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# Degeneration of Cross Striated Musculature in Vitamin E-Low Rats.*

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It has been noted for some years in this laboratory that animals reared and held upon E-low rations develop characteristic disability in locomotion, or partial paralysis accompanied by obvious, naked-eye atrophy of some of the musculature of the flank and posterior limb, particularly adductors of the leg. Because of convenience, we have submitted certain muscles of the leg (gastrocnemius and soleus) of these animals to microscopic examination, although these were not necessarily the muscles most affected. This note is to report the invariable occurrence of degenerative lesions of the gross striated musculature in adult rats that had been placed upon vitamin E-low rations at weaning and autopsied at 22 months. The paralysis was mentioned in a summary by Evans.[1] It was later mentioned by Ringsted[2] and by Burr, Brown and Moseley.[3] A similar condition in young animals was described by Evans and Burr,[4] and later by Olcott,[5, 6] who have reported microscopic changes strikingly similar to those observed in muscular dystrophy in herbivora and to those herein described.

Six animals were placed at weaning (21 days) on vitamin E-low diet 427[7] (5 controls of the same age were put on stock diet I), and held there until the time of autopsy at 22 months. The animals in both groups had a history of one breeding. The disability in locomotion was usually evident by the 15th month. At the time of

* Aided by grants from the Research Board and the College of Agriculture of the University of California, the Rockefeller Foundation of New York, and Merck & Company, Inc., Rahway, New Jersey.

We wish to acknowledge assistance rendered by the Federal Works Progress Administration, Project No. 7787.

The following materials were generously contributed: cod liver oil by E. R. Squibb & Sons, and brewers' yeast by the Vitamin Food Company, New York.

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FIG. 1.
Section of gastrocnemius muscle from a paralyzed vitamin E-low rat 22 months of age.

FIG. 2.
Section of gastrocnemius muscle from a normal rat 22 months of age.
Slides stained with hematoxylin and eosin × 365.

sacrifice the animals weighed on the average almost 100 g less than the controls (252:335 g) and on contrast to the smooth, normal pellage which still characterized the controls, their sparse pellage gave a rough appearance, and in places complete denudation occurred. This was particularly the case on the back in the region of the flanks, where naked-eye atrophy of the musculature was apparent. There was also invariably an accelerated respiratory rate as contrasted with normal animals. The animals were sensitive, irritable creatures and were not easily handled.

*Histological Findings.* Sections of the gastrocnemius were fixed in Bouin's or Zenker formol. After nitro-cellulose embedding, the tissues were sectioned at 6-8$\mu$ and stained with hematoxylin, eosin or iron hematoxylin, aniline blue.

A marked infiltration of leucocytes and connective tissue elements was noted. Cross striations were usually reduced, and in some cases were entirely lacking. Many of the muscle and sarcolemma nuclei were shrunken and pyknotic, staining deeply with hematoxylin.

Within the sarcolemma, multiplication of nuclei often occurred; the nuclei were arranged in rows parallel to the long axis of the fiber. The chains of nuclei, in some instances, persisted after the necrotic fibers had been resorbed and the sarcolemma collapsed. The degenerating fibers were often replaced by fat and other connective tissue elements.

The iron-hematoxylin aniline blue stain showed areas where within the sarcolemma there was a failure of both longitudinal and transverse striations and chains of contiguous nuclei. These areas in the sarcoplasm stained light blue with the stain, in contrast to the pink of healthy fibers. In other instances the entire muscle fiber was replaced by a foamy, light blue sarcoplasm with many nuclei.

*Conclusion.* Muscular dystrophy characterizes old rats reared and maintained on diets devoid of vitamin E. The histological lesions are outstanding.