Folk-lore), Miss J. L. Weston. *Messrs. Constable and Co., Ltd.*, announce "Physiology and the Nation's Needs," edited by Prof. W. D. Halliburton, containing essays by Dr. M. S. Pembrey, Prof. D. Noël Paton, and the editor on, respectively, "Physical Training and the Open-air Life," "Physiology in the Study of Disease," and "Physiology and the Food Problem." They also promise "Elementary Plane Trigonometry," H. E. Piggott.

MESSRS. DULAU AND CO., LTD., 34 Margaret Street, W.1, have issued a Catalogue (No. 80) of nearly six hundred works on Diatomaceæ, Botany, Horticulture, Agriculture, Natural History, Geology, Palæontology, Voyages and Travels, Astronomy, Physics and Mechanics which will doubtless appeal to many readers of NATURE. It can be obtained upon application.

OUR ASTRONOMICAL COLUMN.

HELIOCENTRIC GROUPING OF PLANETS IN DECEMBER.—The astrologers have been amusing themselves and alarming the timid by predicting violent cosmic convulsions as the result of the planetary grouping on December 17. The actual position is sufficiently interesting to warrant a note. During the five days December 13 to 17, six of the eight major planets will be within a range of 26° in heliocentric longitude, while Uranus will be in the same line on the other side of the sun, the earth alone standing out. In the following list the two longitudes given refer to noon on December 13 and 17 respectively:—Mercury, 130° to 154°; Venus, 135° to 143°; Earth, 79° to 84°; Mars, 152° to 154°; Jupiter, 129°; Saturn, 155½°; Uranus, 331°; and Neptune, 130°. There were similar scares when the four giant planets were all near perihelion together. We may safely predict that they will be as baseless now as they were then.

COMETS.—Finlay's periodic comet passed perihelion about October 15·38. It was a fairly conspicuous object in November, and observations are numerous. It will be much fainter in December, but an ephemeris (for Greenwich midnight) may still be of use:—

	R.A. h. m. s.	N. Decl. ° ′		R.A. h. m. s.	N. Decl. ° ′
Dec. 5	1 33 59	13 14	Dec. 13	2 7 12	16 52
7	1 43 7	14 20	15	2 14 13	17 28
9	1 51 41	15 18	17	2 20 47	17 56
11	1 59 42	16 9	19	2 26 56	18 17

Schaumasse's periodic comet is also fading, but more slowly. Ephemeris for Greenwich midnight:—

	R.A. h. m. s.	S. Decl. ° ′		R.A. h. m. s.	S. Decl. ° ′
Dec. 5	14 9 36	2 2	Dec. 13	14 33 13	3 52
7	14 15 38	2 30	15	14 38 54	4 17
9	14 21 35	2 58	17	14 44 31	4 42
11	14 27 27	3 25	19	14 50 3	5 6

Messrs. Braae and Fischer Petersen announce that their supposition that comet 1919*b* (Brorsen-Metcalf) has made two revolutions since 1847 is not correct; its true period is 72·1 years.

FALL OF A METEORITE IN AMERICA.—The daily papers report that on the night of November 27 last a large meteorite descended into Lake Michigan, and that the object was seen before its fall by many persons over a wide extent of country. If this event is fully corroborated, it seems quite possible that the meteorite may have been a fragment of Biela's lost comet, like the Mazapil meteorite of November 27, 1885, on which date there occurred a great shower of ordinary meteors.

The earth passed through the orbit of Biela's comet on that occasion, and must have been very near, if not involved in, the denser portion of the material forming the remains of the comet. The latter had a periodic time of revolution amounting to about 6¾ years, and if we add five periods to the last return near the end of 1885 we arrive at the present time, so that a display of meteors was rendered quite probable. However, no very conspicuous shower occurred, though from reports sent in by various observers for the period November 19–25 a few meteors, including several of special brilliancy, were recorded from the right direction in Andromeda. In all, seventeen paths appear to be conformable to this shower, and the radiant is indicated at 29°+44° near the star γ Andromedæ.

On the same night, at 9h. 50m., that the meteorite is said to have fallen in America, a fireball was seen at Bristol descending slowly in the north-eastern sky, but the atmosphere was very hazy and few stars were visible. Observations of this object from other places would be valuable.

ANNIVERSARY MEETING OF THE ROYAL SOCIETY.

