The brain and spinal cords were fixed in formalin. Sections stained by special methods to demonstrate fat, microglia, myelin sheaths, axones and the usual hematoxylin-eosin stain was also used. In no single specimen was there any evidence of demyelinization, axis cylinder destruction or accumulation of fat. Thus in no manner did the vaccine virus or attenuated rabies vaccine produce a pathological change similar to the post-vaccinal encephalitis in man.

Both series showed a severe meningo-encephalitis. In the vaccinia experiments, the meningeal exudate consisted of many leucocytes mixed with histocytes while the intracerebral vessels were infiltrated with moderate numbers of lymphocytes and the adventitial cells were increased. The rabies group showed an intense lymphocytic meningeal exudate and perivascular infiltration. Negri bodies were found in every case. There was a diffuse ganglion cell degeneration and increase in microglia. Thus in both types of infection a diffuse meningo-encephalitis occurred, varying only in the predominating type of cell and intensity of reaction.

These experiments show that, in the experimental animal at least, attenuated rabies and vaccinia do not produce the pathological changes found in human post-vaccinal (cow pox and rabies) encephalitis. These findings would seem to suggest that the various types of vaccination and exanthematous diseases in man might act as a stimulant to a latent infection rather than by introducing a specific virus.

5309

New Technic for Roentgenographic Study of Renal Vessels.*

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Ralph Graham[1] applied the method of Hill[2] to the injection of the vascular tree in the human kidney. The method, involving the injection of a 25% bismuth oxychloride suspension in 10% acacia, is applicable to postmortem material. In such kidneys it demon-

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1 Hill, E., *Bull. Johns Hopkins Hosp.*, 1929, **44**, 248.

2 Graham, R., *Am. J. Path.*, 1928, **4**, 17.

strates pictorially the blood vessels in x-ray photographs in a manner superior to the barium injections previously used. Since we wished to demonstrate the changes induced by the action of various agents on the renal vessels during life we set out to adapt the method of Hill and Graham to this end.

It is apparent that such solid particles are rapidly removed from the blood stream upon injection, and so in order to obtain them in sufficient concentration in a particular organ to demonstrate the vessels roentgenologically, the opaque substance must be injected directly into or close to the origin of the artery supplying the organ. As we were interested in comparing the relative appearance of the vascular beds in the 2 kidneys, the aorta close to the origin of the renal arteries was chosen as the site of injection.

Dogs were used throughout. Under general anesthesia (Nembutal—Abbott) a left paravertebral incision was made extending from a point 2 cm. above the costal margin caudad for a distance of 7-10 cm. The last rib was removed without opening the pleural cavity and the aorta was approached extraperitoneally and exposed between the crura of the diaphragm. It was also exposed below the origin of the renal vessels at which point it was clamped. The upper segment was lifted into view upon the finger and 50 cc. of a 25% suspension of bismuth oxychloride injected into the aorta through a large bore needle. (bismuth oxychloride (Cosmetic) 25 gm.——water q.s. ad 100 cc.) The puncture point of injection in the wall of the aorta was clamped and after 5 to 10 minutes the kidneys were removed and the animal killed.

The kidneys were hemisected and flat x-ray pictures were made, using a low voltage and low milliamperage with the 3 to 5 second exposure.

In a few animals injection was made into the aorta, below the origin of the renal vessels, with or without intermittent occlusion of the aorta above the level of the renal arteries. The results were somewhat less satisfactory than with the method described above.

A simple suspension of bismuth, without the use of acacia, was found to be most satisfactory in this work and, as was pointed out by Hill and Graham, the most finely divided form of bismuth must be used to obtain delineation of the small vessels.

Postmortem injection of the kidneys of dogs and rabbits was found to be unsatisfactory, although in dogs even glomerular injection can be obtained with India ink.

