

Another claim made for the P. of L. A. is that it leads to Lagrange's equations of motion. That is not remarkable, seeing that both are founded upon Newtonian ideas. I suppose Lagrange's equations can be made to lead to the P. of L. A. But the practical way of proving Lagrange's form is to derive it immediately from Newton's Principle of Activity. Thus, when there are n independent coordinates x , with velocities v , the kinetic energy T is a homogeneous quadratic function of the v 's, with coefficients which are functions of the x 's. This makes

$$2T = v_1 \frac{dT}{dv_1} + v_2 \frac{dT}{dv_2} + \dots; \quad (8)$$

therefore

$$2T = \frac{d}{dt} \frac{dT}{dv_1} v_1 + \frac{dT}{dv_1} \dot{v}_1 + \dots \quad (9)$$

But also by the structure of T ,

$$T = \frac{dT}{dx_1} v_1 + \frac{dT}{dv_1} \dot{v}_1 + \dots \quad (10)$$

So, by subtraction of (10) from (9)

$$T = \left(\frac{d}{dt} \frac{dT}{dv_1} - \frac{dT}{dx_1} \right) v_1 + \dots; \quad (11)$$

and therefore, by Newton, the force on x_1 is the coefficient of v_1 , and similarly for the rest.

Some people who had worshipped the idol did not altogether see that the above contained the really essential part of the establishment of Lagrange's form, and that the use of the activity principle to establish the equation of motion is proper, instead of *vice versa*. To all such the advice can be given, Go back to Newton. There is nothing in the P. of L. A., or the P. of L. Curvature either, to compare with Newton for comprehensive intelligibility and straight correspondence with dynamics as seen in Nature. It must, however, be said that Newton's third law is sometimes astonishingly misconceived and misapplied, perhaps because it is badly taught.

OLIVER HEAVISIDE.

Leonids of 1902, and Quadrantids of 1903.

CLOUDS and full moonlight seem to have impeded observations of the Leonids to a considerable extent in November, 1902. The night of November 14 was fine here, but as there seemed little probability of a display on that date—as is fully confirmed by the negative results of other observers—no extended watch was maintained. The night of November 15 turned out very unfavourable. It seemed unusually bright here about 6h. 30m. on the morning of November 16. No observations were possible in the circumstances. Even if the sky had been clear, very probably nothing unusual in the way of a meteor display would have been visible, owing to the presence of the full moon, then shining with almost maximum brilliancy. M. D. Eginitis, with three assistants, observing at Athens during the night of November 15, did not see more meteors—in fact, they counted one less—than on that of November 14, 1901, on which night the American maximum took place. Both those nights were clear, but possibly the observations may not have been equally extensive. The maximum of 1902 probably took place in America, but in the absence of reports of clear observations at a few stations on the other side of the Atlantic, it is difficult to gauge with certainty the character of the display.

The Quadrantid meteors, on the other hand, were well seen here, considering the broken character of the weather. Anticipating that the display of 1903 would occur early on the night of January 3—the maximum had been determined as due at 8h. 55m.—a watch was begun at 8h. 45m., and during the next hour or so some very fine meteors were observed. The following are the times of their appearance, and their approximate flights:—

| | d. | h. | m. | |
|--------|----|--------|----|--|
| Jan. 3 | 8 | 53, | | from 2° west of Gemini to Orion, = 1st magnitude. |
| „ | 3 | 8 56, | „ | 1° east of the "Guards" to Pole Star, = 1-2 magnitude. |
| „ | 3 | 9 20, | „ | between Castor and Pollux to Orion, = 1st magnitude. |
| „ | 3 | 9 47, | „ | between the "Guards" half-way to Pole Star, = 2nd magnitude. |
| „ | 3 | 9 59½, | „ | 20° west of "Guards" to 10° higher up, = rich streak. |
| „ | 3 | 10 0, | „ | 20° west of "Guards" to Cassiopeia, = Capella. |

