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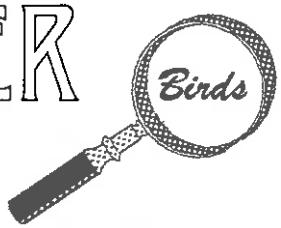
THE NATURAL INQUIRER

an educational newsletter on the environment



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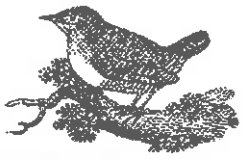
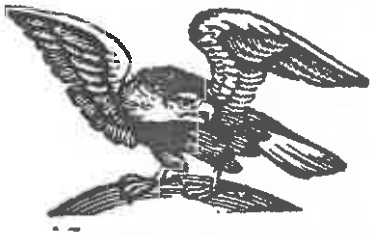


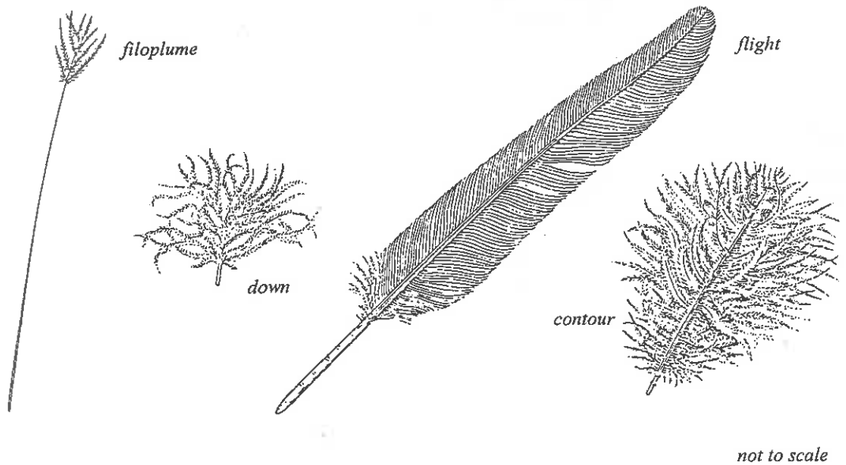
The King of the Birds



A long, long time ago, all birds of the world met at one place to have a congress. They discussed a lot of things, but the most important part was about the king of the birds. The birds had decided that they wanted to have a king too, like a lot of other animals. So they were thinking, who should be the king of them? The smart owl had a good idea. She said: "The ability to fly is the most special characteristic of a bird, so the bird who flies to the highest point in the sky should be our king. We shall have a contest to find this out." All birds were content with the idea, although the penguin and the ostrich mentioned that they were perfect birds too. The first contestant started. It was the swallow, a good insect catcher and a very fast bird. But the next one, the goose, could fly higher. The robin had no chance but was not sad about it. The strong big eagle had the best chance and was the last bird to compete. But one little brown bird was sitting on the fence watching all the good fliers. He was to small to win the competition, but he had an idea. He flew to the eagle and hid himself in the plumage of the big bird. Nobody saw him and he was so light that the eagle didn't recognize his presence. The time had come for the eagle. He started and flew higher and higher into the purple of the evening sky. He reached the highest point of all birds and just at this moment the little brown bird started from his back and flew a few yards higher. The eagle tried to get higher but he was so surprised to meet the small bird here and so tired that he could not. Both birds came back to the ground. The others couldn't say anything, they were absolutely silent. The little brown bird looked at the eagle. The eagle bowed his head and said, "Perhaps I am stronger than you, but you are so smart that you should be king of the birds, you are our king." The little bird was so happy, he flew to his favorite place at the top of the fence post and started singing. Since this moment he had his new name, "King of the Fence". The birds had a big party that night to celebrate the new king. The next morning they spread out going back to their homes. The king of the fence had so many children several years later that he hadn't enough space anymore. So one group decided to search for a new place to live. They flew a long way across a great ocean to a new land… America. But this group had a big problem, this land was a democracy and the citizens did not like kings. So the small birds changed their names to "wren". This was not a special name and so fits a small brown bird. They had a good time in this new land, but they didn't want their children to forget their origin. So they decided to build a throne for each child to remind them of their roots. This is the way they do it even to this day… In a box the wrens build a high throne with a lot of sticks and on the top of it a soft nest for the little kings. And so every wren knows that they were the king of the birds in another country a long time ago.

