

JOHN BURROUGHS

UNDER THE
MAPLES

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PREFACE

It was while sitting in his hay-barn study in the Catskills and looking out upon the maple woods of the old home farm, and under the maples at Riverby, that the most of these essays were written, during the last two years of the author's life. And it was to the familiar haunts near his Hudson River home that his thoughts wistfully turned while wintering in Southern California in 1921. As he pictured in his mind the ice breaking up on the river in the crystalline March days, the return of the birds, the first hepaticas, he longed to be back among them; he was there in spirit, gazing upon the river from the summer-house, or from the veranda of the Nest, or seated at his table in the chestnut-bark Study, or busy with his sap-gathering and sugar-making.

Casting about for a title for this volume, the vision of maple-trees and dripping sap and crisp March days playing constantly before his mind, one day while sorting and shifting the essays for his new book, he suddenly said, "I have it! We'll call it *Under the Maples!*"

His love for the maple, and consequently his pleasure in having hit upon this title, can be gathered from the following fragment found among his miscellaneous notes: "I always feel at home where the sugar maple grows. It was paramount in the woods of the old home farm where I grew up. It looks and smells like home. When I bring in a maple stick to put on my fire, I feel like caressing it a little. Its fiber is as white as a lily, and nearly as sweet-scented. It is such a tractable, satisfactory wood to handle – a clean, docile, wholesome tree; burning without snapping or sputtering, easily worked up into stovewood, fine of grain, hard of texture, stately as a forest tree, comely and clean as a shade tree, glorious in autumn, a fountain of coolness in summer, sugar in its veins, gold in its foliage, warmth in its fibers, and health in it the year round."

Clara Barrus

The Nest at Riverby West Park on the Hudson
New York

I

THE FALLING LEAVES

The time of the falling of leaves has come again. Once more in our morning walk we tread upon carpets of gold and crimson, of brown and bronze, woven by the winds or the rains out of these delicate textures while we slept.

How beautifully the leaves grow old! How full of light and color are their last days! There are exceptions, of course. The leaves of most of the fruit-trees fade and wither and fall ingloriously. They bequeath their heritage of color to their fruit. Upon it they lavish the hues which other trees lavish upon their leaves. The pear-tree is often an exception. I have seen pear orchards in October painting a hillside in hues of mingled bronze and gold. And well may the pear-tree do this, it is so chary of color upon its fruit.

But in October what a feast to the eye our woods and groves present! The whole body of the air seems enriched by their calm, slow radiance. They are giving back the light they have been absorbing from the sun all summer.

The carpet of the newly fallen leaves looks so clean and delicate when it first covers the paths and the highways that one almost hesitates to walk upon it. Was it the gallant Raleigh who threw down his cloak for Queen Elizabeth to walk upon? See what a robe the maples have thrown down for you and me to walk upon! How one hesitates to soil it! The summer robes of the groves and the forests – more than robes, a vital part of themselves, the myriad living nets with which they have captured, and through which they have absorbed, the energy of the solar rays. What a change when the leaves are gone, and what a change when they come again! A naked tree may be a dead tree. The dry, inert bark, the rough, wirelike twigs change but little from summer to winter. When the leaves come, what a transformation, what mobility, what sensitiveness, what expression! Ten thousand delicate veined hands reaching forth and waving a greeting to the air and light, making a union and compact with them, like a wedding ceremony. How young the old trees suddenly become! what suppleness and grace invest their branches! The leaves are a touch of immortal youth. As the cambium layer beneath the bark is the girdle of perennial youth, so the leaves are the facial expression of the same quality. The leaves have their day and die, but the last leaf that comes to the branch is as young as the first. The leaves and the blossom and the fruit of the tree come and go, yet they age not; under the magic touch of spring the miracle is repeated over and over.

The maples perhaps undergo the most complete transformation of all the forest trees. Their leaves fairly become luminous, as if they glowed with inward light. In October a maple-tree before your window lights up your room like a great lamp. Even on cloudy days its presence helps to dispel the gloom. The elm, the oak, the beech, possess in a much less degree that quality of luminosity, though certain species of oak at times are rich in shades of red and bronze. The leaves of the trees just named for the most part turn brown before they fall. The great leaves of the sycamore assume a rich tan-color like fine leather.

The spider weaves a net out of her own vitals with which to capture her prey, but the net is not a part of herself as the leaf is a part of the tree. The spider repairs her damaged net, but the tree never repairs its leaves. It may put forth new leaves, but it never essays to patch up the old ones. Every tree has such a superabundance of leaves that a few more or less or a few torn and bruised ones do not seem to matter. When the leaf surface is seriously curtailed, as it often is by some insect pest, or some form of leaf-blight, or by the ravages of a hail-storm, the growth of the tree and the maturing of its fruit is seriously checked. To denude a tree of its foliage three years in succession usually proves fatal. The vitality of the tree declines year by year till death ensues.

To me nothing else about a tree is so remarkable as the extreme delicacy of the mechanism by which it grows and lives, the fine hairlike rootlets at the bottom and the microscopical cells of the leaves at the top. The rootlets absorb the water charged with mineral salts from the soil, and the leaves absorb the sunbeams from the air. So it looks as if the tree were almost made of matter and spirit, like man; the ether with its vibrations, on the one hand, and the earth with its inorganic compounds, on the other – earth salts and sunlight. The sturdy oak, the gigantic sequoia, are each equally finely organized in these parts that take hold upon nature. We call certain plants gross feeders, and in a sense they are; but all are delicate feeders in their mechanism of absorption from the earth and air.

The tree touches the inorganic world at the two finest points of its structure – the rootlets and the leaves. These attack the great crude world of inorganic matter with weapons so fine that only the microscope can fully reveal them to us. The animal world seizes its food in masses little and big, and often gorges itself with it, but the vegetable, through the agency of the solvent power of water, absorbs its nourishment molecule by molecule.

A tree does not live by its big roots – these are mainly for strength and to hold it to the ground. How they grip the rocks, fitting themselves to them, as Lowell says, like molten metal! The tree's life is in the fine hairlike rootlets that spring from the roots. Darwin says those rootlets behave as if they had minute brains in their extremities. They feel their way into the soil; they know the elements the plant wants; some select more lime, others more potash, others more magnesia. The wheat rootlets select more silica to make the stalk; the pea rootlets select more lime: the pea does not need the silica. The individuality of plants and trees in this respect is most remarkable. The cells of each seem to know what particular elements they want from the soil, as of course they do.

