

**ANIMALS WITH MORE THAN TWO EYES.**

Yes! animals with more than two eyes. But are there really such creatures? you will ask. Do we mean real animals and real eyes, or allegorical animals and allegorical eyes? We have certainly heard of such creatures in ancient mythology. Argus is said to have had as many as a hundred eyes. These eyes were afterwards said to have been transferred to the tail feathers of Juno's favorite bird, the peacock, and people sometimes pretend to see the traces of them in the peacock tails of to-day.

We do mean real animals and real eyes. And the extra eyes in the living creatures are no mere casual occurrences; they are not "freaks of nature," such as the accidental malformations we sometimes see preserved in museums, or shown in popular exhibitions.

The myriad-eyed animals are neither myths nor monsters. They are examples of the beautiful and symmetrical in nature, and not of the uncommon and repulsive. They live in our world of to-day, fellow-tenants of the beautiful earth, peopling the air, the dry land, and the seas. They are marvellous, yet multifarious members of the zoological cosmos, the fearfully and wonderfully made animal world.

There are many-eyed animals both of the sea and of the land. They vary greatly in size, from the little fairy fly the fiftieth part of an inch in length, to reptiles measuring nearly eighty feet.

Strange to say, not all these curious animals have their eyes on their heads. Indeed, many of them have no heads, and yet they have hundreds of eyes. Others have eyes on their backs as well as upon their heads. Some kinds of shell-fish have thousands of eyes, and these are situated not on the animal's body, but on its hard, stony shell!

Again, many of these multitudinous eyes are very curiously shaped. It will surprise you to learn through what wonderful windows with variously shaped panes and minute partitions these many-eyed animals look out upon the wide world around them.

Let us begin with the humbler forms of life. We will take the scallop family as an example. We all know the scallop shell. It has become historical, used as it was as a drinking-cup by the pilgrims to the Holy Land in the time of the Crusaders. We see the scallop in the fishmonger's shops, but how many of us know anything about the curious animal within! The creature is absolutely without a head, and yet it is possessed of nearly one hundred eyes.

Lift up the doubled-edged fleshy "mantle" or envelope which forms the outer covering, and you will find the inner one drooping like a curtain finely fringed. At its base you will see a row of conspicuous black dots, surrounded by tentacles. These are the animal's eyes, which you may count by scores. These eyes have been very carefully examined by zoologists. They are somewhat rudimentary in structure when compared with the eyes of man; but they possess a "cornea" or transparent membrane in front of the eye like our own; a lens for forming the picture of outside objects, an optic nerve, and other accessories for the purposes of vision.

Very remarkable in so humble a creature is the protection of the lower sides of the eye-ball with a dark colored pigment, which prevents the access of too much side light. The microscope tells us much more about these eyes of the scallop.

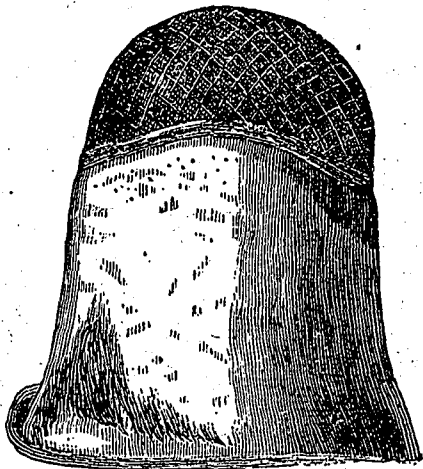
Another animal endowed with more than two eyes is found amongst the various creatures known as onchidia. These animals, which are sea-slugs, live exclusively on the sea-shore or in brackish marshes. They are found in the Philippine Islands, and in certain parts of the southern coast of Australia. For our knowledge of their structure and the strange position in which their extra eyes are placed, we are chiefly indebted to Herr Carl Semper, Professor in the University of Wurzburg.

Onchidium, like other slugs, has two eyes on its head, in the usual place; but it also possesses a large number of eyes on its tough, leathery back! These dorsal eyes, as they are called, have been found in more than twenty species of onchidia. Professor Semper has counted as many as ninety-

eight on the back of a single inch diam. These eyes on the back of the animal occur in groups in some species, and singly in other species. The younger specimens have the greatest number. When the skin of the animal is rough, and raised into little hills, the eye or eyes will be found at the summit. In these cases the eye is retractile; that is, it can be drawn in so as to avoid the dangers to which its elevated position exposes it.

