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BIRDS AND NATURE

IN NATURAL COLORS

A MONTHLY SERIAL
FORTY ILLUSTRATIONS BY COLOR PHOTOGRAPHY

A GUIDE IN THE STUDY OF NATURE

Two Volumes each Year

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ILLUSTRATED BY COLOR PHOTOGRAPHY.

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ALONE WITH NATURE.

Alone with nature I love to roam,
   'Midst forest shades, o'er meadows green,
Where the soft winds blow 'neath the azure dome,
   And only the Works of God are seen.

Away, away, from the city's din,
   Long murmuring brooks, by placid ponds;
Far from the sight of human sin,
   And moral weakness in Satan's bonds.

Away, away 'neath the towering trees,
   Where the thrush pours forth his wildwood song.
And the grey squirrel nimbly leaps with ease,
   From branch to branch of the maple strong.

Where the hornets build their marvelous nest,
   And hang it high from human foe.
Where the blackbird 'neath her soft warm breast
   Shelters her young when the storm winds blow.

Where the tortoise gravely stalks along
   Like sage of old in sombre thought,
And the great horned owl in utterance strong
   Bemoans the changes time has wrought.

Along the hillsides facing south,
   Where the earliest wild-flowers may be found;
Where the big bull-frog with cavernous mouth,
   Welcomes Spring from the marshy ground.

Where the red-wing, swinging among the reeds,
   Saucily sings, "Yer can't cum 'ere."
Where the cunning rail-bird yearly breeds,
   And raises her brood with little fear.

On the banks of streams to lie,
   And watch the gambols of the fish,
While the pond-turtles lazily bask near by,
   In indolent freedom from care or wish.

Thus with Nature to commune,
   And to note her creatures gay;
While mind and heart are in attune,
   With creation's work from day to day.

F. Alex. Lucas.

FLOWERS

A PATTERN FLOWER.

JOHN M. COULTER.

FLOWERS are of very many patterns, and it must not be supposed that there is any special pattern for them all. There are four parts which belong to flowers in general, and they are repeated in various flowers in numberless ways, or one or more of the parts may be omitted.

The flower of the common wild lily, chosen for our illustration, is highly organized, with all the parts represented and well developed. Each part is constructed for some definite work, which we may or may not fully understand.

The flower of the illustration shows on the outside six leaf-like bodies, colored a deep orange or reddish, and bearing dark spots. These six bodies are in two sets of three—an outer and an inner set. When there are two sets of these leaf-like bodies the outer set is called the *calyx*, and the inner one the *corolla*. The three leaves of the calyx are called *sepals*, and the three leaves of the corolla *petals*.

In this case the sepals and petals look alike, and then it is usual to speak of the whole set of six as the *perianth*. In many flowers, however, the sepals and petals do not look at all alike. In the common wake-robin, or *Trillium*, a near relative of the lily, the three sepals are like ordinary small green leaves, while the petals are much larger and showy, giving the characteristic color to the flower.

In the lily it should be further noticed that the sepals and petals are all separate, but in many flowers they are united in various ways to form urns, tubes, funnels, trumpets, etc. The common morning glory is an illustration of a flower in which the petals are united so as to form a beautiful trumpet-shaped or funnel-form corolla.

The general purpose of the perianth, that is, the two outer parts of the flower, is to protect the far more important inner parts in the bud, and when the flower opens the perianth unfolds and exposes the inner parts, which are then ready for their peculiar work.

The bright color usually shown by the corolla, and sometimes also by the calyx, as in the lily, is probably associated with the visits of insects, which come to the flower for nectar or other food. Since it has been found, however, that some visiting insects are color blind, it is doubtful whether the color is so universal an attraction as it was once thought to be, but it is certainly associated with some sort of important work.

A summary of these various duties is as follows: The green, leaf-like calyx is certainly for bud protection; the brightly colored corolla (and sometimes calyx) adds to the duty of protection that of attracting necessary insects, or some other duty that we do not as yet understand.

Just within the corolla the third part or set appears, consisting of six *stamens*. These six stamens are also in two sets of three each, an outer and an inner one. Each stamen consists of a long stalk-like part, called the *filament*, and at the summit of the filament is borne the *anther*, which in the lily consists of two long, narrow pouches lying side by side. When the anther is ripe these pouches are filled with a yellow, powdery dust called the *pollen*. Each particle of this dust-like pollen consists of a minute, but beautifully organized globular body, known as the *pollen-grain*. The anther pouches are therefore full of pollen-grains.

RED OR WOOD LILY.
(Lilium Philadelphicum)

In the lily it will be noticed that when the anthers are ripe and the pollen is ready to be shed, a slit opens lengthwise in each of the two pouches or sacs. This is the common method for opening the anther sacs, but in some flowers it is curiously modified. For example, in the heaths, such as the huckleberry, the sacs open by a hole at one end, and sometimes the tips of the sacs are drawn out into long, hollow tubes through which the pollen is discharged. In other cases, as in the sassafras, the sacs open by little trap doors, which swing open as if upon hinges.

Of the two parts of the stamen, the filament and anther, the latter is the essential one, so that in some cases the filament may be lacking entirely, only the anther appearing to represent the stamen. Furthermore, the essential thing about the anther is the pollen, to manufacture which is the sole purpose of the stamen.

The pollen is necessary to enable the flower to produce seeds, but it must be transferred from the anther which produces it to the fourth part of the flower, not yet described, in which the seeds are formed. This transfer of pollen is known as *pollination*, and the transfer is usually effected in one of two ways, by the wind or by insects. As a rule, also, the pollen made by one flower must be transferred to some other flower to do its work, and sometimes the other flower may be at a considerable distance.

If the pollen is to be transferred by the wind it must be very light and dry, and it must also be very abundant, for the wind is a chance carrier and drops the pollen everywhere in a very wasteful fashion. In such a case the pollen must come down like rain to be sure that some of it strikes the right spot in the right flowers. Occasionally one hears in the papers of "showers of sulphur," which always prove to be showers of pollen carried by the wind from some forest (chiefly evergreen forests) and dropped at random. In the case of pines the minute pollen grains develop wings to assist in the wind transportation.

If the pollen is to be transferred by insects it does not need to be so dry and powdery, or so abundant as in the other case, for the insect passes directly from one flower to another, without any random scattering of the pollen. Only winged insects are used for this purpose, as those which must creep, or rather walk, would brush the pollen from their bodies by rubbing against the various obstructions in the way. The insects most commonly used are the numerous kinds of bees, wasps, butterflies, and moths. These insects visit the flowers for different purposes. The butterflies and moths are after the nectar, while the bees and wasps feed upon the pollen. Visiting insects are therefore often grouped as nectar feeders, and pollen feeders, but in either case they are instrumental in transferring the pollen.

The fourth or innermost part of the lily flower is an organ called the *pistil*. It stands in the center of the flower and is composed of three distinct regions. At the base it is bulbous and hollow, containing the bodies which are to become seeds. This bulbous region is called the *ovary*, and the little bodies it contains, which, through the action of the pollen, are to become seeds, are called *ovules*. Rising from the top of the ovary is a slender, stalk-like part called the *style*; and at the top of the style is a knob-like region called the *stigma*.

The most essential region of the pistil is the ovary, for it contains the ovules. Next in importance is the stigma, for it must receive the pollen-grains. The style is of least importance, and therefore is sometimes wanting, the stigma being directly upon the ovary. The duty of the style, when it is present, seems to be to put the stigma into a favorable position to receive the pollen. It must not be supposed that the stigma always resembles a knob-like top to the style. It is really only a surface prepared to receive pollen, so it may be upon the top of the style, or may run like a line down one side of it, or may display itself in some other way.

The pistil of the lily, however, is not a single structure. If the ovary be cut across, it will be found to be made up of three compartments, each one of which contains ovules. Each one of these compartments represents a unit of structure which has entered into the formation of the pistil. These units are called *carpels*, and the pistil of the lily is made up of three carpels. In this case the three are distinct only in the ovary, and have completely lost their identity in the region of the style. In many relatives of the lily, however, the three carpels are kept distinct in the style region, three styles or a three-parted style appearing upon the ovary.

In some flowers the carpels are kept entirely distinct, each one having its own ovary, style, and stigma. For example, in the buttercup there is a little mound in the center of the flower made up of numerous pistils, each consisting of a single carpel. It is evident, therefore, that a pistil may consist of one carpel or several carpels, and that in the latter case the carpels may be more or less completely united. The sure indication of a carpel is that each carpel bears its own ovules. [Pg 6]

In some flowers there is but a single carpel, as in peas and beans, whose pods have developed from a pistil consisting of a single carpel, as is indicated by the single lengthwise set of seeds.

In some plants the flowers do not have all the four parts described above. In some cases the petals may be lacking, the one set of perianth parts represented being regarded as the calyx, although it may look like a corolla, as in the clematis or anemone. Such flowers are said to be *apetalous*, which means "without petals." In other cases both the calyx and corolla may be wanting, the flower consisting of only stamens and carpels. Such flowers are spoken of as *naked*.

In other flowers the stamens may be lacking, and as the pistil is the only essential part present such flowers are said to be *pistillate*. It may be counted upon, however, that if there are pistillate flowers there are also corresponding *staminate* flowers in which the pistils are lacking and the stamens present. In such cases both staminate and pistillate flowers may occur on the same plant, or they may occur on different plants, so that there may be not only staminate and pistillate flowers, but also staminate and pistillate plants.

It also sometimes happens that staminate and pistillate flowers are also naked, so that in such cases the flower is represented by stamens alone, or even by a single stamen, or by carpels alone, or by a single carpel. It would be hard to imagine a more simple flower than one composed of a single stamen or a single carpel. Such flowers may be found in the willows.

In this study of the lily it should be observed that the number three runs through all the parts of the flower. The flower formula may be expressed as follows: sepals 3, petals 3, stamens 3 plus 3, carpels 3. This number is established in many families related to the lilies, and is one of their characteristic features.

In other groups of flowering plants a different number is established, the number five being the most common. For example, in the common wild geranium the flower formula is as follows: sepals 5, petals 5, stamens 5 plus 5, carpels 5. In still other flowers the number four is established.

In many common flowers it will be noticed that no definite number is established, or that it is not completely established. For example, in the common wild rose there are 5 sepals and 5 petals, but an indefinite number of stamens and carpels; while in the water lily there is no definite number established, the sepals being usually 4, and the other parts indefinitely repeated.

In those flowers in which some number is definitely established, it often happens that one set may be reduced in number, and this is usually the carpel set. In the families of highest rank among flowering plants, such as the figworts, mints, and composites (sunflowers, asters, dandelions, etc.) the flower formula is sepals 5, petals 5, stamens 5, and carpels 2.

Another fact shown by the lily flower is that the different sets alternate with each other in position. The three petals do not stand directly in front of the three sepals, but in front of the spaces between the sepals. In the same way the three outer stamens alternate with the petals; the inner stamens alternate with the outer ones; and the three carpels alternate with the inner set of stamens. It is very uncommon to find one set standing directly in front of the next outer set, and this position opposite the other set always needs some special explanation. As a rule, therefore, the flower sets *alternate* with one another, but in some cases a set may be *opposite*.

The history of a flower does not end with the opening of the blossom. If the stigma has succeeded in receiving some pollen, and the pollen has succeeded in doing its work, the ovules within the ovary become gradually transformed into seeds, and the ovary becomes transformed into the fruit, the outer sets of the flower usually disappearing. In the lily these fruits take the form of dry [Pg 7] pods, some of which may be seen in the illustration. Such pods have various ways of opening to discharge their ripened seeds.

In many cases the commonly recognized fruit includes more than the ovary. For example, in the apple and pear the modified ovary is represented by what is called the "core," and the pulpy part outside, forming the edible part of the fruit, is the thickened calyx. In the strawberry the real fruits are the small, nut-like "pits" which are more or less imbedded in the surface, while the pulpy part is the very much enlarged and fleshy tip of the stem which bore the numerous carpels. In the pineapple the change involves a whole flower cluster, and a pineapple is a cluster of flowers which has formed a pulpy mass, flowers, leaves, stems, and all.

