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The Pennsylvania Game Commission is the State Wildlife Management Agency. Our mission is to manage and protect wildlife and their habitats while promoting hunting and trapping for current and future generations. During this presentation, students will learn what animals have fur, how fur helps these animals to survive in their environment, and the connection between people and animals with fur.

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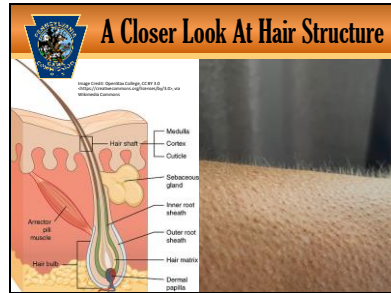
What animals have fur? Mammals! All mammals at some point in their life have hair. Bears, bats, dolphins, and you are all examples of mammals. Can you name other mammals?

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What is fur? Fur is the same thing as hair. The word fur is usually the term used to describe the hair on non-human mammals. Hair is primarily composed of keratin, a structural protein.

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Let's take a closer look at hair. Hair grows from the bottom layer of the dermis (layer of skin). From a bulb, called a hair follicle. A hair shaft projects from the bulb up through and out of the top layer of skin (epidermis). The living portion of the hair is at the base of the hair shaft; as new hair cells form, the older hair cells move up, lose their nucleus, and fill with keratin. The upper half of the hair shaft is not alive. Attached to the hair shaft is an **arrector pili** muscle. This muscle contracts involuntarily from a strong emotion or a cold environment. When the muscle contracts it does two things: it causes the skin to bunch up together making "goose bumps" and causes your hair to stand up.

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When the hairs stand up, they trap body heat next to the skin. The trapped air is warmer than the environment, creating an insulating layer that helps keep the animal warm. More hair equals more insulation (warmth).

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Our hair stands up too, but since we don't have a lot of hair it doesn't really keep us warm. Our hair is essentially a vestigial structure- meaning it lost its use over time (useless/nonfunctioning). To help keep ourselves warm we rely on coats, hats, and gloves to trap our body heat next to our skin.

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Beneath the dermis is a layer of subcutaneous fat (hypodermis). This layer provides nutrition and insulation for some mammals. In aquatic mammals, this layer is more developed and provides them with more insulation in the water but is not as effective in the air or for terrestrial mammals. Black bears are an example of a land mammal that develops a thicker fat layer used as food reserve during hibernation.

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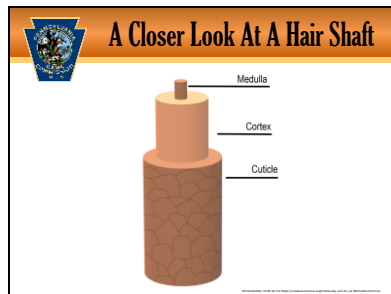
How do mammals generate heat in the first place? Mammals produce heat mostly by metabolizing food. Metabolism is all the chemical processes that occurs in the body when food converts into energy. Fur on mammals helps the animal conserve the heat they produced by trapping it next to the skin.

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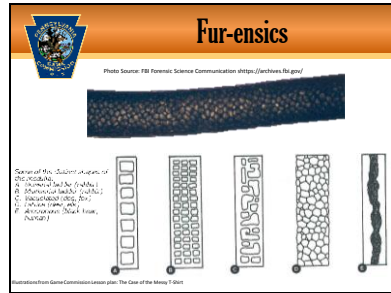
Most of Pennsylvania's mammals have two layers of fur: guard hairs and under fur. Underfur is soft and dense and provides the fur with insulation and water-repellent properties; it may differ in color from the guard hairs. Guard hairs are longer, courser hairs that grow through the underfur protecting the underfur from abrasion and matting. Guard hairs give the animal its coloring.

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Under a microscope, the three distinct parts of a hair shafts are visible: Cuticle, Cortex, and Medulla. The cuticle is the transparent outer layer of the hair that acts as a protective layer. It is made of fine scales all pointing in the same direction. The shape of the scales are different for each animal. The cortex is the main body of the hair and contains pigment that give hair its color. The Medulla is the core of the hair; it provides the hair with flexibility and has unique features that help identify the mammal species.

