Magnificent Flight

by Liz Andreoli
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Something that will never leave my mind is a statement I read some years ago when I first entered the fascinating world of birds. I was investigating the proper design for my bird's living quarters when I came across it. "Never buy a cylinder-type cage," it read, "birds are not helicopters." Well, at that time, nothing on the market came close to resembling an oblong cage. So with a little coaxing I convinced my husband to build me two well-thought-out bird housing units. Elaborately and beautifully designed on a wooden frame they included such "high class" features as a sliding plastic door; draft-proof, washable walls that let in plenty of light; plenty of air circulation, a pull-out tray; provisions for seed hulls to be caught and kept in, etc. We were all set. I sat back and watched my poor birds try to fly in these decently sized living spaces, but no matter how big they were compared to the norm the birds just couldn't get enough exercise in them. After watching in frustration I decided they had to be let out for exercise and often!

So what did all this mean? People have been keeping birds in little cages for centuries, all the pet shops carried only small cages, and their advice was just as small, but here I was trying to be different, again! Maybe I was a bird in a past life? Whatever my problem, there were three questions that were ever-present on my mind: how do birds feel when they fly; how do birds fly; and why must they fly?

How do birds feel when they fly? Boy, that's a simple one: great! Does your bird pace back and forth in his cage, scream or bounce up and down, does he beat up his toys? Can you imagine his pent up energy? What happens when you let him out and he is able to flap his wings free of the cage bars or, better yet, fly around the room? Do you see his whole being light up, his heart race, the excitement of his freedom of movement? Ever travel in a car across country for more than ten hours straight? Do you feel a little "punchy" from confinement? Now you probably know why your bird might have bitten you after you forgot to let him out of his cage for a whole day.

Another thought is the wonderful feeling of complete control a bird must feel as he perches high above looking down at everything. This can be a real problem with some birds as to how to get them down. Before my birds' wings grow out I give them designated places to land within my control. Then when they are able to do morning "flaps" they usually come back to those familiar landing spots.

What are the complexities of flight? How do birds fly? Starting from the inside and working out, the body of a bird has taken on a unique form. Generally speaking they expend an enormous amount of energy during flight and also require a comparable amount of oxygen, especially when migrating birds reach altitudes that are extremely limited in such. To compensate, the entire bone structure of the bird is hollow, and is actually a carrier of oxygen (pneumatic).

Usually the most efficient fliers have the hollowest bones. In addition, birds have a number of what are called air sacs which connect not only to the lungs but also to the air spaces in the bones. Air sacs work like bellows for greater efficiency, through a series of steps, with the lungs to exchange oxygen and carbon dioxide as necessary. Flight requires not only a light weight skeleton but a rigid one as well.

When coming in for a landing a bird will "scoop" its whole body sort of like a mini parachute. Head down, wings and tail are cupped inward to slow the speed rapidly. Just prior to the final descent on its landing target the feet are thrust forward and the head and wings pull backward in the last effort to make the land as smooth and soft as possible. Birds of prey, such as the prairie falcon, drop to their victims at such high speeds that if they happen to miss they tumble over the earth confusedly. To withstand this kind of intense shock all the bones of the hip girdle along with the lower vertebral column and the lumbar vertebrae which comes to rest on the thigh bones are fused together to form a stiff and very strong plate.

The power for flight begins as the two massive pectoral muscles, located on either side of the sternum (breast bône), pull the wings in a downward motion to gain lift. The return stroke is manipulated through a type of rope and pulley system. As the flight muscles relax the supracoracoideus muscles contract and raise the wings by means of a tendon running over the shoulder. The bird's wing bones can be compared in form to that of the human arm except they are fused at the "wrist" and "palm" which support the main flight feathers. Each of the main flight feathers rests in a bone socket and is held in place by means of skin and an elastic tendon.

We watch and we wonder, but so subtle and quick are the maneuvers of

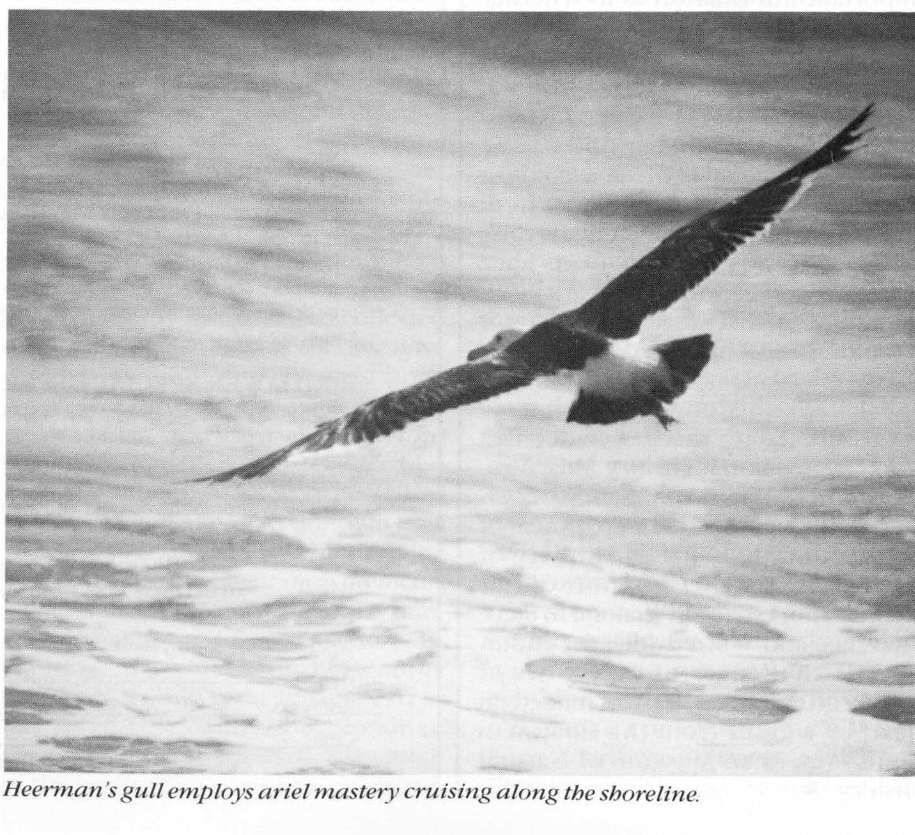

Photo by Patty Barcenas

Heerman's gull employs ariel mastery cruising along the shoreline.

