Activity of (Na\textsuperscript{+}K\textsuperscript{+})-Stimulated Adenosintriphosphatase in the Rat Nephron*

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Summary. In 17 male Wistar rats in antidiuresis 10 different nephron segments and arteries are identified with the aid of Lowry’s technique, dissected and total- and (Mg\textsuperscript{++})-adenosintriphosphatase (= ATPase) determined. (Na\textsuperscript{+}K\textsuperscript{+})-activated ATPase in the distal tubule is four to five times (max. eight times) more active than in the proximal segment. This difference of activity may speak for a high pump mechanism mediated by the way of a (Na\textsuperscript{+}K\textsuperscript{+})-activated enzyme system in the distal nephron and for a partially passive reabsorption of sodium from the proximal convolution.

Key-Words: (Na\textsuperscript{+}K\textsuperscript{+})-ATPase — (Mg\textsuperscript{++})-ATPase — Rat — Nephron — Quantitative Histochemistry.

Schlüsselwörter: (Na\textsuperscript{+}K\textsuperscript{+})-ATPase — (Mg\textsuperscript{++})-ATPase — Ratte — Nephron — Quantitative Histochemie.

The high K\textsuperscript{+}-ions and low Na\textsuperscript{+}-ions concentration found in many animal cells is due to an active process bound to the membrane, where energy stems from hydrolysis of adenosintriphosphate (= ATP).

Our conception about the structure and mechanism of the (Na\textsuperscript{+}K\textsuperscript{+})-stimulated and (Mg\textsuperscript{++})-dependent adenosintriphosphatase (= ATPase) as described by Skou [18] for the transport of monovalent cations remains hypothetic; he therefore proposed the term “enzyme systems” to be used for the so-called transport-ATPase. The enzymatic mechanism probably consists of two stages. In the first stage a phosphorylated intermediate product is formed and associated with the outward movement of Na\textsuperscript{+}-ions. The second stage is characterized by dephosphorylation liberating inorganic phosphate in the interior of the cell and associating with the inward movement of K\textsuperscript{+}-ions. The enzyme system fulfills requirements, which are necessary for active ion transport. Possibly it represents the ion pump itself or is a part of it. A number of experiments support this general supposition. They point out a connexion of character-

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istics for the \((\text{Na}^+\text{K}^+)\)-stimulated enzyme system with cellular transport of sodium and potassium in various tissues \([1,4,13,16,22]\) and many species \([2]\). In the kidney reabsorption of sodium from the tubular lumen proceeds against an electrochemical potential gradient \([21]\). This represents active, energy consuming work. In addition the kidney shows high activity of \((\text{Na}^+\text{K}^+)\)-ATPase \([4]\).

Basis for the following experiments is the assumption, that determination of \((\text{Na}^+\text{K}^+)\)-ATPase is reconciled with the site of sodium reabsorption along the nephron, if this enzyme system possesses a determining significance in cation transport.

**Methods**

17 male Wistar rats\(^1\) of 200—280 g with free access to Nafag food and water are killed at 10 a.m. by decapitation. Both kidneys are decapsulated and cut in small pieces with a razor blade. The tissue pieces are rapidly frozen in liquid \(N_2\). After 8 hours in the cryostat at \(-25^\circ\text{C}\) the tissue is cut 16 µ thick. The first and the third of three consecutive sections coloured with PAS serve for identification of the second one, which is lyophilized for 16 hours in the cryostat at 0.005 mmHg and \(-25^\circ\text{C}\). Further treatment of the lyophilized material is performed according to

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