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AUXIN ACTION AND CELL ELONGATION:
A RATIONAL APPROACH.

A thesis presented in partial
fulfillment of the requirements for the degree
of Doctor of Philosophy
in Plant Physiology at
Massey University.

Pauline Elizabeth Penny

1970

To the courteous and well willing readers:

Although my paines hav not beene spent (courteous Reader) in the gracious discoverie of golden Mines, nor in the tracing after silver veines, whereby my native country might be enriched with such merchandise as it hath most in request and admiration; yet hath my Labour (I trust) been otherwise profitably imploied, in descrying of such a harmelesse treasure of herbes, trees, and plants, as the earth frankly without violence offereth unto our most necessary uses. Wherein though myne art be not able to contervaile Nature in her lively portraitures, yet have I counterfeited likeness for life, shapes and shadows for substance. Yet may my blunt attempt serve as a whetstone to set an edge upon sharpey wits, by whom I wish this course Discourse might be both fined and refined. Faults, I confesse have escaped, some through defects in my selfe to perform so great a work, and some by means of the greatness of the Labour, being void of friends to beare some part of the burden. I trust that the best and well minded will not rashly condemne me. Therefore accept this at my hands (loving countrymen) as a token of my goodwill.

John Gerard, 1597

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A B S T R A C T

A method was developed to measure every minute the growth of a single segment excised from the elongating region of a plant. The method was used to determine the short term kinetics of growth in response to auxin addition. The method is not dependant on the use of hollow coleoptile tissue and the results are plotted as a growth rate against time. The technique has a resolution on order of magnitude higher than those in current use.

The results show that there is a latent phase before auxin-induced increase in elongation rate occurs. After this latent phase, there is a rapid rise in rate to a maximum followed by a decrease and then usually a rise to a second maximum. Three hypotheses for explaining the growth rate curve are considered.

It was found that neither RNA nor protein synthesis were required for the initial action of auxin but that protein synthesis became necessary within a few minutes after auxin addition. The apparent half-life of the protein whose synthesis is stimulated by auxin is about 12 min. This short half life suggests that, after the synthesis of the protein, there is a limited time during which it can act with auxin to increase elongation. A model which incorporated these results has been proposed and its relationship to the three hypotheses for explaining the growth rate curve is discussed.

A C K N O W L E D G E M E N T S

I wish to record and acknowledge with thanks the continual encouragement of Prof. R.G. Thomas for research in his department in general and his interest in this project in particular.

Some of the research in this thesis was carried out in the laboratory of Dr. J.W. Lyttleton at Applied Biochemistry Division, D.S.I.R. It was Dr. Lyttleton's generous sharing of his laboratory space and equipment which made some aspects of this work feasible. During my five month sojourn at D.S.I.R., I had many stimulating discussions with many of the professional staff. For this I would like to thank them and I would like to thank in particular Prof. J.K. Heyes who also taught me the techniques of RNA extraction and acrylamide gel electrophoresis; Dr. M. Clarke who also taught me the use of MAK column chromatography and cellulose acetate

electrophoresis; and Dr. W.S. Sutton who also taught me the use of hydroxyapatite chromatography.

The ingenuity and helpfulness of Mr.C. Saggars and Mr.M. Mannering in the design and construction of the chamber are gratefully acknowledged. I also wish to thank Dr. J.P. Kerr and Dr. H. MacPherson, of Plant Physiology Division, D.S.I.R. for the light intensity measurements.

I would like to thank Mrs. K.F. Miller and Mr. D. C. Marshall for doing some of the later kinetic experiments and Mr. C.N. Wyatt for technical assistance.

Ideas are very seldom generated in vacuo and perhaps the best way for generating them is in conversation with others. I wish to thank the many people who have contributed in such an indirect manner. In particular, the many "discussions" with Vasil Sarafis, who sees problems from a botanist's point of view, have helped clarify ideas and suggested new lines of approach; to my husband, David, who sees the forest in spite of the trees; and to Kathy Miller who is very astute at finding errors in reasoning and typescript.

To Ann and Kim I can only say thank-you - you will understand in a few years.

TABLE OF ABBREVIATIONS

| | |
|-------|--------------------------------|
| DNA | deoxyribonucleic acid |
| DOC | deoxycholate |
| IAA | indol-3-yl-acetic acid |
| NA | numerical aperture |
| RNA | ribonucleic acid |
| m-RNA | messenger RNA |
| r-RNA | ribosomal RNA |
| s-RNA | soluble RNA |
| TCA | trichloroacetic acid |
| 2,4-D | 2,4-dichlorophenoxyacetic acid |