gone necrosis. There are numerous other places where liver cells have completely disappeared and only the collapsed stroma remains. In many places calcification of the stroma is well advanced and larger masses of calcium are frequently seen. Multinucleated giant cells of huge dimensions are often clustered about the masses of calcium or are found in the areas of collapsed stroma.

Liver cells remain but the regular normal architecture is not retained. Rounded groups of liver cells are numerous or only narrow bands of these cells surround portal areas. The liver cells also present a peculiar arrangement in many places. A double column of the cells will open up leaving a considerable space surrounded by the cells. The space contains granular precipitate or large plugs of bile. We have the impression that these spaces may be hugely distended bile canaliculi, because they in some instances contain bile. Necrosis of individual liver cells is also taking place. Cirrhosis negative.

From the evidence obtained from 30 rabbits, all showing the same pathological picture we feel that certain chlorinated naphthalenes or impurities contained in them are capable of producing yellow atrophy of the liver in the rabbit. This, with the history of the industrial cases points to its being a possible etiological agent in the factory cases. No other material used in the factory was found to produce the lesion.

8880 P

Formation of Sulfide by Some Sulfur Bacteria.*

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Previous studies with the strictly autotrophic sulfur bacterium, *Thiobacillus thioöxidans*, growing on elemental sulfur have shown that the sulfur is rapidly oxidized to sulfate without the accumulation of intermediate products.[1] The strictly autotrophic sulfur bacterium *Th. thioparus* transforms thiosulfate to the 2 products, sulfate and elemental sulfur.[2] No question has arisen concerning the initial stages of transformation of thiosulfate, but, by reason of the relatively large size of the particles of elemental sulfur com-

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1 Waksman, S. A., and Starkey, R. L., *J. Gen. Physiol.*, 1923, **5**, 285.

2 Starkey, R. L., *J. Gen. Physiol.*, 1935, **18**, 325.

pared to the tiny bacterial cells (about 0.5 x 0.8μ) it has been suggested that some initial transformation to a reduced or oxidized substance may precede passage of the sulfur material through the cell membrane, after which the reactions leading to the release of energy for growth takes place.[3] However, McCallan and Wilcoxon present evidence which shows that the vapor pressure of elemental sulfur is sufficiently high to permit sulfur vapor to enter cells which are not even in contact with the solid sulfur.[4]

Inorganic media containing sulfur or thiosulfate and supporting growth of these 2 bacteria have been examined for the presence of sulfide. No sulfide or other reducing substance was detected in cultures of *Th. thioöxidans* by titration with 0.01N iodine. No substance formed from thiosulfate by *Th. thioparus* was found by titration with iodine. Tests for sulfide with nitroprusside were negative in both cases. The results do not support the contention of von Deines that the sulfur material precipitated by *Th. thioparus* during growth on thiosulfate is a highly sulfured polysulfide.[5]

Although sulfide does not appear in detectable amounts in the media, sulfide is produced by both organisms during growth. Lead acetate paper suspended over the culture solution containing elemental sulfur and inoculated with *Th. thioöxidans* showed slight darkening after growth for 10 days. The test for sulfide became increasingly stronger with longer growth. Cultures of *Th. thioparus* growing on a thiosulfate medium produced slight darkening of the lead-acetate paper in 4 days and within another week showed deep blackening. The test for sulfide was preceded many hours by the precipitation of sulfur in the medium, a transformation which characterizes growth of this bacterium on thiosulfate.

There can be no question as to the production of sulfide by both bacteria, but there is no indication that any appreciable quantity persists in the medium. It seems most probable that the sulfide is formed in both cases by reduction of elemental sulfur. The reduction of elemental sulfur to sulfide is effected by compounds containing –SH groups in animal and plant tissues and by glutathione. The occurrence of –SH groups has been established for a great variety of tissues and organisms including many filamentous fungi and bacteria. In the present studies, cellular material of several organisms including bacteria, fungi, and actinomycetes has been found to form

[3] Buchanan, R. E., and Fulmer, E. I., 1930. *Physiology and Biochemistry of Bacteria*, The Williams and Wilkins Co., Baltimore, v. 3, 197.

[4] McCallan, S. E. A., and Wilcoxon, F., *Contr. from Boyce Thompson Inst.*, 1931, **3**, 13.

[5] von Deines, O., *Die Naturwissen*, 1933, **21**, 873.

sulfide from elemental sulfur. It is concluded that formation of sulfide by the sulfur bacteria is evidence that these organisms also contain substances possessing active –SH groups.

The fact that the sulfur bacteria hydrogenate sulfur during growth raises the question as to whether or not this is a necessary reaction preceding utilization of elemental sulfur as a source of energy. Should this prove to be the case it would necessitate a revision of conceptions concerning the mechanism of transformation of sulfur by these bacteria. It is equally possible that the sulfide may have no more significance in the nutrition of the sulfur bacteria than in that of the great number of heterotrophic microörganisms which have the same reducing capacity. By reason of the fact that the nature of sulfur precipitated by the sulfur bacteria belonging to the order Thiobacteriales is the same as that formed by *Th. thioparus*, and that the former may be presumed to contain compounds having –SH groups, there is reason to suspect that they are able to hydrogenate their sulfur globules and other added sulfur.

8881 P

Pressor Effects of Kidney Extracts from Patients and Dogs with Hypertension.

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From the Mount Sinai Hospital.

A number of observers have found that extracts from the kidneys of various animals may have pressor effects.[1-7] The object of the present investigation was to determine whether extracts of kidneys from human beings and dogs with hypertension had greater pressor effects than those of control kidneys.

Kidneys were obtained at autopsy from 15 patients with hypertension and from 17 control subjects. The hypertensive group consisted of 9 patients with benign hypertension, 2 with malignant hypertension, 2 with chronic glomerular nephritis, and 2 with pyelonephritis and secondary contracted kidneys. The material was put

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1 Tigerstedt, R., and Bergman, G., *Skand. Arch. f. Physiol.*, 1898, **8**, 223.

2 Bingel, A., and Strauss, E., *Deutsch Arch. f. klin. Med.*, 1909, **96**, 476.

3 Livon, C., *Compt. med. Soc. de biol.*, 1898, **50**, 98.

4 Vincent, S., and Sheen, W., *J. Physiol.*, 1903, **29**, 242.

5 Pearce, R. M., *J. Exp. Med.*, 1909, **11**, 430.

6 Shaw, H. B., *Lancet*, 1906, **1**, 1295, 1375, 1455.

7 Forlanini and Riva-Rocci, quoted from Pearce.[5]