

around the pore stretches less than the thinner parts of the cell wall.

This series of changes does not take place if the leaves are wilted. If wilting occurs after the guard cells are open the point of equilibrium is shifted so that the sugar changes to starch and the guard cells close. If the leaves remain turgid the guard cells remain open until darkness and close by a reversal of this series of changes. These changes can be made to go in either direction by experimentally changing the acidity of the guard cells.

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A BOTANICAL SPELLING MATCH

"CAN one imagine a botanical or an entomological spelling match?" "Could 'aster' or 'grasshopper' be drawn in recognizable detail by the contestants?" These are two of the questions asked by Dr. C. E. Waters in *SCIENCE* for November 24.

The writer can not answer for entomology but he can for systematic botany. Formulæ may be used to express the structure of flowers. For example, the flower formula of the Bora-

ginaceæ can be written $Ca^{⑤} Co^{⑤} P^{④}$, of the Liliaceæ $Ca^3 Co^3 S^6 P^3$. In this way formulæ may be written for families, genera and species. The flower formula expresses concisely the following features: number of parts in the flower, kinds of parts, arrangement of parts, something of the shape of the flower and the position of the flower in evolution. On hearing or reading such a formula the structure and shape, as well as the taxonomic position, of the flower are immediately brought to mind. Surely it would not be difficult to imagine a spelling match in a class in systematic botany!

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SCIENTIFIC BOOKS

A GUIDE BOOK OF THE GEOLOGICAL SURVEY

THE fifth volume of the series of guide books of the western United States which our national

geological survey has been producing in the last seven years is as attractive as its predecessors.

It deals with that portion of Colorado and Utah which is served by the Denver and Rio Grande Western Railway, a region visited by more tourists than any other portion of the country west of the Mississippi. To them this book would be a boon if it could be brought to their notice. Being an official publication bound in a grey paper cover it is not apt to be as widely known as it would be were it published by an enterprising publishing house, bound in bright red cover, placed in all the book stores, and mentioned in many magazines and circulars. But it is worthy of wide publicity because of its excellence. Campbell has beaten Baedeker at his own game. The book is charmingly written, beautifully illustrated and furnished with excellent maps.

The main part of the text presents in clear manner the succession of events which have resulted in the present Colorado and Utah. It does not go back just a few months or years, but begins far enough back to include the whole history of the region from earliest archæan times till 1922 A. D.

The foot notes in fine print contain the side lights on the main circuit. They deal with economic statistics, histories of individuals, explanations, definitions and illustrations of the main theme and are hardly less interesting or important than the main theme.

The central topic—the present constitution, structure and topography of the country and the forces which have produced them—is presented in a clear manner as entertaining as the talk of a clever man at a club. University students in that part of the country will no doubt use the volume as a text book since it may be obtained of the United States superintendent of documents for one fourth the price necessarily charged for the average geology, and since it is so practical and interesting. The average geological text book has the disadvantage of jerking the mind from one part of the world to the other for illustrations. This book illustrates point after point right on the spot. In the regions treated the reader can see nearly every principle of the earth's history strikingly set forth.

To apply geology to a definite locality is an