adjudged. A depositional equivalent has been found in a neighboring State. In central Arkansas, the unconformity is now discovered to be represented by no less than 20,000 feet of sediments. The real values of the new relationships of the horizons are better shown by a rectified general geological section of the Carboniferous of the region.

WESTERN INTERIOR SECTION.

Series.	Terrane.	Thickness.
Oklahoman.	Not here differentiated.	1,500
Missourian.	Cottonwood limestone.	10
	Atchison shales.	500
	Forbes limestones.	25
	Platte shales.	105
	Plattsmouth limestones.	30
	Lawrence shales.	265
	Stanton limestones.	35
	Parkville shales.	75
	Iola limestone.	30
	Thayer shales.	50
	Bethany limestones.	75
Des Moines.	Marais des Cygnes shales.	250
	Henrietta limestones.	50
	Cherokee shales.	200
Arkansan.	Not here differentiated.	20,000
Mississippian.	Not here differentiated.	1,500

Of these five series of the Carboniferous system, the Oklahoman represents the so-called Permian; the next three the coal measures; and the Mississippian the Lower Carboniferous. Measured in sediments, the horizon of the Thayer crinoids is far up in the Carboniferous, instead of being near the base. At Kansas City, where the crinoids were found, the Arkansan is represented by the hiatus—a period of vast erosion in that locality.

Charles R. Keyes.

THE PROCESS OF FREEZING IN PLANTS.

In text-books on plant physiology, and in original articles upon the effects of freezing in plants, or on allied subjects, so far as is known to the writer, there is no working explanation of the process. The matter is referred to by Detmer and Moor, Vines, Haberlandt, Sorauer, Sachs and many others, but without detailed explanation.

The cells bounding the intercellular spaces (in leaves) are always moist on the side in contact with the air. As cooling goes on, all the tissue, contents of the cells and all, are contracting; but when a temperature of about 4° C. is reached, the water content of the cell begins to expand, while the wall goes on contracting. This forces more moisture into the intercellular spaces. When the freezing point for water is reached, ice crystals begin to form outside of the cell in the intercellular spaces. The ice crystals will form first here, because water has a higher freezing point than the solution within the cell. As cooling goes on, and further crystallization takes place, the freezing water gives off its latent heat which tends to keep, for a considerable time, the cell contents from freezing. The crystallizing water without the cell extracts water from the cell by an inherent attractive force which the molecules of the mother crystal have for its liquid. This force is the cause of further water being drawn from the cell to build up the crystal of ice, and this attractive force is a similar one to that which causes plasmolysis in the case of the common experiment with cells of *Spirogyra* and a solution of sodium chloride. The ice forms first in the intercellular spaces and continues to form there until the cell contents become frozen.

If a leaf so frozen be subjected to a higher temperature, water will be formed in the intercellular spaces, resulting in a translucent, 'water-logged' appearance of the tissue of the leaf. If, however, the temperature be raised very gradually, the cells will probably resorb the extracted water as rapidly as it is formed, resulting in no permanent injury to the leaf. Sachs found that the leaves of the beet and the cabbage frozen at from — 4° C. to — 6° C., and thawed in air at 2 to 3° C., were killed, while when thawed slowly in water at 0° C. they survived.

If the temperature be low enough and be continued long enough a permanent injury would result, for then the cell-contents would become solidified.

In the case of the experiment with a beet partially scooped out and subjected to a freezing temperature, the formation of ice in the cavity is brought about in exactly the same way as it is in the intercellular spaces in leaves of plants, excepting on a larger scale. If the

freezing of the beet be brought about slowly, water may be drawn into the cavity from a considerable distance from cell to cell within the tissue.

Certain strong non-poisonous solutions, when applied to the cut ends of the petioles of leaves, produce a similar translucent effect in the tissue of the blades of leaves, as is shown by the writer in a paper now in process of publication.

JAMES B. DANDENO.

BOTANICAL MUSEUM OF HARVARD UNIVERSITY, May 22, 1901.

THE AMERICAN MATHEMATICAL SOCIETY.

A PRELIMINARY circular, which has just appeared, describes the arrangements which have been made for the summer session of the American Mathematical Society to be held at Cornell University, Ithaca, N. Y., during the week beginning on August 19th. The meeting proper, for the transaction of business and the presentation of papers, will take place on the first two days, while the remainder of the week will be occupied by a colloquium. Two courses of lectures by Professor Oskar Bolza, of the University of Chicago, and Professor E. W. Brown, of Haverford College, are announced as the basis for this colloquium, which will be the third organized by the society in connection with its summer meetings. Professor Bolza's subject is 'The calculus of variations, in particular Weierstrass's discoveries.' The principal object of the course is to give a detailed account of the solution of the simplest type of problems, in its historical development, with special emphasis upon the contributions of Weierstrass and his followers. A summary review of the peculiar features of the more general problems is also intended. Professor Brown will lecture on 'Modern methods of treating dynamical problems and in particular the problem of three bodies.' The object of this course is to set forth some of the later attempts to introduce more rigor into the methods of solving dynamical problems, mainly the researches of Poincaré. The course will be chiefly descriptive, in showing the principles of the methods, the mathematical difficulties which arise, and the results which have been obtained. Among the subjects treated will be the following: the various forms of the differential equations of dynamics, the existence of integrals, solutions by infinite series, periodic solutions, stability and instability. In neither course will special knowledge of the subject be presupposed.

SCIENTIFIC NOTES AND NEWS.

DR. IRA REMSEN, professor of chemistry in the Johns Hopkins University since its foundation in 1876, has been elected president of the University.

A COMMITTEE, consisting of Professors Ira Remsen, J. S. Ames and W. H. Welch, has been appointed at the Johns Hopkins University to arrange a memorial to the late Professor Henry A. Rowland.

M. LAVERAN, the French army surgeon who discovered the malaria parasite, has been elected a member of the Paris Academy of Sciences in the section of medicine, filling the vacancy caused by the death of M. Potain. In the third ballot M. Laveran received forty, and M. Ch. Richet twenty-six, votes.

AT a recent meeting of the National Geographic Society, the by-laws were so changed as to merge into the single class of 'members' the two classes hitherto designated 'resident members' and 'non resident members,' and also to increase the board of managers from 18 to 24, including six not resident in the District of Columbia. The board has now been completed by the election of the following non-resident members: Professor William M. Davis, Cambridge; Mr. Russell Hinman, New York; Professor Angelo Heilprin, Philadelphia; Dr. Daniel C. Gilman, Baltimore; Professor Rollin D. Salisbury, Chicago, and Professor George Davidson, San Francisco.

DR. G. A. HANSEN, of Bergen, the discoverer of the bacillus of leprosy, will celebrate his sixtieth birthday in July, and it is proposed to present him with an international testimonial made up of small subscriptions. These may be sent to Dr. Sandberg, Bergen.

PROFESSOR EDWARD F. MORLEY, of Adelbert College, has been appointed a delegate from the United States to the International Conference of Weights and Measures, which is to be held in Paris during September.