

THE MICROSCOPE.

AN

ILLUSTRATED MONTHLY JOURNAL

DEVOTED TO

MICROSCOPICAL SCIENCE.

—EDITED BY—

W. P. MANTON, M. D., F. R. M. S.

FRANK W. BROWN, M. D.

GEORGE DUFFIELD, M. D.

CHAS. G. JENNINGS, M. D.

ALFRED C. STOKES, M. D.

VOLUME IX.

LIBRARY
NEW YORK
BOTANICAL
GARDEN

PUBLISHED BY

THE MICROSCOPE PUBLISHING CO.,
TRENTON, N. J.

THE MICROSCOPE.

PUBLISHED ON THE 10TH OF EACH MONTH,
At 25 Washington Avenue, Detroit, Mich.

All articles for publication, books for review and exchanges should be addressed to the Editors of "THE MICROSCOPE," 25 Washington Ave., Detroit, Mich.

Subscriptions, Advertisements, and all business matters, are attended to by THE MICROSCOPE PUBLISHING CO., 25 Washington Avenue, Detroit, Mich.

All remittances promptly acknowledged. To insure answer, letters of inquiry, not intended for publication, must inclose a two cent stamp.

Authors of papers will be supplied with 25 reprints free, when the desire for such is stated on the manuscript.

Specimens for examination should be sent to the *Microscope Laboratory*, 25 Washington Avenue, Detroit, Michigan. In all cases the transportation charges on these specimens must be prepaid.

VOL. IX.

DETROIT, MARCH, 1889.

No. 3

ORIGINAL COMMUNICATIONS.

ON THE EMISSION OF A COLORED FLUID AS A POSSIBLE MEANS OF PROTECTION RESORTED TO BY MEDUSÆ.

J. WALTER FEWKES.

IN THE year 1880 I described* in the ectoderm of the covering-scales of a medusa belonging to the family of *Agalmidæ*, which was found at Villa Franca, Southern France, very peculiar pigment bodies, which discharge their contents into the surrounding water when the scales are broken from the axis of the animal.

Since my description of these bodies no one seems to have studied them up to the present year (1888), when Dr. Bedot, in a valuable paper on *Agalma clausi*, sp. nov., quotes my account, and again calls attention to these bodies.

Since my observation was published, although I have studied many other genera of Physophores, I have found but one which exhibits this phenomenon of the discharge of coloring matter from its body when irritated. This is the genus *Stephanomia* (*Forskalia auct.*) which was observed to emit a similar coloring matter from its tasters. I can hardly doubt that in both cases we have a similar process which may possibly be a means of defense for the Physophore, which exhibits this peculiar phenomenon. My original description of these colored glands on the covering-scales or bracts of *Agalma* is as follows :

* Bull. Mus. Comp. Zool., Vol. VI, No. 7.

"There are very interesting highly refractile red spots of a problematical function covering the bracts in *Agalma sarsii* and *Agalma clavatum*. * * * The spots on each side of a central line are arranged on every scale in irregular rows, extending longitudinally across the bract, each pigment spot being enclosed in a cell. These peculiar pigment spots of the covering scales, represented also in some genera, as in *Apolemia*, by elevations composed of clusters of cells on the surface of the bract, are the most apparent structures in the transparent tract of *A. sarsii*, since, with that exception, there is hardly any coloration in the covering-scale. In *Agalma clavatum*, the sexually mature young of *A. sarsii*, only four rows of these pigment spots occur, as Leuckart has shown. When the bracts which bear these paralleled rows of spots are detached from the axis, their color changes to yellow, and a fluid of the same color exudes into the surrounding water. I have not been able to find in the descriptions by other naturalists any mention of this rupture of the cell wall and discharge of a yellow fluid when the bract is detached. I think these scale-cells belong to the ectodermic layer."

