

(C_2H_4O)₃. They further show that metaldehyde is by no means so stable as has been supposed; it decomposes completely in a few days' time, the products of decomposition being paraldehyde and a new polymer, tetraldehyde (C_2H_4O)₄. The latter substance, whose composition has been definitely established by vapour density and cryoscopic determinations, is a solid of similar appearance and properties to metaldehyde. It is finally shown that paraldehyde and metaldehyde are in all probability stereo-isomers, like maleic and fumaric acids, the more stable paraldehyde corresponding to the fumaroid or so-called "cis-trans" form, and the less stable metaldehyde to the maleinoid or "cis" form.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus*, ♂) from India, presented by Mr. James Carter; two Vulpine Phalangers (*Phalangista vulpina*, ♂ ♀) from Australia, presented respectively by Mrs. Percy Morton and Mr. W. Hughes; two Garden Dormice (*Myoxus quercinus*) European, presented by Dr. R. B. Sharpe; a Goshawk (*Astur palumbarius*) European, presented by Mr. Duncan Parker; a Jackdaw (*Corvus monedula*) British, presented by Mrs. Dixon Brown; two Striped Hyænas (*Hyæna striata*) from North Africa, a Mitred Guinea Fowl (*Numida mitrata*) from Madagascar, deposited.

OUR ASTRONOMICAL COLUMN.

SUN-SPOTS AND MAGNETIC DISTURBANCES.—The *Memoirs* of the Società degli Spettroscopisti Italiani (vol. xxii. p. 189) contains a paper by Dr. L. Palazzo on the magnetic disturbances of August 1893, considered in relation to the extent of solar spots. When the very large spot, or rather group of spots, was passing the central meridian on August 6 and 7 of last year, the bifilar magnetometer of the Roman College Observatory was considerably disturbed. On August 18, that is, when the spots were again near the plane of the central meridian, but on the other side of the sun, all three magnetic elements suffered a disturbance. Another magnetic storm was recorded at the Marine Observatory of Pola on August 12 and 13. Dr. Palazzo has collected all the facts connected with these three disturbances, and discusses them with the idea of determining the relation, if any, between them and sun-spots. From the paper it appears that the magnetic perturbation of August 6 commenced at 4.7 hours, when the double spot was about $15^{\circ}4$ from the central meridian. The middle point of the pair passed the central meridian at 8.5 hours on the following day. It would be interesting to know whether the sun was under observation at any place east of Rome at a time corresponding to that given for the commencement of the brusque magnetic disturbance described by Dr. Palazzo, and if so, whether any strange phenomenon was observed. The disturbances of August 12 preceded by about twelve hours the transit of the largest spot visible upon the sun at the time. On August 18, however, no spot could be seen near the central meridian when the magnetic needles were recording a perturbation, while neither when the double-spot again appeared on the sun's limb, nor when it passed the central meridian on September 2, did the magnetic needles flutter. We have, therefore, spots without disturbances, and disturbances without spots, thus indicating that there is no connection between the phenomena. Prof. Ricco's discussion of the relation between solar spots and disturbances of terrestrial magnetism (*Mem. degli Spettrosc.* vol. xxi. p. 153, 1892) led him to believe that magnetic disturbances occur, on the average, about 45.4 hours after the transit of spots over the central meridian of the sun. M. Marchand (*Comptes Rendus*, 1887, p. 133) showed that such disturbances occurred when groups of spots or faculæ were near the centre of the sun's disc, and Dr. Veeder has given evidence to prove that the appearance of spots on the sun's eastern edge is the signal for magnetic fluctuations. Dr. Palazzo, however, believes that the position with respect to the earth of the solar region disturbed is really unimportant.

STONYHURST COLLEGE OBSERVATORY.—Father Sidgreaves' report on the meteorological, magnetic, and solar observations

made at Stonyhurst College Observatory during 1893 has been issued. We extract from it the chief points of astronomical interest.

The ordinary work of the solar chromosphere was practically suspended during the year on account of the anticipated dismounting of the telescope for the erection of the Father Perry Memorial. But the sun-spot drawings have been continued, and were carried on with the six-inch objective which was mounted on the equatorial during the absence of parts of the eight-inch telescope. The new objective, with its mountings, was erected on November 6. It has a clear aperture of $14\frac{1}{2}$ inches, and was worked by Sir Howard Grubb, of Dublin. It is valued at £650, and constitutes the substantial tribute to the memory of the late Father Perry, raised by the generosity of his many friends.

