Sensitivity of calcium binding in cerebral tissue to weak environmental electric fields oscillating at low frequency.

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Abstract

Weak sinusoidal electric fields modify the calcium efflux from freshly isolated chick and cat cerebral tissues bathed in Ringer's solution, at 36 degrees. Following incubation (30 min) with radioactive calcium (45Ca2+), each sample, immersed in fresh solution, was exposed for 20 min to fields at 1, 6, 16, 32, or 75 Hz, with electric gradients of 5, 10, 56, and 100 V/m in air. 45Ca2+ efflux in the solution was then measured in 0.2 ml aliquots and compared with efflux from unexposed control samples. Field exposures resulted in a general trend toward a reduction in the release of the preincubated 45Ca2+. Both frequency and amplitude sensitivities were observed. Maximum decreases occurred at 6 and 16 Hz (12-15%). Thresholds were around 10 and 56 V/m for chick and cat tissues, respectively. Similar but nonsignificant trends occurred during other field exposures. All results were statistically compared with matched samples of controls. Tissue gradients could not be measured, but estimates were of the order of 0.1 muV/cm. The susceptibility of the electrochemical equilibrium in the neuronal membrane to small extracellular perturbations is discussed and a possible role for weak intrinsic cerebral fields in neuronal excitability is suggested.

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