ION CHANNELS IN NATIVE ENVIRONMENT: CHARACTERIZATION OF ION CHANNELS IN DENDRITIC AND ENDOTHELIAL CELLS

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Cells rapidly adjust their gene and ion channel expression upon the change of extracellular environment. To obtain valid measurements it is important to use models closest to the *in vivo* systems. In this work we focused on the characterization of ion channels on two different cell types, the human dendritic cells (DC) and the endothelial cells (EC) of the arteria mesenterica superior in rats in the most physiologic circumstances. We also used a DC model cell line (KG-1) during our electrophysiological studies to compare the obtained currents to that of DC. In the immune system VGPC, K_{ir}, and K_{Ca} channels have been described to play a major role in controlling the membrane potential and regulating intracellular Ca^{2+} signaling pathways required for proliferation and differentiation. In this study for the first time we described that immature monocyte-derived DC express voltage-gated Na^+ channels (Nav1.7). Transition from the immature to a mature state in DC however was accompanied by the down-regulation of Nav1.7 expression and the up-regulation of voltage-gated Kv1.3 K^+ channels. The presence of Kv1.3 is common for immune cells; hence, selective Kv1.3 blockers may emerge as candidates for inhibiting various functions of mature DCs that involve their migratory, cytokine-secreting, and T cell-activating potential. Both unstimulated and stimulated KG-1 cells expressed K_{Ca} only, which makes them not an ideal model for electrophysiological studies on DC.

EC function could be considerably altered during the process of isolation and cell culture. Previous electrophysiological studies on EC were conducted on isolated or cultured cells, ignoring the complex and fine network of EC and vascular smooth muscle. We developed a method that allows identifying and characterizing the ion channels of EC in their native environment. Rat mesenteric arteries mounted as ring preparations in a microvascular myograph for recording whole cell currents under '*blind*' patch clamp technique. Neurobiotin staining demonstrated that intact EC are electrically coupled through gap junctions and 18β- gly gap junction blocker decreased the outward and inward currents registered. We observed K_{ir} currents sensitive to $BaCl_2$, K_{Ca} currents of small (SK_{Ca}), intermediate (IK_{Ca1}) and high conductance (BK_{Ca}) that were sensitive to apamin, TRAM 34 and IbTx, respectively. Moreover, Ach increased outwardly directed K^+ currents that were sensitive to TEA. Under physiological circumstances K_{ir} current is involved in maintaining the resting membrane potential, where SK_{Ca} and IK_{Ca1} are mainly responsible for membrane hyperpolarization. The BK_{Ca} current reported in this study may arise from the vascular smooth muscle layer and potentially influence EC membrane potential via myoendothelial transfer of current.

Keywords: Ion channel, patch clamp, dendritic cell, endothelial cell

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