Bedot in his account of *A. clausi* finds similar glands in this species, but was unable to find them in *Agalmopsis sarsii*. It seems possible that in my account I may have confounded the two species, as others before me, and that the species which was observed to discharge the coloring fluid is that separated from *A. sarsii* under the new name, *A. clausi* Bedot.

Dr. Bedot also finds that the detachment of the scale is not necessary for the discharge of the coloring matter, and from the fact that only the anterior bracts of the colonies have this colored pigment in the glands, reasons that the posterior covering scales had evacuated their coloring matter, "au moment où l'Agalme a été capturée." His conclusion is undoubtedly well founded, and in support of it I may mention an observation, never recorded by me, that I have seen a discharge of the color from bracts still attached, and while the animal was alive. I have also observed that it is only when disturbed that this coloring fluid is discharged from the glands.

Nor is the discharge of a coloring matter limited in the Physophores to the colored glands* of the bracts. The same or similar colored discharge takes place in another genus from certain organs called tasters, which have open extremities. This phenomenon is recorded by Haeckel in *Forskalia*, and I have also observed it in a

* The term "gland" is preferable to "cell," by which in my original account these structures were designated, as Bedot has already pointed out.

species of the same genus, *Stephanomia*, from the Atlantic. When irritated, these organs can be made to throw off a colored fluid which calls to mind the discharge from the surface of the bracts of *Agalma*. Haeckel says,* "When a quietly floating *Forskalia* is touched, it suddenly discharges the contents of the chromadenia [pigment glands], and makes the surrounding water dark and intransparent." Kölliker also mentions this discharge of coloring matter from the "Fühler," and the same is described by Leuckart. These last mentioned naturalists regard the discharge, however, as due to a rupture of the wall of this organ rather than an emission from an opening, and the former says of it,† "Ohne Zweifel ist diese Substanz ein Excretionstoff, doch wird ohne genauer Kenntniss ihrer chemischen Beschaffenheit nichts Näheres über ihre Bedeutung beizubringen sein."

Haeckel offers the following explanation of this phenomenon in *Forskalia*: "The excretion of the pigment-masses and the darkening of the water by it have probably the same physiological function as in the Cephalopoda—to protect the attacked animal from its persecutors, and facilitate the capture of food animals." The suggestion may apply also to the pigment glands of the bracts of *A. clausi*, and the situation of these bodies on the bracts is very favorable to such a function. In no case, however, have I observed that the amount of the discharge is large enough to completely darken the water, although it is not impossible that the fluid thus emitted may be of a poisonous nature and therefore fatal to the small animals, the food of the Physophore, with which it comes in contact. The absence of these glands on the nectocalyces and its presence on those organs adjacent to the tentacles is significant, and would seem to have some weight in our judgment of their physiological function.

Although the hydrophyllia or bracts of the Siphonophores are so large and prominent in all medusæ, where they are present, no satisfactory explanation of their function has yet been proposed. They are commonly stated to act as coverings to the polypites and gonophores—a function which they may in part perform. In many cases, also, as in the Anthophysidæ, they assist in locomotion, as I have elsewhere shown in an *Athorybia* from Dry Tortugas, Florida.

It is not impossible, however, that they may be regarded as organs of respiration, for which they seem from their form well suited. In those genera where they are wanting, we generally have an enlarged float, and the possibility of *aerial* respiration, as in Vellidæ, Rhizophysidæ, Physaliadæ, etc., or as in *Physophora* and

* Report on the Challenger Siphonophoræ.

† Siphonophoren von Messina, p. 8.

the new order of *Auronectæ* Haeckel, an enlarged axis by which the polypites and other organs are brought into contact with the water. Respiration probably takes place over the whole surface of the body in all the *Medusæ*, aerial by means of an elaborate tracheal system in *Velella* or the enlarged float in *Physalia* and *Rhizophysa*, or aquatic through the covering scales, nectocalyces and other organs in *Agalma* and others. If the function of respiration belongs to the scales, it may be well to inquire whether the color cells have any relation to it. Their absence in most *Physophores* would seem to have a negative bearing in an answer to this question.