From what has been said it will be noticed that some fruits ripen dry, as in the case of the lily pod, bean pod, etc., and that others ripen fleshy, as in the case of apples, strawberries, etc. It must not be supposed that flesh can only be formed by parts outside of the ovary, for the peach is a modified ovary, whose wall has separated into two layers, the outer of which forms the pulp, and the inner the "stone," the kernel within the stone being the real seed.

Whatever form or structure the fruit may take, everything is with reference to the dispersal of the seeds, which must be carried to places suitable for their germination. How seeds are carried about is a long story, which must be deferred to some later time, but it belongs to the general subject of flowers.

It will be seen from the above brief account that flowers occur in almost infinite variety, so that we are able to tell the various groups of flowering plants by the kind of flowers they produce. Amidst all of this infinite variety, however, there are but two purposes shown, the variety being merely the different ways in which different plants have carried them out. These two purposes are the securing of pollination, in order that seeds may be formed, and the proper distribution of the seeds. All structures found in flowers should be made to answer these two problems.

GOD'S HANDIWORK.

JOHN WESLEY WAITE.

How beauteous every shade
  On Spring's awakened trees!
How perfect the colors laid
  By His most kind decrees!

BIRDS

NATURAL RIGHTS OF BIRDS.

LYNDS JONES.

WHAT DO we mean by a "natural right?" Are there rights of any other sort in the world? Yes, a legal right may not always be a natural right. On the contrary, a legal right is sometimes a natural wrong. In many states it has, at one time or another, been legally right to slaughter the hawks and owls, which are far more useful than harmful. The birds had a clear title to the natural right of life, which the laws denied until the lawmakers discovered their mistake. Long ago our forefathers declared that all men possess the natural right to "Life Liberty and the Pursuit of Happiness." Certainly no one will deny that any creature has a right to life so long as in its life it contributes more toward the welfare of the world than in its death. It also has a right to liberty so long as it can do more good at liberty than as a captive. Granting that the lower animals are capable of happiness, no one would think of denying them the right of the pursuit of their happiness except for some higher good. Without discussing these general principles further let us see how they will apply to the birds as natural rights.

Has the bird a right to live? According to our first principle he has if he is more useful alive than dead. What, then, does he do that can be called really useful? If he is a diver, a gull, a tern, or any one of the really seafaring birds, he eats fish, water insects, offal and whatever small animals resort to the water, doing little or no harm and a great deal of good. Near large sea-coast cities the gulls dispose of the garbage which is taken out a distance from shore and dumped into the ocean, and so prevent its drifting back upon the beach. If he is a duck, goose or swan, he feeds upon fish, the plants which grow in the water and at its margins, upon the insects and worms which inhabit the ooze at the bottom, and sometimes upon grains in the fields and about the marshes. He does a great deal of good and rarely any harm. If he is a heron, crane, rail, coot or gallinule, his food is frogs, snakes, insects and worms, and so he is useful. If he is a snipe, sandpiper or plover, he destroys large numbers of insects, worms and such small animals as are to be found in wet places, and is always a very useful help to the farmer. If he is a bird of the fowl kind or a pigeon, he eats grain mostly, but also many insects. He may sometimes do a little damage to the ripe grain, but he usually gathers that which has gone to waste. If he is a vulture, hawk, eagle or owl, he destroys great quantities of animals that are harmful to man, not often visiting the poultry yard, and so does great good. If he is a kingfisher he eats small fish mostly, and so is not harmful. Among all the remaining birds there are but a few which do not feed almost entirely upon insects or other creatures which menace vegetation. Even these seed eaters feed the young upon insects and worms, and do good by destroying vast quantities of injurious plants. Those which eat ripe fruit pay for what they eat by scattering broadcast the seeds of the fruit. When there is no ripe fruit they eat insects and worms. The crows and blackbirds and bobolink are rather overly fond of green corn and ripe grains in the fall of the year, but they pay for what they eat by destroying immense quantities of insects and worms in the spring. When the whole life of the bird is taken into account we cannot escape the fact that the bird has a natural right to life on account of the good he does.

WILSON'S THRUSH.
⅔ Life-size.

How does the value of the bird's body used for food compare with the good the bird would do if allowed to live? Reckoned in dollars and cents the flesh on an average bird's body would be worth, say twenty-five cents at the price of good beef. But let us say seventy-five cents to do full justice to the greater excellence of the bird's flesh as food. We must consider, however, that the most of the birds which are not good for food, civilized food, are among our largest birds. The size of the average edible bird would therefore be greatly reduced, so our estimate is a very liberal one. But during the average lifetime of the average bird it would destroy many times its own weight of injurious animals. Careful investigations have shown that these injurious animals would do many times more damage than the worth of the bird's flesh. We have no need, then, to take into account the real good we derive in the pleasure which the beautiful plumage, the sweet voice and the graceful form bring to us. That is an added value which nothing can compensate for.

How does the value of the bird's skin as an ornament of dress or of the dwelling, or as a scientific specimen compare with its value as a living creature? As an ornament it may be a thing of beauty, or a hideous caricature. Even as a thing of beauty it could not be made more so than the living bird. No one will be willing to declare that the quill, or the wing, or the skin is *necessary* to the bonnet. Many of us honestly think that the bonnet would look far better without either. As a scientific specimen the skin will serve some purposes, some legitimate purposes, which the living bird will not. The living bird cannot be fully understood without a careful study of its structure any more than a living man can. Unfortunately, birds which die a natural death cannot be found while their bodies are fit to study, if found at all. But happily, the number of dead birds necessary for study is limited. Even for scientific purposes there is no possible excuse for indiscriminate slaughter. Collecting should be left to those and those only who know what is needed and are content with enough. In these days of large collections and advanced knowledge, it is the rare exception when the dead bird will be more useful than the living one. These exceptions do not affect the right of the bird to live. Boys who begin to study birds have a passion for making a collection of the eggs. Eggs are beautiful things, and they look well in a cabinet properly arranged. But all of the eggs which most boys would be likely to find are already well known, so that a study of the eggs in the nest and of the young birds will teach him far more that we really need to know about the birds. The greater good is not to make a collection of birds' eggs.

What shall we say about the bird's right to liberty? Clearly the bird at liberty to perform the part which Nature intended for him can fully accomplish that part only when at liberty to go his own way. But it would be idle to declare that the caged bird is in nowise useful to the world. There are some things which can be learned about birds only from caged ones. If a bird be caged for the purpose of learning these things the very few that will be needed for this purpose will be fulfilling a high good, and if given their freedom again when the lessons have been learned the harm, if there be any, will be fully repaid. But here, again, the caged bird will be the rare exception and so does not affect the right of the average bird to liberty.

We then have only to inquire whether the bird has a right to the pursuit of happiness. No one who has studied the living bird with anything like an appreciation of it will think of denying that birds are creatures of intense life, capable of strong feeling and keen enjoyment. They speak out their feelings in song and action. It is really their human attributes which makes them appeal so strongly to us. We know that they are capable of love and hate, of joy and sorrow, of pleasure and pain. In them we recognize the heroic attribute of martyrdom. In order, therefore, to determine what the attitude of the bird would likely be were his right to the pursuit of happiness denied, we have only to ask what our own attitude would be under the same circumstances. If our happiness should be threatened in this place we would certainly go where it would not be. The birds do the same. But we have already seen that the birds have a right to life and liberty on account of the services they render to the world. If we deny them the right of happiness they will not be able to perform their service for us. Under persecution they cannot do their best, even if they remain to do anything for us. Persistent persecution will either drive them away or destroy them altogether. Since we cannot do without their services even for a single year, it is clear that we must agree that they do have the natural right to the pursuit of happiness.

We are ready, then, to concede to the birds as natural rights what we long ago declared were the natural rights of mankind,—"Life, Liberty and the Pursuit of Happiness." We might properly discuss the question, What do we owe to the birds? but that is a separate topic for a later time.

STRUCTURE AND HABITS OF BIRDS.

From a lecture by Frank M. Chapman, April, 1900.

HOW HAVE the various types of bird life come into existence? To understand this we must study the wings of the creature to learn its evolution from the early reptile-like type of bird. The most primitive use of the wing is as a hand, by which the bird may climb about. In contrast the albatross has the finest developed wings of any species which are fourteen feet across. The man-o'-war, however, is even a better example, perhaps, for although having a body no larger than a hen, it has wings which spread apart to a distance of seven or eight feet, enabling it to soar in the air for several days without touching the earth.

By intertwining the outer feathers of the wings some birds can remain stationary in the air for hours at a time, not once moving a wing. The razor-billed hawk is the nearest living representative of the extinct great hawk, a bird which, having small wings, could not fly, and soon became extinct. The penguin, with its flippers, can fly only on the water, and has to waddle when on land. Certain grebes which find their food in lakes have also lost their power of flight. This is true of some pigeons, auks, parrots, grebes, ducks and other birds which have not found it necessary to obtain their food by flying.

Wings are also used to express emotion. Many young birds, of which the oriole furnishes an example, cause their wings to quaver in supplication. Certain birds also make use of their wings as a musical organ, as is evinced in the whistling sound produced by the woodcock. Our nighthawk makes a booming sound with its wings by extending its outer quills as it dives earthward. A weapon is also found by some birds in their wings, the pigeon, hen and other of our common birds using their wings to strike with.

The foot shares with the wing the duties of locomotion. Birds with highly developed wings have poor feet. The swallow, an aerial bird, is an example. The chimney-swift has a tiny foot, but enormously developed wings, and if placed on a flat surface is unable even to support itself. All aquatic and terrestrial birds have excellently developed feet. The loon is so thoroughly aquatic that it cannot walk on land without the support of its breast and wings. The sea snipe has a foot especially fitted for swimming, and can be found a few hundred miles off the Atlantic coast in flocks of hundreds of thousands, perfectly at home in the water.

The foot is generally related to the length of the neck. The flamingo wades out into the water, and is able to duck its head and secure its food with the aid of its particularly constructed neck. In securing prey the foot also plays an important part. The great horned owl and the duck hawk have enormous grasping power in their claws. In our grouse or partridge a horny, fringe-like growth appears on the toes late in the fall, serving as a sort of snowshoe during the winter, by which the bird is enabled to walk on the surface of the snow. This growth is shed in the spring.

The bill is the most important organ of the four we are discussing. It has the offices of the hand. There is an almost limitless variation in its shape, admirably adapted in each instance to its food requirements. The fish-eating duck grasps its prey with a saw bill. The pelican catches its fish by diving from the air, often from distances of forty feet, and catches its fish in a bill an inch and a half in width. As it throws its head out in diving, it widens the rim of its bill and catches the prey in its curious pouch. The flamingo catches, with its food, mud and sand, which it expels through a curious straining apparatus. The woodcock has the power of curving up the upper portion of its bill, giving it the grasping power of a finger, which greatly aids it in probing for worms. The woodpecker uses its bill as a chisel. In southern Arizona the Californian woodpeckers have used the poles of the Western Union Telegraph Company in which to store acorns, and in some instances have bored large holes entirely through the poles. In those woodpeckers which feed on bark we find the tongue brush-like to swab up the sap. Where woodpeckers chisel the tongue is horny. In prying off cones from trees the cross-bill finds its apparently malformed tongue most helpful. In humming birds there is a marked variation in the bill, enabling them to feed on different sorts of flowers.

The hurabird of New Zealand has the most curious bill known. The male has one sort which he uses in excavating, after which the female can insert her bill and secure the food which the male has thus obtained.

After a study of the various forms of bird structure and habits has been made, it still remains a problem whether their structure is the result of natural selection, or natural selection is the result of their structure.

WILSON'S THRUSH.

(*Turdus fuscescens.*)

THIS very interesting bird is found in all parts of eastern North America. Breeds in the states bordering on the Great Lakes and as far north as Manitoba. It winters in Central America. It is generally partial to low, swampy woodlands. He is much more shy than his pretty cousin, the wood thrush; he lives nearer the ground and is not so likely to leave the cover of his haunts. In localities where he is equally common with the wood thrush he is less frequently observed.