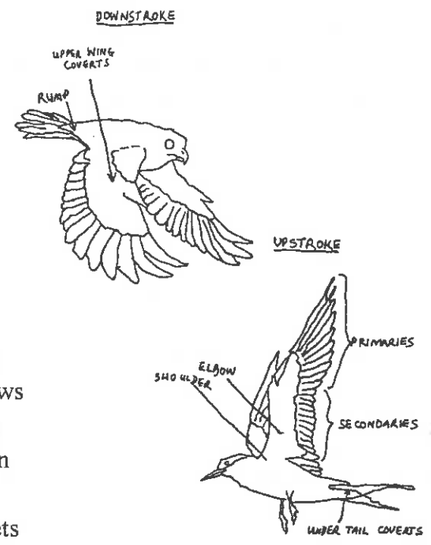
A BIRD IN THE AIR

Most birds can fly. In fact, all birds have feathers, and feathers are important for flight. Feathers are extremely light and structurally strong. There are different types of feathers. Flight feathers are those of the wing and tail. **Contour** feathers give a bird its characteristic shape. Primary and secondary feathers are located on the wing. The coat of contour feathers make the bird's body smooth, so it can easily slip through the air when it flies. Little **hooks** hold the contour feathers branches together while extra hooks at the edges of wing feathers catch on to the feathers next to them. This action makes the whole wing airtight for pushing against air to fly. Clustered around the bases of the contour feathers are the **filoplumes** which are hairlike shafts. Fluffy **down** feathers are soft shaftless tufts hidden beneath the sheath of contour feathers. Down feathers are lightweight and keep the bird warm.

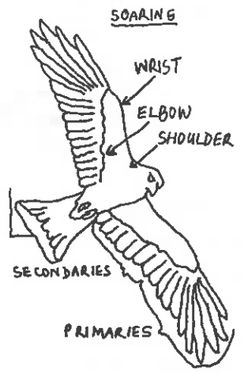


The shape of a bird's wing is beautifully adapted for flight. A bird's wing is thick and blunt along the leading edge, narrower and more blade like on the trailing edge. Its flat or slightly concave underside is to favor lift, while its more rounded upper surface is to smooth the flow of air.

Wings give a bird lift and also move it forward. A bird's chest is shaped by the 2 **muscles** that move the bird's wings. One muscle is much bigger than the other, and its job is to pull the wings down. This action is the **powerstroke** of the wing beat and it makes air rush over the wing to lift the bird. The power stroke also moves the bird through the air. Muscles do not push but can only pull on bones. So, the second muscle loops over the bird's shoulder and attaches to the top of the wing bone. Its pull raises the wing to be ready for the next **downstroke**. Since the **upstroke** does not need to be as forceful, this muscle is much smaller.



The tip halves of the wings, the hand part, and especially the long flexible primary feathers, act as propellers and control surfaces. Swallows employ gliding flight = several strong wing strokes and a glide. **Gliding** saves energy, but gravity and air conditions determine how far a bird can skim before it must flap again. Flight feathers also help in another way. During the upstroke, feathers at the wing's outer edge separate. This lets the air slip through and that makes it easier to pull the wing through the air. During the downstroke, these feathers are together and forced against the air. This helps to move the bird forward. A much more specialized skill is **soaring**, which makes use of rising air currents so effectively that for long periods no flapping is required.



Apart from a bird's feathers, the bird displays a number of other unique **flight** adaptations. A bird's body has a bony skeleton framework. A bird's bones are hard and nearly hollow. To make its skeleton even lighter, a bird does not have heavy jaw bones. **Beaks** have replaced teeth, and **gizzards** inside their bodies help break down food. Birds have fewer joints, and therefore, fewer muscles which also help make them **lightweight**.

Superb eyesight is another requirement for flight and all birds are endowed with extra-ordinary vision. A bird's eye is extremely large. In most birds, the eyes are actually larger than the brain. The eye of an eagle or a large owl may be as large as a human's. Birds can see distant objects with clarity and also see more clearly at much closer range. This is like having a built-in telescope and magnifying glass in the eye. Most birds can see in one direction with each eye working separately and also in three dimensions perceiving depth, both eyes working together. These are called **monocular** and **binocular** visions. Optically, they thus have the best of two worlds.

Birds that fly, from the tiniest hummingbird to the largest albatross, are far more alike in their make-up than other groups of animals are. This is because flight has demanded that they have skeletons that are light but strong, muscles that are powerful but not a burden, feathers that conserve heat while providing lift and propulsion, and the sharpest eyes in the entire animal kingdom.

