certain universities; and the organization of adult education as an integral part of the work of the universities.

DR. DAVID P. BARROWS, president of the University of California, on May 16 presented his resignation as president.

DR. GEORGE P. CUTTEN, president of Acadia University, Nova Scotia, has been elected president of Colgate University at Hamilton, N. Y.

DR. ALAN MARA BATEMAN has been appointed associate professor of economic geology at Yale University, with assignment to the Sheffield Scientific School.

DISCUSSION AND CORRESPONDENCE

THE CYTOLOGY OF VEGETABLE CRYSTALS

THE title of this note involves, especially to those of mechanistic outlook, an apparent contradiction in terms. It is very generally asserted that crystals of calcium oxalate, the commonest type found in plants, are formed by the ordinary processes of crystalization in the fluid of the cell sap, occupying the vacuolated center of the mature vegetable cell. It is the intention of the present preliminary statement to call attention to the fact that this description of the mode of formation of vegetable crystals is in all respects profoundly inaccurate. The commonest type of crystal of calcium oxalate is the compound crystal or druse which prevails from the Ginkgoales to the Angiospermæ. The most favorable object for study is Ginkgo. Longitudinal and transverse sections through the mature tissues as well as through the growing points show the presence of druses in great numbers, and often of large size, particularly in the pith, cortex, and phloem. In spite of the presence of such crystals, sections as thin as five micromillimeters can easily be cut off the tissues. When these are stained and mounted the crystals stand out with particular clearness as occupying practically the entire lumen of the cell.

When measures are taken to remove the calcium oxalate by the use of solvents, the presence of an organic matrix in the crystals becomes obvious, as a residuum maintaining the form of the crystals after the lime compound itself has disappeared. If sections are made in proximity to the growing point, a very interesting situation becomes apparent. The cells in this region are densely filled with protoplasm and those which are to produce crystals are easily recognized from the first. They contain, as do other young cells, a central nucleus and it is obvious in demineralized sections that the crystals are laid down about the nucleus, when the protoplasm of the element is still dense and unvacuolated. From the very beginning the crystals occupy practically the whole lumen of the cell and more or less protoplasm surrounds the nucleus which is the organic center of the druses. The crystals in fact constitute an irregular spiny casing, which surrounds the nucleus and protoplasm. Even in very large and old crystals indications of the presence of a nucleus can frequently be demonstrated by appropriate methods.

Similar observations have been made in the case of crystals of oxalate of lime, so commonly present as a metabolic byproduct in the Dicotyledons. Particularly favorable objects for such studies are the Juglandaceæ, Cactaceæ, Begoniaceæ, Gerianiaceæ, etc. In angiospermous species the nucleus becomes obscured at a very much earlier stage of development of the crystal and not infrequently the latter does not occupy the whole lumen of the cell as in Ginkgo.

Apparently the most interesting fact in the present connection is that compound crystals or druses are not formed in plants by the ordinary routine of crystallization in the watery fluid of the cell sap, as has been universally stated and supposed; but by the action of living protoplasm and under the influence of the nucleus, which is central to the crystal itself. Corresponding to this fact there is only one druse in each cell. A further surprising fact is that the cell-wall in many cases grows in size to accommodate the crystal under the influence of protoplasm contained within the crystal itself. This condition constitutes a very serious problem for those mechanists who attempt to explain all the properties of living beings by the so-called artificial cell and colloidal chemistry. The crystal-containing cells

of the seed-plants do not appear to fit into this conception in even an approximately satisfactory manner.

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RIVER-BANK MOVEMENTS DUE TO THE EARTH'S ROTATION

TO THE EDITOR OF SCIENCE: In SCIENCE, March 17, Mr. O. E. Jennings calls attention to a difference between the east and west banks of one of the short streams flowing across the almost flat southern slope of Long Island: "An almost imperceptibly sloping eastern bank and a western bank rising quite steeply." Mr. Jennings says, "This peculiar situation has long been accepted rather generally by geologists and physiographers as due to the *westerly deflection* of streams by the earth's rotation" (italics mine). The statement just quoted is doubtless an accidental slip. The fact is that because of the earth's rotation longitudinal rivers in the northern hemisphere erode their right banks—whether they flow south or north.

In offering another hypothesis for those Long Island banks Mr. Jennings makes the justifiable suggestion that the stream in question—as regards length and velocity—is incompetent for securing through the earth's rotation the effects observed. If it has a narrow channel and carries a small volume of water these items should be added to its other disqualifications. And finally, the latitude of Long Island—less than half the distance from the Equator to the North Pole—is none too favorable for river-bank movement due to the earth's behavior as a heavenly body.

In this connection reference may here be made to the unquestionable evidence of the earth's rotation afforded by the Yenisei. There is probably nowhere else in the world any other stream so favorable for the study of bank movement on a vast scale. This for three reasons: This Siberian river is closely longitudinal; of great size; and so far north that a considerable section of it lies within the Arctic Circle. Dr. Fridtjof Nansen, who has sailed up this river from its mouth to Yeniseisk—a distance of more than a thousand miles—writes of the very pronounced contrast between the east and west banks. "Every one going up the Yenisei must be struck with the remarkable difference between the east and west sides of the river. While the flat land on the east is comparatively high and falls abruptly with a steep bank to the river, a steeply sloping beach and relatively deep water outside, the land on the west is strikingly low. The steep river bank is not high, and the bare sandy beach slopes quite gently to the water, with a shelving bottom far beyond it, so that as a rule it is not easy to approach this shore in a ship or boat." And again, "It is striking how much higher and steeper the east bank is than the west everywhere along here."

Dr. Nansen's observations[1] of this northern river and his discussion of what he saw forms a distinct contribution to the literature of the subject of such river-bank movements as are to be referred to the rotation of the earth.

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THE DECOMPOSITION OF TUNGSTEN

SIR ERNEST RUTHERFORD, in the statement copied from *Nature* in the April 21 issue of SCIENCE, was in the very difficult position of being "asked to say a few words" in comment on a brief cablegram to the London *Times* which was itself based on an exaggerated Associated Press dispatch to American newspapers concerning the preliminary and oral but as yet unpublished report of Mr. Clarence E. Irion and myself on the apparent decomposition of tungsten at extremely high temperatures. He mentions the need of a complete report before intelligent comment is possible, but proceeds to make three points which are properly conservative and entirely correct but, as will be seen from the complete paper upon its publication in the *Journal of the American Chemical Society*, which are all irrelevant. In view of the publicity given to Sir Ernest's comments in *Nature* and in SCIENCE, however, a few words in reply are needed.

The first point is that the appearance of helium has often been observed in electrical

[1] Nansen, Fridtjof: *Through Siberia, the Land of the Future*, 71, 72, 73, and 157, 158, etc.