The arterial system was visualized on the x-ray plate to and including the fine interlobular vessels. (Fig. 1.) In the normal speci-

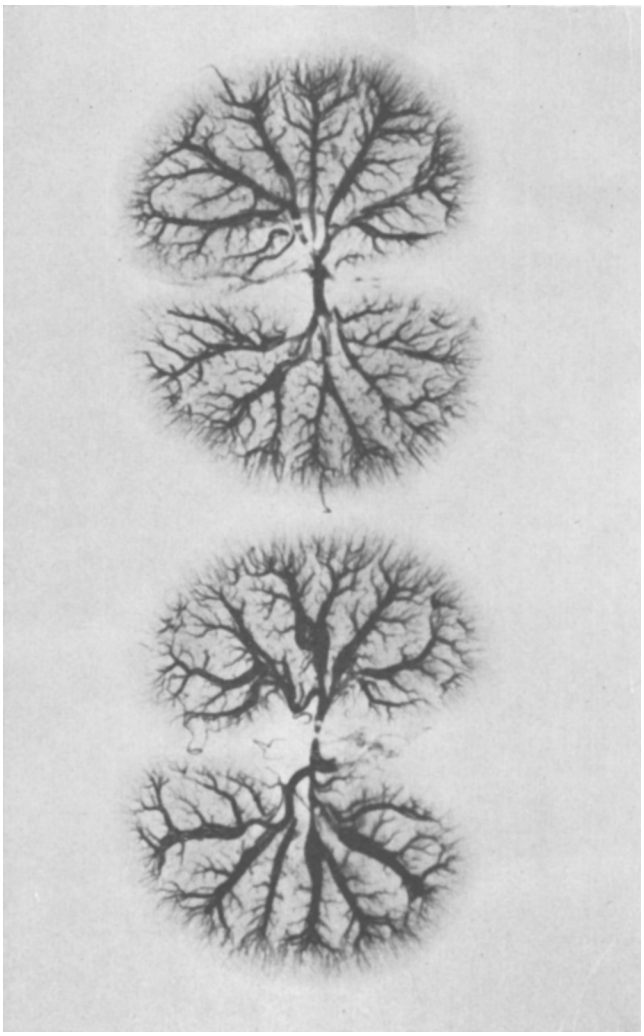

FIG. 1.
Injected kidneys, normal young dog. Note the uniformity of extent and distribution of the arcuate and interlobular vessels.

mens injection of the fine vessels was uniform throughout the kidney. The projection of the interlobular vessels towards the outer margin of the cortex was also uniform. As was pointed out above, glomerular injection was not noted in the x-ray pictures, and was very irregular in the histological sections made from such injected specimens.

One old dog, whose kidneys were grossly scarred and on section showed marked arteriolar alterations, was injected. The picture

obtained is striking in several respects and simulates those described by Graham in human cases of arteriolar-sclerosis. First the roughly beaded appearance of the vessels and, secondly the incomplete and patchy injection of the vascular bed.

5310

Studies in Renal Denervation. I. Roentgenographic Demonstration of Vascular Alteration.*

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The physiological and anatomical changes induced by denervation of the kidney have been carefully studied by Seres,[1] Ellinger and Hirth,[2] Bieter,[3] Bradford,[4] Gironcoli,[5] and others. Gironcoli concludes that the results are chiefly: 1. Increase in the size of the kidney; 2. Generalized thickening of the capsule which he considers nontraumatic; 3. A dilatation of the arterioles and capillaries as seen in the microscopic section. Seres concludes that the changes are: 1. Increase in volume of the urine; 2. Decrease in the specific gravity due to a decrease in the solids per unit of volume, but 3. Little change in the total solids. 4. Earlier and more effective response to the diuretic effect of sodium chloride and glucose.

As a preliminary to a study of the effect of various agents upon the normal and denervated kidneys, we are reporting here the changes in the vascular bed as demonstrated by roentgenogram using the method described in a previous paper.

The denervation was accomplished as follows: Dogs were kept under Nembutal (Abbott) anesthesia, the kidney was exposed and delivered through an incision 2 cm. below and parallel to the costal margin and extending from a point about 3 cm. from the spinous

* The present investigation was aided by a grant from the Josiah Macey, Jr., Foundation.

1 Seres, M., *Rev. Med. de Barc.*, 1924, **1**, 220. Abstracted *Z. f. Urol. Chir.*, 1925, **17**, 54.

2 Ellinger, P. H., and Hirth, A., *Arch. f. Exp. Path. u. Pharm.*, 1925, **106**, 135.

3 Bieter, R. N., PROC. SOC. EXP. BIOL. AND MED., 1929, **26**, 792.

4 Bradford, J. R., *J. Phys.*, 1889, **10**, 358.

5 de Gironcoli, F., *Z. f. Urol. Chir.*, 1929, **27**, 26.