The large grating spectrograph has been employed upon the solar spots and faculæ with the result that 175 photographs were obtained of spot-spectra in the green-yellow region, and ninety-two plates of faculæ-reversals of the H and K lines.

The night-work with the equatorial has been confined to stellar photographic spectra. In May, it was decided to make use of every opportunity upon the variable star β Lyræ; and as the exposures upon this were necessarily long, and there were many failures, other stars were let alone. Out of the whole number of exposures forty-five plates of β Lyræ proved to be available for careful measurements, and the results are published in the December number of the Monthly Notices of the Royal Astronomical Society.

THE "ANNUAIRE" OF THE BUREAU DES LONGITUDES.—A copy of the *Annuaire* of the Bureau des Longitudes, for the present year, has been received. Every year sees an increase in the quantity of matter compressed into that veritable *vade mecum*. To the present volume has been added notes by Prof. Cornu on the physical aspect of the sun, solar spectroscopy, and the spectra of comets and nebulæ. The descriptive note on stellar spectra, begun in the 1893 issue, is completed, and an account is given of recent observations of β Lyræ, and the spectrum of Nova Aurigæ. The articles include one by Prof. Poincaré, on light and electricity, according to Maxwell and Hertz; another, on the origin and use of the compass, by Contre-Amiral Fleuriais; and a third, in which Dr. Janssen describes four days of observation on the summit of Mont Blanc. Altogether, the 1894 *Annuaire* adds to the reputation gained by its predecessors; it is a volume which no astronomer can afford to be without, and which every student of physical science will find useful.

THE SPECTRUM OF NOVA NORMÆ.—A telegram received at Kiel on February 15 announces that Nova Normæ was observed by Prof. Campbell at the Lick Observatory on February 13, and found to have fallen to magnitude 9.5 (*Astr. Nachr.* 3211). The spectrum was seen to consist of four bright lines of the same relative intensity and position as those shown by Nova Aurigæ in August, 1892 (see NATURE, vol. xlviii. p. 524). Like this new star, therefore, Nova Normæ has descended to the condition of a planetary nebula.

THE SMITHSONIAN INSTITUTION REPORT.

THE report of Prof. S. P. Langley, Secretary of the Smithsonian Institution, for the year ending June 30, 1893, has just been published. Its contents refer, not only to the Smithsonian Institution, but also to the work of the U.S. National Museum, the Bureau of Ethnology, the Bureau of International Exchange, the Zoological Park, and the Astro-Physical Observatory. To do justice to the many and various operations of all these sections is impossible within the limits of space at our disposal, but some idea of the work may be obtained from the following abstract:—

Research.

It appears to be an essential portion of the original scheme of the government of the Smithsonian Institution that the secretary should be expected to advance knowledge, in letters, or in science, by personal research. Prof. Langley has continued the traditions of the Institution and the usage of former secretaries by contributing to the objects stated, as far as his increasing administrative duties would permit. During 1893 he continued the researches, of which a portion was published in 1891, in a

treatise entitled "Experiments in Aerodynamics." Interesting results have since been reached, which appear to be of wide utilitarian importance, but though Prof. Langley hopes soon to be able to make some communication of them to the public, they are not yet complete. In this same connection, in pursuit of an investigation begun some years ago, he has made experiments upon the variations continually going on in the atmosphere, in what is regarded for ordinary meteorological purposes as a steady wind. Specially light anemometers have been constructed and mounted upon the north tower of the Smithsonian building, and connected with a suitable recording apparatus. The complete results, which promise conclusions of practical importance, are being collated and will be published at a later date. (See NATURE, January 18.)

The extensive investigations carried on in astro-physics are referred to in the adjoining column.

As in previous years, aid to a limited extent has been given to original investigators who are not immediately connected with the Institution. Prof. E. W. Morley has continued his determinations of the density of oxygen and hydrogen, for which special apparatus has been provided by the Institution.

A paper by Prof. A. A. Michelson, upon the "Application of interference methods to spectroscopic measurements," with a view to increased precision in measuring specific wave-lengths of light, has been published in connection with his work upon a universal standard of length. Mr. F. L. O. Wadsworth was detached from the observatory staff, and sent (at the expense of the Smithsonian fund) to the Bureau Internationale des Poids et Mesures, near Paris, to assist Prof. Michelson during a stay of six weeks in preparation of this standard.

