cells in the peripheral zone of the lobule of the liver which Szittay observed after the feeding of Vigantol to young rabbits is not due to a specific action of vitamin D as he believed. The increase also occurs after the administration of inactivated viosterol, Drisdol, inactivated Drisdol, propylene glycol, absolute alcohol and ethyl ether.

The fact that young rats and dogs do not show this phenomenon, even though vitamin D is known to be just as effective against rickets in these animals as in rabbits, suggests that there is a species difference.

There is no detectable relationship between the effect of vitamin D on the phosphorus and calcium content of the blood and the increase of multinucleated cells in the liver. It is unlikely that an increase in basal metabolism is responsible for the phenomenon since the administration of thyroxin does not lead to an increase in the number of multinucleated cells. Wesson oil and sesame oil are without effect.

The observation that ethyl ether as well as propylene glycol and absolute alcohol may bring about an increase in the number of multinucleated cells suggests that a number of chemically different substances may be responsible for the increase.

13296 P

Hemorrhage Control in *Eimeria tenella* Infected Chicks When Protected by Anti-Hemorrhagic Factor, Vitamin K.

FRANCIS MARSH BALDWIN, OZRO BRANDT WISWELL AND HARRY ANTHONY JANKIEWICZ.

From the Physiological Laboratories, The University of Southern California, Los Angeles.

Excessive amounts of vitamin K in the dietary are usually considered a necessary factor in cases where prothrombin levels must be built up. However, as far as the authors are aware there has been no work on the control of hemorrhage in cases of parasitism by the coccidium, *Eimeria tenella,* in chicks in relation to the anti-hemorrhagic vitamin K. This vitamin was obtained in the liquid form, a peanut oil compound, under the trade name, "Klotogen".* A pure culture of *E. tenella* was obtained from the Los Angeles

* Through courtesy of Abbott and Company, Los Angeles, California. (Each cc of this liquid vitamin is equivalent to 1250 Almquist units, or 46,500 Dam units.)

Poultry Pathological Laboratory, but was sub-cultured through two preliminary groups of chicks in order to establish the purity and virility of this strain. Previous work in this laboratory had shown that an incubation period of 5 days is followed without exception by an interval of high mortality in pens where the inoculation by *E. tenella* has been heavy (5,000 to 6.000 oocysts).

Thirty one-week-old chicks were wing-banded and segregated into 3 groups of 10 each. The segregation was at random, the only thought being to have the total weight similar in each group. The cages were constructed so that all droppings fell through wire-mesh floor where they could be removed for examination.

The 3 groups were fed the same dietary of baby chick mash† consisting of: ground corn, wheat bran, wheat shorts, ground wheat, feeding oat meal, dehydrated alfalfa meal, sardine fish meal, meat and bone scraps, soya bean oil meal, old processed linseed meal, dried skim milk, kelp meal, ground limestone, steamed bone meal, charcoal, salt, yeast, and Napco XX (fortified cod liver oil). Group 1, the controls, were maintained on this diet for the duration of the experiment. Group 2 were given 6,000 oocysts of *E. tenella* each the first day, plus 0.25 cc of Klotogen for 4 successive days. Group 3 were given 6,000 oocysts of *E. tenella* each on the first day but no Klotogen.

Group 1, the controls, did not show any symptoms of infection from any source, and grew rapidly from day to day. The average body weight of this group at the outset of the experiment was 141.6 g, and reached a total of 230 g in 9 days. This was an average daily gain in weight of 10.54 g for each bird. All caeca examined in this group were normal on autopsy.

Group 2, the vitamin K protected group, first showed symptoms of infection late in the fifth day of 5 bloody droppings. Early in the sixth day, bird No. 114 died and 24 bloody droppings were recovered from the group. On the seventh day 24 bloody droppings were examined. On the eighth day all hemorrhage had ceased. This group averaged a daily gain of 5.58 g. On autopsy all caeca were near normal except that of the one that died (114) which contained thick clotted blood. The hemorrhagic cores of the remaining caeca were very small and in one instance was lacking altogether, giving evidence that resorption had taken place.

Group 3, the unprotected group, first showed symptoms of parasitism early in the fifth day; 33 bloody droppings with a much greater amount of blood in each dropping than showed in those of Group 2

† California Milling Corp. Baby Chick Mash.

at the same time. The mortality began early in the fifth day with 7 birds dying during this time. On the sixth day there were 26 bloody droppings but no mortality, and on the seventh day there were 26 bloody droppings which were the last indications of hemorrhage. All the blood in all the droppings from this group was very fluid and watery. The 3 survivors never were very ill since they gained in weight rapidly after the fifth day.

Conclusion. 1. Administration of vitamin K in the dietary of chicks definitely decreased the mortality in chicks parasitized by *E. tenella,* a hemorrhage-producing protozoan, since all autopsies performed show the vitamin K-protected birds had a fibrinated core in the caeca, which was in the process of being reabsorbed. 2. Vitamin K-protected birds showed a mortality of only 10% in comparison to 70% mortality in the unprotected group.

13297

Influence of Body Size on Gaseous Nitrogen Elimination During High Oxygen Breathing.*

ANDRE COURNAND, IRVING G. YARMUSH AND RICHARD L. RILEY.
(Introduced by Walter W. Palmer.)

From the Tuberculosis Service, First Division, Bellevue Hospital, and the Department of Medicine, College of Physicians and Surgeons, Columbia University, New York City.

By breathing a gas mixture whose nitrogen content is low, as by the inhalation of almost pure oxygen, the nitrogen physically dissolved in body fluids and tissues is gradually excreted in the expired air. A correction for excreted nitrogen is important in the determination of the residual air of the lungs according to certain methods, such as that of Christie[1] or the more recent open-circuit method of Darling, Cournand, and Richards.[2]

---

1 Almquist, H. S., and Stokstad, E. R., *Nature,* 1935, **136**, 31.

2 Becker, E. R., *Coccidia and Coccidiosis of Domesticated Game and Laboratory Animals and of Man,* 1934.

3 Dam, H., and Schonheyder, T., *Biochem. J.,* 1934, **28**, 1355.

4 Dam, H., *Biochem. J.,* 1935, **29**, 1273.

* Under a grant from the Commonwealth Fund.

1 Christie, R. V., *J. Clin. Invest.,* 1932, **11**, 1099.

2 Darling, R. C., Cournand, A., and Richards, D. W., Jr., *J. Clin. Invest.,* 1940, **19**, 609.