The nest of this thrush is made of strips of bark, rootlets and leaf stems, wrapped with leaves and lined with fine rootlets. The nest is always on or near the ground.

Mr. Chapman says of him: "He has a double personality, or he may repeat the notes of some less vocally developed ancestor, for on occasions he gives utterance to an entirely uncharacteristic series of *cacking* notes, and even mounts high in the tree to sing a hesitating medley of the same unmusical *cacks*, broken, whistled calls and attempted trills.

Fortunately, this performance is comparatively uncommon, and to the most of us he is known only by his own strange, unearthly song. His notes touch chords which no other bird's song reaches. The water thrush is inspiring, the wood and hermit thrushes 'serenely exalt the spirit,' but Wilson's thrush or the veery appeals to higher feelings. All the wondrous mysteries of the wood find a voice in his song; he thrills us with emotions we can not express."

FISHES

THE FISH'S PLACE IN NATURE.

DAVID STARR JORDAN.

SOME animals have their hard parts on the outside. These may be a horny coat or skin, such as the beetle has, or a double shell, like the oyster's, or a single shell, like the house of a snail. Or they may be a hard crust, like the lobster's coat of mail, or a brittle crust, like the sea-urchin's, or with tough nodules on a leathery hide, as in the star-fish, or any one of a hundred variations from these. But in all such cases there is no backbone, no true skeleton and no real skull.

Then there are a host of animals that have their hard parts on the inside. When this is the case the animal has a regular head, generally with a skull inside to protect a brain from hard knocks.

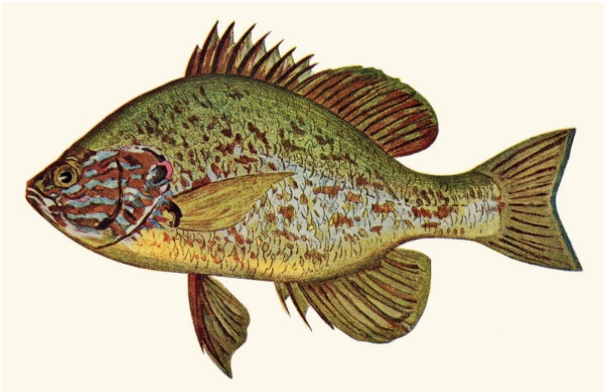
Then behind the skull is a backbone made up of a number of separate joints of bone. To the skeleton other bones are attached to help the animal to move himself about on land or in the water. Sometimes these bones grow out as legs, with toes and claws at the tip of them. Sometimes they take the form of wings or they may spread out into flat paddles or oars of one kind or another, and these we call fins. What shape the parts take depends on what the animal does with them, for every kind of beast is built with direct reference to his business in life.

The backboned animals are the highest of all the animal kingdom. That is, in general; they can do more things, they have a greater variety of relations to the things around them, and they are more definitely fitted for a high position. Some of them are not very high nor very intelligent, even as compared with their lower brethren, the insects. The ant is a tiny creature, with no skull and no backbone, and cannot do any very big thing. But she is a very wise beast by the side of a carp or a herring. Still, on the whole, the backboned animals are the highest and as you and I both belong to that class we could never afford to confess to any doubts as to their superiority.

But we are the highest of the type—that is, we men—and the rest of the tribe are all lower. And the lowest of all backboned animals we call fishes. And we shall know a fish when we see one because the hard parts or skeleton are on the inside, and he stays in the water, breathing the air which is dissolved in it, and he has never any toes or claws or feathers. He breathes with gills and he swims with fins. He has no hair or feathers on his body and when he has any cover on his skin at all it takes the shape of scales. A fish is a water backboned animal. A backboned animal is called a vertebrate. A fish is therefore a water-vertebrate.

There were fishes before there were any other kind of vertebrates. They have been on the earth longer than birds or beasts or reptiles. They came first, and we have good reason to believe that the fishes are the ancestors of all the others.

But when the forefathers of the land animals found means of keeping alive on the land, so many new opportunities opened out to them and they found so much variety in their surroundings, that they throve and spread amazingly. And there came to be many kinds of them, of many forms, while the rest of the tribe kept in the water and stayed fishes.



Life-size.

And there was always a host of these, and nearly all of them had fishes for their food. So they fought for food and fought for place. Those who could swim fastest got away from the rest, and those who could move quickest got the most to eat. Those with the longest teeth were present at the most meals, and those with the biggest mouths dined with them. And some escaped because they had hard, bony scales, too tough to crack. Some were covered over with thorns, and some had spines in their fins, which they set erect when their enemies would swallow them. And some had poison in their spines and benumbed their enemies, and some gave them electric shocks. Some hid in crevices of rock, or bored holes in the mud, and lay there with their noses and their beady eyes peeping out. Some crawled into dead shells. Some stretched their slim, ribbon-like bodies out in the hanging sea-weed. Some fled into caves, whither no one followed them, and where they lay hid for a whole geological age, until, seeing nothing, they had all gone blind. And some went down into the depths of the sea—two miles, three miles, five miles—I have helped haul them up to the light—and these went blind like the others, for the depths of the sea are black as ink and cold as ice. And even there they are not safe, for other fishes go down there to eat them. And some carry lanterns, large, shining spots on their heads or bodies, sometimes like the head-light of an engine. And with these flashing lanterns, these burglars of the deep hunt their prey. And these are hunted by others fish-hungry, too, who lurk in the dark and swallow them, lanterns, head-light and all!

And so, with all this eating and chasing and fighting and fleeing and hiding and lurking, it comes about that wherever there is decent water on land or sea there are fishes to match it. And every part of every fish is made expressly for the life the fish has to lead. If any kind failed to meet requirements, other fishes would devour and destroy it. So only the fit can survive and these people the water after their kind.

All kinds of fishes are good to eat except a few which are too tough, a few which are bitter, and a few that feed on poisonous things about the coral reefs and so become poisonous themselves. Some are insipid, some full of small bones and some are too lean or too small to tempt anybody, unless it be another fish. But this is their business, not ours, and they have flesh enough for the things they have to do.

The biggest fish is the great basking shark, which grows to be thirty-five feet long, and lies on the surface of the sea, like a huge saw-log, filling its great mouth with the little things that float along beside it.

The smallest of all fishes lives in the everglades of Florida and the streams that run out of them. You can find them in the little brook that runs through Jacksonville. I have netted them there with a spread umbrella, which will serve when you cannot get a better dip-net. They are prettily barred with jet black on a greenish ground, and they belong to that group of top minnows to which Agassiz gave the name of *heterandria*. It is hard to say what is the highest fish—what is the one which has undergone the greatest modification of structure. Perhaps this place should be assigned to the sole, with its two eyes both on one side of the head, peering through the same socket, while the socket on the other side has no eye at all. Or perhaps we may place as highest some specialized form as the angler or the sargassum fish, which has the paired fins greatly developed almost like arms and legs, and which has a dorsal spine modified into a fishing rod, which has a bait at the end, hanging over the capacious mouth.

Agassiz put the sharks higher than all these bony fishes because, while lower in most respects, the sharks have greater brain and greater power of muscle. Others again might give the highest place to the lung fishes, fishes of the tropical swamps, with lungs as well as gills, and which can breathe air after a fashion when the water is all gone. These are not high in themselves, but they are nearest the higher animals, especially interesting to us because from such creatures in the past all the frogs and salamanders, and through these all the beasts that bite, the birds that fly and the reptiles that crawl are descended. These are near the primitive fish stock, the ancestors of true fishes on the one hand and of the land vertebrates on the other. As such, they partake of the nature of both. More correctly, their descendants have divided their characters. Their land-progeny lost the gills, scales and fins of the lung fishes, while their water descendants have lost [Pg 18]
their lungs, or rather the use of them, for the lung of the fish is generally a closed sac, called the air bladder. Sometimes it is only partly closed, and sometimes it is lost altogether.

But while we may dispute about the highest fish, there is no doubt about the lowest one. This is the lancelet. It is of the size and shape of a toothpick, translucent, scaleless, and almost finless, burying itself in the sand on warm coasts, in almost every region.

The lancelet has no real bone in it, just a line of soft tissue blocking out the space where the backbone ought to be. It has no skull, nor brain, nor eyes, nor jaws, nor heart, nor anything in particular—just transparent muscle, spinal cord, artery gills, stomach and ovaries, with a fringe of feelers about the slit we call the mouth. And even these organs are rather blocked out than developed, yet it is easy to see that the creature is a vertebrate in intention and therefore essentially a fish—a fish and a vertebrate reduced to their lowest terms.

You can go fishing almost anywhere, but whether it is good to do it or not depends on your reasons for doing it. There are about three good reasons for going a-fishing, one indifferent one, and one that is wholly bad.

One good reason is that you may learn to know fish. Isaac Walton tells us that "it is good luck to any man to be on the good side of the man that knows fish." This is true, but you cannot learn to know fish unless you go forth to find them. There are about 15,000 kinds of fish in the world; 4,000 of them in North America, north of Panama. Now no man knows them all, not even on one continent, though some have written books upon them.

But the man who knows a large part of them has not only learned fish, but a host of other things as well. He calls to mind rosy-spotted trout of the Maine woods, and still rosier of many brooks of Unalaska. He has seen the blue parrot fishes of the Cuban reefs and the leaping grayling of the Gallatin and the Au Sable. He has tried the inconnu of the Mackenzie River and the tarpon of the Florida reefs. He knows the sparkling darters of the French Broad and the Swannanoa, the clear-skinned *pescados blancos* of the Chapala Lake and the pop-eyes and grenadiers of three miles drop of Bering Sea. Till you learn to know fish you cannot imagine what the water depths still have for you to know.

The second good reason why you should go a-fishing is that you may know the places where fishes go. All the finest scenery is full of fish. The Fire-Hole Canyon, the Roaring River, the Agna Bonita, the Rio Blanco, de Orizaba, the creek of Captains Harbor, the Saranna, the Roanoke, the Restigouche, the Nipigon, and the lakes of the St. John, all these are good fishing water of their kind. So is the Rio Almendares, the Twin Lakes, and the Eagle River, the Sawtooth Mountains, the Venados Islands, the shores of Clipperton, the Pearl Islands, Dead Man's Reef, No Man's Land, and the sand reaches of San Diego, Santa Barbara, Pensacola, and Beaufort. If you know all these you know the rest of the United States, with Canada and Mexico as well. All this is a goodly country, which it is well for a good citizen to understand. If you go a-fishing to know the fish, the rest will be granted to you. And with all the rest you have filled your mind not only with pictures of plunging trout, of leaping muscallonge and diving barracuda, but you have enriched it with endless vistas of deep, green pools; of foamy cascades, flower-carpeted meadows, of dark pines and sunny pines, white birch and clinging vines and wallowing mangrove. You have "dominion over palm and pine," the only dominion there is, for your dominion doth not "speedily pass away." You know the crescent bay, with its white breakers, the rush of the eager waters through the tide-worn estuary, the clinging fucus on the rocks at low-tide, the bark of sea wolves, and the roar of sea lions in the long lines of swaying kelp which reach far out into the farthest sea. This is good for you to know, for it is an antidote to selfishness and doubt and care. Then, too, it is good to know the men that live in the open where the fishes are. To shake their hands and share their hospitality will cure you of pessimism and distrust of democracy, and banish all the chimeras and goblins which vex those who live too long in cities. To hear the elk's whistle and the ouzel's call, the whirr of the grouse's wings and the rush of the water in the canyon, will get out of your brain the shriek of cable cars, the rattle of the elevated railway, and all the unwholesome jangle of men who meet to make money. [Pg 19]

So there is a third reason for going a-fishing—not so good as the first two, but still very noble. We may fish for rest or exercise, which is but another form of rest. We may fish placidly in the placid brooks as Walton did, for chub and dace, till our thoughts flow as placidly as the Charles, or the Suwanee, or the Thames. Or we may fish in the rush and roar of the Des Chutes or the Buttermilk, tramping high through the pines to Agua Bonita, or far across the desert to Trapper's Lake, or struggling through the wooded reaches to the Saranac. We may come back at night tired enough to lie flat on the floor and "drip off the edges" of it, but withal at peace with all the world—it matters not whether we have fish or not.