The vital activity of the tree goes on at three points – in the leaves, in the rootlets, and in the cambium layer. The activity of the leaf and rootlet furnishes the starchy deposit which forms this generative layer – the milky, mucilaginous girdle of matter between the outer bark and the wood through which the tree grows and increases in size. Generation and regeneration take place through this layer. I have called it the girdle of perpetual youth. It never grows old. It is annually renewed. The heart of the old apple-tree may decay and disappear, indeed the tree may be reduced to a mere shell and many of its branches may die and fall, but the few apples which it still bears attest the fact that its cambium layer, at least over a part of its surface, is still youthful and doing its work. It is this layer that the yellow-bellied woodpecker, known as the sapsucker, drills into and devours, thus drawing directly upon the vitality of the tree. But his ravages are rarely serious. Only in two instances have I seen dead branches on an apple-tree that appeared to be the result of his drilling.

What we call the heart of a tree is in no sense the heart; it has no vital function, but only the mechanical one of strength and support. It adds to the tree's inertia and power to resist storms. The trunk of a tree is like a community where only one generation at a time is engaged in active business, the great mass of the population being retired and adding solidity and permanence to the social organism. The rootlets of a plant or a tree are like the laborers in the field that produce for us the raw material of our food, while the leaves are like our many devices for rendering it edible and nourishing. The rootlets continue their activity in the fall, after the leaves have fallen, and thus gorge the tree with fluid against the needs of the spring. In the growing tree or vine the sap, charged with nourishment, flows down from the top to the roots. In the spring it evidently flows upward, seeking the air through the leaves. Or rather, we may say that the crude sap always flows upward, while the nutritive sap flows downward, thus giving the tree a kind of double circulation.

A tree may be no more beautiful and wonderful when we have come to a knowledge of all its hidden processes, but it certainly is no less so. We do not think of the function of the leaves, nor of the bark, nor of the roots and rootlets, when we gaze upon a noble oak or an elm; we admire it for its form, its sturdiness, or its grace; it is akin to ourselves; it is the work of a vast community of cells like those that build up our own bodies; it is a fountain of living matter rising up out of the earth and splitting up and spreading out at its top in a spray of leaves and flowers; and if we could see its hidden

processes we should realize how truly like a fountain it is. While in full leaf a current of water is constantly flowing through it, and flowing upward against gravity. This stream of water is truly its life current; it enters at the rootlets under the ground and escapes at the top through the leaves by a process called transpiration. All the mineral salts with which the tree builds up its woody tissues, – its osseous system, so to speak, – the instruments with which it imprisons and consolidates the carbon which it obtains from the air, are borne in solution in this stream of water. Its function is analogous to that of the rivers which bring the produce and other material to the great cities situated upon their banks. A cloud of invisible vapor rises from the top of every tree and a thousand invisible rills enter it through its myriad hairlike rootlets. The trees are thus conduits in the circuit of the waters from the earth to the clouds. Our own bodies and the bodies of all living things perform a similar function. Life cannot go on without water, but water is not a food; it makes the processes of metabolism possible; assimilation and elimination go on through its agency. Water and air are the two ties between the organic and the inorganic. The function of the one is mainly mechanical, that of the other is mainly chemical.

As the water is drawn in at the roots, it flows out at the top, to which point it rises by capillary attraction and a process called osmosis. Neither of them is a strictly vital process, since both are found in the inorganic world; but they are in the service of what we call a vital principle. Some physicists and biochemists laugh at the idea of a vital principle. Huxley thought we might as well talk about the principle of aqueosity in water. We are the victims of words. The sun does not shoot out beams or rays, though the eye reports such; but it certainly sends forth energy; and it is as certain that there is a new activity in matter – some matter – that we call vital.

Matter behaves in a new manner; builds up new compounds and begets myriads of new forms not found in the inorganic world, till it finally builds up the body and mind of man. Death puts an end to this activity alike in man and tree, and a new kind of activity sets in – a disorganizing activity, still with the aid of water and air and living organisms. It is like the compositor distributing his type after the book is printed. The micro-organisms answer to the compositor, but they are of a different kind from those which build up the body in the first instance. But the living body as a whole, with its complex of coördinating organs and functions – what attended to that? The cells build the parts, but what builds the whole?

How many things we have in common with the trees! The same mysterious gift of life, to begin with; the same primary elements – carbon, nitrogen, oxygen, and so on – in our bodies; and many of the same vital functions – respiration, circulation, absorption, assimilation, reproduction. Protoplasm is the basis of life in both, and the cell is the architect that builds up the bodies of both. Trees are rooted men and men are walking trees. The tree absorbs its earth materials through the minute hairs on its rootlets, called fibrillæ, and the animal body absorbs its nutriment through analogous organs in the intestines, called lacteals.

Whitman's expression "the slumbering and liquid trees" often comes to my mind. They are the words of a poet who sees hidden relations and meanings everywhere. He knows how fluid and adaptive all animate nature is. The trees are wrapped in a kind of slumber in winter, and they are reservoirs of living currents in summer. If all living bodies came originally out of the sea, they brought a big dower of the sea with them. The human body is mainly a few pinches of earth salts held in solution by several gallons of water. The ashes of the living tree bulk small in comparison with the amount of water it holds. Yes, "the slumbering and liquid trees." They awaken from their slumber in the spring, the scales fall from their buds, the fountains within them are unsealed, and they again become streams of living energy, breaking into leaf and bloom and fruit under the magic of the sun's rays.

II

THE PLEASURES OF A NATURALIST

I

How closely every crack and corner of nature is packed with life, especially in our northern temperate zone! I was impressed with this fact when during several June days I was occupied with road-mending on the farm where I was born. To open up the loosely piled and decaying laminated rocks was to open up a little biological and zoölogical museum, so many of our smaller forms of life harbored there. From chipmunks to ants and spiders, animal life flourished. We disturbed the chipmunks in their den a foot and a half or more beneath the loosely piled rocks. There were two of them in a soft, warm nest of dry, shredded maple-leaves. They did not wait to be turned out of doors, but when they heard the racket overhead bolted precipitately. Two living together surprised me, as heretofore I had never known but one in a den. Near them a milk snake had stowed himself away in a crevice, and in the little earthquake which we set up got badly crushed. Two little red-bellied snakes about one foot long had also found harbor there.

The ants rushed about in great consternation when their eggs were suddenly exposed. In fact, there was live natural history under every stone about us. Some children brought me pieces of stone, which they picked up close by, which sheltered a variety of cocoon-building spiders. One small, dark-striped spider was carrying about its ball of eggs, the size of a large pea, attached to the hind part of its body. This became detached, when she seized it eagerly and bore it about held between her legs. Another fragment of stone, the size of one's hand, sheltered the chrysalis of some species of butterfly which was attached to it at its tail. It was surprising to see this enshrouded creature, blind and deaf, wriggle and thrash about as if threatening us with its wrath for invading its sanctuary. One would about as soon expect to see an egg protest.

Thus the naturalist finds his pleasures everywhere. Every solitude to him is peopled. Every morning or evening walk yields him a harvest to eye or ear.

