

Capacitation of Mammalian Spermatozoa

It has been previously shown that spermatozoa of the rat and rabbit require to undergo some form of physiological preparation within the female reproductive tract before they are capable of fertilizing eggs¹. This preparatory process, known as capacitation, has hitherto lacked more precise description.

Recently, we have obtained evidence that the acrosome is removed from the spermatozoon head before the entry of the spermatozoon into the egg. Modification and loss of the acrosome have been observed in living spermatozoa of the golden hamster, guinea pig and Libyan jird recovered in the fluid from the Fallopian tubes and in the cumulus oophorus. Further, spermatozoa found embedded in the zona pellucida of guinea pig and golden hamster eggs, lying free within the perivitelline space of golden hamster and jird eggs, and entering the vitellus of golden hamster and Chinese hamster eggs all lacked their acrosomes. In no instance was a spermatozoon that retained its acrosome found within any part of an egg. These and other observations indicate that, in the normal course of events, removal of the acrosome probably occurs at the surface of the zona pellucida.

Clearly the acrosome is not involved in the penetration of the egg, and its function is probably restricted to assisting the passage of the spermatozoon through the cumulus oophorus. Loss of the acrosome exposes a specialized region of the nuclear membrane, the perforatorium, and we believe that this is the organelle that enables the spermatozoon to make its way through the zona pellucida.

We therefore conclude that acrosome removal is a prerequisite of fertilization, and that the induction of those changes that lead to detachment of the acrosome represents capacitation.

A preliminary report of these investigations was presented at the ninth International Congress for Cell Biology, 1957; a detailed account is being submitted for publication elsewhere.

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¹ Austin, C. R., *Aust. J. Sci. Res.*, Ser. B., 4, 531 (1951); *Nature*, 170, 326 (1952). Austin, C. R., and Braden, A. W. H., *Aust. J. Biol. Sci.*, 7, 179 (1954). Chang, M. C., *Nature*, 168, 697 (1951); 175, 1036 (1955). Noyes, R. W., *Western J. Surg. Obstet. Gynec.*, 61, 342 (1953).

Effect of Gibberellic Acid on Fruit Set and Berry Enlargement in Seedless Grapes of *Vitis vinifera*

ALTHOUGH an increased set of fruit as a result of gibberellic acid or related compounds has been observed in tomatoes¹, there are insufficient data concerning the effect of this chemical on enlargement of fruit in any plant.

In several experiments performed at Davis, California, in 1957, an increase in fruit set and/or fruit size resulted from treatment with gibberellic acid. The potassium salt of gibberellic acid, supplied by Merck and Co., contained about 80 per cent active ingredient. 'Dreft' was used for a wetting agent. The procedure for determining average weight per berry, percentage of total soluble solids, and percentage of acid has been described previously².

Girdling (ringing) has long been used to induce fruit set and enlargement in Black Corinth grapes, although in recent years it has been partially replaced by applications of 4-chlorophenoxyacetic acid^{3,4}. In one experiment flowering clusters on mature Black Corinth vines were dipped momentarily on May 31 into solutions containing gibberellic acid at 0, 1, 5, 20, 100 or 500 p.p.m., ten replicates per treatment. When the fruit was collected on July 30 the regulator at 1 p.p.m. had resulted in a fairly good set of large berries, but the clusters were straggly owing to occurrence of small undeveloped berries. The compound in the range 5-500 p.p.m. resulted in an excellent set of enlarged berries (Table 1). Heavier clusters and elongated berries resulted from higher concentrations of the compound. The percentage of total soluble solids was usually comparable even though the treated clusters were heavier. The regulator decreased the percentage of total acid.

Table 1. EFFECT OF GIBBERELIC ACID ON YIELD AND COMPOSITION OF BLACK CORINTH AND THOMPSON SEEDLESS GRAPES

Treatment, concentration (p.p.m.)	Av. wt./cluster (gm.)	Av. wt./berry (gm.)	Total soluble solids (per cent)	Acid (per cent)
Black Corinth				
0 (not girdled)	91.6	0.26	23.4	1.75
1 (not girdled)	206.5	0.47	23.6	1.50
5 (not girdled)	258.0	0.53	23.9	1.29
20 (not girdled)	366.6	0.78	21.3	1.34
100 (not girdled)	391.3	0.99	23.0	1.26
500 (not girdled)	500.7	1.31	22.6	1.30
Thompson Seedless				
0 (not girdled)	0.66	1.59	22.4	0.79
5 (not girdled)	0.95	1.91	23.2	0.73
20 (not girdled)	1.46	2.71	18.9	0.83
50 (not girdled)	2.15	3.15	17.6	0.94
0 (girdled)	1.10	2.26	23.0	0.74

Girdling has been shown to increase size of berry in Thompson Seedless². On June 11, after berry set was completed (berry shatter stage), mature, un-girdled Thompson Seedless vines were heavily sprayed with solutions containing gibberellic acid at 5, 20 and 50 p.p.m., four vines per treatment. One group of vines was un-girdled and unsprayed, and another girdled but unsprayed. Fruit was harvested on August 26. The weight of clusters and berries sprayed with the regulator at 5 p.p.m. was greater than those from unsprayed and un-girdled vines, but smaller than those from unsprayed but girdled vines (Table 1). Very large clusters and berries resulted from treatment with 20 and 50 p.p.m. The percentage of total soluble solids was lowest and percentage of acid highest in fruit sprayed with compound at 50 p.p.m., probably as a result of the greater weight of fruit in this treatment.

Elongation of stems and hastening of flowering, previously reported for other plants^{4,5} occurred in grapes. Accelerated coloration in red grapes, and in ripening, occurred in many experiments not reported here.

It has been suggested that levels of naturally occurring auxins are of importance in fruit set and enlargement^{6,7}. Perhaps naturally occurring gibberellic acid or related compounds may be concerned in fruit set and enlargement on grapes under discussion herein. Berry size of varieties with seeded berries was not increased appreciably. Perhaps seeds produce sufficient quantities of the compound to result in almost maximum berry enlargement. The occurrence of 'gibberellin-like' substances in many seeds⁸ suggests an investigation be made on the regulator in grape seeds.