produced by the current and the solvent alone. Because the method has not as yet been developed to the point where an erythema can be prevented, slightly positive reactions have not been investigated, although as mentioned above, both foods and inhalants have been successfully studied when moderate or marked reactions occur.

The skin can be anesthetized by procaine base even in the presence of M/20 NaOH. Under these circumstances, practically none of the positively charged form of the procaine is present. The undissociated base must, therefore, be carried passively by electroosmosis rather than by ionic migration. In support of this point of view, that the transfer of the procaine is electroosmotic, wheals were produced when the histamine was dissolved in M/30 NaOH. It can be shown that relatively few positively charged ions are present at the pH of this system, and that this is in accord with the point of view holding that electroosmosis as well as iontophoresis (the migration of the ion itself) may be employed to introduce drugs into the skin.

8879 P

Action of Certain Chlorinated Naphthalenes on the Liver.

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Three cases of yellow atrophy of the liver have occurred in each of 3 widely separated plants and under different management within a year or two. In each instance where the illness appeared, the men were exposed to a chlorinated naphthalene heated above the melting point and giving off fumes. Yellow atrophy of the liver is a rare disease and there have been no cases reported where chlorinated naphthalene was the proven etiological agent.

The following experiments were conducted to determine if some of the chlorinated naphthalenes might produce such lesions. Three naphthalenes obtained from one of the above factories were used in this work. They are designated then as A, B, and C.

Compound A is a mixture of tri- and tetra-chlor-naphthalene. *Compound B* is a mixture of tetra- and penta-chlor-naphthalene and may contain some tri-chlor-naphthalene. *Compound C* is a mixture of penta- and hexa-chlor-naphthalene which is plasticized with a relatively small percentage of asphalt.

Compound	Boiling Point	Melting Point	Chlorine Contents %
A	600-650° F	98-90° C	47.9
B	615-655° F	117.5-122° C	49.8
C	680-730° F	123-132° C	47.9
B sublimate	given off at 192° C	87-89° C	35.3
C "	" " " 172° C	117-123° C	53.1

(Sublimates given off by the naphthalenes were collected and injected into the animals under the same conditions as were the original compounds.)

Groups of 5 rabbits weighing approximately 2 kilos were used in testing each substance. Thirty milligrams of the compound dissolved in 2 cc. of paraffin oil were injected subcutaneously each day until the rabbit died.

None of the animals receiving injections of "A" died. The first death in the group receiving injections of "B" died on the 12th day and all were dead by the end of the 15th day. In the group receiving "C" the first rabbit died at the end of the 12th day and the last of the group on the 26th day. None of the rabbits receiving injections of sublimate from "B" died. The first death in the group receiving injections of sublimate from "C" died on the 9th day and the last one on the 14th day.

The animals affected showed no special symptoms outside of losing weight. The blood picture was not affected in either the red, white or differential count. The control animals, and animals receiving paraffin oil, "A" or sublimate from "B" gained in weight.

Autopsy Findings. Animals receiving "A" and sublimate B, when killed after 2 months injections, showed no pathological conditions that could be attributed to the exposure.

The following findings are typical of rabbits receiving "B", "C", and sublimate "C". There appears to be no reason for repeating the findings for each animal.

No. 533. Dosage: 30 mgr. of "C". 25 injections given.

Liver. Very large. Dark red with many opaque yellow areas. Capsule smooth. Cuts without resistance. Cut surface smooth. In many parts of the organ are yellow opaque areas with dull surface, that involve groups of lobules. In between, the liver parenchyma in places is dark red, and the lobules are clearly visible. In other places, the lobulation cannot be seen, the parenchyma has apparently disappeared and stroma is collapsed; these portions are greyish red. The gall bladder is distended.

In peritoneal cavity a moderate excess of bloody fluid.

Histologic Findings. Liver. Presents a most striking change. Beneath the capsule on one of the sections is a wide zone of necrosis, in which portal areas are seen surrounded by a single row of well preserved cells, or none at all. In other places in the section efferent veins are surrounded by wide zones in which liver cells have under-

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.