There is one reason for fishing which is wholly indifferent—that is to go a-fishing for the meat which is in the fish. This is pan-fishing or pot-fishing. If you get your living by it, that is your business. It is frequently an honest business. But it is not a matter of pride. If you caught a hundred trout in the Au Sable and ate them all you were fortunate. They helped out your store of provisions, and trout are very fair eating when properly fried. But don't brag about it. It interests the rest of us no more than if you boasted of catching ten frogs, or eating a hundred chickens in a hundred consecutive days. The matter of fish as food belongs to economics or some other dismal science. By eating trout or bass you can never get "on the good side of the man who knows fish."

There remains one reason for going fishing which is positively horribly, disgustingly bad—that is, to see how many fish you can catch, just for numbers' sake. This is called "hog fishing," and whether your purpose be to brag over the size of your basket or to lie about the catch, or both, it is bad—bad for the fish, bad for the rivers, bad for your neighbors, bad for you. The good man will never slay fish wantonly. We creatures of God on the earth together should enjoy each other, and the beautiful world, which is ours alike.

Because man is the wisest of all, with greatest power of knowledge and capacity for happiness, it is all the more incumbent on him to preserve the world as fair as he found it, and to respect the rights so far as may be of every other man and beast.

[Pg 20]

WATER

SOME INTERESTING THINGS ABOUT RIVERS.

JENKIN LLOYD JONES.

DID THE rivers make the valleys or did the valleys make the rivers? This is not only an interesting but a very difficult question to answer correctly. Ask your teachers about it. Be sure you do not make any mistakes, because when you answer it correctly you have found out a great deal about geology. And geology is a hard name for a subject that contains many interesting and easy things, and the study of the river will help you understand many of these things.

However, it may be about the valleys, we are very sure that the river made many, many other things that we know about. Did you ever hear of the orator in the New York Legislature, who wondered how it was that the rivers most always flowed by the big cities? He certainly got his "cart before the horse," for it is the big cities that always grow by the big rivers. History has always grown along the banks of rivers, because all civilization has grown along their banks. The boundaries of nations change. The political maps of Europe that I studied when I was a boy are now out of date, and you would find they are all wrong, because the boundaries of kingdoms, states, and empires have changed so often; but the life of the world continues to be found largely along the banks of the rivers.

Why is this? And here is another question for you to talk with your teachers about. If you get the answer, you will have the key that will let you into much of the wonders and triumphs of art, architecture, and commerce.

Of course, the very earliest man would keep close to the river's edge, because he would have no other sure way of getting water to drink, and the fish in the water, the birds on the water, and the birds' eggs in the nests along the edge of the river offered him a sure supply of food. And then along the river the grass grows greenest, and this afforded good grazing for his cows, and his horses, and, may be, his camels. What kind of food does the camel like best, anyhow? Primitive man must have learned to swim early, and it must have been fun for the little boys of barbarism, as it is for the little boys of civilization, to plunge into the cooling water on a hot day. Man must have found out very early how to make a raft which would carry him down stream, and soon after he learned how to make a canoe that he could paddle up stream. So the river became his first road. On it he traveled when he went hunting, and with its help he protected his property and that of the tribe. The enemies were driven across the river, and kept on the other side.

A good way to study what a river does for man is to find out all you can about the life that gathered about some particular river, for that will tell you more or less of what happened along the banks of all the great rivers. The best of all rivers for such study is the Nile. It is one of the long rivers of the world, so long that its sources have only been recently discovered by those who make geographies. Read the stories of Livingstone and Stanley, and the early explorers, who went in search of the head waters of the Nile.

A MOUNTAIN RIVER. CHICAGO COLORTYPE CO.

But there are two Niles. One runs through the continent of Africa, and empties into the Mediterranean Sea. Another begins in the very earliest dawn of history, and runs through the human story of thought, feeling, and life. Along the banks of this Nile, in history, we see how human life was developed; all human life beginning away back there, so far back we cannot count it by years; when man made knives of flints and hatchets of stone. And then, because the Nile gently overflowed its banks two or more times a year, leaving after each freshet a soft layer of fertile mud on either side, primitive man began to plant his seed in this field plowed by a river, and to raise his millet, and peas, and beans, and some kind of wheat and corn. He was able to feed his cattle, and to raise chickens and geese along the banks of this river, which was only a green ribbon, from six to ten miles wide, four or five hundred miles long. On this green ribbon a great civilization, so great and so wonderful that only very learned men can understand how wonderful and how great it was, grew up.

Find out something about the pyramids. Look up pictures of the ruins of the Temple of Karnak; and that great stone image, carved out of a hill, higher than a five-story building, with a head so large that if a man stood on the top of one ear he could hardly reach the top of the head with his outstretched hand. The Greeks called this great stone image, with the body of a lion and the head of a man, a sphinx; but the Egyptians called it the "Hor-em-khoo," the "Horus-on-the-horizon;" and Horus was the god-child they most loved, the child of Osiris, the great sun-divinity, and of Isis, the beautiful mother of heaven. All this civilization along the Nile would have been impossible had it not been for the Nile. The great stones that went into the pyramids were floated down the river. Soldiers and workingmen were transported on the river. The fields were made fertile by the river, and the leisure and the wealth that were made possible by the fertile fields on the river's bank gave men time to think and to feel, to invent the beautiful picture writings, to cut out the great tomb temples, and to think the great thoughts of religion, God-thoughts, love-thoughts, and duty-thoughts.

Now, what happened along the banks of the Nile happened to a certain degree along the banks of the Euphrates and the Tigris. Mesopotamia means "the land between the rivers," the mid-river country. Away back five or six thousand years ago there were people who built great cities, erected high tower-temples of burned brick. They invented a curious kind of arrow-headed alphabet (the cuneiform), which they stamped into clay tablets, brick reading books. On the banks of these rivers, in that far-off time, astronomers watched the stars, and found out a good deal about the planets and eclipses. They measured time by the year of three hundred and sixty-five days, and twelve months, which means that they had watched the moon and measured the length of the days.

Then there are other rivers, The Ganges, that runs through the heart of India, on the banks of which there grew up the great religions and the curious customs of the Hindus and the Buddhists; and the Jordan, which, you will remember, flows through our Bible. Around it clusters the great stories of the prophets, of Jesus and his disciples. When we turn to Europe, we will find much about the Germans, by finding out all we can about the Rhine. If you can find out much about the Rhone and the Seine, you will understand the story of France and the French people. The Thames is older than London; and along the banks of the Danube grew up nation after nation. Down that stream have floated war vessels for different peoples for thousands and thousands of years. Would you not like to see a collection of boats that would reach from the boats made of the raw hides of animals by the earlier pagan people along the Danube, up to the latest and best steamer that now plies up and down that great river?

None the less interesting are the rivers of the Western continent, the Hudson, the Mississippi, and the Missouri; the Ohio and the Amazon are the pathways over which the first explorers traveled. Along their banks did the first settlers make their homes, and on their bosom did the men in the wild woods first send their traffics. Who was it that started the first steamboat up the Hudson? You remember how Abraham Lincoln when a boy helped build a flat-boat, and how he steered that flat-boat all the way from Illinois to New Orleans, selling there the truck the early settlers raised, exchanging it for molasses, and sugar, and the calico that they needed in Illinois.

When we remember the great service that the rivers have rendered man, the beautiful stories that cluster around them, the beautiful life that has sported in their waters, floated upon their surface, and gathered on their banks, is it not a pity that they are being so despoiled by thoughtless and reckless men, who wantonly cut down the forests, waste the trees that grow upon their banks? And then, in our cities, instead of beautifying the banks and profiting by the scenery, foolish men turn the back doors of their houses upon the rivers, build barns upon their banks, make of them the dumping-places into which they throw their rubbish, street sweepings, and old tin cans, everything that will soil the water and spoil the scenery.

Do you not think that some day we will again come back to the old love of the river, even if we do not need it so much as a highway now? for railroads go faster. We will keep them clean and beautiful, for the pleasure and the health they yield. You have heard of what a dirty thing the Chicago river is, how unpleasant it is both to the sense of sight and to the sense of smell. It is very much the same with many of the other rivers that flow through our great cities, and even smaller towns. Some day the children of our public schools, who are now studying these things, will grow up, and they will find out how to purify our streams. They will restore their beauty. They will love the fish in the water so much that they will prefer seeing them alive to eating them when dead. They will give back the rivers to the birds, that will sing unmolested upon their banks, and raise their little ones undisturbed in their nests, built low among the sedges, or swinging loftily in the poplar boughs above.

So you see, my children, to know the river is to know much of the geology of the world, much of the plant and animal life of the world, very much of the history of man, and very much of the higher hopes and aspirations, the poetry, the morality, and the religion of the human soul. The rivers were here before man was. They invited man. They nursed him. They fed him. They marked the places for his settlements. They helped the organization of the state.

By the way, as a closing lesson, suppose you find out how many of the states of our Union were named after rivers, and see how many of the river names you can discover the meaning of; for the rivers were on the earth before they were named. The names are of men, and some of them are very suggestive. The rivers are of God. They belong to nature, and they show forth the laws of nature, which are always the laws of God.

INSECTS

SOME WATER INSECTS.

CHARLES C. ADAMS.

IN field and forest bright-colored and active insects attract our attention. Aquatic insects, on the other hand, do not, as a rule, possess such bright colors as their land relatives nor move about with as great rapidity, yet it does not follow that they are less interesting.

As would be expected, some of the most interesting things about these animals are connected with modifications of their form which have resulted from their aquatic life. It is believed that the ancestors of water insects have been land insects which invaded the water and have thus become greatly modified in their new surroundings. Locomotion and breathing, either one or both of these functions, are, as a rule, very different in land and water insects.

The variety of aquatic insects, if we consider only the adults, is not great when compared with the land insects. But when we compare fresh and salt water forms it is surprising how few kinds there are which live in the sea, in spite of its vast area and great food supply. So few are the insects found in the sea, or other salt waters, that, to most of us, to speak of aquatic insects only calls to mind fresh water forms. We shall, therefore, refer almost wholly to fresh water forms. Let us consider briefly a few examples of these.

We may distinguish two general groups, according to their special habitat. Belonging to the first group are those insects which frequent, primarily, the surface of the water. These forms which breathe air directly, and not air dissolved in water, as is the case with many other water insects, must be kept dry and be able to maintain their position on the surface of the water. Surface insects, such as the Water-Skaters, found on quiet ponds and streams, and their marine relatives, *Holobates*, accomplish this by means of fine hairs which cover the feet where they touch the water. The same physical principal is involved here, as when a needle or wire is floated upon water,—that of surface tension.

The fine hairs on the body of a water insect act in the same way as those on the feet, and thus keep the insect dry when below the surface. These insects are thus able to breathe as land insects, on account of their being on the surface, and consequently their respiratory systems are not as greatly modified as in many of the insects living beneath the surface. It must be borne in mind that an insect breathes by means of the air which enters the body by small openings and is led by means of tubes, which become very finely divided, like veins, to all parts of the body. By means of contractions and expansions of the body of the insect, the air within these tubes is caused to circulate, and thus impure air is driven out and a fresh supply is pumped in.

Two of the commonest of these surface dwellers, so well known to the small boy who frequents ponds and streams, are the Whirligig-beetles or Lucky-bugs, and the long-legged Water-striders or Water-skaters.

The Whirligig-beetles are easy to recognize on account of their characteristic circular gyrations when disturbed, and by their habit of associating in large numbers in quiet places. When one of these, groups is disturbed they exhibit such activity that they well deserve their name, "Crazy-bugs." The eyes of these beetles are very peculiar in that each eye is divided into an upper and lower part. Thus the insect has practically an upper and lower pair, one adapted for sight at the surface, and the other for vision under water.

