reprints and translations of thirty-six papers of wide scientific interest. Many branches of science are represented by the papers, and the whole collection forms a most interesting and valuable survey of subjects prominently before the scientific world in 1898. Limitations of space prevent us from giving a list of the papers reprinted from various reviews and scientific periodicals, but we are glad to direct attention to the following translations:—Recent progress accomplished by aid of photography in the study of the lunar surface, from a paper by MM. Loewy and Puiseux; the Le Sage theory of gravitation, translated from a paper by M. Prevost, with introductory note by Dr. S. P. Langley; the extreme infra-red radiations, by Dr. C. E. Guillaume; the perception of light and colour, by M. G. Lechalas; progress in colour photography, by M. G. H. Niewenglowski; oceanography, by M. J. Thoulet; the relation of plant physiology to the other sciences, by Dr. Julius Wiesner; *Pithecanthropus erectus*—a form from the ancestral stock of mankind, by Dr. E. Dubois; our present knowledge of the origin of man, by Prof. E. Haeckel; the laws of orientation among animals, by Captain G. Reynaud; the theory of energy and the living world—the physiology of alimentation, by M. A. Dastre; a sketch of Babylonian society, by Herr F. E. Peiser; the excavations of Carthage, by M. P. Berger; the origin of African civilisations, by Dr. L. Frobenius; dogs and savages, by Dr. B. Langkavel; the life and works of Brown-Séquard, by M. Berthelot. It will be seen from this list that the volume contains no less than sixteen translations of papers on important subjects. By publishing these translations, with the reprints, the Smithsonian Institution records the progress of scientific thought in a most serviceable way, and enlarges the outlook of men of science who do not read German and French with facility.

THE discovery of the organo-metallic compounds nearly half a century ago, by Frankland, opened up a wide field of organic synthesis, which has for some time been regarded as exhausted. It has, however, been recently shown by M. Grignard that many syntheses which are effected only with difficulty with the zinc alkyls can be carried out with great ease with magnesium compounds. In the current number of the *Comptes rendus* M. Grignard gives a *résumé* of his work in this direction, together with a theoretical study of the reaction. By the action of magnesium upon an alkyl iodide the compound RMgI is first formed, and this condenses readily with aldehydes and ketones, without there being any necessity to isolate the organo-metallic compound, giving ultimately secondary or tertiary alcohols, the yields being as high as 50 per cent.

THE additions to the Zoological Society's Gardens during the past week include a Pardine Genet (*Genetta pardina*) from West Africa, presented by Lady Moor; a Common Otter (*Lutra vulgaris*), British, presented by Mr. W. Radcliffe Saunders; a Yak (*Poephagus grunniens*) from Tibet, presented by Mr. A. E. Pitt-Rivers; a Blue Whistling Thrush (*Myiophoneus coeruleus*) from the Himalayas, a Jerdon's Green Bulbul (*Chloropsis jerdoni*), a Black-crested Yellow Bulbul (*Otocampsa flaviventris*), two Blyth's Hill Partridges (*Arboricula rufigularis*), an Indian Green Barbet (*Thereiceryx zeylonicus*) from India, a Great Barbet (*Megalaema virens*) from China, presented by Mr. E. W. Harper; a Grey-backed White-eye (*Zosterops dorsalis*) from Australia, presented by Mr. D. Seth-Smith; a Buzzard (*Buteo vulgaris*), European, presented by Mr. J. A. Harvie Brown; a Black Kite (*Milvus migrans*), European, presented by Mr. H. Wreford; a Red Kangaroo (*Macropus rufus*) from Australia, two Striated Jay Thrushes (*Grammatoptila striata*) from the Himalayas, two Rufous-chinned Laughing Thrushes (*Ianthocincla rufigularis*), a Rat Snake (*Zamenis mucosus*) from India, deposited; a Black-faced Kangaroo (*Macropus melanops*) from Tasmania, a Barraband's Parrakeet (*Polytelis barrabandi*) from Australia, purchased.

OUR ASTRONOMICAL COLUMN.

NOVA PERSEI.—The position of the star, as given by the meridian circle at Greenwich, is

$$\left.\begin{array}{lrrr} & \text{h.} & \text{m.} & \text{s.} \\ \text{R.A.} = & 3 & 24 & 28 \cdot 21 \\ \text{Decl.} = & +\,43^{\circ} & 33' & 54'' \cdot 8 \end{array}\right\}(1901).$$

During the fortnight since its discovery the star has undergone a remarkable series of changes both in brightness and spectrum.

Variation in Brightness.

		Mag.			Mag.			Mag.
Feb.	22	2·7	Feb	28	2·1	March	6	2·9
	23	0·10	March	1	2·2		7	3·0
	24	0·65		2	2·3		8	3·2
	25	1·0		3	2·4		9	3·5
	26	1·1		4	2·6		10	3·7
	27	1·5–2·1		5	2·7		11	3·9

In the current issue of *Comptes rendus* (vol. cxxxii. pp. 535–538) M. H. Deslandres describes his observations on the spectrum made with the spectroscope designed for line of sight measures at the Meudon Observatory. The photograph of the star's spectrum was obtained alongside a comparison showing the lines of iron, calcium, hydrogen, helium and air.

