

# Vitamin E

## A review of our knowledge of Vitamin E and an evaluation of that agent

*Harold E. Held, '42*

**I**N THIS day of vitamin consciousness, vitamin E is receiving its share of publicity in the daily and the farm press. Vitamin E, like many other of our new therapeutic agents, might be classed as a glamour drug, and as such, is accepted and used by many with very little inquiry into its basic chemistry and physiological action.

Vitamin E was first postulated in 1922 by Evans and Bishop (1). A summary of this earlier work was given by Evans (2). Evans found that rats, fed on a diet supposedly complete, failed to reproduce, although they appeared normal in every other respect. The females showed a normal estrus cycle, accepted the male, and conceived, but did not deliver any young at the end of the gestation period. Upon further study it was found that the fertilized ovum developed normally until its growth was arrested due to a breakdown of certain physiological processes in the placenta and fetus. The fetus then was resorbed. Male rats became sterile due to the degeneration of germinal epithelium of the testicles. They retained their sexual desire, however, and appeared normal in every other way. The addition of the missing factor to the diet restored fertility in the females, but not in the males where the action was seemingly not reversible; and, consequently, they remained sterile.

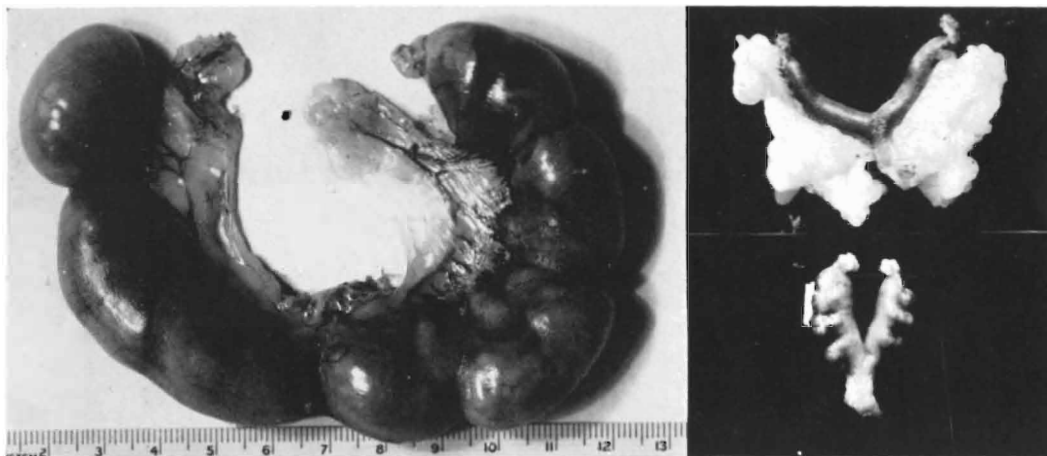
The chemistry of this anti-sterility factor has been the subject of much research since the publishing of the report by Evans (2). Evans, Emerson and Emerson (3) reported the extraction of a concentrate from wheat germ oil which show-

ed vitamin E activity in one milligram doses. To this substance they gave the name alpha-tocopherol. Cold pressed wheat germ oil, however, is still the commercial product and is one of our more potent natural sources of vitamin E.

### **In Domestic Animals**

The question which arises in the mind of the veterinarian is—can the action of vitamin E, as it is known in the rat, be transposed to the reproductive function of our domestic animals? It was with the hope of attempting to answer this question that B. H. Thomas and C. Y. Cannon (4) in the summer of 1933 began an experiment at Iowa State College feeding goats on a vitamin E deficient ration. It was the original plan to use dairy cattle but goats were used since facilities for chemically inactivating the vitamin E of basal rations in large enough quantities proved inadequate.

Seven healthy goats, four proved breeders and three virgin does, were started on a balanced ration of chopped alfalfa hay, ground yellow corn, ground oats, wheat bran, linseed meal, and bone meal. This basal ration was treated chemically to inactivate the vitamin E. To the treated portion of the ration was added vitamin E free cod liver oil, carotene, yeast and iodized salt. The goats were penned in an airy basement room in cages with raised wire mesh bottoms so that no outside food contamination would be possible. The does were mated to proved males, the kids resulting from the matings were raised to sexual maturity, and their fertility proved by making matings and observing the re-



*Upper Right:* Normal uterus of the rat. *Lower Right:* Uterus of a pregnant, vitamin E deficient rat showing resorption. *Left:* Uterus of a normal pregnant rat. All uteri are of the same age and are shown in the same scale.

sulting gestations. This experiment continued through four and one-half years during which time no reproductive abnormalities became evident. In fact, second generation goats went on to produce full term third generation kids. Evidently goats do not require vitamin E in their ration to insure reproduction, if at all. This same ration was at all times checked and found to produce sterility in male rats at from five to seven months of age and to cause female rats to go through resorption gestations typical of vitamin E deficiency.