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Shortly after 10 o'clock, clouds came up from the horizon and by 10h. 15m. the whole north-eastern sky up to Gemini was covered. At 10h. 35m., that part of the sky had again cleared, and, between 10h. 40m. and 10h. 55m., eight meteors, varying from about 1st to 2nd magnitudes, were observed. They were all long-patched, but generally not so much so as the early part of the display, nor did they seem to move in beaten tracks, as it were, like the first meteors. The direction of their flight resembled, on the whole, that of the former, but one of them (= Sirius) shot downwards for about 30° in a direction parallel to the tail stars of Ursa Major. It started from a point about 20° east of that constellation. The latter part of the display between 10h. 40m. and 10h. 55m. was the richest I have ever observed. I observed no meteors, except one or two between 9 and 10 o'clock, that could not be traced. They began to come so rapidly at 10h. 40m. that when making a note of the course of one, another would put in an appearance, and so prevent the completion of the first observation, their paths not being near any well-known stars. An interval of quiescence for a few minutes would then follow, when the phenomenon would be again repeated as before. At 11 o'clock, the sky became again clouded and a heavy shower of rain terminated open-air observation. Between 12h. and 12h. 20m., two more were seen through a window, of about the 3rd magnitude, one on either side of the tail stars of Ursa Major; then clouds once more intervened.

JOHN R. HENRY.

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE fifty-second annual meeting of the American Association was held at Washington, December 29 to January 3, and was in many respects the most successful meeting ever held in the fifty odd years of the existence of the Association. As pointed out in the article in NATURE of July 24, 1902, in the account of the Pittsburg meeting of last June, this is practically the first time in which the Association has met during the winter since the close of the Civil War, and in this meeting culminated the prolonged efforts of a special committee of the Association, of which Dr. Charles Sedgwick Minot was chairman, to bring about an agreement among the scientific and other learned societies and the leading universities and other institutions of learning in the United States to set apart the week in which the first of January falls as a "Convocation Week," and in this week to bring together at one place as many as possible of the scientific societies. This culmination of the efforts of Dr. Minot's committee was eminently satisfactory. The meeting was a great success, and the institution of Convocation Week has apparently been established under the most favourable auspices.

Dr. Ira Remsen, president of Johns Hopkins University, presided over the Washington meeting, and the retiring president, the noted astronomer, Prof. Asaph Hall, U.S.N., delivered his address on the opening night of the session. His subject was "The Science of Astronomy," and it was published in full in our last week's issue.

The local arrangements for the meeting were complete, and the President of the United States acted as honorary president of the local committee, the active chairman being Dr. C. D. Walcott, Director U.S. Geological Survey, and the local secretary Dr. Marcus Benjamin, U.S. National Museum.

The addresses of the vice-presidents of the different sections were given in the afternoon of Monday, December 29, as follows:—

Prof. G. W. Hough before the Section of Mathematics and Astronomy, on "The Physical Constitution of the Planet Jupiter." Prof. Franklin before the Section of Physics, on "Limitations of Quantitative Physics." Prof. Weber before the Section of Chemistry, on "Incomplete Observations." Prof. Culin before the

Section of Anthropology, on "New World Contributions to Old World Culture." Prof. Welch before the Section of Physiology and Experimental Medicine. Prof. J. J. Flather before the Section of Mechanical Science and Engineering, on "Modern Tendencies in the Utilisation of Power." Prof. C. C. Nutting before the Section of Zoology, on "Some of the Perplexities of a Systematist." Prof. D. H. Campbell before the Section of Botany, on "The Origin of Terrestrial Plants." Prof. Wright before the Section of Social and Economic Science, on "The Psychology of the Labour Question."

Many important scientific bodies met in affiliation with the Association. Among these were:—The American Anthropological Association, the American Chemical Society, the American Folk-lore Society, the American Microscopical Society, the American Morphological Society, the American Philosophical Association, the American Physical Society, the American Physiological Society, the American Psychological Association, the American Society of Naturalists, the Association of Economic Anatomists, the Association of Economic Entomologists, the Astronomical and Astrophysical Society of America, the Botanical Society of America, the Botanists of the Central and Western States, the Geological Society of America, the National Geographic Society, the Naturalists of the Central States, the Society of American Bacteriologists, the Society for Plant Morphology and Physiology, the Society for the Promotion of Agricultural Science, the Zoologists of the Central and Western States.

The approximate register of scientific men and women in attendance at this series of meetings was fifteen hundred, of whom about one thousand registered for the American Association. The week was thus a very crowded one, the days being occupied with the meetings of the sections and the affiliated societies, and the general functions being as follows:—

On Monday evening, the annual address of the retiring president, Prof. Hall. Monday afternoon, the addresses of the retiring vice-presidents. On Tuesday evening, the address of the retiring president of the American Chemical Society, Dr. Remsen, and the public lecture of the American Society of Naturalists, delivered by Dr. C. Hart Merriam, on the subject "Protective and Directive Coloration of Animals, with especial Reference to Birds and Mammals." On the same evening, the Botanical Society of Washington gave a reception to visiting botanists. On Wednesday afternoon, the annual discussion of the American Society of Naturalists was held; the subject was "How can Endowments be Used most Effectively for Scientific Research?" On the same afternoon, a public lecture, complimentary to the citizens of Washington, was given by Prof. I. C. Russell, of the University of Michigan, on "The Volcanoes of the West Indies." On Wednesday evening, the annual dinners of the American Society of Naturalists and the Geological Society of America, and the annual smoker of the American Chemical Society, were held.