The Hodgkins Fund.

Numerous applications, which are referred to the advisory committee for consideration, have already been made for grants from the Hodgkins Fund to aid original investigations upon the nature of atmospheric air and its properties. Two have been approved, a grant of 500 dollars having been made to Dr. O. Lummer and Dr. E. Pringsheim, members of the Physical Institute of the Berlin University, for researches on the determination of an exact measure of the cooling of gases while expanding, with a view to revising the value of that most important constant which is technically termed the "gamma" function. Drs. Lummer and Pringsheim were recommended for this work by Dr. H. von Helmholtz, of Berlin.

A second grant of 1000 dollars has been made to Dr. J. S. Billings, U.S.A., Army Medical Museum, Washington, and to Dr. Weir Mitchell, of Philadelphia, for an investigation into the nature of the peculiar substances of organic origin contained in the air expired by human beings, with a specific reference to the practical application of the results obtained to the problem of ventilation for inhabited rooms.

The Naples Table.

In the spring of last year, a petition, signed by nearly two hundred biologists, who represented some eighty universities and scientific institutions, was presented to Prof. Langley, asking that a table be maintained by the Smithsonian Institution at the Naples Zoological Station, for the benefit of American investigators. This step was favourably decided upon, and in April last an advisory committee was appointed, at Prof. Langley's request, in order to obtain opinions as to the best administration of the table. The four members of this committee are:—Major John S. Billings, U.S.A., nominated by Prof. O. C. Marsh, President of the National Academy of Sciences; Dr. E. B. Wilson, Professor of Zoology, Columbia University, nominated by Prof. Chittenden, President of the Society of American Naturalists; Dr. C. W. Stiles, Zoologist, Bureau of Animal Industry, U.S. Department of Agriculture, nominated by Prof. C. O. Whitman, President of the American Morphological Society; Dr. John A. Ryder, Professor of Embryology, University of Pennsylvania, nominated by Prof. Allen, President of the Association of American Anatomists. Dr. J. S. Billings, U.S.A., has been designated chairman, and Dr. C. W. Stiles secretary of the committee.

Satisfactory conditions as to the occupancy of the table have been arranged with Dr. Dolin, the director of the station at Naples, and a contract has been signed and completed.

Numerous applications for the occupancy of the table have been received, but at the close of the fiscal year sufficient consideration had not been given them to render it possible to make any definite assignment.

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The Astro-Physical Observatory.

Prof. Langley has continued his important investigations with the bolometer. The instrument, as now constructed, is a minute strip of metal barely $\frac{1}{1000}$ of an inch wide, and less than $\frac{1}{1000}$ of an inch thick. Through this frail thread of metal a current of electricity is continually kept flowing. When the spectrum, visible or invisible, is thrown upon it, the thread is warmed and the current decreased by an amount corresponding to the intensity of the effect received, while novel instruments specially mounted and constructed are in electric connection with the thread, and now automatically record every minute change in this current.

With late improvements these instruments are so delicate that a change of temperature of one-millionth of a degree is readily detected and even measured, and it is easy to see that as a consequence of this delicacy the greatest care must be taken in their use. Thus the laboratory must be almost completely darkened, and closed tightly, so as to exclude all draughts and to keep it at as nearly a uniform temperature as possible, while for other reasons it must be kept under constant hygrometric conditions.

In spite of numerous difficulties, most of which are due to the very temporary and inefficient nature of the small wooden building in which the work is carried on, and its proximity to the traffic-laden streets, the expectations of last year have been largely realised, and a detailed publication of the work, accompanied by charts showing several hundred new and before unknown lines, will shortly be issued.

The result of the year's work has been the discovery and approximate determination of position of about 150 or 200 new lines in the hitherto unexplored region of the solar spectrum. Important as these results are, they are but the beginning of what Prof. Langley hopes will be accomplished.

