at one centimeter distance. This value seems to be very constant, and the Hefner lamp may possibly become a standard of *total* as well as of *luminous* radiation.

A. St.C. D.

NOTES ON INORGANIC CHEMISTRY.

Two papers have appeared in the *Journal of the American Chemical Society*, by Dr. F. P. Venable, on the 'Nature of Valence.' The idea of valence in chemistry has been of gradual growth and has merely been the expression of certain chemical facts. In the case of the carbon compounds and in organic chemistry in the hands of Kekulé it has proved of immense service, and without it the wonderful development of this field in the past three decades would have been impossible. Its application to inorganic chemistry has been hardly as happy, and the original conception of a fixed valence has been abandoned for that of variable valence, but even this is limited to comparatively simple compounds. As an explanation of the structure of double salts, water of crystallization, metal-ammonia bases and other complex inorganic compounds it is wholly inadequate and possibly a hindrance. While in one form or another the conception of valence has permeated and, one might almost say, dominated chemistry, little or nothing has been known regarding its nature. To be sure, in the last decade or so several hypotheses have been offered by van't Hoff, Wislicenus, Victor Meyer, Knorr, Flawitzky and a few others, attributing valence to electrical phenomena, space relations of the atom, etc., but none of these attempted explanations has received any measure of support. The hypothesis which Dr. Venable puts forth is that valence is dependent upon vibratory (or kinetic) equilibrium of the atoms. "The question as to whether the atoms of two elements will unite is decided by affinity which is in some way connected with the electrical condition of the atoms. There is no apparent connection between this and valence." But the atoms "are endowed with motion, and this motion probably varies in velocity and phases with the different elements." "A molecule, in order to exist, must maintain a certain equilibrium and harmony between these various motions, so that there can be all degrees of equilibrium from the very stable to that which may be upset by the least disturbing influence from without." Variable valence will be, in part at least, dependent upon the temperature, and a "sufficiently high temperature may prevent any harmony of motion whatever being attained, and hence union may become impossible." Valence would then be dependent upon the possible harmony of motion between the different atoms. The hypothesis is simple and satisfactorily explains many at least of the facts; thus, for instance, the zero valence of elements like argon and helium might be due, not to their possessing no chemical affinity (though this may be the case), but to their motion not being capable of harmonizing with that of any other element. The weak point of the hypothesis is the difficulty of proving it to be true. It would be necessary to first know the nature of the motion of the atom, a problem yet unsolved. It is possible that the spectroscope could aid, but at present we have no clue as to why some elements, as iron, furnish a complex spectrum, while others, like sodium, give a relatively simple one. At all events Dr. Venable's idea furnishes a good and simple working hypothesis, and one which may have its practical uses for teachers.

Attention should be called to the *First Supplement* to Dr. H. Carrington Bolton's *Select Bibliography of Chemistry*, 1492–1892, which has just been published by the Smithsonian Institution. It includes works omitted in that volume, and brings the literature of chemistry down from 1892 to the close of 1897. Dr. Bolton has been fortunate in having the cooperation of a number of scholars abroad, who have contributed more than 2,000 titles in Arabic, Finnish, Japanese, Bohemian, Dutch, Portuguese, Swedish, Danish, Norwegian and Russian, no less than 760 titles in the latter language being furnished by Professor A. Krupsky, of St. Petersburg. Dr. Bolton's bibliographical work is invaluable to chemists and is carried out in a manner which is above criticism.

Professor F. Emich, of Graz, has been kind enough to send me a paper from his laboratory by F. Dörner, with a chemical investigation of the cement from antique water conduits. The

material was collected by Dr. P. Forchheimer during an exploring tour in Asia Minor, and was from Ephesus and Smyrna. The different specimens may have been from different periods, from several centuries before Christ to three centuries after Christ, but the general composition of all was the same. The mineral matter was chiefly calcium carbonate, but from 2 to 8 per cent. of organic material was present. This proved to be merely a mixture of fatty acids, and gave evidence that the cement was the oil-cement mentioned by early writers, as Pliny and Vitruvius. A series of experiments showed that a cement of burned lime and olive or linseed oil was not permanent, but that a mixture of two-thirds air-slacked lime and one-third olive oil hardened rapidly and was very durable. It is probable that this was approximately the mixture used in the ancient cements examined.

J. L. H.

BOTANICAL NOTES.

WOOD'S HOLL BOTANY.

IT is encouraging to note the continuation of the good work in botany which has been a feature of the Marine Biological Laboratory at Wood's Holl, Mass., and to observe that from year to year it is gaining in strength, both as to kind and quality. This year, beginning on the 5th of July, work is offered in the following lines, viz. :

1. Plant Morphology and Physiology, including the Cryptogams.
2. Lectures on the Algæ, with a study of many types.
3. Plant Cytology, for advanced students.
4. Special Investigations.

The first course should be especially helpful to students and teachers, since it will afford an opportunity of meeting and hearing many of the men who are adding to our knowledge of plants in many departments of botany. It is worth much to learn something of the personality, methods of work and point of view, of such men as B. M. Davis (algæ), E. F. Smith (bacteria), D. T. MacDougal (physiology), D. H. Campbell (evolution of plants), L. M. Underwood (liverworts), H. J. Webber (fecundation in gymnosperms), G. F. Atkinson (higher fungi), D. M. Mottier (cytology), and D. P. Penhallow (paleobotany), and the teacher who does so cannot fail to carry into his class room next year an inspiration to higher and better work.

CORN PLANTS.

MR. FREDERICK LEROY SARGENT has brought out a pretty and timely little book on 'Corn Plants, their Uses and Ways of Life,' which should be widely used as a supplementary reader in the schools. Unlike many supplementary readers, this one is written by a man who 'knows what he is writing about,' and hence the reader is not shocked by grossly inaccurate statements or crude misinterpretations. It is a thoroughly commendable little book.

The following headings of some of the sections of the book will give an idea of its scope and the treatment of the subject: 'What Corn Plants are'; 'Corn Plants in the Field'; 'How Corn Plants Provide for their Offspring'; 'Wheat, the King of Cereals'; 'Barley, the Brewer's Grain'; 'Rice, the Corn of the East'; 'Maize, the Corn of the West'; etc.

The publishers (Houghton, Mifflin & Co.) have done their share in typography and binding to make this one of the most attractive books of the season.

CANADIAN BOTANY.

FROM the Curator of the Herbarium of the Geological Survey of Canada we have recently received the following papers, viz. : 'Contributions to Canadian Botany,' XI. and XII., by James M. Macoun, containing many new or hitherto unrecorded species (nearly all the new species were previously described by Professor Greene in *Pittonia*) ; 'The Cryptogamic Flora of Ottawa,' by John Macoun, including 220 species of mosses, 55 liverworts and 152 lichens; 'Notes on Some Ottawa Violets,' by James M. Macoun, devoted to the seven species of violets formerly included under the familiar *Viola cucullata* of the older mammals. These species are *Viola septentrionalis*, *V. macounii*, *V. venustula*, *V. cucullata*, *V. cuspidata*, *V. affinis*, *V. populifolia*. Admirable plates accompany the descriptions and make clearer the characteristics by which they are distinguished.