

Stories of Nature

STORY HOUR SERIES

SELECTED AUTHORS

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This Home of Ours[1]

The earth is our home. Ever since we can remember we have been living upon it, and moving about here and there. We have slowly become acquainted with some of its nooks and corners, but our rambles still bring us to many things which we do not understand.

As we climb the hills, or follow the rippling streams, or wander along the beach, we feel that this is a very pleasant place in which to live. For some of us the growing plants and flowers are the most attractive. Some like best to watch the strange behavior of the little animals and insects, while others think the smooth and brightly colored pebbles are of the greatest interest.

As we grow older, the world seems to widen out faster than we can explore it. We travel farther, and catch glimpses of a great range of snowy mountains, at the foot of which are broad fertile valleys, and beyond them the shining Pacific Ocean.

As we have a chance to examine this country closer, we find new things. The streams from the mountains are led out over the valleys, and keep them

moist through the long summers, so that almost everything people need grows here.

In the mountains there are deep canyons through which, in the late spring, flow dashing streams of muddy water. In the fall they are quiet and clear, and we can count the pebbles over which they ripple. In some places they plunge over great walls of rock, and in others they run quietly under drooping willows.

High on the mountains there are no trees; only bare rocks and snow-banks. From a tall peak, we can see over the range to a very different region beyond. In that direction there are no green fields, no houses, nothing but a stretch of parched ground, for on that side of the mountains it seldom rains, and there are few running streams.

If we turn our footsteps to the ocean, we see in some places long ridges running out into the water. Where the waves have washed off the soil from these ridges there are jagged rocks, perilous places for the ships.

Behind the cliffs we see the bays, where the broad valleys come down to the ocean. The rivers wind sluggishly through these valleys, as though they did not know which way to go.

We enjoy seeing all these things, and by and by we begin to wonder about them, and to ask questions. The world becomes to us something more than a mere playground made for our especial benefit.

We begin to realize how large the world is, and how many things it contains which we shall have to study to understand. We see that life itself depends upon these things. If it were not for the great oceans from which the breezes carry moisture to the mountain tops, there to be condensed into rain, and water the thirsty land, no plants or animals could live, and our homes would become a parched desert.

We see that in choosing our homes we cannot go where we please, for we cannot grow our food in the desert, or upon the rugged mountains. We must choose the fertile valleys, if we would be farmers. We must leave the valleys and seek the mountains, if we would be miners.

Great cities do not grow up at any point. They are located in the protected harbor, behind the rocky headland, where the river and the valley meet the ocean, where the ships can come and take the produce. Manufactories must be built where dashing streams roaring among the boulders, or pouring in cascades over the rocky cliffs, furnish the necessary power for running machinery.

It is clear then, that our lives, as well as the lives of the animals and plants, depend upon the oceans, the position of the mountain ranges, and the direction of the winds.

We question the mountains, and the rivers, and the ocean. We wonder if they have always been where

they are now. The mountains look so firm and solid it seems as if they must always have stood where they do now. But some day we find shells upon a high ridge far from the ocean. This puzzles us, for these shells must have lived in the ocean once.

We finally come to the conclusion that before we can know all about the plants; why one kind grows on the hillside, another by the brook; why the animals are distributed as we find them; why cities grow up as they do; and why in one part of the country people till the ground, and in another part dig deep for the minerals, we must know a little more about the foundations of our home.

We must know how the rocks and the soil were made, how the mountains grew, and why the rivers run as they do. We must understand how Nature is shaping the earth about us.

In order to do this, we shall study what the rain and the frost are doing upon the mountain tops. We shall trace the river's course, and find where the mud which it carries to the ocean comes from. We shall try to understand how this mud is spread over the floor of the ocean, and what the waves are doing as they continually beat against the land.

We shall go beneath the rich soil upon which our grain grows, and find out what is going on within the earth. We shall want to know about many things which are dug from the earth, how the coal was

formed, and where the petroleum comes from. The gold, quicksilver, borax, and salt, will also interest us.

Nature has many forces at work, some great and some small. They have worked a long time getting this home of ours ready for us. If we can understand how Nature works, our home will be more dear to us, and we shall be happier.

Birds

The Martins[2]

I dare say you all know that the swallows leave us in the winter, and come back in the spring. The swallows that build their nests under the eaves, are called house martins; and it is about a pair of these I am going to tell you.

It was the end of April when they arrived, and if they could have spoken, they must have had a great deal to tell about the warm countries, where they spent the winter; but as it was, they twittered merrily together and played about, and rested themselves after their long journey.

They were pretty little birds, with wings and backs of a very dark blue that was almost black, they were white underneath; and their legs were covered with soft downy feathers quite down to the toes.

Near the end of May, when the weather was fine and warm, they began to think of making a nest. So they chose a place under the eaves of a house, and went to look for clay. The clay was to build the nest with, but as it would have been too soft by itself, they mixed it with little bits of broken straws, and that made it tough and strong. Then they carried the clay, a little at a time, in their beaks, and plastered it against the wall, where the nest was to be.

Every morning early they worked at the nest, until they had made the sides half an inch higher, and then they knew it was time to stop; for if they built too much at a time, the soft clay did not hold, and they had to do their work over again.

But whilst they flew about and fed and amused themselves, the clay sides of the nest had time to grow hard and dry. In ten days they had built a strong, warm nest, with a little hole to go in at, near the top; but still it was not finished, for though they did not mind it being rough outside, they wanted it to be smooth and soft inside, for the young ones to lie in. So they lined it with small straws and grasses, and feathers; and when all was ready, the mother laid five white eggs in it.

When the young ones were hatched, they were naked helpless little things, and the two martins fed them by turns, and were very careful to keep the little close nest quite clean for them. From early morning, until late in the evening, they flew backwards and forwards to their young ones, feeding them with small gnats and flies. Sometimes they sat with them in the nest and sang to them in a gentle way that was very pleasant to listen to.

When the young ones were older, and their feathers grown, they grew impatient to leave the nest, and they used to sit all the day with their heads out of the hole, looking about them.

When the mother came with food, she clung to the outside of the nest and fed them there.

At last it was time for the nestlings to fly: What little young creatures they were to fly down from such a height! But they managed it very well, and the parents were there, to look after them, and even to feed them as they flew about in the summer air.

One day, a hawk came near, while the young martins were flying, and would have been glad to catch one of them; but an old swallow, that lived in the chimney, cried out to let them know that there was danger near. Then all the martins and swallows that had nests there, joined to chase the hawk away with loud screams. They buffeted him with their wings too, so that he was glad to get off.

By the end of August, the young martins were old enough to take care of themselves, so they left their parents and went to live with a large flock of other young ones.

With them they practiced flying all the rest of the summer; so when the cold weather came, they were able to go with the rest over sea and land, to the warm countries.

The Young Birds[3]

Edwin was once walking out by himself, when he saw something move in the grass. It was two young birds, with pretty speckled feathers and bright eyes. They seemed as if they had just come out of the nest, for they fluttered their wings and opened their yellow throats, as if they wanted to be fed.

Edwin looked about to see whether their mother was near, but he did not see her. Then he thought he should like to take the young birds home and keep them; he was sure his sister Mary would tell him how to feed them.

He caught them easily, for they were weak, and could not fly far. He put them into his cap, that they might not be hurt, and walked home.

As soon as he got into the house, he went to his sister, and said — "Look, Mary! what beautiful little birds I have brought! Will you help me to feed them?"

Mary looked at them, and said — "They are very pretty, indeed, but I am afraid we cannot feed them."

"Give them some bread-crumbs," said Edwin.

"Bread-crumbs will not do," answered Mary; "for these birds are young linnets, I believe, and they live upon insects."

"Oh, dear," said Edward, "what shall we do? They look so hungry — see how they gape!"

"Let us put them in a cage at once," said Mary, "that they may be safe from the cat." And she fetched an empty birdcage, and put the linnets in it.

They did not seem to like it, for they fluttered against the bars, and tried to get out. Edwin did not like to see it. "I wish they would be still," he said; "they will hurt themselves."

Whilst Edwin was watching them, Mary boiled an egg, and chopped it very fine, and brought some of it, to try if the young birds would eat it, but they would not touch a bit. One of them sat on a perch, and made a sad chirping noise, and the other still fluttered and tried to get out.

Then Edwin went to the window and looked out; he began to feel sorry that he had brought the birds. He chanced to see a dead fly lying on the window-sill, and he carried it to the birds, but they would not eat it.

It was getting late, and Mary said — "Perhaps if we put a cloth over the cage, the birds will think it is night, and go to sleep."

Edwin was glad to do it, and in a few minutes the birds were quiet; there was no more fluttering and no more chirping. It was now Edwin's bedtime, and he went upstairs.

He awoke very early the next morning, and went down stairs to look at the birds. They were both alive, but they had not eaten anything, and they fluttered and chirped just as they did the night before. Edwin did not know what to do; he wished that Mary would get up.

Now Mary had been thinking about the poor hungry nestlings, and just then she came in and bid Edwin good morning.

"The birds are as hungry as ever, I suppose," said Edwin, sadly, "for they have not eaten anything. I wish they were safe with their mother again."

"Let us take them back then," said Mary, "I am sure the mother is waiting for them."

"Perhaps she has forgotten them," said Edwin.

"Oh no," said Mary, "mothers do not forget so soon, let us try."

"Very well," said Edwin, "we will;" and he took up the cage and Mary ran for her bonnet, and gave him his cap, and then they set out together.

"Show me the very place where you found them," said Mary. Edwin showed her the grassy spot among the hazel bushes, and there Mary opened the door of the cage, and let the young birds hop out. Then she and Edwin went to a little distance and watched.

The young birds chirped loudly, and in a few minutes an old linnet flew down from the bushes to

them. The young birds fluttered their wings in a pleased manner, and opened their beaks. They did not look at all as they did when they were in the cage!

The mother linnet, for it was really the good mother, was delighted to see them, and after caressing them with her beak, as if she was kissing them, she flew away for a few moments, and came back with some food for them.

When Edwin saw how happy the old bird was with her nestlings, he looked at Mary and whispered, "I will never take young birds away from their mothers again." And Mary smiled, and gave her little brother a kiss.

The Bird Room[4]

When I began to be interested in birds, I lived in a city where not many beside English sparrows were to be seen. I wanted to know something about our common birds; moreover, I never looked into a bird store without longing to set every poor little captive free.

So I set up a Bird Room. Every fall, for several years, I went around to the bird stores in New York and Brooklyn, and bought all the stray American birds I could find. The dealers did not make a business of keeping our common birds, and now it is against the law to do so. They usually kept only such birds as canaries, parrots, and other regular cage birds; but occasionally they would have a robin or bluebird or oriole tucked off in a corner, and these birds were the ones I bought. In one store I would find a catbird moping on a high shelf, or in a dark back room; in another a bluebird scared half to death, and dumb in the midst of squawking parrots and singing canaries.

In this way I collected in my Bird Room eight or ten — usually — of our native birds, and always in pairs when I could get them. I put each one in a big cage, and left the doors open all day; so that they had

the freedom of a large room with three big windows and plenty of perches all about.

Then I gave almost the whole of my time to taking care of them, and studying their ways through the winter, and as soon as spring came, and birds began to come back from the south, I took my little captives, — those who were able to fly, and I thought could take care of themselves, — carried them out into the country or a big park, and set them free. Then the next fall I found a new set for my Bird Room, to be liberated again as soon as it was safe.

I took such good care of the birds, gave them so many things they liked, made them so comfortable, and let them have such good easy lives, that almost everyone was happy, and perfectly contented to stay with me through the winter, when times are sometimes hard for them out of doors. Then, when they began to get uneasy in the spring, I let them go — as I said.

I have explained thus carefully about my Bird Room because I do not approve of keeping wild birds in cages, and I never had one caught or caged for me, not even for study. Everyone I ever kept was set free as soon as it was safe for him.

It is no kindness to set a canary free, nor a bird that is injured, or has been kept for years, and so is unfitted to take care of himself. Canaries are born in cages, of caged parents. They have been taken care of for

generations, and have no knowledge how to get food or find shelter. Turning one out into the world is about like turning a two-year-old baby out to get its own living.

The only way to mitigate the hard lot of a canary is to make him so happy that he will not wish to be free. I could tell you many stories of canaries who had escaped, coming back and beating against a window to get into the only home they knew.

The Bird That Would Not Be Free[5]

Most people think that the best thing one can do for a caged bird is to set him at liberty. Almost always this is true; but there are cases, as I have said, in which the bird is happier to live in a house and be cared for.

If a bird is hurt and cannot fly well, he is better off where food and shelter are always provided. Also, if he was taken when very young, before he had been taught to care for himself, he would find it hard to provide for his own comfort. The case of canaries I have already spoken of.

But I want to tell you about a wild bluebird, who knew enough to appreciate the comforts of a home.

The bird was found in a store in a very bad condition, having been caught in a trap and beaten herself against the wires till her wing feathers were broken so that she could not fly. She was put into the cage of another bluebird, who had been so injured that he could never fly.

The stranger showed herself to be rather ill-mannered. She grabbed the best of everything, and drove the owner of the cage about as if it were hers and not his. In fact, she was so greedy that the mistress thought he would be very glad when she had gone. So as soon as she had moulted and had come out with

new plumage and perfect wing feathers, the cage door was opened and away flew Madame Blue and disappeared.

Then the bird who was left began to call to her. All day he called, till the mistress was very sorry for him, but there was no sign that the runaway heard.

The next day, twenty-four hours after she had been set free, one of the family found her back, and trying with all her might to squeeze into the cage between the wires, while her old cage mate was greatly excited, calling in the sweetest voice, welcoming her, and encouraging her to come in.

The cage door was opened for her and she flew right in, plainly delighted to get home. Then came the most lively chatting between the two. One could not help feeling that she was telling how uncomfortable she found it having to hunt up food and water, and how much nicer it was to have a whole family of people to wait on and care for one.

She ate and drank, and appeared as if she could not get enough, and was evidently perfectly happy. Open doors were no temptation to her.

Mind! I do not say that all caged birds are happy. Indeed, most of them are not, because few of them are well cared for. By that I mean not only supplied with fresh water and fresh food, with plenty of variety, but talked to, made much of, and loved. A bird can be made so happy and comfortable in a house that he will

refuse freedom, but to make him so he must have perfect confidence in, and even love for, the people he lives with.

My First Bird[6]

Many years ago, when I was a schoolgirl, I lived in an old-fashioned house away back from the street, in the outskirts of a Western city. It was before the English sparrows had come to drive other birds away, and our own native birds used to live in town with us. Vireos sang from morning till night in the trees that shaded the streets; Baltimore orioles swung their beautiful cradles from the tall boughs of the elms; and robins ran over the lawns without danger of having their hard-got worms snatched out of their mouths by the impudent foreign sparrows, as they are now.

I knew nothing about birds, and was absorbed in schoolbooks and music lessons and all school-day interests, but the first spring that we lived in the old-fashioned place, one bird forced himself upon my attention, and he was the first I ever noticed.

The grounds around the house were very large, and halfway down to the front fence was an old rustic arbor that was seldom visited. In or about that arbor somewhere, dwelt a bird with his family, and every evening and half the night, as it seems to me now, he sang to us. As soon as it grew too dark to see plainly, the song began, "Whip-poor-will! Whip-poor-will! Whip-poor- will! "

Because it was too late to see to read, I used to sit on the steps and listen, and think it the loneliest bird song I ever heard, but I never saw the singer. Though, as I have said, it was in the edge of a city, with houses all around, so common were birds about us then that no one thought of disturbing him. It being also before the days when every boy thinks he must have a "collection," no one tried to find the nest, though there were three boys in the house with me, and several more next door.

One evening after the whip-poor-will had sung for some weeks, I was surprised to hear a droll baby voice trying to imitate his notes.

On listening, I found that the elder was teaching the youngster — actually giving him a music lesson. First the perfect song rang out loud and clear, and the weak quavering voice tried to copy it. Then the singer repeated the strain, and the infant tried again. So it went on night after night till the little one could sing almost as well as his father.

That was my first bit of bird study, though I could never see the singer, did not even know how he looked, and had nobody to tell me where to find out; besides being always so absorbed in books, which I loved almost more than anything in the world, that I did not try much. But I never forgot the baby whip-poor-will's music lessons, and have always counted him the first bird I ever knew.

The reason I failed to see the whip-poor-will, though I stole down to the arbor so softly, was because he could see in the dark so much better than I could; and when he saw me coming, he slipped off his perch and flew away so silently with his soft plumage that I did not hear him. And the reason I could never find the nest was because the mother bird, the eggs, and the little ones were so nearly the color of the ground where they lay that I might almost have stepped on them without seeing them.

The whip-poor-will is about the length of a robin, but much stouter. His dress is gray and black and brown and white, very much mixed up. His mate is a little more brown than he, and she makes no nest, but lays her two eggs on the ground, or a bed of dead leaves, and brings up her twin babies in the same cheerless place. Droll little birdlings they are, too, in suits of soft down so nearly the color of the ground that when they cuddle down and keep still, as I have said, it is almost impossible to see them.

The Lost Baby[7]

One lovely June evening, a few years ago, I was walking on a lonely road away up in the Green Mountains, where they run nearly to the top of the map in the State of Vermont.

I was engaged in my usual summer occupation of watching and studying birds, and my desire that evening was to hear the twilight hymn of a certain hermit thrush who sang from the thick woods beside the road. For some reason the bird was not singing, and I wandered on and on, not liking to give him up, till it began to grow dark and I found myself much farther than usual from the farmhouse where I was staying.

I was about turning to go back, when suddenly a strange, loud cry burst into the silence. It was unlike anything I had ever heard. No bird, I thought, could utter such a sound, and I did not care to meet any wild beast from the woods, especially as I had already heard very strange voices from that quarter. At that moment I noticed a robin perched on a tall post a little farther up the road, looking over with great interest at something on the ground, and when the cry was repeated, I saw that it came from that spot.

The bird's evident curiosity aroused mine, and I determined to see what it was. Slowly I walked on towards it, the cries sounding louder, with a rustling among the weeds that showed me where the creature — whatever it was — was moving.

As I came nearer, the hopping and thrashing about increased, and the weeds moved violently. I caught sight of a queer-looking creature, more like a big toad than anything I could think of, leaping or jumping along beside the road.

I tried to take him in my hands, but he uttered louder and more frantic cries, and scrambled under a thick patch of low bushes that bordered the way. I followed, — not under, but over the bushes, — for now I began to think it might be a young bird. But as I parted the branches over him, he slipped farther on, till he passed through and came out into the open the other side.

On coming near him, I heard from the woods a low, rapid tapping, which I thought was made by a woodpecker. And knowing that one of the largest of the family, whom I had never seen, lived in that neighborhood, I was more than ever determined to see the youngster, — probably, I thought, a woodpecker baby.

When he appeared outside, therefore, I pounced upon him, and took him up in my hands. He was not a gentle captive. He struggled and tried to bite me, and

as my hands closed over him, he uttered a wail more despairing than any before.

On the instant, as if in reply, there came a shriek from the darkening woods that would have startled me greatly if I had not at once recognized that it was the agonized cry of the mother of the infant I held, for of course it was a young bird I found in my hands.

Unfortunately for the student, bird babies look a good deal alike, so, as the easiest way to name my prize, I glanced up at the distressed mother. She had come into plain sight, forgetting her own danger in her anxiety and terror, and no doubt thinking it was now all over with her precious offspring.

I looked for a woodpecker, but I saw a cuckoo, and knew I was looking, for the first time, on a full-grown young cuckoo.

I did not study him closely, for between his own struggles and his mother's painful cries, I could not bear to hold him long. In a minute I opened my hands, and away he went, half flying, half hopping up the road after his mother. She had instantly, upon his release, slipped back among the trees out of sight, and resumed the tapping sound, which I then found was a modification of the "Kuk! Kuk! Kuk!" of the family. It was her talk to her little one.

It was the first time I had seen a young cuckoo just out of the nest, but the very young nestling is the oddest baby I ever saw. It is about as big as the end of

my thumb, black as ink, and stuck all over with tiny white quills that look like pins on a black cushion. It does not look as if it could ever grow to be as big as its mother.

You have heard or read, perhaps, that the cuckoo does not make a nest, but puts her eggs into the nests of other birds, leaving them to hatch and rear her youngsters. This is true of the cuckoo of Europe, but remember always that our cuckoos make nests and bring up their own young, and are just as tender and careful of them as any bird I know.

It is true that a few cases have been reported of eggs found in other birds' nests, but so far as I have heard, these cases were not positively proved. Moreover, even if true, it happens so seldom that it does not affect the general rule.

The White Owls[8]

There was once a pair of white owls living in an old barn that was not used. They stayed at home in the day time, for owls do not like to go out in the sunlight.

The owls had very pretty pale yellow and white feathers; they had white breasts and wings and soft white feathers round their large eyes; and their legs were feathered down to the claws.

These owls did not hoot as the brown owls do, but they made a strange hissing and snoring noise when any one disturbed them. They screeched too while they flew about at night, and so some people called them screech-owls, which I do not think a very pretty name.

The mother owl laid her eggs under the eaves of the old barn. She did not trouble herself to make a tidy nest, but laid her five eggs among the rubbish on the old wall.

The young owls that were hatched from the eggs were quaint little creatures all covered with down; they looked more like balls of feathers than birds.

They stayed a long while in their rough nest, and the old owls took it in turns to feed them. They would eat nothing but mice, and the old ones knew very well where to find them.

About an hour before sunset they would come out, flying on soft white wings that made no noise, and hunt all along the hedges and about the haystacks and the barn doors; and scarcely five minutes passed without a little mouse being caught and carried to the nest in the barn.

Often when the haymakers were at work in the fields, they saw the white owl fly from the old barn across the meadows by the river side. They knew where the nest was, and had often peeped at the little staring owlets, under the eaves, but they never hurt them or disturbed them at all.

But it happened that there was a boy in the village who was very proud to be old enough to fire a gun; and one evening he went out in the fields with his gun in his hand, to see what he could shoot.

It was just getting dusk, when he saw the mother of the little owls glide by, — he lifted up his gun and fired, and the poor owl fell! The boy ran to pick her up, but she had fallen into the river, and he could not reach her, so he went home with his gun.

The little owls in the nest waited long for their mother; and when they grew hungry they cried and complained so much that the other old owl flew out to get them some food.

He soon found a mouse and brought it home, but what was that to so many hungry mouths? Away he flew again and again, and sometimes he stayed to seek

for his lost mate; but her body had long since floated down the stream, and he could never see her again!

The poor solitary owl tried his best to feed the five hungry young ones, and scarcely took time to eat anything himself. But he could not do it, — one by one they pined away and died in the nest, for they were not old enough to fly.

When the good-natured haymakers went one day to take a peep at their funny little friends, they found nothing but the little starved bodies all lying in a heap.

The poor owl that was left without a mate and without nestlings, flew away and never lived in the old barn any more: and all this was the fault of the thoughtless boy, who was so proud of his gun.

Animals

Animals Who Live in Houses[9]

It seems wonderful to think that an animal should be so clever that he would build himself a house to protect him from the storm and the cold, just as does the house of man. Yet two animals that I know of have been bright enough to do this.

The most important of these house-builders is the beaver, and the other is his cousin, the muskrat, who is sometimes called the little beaver.

The beaver is also clever in other ways and altogether he is the most interesting animal for you to study that I know of. When the beaver wants to build himself a house, he first considers how he shall protect it when it is built, for you must remember that the beaver's house is only a mud hut, and his many enemies could break into it if he did not take great precaution against them.

As the beaver is a good swimmer himself, and many of his enemies are not, he concludes that it will be well to place his house where it shall be surrounded by water. So he sets to work and builds a dam that he may have just the kind of a lake he wants.

The building of a dam seems even more wonderful than it does to build a house, but the beavers have been dam-builders for centuries, and they understand

it almost as well as men who have been trained to build dams.

Here is one way that the beaver builds his dam. He finds a spot where the stream has high, narrow banks, and then fells two trees across it. But how does he fell the trees? you may ask. He has no axe and he could not use one if he had.

No, the beaver does not use an axe in felling trees, but with his sharp, shovel-shaped teeth he gnaws them down. This seems almost too much to believe, but it is true. The beaver stands upon his hind legs and gnaws a girdle about the tree, then he gnaws another about three inches above the first. He then pulls out the chip between and the first cut is made. He keeps on repeating this act until the tree falls. When the beaver has felled his two trees across the stream he thrusts stakes in the mud in front of them and then fills it in with brush. Next come the sods and the mud, and finally the whole is so plastered over that it holds water, and the beaver's dam soon fills, and he has a fine woodland lake.

Another way that he builds dams, is to cut the logs up into short pieces and build a cobwork dam, just as a child would build up blocks. He can also build a dam by weighting down brush with stone, and then piling on sods and dirt.

When the dam has over-flowed the country and made a good-sized lake, the beaver thinks about his

house. This is usually located on an island in the middle of the lake, where the beaver's enemies cannot get at him.

For his house the beaver builds a circular wall, about eight feet in diameter, just as you would build a snow fort. When it gets up high enough so that the mud would fall over, if not supported, he puts in rafters, just as man does. This is done by thrusting sticks in the mud wall, and bending their tops all together, where the beaver's chimney for his house is to be.

He has to use great caution in building the roof of his mud house, for the mud keeps falling through if he is not careful. At the very top of the house he leaves a little opening, which is his chimney. This is done so the bad air can pass out in the winter time, when the beaver stays all day in his house.

During the last of the beaver's house building it is freezing every night, and that helps him, for the mud freezes as fast as he puts it on, so that it will stay in place.

From the middle of the floor inside the house is a hole running down into the ground, and finally out into the lake. This is the beaver's front door. No one can enter his house except by this door, so he is well protected from all his enemies who do not swim.

When the house is finished it is quite late in the autumn, so he thinks of laying in his winter supply of food.

The beaver's principal food is bark, so he goes up stream, and cuts many small trees. These he cuts into sticks about three feet long and then floats them down to the dam, where he secures them under water. This he does by thrusting them under roots and stones. He also piles up a lot of this wood against the dam, and the top sticks will keep the under ones down.

At just the right time the beaver finishes his wood cutting, and then there comes a great freeze, and the beavers are locked under the ice for all winter. Now, do you not see what a bad plight he would have been in if he had not laid in a store of bark to last him through the winter?

Now he will sleep in his warm house when the wind howls outside, and when he is hungry he will swim out under the ice and get a stick from his woodpile. He will take the stick into his house and peel off the bark and eat it at leisure.

There are usually several beavers living in one house, and their breath keeps the house quite warm and comfortable.

The cold weather that froze the ice on the lake and locked them in has also frozen the mud of which the beaver's house is made. So now it is as hard as stone, and a man could hardly break into it with an axe.

The wolverine, who is a mean, sneaking wolf, may come prowling about the beaver's house, but he cannot break in now it is frozen up. The wildcat and the lynx may also visit the pond in hopes of getting beaver meat, but they will go away unfed, for they cannot break into the strong house.

So while the winds howl and the cold freezes, the beaver lies snug and warm in his house, well protected from all his enemies.

And all this because he thought to build him a house, and surround it with a broad lake to protect him from his foes.

Bird and Animal Doctors[10]

Just how much birds and animals know about taking care of their diseases and wounds no one can tell surely. Some writers claim much more for their skill in this particular than do others, but from the best knowledge that can be gathered they do a great deal for themselves that seems quite remarkable.

To all the wild creatures, salt must really be considered as a medicine, as it is not obtained naturally in any of their food products.

All the members of the deer family, among which are the moose, elk, caribou, black-tail and white-tailed deer and many other varieties, know the value of salt. They will travel for miles to the salt lick. The path leading to the lick will often be worn deep into the soil like an old cow path.

At the deer lick is a favorite ambush for the Indian hunter, the bear and the panther, for all know that sooner or later the deer will come to the lick for their medicine.

The mother partridge knows how to doctor chicks better than the poultry fancier does. She knows that if they are to be kept free from lice, nits and all other vermin that the feathered folks are subject to, that they must have their daily dust bath. Not any kind of

a dirt bath will do either, but it must be a spot with certain properties in the soil.

If the chicks become dumpy and drooping, she knows that their systems need clearing out, and she leads them to certain acrid berries which are just the medicine they want. All through the season she varies their food as their size and health vary, and altogether she is one of the very wisest of wild mothers.

When the hunting season comes, if she or any of her family are wounded, and are likely to bleed to death, they will plug up the wounds with very fine down taken from under their coarse feathers and thus stop the flow of blood.

Even creatures as low down in the scale of intelligence as the fishes show considerable skill in taking care of themselves.

Old fishermen tell us whenever the salmon is injured, and his bright silver scales scraped off in the spring migration up the northern rivers, this wise fish at once turns back to the sea. He knows better than anyone can tell him that as soon as any scales are torn away, that at once a fungus growth will begin to form, which if allowed to grow would in time kill him. There is something in the action of the salt water that will prevent this growth, and allow new scales to form.

But the wisdom and intelligence of the wild creatures is most often seen in their knowledge of poison. The squirrels make a practice of eating fungi,

and who told them which are the poison kinds and which not? Many of these growths are so much alike that man is often deceived, even when he has made a study of fungi, but not so the squirrel.

Sheep and cattle will feed in a pasture that abounds with poison plants, yet they do not often get poisoned. Probably each day they feed all about poisonous plants, but they have a God-given instinct that tells them to let it alone. It is probably the same way with the squirrel. I do not imagine that he examines a fungus carefully before he eats it, but if something tells him that it is not well for him to eat a certain fungus he lets it alone.

There is an old proverb that when the cat or the dog eats grass it is going to rain. Now the proverb may mean that, but it means something still more important to pussy or the dog. It means that their system is calling for something green, and that the grass is a simple medicine which will act beneficially upon them.

Notice how pussy will purr and roll about the catnip bed whenever she comes near it. This is the cat cure-all and pussy knows it, and her heart is filled with delight to know there will be a supply for the winter months.

Probably the greatest intelligence shown by any animals in regard to medicine, and particularly poison, is shown by dogs and monkeys.

It says in the Scriptures that even the dogs came and licked the sores of Lazarus, and he could not have had better doctors. There is something in the dog's saliva that is a perfect antiseptic. This means that it cleanses and heals the wound.

A man from Klondike tells of a dog that ministered so often and so well to his fellow-sufferers that he gained the name of the doctor.

When the dog teams are travelling day after day over the frozen snow and ice their feet get very sore, being scratched and cut by the rough road they have to travel. The harness also sometimes galls them.

Each night, when the harnesses had been taken from the dog-team, and they had been fed their dried fish, the dog called doctor, would go the rounds licking all the sores, bruises and cuts upon his fellow sufferers. Each dog submitted to be licked when his turn came, for he seemed to know he was in the hands of a skillful doctor.

The coffee raisers of South Africa have long been troubled by the gray monkeys that eat the coffee fruit of which the coffee berry is the center.

Finally an attempt was made to poison the marauders with strychnine, which is one of the most deadly poisons.

Many of the monkeys became ill, but all began eating a certain plant which acted as an antidote, making the poison harmless. To those who were too

sick to go after the plant, some of the well monkeys brought it, and fed it to them.

The government of this country was so impressed with the remarkable intelligence of the gray monkeys in regard to strychnine that they have appointed a commission to experiment with the monkeys and wrest their secrets from them.

But for the most remarkable demonstration of the animals' knowledge of poison we must return to my old friend, the dog. I have kept the following incident until the last, because to me it is most convincing that there is a God-given instinct in animals that is often much wiser than the intelligence of man.

Dr. Russell H. Conwell, the well-known lecturer and philanthropist of Philadelphia, vouches for the truth of this incident. A Philadelphia minister had a dog which was sick; several persons saw the dog, and all at once, cried rabies, just as most people do when they do not know what is the matter with the poor canine.

Finally a neighbor, who had more sense than the rest, saw the dog, and at once pronounced it poison.

"Open the door," he said, "and let the dog go, and if there is an antidote for his poison within twenty miles, and he has strength left to reach it, he will find it."

So the door was opened, with much fear and trembling upon the part of the spectators, and the

poor dog started, at his best pace, across the lots for the brook, which was a half mile distant.

Arrived at the stream, he plunged in and began eating ravenously of a water plant.

When he had eaten enough, he came out and lay upon the bank and seemed better. By night time he had fully recovered from the effects of the poison.

The minister was so impressed with the cure, that he procured some of the water plant and sent it to Washington to be analyzed.

A few days afterwards Mr. Conwell met his minister friend, who told him that the dog's knowledge of medicine had earned him fifty thousand dollars.

The government at Washington had reported that a very important antidote for poison had been discovered by the poor dog and a large house, manufacturing patent medicine, had bought the dog's secret of his master, paying him a large sum of money.

Thus was the poor brute's instinct again of service to man, putting to shame his science gained through years of study.

In the face of such discoveries, and of the daily and hourly service that the faithful canine gives man, it behooves us not to despise or underestimate even the wisdom of a dog.

What the Little Furred and Feathered Folks Do in Winter[11]

When you children are tucked in your warm beds in winter, while the winds howl outside, and the snow or sleet drives against the window pane, do you not often wonder what the little furred and feathered folks are doing on such terrible nights?

This is a problem that used to worry me considerably when I was a boy, and it still does when I know that nuts and buds are scarce and the winter uncommonly cold.

But these little folks take care of themselves much better than one would imagine. Most of the woodpeckers are still with us and you will hear them on warm days sounding their rat-a-tat-tat on a dead limb, or see them galloping over the frozen fields.

When the woodpecker intends to winter here, he begins making new quarters early in the autumn. You may hear him pounding away for several days, if his winter house is near your own.

He builds this house much as he does the spring nest, making a round hole running back into the trunk of the tree for a few inches, and then running it down a ways. At the bottom he lines it nicely and there he

sleeps away most of the cold winter, only coming out for food once or twice a day.

Of the other birds, we see much of the chick- a-dee and the snowbird, but they are regular winter friends. The snowbird is used to living away up in the frozen North, and he likes the cold and the storm. What tales he could tell us, if he had a mind to, of the blue fox and the musk ox, and all the other Arctic animals.

All of the squirrels are sleeping away the cold winter. The chipmunk has laid up a fine store of nuts under the root of the old pine, and he will not come out all winter long. The chances are that he will still have nuts left in the spring, for he is a provident little chap.

The gray squirrel also sleeps all through the winter, only waking up now and then to take a nibble at his stores. But the red squirrel does not store up as large a supply as his cousins. He is a rattle-brained fellow and he scatters his winter supply about in half a dozen places. Often you will see him out in the winter looking for some one of his half dozen granaries. Sometimes he forgets where he has made his pantry and has to go hungry.

Often the gray squirrel sleeps in a hollow tree, and sometimes he makes himself a fine hammock in the top. This is made by placing sticks crosswise in a crotch of the tree, and then by filling in leaves to make a nest. When the house is done Mr. Squirrel crawls

into the middle of this nest, and lets the wind rock him all the winter long.

The rabbit does not care much how cold it is. The winter is his play time and he likes it. His coat is warm and thick and just the color of the snow, so that his many enemies cannot see him.

If he can manage to dodge the owl, the fox, the weasel, the wildcat and other of his enemies, he has a fine time in the winter.

One of his chief amusements is to play tag on a moonlight night. Then sometimes in the depths of the deep laurel swamp there will be dozens of the white nimble creatures all playing tag.

As the rabbit is a vegetarian, living on bark, he can always find plenty of food in the winter.

The partridge too is a vegetarian, in winter time living on buds, but he is often rather cold, for he is not quite as well clad as is the rabbit.

If the night is not too cold the partridge roosts in a fir tree where the thick boughs shield him, but if it is very cold and windy the partridge dives under the snow and sleeps in a white, soft bed until the morning comes.

Sometimes a strange thing happens to the poor partridge while he is sleeping in his snow-bed. Perhaps there will be a rain storm, and the snow will crust over, so in the morning he will be a prisoner

under the snow. Then if he cannot break through he will starve.

I am afraid that the fox, as witty as he is, sometimes goes hungry in the winter. When there is no snow on the ground he depends to a great degree on mice for his food, but now the mice are all safe, so he must sharpen his wits and catch a partridge or rabbit, or he will even visit the chicken coop if he gets too hungry.

Down in the deep woods the raccoon is sleeping soundly in a hollow tree. The raccoon is a real little brother to the bear. He walks like a bear and he has the same droll countenance.

All through the winter months he sleeps just as the bear does, living on the fat that he stored up in the autumn when food was plenty.

The little furred and feathered creatures often come close to the house in winter and you children can have fun feeding them and watching them come and go.

Here is a list of the friends that you may make if you will be generous with your crumbs and occasionally a bit of grain in the winter.

The snowbird and the chick-a-dee will flock to your window sill and may even be coaxed into the house if you wish. The jay and the grosbeak will come to the shed, and crows, owls, and woodpeckers will also partake of your bounty in a wary manner.

The red squirrel is always on hand to get his share, once he has found you out, and when it is very warm the grayer may wake up for a few hours and come and see you.

There is nothing more pleasant as the winter days go by, than seeing these little friends come and go, and there is keen satisfaction in knowing that you have helped them to brave the stern winter and perhaps given them a breakfast or supper when otherwise they would have gone hungry.

Stories in the Snow[12]

When nature has spread a soft white blanket over the fields and the evergreen trees are gowned with new snow, then the fields and woods are like a great book that one can read as easily as he can the printed page if he knows the alphabet of the forest.

Some of the simplest stories that one may read in the snow I am going to tell you, and you can see for yourself that they are most interesting.

Now that the ground is covered with snow, the fox and the rabbit and the squirrel and the weasel cannot any of them stir abroad without telling all who pass their way, where they have been, and what they have been doing.

If you see a track with four paw prints in a bunch, the two back ones spread out, and the two forward prints following after each other, so that the whole track is fan shaped, you may know that a rabbit has been along. If the tracks are far apart he was going with long jumps, and in a great hurry about something, but if they are near together he was taking his time, and was probably out for his health.

You will notice two sizes of rabbit tracks. The larger are made by the white rabbit, and the smaller by the little gray rabbit.

Sometimes you will see the tracks of one or more dogs following along beside the rabbit track, and then you may know that the rabbit was running for his life and that the hounds were after him. If there is a single track following the rabbit track, and it looks like a dog's track, only it is smaller, you will know that sly Reynard, the red fox, is following the rabbit in hopes of overtaking him at the rubbing tree or while he is feeding or playing, and catching him. The fox is very hungry these cold winter days, and has to sharpen his wits and hunt continually to keep from starving.

