The reaction is brought to pH 7.4-7.6 by addition of NaOH, the phenol red in the medium serving as the indicator, and autoclaved at 10 lb. for 10 minutes. Each tube is inoculated with a 3 mm. loopful of pellicle from a 24-hour broth culture and placed in a slanted position in the incubator.

On 10 cc. of such media approximately 1.9 mg. bacterial nitrogen is formed in 55-60 hours at 35°. The omission of either cystine, tryptophane or methionine causes a drop in nitrogen to the level of 0.2 to 0.3 mg. The growth obtained with this same strain on the usual meat infusion-peptone broth (10 cc.) gives 0.8-0.9 mg. nitrogen.

7662 C

A Renal Lesion Occurring in Rats Maintained at Low Environmental Temperatures.

EATON M. MACKAY, ERNEST M. HALL, AND FRANCIS M. SMITH.

From the Scripps Metabolic Clinic, La Jolla, California, and the Department of Pathology, University of Southern California, School of Medicine, Los Angeles.

During a study of the influence of environmental temperature upon the metabolic rate and certain organ weights of the albino rat a number of these animals were maintained at room temperature of 5° and 10°C. When they were killed it was noticed that the kidneys of many were swollen, soft and mottled in appearance. Fig 1. His-

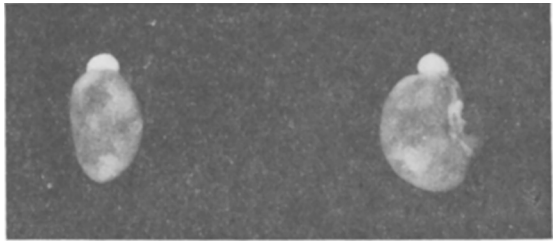

FIG. 1. Gross appearance of kidneys from rats Nos. 6 and 99, grown at 5° C.

tological examination revealed an interesting lesion in their kidneys. Besides its inherent interest it seemed desirable to report the occurrence of this lesion because of the common belief that exposure to cold is often associated with the onset of one form of Bright's disease in man. That the renal lesion reported here was acutally due to the cold environment seems certain for only 0.015% of the

kidneys from 26,000 animals of the same stock raised at ordinary temperatures have shown any renal pathology.

Eighteen young adult rats, 9 males and 9 females were kept 3 in a cage at a constant environmental temperature of 5°C. for 90 days. By this time 7 were dead. Two of these were examined and both had mottled soft kidneys. Of the 11 which remained 4 showed the presence of the renal lesion grossly. Twenty-four young adult rats, 12 males and 12 females were kept under the same conditions as the first group at a temperature of 10°C. for 90 days. When they were killed 6 showed quite obviously the renal lesion to be described here.

Microscopic examination reveals depressed areas in the superficial part of the cortex which appear to be due to partial collapse of the tubules in these areas with necrosis and desquamation of the epithelial cells. Some of the cells are shrunken and clumped together so that they appear as partly fused cellular masses in which the nuclei are very hyperchromatic and closely crowded. The cytoplasm tends to stain a muddy pink or smudgy blue (H. & E.). Masses of amorphous or finely granular calcareous deposits which stain deeply with haematoxylin are found among the desquamated cells, (Fig. 2. In the collecting tubules of the medulla granular, dark blue staining casts are found in moderate numbers. These apparently contain calcium.

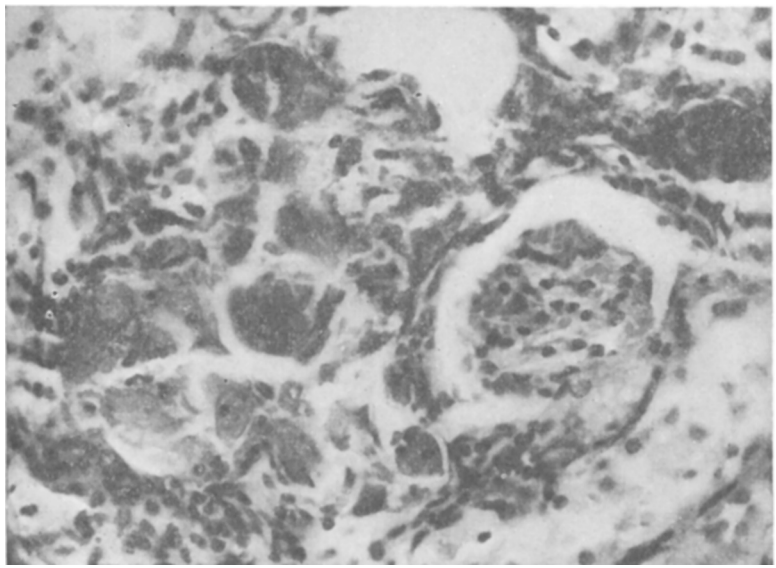

FIG. 2. Necrosis of tubular epithelium with precipitation of calcium. Note the dark-staining mass in the upper right hand corner.

