plasma. Cholesterol feeding does not influence the cholesterol content of the blood cells. Humans are unlike normal rabbits but simulate cholesterol-fed rabbits in the distribution of this sterol between cells and plasma. Cholesterol feeding produces an anemia in rabbits, an observation previously noted in the guinea pig by Okey and Greaves.[7]

12064

Bone Development in the Albino Rat on a Low Manganese Diet.

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Studies by Norris and coworkers[1, 2, 3] have demonstrated the importance of manganese for the normal development of bone in the chick. The present study was undertaken to ascertain whether any similar bone abnormality could be noted in the rat. The low manganese diet used was the one employed by Daniels and Everson[4] with the exception that pasteurized milk was used instead of boiled milk and that cod liver oil was given separately once a week.

Sixteen females and 5 males raised from 21 days of age on this diet have shown as good growth as control animals on our stock diet. X-ray pictures of the right hind legs of these animals have been taken at regular intervals. No abnormalities have been observed in the tibias and no significant difference has been demonstrated between the growth of these tibias, as measured from X-ray photographs taken at intervals, and of the tibias of rats on the stock diet.

Five of the females raised on the low manganese diet were bred, using males reared on our stock diet. In the course of the next few months these females bore 57 living and many dead young. As would be expected from the work of others[4, 5] we were able to rear

7 Okey, R., and Greaves, V., *J. Biol. Chem.*, 1939, **128**, lxxvi.

1 Wilgus, H. S., Jr., Norris, L. C., and Heuser, G. F., *J. Nutrition*, 1937, **14**, 155.

2 Caskey, C. D., and Norris, L. C., PROC. SOC. EXP. BIOL. AND MED., 1939, **40**, 590.

3 Caskey, C. D., Gallup, W. D., and Norris, L. C., *J. Nutrition*, 1939, **17**, 407.

4 Daniels, Amy L., and Everson, Gladys J., *J. Nutrition*, 1935, **9**, 191.

5 Orent, E. R., and McCollum, E. V., *J. Biol. Chem.*, 1931, **92**, 651.

only a few of these. Sixteen of the 57 lived to an age of 100 days or more, and 13 of them were still alive at 300 days of age. Of the 16 here mentioned, 2 had abnormal tibias. These rats were both females. One of them was reared on the low manganese diet, and a series of X-ray pictures of its right tibia is shown in Fig. 1 (B). Paired with the tibia pictures of this rat, for comparison, are tibia pictures (A) of a female reared on the same low manganese diet, but born from a mother receiving a normal diet. Tibia B is abnormal in at least 3 respects. It is short. The epiphysis at the proximal end is thin. The diameter of the tibia at its proximal end is large in proportion to its length.

The other female showing the same abnormalities of the tibia at 23 days of age, was raised on the same diet supplemented with 1.5 mg Mn ($Mn\ Cl_2\ 4H_2O$) per 100 cc of milk. Successive X-ray pictures of its right tibia during growth showed a partial recovery from these abnormalities.

The body weights of these 2 animals showing abnormal tibias were below normal, so that the tibia lengths were not small in proportion to the body weight. In our experience with tibia pictures of several hundred rats on various diets, these 2 cases showing abnormal tibias are unique.

Fig. 2 shows curves of average tibia growth for rats, all of which were reared on the low manganese diet. At 300 days of age the average tibia length for the 6 females from mothers on a normal diet was

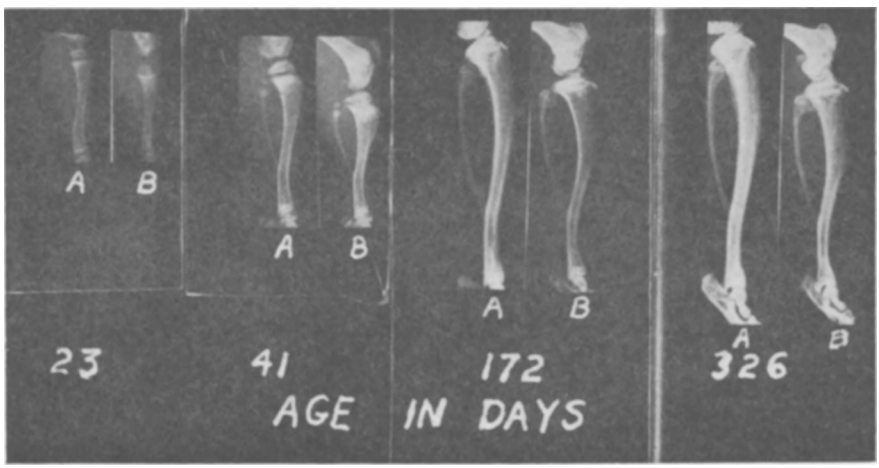

FIG. 1.

X-ray pictures of the tibias of two rats reared on a low manganese diet. A. Tibia of rat from mother on normal diet. B. Tibia of rat from mother reared on manganese-low diet.

