

## Is the renal (Na + K)-ATPase modulated by intracellular messengers?

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The basic cellular mechanisms involved in the regulation of (Na + K)-ATPase are discussed. Various ligands seem to be responsible for the short-term modulation of this enzyme activity (intracellular messengers). Cytosolic Ca<sup>2+</sup> has a key role in mediating changes induced by hormones or receptor agonist; but, in turn, intracellular Ca(2+)-dependent proteins like calmodulin, calnaktin or others, are also needed for these changes. Phosphorylation of effector proteins, following the activation of PKC, PKA or CaM-kinase II, may result in changes of (Na + K)-ATPase activity either by a direct effect on the catalytic subunit or by modulating the Na(+)-H<sup>+</sup> exchanger thereby resulting in an effect on intracellular sodium, whose concentration is known to be rate-limiting for the enzyme activity. Despite the ubiquity of (Na + K)-ATPase in various organs and tissues, its response to modulators partly depends on the heterogeneity of the alpha-subunit that give rise to the existence of different isofo