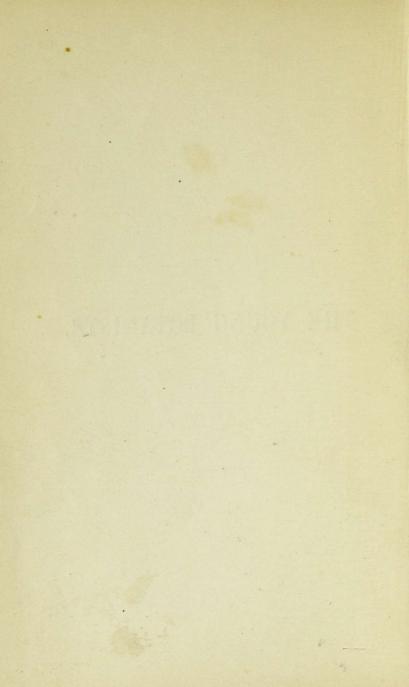
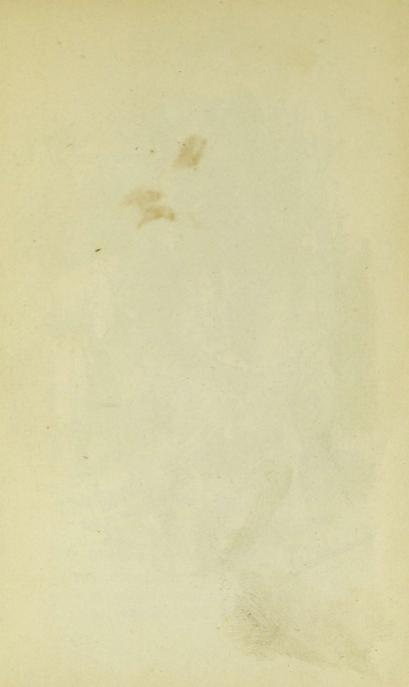


# THE YOUNG BOTANISTS.







# YOUNG BOTANISTS.



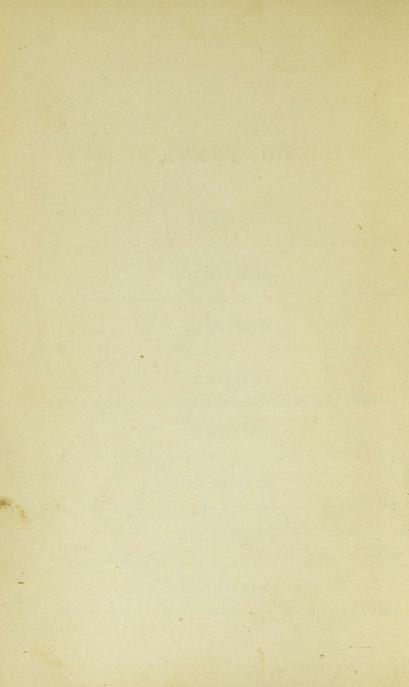
## LONDON:

THE RELIGIOUS TRACT SOCIETY;

SOLD AT THE DEPOSITORY, 56, PATERNOSTER ROW,
AND 65, ST. PAUL'S CHURCHYARD; AND BY
THE BOOKSELLERS.

# CONTENTS.

CHAPTER I.	age.
THE ROOT	1
CHAPTER II.	
THE STEM	15
CHAPTER III.	
THE LEAF	32
CHAPTER IV.	
CLIMBING PLANTS-THORNS AND HAIRS	49
CHAPTER V.	
THE FLOWER	64
CHAPTER VI.	
THE SEEDS	72
CHAPTER VII.	
GRASS	90
CHAPTER VIII.	
FERNS	99



## YOUNG BOTANISTS.

### CHAPTER I.

#### THE ROOT.

"OH! Emily, come quickly; do come and see what a curious thing I have found, a plant growing without earth." So said a little boy of eight years old, to his sister, who was kindly helping him to build a grotto of the white flint stones, which were

heaped up near their garden.

Emily thought the new found wonder very curious. She examined it carefully, and said to her little brother, "I think it has grown from one of the peas you shot out of your gun. Do you remember that you aimed at these white stones? Here are some more just like the one you have found; we will take them in my basket to show to mamma. Lay them in gently, for the poor things look very weak and thin."

Their kind mamma was not far away, and

was never sorry to answer useful questions. She looked into the basket and smiled, as she said, "Ah! you have brought me some young pea-plants; I can guess their history. These roots look as if they had done but little service yet. You did not surely mean them to grow, or you would have sown them somewhere else."

James. But, mamma, we were surprised to see they had grown at all. Those in my box have not done so.

Mamma. Well, do you know what makes the difference?

J. Was it the heat, mamma? Those stones are very hot in the middle of the day. I sat down there in the sunshine, to learn my lessons, but I could not bear it at all.

M. Guess again, dear; heat alone will not do. Your box has been kept in a warm

place, you know.

Emily. Was it the damp cold ground? I suppose they were sheltered from the sun under those stones.

M. It was indeed the dampness. Now let us examine what has really happened to them. Take a new pea from the box, and see the difference between them.

E. These which have grown are softer and larger, as if they had been soaked in water.

M. Do you see the white spot in each of those hard peas? If they were put in a

damp place, or into the ground, in a few days the pea would swell and split just at this place, and a tiny root and stem force themselves out. If you get a bung, or large cork, and put it into a basin of water, and then gently scatter a few mustard seeds on the top, you will have a good opportunity of watching the swelling of the seeds and growth of the young plants. Do you remember going to Mr. Perry's malt-house?

J. Yes, mamma, let me tell you; for I recollect it all. We saw the barleycorns put into water, and then, a few days afterwards, we went again, and we saw them spread out upon the floor, and they looked so clean, and smelt so sweet, and you put some into my hand, and I saw that they were larger than the other grains of barley, and softer, and that they had thrown out tiny roots; and you told me that they would be dried in the kiln to stop their growing further, and then boiled to make growing further, and then boiled to make beer by and by.

M. Very well! Now can either of you

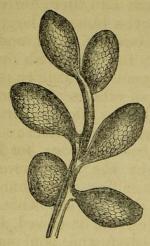
tell me what we mean by a root?

E. The part of the plant which goes under ground, which keeps it firmly fixed.

M. That is not its only use to the plant.

Bring me the little microscope. Do you see how the ends of the roots appear swelled into lumps? Well! at the end of each of these there is a little sponge, called a spongiole,

which sucks in water, and other juices from the ground.



J. Then, mamma, is all the root full of water? Will it run out if I cut it open?

M. No, for it passes on through pipes, up to the stem, and there is another set of pipes by which some of the juices go back into the roots, and again into the ground.

J. Do they suck up the right quantity and spongioles greatly magnified, the right sort of food?

M. Thequantitytaken

up is according to the dampness of the ground, and sometimes the roots take up what is poisonous, if it is within their reach. But, you know, I told you that roots

have the power of returning some fluids into the ground again, and this is one reason why plants are often more healthy for change of situation. Rose-trees are the better for moving after a few years.

J. Ah! they have eaten up or spoiled all the food in their neighbourhood, I suppose, and will be glad to go and get some more

elsewhere.

E. Mamma, do the roses spoil the ground?

M. They make it unfit for their own use, but the juices they send back through their roots are not so injurious to all other plants as to themselves. Have you observed how, in the fields in our neighbourhood, the crops are changed every year? The field in which you saw turnips last autumn will have corn growing now, or perhaps vetches for the horses—almost any thing except the same sort of plant you saw last year. The soil has got so much altered, partly by what they have taken away, and partly by what they have left behind them, that it will not suit them any longer, though it will do for other plants.

J. As the large trees cannot be moved, I suppose the roots can push further, and so

find new food for themselves.

M. Yes, dear, they do, and we may admire God's wisdom in making them able to take care of themselves; but it is very interesting to find out how far we can help the smaller plants to live and flower well. Have you ever noticed how the gardener takes the geraniums out of their pots every year?

J. Yes, I thought that was to give the

roots more room to grow in larger pots.

M. Not only so, for sometimes he puts them in the same pots again. He takes care to give them new rich mould, instead of that which they had exhausted and spoiled.

By and by I shall talk to you about the leaves and you will hear how useful they are

leaves, and you will hear how useful they are

to the trees. You would hardly guess that they can do good to the trees also when dead. They lie on the damp ground, and rot and decay very quickly, and so form new nourishment for the roots. We try to provide this same sort of food for the plants we nurse in our flower pots and gardens.

we nurse in our flower pots and gardens.

You would be surprised to hear how far the roots of our forest trees extend. Yesterday morning, as I was walking in the wood, I measured the roots of a beech-tree, which stretched away from the trunk above

the ground more than twenty feet.

E. How was that, mamma? Do not the

roots go under ground?

M. Yes; but sometimes the tree having grown upon a bank, the earth has crumbled away, or the roots may have found it difficult to pierce deep into the soil. Have you noticed in the summer, how dry the ground round the trunk of the tree is? That is because the branches have sheltered it from the rain, and you will easily guess where the rain from the branches fell.

J. Upon the roots, if indeed they could stretch so far. I suppose there are no sponges except at the ends of the roots, so the rain would be useless elsewhere.

M. You can generally reckon that the roots spread under ground about as far as the branches above your head extend; but it is not always so: some roots go very deep

into the earth, as those of the oak. I cannot pull up an oak to show you, so we must examine another smaller plant of a similar form. Let us look round the garden. Those beautiful stocks would do, but we will not spoil them by pulling them up; but these yellow escheditzias are growing so thickly, that we can take one of them without doing mischief, and we will get a lettuce from the kitchen garden. See how long and tapering the root is. There are spongioles at other parts beside this lowest point, you see.

E. Have not these plants a great advantage in a hot summer, because the ground

will not easily get dry so far down?

M. Certainly.—James, run and ask the gardener for a carrot from that bed he is weeding, and I will show you something else. You see the shape of the root is much

the same, but it is soft and fleshy.

Now I have cut it. Do you see this broad red edge? This is the skin, which botanists call epidermis. It is formed of cells and pipes so closely pressed together that they are not easily distinguished now, and are I suppose of no use to convey or hold liquid. The skin or epidermis of the root is generally thicker than that of the stalk. I think it is made so, that it may more easily push through the ground. You know earth is more difficult than air to pass through. That beautiful ash-tree does not

send its roots so far down into the ground as the oak, or indeed many other trees, and

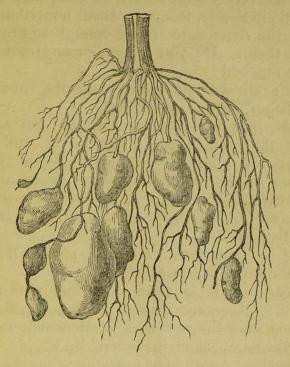


the consequence is, that it takes up more nourishment than is good for the smaller plants on the soil above.

J. Mamma, are not the potatoes we eat at dinner, parts of the root of a plant?

M. Not exactly, and yet they are fastened

to it. Go and ask the gardener to dig up one, and we will come and look at it.



Potato Root

J. It looks like a bundle of dirty strings,

with balls hanging on.

M. These dirty strings are the roots, and the balls are formed by the large quantity of sap which made gradual swellings there. Do you see these black spots in the potatoes I have cut open? They are called eyes. From them, if left in the ground, the new

young potato plants would have sprung, and then the old potatoes would have been useful to the very young plants, as your peas were to their shoots, in giving them nourishment, till the roots were strong enough to provide for them. Do you remember any roots we use for food?

E. Oh yes, mamma:—carrots, turnips,

radishes, and horse-radish.

M. The turnip and radish are not roots, but the swollen part of the stem, and the roots are below. Now I will tell you about some roots which are sent from other countries for our use. There is one which comes from Turkey. Do you know what rhubarb is?

J. Do you mean that red powder I saw

nurse mix for my medicine?

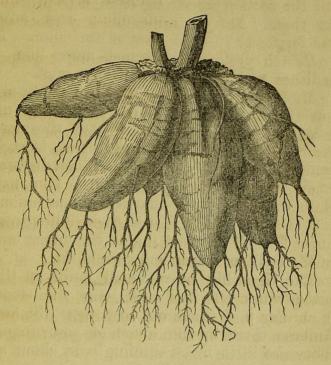
M. Yes, it is made from the root of a tree. Ipecacuanha is another medicine made from the root of a plant which grows in the damp, shady forests of Brazil, in South America. Arrow-root and ginger are foreign roots also.

J. Are not the dahlia roots of the same

kind as the potato?

