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ELECTRICAL RESPONSES TO ACETYLCHOLINE IN
GUINEA-PIG ADRENAL CHROMAFFIN CELLS

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1. Membrane properties and electrical responses to acetylcholine (ACh) were studied in the chromaffin cells of guinea-pig adrenal gland using the patch-clamp technique.
2. Under voltage-clamp in the whole-cell recording mode, K currents were observed in the presence of tetrodotoxin (TTX). These were partially inhibited by replacement of extracellular Ca with Co, or by application of 5mM tetraethylammonium (TEA). The currents were abolished by replacement of intracellular K with Cs and TEA.
3. TTX-sensitive Na currents were recorded after blockage of Ca and K currents.
4. Co-sensitive Ca currents were recorded after blockage of Na and K currents.
5. Under current-clamp conditions, action potentials were evoked by depolarizing current.
6. At -60mV holding potential, application of 10^{-5} M ACh induced inward current abolished by hexamethonium (C_6). Reversal potential of this event was close to 0mV.
7. Application of ACh at 0mV elicited two types of responses, dependent on intracellular EGTA concentration. These were a decrease in outward K current at 10mM EGTA and an increase in intracellular Ca dependent outward K current at 0.1mM EGTA. Co had no effect on the latter response.
8. Both responses to ACh at 0mV were inhibited by atropine or intracellular application of GDP- β s.
9. These results indicate that guinea-pig adrenal chromaffin cells have Na, Ca, and two types of K channels (voltage dependent K channel and Ca activated K channel), and have properties as excitable cells. In addition, these cells are found to evoke inward current through activation of nicotinic receptors, and to evoke two types of muscarinic responses, inhibition of outward K current, and activation of Ca dependent K channel. It is suggested that GTP-binding proteins are involved in both muscarinic actions, and Ca required for activation of the K channel is mobilized from intracellular Ca stores in the guinea-pig adrenal chromaffin cells.