Here is a fox track. Let us follow it and see what Reynard is doing to-night. Down into the meadow it leads us. If it were summer time we would think that the fox was going to hunt mice. Here and there he has stopped at a bush or stump, smelling about to see what he could discover. Here, he has dug under this old log, and there is some crisp last year's grass scattered about on the snow.

Pick up the grass and smell of it. It came from a field mouse's nest, there is no doubt of it, and the sly fox has dug the little fellow out, even though he was well protected by the snow.

In another place we can see where Reynard has dug for a long time at the foot of a tree. What could he be after here?-- another mouse?

No, this time I imagine he spied out the chipmunk's hole and thought to dig him out, but the frozen ground was too hard and he had to give it up.

Under a little scrub spruce are some partridge tracks. They look just like the tracks the hens make about the house after a new snow-storm. Here is a great blur in the snow where the partridge dove under and spent the night. On very cold nights the partridges bury themselves in the snow to get warm, and the foxes go about trying to find where they are hidden, that they may dig them out and eat them. Mr. Fox did not get this partridge, for there are no blood spots or feathers on the snow.

If Mr. Fox does not find his supper elsewhere he will go into the swamp and try to catch a rabbit. He may sit for hours by the rabbit's road which is well trodden and where he knows they are likely to pass. If he cannot get a rabbit in this manner, which is called the still hunt, he will go creeping carefully through the swamp trying to catch one while he is at play. The rabbits are very playful and they love dearly to play tag in the moonlight. Frequently you will see where they have been playing and the snow will be tracked in every direction.

A rabbit swamp is a very interesting place in midwinter, and there are many thrilling stories to be read there after each new snow. Through the middle of the swamp are well trodden rabbit roads or streets,

with side streets branching off in every direction. Each one of these leads up to a bunny's front door, if you could only search it out. These streets are made very crooked, and even the cunning fox cannot always puzzle them out.

Once in a while you will see where the poor cotton-tail ran at the top of his speed, jumping first this way and then that. There is no fox track following his, and no weasels either. The rabbit is quite as much afraid of the weasel as he is the fox and he will sometimes lie right down in the snow and be killed when he sees the weasel following him. This time there is no weasel track, but the poor rabbit seems to be greatly alarmed. Suddenly his tracks disappear, and you wonder where he could have gone to. Did he take wings to himself and fly away?

Not quite that, but something almost like it. See, here by his last jump there is a blur in the snow. That was made by great wings.

Poor little bunny! It was a great hungry owl that spied him at play and swooped down upon him. He only had time to make a few frightened jumps before he was caught.

But only a few of the rabbits get caught, when we consider all that there are, and the rest have a fine time.

Whenever Mr. Skunk stirs abroad he leaves the queerest kind of a track which you cannot fail to tell.

The skunk's legs are so short that his belly drags in the snow, so that his track is just a long furrow. Mr. Skunk does not stir out except on warm days, for he is well protected by his fat and prefers to sleep away most of the winter, just as the woodchuck does.

The prettiest little track of all is made by either the field or wood mouse. It is so tiny that it looks like lace work. But these little mice are very thrifty; they have good stores laid up against the cold winter months and they simply come out to see how the winter is going.

Sometimes the wood mouse will build himself the cutest kind of a house. After the birds have gone south, he will find some empty bird's nest, and build a roof over the top. He will leave a door on the underside through which he can come and go. Then no matter how cold and wintry the weather may be Mr. Wood-mouse will always be warm. Sometimes the snow may even cover over the top of his house, but he does not care, for that will make it all the warmer.

The Long Sleep[13]

There is a wise provision in nature, by means of which the flowers and plants rest when they have spent their strength in flower and fruit.

Just as children need sleep and rest, which they take each night when the dark mantle is spread over the earth, so the flowers take their sleep and rest each winter.

It is for this, as well as to keep them warm, that each autumn Nature spreads a soft white blanket of snow over them and bids them lay down to sweet sleep, saying that she will awaken them in time for the first warm puffs of the south wind.

In the same way certain animals roll themselves up into furry balls when the cold weather comes, and sleep away the winter months.

All summer long the woodchuck has been fattening himself, that he might have sufficient flesh to keep him warm and to nourish him when the cold should come. It was for this that he raided the farmer's bean patch, and fed so persistently all summer. Now that the cold has come he is snug and warm in his hole, several feet under the snow. So that now all the snow that is piled above him but helps to keep him warm,

and the cold cannot get at him. He will not stir abroad until the warm spring days.

The squirrels are also sleeping in their nests in the hollow trees, or in the hammocks that they have hung in the tree tops.

The woodpeckers and the owls also sleep away most of the time for if one is sleeping and not stirring about, he will not need as much food as though active, and food is very hard to find these bitter winter days, when earth is covered with snow, so the wise little creatures keep quiet and do with less food. You will often see where a gray squirrel has dug down under the snow to find nuts, but for the most part he depends upon his winter store, which will be sufficient if he has been a provident squirrel.

But the most interesting of all the wild creatures that sleep in the winter is Bruin, because his sleep is the longest.

In the warm months the bear family live upon roots, berries, and many kinds of vegetable food. Occasionally they vary this diet with a pig or some mutton, but for the better part of the year the bear is a vegetarian.

When the snow and the cold weather comes all these sources of food are gone, so the bear has nothing to do but to hibernate.

But he has been planning for this all the summer and autumn, so his ribs are well covered with fat, which will last him until springtime.

The smallest of all the bear family is the raccoon, who is really a little brother to the bear. The raccoon has a long ringed tail, which is quite different from the tail upon a real bear, but he has many of the other bear characteristics.

As the autumn months went by, the raccoon was fattening himself in the cornfield, or perhaps even helping himself to a pumpkin, scooping out the seeds and eating them with a keen relish so that when the cold comes, he is well fitted for his long winter sleep.

The black bear, who is the smallest of the bear family, next to the raccoon, sometimes sleeps in a hollow log which he will find lying upon the ground, but he more often makes himself a den under the fallen top of a tree. Here the snow will drift over him covering him up and keeping him warm. There is always a small hole left up through the snow. This is kept open by the bear's warm breath, which continually melts it.

Here in the warm den under the snow the little bears are born while their mother is still half asleep. For the size of their mother, the little bears are about the smallest of all woodland babies. It is not until they are three or four months old that they go abroad with their mother.

When the old bear appears in the early spring she is sleek and fat.

As she has been sleeping all the time she has not worn off her flesh, but she soon gets poor, and her coat becomes rusty.

When she first comes forth after the winter sleep, she does not eat ravenously of meat, for she knows that if she did it would make her sick. Instead she eats buds and roots, and does not break her fast upon meat for a week or two. Then if the opportunity offers she will visit a neighboring pig sty and come away with a squealing spring pig.

The grizzly bear, who is three or four times as large as the black bear, also dens up in the winter, but he does not den up in a hollow tree for the simple reason that a hollow tree would not be large enough to hold him. Instead he finds a cavern in the rocks and curls up in the darkest corner. If he cannot find a cavern to his liking, he will often do some digging, to fashion it as he wants it.

In the warmer countries, where food is more plentiful during the cold months, the bears do not den up as long as in the cold country, where they sleep nearly half of the year.

The frogs, the toads, the snakes, the lizards, and a myriad other crawling, creeping things, also sleep through the cold winter months.

You will see by this chapter what good care Nature takes of her children. When they need sleep she has given them an instinct that tells them to seek it, even under a bed of snow.

The Snake[14]

Ah, here is a snake curled up among the leaves. It seems to be asleep, let us watch it awhile without fear.

It is a harmless one, it has no poisonous teeth, only a forked tongue and double row of little teeth, with which it holds its food. It feeds upon frogs and lizards, and small mice.

If you were to take it home and feed it, it would become tame and learn to know you; it would nestle up your sleeve and hide there from strangers. You would not like such a pet, you say? Well, I am sure the snake would much rather be left here upon the bank.

Look at the color, it is brownish gray, and there are yellow spots upon the neck, and rows of black spots down the back and the sides. The snake changes that pretty skin several times in the summer, it strips it off among the thorns, and there is a beautiful new one underneath. The snake lays her eggs in a sunny place that they may be hatched. When the summer is over, and cold leather comes, the snake hides in the earth, or under little heaps of fallen leaves, and sleeps. See, now it uncoils itself; it glides away towards the water. It can swim very well, and will soon be out of sight.

My First Pond[15]

1 am never tired of looking in a pond. What busy life there is in that green world! On the warm mud of the edges, the frog's little tadpole basks and frisks in its black legions; down in the water, the orange-bellied newt steers his way slowly with the broad rudder of his flat tail; among the reeds are stationed the little fleets of the caddis-worms, half-protruding from their tubes, which are now a tiny bit of stick and again a tower of little shells.

In the deep places, the Water-beetle dives, carrying with him his extra supply of breath, an air-bubble at the tip of the wing-cases and, under the chest, a film of gas that gleams like a silver breast plate; on the surface, the ballet of those shimmering pearls, the Whirligigs, turns and twists about; hard by, there swims the troop of the pond-skaters, who glide along with side-strokes like those which the cobbler makes when sewing.

Here are the water-boatmen, who swim on their backs with two oars spread crosswise, and the flat water-scorpions; here, clad in mud, is the grub of the largest of our dragon-flies, so curious because of its manner of moving: it fills its hinder parts, a yawning

funnel, with water, spurts it out again and advances just so far as the recoil of its water cannon.

There are plenty of peaceful shellfish. At the bottom, the plump river-snails discreetly raise their lid, opening ever so little the shutters of their dwelling; on the level of the water, in the glades of the water-garden, the pond-snails take the air. Dark leeches writhe upon their prey, a chunk of earthworm; thousands of tiny, reddish grubs, future mosquitoes, go spinning around and twist and curve like so many graceful dolphins.

Yes, a stagnant pool, though but a few feet wide, hatched by the sun, is an immense world, a marvel to the child who, tired of his paper boat, amuses himself by noticing what is happening in the water. Let me tell what I remember of my first pond, which I explored when I was seven years old.

We had nothing but the little house inherited by my mother, and its patch of garden. Our money was almost all gone. What was to be done? That was the stern question which father and mother sat talking over one evening.

Do you remember Hop-o'-My-Thumb, who hid under the wood-cutter's stool and listened to his parents overcome by want? I was like him. I also listened, pretending to sleep, with my elbows on the table. It was not blood-curdling designs that I heard but grand plans that set my heart rejoicing.

"Suppose we breed some ducks," says mother. "They sell very well in town. Henri would mind them and take them down to the brook. And we could feed them on the grease from the tallow-factory, which they say is excellent for ducks, and which we could buy for a small price."

"Very well," says father, "let's breed some ducks. There may be difficulties in the way; but we'll have a try."

That night I had dreams of paradise: I was with my ducklings, clad in their yellow suits; I took them to the pond, I watched them have their bath, I brought them back again, carrying the more tired ones in a basket.

A month or two after the little birds of my dreams were a reality. There were twenty-four of them. They had been hatched by two hens, of whom one, the big black one, was an inmate of the house, while the other was borrowed from a neighbor.

To bring them up, the big, black hen is enough, so careful is she of her adopted family. At first everything goes perfectly: a tub with two fingers' depth of water serves as a pond. On sunny days the ducklings bathe in it under the anxious eye of the hen.

Two weeks later, the tub no longer satisfies. It contains neither cresses crammed with tiny shellfish nor worms and tadpoles, dainty morsels both. The time has come for dives and hunts among the tangle of the water-weeds; and for us the day of trouble has

also come. How are we, right up at the top of the hill, to get water enough for a pond for our broods? In summer, we have hardly water to drink!

Near the house there is only a scanty spring from which four or five families besides ourselves draw their water with copper pails. By the time that the schoolmaster's donkey has quenched her thirst and the neighbors have taken their provision for the day, the spring-basin is dry. We have to wait four-and-twenty hours for it to fill. No, there is no place there for ducklings.

There is a brook at the foot of the hill, but to go down to it with the troop of ducklings is dangerous. On the way through the village we might meet murdering cats, or some surly dog might frighten and scatter the little band; and it would be a puzzling task to collect them all again. But there is still another spot, part way up the hill, where there is a meadow and a pond of some size. It is very quiet there, and the place can be reached by a deserted footpath. The ducklings will be well off.

What a day it was when I first became a herdsman of ducks! Why must there be a drawback to such joys? Walking on the hard stones had given me a large and painful blister on the heel. If I had wanted to put on the shoes stowed away in the cupboard for Sundays and holidays, I could not. I had to go barefoot over the

broken stones, dragging my leg and carrying high the injured heel.

The ducks, too, poor little things, had sensitive soles to their feet; they limped, they quacked with fatigue. They would have refused to go any farther towards the pond if I had not, from time to time, called a halt under the shelter of an ash.

We are there at last. The place could not be better for my birdlets: shallow, tepid water, with a few muddy knolls and little green islands. The pleasures of the bath begin at once. The ducklings clap their beaks and rummage here, there, and everywhere; they sift each mouthful, throwing out the clear water and swallowing the good bits. In the deeper parts they point their tails into the air and stick their heads under water. They are happy: and it is a blessed thing to see them at work. I too am enjoying the pond.

What is this? On the mud lie some loose, knotted, soot-covered cords. One might take them for threads of wool like those which you pull out of an old ravelly stocking. Can some shepherdess' knitting a black sock and finding her work turn out badly, have begun all over again and, in her impatience, have thrown down the wool with all the dropped stitches? It really looks like it.

I take up one of those cords in my hand. It is sticky and very loose; the thing slips through my fingers before they can catch hold of it. A few of the knots

burst and shed their contents. What comes out is a black ball, the size of a pin's head, followed by a flat tail. I recognize, on a very small scale, a familiar object: the tadpole, the frog's baby.

Here are some other creatures. They spin around on the surface of the water and their black backs gleam in the sun. If I lift a hand to seize them, that moment they disappear, I do not know where. It's a pity; I should have liked much to see them closer and to make them wriggle in a little bowl which I should have put ready for them.

Let us look at the bottom of the water, pulling aside those bunches of green string from which beads of air are rising and gathering into foam. There is something of everything underneath. I see pretty shells with compact whorls, flat as beans; I notice little worms carrying tufts and feathers; I make out some with flabby fins constantly flapping on their backs. What are they all doing there? What are their names? I do not know. And I stare at them for ever so long, held by the mystery of the waters.

At the place where the pond dribbles into the nearby field, are some alder-trees; and here I make a glorious find. It is a beetle — not a very large one, oh, no! He is smaller than a cherry-stone, but of an unutterable blue. The angels in paradise must wear dresses of that color. I put the glorious one inside an empty snail-shell, which I plug up with a leaf. I shall

admire that living jewel at my leisure, when I get back. Other things call me away.

The spring that feeds the pond trickles from the rock, cold and clear. The water first collects into a cup, the size of the hollow of one's two hands, and then runs over in a stream. These falls call for a mill: that goes without saying. I build one with two bits of straw, crossed on an axis, and supported by flat stones set on edge. The mill is a great success. I am sorry I have no playmates but the ducklings to admire it.

Let us contrive a dam to hold back the waters and form a pool. There are plenty of stones for the brickwork. I pick the most suitable; I break the larger ones. And, while collecting these blocks, suddenly I forget all about the dam which I meant to build.

On one of the broken stones, in a hole large enough for me to put my fist into, something gleams like glass. The hollow is lined with facets gathered in sixes which flash and glitter in the sun. I have seen something like this in church, on the great saints'-days, when the light of the candles in the big chandelier kindles the stars in its hanging crystal.

We children, lying, in summer, on the straw of the threshing-floor, have told one another stories of the treasures which a dragon guards underground. Those treasures now return to my mind: the names of precious stones ring out uncertainly but gloriously in my memory. I think of the king's crown, of the

princesses' necklaces. In breaking stones, can I have found, but on a much richer scale, the thing that shines quite small in my mother's ring? I want more such.

The dragon of the subterranean treasures treats me generously. He gives me his diamonds in such quantities that soon I possess a heap of broken stones sparkling with magnificent clusters. He does more: he gives me his gold. The trickle of water from the rock falls on a bed of fine sand which it swirls into bubbles. If I bend over towards the light, I see something like gold-filings whirling where the fall touches the bottom. Is it really the famous metal of which twenty-franc pieces, so rare with us at home, are made? One would think so, from the glitter.

I take a pinch of sand and place it in my palm. The brilliant particles are numerous, but so small that I have to pick them up with a straw moistened in my mouth. Let us drop this: they are too tiny and too bothersome to collect. The big, valuable lumps must be farther on, in the thickness of the rock. We'll come back later; we'll blast the mountain.

I break more stones. Oh, what a queer thing has just come loose, all in one piece! It is turned spiral-wise, like certain flat snails that come out of the cracks of old walls in rainy weather. With its gnarled sides, it looks like a little ram's-horn. How do things like that find their way into the stone?

Treasures and curiosities make my pockets bulge with pebbles. It is late and the little ducklings have had all they want to eat. "Come along, youngsters," I say to them, "let's go home." My blistered heel is forgotten in my excitement.

The walk back is a delight, as I think of all the wonderful things I have found. But a sad disappointment is waiting for me when I reach home. My parents catch sight of my bulging pockets, with their disgraceful load of stones. The cloth has given way under the rough and heavy burden.

"You rascal!" says father, at sight of the damage. "I send you to mind the ducks and you amuse yourself picking up stones, as though there weren't enough of them all round the house! Make haste and throw them away!"

Broken-hearted, I obey. Diamonds, gold-dust, petrified ram's-horn, heavenly Beetle, are all flung on a rubbish-heap outside the door.

"A nice thing, bringing up children to see them turn out so badly! You'll bring me to my grave. Green stuff I don't mind: It does for the rabbits. But stones, which ruin your pockets; poisonous animals, which'll sting your hand: what good are they to you, silly? There's no doubt about it; someone has thrown a spell over you!"

Poor mother! She was right. A spell had been cast upon me — a spell which Nature herself had woven.

In later years I found out that the diamonds of the duck-pool were rock-crystal, the gold-dust, mica; but the fascination of the pond held good for all that. It was full of secrets that were worth more to me than diamonds or gold.

Insects

The Little White House on Bee Street[16]

The little white house on Bee Street is a beehive standing in a row of a dozen white houses which are side by side and of an equal distance apart, like the houses on a street.

Never did the house of man contain as many inhabitants as do these houses of wonderful insects. If the swarm is a small one even, the house will contain fifteen or twenty thousand inhabitants, but if it is a large one it will contain fifty or sixty thousand. This number of people would make a good-sized city.

In all this large family there is but one mother, and that is the queen bee. She is larger and longer than her subjects and rather more beautiful. Her work is to lay the thousands and thousands of eggs necessary to keep the life of the hive going. You must remember that the life of a bee is from a month and a half to two months, so eggs have to be continually hatched out to make up for the bees that are constantly dying. It is estimated that in the laying season the queen lays from two to three thousand eggs per day. In the course of her life, of a few years, she lays over half a million eggs.

Nearly all of the rest of the bees in the hive are the queen's daughters, or the working bees. Her sons are

only a few in number compared with the daughters. They do not work and lay up honey as do the daughters, but are lazy fellows who have a fine time while they live, eating the honey that the workers gather, and flying about the fields.

As soon as the new bees are hatched they are put in charge of some of the workers, who are then called nurse bees. These nurse bees feed the little new bees, and take care of them until they are large enough to fly outside, and look out for themselves.

Sometimes the hive will be fairly alive with the little new bees and then the nurse bees are kept very busy feeding them. They are fed upon what is called bee bread. It consists of pollen taken from the early flowers, stuck together with honey. Upon this food the young bees thrive and they are soon able to go forth and gather honey for the hive.

When the lilac and the first fruit trees blossom you will notice that they are swarming with bees. In nearly every flower there is a bee. She is standing almost upon her head reaching away down into the flower for the honey which the sun and the rain have stored up in some marvelous manner. The bee licks out the honey with her tongue, and places it in her honey stomach. This stomach is just in front of her real stomach. By the time the bee gets home to the hive the honey is partly digested, and that is why sick girls

and boys can often eat honey when they can eat nothing else.

All of the sections at the top of the hive are filled with wax cells and into these cells the bee puts her honey. When the cell is full she seals it up.

The cells were also made by the bees. From flower to flower she went, gathering the wax until she had enough. Then she worked it into place and drew it out into these wonderful cells.

The bees not only visit the orchard and the flower garden for honey, but they go away into the deep woods, and gather fine honey from many of the trees when they are in blossom. The basswood tree is celebrated for its honey.

Also all the wild flowers along the roadside are visited. No flower is too small or too insignificant for the bees to take notice of, provided it contains honey.

They will travel as far as three miles for honey when they cannot readily get it nearer home. The flowers from which they get the most are the white clover, the golden rod, the buckwheat and the blossoms on the basswood tree.

I have seen it estimated that the bees must visit sixty-two thousand heads of clover to get a pound of honey, so you can see how hard they must work, and what labor it is merely to make one pound of honey.

When we consider that a hive sometimes makes one hundred pounds in a season, the number of trips

that they would make would be almost more than one could calculate.

All through the summer months the bees are busy gathering honey and also late into the autumn, for you know the goldenrod and the purple aster bloom very late. It is not until the really cold weather sets in that they go into the hive for good, where they are sleepy until spring comes again.

If the season has been a good one and the bees have laid up a lot of honey, the bee keeper takes away a part of it from the hive for himself.

He usually leaves from ten to twenty pounds for the bees to eat during the cold months. Sometimes he also feeds them melted sugar so that he can keep more of the honey for himself.

During the winter the bees gather together in a large round cluster and keep continually moving about so as to keep warm. Of course, the bees in the middle of the cluster are the warmest, so they keep taking turns at the middle.

No matter how far away from home the bee strays, when she is gathering honey, she is never lost. As soon as her honey stomach is full she will start for home in a course as straight as a ray of light.

The honey bee will rarely go into any house but her own. At the door of each hive are a dozen or twenty sentinels who watch the bees carefully as they enter, so as to see that other bees do not get into the

hive and steal their honey. If any strange bee is found trying to, she is quickly driven away.

Sometimes when the hive gets too full of bees, a very queer thing happens. The queen decides that she will take a part of the members of her household and go away. Then there is a great buzzing of wings, and sometimes the air is fairly black with bees about the hive.

Soon the queen leads them to some nearby tree where all hang upon a limb, each bee hanging to the one above it until there is a long cluster. Often it is as large as a peck measure. Then the queen sends away some scouts to find a new place for them to live.

Perhaps it will be in a hollow tree in the woods, or maybe it is in a hole in a cliff. If the bee keeper does not get them into a new hive before the scouts return they will all fly away and be lost.

The Wasps[17]

One fine summer day, little Ellen was sitting at work by her mama's side. She was sewing very busily, without speaking a word; but all at once, she cried out in pain, and put her hand to her neck. Her mama got up quickly, to see what it was, and said "Do not be afraid, Ellen, I see what it is — a wasp has stung you; but I am taking it away, so it will not hurt you again."

Ellen cried more when she heard that it was a wasp, and the sting really hurt her a good deal. Her mama put the wasp out of the window, and then fetched a bottle from the cupboard, and said, "Come, Ellen, I will put some ammonia on the sting, and that will prevent it from swelling, and soon take off the pain."

The ammonia was put on, and Ellen left off crying, and said to her mama, "Why did the wasp sting me? John always says they do not sting, unless we hurt them. I am sure I never even saw this wasp."

"Your brother John is right, my dear," said Ellen's mama; "the wasp was hurt, though you did not know it: it crept under the hem of your frock — and when you moved, it was squeezed and frightened, and so it stung you."

"I never thought of that," said Ellen; "first the wasp was frightened and hurt, and then I was frightened and hurt."

"Yes," said mama; "but the wasp did not make quite so much noise as you did."

Ellen said nothing to that, but tried to remember what her mama called the stuff she had poured upon her neck, but the name was too difficult for her.

"It is called ammonia," said mama; "and honey is a good thing to put on a sting, or a crushed onion, or even some mould out of the garden."

"I like to know all the cures," said Ellen; "but I don't think I should like to have to take a wasp off anybody's neck, as you did, mama; but I am only a little girl, you know."

"Yes," said mama; "but even little girls are brave, sometimes. One day when I was at the sea side, I was watching a little girl, who was bathing; she was not older than you, Ellen, I think. I saw her stoop to look at an insect that was struggling in the water, and then she took it up in her hand, and carried it on shore, and laid it carefully upon a stone to dry; and then I saw that it was a wasp. I asked her if she was not afraid of being stung, and she said, 'I thought it would be drowned, and that would have been a pity; and I did not think it would sting me, when I was helping it out of the water.'"

"She was a kind little girl," said Ellen, and then cried out to John, who came to ask her if she would play with him — "I have been stung, and mama has put the wasp out of the window. I wonder where it is now?"

"I can tell you where your wasp went," said John.

"Can you, really?" asked Ellen.

"Yes, I know where the nest is," said John.

Ellen thought that only birds had nests, so she wanted to hear all about it.

"It is built in the ivy, against the house," said John, "between the old grey ivy stems; it is not finished yet, and the wasps are as busy as can be. Would you like to come and watch them?"

Ellen said "Yes" and "No," and then "Yes," again, for she thought of the pain of the sting; but at last she went with John, for he said he would not take her very close to it.

The wasps' nest was so near to the ground that Ellen could see it quite well. The wasps were buzzing about, and some were creeping in and out of a little hole.

"That is the way into the nest," said John. "There are pretty little cells inside, where the wasps keep their young ones; they feed them, just as birds feed their nestlings. They are very fond of them, and never tire of working for them."

"But what are the wasps doing outside?" asked Ellen.

"Come a little nearer," said John, "and then you will see. They are making the walls of their nest stronger; each wasp holds a little ball of something between its head and its feet, and plasters and smooths it on as neatly as possible. See, they make the outside of the nest look like shells joined one to another. Is it not pretty?"

"What do they build with?" asked Ellen; "it looks brown, like earth."

"You would not easily guess what it is," answered John. "Those little balls are made of wood; yes, indeed, the wasps have gnawed it from the old post in the garden — I can show you the very place. They gnaw the wood with their sharp jaws, and then wet the little shavings, and roll them into balls, and carry them to the nest, and spread them out as thin as paper. The cells inside are made of the same; there is no honey stored up in them, they are only cradles for the young ones. The old wasps feed them there, day by day; they bring bits of fruit, or little caterpillars, or sugar, or anything sweet they can find. Sometimes a wasp will rob a bee of its load of honey, and take that away to the young ones."

"Oh, poor bee!" said Ellen, "to lose its honey, when it has worked hard to gather it from the flowers."

Ellen then asked when the nest would be finished; and John said in September or October, and that then the cold nights would kill almost all the wasps, and only a few would be left alive till the spring.

"And what will they do?" asked Ellen.

"They will lie asleep until the warm days of spring, and then rouse themselves, and leave the old nest. We may see them in the sunny days of March, flying about the garden, seeking for a safe place to begin a new nest in."

"They must feel very lonely," said Ellen.

"I suppose they have too much to do, to think about that," answered John; "and besides, the young ones soon begin to help their mother with her work."

The Field Poppy and the Wild Bee[18]

A poppy once grew in a large cornfield, it had one scarlet flower that hung its head from the hairy stem. I do not think any little children saw the poppy, because it grew among the tall corn, but there was one little creature that found it out.

It was a little black bee, hardly more than a barley-corn long, with rings of grey round its body, and grey silken hair underneath. This little wild bee did not live in a hive with other bees, but made a nest of her own.

First she dug out a hole in the side of the footpath that crossed the cornfield, and made it quite smooth inside. Then she wanted something to line it with, before she laid her egg in it. She flew away, and when she came to the poppy, she settled on the scarlet leaves — they were just what she wanted.

So she cut off small pieces of the leaf, and carried them away to her nest. She cut the leaf with her jaws, and held it between her feet. When she got to the nest, she laid a piece in at the bottom, and then another and another, so that there were three folds of leaves; then she laid two folds on the sides. If a piece of the leaf did not quite fit, she cut it into shape, and carried away all the little shreds. If you were to cut the leaves of a

poppy with your scissors, you would find that they look crumpled and shriveled; but the little bee knew how to spread the pieces as smooth as glass.

When the whole nest was lined, she put some of the scarlet leaf around the door as well, for she did not spare her trouble; and then she set about getting a store of food for the young bee, which was to live in the nest by and bye. For this she flew to the flowers, and sucked the sweet honey from them, and mixed it with the fine dust that lies upon them, and then she stored it up in her nest. When she had brought enough, she laid an egg in the nest; so that the young bee, when it was hatched, might eat the sweet food. Then she laid folds of the poppy leaf over it, and last of all she covered it with earth, so that no one might notice the door of her nest.

Is it not wonderful that a little black bee should work so hard to make a pretty safe cradle for her young one?

The Earwig[19]

Little Agnes was very busy and very happy — she was putting some flowers into a glass of water. She was very fond of flowers, and took up each and looked at it and smelt it, before she put it into the glass.

All at once she jumped away from the table, and cried out — "Oh, mama! a horrid earwig! do take it away — I can't bear it!" and a great many words of that sort.

Mama looked up from her work, and said — "If you think the earwig horrid, why do you wish me to touch it?"

Agnes did not know what to think about it at first, but at last she said — "Perhaps you do not mind, mama — do you?"

Her mama said — "No, I do not mind, Agnes; I will take it in my hand, and put it out of the window."

Agnes watched her mama whilst she did it, and then said — "Earwigs are ugly, I think; and the gardener says that they eat the carnations."

"The earwig is not pretty, like a butterfly," answered her mama; "but I do not like to hear you say that it is horrid. I have read something about it that would make you like it, I am sure."

"Oh, what can that be?" said Agnes. "Nurse told me something about earwigs, but it was not nice at all."

"I will tell you," said her mama. "The earwig, though it looks so ugly, is as fond of her young ones, and takes as much care of them, as a hen does of her chickens. She sits over them, and keeps them warm, and cares for them a long time after they are hatched."

"Will an ugly brown earwig do that?" said Agnes, and she was astonished.

"Yes," said her mama; "it is true, indeed. There is something good and wonderful to be learnt about all God's creatures, though a little girl like you thinks them horrid."

"I will not say it again," said Agnes. And when she saw an insect that she could not think pretty, she said to herself:— "I wonder if mama could tell me a story about that, as she did about the earwig?"

The Tent Caterpillars and Their Nests[20]

Of course every child who has taken a walk in the country in spring has seen the caterpillars' nests in the apple and wild cherry trees. No doubt you thought they were not very pretty, and perhaps you shuddered when thinking of the "horrid worms" you knew were in them.

But if you could sit on a big apple limb some day and watch one of the nests close at hand, I think you would find much to interest you. In the morning, sometime after sunrise, you would see the "horrid worms" come out of the doors of the tent and march along mostly in Indian file in search of breakfast. When they come to a fork in the branch some will go to the right and some to the left, but each will finally stop when it finds a leaf to its liking. It will then feed upon the leaf, biting it on the edges with its good-sized jaws, and often leaving only the midrib to show that a leaf was there.

After breakfasting an hour or two, most of the caterpillars are likely to march back to the tent and crawl in through the half-closed doors, where they range themselves side by side, much as sardines are packed in a box. By thus seeking shelter during the middle of the day, they hide away from the birds and

from some little flies that are always looking for caterpillars to lay their eggs in them. But I will tell you later why the flies do this.

Towards the middle of the afternoon the procession of the caterpillars may again be seen going forth to war upon the unresisting leaves. As in the morning, they scatter here and there over the twigs, each choosing a leaf for its victim and devouring it piecemeal until hunger is satisfied. Then homeward they go, and through the cold, damp night they keep each other warm beneath the silken folds of the tent.

If you look carefully at the surface of the limb on which the procession has been marching you will see many whitish silken threads. One of these threads is spun by each of the caterpillars as it marches along. The thread comes from the mouth in the form of a liquid, secreted by certain peculiar glands, which on exposure to the air hardens into a silken thread. Probably the caterpillar is guided back to its tent by the thread which it spun on the outward journey.

During cold and wet weather the caterpillars remain within the shelter of the tent, sallying forth again when the spring sun shows his genial face.

About the first of June the caterpillars become full-grown, as far as this part of their life is concerned. They can eat no more leaves, and appear to be seized with a desire to wander away from home. Down the tree they crawl and out into a strange new world a

jungle of weeds and grass they go, seeking here and there the friendly shelter of a stone or board or fence. When such shelter is found, the caterpillar halts for rest. Soon it begins weaving about itself a silken shroud, the glands in the mouth which furnish the thread to guide it homeward from its feeding grounds again doing duty for the shroud. Before long the caterpillar is hidden within the white silken woof. It next ejects from its body a yellow fluid which runs among the silken meshes and gives the cocoon, for so the shroud is called a yellow color.

The body of the caterpillar now becomes shorter and thicker. Before long the skin on the front part of its back splits open and the caterpillar wriggles violently until the skin is finally crowded off to the hinder end, and there lies within the cocoon only a brown chrysalis.

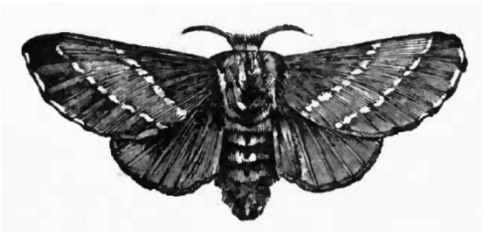


Figure 1 -- Moth of Tent Caterpillar

The change from the active caterpillar to the quiet chrysalis is a strange transformation. The chrysalis takes no food, and its only movement is a feeble wriggle. The insect remains in this condition for nearly two weeks. Then another change takes place: the skin of the chrysalis splits apart and there comes

forth a queer-looking moth that pushes its way through the meshes of the cocoon. When its wings are finally spread out and dried it resembles Fig. 1, if it happens to be a female moth. If it is a male moth it is somewhat smaller. The color in both is reddish brown.

Thus the caterpillar has reached the highest stage of its existence. Within a few weeks the "horrid worm" has become a handsome moth.

The Leaf-Cutter Bee[21]

In the garden there grows a lilac bush which everybody loves for the beautiful sweet smelling flowers it gives us early in the spring. One day after the lilac flowers were all gone, we were looking at the plant, when some of the leaves looked a little strange. They had pieces taken out of them, just as if someone had done it with small sharp scissors. That was quite a puzzle, for why should anyone wish to do that?

By watching the bush day by day the mystery was solved. A little insect, which looked something like a bee, came to the bush. She alighted on a leaf and began cutting out a round piece of the leaf with her jaws. She worked quickly and soon had the piece out and then flew away with it, holding it tightly with her two hindmost legs. After a time, back she flew and began to cut out another piece. This time the piece was a little longer with rounded ends. When she flew away with it, she looked funny with this bit of leaf waving in the air like a tiny flag. What was she up to? That was the next puzzle. Well, quite a way off she came to see a small hole in the ground.

She alighted near it and ran to its mouth and disappeared down the hole with the piece of leaf. Soon she was out again and off for another piece. She

went back and forth from the lilac bush many times for pieces of leaves.

In the hole was her nest in which she would lay her eggs. From these would be hatched the white grubs which would, in time, turn into bees like their mother.

People who have spent much time watching these bees have found many nests and have taken them apart to see how they were made. The bee first digs a hole in the ground a few inches deep. Or she may clean out a place in some rotting post or tree, or she may even use a crack between two boards that just suits her.

After getting the place all ready she seeks for the kind of leaves that suit her. Our bee used lilac leaves, but this kind of bee very often uses rose leaves.

Then she begins to cut out the pieces of leaves. Because she does this she is called the leaf-cutter bee. She has sharp strong jaws which work like a pair of scissors. She alights on the edge of a leaf and very quickly cuts out either a round or oblong shaped piece. It is cut very neatly and true. She takes hold of the piece with her two hindmost legs and flies away to her nest. The round piece she presses down with her head to the bottom of the nest. The oblong piece she uses to line the sides of the nest.

Then she visits some flowers and gathers a little honey and the dust, called pollen, that comes off the stamens, and mixes them together into a sort of sweet

cake. She puts this in the nest and then lays an egg on it. Then she flies to the bush again, this time for a round piece of leaf. She pushes this down to cover over the sweet cake and egg. Now she has provided for one egg.

On top of the lid of this first room of the nest, she builds another with pieces of leaves, just like the first. She gathers honey and pollen and makes another sweet cake, lays another egg and puts a round leaf top on and she has number two done, so that she has now cared for two of her children.

She works away in this manner until she has the hole she made in the ground filled with little nests one on top of the other. Each one with an egg and a sweet cake in it.

Then she may make other holes in the ground and fill them in the same way, for she is a very busy bee and works fast and hard.

In making up these nests she sometimes uses hundreds of pieces of leaves and must visit hundreds of flowers for honey and pollen. One man took apart the nests of one bee and counted one thousand pieces of leaves which she had cut out and carried to her nest. No one knows how many flowers she had to visit to get the things with which to make sweet cakes for her babies.

The eggs in these snug little nests lie still quite a while and then tiny white grubs are hatched, just like

the grubs of all other kinds of bees. Each little grub soon finds the sweet cake its mother made and begins to eat away on it. As this is fine and nourishing, it grows well on it, and needs no other food. In time it gets to be about as big as its mother but does not look like her yet. It looks like a short fat white worm. Then it stops eating and spins a thin silk cocoon about itself and lies still as if asleep. But like most insects while in the cocoon it changes to another strange form called a pupa. Then after some time, the pupa changes into a leaf-cutter bee. Each of these new bees has strong jaws and is able to gnaw its way out of the nest. Soon then, there comes out of the rows of nests a little group of leaf-cutter bees ready for work. Then those amongst them that are to be mother bees fly forth in different directions to find good places to start the work which we found the first mother doing, that of making nests and cutting leaves, gathering honey and pollen and laying eggs for new families of leaf-cutter



Figure 2 ---A lilac leaf with pieces cut out by a leaf-cutter bee.

bees, just as they have been doing for thousands of years.

While mother bees are so hard-working and take such good care of their eggs and children we shall always have the interesting leaf-cutter bees with us.

