this year; but I first saw them on June 12, and again on the 14th; and I think I saw them on June 13 and 17, but was not sure. Previous to that, on May 15 and 16, the green sky, when the sun had set, was of unusual brightness, showing, as I thought, a tendency to the formation of these clouds. Each summer they appear to be growing fainter since they were first generally noticed in 1885.

This year's observations were made in Cornwall, with the exception of last night's, which was at Sunderland.

Sunderland, June 26. T. W. BACKHOUSE.

Earth Pillars in Miniature.

I HAVE taken two photographs of an interesting specimen I obtained from the cliffs here. The stone is composed of very fragile sand-rock containing fragments of flint. A large mass of this became detached from the higher part of the cliff, and some of the pieces chanced to fall on a ledge upon which dry sand was constantly pouring in windy weather. The action of this falling sand wore away all parts of the surface of the stone save those protected by the small embedded fragments of flint, and hence the formation of these miniature pillars.

Owing to the extreme incoherency of the substance, I unfortunately lost one of the most perfect pillars before the photograph was taken.

I conclude that the formation of these pillars was the work of a very few days—perhaps hours. On visiting the spot a few days later, all traces of sand-action had been obliterated by rain. An analogous case was that described by Mr. Blake ("Geol. Miscell. Tracts," 10) as occurring in the Pass of San Bernardino, California; the surface of the granite had been worn by blown sand, but the garnets therein stood out in relief upon long pedicles of feldspar, as a proof of their superior hardness. CECIL CARUS-WILSON.

Bournemouth, June 23.

Egg-masses on *Hydrobia ulvæ*.

CAN any of your readers give me information in regard to the eggs of the Gastropod *Hydrobia ulvæ?*

At a recent excursion of the Biological Society to Hilbre Island, while crossing the great stretch of wet sand which lies in the estuary of the Dee, it was noticed that the surface was covered in some places with vast numbers of *Hydrobia*. Some of these were brought back to the laboratory in their wet sand; and, on being put in a dish of sea-water, the mollusks were found next day to have crawled out of the sand, and I then noticed that nearly every specimen had several little rounded excrescences scattered over the surface of its shell. On examining these, it was found that each was a little mass of small sand grains, in the centre of which was a clear jelly containing several segmenting ova or young embryos. They were undoubtedly molluscan eggs, as I kept them alive until one or two had reached a veliger stage; but did they belong to the *Hydrobia* or to some other mollusk? No other mollusk was, however, noticed in any abundance in the neighbourhood. Has, then, the *Hydrobia* acquired the habit of laying its eggs upon its neighbours' shells, as being the only comparatively stable objects to be found in the fine shifting sands around it? Possibly the method of oviposition of *Hydrobia* is already known, but I have not come across any reference to it. W. A. HERDMAN.

Zoological Laboratory, University College, Liverpool, June 23.

Interpretation of the Differential Equation to a Conic.

MAY I ask, with reference to Mr. Asutosh Mukhopadhyay's geometrical interpretation of the above in NATURE of the 21st inst., how to draw a *curve* at *every* point of which the radius of curvature vanishes, or the curvature is infinite?

Is it not evident that the osculating conic of a conic is the conic itself, and the "aberrancy curve" therefore a *point*, the centre of the conic?

The "sought found," then, is the fact that a conic is a conic!

June 24. R. B. H.

The Nephridia of Earthworms.

THE last number of the *Quarterly Journal of Microscopical Science* has just come into my hands, containing a paper, by Mr. Beddard, on the nephridia of certain earthworms. In November of last year I read a paper, before the Royal Society of Victoria, on the anatomy of the large Gippsland earthworm, *Megascolides australis*. This, which reaches the length of 6 to 8 feet, is, I believe, the largest recorded earthworm, and its nephridial system is of great interest, corresponding closely in many points to that described by Mr. Beddard, in the above paper, as present in *Acanthodrilus multiporus* and *Perichæta aspergillum*. My drawings have been for some time in the lithographers' hands, but as it will still be one or two months before the full paper is published, I should be glad to draw attention to the, in some ways, still more interesting features of the nephridial system in *Megascolides australis*. The nephridia are very evident, and can be divided clearly into two sets.

(1) A great number of small vascular-looking little tufts lining the body-wall, save in the mid-dorsal and ventral lines, especially abundant in the segments containing the reproductive organs (segments 11–19). They have no internal opening.

(2) A series of much larger nephridia, one pair of which only is present in each of the segments in the middle and posterior regions of the body—that is, from about segment 120 to segment 500, or whatever may be the number of the last segment, which varies according to the worm's size. They are placed in the anterior part of each segment, whilst the smaller nephridia form a ring round the body-wall posteriorly. Each one has the usual ciliated funnel opening through the septum into the segment in front.

