

For such systems  $A_i$ , as we have considered, all projective properties will be corresponding to each other, and all metrical properties at least as far as they are dependent upon the interpretation of the constants employed. EMANUEL LASKER.

Ikley, July 9.

P.S.—The same holds true, with slight modifications, for the only curved space that contains no exceptional elements, that is the surface of a globe of  $n$  manifoldness.—E. L.

#### The Feigning of Death.

THE discussion, a few months since, of the feigning of death in reptiles (vols. li. pp. 107, 128, 223, and lii. p. 148), induced me to experiment on the Currant Moth, whose powers of "shamming" are so familiar. The moth was first seized by one wing, and it at once feigned death; thereupon I cut off its head with a pair of scissors, and the animal continued to feign death. I use the expression advisedly, for absolute immobility was maintained for some seconds, and then violent fluttering ensued, causing the animal to rush wildly about the table, but failing to lift it into the air. In this condition any impulse, such as touching or pinching, induced a repetition of "shamming." After a strong stimulus the shamming was prolonged, and indeed a direct connection was obvious between the strength of stimulus and the length of period of quiescence. This power of response to stimulus was maintained for two days, and then weak fluttering set in for some hours, followed by death. Our entire ignorance of the physiology of the nervous system of insects renders it difficult to draw complete conclusions from these phenomena; nevertheless, it is difficult to conceive that volition can persist for forty-eight hours in a decapitated animal. We are forced then to conclude that here, at any rate, death-feigning is a purely reflex phenomenon, and that the sensory stimulus received by the surface of the body causes inhibitory impulses to arise reflexly from the ganglia of the central nerve chain, and prevent all movement of the locomotor muscles. In confirmation of this, it may be mentioned that denuding the wing of its scales over any area caused a marked diminution of sensitiveness over the area so treated. Since all stages between sensory hairs and ordinary scales occur in Lepidoptera, it is not unreasonable to assume that the scales still function as tactile end-organs, in spite of their modification subserving decorative purposes. OSWALD H. LATTER.

Charterhouse, Godalming, July 31.

#### Halley's Chart of Magnetic Declinations.

IN NATURE for May 23 and 30, 1895, are interesting communications from Dr. Bauer and Mr. Ward in reference to Halley's old chart of magnetic declinations.

I have a copy of this chart not referred to by either of these gentlemen.

It is bound in vol. i. of "Miscellanea Curiosa." This work was edited by Halley; it consists of three volumes, containing, in the main, reprints of papers read before the Royal Society. Vol. i. was published in 1705, and was printed by J. B., for Jeffery Wale and John Senex.

The chart is  $7\frac{1}{2}$  inches high and 13 inches long, and embraces just the circumference of the earth.

The title in the upper left-hand corner reads: "A new and correct Sea Chart of the Whole World, showing the Variations of ye compass as they were found Año 1700 with a view of the General and Coasting Trade Winds and Monsoons or shifting Trade Winds by the Direction of Capt. Edm. Halley."

In the lower left-hand corner is the note: "Capt. Halley's map of the World in two large sheets is sold by R. Mount and T. Page on Great Tower Hill, London."

The name "I. Harris, delin. & scu." is in the lower right-hand corner of the chart. CHARLES L. CLARKE.

New York, July 27.

#### THE ERUPTION OF VESUVIUS, JULY 3, 1895.

THIS recent disturbance at Vesuvius is interesting in several ways, and at one time had all the appearance of developing into as grand a display as that of 1872.

The last eruptive cycle of Vesuvius commenced on June 7, 1891, when I had the good fortune to be but a

NO. 1345, VOL. 52]

few hundred yards distant at the time the main bursting of the rift took place. The details of that eruption, with illustrations, can be referred to in my articles and reports.<sup>1</sup> We may briefly state that cycle as follows: the splitting of the whole of the great cone of Vesuvius by a radial rift which extended beyond the base for some distance across the Atrio del Cavallo. At the first moment a little lava issued from the upper part of the rift, but after a few hours all came from its lowest extremity in the Atrio, and continued to flow with practically no interruption for a period of nearly three years, or, more correctly, from June 7, 1891, to February 7, 1894. During that period no great quantity was given forth at any one time, so that no stream could attain much length before cooling. Though the amount emitted during that period is enormous, and if vesicularised into pumice and scoria would, I think, quite equal Monte Nuovo in volume. The consequence of this is, that a great and pure lava cone was built up in the Atrio, of low inclination ( $14^\circ$ ), and adding much to obliterate that interesting and characteristic feature of the volcano. Coincident with the formation of the rift, the central cone rapidly crumbled in, until a deep crater was formed which eventually attained over 150 m.