You may not be able to find any nests of the leaf-cutter bee because they are hidden away very carefully. But you can often find rose leaves or lilac leaves neatly cut out, as in the picture. When you find a leaf like that you can press it and put it in your scrap book and pretend that the little leaf-cutter bee marked her name that way. Whenever you look at the leaf you can think of the careful busy little bee that cut it. We have pressed and kept our lilac leaves so as to remember our bee.

A Small But Valuable Friend[22]

"Ladybird, Ladybird fly away home,

Your house is on fire and your children will burn."

So sang Alice as she leaned over a little ladybird, as it was crawling across a rose leaf. Sure enough the ladybird quickly raised its wing covers and unfolded its filmy wings and flew away. But it was so quickly out of sight, that you couldn't tell if it went to its home. This old song to the ladybird has been sung by children in many countries and for many years. I suppose our grandmothers sang it to ladybirds when they were little girls, and, no doubt, their grandmothers sang it too. Some of them may have called them ladybugs and some ladybirds, but it is all the same, though ladybird sounds nicer.

Everybody knows the ladybird and likes it too and never thinks of harming it. It is so pretty and innocent looking. But everyone would like it still better if he only knew the very great good it does for us.

But how can such a little thing as this tiny beetle do any great good? Well, it often happens in this world that very little things can do a very great good or can do a very great harm. The little ladybird does us an immense amount of good by fighting some very little things that do an immense amount of harm.

There are a number of kinds of very small insects which fasten themselves tight to the stems or leaves or fruit of many kinds of trees. They fit so closely to the stems that they do not appear as insects or anything alive. They look like little scales or scabs on the bark. For this reason they are called scale insects. They pierce down into the plant with a sharp beak and suck out the juices. Just a single one may have so many children that soon there may be thousands all over the bark, leaves and fruit. Although each scale is very small, the very great numbers take so much juice out that they make the plant weak and sick and spoil the fruit. They may get so bad that the plant dies.

The number of kinds of scale insects is so great, that there is one kind for almost every kind of plant. They are very harmful to the different kinds of fruit trees. If left alone they would spoil most of them and kill great numbers of them. The orchard man has to fight them all the time. Now this is where the little ladybird comes in to do its great good. It helps rid the fruit trees of the ruinous scale insects.

The neatly dressed little ladybird looks very charming and innocent as she busies about over the stems and leaves. And she is so harmless to us. But the trim little lady is really a terror to the scale insects. She lives on their eggs and on the scales themselves. She knows how to hunt them out. Although the scale insects have clever ways of hiding their eggs and of

making themselves look like anything but a live insect, they cannot deceive the ladybird.

The ladybird's children are just as destructive to the scale insects and their eggs as is the grown up mother. They do as much good for the orchard trees as the grown folks of the ladybird family.

Of course Alice wished to see some of the children she had been singing about. Well, they were very easily found, for they are as common as the grownups. But when we found some on the plants, Alice could hardly believe such ugly little things belonged to such a tidy little mother. They are somewhat flat, and about half an inch long. The surface of the body is rough and hairy. It is dark with some reddish spots on its back. It has six legs and as it slowly crawls about it gives you a creepy feeling.



Figure 3 -- The larva of the ladybird.

After searching through the garden and orchard we found a number of ladybirds, but they were not all alike. Their shape is very much the same, but they differ in size and color. Some are red, some black, and some red with black spots on the wing covers. Some kinds are more common in one part of the country and some in another.

The different kinds of ladybirds live in much the same way. But some kinds like one sort of scale insect

better than the others do. So you will probably find ladybirds on the plants that have their favorite scale. Different kinds of ladybirds have different ways of placing their eggs. Some hide them one by one on the plant. Others place them in little clusters near where the tiny young ones can find the scale insect food as soon as they are hatched. Of course, the little children of the different kinds of ladybirds are also somewhat different, but they all look more or less like the one we found, whose picture is given here. You can see that it looks something like the aphis-lion and it is about as greedy in eating scale insects and plant lice, no matter where it finds them.

Like the caterpillars of butterflies and moths, the children hatched from the ladybird's eggs must change their skins as they grow. This changing of skin is called moulting. All insects grow in this way. The young that hatches from the egg of an insect is called a larva. The caterpillar is the larva of the moth or butterfly. The aphis-lion is the larva of the lace-winged fly. Thus it is said that the larva of the ladybird moults four times. Every time it moults, it is a little bigger and a little uglier and kills more scales than ever.



Figure 4 -- Pupa of the ladybird.

When it comes time for the larva period of life to end, it hangs by its tail and humps up into a sort of ball. This is something like the chrysalis of the butterfly. It is then

called the pupa. There it awaits the change that goes on inside the ball, and when it comes out it is a complete little ladybird, fitted up with wings, covers, and all the other parts that make up this pretty little beetle.

Many interesting stories could be told to show how important some ladybirds become. In some parts of California there are many orange and lemon orchards. From them car loads of oranges and lemons are sent to all parts of the United States and other countries. Perhaps every boy and girl has eaten an orange or has drunk a glass of lemonade made with lemons from the orchards of California. Now there is a kind of scale insect that lives on orange and lemon trees. Its name is the cottony cushion-scale. It is given that name because its eggs are laid in bunches that look like little pieces of cotton, which lie under the scale like a cushion. This scale lives on other plants as well as orange trees. But it seems to like orange trees very much. One mother scale may lay as many as a thousand eggs. In the summer there may be several broods. Thus the increase in number is very very fast, as you can see. When once the scale gets started on a tree the whole tree is soon covered with thousands, then the tree gets sick, the fruit spoils, and, at last the tree is killed. Well, some years ago the cottony cushion-scale attacked the orange and lemon orchards of California and increased to such great

numbers that people thought all their orange orchards would be destroyed. They did everything they could to kill off the scale insects but they came on too fast for them. Finally a gentleman by the name of Mr. Albert Koebele went to the far away country of

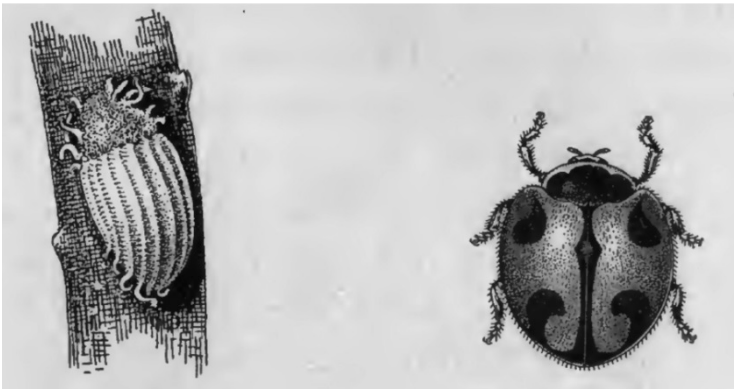


Figure 5 -- The cottony-cushion scale. The fluted part looks like cotton and is filled with its eggs. (left}

The Vedalia – The great fighter of the cotton cushion scale. (right).

Australia, and there found a tiny ladybird which eats only cottony cushion-scale eggs. He caught a number of these and brought them on the long trip across the great Pacific Ocean to California. He set them free in a California orange orchard. Then the great fight began. A few spunky little ladybirds against the millions of cottony cushion-scales that were eating up the thousands of orange and lemon orchards of the state! This little Australian ladybird lays many eggs and raises children very fast herself. The children, the larvae, are great eaters of cottony cushion-scale eggs

as well as are their mothers. They both worked hard eating eggs, the mothers rearing more and more children till at last they checked the increase of the scale and the orange orchards are safe. One name for this ladybird is the Vedalia, which is rather a pretty name. A picture is given of it. The color is red with black markings. It has a fuzz of fine hairs over its back. All the orange men in California know about this little friend and think it is worth many times its weight in gold.

There are other enemies of the cottony cushion-scale. In addition the orchard men keep fighting this scale and other insect enemies with poison gas and sprays of poisonous liquids, but they believe the little Australian Vedalia ladybird was the real savior of the orange orchards. They trust to the Vedalia to keep them safe. Whenever a boy or girl gets a big California orange to eat, he may thank the little friend that Professor Koebele brought from the other side of the world.

Professor Koebele found another ladybird which he brought to the orange orchards and let loose at the cottony cushion-scale. This one helps the Vedalia fight the scale and is an immense help.

This one has been named the Koebele ladybird, to honor the man whose eyes were sharp enough to find these great cottony cushion-scale fighters.

Many other interesting stories could be told of other kinds of ladybirds and their fights against many kinds of scale insects and plant lice to save our fruit trees and other plants that we value highly.

I once saw an interesting sight that astonished me greatly. One winter day I was tramping in the foot hills

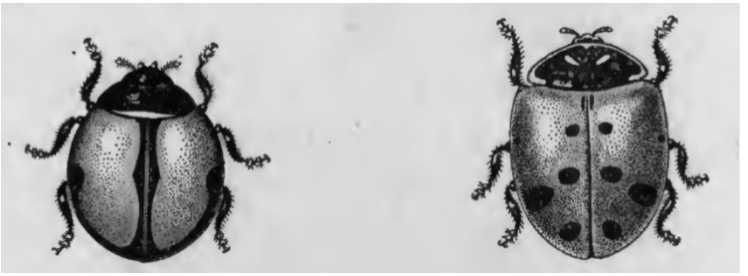


Figure 6 - The Koebele ladybird (left), another great enemy of the cottony cushion scale.

A common kind of ladybird (right). This is the kind that sometimes gathers in great numbers in California in winter..

of Black Mountain near Stanford University in California. In a deep canyon filled with a growth of trees and ferns, I came upon a large stump that had a reddish color. On examining it more closely, I found it covered with thousands of ladybirds, piled up several inches deep. They not only covered one side of the stump, but a thick layer of them was stretched out on the ground, at the bottom of the stump.

Near this was a great log. One side of it was also covered with ladybirds. If they had all been gathered up there would have been several gallons of them.

Later I learned that in the mountains of California, such great gatherings of ladybirds have been found in various places every winter. In some other parts of the United States, it is said that bunches of ladybirds have been found in winter time, although not in such large numbers as those sometimes seen in the mountains of California. It is said that in the spring, the ladybirds leave their companies and scatter to the valleys where they can find scale insects and plant-lice. They were just here spending the winter together.

But why they select those places, and how they select them and find them and how they tell one another about it so that they can get together is a mystery that has not yet been solved.

Not all ladybirds spend their winters in great companies. Some hide in cracks and crevices and in other sheltered places, either by themselves or a few together where they remain quietly, until the winter is over. When spring comes, they come out and fly forth to find their hunting grounds and raise their great broods of homely but hard working children, to carry on the great summer fight against plant lice and scale insects.

The Tomato Worm[23]

It was a beautiful bright warm summer morning. The garden was a delight, for the plants were green and healthy and growing fine. Mary stepped down from the kitchen and went through the garden gate with her basket, on her way to gather some beans, cucumbers and tomatoes for our dinner. I don't blame her for going slowly past the flower beds where the bees, wasps and butterflies were buzzing and fluttering over the flowers, gathering their delicious dinner ready prepared for them. It was set out in hundreds of beautifully shaped and beautifully colored cups and saucers and dishes. These were finer than are ever seen on a table full of china and silver sets.

Then all at once, Mary remembered how hungry we soon would be and hurried on. But in a minute she came rushing back, her eyes wide open with excitement. "What's the matter?" cried Tom. "You'll just have to go without tomatoes before you catch me in that tomato patch again," she answered quickly. "Why, what has happened?" asked Bessie. "When I stooped down to pick a tomato, there sitting up on the vine were three big green worms that looked like dragons. Each had a big horn on its tail and it raised

up on its hind feet and shook its head and snapped its jaws. It looked like it was saying, 'You just dare to touch me and I'll hurt you.'" Mary was surely in



Figure 7 -- The tomato-worm. The caterpillar of the hummingbird moth.

earnest. Dragons! Well that word excited Tom and Bessie and, of course, they were impatient to see them. But I noticed they held back a little and turned to me to know if I would not show them the monsters, as it was quite plain that Mary was not going to do it. I said I would gladly go and that there was nothing to be afraid of, for I knew pretty well that if the dragons were on the tomato plants, they were just some old friends that were up to their old tricks of making a big bluff.

We were soon searching the tomato vines. At first we could see no signs of the frightful beings that had caused Mary to beat such a quick retreat. But soon we found them, crawling on one of the top branches of a tomato vine. They were just nothing but three big tomato-worms. They are perfectly harmless, except to tomato leaves but these they do gobble down pretty fast. But for all that they certainly did look quite fierce, and Mary was not to be blamed for being afraid of them before she understood them. While they were surely big for worms, they were rather small for dragons.

The largest of the three was nearly four inches long. Its body was big and fat. It was a bright green with seven white stripes running obliquely on its side. There was a brightly colored spot on each breathing hole or spiracle. The color was so much like the tomato leaves, that it is no wonder we did not see the worms at first. It was quite true what Mary had said; each one had a large horn rising from its tail. It was sharp and looked as if it might be a big sting. Some people think that the worm does use it as a sting, and that it is very poisonous. But that is a great mistake. It is harmless and the caterpillar does not seem to use the horn for anything at all.

When we shook the vine or touched the worms, they did as Mary had said. They raised their heads and

front part of the body high, shook their bodies and made a little snapping noise with their jaws.

They acted as if they were trying to frighten you away. But when you know that they will not, and cannot, do you any harm, you feel like laughing at their pretending. Whenever they quieted down the children thought it great fun to stir them up again.

The next question was where did these monster caterpillars come from? And as we had learned from the silkworm and the milkweed caterpillars that caterpillars in time change to either moths or butterflies, the children were anxious to find out what the tomato-worm would change into.

Tom made a cage like the one we had put the milkweed caterpillars in. I suggested that he put three or four inches of moist dirt in the bottom, for this kind of caterpillar would need it later. So the three were taken to their new home and every day were given fresh tomato stems with leaves on them.

These caterpillars were full grown so we did not have to feed them many days before they showed signs that they had eaten tomato leaves long enough and that their caterpillar days were about over.

They crawled down from the tomato stems and began to dig holes in the earth and soon buried themselves out of sight. "Well," said Bessie, "that is a strange thing for a caterpillar to do. I think it much nicer to spin a cocoon like the silk-worm or hang up a

beautiful chrysalis in a hidden place like a milkweed caterpillar." They did not like the idea of "not seeing what was going on. They wanted to know how long they would have to wait to see what would come out of the ground. They were much disappointed when told they would have to wait till the next spring. Then they put the cage away in a safe place for the long delay. Two or three weeks after this, Tom said to us, "Couldn't we dig down just to see what has happened to one of those tomato-worms? We can put back what we find just the same as we find it and maybe it will be all right for next spring."

That seemed to be a very good idea.

So out came the cage and he very carefully dug down, where one of the caterpillars had hidden. And this is what he found buried in the dirt. A little brown jug, something more than two inches long, with a handle on one side. When looked at more closely the little jug was seen plainly to be a sort of chrysalis. Through the hard brown skin you could see the divisions of the body at the tail end. Then at the head end were the parts that are to be wings and eyes and the jug handle was to be the tongue. This brown chrysalis showed



Figure 8 - Chrysalis of the humming-bird moth.

itself to be alive by a slight movement of the tail end whenever it was touched.

Well, we felt well repaid in seeing this curious object. While it was not a beautiful chrysalis like that of the milkweed caterpillar, still it was a chrysalis all the same.

The tomato-worm had learned to hide its chrysalis out of sight and where it would be protected from the cold of the winter. Tom put it back very carefully and the children were now more contented to wait for the outcome of this homely but interesting chrysalis.

Senses of Ants[24]

Their sense of smell worth all the rest.

A gentleman once placed a number of ants in a box closed at the sides, but in one corner of which he had made a small hole. There was a piece of glass in the corner that let in a little light, and through it he could see what was going on inside. At first the ants scattered and ran everywhere seeking an outlet to freedom. At last one ant found the hole, but instead of escaping by it the little insect came back and touched a number of its friends with its feelers, or antennae as they are called, and these touched the rest. As soon as this was done all the ants formed into line and marched out of the hole, led by the one that first found it.

In this way it was seen that ants can talk to each other with their antennae as we with our tongues, or rather, perhaps, as deaf and dumb people who are also blind do with their fingers.

If you place a dead fly near an ant-hole and an ant finds it, the little creature will try to carry the fly away. As the fly, to it, is as large compared with the insect as an elephant is to you, the ant, although very much stronger for its size than the strongest man, soon sees

it needs help. It leaves the fly and goes back to its ant-hill. If it meets an ant belonging to its own hill it touches the antennae of its friend with its own and the two start off together, but it does not notice stranger ants. If it does not meet any friend, it goes down into its hole and presently comes out again with a number of house-mates that fall to work upon the fly and carry it home. It is not likely that ants can converse as human beings can, that they can call each other by name, or recite verses or tell fairy stories, for their sense of hearing does not seem to be very well developed; but without any doubt they have a language without words that answers the purpose of making their wants known to each other, and of telling each other such things as are necessary to the comfort and safety of the community in which they dwell.

Human beings think that seeing, hearing, and feeling are the most important of the senses. If a person cannot see, that person is blind; if he cannot hear, he is deaf; if he cannot feel, he is insensible; if he cannot smell — what is he? There is no word that describes the lack of the sense of smell, because the sense itself is so much duller and weaker than any other in mankind that its loss is not important enough to have a word all to itself. The same thing, in a degree, may be said of taste, though this is more developed than smell. With a number of animals the sense of

smell is of even more consequence than those of sight or hearing, and this is particularly the case with ants.

Baby ants have been taken away from the ant family when they were born and brought up by themselves, and after a long time set free close to the ant-hill from which they were taken. As soon as any of the ants from this hill met them they knew at once that the visitor belonged to the family, and the new comers also knew their relatives, and went with them into the hill and lived there the rest of their lives. When, however, ants from another hill were introduced the poor creatures were attacked and killed or driven away.

Unless ants have a sense of which we know nothing, they must recognize each other by the sense of smell, as dogs know the footsteps of their masters. Indeed, unless their sense of smell is so well developed as to answer for that of sight, it is hard to understand how they can build and keep clean and in order their underground homes, and carry on all their domestic affairs — for they are notable housekeepers — when their habitations are kept in utter darkness.

Ants at Home[25]

How They Keep House

There are no lawmakers among the ants, and no one rules over them. Like the bees, they have what are called their queens, but the so-called queens possess no power to command their subjects.

The fact of the matter is, every beehive and every ant-hill consists of an immense family of brothers and sisters, and she who is called the queen is the mother of the whole tribe. She is well taken care of, fed, and kept clean, and the eggs she lays are also the objects of watchful attention, but she has neither the freedom nor the power of any member of her family, for she may not even come and go as do the others, or share in their delightful labors. The only laws ants obey are their own wishes; they do nothing because they feel obliged to do it.

The sense of duty — of forcing one's self to do or not to do some particular thing because it ought or ought not to be done — belongs only to mankind. But ants love to be busy, just as boys and girls love to exercise every muscle in their limbs and bodies in health-giving occupations; and they had plenty to do. First of all in importance in an ant-hill are the baby

ants, for the whole life of the tribe depends on their well-being. While the little ones are yet in the egg they are constantly kept in the part of the formicary or ant nest best suited for hatching them.

In warm days they are brought near the surface, but during wet or chilly weather they are carried away to the deepest chambers. When they hatch they are without legs, and have to be constantly, so to speak, in the arms of their attendants. These baby ants are really what are generally taken for ants' eggs, when on disturbing a nest they are seen as their nurses hurry away with them in their mandibles or pinchers. The real eggs are very minute, and generally escape notice.

These babies, we are told, "are incessantly and carefully tended by their nurses, who clean them and feed them, carry them about during weather changes, escape with them or fight for them if attacked by enemies, and often show a species of attention that has an amusing resemblance to the dandling of an infant by a young mother. The ant children are often assorted according to age and size, reminding one of the class divisions in a schoolroom."

When these baby ants pass the second period of their existence, during which they are called larvae, they either spin a whitish or light yellow cocoon (and it is sometimes these, as well as the larvae, that are mistaken for ants' eggs), shutting themselves up in it, or else they sink into a deep sleep just as they are.

In doing this they enter upon the third stage of an ant's life, and are called pupae, during which time they take no food. When they are ready to awaken again, which they do in the perfect and mature form of ants, the nurses, who have never left them a moment, know it, and help them out of their cocoons, and out of their old skins as well, and unfold their legs — you will remember they had none before — and smooth out the wings of the young queens and the male ants, that are the only kinds born with wings.

The winged ants do not delight in work as do the others, who are called workers. They are taken care of by the workers, looked after, fed, and cleaned like big babies. Sometimes they are free to go out of doors and run about a little, but are then carefully guarded, and not allowed far from the nest.

At last, however, a time comes when they must go away and seek their fortunes, must be fathers and mothers of new tribes, and leave the home of their childhood, never again to return.

They are now old enough, wise enough, and strong enough to look out for themselves, and at the close of a warm day in the fall of the year they may be seen by thousands, swarming from the ant-hills and flying away.

When a young queen ant has found a place that pleases her for her future home, she breaks off her wings — for she will indulge in no future flights —

settles down, and for a time works hard to make a little home for her children; she takes care of her own young, feeds them, cleans them, and brings up her first brood herself. When this is done her labors are ended; hereafter her children wait upon her and upon each other as long as she lives.

As for the male ants, they fly away on their travels, and never return to their old homes or make new ones.

Sea Life

The Star-Fish Takes a Summer Journey[26]

Once there was a little star-fish, and he had five fingers and five eyes, one at the end of each finger, so that he might be said to have at least one power at his fingers' ends. And he had I can't tell you how many little feet; but being without legs, you see, he couldn't be expected to walk very fast. The feet couldn't move one before the other as yours do: they could only cling like little suckers, by which he pulled himself slowly along from place to place. Nevertheless, he, was very proud of this accomplishment; and sometimes this pride led him to an unjust contempt for his neighbors, as you will see by and by. He was very particular about his eating; and besides his mouth, which lay in the center of his body, he had a little scarlet-colored sieve through which he strained the water he drank. For he couldn't think of taking in common sea-water with everything that might be floating in it, that would do for crabs and lobsters and other common people; but anybody who wears such a lovely purple coat, and has brothers and sisters dressed in crimson, feels a little above such living.

Now, one day this star-fish set out on a summer journey, not to the seaside where you and I went last year: of course not, for he was there already. No; he

thought he would go to the mountains. He could not go to the Rocky Mountains, nor to the Catskill Mountains, nor the White Mountains; for, with all his accomplishments, he had not yet learned to live in any drier place than a pool among the rocks, or the very wettest sand at low tide: so, if he travelled to the mountains, it must be to the mountains of the sea.

Perhaps you didn't know that there are mountains in the sea. I have seen them, however, and I think you have, too, at least their tops, if nothing more. What is that little rocky ledge, where the lighthouse stands, but the stony top of a hill rising from the bottom of the sea? And what are the pretty green islands, with their clusters of trees and grassy slopes, but the summits of hills lifted out of the water?

In many parts of the sea, where the water is deep, are hills and even high mountains, whose tops do not reach the surface; and we should not know where they are, were it not that the sailors, in measuring the depth of the sea, sometimes sail right over these mountain-tops, and touch them with their sounding-lines.

The star-fish set out one day, about five hundred years ago, to visit some of these mountains of the sea. If he had depended upon his own feet for getting there, it would have taken him till this day, I verily believe; but he no more thought of walking, than you or I should think of walking to China. You shall see how he travelled. A great train was coming down from

the Northern seas; not a railroad train, but a water train, sweeping on like a river in the sea. Its track lay along near the bottom of the ocean; and above you could see no sign of it, any more than you can see the cars while they go through the tunnel under the street. The principal passengers by this train were icebergs, who were in the habit of coming down on it every year, in order to reduce their weight by a little exercise; for they grow so very large and heavy up there in the North every winter, that some sort of treatment is really necessary to them when summer comes. I only call the icebergs the principal passengers, because they take up so much room; for thousands and millions of other travelers come with them, from the white bears asleep on the bergs, and brought away quite against their will, to the tiniest little creatures rocking in the cradles of the ripples, or clinging to the delicate branches of the sea-mosses. I said you could see no sign of the great water train from above: that was not quite true, for many of the icebergs are tall enough to lift their heads far up into the air, and shine with a cold, glittering splendor in the sunlight; and you can tell, by the course in which they sail, which way the train is going deep down in the sea.

The star-fish took passage on this train. He didn't start at the beginning of the road, but got in at one of the way-stations somewhere off Cape Cod, fell in with some friends going south, and had altogether a

pleasant trip of it. No wearisome stopping-places to feed either engine or passengers; for this train moves by a power that needs no feeding on the way, and the passengers are much in the habit of eating their fellow-travelers by way of frequent luncheons.

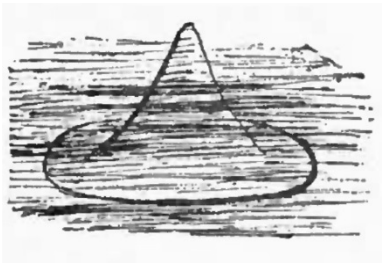
In the course of a few weeks, our five-fingered traveler is safely dropped in the Caribbean Sea; and, if you do not know where that sea is, I wish you would take your map of North America and find it, and then you can see the course of the journey, and understand the story better. This Caribbean Sea is as full of mountains as New Hampshire and Vermont are; but none of them have caps of snow like that which Mount Washington sometimes wears, and some of them are built up in a very odd way, as you will presently see.

Now the star-fish is floating in the warm, soft water among the mountains, turning up first one eye and then another to see the wonders about him, or looking all around, before and behind and both sides at once, as you can't do, if you try ever so hard, while his fifth eye is on the lookout for sharks, besides; and he meets with a soft little body, much smaller than himself, and not half so handsomely dressed, who invites him to visit her relatives, who live by millions in this mountain region. "And come quickly, if you please," she says, "for I begin to feel as if I must fix myself somewhere; and I should like, if possible, to settle

down near my brothers and sisters on the Roncador Bank."

Coraltown on Roncador Bank[27]

Where is Roncador Bank, and who are the little settlers there? If you want me to answer this question, you must go back with me, or rather think back with me, over many thousands of years; and, looking into this same Caribbean Sea, we shall find in its south-western part a little hill formed of mud and sand, and reaching not nearly so high as the top of the water. Not far from it float some little, soft, jelly-like bodies, exactly resembling the one who spoke to the starfish just now. They are emigrants looking for a new home. They seem to take a fancy to this hill, and fix themselves on bits of rock along its base, until, as more and more of them come, they form a circle around it, and the hill stands up in the middle, while far above the whole blue waves are tossing in the sunlight.



How do you like this little circular town seen in the picture? It is the beginning of Coraltown, just as the landing of the Pilgrims at Plymouth was the beginning of Massachusetts. Now we will see how it grows. First of all, notice this curious fact, that each settler, after

once choosing a home, never after stirs from that spot; but, from day to day, fastens himself more and more firmly to the rock where he first stuck. The part of his body touching the rock hardens into stone, and as the months and years go by, the sides of his body, too, turn to stone; and yet he is still alive, eating all the time with a little mouth at his top, taking in the sea-water without a strainer, and getting consequently tiny bits of lime in it, which, once taken in, go to build up the little body into a sort of limestone castle; just as if one of the knights in armor, of whom we read in old stories, had, instead of putting on his steel corselet and helmet and breastplate, turned his own flesh and bones into armor. How safe he would be! So these inhabitants of Coraltown were safe from all the fishes and other fierce devourers of little sea creatures (for who wants to swallow a mail-clad warrior, however small?); and their settlement was undisturbed, and grew from year to year, until it formed a pretty high wall.

But, before going any farther, you may like to know that these settlers were all of the polyp family: fathers and mothers, brothers and sisters, uncles and aunts, all were polyps. And this is the way their families increased: after the first comers were fairly settled, and pretty thoroughly turned to stone, little buds, looking somewhat like the smallest leaf-buds of the spring-time, began to grow out of their edges.

These were their children, at least one kind of their children; for they had yet another kind also, coming from eggs, and floating off in the water like the first settlers. These latter we might call the free children or wanderers, while the former could be named the fixed children. But even the wanderers come back after a short time, and settle beside their parents, as you remember the one who met the star-fish was about to do.



It was not very easy for you or me to think back so many thousand years to the very beginning of Coraltown, nor is it less difficult to realize how many, many years were passing while the little town grew, even as far as I have told you.

The old great-grandfathers and great-grandmothers had died, but they left their stone bodies still standing, as a support and assistance to their descendants who had built above them; and the walls had risen, not like walls of common stone or brick, but all alive and busy building themselves, day after day,

and year after year, until now, at the time of the star-fish's visit, the topmost towers could sometimes catch a gleam of sunlight when the tide was low; and when storms rolled the great waves that way, they would dash against the little castles, breaking themselves into snowy spray, and crumbling away at the same time the tiny walls that had been the polyps' work of years. Do you think that was too bad, and quite, discouraging to the workers. It does seem so; but you will see how the good God, who is their loving Father just the same as he is ours, had a grand purpose in letting the waves break down their houses, just as he always does in all the disappointments he sends to us. Wait till you finish the story, and tell me if you don't think so.

And now let us see what the star-fish thought of the little town and its inhabitants. "Ah, these are your houses!" he said. "Why don't you come out of them, and travel about to see the world?" "These are not our houses, but ourselves," answered the polyps; "we can't come out, and we don't want to. We are here to build, and building is all we care to do; as for seeing the world, that is all very well for those who have eyes, but we have none."

Then the star-fish turned away in contempt from such creatures, "people of neither taste nor ability, no eyes, no feet, no water-strainers; poor little useless things, what good are they in the world, with their

stupid, blind building of which they think so much?" And he worked himself off into a branch water-train that was setting that way, and, without so much as bidding the polyps good-bye, turned his back upon Coraltown, and presently found a fellow-passenger fine enough to absorb all his attention, a passenger, I say, but we shall find it rather a group of passengers in their own pretty boat; some curled in spiral coils, some trailing like little swimmers behind, some snugly ensconced inside, but all of such brilliant colors and gay bearing that even the star-fish felt his inferiority; and, wishing to make friends with so fine a neighbor, he whirled a tempting morsel of food towards one of the swimming party, and politely offered it to him. "No, I thank you," replied the swimmer, "I don't eat; my sister does the eating, I only swim." Turning to another of the company with the same offer, he was answered, "Thank you, the eaters are at the other side; I only lay eggs." "What strange people! " thought the star-fish; but, with all his learning, he didn't know everything, and had never heard how people sometimes live in communities, and divide the work as suits their fancy.

While we leave him wondering, let us go back to Coraltown. The crumbling bits, beaten off by the waves, floated about, filling all the chinks of the wall, while the rough edges at the top caught long ribbons of seaweed, and sometimes drifting wood from

wrecked vessels, and then the sea washed up sand in great heaps against the walls, building buttresses for them. Do you know what buttresses are? If you don't, I will leave you to find out. And the polyps, who do not know how to live in the light and air, had all died; or those who were wanderers had emigrated to some new place. Poor little things, their useless lives had ended, and what good had they done in the world?

Little Sunshine[28]

And now let us look at Coraltown once more. It is the first day of June of 1865. The sun is low in the West, and lights up the crests of the long lines of breakers that are everywhere curling and dashing among the topmost turrets of the coral walls. But here is something new and strange indeed for this region; along one of the ledges of rock, fitted as it were into a cradle, lies the great steamship "Golden Rule," a vessel full two hundred and fifty feet long, and holding six or seven hundred people. Her masts are gone, and so are the tall chimneys from which the smoke of her engine used to rise like a cloud. The rocks have torn a great hole through her strong planks, and the water is washing in; while the biggest waves that roll that way lift themselves in mountainous curves, and sweep over the deck.

This fine, great vessel sailed out of New York harbor a week ago to carry all these people to Greytown, on their way to California; and here she is now at Coraltown instead of Greytown, and the poor people, nearly a hundred miles away from land, are waiting through the weary hours, while they see the ocean swallowing up their vessel, breaking it, and tearing it to pieces, and they do not know how soon

they may find themselves drifting in the sea. But, although they may be a hundred miles from land, they are just as near to God as they ever were; and he is even at this moment taking most loving care of them.

On the more sheltered parts of the deck are men and women, holding on by ropes and bulwarks: they are all looking one way out over the water. What are they watching for? See, it comes now in sight, only a black speck in the golden path of the sunlight! No, it is a boat sent out two hours ago to search for some island where the people might find refuge when the ship should go to pieces. Do you wonder that the men and women are watching eagerly? Look! it has reached the outer ledge of rock. The men spring out of it, waving their hats, and shouting "Success;" and the men on board answer with a loud hurrah, while the women cannot keep back their tears. What land have they discovered? You could hardly call it land. It is only a larger ledge of coral, built up just out of reach of the waves, its crevices filled in firmly with broken bits of rock and drifts of sand; but it seems today, to these shipwrecked people, more beautiful than the loveliest woods and meadows do to you and me.

It would be too long a story if I should tell you how the people were moved from the wreck to this little harbor of refuge, lowered over the vessel's side with ropes, taken first to a raft which had been made of broken parts of the vessel, and the next day in little

boats to the rocky island; but you can make a picture in your mind of the boats full of people, and the sailors rowing through the breakers, and the great sea-birds coming to meet their strange visitors, peering curiously at them, as if they wondered what new kind of creatures were these, without wings or beaks. And you must see in the very first boat little May Warner, three years and a half old, with her sunny hair all wet with spray, and her blue eyes wide open to see all the wonders about her. For May doesn't know what danger is: even while on the wreck, she clapped her little hands in delight to see the great curling crests of the waves; and now she is singing her merry songs to the sea-birds, and laughing in their funny faces, and fairly shouting with joy as, at landing, she rides to the shore perched high on the shoulder of sailor Jack, while he wades knee-deep through the water.

So we have come to a second settlement of Coraltown: first the polyps; then the men, women, and children. Do you see how the good Father teaches all his creatures to help each other? Here the tiny polyps have built an island for people who are so much larger and stronger than themselves, and the seeming destruction of their upper walls was only a better preparation for the reception of these distinguished visitors. The birds, too, are helping them to food, for every little cave and shelf in the rock

is full of eggs. And now should you like to see how little May Warner helps them in even a better way?

Did you ever fall asleep on the floor, and, waking, find yourself aching and stiff because it was so hard? Then you know, in part, what hard beds rocks make. And in a hot, sunny day, haven't you often been glad to keep under the trees, or even to stay in the house for shade? Then you can understand a little how hot it must have been on Roncador Island, where there were no trees nor houses. And haven't you sometimes, when you were very hot and tired and hungry, and had, perhaps, also been kept waiting a long hour for somebody who didn't come, haven't you felt a little cross and fretful and impatient, so that nothing seemed pleasant to you, and you seemed pleasant to nobody? Now, shouldn't you think there was great danger that these people on the island, in the hot sun, tired, hungry, and waiting, waiting, day and night, for some vessel to come and take them to their homes again, and not feeling at all sure that any such vessel would ever come, shouldn't you think there was danger of their becoming cross and fretful and impatient? And if one begins to say, "Oh, how tired I am, and how hard the rocks are, and how little dinner I have had, and how hot the sun is, and what shall we ever do waiting here so long, and how shall we ever get home again!" don't you see that all would begin to be discouraged? And sometimes on this

island it did happen just so: first one would be discouraged, and then another; and as soon as you begin to feel in this way, you know at once everything grows even worse than it was before, the sun feels hotter, the rocks harder, the water tastes more disagreeably, and the crab's claws less palatable. But in the midst of all the trouble, May would come tripping over the rocks, a little sunburnt girl now, with tattered clothes and bare feet, and she would bring a pretty pink conch-shell or the lovely rose- colored sea-mosses, and tell her funny little story of where she found them. The discontented people would gather around her: she would give a sailor kiss to one, and a French kiss to another, and, best of all, a Yankee kiss, with both arms round his neck, to her own dear father; and then, somehow or other, the discontent and trouble would be gone, for a little while at least, just as a cloud sometimes seems to melt away in the sunshine; and so May Warner earned the name of "Little Sunshine."

If anybody had picked up driftwood enough to make a fire, and could get an old battered kettle and some water to make a soup of shell-fish, "Little Sunshine" must be invited to dinner, for half the enjoyment would be wanting without her.

If a great black cloud came up threatening a shower, the roughest man on the island forgot his own discomfort, in making a tent to keep "Little Sunshine"

safe from the rain. And so, in a thousand ways, she cheered the weary days, making everybody happier for having her there.

Do you think there are any children who would have made the people less happy by being there? who would have complained and fretted, and been selfish and disagreeable?

Ten days go by, so slowly that they seem more like weeks or months than like days. The people have suffered from the rain, from heat, from want of food. They are very weak now; some of them can hardly stand. Can you imagine how they feel, when, in the early morning, two great gunboats come in sight, making straight for their island as fast as the strong steam-engines will take them? Can you think how tenderly and carefully they are taken on board, fed with broth and wine, and nursed back into health and strength? And do not forget the little treasures that go in May's pocket, the bits of coral, the tinted sea-shells, and ruby-colored mosses; and nested among them all, and chief in her regard, a little five-fingered star, spiny and dry, but still showing a crimson coat, and dots which mark the places of five eyes, and a little scarlet water-strainer, now of no further use to the owner. Do you remember our old friend the star-fish? Well, this is his great-great-great-great-great-grandchild. In a week or two more, the rescued people have all reached California, and gone their separate ways,

never to meet again. But all carry in their hearts the memory of "Little Sunshine," who lightened their troubles, and cheered their darkest days.

Live and Let Live[29]

"Away down in the deep sea, there is a wonderful little shell, called the date-shell, or borer of the sea.

"This shell is inhabited by a peculiar little animal that is capable of piercing the very hardest substances that are found in the ocean.

"It is not certainly known whether the valves of its shell are the instruments by which it burrows into everything that comes in its way, or whether its foot, armed with sand, is used as a drill to accomplish this purpose.

"At any rate, some of the hardest stones and stoutest shells are found pierced by this strange creature, which seems to have one prevailing instinct, namely, that of boring or piercing its way through everything.

"They are selfish little borers, as you will discover, when I tell you that if one of their own kind happens to be disabled in their path, they proceed right on with their work, and drive their tunnel completely through the body of their companion.

