Library
of the
University of Toronto

23

352

The Swift, Chimney Swallow, House Martin, and Sand Martin.

"THE OBSERVING EYE" SERIES.

WHAT IS A BIRD?

THE

FORMS OF BIRDS, THEIR INSTINCTS, AND
USE IN CREATION CONSIDERED.

BY MRS. WRIGHT,

*Author of "The Globe Prepared for Man," "Listen and Learn,"
"The Passover Feasts," "Our World; its Rocks
and Fossils," &c., &c.*

"Talk ye of all his wondrous works." *Ps. cv. 2.*

"All thy works shall praise Thee." *Ps. cxlv.*

SECOND EDITION.

LONDON:

JARROLD AND SONS, 12, PATERNOSTER ROW.

P R E F A C E .

BIRD-NESTING and bird-hunting have always been objects of lively pursuit with young people. In the spring of 1856, this tendency being actively displayed at a boys' school, an attempt was made by weekly lectures on the instincts, forms, and uses of birds, to direct the ardour of the lads into an intelligent interest for the feathered tribes around them. The plan succeeded beyond the most sanguine hopes of the Lecturer. The thoughtless cruelty of the boys decreased, and the new subjects thus presented to their minds, raised the tone of their general conversation.

On its being finally resolved to publish the lectures, they were submitted to the inspection of John Henry Gurney, Esq., who kindly overlooked the series, and suggested several valuable hints, in addition to those drawn from the works of Cuvier, Yarrell, Mudie, and by permission from the private notes of Charles Buxton, Esq.

Buxton, April, 1857.

HINTS.

IN reading Natural History, the remark is frequently made, "What does the word *Species* mean?" An attempt is made to shew, by the following arrangement, that the word *species* points out a particular family amongst a set of animals somewhat of the same form and habits.

DIVISION.—There are two great *divisions* among living creatures { Those with back-bones.
Those without back-bones.

CLASS.—Among back-boned animals are four *classes*. { Beasts, Birds, Fishes, and
Reptiles.

ORDERS.—Each of these classes contains many kinds. Let us { Birds of prey or of the *air*.
take the class of birds. This class contains five { Perchers and Climbers, Runners,
kinds or *orders*. { Waders, Swimmers.

GENUS.—Each of these orders again contains many kinds or { Finches, Sparrows, Wood-
genera. Among the 'order' of perchers and { peckers, &c.

SPECIES.—Each genus also contains several individual kinds or { Chaffinches, Greenfinches, Lin-
species. Among the genus of Finches are the { nets, &c.
individual species of

Thus we obtain *the natural history* arrangement of a linnet.

<i>Division</i>	<i>Class</i>	<i>Order</i>	<i>Genus</i>	<i>The Species, or individual kind</i>
Back-boned.	Birds.	Percher.	Finch.	The Linnet.

CONTENTS.

LECTURE		PAGE
1.	HOW DO YOU KNOW A BIRD ?	7
2.	DIFFERENCES IN THE FORMS OF BIRDS FROM THOSE OF OTHER ANIMALS	1
3.	WHY WERE BIRDS MADE ?	25
4.	DIFFERENT GROUPS OF BIRDS, AND ON IN- STINCT AND REASON	31
5.	BASKET-WORK NESTS	45
6.	NESTS LINED WITH WOVEN HAIR AND WOOL	60
7.	VARIOUS TROPICAL AND EUROPEAN NESTS	71
8.	FLAT NESTS, AND THE CARE OF BIRDS FOR THEIR YOUNG	82
9.	MUD NESTS	94
10.	THE BIRD IN THE EGG	104
11.	ON MIGRATION, THE EGGS OF BIRDS, AND THE LOVE OF PARENT BIRDS	112
12.	THE BONES OF BIRDS	128
13.	JOINTS AND MUSCLES OF BIRDS	139
14.	THE BACK AND BREASTBONES OF BIRDS	151
15.	FEATHERS OF BIRDS	159
16.	THE OIL BAG, AND SPRING OF BIRDS IN FLIGHT	168
17.	ON THE FEET AND HEADS OF BIRDS	177
18.	THE BEAKS OF BIRDS OF PREY	191

LECTURE	PAGE
19. BEAKS AND FEET OF SEED AND INSECT- FEEDING BIRDS	204
20. CLIMBING BIRDS	216
21. BIRDS THAT FEED ON INSECTS IN FLIGHT	235
22. GRASS-TREADING AND WADING BIRDS ...	250
23. WORM-FEEDING BIRDS, POWERS OF DIGES- TION, ETC.	263
24. SWIMMING BIRDS	272
25. ON THE CAUSE OF VOICE	278
26. ON THE VOICES OF BIRDS	300
27. CONCLUSION	315

WHAT IS A BIRD ?

Lecture One.

HOW DO YOU KNOW A BIRD ?

Boys ! when walking in the fields to-day, did you chance to see any birds pass by ? I thought, before you replied, what you might say ; “ O yes, we saw sparrows, robins, rooks, and two partridges ; and besides those birds, we saw the governor’s hens and ducks.” Very well, you have given me the names of a few of our feathered neighbours, can you go a little further and tell me anything of their private histories ? You saw the field birds as they winged their way from tree to tree, and you heard their warbling notes rise from the hedgerows, but from whence did those birds come ? what had they been about ? and what were they going

to do ? To know something of their intentions, creates an intelligent love for them ; it makes you feel them as pleasant acquaintances.

Birds are always about us ; they are not like lions and tigers, afar off and out of view ; some kind of bird or other is always rising and spreading itself out in the free air, as if to court our notice. To be alive to its modes of flying, feeding, the places it mostly frequents, the nest it builds, where it lives in the summer, and flies to in the winter, are all sources of animated pleasure ; more so than any one can imagine, who has not begun to think of and to watch the proceedings of birds.

There is also much advantage in knowing the habits of birds, since ignorance is sometimes the cause of needless alarm. When a poor little chimney swallow has the misfortune to tumble out of its mother's nest, which she had made for it low down in a chimney shaft, in order to preserve it from owls and other enemies, its rattling descent by the side of the sooty bricks, has often startled the people of the house : and the moment the poor frightened little bird has spread its wings in the room into which it has fallen, it has been driven about and hooted at, as something very frightful

and evilly disposed, instead of being treated as a shiftless, helpless fellow-creature in misfortune.

Still more serious was the alarm that ignorance occasioned to a party of Scotch Highlanders while on their march through a vast forest in America. These men, in the service of the Hudson Bay Company, halted one night amid the lofty trees of that old forest, which had been growing up for centuries. As the evening advanced, a solemn sensation crept over their minds. The dark stems of the tall trees seemed to grow larger beneath the shades of night, and the gloomy effect of their own densely crowning foliage. Not a sound was to be heard far off or near; one intense stillness prevailed, and as the men opened their packages to prepare for their night's lodging, many a strange and foolish tale of wandering spirits rose up in their memories.

In this excited state they became still more uncomfortable by discovering they were close to a tomb, which the wild Indians, according to their frequent custom, had raised in the deep recesses of the forest. However they quietly took their supper, and were piling wood on their fires before going to rest, when a slow dismal sound fell on their ears: it rose so close

to them, and came so suddenly, all were startled. None of them knew what sound it was, and they at once concluded that so strangely hollow and unearthly a voice, must be the moaning of the buried Indian, whose repose they had disturbed, by taking pieces of timber from his tomb for their fires. They could not sleep for terror, and the very men who would have fought like tigers in a battle with their fellow-men, at the first dawn of day packed up their goods, and hastily ran away. And from what do you think they ran? From an owl! In those dense forests, numerous birds live a free and happy life. Had they known this, they might have searched for the disturber of their sleep, for it was near at hand; but no one among them it seems had ever heard that the horned Virginian owl lives among the gloomy depths of these vast forests, often causing them to resound with its loud hallooming night cry. Its notes uttered in a low hollow tone, and coming from among the gigantic trees, is said to bear some resemblance to the human voice, so that travellers are not unusually led astray, by taking its shouts for the voice of a man. The Indians stand in awe of these owls, and any one who presumes to mimic their

hootings, becomes an object of their high displeasure.

Very little knowledge of the habits of such birds would have removed the alarm of the brave Highlanders, and might have led some of them to look for this owl, or to have listened with delight to its native wild notes.

A mind that has some information, is always gathering up fresh stores; it knows how to take advantage of what the eyes see and the ears hear; and birds, as we said, are always at hand. They are found in the fields, in gardens, in streets, and on marshes and commons. Over rivers and lakes they spread their broad wings, and as they skim the ocean, or soar above its broad waves, they have frequently rejoiced the mariner when far, far away from land.

A small bird called the sea swallow or tern, once enlivened by its presence a company of starving sailors, and inspired them with fresh courage. Their ship, the *Lady Hobart*, in sailing from America to England, struck upon an iceberg; the men were obliged to quit their sinking vessel and betake themselves to their boats. Unsheltered in their boats, they drifted day after day and night after night over the stormy waters, every hour expecting to

be swallowed up by the roaring waves which dashed frequently over them. On the evening of the sixth day (after they had left their foundered ship) their spirits sank within them; hope seemed gone. Hungry, wet, and cold, how could they expect in their feeble state to see land again! Whilst in this state of mind, and as the shades of night were setting in, a beau-

One species of Tern.

tiful light grey bird, web-footed, not unlike a dove in size and plumage, came hovering over them, and excited their attention. The bird was a small tern or sea swallow, and continued fluttering around them till dark, often attempt-

ing, notwithstanding the pitching of the boat, to perch on the mast.

Trifling as this circumstance may appear, the bird was considered to be a good omen. "The impressive manner," said one of the mariners, "in which it left us, and then returned to gladden us with its presence, awakened feelings of hope, and we indulged ourselves with the most comfortable assurance, that the same Hand which had sent the bird to solace us in our distresses, would extricate us from surrounding dangers."

It was well of the shipwrecked mariners to turn this small event to profit; to see the Hand of God in it: and as they beheld the light and delicate form of that bird sustained in life and health amid the dreary scene, to take courage in the belief that they were of more value to their Creator and Redeemer than all the feathered fowl in the universe.

And now, boys! let me ask you a question. It is this: How do you know a bird when you see it? What is there in its form that makes you say, "There goes a bird?" You answer, "It has feathers, and it flies." And so do bats fly, and some fish fly; yet neither of these creatures have feathers. And again, some birds that have feathers never fly at all—they only run: besides,

when a bird is not moving, you still say it is a bird. Take this dead bird in your hand and examine it; you see it has a head, eyes, ears, nostrils, but neither lips nor teeth. Has any other living creature such a mouth? A pair of pincers made of horn! or as they are sometimes termed, two mandibles; the lower one of which works up and down.* The body of the bird is something like the form of a long basket or boat, and most of its length is set in firm bone. The chest, you see, is broad, and the body ends with a tail, spread out like a rudder. On its sides are several long bones moved by hinges; these hinges enable the bird to fold the bones together or to stretch them out, somewhat as we move our arms. When covered with feathers these bones form the wing. The lower part of the bird's leg is without flesh, and is clothed with a scaly skin: you see it has no regular feet, it has only three jointed toes in front, and one behind.

Now look at the outward clothing of this bird. It is neither that of fur, hair, nor scales, but is composed of two sorts of feathers;

* A few other animals may be said to possess beaks, but they are different in form and construction to the birds'.

first, warm down, that by pressure mats close to the skin, and over the down are arranged beautifully painted feathers of various lengths. Is there any other creature like it? No, neither fish, reptile, insect, nor beast. Birds stand out as a distinct class of living things, outwardly known by their beaks, wings, feet, and feathers. Naturalists, who look deeper than the outside, and examine their internal construction, tell us they know a bird to be a bird and nothing else, by the form of the breast-bone and merry-thought, two bones different in shape to those possessed by any other animal.

The next evening we meet, we shall have to notice still further differences by which birds are distinguished from other living creatures. /

	PAGE
Of what tribe of living creatures have we been speaking?	7
When we know something of the history of birds, how do we feel towards them?	8
Where are birds to be found?	11
By what is a bird's head distinguished from other animals?	14
What are on its sides?	14

	PAGE
How are its legs and feet made? . . .	14
What are the four outside parts of a bird, by which we can distinguish it from other animals?	15
What bones are peculiar to birds? . . .	15

Lecture Two.

DIFFERENCES IN THE FORMS OF BIRDS FROM THOSE OF OTHER ANIMALS.

ON our table lies a dead bird; handle it, and examine its figure. Consider for a moment the form of its body, or those peculiar marks by which a bird is distinguished from other animals. Do you remember what they are? “The beak, wings, feet, breast-bone, and merry-thought.”

Birds occupy an important and distinct place in the world; but before we enter upon their particular histories, let us notice the formations of a few other animals, that we may the better understand the exquisite skill with which birds have been fitted for their place, and in what way their peculiar bodies have been linked, in their general characters, to the rest of the living

creatures on earth. First then let us notice some of the varied forms to be seen in the mouths of animals.

Those creatures which possess but a small quantity of life, such as corals and star-fishes, have their mouths placed in the centre of their arms or moving powers, something as the yellow summit of a daisy is placed in the middle of its white flowerets.

The mouths of insects are furnished with a variety of instruments, by which they are able to hew, cut, pierce, smooth down, and crunch. In other instances they are supplied with pliable sucker trunks, such as the fly possesses.

Higher animals have an opening in the bones of the head, protected by soft lips; and the two jaws within the mouth are furnished with hard enamelled teeth; but a bird's mouth is unlike any of these; it stands forward as a horny tube, more or less ending in a point. This pointed beak acts for the bird like the front teeth in the higher orders of animals; it seizes hold of, and cracks the food; while the gizzard inside the bird's body, answers the

purpose which double teeth serve in other animals, that of rubbing the food to a pulp. When we consider the life a bird is intended to lead, that is, to be continually darting through the liquid air, often at the rate of fifty miles an hour, can you imagine any form of head better suited for the use of such a creature? When men prepare a wedge to drive into wood, they make the end thin, that it may glide easily between the opening sides: an awl is made fine at the point, that it may pierce quickly. Now the bird's pointed beak opens for its body just such a passage in the air, and so sensible are birds of the benefit of a point in pushing forwards, that you may often observe that sea-gulls and other birds, when taking long flights, form themselves into the shape of a wedge ; and because the one that first cuts the track has the hardest work, they often change places, the last coming up to take the foremost point, whilst the previous leader falls back.

The wings of a bird again are unlike those of any other flying creatures. One species of fish is said to fly, but it is only so long as the fins of those fishes are wet, that they can rise above the waters. Bats fly, and insects fly, but none

of these creatures move with the powerful actions of the bird. The delicate thin wings of an insect are formed of air-tubes covered with skins so fine, that strong winds break them to pieces. The wings of birds, on the contrary, are thick and firm, and without injuring them, the bird can dash on through severe storms, flapping forcibly against the air, as the paddles of a steam ship flap against water. The bones in the wings of birds are remarkably strong. The muscles that move them are very tough, and the feathers that cover their wings are of the stiffest kind. The delicate wings of an insect lie flat on the air; the firm wings of the bird bend over the air, something as the concave top of a watch-glass; by having this form, the air underneath assists in buoying them up. /

Birds and insects both fly, but as you know, their bodies are by no means fashioned alike. Birds approach much nearer in form and in nature to four-footed beasts. They have flesh, blood, and bones, which flies and beetles have not. They have, like quadrupeds, four limbs for motion, while the lowest number amongst insects is six and eight. But on looking at a bird, you will see that in its body, the situation the quadru-

ped's two front legs take, is changed in that of the bird; for, to enable the creature to glide through the air, its front limbs are made to strike out horizontally from the sides, while its two hind legs are left in a perpendicular position, to serve for pillars' of support, whenever the winged creature alights on the ground.

Again, the feet of birds are unlike those of all other animals. Amongst the lowest animals, the hydra in our ditches, which looks like a piece of green stalk, walks by its sucker tail, drawing it up to its head, then stretching it

forth, and again bringing the tail close up; and thus the hydra contrives to creep on at the rate of a few inches or feet in a day.* Worms glide over the ground by shortening the muscles that lie between the rings in their bodies; and some have bunches of hair on the outside of each ring, to give them additional help in

* See "Observing Eye," 1st vol., p. 33.

moving. Crabs sidle and scrape with their eight legs along the wet sands, whilst lobsters spring and crawl.

The legs of insects are finished off at their tips with either pads, cushions, hairs, or suckers. The four legs of beasts end in fleshy feet, that are either covered with horny hoofs, or tipped with toes and sharp claws. Man, like the bird, is a biped, or two-legged animal; his legs are long, fleshy, muscular, and end in flat feet with ten toes. The feet of birds differ from all those we have named; they are simply composed of a few thin toes, formed of bones, muscles, and skin; the shapes of their toes are, however, much varied; and it is interesting to notice how admirably their wide-spreading feet are adapted to the habits of their owners, whether it be to enable them to stand, hop, walk, roost, climb, or swim.

Insects have no jointed neck; quadrupeds and birds have. Did you ever notice how closely the head of a sparrow appears to lie upon its shoulders, almost as if it had no neck? It is true that the sparrow has but a short one, but notwithstanding that, it has nine delicate little bones in its short length, which play and roll upon each other with such ease, that the

bird can move its head with a rapidity our eyes cannot follow. The length of neck in birds, as you must have seen, greatly varies. In the arched neck of the stately swan, are twenty-three beautifully rolling joints. Most birds have not half that number; yet all their necks move with a quickness, that shows that their Maker planned that birds should both require and enjoy rapidity of action in the movements of the head.

Wood-peckers tap upon wood for insects; and such birds as herons and bitterns, strike into water for fish, with a quickness that prevents our counting the strokes. A bird is ever bobbing its head forwards, sideways, and backwards, rolling it in every direction, looking up in the air, down on the ground, burying it under the wing, or laying it flat on its back.

The human finger performs a great variety of work, but its movements are few compared to those of a bird's bill, most of which depend upon the quick and changing actions of the neck.

We shall have next to consider why birds and other living creatures abound, and the kinds of food upon which they are intended to subsist. /

	PAGE
What has been the subject of this chapter? .	17
Where are the mouths of the lowest animals . placed?	18
With what instruments are the mouths of insects supplied?	18
With what are the mouths of the highest animals furnished?	18
How does the mouth of a bird stand forward? .	18
What is the advantage of a bird's beak? .	18
What makes the wings of a bird strong? .	20
In what respects do birds resemble beasts more than insects?	20
Can you name the differences of contrivance in the walking powers of hydras, worms, crabs, insects, beasts, man, and birds? .	21, 22
What is remarkable about the necks of birds? .	22, 23

Lecture Three.

WHY WERE BIRDS MADE?

IN this chapter we are to continue our general survey of animal life, of which birds form one of the most lively and beautiful portions. No place on the face of the globe is quite exempt from the presence of birds; even the dry deserts of Africa have their feathered inhabitants. In them the ostrich finds a home, and may be seen with its two toes, padded heel, and strong muscular legs, running over scorching sands with the fleetness of a race-horse. In grassy fields, on low marshy grounds, and on the waters, are thousands upon thousands of birds. And were you to try to count up the tree and bush birds, which make the woods jocund with their voices, you would find that they exceed in number all the other kinds put together.

Does any one enquire for what purpose such

hosts of birds have been created ? Such a question is worth the asking. It makes us think, and it sends us to our bibles. There we learn that the Almighty Creator of this world delights in life and in action ; and that to carry out His purpose of spreading good, it pleased Him at the first, to create upon the earth a great variety of plants and animals. We shall find that He ordained that grasses and trees should multiply by seed, and that He commanded the living creatures which move on the earth to multiply exceedingly ; His purpose being, that as each one died, it should leave behind it many more like itself.

Such an ordering of things must speedily have filled the earth with plants and living creatures to overflowing, had not our God again ordained that the over-abundance should become a source of food to the living families. Accordingly He gave to His various creatures different inclinations and different instruments, by which each tribe in its place, might be able to assist in clearing off the surplus produce.

Insects, while in their grub states, were appointed to consume young leaves, and all kinds of decaying vegetable and animal substances. Some beasts were to devour other wild animals. Others to feed upon the grasses and plants that cover the

face of the earth. Four-footed beasts were not made to climb high enough to gather the berries and seeds of tall trees. Birds that fly were therefore appointed to be the devourers of seeds, as well as to feast upon the numerous tribes of insects, which from the vastness of their numbers, and from their powers of stinging and biting, have been called in scripture by the terrible name of "armies of the living God."

Unless birds or some other creatures had been appointed to keep these hosts of insects in control, they would quickly have filled the air and the waters. Birds have, therefore, a great work to do; they have to clear off a large amount of vegetable produce, in order that the world may not become one interminable forest; and they have also to keep down the armies of insects, which would otherwise rapidly devour the food intended for man. Viewed in this light, birds are the friends of man, and for their works' sake, they deserve his gratitude. /

It is evident that when the Lord our God made this world, He not only desired to fill it with a vast amount of life and enjoyment, but that He also intended life should be kept up, and always going on in a healthful state. All His arrangements bespeak this intention. / A constant movement is

ever to be seen ; nothing stands quite still ; one part of the creation is always helping to balance or to feed the other. The light gases that form the air, the waters that flow, and the earths of the soil when in a muddy state, are all continually being sucked in by the delicate cells of vegetables ; and in their cells, the raw materials collected from the air, water, and earths, become changed into different substances, among which are found much gluten,* sugar, and starch.† Thus most of the podded plants, grasses, mosses, and heaths, yield excellent provision for living creatures. Animals nourished by feeding upon these vegetables increase rapidly, and by the Divine order, their bodies in some instances become a source of food for creatures that are appointed to feed upon the nourishing substance of flesh. The command given to “arise, slay, and eat,” is an order fraught with good. Among birds and wild animals it often proves a command of mercy. The injured and the sick, having no nurse or friend to attend upon them, are by this means quickly put out of their sufferings, and by the food their bodies yield, healthful life is supported.

* Gluten, from glue or paste. † Starch, a kind of stiff vegetable gum ; it abounds in the potatoe.

We are thus taught that to destroy for food is an ordering in nature : at the same time observation teaches us that cruelty does not belong to the natures of either birds or beasts. They seldom attack but in self-defence, or with a desire to kill for eating, and then instinct leads them to kill their strong prey in the quickest possible way, usually seizing it by its head or neck, that its resistance may be less troublesome. A lion, when he throws down a man, will search for his throat ; and in catching a rabbit, a cat will grasp at the neck, and is often known to bring home in triumph the headless body. In some cases, where the animal which is caught is too feeble to resist, the instinct to kill quickly is not called into action ; a cat will therefore play with a mouse, and a stronger bird will sometimes rob a weaker one. The skua-gulls will rob the terns of the food they have caught, and the bald eagle will rob the osprey eagle of the fish he has taken from under the waves.

It is a fact, and a sad one too, that cruelty or the love of inflicting pain, is peculiar to man. An eagle or an owl that seizes upon a living creature for food, is as innocent and as free from the crime of real cruelty, as the canary bird that picks up its seeds. The bird of prey and the

gentle warbler are both of them carrying out the orders of their Maker. They are both of them working unconsciously according to His laws, and supporting one another in keeping up that glorious system of change, health, and beauty, which is established around us.

Next time we meet, we shall have to speak of the groups into which birds are divided. ✓

	PAGE
What has been the chief subject of our discourse this evening?—(The increase of animals.) .	26
Why have animals been made to multiply so abundantly?—(To increase the general amount of enjoyment and healthful life.) .	27
Why is the charge of cruelty removed from birds and beasts, although they kill living creatures?	29

Lecture Four.

~~~~~

ON DIFFERENT GROUPS OF BIRDS, AND ON
INSTINCT AND REASON.

~~~~~

HAVE any portions of our late conversation on birds, led you to watch with new interest the busy wings moving through the air? You have all received two great blessings, sharp eyes for seeing, and quick ears for hearing. With the eye, the soul looks into the world as through a window, and thence gathers up new ideas. With the ear it collects sounds, as by a hearing trumpet. How have you employed these gifts within the last few days? Upon what sights and sounds have you been dwelling? The character of your souls depends as much upon these things, as the colour of water depends upon the white, red, brown, or blue soil over which it runs.

The works of our Maker afford us thousands of motives for offering Him daily praise. He has implanted in our hearts a love for the notice of His handiworks; and it has been remarked that as soon as nations turn from a barbarous state, they invariably begin to study the histories of plants and animals. Natural history is a kind of book in God's providence that lies open to the eyes of all, and as it is studied, it refines the mind, and throws an interest over the commonest objects around us. I want you to be awake to its enjoyment. Some people think so little of what they see, that they never put a second thought to their first slight notice. It is doubtful whether they would know the difference between a crow and a rook, or that on the sparrow's back there are two hues of brown; yet the attentive notice of such differences, is the ground-work of intelligent observation, by which we store up knowledge.

When we met last, we spoke of the vast amount of life which exists on the face of the earth. We shall now confine our attention to that beautiful portion of the living creation, the feathered tribes. A careful study of these tribes is no light business, for so numerous are the varieties of birds, that naturalists have already given names to nine thousand species, and are at this time adding to

the number by fresh discoveries in the woods of America and Australia.* To remember the names of nine thousand species of birds, with all their different habits, exceeds the power of any one person; naturalists have therefore found it needful to divide birds into groups or orders; but even this has been attended with much difficulty, since families of birds so nearly resemble each other, that to class them, is almost like trying to distinguish where one tint in the rainbow ends and another begins. Neither the sizes nor the shapes of birds, nor the colours of their plumage, afford any good clue by which to divide them into groups. The latest mode of division has been grounded upon the forms of their bills and feet; since it has been found that the bills and feet of birds, as well as the general structure of their bodies, have been made with a view to help their feeding propensities.

To obtain all possible knowledge on these two points of form, naturalists have kept their eyes open; they have read many books, and written

* The most complete museum in the world is supposed to be at Philadelphia; the British Museum, the Leyden Museum, and the Jardin des Plantes stand next; there are very good museums at Frankfort and Vienna, also a very good one at Calcutta.

to people in all parts of the world, and at length birds have been arranged under the following five heads:—

1. Birds of the air, or the highest soarers.—

Birds of prey are among these.

2. Birds of the trees.—Perchers and climbers.

3. Birds of the ground.—Runners and scratchers.

4. Birds of the mud.—Waders.

5. Birds of the water.—Swimmers.

Beak of birds of prey, called Raptores.

The high-soaring birds of the air have hard hooked beaks, and strong hooked talons on their toes. They seize upon and tear to pieces birds, animals, and sometimes fish; frequently carrying their victims to their lofty dwelling-places on trees or high rocks. Flesh-eating birds are termed *birds of prey*, this makes the *first group* or order; among which are the eagles, vultures, hawks, and owls.*

* The learned name for birds of prey is Raptores; they are sometimes called Accipetres.

Most of the birds which perch, such as rooks, sparrows, blackbirds, and finches, eat fruits, seeds, insects, slugs, and worms. Some of these seed

Foot of birds of prey, called Raptores.

and insect feeders have short strong bills, others have long straight ones. They have three toes in front, and one low down behind, quite on a level

Foot of perchers, called Incessores.

with the front toes. With these four toes they cling round branches. Most of the climbers, like the woodpecker, have two toes before and two behind.* These make the second order.

* The learned name for perchers is Incessores; some persons call them Passeres, or little birds.

The birds that are runners and scratchers, we call game and poultry fowls.* These birds generally eat their food as they stand on the ground. They have strong thick beaks, three toes in front, and generally one high up behind.

The fourth group is composed of birds that wade in mud and shallow water, such as the flamingoes, herons, snipes, &c. These birds have usually long beaks, long legs and toes.†

Frequent character of wader's foot and leg.

The fifth group is composed of birds that make the water their natural home. They have broad and often softish beaks with webbed feet, like the duck, albatross, and gull.‡

The frigate bird is web-footed, and being a high soarer, joins the water birds to the birds of the air, and so makes the circle of birds complete.

* Game and poultry fowls are called Gallinidæ.

† The learned name for wading birds is Grallatores.

‡ The learned name for web-footed birds is Natatores.

Birds are inhabitants of the same earth as that upon which you and I stand. They sleep on its surface, they feed on its surface, and rear their young on its surface; and besides this, they live where you and I cannot; high up in the thin transparent air that surrounds our globe. On that air they throw much of the weight of their bodies; through it they are frequently darting hither and thither in an extasy of joy, or gliding onwards as smoothly as ships in full sail.

Nothing can exceed the light, buoyant, and graceful effect of a bird's movements, as it cuts its way through the liquid atmosphere.

But how comes it to pass that the bodies of birds, which weigh from one ounce and a half, to twelve and sometimes thirty pounds, should be kept up in the air; when, if only a feather fall from off the soft plumage of the bird, down it sinks, drawn to the earth by the same power of attraction that keeps us from rising above it? As our lectures proceed, you may perhaps learn why a bird can float; but the living act of flying is a mystery we shall never perfectly understand.

Did you ever notice the rate at which a bird darts forward? Steam carriages go at a snail's pace compared to the flight of some of the feathered tribes. The usual speed of a sparrow is thirty miles in the hour; but when alarmed, it rushes on at the rate of one hundred. Partridges fly at about the rate of sixty-eight miles in the hour. This speed was ascertained by a person looking at his watch, the moment a partridge rose from the ground, and as it tipped over a distant hedge, noticing how many seconds had passed. By the same mode of watching time and distance, an eagle in the Pyrenean moun-

tains has been seen to fly from the point of one rock to another, at the rate of little short of one hundred and forty miles in the hour. The common swallow flies ninety miles an hour, and the swift one hundred and eighty miles. Pigeons have been shot in the forests of America, with fresh coffee berries in their crops, although the nearest coffee plantations were three and four hundred miles distant. Had the berries remained in their warm moist bodies above four or five hours, they would have been injured; consequently, since they were fresh, the pigeons must have flown at the rate of a mile and a quarter each minute. But of all birds, the jer-falcon cleaves the air the most rapidly; one hundred miles is its usual rate of movement, but when darting with wild impetuosity upon its prey, it will double and treble that swiftness; being thought, by its meteor-like speed, to cut through the air at the rate of one thousand miles in the hour. /

Birds often display in their works such consummate skill and such acuteness for the general good of their own tribes, as both astonishes and delights those who narrowly watch them. Yet they lack one thing you and I possess, and that is, a mind able to think upon

unseen and spiritual things ; without which power, no living creature can know the mighty and ever blessed God who has made it. But while birds possess no power of knowing their Creator, He has certainly bestowed upon them some memory, and a low train of thought connected with their pleasures and fears. I lately saw a fine bullfinch, which gave striking proofs of possessing both these qualities. This bird, singular to say, had been taught to sound a few words after the fashion of parrots. It was a great favourite with the family to whom it belonged, and on their visiting Paris for the winter of 1856, they took the bullfinch with them. Whilst in that city, the bird ceased to talk, and could not be induced by notice or entreaty to utter a single sound, or even to leave its cage, although the door was frequently left open. On the return of the family the following spring, the bird had no sooner been landed at Sandgate, than it bowed its head, and said, to every one who approached it, "Pretty Dick! Sweet Dick! Pretty boy!" and when replaced on its stand by the library window at its former home, its joy was unbounded, quickly flying to the breakfast table for its accustomed gifts. This conduct shewed that the bird was able to form a

judgment upon its two situations, and to make a choice. But in most of their proceedings, birds act without premeditation, only accomplishing the things their Maker has taught them. They never go back in knowledge, and never improve by experience, excepting when they live with man, by whom, as in the case of the bullfinch, we see that they may be taught a few lessons.

A South American vulture, which had lost one leg, and had been partly tamed by its owner, shewed some power of memory and calculation, for on those days of the week, when the monks of two different monasteries distributed food to the poor, the vulture was sure at the right hour to fly from one to the other, to obtain his chance of a share, although the two establishments were several miles apart from each other.

Do you remember the name that is given to that excellent but blind impulse in animals which leads them to work aright?—To that impulse which leads them to act well without instruction, without experience?

“It is called *Instinct*.”

Instinct is not a large, but it is a most finished gift. It leads creatures without thought to accomplish well, things that are needful for their good; and not only things which are necessary for their

every-day good, but this blind impulse often induces birds and other animals to prepare for, and to overcome accidental difficulties. Amongst the swans that live on the banks of the Thames, this perfection of instinct has often been noticed. At times the waters of the river swell, and when this happens at the season the birds are sitting on their eggs, they have been seen, before the rush of waters has come down, busily employed in raising their nests, in order to save their eggs from being washed away by the flood. Lord Braybroke tells us, that a swan which had for eighteen years built her nest on the same part of the river banks, was one spring, while sitting on four or five eggs, observed to be anxiously collecting weeds and grasses to raise her nest. A farming man was ordered to carry her down half a load of straw and rubbish, and with this litter she most industriously lifted her nest two feet and a half higher. That very night there came a tremendous fall of rain, which flooded the neighbouring grounds, and did much damage. Man had made no preparation to secure his property, but the bird was in safety, having placed her eggs so high as to keep them above, and only just above the waters. Instinct in this instance prevailed above man's knowledge; it was perfect as far as it went, because God was its director.

Yet man, being able to think deeply and to gain knowledge by experience, possesses a capacity of far higher value than instinct, one that can lead him forward into vast improvement. Do you know the term applied to this gift of thought and application?—"Reason." Reason is a power of thinking, of comparing and of selecting, by the use of which man can treasure up, and weigh the good and bad of what he has seen and heard, and can afterwards bring his knowledge into use, for the benefit of himself, and of his fellow-creatures.

The next time we meet we shall examine the home in which a bird receives the gift of life; its parent's finished and beautiful nest.

	PAGE
Into how many orders are birds divided .	34
What kind of beaks and feet belong to the highest soarers, or birds of prey? . . .	34
Upon what do the perchers feed? . . .	35
What kinds of beaks and toes have the runners and scratchers? . . .	36
What kinds of bills and feet have the waders? ..	36
What kinds of bills and feet have the swimmers?	36
At what rate can the sparrow fly? . . .	38
The pigeon, falcon, eagle, and swallow? .	39
What powers of mind do birds show? . . .	40

What is instinct?—An impulse to do the right thing without having had experience . . .	41
What is reason?—Comparing thoughts and bene- fitting by experience	43

Lecture Five.

