1912 [by Capt. C. S. Wright] at Cape Evans was 983·003 from the July series and 983·004 from the August series. . . . Commander Bernacchi . . . obtained the values 982·970, 982·979, and 983·025. . . . These values may be compared with the standard value 981·292 at Potsdam. . . ."

This suggests the existence of a substantial difference between the results of the two British expeditions. This does not, however, seem to be the case. The final value for *g* derived from Commander Bernacchi's observations (National Antarctic Expedition 1901–1904, "Physical Observations," Table V., p. 34) was 982·985. In obtaining this, for reasons stated in the discussion, half weight only was allowed to the third pendulum. Thus the *apparent* difference between the results from the two expeditions is $0{\cdot}018_5$ cm./sec.$^2$. But this is accounted for by the fact that while Capt. Wright accepted for *g* at Potsdam—on which all the Antarctic results really depend—the value 981·292 quoted by your reviewer, I accepted 981·274 on the authority of Sir Gerald Lenox-Conyngham (Roy. Soc. Proc. A, vol. 78, p. 245). The difference between these two assumed values is 0·018 cm./sec.$^2$. Thus the values obtained by the two Antarctic expeditions—not exactly at the same place—really agreed to six significant figures. Though not assigning the importance that Paley did to "undesigned coincidences," I think this coincidence is remarkable enough to be worth mentioning. It would be of interest in this connexion to know what value the German experts assign now to *g* at Potsdam.

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June 30.

## The Translocation of Carbohydrates in the Sugar Maple.

THE conclusion of Prof. H. H. Dixon (NATURE, February 23, 1922, p. 236, and October 21, 1922, p. 547) that the translocation of organic substances could take place through the vessels of the xylem appears to have created a mild sensation among plant physiologists. Attention, however, does not seem to have been directed to the behaviour of the sugar maple, which furnishes important evidence in this connexion.

The sugar maple or rock maple (*Acer saccharum*, Marsh) is well known in Eastern Canada and New England as the source of the maple syrup and maple sugar of commerce. To obtain the sap, a small hole about half an inch in diameter is bored into the sapwood to a depth of about 3 inches, at a height of about 4 feet above the ground-level at the time when the snow is melting at the beginning of spring. A metal tube is inserted into the hole, and a small bucket is attached into which the sap drops from the metal spout. The sap as it oozes from the tree is colourless, but becomes brown on concentration by boiling.

A bulletin entitled "The Maple Sap Flow," by Jones, Edson, and Morse, published by the Vermont Agricultural Experiment Station in 1903, gives a full account of observations and experiments on this subject. Some of the conclusions reached by these investigators are as follows: The sap contains about 3 per cent. of sucrose and also small amounts of proteids, mineral matter, and acids, mainly malic acid. The greatest sap flow does not occur at the time when the most water is contained in the tree. More sap flowed at the opening of the sugar season than at the close when more water was in the tissues. There is no evidence that the water is forced into the maple trunk by root pressure at any season.

Warm sunny days and freezing nights form ideal sugar weather. On good sap days the pressure from above downwards is greater than that from below upwards. The flow generally, but not always, parallels the pressure. Later in the season and upon poor sap days, upward pressure and flow exceed those from above. The fastest run of sap from a tap hole during the experiments was 17·7 c.c. per minute. Jones and Orton, using lithium chloride, had previously determined the rate of flow in either direction as 2 to 6 inches per minute.

Some observations on this subject were made during the spring on two trees, numbered respectively 185 and 3389, growing in the Botanical Garden at Ottawa. In order to determine whether the flow of sap came from the bark or the wood, several small branches on each tree were chosen which projected horizontally or inclined slightly upward. These were cut across at right angles to their length on March 1, 1923, the cut end was smoothed and the bark peeled off close to the wood for a distance of about an inch from the cut end. In tree No. 185 sap commenced to flow on April 11 and ceased on April 27, while in tree No. 3389 the respective dates were April 17 and May 14. In no instance was sap observed to exude from the cut surface of the bark. Several observations were made on the rate of flow of sap from a cut branch together with records of temperature, etc. In tree No. 185 a branch measuring 15 mm. in diameter (including the bark) was selected, while in tree No. 3389 the diameter of the branch was 18 mm. The number of drops falling per minute was counted; the diameter of each drop was about 5 mm. Some of the results were as follows:

April 19, 1923. Tree No. 185. Time, 3.40 P.M. Shade temperature = 50° F. Fifty-one drops fell in five minutes.

April 20, 1923. Tree No. 185. Time, 3.15 P.M. Shade temperature = 77° F. Sunny. Two counts gave 8 drops each per minute.

April 16, 1923. Tree No. 3389. Time, 3 P.M. Shade temperature = 38° F. Snow was still lying round the base of the tree. Sap was flowing at the rate of 18 drops in five minutes. Another count gave 17 drops in five minutes.

April 19, 1923. Tree No. 3389. Time, 3.55 P.M. Shade temperature = 50° F. Some snow still around the base of the tree. Drops were falling at the rate of 115 in five minutes. Another count gave 22 drops in one minute.

A microscopical examination of twigs cut from each tree on March 1 and on May 7, on which date the buds were swelling, showed abundant starch grains in the medullary rays but none in the pith on both occasions. The amount of water present in several small branches half an inch in diameter taken from each tree was also determined for the above dates, when it was found that each tree contained 1 per cent. less water on May 7 than it did on March 1.

The spring flow of sap was also observed in five other species of maple growing in the Botanical Garden here. In *Acer Myabei* on April 14 an icicle measuring 9 inches long and $1\frac{3}{4}$ inches wide at the base was observed hanging from a broken branch.

While some points in the metabolism of the maple sap may still be obscure, it is abundantly evident that the vessels of the wood are able to carry the sugar solution in both directions in the tree-trunk and that the rate of flow is comparatively rapid.

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July 11.