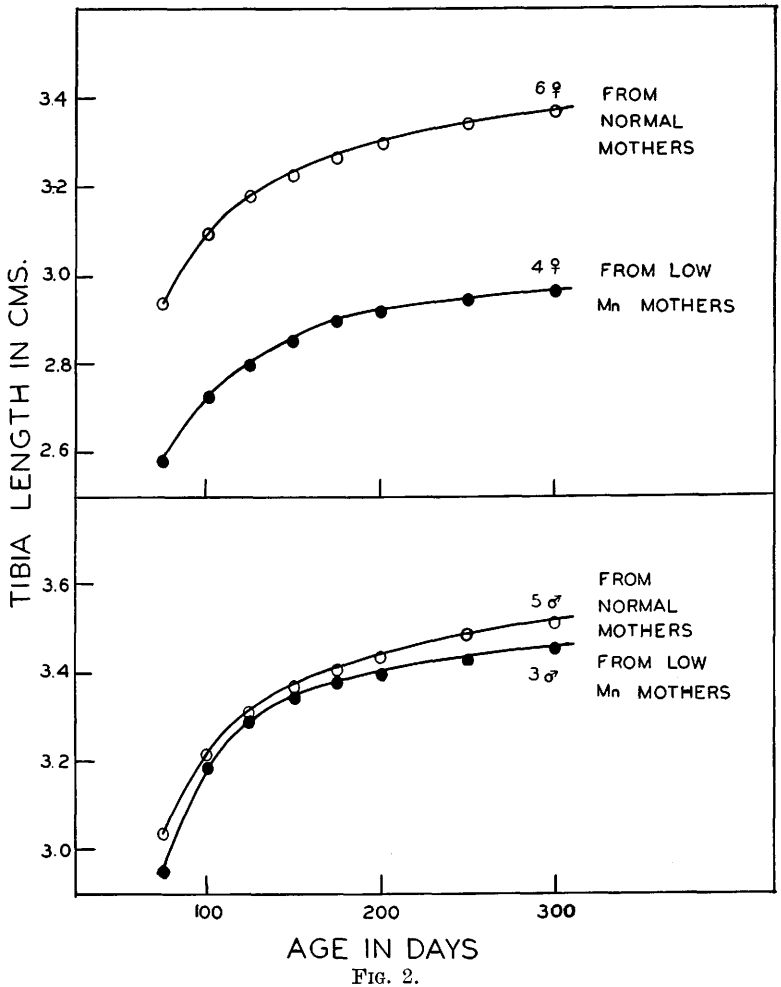

FIG. 2.
Tibia growth of rats reared on a low-manganese diet.

3.38 ± 0.06 cm, and for the 4 females from mothers on the low manganese diet 2.97 ± 0.11 cm. For the 5 males from normal mothers, the average tibia length at 300 days was 3.52 ± 0.05 cm, and for 3 the males from low manganese mothers 3.46 ± 0.04 cm. One is hardly justified in calculating probable error with such small numbers of animals, but the above figures do suggest that with respect to tibia growth, the female may be sensitive to a manganese deficiency in the mother's diet, while the male may not. It should be noted that these experiments were carried out before the rôle of an organic factor in perosis was announced[6] and thus no consideration was given to such a

[6] Hogan, A. G., Richardson, L. R., and Patrick, H., *J. Nutrition*, 1940, **19**, Proc., 14.

factor in our work. The average weight of the females from normal mothers was 25% higher at 300 days of age than the average weight of the females from low manganese mothers. In the case of the males there was very little difference in the average weights.

Summary. We have not been able to demonstrate any abnormal tibia development in the albino rat raised on a diet low in manganese, provided the rat is normal at 21 days of age. In this respect the rat differs from the chick, at least in being much less sensitive to a low manganese diet. Only 2 cases of abnormal tibias have appeared in a total of 16 rats, born of females reared on a low manganese diet. Our limited data on rats from females reared on a low manganese diet suggest that the growth of the female is impaired, while that of the male is not.

12065

Relationship of Pantothenic Acid and Inositol to Alopecia in Mice.

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It has recently been shown in two laboratories[1, 2] that mice become hairless over large areas of the body when they are maintained on a purified diet. It has also been shown[3, 4] that inositol is a curative agent for the alopecia. With the isolation and identification of the anti-alopecia factor, it became of interest to study pantothenic acid deficiency in the presence of all other known essentials and also to determine if there were other unknown vitamins required by mice. It was observed that even in the presence of inositol, but in the absence of pantothenic acid, alopecia developed. The present report deals with alopecia which results from a lack of pantothenic acid and with that which results from a lack of inositol.

A highly purified basal diet which contained no unknown water-soluble constituents was prepared as previously described.[5] Panto-

1 Woolley, D. W., *J. Biol. Chem.*, 1940, **136**, 113.

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

3 Woolley, D. W., *Science*, 1940, **92**, 384.

4 Woolley, D. W., *J. Biol. Chem.*, in press.

5 Woolley, D. W., PROC. SOC. EXP. BIOL. AND MED., 1940, **43**, 352.