In addition to the bolometric work proper, experiments on three special methods of investigation of the infra-red spectrum have formed a considerable portion of the year's work:—(1) Preliminary experiments on the measurement of wave-lengths in the invisible spectrum by interference methods. (2) Experiments on photographing the invisible spectrum by the aid of phosphorescent films. (3) Preliminary experiments on bolometric investigation of the infra-red normal spectrum. What might almost be said to have been the chief work of the observatory for the year, has been the improvement of the apparatus and instrumental conditions of working.

Lunar Photography.

Prof. Langley has been interested for a considerable time in the possibility of preparing a chart of the moon by photography, which would enable geologists and selenographers to study its surface in their cabinets with all the details before them which astronomers have at command in the use of the most powerful telescopes. Such a plan would have seemed chimerical a few years ago, and it is still surrounded with difficulties, but it is probable that within a comparatively few years it may be successfully carried out. No definite scale has been adopted, but it is desirable that the disc thus presented should approximate in size one two-millionth of the lunar diameter; but while photographs have been made on this scale, none of them show detail which may not be given on a smaller one.

The work has been favoured with the co-operation and interest of the directors of the Harvard College Observatory, of the Lick Observatory, and others, who in response to a letter addressed to them on February 10, 1893, have furnished many valuable suggestions.

The preparation of a series of enlargements of lunar photographs taken at the Kenwood and Lick Observatories, has been undertaken at the Astro-Physical Observatory. Some attempts at solar photography have been made at this observatory, but the atmospheric conditions prove to be very unfavourable to any satisfactory work in this direction.

The National Museum.

The National Museum suffers from the want of funds for the improvement of the collections by purchase. It is pointed out that in respect of this provision, the museum stands at the foot of all American museums, being surpassed even by every municipal museum of note in the United States. The disadvantage in which it stands (Prof. Langley remarks), when compared with what are now its competitors in the national

collections of the leading countries of Europe, has grown painfully obvious. Important collections made in America of the objects illustrating the vanishing life of its own native races of men and animals—collections which can never be made again, and never be replaced—are being permanently withdrawn to enrich the museums of Europe. This has already gone so far that it is necessary in order to study the past life of the Mississippi Valley to come to England, while for that of southern Alaska Americans must go to Berlin, and for the Californian coast they have to go to Paris, and so on. It is already then, in European capitals more than in those of the United States, that the most important characteristics of the American races have to be studied, and at the present rate, within a few more years, when the American collector has nothing more left to gather and to sell abroad, it will be in Europe, and not in America, that the student of past American history must seek for nearly everything that most fully illustrates the ancient life and peoples of the American continent.

The Bureau of Ethnology.

As during previous years, the work of the Bureau of Ethnology has been conducted with special reference to the American Indians in their primitive condition, with a view of securing the largest possible amount of information, both in the form of records for print and in the form of material objects for preservation and future study in the National Museum.

One of the most interesting questions ever raised concerning the early peoples of America relates to the artificial mounds scattered abundantly over the Mississippi Valley, and with less abundance over most of the United States. Many investigators have given attention to these works of a vanished race; and it came to be a general opinion that the builders of the mounds were a distinct people antedating the native races found in possession of the land on the advent of the Europeans. Within the last five years extended surveys of the mound territory have been made by collaborators of the Bureau under immediate instructions from the director and by Dr. Cyrus Thomas. An elaborate report on this subject has been prepared during the year, and is now in press. It is the united opinion of the officers of the Bureau that this document contains the solution to the mystery of the mounds; very greatly to the surprise of the investigators who began the work, they have been led to believe that the mounds and the art products contained therein are in no wise distinct from the works of the modern Indians, and that the distribution of tribes can now be studied from the mounds themselves as well as from other aboriginal records.

Many other important investigations have been carried on, one of the chief being the means of interchanging ideas among the American Indians, including gesture, speech, and picture writing, as well as spoken language. The primitive modes of expression by means of gestures or pantomime, and by means of glyphs or pictures, are held by students as of special interest in that they represent the beginnings of language.

Smithsonian International Exchange Service.

As an illustration of the extent of this special part of the Institution's activities, it may be stated that it has now about 24,000 active correspondents, of whom 14,000 are in Europe, 200 in Africa, 500 in Australia, and about 9000 in the various countries of the Western Hemisphere. In the course of this work, the Institution has gathered at Washington an immense collection of books, found nowhere else to so great an extent, bearing chiefly upon discovery and invention, which, with others, now occupy nearly 300,000 titles. Over 100 tons of books passed through the exchange office during the fiscal year 1892-93, and while the service is used almost exclusively for the transmission of printed matter of a scientific nature, natural history specimens having no commercial value are occasionally transmitted under special permission, when they cannot be conveniently forwarded by the ordinary means of conveyance.

