completely known aside from our knowledge of that of the comet. Every August, about the tenth day, we have an unusual number of meteors—a star-sprinkle, as it has been called. A comet whose period is about 125 years moves in the plane, and probably in a like orbit with these meteoroids.

So near the first of December we have had several star-showers—notably one in 1872—and these meteoroids are travelling nearly in the orbit of Biela's comet. In April, too, some showers have occurred which are thought to have had something to do with a known comet.

Thus much as to the meteors of the star-showers. The sporadic meteors are with good reason presumed to be (and observed facts prove some of them to be) the outliers of a large number of meteoroid streams, and the leading problem of meteor-science to-day is to find these streams so faintly shown, and, if possible, the comets they belong to.

Come back with me to the November stream and its comet. The several bodies move along a common path not at all by reason of a present physical connection. They are too far apart, in general a thousand times too far apart, to act on each other so much that we can measure the effect. No; their connection has been in the past. They must have had some common history.

Looking now at the comets, we see that they have been apparently growing smaller at successive returns. Halley's comet was much brighter in its earlier than in its later approaches to the sun. Biela's comet has divided into two, if not more than two, principal parts, and seems to have entirely gone to pieces. It could not be found in 1872, when and where it ought to have been visible. Several comets have had double or multiple nuclei. In the year 1366, in the week after the star-shower, a comet crossed the sky exactly in the track of the meteors. A second comet followed in the same path the week after. Both belonged no doubt to the November stream, and one of them may perhaps have been the comet of 1866.

This stream of meteoroids is a long thin one. In miniature it would be perhaps a mile long to an inch in thickness. We have crossed the stream at many places along a length of a thousand millions of miles, sometimes in advance of, and sometimes behind, the comet, and all along this length have found fragments, sometimes few, sometimes many. This form of the stream suggests continuous action producing it. A brief violent action might give this form, but a slowly acting cause seems more natural.

Again, in the history of Biela's comet we have distinct evidence of continued action. The comet divided into two parts not long before 1845, and yet in 1798 fragments of it were met with so far from the comet, that they must have left the comet long before, probably many centuries ago.

Thus are we led to say, *first*, that the periodic meteors of November, of August, of April, &c., are caused by solid fragments of certain known or unknown comets coming into our air; *secondly*, that the sporadic meteors such as we can see any clear night are the like fragments of other comets; *thirdly*, that the large fireballs are only larger fragments of the same kind; and *finally*, that this stone, which was broken off from one of those large fragments in coming through the air, must once have been a part of a comet.

Here I should naturally close, yet I am sure that you will ask, How came the comet to break up? Perhaps the prior question would be, How came the comet together? In its history there is much that we cannot yet explain, much about which we can only speculate. Thus, how came this stone to have its curious interior structure? As a mineral it resembles more the deepest fire-rocks than it does the outer crust of our earth. It seems to have been formed in some large mass, possibly in one larger than any of our existing comets. Some facts show

that the comets have almost surely come to us from the stellar spaces. Out somewhere in the cold of space a condensing mass furnished heat for the making of this stone. The surrounding atmosphere was unlike ours, since some of these minerals could hardly have been made in the presence of the oxygen of our air. Either in cooling, or by some catastrophe, the rocky mass may have broken to pieces, so as to enter the solar system, having little or no cohesion, like a mass of pebbles; or, it may have come and probably did come, a single solid stone. In either case, as it got near to the sun, new and strong forces acted on it. The same heat and repulsion that develops and drives off from a comet in one direction a tail, sometimes a hundred millions of miles long, may have cracked off and scattered in another direction solid fragments. One of these contained in it this stone, and it wandered in its own orbit about the sun, itself an infinitesimal comet, how many thousands or millions of years we know not, until three years ago it came crashing through the air to the earth in Iowa. Thence this fragment came here to serve as a text to my discourse.

