threads, the relation of sieve-tubes in the parasite Cuscuta to those of its host, etc.

A particularly interesting piece of evidence in favour of the phloem view is to be found in a paper by Schneider-Orelli on a leaf miner of the apple (*Centralb. f. Bakt.*, II Abt., 1909, 24, p. 158; cited by Schroeder, *Zeitschr. f. Bot.*, 1911, pp. 770-71). Where the caterpillar had bored through strong veins the destruction of the tissue affected the storage of starch in the leaf. It was found that the destruction of the xylem and the greater part of the bundle sheath could be brought about without causing an accumulation of starch in the distal part of the leaf (by interrupting the conducting channels), but that injury to the phloem resulted in an accumulation of starch proportional to the extent of the injury. Similarly, it has been found by Quanjer and others that the phloem necrosis associated with the leaf-curl of potatoes interferes with the transport of starch from the leaf, with the result that the tubers fail to develop properly.

It may also be noted that in a paper on the biology of a species of Aphis, Davidson (*Annals of Applied Biology*, v. 1921, p. 60) states that the phloem of the vascular bundles is especially sought for by these insects when tapping the plant for nutriment, and that this point is undergoing further investigation.

Although the case of Lepidodendron undoubtedly presents difficulties (a possible solution was suggested by me, *loc. cit.*, pp. 307-9), the difficulties are scarcely less on Prof. Dixon's view in the case of various aquatic plants which normally produce no xylem or only discontinuous traces.

I look forward with very great interest to the results of the work which Prof. Dixon and Mr. Ball have in hand, as the problem is a long-standing one. An urgent need is for more data on which to elaborate a theory of translocation in general.

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Pricked Letters and Ultimate Ratios.

IT is the purpose of this note to point out an earlier use of "pricked letters" to denote infinitesimals and of the phrase "prime and ultimate ratios" than is recorded in our histories of mathematics.

It will be recalled to mind that as early as 1665 Isaac Newton used "pricked letters" to denote fluxions or velocities. He did not permit his notation to appear in print before 1693. Between 1693 and 1704 the dot came to be used by other English writers, but nearly all of them departed from Newton in interpreting $\dot{x}$ to mean, not a velocity, but an infinitely small quantity or increment, like the Leibnizian dx.

Recently the present writer has noticed that as early as 1668 Nicholas Mercator used the dot to mark an infinitesimal, in an article in the Philosophical Transactions,[1] which contains illustrations of his "Logarithmotechnia" of 1668. Mercator uses in his article the letter I with a dot over it to indicate an infinitesimal difference.[2] This date, 1668, marks the earliest use of the dot for this purpose known to us. It was long before Newton allowed any part of his fluxions to appear in print and before Leibniz began to develop his calculus. Mercator could not have regarded the dot simply as part of the letter I, for (though the type is not quite clear) it appears to have been the capital letter. Moreover, in computing logarithms he writes the dot over a number (64, for example), to serve as a reminder that 64 is the coefficient of a power of an infinitesimal.

In the same article Mercator used a terminology[3] resembling the famous phrase "prime and ultimate ratios," used by Newton in his "Principia," 1687 (Bk. i. Sec. i. Lem. xi., Scholium). Mercator writes "ratiunculae" or little ratios, while Newton uses "rationes" or ratios. Mercator says "primae et ultimae ratiuncularum," Newton speaks of "rationes primae," and "rationes ultimae." We observe also that in 1695 Edmund Halley (Phil. Trans.) used "ratiuncula," and that in 1706 William Jones ("Synopsis Palmariorum," p. 174) made the statement: "Let $\dot{x}$ be a Ratiuncula or Fluxion of the ratio 1 to $1+x$."

It appears on the surface as if there had been a giving and receiving. In his letter to Oldenburg, dated October 24, 1676, Newton mentions Mercator's "Logarithmotechnia," but he nowhere refers to Mercator's illustrative article from which we have quoted. That article is of minor importance. It is not reproduced in the abridged edition of the Philosophical Transactions, and is not mentioned in the biographical sketches of Nicholas Mercator that we have seen. Whether in private Newton had used the phrases "prime ratios" and "ultimate ratios" on or before 1668 we have no means of knowing. He first used them in print in 1687. For some years after 1660 Mercator lived in London, where he became a member of the Royal Society. Newton became a member in 1672. As Newton lived at Cambridge (except during the Plague, when he was in the country), the chances that Mercator received information of Newton's work through private channels are reduced. After 1669 both Mercator's "Logarithmotechnia" and his illustrative article were in print. It is therefore possible that Newton may have adopted the phrase "prime and ultimate ratios" from Mercator. Newton's dot-symbol antedates Mercator's.

FLORIAN CAJORI.
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Einstein's Aberration Experiment.

IN the *Sitzungsberichte* of the Berlin Academy of December 8 last, which has recently come to hand,

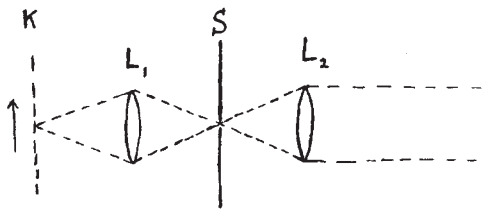

FIG. 1.

Einstein describes an ingenious arrangement which he suggests might serve to decide between the

[1] Phil. Trans., London, vol. 3, p. 759 ff. Reprinted in Maseres, *Scriptores Logarithmici*, vol. I, p. 231.

[2] The passage in question relates to the use of the infinite series for finding log $(1\pm\dot{1})$ and is as follows: "Quare posito maximo termino = 1, et parte infinitissima (sic) differentiae = $\dot{1}$, et mensura rationis minimae itidem $\dot{1}$." He gives proportions like the following:

"$1-\dot{1}.1::\dot{1}.\dot{1}+\dot{1}\dot{1}+\dot{1}^3+\dot{1}^4$, etc."

Here the fourth term of the proportion is an infinite series; ratio is indicated by (.) placed at the lower edge of the line.

[3] The passage in Mercator is, " . . . non nisi semisse primae et ultimae ratiuncularum a prioribus terminis contentarum, id est, ratiuncula minori, quam quae ullis numeris exprimi possit."