

SURPRISES



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A LETTER TO THE BOYS AND GIRLS

Dear Boys and Girls:

There are thirty-nine chapters in this book. Besides these chapters, there are many science games.

Sometimes people who write books for children tell them how to study the books. We think you will not need to be told. We think, when one of you reads a chapter, you will say, "Now I shall try to see for myself everything this chapter tells about." And when you have read about the science games, we think you will play as many of them as you can.

In this book we have told you as many interesting facts as there seemed to be room for in thirty-nine chapters. Every fact may surprise you when you first learn about it. You may say, “I never knew why the cotton plant needs fibers to use!” after you read the chapter that begins on page 1. Perhaps you will say, “I never guessed that spider silk could be made into cloth!” after you have read page 37.

Here is something for you to remember. All the facts and surprises in this book are outside the book, too. Of course they had to be in the world outside before they could be found and put into a book.

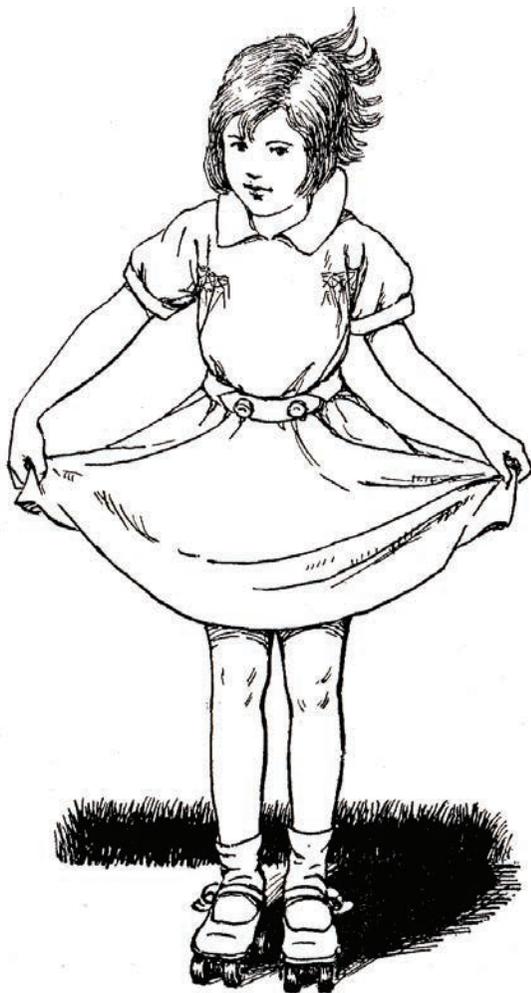
Perhaps, by the time you have read all the chapters and played all the science games, you will have a very good habit. You may have the habit of looking at things in the world outside books and trying to learn about them, too. But perhaps you have that habit already. Many boys and girls have.

So, instead of telling you how to study these chapters, we shall just wish you many good science hunts, both inside this book and outside it. We hope, too, you may have many pleasant surprises.

Your friends,

EDITH M. PATCH

HARRISON E. HOWE



A SUMMER DRESS

1. Cotton Fibers

Before Ruth could have her everyday dress to wear, it had to be cut from cloth and sewed.

Before the cloth could be cut and sewed, it had to be woven from threads.

Before the threads could be woven into cloth, they had to be spun from fibers.

And before the fibers could be spun into threads, they had to grow on cotton plants.

So Ruth liked to say, “Once upon a time this cotton dress was growing on some plants.”

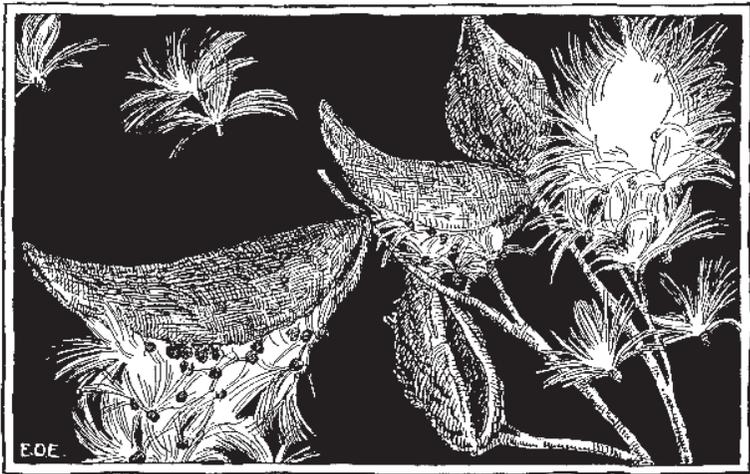
The cotton plants, of course, had no need of dresses. They had other uses for their fibers.