M. Not exactly. They are both called tubers; but in the dahlia, the tubers are collected in one bunch at the bottom of the stem, and the roots grow from them downwards. You cannot cut up each tuber as you can a potato, and find eyes in different

parts. The eyes are generally at that part where the tubers all meet.



Dahlia Root.

E. Is the turnip the same kind of root?

M. No, the turnip and radish are the swollen parts of stems; the roots are below.

E. And the onions too, are they tubers?

M. They are neither tubers nor stems, but bulbs. Hyacinths, tulips, and snowdrops, are also bulbs. I should think you must

know how differently these bulbs are formed from the turnips.



Bulb of the Lily.

J. Yes, I have often amused myself with unrolling case after case of the onion. It seemed more like a bud than a root.

M. They really are buds, containing all the life of the next year's plant, though they may look dry and withered. You may have seen some onions with their bulbs growing at the upper end

of the stalk as flower buds would do.

The tiger lily bears small bulbs at the place where the leaf-stalk joins the stem. You may find them on any tiger lily, and unloose them by the touch of your finger. They are little black shining balls, about as large as peas.

J. Oh! I picked up some of them yesterday, and one of them was shooting out a

little white root.

E. See, mamma, how industrious the strawberries have been in covering their bed so quickly. How long these runners have got! and some of them are really beginning to grow upon the gravel walk.

M. Yes, they seem to call you to notice another way in which plants multiply themselves. You see each of these runners will take root if it is not prevented. Some plants send out stems under ground, which throw up shoots and form new plants at a little distance from the old one. The plum-tree does this.

E. Ah! that accounts for the little shoots of the plum-tree, which grow up in James's garden. We cannot help it then, James; for the roots of the old plum-tree will stretch under your garden. We might let them grow, but then it would be a long time before they would have any fruit.

M. Did you ever hear of the banyan, or Indian fig, which sends down little stems to

form new trees from its branches?

E. Oh yes! and so they will make almost a forest of one tree. How pleasant it must be to have such a large shady place to walk

in, in a hot country.

M. When the gardener wishes to increase the number of the rose-trees, he sometimes pegs down the middle of one healthy looking branch into the ground, and hopes that a little set of roots will grow in a few weeks, when he may separate this branch from the rose-tree. Sometimes he cuts off little slips from the tree and plants them in the ground, watering them to keep them alive till roots have grown to nourish them without his care. Now it is getting late, and we must go in to tea. Try to remember what I have told you, and to-morrow I will talk to you about the stem. You may plant your young peas in the garden, if you like, except this one, which can be put in earth, in this pot, and kept in the dark closet. It must be watered every day, and you may tell me in a few days how it goes on.



### CHAPTER II.

#### THE STEM.

Mamma. Now, James, get your hat and call Emily. We will enjoy this fine morning under the trees in the field. The oak which was cut down a little while ago will furnish us with a seat. Do you remember what I promised to talk to you about to-day?

James. About the stalks of plants, mamma.

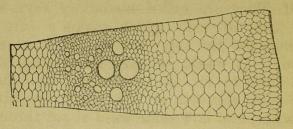
M. Yes. What is the stalk or stem?

Emily. The part of the plant which comes out of the ground, and from which the

branches grow.

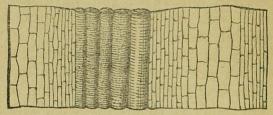
M. You will perhaps remember that I told you it is made of pipes and cells. You will be surprised at the small size of these little cells. In some trees there will be as many as three thousand in one square inch of wood; in others, there will be only two hundred in the same space, but even then you know you could hardly distinguish them without a microscope. I have brought a thin slice of the stalk of a cucumber for you to see through the microscope. The cells are large

and loose, and I think you will distinguish them.



Slice of Cucumber cut transversely.

Here is another slice cut down the length of the stalk.



Slice of Cucumber cut longitudinally.

There is an elder-tree in the hedge behind you. Cut a stick with your knife. Now give me a thin slice of the lower part of the stick. Do you see that in the middle there is a soft substance called pith, and next to this the wood, and over all the bark? The oak on which we are sitting is formed in the same way, only the pith is so very small that you will not distinguish it. You will see, however, if you look at the lower end of the log, that there is a point from which lines are drawn to the bark.

E. I see, mamma: but what makes those lines?

M. They are called medullary rays, and are lines of cells which make a sort of passage for the sap between the bark and wood. It would be very interesting, if I had time to explain to you how beautifully the cells throughout the trunk are fitted together, and how some wind about through the others.

Have you ever noticed how different the bark of some trees is from that of others? The elegant birch-tree you have so often admired, with its slender branches, has a very smooth stem. The bark peels off very frequently in thin skin, and thus it always looks more neat and tidy than the oak and elm. Look at the log we are sitting on.

J. Oh! this is rough indeed. The bark

is all cracked and broken.

M. Yes, as the tree grew bigger every year, the bark became too tight for it, and, after stretching a little, it split in all directions, as you see.

J. Like my coat, when I have out-grown it. Poor trees! they have no friend to

make new coats as I have.

M. Indeed they are as well provided for as you. The bark you see, when it is cracked, is quite ready to crumble away gradually; and every year a new thin skin of bark is formed, just underneath the old

one, and the new wood for the year grows just within the new bark.

E. Then, mamma, the pith is not, as I

thought, the last new wood.

- M. No; the new wood generally comes, as I told you, between the bark and the old wood. It has been said, that every year's growth of wood may be distinctly observed and counted in the trunk of some trees, and their age reckoned accordingly. A traveller named Adanson was visiting Cape Verd in the year 1748, when he was much struck with the appearance of a large old tree, which measured round the trunk fifty feet. He remembered that he had read of an old tree standing in just such a situation as this, on which some words had been carved by some former travellers. He looked round the tree, but no words could be found.
- J. Oh no, mamma. I suppose if they were cut so deeply as to reach the wood, they would be covered by the new layers of

wood.

- M. So he guessed, and accordingly he began to cut into the tree, and, after getting through three hundred layers of wood, he came to the writing, and distinguished the words.
- J. Then was that sentence cut three hundred years before? How very old the tree must have been! Do trees often live so long, mamma?

M. I do not feel at all sure that the sentence had been carved three hundred years. Some learned botanists doubt very much whether the ages of trees can be reckoned by their growth; climate and situation make a great difference in the number and thickness of the layers, so that some trees, which were examined, seemed to tell a very false tale, and claimed twice as many years as their

friends knew they had lived.

I told you that our trees do not increase their size by forming their wood inside. There are some trees, however, which do. The bark of the palm-tree, and some others in tropical climates, is not thrown off, or cracked, but swells a little according to the growth of the wood inside. These trees are called endogenous. Our English trees are called exogenous. When you have learned Greek, you will understand that exogenous means growing from without, and endogenous growing from within. Well, I have more to tell you about the bark .- Do you know how useful it sometimes is to us?

J. You mean, I suppose, for tanning leather. The tanner puts it into the water in which he soaks the skins to harden them.

M. Yes, but some bark is good for other purposes. I will tell you of one:

Many years ago a poor Indian, who had been suffering from a low fever which had weakened him sadly, went to a pool of water

to drink. You know how thirsty fever makes us. He drank a great deal, though it was very bitter, and I dare say you would scarcely have liked to taste it. However. the water seemed to refresh and comfort him more than any he had ever taken. He drank again, and at every draught he got stronger than before, till at last he felt sure that it could not be the water alone which had done him so much good. After looking about carefully, he guessed that the bark of a tree which was lying by the side of the pond, had given the water so much taste, and made him so much better. He recommended it to some of his friends who were weak and unwell, and large quantities were gathered, and now it is in very general use in our own and other countries.

E. I remember that the medicine I took after I had been ill last spring was called

bark. It was not very nice.

M. There is another kind of bark which the doctors are glad to use, though they do not make their medicines with it. How are the bottles closed?

J. With corks, mamma; but surely they are too soft to be made from the bark of a tree?

M. Yes, cork is the bark of a kind of oak which grows in Spain, and France, and Italy. It bears acorns something like those you pick up under our oaks. The bark is

cut off, for the first time, when the tree is about fifteen years old, but this cork is very loose and full of holes, and of little value. In eight or ten years the bark is again stripped off, but this, though better than the last, is only sold to fishermen for their nets. The third cutting is more profitable, and the bark continues good and firm, and is taken off every ten years, as long as the tree lives, which is generally two or three hundred years. There are several cork-trees in England; one very large one is in the Fulham Nursery. Have you noticed how black the cork in the cork-cutters' shops looks sometimes? that is because it has been roasted to harden and dry it. You will be able, I dare say, totell me some other use it is put to beside stopping bottles and floating fishing nets.

stopping bottles and floating fishing nets.

E. Yes, mamma, I have seen some cork jackets and a cork boat. You told me they were made of cork, because it is so light and

will swim so well.

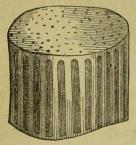
J. Does it hurt the trees to have all their

bark taken away?

M. I am sure it does them no good. But you know their climate is warmer and drier than ours. It is a serious thing to cut the bark of most trees, and they will not often live when it is quite removed. The wood will very often rot and decay completely, when exposed to the cold and rain.

Do you remember the mats which the gardener nails over the fruit-trees in the winter? They are made from the bark of the linden or lime-tree. The bark of some other trees is used, after being soaked in water and beaten to pulp, to make cloth or. even paper. The yellow paper which the Chinese use is made from the bark of the paper mulberry.

J. Is that soft white paper on which Maria paints so beautifully, made of bark?



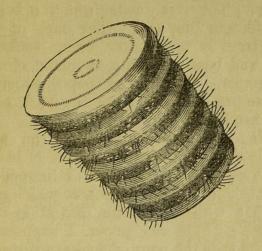
M. No. It is really the pith of a tree which grows in China, but it is called rice paper, I suppose, because it looks as if made of rice. It is cut with a sharp knife into very thin slices round and round.

Do you remember what I mean by pith?

J. Yes, mamma, the very inside part of the trunk, which is sometimes very soft, I think.

M. There is a tree which grows in the south-east of Asia and the islands of the Indian Ocean, in which the pith is very large and very soft. The tree is called the libleytree. The bark is smooth, and if you took your knife to get out the pith from the inside, you would have to cut through two inches of hard wood before you could reach

it. Here is a picture of a log cut from the trunk of the tree.



The whole tree is generally cut down to the ground, and the pith is taken out, and beaten, and mixed into paste with water, and then baked a little while in an iron pot over the fire, which forms it into the little balls which you have seen, called sago. I believe this is always done before it comes to this country. I suppose you know sago pudding, though you never asked where it came from.

J. Yes, mamma, but we shall like it better now we know its history. How I wish these curious trees would grow near us!

E. Yes, but I am glad we can hear about them. Do tell us something else, mamma.

M. Well, then, I will tell you a little

about the juices contained in the stems of plants and trees.

J. You mean the water which the roots suck up, mamma, as it passes along through

the cells.

M. Yes, you know I told you, that some of it returns into the ground through the stem, and this returning sap is very different from that which passed up from the roots. I dare say you have found gum on the cherry or plum-trees.

E. Yes, mamma, when the branch has been broken or cut, but this gum is not like that with which we make our card

boxes.

M. That is the gum of a tree growing in Senegal, in Africa, but they are both the congealed sap of the tree. The Indianrubber you use in drawing is also the juice of several different kinds of trees. It flows as a liquid when a wound is made in their trunk. It is collected upon the surface of lumps of clay shaped like little bottles, and, as it is glutinous, it adheres to these closely till it dries in the sun, when it is firm and hard. Then the clay is easily beaten to a powder, and shaken out. The bright yellow gamboge in your paint box is the juice of another tree. Tar and pitch are procured from some kinds of fir-trees, and varnish is the juice of a tree which grows in China and the East Indies.

E. Do you mean the varnish which makes

our school-maps and pictures so shining?

M. Yes, I will tell you a little about it, for I think you will be interested in hearing of it. When the tree is about seven or eight years old, the men go, in the summer evening, to collect the varnish. They take a knife to cut several holes in the bark, in different places, and then fix shells into the holes, so that the sap when it runs down may fill the shells. Next morning they go again to empty the shells, and this is dangerous work indeed, for the smell or steam from the varnish might make them very ill, and cover their faces, or indeed their whole bodies, with white spots. They therefore cover themselves almost all over with a leathern dress, and put a cloth bag on their heads, with two holes to peep through, and then they tie a leathern bag on in front, to empty the shells into. The varnish is afterwards strained through a cloth, and poured into casks, to be sent to England, where it will sell generally for twice as much as the Chinese give for it.