The born naturalist is one of the most lucky men in the world. Winter or summer, rain or shine, at home or abroad, walking or riding, his pleasures are always near at hand. The great book of nature is open before him and he has only to turn the leaves.

A friend sitting on my porch in a hickory rocking-chair the other day was annoyed by one of our small solitary wasps that seemed to want to occupy the chair. It held a small worm in its legs. She would "shoo" it away, only to see it back in a few seconds. I assured her that it did not want to sting her, but that its nest was somewhere in the chair. And, sure enough, as soon as she quieted down, it entered a small opening in the end of one of the chair arms, and deposited its worm, and presently was back with another, and then a third and a fourth; and before the day was done it came with little pellets of mud and sealed up the opening.

II

My morning walk up to the beech wood often brings me new knowledge and new glimpses of nature. This morning I saw a hummingbird taking its bath in the big dewdrops on a small ash-tree. I have seen other birds bathe in the dew or raindrops on tree foliage, but did not before know that the hummer bathed at all.

I also discovered that the webs of the little spiders in the road, when saturated with moisture, as they were from the early fog this morning, exhibit prismatic tints. Every thread of the web was

strung with minute spherules of moisture, and they displayed all the tints of the rainbow. In each of them I saw one abutment of a tiny rainbow. When I stepped a pace or two to the other side, I saw the other abutment. Of course I could not see the completed bow in so small an area. These fragments are as unapproachable as the bow in the clouds. I also saw that where a suspended dewdrop becomes a jewel, or displays rainbow tints, you can see only one at a time – to the right or left of you. It also is a fragment of a rainbow. Those persons who report beholding a great display of prismatic effects in the foliage of trees, or in the grass after a shower, are not to be credited. You may see the drops glistening in the sun like glass beads, but they will not exhibit prismatic tints. In only one at a time will you see rainbow tints. Change your position, and you may see another, but never a great display of prismatic tints at one time.

In my walk the other morning I turned over a stone, looking for spiders and ants. These I found, and in addition there were two cells of one of our solitary leaf-cutters, which we as boys called "sweat bees," because they came around us and would alight on our sweaty hands and arms as if in quest of salt, as they probably were. It is about the size of a honey bee, of lighter color, and its abdomen is yellow and very flexible. It carries its pollen on its abdomen and not upon its thighs. These cells were of a greenish-brown color; each of them was like a miniature barrel in which the pollen with the egg of the bee was sealed up. When the egg hatches, the grub finds a loaf of bread at hand for its nourishment. These little barrels were each headed up with a dozen circular bits of leaves cut as with a compass, exactly fitting the cylinder, one upon the other. The wall of the cylinder was made up of oblong cuttings from leaves, about half an inch wide, and three quarters of an inch long, a dozen of them lapped over one another, and fitted together in the most workmanlike manner.

In my boyhood I occasionally saw this bee cutting out her nesting-material. Her mandibles worked like perfect shears. When she had cut out her circular or her oblong patches, she rolled them up, and, holding them between her legs, flew away with them. I have seen her carry them into little openings in old rails, or old posts. About the period of hatching, I do not know.

III

Swallows, in hawking through the air for insects, do not snap their game up as do the true flycatchers. Their mouths are little nets which they drive through the air with the speed of airplanes. A few mornings ago the air was cold, but it contained many gauzy, fuzzy insects from the size of mosquitoes down to gnats. They kept near the ground. I happened to be sitting on the sunny side of a rock and saw the swallows sweep past. One came by within ten feet of me and drove straight on to a very conspicuous insect which disappeared in his open mouth in a flash. How many hundreds or thousands of such insects they must devour each day! Then think of how many insects the flycatchers and warblers and other insect-eating birds must consume in the course of a season!

IV

We little suspect how the woods and wayside places swarm with life. We see little of it unless we watch and wait. The wild creatures are cautious about revealing themselves: their enemies are on the lookout for them. Certain woods at night are alive with flying squirrels which, except for some accident, we never see by day. Then there are the night prowlers – skunks, foxes, coons, minks, and owls – yes, and mice.

The wild mice we rarely see. The little shrew mole, which I know is active at night, I have never seen but once. I once set a trap, called the delusion trap, in the woods by some rocks where I had no reason to suspect there were more mice than elsewhere, and two mornings later it was literally packed full of mice, half a dozen or more.

Turn over a stone in the fields and behold the consternation among the small folk beneath it, – ants, slugs, bugs, worms, spiders, – all objecting to the full light of day, not because their deeds are evil, but because the instinct of self-preservation prompts this course. As I write these sentences, a chipmunk, who has his den in the bank by the roadside near by, is very busy storing up some half-ripe currants which grew on a bush a few yards away. Of course the currants will ferment and rot, but that consideration does not disturb him; the seeds will keep, and they are what he is after. In the early summer, before any of the nuts and grains are ripened, the high cost of living among the lesser rodents is very great, and they resort to all sorts of makeshifts.

V

In regard to this fullness of life in the hidden places of nature, Darwin says as much of the world as a whole:

Well may we affirm that every part of the world is inhabitable. Whether lakes of brine or those subterranean ones hidden beneath volcanic mountains – warm mineral springs – the wide expanse and depth of the ocean, the upper regions of the atmosphere, and even the surface of perpetual snow – all support organic beings.

Never before was there such a lover of natural history as Darwin. In the earth, in the air, in the water, in the rocks, in the sand, in the mud – he scanned the great biological record of the globe as it was never scanned before. During the voyage of the Beagle he shirked no hardships to add to his stores of natural knowledge. He would leave the comfortable ship while it was making its surveys, and make journeys of hundreds of miles on horseback through rough and dangerous regions to glean new facts. Grass and water for his mules, and geology or botany or zoölogy or anthropology for himself, and he was happy. At a great altitude in the Andes the people had shortness of breath which they called "puna," and they ate onions to correct it. Darwin says, with a twinkle in his eye, "For my part I found nothing so good as the fossil shells."

His Beagle voyage is a regular magazine of natural-history knowledge. Was any country ever before so searched and sifted for its biological facts? In lakes and rivers, in swamps, in woods, everywhere his insatiable eye penetrated. One re-reads him always with a different purpose in view. If you happen to be interested in insects, you read him for that; if in birds, you read him for that; if in mammals, in fossils, in reptiles, in volcanoes, in anthropology, you read him with each of these subjects in mind. I recently had in mind the problem of the soaring condor, and I re-read him for that, and, sure enough, he had studied and mastered that subject, too. If you are interested in seeing how the biological characteristics of the two continents, North and South America, agree or contrast with each other, you will find what you wish to know. You will learn that in South America the lightning-bugs and glowworms of many kinds are the same as in North America; that the beetle, or elator, when placed upon its back, snaps itself up in the air and falls upon its feet, as our species does; that the obscene fungus, or *Phallus*, taints the tropical forests, as a similar species at times taints our dooryards and pasture-borders; and that the mud-dauber wasps stuff their clay cells with half-dead spiders for their young, just as in North America. Of course there are new species of animal and plant life, but not many. The influence of environment in modifying species is constantly in his mind.

