study of the appearance of such marked differences in reaction in inbred animals of uniform exposure to the infectious agent is being made from both the immunologic and genetic points of view.

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Plant Pigments in the Nutrition of the Chicken.*

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Karrer, Euler and Rydbom[1] have demonstrated that carotene has provitamin A properties for the chicken but that xanthophyll is without effect in this regard. Evidence has been presented by Capper[2] that carotene is converted to vitamin A by the chicken.

The present experiment was an attempt to confirm the results of Karrer and his associates and to extend the study to include chlorophyll. In addition a study was made of the uric acid[3] content of the blood, it having been observed in earlier studies that this constituent increases in amount in the vitamin A deficient condition. Newly-hatched White Wyandotte chicks were placed upon a vitamin A deficient ration: 52.5% white corn, 20% wheat middlings, 10% dried skim milk, 10% meat scrap, 5% wheat bran, 0.5% sodium chloride, 1% calcite flour and 1% steamed bone meal. Sufficient irradiated ergosterol was used to protect against leg weakness. On this ration retardation of growth begins between 3 and 4 weeks of age. The pigments were dissolved in ethyl laurate and dilutions made with cottonseed oil. The daily allowance of each pigment was 0.03 mg. by capsule. Supplementation with carotene (M.P. 170°-173°) began at 26 days, with xanthophyll (M.P. 173°), at 27 and with chlorophyll at 31 days. An immediate growth response took place when carotene was fed but the birds which received the xanthophyll and the chlorophyll not only failed to grow, but lost weight and died within 2 weeks. Their behavior was essentially that

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[1] Karrer, P., v. Euler, H., and Rydbom, M., *Helv. Chim. Acta*, 1930, **8**, 1059.

[2] Capper, N. S., McKibbin, I. M. W., and Prentice, J. H., *Biochem. J.*, 1931, **25**, 265.

[3] Folin, O., *J. Biol. Chem.*, 1930, **86**, 179.

of the non-supplemented control group. Nine or more individuals were used in each group.

The uric acid of the whole blood was determined at 35 to 40 days of age. The average value for the carotene group was 3.7 mg. per 100 cc. of blood, whereas that for the xanthophyll group was 7.2 mg., and for the chlorophyll group 5.8 mg. The birds which subsisted on the unsupplemented white corn ration showed an average value of 9.8 mg., while those receiving the same ration but with the white corn replaced by yellow corn had a uric acid value of 3.3 mg., which is considered normal. Our observations with a number of young chicks show the normal uric acid value to be 4.00 mg. per 100 cc. of whole blood or less. In earlier work a high uric acid value was noted in birds deprived of food. It is not known whether the high values noted in vitamin A deficient chicks are due indirectly to the deficiency which is accompanied by a reduced intake of food or whether the vitamin A deficiency is directly responsible.

The results confirm those of Karrer, Euler and Rydbom with regard to carotene and xanthophyll. In addition chlorophyll has been shown to lack provitamin A properties.

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Quantitative Aspect of the Hypothetical Incorporation of Injected Antigen in Resulting Antibody. II. Experimental.

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The authors[1] have previously examined, from an arithmetical point of view, the Buchnerian hypothesis that antibody is a conjugate of body globulin and injected antigen. These speculations led us to undertake the following experimental investigation based upon the reactivity of artificial compound proteins in which the hapten chosen to confer the new specificity contains integrally an inorganic atom (As) for which a direct and very delicate chemical test is available. Two compounds, ovomucoid-diazo-arsanilic acid and casein-diazo-arsanilic acid, were prepared. The serum of a rabbit immunized against the first reacted with the second, showing the presence of an arsanilic-acid-specific antibody. The optimal precipitation ratio by volumes of antiserum to casein-diazo-arsanilic acid

[1] Hooker, S. B., and Boyd, W. C., *J. Immunol.*, 1931, **21**, 113.