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An Interesting Crab's Claw.

BY ROBERT GREENLEAF LEAVITT, NEW JERSEY STATE NORMAL SCHOOL AT TRENTON.

The editor of this journal has kindly given me a deformed crab's claw in which I became interested through the publication of a brief mention of it in "St. Nicholas" for December, 1907. The claw is interesting because it goes with a number of other things to throw a somewhat new light, or let us say a little light from a new direction, upon the process by which an animal's body is built up. If the principle of the matter is pointed out, readers of THE GUIDE TO NATURE will be likely to find other examples; and if they will carefully describe, and especially if they will carefully illustrate, their discoveries and publish them, they may make real contributions to science.

The claw was found at Stonington, Connecticut, and brought to notice by Miss E. P. Loper. The remarkable feature is an addition, in the form of a small pincer, near the extremity of the movable joint or dactyl. This small organ copies each detail of the larger one faithfully as to the shape and relative size of the two parts, as to the teeth and as to the nature and coloration of the hard material composing the extremities of the pincer-arms. Only in one respect is there an essential difference: in the small pincer the dactyl is not movable at the base, as it is in the larger one. The pincer is therefore useless. Indeed it must have been an inconvenience to its possessor.

Such malformations have several times been noted in the claws of lobsters. It seems pretty certain that they arise in the healing of wounds inflicted when the animal is freshly moulted and its limbs are soft.

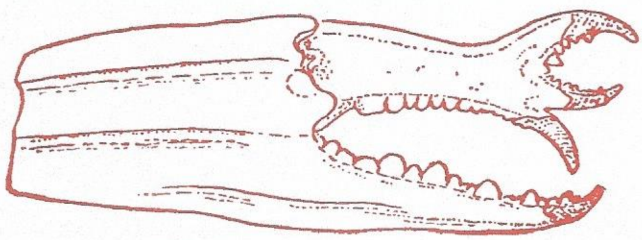
It is well known that crustaceans have a good deal of the power of regeneration. Whole limbs may be replaced. In a case like the one before us, it was to have been expected that the wound would fill up. It was not to have been expected that the growth from the torn edges would take the form of a nearly perfect claw.

The new member imitates another, previously existent, organ. Such abnormal mimicry, or borrowing of character by one region from another, has been called by William Bateson of England, Homoeosis. He detected it in several monstrous formations; for example, in turbots displaying upon the lower surface features proper to the upper side. Weismann, the German zoologist, has argued that the markings on certain segments of a species of caterpillar originated in a like manner by transference from other segments. The present writer has pointed out (Botanical Gazette, January, 1909) the probable derivation of some normal structures in plants by Homoeosis, or translocation of characters. In cases noted in plants Homoeosis has, apparently, proved to be hereditary.

The special interest of our crab's claw lies, as already suggested, in its relation to the development of form in growing parts, and its bearing on the theory of such development proposed by Weismann.

The evolution of the body with its myriad cells of different kinds—nerve, muscle, bone cells, etc., etc.—and with its numerous and often complex organs, all developed from a minute egg of simple form, in which the features of the adult organization are utterly absent, is a most mysterious process. Why do all the parts develop in their proper sequence and compose a harmonious whole rather than a shapeless mass of cells? No one can as yet answer this question.

The evolution is guided from within, for the growing organism is not run in a mold but assumes its shape without the aid of external formative pressures. The process is supposed to be fundamentally a mechanical one, and theories of the mechanism have been attempted. Most speculators have imagined that small bodies exist in the cells, capable of determining the forms of the bodily members—germinal bodies, gemmules (i.e., little buds) or determinants. Each part of the body is supposed to have its particular germinals. It may be supposed that in the egg all the determinants for a perfect body are present. Such has been the idea of Darwin and other natural philosophers of the first rank.



THE CRAB'S CLAW

Weismann has constructed the most elaborate of present day theories as to the nature of these germinal particles and the method of their distribution to the proper parts of the developing body. When the organism is completed the determinants are, according to this hypothesis, thoroughly distributed, and each small region of the system has in it only the determinants proper to that region. Yet as some parts of the body are liable to be broken off—such as the appendages of the lobster or the brittle tail of the salamander—nature has here and there provided reserve funds of determinants. The first formed leg or tail being accidentally lost, these reserve determinants come into play and cause the tissues which sprout out to take the right form.

Such theorizing doubtless seems very speculative. Yet just these bold guesses at the invisible factors of the process have led the way to most fruitful researches. This is the reason for thinking that it pays to discuss them.