The onchidium, then, is better off than the scallop, inasmuch as it has a head, and a multiplicity of eyes in addition. But why should it have eyes on its back? Such eyes are chiefly directed upwards to the sky, and are quite useless for looking down on the earth, where the food of the animal lies. But it is fairly certain that these dorsal eyes are no purposeless "freak of nature." There is very good reason to believe that they serve to warn the animal of the attacks of a fish which seeks to prey upon it above, leaping upon it through the air.

But some shell-fish greatly excel the onchidia in the number of their eyes. The so-called coat-of-mail shells, or chitonidae, are perhaps the most marvellous myriad-eyed animals we know of. Some of them



Loxster's Eye.

have as many as eleven thousand eyes. We may well smile at the comparative poverty of the mythological Argus in the matter of eyes when we look at one of these coat-of-mail shells. But the strangest thing about these thousand-eyed animals is yet to be told. Their eyes are not found on the body, as in the case of the scallop; you will look in vain for them upon its head or mantle, or broad, creeping disk. Then, if not upon the body, where can the eyes possibly be? The question has only been answered within the last three years, for up to that time all the chitonidae were described in the text-books as eyeless. It was Doctor Moseley, Professor of Anatomy in the University of Oxford, who made the discovery. Whilst washing the shell of one of these creatures with spirit, he noticed that it sparkled here and there as if set with small crystals.

Further and prolonged investigation let him into a secret which has astonished the whole world of zoologists. The surfaces of many of these coat-of-mail shells are really full of eyes. They glisten at us like diamonds in their calcareous setting, as we view them with a hand-lens of moderate power.

On taking up an oyster-shell, or, indeed, any shell you may have as an ornament in your house, and examining it, you would hardly expect it to have any power of feeling, any more than a stone, so utterly inorganic and devoid of anything like nervous structure does it seem to be. Yet in the coat-of-mail shells, this stony-looking armor which covers the back of the animal is so thickly set with eyes and touch-organs that in many cases you can barely place a pin's head upon it without touching some of these organs of sense.

I have before me as I write a corephium shell which has at least eleven thousand five hundred eyes on its surface. These eyes have their nerves running down through the shell into the body below, and the outer sensations are thus transferred along the telegraph nerves to the brain.

In the centre of the eye we see the outline of the iris. A perfectly transparent and strongly double convex lens is found behind the iris-aperture. So there is no room left for guess work about these

glistening objects which we found in such enormous numbers on the coat-of-mail shells. Their structure and function has been fully made out.

Before we take leave of these wonders of the shore, and come to the scarcely less wonderfully gifted animals of the land, let us mention, in passing, one or two other marine examples of the many-eyed. Have you ever looked with a magnifying glass at the eyes of the lobster? If not, I would advise you to do so. The lobster's two eyes are made up of many smaller eyes, more, indeed, than you would care to count. Moreover, each of these many eyes has its own cornea, lens, optic nerve, and other accessories which go to make up a separate, yet complete organ. Every one of these separate eyes is set diamond fashion, and on the face of each diamond is a cross.

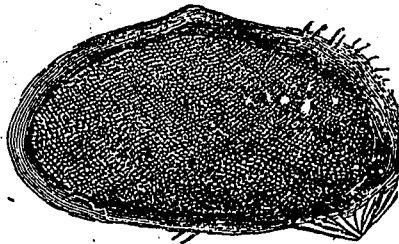
This singular and beautiful pattern is repeated in hundreds of these component eyes, so that the lobster looks out upon the world from a very curiously decorated window indeed.

Our green fields and woods in summer are gay with creatures endowed with more than two eyes. Soaring on gauzy or painted wing, in the sunshine, or making the light air luminous in company with leathern-winged bats as large as themselves, they look upon the world through not merely hundreds, but thousands of eyes,—wonderfully latticed windows and panes of many patterns. The world of moths and butterflies, of bees, ants and beetles, of winged visitants to our gardens and study windows, is an inexhaustible treasury of animals too commonly thought to exist only in fable. At home, indoors in the winter months, the cricket on the hearth, that merry little minstrel, looks upon us with hundreds of curiously shaped eyes.

Among the smaller creatures, the ants of our gardens, conservatories, woods and fields, afford interesting examples of the many-eyed. Some kinds of ants have no eyes at all, but only eye-sockets. The males have generally the largest number of eyes; as many as twelve hundred have been found in a single individual. In the less bountifully endowed species, the eyes are found to vary from one to five in number. Each eye is hexagonal, or six-sided, in shape.