ON BASKET-WORK NESTS.

THE last time we met we spoke of *Instinct* and *Reason*. Are you aware that we ourselves, though immortal beings, and possessing the invaluable gift of reason, are aided in the affairs of this life by a portion of instinct? If a stick be held suddenly before the face, we *instinctively*, without the least thought, close the eye to protect it. A child begins to eat by instinct. It does not wait to be taught; it cries to express its want, and instinct urges it to use its mouth in taking nourishment. Parents love their children by a kind of instinct; they do not stop to think, their love comes without thought, it is planted in the heart.

The same kind of earnest desire or impulse, draws a bird at the right season of the year to prepare her nest. In most of her proceedings the parent bird shows so little thought, that a hen will

generally be satisfied with a piece of ivory or chalk instead of her own egg, provided it be made of about the same size; but in making her nest, you cannot deceive her, she knows how to make it perfectly, she needs no teaching—no experience; her impulse is right, and if you move but a twig, she knows it is wrong. A small canary was so disgusted with a nest her mistress tried to make for her, that she seized the feathers and moss with her beak, and tore it to pieces. A sparrow hatched in a cage, will fly to a bush as soon as it is let loose, and at the right season, will build a nest like other sparrows. Were a young water-hen to be kept some time in confinement, it would run when set at liberty to the waterside, and know how to build its nest amidst rushes, or the roots of trees, like other water-hens; and when obliged to leave the nest for food, it would *instinctively* cover it over with grass or leaves, either to keep the eggs warm, or that no eye of man or dog, rat or bird, might see it.

Let us now proceed to examine the way in which some birds build their nests; then let us consider their eggs; and lastly, the light and beautiful forms of the downy little creatures that come in due time out of those eggs.

I conclude that you have seen several kinds of

nests; by your answer to my next question, you will shew me how well you have used your eyes and thoughts. "In what particulars did those nests differ from each other?" I see you are puzzled, therefore let me tell you, that some birds form the outsides of their nests with dry sticks, twisting them like basket-work. The raven, the crow, rook, bullfinch, jay, and many other birds build in this way.

Others dig holes in banks, and may therefore be called *mining* birds. Some of these birds line the holes they make, with hay, leaves, and with hair or feathers. The bank-swallow, bee-eater, some petrels, puffins, the burrowing-owl, jackdaw, kingfisher, and miner-lark, make nests more or less in such holes. Others again are called *mason* birds, because they build partly with clay; amongst the mason birds are the flamingo, nuthatch, cliff, window, barn, and chimney-swallows. Others are called *weavers*, amongst which are many small birds, the yellow hammer, chaffinches, red-breasts, linnets, the Bengal sparrow, and Baltimore starling. Another set of birds may be called *cementers*, such as the American chimney-swallow, and the esculent swallow, because the nests of the last-mentioned birds are like strong dried jelly. Some

have been called *tailor* birds, from the peculiar mode in which they build their choice little nests.

There is always much joy and alacrity amongst birds during the season of nest-building. The basket-makers with quick eye and nimble beak, search for sticks of all sorts, frequently making choice of the most dead and brittle branches. Flying with them into a tree, they commonly fix upon a forked bough, as the strongest and best resting place. When a sufficient number of rough sticks have been laced together, so as to form an outside wall, the little habitation is then lined with softer materials. Some birds mat over the sticks, the finest fibres they can draw from the roots of trees; others weave dried grass into a soft covering, finishing the inside with hair and feathers.

The rook lays on the upper branches of a tall tree a very rough foundation of dead sticks, and then lines them with a fine basket-work of fibrous roots. The crow adds to these materials, a thick mattress of wool and rabbit's fur, which makes a soft elastic lining, and forms a most comfortable home for the nestlings. Rooks like to build in company. They will often make twelve nests on the same tree, taking care that each nest shall be placed at a respectful distance from its neighbour. When once a collection of rooks have settled

themselves on a tree, they scarcely ever leave it until they find the twigs of the tree, from age or decay, too brittle to support their nests with safety. Ravens, rooks, and eagles, as well as all birds that pair for life, usually build but one nest, which they repair every year, never leaving it with their own good will; so that the important work of making new nests, falls upon the young birds. —

In providing themselves with a home, a pair of young rooks have not only to obtain fresh materials to build with, but they have also to fix upon a new place. Every part of a tree will not do for their purpose. Some branches may not be sufficiently forked, others may not be sufficiently strong, and others too much exposed to the rocking of the wind. White of Selborne tells us, the male and female upon this occasion, can be seen for some days attentively examining all the trees of the grove, and when they have fixed upon a branch that seems fit for their purpose, that they will continue to sit upon it, and observe it very sedulously for two or three days longer. The place being at length determined upon, they begin to gather for their nests sticks and fibrous roots, which they regularly dispose of in the most substantial manner. But here a new and unexpected obstacle may arise; it often

happens that the young couple have made choice of a place too near the mansion of an older pair, who do not choose to be incommoded by such troublesome neighbours: a quarrel ensues, in which the old ones are always victorious. The young couple thus expelled, are obliged again to go through the fatigues of deliberating, examining and choosing, and having taken care this time to keep at a due distance, they set about rebuilding. This industry deserves commendation, but their alacrity is often too great in the commencement. Growing weary of searching for, and bringing up the materials for their nest, they adopt another plan, and with some address, but with less honesty, perceiving that sticks may be found nearer home, away they go to pilfering as fast as they can, and wherever they see a nest unguarded, they take care to rob it of the very choicest sticks of which it is composed. These thefts never go unpunished; no less than eight or ten rooks will come forward upon such occasions, and setting upon the nest of the young couple, will all at once break it to pieces. At length the young pair find it necessary to go more regularly and honestly to work, and while one flies to fetch materials, the other will sit upon the tree

to guard it. Thus in three or four days, after a skirmish or two with the other rooks, the pair will fit up a commodious nest, composed of sticks without, and fibrous roots and long grass within. When the female begins to lay, all hostilities cease; not one of the whole grove, that had a little before behaved so rudely, will now venture to molest her, so that she quietly rears her brood.

Rooks appear to have laws among themselves, and to treat an offender with much severity. If a foreign rook should attempt to settle himself as a member of a neighbouring colony, he would meet with no favour; the whole grove would at once be up in arms against him, and expel him without mercy.

The elder rooks also try to keep the young ones from building far away from the old-established colony of nests. During a visit at a gentleman's house in a quiet little village, I once saw this fact myself. I was looking out of my window early in the morning, when I caught sight of a country girl, who kept walking backwards and forwards under a tall old tree in the garden, around which were strewed a great collection of broken twigs. She kept looking up very eagerly, at the topmost boughs, and on

asking the family what she was doing, they told me they had placed her there on purpose to keep off a party of old rooks, which had been disturbing a pair of young ones, in the act of building their nest on a branch of the great tree. This tree was placed at some distance from the regular colony of birds; and apparently for this reason the old rooks did not approve of the place, and three times they had torn to pieces the almost finished nest of the young couple. Grieved for the persecution they underwent, my friends had sent the girl to throw sticks at the noisy clamorous rooks, which had so protected the young ones, that their nest was then completed. When the girl had watched them a little longer, they intended to have the flower beds and gravel walks, which were strewed with twigs, swept up and set in order. ✓

The missel thrush, that good-sized brown bird with speckled breast, which is often hopping on our grass plots, builds a nest as large as a moderate sized jug. The thrush begins by making a rough basket of rotten twigs; this basket-work it lines with dried grass, hay, and moss. ✓The inside has next a coating of clay spread over it, and upon the clay more fine hay, moss, and lichens are wound round. To hide the outside of its beautiful basket-

work, the bird then dexterously draws around it some of the moss or lichens that cover the branches on which it is built. At times the thrush will catch up any odd material to place around its nest; a lace cap was once found woven within its walls. But generally the nest appears as a part of the tree, cheating the roving eye of the owl or idle boy, by taking the appearance of a lump of moss. But notwithstanding the care with which the thrush endeavours to hide its nest, an experienced observer will soon find it out, by the dropped lichen which lies strewed on the ground beneath it.

Some of our smaller birds make their basket-work more delicately than either the missel thrush or rook. If you look closely, in the summer-time, amongst the thick growing branches of brambles and low bushes, it is very likely you may light upon the white-throat's nest. No harsh sticks stand out from the sides of that little abode; its basket-work is built up of the dry slender stalks of long grasses. For this work, no stem comes amiss, but the grass these little birds seem to love the best, is called catch-weed. There is a slight roughness upon the edges of the blades of this grass, occasioned by minute ranges of prickles that grow on its edges; and after the beak of the bird has once bent the grass around the cup-like little

nest, there is no doubt but this roughness helps to keep the separate pieces clinging together.

The basket-work of the white-throat's nest is very slightly manufactured, so loosely indeed is it put together, that the light often shines through the meshes, but the inside is warmly lined with moss and horse-hair, all matted so closely down, that it looks like one compact substance.

The sedge warbler is a small bird of a yellowish brown colour, and close to the roots of sedges and other water plants, makes a basket-work nest of grass stalks. This nest it thickly lines with the blossom of reeds.

Great numbers of these warblers build their nests among the sedges, on the banks of the Thames. They are merry birds, more often heard than seen, singing almost all day and most of the night. Should one of them chance to stop in its song, you have only to disturb the reeds, when away it will glide among the water plants, and instantly renew its rapid notes, "as if in cheerful defiance of your audacious attempt to find it out. Late at night, hundreds of voices may sometimes be heard, singing in concert, and as the curious piping notes sound forth from the reedy water, the passer-by, at that lone hour, listens with wonder and delight."

The small reed-wren makes a choice little home among high grasses and reeds, that grow in shallow water. The air is cool in such moist rippling situations, and therefore to keep its little ones

Nest of the Reed-Wren.

warm, the reed-wren prepares a deep and famously thick nest. Picking up on the banks of the water, a broken reed, or long strip of dried grass, in it flies between the tall waving plants, and winds its trailing cord around three or four of the upright

stems. The living plants are thus made the supporting pillars of the nest, and as the little bird proceeds in its work, it carefully continues to entwine them into the rising edifice. The coarsest grasses form the bottom of the nest, the finest materials are laid on the top, and not unfrequently, long pliable leaves of the living reeds with their seed tops, are skilfully wound round the whole outside of the nest.

Any one who may chance to peep into the nest of the little reed-wren, will find the inside a model of comfort. They will see it thickly lined with mosses, leaves, tufts of vegetable cotton, wool, hair, or whatever the wren may have happened to meet with. They will see that these good things have not been spared, but that packet after packet has been tucked in, till the interior of the nest has been so filled up, that it is not half the size of the outside, yet it still remains so deep that the hen bird looks buried alive in her little palace; and there she sits brooding her eggs, whilst her mate, perched on a reedy stem close by, regales her with his hurried yet sweet song, during most of the day and the greater part of the night.

Suspended upon the tall grasses, you may see the nest swing to and fro each time the reeds bend before the wind; you may even fear it will be

thrown down; but no, it is safe! the storm may rage, and gusts of wind may force it almost to the water's edge, still the bird and her eggs ride securely; for the little reed-wren knew the height at which her nest should stand above the waters, and the extent of sway or bowing of the reeds, and has built her nest of such a depth, "as to prevent her eggs from rolling out. Are you ready to say, How came the bird to be so wise? Then let me advise you to remember our fourth lecture, the one on *Instinct and Reason*. Did we not there learn that man gains his highest knowledge by much thought and effort? that if he fail on a first trial, he gains experience for a second essay; whilst *instinct* prompts a creature to do the right thing without experience, without reflection! Its knowledge comes direct from its Maker, who knows all its wants, and who gives it skill to work aright. The feeling in its will, leads it at once to collect the right things, and to work them out in the right way. Were a reed-wren to be hatched under a canary, in a few weeks, if the door of the cage were left open, the little bird would fly away, and the next year would build its beautiful little nest with unerring skill, amongst the tall growing water plants.

In the South of Europe and Australia, two species of reed warblers are remarkable for sewing together the materials that form their nests. With their bills they pierce holes through the upright reeds, and through these holes they draw the horizontal fibres which support their delicate little nurseries.

The next time we meet, we shall examine the nests that are lined with woven wool and hair.

	PAGE
What kinds of birds' nests have we been considering in this chapter?—Basket-work nests.	45
Can you name the materials used in forming other nests?	47
How do birds feel as they collect materials for their nests?	48
How do the basket-work builders begin their work?	48
How do they line their nests?	48
How does the rook build?	48
Can you name a few particulars of the private laws among rooks?	51
What kind of nest does the missel thrush build?	53
Of what does the white-throat build its nest? .	54
Where does the sedge-warbler build?	54
Where does the reed-wren build?	55

	PAGE
How does the inside of its nest look? . . .	56
Why is the little reed-wren in no danger of being drowned in her nest? . . .	57

Lecture Six.

ON NESTS LINED WITH WOVEN HAIR AND WOOL.

THIS evening we are to examine the nests of chaffinches, red-breasts, yellow-hammers, linnets, and other birds which may be called *weavers*, as well as *basket-makers*. When these birds have formed their basket-work of twigs and the dry roots of plants, they generally cover the outside and inside with the mosses and lichens that grow upon the branches where they build ; often, it is said, mixing cobwebs with the lichens in order to make the loose pieces adhere. The inside of the nest is afterwards lined with a thick covering of several warm materials, such as wool, feathers, rabbit, horse and cow hair. These substances they press down into a sort of cloth, carefully bending round the inside of the cup-like nest, the short hairs of the cattle ; not one end of which is allowed to stand out, the point of every hair being

carefully pushed in among the moss, that the whole may lie smoothly.

The pied wag-tail makes its nest in a hole in a bank, and lines it with hair, which it works into a sort of cloth of more than half an inch in thickness. Amongst our common birds, the hedge and house sparrows make the shabbiest hair cloth, and the chaffinch about the neatest. The favourite building-place of the chaffinch is on the branch of an apple tree, and so ably does it cover up its nest with the moss or lichens that grow upon the tree, that you must look sharply if you wish to find it. Should the branch which it has chosen for its nesting-place prove rough, the little bird, before it begins to build, will pad that part of the branch upon which its nest is to stand, with a coating of moss, as if aware that the pressure of its own body when passing in and out of its small home, may wear a hole in the side of the nest that rests upon the uneven wood; and it frequently happens, that by the scattered morsels which fall on the ground from this padding, its hiding-place is found out.

The warm tapestry which lines the inside of the chaffinch's nest, is made of pressed, or as it is often called, of *woven* hair, down, wool, cotton, and silk of the spider's nest (the strongest silk by

far that the spider makes). These materials are flattened together by the beak of the little architect, and partly pressed down by the weight of its body, into a mass as solid as the felt of a man's hat. From the remarkable firmness of this lining, it seems likely, that in addition to the weight of the bird, a sticky saliva, which flows from the beak, has softened the whole lump into a pulpy substance. This saliva comes from two little glands or small spongy masses of flesh found in the cheeks of some birds, and which flows, probably at the pleasure of the bird, during the nesting season.

If you wish to examine the woven work of a nest, you must take one that has been built by a small bird that uses hair; you must first remove its outer basketing, then its felt-work of moss and wool, after which you will find a circular piece of hair cloth, not always worked in the same style, but according to the ingenuity of the bird, or the kind of substances which it has been able to procure. Yet I would advise you to check your praiseworthy curiosity to behold this woof and warp, until the little bird has done with its nest; for although by waiting, the interior may be soiled and pulled about through the scuffling of the little ones, at any rate you will have

spared its active loving builder the pain of finding its nest destroyed, and enough will be left at a later hour to show the skill of its workmanship.

Have you ever examined the nest of a common hedge sparrow? as I told you, that pert little fellow is not a first-rate weaver, yet his nursery is worth looking at. In the quiet retreat of some bush or tree, the sparrow lays a foundation of dry twigs, or of fibrous roots of plants; upon these it loosely piles up a round wall of hay and moss, with other odd materials that may happen to fall in its way, for the sparrow is by no means particular; and within this mossy exterior, is generally woven a blanket of hair or wool, mixed with a profusion of feathers, so as to make the inside surface very warm and smooth.

The house sparrow seldom builds upon a tree; this sparrow prefers ivy-covered walls, crevices, in the straw thatch of a house, or even a snug hole under the tiles is not objected to. Such places are generally first lined with a large quantity (considering the size of the bird) of hay, straw, moss, cotton, pieces of ribbon, or whatever else the sparrow may meet with; the inside of the nest, as usual, being neatly finished off, warmly, snugly, and smoothly.

“A SPARROW’S NEST!”

“And what a medley thing it is!

I never saw a nest like this,—
Not neatly wove with decent care
Of silvery moss and shining hair;

But put together odds and ends,
Picked up from enemies and friends.
See, bits of thread, and bits of rag,
Just like a little rubbish bag!

* * * *
* * * *

See hair of dog and fur of cat,
And rovings of a worsted mat,
And shreds of silks, and many a feather,
Compacted cunningly together.

Well, here has hoarding been and hiving,
And not a little good contriving,
Before a home of peace and ease
Was fashioned out of things like these!

Think, had these odds and ends been brought
To some wise man renowned for thought;
Some man of men, a very gem,
Pray what could he have done with them?

If we had said, ‘Here, Sir, we bring
You many a worthless little thing,
Just bits and scraps so very small
That they have scarcely size at all;

And out of these you must contrive
A dwelling large enough for five;
Neat, warm, and snug: with comfort stored;
Where five small things may lodge and board.

How would the man of learning vast,
Have been astonished and aghast !
And vowed that such a thing had been
Ne'er heard of, thought of, much less seen.

Ah ! man of learning, you are wrong ;
Instinct is more than wisdom, strong :
And He who made the sparrow, taught
This skill, beyond your reach of thought.

And here, in this uncostly nest,
These little creatures have been blest ;
Nor have kings known in palaces,
Half such content as is in this—
Poor simple dwelling as it is !”

Two sparrows once committed a theft upon a gardener. They had chosen for their nest a hole in the roof of a house, and to assist in lining this hole, they ran off with a long shred of the man's ravelled matting ; up they flew with their streamer, and quickly commenced tucking it into the hole, in which effort they succeeded ; but to press the strip of matting smoothly down, surpassed their powers, and whilst in the desire to accomplish this end, they kept hurrying eagerly to and fro, their feet became entangled in the matting. Unable to move far beyond the hole, the poor little labourers fluttered hard to release themselves ; the noise they made drew a party of their neighbours around them, who coming

out of curiosity to see what was going on, began twittering and chattering at a surprising rate. Not one, however, appeared to offer the prisoners any good advice, but seemed rather to be scolding the poor birds for their carelessness; nor did any one in the company kindly move either foot or beak, to help them out of their difficulty. The gentleman who had watched this sad accident, at length released the little prisoners, but found them so exhausted by their efforts to regain their liberty that they soon died, and in a few days one of their scolding neighbours took possession of their deserted nest.

It is not at all surprising that the gentleman who heard the neighbouring sparrows chatter on the house-top, should say they were scolding the unfortunate couple. House sparrows are free and easy with man; they live near his dwellings, and are less afraid of him than most other birds, and being a very loquacious or talkative race, people have learnt to distinguish in their cries many expressions of request, fear, anger, and pleasure. On a fine summer's evening, unitedly with hedge sparrows, they will assemble on high trees for the purpose of holding a long and noisy chatter; and when this concert is kept up for some time, it is considered a sign that it will be a fine day on the

morrow. In summer, sparrows may also be seen settling in troops on hedges that border wheat and barley fields, talking earnestly. They do not appear to meet from love of each other's society, for the sparrow is generally an unsocial bird, moving about much alone, and attending but little to the public good; but the hope of plunder attracts them; and as they all like the same kind of food, they meet where it is to be found.

From the sparrow let us now turn to a much larger bird, not because it makes basket-work, or weaves tapestry for its nest; for it does neither, but from its talkative powers; and this is the parrot. In England parrots seldom rear their young, probably they are not supplied with the right materials for nesting, as a pair of these birds were once known to form a nest in a tub of saw-dust, to lay their eggs in it, and actually to rear their young ones. But in their native homes in the Islands of the Southern seas, and in the vast wilds of tropical Africa and America, they abound. In those countries they form their nests of rotten wood, making them either inside the trunks of old trees, or in snug holes in rocks. In these places they first lay a good thickness of worm-eaten wood, and then cover it with dry leaves. Travellers say, nothing can exceed the beautiful appearance of

these gaily-coloured birds, as they climb up and down their native trees, giving to the branches all the tinted effect of a Turkey carpet. They abound in the forests of America, and by their noisy chatterings and active powers of climbing, throw a life over the gloomy silence which otherwise prevails in the depths of those sombre forests, where men may wander for days without catching sight of a single ray of sun-light stealing through the mass of foliage that crowns the tall trees. There, however, the parrot tribes, which are made for climbing, live in their glory,—make their nests,—rear their young,—and feed upon the fruits of the coffee, the cocoa-nut, the lemon, almond, and palm trees.

But to return to the tapestry-building birds. Among this tribe is an interesting little family called the *Tailor* birds, which literally sew leaves together, in order that they may form a support for their nests. Catching up the fibre of a plant, they will run it through the two sides of a leaf with their beaks, and drawing the leaf up into a compact form, will build their nests in its snug little hollow. At other times some of these tailor birds will knit the stalks of grass through and through each other. Mr. Wilson took out of the nest of an American starling, which was suspended from the

twig of an apple tree, one fibre of a long flexible grass, that measured thirteen inches in length, and had been hooked thirty-four times through, and returned by the bird's small beak. "I think," said an old lady who saw the work of one of these birds, "that the little creature which build this nest might be taught to darn stockings."

The ruby humming bird of America, whose body without its feathers is not much larger than a humble bee, constructs its nest very ingeniously. Mr. Kirk happening to see a little ruby at its work, watched it for more than an hour. It first flew with a pile of short grass or lichen to the twig of a tree, about three feet from the ground, and there laid its packet down under a large sheltering leaf.

After it had brought two or three piles of grasses, the little ruby set itself in the middle of the heap, and putting its long slender beak over the outer edge, seemed to use it, and the throat, very much in the same way as a mason uses his trowel to smooth down his work; rubbing itself to and fro, and sweeping quite round. Each visit to the nest occupied but a few seconds, and its absence from it not more than as many minutes. In a few hours, the nest, about the size of half a hen's egg, had all the appearance of being completed, and any

one peeping in shortly after, might have seen two pearl-like eggs, about the size of small peas, comfortably settled within its narrow walls.

The ingenuity and industry of birds in building their nests, is amusing to observe, and their perseverance is a frequent reproof to the indolence of man. In our next conversation we shall continue the histories of nests, beginning with a few of those which are found in the hottest part of the earth.

	PAGE
Of what nests have we been speaking? . . .	60
For what purpose do the weaving birds use the hair of cattle?	60
What does the chaffinch cover over its nest? .	61
What sort of nest does the sparrow build? .	63
In what place does the parrot build?	67
How does the tailor bird build its nest? .	68
How many times did Mr. Wilson find an Amer- ican starling had knit a stalk of grass through and through?	69
How does the little ruby humming bird form its nest?	69

Lecture Seber.

VARIOUS TROPICAL AND EUROPEAN NESTS.

It has been remarked that within the tropics, or those districts of the globe (where the rays of the sun fall with the most fervid heat,) that the largest number of birds build domed or covered nests; the openings for entrance being left at the sides or lower ends. No doubt instinct draws the tropical birds to build in this fashion, that their nestlings may be sheltered by the roof from the scorching rays of the sun, and be guarded by the side admission, from the attacks of snakes and lizards which abound in hot climates, and which eagerly devour the eggs and the young of birds.

It is thought that the most perfect domed nests are built by a family of birds called the Cassicans, or hang-nests of South America. These birds vary in size, some being small, others as large as a

crow, but all of them form nests of woven grass, something in the shape of a bottle, or perhaps more resembling a chemist's retort, from having a bulge on one side; each of these nests they suspend with the neck downward from the end of a

Pensile nest of cassican bird.

Section of interior
of cassican nest with
bird on her eggs.

bough. When the opening into a nest is from below, the bird enters its home on the wing; and on the wing it must fly up the long neck or tunnel, until it reaches the bulging portion that forms the little chamber in which the hen lays her eggs. This little chamber is generally guarded by an inside partition wall, that rises nearly to the roof of the nest, and over this wall the parent bird has to pass before she can seat herself on her eggs. But once secure in her snug abode, the hot rays of the sun are not felt, and her young brood rest in safety from the attacks of hungry snakes; for without wings, those wily enemies to all young birds, are quite unable to dart up the bottle-shaped neck of the cassic's nest, as it swings from the branch of its tree.

The largest South American cassic, forms a nest three feet in length, the bird being rather less than a rook in size. These birds frequently place several of the nests on the same tree, and often make choice of one growing on a small island in a river, such situations being more secure from the attacks of reptiles than the main land.

The insides of pensile or hanging nests, are necessarily dark, and in one species of bird, (a West African grossbeak) the little builder is well known to remedy this defect by sticking small

lumps of moist clay upon the interior of the nest, then catching up fire-flies which shine like large glow-worms, and pushing them into the lumps of clay, thus to make the sparkling luminaries light up the interior of the nest. In some tropical countries fire-flies are very numerous, and their light so brilliant that in Mexico, the Spanish General Cortes is said to have mistaken a large collection of these flies for an army of match-lock men.

Some of the smaller tropical birds fasten their nests to the under sides of leaves, and thus make the leaves to serve both as supports to their nests, and as shelters from the heat. This mode of building is adopted by some of the South American humming birds, and also by the smaller Jamaica swallows, which often select the under side of a particular kind of palm leaf for their canopy.

The sociable grossbeaks of South Africa, are small birds that love to build in companies. The industry of these birds is astonishing. Throughout the day, groups of them are to be seen busily collecting a fine species of grass, which they weave into a wide roof, so compactly and firmly platted together as to keep out the rain, and so large in its dimensions, that hundreds of nests are built all round its under edges, the one common roof of

grass covering them over like the thatch on a cottage. The same nests are used year after year, and their numbers are augmented from time to time, as the growing young birds increase the size of the general family, till at last the branches of the trees on which they are built, will occasionally break down under their accumulated weight. Vailant tells us he once sent a waggon to fetch one of these republican nests, and though only built of grass, it was so firmly put together, he had to cut it open by the blow of a hatchet.

The very reverse of this complicated care in nest building is observed among other kinds of birds. The brush turkey of Australia,* and the birds of two other allied genera found in the same parts of the globe,† make no nest; they simply heap up a regular hot-bed of leaves. Several birds club together at the time of the nesting season, and by the aid of their long claws and toes, collect together a large pile of grass and leaves, in the midst of which pile (it is believed) several females lay their eggs, and the young, when hatched by the fermenting heat of the materials, scratch their own way out of the heap. Some of these Australian brush-turkeys have been hatched in a similar way in the Zoological Gardens of the Regent's Park. X

* Tallegella.

† Leipoa and Megapodius.

The dotterel, a kind of plover, which lays her eggs amongst the heath of high mountains, is also careless in providing for her young, simply selecting near to some sheltering stones a hole in the ground, amidst the heath-blossom on the mountain's side.

The Dotterel, a kind of Plover.

The Ring-dotterel, a small kind of plover, very commonly found on some parts of our English coasts, forms her nest in a little hollow on the sandy shore, paving it with flat stones, smooth pebbles, or pieces of shell. The ring-dotterel thus prepares an ornamental nest for her young ones, but truly a hard and cold one, compared to the nests of the tree and bush birds.

Our evening discourse will now close with the lively description that a French naturalist has given of a small African bush bird, called the Capocier, which bird is about the size and appearance of our reed-wren, with the addition of a much longer tail. When living in Africa—La Vaillant had contrived, by throwing crumbs upon the ground near to his tent door, to tempt a few little capocier birds to enter beneath its canopy, and so tame did they become, that he felt assured they knew him when he passed among the woody thickets in which they lived.

At the nest-making season, he often missed two of his little capocier visitors. For four or five days they would keep away, and then unexpectedly return, and catch up in their beaks small packets of wool. He watched them as they flew away, and found they had begun nest-building for their young. During their former visits, La Vaillant had been stuffing several birds, and no doubt they had observed the cotton, moss, and flax laid on his table for use, and now found it more convenient to furnish themselves with these articles, all ready to hand, than to gather the down from the living plants. So away in their beaks went parcels of his cotton, much larger in bulk than their own bodies.

Having discovered that they had selected a corner in a retired and neglected garden, and were constructing their cradle by the side of a small spring, La Vaillant followed them to the place, and found that they had already laid part of the foundation, by padding a fork in the branch of a tree, with some thickness of moss and flax, interwoven with grass and tufts of cotton.

“I passed the whole of the second day by the side of the nest, which the female never quitted for more than an hour, while the cock-bird made twenty-nine visits to my room in the morning, and seventeen in the evening. As he brought up each parcel of cotton and moss, he laid his little load on the edge of the nest, or upon the branches within reach of the hen’s bill; every third or fourth time stopping to assist her in trampling down and pressing the cotton with his body, in order to make it into a sort of felt.

“This agreeable occupation was frequently interrupted by playful gambols, though the hen often appeared too anxiously employed to enjoy so much trifling, and she even sometimes punished the cock for his frolics, by pecking at him with her beak; he, on the other hand, fought in his turn, pecked, pulled down the work which they had done, prevented the hen from continuing her labours, and

in a word seemed to tell her, "You refuse to be my playfellow on account of this work, therefore you shall not do it." In order to save the fabric from destruction, she left off working and flew from bush to bush for the express purpose of teasing him. Soon after, having made matters up, the

Nest of the Capocier.

hen returned to her labours, and the male sung several minutes in the most animated strains. After his song he set to work again, carrying with

fresh ardour all the materials his mate required ; till the frolic again became buoyant, and a similar scene to the one I have described occurred. Still the work advanced ; on the third day the bottom of the nest was completed, and rendered compact by the birds' repeatedly pressing the materials with their breasts, and turning themselves round upon them in all directions. The sides of the walls now began to rise, and for this purpose they piled tufts of cotton round, trimming the tufts with their beaks, and beating and pressing them down with their breasts, and the shoulders of their wings, taking care to arrange any projecting corner with their beaks, so as to interlace it with the felt-work, drawing at the same time the small branches of the tree into the walls of the nest, but without injury to the roundness of the inside. On the seventh day their task was finished. Their beautiful edifice, which was arched over, was as white as snow, nine inches high on the outside, whilst the inside was only five. Its external form was irregular, from its being fastened to many branches ; but the inside was exactly like a hen's egg with the small end upwards, and its lining so felted down, it might have been taken for a piece of fine cloth a little worn. Not one particle of its substance could be removed, without tearing the whole down, so finely and so compactly was it made."

We shall next have to consider the flat-made nests. /

	PAGE
Why do tropical birds generally build domed nests?	71
Of what form is the nest of the South American cassican?	72
What kind of nest do the sociable African gross-beaks construct?	74
How are the young of the Australian brush-turkeys hatched?	75
Where do dotterel plovers generally build?	76
What sort of nest does the ring-dotterel make on our coasts?	76
By what process did the little capocier birds press down the interior of their nest?	80

Lecture Eight.

ON FLAT NESTS AND THE CARE OF BIRDS FOR THEIR YOUNG.

WHEN we speak of a nest, we commonly think of a cup-like figure, but in the instance of the cassican's pendulous nest, we have seen this idea is not quite correct. Again, birds that build on the ground, make their nests almost flat; and even a few which build on the forking branches of trees, such as wood-pigeons, scarcely leave any hollow for the reception of their eggs; probably the warmth of their own bodies renders it needless to raise sheltering walls around their eggs. The twigs chosen by the wood-pigeon for its nest, are loosely, but neatly laid together in a flat circular form; they are mostly selected from birch trees, and are of several sizes, the undermost twigs being the largest and the longest; but all are so slightly

laid the one upon the other, that in some instances the eggs of the bird have been seen through the sticks.

The eagle builds on ledges of rocks, and occasionally on trees. This noble bird makes its nest as flat as a floor. The nest of the golden eagle is sometimes two yards across, and the sticks it selects for the foundation, are from five to six feet in length; across these are laid finer branches, and above them, one or two layers of rushes and heath. The weight of the nest is great; and when placed on a tree, the eagle, apparently aware of the danger that may arise from the cracking of the main branch upon which it rests, has been known to draw its ends over other branches, in order to support it. Upon this flat nest the eggs are laid, and from its size, there is plenty of room for the parent birds to deposit hares, rabbits, a lamb, or whatever else they can secure, as soon as the young eaglets are able to revel upon such dainties. A Scotch peasant once declared, that an eagle's nest was his best pantry; that he watched the time when the great eagles flew away in search of new game, and then clambering up the steep rocks, always found store enough on the birds' woody platform to fill his bag with good things.

So happy a home do the eaglets find their nest,

that they are often unwilling to leave it. We learn from one passage in the Bible (which is a book invariably true to nature) that in order to drive the young ones from their home, the old birds will sometimes stir up the sticks to make the nest rough and uneasy; no sooner however do the young birds approach its edge, than the watchful parent, "fluttereth over her young, spreadeth abroad her wings, taketh them and beareth them on her wings." Moses compares this tender care of the great bird, to the gracious love of our Heavenly Father, who frequently permits our earthly comforts to be disturbed, that we may be led to rise in spirit to seek after Himself and the superior joys of heaven: forcibly declaring, "The eternal God is thy refuge, and underneath are his everlasting arms;" even His redeeming love, by the knowledge of which the feeble spirit is borne up on its way to heaven.*

Storks build like the eagles, flat nest of sticks, usually placing them on the tops of houses, churches, towers, or any old deserted buildings. Herons also lay a pile of sticks on trees, but so place them as to leave a slight hollow in the centre of the nest.