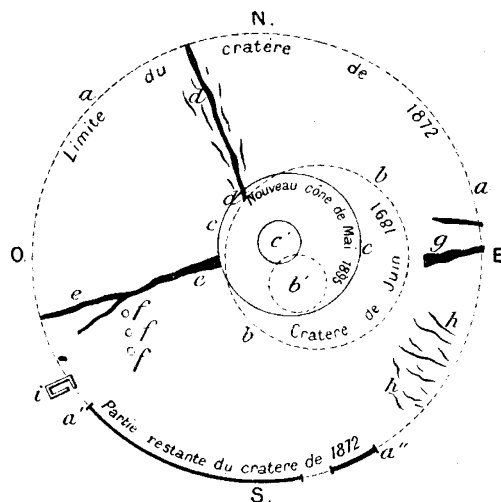


FIG. 1.—Diagram showing the actual state of Vesuvius, from a drawing by M. A. Bourdariat, after an earlier plan of mine (*La Nature*, June 8, 1895). (a) Limit of the crater edge of 1872; the part represented by a dotted line is that covered by more recent lavas of different dates. The parts  $a'$  and  $a''$  are still uncovered. (b) Crater of June 1891. (c) Active vent of the 1891 crater. (c') New cone in process of formation (May 1895). (d) Active vent of the cone on May 12, 1895. (e) Rift and vapour mouth of June 7, 1891. (e') Fissure emitting acid vapours on crater plain formed in the 1872 crater. (f) Very old hot-air passages and fumaroles. (g) Fissure of May, 1889. (h) Numerous fissures on the south-east edge of the crater plain. (i) Guides' shelter.

in depth and diameter. It was at its greatest dimensions in February 1894, when the lava stopped issuing by the lateral outlet, and therefore commenced to rise in the chimney. The immediate result of that stoppage was that the formation of a cone was soon commenced at the bottom of the crater by the ejection of lava cakes. The growth of this new cone of eruption was so rapid that, when I visited and photographed the interior of the 1891 crater in November last, this was not above 60 or 70 m. deep, and the cone of eruption was rapidly increasing in height within it.

My friend M. Alex. Bourdariat has carefully observed the

<sup>1</sup> "Il Vesuvio," *Corriere di Napoli*, June 10, 1891. "L'Eruption du Vésuve," *L'Italie*, Rome, June 13, 1891; *Le Figaro*, Paris, June 17, 1891. "The Eruption of Vesuvius," *Mediterranean Naturalist*, Malta, July 1 and August 1, 1891. "Lettre sur l'Eruption du Vésuve," *L'Italie*, Rome, July 18, 1891. "L'Eruption du Vésuve, visites d'exploration au Volcan," *La Nature*, August 8, 1891 (illustrated). "The Eruption of Vesuvius," *NATURE*, vol. xlv. pp. 160-161, 320-322, and 362 (illustrated). "Report British Association," 1891-92-93-94. "L'Eruzione del Vesuvio," *Rassegna delle Scienze Geologiche*, vol. i. Rome, 1891 (illustrated).

phenomena of the volcano during the early months of the present year, and has recorded the changes in *La Nature*, June 8 (Fig. 1). It appears from his interesting description that in January of this year the apex of the cone of eruption overtopped the edge of the 1891 crater. Lava even flowed out in the crescentic depression between eruptive cone and crater ring. This was followed by a little repose of some days, to be succeeded by powerful ejections of lava cakes to a considerable height (80 to 100 m.), which rapidly added to the growth of the eruptive cone. In May, this new cone was from 15 to 20 m. above the 1891 crater, and at the commencement of July was considerably more, as is shown by Fig. 2, taken from San Giorgio a Cremano, as the others—and also notes—by Mrs. T. R. Guppy.<sup>1</sup> This sketch shows that on the day preceding the eruption, central activity with cone-forming stage was very active, attaining the fifth degree on my scale.

M. Bourdariat's plan of the summit of the great cone, constructed on one of mine of earlier date, shows the axis of the new eruptive cone is not concentric, but to the north-west of the 1891 crater. This he attributed to the wind, no doubt one of the causes at work, but I had seen such displacement to be the case in November last, when from the depth of the cone top within the enclosing crater walls these sheltered the falling cakes from the wind. There was evidently even then the radial fissure directed to the north-west in process of formation, which has now been the point of issue of this new eruption.



FIG. 2.—Vesuvius as seen from San Giorgio a Cremano before the eruption (commencement of July).