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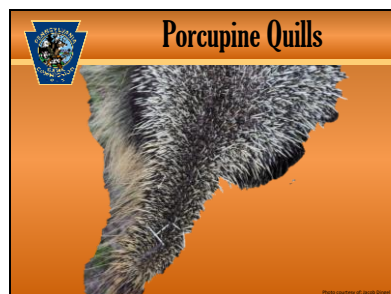
Looking at hair under a microscope can help identify the species or group of animals the hair came from. This can be important for solving wildlife crimes. Using the illustrations at the bottom of the screen, try to identify the animal the microscopic hair at the top of the page belongs to. Did you guess "D" Lattice (deer, elk)? If you did, you are correct.

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Do you think all fur is the same? Not all fur is the same. It comes in a variety of shapes, colors, sizes, and textures. Some animals even have more than one type of hair on their body! In addition to insulation, fur helps an animal camouflage, navigate, communicate or defend itself. Can you think of other ways fur helps an animal to survive?-act as sunscreen, protection, waterproofing, etc.

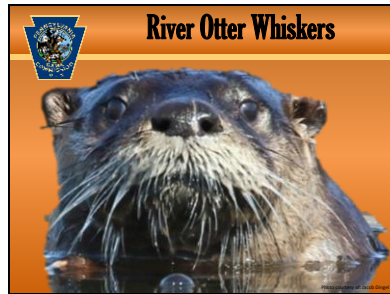
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Porcupines have specialized hairs, called quills that they use for defense. Porcupines have up to 30,000 quills that cover their entire upper parts and sides of their body. Each quill measures 1 to 4 inches long with the longest ones located on their back. The quills are yellow or white in color with a black tip and lined with a foam-like material made up of many tiny air cells. When a porcupine feels threatened and can't escape a predator it will turn its back to the predator, protect its head under an object, and "puff its quills". Involuntary muscle contractions from

fright cause the quills to rise (**Piloerection**). The porcupine cannot throw its quills, but if the predator makes contact with the porcupine, the quills are loose enough that they easily attach and dislodge into the predator. The tips of the quills are needle-shaped and covered with hundreds of tiny, overlapping, diamond-shaped scales. The scales slant backward, acting like barbs, so they stay in the predator once attached. The lodged quills will react with the muscles of the predator, pulling the quills inward by up to an inch per day!

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Vibrissae are stiff hairs, such as whiskers, that are used to sense the environment. River otters are **semi-aquatic** mammals. They have a set of long, stiff, sensitive whiskers just behind and below the nose that help them navigate and detect prey in cloudy or dark waters.



The color of fur, like the fur of a snowshoe hare, may give an animal camouflage. Camouflage allows an animal to blend into its surroundings. In the summer, snowshoe hares have brown fur helping them blend into their shrubby habitat. In the winter, they have white fur that helps them blend into the snowy Pennsylvania landscape. The length of day triggers the fur color change. In the fall, as the days get shorter snowshoe hares begin to molt. White fur replaces the brown fur, starting with their feet and ears then up and back to their rear. In spring, as days are getting longer, brown fur replaces white fur, starting with the head and back and ending with the feet and ears. A complete molt takes about 10 weeks. Their pituitary gland located at the base of their brain controls the fur color change- during the fall molt, the pituitary gland stops pigment (color) production in the fur. During the spring molt, the pituitary gland starts pigment production. The course hairs that grow long on the bottom of a hare's toes and feet making "snowshoes" help the hare travel in deep snow and gives it traction on icy crusts.

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Fur can provide the opposite of camouflage; it can make an animal stick out and be seen, like the black and white fur of the striped skunk. These colors are called “warning colors”. Striped skunks are armed with anal glands that can discharge a stinky musk used for defense. This substance can make a predator sick or even temporarily blind if it sprays directly in the predator's eyes. A skunk can squirt its stinky musk up to twelve feet, but it typically only used as a last resort.

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The term **prime fur** refers to when the animal's guard hairs are at their maximum length and underfur is at its maximum thickness. This typically occurs in mid-winter when the coats are new and fully-grown; the timing may vary depending on species, elevation, and location.