There is another foreign tree, which you will perhaps think more curious than any I have yet described to you. It is called the cow-tree. It grows on the high mountains in South America, where the ground is really so dry and barren that the cattle could not find grass to satisfy them. For many

months in the year no rain waters it, and its branches look withered and dead, but every morning, at sunrise, a sweet and nourishing milk, which tastes like cream, and has a sweet smell, is obtained from the trunk, by piercing it in several places. You can suppose how valuable it is to the people who live near.

E. Yes; but, mamma, what does the tree live upon, if the ground is so dry? How can the sap flow fresh every day?

M. I will answer you this question, dear, to-morrow, when we speak of the leaves. I have more to tell you about the stem to-day. I suppose you will know some of the uses of the wood. What do you think will be done with this log we are sitting on?

E. Will it not be cut into beams for

houses?

M. Very likely. The wood of the oak is strong and lasting. The elm and beech are not so durable, but they are sometimes used in building, and fir-trees from Norway are brought in large quantities to our country to make planks for the floors. Do you know any other foreign wood we use?

J. Mahogany, mamma. I suppose that is worth the trouble of bringing, because it

is so beautiful?

M. Yes; it is also a very hard and lasting wood. The first log was brought to England about two hundred and fifty years ago, by a captain of a ship, who gave it to a friend as a strong wood for use; but the carpenter complained of it sadly for spoiling his tools by its hardness, and it was used to make a candle-box. This candle-box was very much admired, and those who saw it began to wish for something made from such a beautiful wood. And now, you know, a great many noble trees are cut down for our sakes, and brought by ship from the West Indies, and from America. These trees are very majestic, and generally, I suppose, about two hundred years old. hundred years old.

E. My rose-wood work-box is not made from an English tree, is it?

M. No, it comes from China. These woods, and some others you must have seen, which come from those warmer climates, do which come from those warmer climates, do not shrink or swell as our English wood does. It is very inconvenient to the carpenter, when he has carefully fitted the different parts of his furniture together, to see it shrink and stretch away from the nails by which it is held, or perhaps crack in the middle. But this will happen with our English wood, even though he may keep it for years before he cuts it up. I have been told that a cherry-tree, which has not been cut down till it had quite withered, would not change at all afterwards.

E. Would that be because the sap had dried away more completely?

dried away more completely?

M. Yes, and more gradually than when it is stopped by the sudden felling of the tree.

J. I suppose the trees are cut down in the winter, that they may not have too

much sap.

M. The woodman generally chooses the spring or autumn, because the moisture of the sap makes the wood softer, and it is much more easy to fell the tree. There is one foreign wood which we use very much, which is not brought here on account of its beauty or strength. Norway abounds in firtrees, and, as there are few people to use them in that cold and mountainous country, they are glad to sell them to us to be used for our floors, and common boxes, and many other purposes which such a wood will serve. Do you know what we call the wood of these fir-trees?

E. Deal, mamma. Is the wood of our

fir-trees useful in the same way?

M. I think ours is seldom used except for poles. The climate of Norway is better suited to these trees than ours, and, as it is so near, and they are so plentiful there, they are reckoned of little value, and can be obtained easily. I could tell you much more of trees if I had time, but we must not stay any longer; it is getting damp and cold. Very soon I will give you another hour, and explain the form of the leaf.

I hope, dear children, that whilst you

admire the beauty and usefulness of each part of the plant, you will not forget whose work it is. If I were to give you a present, on which I had spent much time and thought, I should feel it a poor return for my kindness, if you just admired its workmanship, and then laid it aside. I should wish you to think of my love in preparing it for you, and planning that which would afford you pleasure: and are not all these beautiful plants so many gifts of our kind heavenly Father, meant to speak to us of his tender love, as well as of his skill? We should have thanked him, if he had only made the corn grow for our food, but surely we should love him more for making it so beautiful, and teaching us to notice it. Do you remember how Jesus, when he was on earth, pointed to the wild flowers as a proof of the kindness and the love of God?

E. Yes, he said, "Consider the lilies of the field, how they grow; they toil not, nei-ther do they spin: and yet I say unto you, That even Solomon in all his glory was not

arrayed like one of these."

J. Were these lilies like our lilies of the valley, mamma? I have been told that they

grow wild, sometimes.

M. The lily of the valley does not grow wild in Palestine, but there are so many flowers which might have been meant by our Saviour, that it is impossible to fix on

the exact one. It is enough for us to know that it is a flower which, growing wild, is cut down, and dried in the sun, and afterwards collected with the dried grass as fuel, to heat the little ovens in constant use there. Now notice the lesson Jesus wished to teach his disciples. Can you repeat the next verse?

E. "Wherefore, if God so clothe the

grass of the field, which to-day is, and to-morrow is cast into the oven, shall he not much more clothe you, O ye of little faith?"

M. Yes; Jesus tells us, that the humblest and meanest of God's children may depend upon his love and protection at all times. His infinite power is able to keep the whole universe in activity, without neglecting one of the smallest or least important of his creatures. You need never be afraid of asking him to supply your wants, or to guide your steps, in the smallest concerns. If you do indeed love him, though your faith may be small, he will be your constant and almighty friend.

J. Was he angry with the disciples when he said to them, "O ye of little faith?"

M. He reproved them for their want of trust in him. Every thing around them told them of the faithfulness and power of God, and though they were poor, it was wrong of them to forget this. Let us be careful that we do not fall into the same fault. Now, as we walk to the house, I will

repeat to you those pretty lines of Heber's about God's providing for the morrow.

- "Lo the lilies of the field,
  How their leaves instruction yield!
  Hark to nature's lesson, given
  By the blessed birds of heaven:
  Every bush, and tufted tree,
  Warbles sweet philosophy:—
  Mortal! fly from doubt and sorrow,
  God provideth for the morrow.
- "Say, with richer crimson glows
  The kingly mantle than the rose?
  Say, have kings more wholesome fare
  Than we poor citizens of air?
  Barns, nor hoarded grain have we,
  Yet we carol merrily:
  Mortal! fly from doubt and sorrow,
  God provideth for the morrow.
- Guides our humble destiny:—
  One there lives, who, Lord of all,
  Keeps our feathers, lest they fall:
  Pass we blithely then the time,
  Fearless of the snare and lime,
  Free from doubt and faithless sorrew
  God provideth for the morrow."



## CHAPTER III.

## THE LEAF.

James. Mamma, will you come and look at the little plant which you told me to put into the closet? I am afraid it is going to die; see, its leaves are yellow, and some of them have quite dropped off.

M. This does indeed look sadly. Shall I

be its doctor?

J. You are in fun, mamma, I suppose, for you do not know any medicines to put to

the roots, I think.

M. No: but I can do it good without medicine. It will be best to pour the water out of the saucer, and put the plant in the garden. You have given it too much to drink, my love.

J. Indeed, mamma, I have only watered it once a day, at the times when I watered

those in my garden. Will you come and see how healthy they look? I shall put some sticks behind them soon, for them to

climb up.

M. Ah! that is very grand: perhaps you will give me a dish of peas from your garden, if the summer lasts long enough. Call Emily to go with us to the garden, and we will stay there, and have another conversation

about plants.

J. Oh, thank you, mamma, and I will bring my little stool, and you and Emily will have room upon the garden-seat. There, we will put the poor little sickly plant on the table, in case you have any thing to say about it.

M. Well, now, James, how can it be that the plants in your garden have grown so much better, and drunk so much more than

this in the pot?

J. Perhaps the roots of this were broken; and yet I think not. Oh! the sun and wind can dry the ground here; and besides, I suppose the water can sink far away into the earth. Can you guess any other reasons, Emily?

E. I think not. The plant can drink, mamma told us, but I suppose it cannot feel or walk. It does not care for liberty

and fresh air, as the birds do.

M. Not just as the birds do, because its powers of feeling do not at all equal

theirs. Now I will give you some reasons why the plant did care for fresh air. Pick



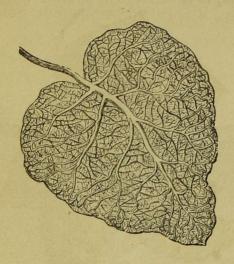
Sycamore Leaf.

one of the leaves of that sycamore. It seems unkind to rob this invalid of a single leaf. Now, what is this made of?

J. Ah! mamma, you must tell us, for, though I think I know, I cannot describe it. I think these are little stalks running along and about it; are they not?

M. They are hollow fibres, or veins, like

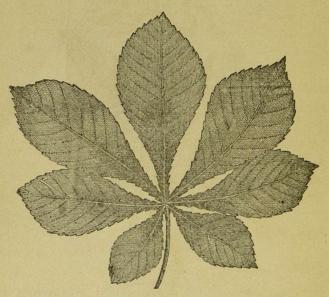
those I described to you in the stem. Here is a decayed leaf which I found this morning in that shady corner. The substance of the



Vessels of a Leaf.

leaf is gone, and the beautiful net-work of fibres remains. See, they all enter together, in one bundle, at the stem of the leaf, and then branch out. Now, James, run and pick a horse-chestnut leaf from the tree at the end of the long walk. Oh no; you have not brought me a whole leaf; this is only a part. There, this will do—now look here.

These five veins, or fibres, might have been filled up entirely with the substance of the leaf, like the sycamore. Then it would have been a simple leaf; now, with its many divisions, it is called compound. Sometimes,



Horse-chestnut Leaf.

simple and compound leaves may be found on the same plant. Here is a picture of a branch of gleditschia, in which you may see that some of the stalks have been united into one leaf, whilst in others, they have been made into several small ones. When you walk out this morning, you may try to



Gleditschia.

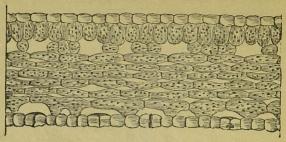
collect as many leaves of different shapes as possible.

E. Oh yes, mamma, we shall be quite pleased. Why, we could find a hundred in

the garden alone, I think.

M. The space between these fibres is filled up with the cellular tissue I have

before described to you. Here is a picture.



Leaf of a White Lily, cut through.

If I were to dip a leaf into nitric acid, the different parts would separate, and we should see that this cellular tissue is made of tiny bladders of different shapes, filled with liquid or air, and over all, there is a thin skin or epidermis formed of empty cells. On the under part of the leaf are stomata, or breathing holes.

J. Breathing holes, mamma? does the

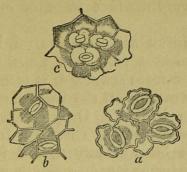
plant breathe?

M. Not exactly as we do. Perhaps when you know the uses of these holes, you will feel more inclined to call them mouths. Part of the moisture, which has been drawn up by the roots, passes off through them; but, what is equally curious, they are so made, that if the plant be in want of water, these stomata will take in the dew or damp, which may rest upon the leaves.

J. Can we see the stomata, mamma? I

think this microscope would help us.

M. They are too small to be seen even by that, but here is a picture of one, seen through a still more powerful glass. You



Stomata, or breathing pores of leaves: a. from the variegated croton:
b. Brazilian lemnocharis: c. strobilanthes Sabiniana.

see there is a thick edge, or what we might call a lip, round the hole, and this will shrink or swell according to the dryness of the leaf. Have you ever noticed a drop of water on the edge of a leaf in the early morning?

E. Yes, mamma, I thought it might be the dew which had fallen in the night.

M. No, it is generally formed of the tiny drops, which have made their way through the stomata, or pores of the leaves, and which are dried up when the sun appears. If you put a tumbler exactly under one of the leaves of the vine, in the sunshine, you may see for yourself, how much clear water the plant disposes of through its leaves. Within an hour the drops will trickle down the side of the glass.

J. Did you say clear water, mamma? Does it not have a taste or colour as the sap has? I have put leaves in my mouth, and found a very distinct taste of one kind or another.

M. Yet that which passes off in steam is pure, or almost so. You know the vapour which rises from sea water is free from salt, and the steam from the tea-pot carries none of the tea with it. Only the light watery particles pass away. The water from marine plants has been examined, and found to be as pure water as steam. Some leaves have, as you say, a very strong taste, and contain strong juices.

J. Ah yes! there is the sorrel, so sharp, and the bay-tree, which tastes like custard; oh! and tea, mamma, you know, keeps its taste, even when it has been dried.

M. There are some leaves which are full of poisonous juices. There is one near you. The laurel leaves contain so much prussic acid, that they would do you harm if you were to chew them. You know that prussic acid is a strong poison. Emily, cut up this laurel leaf, while James fetches a wine-glass. Now put the glass over the pieces of leaf, and catch a fly and bring it me, without hurting it. There, put him too under the glass. Now watch him for two minutes, and I will tell and I will and I will tell you when the time is gone.