Throughout the body, where the smaller nephridia occur, there is a network of intra-cellular ducts lying immediately beneath the peritoneal epithelium in connection with the nephridia, and giving off an irregularly arranged series of branched ducts opening externally. Ventrally, also, there appears to be on either side, in the middle and posterior portions of the body, a longitudinal duct running from segment to segment within the most ventral pair of setæ: into this duct open, first, the larger nephridia, and, secondly, the most ventrally placed small nephridia of the same segment; the latter, again, are united with the network of ducts connected with the ring of smaller nephridia.

In the case of the latter there appear to be two somewhat differently formed sets of external openings. All over the body, except in the clitellar region, where there is a great glandular development in the body-wall, the duct leading to the exterior is intercellular, small, and composed of minute cubical cells; in the clitellar region, on the other hand, the duct, though similarly intercellular, is much swollen out, slightly coiled, and always provided with a distinct coiled blood-vessel running by its side: its lining cells form a flattened epithelium.

The external opening itself is formed of cells of the epidermis, so modified as to present very much the external appearance of a taste-bulb—that is, they form a sphere with the cells thicker in their middle parts, and the two ends attached to the poles of the sphere, the duct passing right up through the centre. This structure of the external opening is common to all the ducts in the body, but is more clearly made out in the case of those referred to.

The large size and ciliated funnels of the paired nephridia distinguish these clearly from the more numerous smaller ones, which are devoid of internal openings, and are without a doubt homologous with those of *Acanthodrilus* and *Perichæta*. At the same time it is important to note that histologically the network of ducts and the longitudinal duct, which are intimately connected with each other, are precisely similar in structure, and, *a priori*, might be expected to have a similar origin, *i.e.* to be derived from the same germinal layer.

Leaving out of consideration at present the question dealt with by Mr. Beddard and others as to the homology of the larval nephridia of Chætopods, and assuming the existence of a genetic relationship between the adult nephridial system of Platyhelminths and Chætopods, the following questions suggest themselves with regard to the various nephridial structures present in different forms:—

(1) Are the longitudinal ducts in *Lanice*, the embryo of *Lumbricus* and *Megascolides*, homologous with each other? Before this can be determined the development of each must be known.

(2) Granted, of which there can be little doubt, that the smaller nephridia of *Megascolides* are homologous with the nephridia of *Perichæta* and *Acanthodrilus*, are not the large nephridia of the former, which are completely wanting in both

of these, homologous with the nephridia of other worms, such as *Lumbricus*, to which they are at all events suspiciously similar in arrangement and structure?

(3) What is the relationship of the large to the smaller nephridia? Are they modifications of the latter, or independent later developments?

(4) In either case the Platyhelminth system must be more closely represented by the small nephridial bodies devoid of internal openings and provided with a network of ducts such as is found in *Perichæta*, *Acanthodrilus*, and *Megascolides*, than by the more specialized paired nephridia of such a form as *Lumbricus*.

Possibly the course of development as represented in living forms may be somewhat as follows:—

(1) A series of numerous nephridia present in each segment devoid of internal openings, and connected by a continuous network of ducts, as in *Perichæta*.

(2) The aggregation of these smaller nephridia into tufts in various parts, as in the posterior region of *Acanthodrilus*; the subsequent enlargement of certain of these nephridia and the acquirement by them of secondary internal openings. It is interesting to note in *Megascolides* that in the anterior part of the body, where the small nephridia are scattered over the whole body-wall of the segment, large nephridia are absent, whilst they are present in the posterior region, where the small nephridia are confined to a ring in the posterior part of the segment. In this case, as the nephridia become aggregated into tufts in the anterior part, the ducts connecting them with those in the posterior region of the segment next in front will become fewer, until when, as in *Megascolides*, only a single, modified, large nephridium remains on either side anteriorly, there will be simply one duct from segment to segment uniting with a network of ducts in the region where the small nephridia still persist.

It is interesting to note that the aggregation of the smaller nephridia, and on this supposition the modification of certain of them to form the larger ones, commences in the posterior region of the body.

In certain worms, such as *Acanthodrilus*, the connection of the network of ducts from segment to segment seems to have been lost, at any rate in the adult: aggregation of these in the neighbourhood of the setæ, and subsequent modification, would give rise to a certain number of nephridia in each segment without any longitudinal duct.

(3) The next stage is reached in such a form as *Lanice*, where the longitudinal duct persists, but all trace of the smaller nephridia is lost.

