

February 5, 1874.

JOSEPH DALTON HOOKER, C.B., President, in the Chair.

The Presents received were laid on the table, and thanks ordered for them.

The following Papers were read :—

I. "On the Anatomy and Habits of the genus *Phronima* (Latr.)."

By JOHN DENIS MACDONALD, M.D., F.R.S., Staff Surgeon R.N., Assistant Professor of Naval Hygiene, Netley Medical School. Received January 15, 1874.

Of all groups of Crustacea the Amphipoda would appear to exhibit the widest range, in the modification of their parts or organs, without obliterating the delicate lines of natural affinity running through them as a whole. This is well exemplified in the interesting paper of Dr. R. Willemöes-Suhm, Naturalist to the 'Challenger' Exploring-Expedition, "On a new Genus of Amphipod Crustaceans" founded by him, and named *Thaumops* (Phil. Trans. vol. clxiii. p. 629). This genus, although exhibiting many characters in common with *Phronima*, presents some striking points of difference traceable in the external jaw-feet, caudal appendages, the position of the generative pore, and certain particulars in its internal anatomy.

Of the several characters given of *Thaumops* the presence of only four caudal appendages is perhaps the most exceptional; for in the generality of the UROPTERA there are six besides the telson, which is obviously the equivalent of the seventh abdominal segment of *Macrura*. Thus the six pairs of abdominal appendages, including the tail-fins of the prawn or shrimp, for example, are represented in *Phronima* and its allies, with the exception of *Thaumops*. The manner in which the fourth and fifth pair of swimmerets and the caudal fins of *Macrura* are modified in the UROPTERA is well seen in the accompanying figures; fig. 2 in *Phronima* and fig. 3 in a neighbouring group of Hyperians, which also serve to show why, at least in the former genus, only five segments have hitherto been recognized in the abdomen.

During the exploratory voyage of H.M.S. 'Herald,' in the S.W. Pacific, numerous species which I have always been in the habit of referring to the genus *Phronima*, were taken in the towing-net; and I may remark that the assumed parasitic habit of these creatures was never, at least, a prominent fact to me; they were so often taken either perfectly free, or tenanted a nidamental case, such as that subsequently to be described. Those who, like Dr. Suhm, are acquainted with deep-sea dredging are usually cautious how they refer the doubtful products to their proper habitat; whether it be the bottom that has been reached, or some zone of the watery space above. Indeed it is quite possible for

the narrow area of the tallow-arming of the deep-sea lead to include fortuitously, and carry down *Phronima* or any other little crustacean naturally living near the surface; and contact with the bottom would finally press it into the tallow, so as to mislead the observer as to its true habitat. Conversely, in bringing up the dredge from a given depth, it may finally carry with it any more superficial objects casually lying in the track which it takes.

Fig. 1 of the accompanying drawings from nature represents a species of *Phronima* captured in lat. $30^{\circ} 16' S.$, long. $176^{\circ} 27' W.$, of which I find the following description in my notes taken at the time:—

Head exceedingly elongated from above downwards, with considerable enlargement of the back part, which contains two masses of transparent, rounded?, and tapering columns, whose bases occupy the fulness of the poll, exhibiting a regularly faceted appearance externally on two rounded protuberances. The apices of these organs, on the other hand, converge and blend with the rays of the compound eye, of which, indeed, they may be said to form part, probably assisting nocturnal vision by the production of luminosity. The long axis of the head is therefore at right angles with that of the body, its form being full above and gradually tapering downwards. The aperture of the mouth is situated at the smaller extremity, inferiorly guarded by its mandibulæ, maxillæ, and one pair of foot-jaws, appertaining to the cephalic segments. The latter organs are more distinctly recognizable than the others, on account of their more superficial position. They are short, apparently united at the base, and curved forwards, terminating in two ovate and acute appendages lying side by side, serrated on the borders and beset with short hairs.

