The stripe is an eye-catching design that helps remind would-be attackers what they're dealing with.

"Stripes on skunks are thought to be a warning sign that will be remembered by animals that attempt to attack them and then get a face full of skunk spray," Erb says. "It's hard to confuse a skunk for another species due to their distinct coloration."

Fur coloration also helps some predators. Cat species like bobcats have spots and barring that provide camouflage. Erb says camouflage is important for wild cats that hunt by stalking their prey in habitats that have a variety of colors and textures.



COURTESY OF MINNESOTA ZOO

Sea otters, like this one at the Minnesota Zoo, have fur that's more dense than any other mammal.

The World's Thickest Fur

Jenny Beem works with sea otters at the Minnesota Zoo. She says sea otters live in frigid ocean water and they have fur that is the densest of any mammal on the planet.

Sea otter fur isn't long compared with other mammals—the longest guard hairs are a little over 1 inch long, and the undercoat hairs are around a half inch long—but these otters have over 1 million hairs per square inch of their body. That super-dense fur requires a lot of maintenance, Beem says.

"The sea otter's fur is very important to

them, and they groom it frequently," she says. "They will blow air into the dense undercoat, and this prevents any water from contacting the otter's skin. Sea otters spend a large part of their day meticulously grooming their fur to make sure it stays in excellent condition."

Minnesota's river otters also have thick fur, though not as thick as sea otters. They have about 373,000 hairs per square inch. That's a lot of hair compared to your Uncle Fred!

The average human head has only about 100,000 hairs total.



Sensing With Facial Hair

Whiskers are a type of specialized hairs that are longer and stronger than normal hairs and can move independently. Think of them as *sensory* hairs because they can help mammals sense objects and other creatures around them.

In wild canines and cats, whiskers have lots of nerves near their bases that send vital information to the brain about the animal's surroundings.

Andrew Tri, a DNR wildlife biologist, says whiskers have sensitive nerves at the base and grow to certain lengths in wild cats to “sense vibrations, detect air movement, and provide sensory input to help determine if they can fit into a certain place, like a hollow log, to hunt mice.”

Beem says sea otters and seals also use their whiskers to sense prey and learn about

their environment in the dark ocean depths.

Wolves, foxes, and coyotes don't have long whiskers like wild cats, but they still use their whiskers to identify and locate objects near their noses.

Hair-Raising Situations

Have you ever seen the hair on a dog go up?

Wolves and dogs puff up their fur to make themselves look bigger to other animals. Called *piloerection*, this hair-raising behavior is used by aggressive or dominant wolves to show other wolves that they mean business. Submissive wolves, in turn, keep their fur flat.

Mammals also use piloerection to trap air next to their skin to stay warm. In humans, this involuntary reflex to cold or to strong emotions is called getting “goose bumps.”

Likewise, porcupines puff up their hair-like quills to fend off attackers. Hair and porcupine quills are both made from keratin. Like many mammals, porcupines have short underfur and long guard hairs on their body. The sharp quills on their back, rump, and tail provide serious protection against predators.

Shortest and Longest Fur

Which Minnesota mammals have the shortest fur and the longest fur? We asked several scientists to find out.

The winner of the short fur award, they said, goes to the smallest mammal in North America: the American pygmy shrew.

These tiny mammals are just 3 to 3½ inches long—including their tail!—and have the shortest life spans (about one

year) and the fastest heartbeat (1,200 beats per minute) of any mammal. They weigh less than a dime. Their fur is so short that it has been compared to velvet.

Several large Minnesota mammal species have very long fur—black bears, gray wolves, and moose among them. But the longest-hair award would have to go to the American bison, the state's largest mammal at 2,000 pounds and 5 to 6 feet tall.

Bison have dense underfur and coarse outer hair that protects them in the coldest prairie winters, fur that was especially valued by Native Americans for its warmth.

Zookeepers at the Minnesota Zoo say bison underfur is 1 to 2 inches long, but their long outer hairs can be 7 inches or longer.

LEFT TO RIGHT: MICHAEL FURTMAN, BILL MARCHEL, DISCOVERLIFE.ORG/SMITHSONIAN, BILL MARCHEL



Scientists recently found a mammal fossil in Spain, the size of a young rat, that was 125 million years old.

