the deficient rats with biotin results in shortening of the lengths of their infections to a point where they are not significantly different from the normals.

With regard to the lack of appearance of further symptoms noted in the latent biotin-deficient rats of Experiment IV, it should be noted that a number of the moderately biotin-deficient rats able to withstand the added strain of infection with *T. lewisi*, had already given the impression of improvement of their deficiency symptoms at or shortly after the height of infection. These phenomena led to the hypothesis that the parasites might be capable of producing sufficient biotin to prevent much aggravation of the deficiency symptoms of their host. Experiments are now in progress to definitely determine whether there is such an effect.

The effect of biotin deficiency in prolonging the infection with *Trypanosoma lewisi* in the rat makes Trager's recent paper[3] indicating a similar lengthening of infection in avian malaria by means of the same deficiency more interesting. This is especially so because the same effect was noted in the Sporozoa as is here noted in Mastigophora.

Studies of the stained material are now being worked out in detail to determine the effects of biotin deficiency on the parasite numbers and on the antibody sequence. Further work is also being done to determine the effect of excess biotin on the infection in the normal rat. It should be noted that since this work was done exclusively with biotin deficiency no claims are made at present that such an effect is specific to biotin.

Summary. Biotin deficiency has been found to prolong the infection with *T. lewisi* in the rat. This effect can be negated by the administration of biotin to the deficient rat during the course of infection. Biotin appears to be instrumental directly or indirectly in the activation of the immune bodies in this infection.

3 Trager, W., *Science*, 1943, **97**, 206.

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Production of Rh Antiserum by Inoculation of Guinea Pigs with Human Erythrocytes.

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Antisera used for detecting the presence of the Rh antigen in human erythrocytes have been of two types: the serum of guinea pigs immunized against the red blood cells of *Rhesus* monkeys,[1,2] and the serum of certain Rh— human beings who have developed antibodies against the Rh antigen.[3,4] These latter sera are not readily procurable since human beings possessing the Rh antibody are infrequently encountered and accordingly the incidence of their employment is greatly restricted. Guinea pig anti-rhesus sera also have limitations to their usefulness. Certain differences have been noted in the Rh antigen as found in monkey and human erythrocytes,[5,6] and the implications of these differences as yet have not been clarified. Further, the production of such sera in certain laboratories may be hampered by the present war-time scarcity of *Rhesus* monkeys. For these practical reasons, as well as for certain theoretical con-

1 Landsteiner, K., and Wiener, A. S., *J. Exp. Med.*, 1941, **74**, 309.

2 Gallagher, Fred W., and Jones, Lloyd R., *J. Immunology*, 1943, **46**, 9.

3 Levine, P., Katzin, E. M., and Burnham, L., PROC. SOC. EXP. BIOL. AND MED., 1940, **45**, 346.

4 Wiener, A. S., and Forer, S., PROC. SOC. EXP. BIOL. AND MED., 1941, **47**, 215.

5 Davidsohn, I., and Toharsky, B., *Am. J. Clin. Path.*, 1942, **12**, 434.

6 Fisk, Roy T., and Foord, Alvin G., *Am. J. Clin. Path.*, 1942, **12**, 545.

siderations, we have undertaken the production of Rh antisera by inoculating experimental animals with Rh+ human erythrocytes.

Guinea pigs were inoculated with varying doses of red blood cells over a period of 3 months. The cells used were from an Rh+, group O, type MN individual. The presence of the Rh antigen in these cells was assured by the fact that they agglutinated in several absorbed guinea pig anti-rhesus sera and in 6 human anti-Rh sera. Immune serum obtained in this manner when absorbed, according to our previously reported technic[2] with group O, type MN, Rh— cells, distinguished sharply between known Rh+ and Rh— human erythrocytes of all blood groups.

In view of these findings it would appear that the possibilities for producing Rh antisera, useful in testing the red blood cells of human beings belonging to any blood group, have been greatly extended.

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Effect of Propylene Glycol on Bacterial Spores.

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Recent publications[1,2] have demonstrated the bactericidal and viricidal activity of propylene glycol. Using air-suspended bacteria as well as broth cultures *in vitro*, the following organisms have been found susceptible to this substance: Hemolytic and non-hemolytic staphylococci, *B. coli*, hemolytic streptococci, *Streptococcus viridans*, pneumococci (Types I, II, and rough), *Hemophilus influenzæ*, *B. pertussis* and PR8 strain of influenza virus.

Bactericidal action is demonstrable in dilutions as high as one part of propylene glycol in 50 million parts of air when air-suspended organisms are tested, while *in vitro* experiments demonstrate that organisms grow in broth containing as much as 15% glycol but are killed when the concentration of glycol in the media reaches 85%.

In view of the widespread interest in the use of glycol vapor as a means of controlling cross infections, this study was carried out in an attempt to throw further light on its possible mode of bacterial killing. Using *B. subtilis* as the test organism, observations were made to determine the effect of propylene glycol on bacterial spores.

I. *Effect of Propylene Glycol Vapor on Air-Suspended Bacteria.* These tests were done in small glass chambers of 2 cubic feet capacity; the air was agitated by means of small fans and standardized broth cultures were atomized into the space. Measured dilutions of propylene glycol vapor were introduced. Samples of 2 liters of air were taken for culture and analysis.

A. *Vegetative Forms.* Eighteen-hour cultures of *B. subtilis* were sprayed into the chambers and results similar to those reported occurred; *i.e.*, there was immediate killing in dilutions as high as 1 g of glycol in 25 million cc of air.

B. *Spores.* A 72-hour culture of *B. subtilis* showing many sporulated forms was heated for 20 minutes at 80°C. After this period of heating a loop of the culture was inoculated in broth. Abundant growth occurred, showing that the spores were viable. An 18-hour culture showing no spore forms was killed by this amount of heat. When the suspension of spores was atomized into "glycolized air" no bactericidal effect was observed even when the introduction was made into a saturated

1 Robertson, O. H., Bigg, E., Puck, T. T., and Miller, B. F., *J. Exp. Med.*, 1942, **75**, 593.

2 Robertson, O. H., Loosli, C. G., Puck, T. T., Bigg, E., and Miller, B. F., *Science*, 1941, **94**, 612.