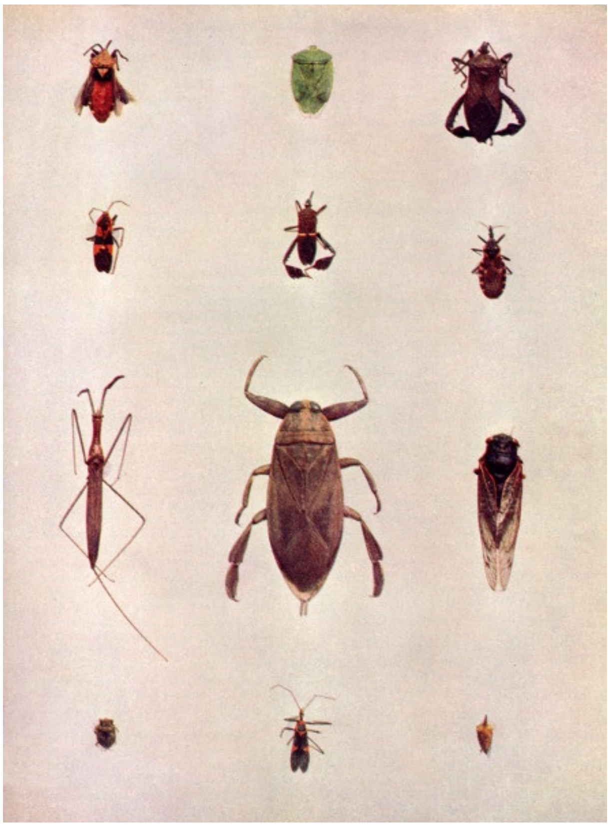
The Whirligigs do not seem to be very particular about their food, as they will accept both live and dead insects which fall into the water, and even under some circumstances will feed upon plants. When a beetle plunges beneath the surface, as he often does when frightened, he carries down a small bubble of air between the ends of his horny wings and the tip of his body. On account of his body being lighter than water it takes some effort to dive, but none to rise to the surface. The two hind pairs of legs which are used so much in swimming are very much flattened and plate like, making excellent paddles, as is shown by their exceedingly rapid movements.

The Water-skaters, or Striders, prefer quiet waters, as do the Whirligigs, but do not have the decided social disposition, shown in the latter to such a marked degree. These Skaters, on account of their long legs and short bodies, are the "Daddy long-legs" of the water. These characteristics and their habitat make them easy to recognize. They are nervous, active insects in their movements, jumping and skimming about on the surface with but little show of grace and ease as compared with the ordinary graceful curves of the whirligigs. Their food habits are very similar to those of other surface insects, that is, dead and dying insects found floating on the water. But their method of taking food is quite different from that of the Whirligigs, because of the great difference in the structure of their mouth parts. The Whirligig, being a beetle, has the typical biting mouth parts, while the Strider has a slender beak or proboscis, by means of which it sucks the juices from its prey, as do other bugs. The fore legs are used to seize the prey and bring it within reach of the beak. The middle and hind pair are used for rowing over the surface, the latter pair, primarily, for steerage, the fine hairs on the legs making it possible, as mentioned before, to make use of the surface tension. Large dimples are formed on the surface of the water where the feet touch it. One would hardly expect it possible for an insect standing on the surface of water to get its feet dirty, yet the great care which they give to cleaning their feet clearly shows that dirt is of common occurrence, even there. The white or gray color on the lower side of the body is due to the reflection of light from minute hairs which cover the surface, and keep the insect dry even when submerged.

The marine relatives of our Striders have some curious habits. Some of them live out at sea, hundreds of miles from land, where they are thought to feed upon the dead bodies of small animals. When the surface of the sea is calm they glide in colonies quickly over the surface, showing great skill in diving, but if the sea begins to become agitated they immediately disappear from the surface.

Perhaps the most remarkable habit which a surface insect has is that possessed by some of the allies of the Skaters, which not only swim in the water, but actually run on the *under* side of the surface film. It would be very interesting to know how such a habit was acquired.

Another interesting group of insects are those which breathe air, as the surface film insects, yet seek their food below the surface. These insects are compelled, on account of their air-breathing habits, to repeatedly visit the surface or communicate in some way with a fresh supply of air.



FROM COL. CHI. ACAD. SCIENCES. INSECTS. Life-size. COPYRIGHT 1900, BY A. W. MUMFORD, CHICAGO.

Archimerus calcarator	Nezara hilaris	Metapodeus femoratus
Oncopeltus fasciatus	Leptoglossus phyllopus	Conorhinus sanguisugus
Ranatra fusca	Benacus griseus	Cicada septemdecim
Galgulus oculatus	Zelus bilobus	Platycotis sagittata.

We have two families of the large-sized water beetles, common in our ponds and streams. The Predaceous water-beetles and the Water-scavenger beetles. These are easily recognized, because in the former, the antennæ are thread-like and not enlarged at the tip. While the members of the Water-scavenger family have the antennæ enlarged or club-shaped at the tip. The Predaceous water-beetles are often quite common under electric lights, where they have been attracted by the intense light. Their large size and clumsy movements, when out of water, attract attention. But when seen in water their skill as swimmers is in striking contrast to their awkward movements made on land. The hind legs are flattened and very powerful, the surface being increased by a fringe of strong hairs on the inner side. In swimming the stroke is made by both legs at once. Perhaps the most interesting facts about these beetles are those associated with their method of breathing. [Pg 29]

The horny wing cases covering the abdomen are very thick and fit close against the abdomen, except at the extreme posterior end of the body. The space between the wing cases and the upper surface of the abdomen forms a large air space. The spiracles, or openings into the respiratory system, are situated at the margins of the upper side of the abdomen. When the beetle comes to the surface for a fresh supply of air it exposes the tip of the body and then by a depression of the tip of the abdomen allows a fresh supply of air to enter into the cavity below the wing covers; this cavity is then closed and the beetle is ready for another trip under the water. When resting in the water they float with their head downward and the end of the abdomen slightly projecting from the water; thus a fresh supply of air is easy to secure. In their food habits these beetles are predaceous, and in addition to other insects, will even kill small fish.

The Water-scavenger beetles are not such perfect swimmers as the Predaceous ones. When the latter makes a stroke in swimming it strikes with both hind legs, while the Scavengers strike alternatingly with the hind legs. Their method of securing and carrying air, as with other water-beetles, is remarkable. In addition to the air reservoir under the wings, they have on the under side of the body large hairy areas which communicate with the one under the wings. All the air spaces are thus in direct communication. The respiratory openings in the Predaceous water-beetles open on the upper side of the abdomen, but in these beetles they are on the lower side and surrounded by short hairs which preserve the air film on the lower surface. When the fresh air supply has been exhausted the beetle comes to the surface, tips the body slightly, so as to bring the region on one side of the body just behind the head, to the surface. The long antenna which is folded backward and reaches to the rear part of the head, occupies an air space in its apical half, and in addition is covered by fine hairs, thus being doubly protected from being wetted. At the moment the beetle reaches the surface, by a stroke of the antenna (on the side which is nearest the surface, the body being tilted), the film from the air space in which the antenna rests is carried upward and outward to the surface of the water, thus forming an opening to the exterior. By movements of the wings, aided by bellows-like contractions and expansions of the body, a fresh supply of air is pumped into the air reservoir.

In speaking of peculiar water insects one must not forget to mention the larva of *Donacia*. The adult female of this interesting leaf-eating beetle often cuts circular holes in the large leaves of water-lilies, and then deposits her eggs at the margin of these holes on the under side. When the larvæ hatch they make their way to the roots, upon which they feed. The really remarkable thing about this larva is how it gets its air supply, as it does not have gills, nor is it known to visit the surface for a fresh supply of air, and yet it has a normal air-breathing system. On the dorsal surface, near the tail end of the body, are two slender, curved, spine-like processes. The air tubes of the body arise from the base of these spines, and spiracular-like openings are found at their base.

Two different views have been advocated to explain how it is possible for the larva to secure air. There seems to be no difference of opinion with regard to the source of the air supply, from the air cells in the root of the plant upon which the larva feeds. One view is that these air spaces in the plant are punctured by the spines and thus the air is taken directly into the air tubes. The other view is that the larva bites a hole into the air space and then, by the aid of the spines, holds the openings at the base of the spine against the air space and thus the air is taken up.

The Back-swimmers are curious little fellows which swim upside down in the water, and by means of their sucking mouth parts, prey upon other small animals. The lightness of their bodies and the large amount of air which they carry with them make it necessary when they wish to remain below the surface to hold fast to some object. Thus it takes constant effort in order to remain below the surface. For this reason it is quite natural that they should very often be found floating at the surface where no effort is needed to maintain their position and where an abundant supply of air is accessible.

Another method of securing fresh air, but differing from that of any of the insects previously mentioned, is by means of elongated breathing tubes, thus allowing the insect to remain submerged and yet secure a fresh supply of air from the surface. This method is used by some predaceous water bugs, as shown in the plate, *Ranatra fusca*. As with all of our Predaceous water bugs, which have the elongated respiratory tube at the end of the body, the Water-scorpion has its fore legs adapted for capturing and holding its prey, which consists generally of small fish and insects. The apical part of the fore leg folds back on the basal part which is grooved on its inner face, as a knife blade folds into its handle. As the slender legs of this bug would indicate, it is not an active swimmer, but crawls about slowly.

Doubtless the best known, to most people, of this type of breather, are the Giant water bugs, which accumulate in such large numbers under and in the globes of electric lights. The paired nature of the breathing tube is well shown in the plate. These bugs are powerful swimmers, as is shown by their flattened hind legs. Even young fish are not overlooked by these voracious bugs. A South American kind is much larger than our species, reaching from four to four and one-half inches in length, or about twice the size of our species. The shortness of the air tube suggests that this organ is not used in just the same manner as in the Water-scorpions, and the areas of fine hairs on the under side of the body suggest that these insects may be somewhat of a compromise between those insects which carry air below with them and those which remain submerged, except for the tube which communicates with the air.

Most of the insects previously mentioned are ones which throughout life live in water, but a very large number are aquatic only during their larval or immature stages. The Mosquito is a good illustration, of this type. In some of its habits the Mosquito is well known, but this is primarily due to the biting habit of the female. The researches of recent years clearly show that the annoyance from the bite itself, is, in the case of some kinds of Mosquitoes, only a small part of the mischief that they can do. The life history of the Mosquito has been summarized somewhat as follows by Dr. L. O. Howard: The eggs are laid at night, in a boat-shaped mass containing from two hundred to four hundred eggs. These may hatch in 16 hours, the larval stage lasting about a week, and the pupal stage about 24 hours. Thus the entire cycle may be completed in 10 days, under favorable circumstances, but may be greatly delayed by a low temperature. The rapidity with which the complete cycle may be passed through makes it possible for a very large number of broods to occur during a single season.

The Wigglers or Wiggle-tails, often so numerous in rain-barrels, are the larvæ of mosquitoes. Every one has noticed that these larvæ when not disturbed rest at the surface, but when frightened drop slowly downward in the water, since they are heavier than this medium, yet they rest at the surface, by means of a rosette of thin plates at the tail end of the body. These act as the hairs on the legs of the Water-strider, and make use of the tension of the surface film which holds the larva up, as the surface tension held up the Water-strider. On the next to the last segment of the Wiggler there is a large breathing tube which reaches to the surface when the larva is floating. The food of the larva is said to be decaying vegetable matter. The short pupal period is also passed floating, but it now has two breathing tubes near the points of attachment of the wings. When ready to transform it crawls out onto the pupal skin and dries its wings preparatory to flight.

Our common mosquitoes belong to three genera, *Culex*, *Anopheles* and *Corethra*. The annoyance caused by the irritation resulting from the bite is not understood, as no poison gland has been found. The females only of our mosquitoes are known to suck blood. From researches made during the past few years it is now definitely known that the bite of certain kinds of mosquitoes is really dangerous. This is not on account of the actual puncture made by the insect, but due to the presence of the germs of malaria, which are introduced into the wound from the infected insect. The only mosquitoes which are definitely known to transmit this malarial parasite to man belong to the genus *Anopheles*. The malarial parasite thus has two hosts, mosquitoes belonging to the genus *Anopheles* and man. This parasite infests the stomach walls of the mosquito, where it rapidly multiplies and becomes mature; then escaping from this locality, accumulates in the salivary glands. From this reservoir they are easily transferred to their human host at the time of sucking blood.

