LETTERS TO THE EDITORS

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A Relation between the Effects of Gibberellic Acid and Indolylacetic Acid on Plant Cell Extension

IF gibberellic acid, a metabolic product of the fungus *Gibberella fujikuroi*, is applied to growing plants, it commonly causes a marked increase in stem internode length, mainly attributable to cell extension. Some dwarf varieties of pea are particularly sensitive, visible increases in internode-length resulting from doses of 0·01 μgm. gibberellic acid per plant[1]. Auxins applied in a similar way have little or no effect; but, since auxins do induce cell extension in some circumstances, comparisons of the physiological effects of auxins and gibberellic acid have been made. It has been shown[2] that gibberellic acid is inactive or of low activity in many conventional auxin assays, does not stimulate rooting of cuttings, does not inhibit development of lateral buds in decapitated plants, does not prevent leaf abscission and neither stimulates nor seriously inhibits root growth; similar observations have been made[3] with the related material gibberellin *A*. Thus the spectrum of activity of gibberellic acid and gibberellin *A* is very different from that of the auxins; Kato[3] has concluded that the mode of action is different from that of the auxins, but we[2] have preferred to leave the question undecided in the absence of more positive evidence. We have recently made some observations which throw light on the relation of auxin activity to that of gibberellic acid.

We have used a technique adapted from Galston and Baker[4]; 5-mm. sections, cut from unextended internodes of dwarf peas (var. Meteor) grown in light, are floated on phosphate buffer (*p*H 6·1), incubated at 15° C. in a light intensity of 800 ft.-candles, and the longitudinal extension of the sections measured after 24 hr. In a series of nineteen experiments with various concentrations of gibberellic acid in the buffer, only small increases in extension were produced, rarely reaching statistical significance; similar results were obtained when 2 per cent sucrose was added to the medium. Indolylacetic acid does induce extension of the sections, the optimal concentration being 10 μgm./ml. In the presence of such concentrations of indolylacetic acid, an extra effect is produced by gibberellic acid; the results of three experiments are summarized in Table 1. Factorial analysis of the data in each case showed a highly significant interaction between gibberellic acid and indolylacetic acid. Thus the former depends on the presence of the latter for its effect on cell elongation in the system studied, which would appear to approximate to conditions in the normal intact pea plant fairly closely. Furthermore, in so far as in the presence of optimal concentrations of indolylacetic acid still further growth is induced by gibberellic acid, it seems reasonable to conclude that its mode of action is different from that of indolylacetic acid, though in some way they are interdependent.

Table 1. MEAN LENGTH (MM.) OF PEA INTERNODE SECTIONS AFTER 24 HR. GROWTH IN BUFFER WITH ADDITIONS OF SUCROSE, INDOLYLACETIC ACID (10 μGM./ML.) AND GIBBERELLIC ACIC (10 μGM./ML.); RESULTS OF THREE EXPERIMENTS, ALL RESULTS BEING MEANS OF THIRTY REPLICATES

Sucrose (per cent)	Other additions	I	II	III
None	None	6·8	6·8	6·6
	Indolylacetic acid	8·2	8·6	8·0
	Gibberellic acid	6·5	7·0	6·5
	Indolylacetic acid + gibberellic acid	9·0	9·1	8·3
2	None	6·9	7·6	6·6
	Indolylacetic acid	9·0	9·1	8·1
	Gibberellic acid	6·9	7·2	6·5
	Indolylacetic acid + gibberellic acid	9·6	9·9	10·0
Standard error		0·17	0·15	0·15

The concentration of gibberellic acid (10 μgm./ml.) used in the experiments just described is relatively high. In the presence of 10 μgm./ml. indolylacetic acid, a significant extension response is produced by 0·01 μgm./ml. gibberellic acid and a nearly maximum response by 0·1 μgm./ml. Even at 100 μgm./ml. gibberellic acid shows no toxic effects. Gibberellic acid significantly increases extension in the presence of indolylacetic acid in concentrations as low as 0·1 μgm./ml., but the greatest response is obtained in combination with 10 μgm./ml.

Though gibberellic acid alone does not significantly increase extension in light of internode sections from pea plants grown in light, it does induce elongation in darkness of sections from etiolated plants[2,5]. This interesting difference is as yet unexplained.

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Distribution of Adrenaline and Noradrenaline in the Hen Adrenal Gland

RECENT studies have indicated that the mammalian adrenal medulla contains both adrenaline and noradrenaline, which can be demonstrated both chemically and histochemically. In the adrenals of several mammalian species, specific chromaffin cell groups have been shown to be carriers of most of the adrenomedullary noradrenaline, while the other cells contain predominantly adrenaline[1]. Studies on vertebrates other than mammals are rather few, but a similar secretory dualism has been demonstrated in the adrenal medulla of the lizard[2]. In this animal the cord of chromaffin cells embracing the cortical tissue peripherally is apparently specialized in the secretion of noradrenaline, whereas islets of chromaffin tissue intermingling with the cortical cells themselves apparently contain predominantly adrenaline. To my knowledge no report of the distributions of noradrenaline and adrenaline in the adrenals of birds has been published.

In the course of an investigation of the adrenals of various domestic animals, I observed that the