flight that, practically speaking, the human eye is worthless. Independently each feather can alter the shape of the wing to change directions. When landing, the "alula" (a small group of feathers at the front of the wing) controls the air-flow over the wing and gives stability so as not to stall at such a low speed. The primary flight feathers propel the body forward while the secondaries provide lift. If one-half of the secondaries are missing the bird is still capable of flight, but with some loss of control. However, without the primary feathers flight is impossible.

Unlike the airplane that works on a propulsion system and uses wings to maintain its flight, a bird uses wing power for both take-off and altitude. Although we can compare the airplane to gliding flight in birds, technology has not of yet been able to copy active flapping flight.

Gliding, as the simplest form of flight, requires practically no expenditure of energy. The bird is being kept aloft by the air flowing above and below the ridgedly held wings, only gradually being slowed down by the airflow resistance. The bird must take some action to stay aloft either by flapping or gliding into an updraft. Technically this is referred to as lift and drag, lift being created when the wing is held at a slight angle to an air current. The air flows faster over it creating less pressure above. Drag is the resistance of the wing against the air current. Thus these two factors (lift and drag) equal to the bird's weight creates gliding flight plus gravity which causes acceleration. Speed depends on the bird's weight and wing size. Small wings on a heavy bird will create a fast glider while large wings on a light bird will create the opposite.

Birds of prey have long, narrow wings that taper, angle backward and can be compared to a high speed jet fighter plane not only in shape but also in the high speed at which they can fly. The backward angle of the wing creates little drag in flight. Peregrine falcons are thought to approach speeds of about 200 mph during certain flight patterns. Other birds such as seabirds have high speed wing shapes that have been altered slightly for long distance gliding as well.

Vultures, eagles and storks are typical soaring birds. Their wings are broad and long with deeply slotted primaries to take advantage of slight changes in air currents. With its head tilted downward it will increase its speed slightly, glide into an upward moving air current and soar for hours with insignificant body or wing movements.

Flapping flight requires short and broad wings with slotted primaries for rapid take off and climbing. The slotted primaries open on the up stroke and allow for less drag as the air flows through them. Like pheasants, such birds need to maneuver quickly among the trees in heavily wooded forests. The hummingbird, fastest of all flapping birds, can remain stationary in the air, move backward, forward, right, left, up, down, and even turn upside down. It can stop and take off instantly. One of the main reasons for such exceptional control over flight is that the hummingbird's elevator muscles are almost 50% of the depressor muscles. Normally that figure is only between five and ten percent. In addition, the upstroke as well as the down stroke is converted into a power stroke allowing for both lift and propulsion. Motionless flight is achieved through a wing beat that replicates a figure eight, whereby the up stroke cancels out the down stroke. In order to achieve such seemingly impossible stunts the short arm bones of the hummingbird are shaped in a V and the shoulder joints allow movement in all directions with an axial rotation of 180. The flight muscles make up 30% of their body weight and the wing tips have a great deal of control. This tiny (the smallest of all birds — between 2½" to 8½") and sweet looking creature is a solitary and aggressive bird capable of perching but not walking. Its wings can beat up to 80 beats per second (the pigeon by comparison is capable of 10 beats per second), and hummingbirds are the only birds capable of true hovering flight in breezeless air. I would imagine, with these birds, their frequent bathing plays an extra important role in feather maintenance and, ultimately, flight insurance.

Actually considered dead after the blood supply ends, feathers play a very significant role in flight as has been shown. From 1,000 to 25,000 feathers on a bird make up to between 15 and 20% of its body weight. During flight an enormous amount of heat is generated by the powerful flight muscles. The body feathers are capable of being raised and separated to allow excess heat to escape through the use of a set of muscles attached to the skin. Generally the moult is gradual with feathers replacing themselves a few at a time so the bird can always fly and maintain sufficient body heat. Lack of feather maintenance is detrimental to flight efficiency. If damaged either during or after its growth the feather will not mend itself, but must wait until the following moult to be replaced. It if is completely pulled out, however, a new feather will grow in. Movement through time and space seemingly defiant of gravity is hard to grasp no matter how well it can be explained, but why must birds fly?

In the wild, birds must fly for obvious reasons: to find food and to escape predators. In captivity, such as the pet bird locked up in a tiny cage, birds need to fly to keep their bodies in good condition. A few "flaps" around the house every day has the same effect on a bird's body as a few laps around the block has on a human's body. It keeps the heart, the muscles, and the circulatory system active and strong. In addition to this it keeps the bird in good emotional spirits. Imagine yourself in a similar situation. Some powerful force captures you, breaks your legs and puts you in prison. Sound like Auschwitz? You hadn't even done anything wrong!

Birds are my favorite creatures. I want them around me all the time, but I have to understand what they are and I must give them what they need. Every bird is different. Some will revert to pulling or plucking themselves when unhappy or bored. There is no better way to alleviate pent up energy than to allow a bird to fly.

It's really not that hard to cooperate with nature, but most importantly when my birds are happy they're beautiful (their life is in balance) and I'm happy too.