These aquatic insects which we have discussed so briefly are only a few samples from a very large number whose history and habits are full of interest to those who find the study of animal life a fascinating subject.

INSECT MUSIC.

The peculiar sounds made by different insects, though usually known as insect music, are probably far from musical in the opinions of those who listen to it with dread. Many superstitious people have firm belief in dire warnings concerning certain calamities which "insect music" portends.

For instance we are told that the "deathwatch" is a popular name applied to certain beetles which bore into the walls and floors of old houses. They make a ticking sound by standing on their hind legs and knocking their heads against the wood quickly and forcibly. Many superstitions have been entertained respecting the noise produced by these insects, which is sometimes imagined to be a warning of death.

There are many insects, however, which produce sound decidedly musical; and many such instances have been enumerated. Everybody is familiar with the music of the katydid. Here it is the male that has the voice. At the base of each wing cover is a thin membraneous plate. He elevates the wing covers, and rubs the two plates together. If you could rub your shoulder blades together you could imitate the operation very nicely.

Certain grasshoppers make a sound when flying that is like a watchman's rattle—clacketty-clack, very rapidly repeated. There are also some moths and butterflies which have voices.

The "death's-head" moth makes a noise when frightened that strikingly resembles the crying of a young baby. How it is produced is not known, though volumes have been written on the subject.

The "mourning cloak" butterfly—a dark species with a light border in its wings—makes a cry of alarm by rubbing its wings together.

The katydids, crickets, grasshoppers and other musical insects are all exaggerated in the tropics, assuming giant form. Thus their cries are proportionately louder.

There is an East Indian cicada which makes a remarkably loud noise. It is called by the natives "dundub," which means drum. From this name comes that of the genus which is known as *Dundubia*. This is one of the few scientific terms from Sanskrit.

Entomologists have succeeded in recording the cries of many insects by the ordinary system of musical notation. But this method does not show the actual pitch, which is usually several octaves above the staff. It merely serves to express the musical intervals.

It is known with reasonable certainty that many insects have voices so highly pitched that they cannot be heard with the human ear. One evidence of this fact is that some people can distinguish cries of insects which are not audible to others. But even if there are a few notes lost to many of us, there is enough insect music to prove vastly entertaining to those who take interest in the insect world, and the peculiar methods of its inhabitants in communicating with each other.

DOMESTIC ANIMALS

CATTLE.

CATTLE is a term applied to the whole of that large variety of domestic animals known as the Bovine family. Naturalists have divided them into two primary groups—the hump-backed cattle (*Bos Indicus*) and the straight-backed cattle (*Bos Taurus*).

Some naturalists claim that these two groups are really only different varieties of the same species, while others claim that the marked differences in structure, habits and voice are such as would indicate a specific distinction.

The hump-backed variety is chiefly found in India and Africa, while the straight-backed cattle are common in all parts of the globe. Cattle seem to have been domesticated as far back as written and traditional history will take us.

The remains of the cow and the ox have been found as a part of the many evidences of the oldest civilizations, their bones having been discovered in the same caves with stone axes and stone knives. That the cow contributed immensely to the earlier civilizations cannot be doubted. Besides contributing to the daily bill of fare she became the common beast of burden, drawing the rudest of plows, sleds and carts, and in fact she does the same to-day to some extent in many parts of the world.

The common straight-backed cattle, as we know them in our country, remain an important factor even in this stage of civilization; while they are not generally used as beasts of burden, they furnish millions of gallons of milk and numberless pounds of butter, and finally sacrificing their entire bodies to the use of man. The principal part of the body goes to the meat block to become steaks, roasts and soup bones; the refuse flesh going to the manufacture of soaps largely; the hide furnishes most of our leather, the bones become fertilizer, the hoofs and horns make our glue, and lastly, the hair makes it possible for us to live in plastered houses.

In olden times a man's wealth seems to have been measured by the number of cattle he owned, and during the same period cattle were used as money, or a medium of exchange. Later when metal coinage came into use in Greece the image of an ox was stamped on the new money in commemoration of the old system. The same idea has left its impression on the languages of Europe as seen in the Latin word *pecunia* and the English word "pecuniary," both words being derived from *pecus* cattle.

America is the great cattle-producing country of the world. In the early settlement of this country the immense tracts of uncultivated grass lands were well adapted to cattle-raising, and many were the large herds to be seen west of the Ohio river on the great prairies of the country once known as the Northwest Territory. But as men came with their plows the herds were gradually driven farther and farther west. Cattle are very interesting animals when we once get acquainted with them.

The writer, when a boy, had some experience herding cattle on an Illinois prairie. In this particular herd of which I wish to speak there were about seven hundred head and it required two of us and also two good shepherd dogs to keep them in control during the early part of the herding season or until we got them "broken in," as the old herders used to say. These cattle had been wintered on various farms surrounding the herd grounds, so when they were brought together in the spring there were about fifteen different clans to contend with, each clan having its recognized leader. Now, these leaders are always a source of trouble to the herder, and especially is this true for the first few weeks after bringing them together.

BRITTANY.

The whole herd would be grazing and moving slowly along, seemingly perfectly satisfied, when suddenly one of those leaders would raise his head very high in the air and act as if he saw something very interesting a mile away and would immediately start off in a rapid walk, bellowing two or three times to notify his followers that he was out for a stroll. Then the whole of his clan would follow him at once. They would not go far until the leader would set the pace in a rapid trot.

But we always had the remedy at hand for these fellows and immediately one of us would mount a horse and taking a dog make a straight run for the leader and begin to give him the "business end" of a long, heavy whip, the horse being trained to this sort of performance would keep close to this leader, allowing us to pour on the whip until he was so completely run down and fagged out generally that he would never aspire to that office again; in fact, he would lose all interest in *cattle politics*, not even making a good follower thereafter. But other leaders would spring up and have to be discouraged in the same manner.

While these clan leaders gave us more or less trouble during the whole of the season and made it necessary to exercise vigilance, it did not have in it that source of danger and excitement that we experienced in a general stampede. We had two of these during this season, one of which turned out rather seriously and furnished enough excitement to have satisfied the most reckless boy in our vicinity. It was some time the last of the month of May. We had "rounded up" our cattle in the evening as usual, putting them in the "pound" for the night. Our cabin was near the "pound" and situated on higher ground, so we could overlook the entire herd. This "pound" had an area of about ten acres, being enclosed by a very strong wooden fence. It was some time after midnight when we were awakened by the approach of a terrific thunderstorm. We knew the danger of a stampede during these storms and immediately got up, dressed ourselves in our rubber clothes, went to the stable a few yards away and saddled our horses. We were then ready for any emergency. When the lightning flashed we could see the cattle walking in a circle round and round the "pound." Soon the rain began to pour down in torrents and the storm was on in earnest. It had not been raining long when with a blinding flash the lightning struck a tree just outside the "pound." The shock was so great that it knocked down a number of the cattle, which we saw regaining their feet during the next flash of lightning. With one mighty surge the cattle mashed down the entire fence on one side of the "pound" and the stampede was on. We had our horses out in a "jiffy" and calling the dogs we started in hot pursuit. All we dared to do was "to follow." There were quite a number of trees in the path they took for about eighty rods from the pound. The almost continuous lightning enabled us to follow the cattle. They were running at full speed and it sounded like distant thunder and fairly shook the earth. They ran about a mile when they came to a small lake, which caused them to separate into two distinct herds. I followed one herd and my companion the other. After running about four miles and through a large farm they finally stopped in some heavy timber. I had not long to wait until daylight, and the storm being over I "rounded up" all I could find and started them back toward the herd grounds, arriving at the cabin about 11 A. M., my companion arriving about the same time. After a hurried meal we went out to look for injured cattle and to make a count. We found two dead ones near the pound, which had evidently lost their lives by running against trees. It was several days before we were able to locate all the stragglers.

MISCELLANY

HOMING PIGEON.

Sleep little pigeon and fold your wings,
   Little blue pigeon with velvet eyes.
Sleep to the singing of mother-bird swinging,
   Swinging the nest where her little one lies.

In through the window a moonbeam comes,
   Little gold moonbeam with misty wings,
All silently creeping it asks is he sleeping,
   Sleeping and dreaming while mother sings?
But sleep little pigeon and fold your wings,
   Little blue pigeon with mournful eyes.
Am I not singing? See I am swinging,
   Swinging the nest where my darling lies.
—Eugene Field.

ONE day a carrier pigeon tapped at the window of Mrs. Nansen's home at Christiania. Instantly the window was opened, and the wife of the great Arctic explorer in another moment covered the little messenger with kisses and caresses. The carrier pigeon had been away from the cottage thirty long months, but had not forgotten the way home. It brought a note from Nansen, stating that all was going well with his expedition in the polar regions. Nansen had fastened a message to the bird and turned it loose. The frail courier darted out into the Arctic air, flew like an arrow over perhaps a thousand miles of frozen waste, and then over another thousand miles of ocean and plain and forest, to enter the window of its waiting mistress and deliver the message which she had been awaiting so anxiously. We boast of human sagacity and endurance, but this loving carrier pigeon, after an absence of thirty months, accomplished a feat so wonderful that we can only give ourselves up to wonder and admiration.

Utilization of the homing instinct of the domesticated varieties of the Blue Rock pigeon, the *columba livia*, by employing the birds as messengers for physicians living at some distance from their patients, is comparatively new and is the latest evidence of the value of these birds. A few doctors have made the experiment, and it only remains to prove the facility with which the pigeons can be employed in order to determine whether they are likely to come into general use for this purpose.

The importance of establishing pigeon service for busy, overworked country doctors is strongly urged in favor of the plan, and it is agreed that there is no other such efficient or speedy means of carrying messages.

The carrier dove, which is the emblem of peace, though used in these times for carrying war messages, obeys the one governing impulse of its small heart when, released at a distance from its mate and its nest, it turns with marvelous fidelity to its home cote. With no compass except that home-seeking instinct, no reliance except in the exquisitely adjusted beat of its wings, it soars upward until its keen eyesight and quick perceptions give certainty of direction; then, at a splendid pace of 1,400 yards in a minute, it speeds on its journey home.

MATED BIRDS THE BEST.

Once a male bird has regularly mated he will fly back to his duties as a husband and father as fast as he can. These duties are serious and practical, for the male bird bears his full share in sitting upon the eggs and in feeding the nestlings when hatched, for which purpose both cock and hen possess special faculties and functions. The homing tendency acts best when it is entirely concentrated. For example, it has been found that a mated pair will not fly home together with anything like proper certainty. They stop and dally by the way; they behave like holiday people who have "got somebody to mind the babies."

In order to have trustworthy messengers for war or peace the pigeons must not be bachelors nor loafers nor be flown with associates; they must be the respectable mated birds with establishments, so that in employing them for war messengers one actually presses domestic virtue, as well as love and parental instinct, into the service of the military.

But even the peaceful pigeon can be sometimes pugnacious on his own account, and a jealous fantail, or tumbler, or Antwerp, or Jacobin often will conduct himself like a game cock, though painters and poets from time immemorial have agreed to regard this bird as the natural emblem of gentleness and peace. It is the accepted token of the Holy Spirit, "which descended in the form of a dove." All literatures are full of this thought.

PIGEONS IN LEGEND AND STORY.

The Arabs have a story that when an angel of Allah offered to King Solomon the water of immortality in a ruby cup it was a dove that dissuaded him from drinking it, and thereby from living mournfully to survive those whom he loved in an earth grown desolate and lonely. And it was because of the maternal courage of a dove which had followed its captive nestlings all the way to the prophet's house that Mohammed instituted that merciful decree which still prevails all over the East, and which forbids true believers to touch or even to taste of the flesh of any creature which has not been "hallalled"; that is to say, over which, while alive, the prayer of pardonable bloodshed has not been uttered.

