

Effects of Adrenalectomy on Pigmentation of Hair in Rats Fed a Deficient Diet.

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It has been reported by Ralli and Graef¹ that graying of the hair in black rats will result from feeding a vitamin B-complex-free diet, supplemented with thiamine, riboflavin, and pyridoxine, but that new hair growing in after the ablation of both adrenal glands in rats kept on such a diet will again be well pigmented. No attempt was made by them to determine whether the pigmentation was due to the absence of the medulla or the cortex of the adrenal. Growth of the hair was also accelerated following adrenalectomy, confirming my earlier work.² More recently Spoor and Ralli³ presented some evidence that the adrenal cortex was involved in the metabolism of the melanin. They observed that adrenalectomized animals fed the deficient diet and treated with desoxycorticosterone acetate did not become pigmented to the same degree as did the adrenalectomized controls.

The present investigation has been undertaken on rats fed a vitamin B-complex-free diet, supplemented with thiamine, riboflavin, and pyridoxine, to learn which part of the adrenal is related to the pigmentation following adrenalectomy.

Procedure and Results. In the present experiments hooded rats of the Long-Evans strain were used. They were kept on the deficient diet which consisted of casein 18%, sucrose 68%, vegetable oil 10% and salt mixture 4%, to which was added daily about 20 μ g of thiamin chloride, 20 μ g of pyridoxine and 60 μ g of riboflavin. Each animal also received one drop of halibut liver oil once a week during the period of the experiments. It has been well established^{1,4,5,6,7} that rats maintained on this diet exhibit graying of the hair.

The hair was removed from the backs of 12 rats with sodium sulphide when they were 22 days old and they were kept on the deficient diet. Sparse and dull gray hair appeared on

5 of the rats between the 45th and 50th days of life and on 4 of them between the 50th and 55th days. Very little hair regrew on the other 3 rats. Six litter-mates from which the hair was removed on the 22nd day and which were kept on a non-deficient diet (Purina dog chow) produced deeply pigmented hair usually on the 36th day of life.

The hair was removed from the backs of 20 other 24-day-old rats and they were completely adrenalectomized via the dorsal approach.⁸ Ten littermates in which a mock adrenalectomy was performed served as controls. All rats were fed the deficient diet and given 1% sodium chloride as drinking water. By the 4th to 5th postoperative day the skin of the adrenalectomized animals developed a bluish color which was due to the growth of hair follicles with much melanin. Abundant and glossy black hair appeared externally on the 15 surviving adrenalectomized animals from the 34th to 38th days of life. Sparse and gray hair appeared on 6 of the controls from the 45th to 55th days while practically no hair grew on the other 4 rats.

When 10 rats which had been fed the deficient diet and on which the hair appeared externally from the 45th to the 50th days of life reached the age of 70 days, the hair was removed from their backs. Eight of these

¹ Ralli, E. P., and Graef, I., *Endocrinology*, 1943, **32**, 1.

² Butcher, E. O., *Am. J. Phys.*, 1937, **120**, 427.

³ Spoor, H. J., and Ralli, E. L., *Endocrinology*, 1944, **35**, 325.

⁴ Emerson, G. A., and Evans, H. M., *Proc. Soc. Exp. Biol. and Med.*, 1941, **46**, 655.

⁵ Morgan, A. F., Cook, B. B., and Davison, H. G., *J. Nutrition*, 1938, **15**, 27.

⁶ Morgan, A. F., and Simms, H. D., *J. Nutrition*, 1940, **10**, 233.

⁷ Anna, K., Richards, C. V., and Sampson, W. L., *J. Nutrition*, 1941, **22**, 553.

⁸ Butcher, E. O., *Am. J. Phys.*, 1940, **129**, 553.

animals were totally adrenalectomized, given 1% salt solution and kept on the deficient diet. Four to 6 days after adrenalectomy, the hair follicles in the 6 surviving animals became active as shown by the pigmentation through the skin and 12 to 14 days after the operation well pigmented hair began appearing externally on the 4 surviving animals. Hair failed to regrow on the 2 rats which were not adrenalectomized. Thus hair better in quality and darker in pigmentation resulted in all of the adrenalectomized animals.

After the hair had been removed in twenty 22-day-old rats, the adrenals were transplanted via the dorsal approach into the kidneys as in previous experiments.⁸ The animals were kept on the deficient diet and 1% solution of sodium chloride served as drinking water for 5 or 6 days after the operation. Ten unoperated littermates with the hair removed from their backs were kept in the same cages. Sparse and dull gray hair appeared on the 18 surviving operated rats and the 10 unoperated between the ages of 45 and 60 days. Rats in which the adrenals were transplanted to the

kidneys were sacrificed after the appearance of the hair. Histological sections of the kidneys showed the persistence of cortical material of the adrenal transplant and the absence of the medullary portion. The well pigmented hair of good quality following total adrenalectomy in the previous experiments can not therefore be due to the absence of the medullary portion of the adrenal but must be related to the absence of the cortex of the adrenal.

Summary. Graying of the hair results in black rats fed a vitamin B-complex-free diet, supplemented with thiamine, riboflavin, and pyridoxine. New hair growing in after the ablation of both adrenal glands in rats kept on such a deficient diet is again well pigmented. To determine whether the increased pigmentation was due to the lack of the medullary or cortical portion of the adrenal, the adrenals were transplanted into the kidneys. The medullary portion of the adrenal degenerated, the cortex persisted, and poorly pigmented hair grew on the animals. Thus the lack of the cortex was related to the increased pigmentation following adrenalectomy.