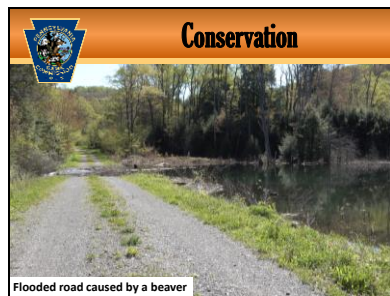
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Humans have hunted and trapped **furbearers** since prehistoric times. A **furbearer** is a term used by wildlife professionals to describe animals that are typically trapped or hunted primarily for their fur. Throughout most of human history, people were dependent upon furbearers to provided meat for sustenance and fur for clothing and warmth, bedding and shelter. During the 19th century, fur was used for clothing and as currency in the west, aiding in European settlement across the continent. Today, hunting and trapping of

furbearers continues as an economic, social, recreational, and conservation value. Trapping provides income for trappers. Furbearers provide fur for hats, coats, mittens, and blankets; they also provide fur for paintbrushes and fishing lures. Meat provides food. Regulated hunting and trapping of furbearers helps to reduce overpopulation, disease spread, and property damage.

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Fur is a renewable resource (replenished naturally when conditions are favorable). Hunting and trapping is a tool used to manage wildlife. Trapping is highly regulated within the United States and Canada. People cannot trap when and how they want. There are laws and regulations on hunting and trapping that people must follow (mandatory education, licenses, trap checking, size and types of traps, areas to set traps, seasons and bag limits, etc.). Regulations for trapping are usually set to allow trapping when fur is in its prime (best condition). Wildlife managers apply scientific methods to maintain furbearer species as viable, self-sustaining populations that are never threatened. Regulated trapping does not cause a furbearer to be endangered or threatened. All legally harvested furbearers for human use are always abundant or overabundant in the area that they are hunted and trapped. Regulated trapping is an important way for biologists to collect information about wildlife, reduce

human-wildlife conflicts, and relocate animals.

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State Game Lands are lands owned and managed by the Pennsylvania Game Commission that provide wildlife habitat and lawful hunting, trapping, and other recreational opportunities for all people. The Pennsylvania Game Commission is Pennsylvania's Wildlife Management Agency. People that work for the Game Commission study wild mammals and birds, manage and protect them, and create habitats for animals to live.

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Pennsylvania has 16 different furbearer species that can be hunted or trapped. They are the (1) raccoon, (2) opossum, (3) red fox, (4) gray fox, (5) eastern coyote, (6) striped skunk, (7) Bobcat, (8) Least weasel, (9) Long-tailed weasel, (10) Short-tailed Weasel, (11) porcupine (trapping prohibited) (12) River otter, (13) Fisher (14) Mink, (15) Muskrat, and (16) Beaver.

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Red foxes are **nocturnal** (active at night) mammals that weigh 8 to 12 pounds. The red fox has an **omnivorous** diet (eats plants and meat). Red foxes live in **habitats** of rolling farm areas with wooded tracts, marshes and streams. The red fox is one of three wild **canines** (dogs) that live in Pennsylvania. Red foxes have fur that is usually red— that's how it gets its name. They have black ears, legs, and feet and a white-tipped tail. They may be another color- a "cross fox," has a dark stripe of hair extending from the head down the center of the back and another dark stripe over its shoulders; or a "silver fox," that has black fur with white tips. The red fox typically has white fur on the tip of its tail, no matter what color it is.

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Gray foxes are nocturnal mammals that weigh 7 to 13 pounds. The gray fox has an omnivorous diet. Gray foxes live in brushy areas, swampy lands and rugged, mountainous terrain. The gray fox is also a part of the canine family, and the only member of the family that can climb trees. Gray foxes are a salt and pepper color, with a black line running down the tail and ending with a black-tipped tail.

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Coyotes are nocturnal mammals found in all 67 counties of Pennsylvania. Males weigh 45 to 55 pounds; females weigh between 35 to 40 pounds. Coyotes are typically the color of a German Sheppard, but they may be blonde, red, or black in color. They have a fluffy tail that they hold downward instead of curled up like many pet dogs. The coyote has an omnivorous diet. Coyotes live in forests, croplands, and cities, often between forest and agricultural areas. The coyote is the largest member of the canine family in Pennsylvania.

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Bobcats are nocturnal mammals that weigh 18 to 24 pounds. The bobcat is one of Pennsylvania's true carnivores. Bobcats live in forested mountains, swamps, agricultural areas, and suburban woodlots. Bobcats have light brown fur on the top of their body and a white belly. They have black spots on the inside of their legs and throughout their coat. They also have a short tail, called a bobbed tail, and that's what gives the *bobcat* its name.