Although it was established by Thomas and Cannon (4) that the vitamin E requirement, if any, is exceedingly small in the goat, it is not to be concluded that the vitamin E requirements of all classes of farm animals are likewise small. It would seem more logical, though, to transpose the results obtained with goats to cattle, sheep, horses, and hogs than those results obtained from the albino rat.

#### **Practical Applications?**

The practical application of vitamin E to animal nutrition was made quite soon after Evans (2) reported this new entity. In our present day business world, it is only natural that vendors of vitamin E enriched proprietary mixtures should make their appearance. These vendors have covered the field quite thoroughly

and have made their appeal directly to the farmer and in a few cases through the veterinarian. Their early claims dealt mainly with sterility, but since have suggested possible indications for the use of wheat germ oil in such a wide variety of conditions as poor hatchability in eggs, high chick mortality, Brucellosis, fowl leukosis, periodic opthalmia, parturient eclampsia, dermatitis, paralytic conditions, and even to hay fever and bronchial asthma in the human subject.

#### **Therapeutic Use**

Most of the wide variety of therapeutic trials made with wheat germ oil have been prompted by sound basic experimental results. The necessity of vitamin E for reproduction in the rat and rabbit is established without question. It has also been conclusively shown that young rats nursing mothers on vitamin E low rations develop a chronic myositis, a condition in which the skeletal muscles undergo hyaline degeneration and are partially replaced by fibrous connective tissue. In poultry nutrition it is accepted that vitamin E is necessary for hatchability, but the requirements are very low. It is exceedingly unlikely that practical poultry rations could be so deficient in vitamin E as to affect hatchability adversely.

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off the nostrils and holding the mouth shut at the same time.

A veterinarian with X-ray equipment will come to rely heavily upon it as a diagnostic aid. In large animals, especially in light horse practice, radiography is an invaluable aid in correct diagnosis of the numerous types of bone and joint pathology of the limbs. The small animal field, naturally, finds greater use for it. Fractures and dislocations with subsequent checks on reduction are conditions for which the X-ray is most generally used. X-ray examinations of the digestive tract for foreign bodies and for content of the lower bowel are helpful in making a correct diagnosis.

Before closing, a note of warning to users of X-radiation is added. Prolonged exposure to the primary tube radiation produces cellular damage in the operator or patient. Fluoroscopy often results in excessive exposure of the technician's hands. This may be manifested locally by an erythema, drying and exfoliation of the epidermis, soreness of the joints and tendons, or a pulsating sensation in the exposed part synchronized with the alternating current. More severe "burns" are seldom encountered in the veterinary field. Reflected radiation from powerful machines may do the same damage. Common sense dictates that the operator will expose the patient and himself to X-radiation no more than is absolutely necessary.

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Most of the work with vitamin E therapy in the larger domesticated animals has been reported by European investigators. They cite case reports in which animals, having a bad breeding history, have been restored to fertility.

The reports of Bay and Vogt-Moller (5) and Moussu (6) include large numbers of case reports, but it is difficult for the unbiased to draw conclusions from mere clinical observations when dealing with a function attended with as many variables as reproduction. Some investigators doubt if vitamin E is necessary at all in our

large animal rations. Others say that due to its wide distribution in nature, its stability, and the low requirements of our animals, that practical livestock and poultry rations do not need to be supplemented with vitamin E. Such a procedure simply adds unnecessarily to the cost of rations.

It is not the purpose of this paper to discredit wheat germ oil. It is without doubt a concentrated natural source of vitamin E as well as the B complex and possibly other nutritional entities. We have simply tried to present true facts concerning the present day knowledge of vitamin E.

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## EDUCATION *(Continued from page 10)*

compelled to. It seemed to me that while the European schools were much better supported financially than our own, our practitioners are kept more on their mettle than they are over there. If they do not deliver the service they are not employed. While no one has higher regard for the service by our Bureau of Animal Industry than I do, I would not want to see a time when our veterinary practice was on anything but a voluntary basis. State medicine may be just around the corner, but if it comes, much of the fine client-practitioner relationship will be lost. While our relation to agriculture is unique, and while both sides may have strained it at times, there is still much to be said for this co-operation. If we can serve the great livestock industry on the one hand and protect the health of the public generally on the other, our place in the American scheme will be assured and permanent.