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these disturbances more difficult to prove it on account of the close double maximums which show variations from one year to another*.

However, it is easy to see, in either of the figs. 4, 5, or 6, that the dotted curves are generally displaced to the right of the plain. This difference in behaviour between the easterly and westerly disturbances still tends to support the supposition of their different sources. It is very probable that these movements are periodical.

The staff at the Observatory who can be engaged in measuring the photographic curves of the magnetograph, and making the calculations upon the monthly tables, is at present engaged with the curves of the bifilar and balance magnetographs for the years 1868 to 1871.

It would be very interesting to know if similar displacements in the disturbance-curves at the stations in Asia and America have been observed, and in what direction.

The following Table gives the total of the disturbances of the declination :—

	West. millims.	East. millims.	East and West. millims.
1864.....	1666·3	1797·4	3463·7
1865.....	1970·6	1598·4	3569·0
1866.....	1313·4	1382·6	2696·0
1867.....	832·1	1164·5	1996·6
1868.....	1635·0	1514·7	3149·7
1869.....	1784·9	1755·8	3540·7
1870.....	2486·0	1813·3	4299·3
1871.....	2045·4	1734·1	3779·5
	13733·7	12760·8	26494·5

Thus near 1870, or a little after, there is a maximum period of disturbances, and from 1866 to 1867 there is a minimum period of disturbances, agreeing with the observed periods for the maximum and minimum of sun-spots.

II. "On the Development of the Crustacean Embryo, and the Variations of form exhibited in the Larvæ of 38 Genera of Podophthalmia." By C. Spence Bate, F.R.S. Received December 28, 1875.

(Abstract.)

The author states that, although the general forms of several genera of Podophthalmous Crustacea are known, yet the details of their structure have been so unsatisfactorily figured and described, that the value

* It is observed that the hollow between the two maximums about noon corresponds closely to another secondary maximum of the easterly disturbances. It thus appears that, during the hours 20 A.M. to 3 P.M., there is another force in action independent of the two principal forces.

and importance of hereditary elements are incapable of being studied and appreciated.

Through Dr. Carpenter he received from Mr. Power an offer of a considerable number of larvæ of exotic species, together with the parents from which they had been obtained; in relation to which Mr. Power wrote:—

"Dear Sir,—I have to thank you for your kindness in answering my letter to Dr. Carpenter, and for the memoirs.

"My collection of Crustacea and the microscope-slides of the larvæ are at present, and have been, packed up in Fort Louis. Now I am again on detachment; and if left here in peace for a few months, I shall arrange my specimens and finish up the microscopic drawings.

"All my larvæ are hatched in basins (the only kind of aquaria my nomad life allows me to use), so each crab or prawn &c. whose larvæ I possess is identified with its young; and this reminds me that on reading Fritz Müller's paper in the 'Annals' (1864, vol. xiv. p. 104), I was much astonished, as none of the prawns or prawn-allies whose young I have hatched show any such *Nauplius* form as shown in figures 1 & 3, &c.; but all I have observed as yet are born like fig. 8, or near it.

"I have been quite unable to rear any crab-larvæ beyond a day or two after birth; whether they require moving water or not I do not know; but certainly, though I have kept the parents alive for several weeks in basins (the water changed once or twice in 24 hours) of salt water, the same method would not succeed with the larvæ. I then tried small aquaria, and signally failed again.

"I have not been in the neighbourhood of fresh water as yet, so have had no opportunities of observing the freshwater Crustacea, though there are a good many crab and shrimp forms. I have found two kinds of that curious parasitic crustacean which adheres like a little polypus, a mere bag with a peduncle, but containing hundreds of young Crustacea whose genus I do not know, as I cannot find any account of them in Van der Hoeven's 'Zoology'*.

"If I succeed in getting posted to one of the regiments here, my life will be more stationary, and I shall have far better chances of working my crab-hatchings.

"In Fritz Müller's paper before referred to, I fancy that he has not hatched the different larvæ mentioned. After reading the paper very carefully, I could not help fancying that the various stages of development were not hatched through, but specimens were captured at different times, and perhaps larvæ of totally different species have been given as stages of the same animal. I say this with great doubt; but reading the paper will, I think, bring every one to the same conclusion. Thus he says, 'the unaltered *Nauplius* form, probably the same in which the animal escapes

[* New genus allied to *Sacculina*, which hatch larvæ in the cirriped pupa stage.—C. S. B.]

from the egg, came under notice only once;' again, 'This larva (taken on the 13th of January) is closely approached by four others, probably *belonging* to the same swarm, which were taken at the same time (24th January);' and so on.

"To tow a net in these tropical seas and to examine all the microscopic Crustacea would give a most extraordinary assemblage of forms; but I doubt if it is so useful as tracing the steps of individuals.

* * * * * * * *

"I have not yet hatched the land Hermit-crabs, though I suppose they are much as the ordinary sea specimens, and they certainly spend their larval life in the sea.

"Pray excuse my rambling letter, and please let me know of any way in which I can be of any use to you in my humble dips into natural history.

"Yours very truly,

"Wilmot Henry Power,

"*Staff-Surgeon, 44th Regt., Lt. Inf.*"

Some time afterwards the author received the promised collection, together with Mr. Power's drawings and notes. These have enabled him to identify the parent forms of some known larvæ, and also to determine those of several unknown genera.

It has also led him to the conviction of a unity of character throughout the various forms and changes of Crustacea; that variety in form is never inconsistent with homological truth; that parts suppressed or rendered abortive for want of use are never absolutely lost, and may be reproduced under conditions that may require them.

The eyes of those Crustacea, such as *Alphœus*, that inhabit dark places are reduced in power according to the condition of their habitat. But these organs are, in their larval state, as well developed, if not more so, as any of those whose life is passed in the bright sunshine of the surface of the ocean.