"I hope," said Aunt Lizzie, after a moment's pause, "that these naughty, selfish little sea-borers will

remain in the bottom of the ocean; for I am afraid they could never be taught the Golden Rule."

And then she asked the children to repeat with her the lines,

"To do to others as I would that they should do to me,
Will make me honest, kind, and good, as every child should be."

During the recitation of this couplet, Fred counted his buttons, and Cora hemmed her apron with a pin.

"How different is the history of the sacred scarabee!" said Aunt Lizzie. The children's faces brightened.

"I will tell you what I once read about that insect. The account was written by a traveler who watched its movements very carefully.

"He tells us that the female wraps up her newly laid egg in a ball of manure, which is to be the nourishment and support of the coming grub. The Egyptians consider this egg a sacred object, and make it their idol of worship, this is why it is called 'sacred' scarabee.

"The first thing to be done is to transport the ball into a suitable place, where it may be buried.

"The insect rolls it along with its hind claws, or, if necessary, hoists it with its head.

"Sometimes the journey is long and tedious. Presently she comes to a small mole-hill; it is a high mountain to her; the ball being lifted to its ridge, rolls down the other side.

"But if a rut or crevice happen to lie in the way, the precious ball drops to the bottom, and would be lost forever, if the scarabee had nothing to depend upon but its own feeble' strength.

"It struggles in vain, trying again and again to mount the steep wall with its recovered treasure; twenty, thirty times it tries, evincing far greater perseverance than most little girls and boys display on matters of more importance.

"But at last it appears to be discouraged, and flies away. And just here is where the generosity of the scarabee is brought into happy contrast with the selfishness of the borer.

"After a while the insect returns; but not alone. It is followed by two, three, or four companions, sometimes more. They all drop down into the place where the ball disappeared, and with united efforts drag it out, and set it on its way again.

"How much sooner," said Aunt Lizzie, reflectively, "would I be a generous, human scarabee, than a miserable, selfish borer!"

Neither of the children made any reply to Aunt Lizzie's last remark.

But presently Cora inquired if the date-shell ever bored through the hulls of ships and other vessels.

"No, that is a different animal altogether," said Aunt Lizzie. "It is the Teredo, or ship-worm, that you are thinking of."

"Why is it called a ship-worm?" inquired Fred. "Are not all these soft bodied animals that live in shells called 'mollusks'?"

"Yes, Fred, they are properly classed as 'mollusks,'" replied his aunt, "but this Teredo looks more like a worm than a mollusk. It burrows in floating timber in tropical seas, and so accomplishes some good in this way, by removing hindrances to navigation.

"But it is generally considered a very destructive animal. It is nearly a foot in length, and bores its way with two sharp, curved valves. Strange to say, it always bores with the grain, and never against it.

"Besides causing many a shipwreck, this busy borer of the ocean undermines and destroys stout piers wherever an opportunity is afforded.

"As it bores, it lines its shell with a limy substance, making a smooth tunnel for itself.

"It is said that this ship-worm furnished the model for the great tunnel which is built under the Thames River at Loudon.

"In Holland, the land is so low and wet that strong stakes called piles have to be driven down into the earth for the support of the buildings which rest upon them.

"But it is feared that these strong piles will yet be undermined by the destructive ship- worms."

"Are all Teredos of the same size?" asked the children.

"Of course, some are larger than others, even of the same species," said their aunt. "But the Giant Teredo produces a shell over five feet in length."

After a moment's silence, Fred asked, "Do you suppose, auntie, that animals and insects have a way of talking to one another? "

"This traveler, of whom I have been speaking," said his aunt, "concluded from his observation of the scarabees that the brute creation is endowed with the power of judging, and of exercising the will, and undoubtedly speak a language of their own.

"And, children," she added, "let us not fall below them in our endeavors to speak kindly and politely to one another; ever ready to lend a helping hand to those who may be in need; believing that it is far more human to act on the principle of 'live and let live,' like the sacred scarabee of the desert, than to tyrannize and rob one another like the cruel borer of the sea. The poet Burns tells us that

'Man's inhumanity to man

Makes countless thousands mourn.'

"And One greater than the greatest poet has said to us: 'I exhort you, little children, that ye love one another.' These words," continued Aunt Lizzie, "include not only little children, but every member of the great human family to which we all belong."

Sea-Anemonies and Corals[30]

My Dear Lisa and Connie,

I was thinking the other day of the pleasant times we passed together at the sea-shore last summer, and remembering how often, in the evening, when your playtime was over, and we were sitting in the quiet twilight, waiting for your bedtime, you used to beg for stories; and it occurred to me that, in the long and snowy winter, I might prepare some stories for next summer, and then, when you come after tea, and say, "Now, Aunt Lizzie, tell us a story," I shall have one all ready, and I need not answer, as I often used to do, that my brain was empty, and, hunt as I would, I could not find a story in any corner of it. But there is one thing you may not like about the stories I think of writing for you; I want them to be true stories, and not about little boys and girls, but about animals. Do you recollect the nets I made for you last summer, and how you used to catch in them the tiny little fishes that lived in the pool left by the sea-waves in the hollow of that large rock near our house? Now, there are many other animals living in the little pools left by the tide on the beaches and between the rocks and stones, which are both beautiful and curious, and which, if you knew a little more about them, would interest you

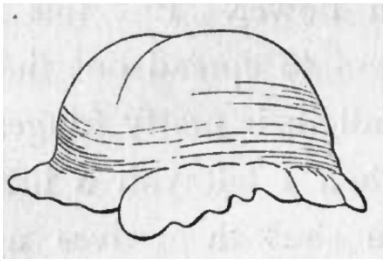
quite as much as the little fishes you liked to see swimming about in your Aquarium last summer.

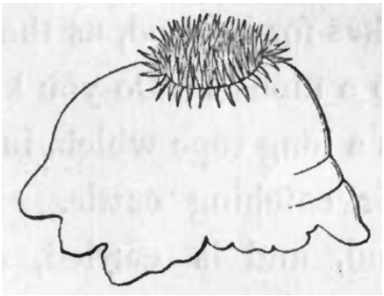
Have you ever heard of a Sea-Anemone? Don't fancy, from its name, that it looks anything like the pretty white or pink Anemones that delight you so much in the woods in spring, and yet they have been called so, because, though they are as much animals as Berty's little dog Pinky, or your pussy-cat, they yet have a look like a flower. But this is only when it pleases them to spread out their little bodies, and flaunt all their pretty fringes; and, as you will see, when I tell you a little more about it, they can shut themselves up, and look as ugly and dull as they please. In this you see, they differ very much from a flower, which cannot fold up its leaves and put them away when it likes. It is true that some flowers close at night, and open in the day, but it is not because they want to do so, but because the state of the atmosphere causes them to shut and open.

Some day next summer at Nahant, we will go at low tide in search of a Sea-Anemone, and, if we are fortunate, we shall find somewhere among the rocks near Sunken Ledge, one of these ocean flowers. It will be rather slippery on the wet sea-weed, but we shall not mind one or two tumbles, if we find what we are looking for. I dare say we shall meet with one, hiding himself away in some little dark corner of the rocks, (for they rather like the shade,) with his fringes all

drawn in, appearing like a brown soft lump, and thinking that, because he has made himself look so ugly and unattractive, nobody will disturb him.

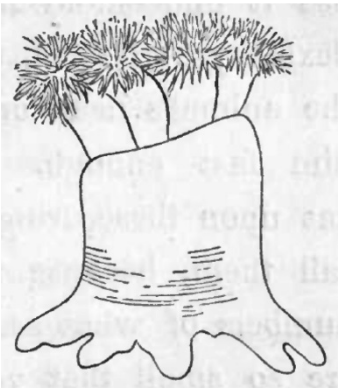
Here we have a drawing of him. But we will not be deceived by his uninviting looks. We will take him up very softly, parting him gently with our fingers from the rock, for he is very tender, and adheres closely to his resting-place, and when we have him safely at the house we will put him in a glass bowl with some sea-weed and a few stones, that he may, if possible, believe himself to be still at home in his puddle. And now we must watch him long and patiently, if we would see how he changes himself into his flower-like form. As he lies now, he is like nothing but a ball of rather dark, soft substance, flat on the side by which he was attached to the rock. But watch him, slowly, very slowly, for he has not the power of any quick motion, he begins to expand, the little soft ball rises gradually, till it stands up, as it does in the picture you see here, from its summit it puts out long and graceful feelers growing





so close that they look to you like fringes, forming a sort of wreath around the top. Very slowly and softly these beautiful fringes creep out from the inside of the little animal, where they have lain, drawn in, and packed away so snugly that you never suspected they were there, and then when they are fully spread, they move gently up and down, with a slow, waving motion.

My wood-cut gives you no idea of their beauty; you must imagine them light colored, and soft and

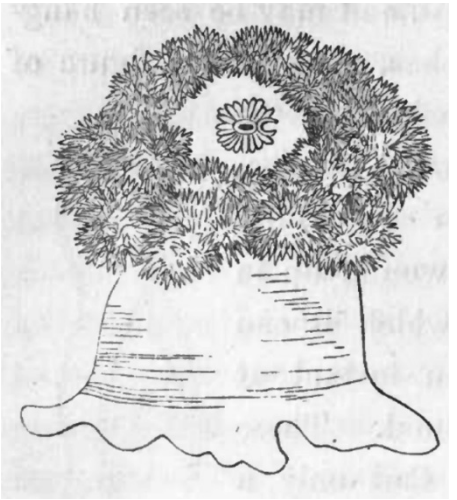


delicate as the down on a feather. So pretty as they are, and so soft, you will hardly believe that they have attached to them an instrument which is as dangerous and deadly to all the little animals which the Sea-Anemone likes for its food, as the claws of your pussy are to a mouse. Do you know what a lasso is? It is a long rope which, in some countries, is used for catching cattle. It has a noose at one end, and is carried, coiled up in the hand, till the animal comes quite near, and then it is thrown suddenly out, and the men who use it understand how to cast it with such dexterity and force, that the noose slips over the animal's head or feet, and then they have him fast

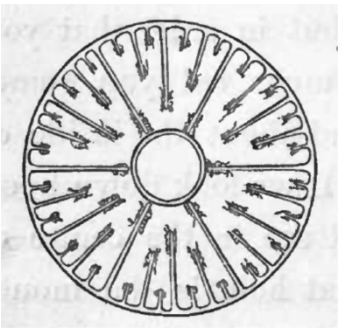
enough. Now the Sea-Anemone has upon these fringes or tentacles, as I will call them, because that is their true name, numbers of what are called lasso-cells. They are so small that you cannot see them with your naked eye, but each little cell contains a long hollow thread coiled up in a spiral within it. Now they have the power of flinging this thread suddenly out, when there is any little shrimp or shell swimming about in the water which they fancy for a meal, and in an instant he finds himself entangled in their tiny cords like a fly in a spider's web. Little shrimps swimming near them, full of activity, are suddenly struck dead at the mere contact with these poisonous whips, and may be seen hanging lifeless on the feelers. Here is the figure of a magnified lasso-cell, with the coil partly turned out. It is a sort of bag, as you see, within which the thread is wound up in a spiral, and from which it can be thrown out in an instant at the will of the animal. These cells are so small, that only a very powerful microscope will reveal them to the sight, for they are no more to be discerned by the naked eye than the separate stars forming the Milky-Way can be distinguished without the aid of the telescope. When



the prey is caught in this way, the tentacles close upon it and pass it into the mouth; but in order that you may understand this, I must tell you something about the



mouth, and about the inside of our little Sea-Anemone. If we look down upon him from above, we shall see in the center of the fringes a hole, and that hole is the mouth which opens into a kind of sac that hangs down below it, inside the animal, and is its stomach, into which all the food passes and where it is digested. If we could make a cut across our little



friend, so as to get a glimpse of his internal arrangement, we should see this sac which makes a cavity in the middle of the body, and we should find that the rest of the body is divided by a number of partitions, running from top to bottom, and radiating from this central sac to the outside; so that looked at from above they run from the middle to the

edge like the spokes of a wheel, but they are continued from the summit to the base, thus dividing the animal by many partitions. Now, in order that you may understand how he his dinner, when he has caught and killed it, you must know that the sac or stomach in the middle of the body opens by an aperture in the bottom into the main body. The sea-water, which enters freely through the mouth with the food, softens it, helps reduce it to a kind of pulp, and it passes from the stomach into the body, circulating through all the partitions and passing from them into the tentacles; for every one of the tentacles connects with one of the spaces divided off by the partitions. Thus you see the whole body is nourished by whatever enters at the mouth. On the inner side of the partitions, little eggs are formed, which hang there till they are ready to be hatched, and then they pass out through the mouth, into the water, where they grow into Sea-Anemones like the one of which we have been talking.

I hope that the Sea-Anemone has interested you so much, that you will like to hear about some other animals of the same kind, which live also in the sea, and of which I have a strange and wonderful story to tell you, tiny little creatures, some of them no larger than a pin's head, yet they have built up large islands, and even considerable portions both of Europe and America. These are the coral animals; and though they do not live on our northern coasts, so that you cannot therefore see them alive, and are much smaller

than our Sea-Anemone, yet, as many of them are constructed on the same plan. What I have told you about his tentacles, his partitions, his internal sac, his lasso-cells, may help you to understand what I have to tell you of the coral animals. They do not live singly, like our Sea-Anemone, whom we found all alone in his puddle, but they grow together in clusters. Such clusters, however, start from a single little animal; it is born free, a little pear-shaped, soft animal, white and jelly-like, swimming about in the water. It moves with great rapidity, because it is covered all over with a little vibrating fringe, and that fringe moves with incredible quickness, and keeps the little Coral in constant rapid motion. But when it finds a suitable place at such a depth in the sea as it likes, and where the water is clear and bright, for it does not fancy muddy or sandy water, it attaches itself either to the rocks or the sea-bottom by one end, which flattens and adheres to the ground, while the other spreads; and the whole has a cup-shaped form a little depressed at the top. That depression marks where the mouth is presently to be, and before long it becomes a hole in the center, and all around it feelers or tentacles begin to appear. It looks very much like our Sea-Anemone, though it has not so many feelers; but then the Sea-Anemone, when young, has not more. It is only in its

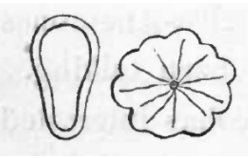


Figure 9 -- The young, just hatched, of Porites, -- a Coral, found on the Reef of Florida, (left) seen from the side; (right) from above.

full-grown condition that it has numerous tentacles. The sides of the coral animal begin to thicken, the sac which is the stomach forms in the center, and also the partitions dividing the rest of the body. If we could make a cut across the little Coral, we should see that he is formed inside like our Sea-Anemone; we should see the cavity in the center formed by the stomach, and the partitions spreading from it like the spokes of a wheel. But I must explain to you a very important difference between them and the Anemone, which will help you to understand the long story I have to tell you about these wonderful little animals, who play such an important part in the history of the world.

We have seen that our little Sea-Anemone is soft throughout, he is just like a mass of jelly, and though the parts of his body are quite distinct, yet his partitions, his tentacles, the walls of his body, and the sac serving him as a stomach, are all quite soft, and he can change his form, contract all his parts, and roll himself up like a little ugly lump, just for the reason that the whole of his substance is pulpy and gelatinous. But with the Coral it is quite different. It is true that when he is first born, he is, as I have described him, a little, oval, jelly-like animal, swimming about in the water; but after he has selected his resting-place, has grown larger, and his mouth, his stomach, the partitions of his body and his tentacles are formed, then begins a process which ends in giving him a very different character from that of the

Anemone. There are hard particles of lime in his substance, and these accumulate, first at the base of the body, where it is attached to the ground, so that it becomes quite firm and solid, then in all the partitions, so that they become like little solid walls, and in the sides of the body, so that they too grow quite hard; and now the whole has a solid frame, the only parts of the little creature which remain soft, being the summit, the mouth, the fringes around it, and the stomach within.

I have said that the coral animals grow in clusters, but thus far I have only described the single animal that begins the coral stock. Now I will show you how he multiplies himself, till, instead of one animal there are countless multitudes living together in one community. The adjoining figure shows you a part of such a community. When the first coral animal has undergone the changes I have described, and assumed its permanent character, it begins to spread and grow taller, and from its surface, either from the base or from the sides, grow up other animals of the same kind, remaining always attached to the first, and increasing till they are crowded together in hundreds and thousands and millions on one foundation. This way of growing is called

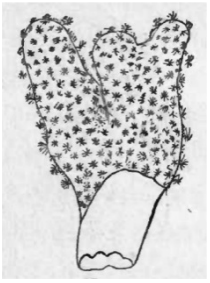
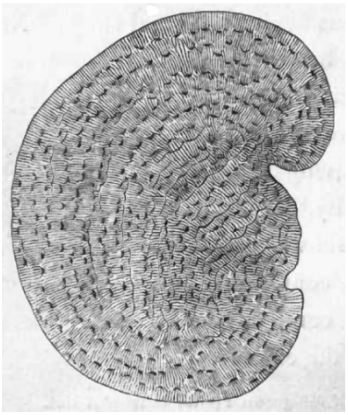
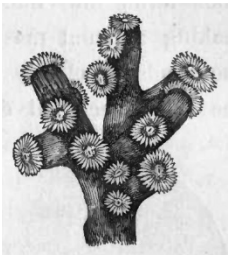


Figure 10 -- A branch of full-grown Porites in natural size.

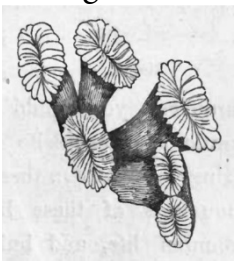
budding, because it resembles a little the branching of a plant, but each bud is nothing but a new animal, remaining connected with the preceding as the branches of a tree with the stem.

The various kinds of Corals grow in different ways and vary greatly in size, some being no larger than a pin's head. Some bud from the base, as in the figure which you see here others from the side, as in our little picture below; in others, each animal widens gradually toward the summit as it grows, assuming thus a sort of trumpet shape, then

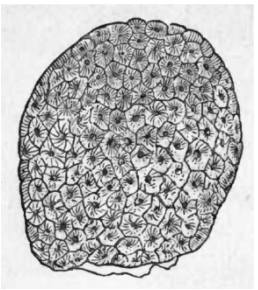




divides so that where there was but one mouth, there are now two, as you see in the picture below, and these again may spread and divide in the same manner, so that the cluster goes on increasing in that way, one animal dividing into two or more, till they become a cluster. In another kind, the individuals do not divide and widen as they grow higher, and cannot therefore, by spreading, fill up the spaces between, which enlarge with their



increasing height; but in those spaces the new buds form, thus filling all the intervals, and making a coral mass covered all over with thousands of closely packed pits, which mark the spots occupied each by a little animal. Others grow in lighter branches, so like



plants that I am sure, if you looked into water where numbers of these singular animals were growing in the sea, waving their branches to and fro, like an ocean shrubbery, you would suppose they were gigantic but exquisite seaweeds, rather than living beings. On these branches are crowded thousands of these little creatures, living a common life, and building up coral groves under the water. Here you have a little picture of one commonly called the Sea-



Fan, which, when living, is particularly beautiful, on account of its ornamented tentacles. They not only form a fringe around the summit of the animal, but they are themselves fringed, or lobed, along their edges. The wood-cut represents only a small branch, but they grow to the height of several feet. Among the branching Corals, there is one kind, the so-called Finger Coral, which differs from the others in having

a somewhat larger animal on the top of each branch, with smaller ones all around the stem and branches. They represent, as it were, the patriarchal heads of the family, occupying the seat of honor at the summit of every branch, while the little ones grow around and below them.

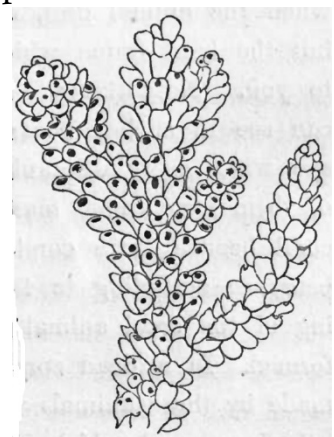


Figure 11-- Finger Coral

I dare say you have seen specimens of Corals, because they are so beautiful that all who travel to the tropical oceans where they grow, to the coast of Florida, to the Pacific, and the East Indies, bring home specimens of them. But when we see them at home, as they are brought from foreign lands, we must remember that all the soft and moving parts, the tentacles or fringes that wave so gracefully in the water, are gone; for they decay when the animal dies, and nothing remains but the hard frame which I have described to you. Notwithstanding this, however, we can see in such a mass of dead Coral the spot where every little animal has lived. Some of them form round masses which are called coral heads. Such coral heads differ in appearance according to the method of growing of the coral animal by which they were formed. In a dead coral mass, for instance, made by those animals which

have the trumpet shape, and which increase by spreading and dividing, the marks that are left are more uneven, forming undulating lines on the surface. In that which does not widen as it grows, but in which the spaces are filled by the budding of new animals, the holes are quite regular, and have a star-shaped figure produced by the partitions arranged like the spokes of a wheel, as I have described them to you in the single little Coral and in the Sea-Anemone. All Corals of the kinds I speak of are formed in this way, whether they grow in branches or in round masses, whether they bud from the base or from the side, or increase by division; the structure of every separate little animal is the one that I have tried to explain to you.

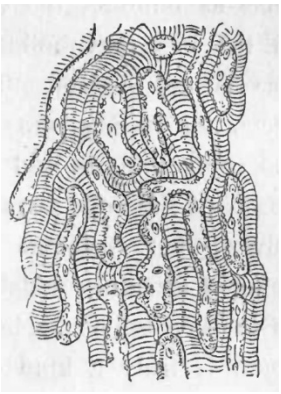


Figure 12 - Meandrina

Persons who have not had an opportunity of watching the Corals when alive, and have only seen the dry coral heads with their regular pits throughout, often talk of coral insects as building the Corals, comparing them to the bee that builds its honeycomb. But this is not correct. There are no coral insects, for insects are entirely different from the coral animals, and the hard Coral is composed of the solid frame of the animals themselves, their skeletons as it were,

instead of being a structure which they build to live in, as the bee builds its honeycomb. The honeycomb is truly a kind of house the bee constructs for itself, to live in and to lay its eggs in, and to fly out of and into at will. But the cells in a coral head are a part of the coral animals themselves, and though they can withdraw their soft parts into their solid frame, or expand them at will, they cannot be separated from it, for it is as necessary to their life, and as much a part of it, as our bones are a part of our bodies.

There is one thing I have not told you about these animals, and that you will think very odd in their way of living. They are all connected with each other, the body of each one opening at its base into that of the next, so that what enters in at the mouth of one, after circulating in his body, passes into the next, and thus you see when one eats his dinner, it nourishes not only himself, but all his neighbors too.

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Plants and Trees

Buttercups[31]

"Down in a field, one day in June,
The flowers all bloomed together,
Save one who tried to hide herself,
And drooped, that pleasant weather.

"A robin that had flown too high,
And felt a little lazy.
Was resting near a buttercup
Who wished she were a daisy.

"For daisies grew so straight and tall!
She always had a passion
For wearing frills around her neck
In just the daisy's fashion.

"And buttercups must always be
The same old tiresome color;
While daisies dress in gold and white,
Although their gold is duller.

" 'Dear Robin,' said the sad young flower,
'Perhaps you'd not mind trying
To find a nice white frill for me,
Some day when you are flying.'

" 'You silly thing,' the robin said,
'I think you must be crazy!
I'd rather be my honest self
Than any made-up daisy.

"'You're nicer in your own bright gown;
The little children love you:
Be the best buttercup you can,
And think no flower above you.

" 'Though swallows leave us out of sight,
We'd better keep our places;
Perhaps the world would all go wrong
With one too many daisies.

"'Look bravely up into the sky,
And be content with knowing
That God wished for a buttercup
Just here, where you are growing.'"

Why Plants Travel[32]

Plants are great travelers; they often wander far and wide. Sometimes they even cross the ocean and take up their abode in a new land.

The oxeye daisy, our common meadow buttercup, and the little Canada thistle, now so abundant everywhere, are not native Americans, but came here from Europe.

Very likely they sailed in the ships with the early settlers and took possession of the New World with them. They are so much at home now that most people think they always grew here. But they did not, and when the Pilgrim Fathers looked over their new home the fields were not white with daisies nor yellow with buttercups. No doubt the Pilgrim Fathers were glad of this, for daisies and buttercups often cover the fields and spoil the hay, and while "daisies in the meadow" seem very lovely to the city people who go to the country for the summer, daisies in the hay are another matter, and the farmers do not think them lovely at all.

It is not the grown-up plants that travel, as a rule, though some of them do. For you must know the plant world is a topsy-turvy kind of place where the

parents stand still at home and the children wander about.

Of course the children are the seeds, and they are free, but when they once settle down and begin to grow their wandering days are over.

Plants with roots are great home-bodies; nothing short of actual violence can make them move from the spot they have chosen. Frequently it happens that they die if moved.

Not so with the seeds, however.

They wander about, and their parents often take great pains to send them out into the world.

For the children of the plants are very apt to die if they remain at home too long. They need to find a place in which to settle down and grow, and it is often better for them to do this at a distance from their parents.

Plants eat what is in the soil, and each kind of plant needs some particular earth food. When plants of one kind are crowded too closely in a place the earth is often impoverished, and the plant might die out if it were not able to find a fresh growing place. Then, again, if the seeds always fell close to the parent plant, the earth would soon become too crowded to support more than a very few new plants.

So for these and other reasons it is best for the seeds to go while they are able and find a place for themselves.

Nearly all seeds are provided with some way of moving about, and while some of them go very short distances others go very long ones.

They travel for their profit, and why may we not say for their pleasure? For if a plant is able to feel and enjoy at all, — and I for one believe it is, — then the dandelion seeds must feel very joyous sailing before the wind in the early summer, and later the thistledown and the milkweed seeds, scudding before the breeze.

Dandelions[33]

Everybody is well acquainted with the dandelion, but not everybody knows that it was brought to this country from Europe. It is not probable that a dandelion seed could come on the wings of the wind three thousand miles across the ocean, nor is it probable that people would bring it on purpose.

Very likely dandelion seeds were accidentally mixed in with the grass and clover seeds the settlers brought from their homes in the Old World.

Before the coming of the white man the Indian did not see the roadsides yellow with dandelions, nor did he see dandelions at all, excepting a kind that grows sparingly way up north and another that grows in the Rocky Mountains.

The European dandelions liked the New World and when they had the chance spread very fast, so that now they are everywhere — at least in the East.

The reason they were able to spread so is that the dandelion seeds were able to fly.

If they had not flown away but had dropped down close to the parent plant and grown there, they would not have been allowed to spread much; for people do

not like dandelions in their fields and lawns, and try hard to root them out.

This would be easy if the dandelions kept together in patches. But they seem to say "catch me if you can"


White-headed dandelions.

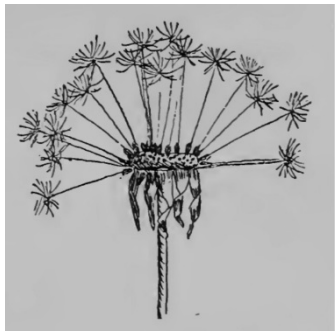
as they fly on the wings of the wind, dropping down here, there, and everywhere, striking root and merrily growing.

The parent dandelion takes very good care of its seed children, and plans for their future success by giving each one a little plume by which it can be blown about by the wind.

Everybody knows the pretty, fluffy, white-headed dandelions that come after the yellow flowers.

Children often blow on them "to see what time it is." If all the seeds fly away but one, they say it is one

o'clock; if two remain, they say it is two o'clock, and so on.



They also blow on them to see if "mother wants me," as every child knows.

Each little silky part that flies away is a seed case and its plume.

If you look carefully at the part of the dandelion that flies about, you will see the little brown seed case at one end, shaped something like a tiny cucumber, and with little teeth near its top.

Out of its top grows a silky white stalk, and at the end of this is a tuft of soft little hairs by means of which the seed case can float in the air.



Each dandelion seed case contains one little seed, but the case fits the seed so closely that most people speak of the whole thing — seed case and seed together — as the seed. The proper name for such a seed case and its seed is akene. Not all akenes have plumes.

The top of the dandelion stem is a flat cushion, and the little akenes, when the seeds are ripe, stand on it, pointing out in different directions so there may be room for every one with its spread-out plume.

The plumes do not open out until the seed is ready to be blown away, and the akenes do not stand pointing out in all directions until the time to fly has come. Before that they are all packed closely together.



Because the little akene is so light and feathery the breeze bears it along, sometimes for quite a distance, but at last it drops down to the earth or else is blown among the grasses or weeds or stones and lodges there, and when the right time comes the seed that is in the little brown seed case sprouts.

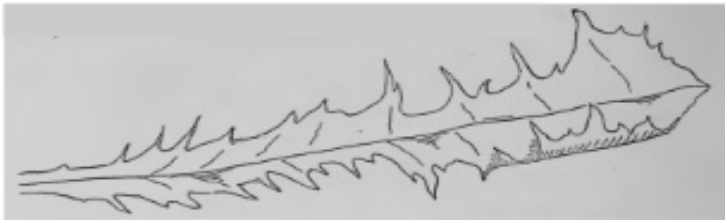


Sometimes the air seems to be full of dandelion akenes floating about. Although the dandelion is so bright and pretty, people do not like it in their lawns.

Excepting when in bloom or when it is "white-headed," it is not as pretty as grass. It does not make a beautiful velvety carpet to the earth, but its leaves look ragged and uneven and spoil the appearance of the lawn.

It is from its leaves that the dandelion gets its name, for "dandelion" means "tooth of a lion"; and if you look at a well-grown dandelion leaf you will understand why it came to have such a fierce name.

Dandelions are very fond of growing in lawns. They like to be taken care of, and they seem to like to have their heads cut off. Anyway the lawn mower does not trouble them in the least.



Their leaves grow close to the ground, in the shape of a rosette, and when the lawn mower passes over, only the large outer leaves are harmed; the young ones towards the center of the rosette remain unhurt and have more light and air and space to grow in; so our dandelion flourishes in spite of its pruning.

When a dandelion once gets its roots started it does not make so very much difference if it has its flowers cut off, for it does not die when winter comes. Only its leaves die. Its root continues alive in the earth, and in the spring wakes up and puts out new leaves.

So cutting off the flowers does not destroy the dandelion, it merely prevents seeds from forming, and more dandelions from starting.

Dandelion roots kill the grass by pushing it aside and taking the earth-food for themselves.

So if dandelions get started in a lawn they will soon kill out the grass, and then there will be a dandelion lawn instead of a grass lawn!

A dandelion lawn is very beautiful for a little while in the early summer. Sometimes it looks like a carpet

of gold, the yellow flowers are so thick and fine. But when they are done blossoming the lawn is a sorry looking sight.

Dandelions do not trouble the hay fields, for where the grass is allowed to grow tall it soon smothers them.

Boys are often hired to dig dandelion roots out of lawns, and near large cities poor women may often be seen digging them out for the sake of the young leaves which, when they first come up in the spring, make very good "greens." These people sell them or eat them instead of spinach. Tender young dandelion leaves are very good indeed, and some people like them better than spinach.

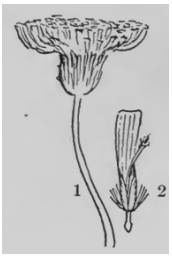


Figure 13- 1. A cluster of flowers.

2. One flower

Dandelion plants have a wise way of protecting their seed children until the time for flight.

The flower buds come out of the center of the leaf rosette, close to the ground. They have very short steins and seem to sit right on the rosette.

There are a great many flowers in one dandelion head. Each little yellow part of the dandelion flower head is a separate blossom, and each separate blossom has one seed case with a seed inside growing to the bottom of it.

All of these blossoms are shut up at first in a case of green, leaf-like parts, and form the bud.

As the bud grows older its stem lengthens a little, — unless it is on a lawn. Then it does not lengthen; it seems to know the lawn mower will come along and take off its head if it grows taller, so it stays close to the ground.



Towards night the dandelion shuts up again; the tiny yellow flowers press close together, and the outer covering of green bracts, as they are called, closes up, too, and shuts them in all snug and safe.

When the dandelion has once closed it does not open again. But its stem, which was very short, begins to lengthen.

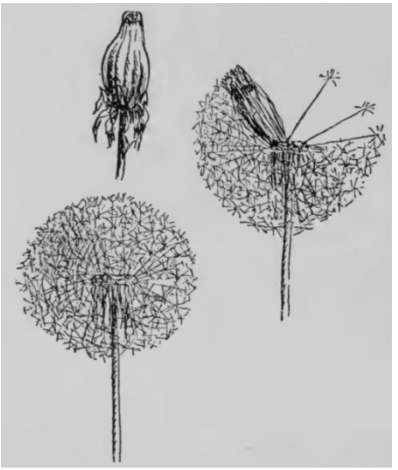
It is a hollow stem, as you know, and has a bitter, milky juice.

Longer and longer grows the stem with the closed-up flower cluster at its top. But this wise stem does not stand up. Oh, no, indeed! it lies down or leans over, concealed by the grass and weeds, unless it grows on a lawn. Then the wise stem does not lengthen much; it is afraid of that lawn mower. If the dandelion is growing among tall grass, the stem will grow very long indeed; if among short grass it will not grow so long.

By this time you can guess why.

When the seeds are ripe and the silky plumes all nicely formed that stem stands up!

It stands straight up and looks over the tops of the grasses. Then the green bracts on the outside turn back, and the silky tufts spread out and pull themselves free from the remains of the tiny flowers which have withered and are no longer yellow. They do not fall off when the flower first closes, but make a little cap to protect the growing akenes, and when these get ready to open out the cap is pushed off by them.



The hollow stem stands up, and its lovely silky head of plumed akenes shines in the sunlight.

There is nothing much prettier in the plant world than this head of fairy dandelion akenes all ready to fly away.

They stand and shine until a breeze comes along that is strong enough to dislodge them, then all in a moment they are off sailing through the air; opening out and pushing off the cap.

The parent plant is not sorry to have them go, for this is what it has worked so hard to accomplish; and as they float away, if it thinks at all, it no doubt hopes that each little shining wanderer will alight at last in a

beautiful home of its own with plenty of space and sunlight and food for its growth.

If there is not breeze enough to carry away the dandelion akenes, when night approaches or a storm gathers the careful parent plant does not allow these silky treasures to become soaked and spoiled by moisture.

Each little plume shuts up again! The silky tufts no longer spread out, and the green bracts, too, turn up and cover them safely as before. They go to sleep, hoping, no doubt, for better luck next day.

There is no better fun than to watch the dandelions do these things.

When children blow the heads of dandelions away, that is just what the dandelions want, for it sets all the akenes flying about in the air above the earth.

The main thing for a dandelion seed is to get started. If it can get up in the air free from the weeds and grasses, it will be sure to take quite a journey and will doubtless settle in a new home.

The bitter milky juice of the dandelion very likely protects it from being eaten by various plant-eating creatures.

This juice is familiar to country children who pick the long stems of the dandelions, split them, and "curl" the parts in their mouths.

These pretty stems make very long and fine curls, as every little country girl knows.

Only a Bean[34]

The Botany class gathered around the table, and ten pairs of bright eyes gazed in disappointment upon one dirty bean.

The children had just commenced the study of flowers; they had learned about petals, and stamens, and pistils, and to illustrate these had been shown bright pictures of roses and tulips; and, of course, they expected something colorful and striking every time. No wonder, then, that the speckled little thing on the table seemed most unattractive.

"We will talk about the bean today," said Miss Lansing, as she took her seat; "it is soiled, for it has been for several days in a pot of earth, because I wished it to swell before showing it to you."

"It does not look as if it would be very interesting," said Florence, who, being the youngest member of the class, always felt privileged to express her candid opinion.

"Wait a little," replied Miss Lansing. "I think that it will interest you more than anything that we have yet talked about." The class looked rather incredulous, but Miss Lansing proceeded. "Do you know that safely tucked away in this bean is a tiny plantlet, all ready to push its way out and begin to grow?

"It consists of two little white leaves on the end of a miniature stem; and when it bursts from the bean and sends down a root to hold it to the ground, it will be almost strong enough to care for itself.

"The bean contains sufficient nourishment, however, to feed the plantlet until the roots take food from the earth, and the leaves reach up into the air."

All the children now were gazing intently at the bean, as if they thought it would suddenly spring open by fairy magic. The "magic," however, proved to be Miss Lansing's penknife; and ten heads were bent very closely together as she carefully cut the bean and revealed the plantlet. It was all there, just as she had said, — the leaves folded together on the end of a stout little stem.

"Does every bean carry a miniature plant inside?" exclaimed Elsie.

"Yes," replied Miss Lansing, "and every other seed that grows holds one as well. If I had left it longer in the pot, it would have burst from its prison and commenced to strike root; but it would have clung closely to the bean, to be fed by it until it was able to seek its own food from air and earth. After that, the bean having done its work, and its starchy nourishment being all gone, its empty and useless coats would fall away."

"I suppose that the leaves are very white and weak when they first appear above the ground," said Harry.

"Yes," replied Miss Lansing, "like children who live in cellars and crowded tenements, and whose little pale faces often show the need of fresh air and sunshine.

"We shall now examine our plantlet through the microscope; and in doing this, we may see how perfect it is, even to the veining." And then another pleasure awaited the class; for how many delights the microscope always reveals to the young scientist.

When the children had taken their seats, Florence exclaimed enthusiastically, "This is, after all, quite the nicest lesson we have had, it has been so full of surprises." And her feeling was echoed by the other children.

"Now," added Miss Lansing, "if we had more time, we might continue our story of the bean until it grew and blossomed into papilionaceous flowers, with their banners, wings, and keels, and later ripened into pods full of beans. Examine some seeds yourselves," she added; "seek the plantlet in a peanut, almond, or even in the tiny apple-seed, and you will find that it is always perfectly formed. Remember, too, that some of the things that we most admire in nature have as humble a covering as our plain little bean. Its story reminds me of a bit of poetry, which I will repeat to you in closing: —

"A little flower so lowly grew,
So lonely was it left,
That heaven looked like an eye of blue,
Down in its rocky cleft.

"What could the little flower do,
In such a darksome place,
But try to reach that eye of blue.
And climb to kiss heaven's face!