J. He is crawling about, and seems trying to find out how large his prison is, and what

the windows are made of. Oh! now he has stopped, and now he lies still, and seems gone to sleep. He does not move; I think he is dead. But yet it cannot be because of the laurel leaves, for he did not taste them at all.

M. No, but he breathed the air which was full of prussic acid. There, we will take him out, and the fresh air will revive him. He has been in his little prison for two

minutes exactly.

J. Only two minutes! I suppose, then, he would be quite killed if he stayed there an hour. Poor fly, we will put you on this leaf in the sunshine, far away from the laurel, that you may not be reminded of your troubles when you awake.

M. There is a plant called fraxinella, the leaves of which contain a great quantity of oil, so much that, if a candle be brought near the plant, the flame will play round the leaves, but without doing any injury to them. This was discovered by a lady, who went to look for something in her father's garden, by night; she held her candle, by accident, near this plant, and was quite startled by the flame which quickly spread around it.

Tobacco and snuff are got from the leaves of a plant, which grows in America, the West Indies, and other countries. The poisons used by the wild Indians are often obtained from the leaves of plants. But now we must

return to the stomata of which I was speaking, for I fear you will not yet understand why this poor little plant looks so sickly.

E. Why, mamma, I suppose the drops you told us of could not dry away from the

leaves without the sunshine.

M. You are quite right, my dear, and therefore the leaves become clogged with the moisture which the roots had sucked up, and you see they are soft and juicy.

J. And they are yellow too, mamma; is that because they have so much water in them? Those in my garden are quite a

bright green.

M. That is owing to the want of light. You have just seen what the want of heat can do, and I think you can understand the reasons for it. I fear you will not so well understand why light is so important. You must wait till you grow older, and have learned something of chemistry. You remember when I was speaking of the sap, that I told you how very much it was altered as it passed through the tree. The water which the roots suck up becomes changed into varnish, or milk, or many other juices. Now this change takes place mostly in the leaves. The sap is spread out through the surface of the leaf, and becomes altered by the action of the light upon it. altered by the action of the light upon it. Then a large part is drawn into the air as steam, and one third part goes back to feed

the new buds, and leaves, and wood. I will not now explain to you how this change is produced. You are too young to understand it. You must be content to know that it is so, and that it is the want of this light which prevents the leaves from taking their true colour. This you may see for yourself. Pick a leaf from the shrub beside you. Which is the darker, the upper or the under side?

E. Oh! the upper side, because it could get most sunshine. I remember how white the inner leaves of a cabbage are, because they have been so closely doubled up from

the light.

J. Yes, and the gardener told me he was tying up the lettuces to prevent the light from getting at the inside, and he said he tried to make the celery grow white by covering it with earth.

M. Yes, if the celery were not covered in this way its stalks would be green, and it would be really poisonous, as the wild celery is. In other countries, where the heat of the sun is greater than it is here, the shrubs and trees are of a much darker green than they are with us. When we lived in London many years ago, our dahlia roots were put by for the winter in a damp dark cellar, and left there, by accident, through the next summer. Can you guess what happened to them?

J. Perhaps they began to grow, as our peas did. How uncomfortable they must have been in the dark, and with so little air.

M. You would have thought so if you had seen them. They had grown to the height of the table, but the stalks and leaves were quite white, and were very weak and thin.

J. I suppose they had no flowers.

M. No, I think a plant in the dark is not likely to be healthy enough to bear flowers. You have seen that the leaf is a very important part of the plant. You will not wonder when I tell you, that trees could not ripen their fruit, if their leaves were entirely stripped from them. Look at this branch of apple. Here are two young apples upon it; we will take all the leaves from it, and you will see, if you watch it carefully, that the apples will both drop off without ripening.

J. But, mamma, all the trees lose their

leaves in the winter, except the evergreens,

without being hurt by it.

M. True; but at that time the trees are

not full of sap, as they are in summer.

E. Do the leaves of the evergreens die?

M. Yes, but they live through a longer time; so that the new leaves come before the old ones have withered and fallen off. If you look at that laurel, you may see some old yellow leaves ready to drop off directly you touch them. These are the withered leaves, and the young leaves of this year have, as you see, grown large enough to be of some consequence before the decay of the others.

In tropical climates, where there is no severe winter, the leaves drop only a few at a time, so that the trees are never bare. Some of our English trees, when growing there, become evergreens, because the buds, which are here formed in the summer, open almost immediately, whilst here they have to wait till the milder weather in spring draws them into leaf.

E. I never noticed the buds on the tree

till the spring time.

M. No, they were so small as to be hardly seen till looked for, before the old leaves fell. If you examined the ends of the branches you would find them always thickened, but in some trees you can see the bud distinctly, and even unfold it leaf by leaf. The buds of the horse-chestnut and some others are covered with a sort of varnish, which protects the young, tender leaves through the winter. Other buds are guarded from damp and cold by down or hairs.

E. Ah, I shall watch next spring. I did not know all this before, so I was only eager for the leaves to come. Now I shall think there is a great deal to notice all the year

round.

M. Well; first we shall see the present

race of leaves wither and fall. Do you know what makes them fall?

E. I suppose because they wither.

M. Perhaps if I asked you why they wither, you would find that you had only moved the difficulty a little backward. Do you know any reason for their withering?

J. Perhaps the heat of the summer dries

up the sap.

- M. No; but the tiny tubes and cells become, in course of time, clogged with particles which cannot pass away, and thus the leaves take the different colours we see in autumn. The fall of the leaf is supposed to be caused by the breaking of the little spiral tubes in the leaf-stalk, which, when they have uncoiled as far as they are able, will naturally snap asunder, and this might be hastened by any sudden cold or damp weather. I dare say you have noticed that some leaves do not fall even when they have withered.
- E. I remember seeing that a large branch of an apple-tree had withered without the leaves falling off.

J. And the tree which was split by light-

ning did not lose its leaves directly.

E. No, indeed; it looked sadly desolate with its leaves brown and dried, when its old companions round were still beautiful and cheerful. But I wonder that I never asked why its leaves did not fall off.

M. Is there any thing in the Bible about the falling of the leaf?

E. Yes. It is said, "We all do fade as a

leaf."

J. Yes. It makes me sad to remember that, when the leaves are falling. I am glad that people do not die in large numbers together, as the leaves do.

E. No: they are more like the laurel, which never looks as if its leaves were dying, but seems so green and cheerful all the

winter through.

M. Yes, dear; and so we live, seeing our friends die around us, and yet forgetting that we too shall die.

E. But we are unlike the leaves in this,

that they never live again.

M. Quite right, dear. So we may watch the falling leaves without sadness, for we know that death is to those who believe on Jesus, only the beginning of a brighter, better life. Oh how much happier we should be if we thought less of the pleasures which so quickly fade away, and more of the pure enjoyments of the heavenly paradise,

"Where everlasting spring abides, And never-withering flowers!"

## CHAPTER IV.

CLIMBING PLANTS. THORNS AND HAIRS.

Mamma. Now, Emily and James, I am



Leaf of the Pitcher Plant.

ready to talk to you again. It rains heavily, and we cannot go into the garden or fields, so you must take your seats at the table beside me. I have some pictures to show you. What part of a plant do you suppose this to be?

J. Well, I should say it is a leaf, though I never saw such a one. It looks something like the nest of the tailor bird.

M. I dare say it will seem most like a leaf to you, though it is not a true leaf, but only a leaf-stalk lengthened and widened into an unusual shape. It grows upon a plant which lives in Ceylon, and different parts of the East Indies. It has been grown in hothouses in England, but the size of the pitcher then is not so large. It is generally found growing in damp marshy places, and though the water, which its roots suck up, might therefore be supposed to be unpleasant and unwholesome, it becomes so changed as it passes through the plant, that these pitchers contain always sweet and refreshing water. They will hold as much as a small tumbler.

J. But, mamma, is it not the rain that fills them?

M. The rain will indeed fill them sometimes, but these pitchers are not empty even when there is no rain. The water is produced by the plant.

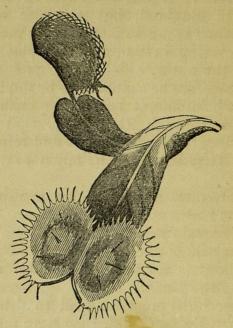
E. The birds must be glad to drink out of them. Do you think they were made for

this purpose, mamma?

M. Travellers, too, are often refreshed by a draught of the water; but this is said not to be their only use. The plant itself is supposed to gain nourishment from them, though you will be amused at the way in which it does so. It is said that many flies are drowned in these pitchers, and the decayed bodies of the flies afford to the plant a useful manure.

Here is a picture of another plant, which

catches flies by entrapping them in its prickly leaves; and it has been ascertained



Venus's Fly-trap

by careful experiments that this plant, if prevented from enriching the ground around it in this way, will be stinted in growth, unless scraped meat, or something else be put to its roots, to supply the deficiency.

E. The poor flies then have enemies when

E. The poor flies then have enemies when they do not look for them. I should think they never guess that the plants would be so

mischievous.

M. Did you notice in the picture of the

pitcher plant, which I showed you, the little spiral stalk, which seems made to coil round the small branches of shrubs, or any thing else by which it may support itself? It is a climbing plant, and has been found in Ceylon, growing over the tops of very high trees, with its leaves and pitchers unusually large. I dare say you will remember to have seen other plants of the same kind.

E. Yes, that yellow nasturtium which winds its leaf-stalk so prettily round the wire trellis.

J. The vine has these long curling stalks without leaves at the ends of them.

M. Those are called tendrils. The cucumber and the melon have tendrils, as well as the vine. Sometimes the plant coils itself round the stem of the tree or shrub, and it is then called a twining plant. Such are the convolvulus, and the common bind-weed. Some of these twining plants turn in one direction, and some in another. If you uncoil one of them, and try to twist it in the opposite direction, it will uncurl again, and take its old turn, as soon as you had set it free. Indeed you could not train a young plant to grow differently from those of its own tribe, except by fastening each new curl as it grew. The ivy clings to the trees, and does not merely climb up as these twining plants do.

J. Oh no! I was trying to pull some ivy off the palings at the bottom of the orchard, but I found every little branch sticking into the wood. I think, however, that its roots were in the ground. How is it that the ivy injures the trees, if so, mamma?

M. By preventing their proper growth. Look here. If I strapped this leather band round your waist, and did not take it off for a whole year, would it not be exceedingly

injurious to you?

J. Yes; it would become so very tight. I see, then, the trees would have their cells and tubes too closely pressed to allow the

sap to flow easily.

E. I am sorry to hear the ivy does any harm, for it is really very beautiful, and makes the trees look green when they have lost their other leaves. I remember some lines about the ivy and oak:—

"Hast thou seen, in winter's stormiest day,
The trunk of a blighted oak,
Not dead, but sinking in slow decay
Beneath time's resistless stroke,
Round which a luxuriant ivy had grown,
And wreathed it with verdure no longer its own?"

M. Did you ever hear of the mistletoe?

J. Yes; our English history says that the Druids used to worship it. They found it growing on the oaks.

M. Yes. It is now seldom, if ever, found on the oaks. It will grow as well on the apple as on any other tree. It strikes its

roots quite into the trunk of the tree, and lives upon the sap which passes by. A plant which grows by means of another in this way, is called a parasite. We have very few such in our country, but in the forests of South America, where the air is damp and warm, and therefore favourable to vegetation, large trees may be found living as parasites. Thus, the wild fig-tree, as large as a common apple-tree, will be seen growing on the top of the mora, which is as lofty as most of our forest-trees, and it will even bear fruit in this situation; and the wild vine will spring from one of the branches of the fig-tree, and seem to bind the two together. Of course this cannot last long. You can guess that it is difficult work for one set of roots, even in that damp, warm climate, to support three trees; and accordingly the lowest tree, in such a case, will generally die, and insure the death of its dependants above.

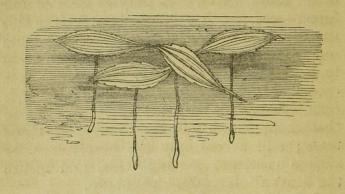
J. I think we might find some amusement in these woods. I should like to see trees

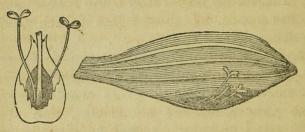
scrambling about in this way.

M. You would indeed like a ramble there. But you must prepare for a few hardships in that case. The long grass would reach above your shoulders sometimes, and you would need a large hatchet to clear every step before you. The climbers grow sometimes with stems as thick as a man's body, and encircle in their arms more than one tree at a time.

There are some plants which will grow and thrive with nothing to depend upon but the dampness of the air. In hot countries these air-plants are hung from the ceiling by a cord, and flourish in this way for some time.