Dandelion seeds with fibers

Did you ever see a dandelion plant after the yellow blossom head had grown into a white seed head? Did you blow some of the seeds with your breath and watch them move away in the air?

Did you ever find a milkweed plant when the seed pods were ripe and open? Did you notice how the seeds



Milkweed seeds with fibers

came out of the pods and sailed far out of sight with the wind?

Dandelions and milkweeds and many other plants have seeds with little fine fibers on them. The fibers act like tiny sails. With the help of

these sails, the seeds travel in the air for a while. In that way they go to new places before they settle down and start to grow.



Cotton seeds with fibers

Can you think, now, what use a cotton plant may have for its fine white fibers?

If you guess that the fibers are sails for their seeds, you will be right.

Cotton seeds grow in pods. There are many seeds in one pod. The pods open when the seeds are ripe. Then the fluffy fibers are taken into the air by the wind and go off with the seeds that are hitched to them.

There was a time when people did not know how to make cloth with cotton fibers. In those days all the cotton plants grew in hot countries.

In such places cotton plants live from year to year. Some kinds grow to be trees or large shrubs. There is no cold weather to kill them.

But long ago people learned how to use cotton fibers. Then men living

in cooler countries obtained seeds and grew these useful plants.

In cooler places, however, cotton cannot live in winter. So the seeds must be planted each year.

There are many places in the southern part of the United States where cotton can grow in summer. The summer is so long that the plants can grow and blossom and have ripe seeds each year.

But in the North the summers are too short for the seeds of these plants to ripen.

Ruth said, “If I lived in the South, perhaps I could see just how the cotton looks before it is spun into threads and made into cloth.”



Cotton plant

2. Blue Dye

Cotton fibers are white and Ruth's cotton dress was blue. So Ruth knew that the cloth had been dyed. But she did not know where the dye came from. Do you?

The name of the blue dye is indigo. There are different kinds of plants from which this blue color can be taken. They grow in many countries.

But the indigo plants from which most blue dye has been made grow in India. There was a time when indigo plants grew on more than a million acres of land in India.

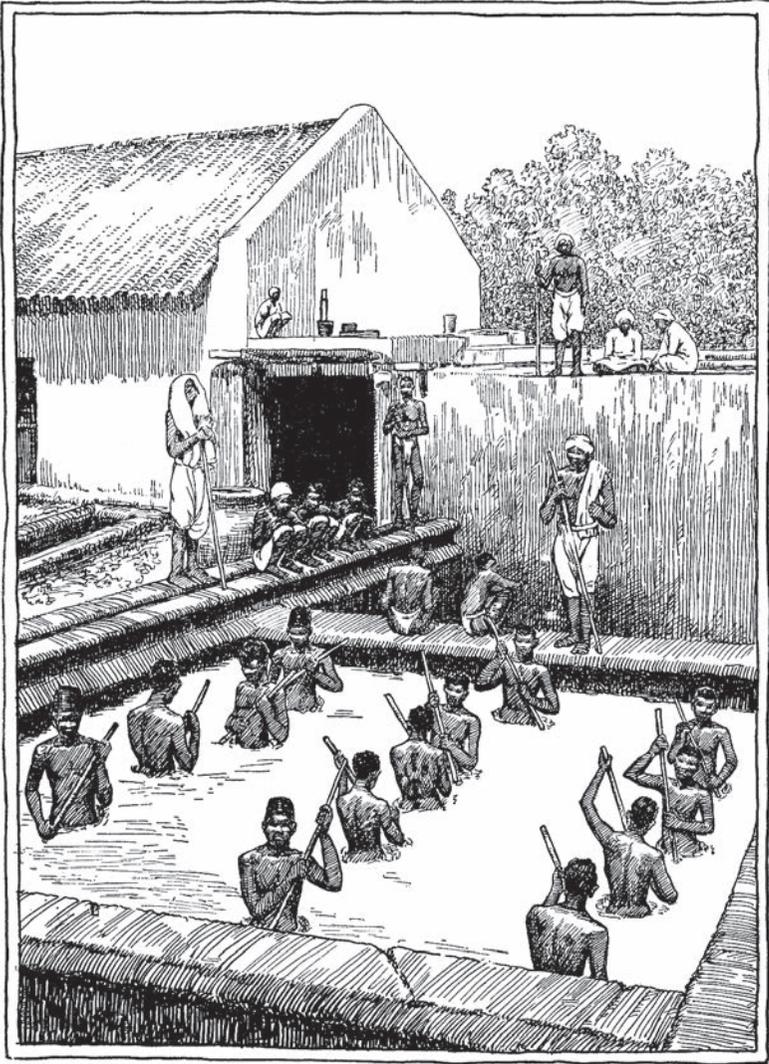
Do you know how a pea plant looks? Have you seen what sort of leaves and flowers and seed pods it has?