The first indication of the final splitting of the great cone was at midnight, when the crater became quiet. In half an hour—that is, on July 3 at 12.30 o'clock—when the guardian of the upper railway station of Mr. G. M. Cook's railroad, which is but a very short distance from the rift, was awakened by a strong shock of earthquake that produced some slight cracks in the masonry foundation of the building. The shocks, though slighter, continued during the night. At eight the stronger shocks were again repeated, and the activity, which had recommenced at the chimney, had again ceased. This was due to the filling of the fissure as it extended outwards by the lava, the level of the surface of which naturally sunk. When this takes place, support is removed from the inner sides of the chimney in the cone, which crumbles in and chokes the vent. The whole top of the mountain had by this time become fissured, in consequence of which, at nine o'clock, seven or eight large blocks of rock, besides a quantity of small ones, were detached from the top of the cone, crashed and ploughed down its side, leaving a scar described as looking like a mud stream, and marked by a number of pits at equal distances, due to the bounding of some of these boulders. This scar is seen in Fig. 3, close by the

<sup>1</sup> I have on several occasions had to thank Mrs. Guppy for notes and sketches that, often at considerable trouble, she has placed at my disposal. They are of much value, as she has observed and knows all the changes of the mountain during the many years she has resided in Naples.

side of the right of the new lava stream. Mr. Treiber, Mr. Cook's engineer, calculates one of these blocks to be at least 20 c.m. The point of detachment and the resulting scar was by the side of the upper part of the new fissure, but a little to the south-west, and the traces left by the rolling masses are parallel to it.

At 10.18, the radial dyke reached the surface of the great cone and formed an eruptive mouth on a level with and to the north of the upper railway station, from which a copious outflow of lava took place, running down the cone, as seen in the figure below.

At 10.30, about 70 m. lower down, a fresh eruptive mouth was opened, and is well seen in Fig. 3, having an oblique



FIG. 3.—Vesuvius as seen on July 3, at 10 a.m.

crateriform appearance, as in the case of the upper one, and on other similar occasions a jet of steam, that constitutes the excavating agent, was converted into a blackish column by the lapillæ, sand, and dust dislodged and carried up with it from the side of the mountain. There is certainly some discrepancy in Mr. Treiber's report, for Mrs. Guppy's sketch, made at ten o'clock, shows this lower *bocca* already in existence. Her sketch likewise exhibits the progress of truncation of the central eruptive cone by the formation within it of a crater. Such a crater is entirely due to the crumbling in of the edges and their fall down the chimney, as no explosions were going on by the top part of the main chimney. Lava continued to pour forth from the lower end of the lower crateret, and probably from a part of the radial fissure that reached the surface below it, but which of course is hidden by the flowing lava. The stream reached the bottom of the great cone at the junction of the Atrio del Cavallo and the Piano di Genista, and then extended towards the upper end of the ridge of the Lion's Paw, or I Canteroni, where was once the old Crocelle. Here it soon formed a fine stream 60 m. in breadth. Besides the two main craterets, already



FIG. 4.—Vesuvius as seen on July 5, at 10 a.m.

described, two minor ones also were formed on the same line of rift.

On July 4, the craterets quieted down, little lava flowed, so that during twenty-four hours the face of the stream only advanced 12 m. This corresponded with a slight return of activity at the main chimney, so as to relieve the accumulating vapour tension of the lava below, which the mountain will not resist for long.

The ejections were, of course, of the *accessory* type—that is, not *essential* to the eruption, but simply the remnants of the crumbled-in portion of the eruptive cone. Each

puff had its characteristic black colour, due to the quantity of accessory sand and dust.

At 22 o'clock, the upper crateret gave out a little vapour and a little lava, but again became quiet. At 23 o'clock, the lower crateret showed new cracks around about it, with the escape of vapour.

During the night, between the 4th and 5th, the lava again increased, so that it is reported the next morning to be advancing at the rate of 25 m. per hour. It had turned to the west, and flowed down on the south side of the Lion's Paw, or the Observatory ridge, and had divided into two main streams, which subsequently subdivided into minor ones that radiated in different directions.

On July 5, the explosions at the central crater were powerful, so as to form from time to time pine-shaped vapour plumes over the volcano. At others, the vapour was bent over the Atrio by the sirocco wind, so as to spread a shower of dust and sand right across that depression. One of these is well indicated in Fig. 4.

So far no damage has been done except to a private carriage road that crosses the Piano di Ginista to the lower railway station. No cultivated land has been reached. The lava is, however, on a steep slope, and is flowing in the direction of the valley called the Cupa Pallarino, over the edge of which a magnificent cascade of incandescent rock was formed in 1872.

The eruption is quite identical in all its details with the usual antecedent ones, resulting from the formation and extension outwards of radial dykes. Many of such eruptions I have described in these pages and elsewhere, and fully explained their mechanism, production, growth and closure.