THE anniversary meeting of the Royal Society was held on Monday, when the report of the council was presented and the president, Sir J. J. Thomson, delivered an address. In the evening fellows and their guests dined together at the Royal Palace Hotel, Kensington, this being the first anniversary dinner since 1913. The assembly received with much satisfaction the announcement of the president that the Prince of Wales is to be admitted a fellow of the society early next year.

The report of the council is largely occupied with an account of the origin and constitution of the International Research Council and the related National Research Council. It is hoped that the British Government will consent to make the annual contribution required from countries forming part of the international organisation, in order to place the Council on a sound financial basis. The report refers also to the increased need of financial assistance for the promotion of research in pure sciences and to developments of the National Physical Laboratory under Sir Richard Glazebrook's directorship. The names of the new officers and council were announced in NATURE of November 13 (p. 295)

In his presidential address Sir Joseph Thomson referred to the retirement of Sir Alfred Kempe (treasurer) and Dr. Schuster (secretary) and to the invaluable services which these officers have rendered to the society. He also announced with regret that the assistant secretary, Mr. R. Harrison, has been obliged to resign his office owing to ill-health. The subjoined extracts are from the president's address.

Einstein's Theory.

I cannot pass over without notice the remarkable result that was announced at our first meeting this session: that the observations made at the eclipse of May 29 showed that light was deflected, when passing close to the sun, by an amount which, within the somewhat wide limits of the experimental error, agreed with that predicted by Einstein.

The deflection of light by matter, suggested by Newton in the first of his Queries, would in itself be a result of first-rate scientific importance; it is of still greater importance when its magnitude supports the law of gravity put forward by Einstein, a law which has explained the long-standing difficulty of the motion of the perihelion of Mercury.

On Einstein's law the velocity of light passing

through a field of gravitational attraction depends upon the gravitational potential, and diminishes as the potential diminishes. Thus the gravitational field round the sun acts like a refracting atmosphere, the refraction diminishing as the distance from the sun increases.

Though there are some hundreds of theories of gravitation, Einstein's is the only one which has predicted a result which has been verified by experience. On Einstein's, as on several other theories, changes in gravitational attraction travel with the velocity of light, and also the mass of a body varies with the proximity of other bodies.

In view of the statements in the Press about the overthrow of the Newtonian law, it may be well to point out that it is only in most exceptional cases—cases which are very difficult to realise—that the difference between the effects of the two laws is appreciable.

The modified theory of relativity by which Einstein arrived at this result is of remarkable interest and subtlety. The space around matter is on this theory distorted by an amount which diminishes as the distance from the matter increases, so that an observer in an aeroplane, if he were provided with infinitely delicate instruments, would, as he rose in the air, find the shapes of objects on the ground continually changing; and again the ratio of the circumference to the diameter of a circle would be changed to a minute amount by placing a weight at the centre of the circle. The laws of morality have been said to be a question of latitude; on Einstein's view those of geometry are a question of altitude.

On Einstein's view, gravitation is due to a particle trying to find the easiest way through space distorted and disturbed in this way. We may put it as follows:—The dynamical principle of least action, when applied to a particle moving through a space of this kind, would lead to a different path from that which would be pursued if the space were Euclidean, and this difference in path is that which would be produced if we supposed the space to remain Euclidean and the particle to be acted upon by an appropriate force. This force is what we call gravitational attraction. Thus we can represent the effect of this distorted space by the effects of suitable forces, and I expect it will be found that even the most enthusiastic relativitists will be tempted to think in terms of forces rather than in those of the geometry of non-Euclidean space.

If the distortion of space were very great, the customary methods of dynamics might lose their significance; and the question arises: Will, on Einstein's theory, the space inside an atom be so far from Euclidean that ordinary dynamical methods are unjustifiable? The answer to this question is, "No." There are two lengths which have special significance in connection with the atom; one of these is what we call the radius of the atom, and is of the order 10^{-8} cm.; the other we call the radius of the electron, and is about 10^{-13} cm. Even at the smaller of these distances the gravitational potential due to the mass of the atom, and therefore the distortion from Euclidean space, would be exceedingly small compared with the corresponding quantities due to earth at its surface, so that there is no special distortion inside the atom, except at distances from the centre which are infinitesimal even when compared with the radius of an electron.

One point of interest in connection with any view we take about mass is that, on the electrical theory of matter, the massive part of the atom is invariably positively charged, so that any state of space which we associate with mass ought to involve something corresponding to a positive charge of electricity.

