

could read, move about to some extent, and sleep for prescribed periods. But his every action was watched through a window and recorded. There were no meals to help him pass the time, and the principal occupation of the prisoner was counting his pulse, and respiration, and carefully collecting his excreta at frequent intervals. These were subsequently analysed, and their various constituents estimated. At the same time, the amount of oxygen used, of carbonic acid and water exhaled, of heat produced, and other factors too numerous even to catalogue, were all determined and recorded. One striking outcome of the work was that in the diaries reproduced comparatively little suffering apart from ennui was recorded. The same has been previously stated by professional fasters; we can therefore hardly doubt that in animals also the actual suffering has been small when they have been subjected to the withdrawal of solid food for a few days. The book is to be commended to all interested in physiological work, and especially to those engaged in a study of nutrition.

W. D. H.

#### RECENT PROGRESS OF THE METRIC SYSTEM.<sup>1</sup>

AN important report by Dr. Guillaume, presented at the meeting of the General Conference of Weights and Measures at Paris in October last, has recently reached us. Dr. Guillaume commences his report with an interesting account of some recent investigations which have been made at the International Bureau of Weights and Measures with respect to the permanency and invariability of the iridio-platinum standards of the metre and the kilogram, which were distributed in 1889 to the several States participating in the Metric Convention of May, 1875. The result of these researches is very satisfactory, and says much for the high standard of accuracy maintained in the metrological determinations of the bureau. Among other investigations which have been undertaken at the bureau since the previous meeting of the general conference in 1901, attention is directed to the work of MM. Benoit, Fabry and Perot in connection with the interferential measurement of light waves. The results obtained confirm in a remarkable manner the value found by Michelson and Benoit in 1892-3 for the length of the metre in terms of the wave-length ( $\lambda$ ) of the red radiation of incandescent cadmium, in dry air at 760 mm. pressure, and at the temperature of 15° on the normal hydrogen scale. The new value, viz. :—

$$\text{Metre} = 1,553,164 \cdot 13 \lambda,$$

leads to the following equivalent for the length of the yard, viz. :—

$$\text{Yard} = 1,420,212 \cdot 04 \lambda.$$

These values differ from the earlier determination of Michelson and Benoit by less than one part in 10,000,000, from which it may be inferred that the interferential method of linear measurement can lay claim to a degree of accuracy far surpassing that attainable with the best micrometer microscopes.

Another important research, which has occupied the bureau for many years past and has now reached its final stage, is the determination of the weight of a given volume of pure water at its maximum density. From this investigation, which has been conducted principally by MM. Chappuis and Guillaume, the weight *in vacuo* of a cubic decimetre of water at 4° C. has been ascertained to be 0·999972 kilogram.

<sup>1</sup> "Les récents Progrès du Système métrique." By Ch.-Ed. Guillaume. Pp. 94. (Paris: Gauthier-Villars, 1907.)

As the weight of a gallon of water at 62° F., weighed against brass weights in air at the same temperature and with the barometer at 30 inches, is defined as being 10lb. avoirdupois, the following value for the cubic contents of the gallon may be readily deduced from the above result, viz. :—

$$\text{Gallon} = 277 \cdot 420 \text{ cubic inches.}$$

It follows that, under the same conditions of temperature and pressure as in the gallon equivalent,

$$\begin{aligned} 1 \text{ cubic foot of water} &= 62 \cdot 288 \text{ lb., and} \\ 1 \text{ cubic inch} &,, = 252 \cdot 325 \text{ grains.} \end{aligned}$$

Further investigations on the subject are in progress at the bureau, but it is unlikely that the final results will be found to differ appreciably from those given above. The values at present legalised in this country, which are based on determinations made by Kater in 1821, are far from accurate, but legislators are naturally chary of prescribing new relations between physical magnitudes before science has said her last word on the subject.