VI

The naturalist can content himself with a day of little things. If he can read only a word of one syllable in the book of nature, he will make the most of that. I read such a word the other morning when I perceived, when watching a young but fully fledged junco, or snowbird, that its markings were like those of the vesper sparrow. The young of birds always for a brief period repeat the markings of the birds of the parent stem from which they are an offshoot. Thus, the young of our robins have

speckled breasts, betraying their thrush kinship. And the young junco shows, in its striped appearance of breast and back, and the lateral white quills in the tail, its kinship to the grass finch or vesper sparrow. The slate-color soon obliterates most of these signs, but the white quills remain. It has departed from the nesting-habits of its forbears. The vesper sparrow nests upon the ground in the open fields, but the junco chooses a mossy bank or tussock by the roadside, or in the woods, and constructs a very artistic nest of dry grass and hair which is so well hidden that the passer-by seldom detects it.

Another small word I read about certain of the rocks in my native Catskills, a laminated, blue-gray sandstone, that when you have split them open with steel wedges and a big hammer, or blown them up with dynamite, instead of the gray fresh surface of the rock greeting you, it is often a surface of red mud, as if the surface had been enameled or electrotyped with mud. It appears to date from the first muddy day of creation. I have such a one for my doorstone at Woodchuck Lodge. It is amusing to see the sweepers and scrubbers of doorstones fall upon it with soap and hot water, and utterly fail to make any impression upon it. Nowhere else have I seen rocks casehardened with primal mud. The fresh-water origin of the Catskill rocks no doubt in some way accounts for it.

VII

We are all interested students of the weather, but the naturalist studies it for some insight into the laws which govern it. One season I made my reputation as a weather prophet by predicting on the first day of December a very severe winter. It was an easy guess. I saw in Detroit a bird from the far north, a bird I had never before seen, the Bohemian waxwing, or chatterer. It breeds above the Arctic Circle and is common to both hemispheres. I said, When the Arctic birds come down, be sure there is a cold wave behind them. And so it proved.

When the birds fail to give one a hint of the probable character of the coming winter, what reliable signs remain? These remain: When December is marked by sudden and violent extremes of heat and cold, the winter will be broken; the cold will not hold. I have said elsewhere that the hum of the bee in December is the requiem of winter. But when the season is very evenly spaced, the cold slowly and steadily increasing through November and December, no hurry, no violence, then be prepared for a snug winter.

As to wet and dry summers, one can always be guided by the rainfall on the Pacific coast; a shortage on the western coast means an excess on the eastern. For four or five years past California has been short of its rainfall; so much so that quite general alarm is felt over the gradual shrinkage of their stored-up supplies, the dams and reservoirs; and during the summer seasons the parts of New England and New York with which I am acquainted have had very wet seasons – floods in midsummer, and full springs and wells at all times. The droughts have been temporary and local.

We say, "As fickle as the weather," but the meteorological laws are pretty well defined. All signs fail in a drought, and all signs fail in a wet season. At one time the south wind brings no rain, at another time the north and northwest winds do bring rain. The complex of conditions over a continental area of rivers and lakes and mountain-chains is too vast for us to decipher; it inheres in the nature of things. It is one of the potencies and possibilities which matter possesses. We can take no step beyond that.

VIII

There seems to me to be false reasoning in the argument from analogy which William James uses in his lectures on "Human Immortality." The brain, he admits, is the organ of the mind, but may only sustain the relation to it, he says, which the wire sustains to the electric current which it transmits, or which the pipe sustains to the water which it conveys.

Now the source and origin of the electric current is outside the wire that transmits it, and it could sustain no other than a transient relation to any outside material through which it passed. But

if we know anything, we know that the human mind or spirit is a vital part of the human body; its source is in the brain and nervous system; hence, it and the organ through which it is manifested are essentially one.

The analogy of the brain to the battery or dynamo in which the current originates is the only logical or permissible one.

IX

Maeterlinck wrote wisely when he said:

The insect does not belong to our world. The other animals, the plants even, notwithstanding their dumb life, and the great secrets which they cherish, do not seem wholly foreign to us. In spite of all we feel a sort of earthly brotherhood with them... There is something, on the other hand, about the insect that does not belong to the habits, the ethics, the psychology of our globe. One would be inclined to say that the insect comes from another planet, more monstrous, more energetic, more insane, more atrocious, more infernal than our own.

Certainly more cruel and monstrous than our own. Among the spiders, for instance, the female eats the male and often devours her own young. The scorpion does the same thing. I know of nothing like it among our land animals outside the insect world.

The insects certainly live in a wonderland of which we have little conception. All our powers are tremendously exaggerated in these little people. Their power makes them acquainted with the inner molecular constitution of matter far more intimately than we can attain to by our coarse chemical analysis. Our world is agitated by vibrations, coarse and fine, of which our senses can take in only the slower ones. If they exceed three thousand a second, they become too shrill for our ears. It is thought that the world of sound with the insects begins where ours leaves off. The drums and tubes of insects' ears are very minute. What would to us be a continuous sound is to them a series of separate blows. We begin to hear blows as continuous sounds when they amount to about thirty a second. The house-fly has about four thousand eye-lenses; the cabbage butterfly, and the dragon-fly, about seventeen thousand; and some species of beetles have twenty-five thousand. We cannot begin to think in what an agitated world the insect lives, thrilling and vibrating to a degree that would drive us insane. If we possessed the same microscopic gifts, how would the aspect of the world be changed! We might see a puff of smoke as a flock of small blue butterflies, or hear the hum of a mosquito as the blast of a trumpet. On the other hand, so much that disturbs us must escape the insects, because their senses are too fine to take it in. Doubtless they do not hear the thunder or feel the earthquake.

The insects are much more sensitive to heat and cold than we are, and for reasons. The number of waves in the ether that gives us the sensation of heat is three or four million millions a second. The number of tremors required to produce red light is estimated at four hundred and seventy-four million millions a second, and for the production of violet light, six hundred and ninety-nine million millions a second. No doubt the insects react to all these different degrees of vibration. Those marvelous instruments called antennæ seem to put them in touch with a world of which we are quite oblivious.

X

To how many things our lives have been compared! – to a voyage, with its storms and adverse currents and safe haven at last; to a day with its morning, noon, and night; to the seasons with their spring, summer, autumn, and winter; to a game, a school, a battle.