Now we will pass on to water-plants, for I have a few curious things to tell you about them. Have you noticed the common duckweed in the pond in the stable-yard?





Duck-weed.

J. Do you mean those green spots? They look more like single leaves than plants.

M. They are plants of a very simple kind.

I suppose you never noticed their flowers, and yet, if you stood by the side of the pond on any clear day in the month of July, you might see them. You must try. I think if you watch carefully you will see here and there a very tiny speck of a pale yellow colour, sparkling upon the edge of the leaf. If you look at some of these through the microscope, you will see that the shining yellow spots which caught your eye are the anthers of the flower, which lie within the floating green leaf till they burst their way through its edge. The root of the duck-weed is like one slender thread, swelling a little at the end, but never reaching to the bottom of the pond. This seems as small as any plant you can well conceive of. There is a water-plant called the Victoria Regina, which is a perfect contrast. It was found, a few years ago, in British Guiana, growing in the smooth water of a river. Its large leaves are of a bright crimson colour underneath, and a light green on the upper part. The flowers are composed of many hundred leaves, which are shaded from white to pink.

J. It must have been a beautiful sight, I

should think.

M. There are several other water-plants of which I have not time to tell you. One thing, common to them all, I must notice: the stomata or breathing holes are never found on the parts below water.

E. They would be useless, mamma, I suppose; they would of course be clogged with water.

M. Another singular thing is, that the stalks of water-plants contain many cells full of air alone. This you will see is of great benefit to the plant, as it helps to buoy it up

on the surface of the water

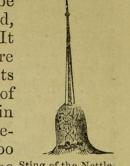
When we spoke of the leaf yesterday, I had no time to tell you of the hairs, which you have often noticed on the leaves and stalks of many plants. Some leaves will have the under side hairy, whilst the upper part is smooth; sometimes, both parts of the leaves are covered with hairs. These hairs, if examined through a powerful microscope, will be seen to be formed of one long cell, or, as you might call it from its length, a tube, or of several smaller cells joined together. These cells contain a liquid which has been observed to run about in different directions through the hairs. Can you guess that these hairs are of any use to the plants?

E. No, except in the stinging-nettle, which seems to punish those who try to

gather it.

M. Those hairs are formed of one cell, and the mischief they do is by means of the strong acrid juice contained at the bottom of the hair, which enters the little hole made by the point in the skin of your hand. You need not fear to touch a dead nettle, because

though the hairs might still be stiff enough to prick your hand, the poison would be dried. It is supposed that hairs are useful to the leaves of plants in collecting the dampness of the air, and perhaps also in shading the stomata, and preventing them from parting too quickly with the juices of the



quickly with the juices of the Sting of the Nettlesplant. They are a defence, too, against insects, and against excessive cold or heat. The hairiness of plants will sometimes be altered by situation. If you remove a wild plant with downy leaves into your garden, the leaves will sometimes become smooth. Water-plants, and those which grow in damp situations, are generally without hairs, and of a soft, juicy substance.

J. Are the thorns which prick me so much when I gather the roses made like

the hairs?

M. Yes, those prickles are made of cells, only they are not so simple, for they contain more cells, and of different shapes. They are not a part of the stem, you see, for they peel off with the outer skin. They die every year, and new ones grow on the new shoots in the spring. This is not the case with the thorns you find on the sloe and many other trees. These last are made of

wood, and covered with the skin which prowood, and covered with the skin which protects the rest of the stem. They are, in fact, buds, which might have become branches if their growth had not been checked. I am sure you have seen and felt the sharp long prickles of the common furze on the heath.

E. Oh yes! It has often seemed so tantalizing. Those bright yellow flowers were just what I wanted to finish my nosegay, but the long thorns kept me from taking them

them.

M. Those long thorns are called spines. You would not guess, I think, that they might be only leaves a little altered by circumstances as they grew. I say leaves, not branches, as the thorns on the sloe might have become. We were speaking of buds just now, and it has reminded me that I never told you the proper cause of the growing of a bud. It is formed by an accumulation of sap in the middle of the trunk. Then, it pushes slowly through the layers of Then it pushes slowly through the layers of wood above it, and if during its course it is overcome, it forms only a small swelling, such as you may remember to have seen on the trunks of trees, or it may not even reach the surface. You may fancy the history of some of these unfortunate buds, if you look at the mahogany dining-table.

J. When I came home from my walk the

other day, I showed you a sprig of the wild rose-tree, which had a shaggy ball of red

moss. I wondered to see another flower growing upon what I knew was a rose-tree, but I think you told me it was not a flower. Was it made of hairs?

- M. No; it is the work of a little insect, or rather of several families of insects. If you examine one closely, you may discover the eggs, or the little grubs which have made their way out of them. The balls you find on the leaves of the oak and maple, which are sometimes as large as a pea, and sometimes no bigger than a pin's head, and which are called oak-apples, are also made by an insect, which pricks a hole where it may lay its egg. The sap, being interrupted in its passage through the leaf, accumulates, and forms those little knots.—Now the shower is over, and we will prepare for our walk.
- E. How fresh and green the garden looks! and the birds are singing so cheerfully, as if they would help the trees and flowers to be thankful for the rain.
- J. I often fancy that the flowers smell more strongly after the rain, but I suppose that is only because I have been away from them some time.
- M. No; the smell of flowers does vary according to the state of the atmosphere. On a hot, dry summer's day, some of our most fragrant flowers and shrubs have little or no scent, unless their leaves are bruised;

but a heavy shower will soon make all bright and sweet again, just as it is in the very early hours of a summer's morning. This beautiful change is often alluded to by poets, and I dare say you will remember how it is used in the Bible to illustrate some most interesting truths. Where the psalmist says of Christ, "He shall come down like rain upon the mown grass, as showers that water the earth," how touchingly does he intimate that the Saviour is as welcome to a soul drooping under a sense of guilt as the refreshing rain to the withering flowers; whilst all the loveliness of true piety is represented by Hosea as owing to the influences of that blessed Spirit who says, "I will be as the dew unto Israel: he shall grow as the lily, and cast forth his roots as Lebanon; his branches shall spread, and his beauty shall be as the olive-tree, and his smell as Lebanon,"



# CHAPTER V.

### THE FLOWER.

Emily. Mamma, can you talk to us as we walk round the garden to day? I am so glad we are come to the flowers at last, I should never be tired, I think, of hearing about flowers. They are much more beautiful than the roots, or stalks, or even the green leaves.

J. Yes. But it seems to me as if the flower were only the ornament, and the

other parts were the more useful.

M. Wait awhile, and perhaps you will find the flower as useful as the leaves and root, though the life of the plant, on which it grows, may not depend upon it.

J. I am sure it does not. I did not kill my marigold, though I picked all the flowers

off, one after the other.

M. What will become of the marigold at the end of the summer? Shall you get any marigolds next year?

E. Ah, I see what you mean, mamma. If

every one gathered their flowers, we should have no seed; so my pretty flowers are use-

ful in making seed.

M. Or rather they contain the seed; and when you pick a flower you take the seed too, in its unripened state. But this you will understand, when I describe the flower to you. It consists of four parts, calyx, corolla, stamens, and pistil.

E. I suppose you mean, only some kinds of flowers; some have such a quantity of different leaves. See, here is a daisy, mamma; I wonder how many pieces I could count:—and there's the rose, with I do not know

how many leaves.

M. Those coloured leaves, which form generally the gayest part of the flower, are called the corolla. You must try to remember this name, for I never mention these long words except when I feel them important. Sometimes the corolla has but one leaf, sometimes two, and sometimes a very large number. You may, if you like, look for a flower with the corolla in one entire piece.

E. Is the honeysuckle of that kind? I suppose it is the corolla I used to pull off, to

suck the honey from it.

M. Yes, and the lilac, and jessamine, and primrose, and many others: I will not tell you all, for I should wish you to search for yourselves. You have discovered already

that it may be of any colour or shape. Can you find me a full blown rose? Take hold of the corolla and pull it off gently leaf by leaf. What is left in your hand?

E. The stalk, and the green leaves, which

were round the corolla.

M. They are called the calyx. The calyx will be, like the corolla, of different shapes, but the colour does not vary so much; it is generally green.

J. The fuchsia has not any green leaves at all round it. It grows at once from the

stalk.

M. In the fuchsia, the bright coloured outer leaf, which forms the great beauty of the flower, is the calyx. Here is one; you will easily find the corolla.

E. Is it this set of folded leaves within? Well, they seem as if they were determined to dress more gaily, and look more bright than the calyx, so it is all right; though the calyx appears to have taken an improper colour.

M. The leaves of the calyx generally serve to protect the corolla before the flower has opened. The rose-bud you will remember at once, and many other of our flower buds. As the corolla grows to its full size, the calyx gradually opens. In the escholtzia, the calyx slips off as the corolla unfolds. You know the little caps which you pull off the flowers sometimes?

J. Oh yes! and the flower unfurls.

M. In the white lily, the calyx and corolla are both white, and you would not notice the difference between them without examination.

E. May I gather one? I think the calyx is hardly so soft and white as the inner leaves; I suppose they sheltered the others before the flower had opened. Oh, mamma, I have shaken some of the yellow dust from the middle of the flower, upon the leaves; what a pity!

J. Is that yellow dust what the bees

change into honey?

M. No, honey is a juice contained in the flower. I will tell you about the yellow dust very soon. Do you see the pretty little threads which come from the middle of the flower? They are called stamens. The yellow tops of each are called anthers. The anthers are hollow and divided into one or two cells, and this yellow powder, called pollen, is formed within them. When the pollen is ripe, it bursts its case, and collects on the outside of the anther, as you see it in the lily.

E. One of the stalks is longer than the

other, and has no anther.

M. No, that is the pistil, a very important part of the flower. It consists of three parts. This thickened part by the stalk, is called the ovary, and contains the seed. The stalk is composed of one or more little tubes

made of the cellular tissue, and there is a skin or epidermis over the whole, except at this top part called the stigma, which, as you may feel, is damp and sticky. The use of this seems to be to collect the pollen as it falls from the anthers, and hold it till it has passed gradually into the pipes, and is thus on its way to the seed. Directly it reaches the bottom, the seed will begin to swell and ripen, and then the duty of the flower is done, and it may wither and fall. But I am not going to tell you of the seed to-day: I have more to say about the flowers. First let me see that you understand the different parts of the flower. Take a flower, Emily, and try to divide it into its separate parts, by name.

E. What shall I choose? Oh! the heartsease. Now then, one, two, three, five, bright beautiful leaves—the corolla, mamma! Then here is the calyx, of its proper green colour; and inside here, are the stamens and pistil, I suppose, but I cannot see them, though I have pulled off all the leaves, which shaded them. May I have the microscope? I see the pistil in the middle, and the tops of the stamens; I mean the anthers, but I cannot

see the threads they grow upon.

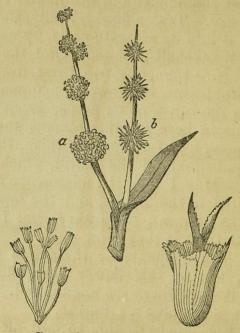
M. The filaments, or threads as you call them, are in this flower very thick. In some flowers, there are none at all. James, you may examine a primrose.

J. Not much trouble to pull off the co-

rolla, however. It is all in one tidy piece, and looks like a whole flower without its stalk. But where are the stamens gone? I see only

the green pistil inside the calyx.

M. Look within the corolla. We will cut it open carefully: there they are, fastened, you see, to its sides. Well, I am glad to hear you have remembered the four parts of the flower. Now, I must tell you that some flowers have no corolla, and a very few have neither calyx nor corolla: the duck-weed is of this kind. Do you remember the picture I showed you yesterday?



Bur-reed: a stamens: b pistils.

The bur-reed, which grows beside the

river, is simply formed. The flowers grow in tufts upon the stalk, some green, some yellow. The yellow tufts are little else than bundles of stamens, whilst the green bunches are made of pistils alone.

J. I have often seen the bur-reed, but I

never noticed its flowers.

M. Some plants have flowers with stamens alone, whilst others of the same kind will



have pistils only. Such, for instance, is the beautiful palm-tree which grows in tropical

countries, and is so much valued for its fruit, called the date. When an invading army wished to desolate the country of their enemies, they found it quite sufficient to cut down one of these kinds of palms. The other would of course be useless.

E. Oh! worse than useless, I think, mamma. It would seem as if they lived only to remind the poor people of their great

loss.