On Thursday evening, the secretary of the Smithsonian Institution, Prof. Langley, held a reception in the National Museum.

On Friday afternoon, a lecture, complimentary to the citizens of Washington, was given by John Hays Hammond, on "Rhodesia, the Site of the Mines of King Solomon." Friday evening, the local committee, with the trustees of the Corcoran Art Gallery, gave a reception to the visiting members of the Association and the affiliated societies at the Art Gallery.

On Saturday morning, President Roosevelt received all visiting members at the White House.

Several important changes in the constitution of the Association went into effect at this meeting, all tending toward the improvement of the stability of the council and the sectional committees. Hereafter, the sectional

committees will hold office for five years; the secretaries of sections will also hold office for five years, and the council will elect annually three members at large to serve for three years. National scientific societies adopting permanent affiliation with the Association are now represented upon the council of the Association, and this body probably at the present time includes a larger number of the active leading scientific men of America than any other organisation, not excepting the National Academy of Sciences.

Many notable papers were presented during the session, and the character of the proceedings, as will appear from the published reports in the journal *Science*, the organ of the Association, will undoubtedly show a very general improvement over the papers of previous meetings.

The general committee decided upon St. Louis as the next place of meeting, the time to be during Convocation Week of 1903-4, and recommended to the next general committee that Philadelphia be the following place of meeting during the Convocation Week of 1904-5.

The officers elected for the St. Louis meeting are as follows:—

President, Carroll D. Wright, Washington.

Vice-presidents:—Section A, Mathematics and Astronomy, O. H. Tittmann, Washington; B, Physics, E. H. Hall, Harvard University; C, Chemistry, W. D. Bancroft, Cornell University; D, Mechanical Science and Engineering, C. M. Woodward, Washington University; E, Geology and Geography, I. C. Russell, University of Michigan; F, Zoology, E. L. Mark, Harvard University; G, Botany, T. H. Macbride, University of Iowa; H, Anthropology, M. H. Saville, American Museum of Natural History; I, Social and Economic Science, S. E. Baldwin, New Haven; K, Physiology and Experimental Medicine, H. P. Bowditch, Harvard University.

General Secretary, C. H. Wardell Stiles, U.S. Revenue Marine Hospital and Public Health Service.

Secretary of the Council, Charles S. Howe, Case School.

Secretaries of the Sections:—Section A, Mathematics and Astronomy, L. G. Weld, University of Iowa; B, Physics, D. C. Miller, Case School; C, Chemistry, A. H. Gill, Massachusetts Institute of Technology; D, Mechanical Science and Engineering (no election); E, Geology, G. B. Shattuck, Baltimore; F, Zoology, C. Judson Herrick, Denison University; G, Botany, F. E. Lloyd, Teachers' College, Columbia University; H, Anthropology, R. B. Dixon, Harvard University; I, Social and Economic Science, J. F. Crowell, Washington; K, Physiology and Experimental Medicine, F. S. Lee, Columbia University.

The treasurer, Prof. R. S. Woodward, of Columbia University, and the permanent secretary, Dr. L. O. Howard, of the U.S. Department of Agriculture, remain unchanged.

BUBONIC PLAGUE AT HOME AND ABROAD.

A VOLUME of reports and papers on bubonic plague has recently been issued by the Local Government Board,¹ in continuation of the series originally commenced by the late Mr. Netten Radcliffe and since carried on by Dr. Bruce Low. In the preceding volume, Dr. Bruce Low carried the history of the distribution of plague throughout the world to the middle of 1898, while the present report comprises the period from the middle of 1898 to the middle of 1901.

Dr. Low follows the occurrence and progress of bubonic plague chronologically and topographically by

¹ "Reports and Papers on Bubonic Plague." By Dr. R. Bruce Low. With an Introduction by the Medical Officer of the Local Government Board. Pp. xi + 446. (London: Eyre and Spottiswoode, 1902.) Price 4s. 1d.