In one of his addresses to workingmen Huxley compared life to a game of chess. We must learn the names and the values and the moves of each piece, and all the rules of the game if we hope to play it successfully. The chessboard is the world, the pieces are the phenomena of the universe, the rules of the game are what we call the laws of nature. But it may be questioned if the comparison

is a happy one. Life is not a game in this sense, a diversion, an aside, or a contest for victory over an opponent, except in isolated episodes now and then. Mastery of chess will not help in the mastery of life. Life is a day's work, a struggle where the forces to be used and the forces to be overcome are much more vague and varied and intangible than are those of the chessboard. Life is coöperation with other lives. We win when we help others to win. I suppose business is more often like a game than is life – your gain is often the other man's loss, and you deliberately aim to outwit your rivals and competitors. But in a sane, normal life there is little that suggests a game of any kind.

We must all have money, or its equivalent. There are the three things – money, goods, labor – and the greatest of these is labor. Labor is the sum of all values. The value of things is the labor it requires to produce or to obtain them. Were gold plentiful and silver scarce, the latter would be the more precious. The men at the plough and the hoe and in the mines of coal and iron stand first. These men win from nature what we all must have, and these things are none of them in the hands or under the guardianship of some one who is trying to keep us from obtaining them, or is aiming to take our aids and resources from us.

The chess simile has only a rhetorical value. The London workingmen to whom Huxley spoke would look around them in vain to find in their problems of life anything akin to a game of chess, or for any fruitful suggestion in the idea. They were probably mechanics, tradesmen, artisans, teamsters, boatmen, painters, and so on, and knew through experience the forces with which they had to deal. But how many persons who succeed in life have any such expert knowledge of the forces and conditions with which they have to deal, as two chess-players have of the pawns and knights and bishops and queens of the chessboard?

Huxley was nearly always impressive and convincing, and there was vastly more logical force in his figures than in those of most writers.

Life may more truly be compared to a river that has its source in a mountain or hillside spring, with its pure and sparking or foaming and noisy youth, then its quieter and stronger and larger volume, and then its placid and gently moving current to the sea. Blessed is the life that is self-purifying, like the moving waters; that lends itself to many noble uses, never breaking out of bonds and becoming a destructive force.

XI

I had a letter the other day from a man who wanted to know why the meadow, or field, mice gnawed or barked the apple-trees when there was a deep coverlid of snow upon the ground. Was it because they found it difficult to get up through the deep, frozen snow to the surface to get seeds to eat? He did not seem to know that meadow mice are not seed-eaters, but that they live on grass and roots and keep well hidden beneath the ground during the day, when there is a deep fall of snow coming up out of their dens and retreats and leading a free holiday life beneath the snow, free from the danger of cats, foxes, owls, and hawks. Life then becomes a sort of picnic. They build new nests on the surface of the ground and form new runways, and disport themselves apparently in a festive mood. The snow is their protection. They bark the trees and take their time. When the snow is gone, their winter picnic is at an end, and they retreat to their dens in the ground and beneath flat stones, and lead once more the life of fear.

XII

Sitting on my porch recently, wrapped in my blanket, recovering from a slight indisposition, I was in a mood to be interested in the everyday aspects of nature before me – in the white and purple lilacs, in the maple-leaves nearly full grown, in the pendent fringe of the yellowish-white bloom of

the chestnut and oak, in the new shoots of the grapevines, and so forth. All these things formed only a setting or background for the wild life near by.

The birds are the little people that peep out at me, or pause and regard me curiously in this great temple of trees, – wrens, chippies, robins, bluebirds, catbirds, redstarts, and now and then rarer visitants. A few days earlier, for a moment, a mourning ground warbler suddenly appeared around the corner, on the ground, at the foot of the steps, and glanced hastily up at me. When I arose and looked over the railing, it had gone. Then the speckled Canada warbler came in the lilac bushes and syringa branches and gave me several good views. The bay-breasted warbler was reported in the evergreens up by the stone house, but he failed to report to me here at "The Nest." The female redstart, however, came several times to the gravel walk below me, evidently looking for material to begin her nest. And the wren, the irrepressible house wren, was and is in evidence every few minutes, busy carrying nesting-material into the box on the corner of the veranda. How intense and emphatic she is! And the male, how he throbs and palpitates with song! Yesterday an interloper appeared. He or she climbed the post by the back way, as it were, and hopped out upon the top of the box and paused, as if to see that the coast was clear. He acted as if he felt himself an intruder. Quick as a flash there was a brown streak from the branch of a maple thirty feet away, and the owner of the box was after him. The culprit did not stop to argue the case, but was off, hotly pursued. I must not forget the pair of wood thrushes that are building a nest in a maple fifty or more feet away. How I love to see them on the ground at my feet, every motion and gesture like music to the eye! The head and neck of the male fairly glows, and there is something fine and manly about his speckled breast.

A pair of catbirds have a nest in the barberry bushes at the south end of the house, and are in evidence at all hours. But when the nest is completed, and the laying of eggs begins, they keep out of the public eye as much as possible. From the front of the stage they retreat behind the curtain.

One day as I sat here I heard the song of the olive-backed thrush down in the currant-bushes below me. Instantly I was transported to the deep woods and the trout brooks of my native Catskills. I heard the murmuring water and felt the woodsy coolness of those retreats – such magic hath associative memories! A moment before a yellow-throated vireo sang briefly in the maple, a harsh note; and the oriole with its insistent call added to the disquieting sounds. I have no use for the oriole. He has not one musical note, and in grape time his bill is red, or purple, with the blood of our grapes.

But the most of these little people are my benefactors, and add another ray of sunshine to the May day. I shall not soon forget the spectacle of that rare little warbler peeping around the corner of the porch, like a little fairy, and then vanishing.

The mere studying of the birds, seeking mere knowledge of them, is not enough. You must live with the birds, so to speak; have daily and seasonal associations with them before they come to mean much to you. Then, as they linger about your house or your camp, or as you see them in your walks, they are a part of your life, and help give tone and color to your day.

III

THE FLIGHT OF BIRDS

To what widely different use birds put their power of flight! To the great mass of them it is simply a means of locomotion, of getting from one point to another. A small minority put their wing-power to more ideal uses, as the lark when he claps his wings at heaven's gate, and the ruffed grouse when he drums; even the woodcock has some other use for his wings than to get from one point to another. Listen to his flight song in the April twilight up against the sky.

Our small hawks use their power of flight mainly to catch their prey, as does the swallow skimming the air all day on tireless wing, but some of the other hawks, such as our red-tailed hawk, climb their great spirals apparently with other motives than those which relate to their daily fare. The crow has little other use for his wings than to gad about like a busy politician from one neighborhood to another. In Florida I have seen large flocks of the white ibis performing striking evolutions high up against the sky, evidently expressive of the gay and festive feeling begotten by the mating instinct.

