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Sommario/riassunto	ATP is normally regarded as the major source of fuel for the energy-demanding processes within cells; however, ATP and other nucleotides (such as ADP, UTP, UDP) can be released from cells, where they act as autocrine or paracrine signaling molecules to affect cellular and tissue functions. In response to various stimuli, ATP and other nucleotides are released from cells in a regulated fashion, either by exocytosis of nucleotide-containing vesicles, or through channels in the plasma membrane. This process occurs in virtually every organ or cell in the body. The cellular effects of these extracellular nucleotides are mediated through specific membrane receptors (P2X and P2Y). These nucleotide signals can be terminated by rapid degradation of the ligand molecules by ecto-nucleotidases (e.g., NTPDases and NPPs). Many of the molecular components essential to nucleotide signaling have been cloned and characterized in detail, and their crystal structures are beginning to emerge. The collected data on extracellular nucleotides suggest a vivid and dynamic signaling system that is modulated by the expression and sensitivity of specific receptors on cells, and by the regulated release and extracellular degradation of ATP and other

nucleotides; thus creating a microenvironment of highly regulated paracrine or autocrine control mechanisms. Within the kidney, extracellular nucleotides have emerged as potent modulators of glomerular, tubular, and microvascular functions. These functions include, but are not limited to, tubular transport of water and sodium, tubuloglomerular feedback and auto-regulation, regulation of blood pressure and the microcirculation, oxidative stress, and cell proliferation/ necrosis/apoptosis. Moreover, studies have also uncovered the interaction of nucleotide signaling with other mediators of renal function, such as vasopressin, aldosterone, nitric oxide, prostaglandins, angiotensin II, and the ATP-break down product adenosine. These insights have provided a more comprehensive and cohesive picture of the role of extracellular nucleotides in the regulation of renal function in health and disease. The availability of transgenic mouse models of the key proteins involved in nucleotide signaling has markedly enhanced our understanding of the physiological and pathophysiological roles of the different components of the system in the kidney. Although at a preliminary stage, the pathophysiological significance of this system in the kidney holds the key for the development of an entirely new class of drugs for the treatment of disease conditions, including disorders of water and/or sodium homeostasis, hypertension, acute kidney injury, etc. Thus, the regulation of renal function by extracellular nucleotides is clearly emerging as a distinct field and discipline in renal physiology and pathophysiology that has the potential to develop new drug treatments. In this e-book, we bring together a spectrum of excellent papers by leading experts in the field which present and discuss the latest developments and state-of-the-art technologies.Last but not least, we thank all the authors for contributing their valuable work and the Frontiers in Physiology Editorial Office for bringing out this e-book.