The birds, gentle and stainless, which Sappho sang of, harnessed to the golden chariot of the "Splendor-throned Queen, immortal Aphrodite," in some cases have been converted into messengers of death and ruin. Some hold that this is better than to see them immolated for prizes by unsportsmanlike gunners at Monte Carlo and such places, for the birds remain unaware of their new duties, and carry messages from a beleaguered fortress, or the call for aid from a sinking warship, or the state of a suffering patient, alike carelessly and ignorantly, as if the missives tied to their feet were perfumed messages sent by lovers.

USED BY PHYSICIANS.

In the early '90s Dr. S. Weir Mitchell of Philadelphia used pigeons in the case of a patient ill of nerve fatigue, several miles from his home, thus accomplishing two purposes—a daily report and the salutary effect of leading the worn mind of the patient into a new channel.

Dr. Philip Arnold, in a recent medical journal, tells of receiving messages from his patients in the country every day, in addition to his daily visits to them. His plan usually is to leave a pigeon the day he makes a visit, and direct that the pigeon be liberated the next day with such a message as he requires. With a little care in the instruction of the nurse, he is informed of the condition of the patient before he starts to make his next visit. In a country practice this is important, since it enables the physician to judge what will be needed for his patient in the next twenty-four hours, and the country physician usually is his own druggist.

Then, again, country doctors cannot often make more than one call on a patient in twenty-four hours, and by an aerial messenger service they can get practically the same information as the doctors in the city or hospital practice by leaving two pigeons and getting morning and evening reports. The country doctor often is called from one patient to other persons sick in the neighborhood. This will make him late in getting back, and it is a great convenience if he can send this information home, practically with the same speed as the city practitioner through the medium of the telephone service.

TELLS WHAT KIND TO USE.

Dr. Arnold suggests that physicians wishing to take this matter up in earnest first of all should purchase only the best of Belgian homing pigeons, one or two pairs well mated. No reliance can be placed on young birds newly purchased for message carriers. Young birds, to be of service, must have been hatched in the home loft. The old birds secured for breeding must not be given their liberty until they have hatched one or two broods. The youngsters at a certain age can be trained.

A young pigeon begins his racing life when he is ten weeks old, with graduated journeys, varying from two to fifty and seventy miles in length. At the age of six months he is usually fed on a diet of beans and maple peas for a few months of hard racing work, the season commencing in April. [Pg 38] The length of the races varies from 50 or 100 to as much as 600 miles. There is not competition between rival fanciers and great excitement about the results.

Winter is the pigeon's time of retirement. He is not compelled to race, for racing is only profitable when wind is fair and the air is absolutely clear. Whatever the wonderful power that guides the pigeon home over hundreds of miles of unknown country, it is certain that sight plays an important part, for the least sign of haziness in the air will put the pigeon in the position of a derelict ship.

A bird of good quality costs from $5 to $20 when one month old, and a practiced racer one year old generally brings from $25 to $100.

When using these birds for messenger service the message is written upon the thinnest rice paper, rolled up and deposited in an aluminum holder, which is fastened to the bird's leg. This holder is in the shape of a capsule, with a small band which is easily attached to the leg of the bird. Professor Marion of the Naval Academy at Annapolis invented the holder, which is water tight when the lid is on, and weighs but eight grains. One of the most remarkable incidents illustrating the wonderful memory of a homing pigeon was that of a bird made a prisoner during the Franco-Prussian war. This pigeon after being in captivity for ten years immediately returned to its home after being liberated from confinement in a foreign country.

The hardships which these birds will unflinchingly face in returning home can hardly be appreciated by those who are not familiar with them. Birds so badly shot or torn by hawks as to be rendered almost helpless, notwithstanding their injuries will struggle onward until at last their home is reached. From extreme distances, such as points beyond 500 miles, the birds are at a great disadvantage, inasmuch as they are thereby forced to forage for themselves, something they are not trained to do. As a result they are unreliable and slow when called upon for such work. There are birds which have homed 614 miles air line the day after, and there are a few pigeons in this country that have covered more than 1,000 miles, air line, the extreme distance covered being 1,212 miles.

It seems really impossible to extinguish the homing instinct in a good pigeon. A story is told of a

French carrier pigeon which was captured by the German soldiers during the siege of Paris in 1870. The bird was being carried in a balloon from Paris to some point in the country, whence it was expected to return to Paris with a message. It was taken to the German headquarters and presented to the commander, Prince Frederick Charles, who sent it to his mother in Germany. Here it was placed in a splendid roomy aviary and carefully fed and nourished; but, although it was kept here, living in the lap of royal luxury for four years, the French pigeon did not forget its fatherland.

At the end of that time the aviary was left open one day. The pigeon flew out, mounted high in the air, flew about for a moment, as if to find the points of the compass and started in a straight line for Paris. Ten days afterward it beat its wings against the entrance to its old loft in the Boulevard de Clichy. There it was recognized and its case being brought to public attention it was honored as a patriot returned from foreign captivity. It remained at the Paris Jardin d'Acclimatation until it died in 1878.

In Belgium, where pigeon racing is as great sport as horse racing is in England and America, the birds have made a speed of seventy miles an hour for short distances. From thirty to forty miles an hour, is, however, the average speed of the average bird. Though not by nature strong of wing or equipped for long flight, the birds have been known to cover great distances. Probably the longest journey of which there is any record was made some ten years ago. A family of birds had been taken from Belgium to New York, where they were to be bred and trained. They were released from the cote before they had been thoroughly domesticated, and straightway disappeared. Two weeks later three of the pigeons, bedraggled, weary and nearly dead, arrived at their native cote in Belgium. How they had made the long ocean voyage nobody ever knew, but they had evidently accomplished it in some manner, and, out of respect for their wonderful achievement, they were allowed to remain in the home to regain which they had suffered so much.

FROM COL. CHI. ACAD. SCIENCES. HOMING PIGEON.

The *San Francisco Examiner* records that "Sadie Jones, C. 21,392," is the champion long-distance homing pigeon of America, and the world, so far as is known. She flew from Lake Charles, Louisiana, to Philadelphia, a distance of 1,202 12-100 miles in 16 days and 3 hours. Sadie Jones is the property of M. S. Sullivan, of West Philadelphia, and was five years of age at the time of making the record. She was named after the daughter of the National Race Secretary, Charles H. Jones, and was personally countermarked and shipped by that young lady, together with five others. She was the only one to return. So far as known no other pigeon has ever flown this distance.

When the writer was many years younger, to please the rising generation he made a dove cote and procured a few tame pigeons. In the course of time the birds had increased by not only rearing young, but by inducing strange birds to accept the quarters offered. The pigeons were regularly fed, the meal hour being announced by a peculiar whistle. The dinner call was soon known to all the birds in the place, and the yard would immediately fill with birds from every direction when the whistle was blown. On one occasion a lame bird in the flock, which had evidently been caught in a snare and escaped with a slip noose on one leg that had cut into the flesh, making the poor bird very lame, came with the rest.

After considerable pains the bird was caught, the string cut, and the bird placed on the ground. It stood a moment as if amazed, and then flew up to its liberator's knee and fed out of his hand.

THE TWO-STORIED NEST.

ETHEL MORTON.

Looking from my study window, one day, last June, I noticed a little yellow and brown bird, who was hopping from bush to bush. She was busily chattering to another bird, who sat on a neighboring tree, evidently much enjoying a worm he was eating. I knew the pair, directly, as my friends of the season before,—the Yellow Warblers.

Mrs. Warbler was looking for a good place to build her nest. After some consideration, she decided on a bush in front of my window. Off she flew to a field of dandelions, and soon returned with several pieces of dandelion fluff. It took quite a while to complete the house, for Mrs. W. was very neat and precise in her work, but after it was finished, Mr. Warbler came over to look at it (he had left the building to his wife!), and as he seemed perfectly satisfied with it, Mrs. Warbler was happy.

Not many days after this, some pretty little blue eggs lay snugly in the nest, and Mrs. Warbler was a mother! Alas! On the day the young Warblers left their shells, their mother came home from a call on Mrs. Robin, to find her children crying most bitterly. An ugly Cowbird had dropped its great, brown, spotted egg right in their beautiful parlor! (It seems to be a custom with these birds, to leave their eggs in the nests of their unfortunate neighbors, rather than hatch them themselves.)

Poor, little Mrs. Warbler! She tried with all her strength to push the egg out of her home, but without success. So, what do you suppose she did? Why, she just built another nest on top of the old one! It was a great deal of trouble, and the young Warblers tried her patience sorely, by persisting in pulling at the threads and straws, as she wove the frame-work of her new dwelling. "Labor is its own reward," however, for there was not a happier couple in all bird land than Mr. and Mrs. Yellow Warbler, when they brought their admiring friends and relations, to see the young Warblers, in the two-storied nest.

INDUSTRY

WHEAT HARVESTING.

J. F. STEWARD.

CHAPTER I.

WE HAVE been told, "Ye cannot live by bread alone," which is no doubt true, but aside from the use of animal flesh as food, bread in some form has played the greatest part in sustaining mankind.

There have been found, on every continent and every island of the globe, rude stone implements that tell, by form only, of their possible use. We read the story of pre-historic relics largely by comparison with modern things, and hence judge that the crescent-shaped flint implements, serrated upon their inner edge, to be seen in the British Museum and elsewhere, may have been used by the savages as reaping hooks.

The natural habitat of wheat must necessarily remain a matter of dispute, for history cannot tell us of the time when the wild grain began to be cultivated by the savages, whose traditions are silent, nor when it was introduced into the various countries.

The first harvest scenes depicted are found upon the stones of ancient Egypt, representing slaves with reaping hooks, at their tasks, scenes cut there before the time of Moses—long before the exodus. In the ruins of Egypt bronze reaping hooks have been found, differing little from those now used for trimming lawn hooks. In the sediment of Lake Neuchatel, in Switzerland, where have been discovered the remains of an ancient and forgotten people, whom we name merely "the Lake Dwellers," wheat and other grains have been found, and also reaping hooks of bronze; and from the bogs of the Scandinavian countries, where, in conformity with religious rites, were thrown prized articles, upon the death of their owners, sickles have been taken.

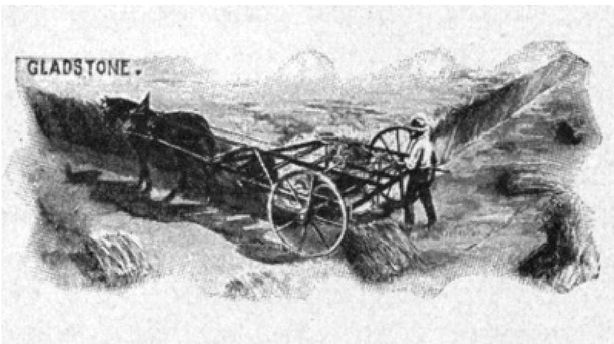
From the time of bronze in Egypt, to the centuries following the dark ages, the reaping hook was probably the only implement used in the harvest.

When comes the beginning of the end of barbarism in a nation, then industrial progress germinates, and in proportion as barbarism has decreased, the efforts for improvements in methods adapted to reduce human labor have been successful. The cloud that cast its shadow over Europe during the so-called dark ages, practically suppressed all efforts, and it is only since then that the energies directed to mechanical progress have had a fair field.

Following the reaping hook, not many centuries ago, came the scythe for mowing hay. It was but an enlarged reaping hook, so planned as to call into action the entire physical system, however, instead of the mere right arm, and with it a man was able to lay in swath many times more grass than had been accomplished by any previous implement. In America at the beginning of this century, the scythe had been modified so as to adapt it to the cutting of grain, and with it the straw was laid in a neat swath by the man who swung it, ready to be raked and bound by another. This, however, was nothing more than an implement.

We read that machines were attempted before the beginning of the present century and are told by Pliny and others of a box-like cart pushed by an ox between rearwardly extending thills, and having a comb at front, adapted to pull the heads from the standing grain. A man walking beside with a hoe-like instrument scraped the heads into the box. It is no marvel that this implement, made by the Gauls as early as A. D. 1, did not come into general use.

