S type culture—which we know commonly possesses a double antigenic configuration. But neither principle acts on certain mucoid resistants arising from the action of the alpha principle on the S type culture.

These observations are impossible of reconciliation with d'Herelle's filtrable virus theory of bacteriophage action, in which the differences in size of the lytic areas (assumed to represent a continuous variation) are correlated with differences in "virulence" of the bacteriophage. And they can be reconciled no more readily with Bordet's theory of nutritive viation. Their significance is still far from clear, but we believe that they offer more substantial support to a conception of the bacteriophage as comprising 2 functionally reciprocal units which may be regarded provisionally as complementary cyclostages in the developmental history of the culture concerned. This conception is developed in greater detail in a series of papers soon to appear.[8]

[1] Bail, O., *Wien. klin. Wchnschr.*, 1922, xxxv, 722.
[2] Bail, O., and Watanabe, T., *Wien. klin. Wchnschr.*, 1922, xxxv, 362.
[3] Watanabe, T., *Zeitschr. f. Immunitätsf.*, 1923, xxxvii, 106.
[4] Gratia, A., *Compt. rend. Soc. biol.*, 1923, lxxxix, 821.
[5] Gratia, A., *Compt. rend. Soc. biol.*, 1923, lxxxix, 824.
[6] Hadley, Ph., *J. Bact.*, 1924, ix, 397.
[7] Kline, G. M., *J. Am. Pub. Health Assn.*, 1927, xii, 1074.
[8] Hadley, Ph., *J. Inf. Dis.*, 1928, (in press).

3855

Anemia Following Splenectomy in White Rats.

PAUL R. CANNON, WILLIAM H. TALIAFERRO AND LESTER R. DRAGSTEDT.

From the Departments of Pathology, Hygiene and Bacteriology, and Surgery of the University of Chicago.

Numerous European workers have observed that rats frequently develop a severe anemia following removal of the spleen. That this is not always the case, however, is shown by the fact that in certain laboratories splenectomy of rats has not been followed by anemia. Lauda[1] made an extensive study of this problem and found that in approximately 75% of his splenectomized rats, a very severe hemolytic type of anemia developed. He proved it to be of an infectious nature and transmissible to other splenectomized rats. Shortly af-

terward, Mayer, Borchardt and Kikuth,[2] in repeating Lauda's work, observed within 24 to 48 hours after splenectomy, small rod-like or dumb-bell shaped inclusions in the erythrocytes. These later increased in numbers until at the height of the anemia there were 12 or more within each erythrocyte, appearing with the Giemsa stain as reddish coccobacillary forms. They concluded that these inclusions were identical with the ones observed by Mayer[3] in 1921 and named *Bartonella muris ratti* because of their similarity to the inclusions found in the erythrocytes of patients with Oroya fever.

We have similar findings in white splenectomized rats. The effect depends primarily upon the source from which the rats were obtained. In 13 rats recently obtained from the Wistar Institute and the Albino Supply Company stock, we have found that no significant anemia follows removal of the spleen. In 2 Wistar rats, however, which had been in the animal room for several months, splenectomy was followed by a very severe anemia. We splenectomized 11 rats obtained from Chicago dealers and in every case, usually about the fifth day, a marked anemia has developed. This anemia appears to be identical with that described by Lauda as "the infectious anemia of rats." The animals show a pronounced pallor of the eyes and mucous membranes, a greatly increased respiratory rate, and in most cases, an intense hemoglobinuria followed by death. The blood picture shows a fall in erythrocytes from 10,000,000 to 2,000,000 per cm., a decrease in hemoglobin from 15.5 gm. to 4-5 gm. per 100 cc. of blood, and a rise in leukocytes from 10,000-15,000 to as high as 70,000 per cm. Giemsa staining reveals a polymorphonuclear leukocytosis. A striking feature at the beginning of the anemia is the marked erythrophagocytosis, many monocytes containing as many as 5 erythrocytes. The erythrocytes contain many *Bartonella* inclusions. A day or so later the blood picture is that of intense blood regeneration with many polychromatophilic cells, noroblasts, reticulocytes and immature leukocytes.

Pathologically, we find the liver enlarged, pale and friable. Sections show the liver cords greatly swollen and the Kupfer cells engorged with erythrocytes in various stages of degeneration. The small intestines contain golden brown fluid and the urinary bladder in most instances contains hemoglobin. The kidneys show a marked nephrosis with iron-containing pigment in the lumina of the convoluted tubules. The bone marrow is actively regenerating with marked erythrophagocytosis in evidence. Sections of the liver, myocardium and kidney stained with scarlet red show distinct changes of the fatty degeneration type.

Etherization or other operations or both might also lead to this anemia. In 8 rats, using such operations as laparotomy and castration or crushing the testicle, removal of one or both adrenals, removal of the frontal lobes of the brain, no significant anemia followed the operation. In 4 of these animals splenectomized from 11 to 13 days after operation severe anemia promptly followed the splenectomy.

In 2 cases thus far we have injected blood from a rat of the infected stock into Wistar rats. Splenectomy of these rats led to the development of a typical fatal anemia in both cases, showing the transmission of the virus.

Our findings further emphasize the great importance of the spleen as a dominant part of the defensive mechanism of the body against latent infections. In addition, we feel that the demonstration of *Bartonella* infections among rats in this country necessitates careful elimination of such infected animals from experiments involving a study of nutrition and particularly from all experiments in which splenectomized animals are used.

---

[1] Lauda, E., *Virchows Arch. f. path. Anat.*, 1925, cclviii, 529.

[2] Mayer, M., Borchardt, W., and Kikuth, Walter., *Klin. Wchnschr.*, 1926, v, 559.

[3] Mayer, M., *Arch. f. Schiffs- u. Tropen-Hyg.*, 1921, xxv, 150.

3856

Circulatory Reactions to Ergotamine and Effect Upon Them Produced by Adrenalectomy and the Blood pH.

WILLIAM SALANT, J. ERNEST NADLER AND KEEVE BRODMAN.

From the Department of Physiology and Pharmacology, University of Georgia, and Biological Laboratory, Cold Spring Harbor, L. I.

According to the observations of Rothlin,[1] Dale and Spiro,[2] and Schegg,[3] ergotamine tartrate in doses not exceeding 1.0 mg. per kilo given intravenously to cats and dogs produces a rise of blood pressure. Rothlin reported that very small doses also produced a slight fall of blood pressure in cats, but he ignored this observation in a later communication.[4] His blood pressure tracings showed that the pressor effect was not of exactly the same type. Some showed a persistent elevation of blood pressure while others showed a steep rise followed soon after by a prompt fall. But in all cases there was reversal of action of adrenalin when given soon after the administration of ergotamine.