TABLE I.

Comparison of Red Count and Hemoglobin of Anemic Rabbits with and without Liver Extract (expressed in % of original normal values).

Rabbit No.	Red cells	Hemoglobin (Dare)	
	%	%	
108	90	97	Received 68 gm. of liver extract in 42 days
110	87	97	Received 78 gm. of liver extract in 43 days
111	88	98	Received 78 gm. of liver extract in 43 days
113	67	80	Control—no liver
120	73	76	Control—no liver

the hemoglobin content. This at once suggests the use of such experiments as a means of standardizing commercial liver extracts. Further work is in progress.

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Secondary Rays from Lipiodol and Bismuth Subnitrate Paste on Staphylococcus aureus and Bacillus coli communis.

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Attempts have been made to inhibit the growth of microorganisms by using secondary rays. These secondary rays are emitted from metals when they are exposed to x-ray. It has been shown that the higher the atomic weight of a metal, the greater is the bactericidal power of the secondary ray.[1, 2, 3] Many substances have been used with varying clinical success by different investigators.[4-10] Holthusen[11] has pointed out that there are many difficulties in the

[1] Halberstaedter, L., and Meyer, P. S., *Fortschr. d. Rontgenstr.*, 1922, xxiv, 489.

[2] Milani, E., and Donati, C., *Radiologia medica*, 1921, viii, 417.

[3] Ghilarducci, F., *Xla riunione della societa italiana per il progresso delle scienze*, Trieste, sett., 1921.

[4] Beck, Emil, *Med. J.*, 1908, xiii, 402.

[5] Christen, T., *Stahlentherapie*, 1912, i, 51.

[6] Ridlon and Blanchard, *Am. J. Orth. Surg.*, 1908, vi, 13.

[7] Lynah, H. L., *J. Am. Med. Assn.*, 1921, lxxvii, 1548.

[8] Abbe, *Am. J. Roent.*, 1922, lx, 152.

[9] Friedrich, W., und Bender, M., *Strahlenther*, 1920, i, 11.

[10] Gudzent, F., *Strahlenther*, 1920, xi, 277.

[11] Holthusen, H., *Ergebn. d. med. Strahlenforsch*, 1925, i, 383.

clinical application of secondary rays. The amount of the substance acting as radiators must be relatively large and still non-toxic. The action of secondary rays is limited, since they are so easily absorbed.

Experiments were conducted with Lipiodol and Beck's paste as the radiators. These substances are non-toxic, contain a metal of high atomic weight (33% Bismuth subnitrate in Beck's paste and 40% metallic iodine in Lipiodol) and have been previously used for their therapeutic value in certain clinical conditions.[4, 13-17] *Staphylococcus aureus* and *Bacillus coli communis* were used as the test bacteria.

The bacteria were grown on agar slants for 18 to 24 hours and emulsions were made containing approximately 3,000,000 and 1,200,000,000 organisms per cc. Of the first emulsion 0.2 cc. was pipetted on to a dry sterile agar plate which had been incubated for 48 hours, of the second emulsion 0.1 cc. was used. With a glass spatula the emulsion was spread evenly over the surface of the plate. These plates were dried in the incubator for 10 minutes before exposure to the x-ray. The inoculated agar plate was turned up side down and the substance acting as radiator was placed 1 mm. below the surface of the agar growth. The x-rays, therefore, first entered the bottom of the glass dish, next penetrated the agar, then the surface culture and finally struck the substance which was being investigated.[11, 12, 18] The secondary rays from the latter were reflected on to the surface of the growth and either caused inhibition of the growth or none at all. Ten erythema doses of x-ray were given in 30 minutes with the following factors: Transformer machine, 200 K. V., 4 M. A., 30 cm. focal distance. No filter. The plates were then incubated at 37° and the results read 20 hours later.

It was found that secondary rays from bismuth subnitrate completely inhibited the growth of *Staphylococcus aureus* and *Bacillus coli communis* under these conditions. Secondary rays from Beck's paste and Lipiodol, on the other hand gave practically negative results. In those cases in which the results were doubtful, it was usually due to some error in technique. Of 18 experiments with Lipiodol, 15 did not show any inhibiting influence and in 3 it was

[12] Liechti, A., *Klin. woch.*, 1924, 825.

[13] Sicard and Forestier, *Bull. et Mem. d. Hoh. de Paris*, 1922, xlvi, 463.

[14] Archibald, *Can. Med. Assn., J.*, 1925, xv, 1000.

[15] Ballon, D., *Can. Med. Assn. J.*, 1925, xv, 995.

[16] Pritchard, S., Whyte, B., Gordon, J., *J. Am. Med. Assn.*, 1928, lxxxvi, 1119.

[17] Fiessinger, N., et Lemaire, A., *Presse Med.*, 1926, xxxiv, 209.

[18] Holthusen, H. Schubsck, und Sielman, H., *Strahlenther*, 1927, xxiv, 557.

negligible. In 9 experiments, the Lipiodol was in contact with the bacterial growth and even in these cases, the inhibitory effect of the secondary rays was only slight. Control experiments with secondary rays from iodine crystals or iodine tincture were impossible, as the vapor itself from iodine and 10% iodine tincture, at a distance of 1 mm. killed the bacteria. Of 8 experiments with bismuth subnitrate paste (Beck's paste—33%), 7 were negative and 1 doubtful. Of 14 control experiments with bismuth subnitrate powder, complete inhibition of growth was obtained in 13, and moderate inhibition in one.

Conclusions: Since the iodine vapor itself and the secondary rays from bismuth subnitrate kill bacteria, and since the secondary rays from the oily preparations of both these substances have no inhibitory effect, it would appear that the concentration of the metals in these preparations is not sufficient under the conditions of these experiments or that the fat interferes with the effect of the secondary rays.

The practical significance of these experiments is that Lipiodol and Beck's paste cannot be used therapeutically for the production of bactericidal secondary rays; for as has been shown the secondary rays emitted from these substances, under the conditions described, do not inhibit the growth of bacteria.

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Action of Ephedrin on Intestine and Bronchi.

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Chen[1] and Kreitmair[2] believe that the pharmacological action of ephedrin in small doses is identical with that of adrenalin, that is, a stimulation of the sympathetic myoneural junction (commonly spoken of as nerve endings), while that of larger doses is due to direct stimulation of smooth muscle comparable to that produced by barium. Among other effects described by these investigators, are those of inhibition of the intestinal movements and relaxation of spasm of bronchial muscle. The former of these effects has been

[1] Chen, K. K., and Schmidt, C. F., *J. Pharm. Exp. Ther.*, 1924, xxiv, 339.
[2] Kreitmair, H., *Arch. f. Exp. Path. u. Pharmakol.*, 1927, cxx, 189.