西方原版教材与经典读物·科学系列

SCIENCE READERS

科学读本 4

〔美〕文森特·默奇（Vincent Murche）/著

天津出版传媒集团
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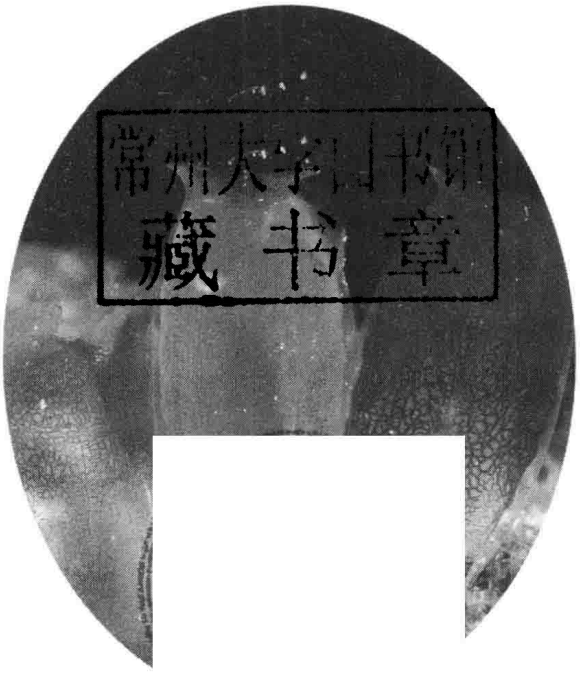

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网址：http://www.tjrmcbs.com.cn

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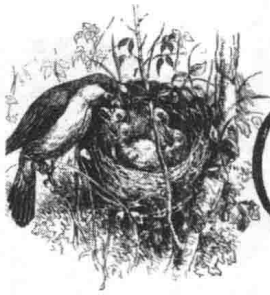
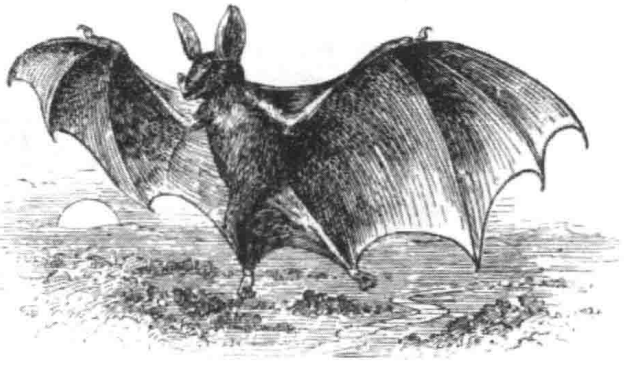
HOLYBIRD

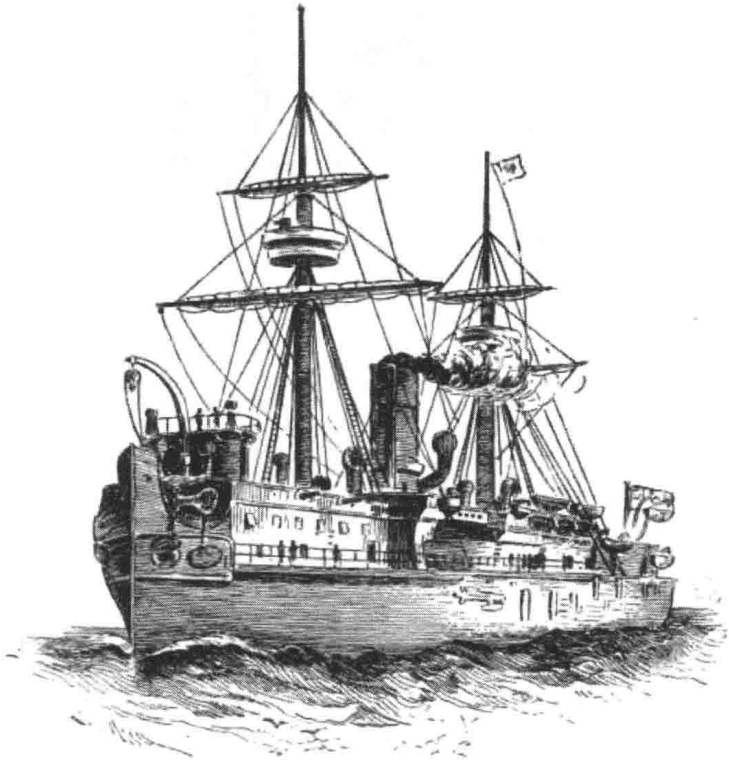
Reading enables us to see with the keenest eyes, to hear with the finest ears, and listen to the sweetest voices of all time.

—James Russell Lowell



CONTENTS





Lesson 01

Cohesion

"Well, how did you like your science lesson today, boys?" asked Mr. Wilson, as he overtook our two young friends, Fred and Willie, on their way home. The boys had been promoted to a higher class, and this was the first lesson of the new course. Mr. Wilson, their teacher, was a rare man for his boys, especially those boys who showed that they took an interest in their work. He had long been struck with the earnest attention these two boys paid, and the trouble they took to follow him intelligently, and he made up his mind to help them.

"I think, sir," said Fred, "we shall soon begin to feel at home, for I am sure, from what I saw today, our lessons in the lower classes will help us very much. We are going to try hard, for father has promised to send us to the Institute by and by, if we learn all we can now."

"Suppose you tell me something about today's lesson, as we walk along," said Mr. Wilson. "Well," said Willie, "the first thing we learned was that new word matter. We know now that the name matter means every substance that exists."

