with IRC and target cells from patients, we showed that perception of the action of IRC by target cells from patients with SLE is disturbed. Besides a low suppression index, this was also shown by manifestation of an activating effect on IRC under these experimental conditions (Fig. 1b). The ability of the patients' target cells to undergo mitogen-induced proliferation did not differ from that of normal subjects (Fig. 3). The fact that perception of the action of immunoregulatory T lymphocytes by proliferating T cells and, evidently, the suppressor cell hyperactivity due to this, recorded during their action on normal target cells, are abnormal thus suggests that the disturbance of T–T-cell interactions is another possible cause of the disturbance of immunoregulation in SLE. We found that this defect can be corrected by adding theophylline to the cultures in the phase of evaluation of immunoregulatory activity (Fig. 2). In concentrations not affecting target cell proliferation. The choice of theophylline was determined by information on the important role of purine compounds as immunomodulators [6]. Theophylline, added to the culture in the phase of induction of immunoregulatory activity by itself caused the appearance of suppressor activity in MNC (Fig. 1A). This is in agreement with data in the literature on the ability of methylxanthines to induce the appearance of suppressor properties in the lymphocyte [3, 7].

One other matter must be mentioned. The opposite action of con A-induced IRC of patients with SLE on proliferation of "SLE" and normal target cells assumes that in the intact organism IRC may have an activating action on the function of some cell populations and may inhibit the same function in other cells. This may explain the combination of defenselessness against infectious agents with the distinct features of autoaggression frequency found in SLE.

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IMMUNOBIOLOGICAL EFFECT OF BITEMPORAL EXPOSURE OF RABBITS TO MICROWAVES

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The part played by the higher autonomic centers of the hypothalamus and pituitary in the regulation of immune functions has now been established. The writers previously showed that secretion of endogenous hormones can be subjected to the influence of high-frequency electromagnetic field energy [1, 3].

The aim of this investigation was to study the immunobiological effect of electromagnetic waves in the decimeter band (DMW; microwaves) applied to the temporo-parietal region of the head.

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EXPERIMENTAL METHOD

Experiments were carried out on 30 male rabbits weighing 2.5-3 kg. DMW irradiation was carried out by means of a contact ceramic source 0.04 m in diameter (460 MHz), with a power flux density of 120 mW/cm² for 6 min daily for 10 days, and applied to the temporo-parietal region of the head. The animals were divided into four groups depending on the period of exposure to DMW relative to the day of sacrifice: group 1) animals killed after six exposures to DMW; group 2) after 10 exposures; group 3) 10 days after the last exposure; group 4) control, animals subjected to sham irradiation. The number of natural (background) hemolysis-forming cells (HFC) against sheep's red blood cells was determined in the animals' spleen [5] and the concentration of serum immunoglobulins of the M, G, and A classes was estimated by the method in [6]. Levels of thyroid-stimulating hormone (TSH), triiodothyronine (T_3), thyroxine (T_4), testosterone, and prostaglandins (PG) A and E (PG_{A+E}) and $F_{2\alpha}$ ($PG_{F_{2\alpha}}$) in serum or blood plasma were determined by radioimmunoassay, and the concentration of total 11-hydroxycorticosteroids (11-HCS) in the adrenals and plasma was deterdmined fluorometrically.

EXPERIMENTAL RESULTS

DMW irradiation of the temporo-parietal region of the head led to a decrease in the number of background HFC. In animals of the first three groups the number of HFC was 70.9, 71.5, and 61.8% of the control, respectively. Changes in immunoglobulin levels were of short duration (Table 1). An increase in glucocorticoid function was recorded in rabbits of the experimental groups. For instance, the 11-HCS concentration in the adrenals was 124.5, 124.8, and 117.6%, respectively, compared with the control. The plasma 11-HCS level also was statistically significantly raised (Table 2). Thyroid function was depressed. In the animals of group 2 a significant but lasting increase in the testosterone concentration was recorded (Table 2). The combined PG_{A+E} concentration was increased, but not significantly, under the influence of microwaves, and it more usually had only a tendency to be increased. The $PG_{F_{2\alpha}}$ levels in animals of all four groups were about equal.

