central nervous system immediately adjacent to the cerebro-spinal fluid.

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ATROPHY OF THE ADRENAL CORTEX OF THE RAT PRODUCED BY THE ADMINISTRATION OF LARGE AMOUNTS OF CORTIN

IT has been observed by Wyman and tum Suden[1] and by Ingle and Higgins[2] that transplants of adrenal glands do not regenerate in the presence of one intact gland. In unpublished studies Ingle and Higgins have noted that the regeneration of the enucleated adrenal does not take place in the presence of one intact adrenal, although the regeneration is consistently rapid when there is a "deficiency" in the activity of the adrenal cortex. Ingle and Kendall[3] found that the oral administration of large amounts of cortin suppressed the regeneration of enucleated adrenals. In addition to these results we have now found that the administration of large amounts of cortin to the normal rat will produce atrophy of the cortex of the adrenal and that this atrophy can be prevented by the simultaneous administration of a fraction of anterior pituitary extract which has high adrenotropic activity.

Male rats of the Wistar strain with body weight of 180 to 190 gm were matched in groups of three. One rat of each group received 10 cc of cortin daily in its drinking water; the second rat received 10 cc of cortin orally, and, in addition, 1 cc of an adrenotropic preparation[4] was given daily by intraperitoneal injection; the third rat was untreated. Six groups of rats were studied. At the end of seven days the adrenal glands were removed, weighed and examined histologically. The data on weights of the adrenals are summarized in Table 1.

TABLE 1
EFFECT OF ADMINISTRATION OF CORTIN ON ADRENAL WEIGHTS (BOTH GLANDS)

Treatment	Number of rats	Average, mg	Range, mg
Cortin only	6	14.7	14–16
Cortin plus adrenotropic preparation	6	25.3	24–29
Untreated	6	27.7	27–30

Our results indicate that the anterior pituitary or some mechanism which controls its activity is sensitive to variations in the amount of cortin in the body fluids or to physiologic functions influenced by cortin and that the changes in the adrenal cortex are mediated by changes in the output of the adrenotropic principle from the pituitary. When the physiologic requirements for cortin are increased there is an increase in the output of the adrenotropic principle, and when cortin is present in the body fluids in excess of physiologic requirements the output of adrenotropic secretions from the pituitary is suppressed. The experimental results and deductions of a number of other investigators support this hypothesis, and at the present time we are not aware of any contrary evidence.

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1 L. C. Wyman and Caroline tum Suden, *Endocrinology*, 21: 523, 1937.

2 D. J. Ingle and G. M. Higgins, *Proc. Staff Meet.* Mayo Clinic, 12: 204–205, March 31, 1937.

3 D. J. Ingle and E. C. Kendall, *Proc. Staff Meet.* Mayo Clinic 12: 505, Aug. 11, 1937.

4 This fraction was prepared by the method of Moon and was supplied to us through the courtesy of Dr. O. Kamm, Detroit, Michigan.

THE SPARING ACTION OF LACTOFLAVIN ON VITAMIN B_1

THE sparing of vitamin B_1 by feeding high levels of certain substances was demonstrated several years ago by Evans and Lepkovsky,[1] at which time they attributed the beneficial effect of autoclaved yeast to the presence of vitamin G or B_2. Since then vitamin B_2 has been identified as lactoflavin and its availability in crystalline form has revived interest in this important problem.

The data presented here were obtained from three groups of 28-day albino rats whose mothers had been reared from weaning on diets adequate in all respects for growth and reproduction and varying only in their content of lactoflavin. The 1E grade of lactoflavin of the Borden Company was used, and, while not in crystalline state, it had tested free of vitamin B_1 and other water-soluble vitamins. The lactoflavin was added to the basal diet in such quantities that the final three diets contained approximately 1, 2 and 3 Bourquin-Sherman[2] units per gram, which for convenience will be designated here as diets 1, 2 and 3. In the experience of the author 2.9 γ of crystalline lactoflavin has been equivalent to 1 Bourquin-Sherman unit.

The 28-day young, whose previous dietary had been similar except for the lactoflavin content of the maternal died, were placed upon the Chase and Sherman vitamin B_1 deficient diet[3] and their weight recorded weekly until death. Three males and three females of typical weight were selected from each of the three diets.

