Growth-regulating Substances in *Laminaria agardhii*

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Growth-regulating substances have been reported from nearly all major groups of the plant kingdom, but in the lower forms little is known of their role in the differentiation of thalli. The presence of a large, differentiated lamina in *Laminaria agardhii* Kjellman, formed from a well-developed intercalary meristematic region, suggested to the author the possibility that IAA (indoleacetic acid) might behave as a growth-regulating substance in this brown alga just as it does in the embryonic apical parts of vascular plants.

Along the southern New England coast this kelp develops laminas which are commonly over 5 ft in length and 8 in. broad. Young laminas are thin and homogeneously flattened, but mature laminas are thick, with peripheral parts undulating from alternate depressed and raised portions. For this investigation, plants were collected during June and July of 1948 from several habitats in the vicinity of Woods Hole, Massachusetts.

According to Fritsch (*1*), the principal formative region in all laminarias is situated in the transition zone between stipe and lamina. From this region 120 disks of living tissue of *Laminaria*, measuring 6 mm in diameter, were used in test series A. Series B consisted of 120 disks from the middle and distal third of laminas; and series C, of 120 disks from the distal third and thin periphery of laminas. An effort was made to get random samples from plants with laminas at a developmental stage just prior to formation of the undulating periphery. The 120 disks of each series were distributed in lots of 20 to liter beakers containing sea water and various concentrations of IAA. A temperature range of 18–21° C was maintained by setting the beakers in running water. Each beaker was covered by a glass plate to reduce contamination and evaporation. Disks were blotted between filter paper before each weighing, which was done on an analytical scale accurate within 1 mg. The blotted weights of disks in any one series were rather uniform.

From Table 1 a gradient for tolerance of IAA is shown by the response of cultured tissue. The rate of poisoning and disintegration in IAA solutions varies greatly with each series, being greatest in series A, less in series B, and least in series C. Apparently IAA is supplied by the alga itself and the disks injured come from regions already containing so much IAA that addition of any more produces an injurious excess.

Because of these results a hormone test was performed. The bending of the *Avena* coleoptile for detecting the presence of growth-promoting auxins in vascular plants is a standard procedure, but except for the method used by Leonian (*2*) with fungi, the author does not know of any procedure for demonstrating the presence of minute quantities of auxin in algae. A crude extract in petroleum ether was prepared by soaking dried macerated tissue from the formative region. The ether extract was mixed with lanolin paste and evaporated. Oat seeds were germinated in the dark between moist filter paper and the inside of liter beakers. The crude extract of kelp was applied by a fine glass needle. After 8 hr, but more pronounced after 17 hr, the following results were noted: Seedlings with kelp extract applied on the outside bent toward the center of the beakers; those with extract applied on the inside bent away from the center, and those without extract treatment and those treated with lanolin only continued to grow straight.

TABLE 1

PERCENTAGE GAIN OR LOSS IN WT OF DISKS FROM *Laminaria agardhii* AFTER 16 DAYS' CULTURE IN INDOLEACETIC ACID SOLUTIONS

IAA in sea water mg/l	Series A Total wt 3554 mg	Series B Total wt 1490 mg	Series C Total wt 920 mg
0 (control)	+13% (healthy)	+10% (healthy)	+ 5% (healthy)
0.1	disintegrated	+16% (healthy)	+ 8% (healthy)
1.0	disintegrated	+ 5% (healthy)	+23% (healthy)
2.0	disintegrated	-20% (fair)	-10% (fair)
5.0	disintegrated	disintegrated	-15% (fair)
10.0	disintegrated	disintegrated	-30% (unhealthy)

The results of this investigation indicate that growth substances, similar to or the same as indoleacetic acid, formed in the meristematic region of *Laminaria agardhii*, may be at least partly responsible for the mature pattern of growth in the lamina, and that the natural growth-regulating substances in this alga have some physiological properties in common with those of higher vascular plants.

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References

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