Irradiation of the temporo-parietal region of the head with DMW (the projection zone of the higher autonomic centers and pituitary) thus leads to activation of the hypothalamo-hypophyseo-adrenal system, with consequent enhancement of the glucocorticoid function of the adrenal cortex and depression of thyroid function. These hormonal changes may lie at the basis of the immunodepression, reflected in a decrease in the number of background HFC. The immunodepressive effect was long-lasting, despite stimulation of proliferative processes in the lymphoid tissue (Table 1). The small and transient increase in concentration of the immunoglobulins can probably be explained by lysis of lymphoid tisuue during stimulation of the glucocorticoid activity of the adrenal cortex.

Our previous investigations showed that microwave irradiation of the projection zone of the endocrine glands activates their function. Hormonal changes appeared sooner than immunologic changes after the first few exposures. Microwave irradiation, repeated 5 or 6 times, caused changes in the immune system which were quite distinct and appeared 10 days after the end of the course of irradiation (flattening out on a plateau, whereas the hormonal parameters could have different tendencies [1].

There is as yet no general agreement on the nature of the natural (background) antibody-forming cells (AFC). For instance, it has been suggested that normal AFC arise, not as a

TABLE 1. Effect of Bitemporal Electromagnetic Irradiation on Immune Parameters (M ± m)

Group of animals	Number of animals	Number of background HFC per 10^6 nucleated spleen cells	Number of background HFC per spleen	Concentration of serum immunoglobulins, g/liter			Total number of spleen cells ($\times 10^6$)
				IgM	IgG	IgA	
1	8	3,53±0,36**	3631±453	3,04±0,3**	19,4±2,6	1,45±0,4*	1035±59,8***
2	8	3,56±0,42**	3938±320	1,61±0,1	16,9±1,4	0,45±0,04**	1174±83,8***
3	8	3,08±0,1***	3211±305*	2,17±0,2	18,9±1,4	0,66±0,15	1061±79,8***
4	15	4,98±0,42	4056±293	1,9±0,2	20,05±1,4	0,65±0,05	782±39,2

Legend. Here and in Table 2: *P < 0.05, **P < 0.025-0.01, ***P < 0.002-0.001 compared with control.

TABLE 2. Effect of Bitemporal Electromagnetic Irradiation on Endocrine Parameters (M ± m)

Group of animals	Number of animals	11-HCS concentration: in adrenal, mg/100 ml tissue	11-HCS concentration: in plasma, mg/100 ml plasma	TSH, mIU/liter	T_3,	T_4, mg/liter	Testosterone	PG_{A+E}	$PG_{F_{2\alpha}}$
1	8	1313±25***	9,3±0,5**	810±150*	3700±300	26 700±2 800**	1300±400	2550±540	260±40
2	8	1317±76**	11,8±1,2***	510±100	3750±260	40 100±5 900	6500±1900**	3070±640	280±40
3	8	1241±50**	9,0±0,4**	350±80	4100±100	27 600±2 600**	2680±800	3470±910	340±60
4	15	1055±25	7,4±0,3	430±120	4150±140	36 500±1 800	1200±180	2280±430	290±16

result of antigenic stimulation (due to cross-reacting external environmental antigens), but by physiological differentiation of precursor cells [2]. A different view on this problem has been expressed by Sterzl: On a model of normal sterile animals and sterile animals kept on an antigen-free diet, he demonstrated the leading role of exoantigenic priming in the formation of the natural AFC population [8]. Similar results have been obtained by other workers also [4, 7]. Our own results are evidence of the regulatory role of the endocrine system in the formation of natural AFC populations. One stage of endocrine immunomodulation may probably be interaction between glucocorticoid and thyroid functions. The formation of natural AFC evidently may depend on both exogenous and endogenous factors, the latter certainly including the genetic and endocrine status of the individual.

To conclude, it must be said that further research into the immunobiological effects of electromagnetic fields, with transcerebral exposure, will provide a basis for their future use as immunomodulators.

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