Creating the Nation's first BioPark

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Letter from the Desk of David Challinor
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The last few letters have discussed the state of the globe's climate and the confusing results that are appearing as scientists correlate their research. Just as enigmatic are the results from research on animal minds. This letter will share with you some surprising examples of animal minds at work, about which I learned from a recent book by Donald Griffin[1]. He apparently used the term "mind" rather than "intelligence" to describe more accurately his topic. One definition of "mind" is the processes of the brain and nervous system that direct the physical and mental behavior of a sentient organism. After considering some examples I have extracted from Griffin's book, I think you will agree that animals may have minds.

Birds are a group of sentient organisms that seem to lie between mammals and reptiles on the evolutionary scale. The following extraordinary examples of bird behavior are presented as evidence that they evidently have a working mind. In the Cairo (Egypt) Zoo, the ponds in winter are often crowded with migrant water fowl. Zoo pelicans have learned to sidle up to a teal, seize it with its bill, hold it under water until drowned, and then swallow it. We think of pelicans as being fish eaters, but here, under Zoo conditions, they have adapted new behavior to exploit a novel food source.

Zoo conditions might possibly lead pelicans to more unusual behavior than that of their wild confreres, but Griffin gives three well-documented examples of other wild bird species drowning their prey. In Griffin's first example, a female marsh hawk caught a gallinule (a chicken-sized water bird) in its talons. Instead of flying off to eat it, she drowned it first and then ate it. The same technique was observed elsewhere when a Cooper's hawk caught, drowned and ate a starling. The third example was of a European sparrow hawk that dropped to the surface of a shallow pond to drown a lapwing (a plover-sized bird) that it had caught in flight. We do not think of birds as being inventive and can only wonder how these three individual hawks came to realize that drowning would be an easy way to kill a captured prey. A fascinating experiment would be to find a hawk that preys on both air breathers and fish. Would the captor try to drown only the air breather? How does the bird discriminate?

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[1]Griffin, Donald R., _Animal Minds_, University of Chicago Press, Chicago and London, 1992.

Another interesting example of bird minds at work is evident in their cooperative hunting. A group of over 100 pelicans were observed forming a line while swimming in shallow water. As the line advanced towards the shore, it became a crescent and finally a tight circle, with each bird almost touching the adjacent ones. The birds had surrounded a school of fish and successfully fed on them.

In yet another example of cooperative hunting, six Harris hawks assembled during the nonbreeding season. One hawk landed and flushed a cottontail from a bush. When the rabbit ran from its hiding place, a second hawk attacked it, and if it missed, a third hawk took over until the prey was successfully captured. These small groups of hawks were probably from one family, but the interesting question in the case of both the pelicans and the hawks is which bird does the planning, or how is the cooperative hunt organized? It is hard for us to envision such a complex sequence of events being executed except by humans, yet it appears that avian minds were indeed at work in organizing the actions observed by the reporting scientists.

Although pelicans and hawks are known to increase their food-gathering success by cooperative hunting, other birds have also shown remarkable adaptive ability to exploit food sources. There are clearly many kinds and degrees of adaptive food-gathering techniques. The European oyster catcher is a good example of a split behavior. This plover-sized bird has a vertically flattened bill, which it uses to feed on mussels. When the tide is low enough to expose mussels completely, the mussel shell is clamped shut. The oyster catcher pulls a mussel loose, carries it to a nearby sand bar where the sand has the requisite firmness to support the mussel, and places it flat side up and curved side down in the sand. So positioned, the bird hammers the mussel's flat side with its bill until the shell breaks; the contents are then eaten. The sand surface has to have just the right consistency to support the mussel during this operation, and in such places, the sand surface is littered with empty mussel shells.

