

ラット副腎クロム親和性細胞のムスカリン性およびニコチン性興奮に関する膜電位と膜電流固定法による研究

赤池昭紀, 三根康毅*, 笹 征史*, 高折修二*

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Voltage and Current Clamp Studies of Muscarinic and Nicotinic Excitation of the Rat Adrenal Chromaffin Cells

Akinori AKAIKE, Yasutake Mine*, Masashi SASA*
and Shuji TAKAORI*

ABSTRACT Characteristics of the muscarinic and nicotinic excitation of chromaffin cells that had been freshly isolated from the rat adrenal medullae were analyzed using voltage and current clamp techniques. A dose-dependent increase in the extracellularly recorded firing of cells was observed when 10^{-6} to 10^{-4} M acetylcholine (ACh) were locally applied to the cells in the vicinity of the target cell being recorded using a microinflow method. During voltage clamp recording at the resting membrane potential, ACh induced two different sequential inward currents: a transient current with a rapid rising phase (fast response) and an apparent inward current with a slow rising phase (slow response). The membrane conductance increased during the ACh-induced fast response, and it subsequently decreased during the slow response. The amplitude of the fast response decreased when the holding potential was shifted to depolarized levels, whereas the amplitude of the slow response increased with depolarization. Nicotine produced fast depolarization and a transient inward current that was reduced by the membrane depolarization. In contrast, muscarine induced a slow depolarization and an apparent inward current that increased with depolarization. Muscarine also reduced the inward K^+ current that had been induced by the application of a high K^+ medium to the outside of the cell at the resting membrane potential. It is suggested that muscarinic excitation is triggered by the suppression of K^+ channels that are open at potentials near the resting membrane potential. The present results indicate that ACh-induced excitation of adrenal chromaffin cells involves two separate

mechanisms mediated by nicotinic and muscarinic receptors.

抄録 ラット副腎髄質クロム親和性細胞におけるムスカリン性およびニコチン性興奮の機序を電気生理学的に解析した。アセチルコリンは用量依存性に脱分極性の興奮作用を発現し、一過性の早い内向き電流と緩徐な内向き電流の2種類の膜電流を誘発した。細胞膜コンダクタンスは早い内向き電流の間に増大し、緩徐な内向き電流の間は減少した。ニコチンは一過性の早い内向き電流のみを誘発し、ムスカリンは緩徐な内向き電流のみを誘発した。細胞膜電位を静止膜電位付近に固定し、細胞外液を高濃度カリウム液に置換するとカリウム性の内向き電流が観察されるが、この静止膜電位でのカリウム性内向き電流はムスカリン投与により抑制された。以上の結果は、副腎髄質クロム親和性細胞におけるアセチルコリン性興奮には、ニコチン受容体とムスカリン受容体を介する2種類の異なった機序が存在することを示唆する。

* Department of Pharmacology, Faculty of Medicine, Kyoto University
京都大学医学部薬理学教室