Technical Papers

Feather Papilla Stimulation by Progesterone*

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The presence of progesterone or a physiologically equivalent substance has recently been found in the blood of the fowl. Although in the hen there appears to be no equivalent of the mammalian corpus luteum, the presence of the corresponding secretion is clear (*1*). A new and interesting role may now be ascribed to progesterone in the fowl, the activation of the resting papilla of the feather.

Hens of comparable age, breed, and state of maintenance were defeathered in similarly selected regions of the breast and neck feather tracts. Eleven hens received, by intramuscular injection, 20 mg each of a progesterone solution (*2*), which is slowly absorbed and has a prolonged physiological action. Three comparable hens served as controls.

Egg production in the treated group ceased immediately after treatment, and upon examination 2 wk later, all treated birds showed full feather regeneration in the areas of the neck and breast that had been previously defeathered. All control birds failed to regenerate neck feathers, and regeneration was sporadic in the breast areas. The progesterone-treated hens, furthermore, showed many new incoming feathers in all regions of the body and proceeded to replace much of the plumage. An average of four primary flight feathers per wing were molted and replaced. It may be deduced from this occurrence that the new growth was from the progesterone-activated papilla and was not due to a stimulation of the resting papilla by the plucking of old feathers.

Progesterone administered to mature cocks caused the same kind of molt but to a less spectacular degree. This effect of progesterone in the male required no estrogen priming.

The initiation of new feather regeneration in birds has long been known to follow the administration of large dosages of thyroidally active material. Conceivably the observed action of progesterone could follow via a stimulation of the bird's own thyroid. Although this is recognized as a possibility, it is unlikely to be the case, since the time interval from the inception of treatment to the initiation of feather proliferation is similar in either treatment. Van der Meulen (*3*) reported that 7 to 8 days after hens were fed 2 to 20 g of desiccated thyroid powder they showed signs of a molt, which reached a maximal degree 14 to 25 days following treatment. In the present experiments, feather regeneration started 8 to 10 days following progesterone treatment, and the heaviest shedding of feathers occurred after about 2 wk. Furthermore, when molt is caused by increasing the circulating level of thyroxin, the structure of the feather is also affected. This was not found to be the case with the progesterone-treated birds. For the present, the effect of the steroid is, therefore, considered to be a direct one upon the feather papilla. The relationship of progesterone-induced molt to reproduction will be described elsewhere.

References and Notes

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Failure of the Newborn Pig to Utilize Dietary Sucrose

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An inadequacy of sucrose in a synthetic milk diet for the baby pig was initially observed by Johnson (*1*). In a recent report Becker *et al.* (*2*) confirmed the detrimental effects of sucrose for the newborn pig and postulated that the difficulty resulted from an inability of the newborn pig to cope with the glycosidic linkage. The observations of Newton and Sampson (*3*) indicate that a failure in the metabolism of fructose may also be involved in an elucidation of the observed effects.

Newborn Duroc pigs that were allowed to nurse their dams for 24 hr following birth were used for this study. Three litters were distributed among four groups as the pigs became available. The pigs were group-fed *ad libitum* for a 9-day period on the floor of a shelter that had not been used for swine within recent years. The ingredients of the diet, except for the specific carbohydrate which varied with treatment, are presented in Table 1. Preparation of the milk diet and management of the pigs were described previously (*2*). Reagent grade sugars were employed, and the invert sugar consisted of an equimolecular mixture of D-glucose and D-fructose.

The results of the study are presented in Table 2. With glucose as the carbohydrate, performance was very satisfactory in terms of weight gain and survival. Although one pig succumbed on the glucose diet, it did exhibit a weight gain prior to death. Pigs receiving glucose occasionally voided soft feces, but they never exhibited a characteristic diarrhea.

Table 1. Composition of diet fed.

