

FRIDAY MORNING SESSION

October 27, 1961

The session convened at 8:45 a.m. with Mr. Dennison Morey, Director of Research, Jackson & Perkins Co., Pleasanton, California, as Moderator. This session was concerned with the propagation of certain selected plants.

PROPAGATION OF SELECTED PLANTS

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Last night as I was putting the finishing touches on my introductory remarks I suddenly realized that I had assumed an obligation that was going to be difficult to fulfill. In moderating the final symposium I have accepted, at least in principle, the responsibility for trying to pull things together. Since we are going to deal with practical solutions to difficult problems, my task as I see it, is to try to provide some basis for integrating the vast amount of knowledge which has been presented to us here so far so that it can be evaluated on the basis of experience. This is not an easy thing to do. We have had a unique privilege here. We have stood on the frontiers of science with genuine pioneers, a rather hazardous place for green troops, as the inadequacy of some of my own questions attest.

Fortunately, my prepared remarks seem to be still appropriate. I feel that a tremendous volume of fundamental information has been presented at this Conference. If all of this information is put to work, many of our problems will be solved. Moreover, if we consider what our speakers tell us today in light of what has been said so far, I believe we may discern a few answers to general questions as well as finding practical solutions to specific problems. I also believe that this pragmatic integration can best be made if we employ the convenience of a working hypothesis. It is my own opinion, at the moment, that the recent concept of auxin action proposed by Kefford and Goldacre (1) provides the best available means of making this integration. However, please bear in mind that this idea is not universally accepted. For a detailed rebuttal see Hillman and Purves (2).

Under no circumstances will I enter into the controversy. I don't know enough to do so. However, I do know that the scheme of Kefford and Goldacre best fits my own observations of plants. Consequently I feel that this idea may be useful in thinking about propagation problems, both for myself and, since you are also primarily concerned with application, it may also prove of interest and value to you.

Rooting Difficult Materials

I believe that the auxin concept and the hypotheses proposed by Kefford and Goldacre (1) are of immense practical as well as theoretical importance to the plant propagator. An appreciation of the possible interactions and intricate competition for precursors among auxin (IAA), kinin (kinetin), 6- (furfurylamino) -purine and n, 6- benzyladenine (Shell 4901) and gibberellin, has fundamental significance for all of us.

I believe this even though we cannot exclude the probability that new agents will be discovered which influence growth and development in plants and which will further alter our thinking in these matters. To my mind perhaps the greatest value which these ideas have for us is the stimulation they provide. No discovery in plant science is without practical value. Moreover, progress has invariably been realized first and in greatest degree by those who apply theory to practice to the fullest possible extent. Very often great practical strides have been made by simply appraising theory in the light of current practice. This approach is particularly productive if one makes a well informed effort to understand the way in which an especially difficult practical solution integrates with all known facts and enlightened theory.

This morning, therefore, we have an unprecedented opportunity. We are going to hear about techniques which have proven fruitful in the rooting of especially difficult materials. I think that if this information is carefully considered in the light of auxin theory, and facts obtained empirically (for which see the references at the end of this article) plus our own experiences, we will have assembled the essential tools for impressive progress.

I should not be surprised to see all plant materials that root at all from cuttings, easily rooted in high percentages within ten years time. Certain extremely difficult clones of walnuts, stone fruits, maples and other recalcitrant materials such as Gymnocladus, Eucalyptus, etc., now budded or grafted or grown from seed, not because of faulty root systems or transplanting factors, but because of rooting problems, will soon become as easy to root as Chrysanthemums and Coleus.