METEOROLOGICAL STATION ON BEN NEVIS

WE are glad to learn that the Scotch Meteorological Society's scheme of a station on Ben Nevis is evoking cordial support from those who have the administration of Government funds available for such objects. The London Meteorological Council, of which Prof. Henry Smith is chairman, has unanimously agreed to offer to the Scotch Society 100*l.* yearly towards the support of the station, provided a copy of the observations is sent regularly to London. This is at once testimony by the most competent judges to the importance of the scheme, and a proper encouragement to the Scotch Society to proceed in its spirited enterprise. We understand that to uphold the station and induce two competent observers to take it by turns to live on the top of the mountain with an assistant will cost about 300*l.* yearly. It is estimated that to purchase a full stock of instruments and erect a building for them and the observers a capital sum of 800*l.* will be required. The Scotch Society has applied for a grant of 400*l.* towards this expenditure from the Committee appointed by Government to distribute 4,000*l.* annually to encourage scientific research. We believe the Committee has not yet met to consider the various claims which are, no doubt, as usual made on the funds.

RESEARCH UNDER DIFFICULTIES

THE following short preface to a very valuable account of the stages of development from the egg of one of the centipedes (*Geophilus*), no member of which group had been studied previously to this account, gives so convincing a picture of the enthusiasm for investigation which may animate the modern naturalist, that it is worthy of a place in *NATURE* for the encouragement of the "craft." Elias Metschnikoff has during the past fifteen years worked more assiduously with the microscope at the observation of the minute details of embryology than any other student. To him we are indebted for our first accurate knowledge of this subject in the case of many important animal forms, *e.g.*, sponges, various jelly-fishes, marine worms, the scorpion, and the book-scorpions, various insects, crustaceans, starfishes, and ascidians. One result has been the injury of his eyesight. In reading to-day his memoir on *Geophilus*, published in 1875 (*Zeitschr. für wiss. Zoologie*), it occurred to me that the following passage has more than technical interest:—

"After having for many years sought in vain for material suited for the investigation of the embryology of the centipedes, I chanced to obtain a quantity of the eggs of

Geophilus. My find, however, took place under such circumstances, and these interfered so much with my investigation, that I feel justified in describing them more minutely. For some considerable time I had been afflicted with a chronic affection of the eyes, and consequently commenced in the spring of the present year a journey to our south-eastern steppes in order to turn my attention to anthropological studies. Instead of taking with me as in previous years all the apparatus necessary for microscopical research, I took this time on my journey only anthropological measuring instruments. When, then, I was in the neighbourhood of Manytsch, nearly in the heart of the Kalmuk steppes, and was visiting a small forest plantation, I discovered quite unexpectedly a number of eggs of *Geophilus* which had been deposited under the bark of a rotten tree-stem where the females were watching over them. I gathered up the precious material, and having packed it carefully in two bottles, set off with all speed to Astrachan, in order there to set about the microscopic investigation of the eggs. But when, after four days' travelling I arrived in a Russian village, Jandiki, near the shore of the Caspian Sea, and inspected my two bottles, I found in them only a couple of dead, opaque eggs, all the others having entirely disappeared. Fortunately I succeeded in Jandiki, where there is also a small plantation, in obtaining fresh material of the same kind, and this I brought in good condition to Astrachan, making the journey by steamboat. In the town of Astrachan I was able to borrow a Hartnack's microscope from a medical man practising there, and on a second journey took it with me to Jandiki. In this way I was enabled to make out the chief features of the developmental history of *Geophilus* by the use of my less seriously affected left eye. At the same time, in spite of the very favourable character of the *Geophilus*-eggs for microscopic research, I could not bring my work to the desired degree of completeness."