We also read that a machine was attempted in Hungary during the latter part of the eighteenth century, and that prizes were offered in England for a reaping machine. It is safe for us to consider, however, the efforts of Mr. Gladstone, of England, who, in 1806, produced a machine adapted to cut grain and deliver it in a swath beside the machine. With what success, we are mainly left to judge by the construction of the machine itself, which embodied many of the valuable elements of the reaping machine that held sway during the second third of the present century, only to be forced into the background by better harvesting methods.



GLADSTONE REAPER.

In order to give Mr. Gladstone the credit due him, it is proper to say that his reaper, like nine-tenths of the modern harvesting machines, was adapted to be drawn, and not pushed, as the implement of the Gauls was. Its cutting apparatus was extended well to the right, so that the horse drawing it might walk beside the grain to be cut. It was supported upon wheels, one at the outer extremity of the cutting apparatus, and the other substantially in the position now placed in harvesting machines, and his cutting devices were operated by it. His machine was not only adapted to cut the grain, but deliver it at one side in order to make a clear path of travel in cutting the next round.

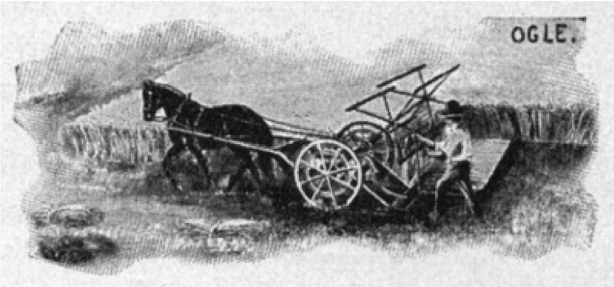
His machine did not come into use, but was patented and thus made public. Whether practical in detail or not matters little, for he left to the world as a legacy the foundation principles of the reaping machine. Those who followed enriched the art only by additions and modifications.

A second patent was granted to him covering improvements. His machine might leave the grain in almost a continuous swath or in gavels, which depended only upon the number of raking devices applied to his rotary cutting apparatus.

In the patent granted to Salmon, who followed him in 1808, is found a grain receiving platform, differing in no respect from that of the early practical reaper, a cutting apparatus placed at its forward edge, a divider to separate the grain being cut from that left standing, and an orbitally moving rake adapted to remove the grain in gavels to the ground.

SALMON REAPER.

While it is of actual achievements that we shall mainly write, it is well to say that the actual achievement of the reaping machine was accomplished largely from knowledge given us by those early inventors, and it is proper that we point out precisely what they have taught us, for more than thirty machines have been patented in England and America before the machine of Bell, the Scotch preacher, of 1828, was placed upon the market in England.

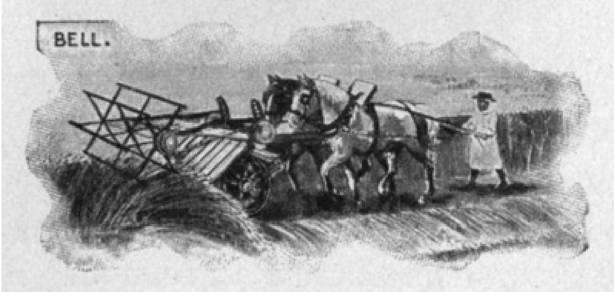


OGLE REAPER.

Kerr, Smith and others added their mite of knowledge, and in 1822 Henry Ogle, an English schoolmaster, invented a reaping machine that was made by a Mr. Brown, and which cut one acre per hour. The trial was so successful that the laborers in the field, fearing the competition of the innovation, mobbed the inventor and maker and broke up the machine. The patent shows its construction.

The cutting apparatus of modern harvesting machines is a modified form of shears; in the early machines, shears, pure and simple, were arranged in series before the receiving platform. As cutting devices they operated well, but were objectionable on account of the fact that they did not clear themselves of shreds of straw and grass.

Bell's machine may be considered the first practical reaper, because in it was found the essential combination of mechanical elements, not only of the reaping machine, but largely of the modern self-binding harvester. His machines were so successful that, as late as 1864, they were busy in the harvest fields of England, and laid a swath more perfect than any implement used before them; they were followed by a troop of girls, the like of which is still seen in the fields of those sections of England and Scotland where the modern self-binding harvester has not yet found its way. [Pg 44]



BELL REAPER.

The erstwhile Scotch student, when working behind closed doors on the little farm worked by his father, though inspired by high hopes, little dreamed that he was in any measure laying the foundation for greater results, and few, at the present day, know that one of the most essential elements of the modern self-binding harvester was reduced to practice by that youth who as the Rev. Patrick Bell administered to the spiritual wants of the members of a little flock in Scotland for many years.

Two machines, at least, were brought to America, but not until American reapers had been perfected to such an extent as to meet all of the requirements.

Bell's machine was pushed before the horses, as modern headers are. Its reel was supported by forwardly reaching arms as now; it had dividers and all essential elements, the only faulty one being the cutting apparatus.

The story of his efforts, as told by himself, is interesting. The facts pertaining to the construction of his machine may be found in cyclopedias and in court proceedings. Although America is considered the cradle of this art, we must bow to Bell and others and claim only that which we have accomplished, founded upon the information and machines they left.

In the fishing village of Nantucket, on the island of that name, of Quaker parents, a boy first saw light who later became famous because of his inventive talent. In that little village the whaling industry, upon which success in life depended, was extensively carried on. Like other boys the lad, Obed Hussey, took to the sea, but tiring, turned his attention to a machine for reaping grain. He made a model of the machine, and in 1832-1833 constructed a machine which he operated in the harvest fields near Cincinnati, Ohio. He "builded better than he knew," for his cutting apparatus sings his praise in the harvest fields of every continent, and will probably do so until man ceases to exist. It has been modified in various ways, but no material improvement has been made since it left his hands.

HUSSEY REAPER.

His machine was a combined reaper and mower. He placed his gearing carriage upon two wheels,—not a mowing machine of the present day is constructed otherwise. He jointed his cutting apparatus to the supporting frame in order that the machine might conform to irregularities of the surface of the ground. Again it may be said not a mowing machine of to-day is constructed otherwise. In order to adapt his machine to cutting grain, a detachable grain receiving platform was applied, and a stand for a raker as well. As "manual delivery reapers" thousands of such machines are made in America and sent to Europe, where the self-binding harvester has not yet won its way.

These four things were new:

His cutting device;

His raker's stand;

The cutting apparatus jointed to the gearing carriage; and the

Detachable grain receiving platform. Limiting our inquiry to hand raking reapers it is proper to say that this was the culmination.

No reaper has ever been made since that time that did not have these elements arranged as he had combined them. In the face of historical facts, court decisions and patent office records, printer's ink will be wasted in vain in any attempts to win the laurels from the modest Quaker.

WHEAT HARVESTING IN THE GREAT NORTH-WEST.

The necessities that called for these machines were the result of the high hopes of the pioneers of the West, who, finding natural garden spots of dimensions greater than the scope of the eye, plowed and sowed more than they could reap,—more than labor could there be found to reap. Naturally, then, the first practical machines of America were invented where the great Western fields, which, in their ripeness, inspired inventors.

On a day, during the harvest of 1833, a group of farmers and idlers were interested in the tests of a reaper about to be made. Mr. Hussey's machine was started, but some disarrangement caused delay. An incredulous young man, strong of arm, picked up the implement of one of the cradlers, and swung it with a broad sweep into the grain, declaring that that was a kind of a reaper to have. Mr. Hussey, though possessed of a quiet manner characteristic of the Quaker, felt stung and asked the bystanders to help him uphill with his machine. He then guided the machine down it on the run, and every straw was laid upon the receiving platform with the exactness in which it grew. The machine repaired demonstrated its ability to such an extent that others were ordered for the following harvest, and manufactured in a little shop on the farm of Judge Algernon Foster, near Cincinnati, Ohio.

For the harvest of 1834 two machines were made and sold, and from that time on have continued to be used up to the present day, where, as said in the so-called manual delivery reapers extensively used in Europe, they are found, substantially as constructed by him, having added thereto only the finishing touches applied by modern mechanics.

As a mowing machine slight improvements have been made; the only competitor for several years was one produced by Enoch Ambler, patented in 1834.

A single supporting and driving wheel was used in Ambler's, and a reciprocating cutting apparatus also, but the specific construction was not like that of Mr. Hussey. It came into considerable use, and may be considered the prototype of the single wheel reaping and mowing machines that found their way upon the market subsequent to 1840.

With the practical features proposed by a third of a hundred inventors carefully embodied in machines at the close of the first third of the century, came the practical reaping and mowing machine. Nearly one-half of the labor of the harvest field was dispensed with; the ring of the cradle blade, when whetting after the cutting of every round, soon ceased to be heard. The sound of the cutting device of the reaper and mower was not so musical, but may be likened to the chuckle of one in his ecstasy who has succeeded in his accomplishment. The burning sun scorched but half as many laborers as before. The labor of weary ones over the hot stove in the crude habitations on the farms was lessened. The harvest time became less dreaded; the scarcity of help became less felt, and the hours of labor were shortened. Homes became more cheerful, for the farmers' wives and daughters, before called from household duties into the burning sun, had now moments that could be devoted to planting the rose and vines.

Reflecting upon those early days, experiences such as can soon only be called by the artist, are brought to mind. In our imagination we see the troop of harvest hands, arisen from an early breakfast, taken after an hour's labor at chores, moving to the fields often before the sun has kissed the dew from the lilies that beckon them on the way, young women as well as young men; though with a hard day's labor before them, they are chatting as merrily as when gathering at school in the winter, when the labors on the farm are not so great. In those days few children who could walk knew leisure. The babe was often taken to the field and a still toddling youngster left in charge while the mother bound after the cradlers. It seems as if the expression "hungry as a hired man" must have originated on these western prairies, for in these early days five meals a day was the rule. About mid-forenoon two boys were spared from the field long enough to go for luncheon, soon to return with a well-filled basket and water jugs. The cloth was spread upon the stubble and a hasty but hearty meal spread. Perhaps a solitary tree shaded them. So far the harvest scene resembled the picnics we enjoy to-day. In the heat of the day an hour was taken for rest. At mid-afternoon another lunch was served. [Pg 48]

Then at sunset came the supper, only after which, from early morn, the kitchen stove was permitted to lose its blush; and the milking time, far into the starlight, while the night hawk boomed, and the rest for the day came after bob white and the whip-poor-will had ceased their calls.

What a change this century has wrought! One man now accomplishes as much as sixteen did in the early days. The self-binding harvester of to-day, through the reaping machine, was of a growth so slow that the efforts of a third of a century were required before the reaper was driven to the hillsides—but of this later.

A CHARMING HOME.

ANNA R. HENDERSON.

Wodie and I in the strawberry bed,
Searching for strawberries juicy and red;
Breathing the airs of a morning in spring,
Listening the notes that the meadow larks sing;
Heart beats and pulse beats keeping in tune
With all that is lovely in beautiful June.
Sharp little twitters near by us we heard;
Where was the haunt of the dear little bird?
Soon the wee nest and its nestlings we found,
Safe in a catnip bush, close to the ground;
Home of the sparrow, whose chirruping brood
Kept their four yellow mouths open for food;
By their fond mother unceasingly fed
With morsels of strawberry, fragrant and red.
"O, Mamma," said Wodie, "did ever you see
So tiny a nest in so tiny a tree?
And isn't it perfectly lovely to stay
In the spicy catnip leaves all day?
And whenever you wish for something to eat,
To dine on a slice of strawberry sweet?
To hear the father-bird singing, a tune
In the old peach tree all the afternoon,
And to be shut out from the dew at night
By the touch of mother-wings, soft and light?
I think when these dear little birdies stray
From their home in the catnip bush away,
Wherever their dear little forms may go,
In the summer's sun or the winter's snow,
They will say, as the old folks always do,
That their baby days were the best they knew."

Transcriber's Note:

- Minor typographical errors have been corrected without note.
- Punctuation and spelling were made consistent when a predominant form was found in this book; otherwise they were not changed.
- Ambiguous hyphens at the ends of lines were retained.
- The Contents table was added by the transcriber.

people in all walks of life.

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