With respect to thermometry, researches undertaken at the bureau during the period covered by this report indicate that the normal scale of temperature adopted by the international committee in 1887 is practically in perfect agreement with the absolute thermometric scale. The corrections previously determined for reducing the readings of mercury thermometers to the latter scale are found to hold good even for instruments of the most recent construction. Formerly Tonnelot thermometers were employed at the bureau in metrological determinations, and thermometers of this type were supplied with the various national prototypes which were distributed in 1889. Of recent years preference has been given to instruments constructed by Baudin, which are subjected to a preliminary course of artificial heating in the vapour of sulphur. It has been found at the bureau that thermometers treated by this process acquire almost perfect stability.

Dr. Guillaume devotes one chapter of his report to recent legislation in different countries with respect to the metric system of weights and measures. During the last few years the metric prototypes of the bureau have been legally recognised in France and Roumania, and the laws of these countries have been brought into harmony with the present conditions of metrology. In Hungary a law was recently passed defining the units of force, pressure, and density in terms of the metric system. The legislature of Denmark has provided for the adoption of the system in that country by the year 1910. The system has also been made obligatory in the Portuguese colonies. On the other hand, Dr. Guillaume does not find much progress to record in Great Britain and its colonies or in the United States, so far as legislation is concerned. Canada has, however, with the acquiescence of the British Government, formally joined the Metric Convention on the footing of a separate State, and in New Zealand an ordinance has been passed prescribing the exclusive use of the system after an indefinite date.

A resolution of the general conference urging upon the various contracting States the formal adoption of a metric carat of 200 milligrams for use in the sale of diamonds and precious stones has been brought by the several Governments under the notice of the industry concerned. At present it is not possible to anticipate what response will be made by the trade. In this country the carat is not legally recognised, but as a customary weight its value is generally accepted as being 3·1683 grains, or 151½ carats to the

ounce troy. This is equivalent to 205.3 milligrams. The carat is an extremely ancient weight, of uncertain origin so far as its present value is concerned, but it would appear to be in some way connected with the old standard of fineness for silver in England, viz., 10 oz. 2 dwt. of fine silver to the pound troy, this ratio of fineness being equivalent to the quotient of 64 grains by 24 carats.

In conclusion, it is pleasing to note the moderate tone and invariable accuracy of statement which characterise this report of Dr. Guillaume on a subject which is often discussed in print with considerable warmth.

#### NOTES.

A COMMITTEE has been appointed for the purpose of erecting a monument to Marcellin Berthelot by means of an international subscription. The president of the committee is M. Loubet, who is to be assisted, we learn from the *Revue scientifique*, by MM. Gaston Boissier, Léon Bourgeois, Darboux, and Levasseur. Donations may be sent to M. Ch. Goudchaux, 16 rue Miromesnil.

PROF. R. A. S. REDMAYNE, professor of mining in the University of Birmingham, has been appointed an Inspector of Mines, under the Coal Mines Regulation Acts, 1887 to 1905, the Metalliferous Mines Regulation Acts, 1872 and 1875, and the Quarries Act, 1894, under the title of "Chief Inspector of Mines."

THE death is announced, in his seventy-first year, of Prof. Leopold Schrötter von Kristelli, professor of internal medicine in the University of Vienna, and distinguished for his work in the science of laryngology.

THE management of the Municipal Exhibition, which will be opened at the Agricultural Hall on May 1, has arranged for an installation of Röntgen-ray apparatus in a special building in the hall, and for demonstrations, illustrating its use, to be carried out at certain hours each day.

WE learn from the *British Medical Journal* that the Riberi prize, of the value of 800*l.*, which is given every five years by the Royal Academy of Medicine of Turin, has been awarded to Prof. Bartolomeo Gosio, director of the Laboratories of Public Health of the Italian Ministry of the Interior, for his studies on the bio-reaction of arsenic, selenium, and tellurium.

A BILL has been passed by the Virginia Legislature establishing a Virginia State Geological Survey. According to *Science*, the bureau is to have its headquarters at the University of Virginia, and the board is to be composed of the Governor (*ex officio*), the president of the University, the president of the Virginia Polytechnic Institute, and two citizens. An annual appropriation of 200*l.* is provided.