M. The alder and hazel produce these two different kinds of flowers upon the same tree. Do you remember noticing in the early spring, before the leaves had opened, the hanging



Catkins of the Alder: a male catkin; b female catkin.

flowers upon the nut-trees? These are formed of stamens only, and you will, I dare say, have quite overlooked the little buds, which contain the pistils. You would not distinguish them from the leaf buds, except by the little pink tuft at the point.

E. But, mamma, did you not say that the seed did not ripen before the pollen had reached it? Do these flowers bear any seed?

M. It seldom happens that all the flowers on a plant will ripen their seeds, but in these cases there seems a worse chance than in those which are formed as I first described to you. The pollen is, however, often blown by the wind upon the anthers, and quite as often carried by the bees, as they pass from flower to flower to collect honey.

E. Oh! I am so glad. I wish the bees could know that they repay the flower for

the sweet honey they take from it.

J. I have often seen them roll themselves in the flower, as if they meant to cover themselves with the yellow powder. That was only fun, I suppose, or because they found it difficult to get the honey. But how do they know to which flower to take it, mamma? I suppose the pollen of one flower will not do for the seed of another.

M. Not if the plant be of an entirely different kind. If they are of the same tribe, but rather different in colour, the seed will probably produce a flower rather different from either; and it is in this way that

new varieties of flowers are obtained.

But it has been noticed, that bees prefe collecting honey from one kind of flower on each journey. If you watch, you will see a bee pass from flower to flower of the same plant, or if it cannot satisfy itself, it will go away to a flower of the same species near at hand. Seldom, if ever, will the bee take home with him honey from two entirely different sorts of flowers.

J. Is the honey different, in different flowers?

E. Oh yes! I remember reading in Mr. Moffat's journeys in Africa, that he was nearly poisoned by honey collected from

poisonous flowers.

M. Yes, and the honey which has been gathered chiefly from the heath flowers, will be very dark, and has a peculiar taste. The rhododendron, and some azaleas produce honey, which is poisonous to us, though it is not known to injure the bees. I said just now that I would not describe all different forms of flowers, nor am I going to tell you how to place them in classes; that you must learn another time; I could not teach it you fully now. But one thing I must tell you, for I fear you would not learn it alone. Some flowers which appear to be one, are formed of very many little flowers. Can you guess what they should be called, then? Do you remember what I called the leaves when they consisted of several little leaves?

E. Compound, mamma. Shall we try to

find a compound flower?

J. I think I see one. The mignonette

is a compound flower, I think, mamma.

M. I am glad you have thought about it, though your thought is wrong. You see, each of the little flowers of the mignonette

has its own little stalk. But now look at this sun-flower. Here is a collection of tiny flowers. Look through the microscope, and you will see them better. Each of these will have its own seed. The dandelion and daisy are flowers of the same kind.

E. I was thinking of the flowers of the hemlock, mamma, but I can scarcely remember whether they are compound or not. They really look like one large white flower.

M. They are, however, many little ones, each with its own stalk; but as they all branch out from nearly the same place, and all meet above, as nearly at the same place as possible, they are all pressed into one broad mass of white flower. Many of the flowers which grow as these do, belong to poisonous plants. Now we must walk to the house, for the sun is setting. See how the little daisies are beginning to close up their flowers.

J. Ah! I have seen many flowers do that; it has often surprised me. Just as if they knew the night was coming, and that they

ought to go to sleep.

M. Well, they really do compose themselves as if for sleep. The leaves often show this as well as the flowers. In some plants they droop lazily down one by one, and in other kinds they fold themselves over the flower, as if to protect it from the damp or cold of the night air. But look, here is one

flower just opening as if to begin its little life. Stand by this evening primrose, and watch the buds as they gradually unfold.

E. I suppose it takes its name from its

loving the evening so much.

M. Yes, there are a few other plants which open their beauties and give their pleasant perfume in the evening, as the night smelling stock does. One of the most beautiful flowers of the cactus tribe opens in the evening, and gives its scent till midnight, when the flower begins to wither and lose its smell.

E. Good bye, pretty flowers. I shall not

forget you, though I am going away.

M. No; and do not forget Him who made them. Do you remember those lines?

Thou art, O God, the life and light
Of all this wondrous world we see;
Its glow by day, its smile by night,
Are but reflections caught from thee:
Where'er we turn, thy glories shine,
And all things fair and bright are thine.

When youthful spring around us breathes,
Thy spirit warms her every sigh:
And every flower the summer wreathes,
Is born beneath thy kindling eye.
Where'er we turn, thy glories shine,
And all things fair and bright are thine.

## CHAPTER VI.

#### THE SEED.

M. Well, Emily, have you eaten all your currants? I see James has scarcely finished his plateful of cherries. Which will know most about seeds, do you think, you, who have eaten so many of them, or James, who is carefully avoiding them?

is carefully avoiding them?

E. Oh, mamma, I had never thought I was eating seeds. The currant-trees do not

really grow from the currants, do they?

J. No, I think not, for the gardener was cutting some tiny sticks from the currant-trees last autumn, and he has taken such care of them, that they have grown already.

M. Most trees grow more quickly, and bear fruit earlier, when raised from cuttings, than from seeds. But all plants have seeds, and there is as much variety in their form and manner of growing, as there is in the different shapes and colours of the flowers. Some, like the cherries on the table, are enclosed in a case of pulp, others are protected in a pod. But we must watch these

seeds during their growth. We saw the flower in its beauty yesterday: we must examine what passes whilst it fades to-day.

J. I have watched the peas, mamma, and seen the little pod within the flower grow every day, till I could feel the peas inside, and then, if they were not gathered when ripe, the pod would dry and crack, and the peas roll out; and then, I suppose, they would grow, would they not, mamma?

M. Yes, most likely, though the winter time would perhaps kill some of the young plants. You know we sow the seeds generally in the spring. You will, I dare say, remember some other seeds which grow in

pods, beside the common pea.

J. The stock grows in a pod, and the

lupin, and scarlet bean.

M. Yes, but the pods of the stock and wall-flower differ from those of the pea. They are like a double pod, and have two lines of seeds, one on each side of the division.

E. Where was the seed in the currant

flower? I do not exactly remember it.

M. It was, like the seed of the rose, between the stalk and the flower. Take this full blown rose, and try to find me the seeds. They will not be ripe of course, but

where do they grow?

J. Oh! here they are, inside this little green ball. This would have been red, if we

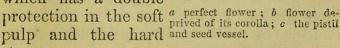
had left it till winter.

M. Yes, and then the seed would be ripe. This case will preserve them from the light, and many other things which might injure them. Do you remember some other seeds which grow as these do?

J. Oh! the hawthorn berries are much the same, only the hips and haws, though they look a little like each other in the hedge, have a very different taste. One seems full of hairs, but the other is real fruit, and would be nice if it had more taste.

M. The apple and pear grow in the same way, at the stalk of the flower, and the seeds are in the middle of the fruit, and have a case of skin round them. This I need hardly tell you, for you know the apple core, and the pips inside. Sometimes the stamens grow from the bottom of the seed case, so that the seed is quite in the middle of the flower. You will see what I mean, by this meadow geranium. The peach, cherry, and

plum are seed cases, and were once small and hidden in the middle of their flowers, and the kernel of the stone is the seed, which has a double protection in the soft



stone.

J. But mamma, I cannot think how the

seed can get out of such a hard case. I cannot break the peach-stones with my teeth.

M. No, but have you not noticed one side, which is sometimes almost split? When the stone has been lying on the damp ground for a very long time it will swell and crack at this place, and in time the young plant will force itself out. The peach and nectarine are natives of a warmer climate, and will ripen their fruit better in proportion to the heat they have. They bear more fruit, and of higher flavour, in Spain and Italy, than they do in England, though we place them in the most sheltered parts of our gardens. I think you have learned from some one else the proper use of the peach, plum, and cherry.

J. Oh yes, mamma, we like to eat them

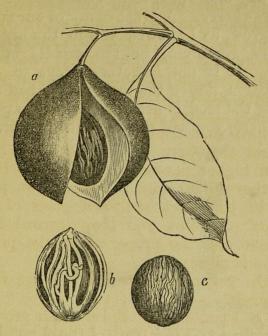
very much.

M. Did you ever see the almonds growing on the trees? What part of the plant is the fruit which we eat?

E. The seed, mamma, I suppose, for there is a sort of shell or stone round it, and then outside there is a case over this. The walnut, too, is something like this, with two shells or cases.

M. The nutmeg is the kernel of a fruit which grows in Ceylon, and the Molucca Islands. It is a hard oval nut enclosed in two cases, as you may see by the picture. The outer one of these is soft and juicy, and

is not of any use. The next case is harder, and seems made of strings, and this is all



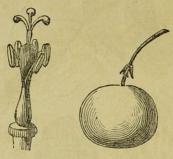
Mace and nutmeg: a the ripe fruit burst; b the mace; c the shell covering the nutmeg.

gathered carefully, for it has a strong taste, and is used to flavour dishes; it is called mace. You may ask the cook to show you some mace and nutmeg in the evening. They are both used as spice. Do you remember how the seeds in the strawberry are placed?

J. Oh yes, they lie outside the skin of the fruit. In the raspberry they are in little

juicy cells.

M. The mulberry, blackberry, and other fruits are like the raspberry, but I do not know any one which has its seed placed like the strawberry. A great many of our flower seeds grow, as I showed you in the lily and meadow geranium, in the middle of the flower. It is not, however, always so. In the passion flower the little round ball containing the seed, is near the end of the pistil. Look here, you will find it in this flower.



Seed-vessel of passion-flower.—Seed-vessel swollen.

E. Yes, I see, but really I could not have seen it, mamma, if you had not pointed it out. The flower looks quite full of different sorts of stamens and pistils.

M. No, this coloured ring does not belong

to them at all.

E. Do you not think it is a beautiful

flower, mamma?

J. Ah! and I like it because I have heard why it was called the passion-flower. Do you know, Emily? That pretty ring is said to be like the crown of thorns which Jesus

wore, and there are the three nails, and these five anthers are like the five wounds



in his hands and feet and side. Do you think God made it to remind us of Jesus on the cross, mamma, when we walk in the

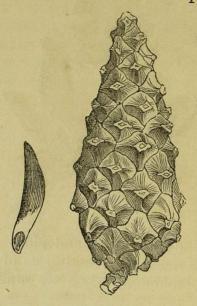
garden?

M. I cannot think so, my dear. It seems to me a strange fancy. But I think this and all our beautiful flowers do speak to us about the love of Jesus in a most attractive manner. They remind us how he delights, not only to supply our absolute necessities, but to provide for us all the pleasures we are able to enjoy. Those sufferings of his, which you mentioned just now, procure not only the pardon of sin, but all the unspeakable privileges of the children of God.

E. Are the yellow balls, I have seen upon

the passion-flower, the ripe fruit?

M. Yes, they are full of seeds of the same bright yellow colour. Here is a picture of a



Fir-cone closed and a winged seed.

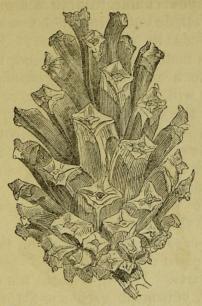
fir-cone, for you will not find one on the firtrees just now. You see it is formed of scales, lapping one over the other so com-

pletely as to look like one solid piece.

J. I remember that we gathered some once, but they were sticky, and you would not let us play with them. Last spring we found some lying under the trees, which were dry and of rather a different shape.

M. They were like this second picture.

They had cracked, and their seeds had escaped. That sticky substance, which you felt upon them in the autumn, seems in-



Fir-cone opened to discharge its seed.

tended to keep the seeds from damp and cold during the winter. The cones burst with a good deal of force and noise, and the seeds are thus thrown to a considerable distance.

E. It is well that the seeds can sow themselves, for then the land need not be desolate even when there are no people to take care of it.

M. Oh yes! plants have grown on the coral islands long before they have been inhabited by men. The different contrivances for the scattering of the seed are well

worth noticing. You know the dandelion, and the round ball of white feathers which succeeds the flower.

J. Oh yes! I like to blow them away.

M. Well, do you know that you are sowing many seeds in one minute? Each tiny feather is fastened to a little seed, and wings its way to a new spot of ground, where of course it will be sure to lodge, seed downward, on the earth.

E. I watched some thistle-down one day, and followed it for a long distance, and saw it at last strike in the earth, as if it had

come to settle and live there.

