Act," providing national support for at least one such station in every state. At the time of his death, in 1909, there were fifty-six of these stations in the United States with an average annual income almost eleven times that of the Connecticut station at its foundation, to say nothing of the enormously increased research activities of the United States Department of Agriculture. Truly the little seed planted in 1853 had become a tree.

In the organization and development of these new institutions the standards established by Professor Johnson and the experience gained at the Connecticut station were material factors in bringing about the success which was so soon attained. At the outset, the American stations were of necessity largely occupied with the analysis and valuation of fertilizers. From the very start, however, original research formed a part of the program of the Connecticut station, while the increase of the state appropriation in 1882 and the assignment to the station in 1887 of part of the Hatch Fund, enabled investigation to be extended to wider fields. Throughout, the work of this station, both under Professor Johnson's administration and that of his successor, has been characterized by the same sane method, the same absence of sensationalism and the same confidence in the power of good works which characterized the fertilizer analyses of the early fifties.

In 1896, Professor Johnson became professor emeritus, and in 1900 resigned the office of director of the experiment station, occupying for a year longer the position of advising chemist which was created for him. He passed peacefully away July 21, 1909, having retained to the last his keen interest in the progress of science and in the problems presented in the development of modern chemistry.

Such was, in barest outline, the active life of an unusually gifted man who had a high conception of the obligations of the scientist to the public. No brief review can do justice to the delightful personality of the man as those knew it who were closely associated with him, and which pervades the book like an aroma, revealing itself especially in the judiciously chosen extracts from his correspondence which constitute the major portion of the volume. His biographer has done her work, not only with filial piety but with notable discrimination and restraint and with marked literary ability. In these days of intense emphasis upon the practical, no more inspiring or elevating volume can be recommended to the student of agriculture who is looking forward to a career as teacher or investigator than this record of a life which attained success in the best sense through the unselfish consecration to the public service of the rigid training and high ideals of the genuine man of science.

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Researches on Irritability of Plants. By J. C. BOSE. London and New York, Longmans, Green and Co. 1913. Cloth, 15 x 23 cm. Pages xxiv + 376; 190 illustrations, largely graphs. Price $2.50.

Physiologists who are familiar with the earlier electrophysiological researches of Bose will be interested in his recent volume on certain kinds of plant responses, which recounts the results of an application of his very ingenious methods to new kinds of problems. Research workers will find this book replete with novel ideas and novel ways of attaining quantitatively comparable measures of plant irritability. The author is not primarily dealing with the fundamental problems of protoplasmic phenomena; his work may be said to concern itself, rather, with the physics of the plant as a whole, or with that of its organs, than with the component cell happenings to which recent physiological inquiry seeks to reduce these aggregates. It is somewhat remarkable that animal physiology, on the one hand, has attained a high state of development along the lines here dealt with (with its studies of the superficial phenomena of muscle contraction, blood pressure, the electrophysiology of muscle and nerve, etc.), and that the findings of this sort of study form a very

considerable basis for the more fundamental researches that prevail at the present time, while plant physiology, on the other hand, has come to the study of cell phenomena largely without passing through this stage. Electrophysiology plays but a very subordinate rôle in plant physiological texts, and refined quantitative studies of the grosser movements of the plant have never had great vogue. It is in just this general field that Bose's writings lie, and his results, while not calculated now to arouse great interest *per se,* must be taken into serious account and will doubtless throw valuable indirect light upon the more fundamental lines of study now mainly attracting attention.

The author makes, at the very beginning of the book before us, a suggestion which has great possibilities in physiological research. "Is there any means by which we might find out whether a given influence has contributed to the plant's well-being or the reverse, whether it has left it more or less excitable," etc.? "The relation between the stimulus and the response would thus form a gauge of the physiological condition of the organism" (pages 1 and 2). In physiological terms, the *tone* of the organism as a whole is here in question, and the quantitative relations between stimuli and response are to be drawn upon as measurements of tone. Now, it is just this matter of the physiological condition of organisms for the estimation of which we most require objective methods; it has been the practise of students of plant physiology to define their organisms in the terms of the older descriptive work, assuming, for example, that a number of given plants are the same thing physiologically because they exhibit the same superficial shapes, sizes, etc., to the taxonomist. Two workers may employ the same species or variety in the taxonomic sense, but their organisms may be very different physiologically and they may disagree entirely on the sort of response attained with a given stimulus or set of environmental conditions. If some of the dimensions or characteristics of the internal condition of the organism used in an experiment could be measured and stated, much would be done to avoid many of the wasteful arguments which so often diminish the efficiency of physiological workers. From Bose's suggestion it appears to the reviewer that the methods of the present work may be of value in the physiological definition of our plant subjects, just as similar methods in animal physiology are proving of value to medical diagnosticians.