Perching birds generally make their nests on

* Deut. xxxiii. 27.

trees. Runners, waders, and swimmers, mostly on the ground. Farm-yard fowls are runners, ducks are swimmers. The young of both these kinds of birds have no need, like the constant flyers, to be housed and fed in warm nests, until the wing is grown strong and feathered. All they want, is to have the foot firm enough for moving on land or water, and since their feet do not require feathers, this is quickly the case; accordingly, runners and swimmers only make hatching places, and are usually satisfied with scraping away a little soil, and lining the hollow with hay or leaves. From these shallow nests, the parent birds lead away their young immediately they are hatched, to pick up their own food.

Some kinds of ducks nest in hollow trees, and bring their young to the water's-edge, by carrying them down in their bills. The Musk duck and the Carolina duck occasionally do so. The golden-eye duck is said to bring its young down to the water, not in its bill, but tucked in between its wing and neck.

The eider duck lives in a cold region of the earth, and on this account makes a very different nest to her more southern kindred, instinct teaching her to provide a warm and sheltered home for her nestlings. Both male and female eider duck work

together in making this nest. They begin by placing on the ground a rather coarse but deep foundation of drift grass, dry sticks and sea-weeds, and upon this rough mattress the female eider duck spreads a thick bed of the finest down, plucked from off her own breast. This down, which often weighs half a pound, she heaps up at the edge so as to form a thick puffed roll, and when obliged to leave her nest to seek for food, she carefully turns the downy roll over the eggs to keep them warm till she return. Should her nest be stolen, which for the sake of the down is sometimes the case, she will build a second, and will even make a third, but to line this last one, the drake is compelled to pluck the down from his own breast; and if robbed of this nest, the poor dejected ducks quit the place in despair. X

The love which birds display in defence of their young is very striking; it overcomes their timidity, often renders them boldly courageous, and sometimes grateful for help. Let us close this conversation with a few anecdotes on these subjects. The first I shall narrate, is the story of a willow wren. The nest of this bird is built on the ground, or in the bank of a hedge skirting a wood, and is a curious piece of architecture. It is oval or rounded, and made of moss and grass externally,

so that it is not easy to detect it among the green herbage in which it is usually concealed. It is lined with feathers, and the bird enters at the side. Such a nest was once seen by a lady, lying on the ground in an orchard. At first she took it for a large ball of grass, but on lifting it up, found to her surprise it was the domed nest of a willow wren: regretting her haste in having so rudely disturbed the little building, she restored it as nearly as she could, to the place in which she had found it, but with small hope that after such an attack, its owner would again notice it. To her surprise she found the little bird the next morning proceeding with its work, and in a few days two eggs were laid. The kind lady now hoped that her little *protégé* was safe from harm; when lo! an invading army of web-footed ducks marched straight upon the nest, which was clearly to be seen, as the grass had not grown high enough to shelter it, and with their broad shovels of bills, spread the nest quite open, displaced the eggs, and left the neat and snug little domicile a complete ruin. The lady this time was in despair; but having driven away the intruders, did her best to restore the nest to something like its proper form, and then replaced the eggs inside. Her perseverance was rewarded, for that same day, she

was astonished to find an additional egg laid, and in about a week, four more. The bird sat, and ultimately brought out seven young ones. It almost seemed as if this persecuted pair looked upon the lady as their guardian angel, and confident in her protection, were determined not to abandon their nest.

In April, 1839, a redbreast built its nest amidst some ivy on a garden wall, at Whitburn, near Sunderland, and had laid four eggs in it, when the gardener, in trimming the ivy with his shears, so injured the nest, that the eggs fell to the ground. The plaintive cries of the parent birds drew the attention of a lady to the place, and after mending the nest as well as she could, she picked up the eggs and replaced them in their small home. Not five minutes afterwards the hen bird came, and sat upon the eggs, which in two days were hatched, when the infant brood became the constant objects of the lady's notice. Great then was her dismay at finding, some days afterwards, that all the little ones had fallen through the patched nest, and were lying stiff and cold on the ground. Perceiving a slight movement in one of them, she carried the nestlings into the house, where by the help of the warmth of the hand and of the fire, they gradually recovered. This time the nest was patched with a

piece of carpet, and the young ones again laid in it. But the little birds were doomed to go through further trials, for in the night heavy rains so completely soaked the nest and the carpet which had been placed inside it, that by the morning the young ones were almost drowned. They were again brought to the fire, thoroughly dried, and now settled in the empty nest of another bird, and placed in a currant bush a few yards from the ivy wall. During the whole course of these proceedings the old birds sat close by; they never seemed alarmed at the liberties taken with their young ones, but soon flew back, and at length joyfully reared them till strong enough to fly away.*

Mrs. Meredith, a lady who lived some time in Tasmania,† and who delighted in watching the feathered songsters around her, has given the following beautiful description of several small birds, as well as of a warbler's nest which she discovered in her garden.

“Amongst these birds,” she remarks, “came that tiny flitting fairy, called the Diamond bird; it is truly a dainty little jewel, all gold and shaded amber, with silver spots. Not less beautiful, and far more common, was my old darling the robin;

* Jenyn's Observations on Natural History.

† Tasmania is not far from the continent of Australia.

as exquisite a beau as ever, with his back of blackest black, and his breast a living flame of scarlet; a warm, brave little heart there beats within it too, or his sparkling eye tells no true story!

“With him came another of nature’s marvels of beauty and brightness, dressed also partly in black, of black-bird velvet, off the same piece as robin’s coat, but with a cap and mantle of blue; such blue! the deepest summer sky is mere dull grey to it! This wondrous little bird is called the ‘Superb Warbler,’ and superb in truth it is; so bright, so swift, so merry, so musical as these little beings are, sure nothing else ever was. The blue-cap has a domestic contrast too in his quiet coloured little wife, who, like her ‘Old-world’ name-sake, ‘Jenny Wren,’

‘Will still put on her brown gown
And never go too fine.’

But though not dressed in grey hues, she is as merry and as sprightly as her mate; a perfect little ‘dot’ of a bird; quite round, like a ball set on two fine black pins, with a sweet little head at one side, and at the other, or more truly on the top, the drollest long straight upright bill that ever was seen.

"One or two pairs of these 'Superb Warblers' lived close to our garden fence, and for a long time I tried in vain to discover their nest. We often fed them, and they came boldly about us, but always baffled me when I endeavoured to watch them home. At last I felt quite sure I had found the grass tassock containing one nest, but although this tassock was not above two feet across, I was some time still, ere I discovered the entrance; for of course I would not disturb any thing, and the little creatures were so artful and so cautious, and in such a sad state of fluttering, chirping, trepidation, when I was peeping about, that they disturbed my attention, as they naturally intended to do. At last I accidentally looked directly into the little tube of woven grass and web that served them as hall and ante-room. Several blades of reeds waved before it, but still on gazing down intently into the dark little cavity, I espied two or three little gaping mouths, and heard a faint small chirp. The two tiny parents of these tinier babes, which could not have been much larger than peas, were all the time flying round and round me, in most distressing terror, almost brushing my face with their delicate wings, in their anxiety to drive me away; and the instant I drew back, both darted into the nest, to see if all was right at home. Poor little flutterers!

they need not have feared me. I only confided the secret of their abode to my husband, and so fearful was he of disturbing them, that I could not induce him to go near enough to examine the nest. In due time we had the pleasure of seeing the whole miniature family out together; the old birds in a great state of importance feeding their droll little offspring most assiduously."

Next week we shall describe the mud nest of the swallow.

	PAGE
What shaped nests have we been studying this evening?	82
Name one or two of the birds which build flat nests	82, 83, 84, 85
Why do poultry build on the ground?	85
How do some kinds of ducks that build in trees convey their young to the water side?	85
What kind of nest does the Eider duck build?	86

Lecture Nine.

ON MUD NESTS.

SWALLOWS are often termed *mason* birds, because their nests are made of moist earth, which is usually of an adhesive nature. Sometimes the swallow uses only stiff clay, at other times it mixes sand and straw with it; and in the end, comfortably lines its lumpy-looking nest with chaff and feathers.

There are several kinds of swallows. These birds are literally children of the summer. They live entirely upon insects and small red spiders; and as they assist in clearing the heated atmosphere of the hosts of minute flying creatures that infest it, they may, with propriety, be called scavengers of the air. The species of swallows most frequently seen in Britain, are the swift, chimney swallow, house martin, and sand martin.* They

* See frontispiece.

arrive in England during April and May, just as flies and moths begin to sport around us, and when the cool weather of October sets in, away they fly to seek a fresh summer in the warm lands of Africa, that lie between the Mediterranean sea and the mountains of the moon. In those vast districts are large deserts of sand, interspersed with large tracts of fine wooded country, where myriads of insects rise from the steaming bogs, and rapidly-growing vegetation of their glowing regions. When our spring returns, back come the swallows, and that the same birds which left us in the autumn return the next year to rear their young in our temperate climate, is quite certain; scarlet threads having been wound round the legs of many swallows, and the following spring those birds have visited the very nests in which they themselves or their broods had been hatched the previous season.

It is a curious instinct in the swallow tribes, and perhaps may exist among other migratory birds, that wherever they have been hatched, to that same land they will return the following year. Swallows are scattered over most parts of Europe; some stop for the summer in Italy and Greece; others fly more into the interior of Europe; other groups, as we know, wing their way into Great

Britain. And all these birds and their families, after going to Africa for the winter, return to their respective native countries in the spring.

In America, the swallows pass from the upper part of North America to Mexico, and to other still more southern quarters. Among the American swallows there is a species called the cliff swallow. This species is distinguished from other tribes, by the feathers in the tail being nearly of one length. Cliff swallows group together in large companies, and make a vast number of small round clay nests close to one another. Skill and industry are required in forming these nests, since the masonry of the cliff swallow needs, with the clay that is used, a mixture of sand or straw, and having neither barrow by which to bring up the sand, nor shovel by which to blend the sand and clay together, these animated little beings are obliged to perform the whole business with their beaks.

In collecting their materials from the borders of rivers and ponds, they work from early morn to mid-day. At noon they stop and dine upon insects, after which they sport for a time up and down, gracefully dipping their wings towards the cliff, and then off again with immense rapidity of motion. In the evening they return to their work, and thus

in about three days, a large colony of these mud-built habitations is completed.

Our common sand martin makes a deep circular burrow in a bank or hill of sand. When the bird wishes to strike out the size of its burrow, it stretches out its head as far as it will reach, and drives the point of its beak into the ground; upon which it immediately draws the beak back through the soil up to its feet. This done, it moves on a step, observing to keep the same distance from the centre, by throwing its beak again forward into the first hole; and thus the bird continues to work on, till a regular round hole is formed; its feet always standing on the outside of the circle. The bill, which is kept shut, is thus used as a pick-axe, and the feet are employed in shovelling out the rubbish brought up by the drive of the bill through the earth.

The real nest of the sand martin is sometimes full three feet below the surface of the ground, and is loosely covered over with dried grass and feathers. In this deep burrow, its young are safe from the attacks of other birds; and the steep side of the face of the hill, generally preserves them from being attacked by small quadrupeds.

The chimney swallow may be known by its

forked tail. This bird makes its clay nest three or four feet down the shaft of a chimney, thus securing its nestlings from birds of prey. Its favourite chimney, is one out of use, but adjoining another that is warmed by a constant fire.

Martins or window swallows are often fanciful in fixing upon a nesting place; beginning many edifices and leaving them unfinished; but when once a nest is completed in a sheltered situation, the labour bestowed in erecting the dwelling is not lost, as they return to the same nest year after year. Thus the older birds get the start of the young swallows which have to build a new mansion for themselves, hatching their young ten days or a fortnight earlier than the new builders.

These industrious artificers are at their work in the long days before four in the morning; and as they bring up their muddy materials, they plaster them on with their chins, moving their heads with a quick vibratory motion, occasionally stopping in their work, that the walls of the rising edifice may have time to dry and harden. The crust or shell of the nest, as before remarked, is a sort of rustic work full of knobs and protuberances, the inside being smoothed with a lining of small straws, grasses, and feathers, and sometimes by a bedding of moss interwoven with wool.

When once the house martins have made choice of a building place, it is very difficult to drive them away. A gentleman who had just finished a handsome house in the neighbourhood of Norwich, was greatly annoyed at finding a party of these birds busy at work under the new eaves, and gave orders to have them disturbed. Their nests were therefore swept down. But as they renewed their labours, the ladder was again raised, and the eaves once more cleared. This was repeated several times, and as the martins persevered, a further command was given, that a bird or two should be shot; upon the death of these birds, the whole party absconded, and, remarkable to say, for eight successive years no martin approached that house. After that period, they were seen flying under the eaves, and to stop their building, a second order was given that a bird should be killed; since which time no martin has attempted to touch the walls of the forbidden mansion. Whether the birds stayed away for eight years, because for that period the information had been handed down that it was a dangerous situation, we cannot tell, but their conduct looks as if some kind of communication had been carried on between the parents and their young ones, by which the rising generation had

been warned of danger for eight successive years, after which period the story had been forgotten.

Soon after the opening of the Boys' Reformatory, in Norfolk, the swallows paid the house a visit; a long continued drought had that year dried up the land, and as the lads who first entered the establishment watched the birds, they felt compassion for their unceasing but fruitless efforts to complete their nests with crumbling earth. Sympathy with sorrow usually excites a desire to alleviate it; it was so in this case, for the Governor, to his surprise, beheld one morning puddles of wet mud glistening in the sun on the gravel road. Enquiring into the cause of this unusual appearance, he was told the mud had been brought to help the poor birds, who instantly prized the assistance thus rendered them, by carrying up beak-full after beak-full; and in a few days their nests were completed.

Again the attention of the lads was aroused, by seeing a pert sparrow seat itself quietly down in one of the martin's nests. The habit of seeking out a good lodging for the winter, is not an uncommon event with the sparrow. He is a hardy bird, but still, as he stays with us during our frosts and snows, he finds it very desirable to provide a good home, into which he may fly for occasional shelter. The swallows, in this instance, did not approve of

so early a selection of one of their mansions, and made many efforts to drive out the intruder; but the sparrow had taken full possession, and seemed determined upon retaining his ready-made home. After a time the swallows assembled in companies, much twittering followed, at the close of which they flew to the mud heaps; each one filled its beak, and flying up with the moist earth, literally built up the little robber in his stolen house. Some time afterwards the lads brought a ladder and broke open the nest, when they found the prisoner dead.

Another touching circumstance occurred shortly after the swallow story, and though not in accordance with remarks upon birds, it may be interesting to notice it. Mice increasing to the annoyance of the mistress, two kittens were brought from different places. These cats never agreed, the black puss domineered over and hissed at the tortoise-shell kitten, driving it away from their mutual plate of food. In a night ramble, the black puss was caught in a trap; the boys found it, and its foot being greatly swelled, it was carried home and laid upon a mat. The tortoise-shell kitten gently crept towards it, and with watchful eye looked at it; appearing to apprehend something was amiss, it laid itself down on the same mat, curled itself

round, so as to allow of the black puss' injured leg resting upon its soft body as upon a pillow, and for hours together remained in that position, evidently to the great content of the sufferer. There was something so forgiving, so deeply feeling in the friendly kitten's kindness; its conduct seemed like the benevolent love of a human being, and it afforded universal pleasure to the household.

Our conversation next week will be upon an egg, and upon the bird hatched in it. ➤

	PAGE
Why are swallows sometimes termed mason birds?	94
What are the names of the four kinds of swal- lows that visit Great Britain?	94
With what do swallows line their nests?	98
Upon what do swallows live?	94

Lecture Ten.

THE BIRD IN THE EGG.

DURING our late conversations, we have been considering the peculiar way in which birds build their nests. We might continue to examine more of their wondrously-formed cradles, but enough has been said to point out the adroitness and skill, which the Creator has been pleased to bestow upon the feathered races. Should you desire further information on the subject, I advise you to read “Rennie’s Architecture of Birds.” *

At present our business is to enquire for what purpose birds have been so urgently drawn to make their various little homes? Your answer would be, “To hold their eggs.” And pray what is an egg? You reply, “A hard roundish shell, filled with a white liquid and a yellow yolk.” So far you are

* Shilling Volume, published by Charles Knight.

right. The contents of a bird's egg are such as you describe them, and the outside is also hard, while the outside of a reptile's egg is soft. Were you to press your finger upon the egg of a snake or of a crocodile, you would make a dent; the reptile's egg being simply covered with a tough leathery or parchment-like skin, while the fine skin over the liquids in a bird's egg, is protected by a coating of hard lime.

And for what purpose do you think a white liquid and a yellow yolk have been shut up in a bird's lime shell? Again you reply, "That a young bird may be hatched." If I broke an egg soon after the hen had laid it, should I find a little bird in it? "No; only the two liquids." Then how is it, that a bird comes out of the shell?

Because it has pleased the great Creator to convert the white liquid within the shell, into a body fit to receive animal life, all ready prepared to see, hear, run, hop, fly, and in some cases to swim. And He has ordained that during the progress of this change, the yolk of the egg shall nourish the forming bird, by being absorbed or taken into the body. Still God works by some outward means, and it is His pleasure that this change of the liquids into a bird, shall take place during the time the mother bird broods over her eggs, and keeps

them warm. The hen knows not what she is doing, but having by the power of instinct made her nest, and laid her eggs in it, she feels an irresistible desire to sit upon the eggs, and in performing this act, quits all her usual habits, scarcely allowing herself time to eat; but there she remains the live-long day, sometimes continuing on her nest for weeks together, and often twittering for joy. At the time of the nesting season, the small veins on the breast of the hen bird fill unusually with blood, and as they swell with heat, it may be that her chest is cooled by the warmth passing from her body into the eggs, and thus her time of nursing rendered a season of pleasant occupation. Some birds sit a fortnight, some six weeks on their eggs. The reason for this is not exactly known; but it has been remarked that birds with the most perfect feathers, are the longest in being hatched.

When a farm-yard hen has sat about six hours on her eggs, a minute cell or bladder, looking like a red point, may be clearly seen floating in the white liquid. That red point is the commencement of the heart of the future chicken. Minute cell upon cell now shoots out from this first point, each cell or little bladder throwing off more cells, until lines are formed that mark the direction in which the veins of the chicken are to run. These

lines, like red streaks, may be seen by the naked eye stretching over the fine skin that separates the white liquid from the yolk, and from these lines the cells go on increasing and uniting together to make the legs, wings, and body, just according as the Creator is pleased to appoint the form of the forthcoming bird.

During the time the body of the fowl is thus undergoing its formation, air is constantly passing into the egg, through innumerable and most minute holes in the shell; and this air joins with the yolk in supplying materials for the increase of the bird. When the body is completed, the limbs of the bird lie folded up in the shell with a beauty of arrangement that nothing can exceed. The head just peeps from under one of the wings, and is so placed, that the beak shall touch the largest end of the shell. Upon the beak, rises a little tip of strong bone, suitable to cut open the shell, which bony lump, as soon as its work is over, peels or falls off; indeed everything we examine in the history of a bird, marks the intelligent wisdom of one Great Mind, directing and guiding its whole being.

As soon as the little bird is quite prepared for active life, it taps against the shell with its pointed beak, asking its mother as it were, to help it to

break it open, though at times it cracks it quite through by itself. The hen upon hearing the noise within, with joy and pride of heart mostly strikes the shell with her own strong beak, and forth comes the little bird dressed, not in feathers, but in soft down; the feathers, like the teeth of a child, being as yet in most birds only in preparation in the skin.

What should you suppose to be the first actions of this newly-hatched living thing? Perhaps you would say, to eat! No, it is to stretch its legs and its wings, to open its beak, and to spread out its down to dry in the air. For some hours the young bird does not require any food, a portion of the yolk of the egg yet remains in its body, and by that it continues to be nourished. Notice the wisdom of this provision; all the eggs in a nest do not hatch at the same hour:—had the first-born bird needed immediate food, it must either have been starved, or the mother, whilst providing for it, must have deserted her other eggs, and thus destroyed the rest of her family; but as things are now arranged, the mother may, without injury to her eldest born, continue to sit on her nest till all her little ones are hatched, which sometimes takes more than a day. After that time the cry of hunger comes. At first the chick may utter but a feeble note, yet

the smallest cry is a proof that it has life, and longs for food.

So in the human family, the feeblest cry of prayer in the human soul bespeaks a spiritual want, the movement of a spiritual life that is alive to its wants. A man living without prayer is dead in spirit. Such an one has no more desire after his God, and the things of the eternal world, than the live bird in its shell has for the things of this world. He is alive and dead at the same time. To rest in such a state, must bring on final ruin and death eternal.

An African Chieftain having listened to the remarks of three Englishmen upon the nature of sin, eloquently attacked the unbelief of his people; and also in the following speech advised them to copy the example of a hen, and cherish the truths they had heard. Advice by no means beneath our attention.

“Rejoice, you Makare and Mokatchini! We have all reason to rejoice on account of the news we have heard. There are a great many sayings among men. Some are true and some are false; but the false have remained with us. Therefore we ought to pick up carefully the truths we hear, lest they should be lost in the rubbish of lies. We are told that we have all been created by one

Being, and that we all spring from one man. Sin entered man's heart when he ate the forbidden fruit, and we have got sin from him. These men say that they have sinned; and what is sin in them is sin in us, because we come from one stock, and their hearts and ours are one thing. Ye Makare have heard these words, and you say they are lies. If these words do not conquer, the fault will lie with you. You say you will not believe what you do not understand. Look at an egg! If a man break it, there comes only a watery and yellow substance out of it; but if it be placed under the wing of a fowl, a living thing comes from it. Who can understand this? Who ever knew how the heat of the hen produced the chicken in the egg? This is incomprehensible to us, yet we do not deny the fact. Let us do like the hen. Let us place these truths in our hearts as the hen does the eggs under her wings; let us sit upon them, and take the same pains, and something will come of them."—*Anderson*.

Our next subject will be upon the eggs of different birds. /

	PAGE
What is the difference between the egg of a bird and that of a reptile?	105
Out of which portion of an egg is the bird formed?	105
Of what use is the yolk?	105
What is first to be seen in the white fluid, after the hen has sat upon her egg?	106
What spreads over the skin of the yolk after the first red spot is formed?	107
What nourishes the forming bird besides the yolk?	107
How does air get into the egg?	107
What is placed on the tip of the young bird's beak?	107
Why can a fresh hatched bird live a day without food?	108

Lecture Eleven.

ON MIGRATION, THE EGGS OF BIRDS, AND THE LOVE OF PARENT BIRDS.

IN our ninth lecture, the swallow was said to be a migrating bird; that is, one which moves at stated periods from one part of the world to another. This flitting life prevails amongst a large proportion of the feathered races. Our cuckoos, warblers, and other birds fly for the winter, like the swallow, to the oases, or woody parts of the warm African lands. / Indeed the whole of Europe, the whole district of Asia north of the Himalayan Mountains, and from hence the whole of Africa north of the Mountains of the Moon, form together one grand field, over which birds of somewhat the same species, flit about from north to south, and south to north.

The most southerly points of Asia and Africa, with their adjoining islands, possess a few birds like ours, but more that are peculiar to their own

districts. Marked distinctions are also found among the birds that live in the two continents of America ; many of which birds fly in each of those vast districts, from north to south, and south to north, as the seasons change.

Among the birds that lay their eggs in Great Britain, but few of them continue in the same place during the whole year. Some species of eagles, kites, all poultry, the pheasant, partridge, black-bird, thrush, robin, sparrow, little wren, &c., may be called tarriers at home : yet as the seasons change, some of these move off in flocks, going to distant counties in search of their peculiar food.

The rest of the birds that enliven our country, come either as summer or winter visitors. Such as the wild-duck, woodcock, and snipe, whose home is in the far north, are winter birds. They arrive on our shores in the autumn, to remain with us till the spring. Stragglers stay behind and rear their young in our marshes and woods, but the main flocks of such birds fly back in the spring to Scandinavia and other northerly regions of Europe, there to make their nests and enjoy the summer.*

* Some woodcocks remain with us to lay their eggs, but they are rare. Snipes much more frequently continue in Britain, yet the chief flocks of these birds migrate for nesting.

Our songsters that winter in the south, arrive in April and May; make their nests in our hedges and shrubberies, and after clearing away innumerable quantities of seeds, insects, and grubs, fly back to the south in the autumn. A few of these birds stop and winter in the mildest parts of Europe; but even such prefer during the summer, to seek their food and rear their young in the genial climate of Britain.

Thus, as the seasons change, each portion of the earth is supplied with a relay of useful and ornamental labourers. When the northern birds depart, the summer ones arrive; and again, as the summer ones depart, the winter ones return. No one tribe idles away life;—all races are actively employed in performing their successive tasks, in rearing their young, and in preserving a due balance among the fast increasing families of seeds, creeping things, and flying creatures.

The number of eggs that birds lay, varies considerably. Large birds of prey which live upon flesh, such as eagles, vultures, and falcons, usually lay two eggs, sometimes three! but they do not often hatch more than two birds, and often only one. About five eggs is the average number laid at a time by the smaller species. Birds that live principally upon seeds and insects, and thus find

abundance of food, often hatch two and three broods in the year, so that their families, as we witness every summer, increase rapidly. Whole flocks of sparrows, yellow hammers, finches, starlings, and other birds rise at once from the hedges, causing the small boughs to dance by their spring as if every twig were alive.

Birds of prey that fly by day, have eggs either of a whitish colour, spotted with red, or of a light reddish ground spotted with brown. Owls, which fly by night, have pure white eggs. And some birds of prey, chiefly the harriers, lay unspotted eggs like the owl. Birds also that nestle in hollow trees, in walls, or rocks, have usually white eggs. The wood-peckers, bee-eaters, king-fishers, and sand-martins, have pure white eggs.

Birds that nestle at about the same height in trees, like the raven, crows, and pies, have usually greenish eggs, sometimes spotted or picked over with brown.

The eggs of wading birds are of several colours, grey, yellowish, greenish, bluish, and reddish, with spots sprinkled over them.

Perching birds again have eggs of several hues, whitish, bluish, and greenish, usually spotted with either red, brown, or black.

Poultry have mostly white eggs; some however

have the ground tinged with green or yellow, and one species in South America, lay purple eggs.

As we examine the history of birds, we shall find their Creator has in a variety of ways protected them from harm. A quick eye and thinking mind will soon discover that in most instances, birds, which deposit their eggs on green herbs, have eggs more or less of a greenish hue: that birds such, as the lark and partridge, which make their nests on the ground, have eggs more or less of a brownish hue. The colour of the eggs and of the nest, as also the dress of the hen, being frequently suited to the place where the mother bird is to sit. In the East where gay flowers abound, the hens are bright coloured; while in our more northern districts, the plumage of the hen is generally less gay in its colours than that of the cock bird.

During a tour in Lapland, Mr. Wolley noticed a curious instance of the care the spotted redshank takes to conceal its nest. At the breeding season, this bird is dressed in an almost entire suit of deep slaty black feathers; and he constantly found that in the large pine forest where charcoal is burnt, the situation this bird selected for its nest, was at the foot of trees where some of the black dust had been left. Consequently the colour of the ground

and that of the bird so perfectly agreed, it was difficult to find its eggs.

During the time that a hen is sitting, the cock bird is usually very attentive. He cheers her with his song, and amongst many species feeds her from his own bill, not unfrequently taking her place when she leaves the nest for more food or for change.

The noble swan stands on one leg for hours together by the side of his partner as she rests on her round nest of sticks, reeds, rushes, and leaves. With arched neck and mild complacent eye, he looks half dozing by her side, yet he is on the watch, for at the sound of distant footsteps he elevates his neck, and listens cautiously. Should the sound near, he will slowly and solemnly drop the leg hidden beneath his snow-white plumage, and with rising wing and outstretched beak, stand ready to strike a blow at the bold intruder upon his domestic quiet. You had better not go too near, or you may have to retire with a broken leg. For six weeks the swan continues this close attention: the male bird mounting the nest whenever his mate wishes to quit it for a short time. At the end of six weeks, the shell is cracked, and the dark slate-coloured cygnets appear. Now begins the joyous period of a bird's life, the care of its

young, that loving care, which the Sovereign Lord and Preserver of the world has planted in the parent's heart for its young and helpless offspring.

The young of four-footed beasts, that receive nourishment from the mother, require no other food than that which she can give them. A cow wants no help in feeding her calf. The mother therefore alone notices her offspring. It is much the same with the poultry hen, upon whom devolves the chief care of providing for her brood. Her young immediately run alone, and as their food of seeds, grain, ants-eggs, and greens is on the ground, the cock bird has little occasion to assist in procuring it. With the greater number of birds, however, much labour falls upon both parents. Their nestlings have usually to be fed with food brought from a distance, and upon food often difficult to be found; accordingly their Maker has beautifully ordered that the exertion of feeding the nestlings of such birds shall be divided between the father and the mother: consequently they both equally love and watch over their little ones. It is said that a pair of robins will carry to their young 3400 caterpillars in a week. During this anxious time of hatching and feeding, birds display courage, discernment, and patient endurance. I shall relate

a few stories on these points ; the first one or two on courage.

The attention of a party of gentlemen fishing on a river, was excited by the hurried actions of a pair of swans, with seven young ones collected between them, all pushing up the stream in great haste. At first they thought the birds were making for the boat in the hope of receiving bread ; but no—on they went, and soon three of the young ones leaped on the back of the mother, who, elevating her wings to receive them, displayed the brilliant whiteness of her plumage in fine contrast to the grey down of the young ones. It was difficult to account for the scared appearance of the party, until at length a magnificent old swan came in sight, rapidly ploughing up the water. This bird it was clear to see, was in high pursuit of the family group, which it seemed had been trespassing upon what he deemed his rightful portion of the river, and to escape from his indignant fury, they were now hurrying away. As the noble bird gained upon the family, on they went, with growing speed, and in their haste, one of the little ones slipped off its mother's back. There was distress, a weakling left behind, struggling along and uttering shrill cries of terror. Up at last came the mighty and indignant bird, and then the father, inferior to the

attacking swan in age and strength, turned to meet him, while the little family huddled close to the mother, and made full haste to escape up the river. Proud as was the stranger swan, the young father was equally so, and throwing back his neck between his arched wings, he faced the giant. This was unexpected, and across the stream they kept sailing backward and forwards abreast of each other, like two war ships. It was a sight worth beholding, to see the watchful turns of their graceful necks and bodies, as each tried to take advantage of the other. At last it seemed as if the battle must come on, for each swan raised himself out of the water, and made a show of attack. By this time the affectionate mother had guided her young ones to a place of safety, which the old swan catching sight of, gave up the conflict, as if satisfied that he had driven the intruders from his royalty. So they parted. The young one went up to receive his reward from the mother of his family, while the great old swan rubbed his neck on his wings and dropped down the stream, evidently well satisfied that he had given the trespassers a lesson.

This scene of the two threatening swans had been watched by a small dog on the banks of the river, who appeared quite to enjoy the prospect of a conflict. At first he sat upon his tail, but as

the affair became more serious, he couched, and when the birds lifted themselves up, as in act to fight, he dropped his head on his outstretched fore legs in all the ecstasy of an amateur; but when he found all was over, he shook himself like a sensible dog, and left the scene.*

The next instance of courage I shall name, was a conflict between a black-bird and a cat. Puss had frequently been seen on the top of a pale-fence near Richmond, watching a black-bird on her nest. On the near approach of the cat, the hen left the nest, flew to meet the cat, and having placed herself almost within reach of her talons, uttered the most piteous screams of wildness and despair. The cock bird perceiving the advance of the enemy, joined the hen in loud outcries, and as he flew about, often alighted for a moment upon the paling before puss, who was unable to give a spring at the nest from the narrowness of the wood. After a time the cock bird flew at the cat, settled on her back and pecked her head with so much violence, that the cat fell to the ground followed by the black-bird, who then succeeded in driving her away. A second and a third time pussey tried to get at the young birds, but with no

* Slightly shortened from "Zoological Recreations."

better success, and after each battle, the black-bird celebrated his victory with a song, for several days afterwards hunting the cat about the garden whenever she left the house.* ~~X~~

A touching instance of parental love being stronger than the fear of man, was witnessed by a lady whom I have known for many years. She tells me in a letter, "I was walking near Binfield, in Berkshire, on a raised pathway, bounded on one side by a road, and on the other by a ditch and hedge, when a little bird sprang out of the ditch, and flew at my feet and against my dress with such an appearance of extreme distress, that it immediately occurred to me it was demanding help. ~~I~~ I looked carefully in the ditch and on the bank, and soon discovered its nest, and in the nest a snake busy with the young birds! Having no weapon by which to strike down the snake, I called a man from the road, but the wily foe glided away too quickly for him. One of the nestlings was evidently injured. I then placed the nest in what I thought a more secure situation; but can give no further account of its history. But the confiding and urgently entreating air of the little bird, I certainly felt as an appeal from the poor mother to aid her in the extremity of her agony.

* "Jessie's Gleanings."

Whether birds have any power of reasoning, that is, of thinking “If I do such a thing I shall be helped,” we do not know, though it is clear that at times both birds and quadrupeds look up to man for assistance ; this truth renders the following remarkable conduct of a duck under anxiety, not unnatural.

A pair of ducks hatched in Westmoreland, had been kept for some time in the town of Kendal, but were at length sent for country air to a farmhouse on the mountain side. Whilst the kitchen maid was busy one morning churning, she was greatly worried by one of these ducks making a great noise. She tried to drive it away, and each time she followed it, it went off briskly, but on her turning round, always came back with redoubled clamour. At last she determined to follow it as far as she could. The duck then led her across two fields to a hedge, by the side of a piece of water, and in that hedge the young woman beheld its fellow duck sticking so tightly that it could not extricate itself, and needing human aid to save its life. This help its companion had brought it. The duck had no words to use, but by energetic persevering signs and a voice of clamour, it had made its wants known.

Now whether this duck acted upon reflection, or only upon an instinct implanted in animals to look up to man, is just one of those mysteries in the world which we must leave, because we have no means of deciding upon which is right.

