was 231. Renal denervation in four of these 7 dogs has restored their pressure to about the normal level.

Further experiments have shown that renal denervation alone neither prevents nor appreciably alters the hypertension produced in normal dogs by modulator nerve section. They have also confirmed the observations of Nowak and Walker[11] that abdominal sympathectomy and division of the splanchnic nerves as well as complete sympathectomy except for one thoracic chain fails to restore the blood pressure of neurogenic hypertensive dogs to normal. Total sympathectomy as described above lowered the pressure of 3 neurogenic hypertension dogs from 239, 226 and 246 to 101, 122 and 91 respectively during 30, 18, and 40 days of observation. After 30 and 40 days in 2 of these animals blood pressure recovery was evident and progressed toward a moderate hypertension level. This parallels but exceeds the recovery following paravertebral sympathectomy in normal dogs previously reported.[12]

11408 P

Renal Phosphatase in Experimental Nephropathies.*

OPAL E. HEPLER, J. P. SIMONDS AND HELEN GURLEY.

From the Department of Pathology, Northwestern University Medical School.

The specific function of the rich phosphatase content of the kidney is still unknown. Since the kidney is almost invariably involved in metastatic calcification and is often the site of pathologic calcification it seemed possible that by comparing the location of the deposits of lime salts in these conditions with that of the phosphatase something might be learned concerning the relation of this enzyme to renal function.

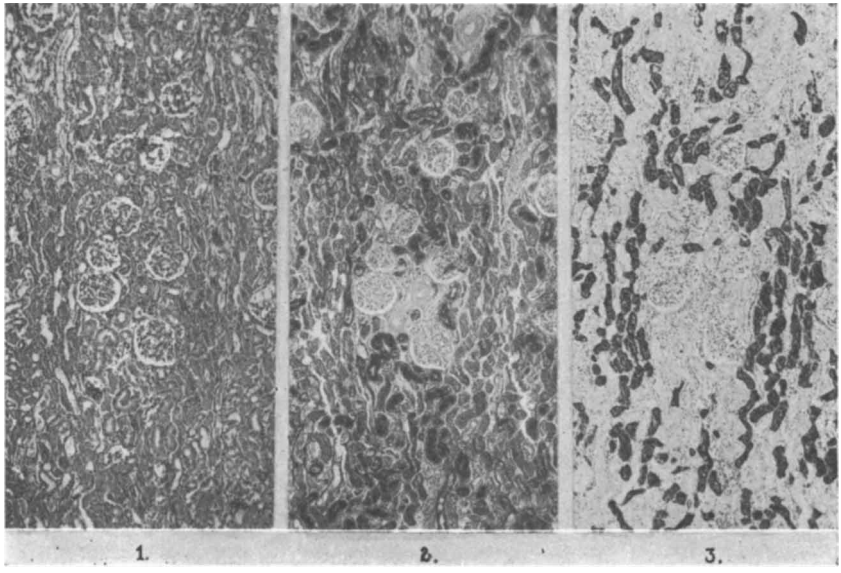
For this purpose we studied phosphatase, acting optimally at a pH of about 9.0 on sodium glycerophosphate, in the kidneys of normal dogs and of dogs in which a toxic nephrosis has been produced by uranium nitrate, potassium bichromate and bichloride of mercury. We compared sections stained for phosphatase by Gomori's[1] method with the quantity of the enzyme obtained in aqueous extracts of the cortical tissue of the same kidneys as determined by Bodansky's

* Aided by a grant from the Committee on Therapeutic Research of the Council on Pharmacy and Chemistry of the American Medical Association.

1 Gomori, G., PROC. SOC. EXP. BIOL. AND MED., 1939, **42**, 23.

chemical method. We soon found, however, that in kidneys in which pathologic calcification was present, there was no correlation between the quantity of phosphatase revealed by the chemical method and the microscopic picture in the Gomori-stained sections.

We therefore stained 3 consecutive sections of kidneys of the dogs used in these experiments, one with routine hematoxylin and eosin, one with Gomori's[1] stain for phosphatase and one for calcium phosphate only by von Kossa's method. The routine sections revealed the location of necrotic or otherwise damaged tubular epithelium. Sections stained by Gomori's method showed all of the calcium phosphate present in approximately quantitative relations. Normally, phosphatase is present in the marginal zone, next the lumen, of the epithelium lining the proximal convoluted tubules. It is most abundant in the first two-thirds or three-fourths of these tubules, that is, in the labyrinth; less abundant in the straight terminal portion, that is, in the medullary rays and in the outer stripe of the outer zone of the medulla. In Gomori-stained sections the calcium was more abundant and stained more deeply where it had been precipitated in normal or only slightly damaged cells by the action of the phosphatase during the process of staining than in those regions where its presence was the result of pathologic changes. Sections stained



K Hg 6.

1. H. & E. 2. Gomori. 3. Kossa. One injection—3 mg. $HgCl_2$ per 100 cc blood. Died 78 hours later.

by von Kossa's method revealed only that preformed calcium phosphate which was the result of pathologic calcification. In our experiments, this was present chiefly in the medullary rays in amounts varying with the length of survival of the animal, while the labyrinth was either free or showed only minute amounts (Fig. 1).

Calcification was found to occur early (28 hours after injection) and abundantly in the kidneys of dogs given a single intravenous injection of bichloride of mercury equal to 3 mg per 100 cc of blood. This dose of bichloride causes very severe injury to the epithelium of the straight distal portion of the proximal convoluted tubules, but no visible injury to the glomeruli. Doses of potassium bichromate and uranium nitrate that induced marked necrosis of the tubular epithelium have not been found to induce pathologic calcification in the kidneys of animals that have survived for 3 days.

None of the poisons (uranium, bichromate, bichloride of mercury) in the doses used appear to inactivate the phosphatase although they may kill the cell that contains it. This conclusion is confirmed by the results of quantitative determinations of the phosphatase in these kidneys by Bodansky's method and by study of stained sections. Necrotic and desquamated tubular epithelium of kidneys of dogs poisoned by bichloride stains diffusely by Gomori's method instead of deeply along the lumenal margin. Granular material stained by Gomori's but not by von Kossa's method in the capsular space of some glomeruli is continuous with similar material in the tubule which takes origin from such a glomerulus. It is believed to be cellular debris containing active phosphatase which has been regurgitated into the capsular space from the damaged tubule. Cellular debris accumulated in the straight terminal portion of the proximal convoluted tubules above the narrow part of Henle's loop stained both by Gomori's and von Kossa's method, and appears, therefore, to contain both active phosphatase and preformed calcium phosphate.