is particularly interesting. Three of them, Fast Wool Blue R, Fast Wool Blue B and Amaranth were not secreted, while 2 of them, Scarlet RR and Chromotrop 8B were. These 2 are comparable to the disulfonate Crocein Scarlet 3BX, which was mentioned before as outstanding by a special disposition of one sulfonate group, which might be supposed to change the intramolecular forces concerned.

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Effects of Anterior Pituitary and Adrenal Cortical Extracts on Metabolism of Adrenalectomized Rats Fed Glucose.

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Whole anterior pituitary extracts given to normal rats fed glucose prevent the usual elevation of R.Q. and increase deposition of muscle glycogen.[1, 2]

Adrenal cortical extracts,[3] corticosterone, and certain adrenotropic anterior pituitary extracts have now also been shown to diminish the rise in R.Q. and to promote glycogen deposition. These findings suggested that part or all of the action of the anterior pituitary extract in fed animals might be mediated through the adrenal cortex. A study has therefore been made of the relative effects of anterior pituitary extract and of adrenal cortical extract (CE) on the disposition of fed glucose in the absence of the adrenal glands.

The experiments were carried out as described previously:[2] young male rats were fasted 18 hours, then fed known amounts of glucose, the respiratory data was obtained during the 4-hour period after feeding, and terminal analyses were made of liver and muscle glycogen, blood glucose and glucose remaining in the gastro-intestinal tracts. Recovery and oxidation of the fed glucose are presented here, calculated as percent of the absorbed amounts. The figures are averages of 9 or 10 experiments in each group.

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1 Meyer, H. S., Wode, L. J., and Cori, C. F., PROC. SOC. EXP. BIOL. AND MED., 1937, **36**, 346.

2 Russell, J. A., *Am. J. Physiol.*, 1938, **121**, 755.

3 Katzin, B., and Long, C. N. H., *Proc. Am. Physiol. Soc.*, 1938.

The rats were adrenalectomized from 3 to 20 days before the experiments and were maintained in good condition in the interim by the administration of saline drinking water. All carbohydrate levels were low in the fasted adrenalectomized rats; the muscle glycogen values, however, were still much above those of fasted hypophysectomized rats. The glucose absorption rates under these conditions were also reduced moderately, but again not to the same extent as in hypophysectomized rats.

The extracts used in these experiments were a 2% saline extract of beef anterior lobes clarified by Sharples centrifugation, and Upjohn's cortical extract from which the alcohol had been removed by vacuum distillation. One ml of the anterior pituitary extract, containing about 10 mg organic solids, was given intraperitoneally 1 to 1½ hours before the glucose was fed. The cortical extract was given in total dosages of 3 to 5 ml, in part injected intraperitoneally ½ to 1 hour before the glucose feeding, and in part injected or fed with the glucose.

Five series of experiments are summarized in the accompanying table: those carried out on untreated adrenalectomized rats, on adrenalectomized animals treated with anterior pituitary extract alone, with cortical extract alone, and with a combination of the 2 extracts, and on normal controls. In the untreated adrenalectomized rats the significant changes in the disposition of fed carbohydrate were: greater increases in the glucose found in body fluids, probably in part because of the low initial levels, and moderate reduction in the storage of liver glycogen (an average value of 1.5% liver glycogen was obtained). The results are in contrast to those observed in hypophysectomized rats where very much more carbohydrate was oxidized.[2]

TABLE I.
Disposition of Fed Carbohydrate in Adrenalectomized Rats.
% of glucose absorbed in 4 hours.

	Glucose recovered after 4 hr				
	In body fluids	As muscle glycogen	As liver glycogen	Glucose Oxidized	Total Accounted for
A Adrenalectomized rats					
1. Untreated	6±0.5*	10±3	9±1	55±5	80
2. A.P.E.†	9±1.3	14±2	4±1	56±3	83
3. C.E.‡	9±0.5	13±2	16±2	41±3	79
4. A.P.E. and C.E.	6±0.5	35±2	13±1	29±3	83
B Normal rats	3±0.2	14±1	17±1	49±2	83

* Standard error.
† A.P.E.: 1 ml saline extract 1 to 1½ hours before glucose feeding.
‡ C.E.: 3-5 cc Upjohn's cortical extract 0 to 1 hour before glucose feeding.

The anterior pituitary extract was without any effect on the apparent rate of oxidation of fed carbohydrate in the adrenalectomized rats. Its only action was to decrease liver glycogen deposition and to increase somewhat the body fluid glucose and perhaps muscle glycogen. The cortical extract, on the other hand, in the doses given brought about moderate reduction in the apparent rate of oxidation of the fed carbohydrate, and increased markedly the liver glycogen deposition. But the depressing effect of anterior pituitary extract on carbohydrate oxidation was not strictly an adrenotropic effect as shown by the results of series 4. In these experiments, when anterior pituitary extract and cortical extract were given at the same time to adrenalectomized rats, the anterior pituitary extract was able to exert its usual full effect: there was a marked reduction of the oxidation rate beyond that produced by cortical extract alone, and the excess carbohydrate was mainly deposited as muscle glycogen.

The effects of these hormones on the disposition of fed carbohydrate, while superficially similar, are therefore to be distinguished. First, in adrenalectomized as in normal rats, when cortical extract is diminishing net carbohydrate utilization it increases liver glycogen but not peripheral tissue glycogen levels. Anterior pituitary extract, on the other hand, increases muscle glycogen stores but not those of the liver in these animals. Further, anterior pituitary extract, which produces a more intense depression of carbohydrate oxidations in normal rats, requires for this action the presence of some cortical hormone, but not the active mediation of the adrenal cortex itself. That is, there appear to be in the circumstances of these experiments both complementary and synergistic relationships between the metabolic activities of the cortical and anterior pituitary hormones.