For discernment, I shall relate the tale of a goose, which is said to be a fact. A man, looking over his flocks of geese near Dickleborough Common, in Norfolk, missed one morning a fine brood of thirteen well-fledged goslings. On making his loss known, he was told that a collector of geese for the London markets had passed a short time before with a flock of some hundred birds. He asked no further questions, but catching up the mother goose, put her in a sack, and waited till a coach passed on the road; away then went goose and man at the rate of ten miles an hour till they came to Epping Forest; there he saw a large collection of geese feeding on the green grass. He begged the coachman to stop, and charged the keeper of the flock with having stolen his thirteen large goslings. The man denied the theft, but said in a confident air, "If you know your own, go amongst my hundreds, and pick them out!" "I cannot do it myself," was the reply, "but I have one with me who can;" and running to the

coach, the farmer took down the sack, untied it, and turned off the old goose amidst the noisy gabbling crowd of feeding birds. In a few minutes, much to the amusement of the people on the coach, she called out her goslings and marched off with them in triumph. The owner of the goose was well contented, and highly approved the mother's keen sagacity. The goose is often said to be a stupid bird; this is quite a libel, for I have heard and read more stories of its sharpness, and of its lively affection for men and animals than of most other birds.

Our evening lecture must close, as soon as I have related an instance of parental endurance in two little fly-catcher birds, which for many years had built their nest amidst the leafy vines on Mr. White's house at Selborne. One spring, probably whilst the weather was cool and shady, these birds selected a naked bough for building upon, but no sooner did the hot season set in, than the reflection of the sun's rays upon the brick wall, rendered the heat insupportable to the half-fledged little birds. Under these circumstances they must have perished, had not the distressed parents contrived, with wings expanded, and mouths gaping for breath, to hover over the nest, and thus to screen their young ones

from the fierce heat. The fatigue and pain the birds underwent they heeded not, but alternately hovered on, although not a particle of their usual labour in seeking food for their loved nestlings was diminished. Love surmounted all difficulties, and saved their little ones.

Our next subject will be on the bones of birds.

How many eggs do large birds of prey usually lay?	114
What is about the average number of eggs laid by smaller birds of prey?	114
How many broods do other kinds of small birds bring off in the year?	115
What food do those birds eat, which lay the greatest number of eggs?	115
Why do birds migrate?	113
What circumstance marks the care that is taken to protect birds and their eggs?	115
Why do both parents usually watch over their young birds?	118

Lecture Twelve.

ON THE BONES OF BIRDS.

+ WE have hitherto been considering the general appearances of birds, as well as those of their nests and eggs. Let us next turn our attention to the *frame-work* of the bird's body, and consider how it has been fashioned, so as to enable the living creature both to run on the ground, and to wing its course through the air. +

First let us examine its bones. These are remarkable for their strength and lightness. A chicken's bone, when held in the hand, does not look much unlike the bone of a rabbit, or of any other small four-footed animal. Both of them are white and solid. Yet naturalists who have examined the two kinds of bones, see a material difference in their composition. The bone of the quadruped

is a substance of the same quality throughout, and is pierced all over with numerous small holes; the centre of the larger bones being left hollow, and that hollow filled with marrow. The bone of the bird on the contrary, is formed of layers of a firm and rather elastic substance; these layers being so pressed and glued together that the outer part looks solid, while the cavity in the middle, instead of being supplied with marrow, is filled with air. This peculiar formation of the bone, renders it very light yet very strong. Bishop Stanley tells us, that two inches of the leg-bone of a goose, being weighed against two inches of the leg-bone of a rabbit, both measuring the same thickness round, differed materially in weight. The bone of the goose was nearly half as light again as that of the rabbit, weighing only 48 grains, while that of the rabbit weighed 75 grains; and yet the bone of the goose was so strong, it could not be broken in two by the hand.

The pelican is a large bird, it is sometimes six feet long from the point of the neck to the end of the tail, and twelve feet across from wing-tip to wing-tip. A large skinny bag is placed under the lower mandible of the beak, which will hold twenty pints of water; indeed, at a single fishing, the

pelican will sometimes tuck as much fish into this bag, as would dine six men. This great bird swims on the water, and also flies very high. It must therefore be strongly built, and yet strange to say, all the bones in its body do not weigh more than one pound and a half; and are so very slight in their texture, they are almost transparent. In the case of such a bird as this, we at once discover the wisdom of its bones having been formed of elastic plates, and of their cavities having been filled with air.

In preparing the bones of animals, the Almighty Creator seems to have acted upon the principle that a fixed quantity of material, moulded into the form of a hollow tube, will make a firmer and stronger support, than when the same quantity is compressed into a solid stem of equal length: just because the leaving a cavity, causes the same amount of substance to extend over a wider space than when it is pressed close together. This principle He has also carried out in making wheat straw. There is very little stuff in the walls of a straw; were it all to be packed together, so as to form a solid stem, it would turn out but a slim and weak pillar; but the same amount of substance spread out into the shape of a hollow rod, forms a

tolerably-sized tube, and one which can bear a surprising weight. I once saw two pieces cut off a straw, each of them about an inch and a half in length; their ends were made perfectly even; and as the finger steadied them on a table, a board was placed upon their tops, and upon the board an iron weight of one pound. The fingers were then quietly removed, and the short lengths of straw left to stand by themselves with the weight upon them, which they bore well. A two-pound weight was next placed upon them; they supported this weight also: then a three-pound weight; and they bore this pressure; then a four-pound weight; with this, down they broke. They could not support much beyond the three pounds, but you will think this was indeed enough for a couple of straws!

From this experiment, as well as from many other facts, it appears that bones have been made hollow in order that the greatest possible degree of strength and firmness may be given to them, at the same time that only a small amount of material is used in their composition. One reason why the bones of birds are lighter than those of other animals, is the greater size of the hollows within them. If you closely examine the leg of a chicken, you may see that the hollow in it is larger for the

size of the bone than the hollow in the bone of a quadruped.

All the air which fills the cavities in the bones of birds, is poured into them from cells or little chambers found in various parts of the body. These cavities are charged with air pressed into them from the lungs, or breathing instruments of the bird. These little cavities are united together by fine channels and tubes; the ends of the tube passing into the bones and even into the quill ends of the feathers. Thus the bones, the cavities in the flesh, and the feathers of birds, are filled with air, as a sponge is filled with water. So much air do birds draw in, that two sparrows, in the act of breathing, take up as much into their bodies as the larger guinea pig requires. This great supply of air inside the bird, makes its pulse run so fast that we are unable to count it, and even brings the blood up to what we should consider fever-heat; the warmth in the body rendering the interior air thinner and lighter than the outward air, and thus giving to the bird a buoyancy something like that of a balloon.

This buoyancy is a beautiful provision for a living thing intended to soar far above the earth. Fish have a bladder for holding air, which is placed

close to the back-bone ; and as they fill it or empty it, so they are assisted in sinking or in rising in the water.

Birds, by reason of their numerous air-cells, may be said to have bladders all over them, and the air that fills these cells becoming, as before stated, heated by the warmth of the blood, expands during its passage round the body, just as other fluids expand under warmth. Steam is only water occupying a larger space, because heat has separated its particles.

The quantity of heated air in a bird, not only renders its body lighter, bulk for bulk, than those of other animals, but enables it to breathe in places where a man would gasp for breath. On the tops of high mountains where the air is very thin, men pant, turn giddy, and faint, whilst birds seem to feel no discomfort. The great Condor eagle will suddenly rise from the deepest valley, and soar far above the summit of the most lofty peak of the Andes. The frigate bird almost lives and sleeps in the skies. It is seen in the hot tropical parts of the world, floating with long out-spread wings high in the air, riding there as easily as the fleecy clouds. Its long wings and light bones certainly help it to rise into the skies, but its power of

floating there, lies in the enormous quantity of light air within its body. In addition to the amount birds usually possess, the frigate bird can at its pleasure fill a large pouch that is placed under its throat, and from thence force the air onwards between the flesh and the skin, as well as into the lungs. Thus puffed out with heated air, the bird is rendered so light, it floats as if it were lying on the atmosphere. It seldom comes on land but to lay its eggs, neither does it need to rest on the waters, but when hungry, darts from on high to skim along their surface, and when it has seized upon a fish with its talons and beak, again rises on high.

Birds intended to live near the surface of the ground, have not so large a quantity of air-chambers in their bodies as the high flyers; and if, (as an experiment,) they are sent far up in a balloon, they, like other creatures, suffer from feeling half-suffocated.

The free air in which birds constantly abide, and the large amount of it contained in their bodies, renders them highly excitable creatures. A bird eats much and sleeps little, and is full of ardour, energy, and vigour. Men and animals that live in low damp countries have usually soft fibres, dull

sensations, and heavy intellects, compared with those that live in higher and brighter situations. Fine air makes the muscles firmer, the nerves more irritable, and the intellect more acute. So birds that inhabit the wide expanse of the atmosphere have generally dry hard muscles, and this firmness of fibre adds in no small degree to the vigour and rapidity of their motions. But as this extreme activity wastes the blood and flesh very quickly, birds necessarily require much food to repair their powers. A green-finch, a gold-finch, and sixteen canaries were fed at one time on weighed food, on purpose to see how much they consumed ; and it was proved that they ate of canary seed, and of a thick paste made of flour and egg, as much, compared with their weight, as if a man were to consume in twenty-four hours, twenty-five pounds of meat.*

Besides the energy and quickness of digestion that air gives to birds, it aids them in another way. The air-chambers in their bodies form soft cushions or elastic paddings, upon which the bones and joints press down, during the quick and sudden turns birds are constantly taking in their rapid flights. But for some such protection as this, their bones

* Stanley.

would have been in continual danger of being either broken or dislocated.

Yet notwithstanding the airy lightness of birds, these creatures never could have risen far above the ground without wings. The wing is a masterpiece of mechanical skill. It is composed of bones, muscles, flesh, and feathers. Not of one bone, for that would have stuck out as stiff as the branch of a tree, but of several short bones united by joints, as you may notice to be the case with our arms, where one bone reaches from the shoulder to the elbow, and below the elbow-joint, two others roll side by side, which bones are again joined at the wrist to the shorter ones that form the hand. Precisely is the same style of division found in the bird's wing, only the bird, from not requiring fingers, has fewer bones at the tip end of its wing.

This jointed division of the bones, enables a bird either to fold up its wing, or to strike it out on the air like an oar. When folded up, the wing lies against the side of the bird, much as our arms are folded when we place the elbow close to the side, the wrist against the shoulder, and the fingers doubled inwards upon themselves.

†

Skeleton of Swan.

+ Li beam

a 23 vertebræ in neck. *b* Caracoid or side bones. The Scapula or shoulder bone very small, it lies embedded in the muscles of the shoulder, close to the head of the humerus bone *l*, and in form is like the blade of a knife.

c Merry-thought or furcal bone ; each separate bone is called a clavicle. *d* Sternum or breastbone. *e* 2 carpus bones, one joined to the ulna bone, one to the radius bone. *f* Metacarpal bone. *g* Phalangers or fingers. *h* Ulna bone. *i* Radius bone. *k* Humerus bone. *l* Head of humerus bone, upon which 12 distinct actions pull.

We shall next examine the joints and muscles which belong to the bird's frame-work.

	PAGE
When you hold two bones, the one of a quadruped and the other of a bird, in the hand, what is their appearance?	123
What difference do naturalists discover in the formation of the two bony substances?	128, 129
With what are the hollows in the bones of quadrupeds filled?	129
With what are the hollows in the bones of birds filled?	129
How much do the bones of a pelican weigh?	130
Why is a tube stronger than the same quantity of stuff made into a thin pillar?	130
How is air carried all over the body of a bird?	132
What makes the air expand in the cell-bags of a bird?	132
What two advantages does a bird gain by having a quantity of heated air inside its body?	133
Which is the important limb on the body of a bird, that enables it to rise in the air?	136
Which limb on our bodies does the wing of a bird resemble?	136

Lecture Thirteen.

JOINTS AND MUSCLES OF BIRDS.

X
HAVING described the bones of the bird, we have now to examine the way in which they are fastened to one another.

You are aware that when an animal dies, its bones soon separate; its skeleton cannot then hold together, because the pieces of which it is formed do not adhere. During life, the several bones are fastened to one another by a beautiful provision of bandages, called tendons, which are a kind of tough fleshy strings, laid thickly side by side, until they form elastic cords. When these cords come to a part where two bones meet, their fibres spread out, and make a flat strap that wraps over the bones; some of the fibres even pass into the hard bony substances, to hold them the more tightly together. The outer sides being thus securely

bound together, the ends of the bones, which are hollowed and rounded to make them fit into each other, are left at liberty to roll and play upon their tips with the ease and motion of a jointed hinge.

Whoever has cut up the leg of a chicken, cannot but remember the strength of the bands or tendons that are wrapped round the joints; neither can he forget how numerous are the tendons which extend down the drum-stick of the leg. In a turkey they are so strong, that in preparing the bird for the table, the cook finds it needful to tear some of them away by main force, and often cannot succeed in doing this, until she obtains a leverage by bending the leg round the side of a door.

The first bone in the wing of a bird, that is, the one close to the chest, presses upon the points of three others; the shoulder bone,* the merry-thought,† and the side bone.‡ This tripod of bones makes a firm foundation for the end of the great wing-bone to roll upon, so that just at their point of meeting, a very curious joint is formed; one that is neither altogether a cup-and-ball-joint, nor a hinge joint, but which has in itself something of

* The scapula.

† The furcal bone. The two furcal bones when united, are called the clavicles, or merry-thought.

‡ The caracoid.

both these contrivances. (*See skeleton of swan, on page 137*). This peculiar kind of joint enables a bird to lift its wing up and down, and to move it backwards and forwards with great ease, elegance, quickness, and power. It is a joint exactly suited for the work it has to do, and that work is by no means trifling, since twelve distinct actions of the bird pull upon this one joint.

Muscles from many parts of the body are fastened to the bones, the ends of which form the great wing-joint, and as these muscles pull at the bones, so the position of the joint is altered, just as pulling at different cords alters the movements of a ship's sails. A bird may have to take an upward, then a downward flight, or a forward, backward, dipping, hovering, or sideway flight; instantly changing from rapid to slow, and from slow to rapid, according as the feelings of the bird prompt it to move. At every one of these changes, whether important or slight, the position of the wing has to be altered, and therefore the joint has to be drawn upon in a different way. *Scarcely* a muscle in the body can be moved, without its action, in some way or other, running forward to the great wing-joint; fancy then the heaving, rolling, opening, shutting, and pulling that is going on in that curiously made hinge. It would be no easy task to count its

varieties of movement. By altering the position of the twenty-six letters in our alphabet, hundreds of millions of different words can be made ; just so it has been said, it would be next to impossible to reckon up all the movements and positions which the great wing-joint of a single bird can display.

Whilst the animal is using its joints, the constant friction, or rubbing, that takes place at the ends of the bones would soon occasion great pain, and also wear away a portion of the bones very quickly, had not their ends been protected by a covering of smooth tough padding, called gristle. To keep this tough gristle soft and pliable, a gland is placed near the joint, in which oil is secreted ; and this oil is made to flow out by a small drop at a time, and so to wash over the inside of the joint. When over-exertion exhausts this oil, the bones are believed to lie closer together. At least, a recruiting sergeant found the men he had enlisted in the morning of the right height, had fallen in the evening under the mark, after a long day's march. It is supposed, that the oil between the joints of the backbone became dried up by the exertion, and that consequently, the bones had fallen closer together. When this happens, pain and stiffness follow.

The wing-bones of a bird are pulled upon by many muscles, three of which, called the pectoral muscles, are very strong, and run the whole length of the wing. The middle pectoral muscle is so thick, that it weighs more than all the other muscles in the body put together. This great muscle springs from the inside of the breastbone, where its fibres are widely spread out. As it leaves the breastbone and passes on to the wing, it goes through a hole in one of the bones, which forms a support to the great wing-joint. This hole acts as a pulley for the muscle, and by means of it, the pull can be thrown into the proper direction, and the wing lifted up with a rapid heave.

Another great pectoral muscle sweeps over the top of the joint. This muscle not only bends down the wing, and thus enables the bird to give a powerful strike upon the air, but being wound round all the bones near the wing-joint, it helps at the same time to lift up the joint, and so to tighten and keep steady the strong pulley muscle. These two great pectoral muscles give the flying strength to a bird's wing. In the case of the swan, they are so strong, that the flap of its wing has been known to break a man's leg; and in the

case of the eagle, men have been struck dead by a similar blow.

The pulling force of these muscles greatly strains the bones to which they are fastened, and therefore to keep the hollow bones from breaking, where the great pectoral muscles clasp their sides, and pull against them like cords, little rings of bone are placed all round their interiors. These rings are often tied together by cross pieces, so that although the bones themselves remain excessively light and full of air, they are nevertheless wonders for strength. +

Slow-flying birds have short bones in their wings; fast-flying birds have long bones. Long bones enable a bird to dash on through the air, as long oars send a boat driving through the water. But whether short or long, the wings of birds are always feathered, and the surface that strikes upon the air consequently extended beyond the stretch of the bones. X

A bird, whilst it either sails straight along, or descends slowly towards the earth, lays the whole of its broad wing upon the atmosphere, somewhat as the open palm of the hand might be pressed upon it; but after each downward stroke, when the bird desires to ascend, the wing is turned slightly

edgeways, so that the large feathers glide easily up through the air. This arrangement enables the wing of the bird to slip through the air without feeling much of its resistance; and without much exertion, it enables the wing to lift up the body, notwithstanding the weight of air that presses upon its whole surface.

The vast strength of the pectoral muscles can only be conceived (and at last but partially conceived), by considering the length of time a bird can keep on the wing. A little tom-tit once alighted on the mast of a ship, when the vessel was nine hundred and twenty miles from land. How many thousands upon thousands of times must the strong pectoral muscles of that little bird have struck upon the air, flapping down and lifting up the wing, without taking rest, and yet they were not worn out. An owl has been seen gliding over the midst of the Atlantic Ocean, with as much apparent ease, as if it had been seeking for mice amongst its native fields. The swift, which is a species of swallow, is known to be sixteen hours in the day darting about after flies. If the little bird felt tired, it would stop, because it is the will of a living creature that keeps it moving; the will having in every action that an animal per-

forms, to give an order to contract or to lengthen the muscles.

When swallows migrate, it is believed they fly mostly at night, speeding along at such a rate, that in three days they pass from England to Sierra Leone, in Africa, a distance of three thousand miles. Even a common sparrow could go there in a fortnight without fatigue, and find plenty of time for roosting on the way.

High in the air, over the South Pacific Ocean, the tropic bird is occasionally to be seen flitting about hither and thither, and by its movements, displaying immense power of muscle. Its wings measure from tip to tip, fourteen feet across, yet to so great a height does it ascend, that while in rapid motion, it often looks like a stationary speck shining as a spangle against the dark blue sky. Then suddenly checking its course, it will descend with the rapidity of a meteor, and hover for a while over the topmost-mast of a vessel, from whence, with its two long projecting tail feathers streaming in the air, it will dart downward upon a shoal of fish, and again rising gracefully with its prize, soar aloft to rest above the clouds.

In passing across the Pacific Ocean, between the Cape of Good Hope and Van Dieman's Land, Mr. Gould, the naturalist, witnessed the vast power

of wing possessed by the chocolate coloured giant petrels. These birds are met with over all the southern oceans. They are between the size of a duck and a goose, and have such powers of flight, it is thought that they frequently perform the circuit of the globe.

One of the petrels that followed the ship in which Mr. Gould was sailing, chanced to have white feathers, from which circumstance it was easily noticed; and whilst the vessel sailed along at the rate of nearly two hundred miles in the day, this white petrel was watched for three weeks, not merely following the ship, but hovering around it. At intervals, it was seen for half an hour hunting up the track of the ship, to secure any offal that might have been thrown overboard. At other times, it was employed in scanning the ocean in immense circles of twenty miles round, flying at the speed of eighty or a hundred miles an hour. From these facts Mr. Gould calculated that the giant petrel must have performed the enormous distance of two thousand miles in twenty-four hours.

Powerful and tough, firm and elastic, must have been the pectoral muscles of those wings, which could keep so large a bird joyfully dashing at the

air with the regular action of a steam engine, for days, weeks, and months together !

If we look at the size of the bones in a bird, at their lightness and strength, at the form of the joints, and the vigour of the muscles ; all these things must strike us as admirably adapted for the use of a flying creature, and as such, betokening not only the wisdom of the Creator, but His endless powers of contrivance.

Let me then ask you a serious question. In what place does the Maker of the bird prepare for it, all its varied apparatus for flight ? Does He make it to suit the wants of the bird after He has given it a will to mount into the air ? Truly not. Before the sun shone upon its light body, before the soft air blew upon its wings, or filled its countless air-vessels, all was prepared inside the dark chamber of its egg-shell. The Lord God accomplished within those thin lime walls, what He had planned from all eternity,—a creature suitable to live joyously in the air, as well as to rest on the ground. Surely there is a voice in the perfection of these things, which declares more loudly than a thousand trumpets could, that matchless skill, power, and love, direct the works of His creation. Never forget that Wisdom is

shewn as conspicuously in all the works of God, as Power.

We have next to consider the back and breast-bones of birds. *f*

	PAGE
When an animal dies, do its bones long hold together?	139
What keeps them together during life?	139
What shape do the tendons assume, when they bind over the ends of two bones, so as to turn them into a hinge?	139
Upon how many bones does the first wing-joint press?	140
What are the names of the three bones that support the first wing-bone?	140
What substance is wrapped over the ends of bones to prevent their being worn out by friction?	142
How is the gristle kept moist?	142
What are the names of the two greatest muscles in the wing of a bird?	143
Upon what part of the bird's bony skeleton are the pectoral muscles fastened down?	143
How are the pectoral muscles fastened down upon the breastbone?	143
How is the inside of the wing-bone strengthened so as to prevent the pull of the muscles from breaking it?	144

	PAGE
What length of wing have slow-flying birds? .	144
When a bird descends, how does its wing lie upon the air?	144
When a bird is rising in the air, in what position does it place the wing?	145
In what place is a bird's flying apparatus pre- pared for it?	148

Lecture Fourteen.

ON THE BACK AND BREASTBONES OF BIRDS.

ANIMALS that move on the earth, and birds that fly in the air, have no intellects by which they can reflect upon the wonderful formation of their bodies. Man, on the contrary, is gifted with a mind that can examine the skill with which the animal frame is put together ; and as far as we have investigated this subject, it has supplied us with much cheerful interest, as well as reasons for lifting up the voice of praise.

In continuing our study this evening, I shall commence by asking a question—"Have you ever noticed the great care that is taken to guard the head and back of an animal from sudden jars, during the time its front limbs are being powerfully exerted ?"

When a horse takes a leap, or when it gallops—

when a bird flies, or a man thrusts out his arm, considerable force is used. Were the legs of the horse, the wings of the bird, or the arms of the man attached directly to the backbone, a sudden check in speed, or a strain in pulling, would endanger instant dislocation of the spine; such an accident, by disturbing the vital nervous matter that runs from the brain down the hollow of the backbone, would quickly bring on death or paralysis. To defend an animal from such injuries, the front limbs are given a slow play upon a bone, that is separate from the back. Our arms pull upon the shoulder blade—the front legs of the horse pull upon the shoulderbone—and the wing of the bird upon three separate bones. These various distinct bones, which are united to the back by elastic muscles, receive the first shock of the animal's rapid movements, just as the springs of a carriage receive the first joltings of a rough road.

The backbone of a bird is differently made to that of any other animal. With men and beasts, the spinal bone is composed of a number of small jointed-pieces that fit into each other; such backs easily bend, whilst that of a bird looks as if it were all of one firm substance. On cutting up a fowl at table, you may however see by a little attention, that the back is not all of one piece, but is com-

posed of five pieces, which are fastened together or soldered down at their edges. Had the backbone of a bird been made as moveable as are the joints in its neck, the pull of the wings in flying would have curved the back inwardly. And again, had it been made of one entire solid piece, a sharp blow or a sudden turn might have snapped it in two. Great wisdom then is shewn in making the backbone of a bird so nearly solid, that it is firm enough to resist a pull, and yet sufficiently elastic by its division into five pieces, to yield to the bird's quick turns.

The breastbone of a bird is formed like the back, of five pieces of bone, all so closely united at their edges, that at first it appears as one large bone. The shape of this breastbone, as we said in our first discourse, somewhat resembles that of a boat or long oval basket, the middle of the bone always having a ridge along it, not unlike the keel of a boat. The breastbone of the bird is made longer or shorter, and the ridge in the middle higher or flatter, according as the bird is intended to cut through the air, to rest upon the water, or to climb up and creep upon trees.

The breastbone is of great use to a bird; it gives solidity to the whole of its frame-work, and forms a ground floor or wide base, upon which to fasten down, and keep steady the powerful wing

muscles; just as the sides and bottom of a boat make a firm foundation upon which to fasten down the ropes that hold in, and guide the swelling sails.

The breastbone also forms a kind of box, which, during the time the body is stretched out in flight, holds up the soft inside of the bird. Thus the harder the wings pull at, or lift up the great muscles which are spread over the inside of the breastbone, the more do those muscles hold up like ropes, the weight of the bird. They bear its weight up to the wings, and the wings again by their long arched form, lay it upon the air. Thus as the bird flies, it is almost insensible of the fact that its body is heavy. Who that hears of this admirable contrivance to relieve a flying creature from the pressure of its own weight, by causing the muscles to lift it up, and then to throw it upon the air, can do otherwise than magnify the wisdom and the kindness of its Creator?

At the crop end of the breastbone are two thin bones, often called the merry-thought. These two bones are joined at the top, and form a fine elastic arch, to keep the wings (whilst in the act of beating the air) from being drawn too near to each other. The merry-thought and its neighbouring side bones, are quite peculiar to birds; no other animal has

any bones like them, for no other creature is subjected to the danger of having its front limbs pulled together with the same force as the bird is, when upon the wing. Some of the small parrots which need but little power of flight, are not given a merry-thought, and a few of the smaller owls are almost without a regularly arched bone.

Thought and skill are stamped upon every bone and muscle in the body of a bird. A naturalist on looking at the skeleton of a swan (*see page 137*) struck by the wonderful contrivance displayed in the arrangement of its bones, exclaimed, "What an admirable piece of animated ship-building is the body of this bird! how the ribs rise from the broad keeled breastbone! See how they lift up and support the shoulder and broad back; what a goodly deck too does that back form for the young cygnets to rest upon, as they ride beneath the sail-like wings of the parent bird finely arching over them! How the twenty-five vertebræ of the neck rise into a noble ornamented prow, crowned with the graceful head! And how skilfully are the oary legs and feet placed, just where their strokes can be best brought to bear for the purpose of putting the living galley in motion. It is a work worthy of the Great Artificer!" *

* The words in this quotation slightly altered.

Clothed in his snowy plumage, the swan with arched neck sails majestically along the placid river! Its appearance is well described in the following lines:—

“Fair flows the river,
 Smoothly gliding on;
 Green grow the rushes
 Around the stately swan.
 What an isle of beauty
 The noble bird hath found;
 The greenest trees and stateliest
 Grow all the isle around.

Low bend the branches
 In the water bright;
 Up comes the swan sailing,
 Plummy all and white.
 Like a ship at anchor,
 Now he lies at rest,
 And little waves seem daintily
 To play around his breast.

Wild bird of beauty,
 Strong, and glad and free
 Dwelling on these waters,—
 How pleasant it must be!
 Like a gleam of sunshine
 In shadow passing on,—
 Like a wreath of snow, thou art,
 Wild and graceful swan.

Thick grow the flowers
 'Neath the chesnut shade ;
 Green grow the rushes
 Where thy nest is made.
 Lovely ye, and loving too,
 The mother bird and thee,
 Watching o'er your cygnet brood,
 Beneath the river tree.

From northern wildernesses,
 Wild, and lone, and drear,
 Ice lake, cold and gleaming,
 Ye have hastened here.
 The pleasant streams of England,
 Your homeward flight have stayed,
 And here among the rushes
 Your English nest is made."

HOWITT.

Our next subject will be upon the *feathers* of a bird.

	PAGE
By what means are the backbones of animals guarded from sudden jars?	152
How are the backbones of birds made differently from those of quadrupeds?	152, 153
How is the breastbone of a bird formed?	153
What are the two great advantages that a breast-bone affords a bird?	154

What is the name of the bone that keeps the wings from drawing too closely together when a bird is flying?	154
Which are the two bones in a bird's frame quite peculiar to their tribes?	154

Lecture Fifteen.

ON THE FEATHERS OF A BIRD.

0 WE have now to leave the more solid portions of a bird's frame, and to examine its painted dress, a part as much needed for its use, as it adds to the ornament of a bird. Without feathers, neither the lightness of the wingbones, nor the beautiful action of the various muscles and joints in the body, could avail to lift a bird into the air, or even give it power to leap far above the ground. To *soar on high*, a bird needs the additional help of *feathers*.

Feathers are of four kinds ; first, *down* or loose under fibres ; secondly, *clothing* feathers ; thirdly, *flying* feathers ; and fourthly, *ornamental* feathers, which latter are chiefly placed on the head. The down which lies next the skin, is the covering with

which some birds come out of the egg, and which remains as an under coating. It is composed of delicate filaments that rise out of the skin in bunches; and also spring separately around the quill end of each clothing and flying feather; thus sprouts of down always lie upon the skin of a full-fledged bird. These downy filaments have no catches on their sides, but hang loosely, and from easily matting down, they form a warm and soft under garment.

Water fowl have a great quantity of down upon their breasts, which is commonly of a white or grey hue. Small birds that winter in England, and have to bear the cold, have black down next the skin; black being the hue that most effectually keeps in the heat of the body. When we watch with an attentive mind and close searching eye into the works of God, we shall always find He has paid, as in this instance, the most minute attention to the comfort of His living creatures.

If you had never seen either down or a feather, and some one had sent you a plucked bird, with the message that you must set your wits to work to contrive a covering for all parts of that body, which must fit it closely; must be made in the highest degree springy, elastic, light, firm, smooth, warm, and beautiful, both in its texture and colours,

and withal a dress that should permit the body of the bird to pass through the air without resistance ; what could *you* have contrived ? If your life had depended upon it, you never could have devised any thing so perfect as a feather ! Every feather is a perfect wonder !

Take one of the flying feathers out of the wing, and look at it. You see it is composed of three parts, of the quill or stem, of some down at the lower end, and of stronger fibres towards the top. The quill part is light, tough, pliant, and elastic. The substance of which it is made, is not like bone, flesh, or muscle ; neither is it like the horns, hoofs, or hair of other animals, nor even like any other part of the bird itself. To make this stem, a mould or small tube was prepared in the skin, and a few weeks after the bird was hatched, this mould became lined with fibres, formed out of a substance which the blood deposits in the mould, and which, when it is dried up, we call the pith of quill.

The fine elastic fibres made out of this moist pith run the whole length of the stem, and are kept in their places by rings of the same fibrous material. This formation you may easily understand when you make a pen ; for before you split

the quill up between the long fibres, you must first scrape off with a knife the outer rings, or the split will be jagged. As soon as the mould in the skin is fully lined with its fibres and rings, the quill is finished, and it is soon after pushed up; just as the teeth of a child rise up through the gums. The quill comes at first out of the skin almost like a stick, the fine down and the stiffer fibres that shoot out on both sides of the stem expanding by degrees.

Take this feather in your hand, and mark how the fine-pointed fibres cling to each other. There is no glue to make them adhere: what then causes each one to cling so closely to its neighbour? Run your finger up the stem of the feather, you will find the fibres lie smoothly; but run it down the contrary way, and they immediately resist, and if you employ force, they become ruffled. Why is this? The natural eye seldom sees any thing to hold them down; but look through the microscope, and the mystery is revealed. For up each side of every fibre, you will see that a vast number of little teeth shoot out; that in form, on one side, are not unlike the latch on a door, and on the other, not unlike that of the hook on the post. When the latch and hook of a door meet, we know that the door becomes fastened; and so it is with the

opposite sides of the feathery fibres ; the catch on the one side unites with the hook on the opposite fibre, and should rough usage unlock them, they will spring back and again fasten the one into the other.*

Next observe how the feathers on the back and wings of a bird point from the head to the tail ; this arrangement was not made without motive. The passage of a bird through the air always occasions a slight current of wind ; had the feathers pointed towards the head, this wind would have been driven under them and would have raised them up ; but as they now lie, the air rolls as smoothly over them as water rolls over a stone ; and by pressing them flat down, causes them to form a close, unresisting, yet warm springy covering.

The ostrich, the emu, and a few other birds, not intended to fly, but to run, have strong and powerful legs and feet ; short wings and loose flowing feathers. The fibres or laminae ranged on each side of their quills, are without hooks and catches ; they therefore hang loose like down, flowing hither and thither as the wind may waft them.

The ostrich is the strongest and tallest of all birds, being sometimes eight feet in height ; its

* In the large feathers of a goose, the catches may be seen by the naked eye.

long legs take huge strides, enabling it to scour the desert with a speed that out-strips the fleetest horse. When such a bird runs with the wind behind it, its feathery filaments rise up and act like sails to speed it on; its short wings at the same time being raised to balance the body. But when the bird turns round and faces the wind, the flying about of the filaments greatly hinders its onward progress. The ostrich is much sought after for the sake of its downy feathers, which sell for ornaments at high prices. When men on horseback pursue these birds to catch them, they generally contrive to make the ostriches run with the wind in their faces; for a time the birds make great efforts to get on, but at last finding that their long downy feathers hinder their speed, they foolishly turn round, and often run right towards the men, who cease not to fire with their guns, till they have killed them.

The clothing feathers of a bird are usually arranged like tiles or slates on a house. They are of different lengths, and are made of different forms in order to suit the various parts of the body. The tail feathers are often long; their chief office is to guide the bird in its flight, as a rudder guides a boat. The varieties of form in the feathers

of a bird, have led naturalists to class them under different names ; but whatever be the size or shape of the feathers, great care is taken to make them fit closely, especially on the front edges of the wings, on the shoulders, and on every exposed part ; so that let the wind blow from what quarter it will, it scarcely ever ruffles them.