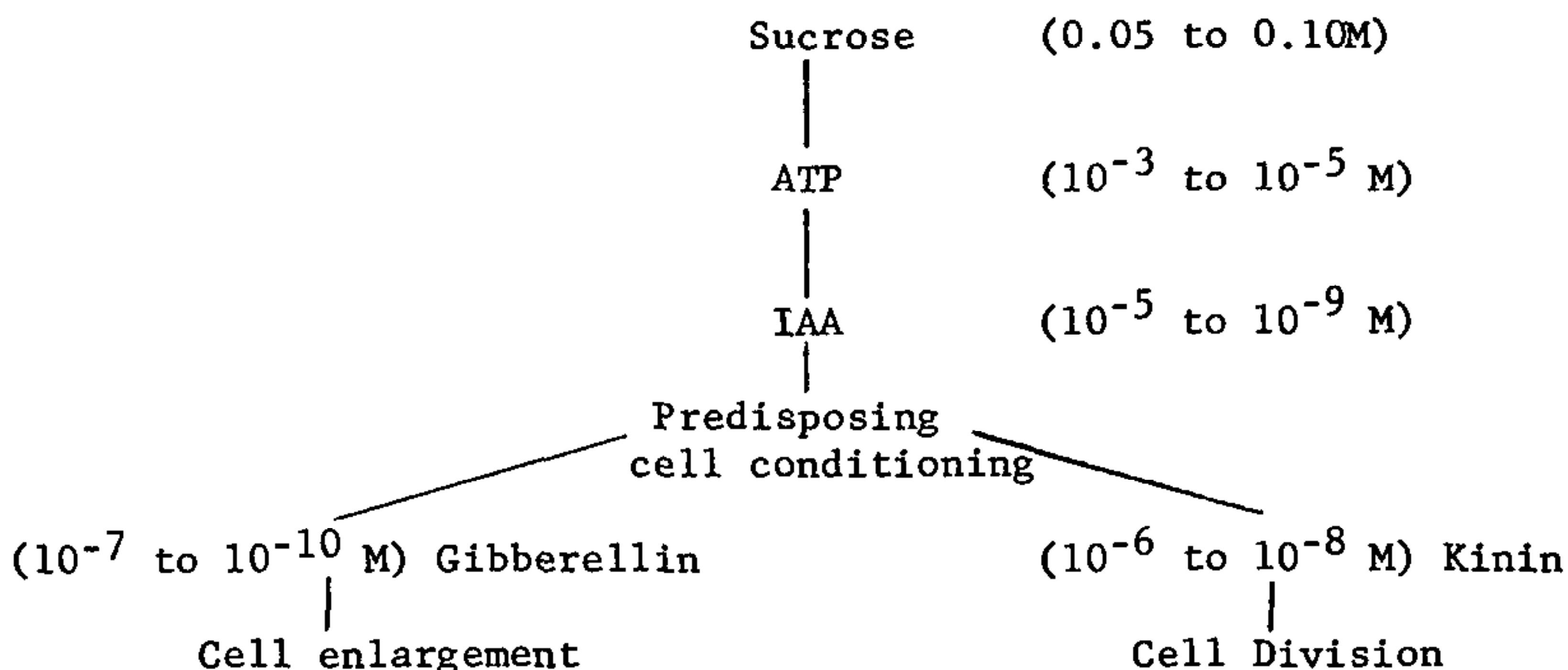
Perhaps it would be well to consider the hypothesis of Kefford and Goldacre for just a moment. They feel that the evidence presently available indicates that IAA and other related auxin-like materials such as NAA and IBA mediate both the action of gibberellin and kinin (kinetin). Since the former is concerned with cell enlargement and elongation and the latter with mitosis and cell division, these authors conclude that there may be, and often is, competition between these two independent systems for IAA and/or the systems involved in its utilization.

Obviously, cell enlargement (gibberellin) can proceed only so far in the absence of cell division (kinin) and vice versa. See Sachs and Lang (3). Neither can function without energy and auxin (IAA). We can conclude that the function of IAA and other similar compounds in rooting is to enable the gibberellin and kinin-mediated processes to proceed.

There appear to be three basic systems that must function before rooting can occur. Perhaps the most troublesome one at the moment, as far as rooting is concerned, is the kinin system. I think practical experience strongly supports this view.

In materials that root poorly, auxins are often of little value, but once rooting has been initiated the roots grow. Well, the problem seems to be one of root initiation; i.e., the origination of new root meristems. Basically this must be a problem of cell division and differentiation. If Kefford and Goldacre are correct, a kinin system must be involved.

They propose the following reaction paths:



I feel that it would be a serious error to identify kinin with any specific substance. I feel each morphogenic phenomenon in plants may have its own special kinin. Instead of equating kinetin or benzyladenine as the kinin in question in rooting, until we know for sure, I would prefer to think of it as "Rhizogen".

My final preliminary thought in this connection is induced by the suspicion that the relative efficacy of the several auxin-like materials and the various mixtures of these materials (e.g. IBA with 2, 4, 5-TCPA) may very well depend upon the predisposing of the overall system in such a way that the proper equilibria are achieved.

Literature Cited

- (1) Kefford, N. P., and P. L. Goldacre. 1961. The changing concept of auxin. *Am. Journ. Bot.* 48: 643-650.
- (2) Hillman, W. S., and W. K. Purves. 1961. "Does gibberellin act through an auxin-mediated mechanism". *Plant Growth Regulation*. Iowa State Univ. Press, pp. 589-600.
- (3) Sachs, R. M., and Anton Lang. 1961. "Shoot histogenesis and the subapical meristem: the action of gibberellic acid, Amo-1618, and maleic hydrazide". *Plant Growth Regulation*. Iowa State Univ. Press, pp. 567-578.

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