Bird Notes

Whether the weather be fine
Or whether the weather be not,
Whether the weather be cold
Or whether the weather be hot,
We'll whether the weather
Whatever the weather,
Whether we like it or not.
(Anonymous)

Darting, hovering helicopter
Fueling at a flower,
Tell me how your engine-heart
Generates such power!
(Joel Peters)

It is true that all vertebrates will weather the weather, but no one accomplishes this essential task like birds do. Birds have adapted to the environment so well that some are able to live and thrive in temperature extremes from -60^0 F. to 120^{0}F. --- all except my robin, it seemed at the time. Poorwills, for example, can tolerate the 120^{0}F. temperature of the Southwest desert because of its highly efficient cooling system. The Emperor Penguin gives birth to and raises young during the coldest, darkest part of the Antarctic winter (the subject of a wonderful book, The Worst Journey in the World, by Apsley Cherry- Garrard). Since we just came through an extremely hot, dry summer for the Southern Appalachians, I decided to first discuss some of the ways birds have adapted to relieve heat stress.

Birds have the highest rates of resting and active metabolism among vertebrates. The energy demand of flying is 10 times that of a resting bird. This life-style produces a very large amount of heat which much be eliminated, especially in a hot environment. Due to the energy demands of this active life-style, a bird maintains a core temperature of around 104^{0}F. compared to the usual human core temperature of 98.6^{0}F. Because birds are small they tend to increase their core temperature quickly with activity and must be able to respond to changes in environmental temperatures. A rise in core temperature to 113^{0}F. is a potential lethal level. Rock Doves produce 7 times more heat in flight than at rest. Their body temperature can increase almost 5^{0}F. with flight. A Budgerigar flying at 21 miles per hour will have its core temperature increase to 112^{0}F. To deal with excessive amounts of heat, both internal and external, birds utilize morphologic, physiologic and behavioral adjustments to deal with heat stress.

Songbirds have a number of behavioral strategies to deal with hyperthermic body temperatures. During the hot days of summer, birds become less active, spend time in shady areas and/or find a puddle in which to bathe. These are simple measures which require little or no heat production by the bird. Panting is a more active form of heat control and is quite efficient in lowering body temperature. Even though flying generates large amounts of heat, air flowing through the bird's multiple air sacs (see last month's **Bird Notes**) will enhance evaporative heat loss. Birds need to replace water used for this type of heat loss which is one reason it is helpful to provide a water source for birds. Another effective form of temperature control used by pelicans, herons, cormorants, doves, boobies and owls is gular fluttering. This involves rhythmic contraction of the throat muscles attached to the hyoid bone. Birds, also, utilize the ability to control their feathers to lower body temperatures. Ruffling of the crown and back feathers will expose the bird's thin skin

to the environment releasing body heat through convection. A fascinating mechanism used to control extremes of heat and cold exists in the legs of birds. The lower extremities of birds are unfeathered. Beneath the skin of the leg there exists a network of veins and arteries which can be regulated to either dissipate or conserve heat. This system is known as the rete mirabile and will be discussed in more detail in next month's article of **Bird Notes.** A few species, primarily vultures and storks make use of their unfeathered legs in a unique way. They defecate on their legs. The cooling effect of evaporation helps cool the bird on a hot day. This behavior is known as urohydrosis.

A morphologic characteristic which has been observed in non-migratory birds of the same species is defined by Bergmann's Rule which states that non-migratory birds of the same species tend to be smallest in hot, humid climates. This is because there is more heat losing surface area relative to the bird's mass.

Next month's topic will discuss many ways birds have adapted to and thrive in cold climates.

--by Rick Pyeritz