"And there's no life so lone and low
But strength may still be given
From narrowest lot on earth to grow
The straighter up to heaven."

In the Orchard[35]

Is there a nicer place in which to play than an old apple orchard? Once under those favorite trees whose branches sweep the ground, you are quite shut off from the great, troublesome, outside world. And how happy and safe you feel in that green world of your own! — a world just made for children, a world of grass and leaves and birds and flowers, where lessons and grown-up people alike have no part.

In the lightly swinging branches you find prancing horses, and on many a mad ride they carry you. The larger ones are steep paths leading up mountain sides. Great chasms yawn beneath you. Here only the daring, the cool-headed, may hope to be successful and reach the highest points without danger to their bones.

Out here the girls bring their dolls, and play house. Nothing can make a more interesting or a more surprising house than an apple tree, its rooms are so many and of such curious shapes. Then, too, the seats in these rooms are far more comfortable than the chairs used by ordinary people in everyday houses. The doings of the Robin family are overlooked by its windows. One is amazed to see how many fat worms Mother Robin manages to pop down the yawning

baby throats, and wonders how baby robins ever live to grow up.

From these windows you watch the first flying lesson; and you laugh to see the little cowards cling to the branch close by, paying little heed to their parents' noisy indignation. All the same, you wish that you too might suddenly grow a pair of wings, and join the little class, and learn to do the one thing that seems even more delightful than tree climbing.

That you children long to be out of the schoolroom this minute, out in the orchard so full of possibilities, I do not wonder a bit. But as the big people have decided that from now on for some months you must spend much of your time with lesson books, I have a plan to propose.

What do you say to trying to bring something of the outdoor places that we love into the schoolroom, which we do not love as much as we should if lessons were always taught in the right way?

II

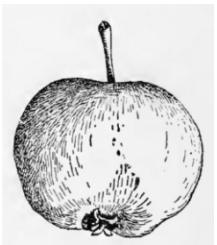
Now let us pretend — and even grown-up people, who can do difficult sums, and answer questions in history and geography better than children, cannot "pretend" one half so well — now let us pretend that we are about to spend the morning in the orchard.

Here we go, out of the schoolroom into the air and sunshine, along the road, up the hill, till we reach the stone wall beyond which lies our orchard.

Ah! it is good to get into the cool of the dear, friendly trees. And just now, more than ever, they seem friendly to you boys and girls; for they are heavy with apples, — beautiful red and golden apples, that tempt you to clamber up into the green sea of leaves above.

Now let us "pretend" that you have had your fill, and are ready to gather quietly about me on the long grass. But first, please, one of you bring me an apple. Let it be well-grown and rounded, with a rosy, sunburned cheek; for, as we are to spend some little time with this apple, the more perfect it is in shape, the richer in color, the sounder all the way through, the better. It is good to be as much as possible with things that are beautiful and wholesome and hearty, even though they are only apples.

Here we have a fine specimen. What do you know, any of you, about this apple? Perhaps this seems a strange question. But when we see something that is fine and beautiful, is it strange that we wish to know its history? If I see a man or a woman who seems to me all that a man or woman should be; if he or she is fine-looking and fine-acting, straight and strong, and



beautiful and kind, and brave and generous, — I ask, "Who is he? Where does she come from? What have they done? "

Of course, a fine apple is not so interesting as a fine man or woman, or as a fine boy or girl. Still there is much of interest to learn even about an apple.

None of you seems anxious to tell the apple's story, so I shall have to start you with some questions.

Do you remember playing in this same orchard last spring?

Yes, you have not forgotten those Saturdays in May. The trees were all pink and white with apple blossoms. The air was sweet with fragrance, and full of the voices of birds, and of bees that were bustling about from flower to flower. No, indeed! you have not forgotten those happy mornings. What is more, you never will. They are among the things that will stay by you, and be a rest and help to you all your lives. I wish there were no child living that might not carry with him always the memory of May days in an apple orchard.

How has it come about, do you suppose, that these trees which in May were covered with flowers are now heavy with apples?

Can any of you children answer this riddle? How have these great apples managed to take the place of the delicate apple blossoms?

There are some children who keep their eyes open, and really see what is going on about them, instead of acting as if they were quite blind; and perhaps some such child will say, "Oh, yes! I know how it happened. I have seen it all," and will be able to tell the whole story at once.

I should like very much to meet that boy or girl, and I should like to take a country walk with him or her; for there are so few children, or grown people either, who use both their eyes to see with, and the brain which lies back of their eyes to think and question with, that it is a rare treat to meet and to go about with one of them.

But I should be almost as much pleased to meet the child who says, "Well, I know that first the blossoms come. Early in May they make the orchard so nice to play in. But in a few days they begin to fall. Their little white leaves come dropping down like snowflakes; and soon after, if you climb out along the branches and look close, where there was a blossom before, you find now a little green thing something like a knob. This tiny knob keeps growing bigger and bigger, and then you see that it is a baby apple. As the weeks go by, the little apple grows into a big one; and at last the green begins to fade away, and the red and yellow to come. One day you find the great grown apple all ripe, and ready to eat.



But I never could see just what made it come like that, such a big, heavy apple from such a little flower, and I always wondered about it."

Now, if we wonder about the things we see, we are on the right road. The child who first "sees" what is happening around him, and then "wonders" and asks questions, is sure to be good company to other people and to himself. (And as one spends more time with himself than with anyone else, he is lucky if he finds himself a pleasant companion.) Such a child has not lost the use of his eyes, as so many of us seem to have done. And when the little brain is full of questions, it bids fair to become a big brain, which may answer some day the questions the world is asking.

Before I tell you just how the big apple managed to take the place of the pretty, delicate flower, let us take a good look at this flower.

But in September apple flowers are not to be had for the asking. Not one is to be found on all these trees. So just now we must use the picture instead. And when May comes, your teacher will bring you a branch bearing the beautiful blossoms; or, better still, perhaps she will take you out into the orchard itself, and you can go over this chapter again with the lovely living flowers before you.

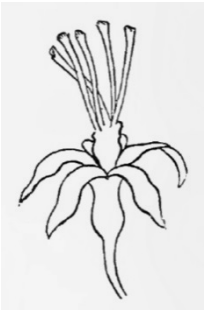


Now, as you look at this picture of the apple flower, you see a circle made up of five pretty leaves. Sometimes these are white; again they are pink. And in the center what do you see? Why, there you see a quantity of odd-looking little things whose names you do not know. They look somewhat like small, rather crooked pins; for on the tips of most of them are objects which remind you of the head of a pin.

If you were looking at a real flower, you would see that these pin heads were little boxes filled with a yellow dust which comes off upon one's fingers; and so for the present we will call them "dust boxes."

But besides these pins — later we shall learn their real names — besides these pins with dust boxes, we find some others which are without any such boxes. The shape of these reminds us a little of the pegs or pins we use in the game of tenpins. If we looked at them very closely, we should see that there were five of them, but that these five were joined below into one piece.

Now suppose we take the apple blossom and pull off all its pretty white flower leaves, and all the pins with dust boxes, what will be left?



This picture shows you just what is left. You see what looks like a little cup or vase. The upper part of this is cut into five pieces, which are rolled back. In the picture one of these pieces is almost out of sight. In the real blossom these pieces look like little green leaves. And set into this cup is the lower, united part of those pins which have no dust boxes on top.

I fancy that you are better acquainted with the apple blossom than ever before, never mind how many mornings you may have spent in the sweet-smelling, pink and white orchard. You know just what goes to make up each separate flower, for all the many hundreds of blossoms are made on the one plan.

And only now are you ready to hear what happened to make the apple take the place of the blossom.

The Story of the Bee[36]

This is what happened. And it is a true story.

One morning last May a bee set out among the flowers on a honey hunt.

Perhaps it would be more true to say that the bee set out to hunt for the sweet stuff of which honey is made; for while this sweet stuff is still in the flower cup it is not honey, any more than the wheat growing in the field is bread. The wheat becomes bread later, after it has been cut and gathered and threshed and ground, and brought into the kitchen and there changed into bread; and the sweet stuff becomes honey only after the bees have carried it home and worked it.

As the bee left home this particular morning, it made up its mind that it would devote itself to the apple blossoms; for did you know that when a bee goes flower visiting, usually it gives all its attention to one kind of flower till it has finished that special round of visits?

So off the bee flew; and in a few moments it saw hundreds of little pink and white handkerchiefs waving at it from the apple orchard.

What do you suppose these were, these pretty little handkerchiefs? They were the flower leaves of the apple blossoms. I call them handkerchiefs, because, just as boys and girls sometimes wave their handkerchiefs when they wish to signal other boys and girls, so the apple tree uses its pretty flower leaves to attract the attention of the bee, and persuade it to visit the flowers. Of course, really, they are not handkerchiefs at all. They would hardly be large enough for any but fairy noses, would they?

When the bee saw so many bright handkerchiefs waving it welcome, along it hurried; for it knew this was a signal that material for honey making was at hand. Another minute, and it had settled upon a freshly opened flower, and was eagerly stealing the precious sweet.

You children know, that, when you are given permission to go to the closet for a piece of candy or cake, you are not apt to set about it very gently. You are in too much of a hurry for that. Often you come very near knocking everything over, in your haste to get hold of what you want.

And bees are quite as greedy as any boy or girl could be. So our friend dived right into the pretty flower, brushing rudely against the little dust boxes. These, being full to overflowing with golden dust, spilled their contents, and powdered the bee quite yellow.

Having made sure that nothing more was to be found just there, off flew the dusty bee to the next blossom. Into this it pushed its way, and in so doing struck those pins which have no dust boxes; and upon their broad, flat tips fell some of the yellow dust grains with which its body was powdered.

Now there began to happen a strange thing.

But before I tell you more, I must stop one moment to remind you that these pins without dust boxes are joined below into one piece, and that this piece is set deep into the green cup which holds the rest of the flower (see Fig. 4); and I must tell you, that, if you should cut open this cup, you would find a number of little round objects looking like tiny green eggs.

The strange thing that began to happen was this: Soon after the yellow dust from the bee fell upon the flat tips of the pins without dust boxes, the little green objects deep within the green cup became full of life, and began to get larger. And not only this: the green cup also seemed to feel this new life; for it too grew bigger and bigger, and juicier and juicier, until it became the fine juicy apple we have before us this morning.

So now you understand a little of what happened to make the great apple take the place of the delicate blossom.

The Apple's Treasures[37]

If we lift our apple by its stem, it hangs in the same position as when growing on the tree. But the blossom whose place in the world is taken by this apple held its little head proudly in the air. So let us put the apple in the same position, and see what is left of the flower from which it has come.

We see the apple stem, which last May was the flower stem. This has grown thick and strong enough to hold the apple fast to the tree till it ripens and is ready to drop.

The upper part of the stem you cannot see, because the apple has swelled downwards all about it, or upwards we should say, if it were still on the tree.

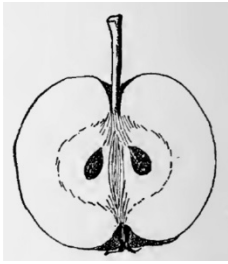
On the top of the apple, in a little hollow, we see some crumpled things which look like tiny withered leaves.

You remember that when the bee left the yellow dust in the apple blossom, the green cup began to grow big and juicy, and to turn into the apple. And these little crumpled things are all that is left of the five green leaves into which the upper part of the cup was divided. These little leaves have been out in all kinds of weather for many weeks, so no wonder they look rather mussy and forlorn.

It is hard to realize that from the center of this now crumpled bunch grew the pretty apple blossom. Now where are those tiny round things that were packed away inside the green cup?



Well, as that cup is now this apple, the chances are that they are still hidden safely away within it. So let us take a knife and cut the apple open. What do you find in its very heart? If you cut it through crosswise, you find five brown seeds packed as neatly as jewels in their case; and if you cut it through lengthwise, you discover only two or three seeds.



Probably I need not say to you that these seeds were once the little round things hidden within the green cup.

Someday I will tell you a great deal more about the wonderful golden dust which turns flowers into apples as easily as Cinderella's fairy godmother turned rats into ponies, and pumpkins into coaches.

But all this will come later. Just now I want to talk about something else.

What a Plant Lives For[38]

When you go for a walk in the country, what do you see all about you?

"Cows and horses, and chickens and birds, and trees and flowers," answers some child.

Yes, all of these things you see. But of the trees and plants you see even more than of the horses and cows and birds. On every side are plants of one kind or another. The fields are full of grass plants. The woods are full of tree plants. Along the roadside are plants of many varieties.

Now, what are all these plants trying to do? "To grow," comes the answer. To grow big and strong enough to hold their own in the world. That is just what they are trying to do. Then, too, they are trying to flower. "But they don't all have flowers," objects one voice. You are right. They do not all have flowers; but you would be surprised to know how many of them do. In fact, all of them except the ferns and mosses, and a few others, some of which you would hardly recognize as plants, — all of them, with these exceptions, flower at some time in their lives.

All the trees have flowers, and all the grasses; and all those plants which get so dusty along the roadside, and which you call "weeds," — each one of these has

its own flower. This may be so small and dull-looking that you have never noticed it; and unless you look sharply, perhaps you never will. But all the same, it is a flower.

But there is one especial thing which is really the object of the plant's life. Now, who can tell me this: what is this object of a plant's life?

Do you know just what I mean by this question? I doubt it; but I will try to make it clear to you.

If I see a boy stop his play, get his hat, and start down the street, I know that he has what we call "an object in view." There is some reason for what he is doing. And if I say to him, "What is the object of your walk?" I mean, "For what are you going down the street?" And if he answers, "I am going to get a pound of tea for my mother," I know that a pound of tea is the object of his walk.

So when I ask what is the object of a plant's life, I mean why does a plant send out roots in search of food, and a stem to carry this food upward, and leaves to drink in air and sunshine? What is the object of all this?

A great many people seem to think that the object of all plants with pretty flowers must be to give pleasure. But these people quite forget that hundreds and thousands of flowers live and die far away in the lonely forest, where no human eye ever sees them; that they so lived and died hundreds and thousands of

years before there were any men and women, and boys and girls, upon the earth. And so, if they stopped long enough quietly to think about it, they would see for themselves that plants must have some other object in life than to give people pleasure.

But now let us go back to the tree from which we took this apple, and see if we can find out its special object.

"Why, apples!" some of you exclaim. "Surely the object of an apple tree is to bear apples."

That is it exactly. An apple tree lives to bear apples.

And now why is an apple such an important thing?

Why is it worth so much time and trouble? What is its use?

"It is good to eat," chime all the children in chorus.

Yes, so it is; but then, you must remember that once upon a time, apple trees, like all other plants and trees, grew in lonely places where there were no boys and girls to eat their fruit. So we must find some other answer.

Think for a moment, and then tell me what you find inside every apple.

"Apple seeds," one of you replies.

And what is the use of these apple seeds?

"Why, they make new apple trees!"

If this be so, if every apple holds some little seeds from which new apple trees may grow, does it not look

as though an apple were useful and important because it yields seeds?

And what is true of the apple tree is true of other plants and trees. The plant lives to bear fruit. The fruit is that part of the plant which holds its seeds; and it is of importance for just this reason, that it holds the seeds from which come new plants.

The World Without Plants[39]

We have just learned that the fruit is important because it holds the plant's seeds; and we know that seeds are important because from them come the new plants for another year. Let us stop here one moment, and try to think what would happen if plants should stop having seeds, if there should be no new plants.

We all, and especially those of us who are children, carry about with us a little picture gallery of our very own. In this gallery are pictures of things which our real eyes have never seen, yet which we ourselves see quite as plainly as the objects which our eyes rest upon in the outside world. Some of these pictures are very beautiful. They show us things so wonderful and delightful and interesting, that at times we forget all about the real, outside things. Indeed, these pictures often seem to us more real than anything else in the world. And once in a great while we admire them so earnestly that we are able to make them come true; that is, we turn our backs upon them, and work so hard to bring them about, that at last what was only a picture becomes a reality.

Perhaps some of you children can step into this little gallery of your own, and see a picture of the great world as it would be if there should be no new plants.

This picture would show the world some hundreds of years from now; for, although some plants live only a short time, others (and usually these are trees) live hundreds of years.

But in the picture even the last tree has died away. Upon the earth there is not one green, growing thing. The sun beats down upon the bare, brown deserts. It seems to scorch and blister the rocky mountain sides. There are no cool shadows where one can lie on a summer afternoon; no dark, ferny nooks, such as children love, down by the stream. But, after all, that does not matter much, for there are no children to search out such hidden, secret spots.

"No children! Why, what has happened to them?"

Well, if plants should stop having children (for the little young plants that come up each year are just the children of the big, grown-up plants), all other life — the life of all grown people, and of all children, and of all animals — would also come to an end.

Did you ever stop to think of this, — that your very life depended upon these plants and trees? You know that they are pretty to look at, and pleasant to play about; but I doubt if you ever realized before, that to them you owe your life.

Now let us see how this can be. What did you have this morning for breakfast?

Bread and milk? Well, of what is the bread made? Flour? Yes, and the flour is made from the seeds of the

wheat. If the wheat stopped having seeds, you would stop having bread made from wheat seeds. That is plain enough.

Then the milk, — where does that come from?

"That comes from the cows, and cows are not plants," you say.

True, cows are not plants, but what would happen to the cows if there were no plants? Do not cows live in the green meadows, where all day long they munch the grass plants? And would there be any green meadows and all-day banquets, in years to come, if the grass did not first flower, and then seed? So then, no grass, no cows, and you would be without milk as well as without bread for breakfast.

And so it is with all the rest of our food. We live on either plants or animals. If there were no plants, there would be no animals, for animals cannot live without plants.

It is something like the house that Jack built, isn't it?

"We are the children that drink the milk, that comes from the cows, that eat the grass, that grows from the seeds in the meadow."

"If there were no seeds, there would be no grass to feed the cows that give us our milk for breakfast."

And so it is everywhere. Plants give us a kind of food that we must have, and that only they can give.

They could get on well enough without animals. Indeed, for a long time they did so, many hundreds of years ago. But animals cannot live without plants.

I think you will now remember why seeds are of such great importance.

How the Apple Shields Its Young[40]

Some time ago you noticed that apple seeds were packed away within the apple as neatly as though they were precious jewels in their case.

When we see something done up very carefully, surrounded with cotton wool, laid in a beautiful box, and wrapped about with soft paper, we feel sure that the object of all this care is of value. Even the outside of such a package tells us that something precious lies within.

But what precious jewels could be laid away more carefully than these apple seeds? And what jewel case could boast a more beautiful outside than this red-cheeked apple?

Pass it around. Note its lovely color, its delicate markings, its satin-like skin. For myself, I feel sure that I never have seen a jewel case one half so beautiful.

Then cut it open and see how carefully the soft yet firm apple flesh is packed about the little seeds, keeping them safe from harm.

But perhaps you think that anything so good to eat is not of much use as a protection. It takes you boys and girls about half a minute to swallow such a jewel case as this.

But here comes the interesting part of the story.

When you learn how well able this apple is to defend from harm its precious seeds, I think you will look upon it with new respect, and will own that it is not only a beautiful jewel case, but a safe one.

All seeds need care and wrapping-up till they are ripe; for if they fall to the ground before they are well grown, they will not be able to start new plants.

You know that you can tell whether an apple is ripe by looking at its seeds, for the fruit and its seeds ripen together. When the apple seeds are dark brown, then the apple is ready to be eaten.

But if, in order to find out whether an apple was ripe, you were obliged always to examine its seeds, you might destroy many apples and waste many young seeds before you found what you wished; so, in order to protect its young, the apple must tell you when it is ready to be eaten in some other way than by its seeds.

How does it do this? Why, it puts off its green coat, and instead wears one of red or yellow; and from being hard to the touch, it becomes soft and yielding when you press it with your fingers. If not picked, then it falls upon the ground in order to show you that it is waiting for you; and when you bite into it, you find it juicy, and pleasant to the taste.

While eating such an apple as this, you can be sure that when you come to the inner part, which holds its

seeds, you will find these brown, and ripe, and quite ready to be set free from the case which has held them so carefully all summer.

But how does the apple still further protect its young till they are ready to go out into the world?

Well, stop and think what happened one day last summer when you stole into the orchard and ate a quantity of green apples, the little seeds of which were far too white and young to be sent off by themselves.

In the first place, as soon as you began to climb the tree, had you chosen to stop and listen, you could almost have heard the green skins of those apples calling out to you, "Don't eat us, we're not ripe yet!"

And when you felt them with your fingers, they were hard to the touch; and this hardness said to you, "Don't eat us, we're not ripe yet!"

But all the same, you ate them; and the sour taste which puckered up your mouth said to you, "Stop eating us, we're not ripe yet! "

But you did not pay any attention to their warnings; and, though they spared no pains, those apples were not able to save their baby seeds from being wasted by your greediness.

But there was still one thing they could do to prevent your eating many more green apples, and wasting more half-ripe seeds. They could punish you so severely for having disobeyed their warnings, that

you would not be likely very soon to do the same thing again.

And this is just what they did.

When feeling so ill and unhappy that summer night from all the unripe fruit you had been eating, perhaps you hardly realized that those apples were crying out to you, —

"You would not listen to us, and so we are punishing you by making you ill and uncomfortable. When you saw how green we were, we were begging you not to eat us till our young seeds were ripe. When you felt how hard we were, we were trying to make you understand that we were not ready for you yet. And, now that you have eaten us in spite of all that we did to save ourselves and our seeds, we are going to make you just as unhappy as we know how. Perhaps next time you will pay some heed to our warnings, and will leave us alone till we are ready to let our young ones go out into the world."

So after this when I show you an apple, and ask you what you know about it, I fancy you will have quite a story to tell, — a story that begins with one May day in the orchard, when a bee went flower visiting, and ends with the little brown seeds which you let fall upon the ground, when you had finished eating the rosy cheeks and juicy pulp of the apple seed case. And the apple's story is also the story of many other fruits.

The Sequoias of California[41]

No tale of the forest is complete without some account of the giant sequoias of California, which are among the largest and oldest trees in the world. The sequoias or big trees are relics of another age. Long, long ago these giants of the forest first began to grow. Centuries have passed, but still they live, vigorous and mighty as of old.

Many thousand years ago these aged trees grew all over the northern half of the earth. Sequoias turned to stone have been found in Greenland. Greenland then was "green" indeed, a lovely spot on the earth's surface. Now it is a frozen waste; these stone trees alone remind us of what it was like ages ago.

Today, in the twentieth century, but a few of these sequoias remain. Their home is on the western slopes of the Sierra Nevada Mountains, in California, where they grow more than a mile above the level of the sea.

These trees of wonderful age were first discovered less than a hundred years ago. In 1841 an old hunter and explorer named John Bidwell was making a trip on foot through the mountain woodlands of eastern California. One day he came upon a group of monster trees. There were at least a hundred of them standing together. He had never seen trees half so large as

these, and when he returned to his home he told his friends wonderful tales of the forest giants he had seen.

Those trees are now owned by the government of the United States. They form what is known as the Calaveras Grove. During the last few years the government has bought several groves of these big trees. But into some of the groves men had already gone and, with ax and saw, and even gunpowder, destroyed many of the noble old trees.

The sequoias are so lasting that, even when fallen, they lie on the ground for hundreds of years without a sign of decay. In California there is one tree with a tunnel cut through the center of its trunk. Stages drawn by six horses pass through the tree every day. In years past, settlers have made their homes in old sequoia trees; hollowed out, the huge stumps must have made very comfortable and fairly roomy houses in which to live.

One old fire-scarred stump has over four thousand rings on it a ring for each year of its life. And this tree was not killed by fire, but cut down many years ago. Had it been left alone, it would probably be alive today. The trees now standing are between four and five thousand years old, and no one knows how much longer they will live if unharmed by man. Some of them are nearly four hundred feet high. Many of the big trees are between thirty and forty feet thick. In

shape they look like pyramids, broad at the base and sharp-pointed at the top. The bark is cinnamon-red, and at least a foot and a half thick. The sequoias are well protected by Nature. Insects, fungus diseases, and forest fires have no effect on these giants of the forest.

The sequoias are more ancient than the Sphinx or the Pyramids of Egypt; older by fifteen hundred years than the ruins of King Solomon's temple at Jerusalem; far older than Jerusalem itself. They were already two thousand years old ere Rome, the Eternal City, was begun; they were living, growing trees fully three thousand years before the beginning of the Christian era.

Oh! not upon that mossy trunk
Let the dire axe descend,
Nor wreck its canopy of shade,
So long the red man's friend,
Nor to the cold, unpitying winds
Those bannered branches give,
Smite down the forest, if ye will
But let its monarch live!
Sigourney.

Rocks

What the Earth is Made of[42]

Did you ever wonder what the world is made of and how it came to be as it is now? There is a great deal to learn, but when you have discovered how interesting it all is I am sure you will not become discouraged.

Beneath our feet is the soil which has had such a strange history. Yonder the men are quarrying blocks of stone to make someone a house. Down by the brook you can fill your pockets with all sorts of pretty pebbles, each one of which has a different story. Upon your finger there is a ring made of gold dug out of the earth by some miner. In your homes there are dishes of silver, copper, iron and porcelain, the materials for which came from different parts of the earth.

I am sure you would like to know about these and many other things, where they came from and how they were made. There are many kinds of minerals and rocks. Each kind has a story of its own, and will be very glad to tell it if you will only ask questions. You will find these stories as interesting as those of animals, of battles, or adventures.

Nature is our first mother. She has had many hard struggles in making our world what it is now. She has

fitted up some portions of it so that they are very home-like, but others are still rough and barren.

She has been ever so long a time doing this; so long, indeed, that you could not count it in years if you spent your whole life trying.

If you look out over the fields you can see what Mother Nature has accomplished. There are green meadows, graceful trees, and bright flowers. Animals are feeding in the fields, birds are singing in the trees, and insects are humming about the flowers. How beautiful it all is!

But the earth has not always been like this. Many things have happened. The land where your home is has at different times been buried beneath the ocean. It has been shaken by earthquakes, and possibly there were fiery volcanoes nearby which threw out lava and ashes. At one time it may have been a desert where nothing could grow, and at another time it may have been covered with ice for many years. Finally, long before our grandfathers came and settled here, Mother Nature succeeded in clothing the rough earth in a beautiful dress.

In making our earth Mother Nature had many substances to work with. We call these substances elements, because we cannot separate them into anything more simple. We have now discovered about seventy of these elements, but many of them are very rare. (Note: 118 known elements as of 2013.)

From these substances Mother Nature made all the rocks and minerals. She is still at work in many places and if we learn how to look we may be able to discover what she is doing.

There was so great a quantity of some of these simple substances or elements that Mother Nature had difficulty in disposing of them. However, she managed to use the most of the common ones in making the rocks of which there are many different kinds in the crust of the earth. The more rare substances, like gold and diamonds, which we greatly prize, she did not leave where they could be found easily, but hid them away in the rocks. We have to hunt long and carefully to discover them.

Mother Nature made the most of the minerals and rocks by melting the substances of which they are composed and mixing them in various ways. Some minerals she made by dissolving their components in water. The water distributed them in various places.

Beneath our feet wherever we go are the rocks and minerals of which we are speaking. They form the hard crust of the earth. Perhaps you live where the soil is deep so that you have never seen this hard crust, but you may be sure if you should dig far enough into the earth that you would find it.

We may call the hard rocks under our feet the skeleton of the earth. The soil is a soft covering which hides this skeleton as our flesh hides our own

skeletons. The covering of soil makes the earth smooth and beautiful.

We must not forget that in most places the soil is very thin. There are many places where water has washed the soil away and left bare the rocky skeleton of the earth. If you walk far enough in any direction you are sure to come to the ocean or mountains, and in the cliffs exposed in these places you can get a good view of the rocks. You will find them also in the beds of many of the streams. If you can find no solid rocks near your home there are certainly many pebbles, and these will tell you a great deal.

Do you not think that it would be very nice to know something about this old earth, about its minerals and rocks? We can make friends of them when they have told us their stories, and be very happy in their company.

The Records of the Rocks[43]

Just at the edge of a thick forest there once lived an old man who led a sort of hermit life all alone by himself.

He was not fond of the busy town with its noisy hum of machinery, its high brick walls, and hard stone pavements. He loved far better the cool shade of the forest trees, the drowsy hum of the insects, and the fragrance of wild-wood flowers that blossomed along his way.

This man was known, all the country round, by the name of "Uncle Jake Benton."

And a true student of nature was Uncle Jake. He knew the names and habits of all the feathered warblers that gladdened his home with their songs; he was also well acquainted with insect life and could tell at a glance which would prove injurious, and which beneficial to his flower-beds and vegetable garden.

As for the animal creations, he had among them any number of pets; and his tame squirrels, rabbits, eats, and dogs all lived together in perfect harmony.

But his books — they were above everything else his most highly-prized treasures. These were neither printed on paper nor bound in cloth, and few indeed

could read without assistance the heavy tomes that comprised his library. But with a little help from him, they were the most delightful and instructive books in the world.

Now although our hermit-friend spent a great part of his time in the forest that surrounded his cabin, yet he was by no means inclined to be unsocial or morose.

On the contrary, all visitors, and especially the "little folks" as he called the children, were sure of a cordial welcome whenever they chose to stop at his cabin door.

"Come in, come right into my school-house," he would say. "I hope you have brought some new books with you, for there are plenty of vacant places on my library shelves, and I want to fill them up."

Then drawing aside a little curtain, behold, there were his stone-volumes all classified and labeled with the utmost care!

As he pointed them out, one by one, he would remark:

"My library is entirely historical, and I have arranged the books in the order in which they should be read."

First came his Archaean histories, the very oldest records in the whole collection. Taking up a piece of granite, he would say:

"In the beginning of things this rock may have been something entirely different from what it appears to be now. For, you see, these stone histories have been revised many times, a fact that 'you can learn for yourselves, if you will read them carefully.

"This rock may have been first granite, then sandstone, and now granite again. Rocks that have been thus changed from their original structure are classified as metamorphic formations from a word which signifies 'to transform'.

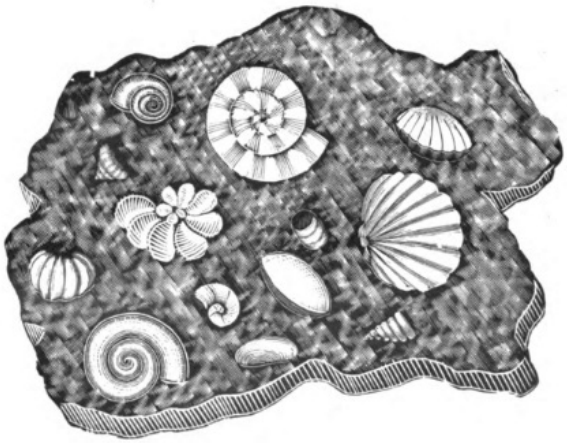
"The Archaean rocks extend over the entire globe, though they are exposed to view only in certain parts of it. Among them we find granite, some kinds of slate, limestone, gneiss and shining mica. They are often classed as crystalline rocks."

Then he would go on to explain how very "lonesome" it must have been at this period of the world's history. No trees, no flowers, no singing birds, not even the smallest insect had an existence in that far-off time.

"Here is a curious volume," he would say, exhibiting a specimen of highly polished sandstone. "It was printed by the waves of the sea. Do you not discover the ripple-marks upon its pages? I found it in a quarry many miles from the ocean; but that makes no difference, it was once washed by the waves of the restless sea.

"It belongs to the Paleozoic department of my library. The true meaning of this word is 'ancient animal,' for in the rocks of this age may be found traces of animal remains. It was a very low order of life, however, and was confined largely to the ocean.

"Queer looking creatures, having the body divided into three lobes, were very abundant in the waters of



that time. They were called trilobites, and are now extinct. There were also many forms of coral existence, mollusks, sea-lilies, and fishes, such as are not to be found in the waters of today. Some of them were immense and had large bony scales.

"On the land, were scorpions, spiders and insects, for now the surface of the earth afforded them a means of subsistence.

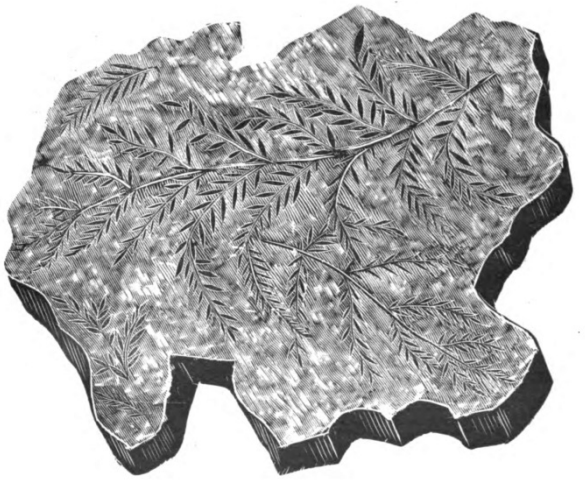
"There were tall ferns and cone-bearing forests, but the plains were destitute of grass, and the bare

rocks wore no bright coverings of moss. Vegetation was for the most part flowerless, for this old world of ours was then very young, and far less beautiful in her youth than in her present advanced age."

We questioned how it happened that this piece of sandstone, marked by wave-ripples, had found its way to a quarry in the side of a mountain.

Then our wise teacher explained to us that the tallest granite hills had once been baptized by the waves of the ocean.

In this Paleozoic division of his vast library he



showed us coal, sandstone, limestone, iron ore, and many other interesting specimens. Selecting a piece of slate, he pointed to a delicate fern, imbedded therein, black as coal and looking very much like a pen and ink sketch on the smooth page of the stone volume.

"My books are all of them illustrated," he would say proudly, as he exhibited them, one after another, before our bewildered eyes.

It was then that we learned for the first time, that plants and animals imprisoned in stone, and wholly changed in structure, like this little fern, are called "fossils," a word that signifies "dug out of the earth."

Here we also found pretty fossil shells and trilobites. No wonder Uncle Jake could state so accurately the condition of land and water in Paleozoic time; for lo, he held in his hand the illustrated pages of the very history itself!

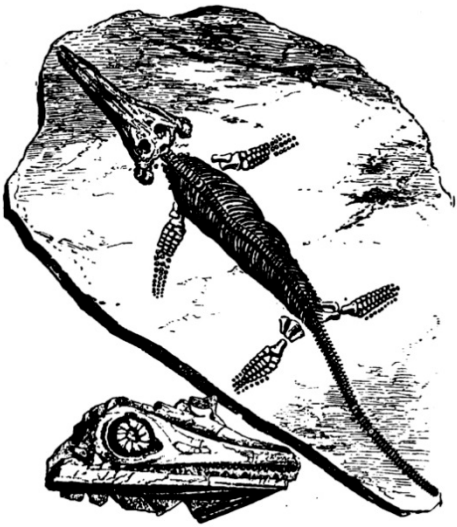
Surely, these creatures had once been inhabitants of the ocean; and so the mountains must have been covered by the restless waves of the sea at some time of the world's history, even as our wise friend had seriously informed us.

How strange that chalk and limestone and marble should be composed of little shells! And those sea-lilies! Why they really looked as if they had been pressed into the soft stone by some careful hand, and just left there for safe-keeping.

How wisely, too, we could talk about peat-beds, and coal measures, after we had studied the Carboniferous age recorded in these Paleozoic volumes. For this was the age in which the decaying animal and vegetable creation was transformed into a

mineral fuel that furnishes the artificial heat of the world.

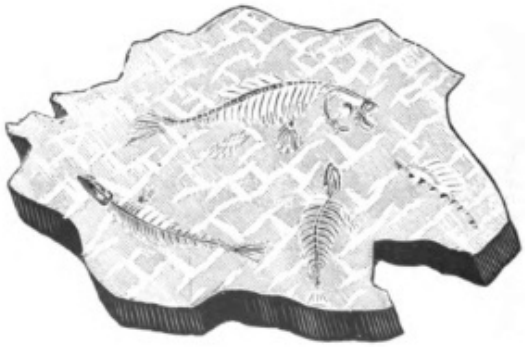
On and on we passed from one history to another till we reached the Mesozoic division. Mesozoic — "middle life" — were we then half way in our study of the world's history?



We were really quite shocked at some of the illustrations that we found here. Such immense reptiles! No wonder that some of the lizards were called Dinosaurs, for that word signifies "terrible." The strangest part of it all is, that water, earth, and air, each had its own species of reptiles.

They swam in the sea, they darted through the air, and they crept about on the ground. It was truly a "reptilian age," and so it is rightly named.

On the surface of the sand-beds and clay-beds of that period, they have left their ugly foot-prints, while



their skeletons are embedded as fossils in the massive stone. And greatly have they aided us in the study of this Mesozoic history.

With ever increasing interest did we pursue our investigation of facts recorded by the rocks, till we finally came to the very last division of the wonderful collection. This was marked "Cenozoic" and signifies "recent life."

Here, for the first time, we found traces of the existence of man. The reptiles of the air had given place to birds of beautiful plumage; bright-hued flowers adorned the hills and plains; green carpets of grass extended down the mountain sides and spread over the fertile meadows and valleys. In fact, the character of marine as well as terrestrial life had materially changed.

But there is a strange preface to the stone volumes that bear the records of this period.

From this preface, we learned that the polar regions were once clothed with rich verdure that grew and flourished in a climate of perpetual warmth and sunshine.

But there came a change and the icy mantle of winter was spread over all the blooming land. The animals, most of them, moved southward to a more congenial clime. The plants became dwarfed and finally extinct.

This was the Glacial period — the period when great boulders were up-rooted from their solid foundations by the moving, melting ice, and carried hundreds of miles away.

"How did we learn all this?" We read it in the scratches and "glacial markings" of massive mountain ledges. We saw immense boulders perched upon lofty summits, and found them scattered here and there all about us in the valley below.

And since that day, we have learned, too, that even now the sharp crystal pens of the Alpine glaciers are writing a history that shall be read by many generations to come.

Gliding like white ghosts between the high walls of the mountains, they move slowly on, on to the valleys below, and melting as they move, send forth dark, turbid streams from their lower portions, that,

dashing down, pass through some clear mountain lake, and are thus freed from all their impurities.