Did you ever see sweet peas growing? Did you notice the leaves and the pods that held the little pea-like seeds?

Indigo plants have leaves shaped somewhat like those of sweet-pea plants. Their seeds grow in much the same sort of pods. Their blossoms, though much smaller, have somewhat the same shape.

There is a good reason why peas and sweet peas and indigo plants should have leaves and flowers and seed pods that are somewhat alike. They all belong to the same family of plants.

At first the people of India had no machinery to help them make



A beating vat

indigo dye. They cut the plants by hand with knives. Then they put them into great vats. There the plants were covered with water.

Later the men let the water and plant juice run into lower vats, called beating vats. The men stood in the vats and beat the liquid with paddles. This was the way they mixed air with the liquid.

There was more blue color in the liquid after it was beaten and mixed with air. It colored the legs of the men who were working in the vats.

After a while the indigo coloring stuff sank to the bottom of the vats. Then it was taken and dried and made into little cakes of dye.

Ruth's grandmother and her grandmother's mother had had blue cotton dresses. These dresses were dyed with indigo that came from indigo plants. In those days that was the best kind of blue dye.

But, now, people can get dye in a different way. They have learned how to make indigo in factories. When they do this they start with coal tar.

Coal tar is black. It is thicker and stickier than molasses. It has a very bad smell. It is a poison.

Many useful things are made from this ugly, black, sticky poison.

Men boil the coal tar and change it in different ways. And after a

while it is not coal tar any more. It has been changed so that it is something else.

Fragrant perfumes and certain good-tasting harmless flavors are made from coal tar. Beautiful dyes are made from it, too. And some of these dyes are blue indigo.

The indigo from coal tar that was used to dye Ruth's dress gave it a lovely color. It was, indeed, lovelier than the indigo blue in her grandmother's dress.

For men can make more shades of blue, now, than they could a long time ago. So Ruth could choose the dark shade or the light shade that she liked best of all.

3. Button, Button

Who has the button? Well, Ruth has it now. It is the large pretty white one on the belt of her blue dress.

Once, however, it belonged to a little animal that lived in the muddy bed of a big river. Of course it was not a button, then. It was a part of the animal's shell. This animal that lived in the river mud was a mussel.

Mussels are related to oysters and clams. The bodies of these animals are nearly alike.

Each of these animals has a shell in two halves. There is a hinge at one edge of the halves. So the shell can open and shut.



Fresh-water mussels

The mussel opens its shell a little when it breathes. Water gets inside the open shell. There is some air in the water that the mussel breathes. This animal has a breathing tube in its body and the water runs through the tube.

A clam or an oyster or a mussel has only one foot, as a snail has. It is shaped a little like your tongue. You can open your mouth and stick out your tongue. And a mussel can open its shell and push out its foot.

Such a foot acts much like a little plow. It can be shoved through the mud ahead of the shell. So that makes it easy for the mussel to move its shell through the mud, too.

Mussel shells are dark and rather rough outside. But inside they are smooth and shiny. They are nearly white, though they often have lovely tints of very pale colors.

Animals like mussels and clams and oysters make their own shells. The shells are small while the animals are young and tiny. The animals grow bigger and they make their shells bigger, too. So their shells are always large enough to cover them.

The beautiful smooth pale lining of such a shell is called mother-of-pearl. That is a good name for it because it is made of the same sort of stuff as a pearl. But a pearl is small and is not fastened to the shell.

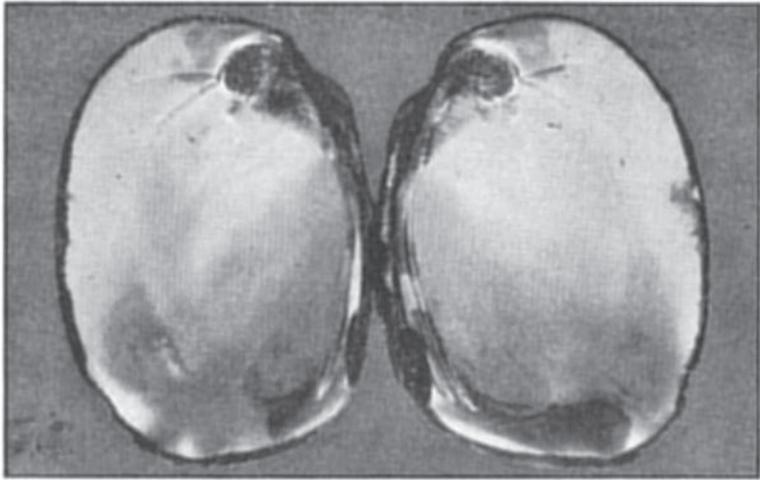
Many of the animals that can make mother-of-pearl to line their shells can make pearls, too.