The eyes are small where the facets are lateral, and the apices are invested with black pigment, but large where they swell out the back of the head, the points of the same cones meeting in a red spot, quite distinct from, and internal to the black one. This condition is also observable in the Hyperians, and is worthy of further study in a physiological point of view.

Two minute two-jointed antennæ arise from the head, just above and in front of the eyes. The posterior or upper surface of the second joint of these antennæ is clothed with short stiff hairs.

There are seven pairs of thoracic limbs; but the first two are separated from the others, to some little extent, by arising on a plane anterior and inferior to them, the first two tergal pieces being somewhat wider than those of the succeeding segments. They are, moreover, distinguished from the other limbs by possessing a minute spine-like movable claw, bounded, on either side, by a short styliform process. There is also a rudimentary manus developed upon the posterior part of the second segment above this claw, that of the first pair being the stoutest, although the limbs themselves are the smaller of the two. Both pairs of members now described, while they very distinctly belong to the thorax, act the

part of foot-jaws as in the higher Crustacea. The five succeeding pairs are more especially restricted to the thorax, the third or middle one being stoutly chelate, normally directed backwards, with the pollex superior, and enjoying a very considerable range of motion.

The first pair is usually thrown forwards over the head, and the last backwards over the abdomen, the first flexure corresponding with the first swimmeret; the second pair is the longest.

The fourth, fifth, and sixth thoracic segments are each furnished with a pair of elongated and laterally compressed respiratory vesicles, connected with the posterior and inferior part of the epimeral pieces behind the articulation of the corresponding limbs. These vesicles increase in size from before backwards; and indeed a very rudimentary one may be seen behind the third pair of limbs. The last, or seventh, thoracic segment is of unusual length, tapering posteriorly, to correspond with the narrowness of the abdomen, in which also the segments are of greater length than those of the thorax. It has been already stated that in *Phronima*, as in the *Macrura*, there are seven segments in the posterior division of the body; functionally, however, three of these may be said to belong to the abdomen and four to the tail. The three abdominal segments bear each a pair of swimmerets, arising near their posterior border, and consisting of a stout or inflated foot-stalk and two narrow, acuminate, annulated and setaceous terminal pieces.

The three anterior of the four caudal segments bear a narrow fan, consisting of three pairs of slender appendages furnished with two short styliform tips. The first and third of these caudal members are much longer than the second.

The oral organs (with the exception of the jaw-feet), the large chelæ, and the foot-stalks of the swimmerets are tinted with a rich purple pigment. All the other parts are hyaline and transparent.

EXPLANATION OF THE PLATE.