The clothing feathers on a bird are often adorned with tints of the richest colours ; and are stamped with varied patterns : each separate fibre on a quill being so painted, that when all the fibres of a feather fall together, they form one figure ; and again, the tintings on a series or collection of feathers, are frequently so arranged, as to make one general painting.

Since the quill part of every feather is imbedded or seated in the skin of a bird, no one fibre can be pressed against or even touched, without the living owner becoming sensible of the movement. This close union of the feathers with the skin, causes them to act as a defensive clothing, a quality essential to a bird's safety ; and moreover, enables the bird as it moves its skin, to lift up any one quill, in a way that appears to us mysterious. How beautiful it must be to have such a dress, one so sensitive to the touch, that its owner can be warned in due time of injury at hand.

At the bottom of every quill, there is a slight opening, by which the blood reaches the pith to nourish it, just as a vein nourishes the root of a tooth. When a feather has grown to its full size, and has lived on for some time, the pith dries up, and then the feather fades like an old leaf. At this time it becomes loosened from the skin, and the bird is able to throw off its clothing, or as we call it, moults. Some birds moult twice in the year, but all birds have one moulting, after which new feathers are formed in the same moulds as those in which the first quills were made. The formation of these new feathers is a great trial to a bird's strength, and occasionally they die during their moulting. But that once surmounted, they again look full of spring and enjoyment.

Nature's bag of oil for preserving the bird's feathery dress, will be our next subject of notice.

	PAGE
What have we been considering in this discourse ?	159
What are the four kinds of feathery dress on a bird ?	159
What is down ? What are the colours of down ?	160
What are the three parts that compose a feather ?	161
Where is the stem or quill of a feather formed ?	161
What is it keeps the long fibres of a quill in their places ?	161
How are the filaments of a feather kept together ?	161
Why do the feathers of ostriches fly about ? .	163
How are the clothing feathers of a bird arranged ?	164
What part of a feather is painted in patterns ? .	165
How is a feather nourished ?	166
When the pith dries up, what becomes of the bird's feathers ?	166

Lecture Sixteen.

ON THE OIL BAG OF BIRDS, AND THE SPRING OF BIRDS IN FLIGHT.

As I find you have remembered the particulars mentioned last week, relating to the feathers of a bird, I shall like to try your observation on another point. It is this. Have you ever noticed that when a live duck comes out of a pond, the water runs off its feathers, leaving them, to all appearance, as dry as if they had never breasted the waters? but on the contrary, that when a dead duck is dipped into a pond, its feathers look drenched?

All birds, whether dead or alive, have a portion of oil spread over their feathers; then why does not the oil preserve the feathers of the dead bird from being wetted, as well as those of the living one? This is a question we cannot clearly answer;

we can only suppose, that in the living bird, there is a power to resist the water, which the dead one has lost; that so long as life remains, the bird can keep its feathers in a position to throw off, and prevent the water from entering between them. This power is of course, lost to the dead bird, and the water then penetrating the outer part of the feathers, wets them throughout. This one simple fact, therefore, of the living bird casting off every drop of water, and of the dead one remaining drenched and spoiled, teaches us that life is a valuable gift; that torpor accompanies death, while vigour and action accompany life. How mighty then in strength and animation must our heavenly Father be, whose name is, "I AM," that is, "The Living One," the Source of all life, the Lord and Giver of life. In Him are the springs of life, and out of Him is stupor and death.

The living bird, whether sporting on a tree, or wandering over the grass, is daily employed in pruning and dressing its coat with an oily varnish. The oil it uses for this purpose, is contained in a small bag, placed near the upper tail feathers. Perhaps you may have seen a bird turning its head round, and laying it almost flat upon its back. At that time it was probably pressing its beak upon

the little oil bag, to force out a small quantity of the butter-like substance which it contained; and after this action, you might have seen it draw its feathers one by one between the beak, leaving upon them a slight varnish. During this trimming, any water resting on the plumage is removed, decayed feathers are drawn out, and ruffled ones set straight.

No living animal, excepting a bird, has this beautiful contrivance for varnishing at pleasure its coat. He who made the bird knew, that if water, even during a shower, were to soak into its soft feathery covering, its elastic spring would be injured; the bird would become too weighty to soar in the air, and in the water would drag itself heavily along. The need of a varnish was foreseen, and within the lime walls of the egg, the oil bag was prepared.

In some birds, this oily matter abounds. The petrels are web-footed sea birds, that seldom touch on land, excepting to lay their eggs. Their home is, therefore, the salt sea wave, and apparently, to preserve them from the damp of the ocean spray, this oily matter has been given them in large quantities. One species of petrel, about the size of a swallow, is called by sailors, "Mother Carey's Chickens." These birds frequent our British

shores, and from hovering around ships before a storm, they are well known; but whether they fly towards them for shelter, or with the object of gathering up food, seems uncertain. Their appearance, however, is beautiful, as skimming over the ruffled ocean, they lightly touch the waters with their webbed feet, walking as it were on the waves, though in fact they are upheld by their long wings.

Another kind of petrel, nearly as large as a gull, is called the Fulmar. The body of this petrel is so full of oil, that in some of the remote islands among the Hebrides, the inhabitants actually convert them into candles. They pass a rush through the body, and after bringing it out at the beak, light up the rush, which will burn as well as if dipped in tallow.

The fulmars utter a most disagreeable cry, something like the croaking of frogs. They make their nests on precipitous rocks by the sea; and feed their young on the animal food they have themselves swallowed and half digested. It is dangerous to approach them when sitting on their eggs, for if taken by surprise, they will immediately dart at the hunter some of the oil secreted in their nostrils. Should this oil touch the eyes of the man, he instantly becomes blind; and from being

unable to see his way back, is in danger of falling over the precipices, and of losing his life in the sea. Many such instances have occurred.

The fulmar petrel is almost as useful to the poor inhabitants of the Hebrides, as the farm-yard fowl is to us. Its down supplies the islanders with warm bedding, and its fat and oil answer for lights and medicine. For these purposes, as soon as the oil is collected, it is stored away in long bladders made of the stomachs of the gannets or solan geese, and preserved for future use.*

We have now slightly examined the outward form of a bird; that is, its bones, wings, and feathers, and I think we have seen that these portions of its frame-work are admirably adapted for the use of the flying creature; yet at last, neither the boat-like shape of its body, its light bones, well-set wings, nor airy feathers, have any real power to lift the bird from off the ground. Before a ball can rise into the air, something must toss it up; before a carriage rolls along the road, something must give it a push or a pull; it must receive from without a moving influence. From whence then comes the power that moves a bird? Nothing we can see throws it up. What then, sets it off, and lifts it above the earth? Surely it is an in-

* Cuvier.

Lecture Seventeen.

ON THE TOES AND HEADS OF BIRDS.

For several evenings we have been examining those peculiar portions in the body, or frame-work of a bird, by which it is assisted to rise up and sport joyfully in the atmosphere. Let us next consider the heads and feet of birds, that we may see how the feathered races are prepared for feeding, and for moving on land.

First for the feet. Birds have commonly four toes, a few have only three, and the ostrich only two. The toes of birds are sometimes as distinct from one another as the fingers on our hands; at other times they are either wholly or partly joined together by a thin tough skin. Birds that perch upon bushes, have usually slender toes; those that walk firmly or scratch, have stout ones; those that run on grass and water plants, have long toes and often long claws. Birds that swim, have their feet

formed in several ways. Such as the duck, have their toes united the whole of their length by a tough skin called the web, which web gives the foot the two-fold power of striking the water like an oar, and then of propelling the bird along, by folding up and opening the web like a fan.

The feet of birds are in several ways made useful to their owners. In many cases they act as pedestals for standing upon, and as clasps for clinging round boughs. In some orders, as a hand for holding their food; in others, like the swallow, as hooks for clinging to upright places. Among the hawks, they act as weapons of war, by which to seize their prey on the wing; whilst among the swimmers, they take as we have already said, the place of an oar.

Foot of Perchers, called Incessors.

Birds that nestle on bushes and trees, as well as occasionally run on the ground, have three of their toes placed in front and one behind. The swift, which is a species of swallow, that seldom walks

and but rarely perches, has all four of its toes in front; this arrangement helps it to cling to rough places on walls. Other birds, such as the woodpecker, osprey eagle, parrot, cuckoo, toucan, &c., have their toes equally divided into two before and two behind. This equal division of the toes, make such birds poor walkers, and in running they are generally obliged to help themselves by lifting up the wing; but it greatly assists them in following out the peculiar habits of their lives. By the aid of this form of foot, the woodpecker can search

Foot of the Woodpecker.

for insects upon the upright trunks of trees; the parrot can climb for leaves and nuts, and the large osprey eagle seize hold of a fish. This last mentioned bird has the power of turning its two side toes to its hind and middle one, so as at right angles to make an angle of 450 degrees between each of the toes. This division, combined with

very sharp claws and very rough soles to the feet, gives the osprey a strong clutch upon its slippery prey, and enables it to grapple a fish with immense

Osprey Eagle, with its four toes at right angles.

power. Indeed with such force does the bird strike its talons into the finny tribes, that if a fish prove too heavy for it to lift out of the water, the osprey is often unable to extricate itself, and then, amidst violent struggling, the flapping of its great wings, and loud hoarse screaming, down goes the eagle deep under the waves and is drowned. It is from this cause that the bird and fish are sometimes found tightly fastened together, and cast up upon the shore both dead.

To awaken your attention to the various forms observable in the feet of birds, it may be well briefly to divide their families into twelve companies, taking each one that is named, as a general type or specimen of great numbers, something like the one here described.

Osprey Eagle's Foot.

1. The osprey eagle, of which we have just spoken, may be taken as a good type of foot, formed for grasping, though no other bird is known to have its feet so equally divided.
2. The woodpecker may be taken as a type of foot for climbing.
3. The parrot for handling.
4. The jay for perching.
5. The swift, a kind of swallow, for clinging.
6. The pigeon for walking.

7. The common fowl for scratching.
8. The ostrich for running.
9. The flamingo for mud-walking.
10. The water-hen and jacana for weed-walking.
11. The swan for swimming.
12. The grebe for diving. *J*

As these birds come under your attention, it will interest you to mark the wise formation that is given to the foot, in order to meet the habits of each particular species of bird.

We have now to notice the heads of birds, which are generally small compared with the size of their bodies ; but were we to examine the inside of their skulls, we should find that they contained a fair proportion of brains.

Birds have no elevated ridge on the head to form a nose, but there are two openings at the upper part of the beak, which serve for nostrils. These openings are variously defended by feathers, hairs, and skin, and in those birds which run among herbage, by a scale. The scent of some birds, as well as their sight, is very acute. Vultures feed upon dead bodies, and generally live in warm countries, where the scent is borne on the air to great distances. Attracted by the breeze-borne odour of their food, these birds are observed to take their longest flights in dry hot weather.

In such seasons, the wild animals upon which they feed, wander over large districts, and often perish from the failure of the pastures. To such scenes of death it would appear that vultures are also guided by vision, since travellers declare, that if a man lie on his back in the wide sandy plains which they mostly frequent, in a few minutes, though nothing was to be seen before, several dark specks become visible, and in a second or two more, many vultures will be hovering over him.

A bird, as you well know, has two eyes. Those birds which feed by day-light, have their eyes

The Owl.

placed far apart, but those that feed at dusk, or in the dark, such as owls, have their eyes closer, and turned more to the front.

The sight of most birds is keen and quick, beyond that of any other example in the animal creation; and what is very remarkable, the eye of a bird possesses the powers of a microscope and those of a telescope. The same bird can see objects close around it; other objects full twenty times further off than either man or dog can discern them, as well as some close at hand, which are too minute for us to see; the smallest insect that floats by, does not escape its sight.

Eagles and hawks have long-sighted eyes. The swallow tribes, the pied fly-catchers, and other birds are, on the contrary, remarkable not only for far-seeing, but for their strongly microscopic, that is, close-sighted magnifying eyes.

The swift darts through the air at the rate of three miles a minute, and all the time keeps looking out for food, both on the right hand and left, and upwards and downwards. The insects upon which it preys are exceedingly minute, and sometimes fly above, and sometimes below the bird; yet they are seen, captured, and swallowed by it, without the smallest check in its rapid career. The

pied fly-catcher will sit perched on some prominent twig that commands a view all round, and in an instant will dart off like a shot—seize upon a fly it saw passing at a long distance off, and as rapidly will this keen-sighted little bird return to the twig, on which it was before perched.

The long-tailed tit has wonderful eyes. This little bird feeds upon the eggs of insects, and upon the fine green flies that frequent the leaves and bark of twigs. These delicate objects it evidently sees on bushes a long way off; and no wonder, for the magnifying power in the eye of a long-tailed tit, is said to make an object look two thousand times larger than it appears to us.

Eagles from their long sight, can dart down from a vast height upon living birds, hares, foxes, and lambs. It was needful that birds of prey should be able to see afar off and to fall rapidly, for without these powers they must inevitably have been starved, as the instant that small birds or animals see them hovering in the sky, they utter a shriek of alarm, and run for concealment.

When the osprey eagle is flying one hundred and fifty and two hundred feet above the waters of the ocean, and a fish rises to the surface of the waves, he will instantly check his course,—

look for a few moments steadily down, then flap his wings as if fixed in air, and suddenly, and with immense rapidity, descend in a cork-screw zig-zag figure to the surface of the ocean, where without seeming to dip his feet in the water, he will seize upon the fish and rise with it again. Should the great bald eagle be near, he will watch the success of the osprey, and if a fish be secured in his talons, the eagle will rush upon him and take it away. This attack does not, however, check the osprey's ascent, for round and round in endless circles, up he continues to go, till he reaches the higher regions of the air, where he glides about in all the ease and majesty of his species; until again from this aërial height, perceiving another fish,—at once he descends like a torrent, and plunges into the sea with a loud rushing sound, the very waters closing over him. In a few moments he will rise, bearing in his claws the struggling fish, which he always carries head foremost;* and having risen a few feet above the surface, shakes himself as a water-spaniel would do, and this time directs his heavy and laborious course straightway to the land.

The beautiful eye of a bird is well protected,

* See page 180.

having three kinds of lids to guard it. One of its lids is similar to that which other animals possess, only with the bird, this lid, instead of falling down from beneath the brow, is raised up from the lower part of the eye. A firm bony ring next defends the whole outside rim of the eye. This bony ring varies very much with the habits of the species. In owls it is elastic, and by its widening or contracting, alters the exterior shape of the eye-ball, so as to enable the bird to meet the different shades of light. With the gannet, a wild sea bird, this rim is so strong that it is almost like a solid bone, and when from a great height, the bird plunges headlong under the waves to capture the fish upon which it feeds, it amply protects the eye from sudden blows against the water.

The third covering of the bird's eye lies concealed in one corner of the socket, and is a soft, elastic, moist, and transparent skin, which by an involuntary twitch of a fine thread-like muscle, is made to start from its hiding place, and to drop over the eye like a curtain. This delicate skin is called the *nictitating* membrane. It is believed that this fine membrane is intended to guard the eye from storms of wind and rain, and also to shelter it from the strong glare of light to which

a bird is exposed in the open firmament. In addition to these lids, a projecting bony ledge further protects the sight of eagles, falcons, and hawks, birds which are liable to injury when darting on their prey.

Light has a great effect upon all living things, stimulating the juices of both the vegetable and animal creation. The quantity of light that pours into the eye of a bird, is thought to be one cause of its vivacity and quick sensibility. It certainly is true, that living creatures which see quickly, are the most animated of all beings; while worms, moles, and snails, that scarcely see at all, are dull and slow of action. The invigorating effect of sunlight upon the blood, was well understood by the little negro boy, who when asked why he busied himself in taking his aged grandmother out of her hut, quickly replied, "I am going to set her on the sunny hill, that it may comfort her."

A bird has ears, but they are so covered with feathers, in order to protect them from currents of air, that till the head is plucked, it is not often we can see them. The owl, which is remarkable for its acute hearing, possesses a more perfect ear than most other birds.

Lips, as we said before, a bird has none. Teeth

it has none ; but it has a mouth. And what that mouth is, and how in various ways it is formed, must be left for the subject of another evening's discourse.

	PAGE
What is the usual number of toes possessed by birds?	177
Are they ever united?	177
Of what service are feet to a bird?	178
How are the toes of birds placed which nestle in trees?	178
How are the toes placed with the swift?	178
With the woodpeckers, parrots, cuckoos, and osprey eagle?	179
How do birds with two toes before and two behind, help themselves in running?	179
Into how many companies is it convenient to divide birds, according to the forms of their feet?	181
What features do we find on the small head of a bird?	182, 183
Where are the nostrils of a bird placed?	182
How are the nostrils defended?	182
What difference do we observe in the situation of the eyes in day and night birds?	183
What remarkable properties do the eyes of most birds display?	184

	PAGE
Can you name any instances of the power of long sight in birds, and of their magnifying sight?	184, 185
By how many lids is the eye of a bird defended?	187
What effect has light upon animal bodies? .	188

Lecture Eighteen.

THE BEAKS OF BIRDS OF PREY.

THE last time we met, we proposed for this evening's consideration the beaks of birds.

A bird, you know, has two pointed jaws, covered with a horny material. These jaws are sometimes called mandibles. The under mandible is the one which takes the widest gape in opening; the upper one, excepting with parrots, moves but little.

The cheek of a bird has not generally muscle enough to lift up the top mandible; the slight movement this mandible receives, is therefore only occasioned by its sliding up upon the bone of the head. Yet the actions of a bird's beak are more rapid than the actions of any other animal's mouth. A poor dog is terribly perplexed when he tries to catch the fly that teazes him, throwing back his head that the muscles in his neck may lift up his

top jaw, while he snaps quick with the under one ; but slow at last are his movements compared with those of the swallow or fly-catcher ; these birds make no second effort to snap at an insect, their mandibles are opened, and the fly is caught.

The beaks of the greater number of birds appear to have no more feeling in them, than the nails on our fingers, although at the part where the bill is joined to the bones of the head, a bird is acutely sensible. A man who had trained a goldfinch to fire off a small cannon, cruelly took advantage of this sensitiveness, and when the poor bird was tired of showing off, he would snap his nail upon the upper part of its beak, evidently to the great suffering of the little creature. How little do men consider that God watches over every bird, even to the sparrow, and that for every act of wanton cruelty we shall have to give an account at the day of judgment.

A bird does not require so heavy a head, or so large a mouth, as those animals which chew their food. The act of chewing demands strong bony jaws set with teeth, fitted for cutting and grinding, and also a strong skull to support this apparatus. Birds usually swallow their food whole, and therefore only need a pointed beak adapted for picking up, and in some cases for tearing to pieces. Now

as birds require the utmost lightness of head, in order to cleave their way through the air, surely, as we have once before remarked, wisdom is strikingly manifest in giving them a small pointed mouth, and a power to grind their food inside the body rather than to have to grind it in the mouth. The beak, though small, is however, a wonderful little instrument, and one that is of immense value to a bird. It serves it for a hand in building, as a weapon of war in defending itself, as a brush and comb in pluming its feathers, often as a hook in climbing, and unceasingly as a collector and gatherer in of its daily food.

As birds are intended to fill the office of general scavengers, the forms and edges of their beaks are varied, in order that each tribe may be furnished with an instrument, suitable for clearing away its allotted portion of vegetable or animal life. The beaks of different tribes are therefore either long or short, thick or thin, hooked, straight, smooth, or bristled with stiff fringe-like hairs, according as they may be intended to act the part of cutting, tearing, grinding, bruising, or flittering instruments.

Some birds of prey, like the vultures, devour decayed flesh; others, like the eagle, fresh slain animals and fish. Many orders or families of

birds live entirely upon worms, grubs, insects, and seeds; and not only is the form of the bill made to suit the particular calling of each individual tribe, but as eating is to be one of the most important occupations in a bird's life, we find its feet also are made in such a way as to assist the bill in its work. Birds which chiefly live upon animal food, such as eagles, vultures, hawks, and owls, have powerful beaks. (*See page 34.*) They needed such to tear flesh; and to give full strength to their beaks, we find that they are broad and deep compared with their length; they are also sharp at their edges, hooked at their tips, and in some cases notched, to give them a biting power like a tooth. In company with such beaks, we find the birds are given strong thick toes and sharp claws, so that while the bill "acts as a knife, the foot serves as a fork."

In most other respects also, the body of a bird, and the whole instincts of its nature, are made to suit its feeding propensities. Look at a vulture, (which bird feeds upon dead flesh)—his sight is keen—his scent is fine—his flight is slow—he did not require swift wings, because his food will not escape from him. Vultures chiefly abound in hot countries where decay proceeds rapidly; they are therefore birds of great value as scavengers, and

eat enormously, still they can seldom remove a whole carcase before it becomes offensive; had their heads, therefore, been covered like other birds with feathers, they would have been left in a wretched state; but what do we see? that their Maker has given them a bald pate, covered with a tough naked skin that frequently extends some way down the neck!

Owls, which are appointed to prey on the quick-eared mouse, and other animals stirring in the dark, have large ears that can catch the rustling sound of a straw, and eyes that can see the smallest creature. Their feathers are very thick, soft, and downy, "for nights are cold," and their wings are edged with a kind of downy fringe, which makes their flight silent; no rustling of feathers interrupts their own hearing, or alarms their prey, as they move stealthily towards it. (*See Owl in page 183.*)

Of hawks there are several kinds; one species is called the harriers. These birds are appointed, among other work, to be the clearers off of lizards, frogs, and other reptiles that live on marshy ground. They usually fly low, since they do not require in seizing on such prey, to pounce down from a height. To catch a small brown lizard on a brown heath,

which, in a twinkling, hides itself under the furze, the bird needs to come silently beating along the bushes, rather than to dart down from a height in the air. On a heath near London, a hen harrier was watched for some time, while in the act of dodging rapidly on the wing round the lower parts of several old trees; and was seen every now and then as it flew past, striking against the trunks with its beak and talons. While thus gliding round and round the old trees, no one could discover what it was about, but after it was shot, nearly twenty brown lizards were found in its body, all of which the bird had artfully driven from their holes, and then seized, by coming suddenly upon them.

Other hawks that soar high in the air, feed upon small birds perched on trees; as also upon mice, moles, and young rabbits, which they catch as they are sitting upon the ground; indeed they will feed upon any small animal they catch sight of at rest, or in the act of moving slowly. Such kinds of hawks are taught by their instinct to fly high, in order to obtain a wide survey; and when they have marked their prey and hovered above it till they have taken a good aim, then to launch themselves down with force upon it. Other species of a much larger size than the common hawks, and of longer wing, are called the *falcons*. Their appointed

work is to seize upon birds in full flight, though they will sometimes strike down birds und animals resting on the ground.

Of the power of flight in the jer-falcon, some account was given in our fourth lecture. The beak of the jer-falcon is a dreadful instrument: it seizes like a hook, and cuts like a knife; and from a peculiar power in the lower mandible of sliding with a cutting motion against the upper one, the bird can slice off the flesh, as if it were using a chisel. The three front toes of the jer-falcon, as well as the one behind, are tipped with smooth but formidably hooked claws, and with these feet it holds its dead prey tight, at the same time that the beak, with the skill of a poulterer, is casting off the feathers and skinning and tearing up the body. The jer-falcon was the favourite hawking bird of our forefathers, but it is now little sought after for that purpose, the amusement of hawking having happily been dropped.

The eagle rises higher in the air than any other of the winged race, except the vultures. The eagle is a large and noble bird. The wings of the female, which is always the larger bird of the two, sometimes measure eight feet across. The whole attitude of the eagle is bold and erect; his eyes have

the glare of those of the lion, and the range of his sight is truly wonderful. Floating hundreds of feet above the summits of our highest mountains, and overlooking a hundred dells and valleys, he can spy a grouse or a hare from a distance, at which the human eye could hardly discern an elephant. His voice is strong, his beak large and hooked, his bones firm, his flesh hard, his feathers stiff, and never can be wetted in water. The eagle clears off larger animals than the hawks and owls can touch; such as fawns, lambs, hares, rabbits, grouse, and all the moderate-sized creatures that live amongst the wild mountainous and rocky places which the eagle inhabits. During times of scarcity, and in the winter season, sea-eagles will sometimes roam far off into fertile districts. Several have been killed close to a decoy for ducks, in Colonel Petre's park, near North Walsham, in Norfolk.

Birds of prey always strike their victims to the ground with their feet, the beak not being used till after the capture is made. The first blow the eagle gives, is almost instantly fatal. The mere force of its body, weighing twelve or eighteen pounds, and coming from an elevation of 1500 or 2000 feet, would of itself be crushingly powerful: but the velocity with which the eagle shoots down,

The Eagle.

E. A. M. P. S.

gives it such additional weight, that it not only dashes the animal to the earth upon which it alights, but plunges its claws deep into the body of its victim, dislocating the spine, or breaking the skull of feebler quadrupeds, such as hares. The pounce of the bird is down and up again, the hind claw catching the prey in passing. The larger falcons often tear open the whole length of the back by the passage of this hind claw.

To carry off its heavy captives to the nest, the eagle needs what it has, a large and powerful body with strong talons, but it does not want that length of wing to give swiftness of flight which the falcon requires. Accordingly we find the wings of the eagle, though powerful, are shorter than those of the falcons, which birds catch their prey whilst on the wing, and as they are darting through the air.

Bruce, the great traveller in Africa, had once the opportunity of standing close by a noble eagle in its own wild haunts.*

The whole party of his servants and assistants had sat down to rest near the summit of a mountain, and were boiling some joints of goat's flesh for their dinner, when an enormous eagle of a rich golden brown hue, came flying slowly along, not stopping till he actually came amongst the men, and sat himself close down by the pot of boiling meat; a shout of alarm was instantly raised, and Bruce went up to see what could be done. The attention of the eagle was then fixed upon the flesh; at length he raised his foot, and put it into the hot water; finding, however, a smart he had not expected, he withdrew, leaving the meat behind him, and went off to a wooden platter, on which were lying a leg and a shoulder, into these he thrust his claws, and carried them off, still casting a wistful look at the large piece that was boiling.

In a few minutes a prodigious shout was again raised by the men, He is coming! he is coming! The eagle then appeared in sight, and once more approached the hot meat; but this time he sat down within a yard or two of the boiling pan, as if to consider what course to take. Bruce watched

* This eagle was a Lammerzeyer or Eagle Vulture.

him, and at the right moment fired off his gun, and so instantly killed the eagle, that his monstrous body, weighing twenty-two pounds, fell upon the grass without a flutter.

Bishop Stanley, in climbing some rocks in Auvergne, in France, also met with a large eagle. He was standing by a waterfall, which dashed downwards with a thundering noise: in the midst of the loud roar of waters, "a short shrill cry," he says, "met our ears, coming as it were from the clouds; on looking in the direction from whence it came, we soon perceived a small dark speck moving steadily on towards us. It was a golden eagle, evidently coming from the plain countries below, and drawing nearer, we could see that his wings scarcely ever moved; he seemed to float or sail in mid air rather than fly; though now and then indeed they slowly flapped as if to steady him. As he was approaching in a direct line, we hid ourselves behind a rock, and watched his motions through a telescope. When first seen, he could not have been at a less distance than a mile, but in less than a minute he was within gunshot, and after looking round once or twice, he darted down, his legs slightly quivered, and alighted on a rock within a few yards. For a moment he gazed about with his sharp bright eyes, as if to assure himself

that all was safe ; he then for a few moments more nestled his head beneath one of his expanded wings, and appeared to plume himself. Having done this he stretched out his neck, and looked keenly and wistfully towards the quarter of the heavens from whence he came : gave a few rapid screams, and then stamping with his feet, we saw him protrude his long hooked talons, at the same time snapping his hooked beak with a sharp jerking noise, like the crack of a whip. There he remained for about ten minutes, manifesting great restlessness, not a single instant quiet, when suddenly he seemed to hear or see something, and immediately rising from the rock on which he stood, launched himself into the air, and floated away as before, uttering the same shrill cry ; looking round, we beheld the cause of his emotion, he had seen his mate approaching. He rose to meet her, and after soaring in a circle a few times they went away, and were soon invisible to the naked eye ! ”

Occasionally eagles have been taken from the nest when young and tamed. The tale that a friend of mine related of an eagle in the Isle of Skye, off Scotland, is mentioned in a small book, called “ Listen and Learn ; ” but as the work is not at hand, I must tell you that when this young eagle was presented to a laird of the Island, he had

him chained to a wall in the kitchen. The noble bird grew large and strong, and showed much affection for those who treated it kindly. As the cook fed it, she soon became its greatest favourite. Having one day to leave the house, she accidentally left a pair of shoes within reach of the eagle's chain; a fellow-servant wishing to remove them, put her hand upon them, when the eagle, with its native wild velocity, darted toward the shoes, and driving away the intruder, thrust its own feet into the two shoes, and never quitted them for full three hours, standing in one attitude, a monument of patience, till the cook's return.

Our next subject will be the beaks and feet of those birds which chiefly feed upon seeds and insects.

	PAGE
By what name are the two jaws in a bird's beak called?	191
Which is the mandible that mostly moves? .	191
Where is the feeling in most beaks placed? .	192
Why does not a bird require so heavy a head as a quadruped?	192
What service does the beak render a bird? .	193
What difference can we notice in the forms of beaks?	193
Why are they made differently in form? .	193
What are the instincts and whole shape of a bird made to suit?	194
Can you name any of the birds we have noticed, as adapted in figure and instinct for the work they are appointed to perform?	194
(Vultures, owls, hawks, jer-falcons, eagles.)	
How is the principal blow generally given by birds of prey, when they pounce down upon living creatures?	195

Lecture Nineteen.

BEAKS AND FEET OF SEED AND INSECT FEEDING BIRDS.

HAVING examined the feet and bills of the flesh-eating birds, let us next consider those of the perchers. Perching birds feed upon worms, insects, fruits, and seeds. Flocks of them are close at hand, such as rooks, blackbirds, thrushes, red-breasts, sparrows, yellow-hammers, and many kinds of finches.

All birds under the name of *perchers*, have three of their toes placed in front and one behind, the hind toe being always on a level with the front toes (*see page 178*). This form of foot enables a bird without effort on its own part, to clasp round a branch. Do you wonder why this should be? It simply arises from the shortening of the muscles that run down the legs into the toes. A bird, in

the act of settling upon a twig, must bend the joints of its legs; this draws the muscles round the bent joint, which shortens them just sufficiently to pull the four toes in a bent form round the branch;—somewhat as our fingers would be doubled up into the palm of the hand, were a string fastened to the tip of each finger, then carried through the length of each, and all four strings sharply pulled up at the wrist.

Birds often roost on one leg, because the heavier the body presses upon the bent joint, the tighter the claws are pulled round the woody branch. The reason of this double tightening is clear, since the weight of the bird must pull harder when it falls upon one set of muscles, rather than when it is divided between the two sets.

The greater number of seed feeders that perch on trees, have their toes quite separate from each other; but those birds which live much upon light bushes, such as the thrushes, golden-crested wren and others, have one of their outer front toes fastened by a thin skin, a short way up the middle toe; this union of the two toes gives the foot a stronger foundation for clasping a slender twig than the loose toes can possess. Pheasants and common poultry fowls, such as the barn-door cock and hen, have three thick toes in front, all slightly

united at the base, the ends being furnished with strong short nails, to scrape the ground for seeds, worms, and insects. The stout spreading feet of these birds give them a stately walk. Every one knows the strutting march of the common cock, as

Spanish Poultry—Cock and Hen.

he heads his party of hens at the public breakfast of scattered corn, looking truly as if he meant you to understand that he and his friends came originally from the despotic lands of India and China.

Some birds have loose rolling joints in their toes. This is the case with woodpeckers, swallows, and parrots; such a form of foot, not only gives them an unsteady action in walking, but when in

a hurry, causes the birds to hop with a half-fly over the ground. In addition to this, the parrot has also a sideways motion, arising from the shortness of its legs, and the wide separation of its loose jointed feet.* So pliable indeed are the joints of the parrot's foot, that it often raises its food to its mouth, by using the foot as we should a hand.

Thus we learn, that a few simple claws, nicely arranged, and curiously drawn up, without any other help, enable the lively energetic feathered races to keep firm hold of places, where men and beasts could neither stand, sit, nor lie down.

General character of bill in seed and insect eating birds.

The perchers are a very large group of birds. Their bills are straighter than those of eagles and vultures, and end usually in a fine point. They seek their food partly on the ground, and partly

* In Australia there are ground parrots, and in America ground cuckoos. The toes of these birds are divided like those of other parrots and cuckoos; that is, two before and two behind, but they are so long and straight, that the birds can walk and run very nimbly.

on trees; seeds, worms, and insects form their principal support, but some of the tribes will catch young mice, and will even condescend occasionally to dine upon carrion; that is, on decaying flesh.

In their feeding, the raven and crow come the nearest to the birds of prey. The raven has a straight beak, slightly hooked at the point, the

A Raven.

edges being strong, but not very sharp. This form enables the bird to hold its food by the hook, whilst the edges of the bill literally cut it up by hard pressure; the bird tugging and tearing away at what it desires to eat, by the motion of its neck. This peculiar bill of the raven, enables it to partake of a variety of food; of seeds, worms, insects, and

carrion; indeed its beak, as well as that of the crow, has been called "a servant of all work."

Birds which feed mostly upon grain and berries, have short thick pointed bills. Look at the sparrow's bill, its fine point enables the bird to pick a seed out of its sheath, and also to skin a grain of wheat so as to get at the pure kernel, whilst the thick sharp edges of the bill give it power to break and shatter the coats of the harder seeds. The nut-hatch will pick up a common hazel nut, fix it into a groove in the bark of a tree, as into a vice, and will then hammer away with its sharp-pointed bill till the shell cracks, and enables it to get at the white oily kernel. Should the nut accidentally fall, the bird will dart down, and in most cases catch the nut with its claws before it reaches the ground, then replacing it in the chink, it will proceed with its work. Song-thrushes in summer, use their bills as cleverly as the nut-hatch, but not with the same force. They enjoy a good snail, but not its shell, and therefore to get rid of the shell, they hold the snail in the bill, and forcibly knock it against a stone. The rapping noise they thus make, may be heard at a considerable distance, and has sometimes puzzled people to know from whence it came.

