LXVIII. NOTE ON THE COLOUR CHANGES IN RATS' FUR PRODUCED BY ALTERATIONS IN DIET.

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THE observations described in this paper arose incidentally in the course of other work and it is thought desirable to publish a brief account, inasmuch as the results may be of interest to others who are working definitely along such lines.

Niemes and Wacker [1922] found that grey-black rats turned brown when fed for a long period on a diet of skim milk and starch; further, the animals regained their original colour when put on a normal diet. Rats fed on starch and full-milk showed no change in colour. These observers suggest that, although the hair-pigment is usually assumed to be derived from protein products (*e.g.* tryptophan, tyrosine), it is possible that other substances are also needed for the manufacture of the pigments, and they put forward the suggestion that the absence of cholesterol from the diet is responsible for the colour change they noted.

Garrod [1909] expresses the view that "the trend of opinion at the present day is towards the view that they (*i.e.* the melanins) are derived from proteins in general, perhaps by the action of a tyrosinase, and that the natural melanins are allied to the melanoid substances which are formed during the hydrolysis of proteins."

The recent work of Saccardi [1922, 1, 2] suggests a pyrrole ring structure for melanins with the possibility of adrenaline as a precursor.

The experiments to be described here indicate a relation between the dietary protein and pigment formation. During the summer months of 1920 some control pied-rats fed on bread and whole milk, began to lose their brown-black colour and became a grey-fawn. About three weeks after the first difference was noticed, the animals had no black hairs at all, and were entirely white and a grey-fawn. It was hot weather at the time and hence it was thought that some preservative in the milk might be responsible for the change in colour. Accordingly other experiments were started using milk from two separate sources, and in 2-3 weeks all the rats showed some change in colour and eventually all the animals became light-coloured. They remained thus for a time, but eventually their hair darkened again, although it was never really black.

Similar results were obtained again in the following summer, but no change of colour could be produced in the winter when the animals were growing more slowly. In 1922 this change of coat colour was obtained in 60 growing rats, some fed on bread and whole milk alone, and others on bread and milk supplemented with kitchen scraps (largely vegetable). Other experimental animals on a high protein diet had jet black coats and showed no variation in colour; therefore it seemed that addition of extra protein might lead to a darkening of the coat.

Twenty-four of the light-coloured animals were divided into two groups; one lot were kept on bread and milk (30 g. bread to 100 cc. milk), and the other half had bread and milk and caseinogen (30 g. bread, 100 cc. milk, 9 g. "food casein" [see Hartwell, 1922]). The latter showed a distinct darkening of their coats at the end of the first week; the coloured patches began to darken at the edges and the darkening spread inwards until at the end of the third week the animals were black and white. The jet blackness of the black was noticeable.

Another series of light-coloured animals were put on a high protein diet consisting of 15 g. bread, 6 g. "food casein," 1.5 g. butter, 0.7 g. salt mixture [Hartwell, 1922], 50 cc. of 3 % marmite. These showed changes exactly similar to those observed in the rats fed on bread and milk and caseinogen. In both cases the rats' coats became black, when the animals were fed on large quantities of protein rich in tyrosine and tryptophan. These experiments, therefore, support the view that the melanins are formed from tyrosine and tryptophan.

Other points noted were:

1. The fur is very thick when the animal is fed on a high protein diet.
2. Adult rats rarely show any change in coat colour, but a few instances have been noted—for example, when the stock animals were fed on kitchen scraps poor in protein, a few animals became lighter in colour. (Just over 1000 litters have been experimented with and only one suckling rat had a light coat, which was noticed about the eighteenth day of suckling.)
3. Microscopically the light-coloured hairs appear similar to the dark ones, except that the pigment is much lighter in shade.

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