THE FUNCTION OF THE PROXIMAL CONVOLUTED SEGMENT OF THE RENAL TUBULE

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It now appears to be definitely demonstrated that the renal tubule is capable of both secretion and reabsorption. Very little, however, is known of the function of the histologically distinct segments of the tubule. The present research is an attempt to assign certain functions to the proximal convoluted segment.

For this study the toadfish *(Opsanus tau)* and the sculpin *(Myoxocephalus octodecimspinosus)* were used. The toadfish possesses only a proximal convoluted segment in its nephron, while the sculpin possesses this segment with the addition of a glomerulus.

Secretion by the proximal convoluted segment is proved by studies already reported on the toadfish. Experiments on the sculpin have shown that this segment can still secrete when a glomerulus is present. The glomerular kidney of the sculpin can be rendered functionally aglomerular by the injection of repeated large doses of phlorizin. Under these conditions secretory activity of the proximal segment can be quite marked. Using the urine/plasma ratio of glucose after small doses of phlorizin as a measure of glomerular filtrate, it is found that as much as 95 per cent of some substances may be secreted by the proximal convoluted segment when the glomerulus is functional.

The same histological type of cell in this segment in the glomerular kidney has been shown to reabsorb water, glucose, and chloride.

EXPERIMENTAL CYTO-PHYSIOLOGY ON NEPHROCYTES OF UNISEGMENTED AGLOMERULAR AND GLOMERULAR NEPHRONS

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According to the program of anatomical and physiological researches on the nephron outlined by Professor E. K. Marshall, a study of experimental cyto-physiology on nephrocytes was undertaken. Marine teleosts which possess very simple unisegmental nephrons of a single cell type were used. The toadfish *(Opsanus tau)* served for the study of the aglomerular nephron, while the sculpin *(Myoxocephalus octodecimspinosus)* as the glomerular nephron. As far as possible quantitative methods were employed to determine the functional and structural differences existing in the cells (nephrocytes).

The results obtained render possible a better understanding of renal secretion in the plurisegmental nephrons, as those of the mammals.

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No fundamental differences have been found between nephrocytes of aglomerular and glomerular nephrons, nor between these and the nephrocytes which compose the first portion of the proximal segment of the tubule of mammals. The chondriome, the chromophile substance of the Golgi complex (substance 0), and the apical zone (border and flagellate diplosome) all have the same morphological structure in the vertebrates. This is noteworthy because it justifies functional homologies between structurally similar tubular segments. Notwithstanding this fundamental similarity, nephrons of different species are composed of nephrocytes which present certain differences characteristic of each. The presence of the glomerulus at the end of the tubule apparently modifies the functional cycle of the nephrocyte by including a phase of reabsorption in the functional cyle of the cell. It has been proved that the kidney cell transports substances from the lymph into the lumen of the tubule. The attempt has been to increase experimentally this secretory work.

Particularly important results have been obtained in the aglomerular nephron. Water and caffein, which have no diuretic effect on the aglomerular nephron, do not modify the cellular structure. Urea has a diuretic effect in the aglomerular nephron but its elimination does not noticeably modify the structure of the nephrocyte. This is in perfect accord with the physiological results which demonstrate that the aglomerular nephron is not able to concentrate this substance. Magnesium sulphate acts directly upon the nephrocyte, in both the aglomerular and glomerlar nephron. This substance, from a cytological point of view, exhausts the renal cell, but allows restitution similar to that of the action of pilocarpine on the pancreatic cell. Magnesium sulphate, which is highly concentrated by the kidney, in doses producing no irreparable changes in the cell causes: loss of cytoplasmatic substance, diminution of the chondriome, modifications and diminution of the chromophil portion (substance 0) of the Golgi complex. These induced cytological modifications do not differ from that which are usually interpreted as a "secretory cycle."

RENAL FUNCTION IN THE ELASMOBRANCH FISHES

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It is known that the teleostean fishes regulate the water and salt content of their blood and tissues by ingesting sea water and excreting the Na, K and Cl by way of the gills. The osmotic work involved in this branchial salt excretion, which is of a considerable order of magnitude, serves to offset the tendency for the organism to become osmotically concentrated while living in a *milieu* of high osmotic pressure.

The elasmobranch fishes have amended the teleostean mode of osmotic regulation by the conservation of the end-product of nitrogenous metabolism, urea. The gills, oral membranes and integument