Sparrows and redbreasts greatly enjoy a house-fly; and in seeking after their lively game, they often come near to our dwellings, which renders them some of our most familiar birds. Were it not for sparrows and redbreasts, the house-fly would in many situations multiply to an extent quite intolerable; soiling our furniture, eating our food, and putting out our lights. Sparrows and redbreasts are also indefatigable in seeking after the caterpillars or grubs of the cabbage butterflies; indeed it is doubtful whether without their help, those plants could be reared at all in gardens.

The tribe of finches have a still straighter outline of bill than the sparrows, and feed more entirely on vegetable food. They are capital helpers to the farmer, for they consume immense quantities of seeds, belonging to the taller and more troublesome weeds. If one bird eat but one hundred seeds in a day, that winged little helper will prevent the growth of thirty-six thousand weeds every year. We cannot possibly tell how many green-finches, bull-finches, gold-finches, chaffinches, linnets, and other finches, are alive at one time in England and Wales; but they are so numerous, that it is calculated if all the seeds were to take root which they must consume in one year—the plants springing up from those seeds, would annually cover

over six hundred thousand acres of ground. This calculation is said to be less than the real quantity, but it is enough to show us the value of having our feathered friends about us. In our garden grounds they may do some injury, but without them, as the Americans often find in new settlements, seeds would overpower us.

Parrots live principally upon the twigs of trees, and upon their leaves and fruits. The beaks of these birds are peculiarly formed ; they are hooked,

The Parrot.

strong, and sharp. This pointed beak the parrot drives into whatever it desires to eat, giving its mandibles a peculiar motion, something like the

wrenching round of a pair of nutcrackers, while the sides are kept pressed close together. By this action, the bill of the parrot can instantly and with perfect ease, both divide and grind down nuts and other hard vegetable substances.

Most birds snap the lower mandible quickly against the upper one; but parrots, which can move both mandibles with perfect ease, never snap. To lift up the top jaw, requires as we have said, stronger muscles in the face than most birds possess. But in the parrot's full swelling cheek, you may see there is ample space afforded for a large supply of such muscular power, and it is owing to this amount of cheek muscle, that the parrot moves its bill with unusual force, and is able to pick out and divide its food in the most finished and delicate way.

The fleshy tongues of parrots are as peculiar as their beaks, and are very useful to the birds in turning a nut or other food, into a right position for the pincer of the bill to bear upon it. This fleshy tongue is found in all parrots, excepting in the Australian group called the Loriquets, which birds feed on the honey of flowers, and have a tongue formed with bristles like a brush, with which they sweep up the honey.

In searching for food, parrots often fly to great

distances. Their pointed ample wings, as well as those of cockatoos and macaws, display a marked preparation for long flight, and people who have seen these birds in their native wilds, accordingly describe their movements as rapid, elegant, and vigorous. Many species of parrots are in the habit of describing wide circles and other airy figures, previously to alighting upon the trees which contain their food ; the whole party keeping up one general cry during their various evolutions.

At times these birds clamber from bough to bough, and from tree to tree, making the fine moveable and delicate green twigs their pasture ground. In moving forward on a tree, the parrot half supports its body by clinging with its hooked beak to a branch above ; then stretching out its wide-spread and loosely-jointed feet, it grasps tight hold with one foot upon a side branch, while throwing out the other leg as far as its length will permit, it catches hold of a more distant bough ; and in this way the bird drags itself rapidly on.

At our next meeting we shall have to notice the humming bird, and then consider the climbing birds that feed upon insects.

	PAGE
Upon what do perching birds mostly feed ? .	205
How is it that the foot of a percher clasps round a branch, without effort to the bird ? . . .	205
In birds that live much on light bushes, which toes are partly united so as to give them a firm foundation ?	206
What kind of feet has the common poultry cock ?	206
Which birds have rolling joints in their feet ? .	207
What is the form of beak mostly seen in perchers ?	208
Which of the perchers comes nearest to the birds of prey in its food ?	209
What is the character of beak in grain feeders ?	210
What insect do sparrows and redbreasts enjoy ?	211
What food do the tribes of finches enjoy ? .	211
How are the beaks of parrots shaped ? . . .	212
Of what use in their eating, are the fleshy tongues of parrots ?	213

Lecture ivc nty.

HUMMING BIRDS, AND BIRDS THAT CLIMB TREES FOR ANTS, GRUBS, &c.

THE countless numbers of insects found in the world may be divided into *fliers* and *crawlers*. In a caterpillar or grub state, insects creep over leaves, hide up in the earth and also in wood,—in a perfect state, they run on the ground like beetles, or fly in the air on light gauze wings;—consequently, they are found to be in various situations. On this account the tribes of birds intended to eat up, and so to clear away the overabundance of insect life, require to have differently formed bodies to fit them for their hunting clearing labours in such different kinds of places.

A duck could not fly all day in mid-air to catch flies; a sparrow could not dip its head to the bottom of a pond to search after water insects; nor could a swallow make a hole in wood to find up grubs. Yet all these places have to be searched

over, and the thoughtful mind feels animated pleasure in noticing the wise and beautiful way in which birds are differently prepared to accomplish their various tasks, whether it be to search for insects on land, to skim after them through the air, or to dabble for them under the waters.

Swallows, fly-catchers, goat-suckers, and all birds which catch insects flying high in the air, have short bills with a wide gape of the mouth. Those which feed upon insects near the ground, have sometimes short thick bills, whilst others have long ones. The richly coloured humming bird is one of the long-billed insect eaters. This bird is chiefly found in America, where it feeds upon delicate flies, fine red spiders, and the sweet juice it finds in bell-shaped flowers that grow in its native lands; in the juices of which flowers are commonly found multitudes of minute insects.

The smallest humming bird is somewhat the size of a bee, and weighs about 20 grains; ten or twelve such birds could therefore be sent by post for one penny. The ruby-necked humming bird is about half the size of a common wren, and is the most beautiful of the species. Its eyes are tiny bright specks, as black as jet. Its feathers display

hues of a golden green, the finest topaz, crimson and emerald, mixed with spots of brown and white.

It is inconceivable how much these birds add to the high finish of a luxuriant American landscape. As soon as the sun is risen, humming birds of different kinds are to be seen hovering among the flowers. They dart and glance about, visiting flower after flower without ever alighting upon them, extracting their nectar "as with a kiss," and then are off again like gleams of light; the rapid motion of their wings producing all the while a humming sound, that has given rise to their present name.

The long and slender tongue of these birds can be protruded to a great extent; it is formed of a substance as transparent as the quill of a goose, and is folded into two parallel tubes, which probably serve as a pipe through which the honey of the flowers can be sucked up; the end of the tongue is usually divided, or split into filaments, brush-like at the tip, which assists the bird in collecting the honey.

When tamed, these little birds have been fed upon a mixture of honey, sugar and water, which they quickly clear away from a cup by the aid of their tube-like tongues.

In a small work called "Humming Birds," a

lively account is given of a family of rubies, which in North America were caught in their nest by a Mr. Webster. After carrying them home and placing them in a cage, he fed his little family upon the mixture which I have mentioned, of honey, sugar and water, but he soon found that the birds could not subsist upon this liquid alone; the additional food of delicate flies, and of fine red spiders, being absolutely needful to keep them alive. As winter approached, and flies became scarce, his little favourites became restless; they wanted to fly away with other humming birds, to the warmer regions of Mexico and Southern America; so he opened the door of their cage to allow them to migrate to regions where no doubt they could find an abundant supply of suitable provision. As they flew away, Webster and his young sister thought they should never more see their favourites; but the following spring he tells us, "I had gone into the garden summer-house with my book, and was dreaming away over its pages, when a soft whirring noise close to my face caused me to look up. About one foot from me, a humming bird poised so steadily upon the wing, that its body seemed perfectly motionless, looked with its bright knowing eye fixedly upon mine. It did not move when I lifted my head, and retaining

this position for nearly a quarter of a minute, with a low chirp darted out and settled upon some flowers near. I started up, while a quick thought sent a thrill of exquisite pleasure and surprise through my whole frame. The bird sat still. I ran with my utmost speed to the house, and catching a glimpse of my sister, cried out to her, almost beside myself with excitement—

“Get the white cup! get our cup! some honey! some sugar! here’s the water! quick! dear! quick!”

“What is the matter with you, brother?” exclaimed the distracted child, endeavouring at the same time to execute these multifarious orders all at once.

“O, our bird is come back! I saw him just now! Where are the closet keys? O, he’s come back to us all the way from South America—the little darling! I thought he couldn’t forget us!”

“But, brother, you are mad—how can you tell it from another humming bird? I’ve seen a dozen this spring!”

“O, I know it was one of the young ones—he came in and looked me in the eye ever so long! Do make haste!”

“The mixture was completed, and off we ran in trembling eagerness, for the test of the white

cup we knew would decide for or against us. We reached the summer house—the magical white cup was raised before us—the bird was still sitting on the flower—we gave one chirp as of old, and without an instant's hesitation it darted to the cup, alighted upon the rim, and plunged its little thirsty bill up to the very eyes in that delicious cup, and took the longest, deepest draught I ever saw taken before by one of them; and this convinced me that it had just arrived, and had come straight to its old home for food and love. My sister burst into tears and screams of joyous laughter, and of what ridiculous capers I might have been guilty I cannot tell. I only remember the self-contented and philosophical manner in which the returned pilgrim continued to plume its storm-ruffled feathers, uttering now and then the old chirps on the side of that cup—which position it retained until we bore him on it to his new house,* of which he assumed possession with a remarkably matter-of-fact or rather matter-of-course air.”†

* A new and elegant house they had prepared for humming birds during the winter.

† The whole of this narrative is interesting, and may be read in the above small work, by H. Adams. Published by Groombridge, at one shilling.

The fine long bill of the humming-bird, is a good trap for snapping at delicate flies when on the wing; but to catch up caterpillars and other grubs that creep upon leaves and twigs, a stouter bill is needed, just such an one as belongs to the sparrow or redbreast. Small grubs and maggots hidden in the blossoms of plants, can only be taken by birds with bills very delicately formed; and such are possessed by the titmice. These little birds rest not a moment on the twigs of a plant, but hovering over the petals of the flowers, dart their bills into the blossoms to find out the hidden grubs. To fit the titmice for this work, they are so constructed as to be able to hang head and back downward in all kinds of grotesque positions, and thus to master the buds and blossoms which cannot be conveniently got at in any other way. Mr. Swainson says, "Every one must have seen the adroitness with which the tomtit clings to the smallest branches of trees; examining every bud, pecking at every hole, and indefatigably seeking for insects hidden in such concealments."

Gardeners generally think that tomtits and bullfinches eat the fruit blossoms at which they are pecking; they are not aware it is after insects and grubs which would destroy the fruit, that the birds are seeking. Under this ignorant view of

destruction, a gardener once came to his mistress with a gun in one hand, and a fresh slain bullfinch in the other, and holding up the dead little bird, exclaimed in a tone of exultation and with a brightened eye; "I saw him at the gooseberry bushes, and I shot him with his wickedness in his mouth!"

Insects and grubs which hide up in rotten wood, that creep into crevices in the bark of large trees, and that sometimes crawl on the ground, such as ants, wood-lice, hundred-legs, beetles, and various grubs, are searched for by another interesting tribe of birds, that have bodies peculiarly formed for climbing and running up trees, and have bills remarkably fitted for drawing the crawlers out of their hiding places. Woodpeckers, which "tap the hollow beech-tree," are among these climbing birds; and as they are meant to break their way right into the rotten wood of the upright trunk, and from thence to fetch out the creeping insects, their climbing and working apparatus are both powerfully and curiously made.

The bill of a woodpecker is long, straight, and wedge-shaped, strengthened in places by double thicknesses of horn in the form of ribs, so that without danger of breakage, the bird can use its

bill as a borer. Its tongue is so constructed, that it can be shot out a long way beyond the beak, far down into holes in the wood; and being covered with a gluey moisture, the moment it touches an insect, the creature is fastened down. The tip is also pointed with a sharp piece of horn, fringed with hairs like an arrow, which enables the bird when it shoots its tongue at an insect with the quickness of a javelin, to transfix it in a moment.

At some seasons of the year the woodpecker searches on the ground for ants, also at the roots of trees, and amongst dead leaves for grubs, beetles, and some kinds of seeds; but the woodpecker's real home is the upright stem of a tree. To that it will cling for hours together, boring away at the wood, either to make for itself a nesting place, or to find out the hidden retreats of crawling insects. Indeed, the trunk of a tree is everything to a woodpecker; it is its castle, pasture-ground, larder, nursery, an alarum drum, and a love lute; for in striking its beak over a hollow place, the bird makes a loud rolling drum-like noise, which attracts its mate to the spot. Whatever work the bird is about, the tap of its carpentering beak may be heard a long way off, as it continues to strike blow after blow in quick

succession ; its strokes following one another with such rapidity that they cannot be counted.*

If you have chanced to see the woodpecker clinging to the bark of a tree, or to have heard its drumming boring sounds, did the thought ever cross your mind, “How does that bird manage to hold itself so tightly on the upright stem, whilst its head and neck are drilling away ?”

Watch the bird at its work, and you will soon see the masterly way in which it stands, or rather lies down to perform it. First look at its feet. Two of its toes are turned behind so that the foot is placed as in *page 179* ; which position throws the chief weight of the body upon the breastbone, and upon the two front claws, leaving the two hinder claws to steady the body upon the tree. The breastbone is unusually long and flat, which form enables the bird to rest against the tree, and like a shield, preserves its sides from being

* A gentleman once put a woodpecker in a cage, but it soon bored its way through the wood. Another gentleman let one loose in his room, when it began clambering up the chairs, and boring holes into the backs ; at last it attacked the window-frames, when he was obliged to set it at liberty in the open air.

injured, whilst the bird presses against the uneven bark. To give elasticity to this long flat breastbone, there are two notches at the end nearest

the tail, which are well padded with gristle; when the bird bends down upon the tree, these notches open, and give breadth to the bone; but when the bird rises, and the pressure is removed, they spring back.

To steady the bird still further on the upright stem, the tail feathers are made very stiff, so that whilst the weight of the bird is thrown upon the breastbone, and the toes clasp hold of the bark, the tail is spread out

The Woodpecker at its work on a tree.

under the bird in a sloping direction to act as a prop; much in the same way as a window-cleaner

steadies the board (upon which he sits at his work outside a house) by having a slanting piece of wood jut from it against the upright wall.

By these dexterous applications of the breast-bone, the feet and tail, the woodpecker may be said to be actually lying down upon a tree, whilst it only seems to be hanging against it. The bird is made for lying down; that posture is its natural position, and therefore when roosting for the night, instead of putting its claws round a branch like other perchers, it lies along the branch.

Thus we see in the form of the woodpecker, several dexterous mechanical contrivances for catching insects in a particular situation. The bird is to be a frequenter of upright stems of trees,—a grubber into holes,—a gatherer of insects out of holes. To accomplish these objects, it must *lie down* at its work; its breastbone is therefore made *flat*, notched at one end that it may be elastic, and the tail feathers *stiff* to keep it steady against the tree. To enable it to *clutch hold*, its toes on each foot are divided two and two; and then to give it power to *bore holes* in the wood, and to *seize upon its prey*, its neck is surprisingly moveable, its bill long, straight, hard, pointed, and sharp at its sides. Its tongue long, soft, sticky, tipped with a needle-like point, and fringed like an arrow.

Again, its whole frame is light and suitable for flight. Surely to every thinking mind, the body of the woodpecker is a living proof of forethought, contrivance, power, and wisdom. It bears about it an eloquent speech of its own, but having no tongue by which to praise its Maker, it needs our help to utter that praise.

The wrynecks are made something like the woodpeckers, but as they do not break into wood, but only climb up and down trees in search of ants and caterpillars, they are not given stiff feathers in their tails, they have simply two toes behind and two before, with climbing claws and sticky long tongues. The bird is called a wryneck from its habit of moving its head in various directions, not unlike those of a snake.

When found in its snug nest in a tree, it makes a loud hissing noise, sets up its crest, and writhes its head quick from shoulder to shoulder with strange contortions; it often alarms the timid peeper into its home, and then taking advantage of this moment of surprise, it darts with the rapidity of lightning from a situation whence escape seemed impossible.

The little tree-creeper is another climber that feeds upon minute insects concealed in the bark of trees. It is the smallest bird we have in Britain,

with the exception of the crested wren. Its toes are not arranged like those of the woodpecker and wryneck, being three in front, and one behind; but to enable it to hold on whilst examining into the crannies in the upright stems of trees, it has twelve stiff feathers in its tail, and long claws on its toes, the hinder one being much longer than the rest. The bird is very clever in using its clambering feet, moving so rapidly that it has more the appearance to the eye of being a mouse than a bird. With a silent gliding motion it runs upwards and downwards upon the stem of a tree, and over, and under, and along the branches, sometimes with the back uppermost, sometimes the breast, for all ways appear to be the same to the little tree-creeper; its feet catching hold, and its wings steadily hovering to support its weight. The bill of this little bird is of a moderate length for its size, slender, pointed, and curved downwards; its tongue is short; its plumage, like that of the wryneck, is brown; which best conceals it while running up and down the fir trees, which are its favourite haunts.

Caterpillars that live among the twigs and leaves of trees, are handed over to the cuckoos; accordingly, cuckoos are climbing birds, and have two toes behind to enable them to turn and twist

about among the boughs ; but as they are not meant to search up and down the trunks of trees for grubs, they have no other apparatus for climbing. So enormously do cuckoos eat, that Mr. Rennie calculates that one of these birds will destroy three millions, five hundred thousand caterpillars in a year.

Perhaps you have never seen the grey dove-coloured cuckoo, though you may have heard its welcome voice heralding in the bright spring. These birds leave their winter homes in far distant lands about April, and after laying their eggs in Great Britain, they again leave us in June or July. The cuckoo never takes the trouble to build a nest. Its plan is, to find out where those small birds build which feed their young on caterpillars and grubs, such as its own little ones require ; and with this object in view, it searches with astonishing sharpness after the smallest nests concealed on the ground or in bushes. Those of the hedge sparrow, linnet, sky-lark, whitethroat, also titlarks and wagtails, all come alike to it ; and after laying an egg in any of these nests, the cuckoo leaves it to the care of the little owner ; and as that owner knows no difference between the cuckoo's egg and its own, it sits closely till it hatches the young intruder. The first work the young cuckoo sets

about, is to toss out of the nest any egg it may find by its side, and also any little bird that may have been hatched about the same time with itself. For this purpose it slides underneath the nestling that it may fall into a hollow place in its own back, which seems formed for the purpose, (as in twelve days that hollow fills up,) and as soon as the young cuckoo feels the little bird resting upon its body, it heaves up its shoulders and jerks it over the walls of the nest. If, however, it cannot succeed in throwing the little bird out, it settles down quietly with it.

There may be two reasons why this ungrateful propensity has been given to the cuckoo; first, it grows so fast, and becomes so large, that there is not often room in the nest for it and another bird; and secondly, it has such a monstrous appetite that it is almost more than its kind foster parents can do, to hunt up a sufficient number of caterpillars and grubs to satisfy it. It is a very remarkable fact, that the young cuckoo is never neglected by its foster parents, but is cared for and watched over by them with even more ardour of affection than they shew to their own young; and when they have not strength enough, or are too small to bring the cuckoo all the food it wants, the

clamorous hungry bird makes such an outcry, that other little birds, hearing its distressed notes, have been known to come and assist them in feeding it. In one instance twenty titlarks were all seen flying backwards and forwards with grubs, to satisfy the overwhelming demands of a big young cuckoo, hatched in the nest of a common titlark. For some wise reasons that we do not yet understand, God has seen it good to order that young cuckoos shall be brought up by other birds; and it is instructive to mark the care He has been pleased to take of the poor helpless young things; causing the foster parents to love their adopted children with a keenness of affection quite extraordinary.

We have now seen that every part of a tree has its appointed visitor, prepared for inspecting the wood, bark, leaves, and buds, in order that insect life may be checked, lest by its rapid increase, it should injure the growth of vegetation. The woodpecker is appointed to draw the crawlers out of deep places in the wood; the wryneck and little tree-creeper to pick out grubs from the crevices of the bark; the cuckoo to search the green leaves for myriads of destructive caterpillars that crawl over, or are rolled up in the foliage; while the tomtit, with its strong but delicate bill, and a few other birds, are sent to peck at the buds and

blossoms of plants, and so to seize upon the maggots that would otherwise destroy them.

We have still other insect-feeding birds to notice, but must not proceed further this evening.

	PAGE
Into what two companies can we divide insects?	216
What kinds of bills have swallows and other birds that catch flying insects?	217
Why has the humming bird a long bill and a folding tongue?	218
What little birds search out grubs and maggots in the blossoms of plants?	222
What three kinds of birds have we named as searching into trees for ants and grubs?	
(Woodpecker, wryneck, and tree-creeper)	
What is the form of the woodpecker's bill and tongue?	223
What is a tree to a woodpecker?	224
How are the feet of a woodpecker placed on a tree?	225
How is its breastbone formed?	225
What use does it make of its tail, when it clings to an upright stem?	226
Of what is the body of a woodpecker a living proof?	228
If wrynecks do not break into wood, how do they get at insects on trees?	228

	PAGE
How does the tree-creeper climb about a tree ?	229
What bird is appointed to clear off caterpillars from the twigs and leaves of trees ?	230
Where does the cuckoo deposit its eggs ?	230
What is the first act of a newly-hatched cuckoo ?	231
What are the two probable reasons for this instinct ?	231
How do the foster parents behave to their stranger nestling ?	231
Where does the tomtit find its food ?	232

Lecture Twenty-one.

BIRDS THAT FEED ON FLYING INSECTS.

IN the vast forests of America, fallen trees are quickly bored into by flies, hornets, and beetles, and the multitudes of maggots their eggs produce, lead to such a rapid destruction of the wood, that we have reason to be thankful that birds have been prepared with bodies fitted for running over living trees, that they may seize upon the ants, caterpillars, and grubs, that lie hidden in the bark and crevices of plants, and in their leaves and painted blossoms. You were told in our last discourse, that the birds especially made for these works, are the woodpeckers, wrynecks, creepers, nuthatches, cuckoos, and titmice.*

* It is curious that there are no woodpeckers found in Australia. In that country the work of destroying the larger grubs seems to be done by cockatoos; and as regards the smaller grubs, they seem to be cleared away by nuthatches and creepers. Possibly, the dry climate of Australia may not be favorable to a large increase of such insects as woodpeckers feed upon.

From climbing birds that feed on creeping things, we next pass to birds which, while they make no objection to a few crawlers or even to worms, add to their feast any spider or winged insect they find quietly at rest; occasionally, also snatching at a fly on the wing, should it pass in their way: the gold-crests, wrens, and many warblers are of this class. But as different insects frequent different plants, so the various birds which are to feed on insects at rest, frequent various situations. The gold-crests fly to the branches of the fir tree for their peculiar insect. The jenny wren seeks her game mostly in ivy and low thick bushes. The grasshopper warblers frequent close grassy banks. The sedge warblers live principally among reeds and sedges. The stone chats and whin chats love whins and furzes; the wheatears open downs: and a little reading and observation will make you acquainted with the habits of many other birds of this tribe.

It is also worthy of notice, that the size, shape, and coloring of each bird is generally adapted to the place in which it is intended to live. Those birds which have to slip through thick foliage, are of a slender make. Those which live among the leaves of trees, are, generally speaking, tinged with a green or brown hue. Those that hide

among the brushwood are brown; and those that run among whins and heather have speckled feathers. The willow wren, the jenny wren, the grasshopper warbler, the titlark, the whin chat, are all strikingly alike in colour to the places which they frequent.

The birds we shall thirdly consider, are such as feed upon low flying insects—upon those myriads of gnats, midges, and other insects that flit about over pools and streams. Upon these the dancing wagtail dines, catching them as they flit past, or regaling himself upon their larvæ which lie on the ground.

Flies, as you well know, do not rest long in one place; the same fly will often rise high in the air, and again quickly descend with buzzing wing, either to hover among the trees of a wood, or to skim over more open spaces. Flies are thus to be met with in many situations; and in order to catch them at every turn, their captors are variously formed. To seize upon flies in wide open spaces, a bird must be able to continue long upon the wing, and to strike through the air at prodigious speed. This is the case with the swallow tribes; which are swift and untiring flyers, and scarcely ever perch on trees.* But in woods, where the

* See Frontispiece.

open space is small, flies could not be caught in this way; a bird sweeping about among trees at the rate of a mile in a minute, would be dashed to pieces against the branches. A wood-frequenting bird must be spider-like in its habits, sitting at rest on a twig until its prey comes near, then darting upon it, and again returning to perch on the bough. Such are the habits of the flycatchers.

Moths of various kinds are amazingly numerous; and as they move about when the sun goes down, their consumers must be out at dusk, and have eyes that are bright and quick. Of this class are the owls and goatsuckers. The goatsucker has a wide gaping mouth, edged with hairy bristles, and a comb on his second toe, apparently designed as a brush to clear his beak of encumbering wings and legs, both of which peculiarities admirably adapt him to revel on the food he is destined to consume.*

It is not possible in the short time we have to give to bird stories, to notice the peculiarities of each insect-catching bird; we can only speak of a

* The food of the bat seems chiefly to consist of insects that fly by night, but which are probably too small, or too horny for the goatsucker to destroy.

few, and among those few I think we must dwell more at large upon the swallow tribes; repeating some things already noticed respecting them, and adding a few more observations.

I have told you that four kinds of swallows visit our land. Swifts, chimney swallows, house martins, and sand martins. These birds live entirely upon gnats, midges, and small spiders; all of which they catch while in the act of flying,—seizing them with such rapidity that the snap of the bill may often be heard as it closes on their prey. In the throats of swifts and martins that have been suddenly killed, a number of small flies have been found sticking together in lumps as large as marbles, and though still alive, unable to escape. It seems likely that these flies were intended for the support of their young; for as swallows feed their nestlings from their own throats, it would not be possible for them to hand over one minute fly at a time; necessity must compel them to hunt on till a sufficient number have been secured to form a good packet.

The kinds of nests which swallows make, and the places in which they build, have been described in our seventh discourse. The faces of cliffs and of banks, the inside of chimneys, the tops of towers and spires of churches, with sheltered spots under

the eaves of houses, seem remarkable sites in which to fix their nests; yet the feet of swallows are so curiously formed, that they enable the birds to work on upright walls with perfect ease and security.

The joint that fastens the toes of the swallow to the leg, is a sort of cup-and-ball joint, a very poor one for walking, and which by its rolling movement gives the bird a gait that might entitle it to being ranked among the awkward squad; but it is one exactly suited to aid the bird in holding itself against any uneven upright place. The joints of its feet are also loose rolling joints; and as no membranes fasten the toes together, they move freely. They are rather long, and being tipped with strong horny, and slightly bent claws, the toes easily catch fast hold. The moment then that a swallow bends its legs against an upright, and not perfectly smooth surface, such as a brick wall, the muscles running down the legs pull up its moveable claws, and cause them firmly to clutch hold upon the inequalities of the place; the different lengths of the muscles giving the toes just such a drag on one side, as to make the feet look as if they were grasping hold of something that rested between them. This curious arrangement of the feet and joints is one which

I cannot fully explain to you, but it throws the weight of the bird against the wall, and causes the feet to cling the firmer, the more the leg is bent, provided there is the least roughness upon which the points of the claws can seize. The wing and tail feathers are very stiff, and when they are pressed against the wall, they also help to prop the swallow up.

By this time you must have gained some general insight into the peculiar construction of a bird's frame, and are therefore in a condition to judge, how far the light, delicate little swallow, is fitted for the place it fills.

You know what is the calling of a swallow. It is simply this, to catch flies in a wide open space. See then how admirably every part of its little person, and also its instincts, are fitted for the performance of this—its grand duty. In the first place, to catch flying insects, great speed is needful, and accordingly the wings of the swallow are very long;—the power of rapidly turning in flight is also needful, so its rudder, (that is its tail) is made long. Then, as the swallow must be almost always floating in the air, its wings are made not only long, but strong; and its body remarkably flat, so that it lies upon the air like a barge. To

catch flies at great speed, a wide gape of mouth is needful, and therefore it has a broad head. The bird carries no needless weight; its legs are very small, for it does not want to walk; but its toes are strong, to enable it to hang to upright surfaces when plastering its nest against them; its eyes too are keen, so that it can see the smallest fly when darting along at the speed of a mile a minute.

Besides these special peculiarities of its own, the swallow has all the common characteristics of the fowls of heaven; in the extraordinary lightness of its bones, and in the warm coat with which nature has clothed it. Every thing is done for the swallow to make it light, swift, and dexterous. If you look at its instincts, you find them no less perfectly adapted to its calling. As flies are killed off in northern climes by the cold of winter, its Maker has taught it to fly in the autumn to southern lands, and to come back in the spring; and when it returns, its Maker scatters its numerous flocks over the face of the country, instead of allowing them to throng together in one spot.

Again, the instinct of the swallow leads it to build at a height convenient for its pursuits, so that when it has carried a mouthful of flies to its young ones, it can fly forth again to its work,

without a moment's delay. But though birds of this tribe usually build high, it would not do for them to build in trees, since they can only skim through the air where there is plenty of open ground. No man ever saw a swallow catching flies in a wood ; therefore this bird has been taught to build under the ledges of cliffs, the only high things in nature except trees, and these cliffs it has exchanged for the eaves of houses, wherever the dwellings of man are to be found. In such situations the inside of the nest must be dark, so we find that the eggs are pure white, the hue best fitted to be seen in a dark abode.

The colour of the swallow might seem an exception to the general law, that the bird is coloured like its haunts, unless we remember, that many of the swallow's natural haunts are dark looking cliff-sides. We certainly see that its cousin, the sand martin, who pierces a hole for its nest in the soft ground, is something of the colour of the sand in which it makes its dwelling, and from which it takes its name.

But now, what I want you to notice is, that the structure of the whole bird is so made as to fit it for the great purpose of its life, which is that of fly-catching in open ground. The shape of its

body, the length of its wings and tail; the width, hardness, and smallness of its beak, the minuteness of its legs, and the strength of its toes; and again, its instincts, that which leads it to migrate in autumn, and that which leads it to build, not upon trees, but upon walls and cliffs; in a word, its whole being, within and without, is constructed with a single eye to its calling.

The idea that the bird is to be a slayer of flies in open spaces, is the *great leading idea* which has been shewn, in the whole formation of the swallow, just as the *great leading idea* which a man works out, when he makes a *sporting gun*, is, that it shall be a suitable instrument throughout all its parts, for killing partridges in the *best possible way*.

Certainly the swallow is well prepared for its office, and we do not find its will falls short in following it out; for one of these birds on being killed, was opened; and without the motive of feeding its young, there was found in its crop a mass of flies and red spiders, which when pressed close down, filled a table-spoon. *Small spiders* at some seasons of the year soar on their silken threads high up in the air; and that their numbers are *very great*, we may learn from the *wide sheets*

of glittering gossamer which their webs often spread during the night, over an entire field in the autumnal season.

So full indeed, is the air of living things, that in the height of summer, when the days are long, and the wind is still, a continued humming may be heard. Mr. White, of Selborne, says that a person at such times might suppose a swarm of bees was in motion, and playing about his head. The noise, however, is not the noise of bees, but the hum of vast multitudes of different insects on the wing, filling the air in every direction, and causing it to resound with their rapid movements. Yet so small are they, that we cannot always perceive them. It is well to listen to this wide-spread universal humming, for it cannot fail to impress upon the thoughtful mind some idea of the fulness of nature, and of the presence of that Being from whom all life and enjoyment comes.

To clear the air in some degree of its overabundance of living swarms, our Creator has given the swifts, swallows, and martins, four different spaces to hunt over (*See Frontispiece*). Very high up in the atmosphere the fewest flies are to be found. There the rapid swift is sent, and for sixteen hours at a time do his beautiful untiring

wings, bear him along one hundred and eighty miles each hour; his beak snapping all the while at his game. The chimney swallows take a lower region, and fly more slowly, about ninety miles in the hour, for in their appointed track there are more insects to be met with. Then come the house martins, and at the speed of a little more than a mile in a minute, they catch those insects, which, except when rain is near, move along at a height of from fifteen to forty feet above the ground. The sand martin has his post still lower down, for he usually skims after gnats and other flies, just over low flat grounds. The benefit of these orderly arrangements are felt by man every year; for no sooner do the swallows, martins, and other summer insect-feeding birds depart for their winter quarters, than late in the autumn the noisy wings of gnats, larger flies, and hosts of midges surround our path, and continue with us till cold weather kills them, or causes them to hide up.

As we watch the various objects in nature, we often find that they lift up our hearts with sweet and refreshing thoughts. Take the following instance: A person much distressed in mind on account of the little strength he felt to love his Saviour, began one summer's evening, as he was walking alone in the fields, to doubt if his prayer

for the help of the Holy Spirit had been answered. He thought that the work of the Spirit could never be so weak as it seemed to be in his heart. The day was clear, and the insects were sporting in the sun; and whilst gazing on them it occurred to him, that each of those tiny insects was as much the work of Omnipotence as the mightiest angel, and that its gentle hum could only have been called forth by the same power which inspired the hymn of the archangel. This was a simple process of thought: but, he adds, “I then saw in a moment, that small things in the beginning of a work of grace, may be as really the work of the Spirit, as the gift of prophecy or miracles; for as nothing but Omnipotence could have created an insect or an angel, so nothing but the Holy Spirit could turn the heart to desire the holy salvation of God; such a desire being utterly unnatural and abhorrent to man.*

Have you, who listen to these remarks, ever desired to know and love your God? That desire was not from Satan, neither did it spring from your own hearts. It was the work of the Spirit! nourish that desire by prayer, reading, and watchfulness,

*. Philips' Guide to the Devotional.

and the same God who upholds all creation, will lead you on to glory and honour.