Why Did Feathers Evolve ?

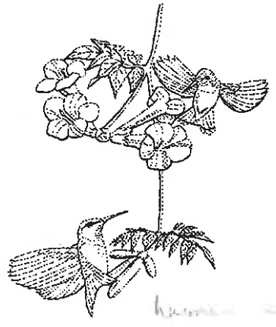
Some ornithologists believe that feathers first developed as protection against temperature changes, and later became an aid to **flight**. Others contend that feathers initially emerged to sustain flight. Evidence shows that climatic conditions were mild and uniformly warm throughout the world at the time birds emerged; this indicates that feathers developed first as an aid to **gliding** and flying, and later, when climatic conditions changed, assumed a secondary role as insulators.

Care of Feathers

A structure as intricate as a feather, tough though it may be, is not immune to wear. It frays and may even break. Therefore, every grown bird must renew its cloak completely at least once a year, usually in late summer after the **nesting** season. The powder-down feathers are found in a few groups of birds. These feathers constantly disintegrate into fine powder and are used by herons and bitterns to dress their plumage.

Hovering Hummingbirds

If you have ever watched a hummingbird, you know it can hover in one place. It can also fly straight up or backward. Hummingbirds can fly this way because of their special wings. Most birds have three wing joints, which let the wing bend. Hummingbirds, though, have only one free-moving **joint**, so their wings are stiff. A hummingbird can also tilt its wing. This motion lets the hummingbird gain lift without moving forward. By **hovering**, the hummingbird can reach tube-shaped flowers. Flying takes much energy, so birds eat energy-rich foods.



House Wren

Wren of the house you sordid type, with tilted tail and full of fight,
your chattered song of brave new height, recluse, bandit, troglodyte.
My talkative friend of casual wear, how bold your daring brown eyes stare.
Inquisitive to a fault, with relentless verbal assault,
you pursue the truth from me each day, while debating all I have to say.
Hiding now in bushes thick, with a nervous twitch, you pick up a stick,
oh puzzled soul in such a fix, to fill your nest box up with sticks.
But you can't delay your hurried pace, and so build two nests, just in case.
Inspired I follow your every feather, for days on end, in any weather.
While together we anxiously await, the arrival soon of your precious mate.
And soon your silent mate arrives, perhaps just one of several wives.
With song incessant from atop each nest, you are sure to prove your sticks are best.

Studying House Wrens

with Tom Alworth

I began watching house wrens when I was 10 years old at my parents cabin in the Catskill Mountains. My father had always enjoyed watching and feeding the birds or building homes for them to nest in. We put up about 6 nest boxes around our cabin which had a small yard, but was bordered by both fields and mature forest .We expected Bluebirds to use the boxes, since we often saw them sitting on nearby telephone wires searching for insects. One morning in early May however, we awoke to a loud, jazzy, beautiful song, coming from near one of the boxes. We scrambled for our binoculars and ran outside to discover a small brownish bird, whose volume defied his size, and whose body seemed to almost explode with sound as he threw his head back with each song. My father quickly identified it as a **House Wren, *Troglodytes aedon***, which in Latin means "cave dwelling nightingale."

Since that time, I anxiously await the arrival of House Wrens each spring from their winter homes in the southern United States. House Wrens are nondescript brownish birds slightly smaller than a chickadee. Males and females are **monomorphic** (they look alike), but only the male sings. Their diet is made up predominately of insects (**insectivourous**) which they rarely catch on the wing, but instead find by searching the ground or the leaves and bark of trees. Both sexes feed the young and males may mate with more than one female each season. House wrens nest in **cavities**, such as hollow trees, but readily except nest boxes. They build the nest in two stages, first, a bulky foundation is built with sticks which is entertaining to watch as wrens are almost acrobatic trying to get long sticks into the nest box hole. Second, females build a soft nest on top of the sticks made of rootlets, grasses, and feathers. It was their nest building behavior that first interested me when I was 10 years old. I wondered why wrens used sticks to build part of their nest with? Lots of sticks, in fact, I have recently learned that there are over 600 sticks per box! Why would a bird that nests in a box with a tiny entrance hole, choose inflexible sticks to build its nest with, instead of soft, flexible materials?