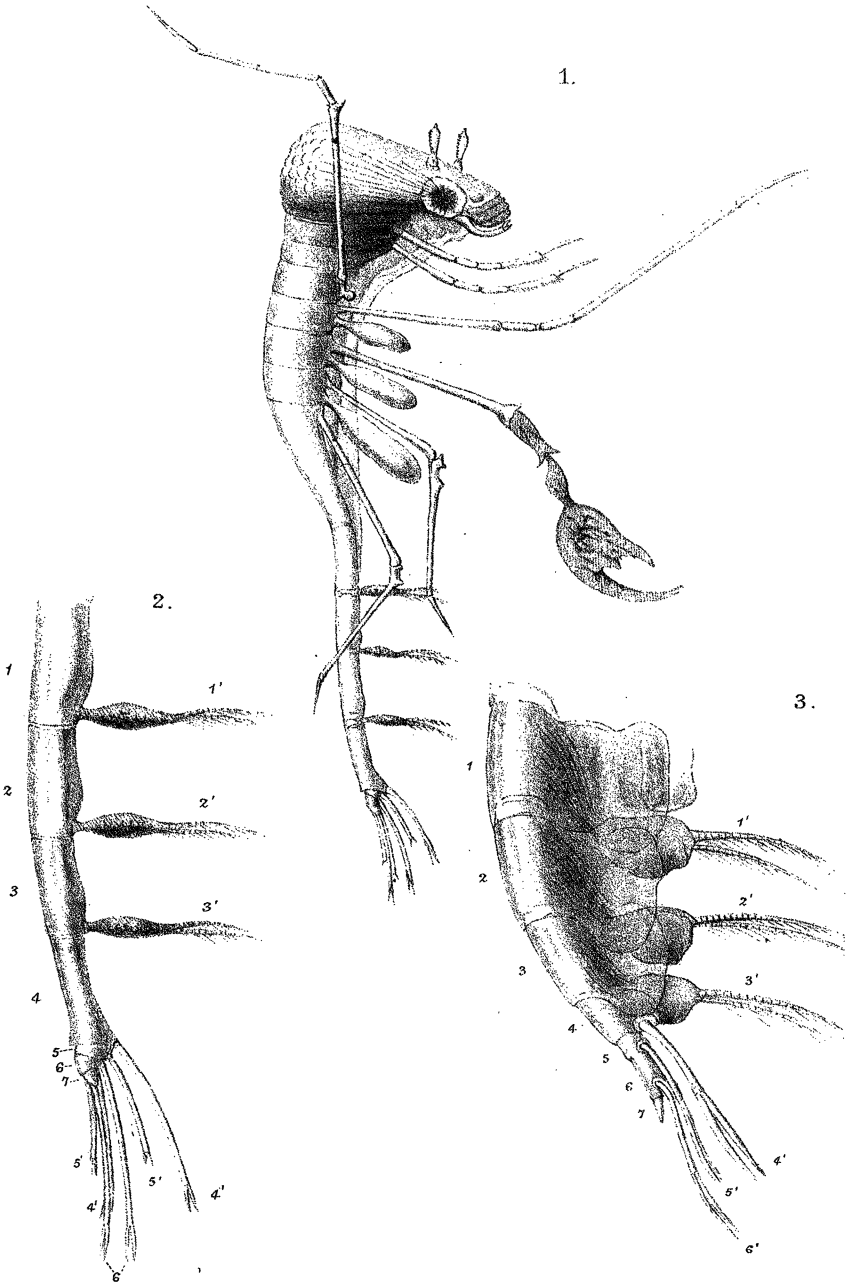
Fig. 1. Lateral view of *Phronima* (species —?). With the exception of the antennæ, the limbs and appendages of one side only are represented, magnified about 9 times.

Fig. 2. The abdomen and tail of the same, further enlarged, to show the several segments, numbered (from before backwards) 1, 2, and 3, with swimmerets, and 4, 5, and 6 bearing caudal appendages, while 7 is the terminal segment or "telson."

Fig. 3. The abdomen and tail of a Hyperian for comparison, all the numbers having the same signification *.

The evidence of Dr. Willemöes-Suhm supports my own experience, that there is no metamorphosis in this group; and as it is very probable that the history of the development of *Thaumops* would resemble that of *Phronima*, the following observations may be of some importance, as

* 1', 2', 3', 4', 5', and 6' being the appendages of the corresponding segments.



carrying the process a little further than it has perhaps yet been traced by him :—

In lat. $21^{\circ} 0'$ S. and long. $17^{\circ} 45'$ W. off the island of Ono, Fiji Group, apparently the same species of *Phronima* as that above described was taken in the towing-net, but with the addition of a numerous progeny of young in a large gelatinous but tough nidamental case. This interesting nest was shaped like a barrel, but with both ends open, and the external surface was somewhat tuberculated and uneven. The wall of the tube presented numerous round and puckered openings, observing no very definite arrangement, but through which entering currents were observed to pass. These openings generally, though not invariably, pierced the tuberculations.

An external membrane, with an internal lining, were distinctly visible, both seeming to be continuous at the rims of the tube. The space between these layers was filled up with a pulpy substance, in which scattered nucleiform bodies were detected with a higher power of the microscope.

I have been particular in the description of the case, as some far-fetched guesses were made as to its real nature. The cutting, piercing, and tearing implements of *Phronima* would very soon alter and reduce a bell-shaped Medusa, a Salpian, or a Pyrosoma tube to the required pattern ; for there is usually a great uniformity in the character and appearance of this case.

