full of suggestive thoughts for physicists, chemists and biologists, who are too apt to overlook the many metaphysical conceptions used by them in their most rigid scientific investigations.

On the other hand, the scientist or the 'plain man,' accustomed to use trans-subjective things as his models of reality, is tempted to say that the 'reality,' with which Professor Ladd deals, is only a metaphysical abstraction, quite of a kind with the 'stream of consciousness' conception of the Self, which is adopted as his model. If a 'stream of consciousness' had no channel in the bed-rock of real things to flow in, such a man might ask, How could any knowledge of the reality of the Self arise? From a common sense point of view, such a criticism would appear to be valid, since our idea of, as well as our term for, reality is obtained from the thing (Latin, *res*). The thingness of the thing is reality; this does not, however, invalidate the theory that the 'ground of things' may be, metaphysically, in the same class with the Self. The 'plain man' will, however, contend that it is by reason of its derivation from the thing, as its ground, that the conception of reality derives its meaning, and he will naturally infer that the putting of reality and the self into the same class will reduce self to a ground of a particular trans-subjective thing, viz., of its physical organism. Only when we take the point of view of the author, by adopting self in contrast to thing as our model of reality, do we reach the conclusion that reality is the selfness of the thing and of all things. This volume is of chief value to the scientific student for the light it throws, from this view point, upon some of his most difficult problems.

Henry S. Williams.

New Haven, Conn., November, 1899.

Determination of the Density of Water at 4° C. by the International Bureau of Weights and Measures, 1899.

The interest attaching to the recent Report* on this subject is two-fold in that this constant is the connecting link between the metric units of capacity and mass as well as in most scientific volumetric measurements, and in that the present result bears the hall-mark of the institution that has given us our accurate standards of length, mass, and temperature. That the investigation was conducted by M. Guillaume, whose rare ability in quantitative research has become widely recognized through his memoirs as adjunct of the Bureau and through his admirable 'Thermométrie de Précision,' 'Unités et Étalons,' etc., is abundant guarantee that no refinement known to modern metrology has been omitted in this work.

After a discussion of the method, results, and sources of error, the report concludes:

"For the present it is probable that in adopting for the specific mass of water the value 0.99 995 or 0.99 996 the error committed will not exceed 2 centigrammes per kilogramme. We hope to be able by an exhaustive discussion of the measurements to reduce a little more these limits of uncertainty." (Translation.)

The method was the familiar one of weighing a solid of measured dimensions successively in air and in pure water from which the dissolved air had been withdrawn. Four hollow cylinders were used, two of bronze and two of brass. Their diameters ranged from 14.4 to 6.6 centimeters, and the height of each was about the same as the diameter. The corresponding weights of water displaced ranged from about 2 to 0.2 kilogrammes. The mean temperatures of the water when the weighings were made were about 8°, 8.°5, 9°, and 15°, these being selected, except the last, as giving about the maximum weight of displaced water. The linear dimensions of the cylinders were measured at a large number of systematically distributed points by the usual comparator. Sliding contact bars bearing reference marks were brought into contact with the cylinder at opposite ends of a diameter or of a height, and the distance between the marks measured by the microscopes and standard scale. This distance, less that found when the stops were in direct contact, gave the desired dimension. The density of the water was reduced to 4° by means of the tables of the expansion of water from the measurements of M. Chappuis (See *Procès-*

* Détermination de la masse du décimètre cube d'eau. Rapport préliminaire présenté au Comité International des Poids et Mesures dans la séance du 18 avril, 1899, par M. le Dr. Ch.-Ed. Guillaume.

verbaux for 1892, p. 147). The report clearly points out that the difficulty in reducing the uncertainty in the measurement by this method to even the amount here attained, 2cg. per kg. (2 in 100 000), lies mainly in the impossibility of obtaining by linear measurements the true volume of the cylinder.

Although the liter was originally defined as having the volume of one cubic decimeter, yet the International Bureau, in 1880, deemed it best to adopt as a provisional re-definition, the volume of one kilogram of water at 4° C., its temperature of maximum density. This was necessary for three reasons; first, the adoption of the platinum kilogram instead of the mass of the cubic decimeter of water at 4° as the standard of mass; second, the uncertainty as to the exact relation between the kilogram and the mass of the cubic decimeter of water; and third, the fact that the great majority of scientific measurements of volume or capacity are made by weighing the volume of water displaced or contained by the space to be measured. The scientific fraternity has unanimously adopted this practice. It is, therefore, pleasing to know from the above cited investigation that the discrepancy between the liter, as thus redefined, and the cubic decimeter, is but 5 parts in 100,000, or one two-hundredth of one per cent. No revision of past work and no correction of future results is, therefore, necessary where an error as large as one one-hundredth of one per cent. is unimportant; and this covers all engineering and the vast majority of scientific measurements. For work of an accuracy not exceeding one one-hundredth of one per cent. we may assume the volume of one gram of water at 4° C. to be one cubic centimeter, and the liter to be equal to the cubic decimeter. If the greatest possible accuracy is requisite, then we must add 5 parts in 100,000 to the volume as thus computed. So corrected, the results will probably be trustworthy within 2 parts in 100,000.

The following data, computed from the above specific mass of water, and from the relation, 1 inch = 2.54 000 $\overline{5}$ centimeters, derived from the Bureau's comparisons of yard and meter, are convenient:

One gram of water at 4° C. has a volume of 1.00 005 cc. (± 0.00 002 cc.).

One cubic foot of water at 4° C. (39.2° Ft. has a mass of 62.4252 lbs. (± 0.0012 lbs.).

One cubic inch of water at 4° C. has a mass of 252.880 grains (± 0.005 grains).

S. W. HOLMAN.

BOOKS RECEIVED.

System der Bakterein. W. MIGULA. Jena, Fischer. 1900. Pp. x + 1068. 18 Plates. Mark 30.

Practical Exercises in Elementary Meteorology. R. DEC. WARD. Boston, Ginn & Co. 1899. Pp. xiii + 199.

A Century of Science and other Essays. JOHN FISKE. Boston and New York, Houghton, Mifflin & Co. 1899. Pp. vii + 477. $2.00.

SCIENTIFIC JOURNALS AND ARTICLES.

Journal of Physical Chemistry, November. 'Thermal Coefficients,' by J. E. Trevor; 'On the Theorems of Robin and of Moutier,' by Paul Saurel—both mathematical papers; 'Hydrates in Solution,' by Wilder D. Bancroft, a criticism of Nernst's deduction that the percentage of hydrated substance in a dilute solution is independent of the concentration.

Bird Lore for December brings the first volume to a close. Witmer Stone contributes an interesting description of 'A Search for the Rudy Island (N. J.) Crow Roost,' and W. E. Cram, 'Winter Bird Notes from Southern New Hampshire.' A. A. Crolius tells 'How the Central Park Chickadees were Tamed,' and under the caption 'The Surprising Contents of a Birch Stub,' Frank M. Chapman describes a family of Chickadees, while P. B. Peabody furnishes two pictures of 'Richardson's Owl,' with accompanying text. The most important article, 'Humanizing the Birds,' by Caroline G. Soule, is a timely protest against ascribing to the birds human qualities that they do not possess. There are numerous notes, reviews and reports from Audubon Societies.

The Osprey for November commences with an article on the 'Breeding of the Fish Crow in Pennsylvania,' by Frank L. Burns, and this is followed by a short account of 'Dusky, or Some Traits of a Canary Bird,' by Miriam Zieber. The main paper is a reprint of a very interesting