After noting the great breadth of the bright lines, he states that the middle of each band is displaced *towards the red* with respect to the terrestrial spectrum. The spectrum is similar to Nova Aurigæ, but the lines are broader. He then draws attention to the minute structure of the Hβ (F) line of hydrogen, which shows *three* maxima of brightness, the more refrangible component being the most intense. The other lines show similar structure, but not so clearly.

On the other hand, the calcium lines at H and K each show a fine, clear, dark line, the only sharp lines in the spectrum; both are displaced slightly towards the red. M. Deslandres discusses the two explanations of the width of the lines, that of Doppler-Fizeau ascribing the appearance to motion, the other, suggested by the experiments of Humphrey and Mohler and Wilsing, indicating the cause to be the great pressure to which the gases are probably subjected. He concludes by ascribing the group of lines immediately less refrangible then Hβ to magnesium and asterium, but these have been traced by other observers to the most prominent enhanced lines of iron.

CO-OPERATION IN OBSERVING VARIABLE STARS.—*Circular* 53 of the Harvard College Observatory consists of an outline plan drawn up by the Director, Prof. E. C. Pickering, for enabling a systematic investigation of variable stars to be made by the cooperation of observers in various localities. This has been induced by the fact that the number of long-period variables is now so great that many of them are neglected.

In the case of variables of small range the difficulty is not so great, as the variation is in most cases regular, but many of the variables of long period appear to change irregularly, and continuous observations are required until the nature of the changes are known. Moreover, the range is, in many cases, so great that the errors of observation are not sufficient to affect seriously the form of the curve.

It is recommended that in the vicinity of each variable a series of about twelve comparison stars be selected, the brightest being slightly brighter than the variable at maximum, and the faintest fainter than the variable at minimum. The intermediate ones should gradually decrease in brightness with about half-a-magnitude differences.

The actual magnitudes of all such stars brighter than the *seventh* magnitude can be supplied from the meridian photometer records, and means are now being adopted for furnishing on a uniform scale the brightness of the faintest stars likely to be visible in any telescope. At least one observation of each star should be made every month.

For searching out comparison stars the excellent charts of Father Hagen are recommended for stars fainter than the ninth magnitude. For brighter ones copies have been made of the Bonn Durchmusterung charts, giving 3° square about each variable, and these will be supplied to experienced observers willing to co-operate in the work. A list of seventy-three variables for which these charts will soon be ready is furnished.

DIMENSIONS OF THE SATURNIAN SYSTEM.—Prof. T. J. J. See has recently completed a long series of measures of the various planetary systems with the 26-inch refractor of the United States Naval Observatory at Washington. In the *Astronomische Nachrichten* (Bd. 154, Nos. 3686–7) he gives the details and results of the investigations of Saturn, including measures of the planet, rings, and the satellite Titan. He attributes much of the consistency of the values determined to the use of various colour screens placed between the eye and the telescope, which reduces or eliminates entirely the secondary spectrum produced by the objective, thereby enabling a much more sharply defined disc to be obtained.

In addition to his own recent measures, the author also brings together previous work on the subject from 1659. The following is a summary of the new determinations :—

	″	km.
External diameter of the outer ring ...	=40·304	278,768
Internal diameter of the outer ring, *or* External diameter of Cassini's division	=34·787	240,610
Diameter of the centre of Encke's division	=37·777	261,290
Width of Encke's division	= 0·107	740
Total width of the outer ring	= 2·758	19,076
Width of the outer part of the outer ring	= 1·237	8,556
Width of the inner part of the outer ring	= 1·414	9,780
Width of Cassini's division	= 0·418	2,891
External diameter of central ring ...	=33·951	234,827
Internal diameter of central ring, *or* External diameter of dusky ring ...	=25·952	179,501
Width of central ring	= 4·000	27,667
Internal diameter of dusky ring ...	=20·582	142,359
Black space between Saturn's globe and dusky ring	= 1·567	10,838
Equatorial diameter of Saturn	=17·448	120,682
Assumed oblateness of Saturn (H. Struve)	= 0·1013	
Polar diameter with this oblateness ...	=15·681	108,457
Assumed mass of Saturn (Bessel) ...	= 1:3501·6	
Resulting mean density of planet ...	= 0·1234 = 0·679 that of water.	
Diameter of the satellite Titan ...	= 0·487	3,368

HYDROGEN IN AIR.

IN a recent number of the *Annales de Chimie et de Physique* (January, 1901), M. Armand Gautier, professor of chemistry at the École de Médicine, Paris, gives a connected account of his researches on the combustible gases of the atmosphere. These researches have occupied some years, they have been carried out with extraordinary care and completeness, and they have yielded results of very great interest both in regard to their main object and also in relation to incidental scientific questions.

The most striking fact elicited by M. Gautier is that pure air contains free hydrogen as a normal constituent to the extent of about two volumes in 10,000. This conclusion, taken in conjunction with the recent experiments of Profs. Liveing and Dewar (NATURE, December 20, 1900, p. 189), in which they record the isolation of a fraction of air containing 43 per cent. of hydrogen, which they actually exploded, seems to admit of no doubt.