“With regard to *Phronima*,” says Mr. Spence Bate*, “our knowledge is small : its habit is that of an inhabitant of the gill-cavities of some one or more species of *Medusa* ; but in the Collection of the British Museum, entrusted to my care for examination, is a very curious case that was sent home from Naples by S. P. Pratt, Esq., as being the one in which the animal was taken. The structure is thick, fleshy, semitransparent, and studded over the surface and round the orifices—one of which is smaller than the other—with numerous white excrescences. Examination with the microscope shows the substance to be pervaded by bundles of fibres ; each fasciculus is twisted together near its centre ; these, some of them being larger than others, star the structure thickly, and still more plentifully where the white excrescences appear.”

However problematical the nature of the case, that its use is for nidification there can be no further doubt.

Though I have already given figures of the specimen above noticed to my friend Major Holland, R.M.L.I., for a paper on *Phronima*, published in ‘Science Gossip’ (April 1869), I trust that allusion to it here may not be out of place.

In a subsequent commission on the North-American and West-Indian Station in H.M.S. ‘Icarus,’ I have frequently captured “*Phronima* in its bag,” as my messmates would say. In order to bring the swimmerets into full play, the animal protrudes its body tail foremost from the case,

* Annals and Magazine of Natural History (Third Series), March 1858.

only calling into use the fine tips of the third and fourth pairs of thoracic limbs to hold fast its charge. When it fully retires into the case, the claws of the two posterior pairs of legs are pressed backwards against the lining membrane, so as still more effectually to secure its hold on the approach of danger.

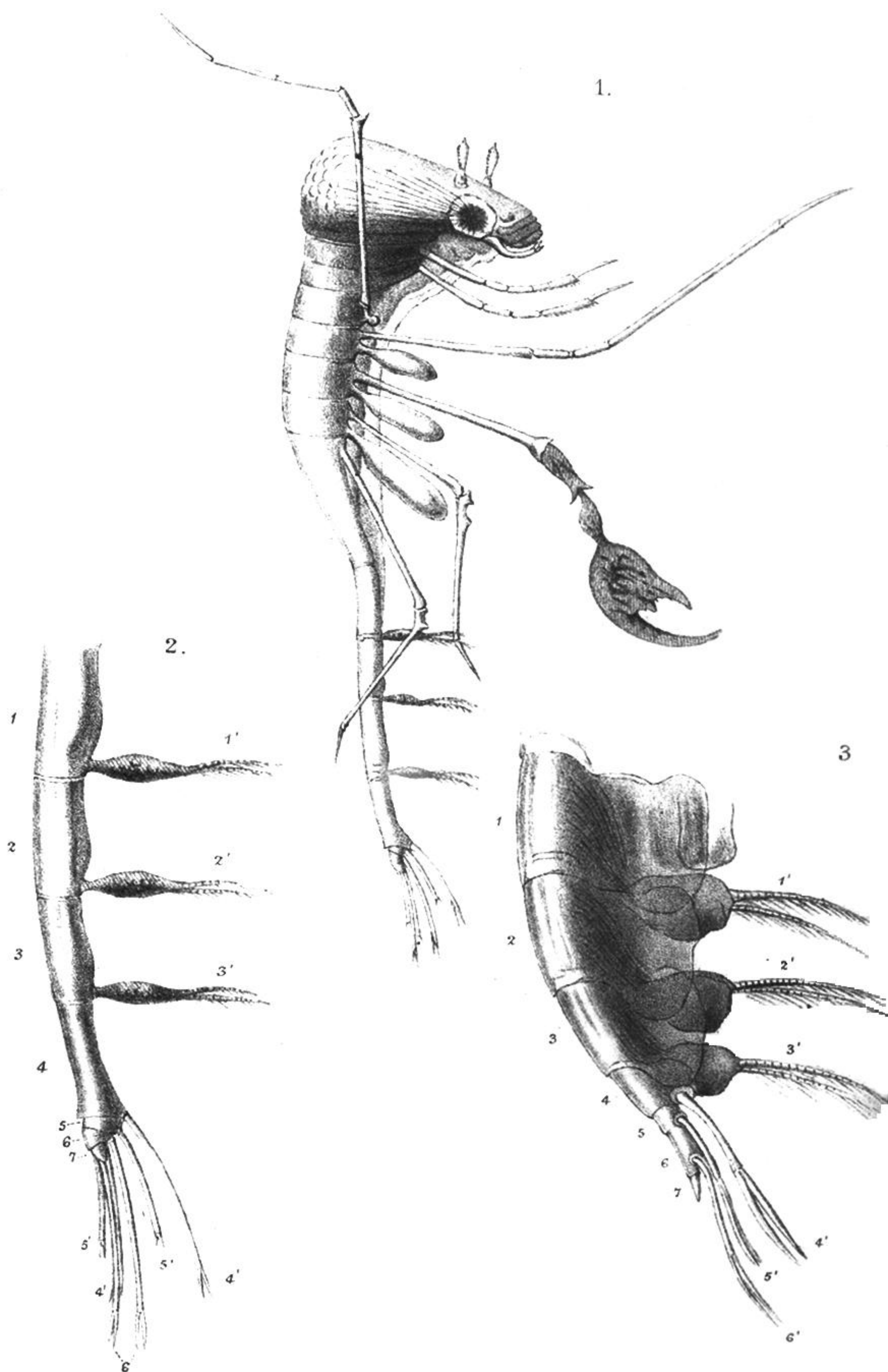
II. "On a Self-recording Method of Measuring the Intensity of the Chemical Action of Total Daylight." By H. E. Roscoe, F.R.S. Received November 27, 1873.