The covering-scales have been homologized with portions or fragments of swimming-bells. A. Agassiz compares them in *Nanomia* to the spheromere of a gelatinous bell, and finds in *Hybocodon* a medusa presenting an asymmetrical reduction of its bell, which is significant in the determination of their homology. The genus *Athoria* of Haeckel would seem to show that the covering scales are homologous to the apex of a medusa bell, for in this genus we have a bell cavity with radial tubes at the distal tip of a well developed bract. Accepting this interpretation, the central canal would seem to correspond perfectly, not with the *radial* canal as A. Agassiz's theory would necessitate, but with the *central apical* canal of a larval medusa before its rupture from a hydroid, or the same *central* canal of a nectocalyx. The cluster of nematocysts at the free end of the scale would thus represent the remnants of the tentacles, to which homology the large size of the lasso-cells in the half developed scale adds some weight, as does likewise the character of the covering-scale of *Eudoxia* and *Praya*.

On the other hand it is worth our consideration, in the study of the homology of the covering-scale, to remember that in the genus *Pterophysa* we have lateral wings on the polypites and we may suppose if these lateral wings became very much enlarged we would have an organ very similar to the covering-scale of *Agalma*. On the other hand, if the covering-scale was reduced, it might readily be converted into a simple tubular body such as we find in certain forms of the tasters. We have then the probability that tasters and hydrophyllia are homologous, although their form is so different, and we see that in some genera they have the same power of discharging a colored fluid from certain glands. The structure of the base of the taster* of *Nanomia* is different from that of other *Physo-*

*The division of the taster of *Physophores* into three kinds—those with tentacles and closed distal ends, those with open extremities without tentacles and those which bear at their bases the sexual bells—seems necessary and requisite to designate the different functions which they appear to have. The so-called tasters of *Nanomia* would seem to belong to the second of these three divisions, or to the cytons of Haeckel's descriptions of the anatomy of the *Physophores*.

phores. It possesses a large bright red globule remotely resembling the float. An accurate description of this taster is yet to be made, for its histological structure has never been determined. One is, however, tempted to regard it as in some way connected with the glands of *Forskalia*, which discharge their contents when the animal is alarmed. I have never, however, seen this so-called oil-globule lose its contents, even when the taster is broken from its connection with *Nanomia*.

It seems not unreasonable to conclude that the discharge of a highly colored fluid by the scales of *Agalma* is in part a means of protection for the medusa, and it would seem natural to connect it with the function of excretion. We know so little about the character of the excretions, and the manner in which they are produced in *Medusæ*, that at present we can hardly definitely ascribe the special function to these glands. Possibly similar glands are found in other *Physophores*, and the excretion has not been recognized from the fact that it is not so highly colored as in *Agalma clausi* and *Forskalia*. The discharge of this fluid from a living animal, if it take place without rupture of the wall of the scale, would imply special excretory openings somewhere on the bract. One is tempted to search for such openings, if they exist, on the distal tip of the scale, when they would be homologous to the excretory openings known to exist on the bell margin of certain *Hydromedusæ*, as *Metschnikoff* and others have shown.

BOSTON, MASS.

CEMENTS, VARNISHES AND CELLS.*

H. N. LYON, M. D.

EVERY one who continues in a given line of work for a number of years gradually confines himself to the use of a few agents. It is especially so in microscopy, and in these few remarks on cements, varnishes and cells, I shall mention only those that I have adopted, after having tried many and met with many failures.

I have selected this subject because, to me, it is of great importance, and while I may not add anything to the existing knowledge of the subject, my testimony may be of value in helping to settle that vexed question as to what makes the best cement, varnish, or cell.

For some eight years I have been experimenting in this line and the experiment which finally settled the question, in my mind,

* Read before the State Microscopical Society, January 11th, 1889.