

spectacled-eye¹⁵ factor inositol was omitted in the diet of another group of 75 mice, the typical^{16, 17} alopecia appeared in about 80% of the animals. However, when inositol and p-aminobenzoic acid were omitted, the inositol-deficiency did not occur.¹² Since the addition of p-aminobenzoic acid to a heated vitamin K-deficient diet was observed¹⁸ to result in an earlier incidence of avitaminosis, suggesting an inhibition of bacterial vitamin synthesis by the aromatic amine, it may be that inositol deficiency in mice on rations containing the amine is attributable to a bactericidal or bacteriostatic action of p-aminobenzoic acid. The report of Spink and Jermsta¹⁹ "that the smaller concentrations of p-aminobenzoic acid in combination with a sulfonamide compound often appeared to inhibit growth more than was obtained with the sulfonamide compound alone," as well as preliminary bacteriological studies seem to substantiate this hypothesis.

Summary. Para-aminobenzoic acid has anti-gray-hair activity in the nutritional achromotrichia of the mouse. It is a dietary factor necessary for the demonstration of the anti-alopecia effect of inositol.

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Accelerated Hair Growth in the Rat After Adrenalectomy Cannot be Attributed to the Thyroid.

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It is difficult to provide an explanation for the rapid hair growth following adrenalectomy in the albino rat since the function or functions of the cortical portion of the adrenal are not well understood (previous experiments¹ indicate that it is the cortex which is involved). This unusual growth upon adrenalectomy might be due to the thyroid or thyroxin as the following suggests: Thy-

¹⁵ Pavcek, P. L., and Baum, H. M., *Science*, 1941, **93**, 502.

¹⁶ Woolley, D. W., *J. Biol. Chem.*, 1940, **136**, 113; 1941, **139**, 29; *Science*, 1940, **92**, 384.

¹⁷ Norris, E. R., and Hauschildt, J., *Science*, 1940, **92**, 316.

¹⁸ Ansbacher, S., *PROC. SOC. EXP. BIOL. AND MED.*, 1941, **46**, 421.

¹⁹ Spink, W. W., and Jermsta, J., *PROC. SOC. EXP. BIOL. AND MED.*, 1941, **47**, 395.

¹ Butcher, E. O., *Am. J. Physiol.*, 1937, **120**, 427.

roxin administration accelerates hair growth in the adrenalectomized rat;¹ the thyroid frequently hypertrophies and the appetite, glossiness of the fur, metabolism, and body temperature of rabbits often increase upon adrenalectomy;² the metabolism of the abdominal muscle of mice,³ and the metabolism and body temperature of rats, cats and dogs⁴ increase after adrenalectomy, but no increase is noted when both adrenals and thyroids are removed.

On the other hand since activity in the hair follicle often starts within 48 hours after adrenalectomy in the rat,⁵ it seems highly improbable that the thyroid can hypertrophy so quickly and induce the growth. In this study experiments have been undertaken to determine if adrenalectomy induces hair growth via the thyroid.

Procedure and Results. Underfed albino rats* with the hair removed from their backs were thyroidectomized and adrenalectomized when 36 days old (given 1% NaCl solution as drinking water after adrenalectomy). These animals produced visible hair on their backs in 8 or 9 days after the operation or as soon as litter mates which were only adrenalectomized. Rats which were thyroidectomized at the age of 36 days and then adrenalectomized 7 to 10 days later, likewise, produced hair apparent externally in 8 or 9 days after adrenalectomy. After the hair was growing well, the thyroidectomized animals were killed and the region around and including the larynx was fixed, sectioned in paraffin, and stained to see if all of the thyroid had been completely removed. In 13 of the 15 cases serial sections presented confirmatory evidence that thyroidectomy had been complete. Furthermore, no differences were detected between histological sections of the thyroids of underfed adrenalectomized rats and underfed litter mates.

It might be thought that thyroxin which is in the body at the time of adrenalectomy may induce activity in the hair follicles after adrenalectomy. To reduce the thyroxin in the body, underfed rats were thyroidectomized and 3 weeks later were adrenalectomized. The hair appeared externally in 8 or 9 days after the adrenalectomy

² Marine, D., and Bauman, E. J., *Am. J. Physiol.*, 1921, **57**, 135.

³ Davis, J. E., and Hastings, A. B., *Am. J. Physiol.*, 1933, **105**, 110.

⁴ Grollman, A., *The Adrenals*, The Williams and Wilkins Co., 1936, p. 206.

⁵ Butcher, E. O., and Richards, R. A., *Endocrinology*, 1939, **25**, 787.

* Rats were weaned and isolated at the age of 22 days, and thereafter fed finely ground Purina dog chow, usually 2 g in the morning and 2 g in the evening or just enough to prevent a loss in body weight. If the hair is removed from the backs of such underfed rats by shaving or by using sodium sulphide, the hair fails to grow back for long periods.⁶

⁶ Butcher, E. O., *J. Nutrition*, 1939, **17**, 151.

which shows that thyroxin is in all probability not responsible for the immediate growth after adrenalectomy.

Summary. When the hair is removed from the backs of underfed rats it does not grow externally for long periods. Upon adrenalectomy of such underfed rats, the hair grows on their backs in 8 or 9 days. Histological sections show no increased activity of the thyroid in such adrenalectomized animals. When underfed individuals are thyroidectomized one to 21 days previous to adrenalectomy, the hair, likewise, grows in 8 or 9 days after removal of the adrenals. There is, therefore, no evidence that the thyroid is responsible in any way for the rapid growth of hair in the rat following adrenalectomy.

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The Nature of Sulfanilamide Inhibition.*

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The mechanism of the action of the sulfonamides and the nature of the inhibition of their bactericidal effect by a number of compounds has not been clearly demonstrated. The discovery of the anti-sulfanilamide effect of p-amino benzoic acid by Woods¹ has opened a new approach to the problem. Fildes² explained this action as the inactivation by the sulfonamide of an essential enzymic grouping involving in some way p-amino benzoic acid. Support for this thesis was advanced when Rubbo and Gillespie³ showed the compound to be a growth factor for *Cl. acetobutylicum*. They also showed that large amounts of sulfanilamide (23,000 mols. per mol. of p-amino benzoic acid) would prevent the growth occasioned by the presence of the growth factor. Thus it appears that p-amino benzoic acid may be an essential metabolite, the normal metabolism of which is disturbed by the presence of sulfanilamide.

The competitive nature of the actions of the sulfonamides and p-amino benzoic acid has been discussed by Lockwood.⁴ Actual

* The author is indebted to Dr. F. C. Schmelkes for comments and suggestions.

¹ Woods, D. D., *Brit. J. Exp. Path.*, 1940, **21**, 74.

² Fildes, P., *Lancet*, 1940, **1**, 955.

³ Rubbo, S. D., and Gillespie, J. M., *Nature*, 1940, **146**, 838.

⁴ Lockwood, J. S., *Surg., Gynecol. and Obstet.*, 1941, **72**, 307.