Ingredient*	Percentage
Carbohydrate	56.58
Casein, vitamin-free	30.00
Corn oil	5.00
Methyl cellulose, 4000 cm/sec	1.00
Potassium phosphate, dibasic	1.55
Sodium bicarbonate	1.42
Mineral mixture 12†	4.45
Vitamin mixture 16†	+
Antibiotic mixture‡	+

* Ingredients were incorporated into a milk containing 20 percent solids.
† Becker *et al.* (2).
‡ A mixture of equal parts oxytetracycline HCl, procaine penicillin and bacitracin fed to supply 396.8 mg/kg.

On the sucrose or fructose regimen, all pigs failed to show body-weight gains. One pig fed sucrose and two pigs fed fructose survived the experimental period, although no increases in body weight were observed. Diarrhea was severe. Following 18 hr of feeding, pigs fed either sucrose or fructose showed severe diarrhea, although it was more acute with the former carbohydrate. The severity of the diarrhea progressed, with the pig becoming thin, weak, and unthrifty. Appetites remained excellent until the pig became moribund. Usually death followed, at which time the average loss in body weight was approximately 0.3 kg. All manifestations supported the view that the reaction to fructose was less severe than to sucrose.

In contrast to sucrose or fructose, pigs fed invert sugar showed satisfactory survival, being comparable to glucose-fed pigs. The single pig that died on invert sugar did exhibit a weight gain during the test. With regard to rate and efficiency of gains, the glucose-fed pigs were significantly superior ($P < 0.05$) to pigs fed invert sugar. The feeding of invert sugar produced an intermittent, moderate diarrhea.

Table. 2. Survival, growth, and feed data for baby pigs fed sucrose or related sugars.

Item of interest	Dietary carbohydrate			
	D-glucose	Sucrose	D-fructose	Invert sugar
No. of pigs	7	7	7	6
No. of deaths	1	6	5	1
Avg. time until death (days)	8.0	4.3	6.0	8.0
Avg. initial weight (kg)	1.24	1.29	1.33	1.29
Avg. final weight (kg)*	2.36	0.97	1.02	1.78
Avg. gain per pig (kg)	1.12	−0.32	−0.31	0.49
Solids intake per pig (kg)	1.53	0.43	0.61	1.46
Solids per kilogram gain (kg)	1.37			2.98

* Weight at death or termination of the test.

In view of the disastrous results with sucrose, the livability and weight gains recorded on pigs fed invert sugar indicate that the newborn pig lacks the ability to hydrolyze the glycosidic bond of sucrose. An intestinal sucrase accomplishes this feat in the older mammal. Hence, the presence and/or activity of such a carbohydrase in the newborn pig seems worthy of study.

A failure of the newborn pig to hydrolyze the glycosidic linkage between the fructose and glucose moieties of sucrose is apparently the primary factor in an explanation of the failure to grow and survive on diets high in this sugar. Assuming that a limited degree of hydrolysis could be accomplished, however, the inability of the pig to utilize fructose would probably restrict performance.

References

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Improvement in Low-Temperature Resistance of Sugar-Beet Seedlings Treated with Dalapon (2,2-Dichloropropionic Acid)

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An earlier communication of mine (*1*) reported improvement in frost resistance of parsnip tops sprayed with chemical growth substances in the fall. Similar subsequent field experiments during the autumn of 1953 did not show visible differences, probably because of a different complex of weather conditions. More recently Crane (*2*) has published observations on the effectiveness of 2,4,5-trichlorophenoxy-acetic acid in promoting growth of apricot fruits sprayed before frost.

This paper describes laboratory studies in which a sodium formulation of 2,2-dichloropropionic acid (Dalapon, Dow Chemical Co.) improved low-temperature resistance of sugar-beet seedlings grown and frozen under controlled conditions in replicated experiments.

Sugar-beet seeds of the variety Kuhn were planted in Petri dishes containing a measured amount of vermiculite, moistened to capacity at the outset with a standard volume of water or of chemical solution. The temperature was 21.5° to 22°C with the humidity at a high level during 6 days of incubation in a dark chamber. By this time seedlings had not yet stopped increasing in height.

The concentrations of Dalapon (acid equivalent) reported here had no visual adverse effect on the growth of seedlings. Table 1 summarizes data in support of this conclusion. There is, of course, consider-