The most beautiful flyer we ever see against our skies is the unsavory buzzard. He is the winged embodiment of grace, ease, and leisure. Judging from appearances alone, he is the most disinterested of all the winged creatures we see. He rides the airy billows as if only to enjoy his mastery over them. He is as calm and unhurried as the orbs in their courses. His great circles and spirals have a kind of astronomic completeness. That all this power of wing and grace of motion should be given to an unclean bird, to a repulsive scavenger, is one of the anomalies of nature. He does not need to hurry or conceal his approach; what he is after cannot flee or hide; he has no enemies; nothing wants him; and he is at peace with all the world.

The great condor of South America, in rising from the ground, always faces the wind. It is often captured by tempting it to gorge itself in a comparatively narrow space. But if a strong enough wind were blowing at such times, it could quickly rise over the barrier. Darwin says he watched a condor high in the air describing its huge circles for six hours without once flapping its wings. He says that, if the bird wished to descend, the wings were for a moment collapsed; and when again expanded, with an altered inclination, the momentum gained by the rapid descent seemed to urge the bird upwards with the even and steady movement of a paper kite. In the case of any bird *soaring*, its motion must be sufficiently rapid for the action of the inclined surface of its body on the atmosphere to counterbalance its gravity. The force to keep up the momentum of a body moving in a horizontal plane in the air (in which there is so little friction) cannot be great, and this force is all that is wanted. The movement of the neck and body of the condor, we must suppose, is sufficient for this. However this may be, it is truly wonderful and beautiful to see so great a bird, hour after hour, without any apparent exertion, wheeling and gliding over mountain and river.

The airplane has a propelling power in its motor, and it shifts its wings to take advantage of the currents. The buzzard and condor do the same thing. They are living airplanes, and their power is so evenly and subtly distributed and applied, that the trick of it escapes the eye. But of course they avail themselves of the lifting power of the air-currents.

All birds know how to use their wings to propel themselves through the air, but the mechanism of the act we may not be able to analyze. I do not know how a butterfly propels itself against a breeze with its quill-less wings, but we know that it does do it. As its wings are neither convex nor concave, like a bird's, one would think that the upward and downward strokes would neutralize each other; but they do not. Strong winds often carry them out over large bodies of water; but such a master flyer as the monarch beats its way back to shore, and, indeed, the monarch habitually flies long distances over salt water when migrating along our seacoast in spring and fall.

At the moment of writing these paragraphs, I saw a hen-hawk flap heavily by, pursued by a kingbird. The air was phenomenally still, not a leaf stirred, and the hawk was compelled to beat his wings vigorously. No soaring now, no mounting heavenward, as I have seen him mount till his petty persecutor grew dizzy with the height and returned to earth. But the next day, with a fairly good breeze blowing, I watched two hawks for many minutes climbing their spiral stairway to the skies, till they became very small objects against the clouds, and not once did they flap their wings! Then one of them turned toward the mountain-top and sailed straight into the face of the wind, till he was probably over his mate or young, when, with half-folded wings, he shot down into the tree-tops like an arrow.

In regard to powers of flight, the birds of the air may be divided into three grand classes: those which use their wings simply to transport themselves from one place to another, – the same use we put our legs to, – those which climb the heavens to attain a wide lookout, either for the pleasure of soaring, or to gain a vantage-point from which to scan a wide territory in search of food or prey, and those which feed as they fly. Most of our common birds are examples of the first class. Our hawks and buzzards are examples of the second class. Swallows, nighthawks, and some sea-birds are examples of the third class. A few of our birds use their wings to gain an elevation from which to deliver their songs – as the larks, and some of the finches; but the robins and the sparrows and the warblers and the woodpeckers are always going somewhere. The hawks and the buzzards are, comparatively speaking, birds of leisure.

Every bird and beast is a master in the use of its own tools and weapons. We who look on from the outside marvel at their skill. Here is the carpenter bumble-bee hovering and darting about the verge-board of my porch-roof as I write this. It darts swiftly this way and that, and now and then pauses in midair, surrounded by a blur of whirring wings, as often does the hummingbird. How it does it, I do not know. I cannot count or distinguish the separate stroke of its wings. At the same time, the chimney swifts sweep by me like black arrows, on wings apparently as stiff as if made of tin or sheet-iron, now beating the air, now sailing. In some way they suggest winged gimlets. How thin and scimitar-like their wings are! They are certainly masters of their own craft.

In general, birds in flight bring the wings as far below the body as they do above it. Note the crow flapping his way through the air. He is a heavy flyer, but can face a pretty strong wind. His wings probably move through an arc of about ninety degrees. The ph[oe]be flies with a peculiar snappy, jerky flight; its relative the kingbird, with a mincing and hovering flight; it tiptoes through the air. The woodpeckers gallop, alternately closing and spreading their wings. The ordinary flight of the goldfinch is a very marked undulatory flight; a section of it, the rise and the fall, would probably measure fifty feet. The bird goes half that distance or more with wings closed. This is the flight the male indulges in within hearing distance of his brooding mate. During the love season he occasionally gives way to an ecstatic flight. This is a level flight, performed on round, open wings, which beat the air vertically. This flight of ecstasy during the song season is common to many of our birds. I have seen even the song sparrow indulge in it, rising fifty feet or more and delivering its simple song with obvious excitement. The idiotic-looking woodcock, inspired by the grand passion, rises upon whistling wings in the early spring twilight, and floats and circles at an altitude of a hundred feet or more, and in rapid smacking and chippering notes unburdens his soul. The song of ecstasy with our meadowlark is delivered in a level flight and is sharp and hurried, both flight and song differing radically from its everyday performance. One thinks of the bobolink as singing almost habitually on the wing. He is the most rollicking and song-drunk of all our singing birds. His season is brief but hilarious. In his level flight he seems to use only the tips of his wings, and we see them always below the level of his back. Our common birds that have no flight-song, so far as I have observed, are the bluebird, the robin, the ph[oe]be, the social sparrow, the tanager, the grosbeak, the pewee, the wood warblers, and most of the ground warblers.

Over thirty years ago a writer on flying-machines had this to say about the flight of sea-gulls: "Sweeping around in circles, occasionally elevating themselves by a few flaps of the wings, they glide

down and up the aerial inclines without apparently any effort whatever. But a close observation will show that at every turn the angle of inclination of the wings is changed to meet the new conditions. There is continual movement with power – by the bird it is done instinctively, by our machine only through mechanism obeying a mind not nearly so well instructed."

The albatross will follow a ship at sea, sailing round and round, in a brisk breeze, on unbending wing, only now and then righting itself with a single flap of its great pinions. It literally rides upon the storm.

IV

BIRD INTIMACIES

When, as sometimes happens, I feel an inclination to seek out new lands in my own country, or in other countries, to see what Nature is doing there, and what guise she wears, something prompts me to pause, and after a while to say to myself: "Look a little closer into the nature right at your own door; do a little intensive observation at home, and see what that yields you. The enticement of the far-away is mostly in your imagination; let your eyes and your imagination play once more on the old familiar birds and objects."