It was this simple observation and question 30 years ago that has become a 6 year study of House Wrens at the E. N. Huyck Preserve and Biological Research Station. This is not that unusual. Doing science does not necessarily mean thinking abstract thoughts about complex questions. In fact, all science begins first with a **question**, sometimes a simple question based on an **observation**. Then using the **scientific method**, we attempt to answer that question. Sometimes we do, sometimes we don't, but inevitably we learn more about our subject, thereby generating new questions. Here is how my study of house wrens evolved from those early observations.

To determine why wrens fill nest boxes with sticks, I prevented 20 **randomly** chosen pairs over a three year period from filling their boxes with sticks. Every day I visited all the boxes removing the sticks from some (**treatment** boxes), but leaving the sticks in the others untouched.(**control** boxes). I expected to in some way effect the nesting success of the treatment pairs since without the sticks, they would likely be at a disadvantage. As is often the case in science, what we think will happen does not. Not only did removing the sticks have no affect on the number of eggs laid or young hatched, but on average, treatment pairs fledged more young than did control pairs! Not having any sticks in their boxes did not seem to matter to the wrens. Although I still cannot explain the function of sticks in the nests of wrens, I demonstrated that wrens can successfully raise their young without them.

While conducting this experiment I observed both males and females carrying sticks to the nest box. This was not supposed to be the case since scientists have long thought that only the male builds the stick portion of the nest. With evidence to the contrary, I set out to determine who was correct. Since wrens are monomorphic, I would have to observe their behavior to determine their sex, then catch and mark each individual by placing **color bands** on their legs. I caught the birds using **mist nets**, which are six foot by 12 foot nets made with very fine black mesh that almost disappears when it is spread tightly. The birds accidentally fly into them and become entangled in the mesh. I remove them from the net quickly and without injury, and then place the color bands in specific combinations on their legs. After almost 400 hours of observation I have concluded that females carry more sticks than males by a margin of three to one. This discovery has forced me to rethink the **function** of sticks since it is not only a typical male behavior, but a typical female behavior as well.

Tom Alworth using his arm to demonstrate the portion of the wing that blood samples are taken from.

Since both sexes carry sticks together, perhaps they play a role in **courtship**, preparing both individuals for mating. If this were true, perhaps the female has different levels of circulating **hormones** when she is carrying sticks compared to when she is carrying soft material which is just prior to egg laying. Hormones are chemicals in the bloodstream that can have dramatic effects on how animals behave. The hormone in female birds that increases as they near egg laying is **estradiol**, similar to estrogen in human females. I am currently taking small blood samples from females while they are carrying sticks, and then again while they are carrying soft material. No difference in estradiol levels suggests that the sticks are part of the nest itself and both sexes participate in nest building. If estradiol levels are higher when she is carrying soft, then perhaps the sticks serve as a **preparatory behavior** such as pair bond formation and courtship.

Regardless of the results, what is most important about any experiment is that it be based on a clearly stated question and sound observation. If you collect the **data** in an organized fashion and objectively **analyze** the **results**, you are on your way to doing good science. Be curious, ask questions, debate answers and most importantly, have fun!

Search for terms for bird flight

A	D	B	B	N	E	S	T	I	N	G	S	I	X	Z	Z	D	R
P	O	W	E	R	S	T	R	O	K	E	F	U	N	U	T	I	E
P	W	I	D	B	Y	G	M	P	X	I	B	A	N	P	J	B	A
L	N	J	B	I	N	O	C	U	L	A	R	P	A	S	O	M	L
E	S	Y	K	I	I	R	O	O	O	U	E	E	N	T	I	O	W
J	T	D	R	H	A	G	P	I	N	C	M	O	O	R	N	N	O
A	R	A	O	V	A	L	Y	O	A	N	O	A	X	O	T	O	R
Y	O	O	B	W	U	I	G	L	I	D	I	N	G	K	W	C	L
S	K	T	A	M	N	Z	C	F	L	I	G	H	T	E	I	U	D
S	E	K	E	Z	M	U	S	C	L	E	S	I	B	O	N	L	A
H	O	V	E	R	I	N	G	X	B	E	A	K	S	Q	U	A	S
F	A	W	L	T	Y	T	O	W	E	R	G	I	Z	Z	A	R	D
L	I	G	H	T	W	E	I	G	H	T	W	B	A	R	B	T	A

There are 20 words associated with bird flight here, lying vertically, horizontally and diagonally. Can you find them? Draw a line through each word. Now what do these words mean? Discuss this with your friend, teacher and parents at home.

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