recently, Keeble, Nelson, and Snow[2] performed experiments in which positive geotropic curvatures were obtained when unstimulated root tips were stuck on to stimulated root stumps which had been decapitated before stimulation.

It was pointed out to me by Dr. T. A. Bennet-Clark that opposite stimulation of root and stump would give more exact information of the functions of tip and stump in the perception of gravity. Accordingly, four parallel series of experiments, using seedlings of *Vicia Faba*, were carried out, as follows (about forty seedlings being used in each series):

(*a*) A number of roots were decapitated and placed in a horizontal position in a damp chamber for 3-4 hours, after which these roots were re-headed with tips from other roots which had also been stimulated in a horizontal position for the same period of time. These tips were stuck on in such a manner that the side of the tip which had been lowest during stimulation was exactly *opposite* the side of the stump which had been lowest during stimulation (Fig. 1, *A*). The roots were then placed in a vertical position.

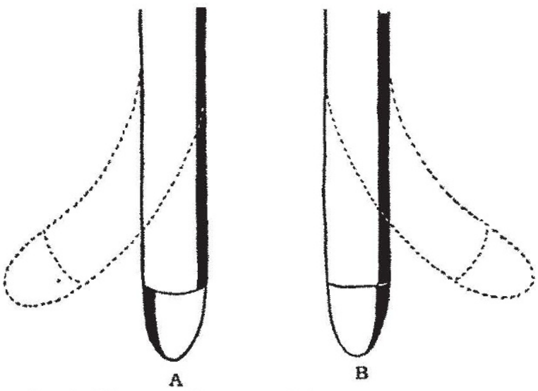

FIG. 1.—*A*—Diagrammatic representation of a root in series (*a*). *B*—Diagrammatic representation of a root in series (*b*). The thick black line indicates the under side of the root during stimulation, and the dotted line indicates position of root after response.

(*b*) A number of roots were treated similarly to those in series (*a*), but the new tips were stuck on in such a manner that the side of the tip which had been lowest during stimulation was on the *same* side as the side of the stump which had been lowest during stimulation (Fig. 1, *B*).

(*c*) The roots from which the tips had been cut to re-head series (*a*) were also placed in a vertical position.

(*d*) Normal roots were stimulated and then placed in a vertical position.

The results obtained were as follows:

Series *a*. 67·5 per cent curved towards the side of the tip which had been lowest during stimulation.

15 per cent curved towards the side of the tip which had been uppermost during stimulation.

17 per cent remained straight.

Series *b*. 70 per cent curved towards the side which had been lowest during stimulation.

30 per cent remained straight.

Series *c*. 63 per cent gave a positive curvature.

37 per cent remained straight.

Series *d*. 70 per cent gave a positive curvature.

30 per cent remained straight.

From the results of series (*a*), it can be seen that, in decapitation experiments with *Vicia Faba*, the root tip has a much stronger directional influence on response to gravity than the root stump. The results of series (*a*) are seen to be significant, since the percentage response obtained in the control series (*b*), (*c*), and (*d*) is of the same order as that in series (*a*).

It is hoped that a full account of this work will be published later. LILIAN E. HAWKER.

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[1] *Ber. deut. bot. Ges.*, **42**, 1924.
[2] *Proc. Roy. Soc.*, B, **105**, 1929.

Molecular Structure of Cellulose and of Amylose

FROM the purely chemical properties of cellulose, recent experiments have enabled us to gain further information as to the nature and length of the cellulose chain. It will be remembered that earlier work from this Laboratory showed that cellulose contains repeated units of β-cellobiose, and the present views on the intimate structure of this polysaccharide are based on these researches published in 1925–27.

We have now obtained evidence that cellulose, in the form employed in our experiments, is a straight chain of limited length containing not more than 100 cellobiose units or 200 glucose units. This represents a molecular weight of about 30,000. The lower possible limit is 25,000.

This result was attained by preparing in one operation completely methylated cellulose from its acetate and submitting this to hydrolysis with aqueous hydrochloric acid at 0°. The cleavage products from 200 gm. yielded almost quantitatively the methylglucosides of the methylated glucose fragments, and by fractional distillation under diminished pressure, using a special column, a yield of 0·55 per cent of tetramethyl methylglucopyranosides was obtained. The remaining fractions consisted only of 2 : 3 : 6-trimethyl methylglucosides.

Control experiments were conducted by distilling an artificial mixture of 2 : 3 : 4 : 6-tetramethyl methylglucosides and 2 : 3 : 6-trimethyl methylglucosides and determining the quantity of the former which was separable. This was found to be almost quantitative.

It is clear, therefore, that in our specimen the cellulose chain was not endless, since to the extent indicated above, one of the glucose units formed an end group containing one more methyl residue than did the intermediate members. It was thus possible to assay this component by quantitative methods, and hence determine the molecular size of the cellulose derivative. This evaluation corresponds very nearly to that derived by Svedberg's method for the high polymeric forms of a number of natural products. Dr. H. Machemer has collaborated with me in this work.

Applying this procedure also to the amylose portion of starch, we have found that a much larger proportion (5 per cent) of the tetramethyl glucose component can be recovered by hydrolysis of completely methylated amylose. This result, on the above interpretation, corresponds to only ten maltose units or twenty α-glucose units in a chain which is not endless, or a molecular weight of not more than 4000. This conclusion is unexpected, and we are led to believe that similar experiments on the amylopectin portion of starch will yield a much higher value for the molecular size. Dr. E. L. Hirst, Dr. M. M. T. Plant, and Miss Wilkinson are specially identified with this work.

We are reserving the application of this experimental method to glycogen, inulin, xylan, and other types of polysaccharides, and this work is already in hand. W. N. HAWORTH.

University, Birmingham,
Feb. 18.