oil. We have shown elsewhere (Klempner, Hollander and Frank[5]) that even with the same solvent such a difference in volume may produce a considerable increase in comb response; for 11 experiments with a range in dosage of 10-50 γ, the mean IR-value was 67.9 $\pm$ 5.4%. However, in the present investigation the mean IR value is 155.7 $\pm$ 10.1%. The difference between these two is 87.8% with a standard deviation of 11.5%. This difference is 7.6 times its standard deviation and is therefore statistically significant.

It may be concluded, therefore, that the improvement in comb growth response obtained in these experiments resulted from the substitution of alcohol for sesame oil, apart from the diminution in volume of vehicle. Such improvement may be ascribed to the rapid evaporation and absorption of the alcohol, with consequent diminution in loss by spreading to less responsive areas. It is also possible that the use of alcohol increases the rate of absorption of the androgen itself by the comb surface, but as yet we have no direct evidence of this.

We desire to express our thanks to Dr. Erwin Schwenk of the Schering Corporation of New Jersey for supplying us with the androsterone used in this investigation.

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Prevention of Nutritional Muscular Dystrophy in Suckling E-low Rats with Alpha-tocopherol and Related Substances.*

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That alpha-tocopherol was effective in preventing the dystrophy that appears in the suckling young of vitamin E-low mothers was first shown by Barrie,[1] Demole and Pfaltz,[2] and Goettsch and Ritzmann.[3] Goettsch and Ritzmann found that $FeCl_3$-treated wheat

* Aided by grants from the Research Board and the Department of Agriculture of the University of California, the Rockefeller Foundation and Merck and Company, Rahway, New Jersey. The following materials were generously contributed: alpha-tocopherol by Merck and Company, Rahway, New Jersey. Assistance was rendered by the Works Progress Administration, Official Project No. 65-1-08-62, Unit A-5.

1 Barrie, M. M. O., *Nature*, 1938, **142**, 799.

2 Goettsch, M., and Ritzmann, J., *J. Nutr.*, 1939, **17**, 371.

3 Demole, V., and Pfaltz, H., *Schweiz. Med. Wochenschrift*, 1939, **69**, 123.

germ oil (which had no activity as vitamin E in the cure of sterility) likewise had anti-dystrophic activity.

We are able to confirm the findings of Barrie, Demole and Pfaltz, Goettsch and Ritzmann as to the anti-dystrophic activity of alpha-tocopherol.

Young female rats reared on our vitamin E-low diet 427[4] and of proved sterility were bred for their second gestation and were given a single dose of 3 mg of natural alpha-tocopherol on the day of finding sperm. The litters resulting from these pregnancies were reduced to 6 young. In the first group of test animals the mothers were given 6 mg of alpha-tocopherol by stomach tube on the day of littering. They were allowed to suckle 3 of their own young and 3 foster young of the control mothers which received the solvent for the alpha-tocopherol (ethyl laurate). Likewise, the control rats were allowed to suckle 3 of their own young and 3 from the experimental animals. Six mg of alpha-tocopherol was almost adequate to prevent the dystrophy that would otherwise have developed toward the end of the lactation period. Two animals, however, in this group exhibited a slight stiffness (Table I). Ten mg of alpha-tocopherol appeared to be adequate to prevent the dystrophy.

TABLE I.
Prevention of Muscular Dystrophy in Suckling E-low Rats with α-tocopherol.

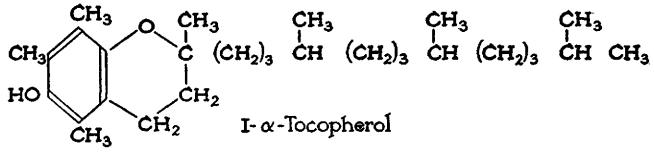
Treatment	No. of young	Dystrophic or dead Days 15-25
Mother received 6 mg α-tocopherol (in ethyl laurate) on day of littering	30	2 (slight stiffness)
Mother received ethyl laurate only	64	64
Mother received 10 mg α-tocopherol on day of littering	41	0
Young received 1 mg α-tocopherol daily from day 10	13	0
Young received ethyl laurate only	12	6
Young received 3 mg α-tocopherol daily from day 15	12	0
Young received ethyl laurate only	9	6
Young received 3 mg α-tocopherol daily from day 18	30	25
Young received ethyl laurate only	25	19

In a second experiment the young were given alpha-tocopherol: one group received 1 mg daily from day 10; a second group received 3 mg daily from day 15; and a third group, 3 mg daily from day 18. The results of this experiment demonstrate that alpha-tocopherol when administered as late as day 15 of lactation was effective in preventing the paralysis but that the young receiving the alpha-tocopherol from day 18 were not protected. It can be seen that not all the ethyl laurate treated young developed dystrophy although this was the case when the mothers were so treated. An explanation

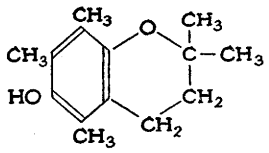
[4] Emerson, G. A., and Evans, H. M., *J. Nutr.*, 1937, **14**, 169.

may be afforded by the necessary conditions of the experiment for young in the same litter were fed the alpha-tocopherol by dropper and slight oral residues could have been licked off by litter mates.

