line egg albumin (1.5%) and agar-agar (0.38%) affected the diffusion of glycine at pH 5 in similar fashion.

The persistence of this unequal distribution in isoelectric protein solutions demonstrates that the equilibrium is not of the Donnan type.

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Studies on the Combination of Manganese with Certain Amino Acids and Related Compounds.*

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The present work is a continuation of the studies which have been carried out in this laboratory on the combination of proteins, amino acids, and allied compounds with the inorganic elements.[1, 2, 3] This work has now been extended to include the manganous compounds.

The method employed consists in adding the substances to be tested to a solution of manganous chloride. The solution is adjusted to pH 9.25 by means of a borate buffer. The aqueous solution is shaken for 20 minutes with a solution of isonitrosoacetophenone dissolved in chloroform. The color of the chloroform solution is compared in a colorimeter with a chloroform solution obtained in a similar manner except that the test substance is omitted. If the substance tested forms a compound with manganese (*e. g.,* complex ions) such as to decrease the activity of the manganous ions in the aqueous phase, the color of the resulting chloroform solution will be less intense than the standard when both are shaken for a period of 20 minutes. If the manganous compound is dissociated to a greater extent no effect on the color will be observed.

The results show that oxalic, malonic, succinic, and glutaric acids have a decided influence in decreasing the color. The quantitative effect is greatest in the case of oxalic acid and least in the case of glutaric acid. The effect of the addition of aspartic or of glutamic acid is approximately the same as that of the corresponding nitrogen-free acids. The addition of alanine or of sodium chloride was

* Aided by a grant from the Chemical Foundation, Inc.

[1] Greenberg, D. M., and Schmidt, C. L. A., *J. Gen. Physiol.*, 1924, **7**, 287.

[2] Greenberg, D. M., and Schmidt, C. L. A., *J. Gen. Physiol.*, 1926, **8**, 271.

[3] Smythe, C. V., and Schmidt, C. L. A., *J. Biol. Chem.*, 1930, **88**, 241.

without effect on the color. The effect of glycine was slight and that of glycylglycine slightly more, but not so great as that of the dicarboxylic acids.

The present work is being continued.

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Allergy and Immunity in Coccidial Infections.

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Immunity to the several species of coccidia which occur in chickens has been thoroughly demonstrated by Tyzzer[1] and by Henry.[2] A similar host response has been shown to occur in rabbits (Bachman[3]) and in cats and dogs (Andrews[4]).

The purpose of this paper is to report the development of a similar immunity in guinea pigs infected with *Eimeria caviae,* together with the appearance of degenerate forms of the parasite in partially immune animals, observations on the production of hypersensitivity to the protein of the infecting organism, and a cutaneous hypersensitivity to *E. caviae* in this host.

The reinoculation of 35 previously infected guinea pigs has in all cases shown the presence of some immunity. In most cases the resistance has been sufficient to completely prevent the occurrence of clinical symptoms, which are invariably present in initial infections. While the mortality in guinea pigs upon infection with *E. caviae* for the first time has been found to be 40%, not one of the guinea pigs infected 2 or more times died from a typical coccidial infection.

A rather constant indication of the effect of previous infection was the altered prepatent period in cases of the second infection. While this period has been found to be exceedingly constant in all of the initial infections, a variation from 2 to 4 days from the normal 11½-day period in the appearance of oocysts was found in most cases. A more striking indication of the effect produced by the host upon the parasite as a result of the development of partial immunity is the occurrence of degenerate cysts. These occur only

[1] Tyzzer, E. E., *Am. J. Hyg.*, 1929, **10**, 1.

[2] Henry, D. P., *Univ. Calif. Publ. Zool.*, 1931, **36**, 157.

[3] Bachman, G. W., *Am. J. Hyg.*, 1930, **12**, 641.

[4] Andrews, J. M., *Am. J. Hyg.*, 1926, **6**, 784.