what they ought to do. They were simply left alone to do as they thought best, and they did so. "By their fruits ye shall know them."

It seems to me that the Carnegie Institution is to be greatly congratulated on the methods of its work.

GRAHAM LUSK

TINGIIDÆ

MR. PARSHLEY (SCIENCE, Vol. LVI, p. 754) credits me with too much. I can not lay claim to any "novel idea." And I wish here to state only three facts.

First: Words like Aphiidæ have been used for a long time. See Aphiidæ, "Traité d'Entomologie Forestière," Barbey, 1913.

Second: We are here concerned not with Latin usage and with professors' opinions but with the International Rules of Zoological Nomenclature.

Third: Article 4 of these rules simply states that *idæ* is to be added to the stem. No latitude is given us. It is the writer's humble opinion that any desired modification or interpretation of this article should be made by the International Commission and not by an individual.

A. C. BAKER

BUREAU OF ENTOMOLOGY

SCIENTIFIC BOOKS

The Cactaceæ: Descriptions and illustrations of plants of the Cactus family. By NATHANIEL L. BRITTON and J. N. ROSE. Vol. III. Carnegie Institution Publication No. 248. 1922.

What Professor Wheeler irreverently calls silo and saleratus botanists, and doubtless others, often sniff in private over "the futility of spending fortunes in monographing the Cactaceæ," or any other group of plants. Whiffs of such sedition occasionally reach the outside world, but scarcely penetrate the costly shrines wherein such deeds are accomplished. It is not the purpose of this review to make the appearance of the third sumptuous volume of this greatest of modern monographic ventures either the occasion, or the excuse, to fan into a breeze the undeniable zephyr of discontent that comes from botanists who feel that a great deal too much money is being spent on them. And they are unquestionably costly, as rumors of fourteen thousand dollars spent for illustrations alone on this third volume amply testify—not to speak of the still greater cost of exploration, cultivation of specimens and years of study. So that each of these four volumes, judged by a botanical gauge of wealth, costs a fortune, and by any gauge the four of them are perhaps the most expensive of any recent botanical publication.

The completion of this volume, however, with its twenty-four gorgeously colored plates and two hundred and fifty half-tones, does make a good occasion to reiterate that the enterprise is one that only modern conditions could have produced. For in the hurly-burly of the modern educational and scientific world, the three things that can produce such a work are hard to find, and to find them together is all but a miracle. They are knowledge and the opportunity to increase it, time and money. The authors supplied the first, bringing to their work long experience, and having, in the equipment of the New York Botanical Garden, unexampled opportunity to increase it. Freedom from the rush to produce "research" as a manufacturer might produce a foundry was made possible by the far-sighted policy of the Carnegie Institution in providing sufficient money over a long period of years. The whole enterprise is one where cooperation between great institutions and individuals, willing to sink institutional or personal aims for the sake of the work, has been a conspicuous success.

As to the botanical merit of the volumes, specialized journals will no doubt report upon that in due season. All the botanical world knows that the authors are the greatest living students of the Cactaceæ, and their studies have led them into every part of North and South America, to which the group is practically confined. As something over half a million square miles of North America is a desert country, the necessity of knowing pretty accurately the cactus constituents of this flora is obvious. These volumes are, therefore, the foundation upon which all ecological, phytogeographical and physiological work on desert cacti must be based. And in spite of gentle zephyrs of doubt, such as were noted above, the logic of their preparation and the excellence of the product must be as great a satisfaction to their collaborators as the volumes

are undeniably a great contribution to botanical literature.

NORMAN TAYLOR
BROOKLYN BOTANIC GARDEN

SPECIAL ARTICLES

THE CYTOLOGY OF VEGETABLE CRYSTALS

WHILE studying the mucilage cells of cacti, chiefly *Opuntia* spp., I noted the occurrence of calcium oxalate druses both in these cells and in the ordinary parenchyma cells of pith and cortex. The wording of my description[1] exposes me to criticism as to the correctness of my observations, if Professor Jeffrey's views, as expressed in a recent issue of this journal,[2] are found to be well founded. As to this, however, I venture to express doubt, and therefore oppose my own observations to those of Professor Jeffrey.

He states that in "ginkgo," the "Juglandaceæ, Cactaceæ, Begoniaceæ, Geraniaceæ, etc.," the druses (spheroidal aggregates of calcium oxalate crystals) are formed by the laying down of "crystals . . . about the nucleus, when the protoplasm of the element is still dense and unvacuolated." "The crystals in fact constitute a spiny casing which surrounds the nucleus and protoplasm." "The nucleus is therefore central to the crystal itself. Corresponding to this fact there is only one druse in each cell." My own observations lead me to the following results:

The growing buds of ginkgo are indeed very favorable material, the young leaves especially. I have had no difficulty in finding young cells in which minute druses, in diameter less than one third that of the nuclei, could be seen lying in the protoplasm, there being at this time only small sap vacuoles, or none. If a vacuole is present, the druse is usually not found lying free within it and I think it doubtful if a druse ever originates in the sap vacuole, free from the protoplasm. On this point it must be conceded that the current texts do not speak convincingly, while some of the illustrations (*e. g.*, Frank's, see Stevens, "Plant Anatomy," p. 206) are, I think, a bit too diagrammatic, if not fanciful. As the druse increases in size it may come to occupy the greater portion of the total volume of the cell, when the nucleus may be seen crowded against the cell wall and between projecting crystals of the druse. There may then be no sap vacuole recognizable, the druse being clothed with dense protoplasm, with the nucleus as described. Later, in many cases, the protoplasm disappears so that a large druse may then be seen surrounded only by a thin cell wall which has never acquired the thickness of the walls of the living neighboring cells, and which also separates from them more or less. On treatment with hydrochloric acid, the middle of the druse is dissolved more readily than the peripheral larger crystals, and if the action of the solvent is stopped, so as to make the identification of the druses still unequivocal, one can then see some granular material, derived, I believe, from the druse, but which does not stain as protoplasm. Sometimes small flocks of material, staining as protoplasm, may be seen, probably relict of the once living protoplast. I conclude that there is some colloidal material imprisoned within the druse, and this may be essential in conditioning the growth of a crystal aggregate—as the mucilage of raphide cells may do also—but that this colloidal material is the protoplast occupying the central portion of the druse I deny. Accordingly, it is no matter of surprise to find two druses in a cell—though Professor Jeffrey appears not to have found this to be the case. This happens occasionally in narrower cells, in which the nucleus may be seen; it may happen ensconced between two druses. These latter may be of the same, or different—even widely different—sizes. When very small, the projecting crystals may not be easily distinguishable.

The granular, colloidal material above referred to can be seen in many of the larger druses even before treatment with acid, and appears to have a more or less radiating form. This it may be is the material regarded by Buscalioni (*vide* Tunmann, "Pflanzenmikrochemie," p. 139) as mucilaginous.

At any rate the presence of some such material within or intimately associated with the crystalline mass has already been observed; but whether there is a specific body which

[1] *Amer. Journ. Bot.*, 6, 156-166, April, 1919.

[2] E. C. Jeffrey: "The Cytology of Vegetable Crystals," SCIENCE, N. S., 50, 566-567, May 26, 1922.