1 H. M. Evans, S. Lepkovsky and E. A. Murphy, *Jour. Biol. Chem.*, 108: 429, 1934.

2 A. Bourquin and H. C. Sherman, *Jour. Am. Chem. Soc.*, 53: 3501, 1931.

3 E. F. Chase and H. C. Sherman, *Jour. Am. Chem. Soc.*, 53: 3506, 1931.

BEHAVIOR OF LACTOFLAVIN FED RATS ON VITAMIN B_1 DEFICIENT DIET

	Males			Females		
Maternal diet	1	2	3	1	2	3
Initial weight—gm..	44	57	51	44	43	48
Final weight—gm ..	39	41	43	34	36	36
Maximum gain—gm (2 weeks)	15	21	22	15	20	17
Days of survival ..	31.6	35.0	37.6	34.6	37.6	45.3

The growth and length of survival during the period of vitamin B_1 deficiency was directly dependent on the lactoflavin content of the maternal diet. While the number of cases was small, the regularity with which the age at death depended on the previous lactoflavin intake leaves little room for doubt that this vitamin, in some as yet undetermined way, spared the vitamin B_1 reserves of the body. These results are in agreement with those of Evans and Lepkovsky,[4] who fed autoclaved yeast as the source of vitamin B_2 at different levels during the experimental period.

The sparing action has been found so far to be specific only for vitamin B_1. A similar group of 28-day rats when fed the Sherman-Spohn diet,[5] deficient in all the water-soluble vitamins, showed no such regularity of survival or growth response. In this case the first limiting factor of the multiple deficiency was probably vitamin B_6, since the growth was poorer than on either a vitamin B_1 or lactoflavin deficient diet.

This sparing action is being investigated further. Both vitamins are required for normal carbohydrate metabolism, though the sites of their influence are apparently widely separated; and both vitamins contain a pyrimidine nucleus. The possibility that, through a similarity of chemical structure and physiological action, the two vitamins can substitute for each other for a short space of time in an emergency and thus in turn be spared opens an interesting field of study.

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PARTHENOCARPIC FRUITS INDUCED BY SPRAYING WITH GROWTH-PROMOTING CHEMICALS

PARTHENOCARPY, a not uncommon phenomenon, occurs in some plants without the aid of an outside stimulus and has been artificially induced in other plants by a number of means. Gustafson[1] was able to cause fruit development in several species which do not normally exhibit parthenocarpy, by dabbing lanolin mixtures of growth-promoting chemicals on the styles, which were first shortened by cutting them off close to the ovary. Hagemann[2] also reports parthenocarpic fruits in Gladiolus obtained with indoleacetic acid in lanolin. Recently, the authors produced parthenocarpy by spraying blossoms with dilute aqueous solutions of growth substances and without first altering the floral organs.

Of the various plants experimented with, the most notable success was encountered with the native American holly, *Ilex opaca*. As is well known, this plant is dioecious and is therefore particularly well adapted for tests of this kind, since young pistillate flowered plants involve no emasculation and can easily be isolated from any possible chance of pollination. Previous attempts to induce fruit setting in this species with pollens of miscellaneous unrelated species have resulted in complete failure. The application of *Ilex opaca* pollen, however, normally results in 100 per cent. fruit setting.

The holly plants used were propagated by cuttings from a bearing tree during the summer of 1936 and were well supplied with flower buds which had differentiated before the cuttings were removed from the parent tree. Planted in small pots, these miniature holly trees put forth vigorous new growth and blossomed in May, 1937.

When the plants were in full bloom the flowers were sprayed with four different growth substances, namely: indoleacetic, indolebutyric, indolepropionic and naphthaleneacetic acids in aqueous solutions ranging in concentrations from 1:1000 to 1:1,000,000. Although each of the four substances induced parthenocarpy, naphthaleneacetic acid was by far the most potent, causing all the flowers to set fruit when used in .006 per cent. concentration. Even a solution of 1 part per million induced 10 per cent. of the flowers to set fruit. Acetic acid in comparable concentrations and also in considerably stronger ranges than used with the above-mentioned growth substances produced no parthenocarpic effect. The details of the experiments showing the relative effectiveness of these four chemicals in producing parthenocarpy will be presented at a later date.

At the present writing the parthenocarpic holly fruits compared with those obtained by pollination have developed in an apparently normal fashion and have reached mature size.

Some fruits were also set on the holly by watering the soil around the young plants while in bloom with a relatively strong solution (.15 per cent.) of indoleacetic acid. Sufficient solution was added in each of two successive waterings so that considerable drainage from the pots ensued. Strangely enough, the concentration of .15 per cent. produced no apparent injury and no epinasty. Plants watered with a .02 per cent. solution of indoleacetic acid did not set any fruits.

In addition to holly, individual potted plants of a pistillate strawberry selection were sprayed with in-

[4] *Loc. cit.*

[5] H. C. Sherman and A. Spohn, *Jour. Am. Chem. Soc.*, 45: 2719, 1923.

[1] F. G. Gustafson, *Proc. Nat. Acad. Sci.*, 22: 628–636, Nov., 1936.

[2] P. Hagemann, *Gartenbauwiss*, 11: 144–150, April, 1937.