"I think I understand, sir," said Fred, "what you mean by molecules of matter, although it seems difficult to

imagine particles so small that they cannot be seen even with the help of a powerful microscope. We learned from our lesson that matter of every kind—solid, liquid, and gas—is made up of extremely small particles, and these particles are called molecules. A molecule is the name for the smallest particle of matter that can possibly exist."

"Quite right, Fred," said Mr. Wilson. "If you will keep two things in your mind, you will be pretty clear about these molecules of matter.

"First think of the dissolved particles of a soluble substance. They are all in the liquid, but they have been divided up into such minute particles that they are invisible.

"Then think of our little experiment with mercury. We boiled the mercury in the tube, and as it boiled it passed away in vapor. But we could not see the vapor, because the particles had been divided up too small to be seen. These were molecules of mercury.

"We knew they were there, and we found them when we held the cold slate over the tube. The tiny drops, as

they condensed, ran together again and again, till at last they were large enough for us to see."

"We learned, too," said Fred, "that, as all matter is composed of molecules, there must be a force of some kind, which holds them together, or else everything in the world would at once fall away to the finest dust or powder. This force which holds the molecules of matter together is called cohesion. It is so named because the word cohesion means holding together."

"That's very good," said Mr. Wilson. "Try and think of our experiments with the poker, and the pieces of lead, wood, glass, and chalk, and tell me what they teach us."

"Oh yes, I remember, sir," said Willie. "We can't break or twist the poker with all our trying. This means that the force of cohesion is so strong that we cannot separate the molecules from one another. We can bend the piece of cane and the lead, but they do not easily break. We say they are tough. The glass and the chalk snap quickly. There is less cohesion between their molecules than there is between the molecules of either lead, wood, or iron. We say the glass and the chalk are brittle."

Lesson 02

Solids, Liquids, Gases

"May we walk home with you this afternoon, sir?" asked Fred.

"Certainly, my boys," replied Mr. Wilson. "I was thinking of putting my museum cupboard into your charge," he continued. "You could keep the things in order, dust them regularly, and help me with the experiments during the lessons. Would you like that?"

"Oh, thank you very, very much, sir," said both the boys at once. "We'll be very careful with everything."

"Now, what have you got to chat about as we walk along?" asked Mr. Wilson.

"Our lesson on the force of cohesion, sir," said Fred, "helps us to understand, better than we have ever done, why there should be three distinct states of matter—the solid, the liquid, and the gas.

"A solid is a body whose molecules are held strongly together. It is a solid simply because the force of cohesion is very strong in it. Even when we break a soft solid, like a piece of chalk, it does not fall to powder. It breaks into pieces, and these pieces still hold together."

"It was so easy, sir," said Will, "to compare the cohesive

force in a liquid and a solid, when you set me to take the water out of the basin, a spoonful at a time. It was no trouble to separate the molecules of water from one another with the spoon, because they are not held together firmly, as the molecules of a solid are."

"Quite right, boys," said Mr. Wilson. "Now what have you to say about the gases?"

"The molecules of a gas soon spread themselves out till they seem to fill the room," said Fred. "This proves that gases are quite different from either solids or liquids. Their molecules have no cohesion at all; they actually repel each other. They are always trying to get as far away from each other as possible."

"Now I want you to try and tell me how the force of cohesion acts," said Mr. Wilson.

"The force of cohesion can act only when the particles are in close contact," said Fred.

"Do you remember," asked Mr. Wilson, "how I proved that?"

"Oh, I remember," said Fred. "It is useless to try and join the two edges of a broken plate or saucer, or any other solid body, by pressing them together, because we cannot bring all the particles into actual contact, and without actual contact there can be no cohesion. But it is possible to join two perfectly smooth and level sheets of glass by pressing them together. All their particles are in actual contact, and cohesion acts and joins them."

"Are we to understand, sir," asked Willie, "that cohesion acts only between the molecules of the same kind of substance?"

"Yes," said Mr. Wilson, "the molecules of solid bodies are held together by cohesion, and the molecules of liquids are also held together by cohesion. When we mix two glasses of water, they immediately mingle and form a compact whole, because the molecules are brought into actual contact with each other on all sides."

Lesson 03

Our Bodies

We can feel, in every part of our body, portions of the hard, solid framework on which the body is built. This strong framework is called the skeleton, and consists of upwards of two hundred distinct and separate bones of various shapes and sizes, intended to give strength and solidity, and to support the softer fleshy parts. If you call to mind the various skeletons of animals you have seen, you will at once understand that in every animal it is the skeleton which determines the shape of the body. The skeleton itself suggests at a glance the well-known shape of the individual animal.

Let us examine our own skeleton, and see how it is made. We will commence with the head, which comprises two parts—the skull and the face.

The skull is a hollow box intended to hold and protect the brain. It is built of eight separate bones, most of them broad flat plates. They are joined together firmly at their edges, because, as they simply form a box, there is no need for these bones to move. The face comprises all the rest of the head that is not included in the skull. It is formed of no less than fourteen separate bones. The

only thing calling for special notice in the arrangement of these bones is the provision, which is made by them for the protection of the eyes, by lodging those organs in great hollows formed in the bones themselves. These hollows are called the orbits or sockets of the eyes. Notice how providentially they are surrounded by the broad frontal-bone of the forehead above, the nose-bone between them, and the cheekbones below. These effectually protect the delicate organs from injury. Only one of all these fourteen bones of the face is capable of movement. Which is it?

The lower jawbone moves so as to open and close the mouth. It is attached on either side by a sort of hinge to the other bones of the skull.

Both jaws are armed with teeth for biting and chewing our food. We have during our lives two sets of teeth. The first, called the milk teeth, are twenty in number, and are shed while we are young. The others, known as the permanent teeth, last through the rest of our life. There are thirty-two permanent teeth in the complete set.