The History of Hair

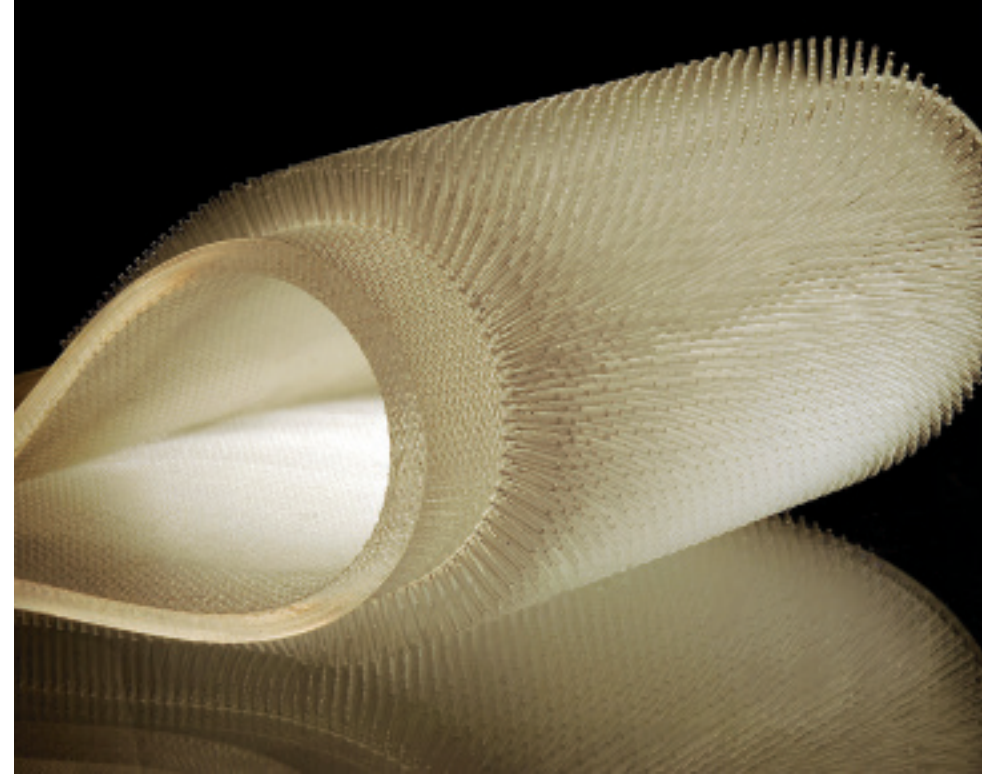
It is hard to know precisely how long hair and fur have been around. Because it is soft tissue, hair does not fossilize and survive well in rock. The first fossils thought to be mammals are more than 200 million years old. Scientists believe small, furry mammals became abundant between 65 million and 141 million years ago.

Scientists recently found a rare 125-mil-

lion-year-old mammal fossil called *Spinolestes xenarthrosus* in Spain that had remarkably well-preserved hair. This ancient mammal was the size of a young rat. Some pieces of mammal hair have been found in 165-million-year-old fossils.

Scientists believe furry mammals have probably inhabited the area that is now Minnesota for as long as mammals have been on Earth.

COURTESY OF PHILLIP L. MANNING VIA CREATIVE COMMONS



Animal fur inspired the design of this new material that may be used to make warmer wetsuits for surfers.


“Fur” for Surfers

Fur is so good at warming that it has inspired human innovation. In 2016, scientists at the Massachusetts Institute of Technology (MIT) began thinking they might be able to design a warmer wetsuit for surfers if they knew precisely how air entrainment worked in animals like beavers and otters.

The MIT scientists began designing rubber “fur” and experimenting with the spacing of rubber hairs. They made molds, experimenting with different densities of the rubber hairs. They

plunged the fake fur in and out of the water to see which rubber hair spacing best trapped air.

Once they had the correct spacing, they turned their experiment into a mathematical formula to predict how to arrange and space the rubber hairs to get the best air-trapping qualities.

With that knowledge, the MIT scientists think they can create warmer, air-trapping wetsuits for surfers, who are in and out of the water often, just like beavers and otters. 

FELICE FRANKEL, COURTESY OF MIT PRESS

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