Following the observation of Goettsch and Ritzmann demonstrating the activity of $FeCl_3$-treated wheat germ oil in preventing the dystrophy, we fed substances related chemically to alpha-tocopherol (I).

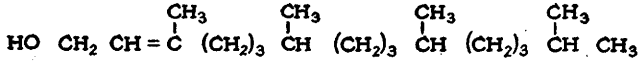


I-α-Tocopherol



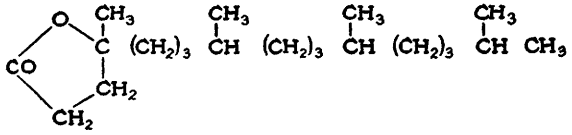
II-2,2,5,7,8 pentamethyl 6 hydroxy chromane

has the same ring structure as alpha-tocopherol. The side chain of alpha-tocopherol is derived from phytol (III),



III-Phytol

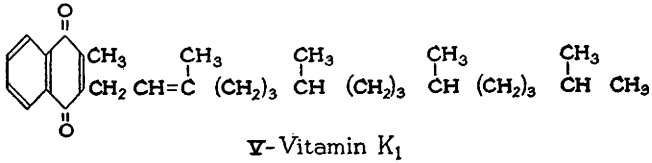
Fernholz obtained the gamma lactone (IV)



IV-gamma lactone *(Fernholz)*

on oxidation of alpha-tocopherol. All of these substances were inactive whether fed to the young from day 15 or to the mothers on the day of littering (Table II).

The resemblance in structure between vitamin K_1 (V)



V-Vitamin K_1

and alpha-tocopherol suggested that this substance might act as vitamin E but vitamin K_1 was also found to be inactive in the prevention of muscular dystrophy.

TABLE II.
Failure to Prevent Muscular Dystrophy in Suckling E-low Rats with Substances Related to α-tocopherol

Treatment	No. of young	Dystrophic or dead Days 15-25
Young received 3 mg phytol daily from day 15	16	14
Young received 3 mg 2,2,5,7,8, penta methyl 6 hydroxy chromane daily from day 15	20	13
Young received 3 mg gamma lactone (Fernholz) from day 15	16	13
Young received ethyl laurate only	52	45
Mother received 15 mg 2,2,5,7,8 penta methyl 6 hydroxy chromane on day of littering	54	53
Mother received 15 mg vitamin K_1 on day of littering	18	17
Mother received ethyl laurate only	28	26
Mother received 15 mg gamma lactone (Fernholz) from day 15	24	24

Summary. The dystrophy that almost invariably appears toward the end of the lactation period in the suckling young of vitamin E-low mothers can be prevented by the administration of 10 mg of alpha-tocopherol to the mother on the day of littering or the feeding of 1 mg daily to the young from day 10 or 3 mg from day 15. The administration of 3 mg of alpha-tocopherol daily from day 18 was ineffective. The following compounds related chemically to alpha-tocopherol were tested for anti-dystrophic activity and found inactive: 2,2,5,7,8-penta-methyl, 6 hydroxy chromane, phytol, gamma lactone and vitamin K_1.

11555 P

Reimplantation and Transplantation of Eyes in Anuran Larvae and *Fundulus heteroclitus*.*

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These experiments were undertaken on anurans and fishes to compare the results with those obtained from a series of studies on the grafted eyes of urodeles.[1-5] In one group the functional eye in

* Aided by grants from the John and Mary R. Markle Foundation and the Fluid Research Fund of Yale University School of Medicine.

1 Stone, L. S., *J. Exp. Zool.*, 1930, **55**, 193.

2 Stone, L. S., and Cole, C. H., PROC. SOC. EXP. BIOL. AND MED., 1931, **29**, 176.

3 Stone, L. S., Zaur, I. S., and Farthing, T. E., PROC. SOC. EXP. BIOL. AND MED., 1934, **31**, 1082.

4 Stone, L. S., Ussher, N. T., and Beers, D. N., *J. Exp. Zool.*, 1937, **77**, 13.

5 Stone, L. S., and Chace, R. R., PROC. SOC. EXP. BIOL. AND MED., 1937, **36**, 830.