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DC MAGNETIC FIELD ALTERS MEMBRANE POTENTIAL IN IEC-18 EPITHELIAL CELLS

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Some effects of electromagnetic fields (EMFs) may be mediated by an interaction with a mechanism that contributes to cell membrane potential (V_m).

Evidence that EMFs can affect V_m was sought: The effect of DC EMFs on V_m (measured with 3 M KCl micropipettes) of IEC-18 epithelial cells (rat ilium) was observed before, during and immediately following application of the EMF. A successful impalement was (1) an abrupt change in V_m on entry; (2) a stable potential for 2 minutes (period T_1); (3) return of V_m to baseline after withdrawal of the microelectrode. Cells that met the first 2 conditions were randomly assigned to EMF-exposed or control groups. Cells in the first group were exposed for 2 minutes (T_2), and then followed for 2 minutes (T_3) under ambient EMF conditions. The control cells were treated in a similar fashion, except that no EMF was applied during T_2. V_m was measured in a bath solution consisting of (in mM): NaCl, 145; KCl, 5.4; $CaCl_2$, 1.5; $MgCl_2$, 1; HEPES, 5; glucose, 5; pH, 7.4.

The EMF was generated with a 15-cm coil and measured using a fluxgate magnetometer. The 35-mm dish containing the cells was located coaxially and in the same plane as the coil. The vertical component of the earth's magnetic field at the location of the cells (B_V) was 535 mG (control field). The effect on V_m of doubling or eliminating B_V was measured.

TIME PERIOD	*MEMBRANE POTENTIAL (mV)*			
	CONTROL (B_V)	B_V–B_V=0	B_V+B_V=2B_V	
T_1	^{A} 42 ± 6 (N=40)	^{A} 42 ± 5 (N=15)	^{A} 42 ± 3 (N=15)	Means having no common superscript differed at P<0.05.
T_2	^{A} 42 ± 6	^{B} 28 ± 13	^{B} 53 ± 10	
T_3	^{A} 42 ± 6	^{B} 29 ± 16	^{AB} 44 ± 18	

We concluded that DC EMFs were transduced by IEC-18 cells via a directionally-dependent post-translational ionic mechanism.