

organs, etc., knowing that regeneration will take place without permanent injury. We feel justified, therefore, in suggesting crystalline hexylresorcinol as an ascaricide in spite of its irritant properties, because we feel that it is exceptionally effective, it kills rather than anesthetizing the parasites, thus reducing the danger of migration, its irritant action, which should theoretically be merely superficial, has been shown by experiment to be so, and finally because hundreds of patients have taken this substance in olive oil solution as a urinary antiseptic in much greater amounts than we suggest for ascariasis without known complications. When given as an ascaricide, it should be taken on an empty stomach to prevent the possibility of its combination with the proteins of the food. Although Leonard has been unable to show any pathological changes after its long continued use the general pharmacology of this substance remains to be worked out.

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5093

The Accumulation of Iron in Tuberculous Areas.

VALY MENKIN.*

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In previous communications^{1, 2, 3} it was shown that a vital dye, trypan blue, or a metal in the form of its salt, ferric chloride, when injected into the circulating blood stream rapidly accumulates in an area of inflammation, where the substance is fixed and fails to drain to the tributary lymph nodes.

Bowman, Winternitz, and Evans by microscopic studies⁴ found

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¹ Menkin, V., *J. Exp. Med.*, 1929, 1, 171.

² Menkin, V., *J. Exp. Med.*, 1930, li, 879.

³ Menkin, V., and Menkin, M. F., *J. Exp. Med.*, 1930, li, 285.

⁴ Bowman, F. B., Winternitz, M. C., and Evans, H. M., *Centralbl. Bakteriol.*, 1912, lxx, 403.

that, in experimental tuberculosis, trypan blue injected intravenously stains tubercles in the liver. They pointed out the great affinity of giant and epithelioid cells for this vital dye, which was always found as granules within these cells. Lewis⁵ found that if the cornea of a rabbit is inoculated with a living culture of the tubercle bacillus, a progressive lesion results characterized by an intense congestion of the conjunctiva. If the animal is given an intravenous injection of trypan red 24 hours or more after such inoculation, the fluid in the anterior chamber of the inoculated eye always becomes colored.

In view of the observation that iron, intravenously injected, accumulates in inflamed areas, a few experiments were set up to determine whether this metal when injected into the circulating blood stream would accumulate and be detected in tubercles.

Bovine tuberculosis was induced in several rabbits by the intravenous injection of 0.001 mg. of a saline suspension of Ravenel strain. From 4 to 5 weeks later extensive tuberculosis had developed in the lungs of most of the animals. These rabbits were given several daily intravenous injections each consisting of 5 cc. of a 0.25% solution of ferric chloride crystals. Three animals were killed after 3, 4 and 7 injections of ferric chloride. The lungs were carefully removed and dipped in acidified potassium ferrocyanide (3 parts of 1% HCl to one part of 2% $K_4Fe(CN)_6$).

After an interval ranging from 45 minutes to 1 hour or sometimes less the tubercles showed a marked Prussian blue reaction on gross examination. The blue color was intense in the caseous or central part of the tubercle. The dye or iron that penetrated from the blood stream into the periphery of an inflamed area (loc. cit. 1, 2) on the contrary failed to enter the central part in which the circulation is relatively inactive. It is noteworthy in this connection that various dyes that cannot penetrate living cells stain dead or dying cells.⁶

Gierke⁷ pointed out many years ago that calcified tubercles in the lungs fail to react to the microchemical test for iron. As control to the observations described above, several tuberculous animals that had not been injected with iron were killed by ether anesthesia a few weeks after infection with the bovine microorganism. The lungs were immediately tested for the presence of the metal in the tubercles by the Prussian blue reaction. The results in this group of animals were negative. It was also found that a single injection of

⁵ Lewis, P. A., *J. Exp. Med.*, 1916, xxiii, 669.

⁶ Steckelmacher, *Beitr. Path. Anat.*, 1914, lvii, 314.

⁷ Gierke, *Virchow's Arch.*, 1902, clxvii, 318.

20 cc. of 0.25% solution of ferric chloride produced no demonstrable Prussian blue reaction in the tubercles.

Further experiments are being conducted to substantiate these preliminary results and to determine the effect of the accumulation of iron in tuberculous areas on the course of development of the disease.

5094

Complete Atrophy of Kidney in Pigeons Following Section
of the Ureter.

OSCAR RIDDLE.

From the Carnegie Institution, Station for Experimental Evolution.

In a publication dealing with effects of extirpation of the *bursa Fabricii* in young doves Riddle and Tange¹ showed that this operation sometimes involves the section of one or both ureters. Among 31 operated animals which they reared to maturity 2 individuals were found at autopsy to have each only a single kidney. It was concluded that "the section of the right ureter probably caused the complete disappearance of the right kidney in these 2 animals." The earlier study was carried out on ring doves. More recently Riddle, Krizenecky and Polhemus (unpublished) have bursectomized and thymectomized a series of young common pigeons as part of a study of possible functions of bursa and thymus in relation to sex and reproduction. Incidental to that study 3 additional cases of absent or partially atrophied kidneys have been found. It now seems possible to demonstrate that the section of a ureter in young doves and pigeons is often followed by (a) its occlusion at the point of cutting, (b) the accumulation of pressure in this ureter and in the corresponding kidney, and (c) the partial or complete disappearance of the kidney tissue.

The principal facts are presented in Table I. Cases 1-3 were obtained in ring doves; cases 4-6 in common pigeons. Case 3 is particularly interesting since it indicates the rapidity of the changes in the kidney. Only 20 days after the right ureter was cut this duct was found to be bulbous and much distended throughout its course from the kidney to its blind end, at the point of cutting, near the cloaca; the right kidney had evidently undergone considerable atrophy and

¹ Riddle, O., and Tange, M., *Am. J. Physiol.*, 1928, lxxxvi, 266.