AN interesting exhibit of photographs, instruments, and other astronomical objects is now on view at Cardiff Museum. It was arranged by the Astronomical Society of Wales, and was opened by the Lord Mayor of Cardiff on April 23. Much interest is being taken in the exhibition, which will remain open for some weeks. The Cardiff City Council is now taking a commendable interest in the furtherance of popular astronomy, maintaining an observatory at Penylan Hill, which houses a 12-inch reflector. This observatory is also a meteorological station of the second class.

AN appeal is being made for subscriptions to a fund for the widow and daughters of the late Mr. Gerald

Massey, whose literary works on subjects relating to myth, religion, and Egyptology are known to many readers and widely admired. A donation of 200*l.* has been received from the Royal Bounty Fund, and friends of the family have felt that this sum might form the nucleus of a fund which would yield a small income. Subscriptions will be received by Mr. James Robertson, 5 Granby Terrace, Hillhead, Glasgow, Scotland, who will render an account to all senders.

A CORRESPONDENT asks for information or references in regard to the deviation of rivers caused by the rotational velocity of the earth. Prof. G. A. J. Cole has kindly sent the following answer to the inquiry:—"The effect of the earth's rotation on the courses of rivers is regarded by many geographers as distinctly noticeable. The deflection is to the right in the northern hemisphere, the bank being, it is said, typically excavated on this side, while a shoal is left upon the other. In any series of meanders, therefore, those directed to the right side should tend to become more pronounced than those directed to the left. The reverse effects should occur in the southern hemisphere, the left bank being here eroded. Babinet and E. von Baer developed this theory in 1859 and 1860 respectively. The matter is discussed by G. K. Gilbert, *American Journal of Science*, vol. xxvii. (1884), pp. 427-32, and A. C. Baines, *ibid.*, vol. xxviii., pp. 434-6, and excellently and fully by A. Penck, 'Morphologie der Erdoberfläche' (1894), vol. i., pp. 351-60, with numerous references and examples; a sketch is also given by I. C. Russell, 'Rivers of North America,' Progressive Science Series (1898), pp. 39-43. F. Wahnschaffe, who has to deal with the great rivers moving in loose materials over the Prussian plain, throws doubt, like some other writers, upon the efficacy of the earth's rotation in producing a noticeable divergence by erosion ('Die Ursachen der Oberflächengestaltung des norddeutschen Flachlandes,' 1901, p. 188)."

THE general type of weather was very wintry and unsettled during the past week, and at many places in the northern portion of the kingdom a lower minimum temperature has occurred than has been previously recorded in April for about forty years, the shade readings ranging from 18° to 22°. Much snow has also fallen in all parts of the country. The report of the weather issued by the Meteorological Office for the week ending April 25 shows exceptional conditions for the time of year. The mean temperature had a deficit of 10° in the east of Scotland and in the Midland counties, and of about 9° in many other parts of the kingdom. The absolute minima were generally registered on April 24 or 25. At Balmoral the sheltered thermometer fell to 10° on April 24, whilst on the grass the reading was as low as 4°. On April 25 the highest reading throughout the day was 35°, at Oxford, and 34°, at Cullompton and Buxton. Nearly all the precipitation took the form of sleet or snow, and the fall was exceptionally heavy in the east and south of England. At Oxford the gauge yielded 1.66 inches for the twenty-four hours ending 8 a.m. on Sunday, the depth of snow being 16 inches, whilst at Southampton the depth was 14 inches, and at Marlborough 11 inches. At Bournemouth the snow which fell for twelve hours during Friday night yielded 1.13 inches of water, equal to about 11 inches of snow. The snowstorm on our south coast on Saturday, April 25, has been characterised as a blizzard.

WE welcome the formation of the Research Defence Society, the object of which is to make known the facts as to experiments on animals in this country. The society was formed in January last, and already numbers more