A Tribute to Karl Julius Ullrich, Prof. Dr. med. Dr. h.c.

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This issue of *Cellular Physiology and Biochemistry* encompasses 12 contributions dealing with anion and cation transport across cellular membranes. All papers are related to research fields that have been, and still are, largely influenced by Dr. Ullrich. His longstanding interest for stimulus-secretion coupling in exocrine pancreas is reflected by two articles by F.

Thévenod et al. and by A. Zde-bik et al., who studied the role of chloride conductances in zymogen granules and in the plasma membrane of acinar cells.

In the early seventies, Dr. Ullrich worked on the reabsorption of organic buffers and of bicarbonate and used stilbene disulfonates as a tool to define transport pathways. In this issue, S. Faber et al. introduce an optical screening method for inhibitors of a Na⁺-coupled Cl⁻/HCO₃⁻ antiporter. Stilbene disulfonates and chloride channel blocker analogs turn out to be efficient inhibitors of this anti-porter.

Another topic of Dr. Ullrich's work in the seventies was renal phosphate absorption and its regulation by parathyroid hormone and phosphate diet. Here, C.A. Wagner et al. report on the regulation by intracellular second messengers of the cloned human renal Na⁺-phosphate symporter, NaPi-3, expressed in *Xenopus laevis* oocytes.

In the eighties, Dr. Ullrich began a large, unsurpassed series of studies on the definition of substrate specificity of renal transporters for organic anions. The Na⁺-coupled transport systems for monocarboxylates and di-/ tricarboxylates in the luminal (brush-border) membrane of proximal tubule cells served as starting points. The development of the stopped flow capillary perfusion method enabled Dr. Ullrich to extend these studies to the contraluminal (basolateral) membrane of proximal tubule cells and to clearly define three transporters for organic anions with overlapping substrate specificities: the sul-fate/oxalate transporter, the (Na⁺-dicarbox-ylate symporter and the transport system for /> aminohippurate (PAH).

J.B. Pritchard and D.S. Miller review here all steps involved in the renal secretion of PAH and of its analogue, fluorescein. From these and other studies an additional transport system must be envisaged that causes accumulation of fluorescein in intracellular organelles and thereby sequesters organic anions. W.H. Dantzler covers the comparative aspects of renal organic anion transport em-

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phasizing that these transporters are old in a phylogenetical sense. Comparative aspects of urate transport in the kidney and, in particular, the mode of urate uptake across the brush-border membrane in human kidneys is dealt with by F. Roch-Ramel et al.

Organic anion transporters are not limited to the kidney. The liver is an important site for handling of amphiphilic anions, among them bile salts, bumetanide and bromosulphophthalein. B. Brühl et al. have performed an extensive work on the isolation and microsequencing of hepatic proteins that bind bile salts and bumetanide. C. Basoglu et al. report on an inhibitory effect of bromosulphophthalein on renal transporters for PAH, D-glucose and L-alanine. A PAH transporter is also responsible for a considerable part of cortisol release from cultured adrenal cortical cells as reported by J. Steffgen et al. This novel finding is in concert with Dr. Ullrich's earlier results on cortisol transport by the renal PAH transporter.

With the beginning nineties, Dr. Ullrich turned to the transport of organic cations in the apical and contraluminal membrane of proximal tubule cells. Again, the definition of transport systems and their specificities were the goal of these investigations. This field is reviewed by S.H. Wright who studied structure-transport relationships for luminal and contraluminal organic cation transporters. Finally, A. Stachon et al. provide a new optical method to follow organic cation transport in a kidney cell line. This method will allow to extend substrate specificity studies to cultured cells.

We all dedicate this special issue of *Cellular Physiology and Biochemistry* to Prof. Dr. Dr. Karl J. Ullrich on the occasion of his 70th birthday. His contributions to epithelial transport processes in general, and to definition of substrate-transporter interaction in particular, have become milestones. Dr. Ullrich's work provided the basis for our own investigations and his brilliant ideas and generous help are deeply acknowledged.

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