M. We were looking just now at the flower of the meadow geranium. You saw the seed-case in the middle of the flower, with the pistil rising out of it. It is formed of four parts. If you wish to see this plant sow itself, you must gather a little bunch of the ripe seeds on a fine summer morning before the dew has dried away from it, and



Meadow geranium sowing its seed.

lay it in the sun. You will soon hear a sudden snapping sound, and see one after another of the small seed-cases spliting away from the flower stalk and curling up, being only held to the plant by the top of the pistil, and the

little seed contained in each division is

thrown off by the jerk to a short distance. These little seeds themselves are worth examining with a microscope, marked as they are so prettily with lines like network. Indeed the seeds of plants are often very beautiful.

J. I have often admired the gay colours of the French beans.

E. Yes, and I broke one of the little scarlet balls in my small box of shells, and found it white inside; and you told me that it was the seed of a plant which grows in India. But these are larger than the seeds of the meadow geranium. I shall certainly try to find one of them, and put them into my

microscope.

M. A great many seeds are useful on account of the oil which they contain. You have seen the children under the trees in the wood in autumn, filling their sacks with beech-mast. I believe the oil pressed from them is sometimes used in manufacture. In some parts of Switzerland the kernels of walnuts are crushed and pressed to extract the oil, and the substance left after the oil has been taken out, is made into little cakes, and sold to poor people and children.

E. I should think it cannot be very nice. It must be hard and dry, when it has been

used in this way.

M. I never tasted it, but its name agrees with your idea of it. It is called pain amèr,

or bitter bread. The oil with which painters mix their colours is extracted from linseed, the seed of flax, by heavy pressure, and the cakes which are left are used to fatten cattle.

J. How very useful the flax-plant is, mamma! Its stalks provide the threads for my shirts and pinafores, and its seeds help to paint our houses.

E. It is not an English plant, I suppose,

for I never remember to have seen it.

M. Oh yes, it grows wild in Britain, but it is cultivated mostly in the north of Ireland, where there are large linen factories, which is the reason why some of our linen is called Irish. I have seen it growing in Scotland, and admired its delicate blue flowers, and its slender stalks, waving in every breath of wind.

E. Is not salad oil obtained from the fruit of the olive?

M. Yes, but the remarkable thing is, that this oil is not obtained from the nut, but from the purple berry which surrounds it. The olive is an ever-green, which will not grow in a country so far north as ours. Its leaves are shaped like those of the willow, and its white flowers grow in small bunches among the leaves. It is not a very lofty tree, but it will live to a very great age. We are told that eight olive-trees in the garden of Gethsemane were there at the time of the crusades.

J. Are any of them still standing? How

very much I should like to see them!

M. There are eight so very large that they are supposed to have been there when Jesus was on earth. Josephus tells us that Titus cut down all the trees within one hundred furlongs of the city of Jerusalem, but as the olive sends up new shoots from its roots when cut down, very likely these are in that sense the same trees. They look old, and their trunks are rough and gnarled. The Roman Catholics venerate them highly, and would punish any one who should cut or injure them in any way. Beads are made from the stones of these olives and preserved as relics. It is very sad to think that many persons who treasure up these relics and are so fond of the cross and the beads, show small love to Christ, and pay very little regard to his will. They dwell upon these outward circumstances, and quite forget to think of the love which enabled Christ to suffer so much and die for them. May you, dear children, never be led astray by those sentimental feelings which too often take the place of enlightened devotion and practical obedience. I cannot talk to you more this afternoon. To-morrow we will walk in the meadow, for I am going to speak of grasses, and we shall find all we want around us.

### CHAPTER VII.

#### GRASS.

E. Well, mamma, we are so glad to see you. We have been waiting a long time. I have found sixteen sorts of grasses, and James has still more, I think. We were afraid some visitor had come in, and kept you from coming to meet us. But sit down, dear mamma: you look tired and warm.

J. The hay-makers have not cut down the grass in the large elm field, and I found more different sorts there than any where else. May I pour them in your lap, mamma, and then you can choose which you like to

explain first.

M. Oh! here is the quaking grass; it is

very pretty.

J. Yes, I like it as much as any. But I wish grasses had coloured flowers; the meadows would look so much gayer.

M. I think, however, that you would soon grow tired of the gaudy fields. Green is a

very pleasant colour to the eye, and I am often thankful for the kind providence which made its soothing tint prevail throughout our landscape.

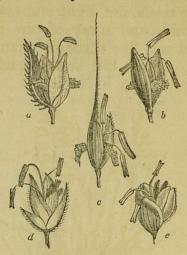


Quaking Grass.

E. Do grasses ever have flowers?

M. Yes, many of these are in flower now. Their flowers are very simple, and have neither calyx nor corolla. You may see the two green scales, and within these are the stamens and pistil. They are not exactly alike in all grasses, but the flowers of all are formed with these green scales instead of the usual parts of a flower. On account of this and other peculiarities, grasses are reckoned

by botanists a distinct class of plants. Can you tell me any other points in which they differ from the plants I have been describing to you day after day?



a branching lappago: b perennial darvel; c wood barley grass; d creeping panic grass; e middle quaking grass.

E. The leaves are long and slender, and fold round the stem of the plant instead of

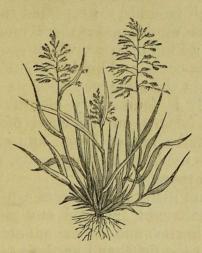
growing on a little stalk of their own.

M. You are quite right. Now I will cut this stalk open with my penknife. Do you see that it is empty inside, and seems made of hollow cylinders, fitting into each other, with a partition across the stem at every joint? All the grasses you have brought me to-day are alike in this. In hot countries the plants of this tribe grow to a much greater height than we ever see them here.

The grass in a field is often taller than a man.

J. Grass seems to grow up every where without the trouble of sowing the seed.

M. The seeds are light and easily carried by the wind, and most of our grasses are hardy, and will live through changes of cold and heat, which kill more tender plants.



Annual Meadow-grass.

This, which is the most common kind, is in flower through the greater part of the year. It is well for us that grass does grow so easily, for it is useful, not only as food for cattle, but to bind together the banks by the road side, and the still higher mounds and embankments made for various purposes.

J. Oh yes! I saw that they were sowing

grass seed upon the railway embankment; but do these little plants strengthen those

large high mounds?

M. They are like a network over the whole, or even better than this, for the roots work themselves into the substance of the earth itself, and thus prevent the rain from washing it down; and you know that though one shower of rain would not sweep away those high mounds, the repeated rain of days and years would make them much flatter. There is a kind of grass, which grows mostly on the sea-coast, and binds the shifting sands together in the same way with its entangled roots. It is found very plentifully in the Western Islands, on the coast of Scotland, and its stalks are so tough and strong that they are used for making mats, and bags, and even ropes.

E. I am glad to see grasses are so useful. I never thought they did any good, except to feed horses and other animals, and to

ornament the fields and gardens.

M. You do not remember that some of our chief articles of food are obtained from this same tribe of plants. You surely have not forgotten the corn, for James has brought me a stalk of barley.

E. That is generally used for making beer I think, is it not? Wheat is very important. I cannot think what we could eat instead of

bread.

M. Barley and rye are sometimes used for making an inferior kind of bread, and the usual food of the poor in Scotland, and the



Barley.

northern parts of England, is made from oats. The oats are ground into a coarse flour, and then baked in thin cakes. They are rather bitter, and I think you would not like them much, though the cottagers seem to eat them very heartily.

J. Why do they use oats instead of wheat? We only grow the oats to give to horses. I wonder the Scotch people do not plant wheat

in their fields instead of oats.

M. Barley and oats are more suited to cold countries than wheat, and the crop is therefore more certain. Wheat and rye are grown in the south of Scotland, but in the northern parts barley and oats. You have seen wild oats growing by the sides of the road many times. The grains are so exceedingly small that they are not worth gathering, but, except in size, they are not very different from common oats.

J. I shall look for some as I go home.

M. I have heard that oats have been found growing wild in the island of Juan



Maize.

Fernandez, but most likely the seeds had been scattered by the sailors of some ships which passed that way. The corn which grows in India and other countries of that

temperature is called maize. It was cultivated in America before that country was discovered by Columbus. It is larger and more productive than the other sorts of corn we have spoken of; one stalk of maize will produce two thousand seeds. The grains of wheat are not nearly so numerous. I have found as many as eighty-six grains in a very large ear; but the number varies according to the richness of the ground and many other circumstances.

J. What corn was it which grew in the Holy Land? It could not have been maize, I think, because Jesus never spoke of more than a hundred fold. That means a hundred seeds for every plant, does it not?

M. It is not likely to have been maize. The only wheat grown in Palestine is bearded, and looks like barley. It bears much more

plentifully than our corn does.

E. The stalks of wheat are used as straw, are they not? So we owe our summer bonnets to the wheat.

- J. Yes, and the horses enjoy the straw quite as much as you do. What would they do without clean straw in their stables, sometimes?
- M. The straw of wheat contains many small particles of flint, and it is said that it may be melted by very strong heat into a colourless glass. Barley-straw melts into glass of a topaz yellow colour. Whenever a

hay or wheat stack has been burned down, large pieces of a glassy substance are found. Now I must tell you of a foreign grain of which large quantities are used in England, but very much more in the countries where it grows.

E. I think you mean rice, mamma. I have found a grain now and then in the pudding, with the skin not taken off, and you told me that it had escaped the

threshing.

M. Rice is cultivated with most success in the damp marshy districts of Hindostan, and Carolina in North America. It will grow in



Rice.

many other countries, but will never thrive unless abundantly supplied with water. It is to many nations as important an article of food as wheat is to us.

J. It is more tasteless than wheat, I think. I like it in puddings, but I should be sorry

to eat it for my other meals.

M. Those who have not wheat to make bread, must find something they can eat instead of it. I think rice is as good as most of these substitutes. The Indians of the Caribbee Islands use cassava as bread. They make it from the poisonous root of a shrub.

E. Oh, mamma! but how can they eat the

bread? Would it not kill them?

M. They press out the juice, which contains the poison, before they use the rest of the root.

J. Well, I would not breakfast with them on any account. I should be fancying, all the time, the poison had not been quite

squeezed out.

M. The tapioca, of which we make puddings sometimes, is a substance of the same kind, but not made from the same poisonous tree. As we shall not have time to-day to speak of all the different plants of the very large family of grasses, I will tell you of just one or two so large and so useful, that you ought to distinguish them from the rest. There is none you love more than the sugar-cane.

E. Well, I never expected to hear of that to-day. Is it one of the tribe of grasses?

and is its stem hollow like them?

M. It is of the tribe of grasses, but is not hollow. The sugar is obtained from the

sweet juice extracted from its stem, as you know. The stem is porous, and has knotty joints, and the leaves grow at each joint. It



Sugar-canes.

takes from eleven to thirteen months from the time it is planted till it is ripe, and during that time the fields must be carefully weeded and watered, or the juice of the plant will be poor and inferior. It grows to different heights, sometimes being only six or eight feet, whilst it is occasionally found as tall as twenty feet. The sugar cane is cultivated in most tropical countries.

J. The brown and white sugar come from

the same plant, do they not?

M. Yes: the difference is only in the methods of refining them. Sugar is contained in many other plants. It has been obtained from beet-root and parsnips, but not in such quantity and quality as to interfere with the foreign sugar. In some districts of America the juice is drawn from the trunk of the maple tree and makes a very good sugar. One of the largest specimens of

the grass tribe is the bamboo, and perhaps we might call it the most generally useful.

J. The Chinese umbrella which Mr.

J. The Chinese umbrella which Mr. Porter gave me the other day, was made of

bamboo.

M. The bamboo grows to different heights. Sometimes it will grow to eighty or a hundred feet, or even higher still, and will rival the palms in magnificence. Its light feathery top waving upon its slender and elegant stem looks very beautiful.

E. But is it not easily broken, if its stem

is hollow and yet so tall?

M. No; it is very strong. It is used by the Chinese sometimes for water pipes, or for posts to support their houses, or, when cut into strips, it is manufactured into hats, baskets, mats, and many other useful articles. Its young leaves are gathered and used as vegetables, or sometimes cooked as sweetmeats.

J. Well, I should like the bamboo to grow in our country; but I would not give up the wheat for that. I am glad the Chinese and Indians have some good things as well as

ourselves.

E. I have been thinking to-day how glad we ought to be that plants have so many

seeds, that they can spare some for us.

M. Yes; indeed, dear, this is worth noticing, and may well excite our gratitude. James has been saying many times to-day

how much he values bread. Do you remember who said, I am the Bread of life?

E. Yes; Jesus said so when he had been

talking about the manna.

M. Just what bread is to our bodies, that Christ is to our souls—needed daily for our support, and yet not the less desired from frequent use. As our poor bodies would soon faint and fail without our daily food, so would our souls become weak, and tire in the ways of holiness, if they depended not daily upon Christ for strength and nourishment.

