

the crude egg white. In a small series with crystallin egg-albumin and ovomucoid, no sensitization leading to necrotic reaction was obtained.

Although the observations at our disposal do not permit the identification of the described sensitiveness with the tuberculin sensitiveness, the conclusion seems at hand that the mechanism underlying both is similar. The tuberculous infection creates in an unknown manner the conditions necessary for the development of the local sensitiveness, as well as the conditions for an increased antibody production, which are not specific to a certain antigen. The protein substances of the tubercle bacilli, as any foreign protein substance which is present in the organism, determines the specificity of the sensitiveness. It is a very interesting problem whether in the resistance against the tuberculous infection, which we observe always as the result of a slight infection, the same factors are at work—a non-specific altered reaction of the organism and a specific reaction made possible by the former.

¹ Lewis, P. A., and Loomis, D., *J. Exp. Med.*, 1924, xl, 503; 1925, xli, 327; 1926, xlii, 263.

3218

The Effect on Blood Sugar of Injections of Bacteria.

VICTOR E. LEVINE AND J. J. KOLARS.

From the Department of Biological Chemistry and Nutrition, School of Medicine, Creighton University, Omaha, Nebraska.

Intercurrent infection unfavorably influences the course of diabetes. Graham¹ finds that infection may be instrumental in precipitating the diabetic into a state of coma. Graham¹ and also Rab-inowitch² report that infection diminishes the potency of insulin. The dosage required to lower the blood sugar to a certain level is much greater in a diabetic in whom infection is present than in one without this complication. Clinical evidence is accumulating with reference to the fact that infection, focal or generalized, may be an etiological factor in *diabetes mellitus*. Rosenow has recently demonstrated a relation between focal infection and this disease.³

Infection in the non-diabetic has been reported by several investigators to give rise to hyperglycemia.⁴ The invading organism is believed to lower the carbohydrate tolerance.⁵ Menten and Manning,⁶ and Jeckwer and Goodell⁷ have demonstrated hyperglycemia as a result of the injection of some types of bacteria. Thomas⁸ observed that guinea pigs in whose organs bacilli of the enteridis-paratyphoid B group were isolated, showed characteristic lesions in the pancreas, such as hydropic degeneration of the islands of Langerhans.

In view of the above facts, a study of the relation to carbohydrate metabolism of bacteria invading the animal organism is of paramount importance. The experiments here reported deal with the effect on the sugar level in the blood of rabbits receiving intraperitoneal injections of three billion heat-killed bacteria. The organisms were obtained from 24-hour cultures. They were removed from their growth media and suspended in saline, and the saline suspensions rendered sterile by heating for several one-hour periods at 60° C. (We are much indebted to the Research Department of Parke, Davis & Co., Detroit, for the growth of the cultures and the preparation of the sterile saline suspensions used in our experiments.) The animals were starved for 18 to 24 hours previous to the administration of the bacterial suspension. Blood sugar was determined by the method devised by Shaffer and Hartmann,⁹ and calculations made according to their directions. Temperature readings were taken immediately after the withdrawal of blood from the ear vein.

The results of the work thus far indicate that bacteria may be divided into three groups with relation to their effect on the sugar content of the blood.

Group I. Those That Cause an Increase in Blood Sugar.

To this group belong *Bacillus coli communior*, *Bacillus coli communis*, *Bacillus dysentery*, *Staphylococcus pyogenes aureus*, *Bacillus paratyphoid A*, and *pneumococcus* type I.

BACILLUS DYSENTERY.

Weight of rabbit, 1750 gm.

Amount injected, 3 billion bacteria in 1 cc.

	Blood Sugar	Rectal Temp.
	Per cent	
Control	0.107	100.6
2 hours after injection of bacterial suspension	0.160	104.2
3 hours after injection of bacterial suspension	0.174	105.0

Group II. Those that do not Cause a Change in the Sugar Concentration of the Blood.

In this group are to be found *Bacillus pyocyaneus*, *Bacillus pertussis*, *Friedlander's bacillus*, *Bacillus diphtheriae*, *Bacillus influenzae*, *Bacillus faecales alkaligenes*, *Streptococcus viridans*, and *Bacillus typhosus*.

BACILLUS ENTERIDIS.

Weight of rabbit, 1200 gm. Amount injected, 3 billion bacteria in 1 cc.

	Blood Sugar	Rectal Temp.
	Per cent	
Control	0.120	101.4
1½ hrs. after injection of bacterial suspension	0.120	102.0
3 hours after injection of bacterial suspension	0.126	102.0

Group III. Those that Cause a Decrease in Blood Sugar.

Streptococcus hemolyticus is the only one we have thus far found to belong to this group.

STREPTOCOCCUS HEMOLYTICUS.

Weight of rabbit, 1300 gm. Amount injected, 3 billion bacteria in 1 cc.

	Blood Sugar	Rectal Temp.
	Per cent	
Control	0.098	101.5
2 hours after injection of bacterial suspension	0.079	102.0
3 hours after injection of bacterial suspension	0.082	102.0

¹ Graham, C., *Quar. J. Med.*, 1925, xviii, 294.

² Rabinowitch, I. M., *Can. Med. Assoc. J.*, 1924, xiv, 481.

³ Eustis, A., *New Orleans Med. and Surg. J.*, 1923, lxxv, 449; Cousins, C. S., *U. S. Vet. Bur. Med. Bull.*, 1925, ii, 7; Labbé, M., and Boulin, R., *Bull. et Mem. Soc. d' Hôp de Paris*, 1925, cxxxv, 1925; Barber, W. H., *Proc. Soc. Exp. Biol. and Med.*, 1925, xxiii, 101; Visher, J. W., *Am. J. Med. Sci.*, 1926, clxxi, 836; Rosenow, E. C., *Exp. in Focal Infection and Elective Localization. Resumé, Newer Findings and Applications*, Mo. Valley Med. Assn., Ann. Meeting, Omaha, Sept., 1926.

⁴ Gettler, A. O., and St. George, A. V., *J. Am. Med. Assn.*, 1918, lxxi, 2033; Pemberton, R., and Foster, L. G., *Arch. Int. Med.*, 1920, xxv, 243; Olmstead, M. M., and Gay, L. P., *Arch. Int. Med.*, 1922, xxix, 384.

⁵ Richardson, H. B., and Levine, S. Z., *J. Biol. Chem.*, 1925, lxiii, 465.

⁶ Menten, M. L., and Manning, H. M., *J. of Med. Res.*, 1924, xlv, 675.

⁷ Jeckwer, I. T., and Goodell, H. I., *J. Exp. Med.*, 1925, xlii, 43.

⁸ Thomas, G. H., *J. Inf. Dis.*, 1924, xxxv, 407.

⁹ Shaffer, A. P., and Hartmann, A. F., *J. Biol. Chem.*, 1920-21, xlv, 365.