One season in my walks to the woods I was on the lookout for a natural bracket among the tree-branches, to be used in supporting a book-shelf. I did not find it; but one day in a shad-blow tree, within a few feet from the corner of my own house, I found what I was searching for, perfect in every particular – the right angle and the supporting brace, or hypotenuse. It gave me a hint I have not forgotten.

I find that one has only to overcome a little of his obtuseness and indifference and look a little more closely upon the play of wild life about him to realize how much interesting natural history is being enacted every day before his very eyes – in his own garden and dooryard and apple-orchard and vineyard. If one's mind were only alert and sensitive enough to take it all in! Whether one rides or walks or sits under the trees, or loiters about the fields or woods, the play of wild life is going on about him, and, if he happens to be blessed with the seeing eye and the hearing ear, is available for his instruction and entertainment. On every farm in the land a volume of live natural history goes to waste every year because there is no historian to note the happenings.

The drama of wild life goes on more or less behind screens – a screen of leaves or of grass, or of vines, or of tree-trunks, and only the alert and sympathetic eye penetrates it. The keenest of us see only a mere fraction of it. If one saw one tenth of the significant happenings that take place on his few acres of orchard, lawn, and vineyard in the course of the season, or even of a single week, what a harvest he would have! The drama of wild life is played rapidly; the actors are on and off the stage before we fairly know it, and the play shifts to other stages.

I wonder how many of the scores of persons passing along the road between my place and the railway station one early May day became aware that a rare bird incident was being enacted in the trees over their heads. It was the annual *sängerfest* of the goldfinches – one of the prettiest episodes in the lives of any of our birds, a real musical reunion of the goldfinch tribe, apparently a whole township, many hundreds of them, filling scores of the tree-tops along the road and in the groves with a fine, sibilant chorus which the ear refers vaguely to the surrounding tree-tops, but which the eye fails adequately to account for. It comes from everywhere, but from nowhere in particular. The birds sit singly here and there amid the branches, and it is difficult to identify the singers. It is a minor strain, but multitudinous, and fills all the air. The males are just donning their golden uniforms, as if to celebrate the blooming of the dandelions, which, with the elm-trees, afford them their earliest food-supply. While they are singing they are busy cutting out the green germs of the elm flakes, and going down to the ground and tearing open the closed dandelion-heads that have shut up to ripen their seeds, preparatory to their second and ethereal flowering when they become spheres of fragile silver down.

Whether this annual reunion of the goldfinches should be called a dandelion festival, or a new-coat festival, or whether it is to bring the sexes together preliminary to the mating-season, I am at a loss to decide. It usually lasts a week or more, and continues on wet days as well as on fair. It all has a decidedly festive air, like the fête-days of humans. I know of nothing like it among other birds. It is the manifestation of something different from the flocking instinct; it is the social and holiday instinct, bringing the birds together for a brief season, as if in celebration of some special event or

purpose. I have observed it in my vicinity every spring for many years, usually in April or early May, and it is the prettiest and most significant bird episode, involving a whole species, known to me.

The goldfinch has many pretty ways. He is one of our most amiable birds. So far as my knowledge goes, he is not capable of one harsh note. His tones are all either joyous or plaintive. In his spring reunions they are joyous. In the peculiar flight-song in which he indulges in the mating season, beating the air vertically with his round, open wings, his tones are fairly ecstatic. His call to his mate when she is brooding, and when he circles about her in that long, billowy flight, the crests of his airy waves being thirty or forty feet apart, calling, "Perchic-o-pee, perchic-o-pee," as if he were saying, "For love of thee, for love of thee," and she calling back, "Yes, dearie; yes, dearie" – his tones at such times express contentment and reassurance.

When any of his natural enemies appear – a hawk, a cat, a jay – his tones are plaintive and appealing. "Pit-y, pit-y!" he cries in sorrow and not in anger.

When with his mate he leads their brood about the August thistles, the young call in a similar tone. When in July the nesting has begun, the female talks the prettiest "baby talk" to her mate as he feeds her. The nest-building rarely begins till thistledown can be had – so literally are all the ways of this darling bird ways of softness and gentleness. The nest is a thick, soft, warm structure, securely fastened in the fork of a maple or an apple-tree.

None of our familiar birds endear themselves to us more than does the bluebird. The first bluebird in the spring is as welcome as the blue sky itself. The season seems softened and tempered as soon as we hear his note and see his warm breast and azure wing. His gentle manners, his soft, appealing voice, not less than his pleasing hues, seem born of the bright and genial skies. He is the spirit of the April days incarnated in a bird. He has the quality of winsomeness, like the violet and the speedwell among the flowers. Not strictly a songster, yet his every note and call is from out the soul of harmony. The bluebird is evidently an offshoot from the thrush family, and without the thrush's gift of song; still his voice affords us much of the same pleasure.

How readily the bluebirds become our friends and neighbors when we offer them suitable nesting-retreats! Bring them something from nature, something with the bark on – a section of a dry beech or maple limb in which the downy woodpecker has excavated his chamber and passed the winter or reared his brood; fasten it in early spring upon the corner of your porch, or on the trunk of a near-by tree, and see what interesting neighbors you will soon have. One summer I brought home from one of my walks to the woods a section, two or three feet long, of a large yellow birch limb which contained such a cavity as I speak of, and I wired it to one of the posts of the rustic porch at Woodchuck Lodge. The next season a pair of bluebirds reared two broods in it. The incubation of the eggs for the second brood was well under way when I appeared upon the scene in early July. My sudden presence so near their treasures, and my lingering there with books and newspapers, disturbed the birds a good deal. The first afternoon the mother bird did not enter the cavity for hours. I shall always remember the pretty and earnest manner in which the male tried to reassure her and persuade her that the danger was not so imminent as it appeared to be, probably encouraging a confidence in his mate which he did not himself share. The mother bird would alight at the entrance to the chamber, but, with her eye fixed upon the man with the newspaper, feared to enter. The male, perched upon the telegraph wire fifty feet away, would raise his wings and put all the love and assurance in his voice he was capable of, apparently trying to dispel her fears. He would warble and warble, and make those pretty wing gestures over and over, saying so plainly: "It is all right, my dear, the man is harmless – absorbed there in his newspaper. Go in, go in, and keep warm our precious eggs!" How long she hesitated! But as night grew near she grew more and more anxious, and he more and more eloquent. Finally she alighted upon the edge of the overhanging roof and peered down hesitatingly. Her mate applauded and encouraged till finally she made the plunge and entered the hole, but instantly came out again; her heart failed her for a moment; but she soon returned and remained inside. Then her mate flew away toward the orchard, uttering a cheery note which doubtless she understood.