Between the depressed areas may be seen tubules filled with swollen, granular epithelial cells which stain quite intensely with eosin. The lumina of the tubules are practically obliterated by the swollen cells. The nuclei are pycnotic in many of the cells and the cytoplasm shows radial fissuring. Throughout the cortex are groups of "ghost" tubules which belong largely to the proximal convoluted portions of the tubular units. In these the nuclei have disappeared completely or show but faintly while the cytoplasm is granular and pale-staining, Fig. 3. In some of the tubules irregular hyaline masses are seen. In some areas whorls and strands of this material fill tubules in a bizarre manner. The tubules everywhere seem to be moderately to severely damaged.

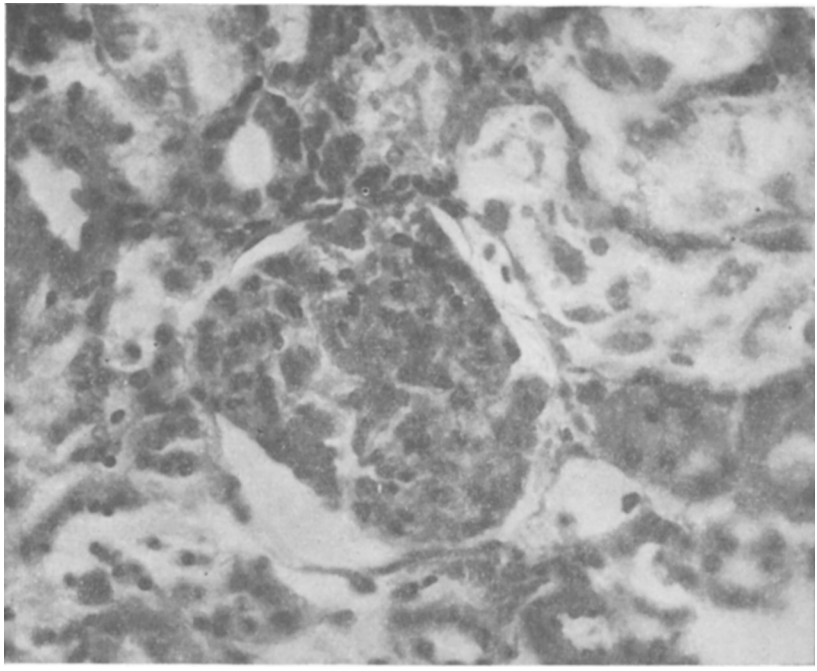

FIG. 3. Glomerulus under high power showing agglutination of red blood cells within the capillary loops. Several of the proximal convoluted tubules show almost complete necrosis of their epithelium.

The glomeruli are greatly congested. The capillary loops are moderately dilated and filled with clumps of red cells which are partially or completely fused into hyaline masses, Fig. 3. Not only is this true in the glomeruli but the red cells in the smaller and larger vessels show a marked tendency to agglutination, Fig. 4. The severe changes described above are seen in the kidneys of rats grown at

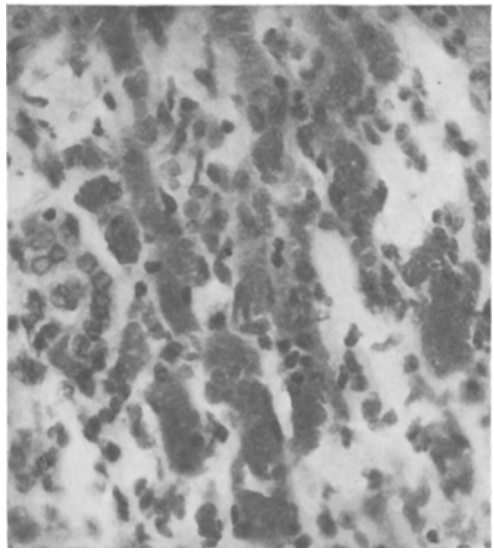

FIG. 4. Marked clumping of red cells in the capillaries of the medulla.

5°C. A larger series, 7 female and 2 males grown at 10°C. all show precisely similar changes varying only in the degree of severity.

The mechanism which leads to the development of tubular necrosis is not clear. The presence of agglutinated and hyalinized red corpuscles in the vascular channels and in the glomeruli suggests at once the immediate cause. All of the 13 animals examined histologically reveal this hemagglutination with (probably ensuing) necrosis of the tubular epithelium. The deposition of calcium in some of the areas is no doubt secondary to the necrosis. As for the cause of the initial hemagglutination we have no evidence to offer at this time.

7663 C

Rate of Absorption of Glucose from the Intestinal Tract of the Rabbit.

EATON M. MAC KAY, H. C. BERGMAN AND RICHARD H. BARNES.

From the Scripps Metabolic Clinic, La Jolla, California.

We concluded elsewhere[1] that the true relation of the rate of absorption of glucose from the intestine to the concentration in this

[1] MacKay, E. M., and Bergman, H. C., *J. Biol. Chem.*, 1933, **101**, 453.