We shall have next to notice the birds that walk on grass, and wade in shallow waters.

	PAGE
What birds mostly sit on the branches of trees to catch at insects and spiders quietly at rest ? (Gold crests, jenny wren, grasshopper warblers, sedge warblers, wheatears)	
For what is the size and colour of a bird usually adapted ?	236
Where are flies often found ?	237
Can the same bird catch a fly in all the different places that one fly may frequent ?	237
What must a bird have to enable it to catch flies in a wide open space ?	237
What birds fly in open spaces ?	237
What are the habits of the birds which feast upon flies as they rest quietly on the ground or on wood ? (Spider-like.)	238
What birds feed upon moths that fly at dark ? (Goat-sucker owls.)	
How many kinds of swallows visit our land ?	239
Upon what do they feed ?	239

	PAGE
In what part of their bodies have lumps of flies been found?	239
Where do swallows make their nests?	239
What kind of joint in the foot of a swallow enables it to cling to an upright place?	240
What is the calling of a swallow?	241
Can you tell me in what way he is fitted for his calling?	241 to 244
What noise may we sometimes hear in the air when the weather is calm and warm?	245

Lecture Twenty-two.

ON GRASS-TREADING AND WADING BIRDS.

BIRDS that walk on soft grassy ground, have long-spreading toes. The lark (that song-bird of the skies) has the middle toe two inches in length, with the hind one extending far out. These

The Lark's wide-spreading foot.

long feet enable the bird to run over grass, as cleverly as the Laplander walks upon snow, when

he fastens a wide frame of wood to his shoe, the extended pressure of which frame keeps him from sinking into the cold soft bed below.

The broad foot of the lark acts somewhat in the same way, and not only presents a wide surface to support the bird on the tops of the grass, but it spreads the weight of its body over so large a space, that the grass can spring up under its feet; a point of great importance to the bird when it seeks to mount from off the level ground into the air.

On first quitting its lowly nest, the lark throws itself forward with a kind of jerking, running action; but as soon as it feels the elastic grass rise under it with the motion of a spring, it spreads out its wings and mounts on high, warbling as it rises; its song grows stronger and stronger, till "melted into melody and sky;" it stays a few moments on poised wing, and again descending, falls like an arrow through the air, straight down to its simple nest, "the centre of all its joys."

Placed among the grass, the nest of the lark is sometimes in danger of being trampled upon by cattle, or of being cut down by the mower. In such cases of alarm the bird has been known to use its long foot like a hand, clasping its eggs one by one between its claws, and then flying away

with them to a place of safety. Even their young ones they have been seen to remove in this way. A clergyman in Sussex once witnessed this sight. Riding between two thick hedges not far from Chichester, his attention was attracted by a shrieking cry, when he discovered that a pair of skylarks had risen from a stubble field, and at a slow rate were in the act of crossing the road that lay before him. One of the larks held a young bird in its claws, which on reaching the opposite field, it dropped at a height of about thirty feet from the ground. The nestling was killed by the fall; and on its being taken up, it appeared to have been hatched about eight or nine days. It was evident that the affectionate parent bird had been endeavouring to convey its young one to a place of safety, but that its strength had failed in the attempt.*

Some of the birds which have the longest bills, are found in the order called waders,† among which are snipes, woodcocks, rails, and herons. Perhaps in the winter season you may have seen woodcocks and snipes. In the beginning of October, these birds leave their frost-bound homes in the far north and, flying over the seas, come to

* Jesse's Gleanings.

† Grallatores.

seek their food in our milder country. And since they principally feed upon water insects, worms, and grubs, they at once fly to boggy heaths, and marshy lands, where such earth-dwelling creatures abound.

Birds that have their larder underground, seldom see their food, they are therefore obliged to feel for it. Accordingly we find the bills of many waders are very sensitive. They are generally

General character of Bill in wading birds.

soft in their texture; long, tapering, and easily driven into moist earth. Birds which eat nothing hard, do not require the strong short horny bill of the seed-cracking birds; but a long and sensitive bill is of the greatest service where they have to grope much after soft food in muddy earth.

The bills of the curlew, woodcock, and snipe families, have six large nerves passing along the roof of the mouth; and these nerves extend quite

down to the point of the beak. Even small blood-vessels have been seen in the beaks of these birds. The whole extent of such bills must therefore be acutely sensible to taste and to the enjoyment of food. The difference between their beaks and those of most other birds, must be nearly as great as if nerves and blood vessels were placed in our nails, instead of in the quick that lies under them. The feeling bills of these birds are not, however, sensitive to pain, they only possess quickness of taste. Such tasting bills are a great boon to waders ; since they have not only to grope in mud, but also frequently to seek their food during twilight ; the animals that reside in damp, marshy places, mostly retreating during the day, but coming abroad when darkness sets in.

Look some day when you have the opportunity, at the long toes and tapering bills of woodcocks and snipes. You will see that these birds have just the kind of feet they want for moist, but not wet land, and exactly the boring and collecting bills they require for hunting after worms, slugs, and water insects.

As many wading birds feed by the edges of water, and have at times to stand upon slippery ground, as well as occasionally to run over the broad yielding leaves that grow in shallow waters,

they require both long legs and wide-spreading feet to enable them to stand firmly. And as different birds are intended to hunt over different

The Snipe.

situations, so the feet and legs of waders are made of various lengths* to meet their wants. Those that feed principally upon fish, and upon shell-fish and frogs, found in shallow waters, are in some instances mounted upon legs so tall, that they look as if they were walking upon stilts. This is the case with the flamingoes and crane families. Amongst the latter birds are the herons, which are

* See style of wader's foot, page 36.

distinguished from the rest of the cranes, by having one side of the middle toe notched like a saw; affording a roughness that enables the bird to hold fast its slippery food of eels and other fishes.

The bills of most fishing birds are lined towards the point, with bristles that point backwards. The position of these bristles makes it easy for the bird to receive food into the beak, but impossible for anything to escape after it has once

The Heron.

entered; since any living creature that attempted to escape out of the bill, would be pierced by the sharply-pointed bristly hooks.

These fish-eating birds have no crop; all they swallow, however large it may be, goes at once into the stomach, where it is quickly digested. They are remarkable for their voracious appetites. In the heron, the expanding power of the throat is

truly wonderful. One of these birds has been seen to force a flounder, wider than a man's hand, down its swallow; the throat becoming stretched into a fan-like shape as the heron, apparently half-choked, strained itself to gulp the fish down.

The fish-loving, eel-loving heron, does not often swoop down on the wing to seize its prey, but patiently waits in shallow water for the passing by of some straggler. To fit the bird for standing without inconvenience in such places, its legs are made tall, and kept bare of feathers some way above the knee. Its neck is long and pliable, which, together with the skilful form of its sharply-pointed beak, forms a powerful harpooning instrument, that for its size, is probably unrivalled in nature or art. That the fish may have time to come round the heron, the bird is given with its tall legs, long neck, and pointed beak, a patiently waiting nature. Sometimes in the absence of fish, the heron will regale itself on side dishes of frogs and their spawn, and on water beetles and water rats. This bill of fare supplies the usual kinds of food sought for by herons and other wading fish-eaters, such as storks, egrets, and bitterns. The bitterns also eat small water-birds, such as the water rail.

The benefit of having several kinds of birds to keep down the superabundance of fresh-water fish in brooks and rivers is evident, since it is well-known, that one river fish will lay on an average, fifteen thousand eggs at a single spawning. Were these fifteen thousand eggs to be hatched, and the young fish to live, the offspring of one parent, (at the same rate of increase,) would amount, in three years to countless *millions of fishes*, which in the end, would choke up the waters.*

Now look again at the heron, notice its long beak and tall body, and see if its whole shape and character, its body and instincts, are not moulded upon the one idea, "that the bird was to be a fish and frog slayer." Where do the fishy creatures live which the heron seeks? Is it not in ponds and lakes and river sides? The heron needed therefore long legs bare of feathers much above the knee, that it might stand in the water and fish for them; and such legs its Maker has given it. It needed a strong sharp bill a little jagged at the

* It is true that fish feed one upon another; pike are great devourers of some kinds of the finny tribes, but seldom touch eels, the favourite food of the herons. Otters destroy much fish, but they generally eat that which is of a larger size than such as the heron prefers.

edges, or how could it hold its slippery prey ; a slimy eel for instance ? and just such a beak it has. It needed a long neck that it might shoot its javelin beak quickly down, and it has it. Broad strong wings were provided for it, in order that it

might sweep the country far and wide ; and when its work was over, that it might return many miles to live in sweet society with its friends at home, each one, during the day, having fished in a separate pool. Yet the heron's great round, swiftly moving wings, must not flap loudly ; such a noise would alarm the fish ; accordingly, with a slightly concave form, they are so contrived as to fall together like a parachute ; and thus the heron drops gently down into its quiet pool, and makes no ripple to frighten the fish away. Its very dress also assists in concealing it, being of a pale bluish grey, somewhat resembling the hue of the sky and the water.

“ Now look at the instincts of this bird ! What virtue does a fisherman most need ? Patience ! Well, that virtue is bestowed in large measure upon the heron and its compeers, and upon them, almost alone of the feathered tribes. A robin and a jackdaw are always in a fidget, but the heron will stand by the hour immoveable.”

Observe too, how well a love of company and of loneliness are blended in the nature of the heron ; no creature more dependent upon the society of its friends during the nesting season than this bird ; twenty, thirty, and even eighty nests have been counted on one tree. Yet no one

more given up to business than the heron in its solitary pond, when duty calls it there. How remarkable! that such a sociable bird should be willing to spend its long days by itself! but this was a necessity for it as an angler.

In the form of the heron we see clearly the why and the wherefore of its whole construction. Had an order been passed in the great workshop of nature for a fly-slayer to be prepared on the best principles, could anything have been imagined better than the swallow? And when a quiet feeder on fish was required, what improvement could have been made upon the heron?

We clearly see by instances such as these, that the mighty Artificer of nature did not construct a great variety of birds, and then turn them loose to eat anything that came in their way; but having made the earth to teem with a wonderful variety of food, He gave to the feathered tribes remarkable instincts, which lead them to select different kinds of provisions, and with those instincts, he has given them in unerring skill, bodies fitted for the work assigned them. Facts like these, teach us there is a Lawgiver who rules the world.

Our next lecture will contain a further description of worm-eating birds, with some particulars on birds in general.

	PAGE
What kind of toes have birds that walk on grassy land?	250
How does the broad foot of a lark help it to rise into the air?	251
Amongst what kinds of birds are the longest bills found?	252
Why are the bills of waders made very sensitive?	253
What makes the bills of woodcocks, snipes, curlews, &c., full of feeling?	253
Why have cranes, herons, and flamingoes long legs?	255
What makes it difficult for any food to escape out of the bill of a heron?	256
What is the neck and beak of a heron superior to?	257
What kind of food do herons, bitterns, storks, and egrets feed upon?	257
Why is it a good thing to have fish-eating birds in the world?	258
Can you give any particulars to prove that a heron is well made for his work?	258 to 261

Lecture Twenty-three.

ON WORM-FEEDING BIRDS, THE POWERS OF DIGESTION IN BIRDS, AND VARIOUS REMARKS.

THE last time we met, I promised you a further account of worm-eating birds. Worms, as you know, live in the earth; and as the nature of land varies in different situations, so the bills and feet of the various birds appointed to dig them up, are made strikingly different in form.

The greater number of worms are found in muddy and wet lands, and to hunt for them in such situations, a bird needs a long bill for probing, and long legs for wading. You heard last week that the snipe is a bird which probes in marshy ground, and amongst its companions in this marshy worm-hunting, are the long-legged godwits, the redshanks, and ruffs.

On the sea-shore are many kinds of worms, and the best examples of those birds that probe

after them in the damp sand left exposed by the retreat of the waves, are the stint, the sanderling, and the curlew. The ring-dotterels with their long legs, hunt for worms and shore insects, over sand-hills covered with small pebbles ; and at the season of nest-making on these sand-hills, their plaintive, but not unmusical whistle, may be heard for hours together. These birds are sometimes seen flitting after each other, with a flight resembling that of a swallow, and at other times running rapidly along the ground, every now and then jerking up their wings till they meet above their backs. The oyster catchers with their red bills and bright black-and-white plumage, also search over pebbly banks for sea worms, to which repast they add, as they can meet with them, small fish, shell fish, shrimps, and young crabs.

Worms that live by the sides of lakes and rivers in soft muddy sand, are especially the property of the sand-pipers, who rarely, if ever, search for worms by the sea. The worms that live in soft ground formed in woods by the decay of leaves and moss, can only be searched out by a bird that has a long bill ; such an one, however, does not require long legs, because the ground though soft, is not watery. Here our former friend, the woodcock, steps in with its length of

bill, which is made after the fashion of those of the wading worm-eaters, but the rest of its body, from the shortness of the legs, is unlike that tribe of birds.

Great numbers of worms, slugs, and snails are met with by the side of pools, in watercourses, boggy woods, and under the grass of meadows. As these creatures rise to the surface of the ground, they are picked off (not dug for) by the water-hens, water-rails, and crakes; these birds also partake of some green food; and the water-rail sometimes catches up small fish.

Lapwing.

Then again, worms and slugs abound upon moors, heaths, and downs. These drier situations seem committed to the oversight of the long-legged plovers. The plovers are not probers in mud, though they sometimes frequent moist lands; but with their long

bare legs they run rapidly over open plains, from the surfaces of which they pick their creeping prey: sometimes like the lapwing, stamping upon

the ground to make the worms rise. Plovers are also insect-eaters, and so is the thick-knee, or as it is frequently called, the Norfolk plover. This bird is a great devourer of earwigs; it will also eat frogs, and probably mice when it can catch them. The legs of the thick-knee, though long, are not made for wading, they are only adapted for running, therefore we find the thick-knee lives on plains and dry sheep downs, over which it runs with rapidity; as does its second cousin, the bustard, which bird is partly a grain feeder, but more of a leaf-eater, loving the tops of turnips and other large leaves, as well as occasionally picking up a mouse or frog.

In some of our former lectures, we noticed the worm-eating birds that are found among the families of the perchers, such as the rook, crow, thrush, &c. These kinds of birds usually seize upon worms that rise to the surface of the dry ground in gardens and fields, sometimes pushing their beaks a short way after them, into the earth. Seeds and grain, however, form the largest proportion of the food of such worm-eating perchers. And here let us notice the peculiar kind of machinery in the bodies of birds, for bruising and dissolving that which they eat.

All birds that feed upon seeds and grains of

corn, swallow their food whole, sending it down the gullet into a loose bag called the crop. In this crop the seeds become moistened, and after they have swelled, fall little by little, like corn from a miller's hopper, lower down into the body, until the moistened seeds pass between two wide muscles, called the gizzard. These gizzard muscles are simply the coats of the stomach very much enlarged, and forming lobes which are covered with plaits of gristle, yet these lobes are so strong, that as they rub together, they can, with the help of a little sand or a few small stones, grind down the firmest grain, as perfectly as a coffee-mill grinds down coffee berries.

The moisture in a bird's crop possesses no dissolving qualities, it appears simply to swell the corn, and to prepare it for grinding; a chicken would therefore be starved to death in the midst of a heap of barley, had it no gizzard by which to break the seeds it had swallowed.*

Birds, such as the woodcock and snipe, that live upon soft worms, slugs, and bulbous roots moistened in water, do not require gizzards.

* The resting in the crop probably produces some chemical change in the corn, though not apparent to the eye.

The coats of their stomachs are firm enough to break up such food; and as soon as the pulp thus formed becomes mixed with the juices of the stomach, the food is turned, as with other animals, into nourishing liquids. These liquids are caught up by numerous fine vessels and driven forward to the heart, from whence at every beat, they are sent round the body to renew its wasted vigour.

Birds of prey that live upon flesh, are also without gizzards; they eat nothing so hard as to require a mill to grind it down. Yet as animal food is of a more solid character than the food taken by suction birds, the stomachs of flesh-eating birds are supplied with strongly-dissolving juices, not unlike those possessed by four-footed beasts.

Thus we see that all things in the works of God have been made to harmonize or to suit one another: that the outside limbs of an animal have been adapted to suit the internal construction of its body, somewhat as a clock-maker forms the outside case of a watch to suit the size and quality of its internal machinery. We see that birds which are supplied with bags for moistening hard seeds, and with gizzards for grinding, have beaks suitable for picking up corn or berries,

and toes suitable for perching on trees. That birds which have stomachs simply prepared for suction, or for taking soft food, have long sensitive beaks for probing, and long toes to support them on the moist lands where that food can be found, while birds of prey, with soft but strongly digesting stomachs, have been given large hooked beaks, short legs, and crooked sharp talons, by which they can seize upon and tear up animal food.

Birds of prey are few in number, compared with those of other tribes. Seed and insect feeders abound in every quarter, and waders also are plentiful on marshy land and in moist places; but as these birds generally feed by twilight, a person may wander the whole day by the side of a stream without hearing a voice, or seeing a feather of one of these long-legged birds; but as soon as night sets in, the bitterns, rails, and other tribes, make the wilds alive with whistling and screaming.

Our observations upon birds of prey, as well as upon perchers and waders, are now drawing to a close. Have any remarks you have heard upon their instincts, their uses in creation, and upon the forms of their bodies, supplied you with a new set of ideas? "It is very well to look at

birds, to skin owls, and to gum eggs upon card-board," but the great thing is to perceive that the shapes, the colours, and the instincts of the bird-race, have not been flung together any how, "like the patterns of a kaleidoscope," but that each bird has been fitted by the most exquisitely calculating skill, to fill the place it now holds in nature.

Our next subject will be on the swimming birds.

	PAGE
Where are the largest number of worms found ?	263
What birds frequent wet muddy lands ? . . .	263
What birds hunt for worms on the wet sea-shore ?	264
What birds frequent the muddy sides of rivers for worms ?	264
What bird searches for worms in the leafy mould of woods ?	264, 265
What birds pick up worms, slugs, &c., off the surfaces of moist places ?	265
What birds do this work on heaths, downs, &c. ?	265
Where do perching birds find up their worm dinner ?	266

	PAGE
How is grain ground down in the bodies of birds?	267
Where is soft food dissolved in suction birds? .	268
What dissolves the food in the stomach of birds of prey?	268
What are made to suit one another in the forms of animals?	268
What kinds of birds are the most numerous? .	269

Lecture Twenty-four.

SWIMMING BIRDS.

BIRDS that swim, have generally short legs compared to the length of their bodies, and these short legs are usually placed far back towards the tail, so that full space is allowed for the breast-bone to rest upon the water.*

The feathers of water birds are close, smooth, and glossy; and underneath is very frequently a thick mass of down, to defend the skin from being chilled by the water. Down, of all animal substances, being the lightest and closest description of clothing; and the one that best preserves the body in an equal state of warmth.

The toes of most swimming birds are united by a thin yet firm and easily folding skin, which

* Those birds that dive as well as swim, have their legs placed still further back than the simply swimmers.

is called the web. This form of foot, as mentioned in our seventeenth lecture, gives the bird power to strike the water with peculiar force,—to press against it as if it were using an oar, and then to drive it forward by the opening and shutting of the web, an action not unlike the flappings of a fan or parasol.

Foot of the Coot.

Water-fowl, such as the coots, that paddle among the stems of reeds and other water-plants, have their webs tied in knobs or lobes along the sides of the toes.

This arrangement enables the bird to draw its foot safely between the close standing stalks. Had the web of such birds been spread out, as in the duck's foot, it would have been in continual danger of becoming entangled or torn among the reeds.

Swimming birds do not move well on land; a duck and a goose, which are web-footed, roll as they walk. This arises from the construction of the leg-joints, which are so made, as to throw the foot outward from the body, and yet to allow of the legs being thrown steadily backwards

under the body, a very convenient arrangement for a bird when moving on the water, but one that on land occasions a slow rolling action.*

The Duck.

The bills of some water-fowl are broad and flat, like those of the common duck, others are more pointed. Some of these birds seek their food low down under the waters, others again find it nearer the surface ; but as their food lies gene-

* The goose is the best walker of any of the web-footed birds. The form of the joint that unites the foot to the leg somewhat approaching to that of the cranes.

rally out of sight, swimmers, like the waders, have

Beak of Shoveller Duck with fine
bristles.

been given sensitive bills. The inside of many of their bills are thickly set at the edges with three or four rows of short stiff comb-like bristles; and it is in these bristles that the

power of tasting is believed to reside. The broadest bills are the most thickly bordered with such bristles, and the fleshy tongue with which every bill of this kind is filled, has also the same kind of sensitive comb-like hairs upon it. These bristles often act as filterers or sieves. The common duck has a filterer. As the duck drives its head under the water, it catches up its breath to stop any soft substances that may be floating past; and on those substances being drawn through the filterer, they become broken up. What the duck approves is kept in the bill, what it does not like is quickly sent out. These various proceedings produce that hurley-burley in the water, you may have

remarked when a duck is paddling about in a pond.

When the bristles or processes in a bill are fine, as in the case of the common duck, and still more so with the shoveller duck, (*see p. 275*), they act as strainers: when they are thicker and stronger, they serve as with geese, to grind down grass; and when very strong and sharp, as in the mergansers, to seize upon and hold fish.

Geese have shorter bills than many of the water-birds. They live much upon grass, and to enable them to cut it from off the meadows, the point of the upper mandible is tipped with a hard piece of horn, the grass being afterwards rubbed down upon the small lumpy bristles which are placed some way along the edges of the bill.

The food of swimming birds varies. Some, as we have seen, eat fish; others, water-plants, grass, slugs, shell-fish, worms, and water insects. Those that search for their food low down in the mud, have either long necks like the swan, or else a power like the duck, of plunging neck and body under the water. Mallards, teal, and many ducks eat in this way. Others that feed at the bottom of deep waters are divers. For

this purpose their feet are set far back, as you may have noticed in the pictures of grebes and penguins. The backward position of the feet

The Penguin.

gives to these birds when on land, the peculiar effect of appearing to sit on their tails like kangaroos. On the water, it causes their legs to act as levers, in overcoming its natural tendency to float the body; and thus the divers are enabled to turn head over heels, and dive downwards, an action rendered additionally easy, from the length and narrowness of their

bodies, which are shaped like a racing boat, the best possible form for enabling a bird to glide swiftly through the yielding waters.

Some web-footed birds live entirely on rivers and ponds; others only frequent the salt seas; whilst others again divide their time between the two. Sea-gulls, of which there are several species, not unfrequently pass over the land, quitting the sea in large flocks on the approach of stormy weather.

Gulls are long-winged sea-birds, clothed in bluish white feathers. They are constantly on the wing, and from their powers of flight, are met with in all parts of the globe. Indeed, were it not for the purpose of rearing their young, one would think they never need to visit the solid earth, since they can feed at sea, and can rest when wearied on the tossing salt wave.

Gulls have longer legs than most swimming birds, and the joints in their feet are so formed, as to allow of their either walking or swimming. They feed upon worms, shell-fish, and upon carcases of every description, whether they be floating at sea or decaying on land. They are clamorous and voracious, and the shipwrecked mariner is sometimes in danger of being attacked by them.

A few years ago, a boat with several sailors left the Yarmouth jetty in fine weather. When about eight miles from land, a sudden squall of wind upset the boat, and all on board perished, excepting two of the men. One of these struggled for a time in the water, and then sunk. The surviving man being a good swimmer, and finding that his companion was drowned, determined to use every effort to reach the land. His heavy water boots proved a great incumbrance to him, he therefore contrived to draw his knife from his waistcoat pocket, and by degrees, and by dint of great exertion, managed to cut them from off his legs. Thus lightened, he set off at full stretch. For some time the tide favoured him, and he made rapid progress; but at length it turned and feeling exhausted, hope declined. In his distress he commended himself to God, and turning on his back, laid himself flat on the waters to be drifted as either the wind or the currents might carry him. Night came on, and by the stars he saw that he was bearing towards Lowestoft. Then clouds arose, and he lost sight of his bright twinkling guides; he could therefore do nothing but occasionally move his hands and feet to keep himself afloat. As day dawned, he saw

by the first streaks of light, that he was passing a sea-buoy anchored on a sand-bank. He instantly knew by the appearance and situation of this sea-buoy, that he was not above two or three miles off shore, but he had no strength to strike towards the land, and therefore again commending himself to his Creator, he drifted on. At this time the sea-gulls began to hover over him, and no doubt supposing him to be a dead carcase, they flapped their long wings across his face, and endeavoured to seize upon his eyes. Exerting all his force, he roared amain, and struck at them with his arms; still they hovered over him, and almost dead with exhaustion, he was on the point of giving up, when he thought he saw, not far off, something dark on the water. It proved to be a ship; again he screamed; the man at the helm heard his voice, and shortly a splash was heard; a boat had been lowered from the ship; it glided on, and he was picked up. Excepting for this providence, he must have become the prey of the sea-gulls; but his prayer had been heard, and he was mercifully delivered out of the depths.

We could speak of many more water-birds, but of these you can read in books of natural history. Yet there is one sea-bird I should like

to describe, it is so wonderfully made for pouncing down with intense force upon a fish, as well as for darting under the water in a way that would kill most other breathing creatures; its Maker, who gave it this peculiar instinct to rush on with impetuosity, has however well guarded it against injury. This wild sea-bird is the gannet or solan goose. The beak of the gannet is pointed and very strong, and by the velocity with which the bird descends, the bill strikes into a fish like a spear, and holds it like a barbed hook. So vehement is the stroke of the gannet, that if a board be laid over a dead fish, and the bird descends upon it, the bill will strike through the board and pin the gannet down.

To protect the gannet from being stunned by its immensely rapid fall, the front of its head is curiously covered with a horny mask; and probably to protect it from a rush of water into the head, it is made without nostrils; yet the gannet breathes freely, having three large air-cells inside its throat and breast. These cells, whilst they supply the body with air, break the force of the bird's rapid contact with the water, and from being buoyant like bladders, not only stop the gannet from going too deeply under the waves, but also assist it to rise through the

waters, and again to remount into the higher regions of the air.

The foot of the gannet is differently made to that of the common duck, since the web between its front toes is carried round on one side, so as to enclose the hind toe. All birds with this kind of foot are good fishers. The pelican, cormorant, and darters, have webbed feet of this form.

At most times of the day, when the weather is calm, some kinds of sea-fowl may be seen gliding over the ocean waves, giving life and beauty to the scene. But the place and hour in which their presence imparts the most exhilarating pleasure, is some way out at sea, just at break of day on a fine summer's morning. At such times, when the sparkling rays of the rising sun tip the rippling waves, bird after bird will appear in sight. No one can tell from whence they spring; but there they are, coursing along high up in the heavens, then dipping the wing sideways and downwards over the waters; and again striking forwards in the most graceful of attitudes; the glowing light giving to their feathers, which are chiefly of sober black and white, or bluish hues, all the effect of a dazzling plumage.

Far out at sea amid the wide oceans, birds are still to be seen enlivening the watery scene; and with these remarks, we must close our search into the nature and instincts of the feathered tribes.

The next time we meet we shall consider the causes of voice in living animals.

	PAGE
What length of legs (as compared to their bodies) have swimming birds?	272
What kinds of feathers have swimming birds?	272
With what are the toes of most swimmers united?	272
What is the advantage of a webbed foot?	273
In what position is the web of the coots placed?	273
Why do not swimming birds walk well on land?	273
In what places do swimmers find their food?	274
Why are they given sensitive beaks?	275
What are the common shapes of their beaks?	274
With what does a goose bite grass from off a meadow?	276
With what does it afterwards grind down that grass?	276
What is placed along the sides of the bill and tongue of a duck?	275
How does the duck draw its food into the bill?	275
When the bristles on a bill are fine, what do they act as?	276

	PAGE
When they are thicker, what do they serve for ?	276
When very strong, what help do they give the merganser ?	276
On what kinds of water do web-footed birds live ?	278
Can you give any particulars of the gulls ? of their colour, powers of flight, where they can rest, upon what they feed, and their temperament ?	278
In what way is the gannet prepared for pouncing rapidly under the waters ?	281
What food do swimming birds eat ?	276
Why are some of their necks long ?	276
Why are the feet of the penguin, &c., set very far back on their bodies ?	277

Lecture Twenty-five.

ON THE CAUSE OF VOICE.

VOICE is a sound produced at the back of the mouth, by the trembling of little strings, which are stretched tightly over the top of the windpipe, so as to form a musical instrument.

In the throat are two passages ; by the one (called the swallow) food descends into the stomach ; by the other, (called the windpipe) air first descends into the chest, and then re-ascends ; and it is by the passage of the air through the upper part of this windpipe that sound is produced.

If you touch the outside of your throat, you can feel the rings of the windpipe through the skin. This tube is formed chiefly of gristly rings, in

order that the air-passage may be kept constantly open, but the rings do not go all round, for at the back, a small portion of its wall is made of a tough soft membrane that yields to pressure, and thus gives more space for the food when it has to descend the swallow.

It is well known that the lining which covers the inside of the windpipe is very susceptible. The smallest crumb or even drop of water that touches it, producing so much irritation, that the windpipe resents the attack fiercely, and instantly tries to close itself, which gives a choking sensation. But when air only passes up and down this passage, the susceptible lining remains so quiet that people are scarcely sensible that they have a windpipe. Paley, a celebrated writer, when speaking of the characters of the windpipe, says, "It is to the union of these two incompatible qualities of extreme sensation and quietness, that we owe our safety and comfort."

When you are told that at the back of the mouth lie two open passages ;—the one for receiving air, the other for receiving food, are you not inclined to ask the question, "What prevents food from falling down the windpipe?" The answer to such an enquiry is, He who made our bodily frames, has placed over the top or entrance of the windpipe,

a small lid or flap of gristly flesh, which, whenever food is about to descend the swallow, falls down over the windpipe at the right moment for the food to pass over it, and as regularly, when the food has passed, does it rise up again and admit the air.

This sensitive windpipe not only admits air to the chest, but as we said, is moreover a musical instrument. Over the opening, in its uppermost ring, is stretched a drum-like membrane that has a slit in it. The air in going to and from the chest, has to pass through this slit, and whenever its edges are tightened, the rush of the air against the edges causes them to tremble, just as the bow of a violin sets the tightened cords of the instrument trembling, when it is drawn over them. This trembling, whether it be of the vocal cords, or of the violin cords, agitates the surrounding air, something as you may have seen a stone disturb the waters of a pond, when splashed into it, causing waves or rings to be spread over its surface. This agitation in the tremulous air, when it reaches our ears, is felt by them as sound; the sound being higher or lower, according as the cords from which the agitation comes, were at the time drawn tighter or let looser.

The quality of sound depends upon three things;

upon the fineness or thickness of the top gristle-ring of the windpipe; upon the delicacy of the drum-like gristly membrane that is divided by a slit, and somewhat upon the size of the air tube beneath, which as a sort of flute, re-echoes the sound formed on the edges of the slit. Would you not expect to hear a sweeter tone from a silver flute than from a brass horn? and so in the voice instruments of animals, some of their gristly tubes are as soft and sweet sounding as if they were made of silver, and others, in their natures, are as harsh as brass.

The sounding powers of the edges of the little tightened membrane placed on the top of the human windpipe, are truly wonderful. The variety of tones which can be made to flow from them, surpass in number, those produced by most instruments which human art has constructed. Yet while a man is speaking or singing, the air plays over, and rushes past these vocal cords so smoothly and easily, that he is altogether unaware of the exquisite skill with which his Maker has prepared his sounding instrument.

As the air, made to tremble on the top of the throat, passes on through the mouth, it can be stopped; and in the family of man, be driven at the will of the individual against the palate, the

cheeks, the tongue, or the teeth; by this means, a great variety of sharp, hissing, soft, rough, or dull sounds can be produced. Among these sounds, a few distinct tones are formed, called letters, and it is according as a man strings these letter-sounds together, that he utters words.

The organ of the human voice is simple in its first movements, it is merely a rush of air over delicate cordy edges; but when we examine the mode by which the trembling air is made to produce vast numbers of different sounds, we at once discover that the voice of man arises out of a highly complicated and beautiful kind of machinery. To enable a man to stretch or to loosen the edges of his sounding instrument, and to enable him to guide and mingle its tones as they pass through the mouth, there is placed under the control of his will, a countless number of fine elastic muscle-cords, which are connected with the brain by an equal number of feeling threads called nerves. Whenever, therefore, a man would change the tones of his voice, his mind has to send down to the voice-cords a particular message by some one of these minute nerve-threads. "The meshes of the spider's web, or the cordage of a man of war," Sir Charles Bell tells us, "are few and simple

compared with the concealed filaments of nerve, which move these vocal parts." And if ever so slight a derangement takes place in their action, every one knows how a man will stand with his mouth open, moving his tongue and lips in vain attempts to utter a word.

Thus man, by the movement of many delicate nerves and fine muscle-cords, is given the power to catch up the notes poured out by his voice, and so to marshal them into words, as to lay before the minds of others, (by means of sound) the thoughts or images in his own spirit. This ability to hold conversation forms a grand distinction between himself and the inferior animals.

For the use made of this wonderful gift of speech, man is held responsible to his Maker. It is a solemn declaration of our Saviour Himself, "That for every idle word that men shall speak, they shall give account in the day of judgment." St. James tell us, "The tongue is a fire; a world of iniquity, an unruly evil." But again the word of God has said, "The lips of the wise shall be as a well of life, as streams in the desert"—diffusing health, peace, and joy on earth, and glory to God when they sound forth His praises. Blessed are they who watch against the evil use of this gift,

and happy are they who strive to turn it to the best account.

The feathered tribes as they sing among the branches, warble the praises of their Creator; but though they give back in melody the joy of their hearts, they cannot, like man, acquaint themselves with God, or speak of His goodness.