The National Zoological Park appears to be in a satisfactory condition, and fulfils the chief purpose for which it was made, viz. to keep from extinction species of American animals, several of which are now upon the point of vanishing from the face of the earth, and would vanish for ever if something were not done to preserve them.

In conclusion we must say that the report covers so many branches of science, and so much has been done to advance each of them, that in the above abstract it has only been possible

to mention a few of the investigations. Sufficient has been said, however, to show that considerable contributions to knowledge have been made.

THE GREENLAND EXPEDITION OF THE BERLIN GEOGRAPHICAL SOCIETY.

PARTICULAR interest is felt by the Geographical Society of Berlin in the results of an expedition to the north of Greenland, which they fitted out some two years ago. At the sitting of the Society held on November 4, 1893, Dr. Erich von Drygalski and Dr. E. Vanhöffen communicated papers on the work of the expedition, Dr. Drygalski giving a general account of their life in Greenland.

On June 27, 1892, they reached Umanak, a Danish colony on the shores of North Greenland, and selected as their base of operations a position some distance inland at the head of the Umanak Fjord. They placed their house in the hollow of a great ice-cirque. East and west were the ice-streams of the Great and Lesser Karajak, behind them stretched the bare expanse of the ice-sheet of the interior, in front lay the open water of the narrow fjord. Dr. Stade had charge of the meteorological station; Dr. Drygalski and Dr. Vanhöffen made journeys into the interior and along coastal regions of glacier and moraine.

At first, when they ascended the Karajak, none of the Greenlanders were willing to accompany them, as they are full of superstitions about the ice-wastes of the interior. Three ultimately consented, and overcame their fears so far as to enter with spirit into the difficulties of the tour. Bamboo canes were fixed as marks in the ice, and the "interference area" studied where the upper ice of the Karajak streams meets the inland ice. In the winter months, Dr. Drygalski, with two trusty Greenlanders, explored the Great Karajak glacier. He took measurements on the relative rate of movement in the smoother and more cleft parts of the glacier. He tells how, as the big blocks of ice tumbled down, fine ice-dust was raised, which hung like a transparent veil around the ice-pillars and hummocks, sometimes catching the sun-rays and glancing with colour effects. Ice-grottoes were found, the remnants of old water-channel in those the temperature was wonderfully high, and the ice-waste quite moist.

From February until June, Dr. Drygalski and Dr. Vanhöffen were engaged in a long sleigh journey to the most northerly part of the Upernivik colony, in Lat. N. 73°. At this latitude the outer margin of the great ice-mantle of the interior extended to the sea level. Another tour which they attempted in June had to be given up on account of the warm Föhn wind. Before their final departure from Karajak, they ascended the ice once more to take observations on the bamboo marks previously set. Dr. Drygalski attributes the movement of the ice-streams to their content of water, and says there would be no motion whatever unless the melting temperature were reached. Farther, the increase of temperature in summer, due to the downward passage of heated surface-water, is much greater than the decrease of temperature in winter. The warming effect of the water is at its maximum in the deepest layers of ice, where also the movement is most marked. Microscopic examination of the ice also proved that it was thoroughly penetrated with water. It will be some time before the expedition can publish their results in detail. Dr. Vanhöffen's work was mainly biological.

THE SUN-SPOT PERIOD AND THE WEST INDIAN RAINFALL.

THE irregularities of the rainfall from year to year are so large that apparently there is no connection whatever between the sun-spot period and the Jamaica or any other rainfall; but if we smooth down these irregularities by taking the mean for three years as the rainfall for the middle of those years—that is to say, if we take the mean of the rainfall during 1866, 1867, and 1868 as applying to the middle of 1867, the mean of the rainfall during 1867, 1868, and 1869 as applying to the middle of 1868, and so on—we shall then get a series which rises to a maximum about the time of a solar minimum, and which falls to a minimum about the time of a solar maximum.

It is now about a year ago since this connection was found between the sun-spot period and the Jamaica rainfall, and my article on the subject appeared in the *Journal* of the Jamaica Institute, No. 5.