In Fig. 3, the pit generation intensity, λ_0, for unit area of the surface is plotted against the potential at which pits are generated; the pit generation rate estimated by the least squares method is also shown for comparison. The pit generation probability increases and appears to approach a ceiling asymptotically as the potential becomes more noble.

In view of stochastic process, the critical potential for pit generation may be defined as the least noble potential at which the pit generation probability is practically recognizable. Notice that the pit generation probability depends on the area of the metal surface.

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Evaluation of Electrochemical Information Transfer System

I. Effect of Electric Fields on Living Organisms

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The concepts of electrochemical information transfer occurring at membrane interfaces in biological systems (1,2) imply that exposure of living organisms or cells to electromagnetic fields will produce nonthermal effects. In view of the widespread alteration of the electrical environment produced by electrical power transmission facilities, the question of a resultant biological effect becomes significant. A preliminary study involving chronic exposure of rats to 60 Hz, 150 V/cm, electric fields is reported herein. Our object was to determine whether such exposure would; (*i*) act as a body stressor, *i.e.*, direct glandular (cell) effect, (*ii*) affect the blood proteins, *i.e.*, the cells which produce them, (*iii*) affect the growth rate of immature animals. To these ends we measured the concentration of serum corticoids, the relative distribution of serum proteins, and body weight.

Methods

Twenty-one day old male Sprague-Dawley rats, fed and watered *ad libitum*, were exposed continuously for one month to a 60 Hz electric field generated between the plates of a capacitor which was oriented to produce an electric field vertical to the earth's surface (3).

Each experimental and control group consisted of a minimum of 11 rats. In the first three experiments, the rats were weighed at the end of the exposure period, decapitated, and the sera from each group was pooled and analyzed. In the fourth experiment, the rats were subjected to a cold stress ($-13°C$ for 1 hr) at the end of the exposure period, after weighing and prior to sacrifice. All experiments were performed consecutively.

The relative percentages of the four major groups of serum proteins were determined by electrophoresis on cellulose acetate with planimetric integration (3). The concentration of 11-hydroxycorticosterone in the pooled sera (serum corticoids) was measured fluorometrically by Mattingly's method (4) as modified by Purves and Sirett (5).

Key words: electric field, information transfer, stressor.

Results

The final weight of all four experimental groups was lower than that of the corresponding control group, significantly so ($P < 0.05$) in two experiments (Table I). In the three experiments in which they were measured, a statistically significant elevation in albumin percentage and a statistically significant decrease in gamma globulin percentage was noted, compared to the corresponding control group (Table II). In the first three experiments, the serum corticoids were consistently lower in the experimental group as compared to the corresponding control group (Table I). All experimental and control animals were autopsied at sacrifice and no gross pathology was observed.

Experiment 4 was performed to determine whether the observed disturbances in the adrenal-pituitary system (control system for serum corticoids) would prevent the exposed rats from responding to a known stress. When subjected to a cold stress, the serum corticoids in both groups rose markedly (Table I), indicating that the exposed rats remained capable of responding to a known stress in the predictable fashion.

All the observed metabolic alterations are consistent with the effect of chronic exposure to a non-

Table I. Effects of continuous exposure to 60 Hz electric fields on body weight and serum corticoids of rats

Experiment No.	No. of rats		Final body weight (g)	Serum corticoids (μg/100 ml)
1	Experimental	(14)	244.0* ± 12.6	14.6
	Control	(19)	273.1 ± 16.7	22.0
2	Experimental	(14)	276.5 ± 24.1	12.4
	Control	(22)	290.8 ± 27.9	18.0
3	Experimental	(14)	270.4 ± 14.3	10.4
	Control	(18)	277.8 ± 15.8	14.5
4	Experimental	(14)	228.7* ± 26.1	56.8
	Control	(11)	251.0 ± 11.3	53.4

* $P < 0.05$.

Table II. Electrophoretically determined serum protein relative percentages of rats exposed continuously to 60 Hz electric field for one month. For each group, the listed values are averages and standard deviations of 10 determinations (5 strips/pool, 2 scans/strip).

Experiment No.		Serum proteins (%)			
		Albumin	α-globulin	β-globulin	γ-globulin
1	Experimental	$59.1 \pm 1.7^*$	$22.3 \pm 1.0^*$	12.2 ± 0.9	$6.4 \pm 1.4^*$
	Control	53.8 ± 1.6	24.1 ± 0.9	13.6 ± 0.9	8.6 ± 1.2
2	Experimental	$52.4 \pm 2.8^*$	25.7 ± 1.0	14.6 ± 1.1	$7.5 \pm 0.8^*$
	Control	49.2 ± 1.0	26.9 ± 1.0	14.7 ± 0.6	9.2 ± 0.7
3	Experimental	$52.7 \pm 1.4^*$	25.9 ± 2.1	14.8 ± 0.9	$7.3 \pm 0.9^*$
	Control	49.1 ± 3.3	27.2 ± 2.4	14.0 ± 0.6	9.6 ± 1.2

* $P < 0.05$.

specific environmental stressor (6-8), with the development of the general adaptation syndrome as described by Selye (6). Since data were obtained only at the termination of one month's exposure, the initial stages of this reaction were not documented.

In summary, the results support the concept of electrochemical information transfer in biological systems, and indicate that it involves at a minimum, direct cellular and glandular responses quite distinct from that due to Joule heating.

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