

In division III. (Echinodermata) we find present desire, simple sensation and simple feelings, and associations among all three of these elements.

Finally in division IV. (Vermes) we have a still higher grade of consciousness. Taking the cases as a whole we find not only simple desires, simple sensation and feelings together with associations, but perception and acts of recognition as well.

In criticism, we may say that the author's conclusions regarding the behavior of these organisms seem to be based upon but little first-hand experimental evidence. The observations are general and not designed to test his assumptions step by step. The author's lengthy discussions on the anatomy and life history of the animals in question can be largely found in text-books on zoology. His references are to the work of Romanes and to the latter's contemporaries, while the work of Jennings, Pearl, Yerkes, and that of the host of other writers, both in America and in Germany, who for the last three or four years have been studying intelligently, minutely, and laboriously, these same animals, is nowhere mentioned. Finally, the book is full of naïve assumptions both psychological and metaphysical.

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*Recherches sur le sens olfactif de l'escargot (Helix pomatia).*

EMILE YUNG. Archives de Psychologie, 1904, III., 1-80.

The author gives us a survey of the previous publications concerning the sense organs of the snails. He shows how contradictory most of the reports are which are found in literature, and presents a number of careful experiments made by himself on the sensibility of the snails, chiefly of the large edible snail. Simple observation of the life of the snails shows that they are sensitive to movements of the air, to trembling of the object supporting them, to temperature, and to moisture. Whether they possess an olfactory sense is a question which cannot be answered so easily. They possess an eye at the tip of the large tentacles, but they do not seem to use this in order to distinguish objects. The eye is of very little importance in their life. The author describes in detail his experiments. When a snail is touched anywhere with a pencil point, it reacts by a receding movement of the area of the skin surrounding the point where it has been touched. When the shock received is greater, the whole snail recedes into its shell. The only difference between touching the tentacles and touching any other part of the skin consists in the greater sensibility found

on the tentacles, and particularly the tip of the tentacles. The tip of a tentacle (large or small) is also capable of perceiving the presence of an object at a distance, if this distance is not more than a millimeter. The author is inclined to regard this effect as produced, not by a light or a temperature stimulus, but by an olfactory stimulus. It is possible, he thinks, that the snail is affected by an olfactory stimulus which is too weak to be perceived as an odor by a human being. In order to test the sensitiveness of the snail to olfactory stimuli which we perceive as odors, he used a pencil point moistened, not with water, as in the previous experiments, but with essence of camomile. He found that any point of the skin which was approached by the pencil showed a reaction by a receding movement of the surrounding area. The only difference between the tentacles and other parts of the skin in this respect was found to be a greater sensitiveness of the tentacles. The most sensitive parts are the tips of the large tentacles, next the tips of the small tentacles; least sensitive is the rear part of the back. The relative sensitiveness is measured by the distance at which the different parts of the skin showed an immediate reaction, these distances varying in the case of camomile from 1 to 4 millimeters. The use of other odorous substances did not reveal any difference in the reaction, except that the snail is affected at slightly greater distances by those essences which smell more strongly to us. The receding movement does not indicate that the odor is disagreeable to the snail. The same reaction takes place at the moment when the odor of a carrot or a cabbage leaf is perceived: the tentacle withdraws, but, of course, reappears the next moment. An interesting fact is the rapid decrease in sensitiveness of the snail (just as of man) if the sense organs are exposed for a short time to the same olfactory stimulus.

The author now raises the question, at what distance a snail perceives the presence of nourishing substances, of its most common food. His numerous careful experiments prove that the snails are unable to find their food by the aid of its odor if the distance is at all considerable, more than 10 centimeters or so. The usual reports concerning the ease with which snails in nature are said to find their food by the odor, must therefore be regarded as greatly exaggerated and based on superficial observation of the conditions of the case. The author further deprived many snails of one or both of the pairs of tentacles. Their reactions showed a lesser sensitiveness to odors, but by no means insensibility.

The last part of the paper contains a critical discussion of the anatomical facts known, including some work of the author himself

The sensory cells found in the tentacles and other parts of the skin differ but slightly. He reaches the conclusion that neither the sensitiveness of the different parts of the body surface nor the structure of the sensitive cells under these different parts permit the assumption of any differentiation in the sensory function of the several parts of the body surface. The only approach towards a differentiation which one may speak of consists in the greater accumulation of sensory cells on certain areas (especially the tips of the tentacles) than on others. The name of 'the olfactory organs' which is so commonly applied to the large tentacles is not in accordance with the facts. They are neither more nor less 'olfactory organs' than any other point of the body surface.

*Sur la biologie et la psychologie d'une araignée (Chiracanthium carnifex Fabricius).* A. LECAILLON. Année Psychologique, 1904, X., 63-83.

The animal whose maternal instincts the author has studied is a spider common in oatfields. The female builds a nest on the top of an oat plant, lays about 160 eggs which she collects in a cocoon, and then closes the nest completely, staying within until the young have sufficiently developed to take care of themselves. The purpose of the mother's presence in the nest is to afford protection. If by any accident the nest is broken open, the mother at once sets to work repairing and closing it again. The author subjects this maternal instinct of the spider to several interesting tests. The chief results of his experiments are the following: The spider's attachment to the nest grows while she stays within. It is stronger after some of the young are hatched than when unhatched eggs alone are present in the nest. If a nest is opened, the mother removed, and another female placed on the nest, the latter adopts the nest, enters and at once begins to close it. She is, however, easily driven out by the mother, if this one is soon placed on the nest. But if the foster mother is left in possession of the nest for a number of days, her attachment to it becomes so strong that she defends it against the legitimate mother when the latter is replaced, until one of the contestants remains dead. Even the real mother's attachment to her nest weakens gradually, however, if she is separated from it for rather a long time. The spider does not take any interest at all in the individual young. If the nest is opened and some of the young spiders escape, the mother does not make the slightest effort to prevent them from doing so. All she does is to repair the nest. On this her whole attention seems concentrated.