Analytical Methods.—M. Gautier set himself to determine the character and amount of combustible gases in the atmosphere by aspirating a large volume of air through a train of absorbents. Nothing could be more obvious and simple in principle than such a method ; the difficulty of making it available for determining with any degree of certainty the character and quantity of very small amounts of combustible gases will, however, be thoroughly appreciated by chemists.

The first part of M. Gautier's memoir is devoted to a description of the preliminary work which was necessary for the selection and proper use of the absorbents. Beginning with carbon dioxide, he confirmed the previous observation of Boussingault and Eliot and Storer that carbon dioxide is very difficult to absorb from a large admixture of other gases. After circulating 90 litres of ordinary air during forty-eight hours through a tube 80 centimetres long and containing glass beads moistened with caustic potash solution of density 1·3, it was found that 10·7 c.c. per million of CO_2 remained unabsorbed. A satisfactory absorbent in respect both to rapidity and completeness was found in barium hydrate, either dissolved or simply moistened with water. This substance would, of course, also absorb other acid gases, such as H_2S, SO_2 and NO_2.

The desiccation of air by sulphuric acid was also shown to be incomplete ; a satisfactory agent was found in phosphoric oxide previously heated with oxygen at 260° C. to get rid of lower oxides.

For the absorption of minute quantities of carbon monoxide the ordinary reagents are ineffective and a new one was found in iodine pentoxide. Air containing 1/100,000th of the gas loses it completely and at once when passed over the pentoxide heated to 70° C. Carbon dioxide, oxygen, nitrogen, hydrogen, marsh gas have no action on the oxide at that temperature, and other more strongly reducing gases, such as alcohol vapour and benzene when much diluted are also without action. When carbon monoxide acts upon iodine pentoxide, iodine and carbon dioxide are produced ; the iodine is absorbed by a tube containing finely divided copper and the carbon dioxide by barium hydrate. The estimation of hydrogen and hydrocarbons is next dealt with. When a mixture of 50 c.c. of hydrogen with 235 litres of pure air was passed over heated oxide of copper the hydrogen was entirely burnt provided that a tube of 70 centimetres was employed. With a tube of 30 centimetres, only 70 per cent. of the hydrogen was burnt. When using shorter tubes in subsequent experiments the weight of water obtained had to be multiplied by a factor in order to give the effect of an "infinite" tube of copper oxide.

When diluted marsh gas is passed over heated copper oxide there is neither complete combustion nor equivalent combustion of the carbon and hydrogen, and here also the use of factors is necessary. The hydrogen burns in greater proportion than the carbon. With a diluted mixture of marsh gas and hydrogen it was found that the presence of the hydrogen facilitated the combustion of the hydrogen of the marsh gas but retarded that of the carbon. Admixture of the copper oxide with spongy platinum or with other metallic oxides did not improve the efficiency. It was found that the copper oxide, after continued heating to redness, gradually lost its power of oxidising, and after 1500 hours it was without effect upon hydrocarbons, and it only partially oxidised free hydrogen.

For a detailed description and drawing of the apparatus the original memoir must be consulted. The air was filtered from suspended impurities by filtration through glass wool, its carbon dioxide was then absorbed—and in this connection the author devised a special form of absorption tube which he strongly recommends—water was then absorbed and the air entered the combustion tube. The combustion tube was heated in a furnace of special construction, in which great uniformity of temperature could be maintained from end to end. Water and carbon dioxide formed by combustion were then absorbed, and the apparatus terminated in an aspirator, a "decanteur" and a meter. There were in all twenty-eight pieces in the train ; they were connected together by clamped india-rubber joints made from purified tubing, which experiment showed to be proof against diffusion.

The Air of Paris.—Beginning first with towns, M. Gautier examined the air in the region of the École de Médicine. The average ratio of carbon and hydrogen found corresponded pretty nearly to CH_4, but there was evidence at times of some more highly carburetted hydrocarbon being present, at others of free hydrogen.

There was no evidence of hydrocarbons of the ethylene or acetylene series being present.

The quantity of carbon monoxide found was extremely small, it averaged 2·11 volumes per million, but this included one very abnormally high instance. Neglecting this one instance the average of ·56 volume per million was obtained. The quantity of carbon monoxide varied in different places ; it increased in densely populated places. In a small room at the laboratory heated by an old-fashioned faïence stove and illuminated for several hours by three gas jets 12·3 volumes were found. On the whole the quantity of CO and unsaturated hydrocarbons in town air may be said to be insignificant.

The Air of Forests.—The next experiments related to the air of forests, and the station fixed upon was a clearance in the middle of a wood at Lainville, 70 kilometres from Paris.

Here the proportion of carbon to hydrogen pointed distinctly to the presence of free hydrogen along with marsh gas. It did not seem probable that the hydrogen came directly from living vegetation, but it was possible that it might arise from decomposition going on in the soil, and it was therefore decided to make analyses in localities where this possible source would be removed to a large extent.