These six-sided eyes are the form most commonly found in insect-life. Bees, butterflies, beetles and ants afford good examples of them. The compound eye of the living bee, when examined under a lens, shows them in startling numbers. As many as twelve thousand six hundred six-sided eyes have been found on the head of a single worker bee.

But another fact remains to be told. Mr. Frank Cheshire, one of the most successful "workers" of the London Royal Microscopical Society, has carefully measured the diameter of one of these twelve thousand six hundred eyes; he finds it to be a little more than the thousandth part of an inch. Do not forget that each of these six-sided panes is really a separate eye, with its own lens, crystalline cone, and microscopic telescope behind, running back to the retina, where the picture is formed.



Eye of a Fly.

There is reason to believe that one use of this vast multiplication of eyes is to enable the insect to see with tolerable clearness in what would be to us darkness. Nearly all the operations carried on in the hives are done during the day time, in very dim light; and in the night time, when work is by no means intermitted, there would be to our eyes absolute darkness. To the bees, however, the scanty rays received by so many sensitive points of sight may be sufficient to enable them to see with comparative clearness.

As we have said, the hexagon is the form most commonly found in insect eyes. But there are some very curious exceptions to

the rule. The thousand-eye drone-fly and the house-cricket are instances in point. We shall find the drone-fly, known as *Bristalis tenax*, hovering over or alighted on a head of flowers in full bloom. He is sucking the juices from the petals or eating the pollen from the anthers. He is a stout, pitchy-black, hairy fly, more than half an inch in length. Notice the tawny spots on the abdomen, and the triangular spots of the same color on the side, and you will remember him.

The two compound eyes, projecting on each side of the head, are easily seen; half globular in shape, they are relatively immensely larger than the eyes of the higher animals. I take a dead specimen, and tenderly remove the front membrane of one of these compound eyes. I carefully remove the dark coloring matter at the back, using a soft camel's hair brush for the purpose; and, after washing the membrane in spirit, I put it on a thin slip of glass, and then look at it, or, rather, through it, with a hand-lens.

What do I see? The cornea proves to be a beautiful transparent lattice, fitted with thousands of six-sided window-panes. Is any cathedral window, however vast, half so wonderful? I can count the number of these separate window-panes, each of which, again, is a complete eye. There are more than four thousand of them. But, as I trace them downward, I notice a curious change in their shape.

They gradually pass from hexagons into squares—from six-sided panes into four-sided panes. The upper half of the window, as I have called the compound eye, is filled with panes of one pattern, and the lower half with panes of another pattern. This is a very remarkable occurrence. As far as I know,—and I have examined some scores of insects' eyes of different species,—it is confined to the drone-fly.

The "portecullis eye" of the house-cricket is an example of the square-shaped eye-facet, in which the lens is framed; but in this case all are squares, and none of them hexagons. If you examine this cricket's eye, you will find hundreds of eye-facets arranged in rows. Each facet is barred off from its neighbor by a thick, horny partition, giving the whole the appearance of the heavily-timbered framework which used to be let down before the entrance of old castle gateways. Hence the name "portecullis" eye.

We have next to deal with much larger kinds of animals than those hitherto mentioned. The discovery that lizards have a third eye, now in most cases buried beneath the skin, but formerly situated at the top of the head, is one of the very newest and most startling achievements of zoological investigation. In some of the smooth-skinned lizards, this third eye, though no longer in use, is still visible on the top of the scaly head, being placed just under a large transparent scale, which serves to protect it. All the lizards are found to possess this third eye at the crown of the head, the other two eyes being in the usual position. The giant lizards of geological antiquity were also three-eyed. Some of them, like the mososaurus, were as much as seventy-five feet in length.

The zoologists tell us strange stories about the wonderful forms of life which existed in the times of the mososaurus. Yet it is well to know that we are living amongst the descendants of these three-eyed giants, and that in almost any museum the skull of the commonest lizard of to-day shows the socket for the accommodation of this extra eye.

The world of to-day is quite as wonderful as that of the past. Every winged creature that flies in the firmament, except birds and bats, and untold millions more that creep on the green earth, are equipped with two beautiful, geometrical windows, in which are hundreds or thousands of complete and perfect eyes.

In the ocean, too, as we have seen, argus-eyed creatures abound. Strango, yet true, is the conclusion at which the zoologists have arrived. Animals with more than two eyes, so far from being rare and exceptional productions of nature, are actually in the majority. They vastly exceed in numbers those which are endowed with no more than two. The story of Argus is indeed outdone by the story we may read for ourselves in nature's ever-open page.—Henry Walker, F.G.S., in *Youth's Companion*.