Those were, indeed, happy and profitable hours that we spent in the historical library of our old friend. And many a time in later years have we had occasion to recall his oft-repeated precept: —

"The rocks are the lasting witnesses of the world's creation; and if you question them honestly and patiently they will truly guide you from the beginning of the earth's history even to the present time."

The Clue Found in the Rocks[44]

More than sixty years ago there lived in a fishing town on the north-eastern coast of Scotland a boy who afterwards became a very famous man. When he was only five years old, his father, who was a sailor, was lost at sea. His mother, though very poor, managed to send little Hugh to school, and there he learned a good deal from books; but if he had learned no more than to read and to write, he would probably have still been a great man, for in the meantime he had found something else worth more to him than many books. He had learned to read another language. He had found out that he had two eyes, and how to use them. The rocks about the Firth of Cromarty were waiting for just such a pair of eyes to read their open secrets. Thousands of boys had played about those rocks, and thousands of men had fished and spread their nets and loitered there, but no one of them all had read the writing on the stones till Hugh Miller came.

The boy used to go down to the beach with his uncle Sandy when the tide was low, and look at the ripples left in the sand by the water. He would gather shells, half buried in the sand, and seaweed lying upon it. His uncle had eyes that saw, too. It seemed to run in the family and he helped little Hugh to see the

wonderful life of the sea-shore, and to think about what he saw. These lessons, far more than anything he had read in books, helped him in after-life, though he was a great reader of books, too.

When Hugh grew to be a tall, lanky boy he chose his work in life; he chose to be a mason. His work lay in a quarry near Cromarty, close by his beloved sea. One day, as the men were lifting up the great slabs of sandstone, Hugh saw some markings on the piece of rock laid bare. These were the old familiar ripple-marks in the solid stone just such marks as he had often seen on the sandy beach (Fig. 14). He did not say, "How strange!" and then forget all about it. He began to think, and ask himself questions. Could it be that this was an old sea-beach? How could it be, under those tons and tons of solid rock? The answer came to his questions after a while.

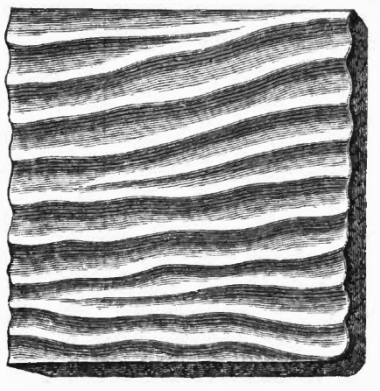
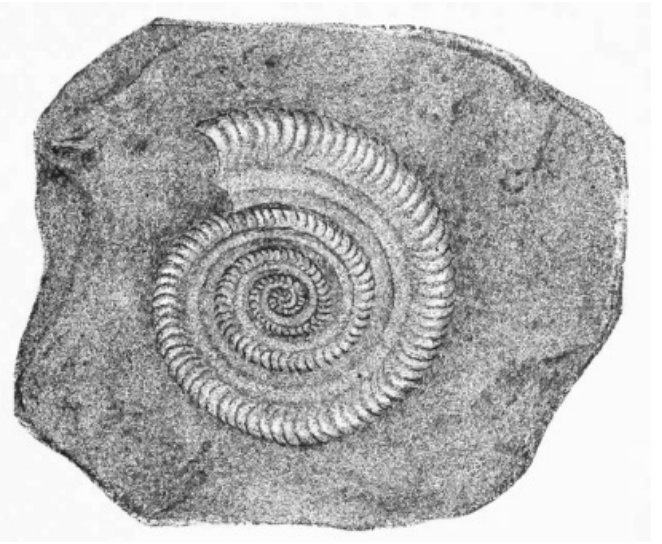


Figure 14 -- Slab of Ripple-Marked Sand-Stone.

Strewn along the water's edge, washed up by the waves, were curious roundish pieces of limestone rock.

One day, hammer in hand, Hugh strolled along



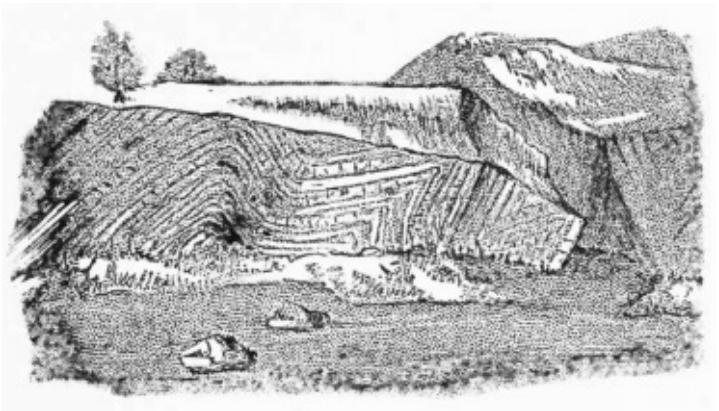
the beach. He struck one of these lumps, and it broke open, showing embedded in part of the stone a creamy-white shell, beautifully carved, and showing tints of color like the pearly lining of many of our



shells. Another and another of these stones were broken open. In some of them he found scales of fish; in others, fern-leaves; in others, again, bits of decayed wood all in solid stone.

Now he could answer his questions. These things had once been alive. He had spelled out one word from the tables of stone written upon by the finger of God himself. He had found the clue in the rocks, and he never rested until he had followed up this clue, and found, by examining the rocks themselves, and by reading about what other men had discovered, how the earth as it is had come into being.

If you have never carefully looked at the rocks of a railway-cutting as your car went through it, be sure



that you do so the very first chance that you have. You will probably see that the rocks are in layers. Sometimes these lie level with the ground; sometimes they are very much bent or tilted.

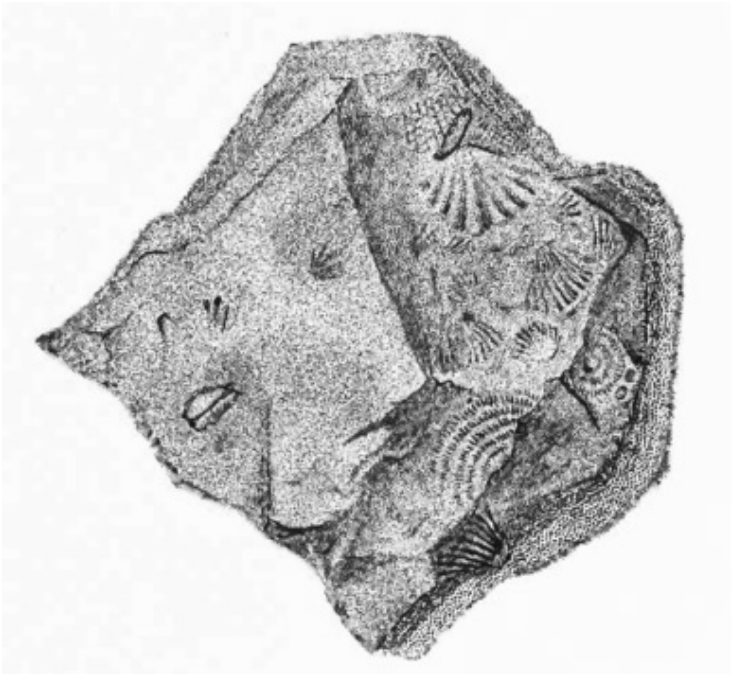
To understand how these came to be so, we must understand some things which are very simple, but yet they are things that we would not naturally think of. What we call earth, or soil, is only rock finely

powdered, mixed up with some of the dust from the dried parts of dead plants and animals. Earth is to rock about what the pulverized sugar you sprinkle over your berries is to the block-sugar your mother drops into your tea.

The surface of the earth was once rock which had no layers in it, like granite. Part of the round globe was covered with water, and a little of it was dry land. The beating of this old ocean's waves, the rain, and the air, all helped to grind the rock to powder, and with it muddy the sea-water. Take a tumbler of water, and into it drop a teaspoonful of finely ground earth. Your muddy water is something like the sea-water was then. Now watch, and you will see what happened. The fine-powdered rock settled in the bottom of the sea-bed as the earth settles in your tumbler, and the first layer was made. Layer after layer was formed in this way. After a while "the spirit of God moved upon the face of the waters." A feeble life stirred in the bottom of the sea. Some very simple animals lived there, and we can find the curious shells in which they lived in those deep -down rocks. We know that plants must have come first, because plants are the only fairies that can turn rock and earth and water into the food that all animals need to feed upon; but the soft, delicate sea-weed had died and left no sign. The early animals, however, had hard, glassy shells, and when they died these shells sank to the bottom of the sea, and the next

layer of powdered rock settled over them and preserved them; some of them until now.

You can see how this would be, and that when we lay open the rocks, as Hugh Miller did with his



hammer, we might find the shells. Here is a drawing of a bit of such earth that was turned into stone, with its corals and shell lying thick in the layer, which is half broken away. This was picked up just below my house, on the shores of Newark Bay.

The work went on through thousands of years, the sea laying one upon another these wonderful beds of rock of different kinds. All this was not an adding to

what already existed, but only a new arrangement, with some change in the character of the old materials already there. How this great earth came to be is one of the secret things of God. The Bible begins with, "In the beginning God created the heavens and the earth." That is all we know. A guess here and there has been made as to how it was done, but no one knows, and no one probably ever will know.

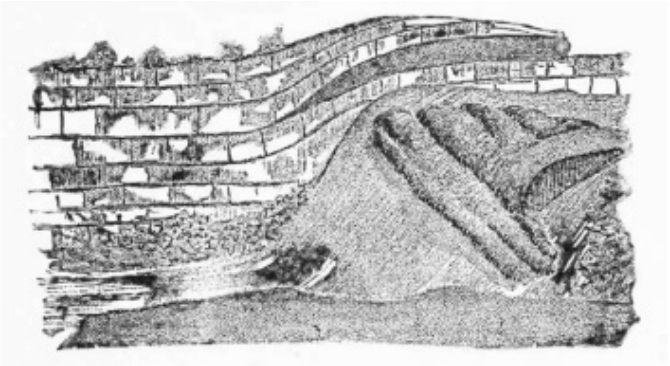
But we can tell the way the crust of layers was put on, because we can watch the same things going on now which went on thousands and thousands of years ago. At the bottoms of shallow seas and lakes, at the mouths of rivers, in the coral islands of the Pacific, the earth is still abuilding.

About a hundred years ago men began to be interested in these strange things found in the stones. They hunted up pieces of such stone, and wrote out all they could find about it. They arranged the facts, and called the new science geology, or the science of the earth.

It is very easy to see that if the seas had stayed all the while in the same place, with no disturbance going on, that the layers would have settled one on top of the other, according to age, the oldest being the lowest, and so on up. But you must remember that the earth was then, as it is now, part dry land and part water, though there was much less land in proportion then than there is now. It was only under water that

the layers were formed. But there were other things at work besides this gentle wearing away of the rocks and building up of the sea-bottoms.

Long ago people believed that under the volcano of Ætna, on the island of Sicily, a giant was imprisoned, and that the trembling and cracking of the earth before an eruption were his struggles to get free. This had a meaning in fact, though it was only a fable. Under the whole earth the giant fire has been



imprisoned. When the crust of the earth was thinner than it is now, the giant's struggles cracked and bent it; sometimes the bottom of the sea would be suddenly lifted up, and the dry land would sink and be covered with the waters of the ocean. On the left side of the picture are the level layers of rock, broken up so that they look like a stone wall. After a while we will see just why these are so broken. On the right-hand side you see the layers are lifted up by the curious, curly-looking rock which boiled up out of the earth beneath as lava comes out of a volcano. Whichever

part of the earth happened to be under the water would be covered up with layers of mud, and in them plants and shells, fish and animals, would be buried, and their hard parts preserved. The other part, the dry land, would not be very much changed; the plants and animals there would die, and mostly be blown away as dust.

This history of the earth written upon the rocks, you can see, is not a very easy history to read. Its leaves were all scattered and torn and twisted, and the writing on them often rubbed out, and many of them lost. It had to be gone over again and again, in many different places and by many different men, before these stone leaves could be put together in the right order.

If these layers, or strata, as they are called, had remained just as they were placed, there would have been no way to reach them but to dig down to them, for twenty miles in some places, and that would have been impossible: nobody has ever been down, in the deepest mine, more than a mile. But the movements of the earth's surface, caused by the struggling fire underneath, would tilt and break through the layers, and so the broken edges would be on the surface (Fig. 6), and the geologist could in places study the very bottom layers without digging down to them.

A Handful of Sand[45]

I have here a handful of clean, white sand, scraped up from the beach. It is the sand which the children so delight to play in, and which never soils their clothes.

It is the same kind of sand that they use to make mountains and hills in their geography studies.

Sand is not only nice to play in, but it is useful in many ways. Glass is made of it, and the plasterer mixes it with lime to form the mortar with which he lays the bricks, and plasters the walls of our houses.

What is the history of the little grains which the winds blow in our faces, and the waves wash up and down the beach?

Examine these grains with a pocket microscope and you will see that they are clear like glass and quite smooth. They have been thrown about by the waves, and rubbed upon each other, until all the sharp points are gone.

We will call them quartz grains and the sand, quartz sand.

Very long ago these grains of sand formed a part of a granite mountain. The mountain was high and rugged and stood upon the border of what is now one of the deserts of Southern California.

Now the mountain is nearly gone, and the little grains of which it was composed are scattered far and wide.

The picture before us shows a low hill in the desert. It is the heart of the old mountain, and is all that is left of it. How beautifully it tells the story of what Nature is always doing. She is tearing the rocks down in one place, and building them up again in another.

One lone granite pillar stands in the center of the hill. Lying about on all sides are the great blocks of granite which have broken off and tumbled down the sides of the hill.

These blocks are still hard, and if you should hit them with a heavy hammer they would not break. Those farthest from the hill, which have lain on the ground for a long time, are crumbling to little grains, which will form a part of the desert sands.

Scrape up some of the sand, and look at it carefully. It consists mostly of grains of quartz like those upon the seashore, only they have sharp angles instead of being rounded. Among the quartz grains are some little black scales and particles of clay.

With a hammer you can soon crush a piece of the granite to sand. Nature did not go to work in that way. She is very quiet, and it takes her many years to make great changes.

Let us look at a piece of the granite, to see what it is made of, and then, perhaps, we can understand how it crumbles to sand.

The clear, glassy grains which you cannot scratch with a knife, are the quartz about which we have been talking.

The shining black mineral which you can dig out in thin scales with the point of a knife is called mica. You have all seen it in the windows of stoves. The mica is used there because it is not easily broken or affected by the heat.

You will notice also some grains of another mineral, which is nearly white, but not as clear as the quartz. This mineral has little faces, which reflect the light, and it can be scratched a little with the knife. It is called feldspar.

Now let us see, if we can, how Nature changes a piece of solid granite to sand.

When the mountain of granite stood where the hill does now, there were narrow cracks running all through it. They were just like those which can be seen in the granite in the picture, if you examine it closely.

The rains soaked into the cracks, and the roots of the bushes and trees penetrated them. As the roots grew larger, they pried the masses of granite apart, just as a man would do with a bar. The loose pieces finally rolled down the mountain side.

As we have seen, every piece of granite is composed of three different minerals, the quartz, the feldspar, and the mica. As the sun shone upon the granite it made it warm, and each grain expanded a very little. At night, when it was cool, the grains contracted. In this way they became loosened, and after a long time slowly fell apart, forming sand.

This is Nature's way of tearing down a mountain. It is very slow, but if you could live long enough you could see how much she accomplishes.

The little brooks which used to run by the granite mountain had plenty to do. As the granite crumbled, the feldspar became soft, and turned to clay. The brooks picked up the particles of clay first, but they made themselves muddy in doing so. They could not get rid of the mud which the clay made, and so had to carry it to the ocean.

The water also washed the scales of mica along very easily. Look in some brook on a summer day, and you will see the shining scales of mica moving along on the bottom with the current. Perhaps the brook is carrying them from some mountain which is now being torn down. The most of the little scales will not stop until they reach the ocean.

It was not so easy to move the grains of quartz, but the brooks did it when the rains fell, and they rushed along more swiftly.

The clay and the mica scales were carried far out into the ocean, where the water was quiet, and then fell to the bottom.

The quartz grains were not carried out so far, and the waves piled them up on the beach. The waves never tired of playing with the sand. They turned the grains over and over, and ground them together, until they were perfectly smooth.

You see now how the ocean sorted the different minerals in the granite. It put the clay and mica scales in one place, and the quartz grains in another. The work is not always done so well, for along some ocean shores the clay and mica and quartz are all mixed together.

When the waves have done with the grains of sand, and thrown them up high on the beach, the wind takes a hand. It picks them up and whirls them through the air as it does the snowflakes.

What do you suppose will become of the granite pillar which is all that remains of the mountain about which we have been talking? It seems to defy the rains and the frost, but by and by it also will fall, and crumble to sand. Then there will be nothing left to tell of the mountain but a small mound of sand in the desert.

The forces of the weather never rest. They are tearing down all the mountains around us. Although the carpet of soil in which the trees and grasses grow

protects the rocks in many places, yet they are crumbling and decaying in spite of it.

After a time the mountains will all disappear, if something does not lift them up again.

We love the wild rocks, and do not like to think of their being torn down; but we must be content, because their materials are necessary to make the soil.

Stars

Stories of Starland[46]

by
Mary Proctor

The heavens declare the glory of God; and the firmament sheweth his handiwork. — Psalms.

Preface

This book has been a labor of love from the beginning to the end, and I have thoroughly enjoyed conversing with my little friends Harry and Nellie. Now that the book is finished, I leave it with regret.

It is impossible to give all the authorities for my legends of the stars. Many were told to me by my father when I was a little girl, or I found them among books in his library, which is now scattered far and wide. Others are from Grecian mythology, Japanese folklore, Hindu legends, while some of the American Indian stories were found in musty volumes of the Bureau of Ethnology at the Smithsonian Institution.

As for the descriptive astronomy, among my authorities are Professor C. A. Young, Professor Barnard, Agnes M. Gierke, Professor R. S. Ball, Schiaparelli, Flammarion, Professor Todd, Mr. Lowell of Flagstaff, Ariz., and my father, the late Richard A. Proctor.

I now submit this little book to my young readers, sincerely hoping its pages may inspire them with a renewed interest in the wonders of Starland.

Mary Proctor

New York City, June, 1898.

Stories of Starland

Light

Night has a thousand eyes,
And the day but one;
Yet the light of the bright world dies
With the dying sun.

The mind has a thousand eyes.
And the heart but one;
Yet the light of the whole life dies
When love is done.

— F. W. BOURDILLON.

The Story of Giant Sun

"Sister, come here and talk to me. I am so tired of being alone."

His sister Mary at once closed her book, and took a chair beside Harry's couch. Poor little Harry was not like other boys. He could not play and run about as they did, for he was a cripple. All the long weary days he had to lie on a couch which was placed under the shady trees during the warm summer season. He had learned to love the flowers and trees, and the bright blue sky overhead, and his sister often told him pretty stories about them. She was just thinking of telling him one now, when he said gently:

Ancient Stories of the Sun

"Sister, you have told me so many stories of the flowers. I wish you would tell me something about the sky. I have been looking at it for such a long time, watching the little white clouds floating across it like boats with silver sails; and then I tried to look at the bright yellow sun, but it dazzles my eyes. Won't you tell me about it, and where it goes in the evening when we cannot see it anymore? Is it always ready in the morning to give us light? Is it ever late, do you think?

What would we do if it forgot to come round the edge of the earth and give us light?" he continued anxiously.

"There is no fear of that," said his sister Mary, laughing at the idea. "But a long time ago people asked the very same question. In those days they thought the earth was flat, and surrounded by an ocean without end. The Hindus supposed that the earth rested upon four elephants, and the four elephants stood on the back of an immense tortoise, which itself floated on the surface of an endless ocean. It was thought that the sun plunged into the ocean when it disappeared in the evening, and some people said they heard a hissing noise when the red-hot body went under the waves.

"But if the sun dropped into the water each evening, how did it happen that next morning it was seen again, as hot and bright as ever? The people could not tell why, so they said that during the night the gods made a new sun to be used the next day."

"That must have kept them busy," said Harry, laughing.

"The good people made up another story about the sun, so that the same one could be saved each night. Just as it was dropping into the ocean, a god named Vulcan, who had a great boat ready, caught it, and all night long he paddled with the blazing sun. Next morning he was ready at sunrise to send the sun up into the sky in the east. He threw it with so much

force that it would go very high, and when it came down on the other side in the west, he stood ready to catch it again."

"But where does the sun really go to at night?" asked Harry curiously. "I should like to know."

Heat of the Sun

"We live on a big round globe called Earth," replied his sister, "and we travel round the sun, which gives the earth light and heat. The sun is like a great lamp in the sky, and when you face the lamp you see the light, but if you turn away from it you are in darkness. As the earth goes around the sun, it whirls around like a huge top; first one side and then the other is turned to the sun and gets sunlight, and so we have day and night. If the sun, or the lamp in the sky, went out and stopped shining, all the light would go out on the earth, and we would miss its heat as well.

"It is so hot that if it kept coming nearer and nearer until it was as far from the earth as the pretty bright moon, the earth would get warmer and warmer and melt like a ball of wax."

"Just like Nellie's doll, then," said Harry, "when she left it on the grass the other day. The sun was so hot that day that when Nellie picked up her doll, she found that its wax face had melted and the eyes had fallen in. So the sun did that," continued Harry,

laughing heartily. "Poor Nellie! I must tell her that the next time I see her."

"I can show you something else to prove how hot the sun is," said Mary, as she picked up a leaf from the ground. "Just wait a moment while I go into the house and get a magnifying-glass."

In a few minutes she returned, holding the glass in one hand and the leaf in the other. She held it so that the sun shone directly upon the glass and passed through it onto the leaf. In a few seconds the leaf began to smoke, and then burn, until a little hole could be seen.

Harry was so surprised that he had to try it for himself, and he looked forward with much delight to a visit from his cousin Nellie.

"Won't I have a lot to tell her?" he said to his sister: "all about the sun's melting her dollie, and how to make the sun burn a hole through a leaf. But the sun cannot be very far away, can it?" he asked.

Distance of the Sun

"Yes, it is very far away," replied Mary. "If a railroad could be made from the earth to the sun, and a train started going at the rate of a mile a minute, it would take days and weeks and years to get there.

"Let me see," said Mary, making a little note in her note-book. "There are sixty minutes in an hour, and

twenty-four hours in a day, and three hundred and sixty-five days in a year. Why, Harry, do you know it would take that train nearly one hundred and seventy-five years to get there?"

"It must be very far away, then," said Harry, "more than a hundred miles."

"It is more than a million miles," said Mary. "It is nearly ninety-three millions of miles away. Now let us suppose you want to go to the sun. You would call at the railroad office and ask for a ticket to Sunland. The officer in charge would appear a little surprised, because that is quite a long trip. Then he would look up the cost of the journey in his book, and hand you a mileage book, saying: 'Sir, if you want to save money on this trip, you had better take a mileage book with you, costing two cents for every mile. Even then your fare will be nearly two million dollars.'"

"Then I would say: 'Dear sir, I cannot go, as I know my sister could not spare all that money. I think I would rather walk to the sun.' How long would it take me to walk there, supposing I could walk?" asked Harry thoughtfully.

"Dear, you would have to keep walking a very long time before you would ever get there. Supposing you walked four miles an hour, and ten hours a day, and kept this up for hundreds of years, you would be more than six thousand years on the way. When you

reached the sun you would be footsore and weary, and as old as the hills."

Harry laughed heartily at the idea, and thought again of poor Nellie's doll and the melting wax running like tears down its cheeks.

"But suppose," he asked, his eyes bright with excitement, "someone fired a big cannon at the sun. Would the cannon-ball ever get there?"

Again Mary brought out her little notebook, and, with rather a look of surprise, she said: "Supposing the cannon-ball went as fast as it could go, it would take nine years to reach the sun, and the sound of the explosion would reach there in fourteen years. The cannon-ball would come along first, and five years afterward, if you were living on the sun, you would hear the sound made when the cannon was fired off.

"It takes time for me to walk from the garden to the house, so it takes time for sound to travel from the earth to the sky; and sound travels only one-fifth of a mile in a second. Do you remember the thunderstorm the other day, Harry, that frightened you so?"

"I shall never forget it," said Harry, trembling at the thought. You said, 'Count slowly '; and I counted one, two, three, four, five, up to fifteen."

"Then I said: 'Don't be afraid, brother; the storm is three miles away.'"

"Yes, I remember," said Harry; "and I thought you were very clever, and wondered how you knew."

"It was not so wonderful, after all, was it?" said Mary, laughing.

"Now tell me, sister," said Harry. "Supposing I had a very long arm, and stretched it out toward the sun, and touched it with the tip of my little finger. What would happen?"

You would never know that you had burned it, for the pain of burning would be one hundred and fifty years going along your little finger, and down your giant arm nearly ninety-three millions of miles long, before it at last reached your brain. Then it would let you know that one hundred and fifty years before you had burned your little finger."

Harry stretched out his little arm in the direction of the sun and looking at it critically, laughed at the idea of a giant arm millions of miles long.

"It is too short by several inches," said his sister, reading his thoughts, and joining in the laugh. "It would take hundreds and hundreds of little arms as long as yours, would it not? Now what else do you want to know about the sun?"

Size of the Sun

"If you are not very tired, sister," said Harry coaxingly, "I should like to know how large it is. Is it as large as the earth?"

"Ever so much larger," replied Mary. "It is so large that if it were cut up into a million parts, each part would be larger than the earth. If we could weigh the sun in a pair of giant scales, it would take over three hundred thousand globes as heavy as the earth to make the scales even. If the sun were hollowed out, and the earth placed in the center, there would be room for the moon as well. Now the moon is thousands of miles from the earth, and yet the edge of the sun would be thousands of miles from the moon, as you will see in the picture. If a tunnel could be made through the center of the sun, and a train started going at the rate of a mile a minute, it would take six hundred days for the train to reach the other side of the tunnel. If this same train went around the edge of the sun it would take five years. A train going around the earth would take seventeen days to complete the journey."

"But suppose we went around the sun in a big steamer, like the one Uncle Robert came over in; how long would that take?" asked Harry curiously.

"Only fifteen years," said his sister, laughing. "If you had started when you were a little baby you would still have five more years to travel before you would get back again to the starting-point."

"Then the sun must be very large," said Harry thoughtfully. "Let us call it GIANT SUN. Has it always been as large as it is now? "

The Sun in the Days of Its Youth

"Ever so much larger," replied Mary. "Once upon a time it was a ball of glowing gas reaching as far as the path of the last planet.

The ball whirled around rapidly and the outer edge cooled. A ring formed and separated from the ball and whirled around on its own account, until it broke up into fragments. One of the fragments drew all the others toward it, and another ball was formed, but quite a small ball this time, called a planet. Just like the central ball, the planet kept whirling around, threw off a ring, the ring broke up into little pieces, and the pieces, coming together, made a little moon. The planet is Neptune, and it still has only one moon. Meanwhile the ball in the center kept whirling around, other rings formed other planets with their attendant moons, completing the family of Giant Sun.

"The Sun is in the center and his planets circle around him. Next to him is playful little Mercury, then beautiful Venus, then our own planet Earth. Beyond it, we find ruddy Mars, the four hundred and fifty baby planets, giant planet Jupiter, the ringed planet Saturn, and the last two planets, Uranus and Neptune. All these planets are under the control of the sun, and cannot get away from him."

"What is the sun made of?" asked Harry.

"Of iron and copper and silver, and many other things we can find on earth; but the sun is so hot that

they are melted together into a mass like glue. This is the center of the sun. Outside is a shell of bright clouds, from which rosy flames leap to a height of thousands of miles above the surface of the sun. All around the edge of the sun, and reaching millions of miles beyond it, is the pearly light of the corona like a crown of glory. The pearly corona fades away into a soft beam of light."

"How beautiful the sun must be!" said Harry, as he listened attentively to his sister. "But is it all alone in the sky, and does it not have any little stars to play with?"

"It is not at all lonely," said Mary, laughing at the idea of the stars as playthings for Giant Sun, "and is kept quite busy looking after its large family of planets. I will tell you about them tomorrow, or nurse will scold me for tiring you. And now, good-bye, my dear. Don't forget all I have told you about Giant Sun."

"Forget! how could I, sister? It is better than any fairy tale I have ever heard. Giant Sun! Why you have told me enough to keep me thinking all day and all night. Here comes Nellie. Hello! Nellie, come here and let me tell you all about GIANT SUN, and how he melted your dollie for you the other day."

"Melted my dollie!" said a pretty little golden-haired girl, as she tripped like a little fairy up the garden-path. "So he melted my dollie, did he? I should like to see him do it again!" Tears came into her eyes

at the thought of her sad experience. Since then, however, a china head had replaced the melted wax, and Nellie's fickle little heart had been comforted. So the tears soon vanished in a smile as she showed her new treasure to Harry.

The Family of Giant Sun

The next morning, when Mary came out in the garden to sit with Harry, she was surprised to see an audience of three instead of one: Harry, whose face beamed with delight when he saw her; Nellie, who was seated in a tiny rocking chair beside him, and Nellie's doll.

"You see, dollie wants to know all about Giant Sun, too," Nellie gravely informed Mary. "I never could remember all, and she might remember what I forget. Besides, she must learn some day. That is what mamma said about me. I heard her," Nellie continued wisely, as she looked up at Mary. "Do you mind telling me about the sky-people too?"

"Mind? Why you little bit of a doll baby," laughed Mary, as she picked her up, doll and all, and hugged her, "if you and dollie promise not to go to sleep, you can stay here as long as you want to. But does Aunt Agnes know you are here, Nellie; or have you run away from home?"

"No, I have not run away," said Nellie earnestly, "but my dollie has. Nurse brought me over here, but she did not know my dollie was here. I forgot all about her yesterday, while Harry was telling me about Giant

Sun, and I left her out on the grass. But she didn't melt a bit. I knew you wouldn't, dear little dollie, would you? Now, dollie, sit up straight, and listen to Cousin Mary talk. My, how she can talk, too! Can't you?"

"I'll try," said Mary, laughing. "So you want to hear about Giant Sun and his family. He has such a large family, and he has to give them all plenty of light and heat. If he put out his big lamp in the sky, it would be always dark here, and we would shiver with cold and die. When I come to your room at night, Harry, to say good-night, I always carry a lamp in my hand so that I can see you; but supposing a puff of wind blew it out, then I could not see you at all.

"Now this light is not only for us, but for the rest of the sun's family as well. First, there is little Mercury, who was named after the god of thieves; and he deserves this name, because he steals more light and heat from the sun than any of the other planets."

What is a Planet?

"What is a planet?" asked Harry.

"A planet is just like this earth we are living on, and only shines with the light it borrows from the sun. If we lived on planet Mercury, and could look at our earth, we would see it shining like a bright star in the sky; but all the light comes from the sun."

"Do we live on a star, then?" asked Nellie, her little eyes wide open with amazement.

"No; we live on a planet. We could not live on a star, as a star is blazing hot. That is the difference between a star and a planet. A star is hot and bright and shining and gives light to the planets, if it has any. Planets are little globes like the earth that circle around the sun."

"Then the sun must be a star," said Harry, "as you told me yesterday that it is very hot."

"That is right," said Mary; "and every star in the sky is a sun."

"And has lots of weensy-teensy planets going all around it?" asked Nellie excitedly.

Story of Planet Mercury

"Some of them have, I am sure," said Mary. "But now we are running along too fast, and I must tell you about our own sun first, and its nearest planet Mercury. Well, Mercury is a very warm little world, and it gets so near the sun that sometimes it is about nine times as warm as here, and at other times it is only four times as warm. You see. Mercury does not go round the sun in a perfect circle, so at times it is farther away than at others. Now, the sun is like a great fire in the sky, and the nearer we go to it the warmer we are. How would you like to live on a little world where it is nine times warmer than it is here? "

"I should not like it at all, would you, dollie? "said Nellie; "we would roast if we went to world Mercury."

"Is a planet made of earth and stones and trees and flowers, just like planet Earth?" asked Harry.

"Yes, dear," replied his sister; "only some planets, like Jupiter and Saturn, are still wrapped up in a blanket of clouds and steam, and we cannot see them yet. They are very hot indeed, and all the water that will make the oceans and seas and bays is now steam and clouds hiding the true planet from view. Water could no more rest on the surface of the planets Jupiter and Saturn than it could rest on red-hot iron. Don't you remember, the other day, when nurse upset a cup of water on the hot stove, how the water sizzled and turned into steam in a moment?

"Now planet earth, a long time ago, when it was a very young world, was very hot like Jupiter. All the lakes and seas and oceans were turned into steam and blankets of cloud. It would have been a very uncomfortable world to live on then. But it became cooler and cooler, and the clouds changed into the oceans and seas and lakes that make our earth so beautiful.

"Someday this little world will grow old, and the oceans will get smaller and smaller, and the earth colder and colder. Then there will be scarcely any air to breathe, and we would gasp, and die just like that poor fish that Uncle Robert caught last week and threw in the bottom of the boat. Don't you remember, Nellie, how the poor little thing gasped and jumped

around? It could not live out of the water, so it died. Now, we cannot live without air, and if this earth had not any air we would die. But this will not happen for a very long time."

"Are you quite sure?" asked Harry, with an anxious look on his face; "because I don't want to die yet, sister."

"Quite sure, my little brother," she said, kissing him tenderly; "for hundreds and hundreds of years must pass away before anyone will have any idea that the earth is growing old."

"And what will become of the poor little fishes when the oceans dry up?" asked Nellie sadly, as she clasped her dollie closely in her arms, as though to protect it from the coming trouble.

"I expect they will all die," said Harry wisely; "because you know, Nellie, they can't live out of water. Can they?"

"Or else that fish Uncle Robert caught would have lived," said Nellie. "But please tell us a story about Mercury, Cousin Mary, and the other little planets."

"Well, Mercury is a very little planet, and instead of taking a year of three hundred and sixty-five days, it goes around the sun in eighty-eight days. That is, it goes round the sun four times while we go round it only once. Some think Mercury always keeps the same side turned to the sun, so that it is always day on

one side and night on the other, but we are not quite sure about this yet."

"I should like to live on Mercury, wouldn't you, Harry?" said Nellie, clapping her hands with glee. "Just think of day all the time, and never having to go to sleep!"

"But you would get very tired of that," said Mary, "and long for the night to come. And, besides, would you not miss seeing the moon and the beautiful stars?"

"I would live on the edge of Mercury," said Harry thoughtfully, "so that when I was tired of day I might slip around it and have night. It must be very cold on the other side, where the sun does not shine, if Mercury gets all its heat from the sun."

"I suspect it is," said Mary, "and I don't believe we should like to live on Mercury, after all; so let us try the next planet, which is called Venus."

Story of Planet Venus

"What a pretty name," said Nellie; "and is Venus very warm, like Mercury?"

"It is not so near to the sun," replied Mary, "but it is about twice as warm and bright as our planet. Venus is nearly as large as the earth, and sometimes she is called her twin sister.

"Like Mercury, she may probably always turn the same face to the sun, and get baked on one side and

frozen on the other. She looks like a beautiful silver globe in the sky. Sometimes we see her early in the morning as a morning star, or just about twilight as an evening star. Like Mercury and the earth, she borrows all her light from the sun. We only see her because the sun is shining on her. Next to Venus is our own planet, earth, and around it circles the moon, but I must tell you about that another time."

A Ramble on the Moon

The moon was shining brightly and flooding Harry's room with its rays. He was suffering so very much, and had tried in vain to sleep. Presently he asked his nurse if she would not let Mary come and talk to him. "It will not tire me," he begged earnestly; "and it does tire me to lie here hour after hour with no one to talk to."

His nurse understood him so well, and her heart ached for the lonely child who had so little to amuse him in life. She never refused a request if it were at all possible to grant it. So she called his sister Mary, who hastened at once to his room, and brother and sister were soon far away on a ramble in starland.

"We shall go to the moon this evening," she began, "and find out what a queer old world it is."

"Old?" asked Harry; "why do you call it old, when it looks so bright and new? See, sister, how it seems to be looking right into the window and watching us. I wonder if it knows what we are saying about it. Now what would it think if it heard you calling it old?"

"But it is," said Mary, laughing; "and very old indeed. Its face is wrinkled and scarred, and is just like that of the old dried-up apple we found in the orchard the other day."

"What makes it so bright, then, if it is so old?" asked Harry, as he looked curiously at the moon.

"It borrows its light from the sun," replied his sister; "if the sun were to stop shining you would not be able to see the moon at all. It would be as dark as night and twice as gloomy."

"Do you think there are people on the moon?" asked Harry excitedly.

No, dear, not even the 'Man in the Moon,' though I am going to tell you some stories about him presently. Besides, no one could live on the moon, as there is not any air to breathe, and you cannot live without air. There is not any water to drink; in fact, there is not a drop of water on the moon."

"Then it must be very old," said Harry thoughtfully, "because you know you told me, sister, some time ago, that if a planet grows very old all the oceans and bays disappear."

"Yes, the moon is very old; it is a dead world. If you could go there, you would find it a very gloomy spot. There are no trees or flowers; and there is not even a blade of glass. The sky is always black and the stars shine night and day. The shadows are so black on the moon that it would be a fine place to play hide-and-seek. The moment you stepped into a shadow you would become invisible."

"Just like the prince in the fairy tale who put on a little cap and no one could see him," said Harry.

"Yes; that prince would not need the cap on the moon. If he did not want anyone to know he was there, all he would have to do would be to keep in the shadow. No one would hear his foot-steps, as not a sound can be heard on the moon. It would be useless to speak, as there is no air to carry the sound of a voice."

"I should not like to go to the moon, then," said Harry seriously, "because you could not tell me any stories, sister, could you? What would I do then?"

"I really cannot imagine," said Mary, laughing; "but perhaps you might come across the Man in the Moon and talk to him in sign-language."

"Like the deaf-and-dumb people?" asked Harry.

"If he could understand it," said Mary; "but then, we know there is really not any Man in the Moon."

"But there is a story about him," said Harry coaxingly, "and I do wish you would tell it to me, just now while the moon is looking at us from the sky."

Story of the Man in the Moon

"Well, once upon a time," began Mary, in true fairy-story fashion, "there was a man who went out into the woods and picked up sticks on a Sunday. That was very wicked of him, you know, because Sunday is a day of rest, and picking up sticks is work. He tied the sticks together into a bundle, and, putting them on his

shoulder, started to walk home with them. On the way he met a handsome stranger, who said to him:

"What are you picking up sticks for on Sunday?"