Sometimes a grain of sand gets inside a mussel's shell and hurts the mussel. Its body is comfortable only when it touches smooth things.

So what does the mussel's body do with the hard scratching grain of sand? It makes a smooth round pearl to cover it. The sand is in the middle of the pearl. The smooth pearl does not hurt the soft body of the mussel.

Pearls can be used for beads. Mother-of-pearl shells can be cut into different shapes and used for buttons and knife handles and other things.

So people catch these animals for their shells and hunt for pearls.



Shells lined with mother-of-pearl

Some kinds of animals that make mother-of-pearl and pearls live in salt sea water. Others live in rivers and ponds. The kind that had Ruth's button first and lived in the muddy bed of a river was called a fresh-water mussel.

4. Starch

Ruth liked to have her cotton dress starched every time it was washed. Not enough to make it too stiff! Just enough to make it seem fresh!

The starch came from the store in hard dry white lumps. The lumps could be crushed into fine powder.

A little starch was put into water and boiled until it was a sticky paste. More boiling water was added until the starch paste was thin enough. Then Ruth's dress was dipped into it and dried and ironed.

One day Ruth said: "Mother, a plant made the fibers in my cotton dress. An animal made the



Corn seeds have starch in them.

mother-of-pearl in my button. The color came from coal tar. Where did the starch come from?”

So her mother told her about starch.

Plants make starch. They use it for food. It is the most common food they use when they start to grow.

Many kinds of plants store up starch food in their thick parts.

The thick bulbs of lily plants have a great deal of starch in them. It is ready to use for food when the lilies start to grow in the spring.

Potatoes have much starch. If you cut a potato in thin slices and leave it in a dish of cold water, you can find some starch in the bottom of the dish in a few hours.

Most plants put starch into their seeds. Then the baby plants have the right food when they start to grow.

Animals cannot make starch in their own bodies. But they can get it for food when they eat certain parts of plants.

People get starch to eat in potatoes and bananas and Hubbard squash. We get it in foods made from seeds like rice and wheat and oats and corn.

We use more starch for food than in other ways. But we have many other uses for it, too. And one of our uses for starch is to make some kinds of cloth stiff with it. Such starched cloth does not soil so easily as cloth that has not been starched.



Field of Indian corn, or maize

Rice starch is sometimes used for very fine thin clothes.

Most starch that is taken from potatoes is sent to factories. It is used to stiffen new cloth.

Wheat starch is used in many laundries. Cloth bends easily when it is stiffened with this kind of starch.

Corn starch is also good and it is cheap. This kind is used a great deal for starching clothes.

The corn plant stores starch in its seeds. The seeds are the kernels that grow on the corn cob. A kernel is more than half starch.

“The next time I see a corn plant growing,” said Ruth, “I shall thank it for laundry starch.”

SCIENCE GAMES

1. Three Puzzles

I have fine fibers on my seed.
Men take my fibers when they need
To make white thread or cloth to sell.
What boy or girl my name can tell?

Before men learned to be so wise,
They did not make gay coal tar dyes;
But colored with my juice so blue.
You know my name? I think you do!

My pretty seeds, in even row,
Upon a cob they always grow.
My starch is used for many a dress.
My name is easy, now, to guess!

2. Pictures

1. Draw a picture of a shell that is lined with mother-of-pearl. Show the two halves of the shell. Show where the hinge is.

2. Draw pictures of things that can be made from mother-of-pearl.

3. Read the last four lines that you find on this page. Then write these four lines on a piece of paper and draw a picture of an animal to go with them. Put the animal's name under the picture.

I have one foot and only one.

I plow through mud. I cannot run.

I have a very lovely shell.

My name? I think you know it well!

3. Questions to Answer

1. Is there more warm weather in the northern part of the United States than in the southern part?

2. What sort of weather does a cotton plant need?

3. Do people raise corn in the state where you live? Do they raise potatoes there? (If you do not know how to answer the questions about potatoes and corn, ask some older person to tell you.)

4. Can you name three kinds of seeds that have fibers on them? How do seeds use these fibers?

5. If you wished to have some relatives of indigo plants in your garden, what seeds would you plant?

4. Starch Gardens

Plant some seeds of corn, wheat, and rice in a school garden or a home garden, if you can.

If you have no garden to use, plant some of these seeds in tin cans (with holes in the bottoms) or in flower-pots. They will grow for a while in cans or pots.

What food is there in these seeds for the young plants to use?

Ask some one how to cut a potato in pieces to be planted. Plant some pieces in a garden or a can or a pot.

What food is there in old potatoes for young potato plants to use when they start to grow?