Creating the Nation's first BioPark

National Zoological Park · Smithsonian Institution · Washington, D.C. 20008-2598

Letter from the Desk of David Challinor
July 1992

We often find ourselves perusing a restaurant menu and choosing what we would like to eat. Humans are fortunate among mammals because they are relatively omnivorous, that is, they can digest a wide variety of food. Our choice of food is governed more by culture and taste than by our ability to assimilate nutrients. Among human populations, however, there are local groups with digestive restrictions. For example, many southeast Asian adults stop producing lactase, the enzyme that breaks down raw milk, when they reach adulthood and cease drinking raw milk regularly. If they lack this enzyme and drink a glass of milk, they are likely to become ill. This is not a major evolutionary problem as calcium and milk's other important nutrients can be acquired from other foods. Humans' omnivory is an advantage over the long term because mammals with this characteristic can exploit a wide variety of habitats. Some examples of extreme human diets are those of the Inuit in the polar regions who are (or were) almost exclusively carnivores, versus other humans who, due to religious or other reasons, are exclusively herbivores (vegetarians).

The evolutionary pathways that led us to be omnivorous are not clearly understood, but our ability to eat many foods was undoubtedly an important component in the rapid spread of early Homo sapiens.

Accompanying humans on their early dispersal was probably another well-known omnivore: the dog. Although evolving from primarily carnivorous wolves, dogs adapted to a diet of scraps and were easy for humans to keep. Moreover, the dietary flexibility of dogs and that of pigs and goats lets them survive even when deprived of human-provided food. There is ample evidence of dogs, pigs, goats, cats and rats living on isolated islands devoid of humans. While pigs and goats were often purposely introduced to such places by humans as potential emergency food, dogs, cats and rats generally arrived accidentally.

Today enormous energy is spent trying to rid oceanic islands of goats and pigs. On the island of Pinta in the Galapagos, with an area of only 15 square miles, more than 40,000 goats were shot over a decade before they were finally exterminated. The resulting proliferation of vegetation, long thought to have been eliminated by grazing goats, has made Pinta almost unrecognizable to those who visited it during the goat infestation.

This ability to switch food sources to take advantage of available nutrients is relatively common among wild mammals and birds. Brown bears, for example, eat salmon when these fish are concentrated on their spawning runs, but they also eat insect grubs and rodents when they are plentiful. In the fall the bears will browse on berries along with foxes and raccoons. Carrion, too, is an important food source, not only for bears, but also for such unlikely animals as deer and feral pigs.

Tree swallows switch from eating flying insects to bayberries when they begin their fall migration, and robins seasonally change from earthworms to ripening fruit. Opportunistic feeding serves as an important evolutionary advantage in the survival of a species in case one food source disappears.

It is hard to find a bird or mammal dependent on a single food source, but some, like the Everglade kite and the brown, long-billed Limpkin come close. Their favorite food is the large apple snail found in the permanent shallow water sloughs of Florida. Howell's Birds of Florida (1923) reports (page 171) "all observers agree...that the Everglade Kite feeds exclusively on the large freshwater snail...." Captive kites have been successfully maintained on red meat, which is evidence that wild birds could live on another food source if they were physically able to catch other animals. The Limpkin also appears to feed exclusively on this same snail, but does so during the day when the snail is in the shallow water mud. The kite, on the other hand, feeds at dusk and dawn when the snails climb above the water surface to feed. Once common, both birds are now rare in Florida because so much of the wetlands have been drained for agriculture. The dependence of these two bird species on one freshwater snail is a good example of how vulnerable exclusive feeders are to extirpation because of landscape alteration, and thus illustrates the disadvantage of a narrow diet.

Specialist feeders are relatively common among insects, but because they are so small and inconspicuous, scientists are still discovering new instances of restrictive feeders among them. A well known example is the larvae (caterpillars) of the Monarch butterfly, which feed exclusively on the foliage of milkweed. This plant is named for its sticky, white sap, which also makes the plant toxic to most foliavores (leaf eaters). The Monarch caterpillar, however, can neutralize the toxins when it eats the leaves, and thereby makes itself distasteful to predators. Furthermore, when the caterpillar changes into a butterfly, the butterfly retains the same distastefulness to predators it had as a larva.

To illustrate how one insect can capitalize on a restrictive feeder's ability to repel predators, the Emperor butterfly has evolved virtually the same wing pattern as the Monarch. By mimicking the latter, Emperors avoid being eaten by birds which have learned not to eat Monarchs. Emperors, therefore, have not had to evolve the complicated chemical pathways to neutralize milkweed toxins.

Within the insect family, those with stingers (the aculeates) have become specialist feeders, particularly the larvae. This group includes stinging wasps, ants and bees. The sting, in turn, is an evolutionary modification of an ovipositor, the tube through which many female insects lay their eggs. In this group the stinger is connected to the gland that produces the poison used to capture prey and no longer serves as an egg-laying device. However, because of its evolutionary source, only females have stingers.

Females in the aculeate subgroup use their stinging devices to kill or paralyze specific insects on which they lay their egg(s). When the larvae hatch, they then feed on the carcass provided by their mother until they pupate and turn into adults. The carcass, so carefully prepared and stored by a female aculeate wasp for its own progeny, may be parasitized by other specialized aculeate wasps, which have developed clever ways of invading the storage chamber prepared by the original female so that the invader too can lay its own egg(s) on the insect carcass.

The insect world is replete with specialized feeders, but because they are so small by human standards, we fail to realize how large their ecological niches can be relative to their size. The foraging honey bee, for example, has an enormous range and exploits a wide variety of flowering trees and plants. As a result, honey bees can easily adapt, like humans, to many new conditions, and they were one of the earliest domestic animals brought by Europeans to the New World. The honey bees' wide choice of nectar sources serves as a sharp contrast to such specialized feeders as the threatened Everglade kite. These animals with restrictive diets are continually vulnerable to any habitat change which could upset the delicate balance between food source and consumer. Omnivores *generally* survive, but humans' ability to alter drastically the environment makes it imperative that we understand the biological consequences of our actions. Only in this way can we insure that we do not knowingly extirpate "specialist" animals of any kind.

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