Let us see how Homoeosis as exhibited by our crab's claw affects the idea of Weismann that the determinants, allowing that such bodies really exist, are thoroughly sorted out and distributed to their appropriate bodily members in development, and so become the means of making the parts take their proper shapes.

If the determinants or governors of form are sorted out into each bodily member according to its kind, then a given piece of a crab's claw should have only the determinants for that particular piece, as, for example, the back of the dactyl. Or, at most, it may have a certain supply over and above the demands of first growth, to guide a second if that is required by the loss of the original piece of claw. And if that piece is lost, by the theory only that piece can grow again in that place, the determinants of all other bodily parts being absent from this one.

But when our crab gets into a quarrel with a neighbor and the neighbor bites out a portion of his claw, and when the wound edges, irritated by the removal, proceed to build up the breach, behold, the growing tissues take not the form suitable for filling in the gap, but of almost an entire claw, teeth and all! In these growing tissues, therefore, there must be, if we grant that there are any such governing bodies at all, the determinants for a nearly complete claw.

These particles must be in the wound edges; for from these all the growth starts. And we must suppose that they were there before the wound was made. Suppose the wound to have been a very little deeper or less deep or a little to the right or left of the place where it actually occurred. Would the new growth still have been a nearly perfect claw? In all probability it would have been so. Then we must suppose that cells throughout this particular region contain determinants, if any, for a whole or nearly a whole claw.

This conclusion, the reader will see, is much against the idea of the strict distribution and sorting out of form giving particles in the development of the body.

Perhaps there are no such special form governors residing within the cells of the tissues. But if not, how then is the growth and development of the body managed with such precision that not once in hundreds of thousands does any part fail to arise in its proper place or to take on the shape, color, etc., which it should have?

We cannot think of any such thing as *ideas*, apart from substance and structure, transmitted from generation to generation. If we say, "Law," then the law must have something material to execute it. We know nothing of biological law apart from material structures transmitted in heredity; nor can we clearly imagine such a thing. All experience and knowledge lead us toward the conclusion that the development of the new individual into the likeness of its parent must be brought about by some mechanism existing first in the egg, as the egg of this crab, and passing thence to each cell of the body derived from that cell. It seems necessary to imagine microscopic form determiners in the cells. And how shall we escape thinking that they must be separated out so as to have their due effects, and make in each region of the body only that structure appear which should be there in order that the whole body may do its work?

Yet the few cases of Homoeosis that we know in animals certainly suggest that in some parts more than the local form factors may be present.

Who can bring forward more evidence from nature along this important line of inquiry? Insects should occasionally show a translocation of characters from one part of the body to another. Search in insect collections and in the field for cases of Homoeosis—antennae transformed to legs, wings to legs, legs to antennae—and let us hear about them.

A Bit of Spider Lore.

BY DR. R. W. SHUFELDT, WASHINGTON, D. C.

When we go as far back into history as we can for all nations, we find that there has been enough written on the subject of spiders to make up thousands of books or fill many a big library.

A large part of this literature is illustrated, yet myraids of spiders in nearly all parts of the world are entirely unknown to science, and enough yet remains to be ascertained with respect to their habits to fill many another score of volumes in the future.

Of all the genera and species of spiders none have attracted wider attention than the famous tarantulas, of which there are many kinds possessing the most diverse habits. We have some great hairy tarantulas in this country but they are confined to the south-western section of it. One is very common in Texas, a species known to science as Mygale hentzi, and here shown in our half-tone illustration, reproduced from a photograph of a specimen collected in that state. It is taken life size, and it is a spider held in the greatest dread by most people in the region where it occurs. The bite of this particular form, however, does not seem ever to be followed by any very dangerous symptoms, and never by death. There are in South America some tarantulas very much larger than ours, one especially called the "bird-spider" which is able to prey upon small birds. Big tarantulas are also found in tropical regions throughout the world, but they belong to very different genera of the group. Most of the large ones are hairy, and some of them are poisonous, as for example the giants of the tribe which we meet with in Java and Sumatra. Many are highly colored and most striking in appearance, quite awe-inspiring to the timid beholder. Others construct very remarkable nests, and the famous "trapdoor spider" belongs to a group of tarantulas, and the singular nest it builds is doubtless well known to many of the readers of this article, as the collectors of such objects frequently bring them away with them from the south

TEXAN TARANTULA
(M. hentzi.)
Photographed from life by Mr. S. Emmet Robertson.