The determination of the consequences of Einstein's theory on the principles of relativity, where the ideas of space and time are so intimately correlated that time has to be treated as a fourth-space dimension, introduces us into a space of four dimensions which we cannot visualise, and the properties of which are very remote from our experience. It is this which makes any general explanation of Einstein methods so difficult. To the analyst the difficulties presented by space of four dimensions are mainly those of an increase in the number of his symbols and equations; his difficulties begin when he has to explain his results to someone who is not an analyst. It is a remarkable and most interesting fact, from the point of view of either physics or metaphysics, that from such transcendental considerations as those I have indicated should have emerged a result so closely connected with such a prosaic thing as that it is more tiring to go upstairs than down.

According to Einstein's theory, the Fraunhofer lines in the sun must be displaced towards the red. This effect, though looked for by several observers, has not been confirmed; but even should it turn out that the theory has greatly to be modified, or even abandoned, its conception and development will, I think, always be regarded as one of the great triumphs of human thought.

Another interesting consequence of Einstein's theory is the exceeding minuteness of structure which it demands from matter. The electron, with a radius of 10^{-13} cm., carried our notions of the minuteness of some constituents of the universe far beyond those associated with the older atomic theory, but the size of the centres of disturbance, which in Einstein's theory are associated with matter, bears to the size of the electrons about the same proportion as the size of the smallest particle visible under the most powerful microscope to that of the earth itself.

I am afraid that the termination of the war has not brought to an end the difficulties in the way of scientific research in this country. Not the least of these is the difficulty and expense of procuring apparatus; it is perhaps surprising that in these circumstances the Government should have put obstacles in the way of the importation of philosophical instruments. Another very real difficulty is that the large increase in the number of students in our universities has greatly increased the educational duties of many of our most active workers, and so diminished the time they can devote to research.

The demands of war required large quantities of substances which previously were obtainable only in small quantities and at great expense. Prominent among these is helium, which can now be procured on a scale which, measured by laboratory standards, is unlimited. Such supplies of helium put cryogenic research on a new footing, and render possible investigations which promise to be of the greatest importance to many different branches of science. It is greatly to be regretted that in this country, the birthplace of cryogenic research, we have no adequately equipped cryogenic laboratory.

The Medallists.

The COPLEY MEDAL is awarded to WILLIAM MADDOCK BAYLISS.

Prof. W. M. Bayliss has been engaged in the investigation of physiological problems for the last thirty-five years. His work has ranged over a wide field. His paper with Starling on the electrical phenomena of the mammalian heart was the first to give the correct form of the normal variation, as confirmed by later investigations with the spring galvanometer. Again, he and Starling showed that the pancreatic secretion was effected by the production of a

specific chemical messenger, which travelled by the blood, and not by the stimulation of nerve-endings and the passage of impulses through nerves and the central nervous system. They showed that this secretin was but a type of a whole group of substances which they designated hormones. The discovery of these hormones, and the precise definition of their nature and of the conditions of their activity, mark an important epoch in the development of our knowledge of the organs of the animal body. Prof. Bayliss's researches on the mode of action of enzymes and on the closely related questions with regard to the nature of colloidal solutions have obtained universal recognition. The war led to Prof. Bayliss making a great advance in practical medicine. He studied the condition known as shock, which follows great loss of blood. The condition had previously been treated by the injection of saline solution, but the effect produced was characteristically transitory, and sometimes no benefit accrued at all. Prof. Bayliss, amongst other things, proved that perfused fluid to be effective must contain colloidal matter sufficient to give the osmotic pressure of the normal colloidals of the blood.

A ROYAL MEDAL is awarded to PROF. JOHN BRETLAND FARMER for his researches in botany, especially in the cytology and anatomy of plants.

Prof. Farmer's work is characterised by the fundamental importance of the problems worked upon; thus his memoirs on the meiotic phase (reduction division) in animals and plants are of as great value to zoologists as to botanists, and his conclusions and interpretations of the complex nuclear changes which precede the differentiation of the sexual cells have stood the test of criticism, and remain the clearest and most logical account of these very important phenomena. His papers, in collaboration with his pupil, Miss Digby, on the cytology of those ferns in which the normal alternation of generations is departed from has thrown new light on problems of the greatest biological interest, and especially on the nature of sexuality. In his cytological work on cancerous growths Prof. Farmer has established the close similarity between the cells of malignant growths and those of normal reproductive tissue.