"It does not matter to me whether it is Sunday or Monday," replied the man roughly. "I pick up sticks when I want to."

"'Very well, then,' replied the handsome stranger sternly, 'since you will not observe Sunday as a day of rest on earth, you shall have an everlasting moon-day in heaven.' Next moment he went whirling away to the sky, and landed on the moon, where you can still see him with his load of sticks on his back at full moon."

"Can I see him now, sister?" asked Harry.

"Not tonight," she replied, "because there is only a quarter moon. But perhaps you can see the face of the woman in the moon, if you look very carefully. See her sharp chin and pointed nose and shaggy eyebrows."

"Why, is there a woman in the moon, too?" asked Harry, as he looked intently at the moon, trying to see all his sister had pointed out, but having to rely largely upon his imagination.

The Story of the Woman in the Moon

"I have heard a story of an old woman who was sent to the moon."

"Why, what had she done?" asked Harry.

"She was very unhappy while on earth, because she could not tell when the world would come to an end; that is, when it would get old and dead like the moon, so that no one could live on it any longer. For this she was sent to the moon. She has been weaving a forehead strap ever since. Once a month she stirs a kettle of boiling hominy, and her cat sits beside her unraveling her net. So she keeps on weaving and weaving, and the cat unravels her work as soon as it is done. This must continue to the end of time, for never till then will her work be finished."

"Poor old woman!" said Harry; "I wonder she does not hide her work from the cat, or send the cat away. But then, that is only a story. Can you tell me another?"

"Do you never tire of stories?" asked Mary, smiling.

"Never, when you tell them to my, sister. And you seem to know such a lot of them."

"But these stories are only fairy-tales," said Mary, laughing; "these moon-stories, I mean."

"I don't mind," said Harry roguishly; "we must have a little make-up story now and then, or I would get tired. Do you make them all up yourself, sister?"

"No, indeed," said Mary. "I find them here and there and everywhere; sometimes right in the middle of a big book on astronomy, or in the corner of an old

newspaper, or hidden away in a book covered with dust on the top shelf in the library."

"Where did you find that story about the old woman and the cat?"

"In a book of Indian legends, and the story is told by the Iroquois Indians. Here is another one I found. Would you like to hear it?"

"You know I would, dear," said Harry, nestling closer to his sister, as she clasped his hand in hers.

Story of the Toad in the Moon

"Once upon a time a little wolf fell very much in love with a toad, and went a-wooing one night. Just like the frog, 'he would a-wooing go.' You remember, Harry, don't you?"

"'Whether his mother would let him or no,'" continued Harry; "of course I remember all about him. So the wolf went after the toad and --"

"He prayed that the moon would light him on his way," continued Mary; "and his prayer was heard. By the clear light of the full moon he ran after the toad, and he nearly caught her, when, what do you think happened?"

"Oh, go on, sister; tell me quickly!" said Harry excitedly.

"Why, the toad jumped right onto the face of the moon, and, turning round to the wolf, said: 'How's

that, Mr. Wolf?' And she is laughing at the wolf to this day."

"That was a clever little toad," said Harry, laughing; "and how vexed Mr. Wolf must have been! Are there any more people on the moon — I mean story people?"

"Yes, there is one we read about in the legend of Hiawatha. Don't you remember how Nokomis tells about a warrior?

" ' . . . Who very angry

Seized his grandmother, and threw her

Up into the sky at midnight.

Right against the moon he threw her:

'Tis her body that you see there.'"

"Do you think he meant the black marks you can see all over the moon, sister?"

Scenery on the Moon

"Very likely," replied Mary; "and perhaps you would like me to tell you what those black marks are. They are enormous plains and gloomy caverns on the moon. A long time ago, perhaps, these plains were bays and seas. At least, a great astronomer named Galileo thought they were, and he gave them such pretty names — the Sea of Serenity, the Bay of Dreams, and the Ocean of Storms. But he lived in the days before it was known that there is not any water

on the surface of the moon. Then the caverns on the moon may once have been volcanoes pouring forth hot lava and ashes, just as the active volcanoes on the earth. But the volcanoes in the moon have gone out. They are now like huge dark caverns, some of them more than fifty miles across. One is three miles deep, and it is named Tycho, after a great astronomer of olden times.

"Then there are mountains on the moon just like the mountains on earth, and quite as high. In walking over the moon you would find it very rough and uneven, but you would not mind this very much, as you would weigh so much less. Just think, Harry, you would weigh only one-sixth as much as you do here."

"And what would Uncle Robert weigh?" asked Harry, with a gleam of mischief in his eye.

"He would only weigh forty pounds," said Mary, laughing; "and if he played football on the moon, a good kick would send the ball six times as far away as here. Supposing we were on the moon now, you could throw a stone at Uncle Robert's house on the other side of the grounds, six hundred yards away, and hit one of the windows."

"I expect Uncle Robert may be glad then we are not on the moon," said Harry, laughing; "because I am afraid I should be throwing stones at the windows all the time. I can see the windows plainly from here. There is a light in the library."

"Then it must be very late," said Mary, looking over at the house; "because uncle said he would not be home till nine o'clock. So I can only tell you one more little story about the moon, and then I must let you go to sleep. This story is told by the Hindu people, and gives the reason why the moon shines with such a soft, silvery light."

The Hindu Legend

"The Sun, the Moon, and the Wind had been invited to dinner one day by their uncle and aunt, Thunder and Lightning. Their mother (one of the most distant stars you see far up in the sky) waited patiently at home for the return of her children. Sad to relate, the Sun and Wind were both greedy and selfish, and, while enjoying the good feast, forgot all about their poor hungry mother at home.

"But the gentle Moon did not forget, and whenever a dainty dish was placed before her she would put part of it aside for the Star who waited so patiently at home. When the Sun, Moon, and Wind returned home, the Star, who had kept her bright little eye open all night long, said:

"'Dear children, have you brought anything home for me?'

"Then the Sun, who was the oldest, said: 'I have brought nothing home for you. I went out to enjoy

myself with my friends, not to get a dinner for my mother.'

"And the Wind said: 'Neither have I brought home anything for you, mother. You could scarcely expect me to think of you when I merely went out for my own pleasure.'

"But the gentle Moon said: 'Mother, see all the good things I saved for you,' and she placed a choice dinner before her mother.

"Then the Star turned to the Sun, and said: 'Because you went out to amuse yourself with your friends, without any thought of your poor, lonely mother at home, you shall be cursed. Henceforth your rays shall be ever hot and scorching. They shall burn all they touch, and men shall hate you and cover their heads when you appear.' That is why the sun is so hot to this day.

"Then she turned to the Wind and said: 'You also, who forgot your mother while you were enjoying yourself, shall be punished. You shall always blow during the hot, dry weather, and shall parch and shrivel all living things. Men shall detest and avoid you from this time till the end of the world.' That is why the wind is so disagreeable during the hot weather.

"But to the gentle Moon she said: 'Daughter, because you remembered your hungry mother at home, you shall be cool, calm, and bright. No dazzling glare will accompany your pure rays, and men will call

you "blessed."' That is why the moon's light is so soothing and beautiful."

The Planet Mars

Next morning Harry and his little cousin Nellie, with her doll, awaited Mary. Harry had told Nellie about his delightful ramble on the moon the evening before, and she was delighted with the stories of the man, the woman, and the toad in the moon.

"I wonder what cousin Mary will tell us about this morning," she said.

"I am going to tell you about a pretty little planet named Mars," said Mary, as she came into the room and overheard Nellie's remark. Picking up Nellie, and placing her on her knee, she began the story of Mars as follows:

Story of Planet Mars

"Next door to our own planet earth is a beautiful little world tinted with red. It has snow-white caps at the north and south poles just like our earth. But there is not much water on Mars, because Mars is an old planet." "How do you know it is old?" asked Harry.

"I know it is old," replied his sister, "because the older a planet is, the smaller are the seas and lakes and the amount of water on its surface. As the planet gets older and older, the water disappears, until not a drop

is left. But there are wonderful canals all over Mars, and if there were boats up there, you could go all over Mars by means of these canals. When Mr. Lowell looked at Mars through his fine telescope, he not only saw the canals, but round spots where the canals meet."

"Perhaps the spots are landing-places where the captains take new passengers aboard," said Harry earnestly.

"Perhaps, Harry," said his sister, laughing; "that is, if there are any people on Mars, and captains and boats. How you would enjoy going in a yacht up and down these canals?

"It is not quite as bright on Mars as it is here, since it is farther away from the sun and only gets one-half as much light and heat. The year is also nearly twice as long and lasts six hundred and eighty-seven days, instead of only three hundred and sixty-five. Therefore, the summer season is nearly twice as long, but not nearly as warm as here."

"Then the winter must be twice as long and much colder than here," Harry said. "I do not think I should like that. But perhaps the canals freeze over in the winter time, and there may be fine skating up there?"

"No, the canals disappear altogether during the winter time," replied Mary; "or, rather, we cannot see them until they reappear again as faint dark lines in the spring-time. They get wider and wider until the

summer season, then they get narrow again and disappear."

"Do you think there are any little girls on Mars who have beautiful dollies like mine?"

"I really do not know," replied Mary; "but if there are any people living on Mars, I do know they are not like us. We could not live there, as there is not enough air for us to breathe. We would gasp just as that poor fish did the other day, when Uncle Robert hauled it up out of the lake and threw it into the boat. We must have air, and plenty of it, if we want to live."

"So we could not live on Mars, could we, sister?" said Harry.

"It would not be comfortable," replied Mary; "besides, it is not nearly as warm as here. Poor Uncle Robert would nearly freeze during the long winter. He would also find another surprise awaiting him if he went to Mars. Mars is a smaller world than the earth, so everything weighs less."

"Ah! I see," said Harry, clapping his hands with glee. "Uncle would not be so heavy on Mars. How glad he would be to go there! Poor Uncle Robert! He is so heavy he just shakes the house when he walks across the floor. Next time I see him I shall say: 'Go to Mars, Uncle Robert, and see what will happen to you there.' How much would he weigh on Mars? "

"He weighs two hundred and forty pounds here, and would weigh only ninety pounds there, and you

would weigh only thirty pounds. So I could pick you up, couch and all, and carry you as easily as Nellie carries her doll in its doll-carriage."

"Then dollie would weigh nothing at all," said Nellie, looking at her doll curiously.

Harry looked puzzled, and after thinking a moment, he said to his sister:

"I cannot see why I would weigh less if I went to Mars."

"Because the planet being smaller than the earth, it has less power to attract you and to hold you down to its surface. The earth is like a great magnet, and if there were not something drawing us to it and keeping us there, we would be greatly puzzled. Tables and chairs would not stand firm, and we would stagger about for want of weight, just as when a diver tries to walk in deep water. He has to have heavy weights fastened to him so as to keep him in place. A stone that would be quite heavy on earth would weigh only a few ounces on Mars. Nellie could carry this large rocking-chair I am sitting in and eight or ten dollies as well. Do you remember seeing the men at the circus jumping over bars five feet high? Well, on Mars they could jump fifteen feet, while the clumsy old elephant we saw there would probably be as graceful and nimble as a deer."

"How would football be on Mars?" asked Harry.

"Very unlike football here, dear. A good kick would send the ball much farther than here."

"Is Mars very far away?" asked Nellie. "If we could go there in a train, would it take us ever so long going?"

"About sixty years," said Mary, laughing, "if the train went a mile a minute. If you tried to walk it, going four miles an hour and ten hours a day, it would take you more than two thousand years to get there. So, I don't think we can take that trip, little girl, can we?

"And I must go home now," said Mary, as she kissed Harry lovingly. "And I shall tell you about the rest of Giant Sun's family tomorrow. Good-bye."

Story of Jupiter and His Moons

It was several days before Mary could see Harry again and tell him "sky-stories," as he called them, for he had been suffering much pain. Even her gentle voice irritated him, and perfect quiet was ordered by the doctor until the little sufferer was better. At last he was able to enjoy the sunlight and the flowers and the song of the birds again, and one bright morning he was all ready, as he told his sister, to take another trip to Starland. As Mary arranged the pillows on the couch for him, and a large sunshade, so that the glare of sunlight would not hurt his eyes, he caught hold of her hand and, pressing it lovingly, he said:

"Darling, what should I do without you? You are so good to me."

"How can I help it, little sweetheart!" said Mary, as she turned her head aside to keep him from seeing the tears that would come to her eyes; "how can I help it, when I love you so dearly. Besides, you are my own dear little brother, and you don't know how I missed you all last week."

"Did you really, sister? And I was dreaming away all day long about the wonderful stories you have been telling me. I played football on Mars, and had beautiful wings when I lived on the baby planets, and

flew from one to another, and now I want to know something about the giant planets. You said they lived next door to the little tiny planets."

Story of Jupiter

"Yes, next door to the baby planets we come to the largest of all, the giant planet Jupiter. If a tunnel were made through the center of Jupiter, eleven globes as large as the earth, placed side by side, would reach from one side to the other. You could make thirteen hundred globes out of planet Jupiter as large as the earth. If the earth were a large snowball, and a giant could roll thirteen hundred such snowballs into one, he would have a ball to play with as large as planet Jupiter.

If it were made of the same material as the earth, it would be more than three hundred times as heavy."

"It would take a very big giant to play with that snowball, wouldn't it?" said Harry, smiling at the thought. "There would not be much room in the sky for him to play in, would there?"

"Plenty of room," replied his sister, laughing; "room for millions and millions of balls as large as Jupiter, and much, much larger."

"What a wonderful place the sky must be!" said Harry, in awe. "Now, tell me some more about Jupiter. Didn't you tell me last week that he is hidden away among blankets, and very, very hot?"

"That is right, Harry, but some day he will cool down, and the blankets will change into beautiful oceans and seas and lakes. Then it will be a world like ours, with trees and flowers, and perhaps people will live there."

"The sun is so much further away from Jupiter than from the earth that it gives it only one twenty-seventh as much light and heat. If you can imagine the sun as a bright lamp in the sky, and someone turning down the wick of the lamp till its light is only one twenty-seventh as bright as it is now, you can imagine how dim the light and small the amount of heat must be on Jupiter."

"How long does Jupiter take in going round the sun?" asked Harry.

"About twelve years," replied Mary; "and the day is only about ten hours long, instead of twenty-four as here."

"What a short day!" said Harry, in surprise "Then you could work only five hours and sleep five hours. I believe I would sleep all day, and all night, too. I must tell Nellie about that next time I see her."

"Why did not she come this morning, I wonder?" said Mary. "Perhaps she has gone for a walk with her nurse."

"I'll tell her about my trip," said Harry generously, "when she comes over here again. And now what else is there about Jupiter?"

Jupiter as Seen through a Telescope

"If you look at it through a large telescope you will see that it is beautifully colored, as if Uncle Robert had taken his paint-box, and dipped his brush into browns and reds, and tinted the cloud-belts around Jupiter here and there with touches of yellow and orange, olive-green and purple. Only an artist could get such beautiful effects, if we could journey to one of the little moons of Jupiter."

"Has Jupiter moons also?" asked Harry, delighted at the thought. "Five of them," said Mary; "and I shall tell you about them later. Supposing we could journey to one of these little moons, what a glorious sight Jupiter would be! From the nearest moon it would look thousands of times larger than our moon. The colors we see only faintly through our telescopes would present a magnificent sight when seen at close range, while constant changes would be taking place, as varied as the changes in the clouds flitting across a summer sky. Great cloud-masses drift hither and thither with enormous speed, driven by winds of hurricane force. By watching the changes that take place in the clouds, we know there must be winds blowing at the rate of nearly two hundred miles per hour. Do you remember the cyclone Uncle Robert told us about, when several houses were blown down and trees uprooted?"

"Yes, indeed, I do," replied Harry, "and his poor little dog Fido was nearly killed by a falling chimney."

"Poor little Fido would not have much chance on Jupiter. The storms there are ever so much worse than here. The strongest buildings would be blown down in a few moments; sturdy oaks would be uprooted and blown about by the wind like straws."

"Do the storms last very long?" asked Harry.

"They last six and seven weeks at a time," replied Mary, "so that Jupiter would scarcely be a comfortable world to live on yet. Besides, it is still in the fiery stage."

"Won't you tell me some more about the little moons of Jupiter?" asked Harry.

The Moons of Jupiter

"They are not so little, after all, brother, except the first one, which is only one hundred miles wide. It is such a shy little moon that it keeps hiding behind Jupiter, or gets so close to him that it is lost in the glare of light from the giant planet. We had no idea it was there at all until an American astronomer, Professor Barnard, caught sight of it one evening. It was playing hide-and-seek as usual; but Professor Barnard, with his keen eyes, spied the little speck of light. It is now known as the fifth moon of Jupiter. It was only discovered in 1892, and just think, that for the hundreds and hundreds of years it has been there, yet

no one had seen it. The French people were so delighted because Professor Barnard caught sight of the little truant that they gave him a beautiful gold medal."

"Won't you show the little moon to me sometime?" said Harry. "I should like to see it so much."

"You can only see it through a very large telescope; but I can show you the other four moons if Uncle Robert will lend us his telescope."

"Here he comes," said Harry, in great glee, as he saw Uncle Robert crossing the meadow. "Won't you bring over your telescope this evening?" said Harry pleadingly, as he told him what Mary had just said.

"Certainly, my little man," his uncle replied; "but we can only see three of the moons this evening as one of them is eclipsed."

"What's that?" said Harry, in surprise at the strange word.

"Eclipsed means hidden," said Mary, laughing. "If Uncle Robert stands right in front of you, as he is doing just now, he hides me from you, so I am eclipsed."

"Very true," said Uncle Robert, laughing heartily at the hint. "Planet Mary is eclipsed by Uncle Robert, and poor little Planet Harry cannot see her till Uncle Robert gets out of the way." This he immediately proceeded to do, and next moment he was pursuing

Fido, who was having a not over-friendly encounter with a strange cat in a neighbor's garden.

"Oh, dear," said Harry, in distress, "where were we? We were up in the sky among the planets, and now Uncle Robert has brought us back again to earth. Do listen to poor Fido." He certainly seemed to be getting the worse of the encounter with the kitty; but when Uncle Robert came to the rescue the enemy vanished, and Fido, nothing daunted, went in search of other prey. When peace and quiet were once more restored, Mary resumed her story.

Eclipse of Jupiter's Moons

"Do you know, the appearance and disappearance of the little moons of Jupiter once gave a great deal of trouble to astronomers? They had a way of appearing a little too soon or a little too late. They were very seldom on time. This was very provoking, as astronomers were rather proud of being able to tell exactly when these little moons could be seen. At last they found out what was the matter, and that they were to blame and not the moons. We see the little moons on account of their light, and light takes time to travel. Don't you remember, I told you sound travels a mile in five seconds? Light travels even more quickly, for it only takes a little over a second in coming to us from the moon. It takes about eight minutes in coming to us from the sun; but Jupiter is

about five times as far away from us as the sun, so that light takes about half an hour in coming to us from Jupiter. We do not see it as it is, but as it was more than half an hour ago, when its rays of light started out to Planet Earth.

"Now, Jupiter, in going around the sun, is sometimes on the same side of the sun as we are. Then the light from the moons reaches us in about thirty-two minutes. But when Jupiter is on the opposite side of the sun, and as far away from us as it can be, then light takes as much as forty-eight minutes in coming here — over a quarter of an hour longer. So a clever astronomer decided that when Jupiter and his moons are nearest to us, it does not take as long for their light to reach us as when they are farther away, and this is because light, like sound, must have time to travel.

"Even though light can go round the earth seven times in a second, traveling at the rate of about 186,000 miles a second, yet, as Jupiter is millions of miles away, it takes light about half an hour, and sometimes forty-eight minutes, for it to cross that great distance. It is just the same as if Uncle Robert were in India. It would take him a much longer time to come and see you than if he were at his home just a few hundred yards away. It takes time for him to travel here, just as it takes time for light to travel from the little moons of Jupiter."

"I wish we had five moons shining on our earth," said Harry; "how pretty it would be! Does it take the moons as long as our moon to get around Jupiter?"

"They are much livelier than our moon," replied Mary; "and the second moon flies right around Jupiter in a little more than a day and a half, and even the outside moon only takes about two weeks; so there must always be a moon shining in the sky for Jupiter. These moons, except the moon discovered by Professor Barnard, are all larger than our moon, and the fourth one is nearly as large as Mars. But I hear the bell for lunch, Harry, and I must run away now. I will tell you about the other planets later."

"How many are there?" said Harry, as his sister kissed him good-bye.

"Only three," replied Mary; "and I shall tell you about them tomorrow, if you are not too tired."

"Too tired!" said Harry. "I am never too tired to listen to you."

The Giant Planets

The Planet Saturn

Harry had spent a most delightful evening looking through Uncle Robert's telescope at the little moons of Jupiter, and he also had seen the planet Saturn, with its rings and moons. Next evening when his sister came to talk with him he had many questions to ask her. First of all he wanted to know what the rings were made of.

"Millions of little moons," replied his sister. "I wish you could see Saturn and its rings through the great telescope at the Lick Observatory. It makes such a pretty picture. Like Jupiter, the planet Saturn is surrounded by clouds; but they are tinted with blue at the poles, yellow elsewhere, and dotted here and there with brown, purple, and red spots. Around the center is a creamy white belt. Then, there are eight moons that accompany Saturn in its journey around the sun; but they give very little light to the planet, since if they could all be full together they would give but a sixteenth part of the light we receive from the moon."

"Why is that?" asked Harry.

The Planet Uranus

"Because Saturn is so far away from the Sun," replied Mary. "Next to Saturn we find Uranus. This planet was first seen by William Herschel, who afterwards became one of the greatest astronomers the world has ever known. When Herschel was a little boy his home was in Hanover. He had great talent for music, and when he was fourteen years old he joined the band of the Hanoverian Guards. What a proud boy he was when he dressed in his new uniform! However, pride must have a fall, and it was not very long before he wished he had never entered the army. Just about this time war broke out between France and England, and as Hanover belonged to the English it was attacked by the French. The Hanoverian Guards were badly defeated. Herschel spent the night after the battle hiding away in a ditch, and next day, assisted by his friends, he ran away to England. There he continued his musical studies, and some years later he became a fine organist."

"Did he have to play a big organ like the one in our church?" asked Harry.

"Something like that, I suppose," said Mary; "and he played very well indeed. He learned more and more about music, and in the evenings when going and coming from the church he used to notice the beautiful stars overhead, and he wished to learn something about them."

"Just the way I feel," said Harry. "I get nurse to pull up the window curtain at night so that I can see the stars from my bed, and they seem to laugh and wink their little eyes at me as if they knew I was watching them. Did Herschel have a telescope like the one Uncle Ebert has?"

*' He was not so fortunate, but he wanted one very much indeed. So he borrowed a telescope from a friend, and every night after practicing in the church he would amuse himself looking at the stars. He longed to have a telescope of his own; but he found that they cost more than he could afford to pay, so he decided to make one. He bought all that was necessary, and turned his home for the time into a workshop. He had a dear, good-natured sister named Caroline, and she did all she could to help her brother. Sometimes he was too busy to eat and she used to feed him. When he was tired she would read to him from the 'Arabian Nights.'"

"The same book I have?" asked Harry, in surprise.

*' The very same; and this helped to pass away the time while Herschel polished away on the great mirror of his telescope. When the telescope was finished people came from far and near to see it. One evening when Herschel was gazing at the stars with this magic glass he spied a star not marked down on his charts. 'Something wrong here,' thought Herschel; 'this must be a comet.' But after noticing it for a while

he found that it was not a comet, but a planet or wanderer among the stars."

Difference Between a Planet and a Star

"How could he tell the difference?" asked Harry. "When I looked at Planet Jupiter last night it looked like the stars, only rounder and bigger."

"The planets are so much nearer to us than the stars that we can follow them as they slowly creep between us and the stars in their journey around the sun. The stars are so far away that we would have to watch them for thousands of years before they would seem to move at all, yet we know they are moving."

"Are the stars moving?" said Harry, in surprise.

"Yes, they are moving, just as distant steamers seen at sea are moving; but they are so far away that they seem motionless. Don't you remember how we used to watch them from the seashore? Still they were going as fast as steam could take them. We might compare the steamers to the stars, and the little boats nearer shore were more like the planets. We could easily follow the boats with our eyes as they danced over the waves, and in the same way we can easily follow the planets as they creep across the sky, because they are so much nearer to us than the stars."

"The new planet was called Uranus, although at first the friends of Herschel wanted to name it after

him. Next to Uranus comes the planet Neptune, which was discovered before it was ever seen."

The Discovery of the Planet Neptune

"How could that happen?" asked Harry.

"Because Uranus behaved so strangely," replied his sister. "The planets attract each other; for instance, the earth is swayed to and fro by Jupiter and Venus, and a great struggle is always going on among the planets in the family of Giant Sun. It could be plainly seen that Saturn was taking part in the struggle and dragging Uranus toward it, but something beyond the newly discovered planet was pulling it the other way. 'There must be another planet,' said the astronomers, and they were right. After puzzling over the problem two astronomers found the truant, and announced exactly when and where it was to be seen. And there it was, nearly exactly where these learned men said it would be. The new planet was christened Neptune, and it takes about one hundred and sixty-four years to go around the sun. It is so far away from the sun that it only receives one nine-hundredth of the amount of light and heat we receive on planet earth."

"Then it must be very cold on planet Neptune?" said Harry.

"And very dark also," said Mary, "since from this planet the sun only looks as large as an electric light seen at a distance of a few feet."

Comets and Meteors

A few evenings later Mary had a wonderful story to tell her brother about some visitors from space who often visit the kingdom of Giant Sun. "They are called comets, or hairy stars, but I rather enjoy calling them 'celestial tramps.'"

"What are they like?" asked Harry.

Story of Comets

"They usually have a bright golden head, sometimes as large as the earth, and as they approach the sun they adorn themselves with a glittering train millions of miles in length. Some of the comets are regular visitors, and we know just when to expect them; others come, and do not return for hundreds of years, while a few visit the sun never to return again."

"Where do they come from?" asked Harry.

"We scarcely know," replied Mary, "except that it is from outer space, just like tramps on earth. We do not know where tramps come from, nor do we expect to see them again. If they do revisit us, however, we can usually recognize them. Do you remember the old man who came to the kitchen door the other day and begged for food? You felt so sorry for him. You would

know him if you saw him again on account of his long white beard, white hair, and shabby clothes.

"When a celestial tramp returns, however, it is not so easy to recognize it. When it first greeted us it may have had a large head and a gorgeous train millions of miles in length. Next time we see it, how it has changed! Its head may be small, its train may have vanished, or it may be the proud owner of three or four trains. A comet usually changes its appearance at every visit. Just as if the old man we saw the other day were to cut off his beard, dye his hair black, and wear Uncle Robert's dress-suit. We should not know him, should we, Harry?"

"I should think not," said Harry, laughing at the very idea. "Then how can you tell when the same comet visits us again?"

"Because it has a regular path marked out for it in the sky," replied Mary, "and it travels along that path unless something happens to it on the way. It may go too near giant planet Jupiter. Just like our tramp again, let us suppose he has a regular path marked out and it takes him across Uncle Robert's farm and leads to our kitchen door. We may expect to see Mr. Tramp tomorrow, but as he crosses the farm a dog bites him and frightens him away. Perhaps then we may not see him again."

"Poor old man," laughed Harry. "I hope that won't happen to him. Do the 'celestial tramps' travel very quickly through the sky?"

"Not very quickly until they come close to the sun. Then they rush around it ever so much faster than an express train; but as they recede from the sun they go more slowly until they seem only to creep along, as if worn out by their long journey. They also lose their trains after they go away from the sun, and the train becomes shorter and shorter, till the comet looks like a round, fluffy ball, just as it did before it came too near the sun. It is the sun's heat that drives the particles from the head of the comet and forms a train."

"What are comets made of?" asked Harry.

"Of millions of tiny little particles covered with coats of glowing gas. These particles are made up of carbon, sodium, iron, and magnesium. You will find plenty of sodium in the sea, while common table salt is partly sodium. You know what magnesium is. Some of that medicine doctor gives you is made of it."

"So if I get some iron and salt and coal and some of my medicine, and put them all together, I should have a bit of a comet," said Harry.

"But you must remember the coal, iron, sodium, and magnesium must be very much heated, and don't forget the coat of gas. Sometimes a comet breaks into pieces, and the fragments travel along by themselves as meteors."

"Sometimes the earth plunges through swarms of meteors, which journey in regular paths around the sun. At such a time, the bright masses seem to fall in showers from the sky. There are three great showers which we always know when to expect. Some come in August, some on the 13th or 14th of November, and there is another shower which always appears within a day or two of the 27th of November.

"'If you November's stars would see,
From twelfth to fourteenth watching be,
In August too stars shine from heaven,
On nights between nine and eleven.' "

Story of Meteors

"What are meteors?" asked Harry.

"Meteors are great masses of stone or iron which sometimes weigh several tons. Lieutenant Peary found one not long ago in the Arctic regions, and it weighed about eighty tons. It is lucky for us that many meteors do not fall on the earth, or we should have to walk about with iron umbrellas over our heads as a protection. When they do fall on earth, they are much prized and placed in our museums as curiosities.

"A story is told about a meteor that fell on a farm some time ago. The landlord said it belonged to him, for when he rented the farm to the tenant he claimed all minerals and metals found in the ground.

"'But it was not on the farm when the lease was made out,' said the tenant.

"'Then I claim it as flying game,' replied the landlord angrily.

"'But it has neither wings nor feathers, so I lay claim to it as ground game,' said the tenant in reply.

"While the dispute was going on the custom-house officers seized the meteorite, because, as they said, it had come into the country without paying duty."

"That is not a true story, is it?" asked Harry, laughing.

"Scarcely," replied Mary; "but it was a good joke on the landlord. And now we come to the very smallest members of the family of Giant Sun. I mean the shooting stars."

"Those bright little flying stars we can see at night?" asked Harry.

Story of a Shooting Star

"Yes," replied Mary; "and if they could only talk, what a wonderful story they would have to tell! A shooting star is very much smaller than a meteor, and the largest does not weigh more than a quarter of an ounce. You could easily hold one in your hand, for it is like a small stone, only, unlike a stone, it is always on the move. It hurries along through space ever so much faster than an express train, and all goes well as long as it keeps above the blanket of air that surrounds the earth. If it comes too near, however, it is sure to be destroyed. It dashes into the air at the rate of twenty-five miles a second, rubbing against every particle it meets on its way. This makes it intensely hot, until it glows with brilliant light. We see it for a few moments as it flashes out against the dark sky; but the light soon fades and all that remains of the shooting star is its ashes. Sometimes they sift down upon the earth and settle on the tops of high mountains, or sink into the

ocean, or float in through an open window and rest upon tables and books as fine dust. But when our good housekeeper finds it there she carefully removes it with her duster. She does not know nor does she care where it came from; it certainly has no right there, and she treats it with small ceremony."

"I wonder what she would say if she knew that the dust had come from the sky," said Harry.

"I do not think it would make any difference," said Mary, laughing. "And now I am going to tell you a little story about a shooting star, and then I must say good-night.

"It is said that the evil genie — you remember reading about them in the Arabian Nights, don't you, Harry? "

"Indeed I do," he replied.

"Well, at night they are said to fly up to the gates of heaven and listen to the conversation of the angels. When the angels see their hidden foes, they hurl fiery shooting stars at them and with so good an aim that for every shooting star we may be sure there is one spirit of evil less in the world."

Stories of the Summer Stars

It was a glorious night in June, and the stars sparkled like gems against the dark background of the sky.

Harry was enjoying the scene, as the doctor had allowed him to spend the warm summer evenings out on the lawn in front of the house. This was a royal treat to him. He could see all the sky at once, he said to his sister, and could look at the stars while she told him stories about them. First of all, there was the Great Dipper in the North, and the Little Dipper with the Pole Star. He was surprised when his sister said that the Great Dipper formed part of the group of stars known as the Great Bear, and he listened intently while she related the story as told in olden times by the Grecians.

Legends of the Great Bear

"The Great Bear was said to be Calisto, the beautiful daughter of Lycaon, king of Arcadia. Juno, the wife of Jupiter, was jealous of Calisto, and threatened to destroy her beauty. Fearing that Juno would harm her, Jupiter changed her into a bear.

"'Her arms grow shaggy and deformed with hair,

Her nails are sharpened into pointed claws,
Her hands bear half her weight, and turn to paws;
Her lips, that once could tempt a god, begin
To grow distorted in an ugly grin:
And, lest the supplicating brute might reach
The ears of Jove, she was deprived of speech,'

"Calisto had a son named Arcas, who became a great hunter. One day he roused a bear in the chase, and, not knowing that it was his mother, was about to kill her, when Jupiter, taking pity on them both, changed Arcas into the Little Bear."

"Who was Jupiter?" asked Harry.

"In the olden times, he was supposed to live on the top of Mount Olympus, with his beautiful wife Juno. When Jupiter was angry with people, it is said he would hurl thunderbolts at them, and when he was pleased he placed them after death among the stars."

"So he was pleased with Calisto and her son?" said Harry.

"So the story says," replied Mary. "But he also seemed to be afraid of his jealous wife Juno.

"A modern Greek legend gives another account of this constellation or group of stars. It is supposed that at one time the sky was made of glass and it touched the earth on both sides. It was soft and thin, and someone nailed a bear skin upon it, and the nails

became stars; and the tail is represented by the three bright stars known as the handle of the Great Dipper.

"Another story is told about a princess who was turned into a bear on account of her pride in rejecting all suitors. For this her skin was nailed to the sky as a warning to other proud maidens.

"Would you like to hear what the Indians tell about the Great Bear?" asked Mary.

"Indeed I should," replied Harry. "I had no idea the Indians looked at the stars."

"They spend so much time on the open plains that they cannot help noticing them," said Mary; "and they tell many strange legends about them. The Iroquois Indians tell the following story about the Great Bear, which must have seemed like a Bear to them, just as it did to the Grecians.

"Once upon a time a party of hunters who were in pursuit of a bear were suddenly attacked by three monster stone giants who destroyed all but three of them. These, together with the bear, were carried up to the sky by invisible hands. The bear is still being pursued by the first hunter with his bow, the second hunter carries a kettle, and the third is carrying sticks wherewith to light a fire when the bear is killed. Only in the autumn does the hunter pierce the bear with an arrow, and it is said that it is the dripping blood that tinges the autumn foliage."

"I like that story," said Harry. "Don't you know another bear story?"

"I can tell you one," replied his sister, "that is told by the Fox Indians of Louisiana. In the days of long ago the Indians believed that the trees were able to walk about at night and talk to each other. One dark night as a bear was wandering homeward through a lonely wood, he was very much surprised to see the trees walking about, nodding their heads and whispering to each other.

"At first Mr. Bear thought it was only the wind; but where he saw a mighty oak before him, the next moment it was far behind him or on the other side of the road. Presently he happened to run against a tree. It was the oak, the lord of trees. The oak was angry and reached out one of its long branches and grabbed the bear by the tail. The bear struggled all night long to get away, and at last the oak, losing all patience, gave his tail a final twist and hurled him up into the sky. They say his tail was stretched in the struggle."

Stories of the Great Dipper

"That is a funny story," said Harry, enjoying the account of Mr. Bear. "Are there any stories about the Great Dipper? I wonder why it is called the 'Dipper'?"

"Because it is supposed to look like a dipper," replied Mary. "You can see the four large stars representing the dipper and the three stars that form

the handle. It is known as the 'Saucepan' in the South of France, and in other parts of France it is called the 'Chariot of David.' In England it is called the 'Plow' and sometimes 'Charles's Wain.' That means wagon. In Italy it is known as the 'Car of Bootes.' Bootes was supposed to be an ox-driver and inventor of the plow — the Dipper. One day the driver, oxen, and plow



Figure 15 -- The Great Dipper and the Little Dipper

were suddenly lifted off the earth and placed in the sky. You can see Bootes now, and in front of him are the seven stars of the Great Dipper, which he must drive around the Pole Star for all eternity.

"A pretty story is told of a peasant who met our Savior near the shores of Galilee and gave Him a ride in his wagon. As a reward he was offered a home in heaven; but he preferred to drive his wagon from east to west for all eternity, and his wish was granted.

There stands his wagon in the sky, and the brightest of the three stars is called 'The Rider.'

"In North Germany 'The Rider' is supposed to start out on his journey before midnight, and to return twenty-four hours later, his wagon turning round with a great noise. He urges on his horses with loud cries of 'hi! he!' which it is said have sometimes been heard by lucky mortals."

"Hush, sister," said Harry softly; "let us see if we can hear him now."

"No, you could only hear him at midnight," replied his sister — "that is, if the story were true."

"It is only like a fairy story, then?" asked Harry.

"All these stories are fairy stories," replied Mary; "and here is another.

"A Basque legend relates that a certain husbandman had two oxen stolen from him by two wicked thieves. He sent his laborer after them, but he did not return. Then he sent his housekeeper, and his dog, and finally he decided to go after the thieves himself. He was so angry that he lost his temper, and in punishment for the remarks he made he was condemned to continue his search through the sky for all eternity. There you can see him now. The two oxen are the first two stars, then follow the two thieves, and lastly the two servants, the husbandman, and the little dog."

"Where is the little dog?" asked Harry.

"Look at the three stars in the handle of the Dipper," replied Mary. "Now look at the middle star, and if you have good eyes you can see a little star close beside it. Here, look through this opera-glass and you can see it better."

"I see it now," said Harry, as he looked through the glasses. "So that is the little dog? "

"Yes," replied his sister; "and the Arabians gave it the name of Alcor."

"Dear little Alcor," said Harry, as he continued looking at him, "I am going to look for you every evening now, because I can see the Great Dipper from my window."

"So you can," replied Mary; "I forgot that it faced north.

"The American Indians tell a quaint story about the Little Dipper. Would you like to hear it?"

"If you are not tired, sister," said Harry.

"You will get tired first, for I enjoy telling you these stories, if they amuse you, dear. Well, here is one that I came across some years ago among a collection of Indian legends.

"Once upon a time a party of Indians went out hunting in a strange country and lost their way. They wandered about for many moons."