Three results may happen: (1) The radial sheet of rock may cool and seal the rift so that the volcano will soon return to the cone-forming stage, as seems to be indicated by the appearance of pasty lava cakes amongst the ejecta on July 5. (2) The fissure may enlarge and extend downward with the outflow of lava, as in 1872, with the formation of a much larger central crater. (3) It may follow the more usual course, as its immediate predecessor, and give issue to a small but almost continuous outflow of lava during months or years.

H. J. JOHNSTON-LAVIS.

*P. L. CHEBYSHEV (TCHEBICHEFF).*

THE death of Prof. Chebyshev has hardly been noticed in the English papers; and even in Russia, except for a short sketch in the University *Bulletin*, and in a speech of Prof. Markoff's with reference to him, which is reported in the *Bulletin de l'Académie impériale des Sciences de St. Pétersbourg*, no biographical notice has appeared in this celebrated mathematician.

Paphnyty Levovitch Chebyshev was born on May 14, 1821, at Akatovo, in the government of Kaluga; and after being educated privately, entered Moscow University; he completed the usual courses, and took his Bachelor degree. In 1846 he received his Master's degree at the same university for his "Essay on the elementary analysis of the theory of probability," and in the following year commenced a series of lectures as assistant lecturer in Petersburg University. He received the Doctor's degree in 1849 for his well-known "Theory of Comparison," which contained a model exposition of the formation of the theory of numbers, and clearly proved the strength of his mathematical genius. In 1852 Chebyshev was promoted to an extra professorship, and in 1860 to a regular professorship. During 1853-59 he was elected successively assistant, extra, and ordinary tutor in the Academy of Sciences. He remained a professor, doing active work of the most valuable kind, thirty-five years, during the course of which, at various times, he lectured on every branch of pure mathematics, and during one period—in 1849-51—on practical mechanics.

NO. 1345, VOL. 52]

In his numerous writings Chebyshev left a very great deal to the reader's imagination, often giving deductions simply without proofs, but in his lectures he never left a point without the fullest explanation; and his lectures are distinguished not only for elegance and accuracy, but for their extraordinary simplicity; the already-mentioned "Theory of Comparison" may serve as a good example, as well as his proof of Bernoulli's theorem, which is now given in all works on the theory of probability.

The professorial services of Chebyshev had a great significance to the Petersburg University. He placed the teaching of mathematics on a firm basis, and formed an independent school of thought. All the present staff of mathematical teachers in the Petersburg University, except a very few of quite the youngest, are his pupils and follow in his footsteps. His moral influence did not, therefore, cease when he resigned his professorship in 1882. The Council of the University elected him an honorary member, and his pupils kept up the habit of going to him on certain days to have lively discussions on various scientific subjects, in which his indomitable energy acted on his hearers in the most animating manner. He was always to be found engaged either on some complicated calculation or on models of mechanism he had invented.

Everything Chebyshev did bore the impress of genius; he invented new methods for the solution of difficult problems, which had appeared and had remained unsolved; he suggested himself a series of most important problems, and worked at them till the end of his life. His very first writings on the theory of numbers, devoted to the problem of the inter-dependence of the prime numbers, and on limits, gave him a European reputation, and his succeeding investigations on irrational differentials, and maximal and minimal quantities, assured his position as the most original mathematician of the nineteenth century.

He died November 26, 1894; his works will shortly be republished by the Petersburg University.

NOTES.

As already briefly announced in these columns, the Institute of France will celebrate its centenary next October. The programme of the *fêtes* which have been organised in connection with that event has just been sent to the Members and Correspondants of the Institute, the intention being that the centenary shall be marked by a reunion of all the men of light and leading who belong to the Institute. On the afternoon of October 23, there will be a reception in the Palais de l'Institut of the Foreign Associates and Correspondants and of French Correspondants, and in the evening the Minister of Public Instruction will hold a reception. On October 24, a meeting will be held in the Great Hall of the Sorbonne, at which the President of the Republic will attend. Discourses will be delivered by the President of the Institute, the Minister of Public Instruction, and M. Jules Simon. A banquet, to which all the Associates and Correspondants are invited, will take place on the evening of the same day. On October 25, there will be a special performance at the Comédie Française, and a reception will be held by the French President. The celebration will be concluded on October 26, by a visit to the Château de Chantilly. It will be seen from this that the hundredth anniversary of the foundation of the Institute of France will be celebrated in a manner worthy of the high position which the Institute holds among the world's societies of science, art, and literature.

THE seventh session of the Australasian Association for the Advancement of Science will be held in Sydney, from January 3 to 10, 1897, under the presidency of Prof. A. Liversidge, F.R.S. The Presidents and Secretaries of the Sections are