(4) The final stage is present in most earthworms where, in the adult, all traces of both small nephridia and longitudinal duct are lost, though the latter is present, as in *Lumbricus*, during development.

These lead to three conclusions, two of which are practically identical with those of Mr. Beddard:—

(1) That the smaller nephridia without internal openings, irregularly scattered, and with a network of ducts such as are seen in *Acanthodrilus*, *Perichæta*, and *Megascolides*, are homologous with the nephridial system of Platyhelminths.

(2) That the larger nephridia typical of most earthworms are secondary modifications of certain of the smaller ones subsequent to their aggregation into groups; the modified ones acquiring each an internal opening.

(3) That there is no homology between the longitudinal duct of *Lumbricus*, *Lanice*, *Megascolides*, &c., with that of the Platyhelminths, since it has only been developed in the above forms in connection with the larger nephridia and as a modification of the original network, and has thus had its origin within the Chætopod group.

W. BALDWIN SPENCER.

Melbourne University, May 3.

Strange Rise of Wells in Rainless Season.

MY attention has been directed to a letter published by you a few weeks ago (May 31, p. 103) under the above heading. It would appear that there is something mysterious in the eyes of the author of the communication in question in the fact that the water in two wells at Fareham rose several feet in the month of March, as he states, "after a continuance of north-east wind, *without rain*," but with half a gale blowing"; so that it would appear that there was some connection between the north-easterly gale and the rise of the water.

In this, however, the author is entirely mistaken; the rise of water in the wells in question is nothing more than the ordinary seasonable rise due to percolation. For twelve years past I have been carrying on constant observations of the underground water-supplies in various parts of this country, and it is quite true, as mentioned by the writer of the letter, that ordinarily the water in wells rises in the winter and falls in the summer; but this is by no means an exceptional rule, for in the present season there have been two low waters, the last of which occurred in the southern counties on the 8th of March in the present year. After that date commenced a very wet period, and before the end of the month over 2½ inches of rain had absolutely passed through the ground as measured by my percolation gauges. The water in a well on the Surrey hills, which had been falling up to March 8, rose before the end of the month over 30 feet, which rise was entirely due to the replenishment from rainfall. I may point out that there are many wells at the present time in which the water is still rising, while in others in the same districts the water is falling, for the simple reason that as a rule underground water follows the same law as water flowing in a river, and that the floods or high waters descend from the highest to the lowest districts, so that at present in wells situated in high positions the water is falling, while the crest of the wave of high water in the same watershed has not yet been reached in the lower levels of the district.

That the water in wells *does* fluctuate under certain conditions of the wind there is no doubt, as I have already drawn attention both to the fluctuations which take place in the water-levels of wells under barometric pressure and also in the volume of water discharged from the ground with a fall of the barometer. It should be noted that the rise of water in wells when due to barometric changes coincides with the fall of the barometer. Now a north-easterly wind as a rule is accompanied by a high barometer, and therefore is not likely to influence the rise of water in a well. During the month of March the rainfall was above the average, while there were comparatively few days with easterly winds, the only time when it could be termed a half-gale from the north-east occurring on the 19th of March, by which time the water in all the wells had made a considerable rise, due simply to ordinary percolation. Thus there is no mystery attaching to the rising of the water in these wells at Fareham. The rise simply took place from the replenishment of the springs, which this year occurred at a period somewhat different from ordinary years.

BALDWIN LATHAM.

7 Westminster Chambers, Westminster, June 21.

THE OPENING OF THE MARINE BIOLOGICAL LABORATORY AT PLYMOUTH.

THE Laboratory at Plymouth, which is now ready for work, is remarkable as being the first institution in this country designed purely for scientific research which has been originated and firmly established by the efforts of scientific men appealing to the generosity and confidence of wealthy individuals and corporations who desire the progress of knowledge for practical ends and the general good of the community.

It may be said that the Marine Biological Association will begin its active career on and after Saturday next. On that day Prof. Flower will, on behalf of the Association, declare that the Laboratory at Plymouth, which is now complete, is open for the purposes of biological research. The opening of the Laboratory may be said to mark an epoch in English zoological science, just as the opening of the Stazione Zoologica at Naples, which is essentially a German undertaking, marked an epoch in German science. It is true that small sea-side laboratories have already been established in the United Kingdom—at Granton, St. Andrews, and Liverpool Bay; but none of them can compare with the present undertaking in size and importance, and none can offer such advantages to the investigator.

The present institution, it may be remembered, is historically the outcome of the International Fisheries Exhibition held in London in 1883. That Exhibition served partly as an amusement to Londoners, but it also performed a far more important service—it directed