"Bread of heaven! on thee I feed,
For thy flesh is meat indeed.
Ever may my soul be fed
With this true and living bread:
Day by day with strength supplied
Through the life of Him who died."



## CHAPTER VIII.

FERNS.



The male seed fern: a root of a young plant—showing the form of a leaf-bud previous to expansion; b portion of one of its doublywinged fronds, or leaves; c portion of a leaflet, showing on its under side the cluster of sporules, or seeds.

J. Oh! mamma, we shall be glad to hear something more from you about plants.

M. To-day I am going to tell you of a great many different sorts of plants, more simple than the grasses, for they have no spiral tubes in their stalks, nor flowers, such as I have described to you in the other plants. We will begin with the ferns. You know what I mean. You have often seen and gathered them in the wood.

J. Yes, but their stalks were so hard, I could not break them without my knife. What are the stalks made of, if they have

not the tubes for the sap?

M. I told you that the stalks of other plants contain both cells and tubes for the liquid. These ferns and all the plants I shall speak of now, have cells alone, covered with skin.

J. How are they increased in number, if

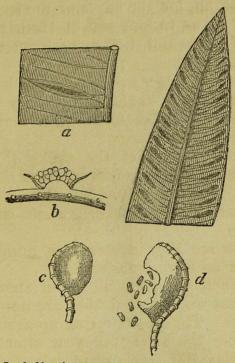
they bear no flowers nor seed?

M. When you know all about them you will almost wonder that they are not more numerous. The plants spring up again and again from the same root year after year, and besides this, each plant possesses the power of producing many others. Have you noticed in the autumn on the under part of the leaves of some ferns, some brown spots raised a little above the leaf itself? These are hollow cases containing little brown halls filled with grains of matter, every

one of which will, if sown, produce a new plant.

E. Then, mamma, are not these the seeds?

M. They are exactly like them in effect,
but as they are not produced by stamens



Leaf of hart's tongue fern: a spores escaping.

and pistil, as the seeds of flowers, botanists choose to call these spores or sporules. You know how many of these brown spots you have seen upon the leaves, and when I tell you that each little case within them contains very

many spores, you will see how very quickly the plant may multiply itself. These spores are not always placed in the same way upon the leaf. In some ferns they seem to grow from the edge, and in one called the brake, you would most likely be unable to find them at all, for the edges of the leaf are so curled up as to hide within them the little row of spores and their cases.



Tree-fern.

J. We will remember to look for that, Emily, in our walks.

M. There is a tree found in tropical

103

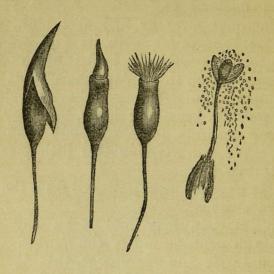
climates, which seems in all points like a gigantic fern. The trunk, which is formed of the decayed leaf-stalks of past years, is sometimes forty or fifty feet high, and looks very beautiful, with its fine head of small and regularly cut leaflets at the top. The leaves of all these plants have veins and breathing holes. The mosses have not either air vessels or breathing holes, but they are in some respects more complete than the ferns. We will examine this little piece of wall tortula.

E. Is that the moss gathered from the old

garden wall?

M. Yes, you may find it on any cold damp wall growing out of the mortar. We shall see with the microscope, that there is to every plant a little mass of roots, out of which grow some tiny green leaves placed very regularly round a slender stem. At the top of the stem is a brown cap, which we might guess to be the seed case. Let us look at this more carefully, for small as it is, it is wonderfully made. See here is first the little cap, which seems splitting, and as if it would have dropped off soon, if we had not interfered. Underneath is a lid, shaped like an extinguisher, which will also come off. And now within the case here are some brown threads, a sort of fringe fastened round the inside of the cap. You think you have found the spores now; but no, they are

under this fringe. They are not unlike the spores of the ferns in appearance. You may



Seed-vessels of mosses.—1. veil. 2. lid. 3. Interior cover. 4. seed-vessel bursting.

find many other kinds of mosses in your walks. It will be a pleasant and useful occupation for you to examine them with the microscope, and you will, if you look carefully, discover as many wonders as I have shown you in this.

E. I am most surprised at the small size of each tiny part, whilst it is still so perfect. It seems as if it would say to us, "Look very closely. I seem of no use or consequence at first, but I can at least teach you how wonderful is the God that made me."

When we think of it, mamma, it seems strange that these things, so finely made,

grow without trouble.

M. Yes, God, in his smallest and most unimportant works, has far surpassed what we can do with all our skill and care; and his works, unlike most of our clever contrivances, will bear to be most minutely examined. But when I have shown you the uses of these mosses, you may be even more struck with the truth of what we have been saying. These seeds will adhere to rocks or walls, on which nothing else could fix, and if the air is damp enough, they will grow with the little they can get to sustain them. When they decay they will form a thin layer of vegetable mould, and thus prepare the way for grass, and, in time, for shrubs and trees.

J. Are those grey shaggy beards, which grow upon the old branches of the goose-

berry trees, mosses?

M. They are called lichens, plants without either stems or leaves. In fact they are nothing but masses of vegetable matter, with oval shields which are full of spores. You have seen these lichens on the trunks of trees, and you may find others on old walls, where they look merely like patches of green and yellow crust. In the cold countries of the north they cover the ground with their cold slimy substance.

E. Are all the yellow and grey, and different coloured lichens the same in kind?

M. Oh no! but they are all formed very much like this one. Do you remember how much you admired the ruins of Carisbrooke Castle? I think if the many coloured lichens had been scraped off, those ruined walls would have looked very different, and lost most of their charms.

E. Not all, mamma, for I should have felt interested in the building in which poor king Charles was imprisoned, even if it had not

been so beautifully dressed.

J. But are all ruins covered with lichens?

M. Stone does not become overgrown so easily as brick. The mortar in brick buildings is a soft soil, easily penetrated by the little roots of the lichens. Melrose Abbey is quite free from lichen of any kind. The stone is so hard and imperishable that it looks even now fresh hewn, though the abbey is roofless and ruined.

J. It must look very cold and dreary, I

should think.

M. I did not think so. It is so beautifully built, and with so much ornamental carving, that I should have been sorry if its beauty had been concealed by lichens. Besides, we may hope for its continuance much longer, for you know these little plants must help to crumble away the surface of the building, though they do so very

gradually. There are so many plants of this kind, that I could not describe them all to you. I must pass on to the fungi, which are different from mosses, ferns, and lichens, in their formation and manner of growth. Mushrooms and toad-stools are of this class.

J. They are not at all like the strong, tough ferns. Poor frail things! I can

crush them with my little finger.

M. The substance from which they grow looks at first like nothing but cobwebs, but after a time a few white bladders may be distinguished here and there in the cobweb mass. If you were to cut one of these open, you would find it alike throughout, but as these bladders grow a small mark appears. This is really the little mushroom, and the part around becomes only the shell to protect it in its youth. You must have seen it in its different ages on the mushroom bed, and you may have noticed when the mushroom has grown too large to live in its case, how it will split it, and then burst out, and gradually unfold its cap, whilst the remains of its old wrapper or case shrinks round the bottom of the stalk.

E. But mamma, where are the seeds, or, as you call them, spores to be found?

J. Oh, I can guess; under the umbrella between those dark lines.

M. If you could prove that guess to be true, you might be of some use, for it is a

point still unsettled among botanists how these mushrooms do propagate themselves. The little bladders from which they grow may be found where mushrooms have not been known to exist. You have seen fungi of all kinds, and probably noticed that they prefer very damp situations, and grow most frequently in rainy weather.

J. I think that bright crimson one, which grows in the greep lane, is as beautiful as any. It is about as large as the mushrooms, and its red can looks very pretty among the grass. I

red cap looks very pretty among the grass. I suppose it is poisonous, like other toadstools.

suppose it is poisonous, like other toadstools.

M. Most of the fungi are poisonous, on account of the strong acrid juice which they contain. Nearly all the kinds which we consider poison, are eaten in Russia and Poland, having been first dried and powdered to destroy the power of the juice. The morel is a sort of fungus, which is very common in the spring in France and Germany. It grows in the beech woods, especially in any places where wood has been burned, and is reckoned good to eat. The morels when gathered are hung up to dry, a string having been run through their stalks, and in this state they are generally sent to England. sent to England.

The truffle, too, grows in Germany. It is black, and grows underground, and as it sends up no stalk it is difficult to find. Dogs

and pigs are trained to search for it.

109

E. But how should they discover them?

M. By their strong smell. The men take these animals to the woods, and dig for the truffles, wherever they see them scratch up the ground. The mould which grows upon rotten fruit is a small sort of fungus.

J. What, that which I found upon the

rotten strawberry?

M. Yes, and there are different kinds of mould on different sorts of fruit, but they are all varieties of fungi. Most seaweeds are formed like one or other of the plants I have described to-day, except that they are rather inferior in their organization. Many of them are only masses of bladders, with here and there a bag of spores. Upon the sea coast of Normandy and Picardy, upon the rocks, which are covered by the tide at high water, grows a sort of sea-weed which is made of yellow brown threads, so very fine, that it is only by their number they show themselves at all, but each of these small threads contains numbers of tiny living things, shaped like worms, which will on escaping from their little prison move about, apparently according to their own free-will. Many of these little creatures will measure only the four-hundredth part of an inch in length. When they are separated from the thread in which they were incased, they fall upon the rocks near them, and in turn give rise to new ones of their own species.

E. But, mamma, should any creatures which can move about in this way be called vegetables? I thought this was just the distinction between animals and vegetables.

M. And yet they look like vegetables, and resemble them in many respects. You must notice how very near the lower orders of the animal and vegetable kingdom approach to each other. It is indeed difficult to draw the line between them. And now we must prepare for our walk, and you may as well take your baskets with you, that we may collect as many specimens of moss as we can. You will find that I have not described to you so many as you can gather in one morning.

E. I love mosses very much, because they stay with us through the winter, when the grass has withered, and give beauty to the woods when there is little else to ornament them. I cannot say so much for the ferns, for they wither, and their brown leaves do not fall off, but look most desolate.

M. You must have noticed, I think, how much the trees in the woods by the sea shore in the Isle of Wight were covered with lichen. Can you guess the reason?

E. Is it owing to the spray from the sea, which would help to feed them?

M. Nordonht, for you know the decrees.

M. No doubt, for you know the dampness of the air is very important to their growth. The island of St. Helena is one of the most fruitful spots for this kind of plant. And now, dear children, I shall not talk to you any more about plants at present, though I shall be always ready to answer any questions you wish to ask me. I hope that what I have told you will give fresh interest to your walks, and help you to discover more of the wonders of this part of God's works.

E. It seems to me as if God had shewn his power and wisdom in plants more than

he has in animals and other things.

M. Oh, no; indeed that is a mistake. You fancy so only because you have not examined the rest of his works. Think of yourself, for instance. The flowers we have been admiring are unconscious of their beauty, and unable to derive pleasure from their existence. But it is far otherwise with you.

James. I know what you mean, mamma. The flowers, after all, have no thought and feeling, and this is the most wonderful part

of us.

M. Yes. We alone can thank God for all these wonders of his hand, and the power to thank him is the greatest favour of all. Then, Emily, you must remember that these beautiful leaves and flowers are fast fading away, and that a time will come when they shall all be over. Not so with those thoughts and feelings God has given to us.

E. I see, mamma, God has shown greater

power in making our thinking and immortal

spirits than in any thing else.

M. Yes, they are indeed the most wonderful of all God's works; but these souls, debased and enfeebled by sin, are a poor representation of what he first created in his own image. "He planted a noble vine, wholly a right seed," but how wild and degenerate has it become. Yet God is able to graft this barren stock with a fruitful branch, and he will do so "if we continue not in unbelief." The Holy Spirit has already retraced the image of God upon many If it was surprising power to create such a noble being at first, how much more glorious to restore it again, and make it fit to dwell in that beautiful Paradise above, which sin can never spoil.

> There's not a leaf within the bower, There's not a bird upon the tree, There's not a dewdrop on the flower, But bears the impress, Lord, of Thee.

Thy hand the varied leaf designed,
And gave the bird its thrilling tone;
Thy power the dewdrop's tints combined,
Till like a diamond's blaze they shone.

Yes, dewdrops, leaves, and buds, and all, The smallest like the greatest things, The sea's vast space, the earth's wide ball, Alike proclaim Thee King of kings.

But men alone to bounteous Heaven
Thanksgiving's conscious strains can raise;
To favour'd man alone 'tis given,
To join the angelic choir in praise!

MRS. OPIE.

The Religious Tract Society.