Determination and pluck have their scope in embryology! —
E. RAY LANKESTER

ON THE RECENT ERUPTION AND PRESENT CONDITION OF VESUVIUS

AT the end of the great eruption of 1872 the crater of Vesuvius was left as a wide and deep abyss, the floor of which did not possess a very high temperature, and was free from fumarole. Gradually, however, fumarole appeared, the temperature increased, and large quantities of steam and carbonic acid were evolved. The temperature continued to increase and sulphurous acid made its appearance, finally in 1875 the evolution of carbonic acid diminished, and that of hydrochloric acid commenced. This is always the commencement of the highest stage of fumarole activity. In January, 1875, when I ascended the mountain, large quantities of sulphurous acid were being evolved, and it was quite impossible to descend into the crater. On December 18, 1875, a deep chasm opened in the bottom of the crater, at the bottom of which glowing lava could be seen. This was the commencement of a new period of eruption, which Palmieri predicted would last a long time, and which is still going on. The lava gradually rose to the top of the chasm, and a new eruptive cone was soon afterwards formed on the floor of the great crater. Small quantities of lava issued from time to time from the new cone, and spread over the interior of the crater, until on the night of November 1, 1878, it rose to the lowest portion of the edge of the crater, and began to flow down the great cone of Vesuvius in a north-westerly direction. The lava continued to flow in a somewhat intermittent manner until nearly the end of the year, but it did not go beyond the foot of the cone.

On December 29 last I visited the new cone. I left Naples at 8.45 A.M., drove to Portici, and walked to

Resina. Left Resina on foot at 10 A.M., came upon the lava of 1451 (according to the guide, but I suspect it was lava of 1631) at 10.30, then bore somewhat to the west, and struck the lava of 1858. Reached the observatory at 11.15 A.M., the foot of the cone at 11.45, and the summit of the cone at 12.40 P.M. Thus the ascent of the cone occupied fifty-five minutes, including about ten minutes of rest. The angle is approximately 32°, and the ash of which the cone is composed is very loose. On arriving at the summit we turned to the west, and walked along the edge of the great crater, until we came to its south-western extremity, beyond which it is broken down by the recent flow of lava. Then we descended the crater by a very precipitous path, and presently found ourselves upon the new lava, surrounded on three sides by precipitous walls of apparently not more than 100 feet in height. Facing due north-east, we had on our right the new cone of November, 1878, and on our left the stream of lava which had issued from it, and which was still very hot, and in some places could be seen to be red hot a little distance beneath the surface. Occasionally a puff of very hot air was blown into our faces from the hotter portions of the lava. In many places hot fumes of hydrochloric acid escaped from the lava, and great cavities (in one or two cases small caverns), from whence the hot acid vapours issued, were coated with brilliant red and yellow sublimates of sesquichloride of iron. These sublimates are constantly spoken of as sulphur. I am inclined to assert that in more than ninety-nine cases out of a hundred, they are sesquichloride of iron formed either by direct sublimation of previously formed chloride from lower recesses in the lava bed, or by the action taking place then and there of the hot hydrochloric acid upon the exposed surfaces of the lava. Sublimations of salt were also apparent in certain portions of the lava bed. Prof. Palmieri informs me that he has detected sulphates in the sublimates, also lithium and boracic acid. I have not yet had time to examine various specimens of sublimates, which were collected from the new lava, and were placed in a dry bottle as soon as I reached Naples.

Prof. Palmieri has kindly furnished me with a MS. account of "Il Vesuvio dopo la grande eruzione del 1872," from which some of the above facts were derived. My own recent experience on the mountain does not, however, allow me to agree with him when he says: "Comunque sia, in tutto il tempo trascorso il cratere ha di mostrato poca attività dinamica. Pochi brani di lava gettati fino all'altezza di 20 o 30 metri, soffii più o meno vigorosi e qualche rara detonazione han rappresentato il vigore della forza eruttiva." The new cone, when I saw it, was pouring out vast volumes of smoke and steam, detonations occurred at frequent intervals, and loud noises as if of the lava surging within the crater. At intervals, also, the smoke was intensely illuminated as if the lava had leapt up within the cone. The cone discharged a perpetual shower of red-hot pieces of lava of a more or less cindery character, and certainly to a height far exceeding the "20 o 30 metri" of Prof. Palmieri. It is difficult to judge of heights under such circumstances, but many of the fragments appeared to be projected to a height equal to that of an ordinary sky-rocket. The ejected masses nearly all fell on one side of the cone, and helped to raise it. Occasionally, however, a sudden burst would come which scattered the red-hot masses in all directions. We approached as near as we could to the cone, and stood upon the bank of cinders (*vide* the accompanying woodcut) in immediate contact with it, and not a dozen yards from its vomiting crater. Showers of red-hot stones were projected from the crater, many of which fell into it again, and the rest for the most part on the side remote from us. There came a sudden burst, however, which shook the ground under our feet, and scat-