representing conversion of 2.2% of the original sulfanilamide. This supports the suggestion previously made that irradiated sulfanilamide solutions may owe their anticatalase activity to the presence of a hydroxylamino derivative. The presence of free hydroxylamine remains to be proven and the relative anticatalase activities of hydroxylamine and *p*-hydroxylamino-benzenesulfonamide is not at present known.

The method was applied to certain related compounds which had been examined for anticatalase activity. Non-irradiated solutions of 4,4′-diaminobenzene-sulfonanilide gave no measurable color when acetylated and diazotized. Irradiated solutions gave definite, measurable color. Sulfapyridine gave no color before or after irradiation. Three sulfones (methyl *p*-aminophenyl, *n*-amyl-*p*-aminophenyl and *β*-hydroxyethyl-*p*-aminophenyl sulfones) showed the failure of complete acetylation mentioned by Rosenthal and Bauer for other sulfones. The suggested double acetylation was not carried out. However, these sulfones did give stronger colors after irradiation, indicating a change similar to that in sulfanilamide.

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Experiments on the Antidermatitis Component of the Filtrate Factor in Rats.

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In rats fed a basal diet deficient in vitamin B and supplemented with vitamin B_1 and riboflavin, skin manifestations may persist or develop anew after the specific acrodynia has been moderated or cured by treatment with pure vitamin B_6 (natural or synthetic).[1, 2] Three more or less distinct types of lesions have been observed. In the most common type the lesions begin as sores around the mouth and as scaly dermatitis visible at first around the axillae, the groin and over the back between the scapulae. Later, alopecia follows and extends to the neck and over the back. In several animals, generalized scaliness (exfoliative dermatitis) has been observed.

1 György, P., *J. Am. Chem. Soc.*, 1938, **60**, 983.

2 György, P., and Eckardt, R. E., *Nature* (London), 1939, **144**, 512.

Administration of the proper doses of liver and yeast and of filtrates from extracts of wheat germ, yeast and rice polishings, which have been adsorbed on fuller's earth, assures complete cure of these skin manifestations. Thus, the factor curative of dermatitis in rats must be part of the filtrate factor (Factor 2).[3] The latter factor, as it appears to be a complex in itself, we prefer to designate the filtrate fraction.

With the production of a specific extensive dermatosis in rats that is due to lack of a part of the filtrate fraction, it becomes particularly interesting to know whether or not this component corresponds to the chick antidermatitis factor recently identified[4-7] with pantothenic acid.

Oleson, *et al.*,[8] were unable to reach a definite conclusion as to whether pantothenic acid was essential for the rat. Using growth as an unspecific criterion, Hoffer and Reichstein[9] stated that *beta*-alanine is active in promoting growth in rats deprived of the filtrate fraction, a finding which El-Sadr and his coworkers[10] were unable to confirm. In our experiments, *beta*-alanine in doses up to 500 micrograms daily had no effect on growth or on skin lesions.

Subbarow and Hitchings[11, 12] have prepared a crude calcium salt of pantothenic acid and were able to demonstrate definite growth-promoting activity in doses of 1 mg daily administered to rats fed a basal diet deficient in vitamin B and supplemented with vitamin B_1, riboflavin, and a fuller's earth adsorbate from liver extract as the source of vitamin B_6. Skin lesions were not observed.

Seemingly in contrast to these experiments, Ali Mohammad and his coworkers[13] reported lately that the growth-promoting activity of an iso-amyl alcohol extract from a rice bran preparation was not

3 Lepkovsky, S., Jukes, T. H., and Krause, M. E., *J. Biol. Chem.*, 1936, **115**, 557.

4 Jukes, T. H., *J. Am. Chem. Soc.*, 1939, **61**, 975.

5 Jukes, T. H., *J. Biol. Chem.*, 1939, **129**, 225.

6 Woolley, D. W., Waisman, H. A., and Elvehjem, C. A., *J. Am. Chem. Soc.*, 1939, **61**, 977.

7 Woolley, D. W., Waisman. H. A., and Elvehjem, C. A., *J. Biol. Chem.*, 1939, **129**, 673.

8 Oleson, J. J., Bird, H. R., Elvehjem, C. A., and Hart, E. B., *J. Biol. Chem.*, 1939, **127**, 23.

9 Hoffer, M., and Reichstein, T., *Nature* (London), 1939, **144**, 72.

10 El-Sadr, M. M., Hind, H. G., Macrae, T. F., Work, C. E., Lythgoe, B., and Todd, A. R., *Nature* (London), 1939, **144**, 73.

11 Subbarow, Y., and Hitchings, G. H., *J. Am. Chem. Soc.*, 1939, **61**, 1615.

12 Hitchings, G. H., and Subbarow, Y., *J. Nutrition*, 1939, **18**, 265.

13 Mohammad, A., Emerson, O. H., Emerson, G. A., and Evans, H. M., *Science*, 1939, **90**, 377.

destroyed by heating in 1 *N* NaOH solution at 100°C for 1 hour and concluded that this factor is "not identical with the 'chick antidermatitis factor'."

As rats fed a diet devoid of the filtrate fraction exhibited specific skin symptoms which were at least comparable with those occurring in chicks, they were deemed to be suitable for testing an active concentrate containing the factor curative of dermatitis in rats. A zinc salt of pantothenic acid (containing other materials as listed below) was prepared by a slight modification of the method used by Hitchings and Subbarow.[12] This salt was tested on a sufficient number of rats (25 up to the present time) which were suffering from the specific skin lesions. The salt was composed of about 20% of zinc, 15% of pantothenic acid as determined by the streptococcus growth method, 30% of nicotinic acid amide, 10% of uracil, and the balance, about 25%, of unidentified material, mostly organic acids.

This preparation containing the zinc salt of pantothenic acid has been found very active in the cure, in from 3 to 4 weeks, of the specific skin lesions and in promotion of growth in the rats kept on a diet free from the filtrate fraction. The lowest active daily dose tested to date is 0.5 mg in terms of the zinc salt, which is equivalent to 75 micrograms of pantothenic acid. The zinc was precipitated by phosphate before it was administered. A fresh solution was prepared daily. Autoclaving at pH 10 for 2 hours at 120°C destroyed the activity of the salt.

Rats fed, in addition to their vitamin B-free basal diet, vitamin B_1, riboflavin, vitamin B_6 and the crude zinc salt of pantothenic acid appear still to manifest deficiency of other factors. Hepatic injury[14] was frequently observed in this group of animals.

The experiments here reported favor the view that pantothenic acid is efficacious in the cure of specific skin conditions in rats. A final conclusion requires repetition of the experiments, with a pure preparation of pantothenic acid.

Summary. A purified but still crude zinc salt of pantothenic acid proved to be active in the cure of specific skin lesions and in promotion of growth in rats fed a diet devoid of the filtrate fraction. Autoclaving at pH 10 destroyed the activity of the preparation.‡

14 György, P., and Goldblatt, H., *J. Exp. Med.*, 1939, **70**, 185.

‡ Since this paper was submitted for publication, experiments with a crude but further purified barium salt containing 40 to 50% of pantothenic acid have shown it to be active in rats in a daily dose of 150 micrograms and over.