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Purinoceptor and Intracellular Ca^{2+} Regulation in Rat Prostate Neuronencocrine Cells

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Extracellular ATP regulates a wide range of cellular function including the growth of prostate gland. Purinoceptors (ATP receptors) are divided into P2X (ligand-gated ion channels) and P2Y (G-protein–coupled receptor) subfamilies. In the present study, we investigated the types of purinoceptors in rat prostate neuroendocrine (RPNE) cells using whole-cell patch clamp technique, intracellular Ca^{2+} measurement and RT-PCR analysis. When membrane potential was held at –60 mV, ATP or α,β-meATP (1 μM) induced a transient inward current (I_{ATP}) with rapid desensitization. The current to voltage relation showed an inwardly rectifying property with nonselective permeability to cations. I_{ATP} was blocked by TNP-ATP, an antagonist of $P2X_1$ and $P2X_3$ receptors. A fast Ca^{2+} influx was observed along with the activation of I_{ATP}, indicating the Ca^{2+} permeability of P2X receptor channels. In external Ca^{2+} free condition, UTP or ATP, but not UDP, induced the release of Ca^{2+} from intracellular stores with similar potency. RT-PCR analysis confirmed the presence of transcripts for $P2Y_2$, $P2X_1$ and $P2X_3$ in the rat prostate tissue. Concomitant activation of P2X and P2Y receptors revealed the different time-courses in their effects on $[Ca^{2+}]_c$; the fast rise of $[Ca^{2+}]_c$ by P2X-mediated Ca^{2+} influx prior to the later Ca^{2+} release through the IP_3-mediated signaling pathway. The time-difference in the increase of $[Ca^{2+}]_c$ may be directly coupled with the exocytotic release of hormones in RPNE cells.