"What does that mean?" asked Harry.

"I suppose they did not know anything about our months, so they counted from full moon to full moon. This shows how much they observe the sky. But, as I was saying, they wandered about for many moons, and at last the chiefs decided to hold a council and pray to the gods to show them the way home. During the dance that preceded the council, while the flames of burnt offerings were ascending to the gods, a little child appeared suddenly in their midst and said she had been sent as their guide.

"She said she was the Spirit of the Pole Star, and that if they followed where it led them they would reach their home in the far North. The hunters thanked the child, and following her advice they soon reached home. Here they held another council, and decided to call the Pole Star, 'the star which never moves,' by which name it is known among these Indians to this day.

"When the hunters died it is said they were taken up to the sky, and we can see them still following the Pole Star. The hunters are supposed to be the stars that form the Little Dipper."

"They are smaller than the stars of the Great Dipper," said Harry, "and the dipper is smaller, but I can see it quite well. And what are the stars between the two Dippers? "

Story of the Dragon

"They curve in and out like a great dragon," said Mary; "and two bright stars mark its eyes."

"Yes, it does look something like a dragon," said Harry. "What is its name?"

"It is called the Dragon, as that was the name given to it by the Grecians long ago. This was supposed to



Figure 16 -- Bootes and his hunting dogs.

be the dragon that Juno placed as guardian of a tree covered with golden apples. No one dared to touch the tree while the dread monster was there. But a brave man named Hercules was not afraid, and killed the dragon. To reward it for guarding the tree Juno placed it among the stars.

"See the two bright stars that mark the eyes of the Dragon, and quite close to it is Hercules, represented in the olden maps as crushing the head of the dragon

under his foot. Bootes, who drives the Great Bear around the Pole Star, is very near Hercules. There you can see him, with his hunting dogs."

"Where, sister? I cannot see him," said Harry.

"Look right overhead, and to the west you will see Bootes with a very bright star; and to the east is Hercules, or the Kneeler, as he is sometimes called. Now, in between there is a pretty little half-circle of stars like a crown. This is called the Northern Crown.

Stories of the Northern Crown

"I can see that very well," replied Harry, "for it is exactly overhead, and I cannot help seeing Hercules and the Bear-driver. They are large enough," he continued, laughing. "Why are the little stars called the Northern Crown? "

"This was supposed to be a beautiful crown of seven stars given by Bacchus to Ariadne, the daughter of Minos, second king of Crete.

"'Her crown among the stars he placed,
And with an eternal constellation grac'd,
The golden circlet mounts, and as it flies
Its diamonds twinkle in the distant skies.'

"There is a pretty legend told about it by the Shawnee Indians. They call this group of stars the 'Celestial Sisters,' on account of the story, which is as follows:

"White Hawk was a great hunter, handsome, tall, and strong. One day, while wandering through the forest in search of game, he suddenly found himself on the borders of a prairie. It was covered with grass, and flowers, and a ring was worn through the grass, without any path leading to or from it. White Hawk was surprised at this, so he hid behind some bushes and watched.

"'Soon he heard, high in the heavens,
Issuing from the feathery clouds,
Sounds of music, quick descending,
As if angels came in crowds.'

"Looking up he saw a small speck in the sky which gradually became larger and larger. It was a silver basket containing twelve beautiful maidens, who leaped out as it touched the ground. They danced around in the ring, beating time on a silver ball. White Hawk gazed at the fairies in wonder, and, rushing out from his hiding place, tried to capture the youngest and prettiest. But the sisters were too nimble for him, and, jumping into the basket, they were soon far away in the sky.

"White Hawk was vexed, but he came again next day. This time he disguised himself as a rabbit, but one of the little sisters saw him creeping toward them. She gave the alarm just in time for them to escape.

"Next day White Hawk disguised himself as a mouse, and hid in the stump of a tree that he had

moved close to the fairy ring. The sharp-eyed little fairy noticed that the stump was not in the same place, and warned her sisters, but they only laughed at her. They even ran around it striking it in fun. Out ran White Hawk, caught the youngest and prettiest, and took her home as his bride.

"For a while they were happy, but the 'Celestial Sister' became homesick, and longed for her sisters in the sky. One day when White Hawk was out hunting she made a silver basket and, taking it to the fairy ring,



Figure 17 -- The Northern Crown, and Bootes, The Bear-Driver

she stepped into it, while she sang a magic chant. White Hawk was returning home across the fields just as the basket rose above the tops of the trees, and, hearing the music, he knew what had happened.

"But his wife did not forget him, and her father sent for him and invited him to come to the sky, where

he is now one of the bright stars shining near the Northern Crown."

"That must be the brightest star in Bootes," said Harry. "What is it called?"

"Arcturus," replied his sister. "Near Bootes is Virgo, the Virgin who lived on Earth during the Golden Age when people were very good. Near her are the scales in which she weighed the good and evil deeds of men,

Story of the Lion

"Just above the Virgin, in the west, you can see some stars that look like a sickle," said Mary.

Harry looked in the direction pointed out by his



Figure 18 -- Leo, the Lion.

sister, and there he saw the sickle plainly outlined by a few bright stars.

"Is there a story about it, sister?" he asked.

"Yes," replied his sister; "or rather there is a story not about the sickle, but about the group of stars to which it belongs, known as the constellation of the Lion.

"You remember how jealous Juno was, and she was even displeased with a brave man named Hercules, because he was afraid of nothing. She told her cousin to command Hercules to bring him the skin of a fierce lion that roamed at large through the forests. Hercules was not afraid, and attacked the lion. Finding he could not kill it with his club and arrows, he strangled the animal with his hands. He returned home carrying the dead lion on his shoulders, but Juno's cousin was so frightened at the sight of it and at this proof of the great strength of the hero that he ordered him to tell the story of his brave deeds in future at a safe distance outside the town."

"What a coward Juno's cousin must have been!" said Harry disdainfully. "I suppose Hercules laughed at him."

"Of course he did," said Mary. "But he was not the only brave man Juno disliked. Orion, the mighty hunter, also aroused her anger because he boasted that nothing could harm him. She sent a scorpion out of the earth, and it stung him, causing his death. See the heart of the scorpion, marked by a bright red star

named Antares. Above it is the serpent and the serpent-holder.

The Milky Way

"Now look at the band of silvery light reaching from the north to the south. That is the Milky Way, and it is made up of millions of bright stars. There are large stars and little stars, and Professor Barnard thinks that there may be some very small stars forming out of the star-mist. These little stars glitter in vast beds of glowing gas. As scientists believe, this gas is the matter from which worlds and suns are made. The stars at these points in space seem to be actually growing out of the star-mist now surrounding them.

"According to a French legend, the stars in the Milky Way are lights held by angel-spirits to show us the way to heaven. The Grecians called the Milky Way the road to the palace of heaven. On the road stand the palaces of the illustrious gods, while the common people of the skies live on either side of them.

"Even the Algonquin Indians had something to say about it, for they believed that it was the 'Path of Souls' leading to the villages in the sun. As the spirits travel along the pathway, their blazing campfires may be seen as bright stars. Longfellow refers to this in his poem 'Hiawatha,' in describing the journey of Chibiabos to the land of the hereafter.

A Swedish Legend

"According to a Swedish legend, there once lived on earth two mortals who loved each other. When they died they were doomed to dwell on different stars, far, far apart. But, 'as they sat and listened to the music of the spheres,' they thought of building a bridge of light that should reach from star to star, till it spanned the distance separating them from each other.

" 'They toiled and built a thousand years in love's
all-powerful might.
And so the Milky Way was made a bridge of starry
light.'

"Now, Harry, look at the Milky Way in the northern part of the sky, and what do you see?" asked Mary.

"Some stars that look like a W," replied Harry; "and just below it is another but larger W."

"The small W is Cassiopeia," said Mary, "and the large one is Cepheus; but I shall tell you their story another time, as it is getting late now. Under the large W, you will see some stars that look like a large cross. This is sometimes called the Northern Cross, but it is better known as the Swan.

Legend of the Swan

"The 'Swan' is supposed to represent a wonderful musician named Orpheus. Apollo gave him a magic harp, which he played with such sweetness that the wild beasts of the forest were tamed by its sounds, rapid rivers ceased to flow, and mountains and trees listened to the music.



Figure 19 -- The Swan.

"One day Orpheus met a beautiful maiden named Eurydice, and won her for his bride. But their happiness did not last long, as a serpent lurking in the grass stung her foot, and she died of the wound.

"Orpheus mourned her sadly, until at last he died and his spirit met hers in the kingdom of Pluto. Afterward Orpheus and Eurydice were placed among the stars. You can see the harp beside Orpheus, and it is adorned with a sparkling blue star named Vega.

"And now one more story," said Mary, as she heard the church clock chime nine, "and then we must say 'good-bye' to the stars for tonight."

"It has been lovely," said Harry. "I could listen to these stories all night long. How I shall enjoy the stars since you have told me s

o much about them! What are you going to tell me now? "

"Just under the Swan can you see a bright star, and a little star on each side of it?" asked Mary.

Harry looked, and after a few moments he found them. When his sister had made sure that he could see the stars she meant, she began her story as follows:

Meeting of the Star-Lovers

"The Japanese call the Milky Way the Silver River of Heaven, and they believe that on the seventh day of the seventh month (7th of July), the Shepherd-boy star and the Spinning-maiden star cross the Milky Way to meet each other. Vega, the bright star in the harp, is supposed to be the spinning-maiden, and on the other side of the Milky Way, crossing over where you see the bright star and the little star on each side, you will find the shepherd boy, otherwise known as the Goat. These stars are known among the Japanese as the 'boy with an ox' and 'the girl with a shuttle,' about whom the following story is told:

"There once lived on the banks of the Silver River of Heaven a beautiful maiden who was the daughter of the Sun. Night and morning she was always weaving, blending the roseate hues of morning with the silvery tints of evening. That is why she was called the Spinning maiden. The Sun-king chose a husband for her. He was a Shepherd boy who guarded his flocks on the banks of the celestial stream.

"After meeting him the Spinning maiden ceased to work, and the bright hues of morning were left to take care of themselves, while the silvery tints of evening hung like ragged fringe on the dark mantle of night. The Sun-king, believing that the Shepherd boy was to blame, banished him to the other side of the Silver River, telling him that only once a year, on the seventh day of the seventh month, could the Spinning maiden come to see him.

"The king called together myriads of doves and commanded them to make a bridge over the river of stars. Supported on their wings, the Shepherd boy crossed over to the other side. No sooner had he set foot on the opposite shore than the doves flew away, filling the heavens with their billing and cooing. The weeping wife and loving husband stood awhile gazing at each other from afar, and then they separated, one in search of another flock of sheep, the other to ply her shuttle daring the long hours of daylight.

"Thus the days passed away, and the Sun-king rejoiced that his daughter was busy again. But when night comes, and all the lamps of heaven are lighted, the lovers stand beside the banks of the starry river and gaze lovingly at each other, eagerly awaiting the seventh day of the seventh month. As the time draws near the Japanese are filled with anxiety. What if it should rain, for the River of Heaven is filled to the brim, and a single raindrop would make it overflow! This would cause a flood, and the bridge of doves would be swept away.

"But if the night is clear, then the Spinning maiden crosses over in safety, and meets her Shepherd boy. This she does every year except when it rains. That is why the Japanese hope for clear weather on the 7th of July, when the 'meeting of the star-lovers' is made a gala day all over the country."

"Sister, I can see the Spinning-maiden star, and the Shepherd boy, but where is the bridge of doves?" asked Harry.

"Across the Milky Way," said Mary.

"See the bright star, which is called Altair, and one little star on each side. We call that the Eagle, so if you change the story a little you can say the Eagle takes the Spinning maiden across the Silver River of Heaven."

Story of the Winter Stars

Winter had come with its cold north winds and frosty air. The stars glittered like gems against the dark velvet sky, and seemed reflected in the mantle of pure white snow that covered the earth. Mary had asked Harry's nurse to move his couch into her room so that he might see the stars from the windows, one looking south, and the other east. Impatiently Harry now awaited his sister, who had promised to take him on another trip to starland. The room was in total darkness, and nurse had raised the curtains. Looking right into one window was the mighty giant Orion, while the Twins peeped into another.

Story of the Royal Family

"It is as good as a play," said Harry, as his sister started to tell him about them.

"First of all," she said, "I am going to tell you the story of the Royal Family, although we cannot see them from this window. You can get a glimpse of Cepheus from your own room, but the rest of the Royal Family are overhead. You would have to make a hole through the roof if you wanted to watch them while I told their story."

"If we could go out-of-doors, as we did last summer, could we see them overhead?" asked Harry.

"Yes," replied his sister; "but it is too cold now to look at them except from a warm, cozy room. Tomorrow I shall show you a map of these stars, and when the days grow warm again we can look for them in the sky."

"Can you see them during the summer-time as well as the winter?" asked Harry.



Figure 20 -- Queen Cassiopeia.

"Yes, we can see them all` the year round, just as we can always see the Pole Star and the Great Dipper. The Royal Family consists of King Cepheus, Queen Cassiopeia, and her daughter Andromeda, sometimes called the 'Chained Lady.' Perseus, the rescuer, is at the feet of Andromeda, while her head rests upon the shoulder of the winged horse Pegasus.

"The Grecians told a wonderful story about this family. It appears that Cassiopeia boasted of her beauty, and said she was more attractive than Juno, the wife of Jupiter. As for her daughter Andromeda, not a nymph in the sea could compare with her in good looks. You may imagine how Juno and the sea-nymphs felt when they heard this vain boast!

"They determined to have revenge, and Juno asked Jupiter to punish Cassiopeia. So she was sent away from the earth and placed among the stars with her husband Cepheus.

"As for Andromeda, the sea-nymphs asked Neptune to send a sea-monster to devour her. She was chained to a rock so that she might not escape this terrible fate; but just as the monster was approaching a brave hero named Perseus came to her rescue.

"Perseus was returning through the air on his winged horse Pegasus from a terrible encounter with the Gorgons. These were three sisters who frightened everyone that saw them. Serpents were wreathed around their heads instead of hair, their hands were of brass, their bodies were covered with scales, and their eyes had the power of turning all they looked at to stone. Perseus had cut off the heads of one of these terrible beings, and when he saw the monster approaching Andromeda, he turned the head which he still held in his hand toward it, and in a moment it turned to stone.

"As a reward for his bravery, he was placed after his death among the stars, and near the fair Andromeda.

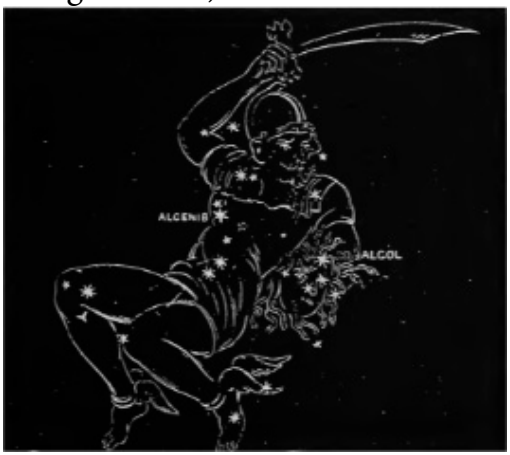


Figure 21 -- Perseus.

He still holds the head in his hand, and a star named Algol, or the Demon, as the Arabs call it, marks the evil eye. Sometimes it is bright, but in a few hours it will grow dim, as though winking at the people on earth. For this reason it is called a variable or changing star."

"What is that, sister?" asked Harry.

"A star that is brighter one time than another. Supposing someone kept turning the wick of the lamp up and down so that at one moment the room would be very bright and the next moment quite dim. You would call that a changing light. So it is with these stars, only in the case of Algol it is a planet that goes around it and at times cuts off part of its light. For two days and a half it is very bright, then during three or

four hours it begins to get dim, and remains so for twenty minutes and then it gets bright again.

"Supposing you were trying to read by lamplight, and I should now and then hold a book between the lamp and you. Each time I did so the light on your book would grow dim. There is another variable or changing star named Mira, in the group of stars called Cetus, which is no other than the sea-monster which was sent to devour Andromeda. You can see it if you look out of the window facing south, and you will notice that it is at a safe distance from Andromeda who is almost exactly overhead just now.

Story of the Fishes

"Not far from the sea-monster are the Fishes, and the story about them is as follows:

"One day when Venus and her little son Cupid were walking beside the banks of a river they were frightened at seeing a terrible giant named Typhon. Flames flashed from his eyes, and as he glared at Venus and Cupid they were overcome with fear and called on Jupiter to help them. He changed them into fishes, and afterward placed them among the stars.

"Between Cetus and Orion you can see some stars winding in and out, and they are part of the River Eridanus. A daring youth named Phaeton tried to drive the chariot of the sun through the sky one day.

Jupiter struck him with a thunderbolt, and hurled him from heaven into the river below.

"'At once from life and from the chariot driven,
Th' ambitious boy fell thunderstruck from heaven.

The breathless Phaeton, with flaming hair.
Shot from the chariot like a falling star
That in a summer's evening from the top
Of heaven drops down, or seems at least to drop.'

"His sisters mourned his unhappy end, and were changed by Jupiter into poplars, which are still to be seen on the banks of the River Eridanus.

"'All the night long their mournful watch they keep,
And all the day stand round the tomb and weep.'"

"Poor Phaeton," said Harry, as Mary finished the story. "And is that Phaeton with those three bright stars near the river? "

"No; that is Orion," replied his sister, "and the three bright stars mark his belt. Under it you can see a small cloud of mist, if you look at it through your opera glass. It is clinging around one of the faint stars in the sword. This is star-mist, from which other stars are being made, and it looks small only because it is so far away from us; but there is enough star-dust there

to make thousands of bright stars. Astronomers called these clouds nebulae."

"Who was Orion?" asked Harry. "Won't you tell me more about him?"

"He was a mighty hunter, and in the old maps you can see him represented as warding off the attack of



Figure 22 -- The Bull, and the Pleiades.

the Bull, which is glaring at him with its bright red eye named Aldebaran. A story was told by the Grecians about this bull:

"Once upon a time there was a beautiful little girl named Europa, and she was a princess of Phoenicia. One day she was playing with some friends and gathering flowers in a meadow near the seashore. Suddenly a snow-white bull appeared, and the little children were very much afraid. But the princess was not afraid. She made a pretty garland of flowers and placed it around the bull's neck. When it knelt down

in front of her as though to thank her, she jumped on its back, and it ran away with her down to the sea. Plunging under the waves, it swam with her to Crete. The Grecians thought they saw the bull outlined among the stars in the sky, but only its head and shoulders are there."

"But there are not any animals really in the sky, are there?" said Harry.

"No," said Mary, laughing at the question; "but if you look at the stars you can imagine you see outlines of bulls and serpents and all kinds of strange animals. Only you have to imagine very much, and this is exactly what the Grecians did.

"In the shoulder of the bull is the pretty little cluster of stars known as the Pleiades."

Story of the Pleiades

"What is a cluster of stars?" asked Harry. "Hundreds and thousands of stars forming a family party, as it were; and seen from earth they seem to be closely packed together. But if we could draw near to them, however, we should find that they were very far apart If you look at the Pleiades through your opera glass you will see quite a number of little stars, and if you could see it through the large telescope at the Lick Observatory you would be able to count hundreds of stars. When the cluster had its photograph taken, not long ago, six thousand stars were counted, so you

might call the Pleiades a 'ball of suns.' There are hundreds of these clusters, or 'family parties,' in the sky — mighty regiments marching across the star-depths."

"What do you mean, sister?" asked Harry in surprise.

"All the stars are moving," replied his sister. "Some in one direction, some in another; but the stars in the Pleiades are all drifting in the same direction.

"The Pleiades were said to be the seven daughters of Atlas, and were so beautiful that Orion pursued them across wood and dale, till the sisters called on Jupiter to help them. He changed them into doves, and afterward placed them among the stars. Orion still seems to be pursuing them among the stars; but, strange to say, they are drifting toward him now instead of away from him."

"Then he will soon catch them," said Harry, laughing at the idea. "I once heard something about the 'Lost Pleiad.' What does that mean?"

"One of the seven stars supposed to represent the sisters does not shine as brightly as the rest, so the Grecians called it the 'Lost Pleiad.'

"Some say the Lost Pleiad is Electra, who hid her face in her hands so that she might not see the burning of Troy. But she seems to have recovered from her fright, as her star now glows as brightly as the rest.

Others said it was Merope, who married a mortal while her sisters married gods.

"An Iroquois legend accounts for the Lost Pleiad by saying it is a little Indian boy in the sky who is very homesick. When he cries he covers his face with his hands and thus hides his light."

"Do tell me about him," said Harry, looking forward to a treat, as he always enjoyed these Indian stories.

"The story is as follows," said Mary:

Story of the Seven Little Indian Boys

"Once upon a time seven little Indian boys lived in a log cabin in the woods. Every evening when the stars peeped out of the sky these children would take hold of hands and dance around, while they sang the 'Song of the Stars,' and the stars learned to love them. They would often beckon to the little boys, inviting them to come up to the sky; but the children loved their home on earth too well.

"But one day they found fault with everything. The oatmeal was too hot at breakfast, there was an absence of pie at dinner-time; and the distressing news that they were only to have corn and beans for supper was a climax to their 'tale of woe.'

"Meanwhile their mother calmly ate her supper, while her seven little boys looked on in hungry

dismay. When supper-time was over they filed slowly and sadly out of the cabin. Their mother felt sorry for them, it is true; but she knew that if she gave in now she would have to give in always. She watched her boys as they danced as usual that evening and sang their song to the stars; and then she hurried into the cabin and cleared away the uneaten corn and beans.

"Alas! she did not hear the song her children sang to the stars. When the stars beckoned as usual to the little boys, inviting them to come up to the sky, they had accepted the invitation. As they danced round and round their heads and their hearts grew lighter, and in a few moments they were soaring like birds through the air. Just then their mother went to the cabin door to tell them it was time to come home; and imagine her horror when she saw her children slowly disappearing in the sky!

"And now every evening the lonely mother gazes at seven bright stars in the sky, which she fondly believes are her seven little boys, but which are really the seven stars known to us as the Pleiades. One star in the group does not shine as brightly as the rest, and this must be one of the little Indians who is homesick."

"I shall never forget that story," said Harry, who had enjoyed every word of it; "and now I wish you would tell me about that very bright star on the other side of Orion. I can only just see it, but it is so beautiful. It is bluish-white, and twinkles so brightly."

"That is Sirius, the brightest star in this part of the sky." replied Mary, "and ever so much larger than the sun."

"What makes it twinkle?" asked Harry.

Why the Stars Twinkle

"When we look at the stars we have to see them through the great ocean of air that surrounds the earth," replied Mary. "Like the Atlantic Ocean, when the ocean of air is disturbed there are waves, and we have to look at the stars through the waves. That is why their light seems to dance about so. When the air is still then the starlight is steady, but when it moves the stars twinkle. If we could go to the moon, where there is not any air, we would not see the stars twinkle."

"Then I should rather stay here," said Harry, "because I like to watch them dancing about. They seem so merry, I am sure they are laughing at us, sister. Is there a story about Sirius?"

"It is part of .a group of stars named the 'Great Dog,' she replied; "and higher up you will see the 'Little Dog.' These are the hounds that Orion always took with him when he went hunting. They seem to have even followed him to the sky.

Sirius is also known as the Dog-star, because when it was seen by the Egyptians in the east just before dawn it was thought to announce the overflow of the

Nile. Therefore the Egyptians watched this star,



Figure 23 -- The Great Dog.

which warned them, like a faithful dog, of the coming deluge. It was their watch-dog or sentinel.

"Now I am going to tell you about the Twins, two brothers who loved each other dearly while on earth.



Figure 24 -- The Heavenly Twins, Castor and Pollux.

They were named Castor and Pollux. Castor was killed in battle. Pollux could not bear to remain on earth without him, so Jupiter placed him in the sky next to his brother.

"If you look through the glass you can see that Pollux is a golden-yellow star and Castor has a green tinge."

"Are all the stars colored?" asked Harry.

Flowers of Heaven

"Yes," replied his sister, "and they are as varied in color as the flowers of the earth. The stars may be called 'The flowers of heaven.' Longfellow says so beautifully:

"'Silently, one by one, in the infinite meadows of heaven
Blossomed the lovely stars, the forget-me-nots of the angels.'

"Some of the natives of Australia believe that when the flowers die on earth they rise on the winds and float away to the fair fields of heaven, where they flourish forever in immortal beauty. We cannot see the colors of these flowers of heaven very well, on account of the air that surrounds the earth. If it were removed, then the dark sky would seem to be covered with starry flowers of all the colors of the rainbow."

"How beautiful!" said Harry thoughtfully. "How I wish we could see them that way!"

"But even as it is," said his sister, "you can see some of these colors. Look at white Sirius, that sometimes seems to me tinged with blue, and then at red Aldebaran in the eye of the bull, and a creamy star called Capella just near the Twins. So you can see some of the colors. And now a few more words about Castor, which is a double star. That is, it is made up of two bright stars, and they go around each other.

"Professor Ball was once showing the stars through his telescope to some friends, when he pointed out this double star to them. First of all, he told them to note the different colors of the stars, for one was white, the other green. All double stars are of complementary colors. One may be green and the other red, one blue and the other orange.

"Then Professor Ball told his visitors that the stars went round each other.

"'Oh, yes!' said one of the visitors. 'I saw them going round in the telescope.'

"But it was the twinkling that made the stars appear to dance around each other. In reality, he would have had to remain with his eye at the telescope more than a hundred years before he could have seen the stars go completely around each other."

Number of the Stars

"I wonder how many stars there are in the sky, sister," said Harry. "Do you think we could count them?"

"I read somewhere," replied his sister, "that the stars are as plentiful as the sands on the seashore. Still, in the whole sky, the number bright enough to be seen without a telescope is only from six to seven thousand in a clear, moonless sky. With an opera glass you can bring the number up to one hundred thousand. A small telescope can show about three hundred thousand, while with a telescope such as the one at the Lick Observatory the number would be nearly one hundred million. But it is possible to photograph the stars, and millions of stars have had their pictures taken. Probably we would never have known anything about them but the camera caught them, and now they are being named and labeled, so that they cannot escape us again. In fact, some of the stars are so far away that if we had not captured them in this way they would have remained hidden to us forever."

"What do you mean, sister?" said Harry, his eyes filled with surprise.

"I mean, dear, that some stars are so far away that their light has not yet reached us. Don't you remember what I told you about Jupiter's moons: that they are so far away that light takes about half an hour in coming from them to the earth? Well, the stars are

hundreds of times as far away as Jupiter's moons. So far away are they that even from the nearest — a star seen in the southern hemisphere — light takes four years and four months in reaching us, although light travels more than 186,000 miles a second.

Distance of the Stars

"Look at the Pole Star some night, and you will not see it as it is now, but as it was more than sixty-two years ago. All this time its light has been on its way to Planet Earth. If a planet travels around the Pole Star, or Polaris, as it is sometimes called, and an astronomer on that planet looked at the earth he would not see it as it is now, but as it was more than sixty-two years ago. There are other stars so far away that light takes hundreds of years in coming here. Perhaps they faded out long ago, but the message is still on its way. It does seem strange to think of people who may be living on distant worlds in space, watching our little world, but we need not fear. The earth is so small that it could not be seen at all, even from the nearest star. At that distance Giant Sun would not look quite as bright as Sirius does to us, and giant Planet Jupiter would only appear as a faint speck of light near the sun."

"How far away everything seems to be! "said Harry. "Yet you said just now that we could tell what the stars are made of. How can we do that? "

What are the Stars Made of?

"The stars are made of iron, copper, zinc, and other such metals, but the heat is so intense that these metals are turned into vapor. You have seen the steam coming from the spout of a kettle when water is boiling, and you know then that the water is scalding hot. But imagine heat so great that masses of iron and copper are not only melted but turned into vapor. Then you have some idea of the intense heat that prevails on the stars. The rains that fall on earth are made up of drops of water, but the rainfalls on the stars must be drops of melting iron, while the clouds that form are sheets of molten metal."

"How wonderful!" said Harry; "and how do we know this, as the stars are so far away?"

"By means of a little instrument known as the spectroscope, or light-sifter. But you must wait till you are a little older before I can explain that to you, as it is something very difficult to understand. At any rate, I can tell you this, that when we want to find out what a star is made of we catch a ray of its light and examine it with the light-sifter. As Professor Ball quoted in one of his lectures:

"'Twinkle, twinkle, little star,
Now we find out what you are,
When unto the midnight sky
We the spectroscope apply.'"

"And can you tell how old the stars are?" asked Harry; "because when you were talking about the planets you said some are old and some are young."

"This same little spectroscope tells us that as well, and we can recognize the stars that are in their infancy, and others that are middle-aged or nearly worn-out."

"How strange to think of worn-out stars," said Harry; "yet I suppose they must grow old sometime, just as we do; only I suppose they take ever so much longer growing up."

"Hundreds of years," said Mary, laughing at the idea of grown-up stars. "There are young stars and old stars, and even the star that gives us light and heat will grow cold and dead some day, and not warm its planets any longer. But that will be millions of years hence, long after we are dead and gone.

Our Island Universe

"So it is all over the heavens. Our little universe is like an island in space. There are other islands like our own, with their millions of stars and star-clusters and star-mist, passing through the periods of youth, middle age, old age, and decay. Our little universe is not eternal. It cannot last forever, but as long as it does we should feel glad that we are here to enjoy it.

"Now, Harry, I really think we have had quite a long ramble in starland for one evening, and I believe two little stars I know need a rest."

"They are a little tired," said Harry, smiling; "two little worn-out stars, sister; and perhaps they do want to let the curtains down over them for a while."

"I believe they do," said Mary softly; and the stars were hidden by their curtains almost before she had said the words.

"God Bless the Star!"

"Darling, I am feeling so tired this evening, won't you sit beside my bed and hold my hand in yours while you tell me about the stars?"

His sister Mary suggested lighting the lamp and reading a story, but he held her hand with gentle force, saying:

"Do not light the lamp. Leave the curtain up so that I can see the stars from my window, and tell me in your own words that story you told me of a star the other day — Dickens' story of a star. Don't you remember, sister?"

Still holding his little hand in hers, and giving it a loving pressure, she rested her head on the pillow beside his, and began, in low soft tones:

"There was once a beautiful bright star that shone down upon the home of a little boy and girl who wondered at its light. They learned to know it so well that every evening the one who saw it first would say, 'I see the star.' and before they went to sleep at night they would say 'Good-night' to the star, and, 'God bless the star!'

"But the little girl, while she was still very young, became very weak and feeble, so that she was unable

to go to the window and look at the star, so the brother would stand there alone and watch for it. As soon as he saw it he would turn round to his sister, and say, 'I see the star,' and the little sister would answer gently, 'God bless my brother and the star!' One evening the brother looked at the star alone, for his little sister had passed away to her home among the stars. That was a sad and lonely evening for the brother, and at night he dreamed of his sister. Her face seemed to be looking at him from the bright star, and he could see a pathway of light reaching from it to his room.

"Along the pathway were people passing from this earth to the stars. Angels waited to receive them, and as they reached the star people came out to welcome them. Kissing their friends tenderly, they went away together down avenues of light. But there was one who waited patiently near the entrance of the star and asked the guide who led the people thither if her brother had not yet come.

"'Not yet,' he replied kindly, and as she turned sadly away the little brother reached out his arms toward her, and said, 'Here I am sister; I am coming to you.'

"As she turned her beaming eyes on him, the star was shining into the room, and he could see its rays of light through his tears. From that hour the child

looked on that star as his future home, where he would someday meet his angel sister again.

"And he waited, oh! so patiently, and the years rolled slowly by. He grew to manhood, and still the star shone down upon him at night. Then he grew to be an old man with gray hair and wrinkled face, and his steps were slow and feeble. Others had gone before him to the star. A little brother who died while he was young — his mother — his daughter — and now surely his own time had come.

"One night he lay upon a bed of sickness, and as his children gathered around him he suddenly cried out, as he had long ago, 'I see the star.' Then they whispered to each other, 'He is dying,' and he heard them, and said: 'I am. My age is falling from me like a mantle, and I move toward the star as a child. And, my Father, now I thank thee that the star has so often opened to receive those dear ones who await me!'

"And next day the star was shining, and it still shines, upon his grave."

Harry had been lulled to sleep by the sound of his sister's voice, and in the dim light Mary could see that he was smiling in his dreams. Were his dreams, she wondered, about Stories of Starland?

A Country Road[47]

I have taken a walk along a country road which was bright with flowers of many kinds, where lovely-colored butterflies and buzzing bees were hard at work hunting for sweet stuff, where birds were singing in the trees as they watched their nests, where a rabbit would dart from the bushes close by, and a squirrel would scold at me from overhead, — where, in short, there was so much to look at and delight in, that I could hardly make up my mind to keep on to my journey's end, instead of stopping to see if I knew the names of all the flowers, to admire the bright-colored little patterns on the wing of the butterfly which was resting on a neighboring blossom, and to find out what sort of eggs were in the nest that I knew must be near at hand, for the mother bird let out her secret by her frightened clucking.

Well, I have taken just such a walk; and on going into the house I have felt as if I were obliged to put aside a book of enchanting fairy stories, or rather as if I were turning my back on fairyland itself, with all its wonderful sights and sounds and adventures.

And then what has happened?

Why, some child (it has not always been a child) has come in, and I have said, "Was not that a fine walk? What did you see along that lovely road?"

Now, if he was a boy (for I want to be quite fair), he probably had seen the rabbit and given it chase; and it is more than likely that he had stopped long enough to chuck a stone at the squirrel; and if the mother bird had not finished with her foolish chatter, I fear he gave her some evil moments by hunting for her nest, with no good intentions. But if, fortunately for them, he had met none of these creatures, he probably looked at me in surprise, and answered by look, if not by words, "No, I thought it a long, stupid walk. I did not see a thing."

And if it was a girl, I fear the answer, silent or spoken, was much the same.

Now, I say that boy or girl must have been partly blind to have missed seeing those wonderful flowers, and butterflies, and bees, and birds, and many other interesting things which I have not time here to tell about. Certainly they were not using their eyes properly; and the longer they go about in such a way, more worthy of a bat than of a well-made child, the more useless and bat-like will their eyes become.

It is really more natural for a child to use his eyes constantly than it is for an older person. The grown-up man or woman is likely to have so many things to

think about, that eyes and brain do not always work together, and so the surroundings are not noticed.

For every boy knows that if his head is full of the ball game he is going to play, he runs along without eyes or thoughts for other things.

And every girl knows that if she is on her way to some friend to whom she has a secret to tell, she is in such haste to reach her journey's end, and is so busy thinking what her friend will have to say about it all, that of course there is no time to pay attention to anything else. Her eyes may be in good working order, yet they are not of much use unless her brain is ready to help them; and that little brain just now is too busy with its secret.

No, by the people who are half blind I mean only those who much of the time use neither eyes nor brain, who can neither tell you what they have seen nor what they have been thinking about. Sometimes it seems as if such people were not only half-blind, it seems as if they were only half alive.

A Holiday Lesson[48]

But I am in hopes that some of the children who read this book will say, "I do not think it fair to call children half blind and only half alive. I know I am not half blind. I saw all those things that Mrs. Dana saw along that country road, and (perhaps some of them may add) a good deal more too. I know all the different flowers by sight, and the sunny hollows where the first ones come. I know where ever so many of the birds build their nests, and how their different eggs are marked and colored. Often I go down to the little pool in the woods where they come for their bath. I know how the caterpillars wrap themselves in leaves and come out beautiful butterflies. I have peeped into the hollow of the tree where the red squirrel is bringing up its family; and I have seen how the pretty green katydid scrapes his wings along his sides, and makes the sound, 'Katy did, Katy didn't,' and oh, so many more things that I have not time to tell them all."

Ah! that is just it. The child that knows how to use his eyes can see so much, so many wonderful things!

That is why I am so anxious that he or she should not miss through carelessness the revelations that come to the child alone.

It seems as though the woods and fields were more ready to tell their stories, to whisper their secrets, to children than to grown people. If people learn to use their eyes and ears only after they are grown, I hardly think that they will ever read quite the same stories, ever listen to quite such wonderful secrets, as if they had begun to look and to listen when they were little children.

If fairy godmothers came now, as the stories tell us they did once upon a time, to the christenings of our little ones, offering whatever gifts the parents should choose, it seems to me one of the wisest selections would be the power to see.

And so when I ask you children, now that you are putting by your lesson books for many weeks, to learn one lesson this holiday time, — to learn to see, — I am asking you to do something that will make your lives far happier than they could be were this lesson left unlearned.

Sources of Stories

1. Stories of Our Mother Earth
2. Natural History in Stories for Little Children
3. Natural History in Stories for Little Children
4. True Bird Stories from My Note-Books
5. True Bird Stories from My Note-Books
6. True Bird Stories from My Note-Books
7. True Bird Stories from My Note-Books
8. Natural History in Stories for Little Children
9. Nature's Children
10. Nature's Children
11. Nature's Children
12. Nature's Children
13. Nature's Children
14. Nature's Children
15. True Bird Stories from My Note-Books
16. Nature's Children
17. Natural History in Stories for Little Children
18. Natural History in Stories for Little Children
19. Natural History in Stories for Little Children
20. Stories of Insect Life
21. Interesting Neighbors
22. Interesting Neighbors
23. Interesting Neighbors
24. Curious Homes and Their Tenants

25. Curious Homes and Their Tenants
26. The Stories Mother Nature Told Her Children
27. The Stories Mother Nature Told Her Children
28. The Stories Mother Nature Told Her Children
29. Leaves from Nature's Story-Book, Volume 3
30. A First Lesson in Natural History
31. A Bunch of Wild Flowers for the Children
32. Little Wanderers
33. Little Wanderers
34. A Bunch of Wild Flowers for the Children
35. Plants and Their Children
36. Plants and Their Children
37. Plants and Their Children
38. Plants and Their Children
39. Plants and Their Children
40. Plants and Their Children
41. The Story of the Forest
42. Stories of Rocks and Minerals for the Grammar Grades
43. Leaves from Nature's Story-Book, Volume 3
44. The Earth in Past Ages
45. Stories of Our Mother Earth
46. Stories of Starland
47. Plants and Their Children
48. Plants and Their Children