(Abstract.)

The object of the present communication is to describe an instrument by which the varying intensity of the chemically active rays, as affecting chloride of silver paper of constant sensitiveness, can be made self-recording. The method described by the author in the Bakerian Lecture for 1865, although it has been the means of bringing into notice many important facts concerning the distribution of the sun's chemical activity throughout the atmosphere, as well as in different situations on the earth's surface, has not as yet been introduced as a portion of the regular work of meteorological observatories, owing to the fact that, in order to obtain a satisfactory curve of daily chemical intensity, at least hourly observations need to be made, and this involves the expenditure of more time and labour than it has been found possible to give. In the present communication a method is described, which, whilst preserving untouched the principles and accuracy of the former method, reduces the personal attention needed for carrying out the measurements to a minimum, and thus renders its adoption in observatories possible.

According to this plan, a constant sensitive paper is exposed by a self-acting arrangement for accurately known times, at given intervals throughout the day. The insolation apparatus stocked with sensitive paper is placed in position either early in the morning of the day during which the measurements have to be made, or on the previous night, and by means of an electric communication with a properly arranged clock, the sensitive paper is exposed every hour during the day, so that, in the evening, the observer has only to read off, in the ordinary manner, the hourly intensities which have been recorded on the paper during the day.

This self-recording arrangement, though apparently simple, involves points which have rendered its successful completion a somewhat difficult matter, owing, in the first place, to the great variations which occur in the chemical intensity of total daylight in different places, at different times of the day, and in different periods of the year; and secondly, owing to the fact that, in order to be able to estimate the chemical intensity, the coloration acquired by the paper must reach, but not much



EXPLANATION OF THE PLATE.

Fig. 1. Lateral view of *Phronima* (species —?). With the exception of the antennæ, the limbs and appendages of one side only are represented, magnified about 9 times.

Fig. 2. The abdomen and tail of the same, further enlarged, to show the several segments, numbered (from before backwards) 1, 2, and 3, with swimmerets, and 4, 5, and 6 bearing caudal appendages, while 7 is the terminal segment or "telson."

Fig. 3. The abdomen and tail of a Hyperian for comparison, all the numbers having the same signification*.