small, and suggested non-acid-fast cocci surrounded by a mere wisp of cytoplasm.

Smears taken from 2½-to-4½-weeks-old cultures showed few granule forms, many non-acid-fast bacilli and acid-fast bacilli as well. Many were rather light red in color, and in some instances contained one or more deeply stained acid-fast bodies. Occasional forms were noted which appeared to be transitional between the non-acid-fast and acid-fast stage. These transitional bacilli contained one acid-fast body and one or more non-acid-fast bodies lying within the same bacillus. Both of the transitional forms described above indicate that the granules or bodies of the tubercle bacillus are the last portions of the organism to lose acid-fastness, and the first portions to regain or reacquire acid-fast properties.

Each of the 4 strains, including both R and S forms, followed the same course of development.

7456 P

Hemorrhages in Skin Lesions After Intravenous Injection of Starch.

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When rabbits are injected intravenously with cholera vibrios and on the following day the same material, or *B. coli* or proteus bacilli, is again injected intravenously, hemorrhages occur in the intestines at the site of the localization of cholera vibrios. This hemorrhagic phenomenon was discovered by Sanarelli.[1] Shwartzman[2] and Hanger[3] have shown that when certain species of bacteria or their products (*B. typhosus, B. lepisepticum, B. coli,* meningococci) are introduced into the skin of rabbits and one day later the same material injected intravenously, hemorrhagic necrosis occurs in the skin at the site of the first injection. The nature of this hemorrhagic reaction is still obscure. It seems reasonable to hope that the discovery of new substances capable of producing the reaction may throw light on the nature of the phenomenon. Sickles[4] observed that bacterial filtrates, of the second injection, can be

1 Sanarelli, G., *Ann. Inst. Pasteur,* 1924, **38**, 11.

2 Shwartzman, G., PROC. SOC. EXP. BIOL. AND MED., 1928, **25**, 560.

3 Hanger, F., PROC. SOC. EXP. BIOL. AND MED., 1928, **25**, 775.

4 Sickles, G., *J. Immunol.,* 1931, **20**, 169.

replaced by a 0.1% agar suspension but not by purified agar, galactose, 10% gelatin, or India ink. Shwartzman[5] reported that mixtures of precipitinogen and serum containing homologous precipitins injected intravenously produce hemorrhage in the skin prepared by bacterial filtrates. Sickles did not express her view as to the mode of action of the agar suspension. It is possible that the action of agar is due to its colloidal character but we have found that a suspension of collodion particles, of less than 3 micra in diameter, injected intravenously did not produce hemorrhages in areas injected with bacterial filtrates.

It is known that the intravenous injection of agar mixed with fresh guinea pig serum and kept at 37°C. for 30 minutes produces anaphylactoid symptoms in guinea pigs, but agar alone or a mixture of agar and heated guinea pig serum are entirely inactive in this respect. Since starch, like agar, produces anaphylactoid symptoms in the guinea pig we wanted to find out if starch used as a second injection causes hemorrhagic phenomenon. Starch has the advantages that it is a relatively pure substance and its action upon the vascular system, when introduced into the blood stream, has been studied by physiologists (Bayliss and others).

In one group of rabbits from 0.1 to 0.25 cc. of filtrates from *B. coli* or meningococci were injected into the skin. On the following day, the rabbits received an intravenous injection of soluble starch or cornstarch solution. In another group of rabbits, eel serum was used to prepare the skin, since in previous experiments we found that fresh eel serum is very potent in preparing the skin for the hemorrhagic reaction. Six of 7 rabbits injected with 10 cc. of a 10% starch solution reacted with hemorrhage; the incidence of hemorrhagic reactions was slightly lower when 5 cc. of a 10% or 10 cc. of a 5% solution was used. Starch did not act as a skin preparatory agent.

After the intravenous injection of soluble starch solution, many of the rabbits appeared excited, their breathing was labored, and in some of them urination and frequent defecation was observed.

The hemorrhagic reactions appeared within from 5 minutes to 2 hours after the intravenous injection of soluble starch. According to Shwartzman and others, the hemorrhagic reaction, as a rule, occurs only between 4 to 5 hours after the injection of bacterial filtrate. It has been found by various workers that about 30% of the rabbits are refractory to the hemorrhagic reaction when bacterial

[5] Shwartzman, G., PROC. SOC. EXP. BIOL. AND MED., 1931, **29**, 193; Shwartzman, G., *J. Exp. Med.*, 1933, **57**, 859.

filtrates are used for both injections. In the rabbits injected with 10 cc. of 10% soluble starch solution, only 1 of 7 failed to react with hemorrhage. The literature of the subject shows that from 25 to 30% of rabbits die after the intravenous injection of bacterial filtrates. No deaths occurred after the intravenous injection of soluble starch.

7457 P

Rôle of Pressor Substances in Etiology of Arterial Hypertension.

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The theory that circulating substances play an etiological rôle in arterial hypertension has been revived recently by a series of studies carried on by Bohn and his associates.[1, 2, 3] These investigators of the Volhard clinic have reported the finding of increased amounts of pressor substances in the urine and in the blood of patients with "pale hypertension" (Volhard). In view of the important implications of Bohn's conclusions, we have reinvestigated this problem.

Because of the fact that several hormones and chemical substances are present in greater concentration in the urine than in the blood, and because large amounts of urine are readily obtainable for maximum chemical concentration, we have studied particularly extracts of urine. Blood and chest, abdominal and cerebrospinal fluids were also tested, both before and after extraction. In order to ascertain the efficacy of the alcohol-acetone fractionation of pressor and depressor substances, we have tested biologically not only the alcohol but also the acetone fraction, whereas Bohn utilized only the former. Twenty-one subjects were studied, 8 of whom were normal, 7 had malignant hypertension, 2 benign hypertension, and 4 chronic glomerulonephritis with hypertension. Extraction of a number of 24-hour urine specimens on each subject was performed. A total of 120 extracts were repeatedly tested on 55 cats. Dial and amytal given intraperitoneally were used as anesthetics, but

[1] Bohn, H., *Z. f. klin. Med.*, 1931, **119**, 100.

[2] Bohn, H., *Z. f. klin. Med.*, 1933, **123**, 558.

[3] Bohn, H., *Verhandl. d. deutsch. Gesellsch. f. inn. Med.*, 1933, **45**, 182.