A ROYAL MEDAL is awarded to MR. JAMES HAYWOOD JEANS.

Mr. Jeans has successfully attacked some of the most difficult problems in mathematical physics and astronomy. In the kinetic theory of gases he has improved the theory of viscosity, and, using generalised co-ordinates, has given the best proof yet devised of the equipartition of energy and of Maxwell's law of the distribution of molecular velocities, assuming the validity of the laws of Newtonian dynamics. In dynamical astronomy he took up the difficult problem of the stability of the pear-shaped form of rotating, incompressible, gravitating fluid at a point where Darwin, Poincaré, and Liapounoff had left it, and obtained discordant results. By proceeding to a third order of approximation, for which very great mathematical skill was required, he showed that this form was unstable. He followed this up by the discussion of the similar problem when the fluid is compressible, and concluded that for a density greater than a critical value of about one-quarter that of water the behaviour is generally similar to that of an incompressible fluid. For lower densities the behaviour resembles that of a perfectly compressible fluid, and with increasing rotation matter will take a lenticular shape and later be ejected from the edge.

The DAVY MEDAL is awarded to PROF. PERCY FARADAY FRANKLAND for his investigations in three sections of chemical science.

Prof. Frankland's early work on the illuminating power of burning hydrocarbons was considerable in amount, and had the further merit of inspiring others in the study of combustion. He was one of the first after Pasteur to study seriously the chemical reactions which occur during the vital processes of numerous lower organisms, and to apply such reactions to the preparation of pure products. During the last twenty years he has devoted himself to the elucidation of the relationship existing between the chemical constitution and the rotatory power of optically active substances.

The SYLVESTER MEDAL is awarded to MAJOR PERCY ALEXANDER MACMAHON.

Major MacMahon's researches on the combinatory analysis and on subjects allied to the partition of numbers are of the highest value, and display great originality and invention. He has shown equal power in the discovery and treatment of the wonderful ranges of partition theorems which are derivable from the theory of elliptic functions, and of the similar theorems to be obtained by the application of analysis to purely arithmetical principles.

The HUGHES MEDAL is awarded to DR. CHARLES CHREE.

Dr. Chree has for many years devoted himself to the intimate study of the phenomena of terrestrial magnetism, notably those which are recorded by self-registering instruments. He has investigated the differences which occur in the diurnal variation on quiet or moderately disturbed days, studied the initial stages of magnetic storms, and investigated various problems connected with the relation of solar phenomena and manifestations of terrestrial magnetism. Perhaps the most notable result obtained is that called by Dr. Chree the "acyclic change." This manifests itself on taking the averages of quiet days, when it appears that the mean value of the magnetic force is not the same at the end as it was at the beginning of the 24-hourly period, but shows a difference which is always in the same direction.

THE HYDRO-ELECTRIC SURVEY OF INDIA.[1]

AT a time when so much enterprise and energy are being displayed in collecting facts and data concerning the world's water-power resources, the issue of a preliminary report on the water-power resources of India is an incident of considerable interest and importance. The investigation was commenced in 1918 under instructions from the Indian Government by the late Mr. G. T. Barlow, C.I.E., who was placed in charge of the survey, with Mr. J. W. Meares as his assistant. The untimely and deplorably sudden death of Mr. Barlow in April, 1919, towards the close of the tour of inspection, left the compilation of the report in the hands of Mr. Meares, who was appointed as his successor in the post of Chief Engineer. Mr. Meares has discharged his exacting task in a very able manner. The removal of Mr. Barlow's collaboration was, of course, a serious deprivation, as a number of places were visited by him unaccompanied; and, although he compiled his notes with every care, his unrecorded impressions would have been of great value. Notwithstanding this the report is excellently put together, and full of useful information.

The earliest water-power installation in India was the electric lighting plant of the town of Darjeeling, carried out by Mr. Meares himself in 1897. Five years later considerable power for industrial purposes was developed in Mysore from the River Cauvery. Then nothing of importance happened until the initia-

[1] "Hydro-electric Survey of India." Preliminary Report on the Water-power Resources of India. Ascertained during the Season 1918–19 by the late G. T. Barlow, assisted by J. W. Meares. Compiled by J. W. Meares. Pp. vii+108+iii plates. (Calcutta: Superintendent Government Printing, India.) Price Rs. 3.2 or 4s. 9d.