Most backboneed animals are furnished with an instrument of sound in the throat, by which they are able to give out signs of pain, anger, and pleasure. The bellowings of the bull, the lowing of the cow as she slowly moves homeward, or her bitter moan when separated from her calf, clearly mark different states of feeling. The growl of the dog when angry, his guarding bark, and his whine of affection, are equally well understood. With birds it is the same. Their notes change according to their feelings, producing the song of joy, cries of alarm, or notes of recognition. In some instances their voices almost resemble language, yet their sounds are not language, for it is the expression of feelings, not of ideas, that birds and beasts utter. Birds twitter over their food, and chirrup happily over their offspring, but they never give out a sound to tell how many miles they have flown. They scold one another in a sharp tone,

but they have no power of distinguishing between good and evil. Their voices simply give out natural cries of joy, astonishment, anger, or grief.

“The mother bird comprehends the wants of her little ones, by their piping notes of appeal. The swallow chirps in her nest to her young ones, and appears to hold conversation with them. When the hen is alarmed for her chickens, she utters a cry of warning, and they instantly shelter themselves under her wings. In North America, flocks of wild turkeys pass so constantly at stated seasons from one district of wasted land to a richer portion, that the Indians call that time “the turkey month.” As they travel on, the turkeys are occasionally checked in their progress by meeting with a wide river; for on these journeys they always go on foot; a party of the cock birds head the troop, sometimes ten together, sometimes a hundred, while many groups of hens, from seventy to eighty in each flock, follow with the young ones. At sight of the river, they select one of the highest pieces of ground near to its banks, and there remain sometimes for more than a day, as if for the purpose of consultation. The male birds during this time gobble obstreperously, and strut with extraordinary importance, as if they wished

to animate their companions with a spirit of hardihood. The females spread out their tails and move silently along. At length the assembled multitude mount to the tops of the highest trees, from whence at a single note from a leader, the whole party wing their way together towards the opposite shore. Some arrive safely, some fall, but by spreading out their tails, keeping their wings close, stretching the neck forward, and forcibly striking the water with their feet, they contrive to swim to land; others again sink, to rise no more. These proceedings of the turkeys look very much like consideration of coming danger, and of advice to meet it in the best possible way.

In March, flocks of wild geese come from Norway and Russia to the northern parts of Scotland. They always take up their abode near to some bay, or inland lake. Great order attends their movements, which are evidently guided by a language understood among themselves. Charles St. John says, "Of a morning the geese fly away in companies in search of corn and clover fields. Those that feed on ground at some distance off, start before sunrise. Those that feed near their roosting place do not leave so early. Having fixed upon a field of new-sown grain for their

day's repast, before alighting they make numerous circling flights round and round, when the least suspicious object will prevent their pitching. Supposing that all is right, and they do alight, the whole flock, for the space of a minute or two, remain motionless, with head and neck erect, reconnoitring the country round. They then, at a given signal from one of the largest birds, disperse into open order, and commence feeding in a tolerably regular line. They now appear to have made up their minds that all is safe, and are contented with leaving one sentry, who either stands on some elevated part of the field, or walks slowly with the rest—never, however, venturing to pick up a single grain of corn, his whole energies being employed in watching. The flock feed across the field; not waddling like tame geese, but walking quickly, with a firm, active, light infantry step. They seldom venture near any ditch or hedge that might conceal a foe. When the sentry thinks that he has performed a fair share of duty, he gives the nearest bird to him a sharp peck. I have seen him sometimes pull out as many as a handful of feathers when the first hint was not immediately attended to, at the same time uttering a querulous cry. This bird then

takes up the watch, with neck perfectly upright, and in due time makes some other bird relieve guard. On the least appearance of an enemy the sentinel gives an alarm, and the whole flock invariably run up to him, and for a moment or two stand still in a crowd, and then take flight; at first in a confused mass, but this is soon changed into a beautiful wedge-like form, which they keep till about to alight again.

“Towards evening I observed,” continues Charles St. John, “the geese coming from the interior, in numerous small flocks, to the bay; their peculiar cry being heard some time before the birds were in sight. As soon as they were above the sands, and the coast seemed clear, flock after flock wheeled rapidly downwards, and alighted at the edge of the water, where they immediately began splashing and washing themselves, and keeping up an incessant clamour.”*

Rooks and crows certainly utter sounds full of instruction to one another. Every one who has listened, must know, that the *caw* of the rook is varied according to the occupation of the bird. At the time when two or three companies meet in

* “Wild Island Sports.”

the air, they evidently engage in consulting which of the fields below them it will be best to alight upon. Sometimes a single rook on the outermost edge will utter two or three caws in a very peculiar tone, and instantly leave the group to wheel off in a totally different direction to that in which the rest are going; and without turning to see whether his companions follow him, will speed forward. But the signal is not lost upon the leaders of the company; they turn the whole column of birds by a half circular movement, and then follow the flight of the rook, which by that time is perhaps a quarter of a mile a-head.

Rooks generally feed in large flocks together, and walk about a field nodding their heads and their tails with as confident an air as if they were the true proprietors of the land, and as if all were safe and right; when suddenly, they are off! loudly vociferating as they ascend almost up to the clouds. A sentinel, at these seasons, sits perched on the bough of a high tree, and the moment he perceives danger approaching, utters a cry of alarm which is well understood, when the whole peaceful crowd are thrown into an uproar, and instantly make off to their homes, or to another field. Human language could not give a

more distinct warning than this one note, by which the discerning watching rook can tell its tale to the rest.

The plaintive tones of birds are equally clear to understand; many instances might be named, perhaps one is sufficient. A couple of swallows had built their nest in a stable belonging to a lady;—the eggs were laid, and the little hen had begun to sit; when some days afterwards several people saw the female still on her eggs, but the cock bird flying about the nest, and sometimes settling on a nail, uttering a very plaintive note of uneasiness. This induced them to examine the nest, when they found the hen, though still covering her eggs, quite dead; upon which the people removed the little dead bird. The male then went and sat upon the eggs; but after two hours he flew away, and in the afternoon returned with another hen swallow which took the place of the former one upon the nest, and continued to feed the young ones till they were able to provide for themselves.*

The peculiar windpipes of birds, and their

* Bingley.

different styles of singing, will form our next, and last subject.

	PAGE
What is voice ?	285
How many passages are there in the throat ? .	285
With what is the top ring of the wind-pipe covered ?	286
What kind of opening is found in the lid of the membrane upon the top ring ?	287
When the air rushes past the edges of the slit, what does it turn the edges into ?	287
Does the trembling of the air upon these vocal cords stop in the throat ?	287
Upon what does the quality of the vocal sound depend ?	288
What part of the mouth divides and directs the trembling air that comes from the throat ?	288
And into what kinds of sounds can man direct the moving air ?	289
By what assistance does the will of man convey intelligence to the windpipe, and to the mouth, of the sounds he wishes should arise ? .	289
To whom shall we have to give up an account of the use we make of the gift of speech ? .	290

Animals cannot combine sounds like man, but we can notice in their voices some variations of feeling ; what are those varied feelings which are shewn by cattle and birds ? . 291

Lecture Twenty-six.

ON THE VOICES OF BIRDS.

THE windpipes of birds differ in some respects from those of men and quadrupeds. They are often longer, and always more firmly made; the gristle of the rings being carried all the way round. And, again, the stretched cords which give forth the sound of the voice in birds, are not placed at the top of the windpipe, as with man, but at the lower part, not far from where the windpipe enters the lungs. This causes the hollow of the windpipe, (that part which surmounts the sounding membrane) to strengthen the sound, by serving as a speaking trumpet. The voice, in its ascent up this tube, strikes against the hard rings, and in rebounding from one to another,

resounds with force. The wider also are the spaces between the hard rings, the greater is the variety of tone produced. Thus the quality of a bird's notes depends almost entirely upon the internal formation of the windpipe, and upon the fineness of the material of which it is formed.

The windpipe of a bird may truly be said to act as a double instrument; since the lower entrance gives out tones like the reeds of a clarionet, while the upper outlet acts as a trumpet tube. The cheeks, the tongue, and the bill of a bird, excepting in parrots and a few other kinds, have scarcely any power to stop the sounds that come from the throat, so as to mould and join them into distinct words.*

The great volume and strength of sound thrown out by birds, arise not only from the make of the windpipe, but also from the general construction of the bird's body.

Birds, like other chest-breathing animals, draw in air, and then send it out again, somewhat after the fashion of a pair of bellows. The lungs which receive the air, do not, however, fill the chest of the bird, but are fastened to the ribs;

* In a slight degree jackdaws, starlings, and magpies, possess this power.

and out of the cavities in the lungs of birds, proceed, as you have been told before, a vast number of fine tubes that carry the air forward into minute cells, or delicate bags of membrane which are thickly dispersed about the frame. It is probable that a bird's wonderful power of long-continued song, arises from its ability to send air-blasts forward out of these cells into the windpipe, where they rouse up the vocal tones. Little feathered songsters, when under the excitement of musical rivalry, have been known to fall down dead, suffocated in consequence of having exhausted their over abundant supply of vital air.

In some kinds of geese, ducks, and wading birds, the windpipe of the male birds is so long, that before it enters the lungs, it takes a folding turn under the breast-bone. Some of the males of these birds have also a sort of gristly cavity, near the end of the windpipe, which gives to their tones a loud whistling sound, not unlike the notes of a harsh bugle. The trumpeter swan is one of these whistlers. These swans live during the summer in the cold regions of North America: towards winter, they fly in large flocks more to the south, and as they shape their course down the valley of the Mississippi river, they may be

heard a long way off, uttering their loud music, which many people have described as like a wild chorus of horns clanging in the air.

For their size, birds are able to produce a larger amount of sound than any other animal. The shrill crowing of a cock will reach to a far greater distance than the shout of a man. Storks and wild geese may be heard sounding away high up in the air, at a distance of three miles. The croak of the raven, the cry of the duck, of the peacock, and of the goose, can be heard further off than the bellowings of a bull; and the song of the blackbird reaches to as great a distance as the voice of a man. The attention of a gentleman walking in one of the most densely crowded and noisy parts of London, was suddenly arrested in the midst of the rattle of carriages, and the hum of human voices, by the notes of a bird in full song: he looked up, and beheld a small skylark pouring out its tuneful voice with such fulness of strength, that it rose above the din of confused sounds that streamed up from several streets.

Perhaps you may wonder why birds have had such strong voices given to them. As no decided reason is known, we are left to infer that their Maker has conferred this gift upon them, to

increase their enjoyment, and to make them aware of each other's presence. Four-footed beasts, that live upon the ground, when in quest of their companions, can discover them by sight and by smell; and from being restricted in their ability to wander far away from each other, a slight exertion of voice is enough to serve their purpose. But the birds of the air are continually far apart from each other, and even when near to one another, many of them are so small, that they are hidden by the foliage of the trees amongst which they rest. Consequently those which live habitually together, whenever they quit one tree for another, keep up a peculiar sort of twitter, as if to inform their mates of every fresh movement. "A pair of bullfinches," Mr. Swainson says, "which crossed our path in a shady lane this morning, were sometimes on the same hedge, and sometimes opposite to each other, never separating to a greater distance than fifteen or twenty yards; when nearer, no calling note was to be heard, but as soon as one flew to a further bush in search of fresh food, it apprized its companion by a chirp, and it immediately followed." When birds are exploring with their mates the best spot for building their nests, or are gathering materials to make them, the same signal notes are

continually to be heard. In the autumn there is much less chirping, because these labours of affection are then over.

The different characters of the various families of birds may be traced in their voices. The male birds are distinguished from the hens by the strength of their notes. The piercing cries of the birds of prey shew their savage tendency; the re-echoing screaming of the swimmers, the harmonious warbling of the small insect and grain-feeding races, the importunate clamour of the waders, and the shrill sonorous call of the poultry, all mark the peculiar disposition, constitution, and habits of these different tribes.*

Many peculiar species of birds probably learn their song when in the nest, by attending to the notes of the parent bird, just as children learn from their nurses and parents the language of the country in which they live. Bird fanciers find that the first attempts of a nestling to utter sounds is not at all like its after song, but that as the bird grows older and stronger, it is not difficult to perceive what kind of sound it is attempting to copy. Whilst the winged scholar is thus endea-

* Griffiths Cuvier.

vouring to form his song, he commonly raises his tone when he has caught a passage, but lets it drop when he fails. What he is not thoroughly master of, he hurries over, lowering his voice as if he did not wish to be heard, and as if he could not yet satisfy himself. A common sparrow that was taken from the nest and placed near to a linnet and goldfinch, adopted a song that was a mixture of the notes of these two. Three nestling linnets were educated, one under a skylark, another under a woodlark, and the third under a titlark, and instead of the song peculiar to their own species, they adhered entirely to that of their instructors.*

Melody of voice belongs almost entirely to the *perching* birds. The nightingale is thought by many to be our sweetest songster. There is a fulness, flexibility, variety, and harmony in its notes, which are quite astonishing. Dwelling for a minute in an under tone, on two or three melancholy notes, the nightingale gradually swells into a lofty key, till rising to its utmost pitch of strength, it sinks down to a dying cadence, and again strikes off into a rapid succession of more brilliant sounds, ending in various detached

* Bingley.

ascending notes. Twenty-four different strains, with many delicate variations, have been reckoned in the song of a fine nightingale. On examining the sounding organs of these birds' windpipes, it is found that for their size, they possess stronger muscles than those of any other of the feathered tribes.

The song of the thrush is said to be the finest of any of our staying woodland birds, and indeed is superior in power and clearness, though not in variety, to that of the warblers. The song of the little wren is much admired; and for the size of the bird, is very loud. The wren continues with us throughout the year, and warbles its sweet song very late in the season. In the cold of winter it has been heard to sing in the midst of a fall of snow.

Large birds are generally grave in their demeanour, and live much alone, while nothing can stop the constant prattle of the little company-loving songsters of the wood. The voice of the eagle is piercing, somewhat resembling the sharp barking of a dog, and is occasionally heard when the bird is flying so high that its form is completely lost sight of.

Most of the waders and swimmers, as before remarked, have loud screaming voices. The

bittern has a very hoarse voice. When it comes out of its ready hiding-place in the evening, and takes to its wings, its music quite startles the listener; it sounds as if the voices of a bull and a horse were mingled together, and mocking you from the skies; yet listen patiently, and you will at last find some melody in its tones.*

Several birds which have a wide beak, and a thicker and more fleshy tongue than the warblers, can be taught, as already remarked, to sound words, though they do not understand them. Parrots, pies, jackdaws, crows, blackbirds, starlings, and some others, which have this kind of bill and tongue, can be made to chatter continually; but as their words express no thoughts, they do not at last speak. Some birds, from the form of their sounding organs of voice, and from the shape of their tongues produce strange tones. The horned owl is one of these. In South America there is a bird called the campanero or bell-bird, which gives out a note exactly resembling that of a tolling bell. A bird with a similar note has been heard in South Africa. Two missionaries journeying in the wild solitudes of that land,

* Slightly altered from Mudie.

listened to one of these birds with astonishment, and exclaimed to each other, "Did you not hear a church bell?" The sound came to their ears heavy and slow, like a heavy toll. It never seemed to be nearer, but came as a deep, solemn, dream-like sound, sometimes ceasing, and then again the solemn peal was borne upon the wind.

In North America and the West-Indian Islands there is a thrush called the mocking-bird, which can imitate the sounds of many birds and animals. One of these birds confined in a cage, has been heard to mimic the mew of a cat, the chattering of a magpie, and the creaking of a sign-post in the wind. This kind of thrush often frequents the dwellings of the American farmers, and sitting on the roof or chimney, will sometimes pour forth its own sweetest and most varied notes: at other times, it will borrow its song from every bird around; and on this account has been termed by the Mexicans, "the bird of four-hundred tongues." It sings from March to August. Mrs. Meredith, who resided some time in Tasmania, amusingly describes some birds, which the people around her called "the miners." These birds had a note like a sharp, short word. They were about the size of a blackbird, were clothed in feathers of a delicate French grey, with darker shades on

the wings, and had a little black cap with touches of yellow on the head. The general air and expression of these miners "was extremely piquant and saucy." "They are," this lady says, "evidently great gossips, perpetually hunting out and interfering with every bird in the neighbourhood, and a whole troop may frequently be seen chasing a marauding hawk, or egg-stealing crow flying all round in the busiest manner, and uttering their quick sharp cry of 'thief! thief! thief!' Their own morals being none of the purest, we might expect them to be chary of abuse; but apparently, their individual experiences in theft, only render them more alert in detecting the peccadillos of their brethren, and we have often traced out our poultry foes through their agency!

"Their depredations in orchards are really serious, and their impudence so great, that nothing short of mortally wounding will scare them from their banquet. A fine bearing cherry tree, one of our richest prizes from the Cambrian orchard, was planted close to the end of the veranda, in the belief that there the fruit would be safe, as persons were constantly passing to and fro; but our busy friends took up their daily abode in it, as soon as the cherries began to ripen, and

continued to partake of our store, in the proportion of the lion's share, as long as any remained. Yet was it well worth the loss of a few cherries, to witness the impudent nonchalance of these miners; how they would hop and creep about the branches, and instead of flying off when pelted with gravel or shouted at, would pop out their bright-eyed saucy heads from amidst the clustering leaves, and cry, 'thief! thief! thief!' as loudly as ever, straightway making a fresh onslaught on the fruit with such honest-looking, confident assurance, that I almost began to doubt whether they or we were the rightful proprietors of the tree."

With the song of the lark, we shall close our history of voices. The changing, sweet and thrilling music of this bird, charms every ear that listens to its notes; and those who understand the form of its windpipe, see impressed upon it the stamp of the Divine hand. The causes that produce the lark's changing tones, have been interestingly described by Mr. Robert Mudie; the following are his words:—

"Every one in the least conversant with the structure of birds, must be aware that with them, the organs of intonation and modulation are *inward*, deriving little assistance from the tongue, and none, or next to none, from the mandibles

of the bill. The windpipe is the musical organ, and it is often very curiously formed. Birds require that organ less for breathing, than other animals having a windpipe and lungs, because of the air-cells and breathing tubes with which all parts of their bodies are furnished. But those diffused breathing organs must act with least freedom when the bird is making the greatest efforts in motion ; that is, when it is ascending or descending ; and in proportion as these cease to act, the windpipe is the more required for the purposes of breathing.

“The skylark thus converts the atmosphere into a musical instrument of many stops, and so produces an exceedingly wild and varied song ; a song which is perhaps not equal either in power or compass, in the single stave, to that of many of the warblers, but one which is more varied in the whole succession. All birds that sing, ascending or descending, have similar power ; but the skylark has it in a degree, superior to any other.”

A bird is the child of nature ; it loves its liberty. The most admired and sweetest song warbled from a prison-house of wire, often conveys to the instructed ear, a cry of irritation and distress. Both a lark and a robin, imprisoned

far away from their loved tuft of grass, and green mossy tree, have a plaintive accent in their notes, that may well convey to our minds a faint representation of the mournful cry of the captive Israelites, who on being asked to sing the songs of Zion, replied; How can we sing the songs of our God in the place of our captivity?

	PAGE
In what two respects are the windpipes of birds made differently to those of men? . . .	300
Which part of a bird's windpipe gives the trumpet effect to its voice?	300
What effect do the gristly rings produce upon the sound, as it ascends up the windpipe? .	300
What birds are assisted by the tongue to give out distinct sounds?	301
What helps materially to give loudness to the voices of birds?	301
Some geese and ducks loudly whistle, what occasions this sound?	302
Where do birds first learn their notes? . . .	305
What kinds of birds have the most melodious voices?	306

	PAGE
How many different strains have been counted in the song of a nightingale?	307
What is the form of tongue in parrots, jackdaws, crows, starlings, and other birds, which en- ables them to copy the sounds of some of our words?	308
What curious sounds proceed from the mouth of the bell birds, and mocking birds of America?	309

Lecture Twenty-seven.

CONCLUSION.

Our last chapter on voice, completed the examination we had proposed to make of the five great divisions of birds.

<i>That is, of the</i>	<i>Sometimes called</i>	<i>Scientific Name.</i>
Birds of the Air	Birds of Prey	Raptores & Accipetres
Birds of the Trees	Perchers & Climbers	Incessores and Passeres (little birds)
Birds of the Ground	Runners & Scratchers	Gallinidæ
Birds of the Mud	Waders .	Grallatores
Birds of the Water	Swimmers .	Natatores

Finally let us look upon birds as one great family, and take a general survey of their fitness to answer the ends of their creation.

You are aware that a vast increase of living

creatures is ever going on; that insects would multiply and fill the air,—worms, beetles, slugs, spiders, moles, mice, and other creeping and crawling things, would swarm on the earth,—and fishes darken the waters, had not many checks been provided to keep their numbers under control. You have been told that much of the labour belonging to this needful work, is laid upon birds. This fact leads us to see why birds have been given such various forms. Let us in a few words rehearse what has several times been largely dwelt upon; namely, that

The length and shape of the beak are suited to the kind of food the bird is to pick up.

The legs and feet are frequently suited to the situations in which the particular food of the bird is to be found. With the swift which seeks its food in the air, the feet are formed with reference, not to its food, but to the manner of its roosting.

The wings and tail of a bird are made (by a frequent rule) longer or shorter as the food has to be flown after quickly or slowly; but in other instances, the manner of catching the food regulates their length.

The colour of the bird is generally suited to its haunts. In the far north, most birds are white, like the snow. In the temperate zone, most are

dull-coloured, like the vegetation. In the torrid zone, most are resplendent, like the blossoms around them.

The colour of the nest and of the eggs, are in many cases made to resemble the haunts of the bird, so that they too may be hidden.

And the height at which the bird builds, is that which is the most convenient for its feeding, and for the security of its nest.

In looking at birds a naturalist once hinted, “I think we can see that *three leading principles* were kept in view at their first creation—*use, order, and beauty.*”

Firstly. Use; that is, they were given *mechanical efficiency*, or power of body for the work appointed them.

Secondly. Order; that is, *skilful adaptation*, or a fitness to suit the situations in which they were to be placed.

Thirdly. Beauty; that is, *visible harmony*, to delight the eye and the mind.

Let us see if we can further understand these terms. . *Mechanical efficiency*, means an instrument, or power of body well adapted to move masses of matter, so as to change either their places or forms.

When a piece of machinery moves with ease, and executes well and aptly the work for which it has been prepared, it excites our admiration. Were you to go into a cotton mill worked by steam, and to watch the great piston-rod of the steam-engine moving up and down with regularity and force, turning great wheels that turn smaller ones ; and these again acting upon rods and frames ; and further, were you to see all the little spindles and shuttles flying by the working of this one powerful rod,—it would give you an example of useful *mechanical efficiency*.

Or, if you were to behold a steam ship as she moves through the waters, turning at the will of the helmsman, and by the dash of her paddles working her way (unchecked by opposing winds and waves) quickly and steadily to the distant port ; this too would help you to understand the operation of a powerful, though hidden *mechanical efficiency*.

Now can we find any traces of such mechanical efficiency in a little bird ? Yes,—and for the purposes which have to be obtained, a much greater suitability, and a more marvellous and varied mechanism. Recall to mind what we have already learnt of the various bones in the framework of a bird,—of their lightness and of their

hollow forms,—of the varied capacity for movement in the joints—of the strength of the muscles,—and of the beautiful clothing on the body, and you will see in each of these parts of a bird, instances of mechanical contrivance, skilfully prepared to accomplish their allotted work.

Every portion of a feather speaks of the same mechanical contrivance. It is seen in the fine flowing down, in the long fibrous stem, and in the crowning latched and hooked filaments. It is equally manifest in the arrangement of the feathers on the body, which fall rank and file one over the other, fitting each tribe of birds precisely in the very way which is most convenient to the habits of the creature. Nothing is too minute for the display of this mechanical efficiency; it presides over the softest down of the smallest bird, as well as over the firm and splendid plumage of the stately peacock.

Again, how admirably is the tough and flexible skin of the bird fitted to bear without inconvenience the bulky apparatus of the feathers, while forming at the same time an invaluable protection to the delicate frame-work of the body.

In the gem-like eye of the bird there are three remarkable mechanical contrivances. One for the *purposes of vision*, such as are common to other

creatures as well as birds ; another which possesses a *telescopic*, and a third, a *microscopic* power. To cause vision, (that is, sight) the rays of light which enter the eye, are made to fall on the fine points of a minute nerve that is spread out at the back of the eyeball, upon which points they paint a sort of image of the wide landscape, or whatever else is in sight. Then in a moment, and at will, some internal alteration can be made in the parts of the eye, by which the rays of light that come from an object at a great distance, are made to present a clear image of a far distant thing. It is on this account that the eagle can see a hare on the ground, when he is soaring at a height whence a man could hardly discern an elephant. Another change in the form and internal state of the eye turns a speck into a complete picture. Thus the tomtit can see objects 2000 times larger than they appear to man. These three distinct states, (each one of which arises out of a beautiful mechanical efficiency, or power) change at will the vision within the minute ball of a bird's eye.*

* By means of the telescope, however, man can see into far distances that greatly exceed the reach of any bird's eye ; and by means of the microscope, he can enlarge objects thousands of times beyond the power of any bird's vision.

Again, who does not admire the able provision of air-cells in the body of a bird, which enable it to rise like a balloon, and to sail at its will in the clear atmosphere, over the heads of the tallest trees, over hills, and here and there over the mountain tops? Its joyous heart beats like ours, and the life-blood flows as steadily through its blood-vessels, while its head never turns giddy at the most dizzy height. God has made the bird a living thing of perfect *mechanical efficiency*.

In the second place, that we may understand the meaning of "*skilful adaptation*," let us return to the cotton factory, and mark for what purposes the powerful steam engine has been called upon to set the wheels of its machinery in rapid motion. Those wheels are working spindles, rollers, and looms, fitly contrived to smooth down, and to draw out into lengthened threads the raw cotton that has been collected from the pods of the cotton tree, and finally the machinery is interlacing the well-spun threads, so as to produce a warm and useful article of clothing for man. In the factory we see a fitting suitability, a nice agreement between the cotton, that admits of being drawn out into threads, and the machinery, that is able to convert it into cloth;—the cotton and the machinery are both made to work together for a determined end.

There is order, skilful adaptation, or a right fitting, set up between them.

Again, the steam ship, while urged on by the mechanical energy of her powerful engine, requires to be made with a skilful fitness for the place she has to fill. Her office is to bear across the ocean a ponderous burthen; her form must therefore be adapted to support it, as she cuts her way through the waters. Her weight must be calculated, that she may displace just so much of the yielding water, as to form a trough in which to lie;—she must not be so light as to reel over, nor so heavy as to sink. If she rides well on the watery main, her fitness for moving on the water, and the fitness of the water to bear her up, are proved; thus a *skilful adaptation*, or a nice agreement, is displayed between the two.

And, do we not see this skilful adaptation worked out in a much higher degree in the birds of the air? Are not their bodies exactly fitted to rest upon and to cut through the air—their wings to strike upon the air—the eye to receive the rays of light and the ear sounds? There is an order in these things, a fitness of one thing to another. Birds are also as fitted for their food, as the food is for them. The materials fitted to make safe and warm the little abodes for their

nestlings, they find at hand, and know how to employ them with a skill and industry that might shame the lazy and slovenly cottager. Their devotion to their offspring is a perfect model of parental affection. In attending to the wants of their young, the most exact correspondence is manifested between the demands of their family, and the zeal and ability of the parent birds to answer their calls. Did ever bird build its nest where there was no provision at hand for its little ones? Such a choice was perhaps never known, where the bird was free to choose the place in which to build its home. The perfect instinct God has implanted in birds leads them to mind the fitness of things in the labours to which they are called.

A fitting choice amid variety is a distinguishing property of the laws of instinct. Birds seem to adopt and to love that which their Maker has chosen for them. As their bodies are formed with mechanical *efficiency*, that is with power to perform their work, so their spirits manifest a sensibility for the proper things to be done; and their whole natures, a *skilful adaptation* to the creation around them.

Not less interesting are birds when looked upon as living proofs of *beauty* and of *harmony*. The

smooth and often richly adorned clothing of the feathered tribes, has rendered them fair and beautiful to a proverb. The metallic gloss of the humming-bird, the splendid tail of the peacock, and the purples of the pheasant, do not however appear *necessaries* to the birds; the hens, which are destitute of these ornaments, being as well off without them; but since these things have been given them, we are warranted (till we know better) in looking upon their lovely plumage as a beauty intended to charm the eye, and given for *beauty's* sake!

When we take a deeper view of birds, and dwell upon their forms, habits, and lives, we discover a grace and harmony in their natures, that charms the mind, as outward beauties charm the eye. To return to the works of man, we find that any skilfully-working machinery of his invention, imparts to the mind a sense of *beauty*. When an observer enters a well-conducted factory, and sees before him its apparatus clean and bright,—every wheel in motion,—the cotton spinning on the winders, and the loom throwing out the finished piece, he is filled with admiration at the process going on, and is ready to exclaim, “How wonderful! how beautiful! is this concert of movements, harmoniously at work, in producing the woven material!”

When we look upon the noble steam ship gliding rapidly by, we gaze with delight upon her easy, almost noiseless course, “as she walks the waters as a thing of life.” Had we seen her on the stocks, painted in all the colours of the rainbow, she would not have inspired equal admiration. It is the contemplation of her fitness, when at her proper work,—it is the beholding her on the waters, making for herself a path in the seas, that raises within us the delightful sensations of *harmony* and *beauty*.

The actions of birds inspire a still higher delight. We behold them sailing along, as exquisitely fitted for the air as the air is for them; we contemplate them not only as tenants of the atmosphere, but also as linked to the land, in order to carry forward with joy and alacrity one general good, with the rest of the living creation. Truly the whole being of a bird, body and instincts, is so admirably adapted for carrying out the intentions of its Maker, that its life appears but as one *harmonious* movement, visibly accomplishing His will.

As we love the notes of the voice that sings sweetly and skilfully, so we love the lively and graceful natures of birds. Their very freedom from vanity, charms. Their clothing, however

rich and gay, is worn with a simple heart, unconscious of its attraction; flowers cannot surpass some of their brightest plumage, yet this never fosters a thought of pride. The blackbird, in his grave and solemn dress, knows nothing of the stain of envy; but sings as sweetly and as joyfully, as if clothed in scarlet and gold. Their cheerful contentment in every station which their Creator has allotted them, whether it be to live in the torrid climes, or in a more favoured temperature, should also make them our instructive companions amid the wide family of the creatures of God.

The pleasant but short examination which we have for some time past been taking of the *forms*, the *instincts*, and the *uses* of the feathered tribes, is now finished; and in concluding I would say, that the attempt which has been made in our last pages to illustrate by the works of man, the power, skill, and manifest beauty in the works of God, has only betrayed the meagreness of human contrivances, when contrasted with the exuberant fertility of the Divine Creative power. Indeed it is hard to draw any comparison between them. A cotton mill displays efficiency in the movements of *mechanical power*, so far it does well; but in pursuing the illustration, were its rattle the melody

of music, its height the architecture of a temple, and its finished work without a flaw, it still could bear no real comparison to the *adapting order*, and to the *perfect beauty* manifest in the works of creation.

It sometimes pleases the Almighty to let us catch a glimpse of the designs which he purposes to carry out by the machinery of creation; but in most cases we must be content to say, in things of the earth, as in things spiritual, “His thoughts are not as our thoughts, nor His ways as our ways.” We must be content to own our *present* ignorance, and to hope that in a future state, we may know more than we can know now, of the works of our Creator, and be enabled to contemplate through an endless eternity, the action of that Almighty power, which is as *infinite*, and as *boundless*, as that eternity itself.

The End.

MRS. JOHN WRIGHT'S WORKS.

THE OBSERVING EYE:

OR, LETTERS TO CHILDREN ON THE THREE LOWEST DIVISIONS OF ANIMAL LIFE.

Sponges, Corals, Star Fishes, Worms, Lobsters, Insects, Shell-Making Creatures, &c. With numerous illustrations, embossed cloth, 2s. 6d. Fifth edition. This little volume, designed to interest and instruct the Young in Natural History, has attained extensive popularity. It is used by the ROYAL CHILDREN.

WHAT IS A BIRD?

The forms of Birds—Their Instincts and Use in Creation Considered. With Anecdotes and Illustrative Wood Engravings. Second Edition. Handsomely bound in cloth, 2s. 6d.

OUR WORLD: ITS ROCKS & FOSSILS.

Numerous Illustrations. Eighth thousand. Fcap. 8vo, cloth, 2s. ; or gilt edges, 2s. 6d. This little work was issued in Eight Numbers at Twopence each. The separate numbers are still on sale, and are used as Class Books.

LISTEN AND LEARN.

A Short Narrative of a Three Days' Ramble by the side of the beautiful Lakes in the North of England. Embossed cloth, price 2s.

THE PASSOVER FEASTS,

AND

OLD TESTAMENT SACRIFICES:

Shewing their Typical meaning and Fulfilment in Our Lord Jesus Christ; with a slight Sketch of Jewish History. Third Edition. Price 2s. 6d.

London: Jarrold and Sons, 12, Paternoster Row.

JUST PUBLISHED.

EVERY-DAY WONDERS OF BODILY LIFE.

IN THREE PARTS, 2d. each. Or complete in handsome volume, One Shilling. (*Recommended by Professor Owen.*)

CATERPILLARS, BUTTERFLIES, & MOTHS:

Their Manners, Habits, and Transformations. By MARY and ELIZABETH KIRBY. With Illustrations. Embossed cloth, 2s.

PATIENCE HART'S FIRST EXPERIENCE IN SERVICE.

By the Author of "MOTHER'S LAST WORDS." Second Edition, Seventh Thousand. Handsomely bound, 2s.

HOUSEHOLD TRUTHS FOR YOUNG MEN.

Containing, How to Rise in the World—Life's Battles, and Men who have Won them—Men who have Fallen—How to take Care of Number One—Straightforwardness, the Road to Honour, Happiness, and Wealth—Young Men in Great Cities. Handsomely bound in cloth, 1s. 6d.

THE NEW HOME:

WEDDED LIFE: ITS DUTIES, CARES, AND PLEASURES.

By the Author of "A Woman's Secret; or, How to Make Home Happy." Third Edition, Eleventh Thousand. Handsomely bound in cloth, 1s.

London: Jarrold and Sons, 12, Paternoster Row.