The birds soon became used to my presence and their household matters progressed satisfactorily. Both birds took a hand in feeding the young, which grew rapidly. When they were nearly ready to leave the nest, a cruel fate befell them: I slept upon the porch, and one night I was awakened by the cry of young bluebirds, and the sound of feet like those of a squirrel on the roof over me. Then I heard the cry of a young bird proceed from the butternut-tree across the road opposite the house. I said to myself, "A squirrel or an owl is after my birds." The cry coming so quickly from the butternut-tree made me suspect an owl, and that the bird whose cry I heard was in his talons. I was out of my cot and up to the nest in a moment, but the tragedy was over; the birds were all gone, and the night was silent. In the morning I found that a piece of the brittle birch limb had been torn away, enlarging the entrance to the cavity so that the murderous talons of the owl could reach in and seize the young birds. I had been aroused in time to hear the marauder on the roof with one, and then hear its cry as he carried it to the tree. In the grass in front I found one of the young, unable to fly, but apparently unhurt. I put it back in the nest, but it would not stay. The spell of the nest was broken, and the young bird took to the grass again. The parent birds were on hand, much excited, and, when I tried to return the surviving bird to the nest, the male came at me fiercely, apparently charging the whole catastrophe to me.

We had strong proof the previous season that an owl, probably the screech owl, prowled about the house at night. A statuette of myself in clay which a sculptor was modeling was left out one night on the porch, and in the morning its head was unusually bowed. The prints of a bird's talons upon the top told what had happened. In the bronze reproduction of that statuette the head has more of a droop than the artist at first planned to give it.

The next season the bluebirds occupied the cavity in the birch limb again, but before my arrival in July the owls had again cleaned them out. In so doing they had ripped the cavity open nearly to the bottom. For all that, early the following May bluebirds were occupying the cavity again. It held three eggs when I arrived. I looked over the situation and resolved to try to head off the owl this time, even at the risk of driving the bluebirds away. I took a strip of tin several inches wide and covered the slit with it and wired it fast. Then I obtained a broad strip of dry birch-bark, wrapped it about the limb over the tin, and wired it fast, leaving the entrance to the nest in its original form. I knew the owl could not slit the tin; the birch-bark would hide it and preserve in a measure the natural appearance of the branch. When the bluebirds saw what had happened to their abode, they were a good deal distressed; they could no longer see their eggs through the slit which the owl had made, and they refused to enter the cavity. They hung about all day, uttering despondent notes, approaching the nest at times, but hesitating even to alight upon the roof above it. Occasionally the female would fly away toward the distant woods or hills uttering that plaintive, homesick note which seemed to mean farewell. The male would follow her, calling in a more cheery and encouraging tone. Once the couple were gone three or four hours, and I concluded they had really deserted the place. But just before sundown they were back again, and the female alighted at the entrance to the nest and looked in. The male called to her cheerily; still she would not enter, but joined him on the telephone wire, where the two seemed to hold a little discussion. Presently the mother bird flew to the nest again, then to the roof above it, then back to the nest, and entered it till only her tail showed, then flew back to the wire beside her mate. She was evidently making up her mind that the case was not hopeless. After a little more maneuvering, and amid the happy, reassuring calls of her mate, she entered the nest cavity and remained, and I was as well pleased as was her mate.

No owls disturbed them this time, and the brood of young birds was brought off in due season. In July a second brood of four was successfully reared and sent forth on their career.

The oriole nests in many kinds of trees – oaks, maples, apple-trees, elms – but her favorite is the elm. She chooses the end of one of the long drooping branches where a group of small swaying twigs affords her suitable support. It is the most unlikely place imaginable for any but a pendent nest, woven to half a dozen or more slender, vertical twigs, and swaying freely in the wind. Few nests are

so secure, so hidden, and so completely sheltered from the rains by the drooping leaves above and around it. It is rarely discoverable except from directly beneath it. I think a well-built oriole's nest would sustain a weight of eight or ten pounds before it would be torn from its moorings. They are also very partial to the ends of branches that swing low over the highway. One May I saw two female orioles building their nests twenty or twenty-five feet above our State Road, where automobiles and other vehicles passed nearly every minute all the day. An oriole's nest in a remote field far from highways and dwellings is a rare occurrence.

Birds of different species differ as widely in skill in nest-building as they do in song. From the rude platform of dry twigs and other coarse material of the cuckoo, to the pendent, closely woven pouch of the oriole, the difference in the degree of skill displayed is analogous to the difference between the simple lisp of the cedar-bird, or the little tin whistle of the "chippie," and the golden notes of the wood thrush, or the hilarious song of the bobolink.

Real castles in the air are the nests of the orioles; no other nests are better hidden or apparently more safe from the depredations of crows and squirrels. To start the oriole's nest successfully is quite an engineering feat. The birds inspect the branches many times before they make a decision. When they have decided on the site, the mother bird brings her first string or vegetable fiber and attaches it to a twig by winding it around and around many times, leaving one or both ends hanging free. I have nests where these foundation strings are wound around a twig a dozen times. In her blind windings and tuckings and loopings the bird occasionally ties a substantial knot, but it is never the result of a deliberate purpose as some observers contend, but purely a matter of chance. When she uses only wild vegetable fibers, she fastens it to the twig by a hopeless kind of tangle. It is about the craziest kind of knitting imaginable. After the builder has fastened many lines to opposite twigs, their ends hanging free, she proceeds to span the little gulf by weaving them together. She stands with her claws clasped one to each side, and uses her beak industriously, looping up and fastening the loose ends. I have stood in the road under the nest looking straight up till my head swam, trying to make out just how she did it, but all I could see was the bird standing astride the chasm she was trying to bridge, and busy with the hanging strings. Slowly the maze of loose threads takes a sacklike form, the bottom of the nest thickens, till some morning you see the movement of the bird inside it; her beak comes through the sides from within, like a needle or an awl, seizes a loose hair or thread, and jerks it back through the wall and tightens it. It is a regular stitching or quilting process. The course of any particular thread or fiber is as irregular and haphazard as if it were the work of the wind or the waves. There is plan, but no conscious method of procedure. In fact, a bird's nest is a growth. It is not something builded as we build, in which judgment, design, forethought enter; it is the result of the blind groping of instinct which rarely errs, but which does not see the end from the beginning, as reason does. The oriole sometimes overhands the rim of her nest with strings and fibers to make it firm, and to afford a foundation for her to perch upon, but it is like the pathetic work which an untaught blind child might do under similar conditions. The birds use fine, strong strings in their nest-building at their peril. Many a tragedy results from it. I have an oriole's nest sent me from Michigan on the outside of which is a bird's dried foot with a string ingeniously knotted around it. It would be difficult to tie so complicated a knot. The tragedy is easy to read. Another nest sent me from the Mississippi Valley is largely made up of fragments of fish-line with the fish-hooks on them. But there is no sign that the bird came to grief using this dangerous material. Where the lives of the wild creatures impinge upon our lives is always a danger-line to them. They are partakers of our bounty in many ways, but they pay a tax to fate in others.

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