

I cut this outer shell with my sharp knife. What do you see inside?

S. There is another woolly looking shell inside.

T. How much vacant space is there between the two shells?

S. An eighth of an inch—no, it is about a quarter of an inch, I am sure. It is not completely vacant, as there are a few silky fibres which keep the smaller shell exactly in the middle of the larger.

T. What use would such a space serve, supposing our caterpillar to be living within the inner shell all winter.

S. It would help to keep the cold out.

T. How? Have you seen any other creature use double walls to keep the cold out?

S. Yes. Our houses have boards outside and inside the frame, with a space of air between.

T. Can you think of any other example?

S. Yes. They put double windows on in our house during winter, and the cold can hardly get across the air space between them, so that there is hardly ever any frost on our inner windows.

T. Very good. But who would have thought that the caterpillar knew so much?

S. (*Hand up, teacher nods*). You said that the caterpillar spins its cocoon with fibres of silk, but the outer shell which you have just taken off is more like parchment, or a thin skin, than cloth made up of fibres. How could all the fibres be cemented together to form this complete skin-like covering?

T. When you capture your caterpillar next fall, you will find that as soon as he has completed the fibrous covering of his shell he pours out a quantity of soluble silk which fills all the meshes of the fibrous structure, and soon drying cements the whole into one continuous sheet. He then proceeds to spin the inner shell. You see that this inner shell is quite heavy. There is something in it which can be seen to move. Let us cut open the tough woolly looking shell. There! see what has come out!

S. A big, oval, blackish thing, covered with a shining and ornamented surface. And it is alive. It moves.

T. Here is some rubbish found in the inner cocoon with this black living object. What is it?

S. Why! they are fragments of the skin of a caterpillar—of its head—and of its feet.

T. Correct. After the caterpillar completed its inner cocoon it had no further use for its feet, mouth, spinners, etc. These parts were moulted off, and its whole body became contracted into the roundish form covered by the sculptured skin you see surrounding it.

S. (*Hand up.*) Do all caterpillars go through such changes?

T. They all go through similar if not the same changes. In some there are no outer cocoons—only this thin, tight-fitting, ornamental covering which in some species shines like metallic substances. Some species shine like gold, hence the Greeks called them the *chrysalis*, which meant in that ancient language *golden colored*. We have, then, before us, the *chrysalis* stage of the caterpillar. I write the word on the board, and shall then see if you all can spell and pronounce it properly.

But I am going to open this chrysalis case, and we shall then see the living transformed caterpillar. I break the thin case away carefully with the point of my pen-knife. There it is. What do you see?

S. A large, wet-looking, juicy body, with small wings no bigger than a bumble-bee's, laid flat on its side and meeting over its back. Two long feathery things from its head are also folded back over its body, and it has six feet crumpled up under the front part of its body. The greater part of its body is very plump, like the body of a huge moth.

T. Correct. This chrysalis is the stage before the moth. I will give you a more common name than *chrysalis*, however. As we have seen, this stage is not always accompanied with the golden color which the word *chrysalis* implies.

Little boys and girls present are called *pupils*, from the Latin word *pupus* a boy, *pupa* a girl. From *pupus*, comes the Latin *pupilla*, a little girl. The French shortened it to *pupille* (pronounced in two syllables). The English still further shortened it to *pupil*. But pupils become eventually full grown men and women. And this *chrysalis* in the ordinary course of nature would have become a full grown moth. Naturalists therefore call the chrysalis stage the *pupa*. Pupils should therefore be able to remember the meaning, spelling and origin of the word. The pupa is the young, the immature, the growing stage of a moth, a butterfly, a beetle, a house fly, or any insect. When the pupa comes out of its chrysalis shell, it is all at once a full grown, finished animal.

S. (*Hand up near the window*). There is a noise going on in the cocoon in the jar, and there is something coming out at the lower end.

T. Hurrah! The luckiest thing in the world! Just what we are wanting to see. The moth, under the influence of its warm surroundings, is coming out of its cocoon. I place the jar here, and let us watch it. What do you see?

S. The lower part of the cocoon appears to be moistened, and little bushy feet are pushed out in front, and the moth is pulling itself out by them.

T. What does it look like?

S. Its head and fore part of the body are covered