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

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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 inriched 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 frankely 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 an 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.

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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