The subject-matter of this book defies useful treatment in a review. A few statements may, nevertheless, be made here. Most of the study has to do with the familiar paratonic movement of the leaf of Mimosa, though other organs receive attention at particular points. To obtain an automatic graph ("phytogram" or "plant script") of this response, a thread is attached to the petiole and to a light bent lever above, the latter counterbalanced and carrying a writing point which moves over a smoked surface. A glass plate, allowed to fall by clock work, furnishes the receptive part of the apparatus. To avoid too great friction it was found necessary to make the recording point vibrate in a plane at right angles to the receiving plate, and it was possible to arrange the vibrations so as to mark time. Thus a record with this "resonant recorder" appears as a line indicated only by a series of dots on the smoked surface, the distances between the dots indicating small units of time. The apparatus is so ingenious and delicately efficient as to excite wonder and admiration in and for itself. Stimuli of several kinds are employed, applied to the leaf in various ways. The most frequently used are thermal (obtained electrically, so as to be quantitatively controlled) and electric. The graphs show a short latent period, a period elapsing between beginning and end of the fall of the leaf ("apex time") and a long recovery period. Besides these three time periods is of course to be considered the amplitude of the movement, in characterizing the nature and intensity of the response.

Some of the topics experimentally dealt with are the following—the terms themselves show the parallelism between the plant phenomena here described and the familiar ones

called by the same names in animal physiology: additive effects; influence of load, temperature and intensity of stimulus; fatigue; staircase response (quite like that of muscle); tetanization; death spasm (it looks as though a means were here offered for determining when death of a tissue ensues); influence of gases on excitability; effect of intensity of stimulus, of fatigue and of temperature on latent period; effect of various conditions on velocity of transmitted impulse; positive and negative galvanometric and turgidity responses (each stimulus gives rise to both, but the weaker positive—erectile—response is quickly followed and masked by the stronger negative—"contractile"—one); polar effects, etc. Polar effects are very thoroughly investigated. "With feeble current the kathode excites at make and not at break. The anode excites at neither make nor break," etc. The variation of polar reaction under tissue modification, as with age, etc., is studied, with important results. In the later chapters of the book *Biophytum* and *Desmodium gyrans* are employed in studying multiple and automatic (autonomic) responses. The pulsations of *Desmodium* leaves are thoroughly investigated.

The first two sentences of the last paragraph of Bose's book sum up the general outcome of his studies as well as can be thus briefly done: "In surveying the response of living tissues we find that there is hardly any phenomenon of irritability observed in the animal which is not also found in the plant. The various manifestations of irritability in the plant have been shown to be identical with those in the animal."

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SOCIETIES AND ACADEMIES

ANNUAL CONVENTION OF THE UTAH ACADEMY OF SCIENCES

THE seventh annual convention of the Utah Academy of Sciences was held at Salt Lake City, December 26 and 27, 1913, in the chemistry lecture room of the University of Utah.

In all, three sessions were held—the first beginning at 8 o'clock Friday evening, the second at 9:30 o'clock Saturday morning, and the closing session at 2 o'clock Saturday afternoon.

From the standpoint of business transacted, this convention of the academy will rank as one of the most important in its history. A committee was appointed to take steps toward the publication of a bi-monthly magazine under the auspices of the academy. Another committee was appointed to look after the entertainment of distinguished scientists who may be visiting in Salt Lake City, and to assist them should they desire to investigate features of the region of scientific interest in their especial lines.

Professor C. W. Porter, of the Utah Agricultural College, was elected to fellowship. Miss Florence Knox, Professor Christian D. Steiner, Professor Jakob Bolin, Professor Franklin O. Smith, Dr. Helen I. Mattill, all of the University of Utah; Dr. Fred W. Taylor and Mrs. Amelia R. Taylor, of Provo; Willard R. Harwood and N. W. Cummings, of Salt Lake City; Professor George R. Hill, Utah Agricultural College, Logan, and H. R. Hagan, Logan, were elected to membership.

The constitution was amended to provide for a permanent secretary-treasurer.

The following are the officers for the ensuing year:

President—Professor Marcus E. Jones, Salt Lake City.

First Vice-president—Dr. Harvey Fletcher, B. Y. U., Provo.

Second Vice-president—Dr. C. N. Jensen, B. Y. C., Logan.

Permanent Secretary-treasurer—A. O. Garrett, High School, Salt Lake City.

Councillors-at-large—Dr. A. A. Knowlton, U. U., Salt Lake City; Dr. Joseph Peterson, U. U., Salt Lake City, and Dr. F. L. West, U. A. C., Logan.

The following papers were read at the annual convention:

"The Question of Valency in Gaseous Ionization," by Dr. Harvey Fletcher, B. Y. U., Provo.

"Community Life among Insects" (the presidential address), by Dr. E. G. Titus, U. A. C., Logan.

"Some Metabolic Effects of Bathing in Great Salt Lake," by Dr. Helen I. and Dr. H. A. Mattill, U. U., Salt Lake City.

"Corn under Irrigation," by Dr. F. S. Harris, U. A. C., Logan.

"Practical Experiments with Root-borers," by