The oyster catcher uses a different technique when the mussels are just below the water surface and their upper and lower shells are open so that it can feed. The bird then skillfully inserts its bill between the open shells, cuts the large abductor muscle that opens and closes the shell, pulls the mussel from the substrate, and carries it to a convenient place to eat. At first glance the observing scientist assumed that the birds had merely adapted two techniques to open mussels depending on whether their shells were open or closed. However, when the researcher marked the birds he found that each bird specialized in one procedure or the other, but not in both. Evidently the young learn only one technique from their parents and are not genetically programmed to open mussel shells in a particular way. An interesting experiment would be to try to develop an experimental protocol to teach chicks both feeding techniques. The current implication is that hammerers breed with hammerers and muscle cutters with their kind, but we cannot be sure. If a chick's parents each had a different feeding technique, would it learn both? This observation of split oyster catcher behavior is an excellent example of the reward of having one scientific discovery lead to a series of further fascinating hypotheses to test. Eventually we hope to solve the mystery behind the two oyster catcher feeding techniques.

The pressure to evolve feeding techniques is probably greatest when birds colonize a new habitat. A good example of this adaptability was the arrival of Darwin's finches on the Galapagos Islands within the last million years. Since coming there the finches have evolved into thirteen species, varying in size and shape according to the food they eat. Their bill shape is the characteristic by which the species are most easily separated. Finches with the thickest bills eat the largest and hardest seeds, and nectar feeders have long, pointed bills. In between these two extremes are small seed eaters and insect eaters. Even more amazing are those Darwin finches that use sharp twigs or cactus spines to extract insects from bark in the manner of a woodpecker or tree creeper, which are absent from the Galapagos. The most remarkable evolution of a feeding habit occurs on only one island, Wolf, the most remote one of the entire archipelago. There a species of sharp-beaked finches have learned to draw and drink blood from the wing elbow joint of nesting boobies. Although the nesters try to drive away the finches, the latter are usually successful enough to drink blood. What is surprising is that on all the other islands where this species of finch lives near nesting boobies, none have acquired this vampire characteristic. We can only speculate on how such blood drinking originated. It may have started when the finches looked for ectoparasites among the feathers of the brooding boobies. When one bird accidentally pierced the booby's skin, it evidently liked the taste of blood -- a new food source. How did it "tell" the other finches? If vampire finches were moved from Wolf to other islands with booby colonies, would they continue this practice? Would they "teach" the other birds about the new food source?

The final provocative examples of an active bird mind involve deception. The first involves great tits (a large European chickadee) that were observed giving false predator alarm calls. Such calls, usually made in winter when food is scarce, caused a competing flock of sparrows to scatter and leave the birdseed to the tits. A more complex example of deceptive behavior was reported by a scientist studying Anna's hummingbirds. In this species the male is very territorial and drives out competing males from its territory. The researcher installed a mist net in one male's territory to catch the male for banding. The hummingbird spotted the net because a heavy dew made its gossamer threads visible. Once a hummingbird sees a mist net, it generally is successful in avoiding it. However, in this case, the defending male, when hearing the call of an invading male, instead of flying at him directly with his threat call, flew low around the edge of his territory until he was behind the intruder. He then charged the intruder while giving his territorial song and forced him directly into the net. The author suggests that such behavior is suggestive of intentional planning. Could it be otherwise?

From my examples, we can infer animal consciousness in two ways: birds can adapt their behavior to completely new circumstances, and they seem able to communicate or to convey to each other their plans for a future action. If scientists are to discover the existence of animal minds, then the key element will be to find whether the animal is working things out in its brain to perform a task, or merely resorting to trial and error. The evidence is accumulating to support the concept of animal consciousness. For some humans this is a radical idea, but I chose birds for my examples because they seem to us less human-like than mammals. The existence of consciousness (if that is what it is) in animals other than humans has profound ethical and philosophical considerations in how we behave towards them and how we feel about sharing the Earth with them. Examples abound of equivalent consciousness in fish and insects, with which it is even harder for us to share affinities. There is plenty of evidence for scientists and lay people to ponder on the existence of animal consciousness.

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