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Development and Cure of "Ring-tailed" Condition in Rats on Vitamin B₆ Deficient Diets.

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In the course of an experiment in which sheep and cow rumen contents were being assayed for vitamin B₆ by a modification of

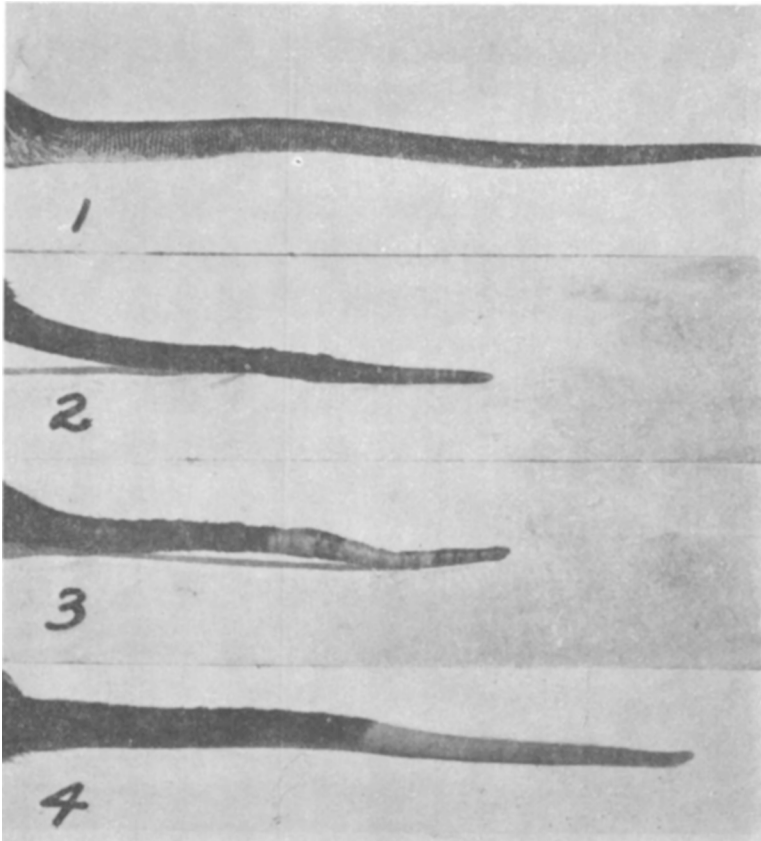


PLATE I.

1. Tail of normal rat same age as 2 and 3.
2. Rat from basal group showing "ring-tail" lesions which began to appear after 42 days on the depletion diet. Photograph taken on 62nd day of depletion.
3. Rat from group supplemented with 10 μ g of vitamin B₆ daily. There was no evidence of tail lesions on this rat when supplementation with vitamin B₆ was begun after 49 days on the depletion diet. Lesions appeared after 3 days of supplementation and became very severe by the tenth day, after which healing began. Photograph taken on the 14th day while the lesions were still distinct and the tail kinked.
4. Same rat as "3" after 27 days of supplementation with 10 μ g of vitamin B₆, showing marked healing and growth of the tail.

the method of Dimick and Schreffler¹ we observed, in addition to the usual dermatitis of the face, ears and paws, ring-like (see plate I) lesions on the tail. This condition was first noted after the rats had been on the depletion diet for a period of 5 to 6 weeks and it developed in about 10 out of 100 animals used during the depletion period of approximately 7 weeks.

The basal diets used had the following composition:

	A	B
Glucose (cerealose)	60	60
Casein, washed with water at pH 4.5	27	27
Hydrogenated cottonseed oil (crisco)	8	4
Lard	—	4
Salt mixture ²	5	5
Fish oil blend, 3000 U.S.P. units of vitamin A and 400 A.O.A.C. units of vitamin D per g	0.2	0.2
Thiamin chloride hydrochloride, 15 µg per rat daily.		
Riboflavin, 30 µg per rat daily.		

In the first assay, using diet A, factor II was supplied by feeding 0.5 cc daily of a liver filtrate concentrate prepared from Lilly Liver Extract Powder 343* by 5 treatments with fuller's earth after the method of Lepkovsky, Jukes and Krause.³ The filtrate secured by this procedure was further treated with 8 volumes of 95% ethanol and the resulting precipitate was discarded. The final filtrate was concentrated under reduced pressure to the point where 1 cc represented 2 g of the original liver extract powder. In the second assay using diet B a filtrate was used which had been prepared from Armour's Liver Extract 70 A.S.† by similar treatment. This preparation was fed at a level of 0.2 cc daily since preliminary experiments showed that this amount supplied sufficient factor II to satisfy the growth requirement of the rat.

Basal diet B contained 4% hydrogenated cottonseed oil and 4% lard. This change was made to avoid the possibility of a deficiency of unsaturated fatty acids in the diet. Since no difference was noted in the response of the rats in the two assays it is believed that both diets were equally satisfactory.

The tail lesions which developed in rats on these diets were characterized by slight constrictions encircling the tail at intervals and bounded at first by slightly swollen scaly areas. In the continued absence of vitamin B₆ the condition remained practically

¹ Dimick, M. K., and Schreffler, C. B., *J. Nutrition*, 1939, **17**, 23.

² Jukes, T. H., *Proc. Soc. Exp. Biol. and Med.*, 1939, **42**, 180.

* Kindly furnished by Ely Lilly and Company, Indianapolis.

³ Lepkovsky, S., Jukes, T. H., and Krause, M. E., *J. Biol. Chem.*, 1936, **115**, 557.

† Kindly furnished by the Armour Laboratories, Chicago, Illinois, through the courtesy of Dr. E. F. Pike.

unchanged over a period of 4 weeks but when the positive control groups were supplemented with 3 and 10 μg respectively of synthetic vitamin B₆ the condition was first aggravated and then cured. Within 2 to 5 days of supplementation the tail lesions appeared in an additional 15% of the animals and in the more severe cases the tails became marked by a series of constrictions and intervening wet swollen areas denuded of hair. The tail lost much of its flexibility and frequently became kinked in one or more places. The stage of pronounced swelling and stiffness lasted from 3 to 7 days and was followed by a period of healing and rapid growth of the tail. The dermatitis of the face, ears and paws disappeared at the 10 μg level, and improved at the 3 μg level several days before healing of the tail lesions took place.

The same series of symptoms was noted in the groups supplemented with dried sheep or cow rumen contents. The reaction to the pure vitamin and to the rumen contents was similar also in that while the most severe swelling occurred in those groups receiving the highest levels of the supplement, complete healing occurred most quickly in these same groups.

The experimental evidence does not demonstrate whether the effect of vitamin B₆ in this condition is direct or indirect. György⁴ has shown that the addition of crystalline vitamin B₆ to a choline-low diet aggravates the development of cortical necrosis of the kidneys. It is possible that a similar relationship may be involved in the present experiments.

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Flavin-Dinucleotide in Eggs of the Sea Urchin, *Arbacia punctulata*.

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In the course of an investigation of the respiratory systems of various marine eggs, the eggs of *Arbacia punctulata* have been analyzed for flavin-dinucleotide by the following adaptation of the d-amino acid oxidase method of Warburg and Christian.¹

⁴ György, Paul, and Goldblatt, H., *J. Exp. Med.*, 1940, **72**, 1.

¹ Warburg, O., and Christian, W., *Biochem. Z.*, 1938, **298**, 150.