the plastid in which they are formed and these are usually removed in the process of purification. There is, in fact, evidence to the contrary. If α-amylose or amylopectin were localized at the periphery, one would expect those natural granules to have the thickest and strongest membranes that have the greatest phosphoric-acid content. One would expect such granules when boiled to hold together better than sorts with a lesser phosphoric-acid content. As a matter of fact, there is no such relationship between phosphoric-acid content and mechanical resistance to boiling. Potato starch with a fairly high phosphoric-acid content disintegrates rapidly, whereas tapioca starch, also a root starch, but with a much lesser phosphoric-acid content does not. The observations of Lynst-Zwikker,[6] which the writer has been able to confirm, indicate that the membrane of gelatinized granules is an artifact formed during gelatinization by the accumulation of the less soluble materials at the periphery of the granule.

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Differentiation between Vitamin B_4 Deficiency and "Encephalomalacia" in Growing Chicks.

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We[1] described a deficiency disease in growing White Leghorn chicks which was corrected by concentrates of Reader's vitamin B_4. The main symptoms described were lack of growth and incoordination which resulted in extreme difficulty in locomotion. Accompanying the lack of coordination of the muscles and disturbed gait was a tendency of the bird to fall upon its side with the legs in tension and pulled against the abdomen. Examination of the brains of a number of the deficient birds revealed gross lesions in the cerebrum and degeneration which could be observed histologically in both the cerebrum and cerebellum. At that time we stated that the condition encountered was probably the same as that observed in chicks by Pappenheimer and Goettsch[2] and designated by them as

[6] Lynst-Zwikker, J. J., *Rec. trav. bot. néerlandaises*, 1921, **18**, 1.

[1] Keenan, J. A., Kline, O. L., Elvehjem, C. A., Hart, E. B., and Halpin, J. G., *J. Biol. Chem.*, 1933, **103**, 671.

[2] Pappenheimer, A. M., and Goettsch, M., *J. Exp. Med.*, 1931, **53**, 11.

an "encephalomalacia." This conclusion was based largely on the histological preparations of the tissues from our animals with the comparison of the histological preparations of the tissues from our animals with the histological results of Pappenheimer and Goettsch.

During the continuation of our studies on deficiency diseases in chicks we have encountered another type of paralysis, the gross symptoms of which are distinctly different from those observed in vitamin B_4 deficiency. We have observed this condition upon a number of different rations, and have had some success in the development of a ration which will produce the condition in 100% of the birds. Only those rations which allow considerable growth will produce a large incidence of the disease. It is more likely that this condition is the encephalomalacia described by Pappenheimer and Goettsch. Very probably our observations on brain degeneration in what we called vitamin B_4 deficiency were complicated by changes due to encephalomalacia. In vitamin B_4 deficiency growth is checked rather early and the bird succumbs to a vitamin B_4 deficiency before gross symptoms of encephalomalacia appear, although the ration may be low in the encephalomalacia factor. Preliminary histological examination indicates that in severe cases of B_4 deficiency there is no marked degeneration and liquefication of the cerebrum like that which characterizes the encephalomalacia of Pappenheimer and Goettsch. The rations used in producing the B_4 deficiency have been described by O. L. Kline, H. R. Bird, C. A. Elvehjem, and E. B. Hart in the *Journal of Nutrition*, 1936, **11**, 515. The histology of the two distinct deficiency diseases and studies on the properties and the distribution of the two factors will appear in future papers, but in this short note we wish to describe briefly the gross symptoms of the encephalomalacia-like condition and distinguish it from vitamin B_4 deficiency.

The encephalomalacia-like paralysis develops very rapidly. Birds appearing normal in every way may show very severe symptoms in a few hours' time. At first the birds show nervousness and increased activity when disturbed. Soon the animals show a tendency to sit on their hocks and at frequent intervals move backwards pushing with their legs and assuming a penguin-like attitude. If the animal is held and brought near any firm object, it will immediately push against that object with its feet. When completely exhausted the animal will lie on its side still pushing with its feet, but it will never exhibit the tendency to fall to one side or the other like those suffering from vitamin B_4 deficiency.

The accompanying photographs show the distinction in behavior of the birds suffering from the two deficiencies. The encephalo-

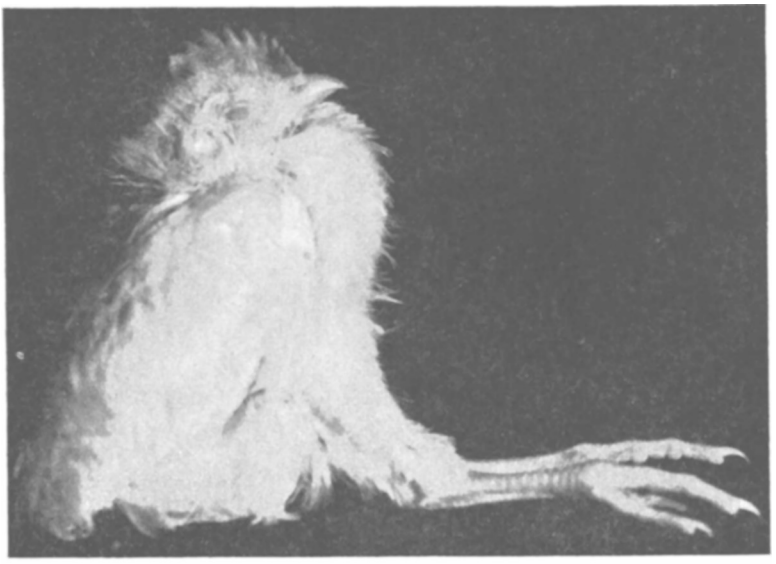

FIG. 1.
A case of "encephalomalacia."

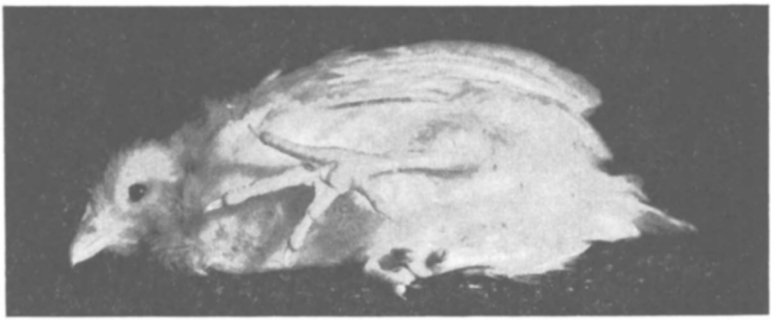

FIG. 2.
A vitamin B_4 deficient chick.

malacia-like condition appears to be very similar to that described by Pappenheimer and Goettsch and also to the condition recently described by Jungherr[3] in birds on certain practical rations.

[3] Jungherr, E., *Science*, 1936, **84**, 559.