The blind *Didamia* brought from the depth of four miles below the surface of the Atlantic by the dredges of the 'Challenger' differs in no respect from *Polycheles*, taken by Heller in the comparatively shallow Adriatic sea. In the blind prawn from the Mammoth Cave of America, and the sightless *Nephrops* of Formosa, the organs of vision are reduced to the smallest condition consistent with their retention; and in the Cirripedes the eyes are represented by their nervous apparatus only.

The several forms of larva have not, in the prawn-allies, shown any approach to the *Nauplius* state, as mentioned by Fritz Müller, so that the author believes that it must be confined to the genus *Penæus* alone among the Podophthalmia. Nor should it be forgotten that the *Nauplius* form has only been observed as a free-swimming animal.

The author has taken this opportunity of making a close examination

into the earlier stages in the development of the embryo, and comparing the progress within the ovum of some of the larvæ that arrive at or near maturity before being hatched, with those of the larval forms that are hatched in a more immature condition; and he states that, as soon as the protoplasm assumes any thing like a definite plan, distinct lobes, corresponding in position with those of the several appendages in the *Nauplius*, together with an embryonic or ocular spot, are present; that in the *Nauplius* forms they exist as deciduous appendages only, and are soon cast aside and replaced by others more adapted to the wants of the adult existence.

In the embryos of other Crustacea the anterior pair of lobes enlarge in size with little alteration of form, while the posterior two pairs are developed into appendages that have but a deciduous value, since they never fulfil the office of permanent organs, and are generally cast off with an early moult.

This is observable within the ovum in *Palæmon*, *Crangon*, &c., and also in the marsupial embryo of *Mysis* after it has quitted the ovum.

The relation of these parts to the permanent organs the author has closely traced, and believes that he has demonstrated that the three pairs of mobile appendages in the cirripedal or *Nauplius* form of larva homologize with the eyes and two pairs of antennæ, and not with the antennæ and mandibles, as stated by Fritz Müller, Anton Dohrn, and others.

The author, moreover, contends that the small pair of filamentary appendages seen on each side of the ocular spot, existing in the *Nauplii* of Cirripedes, homologize with the peduncular appendage existing in the larva of *Caligus*, the arm-like appendages in the pupa-stage of Cirripedes, the peduncle of the stalked Cirripedes, and probably also with the long multiarticulate, antenna-like organs belonging to the fossil *Pterygotus*.

He also demonstrates the origin of the nerves in a mass of cellular material that reaches from one extremity of the embryo to the other. This divides into parts corresponding to the various somites into which the animal divides. These masses gradually separate from each other as the animal increases in size, and concentrate into the several ganglia that form the great nervous chain.

The author also shows the origin of the permanent organs of vision, and the manner in which the number of lenses increases with the growth of the animal, and traces the origin of several of the internal viscera and their mode of growth.

He also figures, in minute detail, the larvæ of the following genera (those in *italics* are from British specimens, while all the others are from the collection sent to him by Mr. Power):—

Palæmon fluvialis, n. sp.
—— *squilla*, Leach.
Crangon vulgaris, Leach.
Hymenocera, *Heller*.
Alphæus obesimanus, *Dana*.
Homaralphæus, n. g.
Homarus marinus, Leach.
Palinurus vulgaris.

Astacus fluviatilis.
Squilla.
Porcellana rugosa.
—— *longicornis.*
Galathea.
Pagurus tibicen.
—— elegans.
—— Bernhardus.
Clibinarus.
Trichia.
Gelasimus.
Cyclograpsus.
Libinia.
Menætheus.
Stenorhynchus.
Mithrax.
Trapezia pectinata.
—— ferruginea.
Pilumnus.
Melia tessellata.
Carpelodes rugipes.
Actinurus setifer.
Xantho Lamarckii.
Actæa obesa.
Thia ?
Liomera.
Pirimella ?
Thalamita.
Achelous.
Euriphia.
Thalassina.
Carcinocystus, n. g.

III. "On a Secular Variation in the Rainfall in connexion with the Secular Variation in amount of Sun-spots." By CHARLES MELDRUM, M.A., Director of the Mauritius Observatory. Communicated by B. STEWART, F.R.S., Professor of Natural Philosophy, Owens College, Manchester.

(Abstract.)

In this paper the author sums up the principal results obtained by his investigations as follows :—

(1.) Taking for the individual years of maximum and minimum sun-spot those given in par. 4*, it is found that the rainfall in the maxima exceeds the rainfall in the minima years in each country or district, and therefore in all taken collectively, the mean annual excess for Great Britain being 1·94, for the continent of Europe 3·64, for America 5·17, for India 8·98, and for Australia 6·23 inches, which gives a mean excess of 5·19 inches. In Great Britain the rainfall in seven of the nine years of maximum sun-spot exceeds the rainfall in the corresponding seven out of nine years of minimum sun-spot; on the continent of Europe six out of seven maxima years are similarly favourable; in America five out of six are favourable, in India four out of six, and in Australia two out of three.

A comparison of the mean rainfall of all the stations taken collectively gives an average annual excess of 7·01 inches in favour of the years of maximum sun-spot, and seven of the nine maxima years are favourable.

(2.) It is thus seen that the excess is not owing to abnormal and casual heavy falls in one or two years of maximum sun-spot, but that it

* Namely :—Years of maximum sun-spot, 1729, 1739, 1750, 1761, 1770, 1778, 1789, 1804, 1817, 1829, 1837, 1848, 1860, 1871; years of minimum sun-spot, 1733, 1743, 1756, 1766, 1776, 1785, 1798, 1811, 1824, 1834, 1843, 1856, 1867.