

guinea pigs sensitized to horse serum only the trachea, larger bronchi and some small nests of atelectatic alveoli were filled. In 4 shocked guinea pigs showing mild symptoms or in animals which survive shock, varying degrees of filling of the bronchial bifurcations and lobes were observed. Six sensitized animals given a simultaneous intracardiac injection of a shock dose of serum in combination with epinephrine (0.2 mg. per kilo of body weight) survived. The lungs of these animals as well as those of 4 normal guinea pigs injected with serum alone or epinephrine alone showed complete filling.

The effects of other broncho-dilators on sensitized bronchi such as atropine in combination with serum are being studied.

Histamine in doses from 0.25 to 0.4 mg. per kilo of body weight produced varying degrees of bronchoconstriction. The injected lungs of 4 of these animals showed different degrees of filling of the bronchi, bronchioles and pulmonary alveoli. In some of the stereo X-rays actual beading of the smaller bronchi could be seen, points of constriction, alternating with points of relaxation, thus indicating that not all of the bronchioles are acted upon by the histamine.

These experimental observations suggested the possibility of demonstrating and analyzing calibre-changes in the bronchi of human subjects by stereo-roentgenography. We are accordingly employing lipiodal, introduced by tracheal catheter for visualization of the bronchi of allergic patients before and after the production of bronchospasm by the subcutaneous injection of antigen (pollen, horse dander), in carefully graded doses, and under controlled conditions. Results of these observations will be reported later.

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Evidence of Excretion of Iron Salts by Proximal Convolution of the Nephron of the Frog's Kidney.

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It is becoming increasingly evident that the glomerulus and tubule constitute functionally different sites for the elimination of the various urinary constituents. Several investigators have demonstrated that the proximal convolution of the vertebrate kidney is

secretory in function. The studies of Holton and Bensley¹ on the mammalian kidney when it is excreting dyes and iron salts under conditions of very low blood pressure indicate a secretory process in the elimination of these substances. Verne,² however, studying the aglomerular fish kidney, shows that this type of kidney does not excrete iron salts in appreciable amounts. These studies suggested that the Nussbaum experiment, with modifications, might prove valuable in determining the possible function of the proximal convolution in the excretion of iron salts.

Male frogs (*Rana pipiens*) were used in the experiments, the account of which follows. The animals were anesthetized by injecting from 1.0 to 1.4 cc. of a 10% solution of urethane into the submaxillary lymph sac. Operation to expose the kidney was made by using a thermocautery. Pelvic lymph hearts were removed in order to eliminate possible lymphatic circulation, the coeliacomesenteric artery ligated, and the intestine removed. The peritoneum extending from the right kidney to the right body wall was cut through and the lateral branches of the renal portal were cauterized, permitting deflection of the kidney and exposure of the dorsal aorta and the urogenital arteries. The latter were pulled out to the right with a small hook, doubly ligated, and severed, care being taken to treat in like manner all branches of the aorta between the juncture of the coeliacomesenteric artery and the bifurcation of the aorta to form the iliac arteries. The right kidney was then replaced and both kidneys examined microscopically by means of reflected light. When the circulation in all visible glomeruli was completely stopped (usually from 10 to 15 minutes after completion of the operation), 1.0 cc. of a mixture consisting of 4 parts of a freshly prepared 1.0% solution of ferric ammonium citrate (green scale) and 3 parts of a 1.0% solution of potassium ferrocyanide was injected into the submaxillary lymph sac. This was immediately followed by injection of 0.5 cc. of a weak solution of india ink in order to establish a check on possible glomerular activity. The animal was then placed in an oxygen atmosphere.

After a period varying from 5 minutes to 4 hours the kidneys were excised, washed out with Ringer's solution followed by 5% trichloroacetic acid, and placed in 5% trichloroacetic for 18 hours.

Microscopic examination of sections cut 10 micra thick and stained in Mayer's acid carmine showed iron to be precipitated in the form of Prussian Blue as follows:

¹ Holton, Sylvia G., and Bensley, R. R., *Am. J. Anat.*, 1931, **47**, 241.

² Verne, J., *Arch. d'Anat. Micros.*, 1921, **18**, 357.

1. In the peritubular capillaries.
2. In the proximal convolution: (a) From 5 to 40 minutes. No appreciable amount in either cells or lumen of the tubule. (b) From 40 minutes to one hour. Uniformly distributed in particulate form throughout the cells except an area at the periphery equal to one-third to one-fourth of the width of the epithelium. (c) From one hour 50 minutes to 4 hours. In the lumen of the proximal convolution in pale, blue-green, diffuse form.
3. In the distal convolution: (a) From 5 minutes to 2 hours and 20 minutes. No iron in either cells or lumen of the tubule. (b) From 2 hours and 20 minutes to approximately 3 hours. In finely particulate form in the lumen. (c) From approximately 3 hours to 4 hours. In larger aggregates of intense blue in the lumen, and in particulate form in the nuclei alone of some of the cells of the epithelium of the distal convolution.

India ink was present in glomerular tufts in one of a total of 42 experiments. This was taken to be evidence of incomplete ligation of urogenital arteries and the protocol was discarded.

To determine the site and extent of occurrence of iron in the tubule, as well as possible variations in amounts present, without recourse to serial reconstruction, several kidneys were macerated, the entire tubule isolated by teasing with glass needles and mounted for microscopic examination by the method of Edwards which was demonstrated to the author. This method has not as yet been published but the results obtained by its use are in part available.³ Microscopic examination of these whole, mounted tubules confirmed all observations made of the sectioned kidney.

These results offer added support to the view of Holton and Bensley,¹ Stieglitz,⁴ and Edwards³ that excretion of iron salts is accomplished, at least in part, by the epithelium of the proximal convoluted tubule.

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³ Edwards, J. Graham, *Am. J. Phys.*, 1930, **95**, 493.

⁴ Stieglitz, Edward J., *Am. J. Anat.*, 1921, **29**, 33.