



Winter on the Delaware Bayshore can be brutally cold. This clapper rail ruffles its feathers to stay warm. Besides Countercurrent circulation birds have very few pain receptors in their feet which helps them withstand cold more easily. Squatting down also covers the bird's legs with feathers. Photo: Anthony Klock

Birds Huddle

We're not talking about a certain winning sports team here, but rather about one of the many techniques birds use to keep warm in winter.

By J. Morton Galetto, CU Maurice River

While leading a fieldtrip to Edwin B. Forsythe National Wildlife Refuge, one of our participants observing the

waterfowl queried, "How do they keep their feet warm?" I'd read an excellent explanation in David Sibley's book *What It's Like to Be a Bird*, but was having trouble recalling the particulars. I offered, "It has something to do with warm blood vessels being adjacent to cold ones."

Then attendee Dr. Coifman offered, "*Countercurrent circulation* transfers heat from outflow to cooler inflow blood." Admittedly not a direct quote; he was more eloquent and knowledgeable.

You may recall that arteries carry oxygen-rich blood away from the heart and veins carry oxygen-depleted cooler blood back to the heart for reoxygenation.

I assume this question comes up rather often when people view a duck in its downy coat of water-repellent feathers perched upon exposed, bare legs. Sibley gives greater detail to what happens in the bird's more muscle-bound thigh surrounding the tibia bone. Here the arteries and veins actually split into many multiple smaller vessels and become intertwined, allowing for greater heat transfer between the two, before flowing to the skin-covered tarsus. The tarsus is the portion of the leg that is not covered by feathers, but

is just leathery skin. This leathery skin is also scaly which further conserves heat.

Birds are not the only species that uses countercurrent circulation. In humans the arteries of our arms and legs run parallel to a set of deep veins. The warmer blood running in the arteries gives off some heat to the colder blood returning from our extremities in the veins, thus keeping us warmer by minimizing heat loss.

Strategies for keeping warm vary from one species of bird to another. Some birds migrate to warmer locales. Those that don't employ bodily defenses and conscious strategies of which we will discuss a few. This is not intended to infer that birds in warmer climates don't regulate temperatures using strategies, but rather that those who remain in cold climates must employ these techniques to avoid freezing!

Some birds, when they molt or replace seasonal feathers, grow more down for the winter. These are the fluffy light feathers which lie under the stiffer sturdier feathers that repel water and wind. The looser soft down traps air that is heated by their body. If you have ever worn a down vest or slept under a down comforter you have

experienced the luxury of warmth that these feathers offer.



Thermoregulation: Chilly spring weather also prompts birds to warm up by fluffing their feathers and trapping air to insulate themselves. Birds can reduce 20 to 50% of heat loss by sitting, like this prothonotary warbler. Photo: Anthony Klock

Feathers are an incredible aspect of a bird's anatomy; they have an enormous amount of muscle control over them. You surely have seen birds near a feeder in winter "fluffed up" to stay warm. Many birds puff up or raise feathers to make space for trapping and heating air, essentially creating their own insulation.



This blue jay is barely recognizable with extended feathers. The reflex of extending feathers or fur to keep warm is called piloerection. Photo: Anthony Klock

For feathers to do their job properly they must be kept interlocked in an orderly fashion. Feathers are much more complex than you might notice at first blush. Each feather has a central shaft or *rachis* that is also arched. Then off this main shaft are *barbs*, like mini shafts, and then there are *barbules* with fine hair-like hooks that act like Velcro, holding each neighboring barbule in place. For all this to work a bird has to be well-groomed. This is

why birds shake and continually comb their feathers with their beaks, a maintenance behavior called *preening*. Part of the process involves moving oils from a gland at the base of their tail and redirecting it to their feathers, which helps to weatherproof them.

Birds may place their beak within the feathers of their chest or back, or put their head under a wing to keep warmer.

Another less noticeable aspect is shivering. Birds do not shiver like mammals; you don't see a tremble like that in people or our dogs. Instead their muscle groups involuntarily contract and expand to create body heat. When you see a bird that appears to be shivering it is actually quaking: normally a sign of excitement, fear, grooming, pleasure, sickness, or overheating. Overnight many small winter birds can lose all their body fat through shivering, making adequate food resources very important for survival.

Possibly if you are a hiker or camper you have read that hypothermia can be prevented by getting in a sleeping bag with a partner; I'll spare you the details. Well, birds will cuddle up to stay warm, much like the intertwining of arteries and veins. Bobwhite quail

sleep in a wagon-trail formation, all facing outward to watch for intruders. The colder the weather the more closely they will huddle.



Bob white quail sleep in a circle with heads facing out. This enables many eyes to be on a look out for predators; if they flush it startles the attacker as the quail seemingly explode in all directions. In winter this huddle formation has an added advantage of warmth. Photo: Texas A&M Natural Resources Institute

Male emperor penguins gather in Antarctica in a massive incubation event. For two months they carry an egg over the tops of their feet within a brood pouch, enduring temperatures as low as minus 80°F. During incubation they rely on accumulated body fat and a huge huddle with other incubating males. They shuffle frequently, taking two-inch to four-inch steps every minute or so. They stay packed tightly while rotating placement from outside to inside the flock to stay warm. This is one of the most selfless, often poignant child-rearing events on the planet. If

you haven't seen the acclaimed movie *March of the Penguins* (2005) it is truly an awe-inspiring portrayal of dedication. The winter wonderland setting and devotion to raising young makes it the perfect holiday family movie.

Shelter is another a common way to keep warm. Birds make use of cavities in trees excavated by woodpeckers. They can also gather and cuddle. University of Vermont Biology Professor Bernd Heinrich relays his escapades of climbing trees to look in cavities. Once he found a hairy and a downy woodpecker sharing the same tree hole. He also discovered four kinglets huddled together in a massive pine, heads first with tails protruding.

Birds, especially turkey vultures, often perch on the peak of roofs to take advantage of heat escaping from poorly insulated houses. Furthermore black shingles absorb heat from the sun providing additional warmth. As well, blacktop roads absorb warmth from the sun during daylight hours. For this reason, on cold winter mornings a number of ground birds can be seen on road surfaces, notably mourning doves and woodcocks.



Black top roadways retain a lot of heat overnight, which attracts animals warm up on the surface. Cold blooded reptiles using this strategy are especially susceptible to being killed. This tree swallow uses piloerection (fluffed feathers) and the road to warm up. Photo: Anthony Klock

When it is cold but clear animals seek shelter from the wind, allowing the sun's rays to warm them. Often on a hike I will seek a sunny spot surrounded by red cedars. An isolated niche is amazingly cozy compared to an open area just a few feet away.

Adding people to the discussion to help readers better relate to birds' winter strategies. In grade school we studied the Inuit from Alaska and learned that they eat whale blubber before winter to insulate their bodies from the cold. In the early 2000s scientist studied the Denisovan genome, the DNA of a group of archaic humans from Arctic climes where temperatures are freezing for at least half the year. This archaic DNA mixed with Neanderthals, and the

genome persists in Arctic peoples today. Scientists found that the people with this genetic make-up have biological adaptations that help them tolerate cold by promoting heat-generating fat.

Fattening up is an important aspect of staying warm in winter. Fat is also important fuel for migration. Birds can't afford to burn precious muscle needed for flight; this is why birds build up fat resources prior to their long journeys.

In these winter months you may want to consider a migration of your own – what Australians call a walk-about. I hope to see you out there on a trail in the great-out-of-doors. Happy holidays!

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