ROLE OF VITAMIN E IN THE PREVENTION OF MUSCULAR DYSTROPHY IN GUINEA PIGS REARED ON SYNTHETIC RATIONS

MADSEN *et al.*[1] were the first to attain any notable success in inducing the guinea pig to eat synthetic rations. In the course of their experiments they observed the relatively early appearance of severe muscular dystrophy not unlike the lesions first extensively studied by Goettsch and Pappenheimer.[2]

When the cod liver oil was removed from the diet, being replaced by other substances which satisfied the A and D requirements, the dystrophies were not prevented but were very notably delayed. It was hence apparent that the dystrophies were not actually caused by the cod liver oil, although they were precipitated and exaggerated in some unknown way by it.

Some three years ago we began the study of the nutritional requirements of guinea pigs with synthetic rations. With a slight modification of the diet of Madsen *et al.*, we have had no difficulty in producing the early severe dystrophies of these observers. This animal material, with the particular diet employed—a diet in which the increased proportion of cod liver oil seems responsible for particularly early and severe dystrophy—appeared ideally adapted for experiments attempting evaluation of the possible role of vitamin E in the prevention of such dystrophies.

A year was spent demonstrating that the administration of 0.75 cc or even of 0.5 cc of wheat germ oil daily to guinea pigs on this diet prevented the development of dystrophies up to the 355th day of life, when the experiment was discontinued. The muscle creatine values in these animals were normal. The controls (without wheat germ oil) all developed typical early dystrophies and in each case were sacrificed when practically moribund at times varying from the end of the first to the end of the third month.

These encouraging results with wheat germ oil led us to a repetition of the experiment employing the pure substance, alpha tocopherol, instead of wheat germ oil. In the midst of this work, several important papers appeared, reporting the employment of alpha tocopherol. Barrie,[3] as well as Goettsch and Ritzman,[4] have shown that alpha tocopherol prevents the development of muscular dystrophy in suckling rats from mothers reared and held on low E—facts which we can confirm. Mackenzie and McCollum[5] have also reported that alpha tocopherol cures the dystrophy which develops in rabbits maintained on the Goettsch and Pappenheimer diet, supplemented with 10 per cent. ether extracted wheat germ.

Since Cummings and Mattill[6] have shown that oxidative reactions initiated by the auto-oxidation of cod liver oil are destructive to vitamin E, we fed the cod liver oil (1 cc per os) and alpha tocopherol (3 mg per os) on alternate days. These guinea pigs likewise remained free of evidence of muscular dystrophy and have now been sacrificed on the 200th day of life, showing normal values for muscle creatine.

It is therefore apparent that in another animal form and with a particular dietary regimen in which an early severe dystrophy of the striated musculature invariably appears, alpha tocopherol acts effectively to prevent the dystrophy.

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A QUANTITATIVE STUDY OF MEANING BY A CONDITIONED SALIVARY TECHNIQUE (SEMANTIC CONDITIONING)

IF a human subject has acquired a conditioned reaction to some specific verbal stimulus, let us say the sight of the word "cent," what will be the course of the generalization or the transfer of the conditioning to other words similar in meaning or in visual-auditory form? Will there be more transfer of conditioning to a word like "penny" than to a word like "scent" or will the reverse be true? A number of experimenters have established conditioned responses to verbal stimuli,[1] and most of them have noted transfer from conditioned sensory stimuli to their verbal correlates and *vice versa*.[2] But in no case was there any attempt to separate the semantic—or meaning-content—factor of the verbal conditioning from its mere visual-auditory form. It is clear, however, that such a separation lies well within the limits of the conditioning technique. By using, for instance, in the transfer tests one series

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[2] M. Goettsch and A. M. Pappenheimer, *Jour. Exp. Med.*, 24: 145, 1931.

[3] M. M. O. Barrie, *Nature*, 142: 799, 1938.

[4] M. Goettsch and J. Ritzman, *Jour. Nutr.*, 17: 371, 1939.

[5] C. G. Mackenzie and E. V. McCollum, SCIENCE, 89: 370, 1939.

[6] M. J. Cummings and H. A. Mattill, *Jour. Nutr.*, 3: 421, 1931.

[1] O. P. Kapustnik, in "Fundamental Mechanisms of Conditioned Reflex Activity in Children" (edited by A. G. Ivanov-Smolensky), Moscow-Leningrad, 1930, 11–22 (Russian); N. N. Traugott, E. P. Smolenskaya, N. N. Traugott and V. K. Fadeyava, L. E. Khozak, T. V. Kovsharova, L. I. Kotliarevsky, in "Studying the Highest Forms of the Neurodynamics of Children" (edited by A. G. Ivanov-Smolensky), Moscow, 1934, 273–450 (Russian); C. V. Hudgins, *Jour. Gen. Psychol.*, 8: 3–52, 1933; G. H. S. Razran, *Arch. Psychol.*, 28: 1–124, 1935; R. Menzies, *Jour. Psychol.*, 4: 75–120, 1937; K. Diren, *Jour. Psychol.*, 3: 291–308.

[2] Kapustnik, Traugott, Smolenskaya, Traugott and Fadeyeva, Khozak, Kovsharova, Kotliarevsky, Diren and Razran, *loc. cit.*