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Beavers are North America's largest rodent. They weigh 18 to 24 pounds. Beavers are nocturnal and have an herbivorous diet (eats only plants). Beaver habitat consists of streams, creeks, rivers, and around forest edged lakes. Beaver fur is brown; they have dense underfur and longer guard hairs. Beaver also have body fat that helps to insulate their bodies. Beaver fur is thick and considered valuable.

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The striped skunk is a nocturnal mammal that weighs 3 to 12 pounds. The skunk has an omnivorous diet. They live in mixed woods, brushland, rolling weedy fields, fencerows, wooded ravines and rocky outcrops in or near agricultural areas. Striped skunks have mostly black fur with white stripes that start at the shoulders and end at the base of the tail, forming a V-shape.

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The raccoon is a nocturnal mammal that weighs 10 to 30 pounds. The raccoon has an omnivorous diet. They live in forests, swamps, marshes, and meadows near ponds. Raccoons have long, soft fur that is a grizzled-black brown color. Their tail is bushy with alternating rings of light and dark fur. They have a black "mask" across their eyes. By November, raccoon fur is in its prime. Starting in April, raccoons replace winter fur with thinner, lighter guard hairs.

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Fishers are nocturnal mammals. Males weigh 7 to 15 pounds and females weigh 4 to 9 pounds. Fishers have an omnivorous diet. They live in forests with abundant downed woody debris. Fishers are well furred and have an overall dark appearance. They have tricolored guard hairs on their back and shoulders giving them a grizzly appearance in those areas.

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Opossums are North America's only **marsupial**. They are most active at night. They weigh 4 to 12 pounds. They live in farmland and woodlots, reverting fields, brushy woods, and open woods. Adult opossums are about the size of a cat, they have long, light gray fur on their body, white fur on their face, and black fur on their legs and feet. An opossum has a long, pointed snout with a pink nose. They have small, dark eyes and rounded bare ears. Their tail has no fur on it, and it is scaly. Opossums will add a layer of fat, but they do not grow a winter coat and their fur is poor insulation. Many opossums lose the tips of their tails and ears to frostbite.

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River otters are both nocturnal and diurnal (usually winter) animals that spend a great amount of time in the water. They are semi-aquatic mammals. They have long bodies with two fur layers and a subcutaneous layer of fat to insulate their body. In the winter, their fur grows in thicker giving them extra warmth. All four of their feet are webbed and they have a long tail to help them swim well. Their whiskers help them move around in dark waters to find prey. They are true carnivores. River otters weigh 10 to 25 pounds.

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Mink are nocturnal carnivores. They have dark brown fur on their long bodies and a bushy tail. They live on the edges of lakes, streams and rivers. Mink swim and dive well. They have stiff hairs between the toes of their hind feet, which helps them move through water. They weigh 1.5 to 2 pounds.

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Musk rats are nocturnal mammals that weigh 2 to 3 pounds. They have long, brown fur on the top part of their body and short, soft gray underfur. They are the nation's most abundant furbearer. Their tail looks like a rat's tail, and that's part of the reason they are called *Musk rats*. The other part of their name comes from a stinky smell they make called *musk*. Musk rats live on or near slow-moving water of ponds, wetlands and streams.

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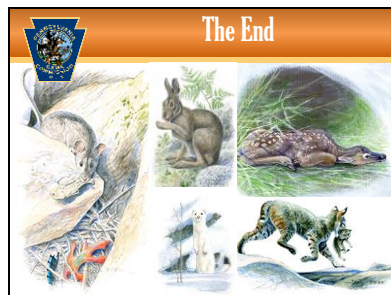
Porcupines are the second largest rodent in Pennsylvania. They are nocturnal, live in forests, and have an herbivorous diet. Porcupines weigh 9 to 15 pounds. Their fur is a collection of three different fur types: long, coarse guard hairs; dense wooly underfur; and quills (specialized hairs) on the upper parts of its body. Their fur color is an overall brownish-black color intermixed with light colors on their belly and sides.

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Pennsylvania has three weasel species: long-tailed, short-tailed, and least weasel. The least weasel is the world's smallest carnivore! They mostly eat small rodents like mice. During spring, summer and fall, their fur is brown on top of their body and a lighter color on their belly and chin, during the winter their fur may change to white. They have soft, short underfur and long, course, glossy guard hairs.

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