MOSCOW STATE UNIVERSITY

and

State Research Center
THE INSTITUTE OF BIOPHYSICS
Moscow, Russia

REPORT OF COLLABORATIVE REPLICATION STUDY

Tecno AO technology compensation of lethal effect induced by non-ionizing radiation (NIR) from GSM cell phones during embryonic development in chickens

by

Professor A.O. Kasumyan
Professor Yuri G. Grigoriev

Biological Faculty
Moscow State University,
Prof., DBS

A.O. Kasumyan

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Main Research Scientist
of Institute of Biophisics
Prof. Dr MD Sc

Yu. G. Grigoriev

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I. Aim of the study

The present study was an attempt to replicate a previous one performed at the University of Montpellier (France) showing 1) increase of mortality rate among chicken embryos exposed to non-ionizing radiation (NIR) emitted by GSM cell phones, as well as 2) substantial reduction of reported lethal effect by means of a compensation technology (Tecno AO technology) designed to prevent NIR-induced deleterious bio-effects.

II. Site of the study

The study was performed in the Laboratory of Ichthyology (Biological Faculty Moscow State University, Russia) under the supervision of Professor A.O. Kasumyan, in collaboration with the State Reserch Center – Institute of Biophysics (Moscow, Russia) headed by Professor Y.G. Grigoriev.

III. Materials and methods

III.1. Biological material

Freshly hatched chicken eggs (Brown Loman) were purchased from the State bird factory in Sergiev Posad.

III.2. Incubation material

Incubation of the eggs was carried out in a single room (L = 6 m; l = 4 m; h = 4 m) with 22 ° C and 45–48 % ambient temperature and humidity respectively.

The incubation material consisted of 3 identical plastic incubators (H = 75 cm; l = 62 cm; P = 63 cm) identified by the letters A, B et C and separated from each other by a distance of 2 m.

The three incubators were water-heated. The temperature within each incubators was 37 ± 1 °C and relative humidity was 50–65 % during the incubation session. The incubators were ventilated in order to allow gas exchange and to homogenize temperature and humidity inside.

The egg support was a polystyrene-doubled Plexiglas platform with a capacity of 63 eggs.

III.3. Set up for electromagnetic exposure

The radiation source was a dual band 900/1800 MHz GSM cell phone (Motorola M3788, Germany) fixed horizontally with keyboard downwards, 10 cm above the egg platform (Figure 1). The cell phone operation was remotely controlled by means of a time-switch wired to the electronics of the cell phone. The irradiation schedule consisted in sending a phone call of 1.5 min. duration followed by 0.5 min. of rest, continuously during the incubation session (21 days). The magnitude of microwaves (MW) was measured using EMR-20 radiation meter (s/n A-0072; Wandel & Goltermann, Germany). Extremely low frequency (ELF) field was measured by means of EFA-3 field analyzer (s/n FM-0104, Wandel & Goltermann, Germany) with external B-field precision probe (A = 100 cm^2).

The compensation technology (Tecno AO technology) consists of electromagnetically charged saline solution emitting an hyperweak electromagnetic signal (***International trade and registration patent n°***).

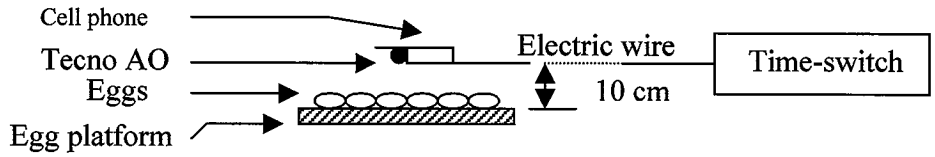

Figure 1: Set up for electromagnetic exposure of chicken embryos

III.4. Experimental protocol

Prior to incubation, the eggs were candled under white light for the detection of fissures and cracked eggs were discarded. Afterwards, the eggs were randomly distributed into three groups of 63 eggs each. Then their were incubated during 21 days under 37 ± 1 °C, 55-65 % humidity and permanent darkness. Developing embryos were submitted to different electromagnetic treatments, continuously during the incubation session : sham exposures were exposed to switched off GSM cell phone; the cell phone group was exposed to operating GSM cell phone; the cell phone + Tecno AO group was exposed to operating GSM cell phone with the Tecno AO technology installed. From 3 to 13 days of development, the eggs were mirrored at 2-day intervals for the detection of dead embryos. From day 13 onward, the eggs became so opaque that the embryos could hardly be candled through the shell. Therefore, embryonic mortality during the latter period was evaluated by opening the eggs from which chicks did not hatch at the end of the incubation session, i.e after day 21.

IV. Results

IV.1. Measurement of MW and ELF field strength

The values and distribution of MW and ELF field strength are presented in Figure 2 and Figure 3 respectively. MW were detected at 1714 MHz and ranged from 2 to 16 V/m with maximum values in the vicinity of the cell phone case and antenna. ELF field at 217 Hz was below 40 nT over the egg platform except in the center of the plate were 102 nT were recorded. For the frequencies of 35, 38 and 40 Hz, the ELF field strength was also below 40 nT over the egg platform. At 50 Hz, the magnitude of ELF field ranged from 46 to 374 nT.

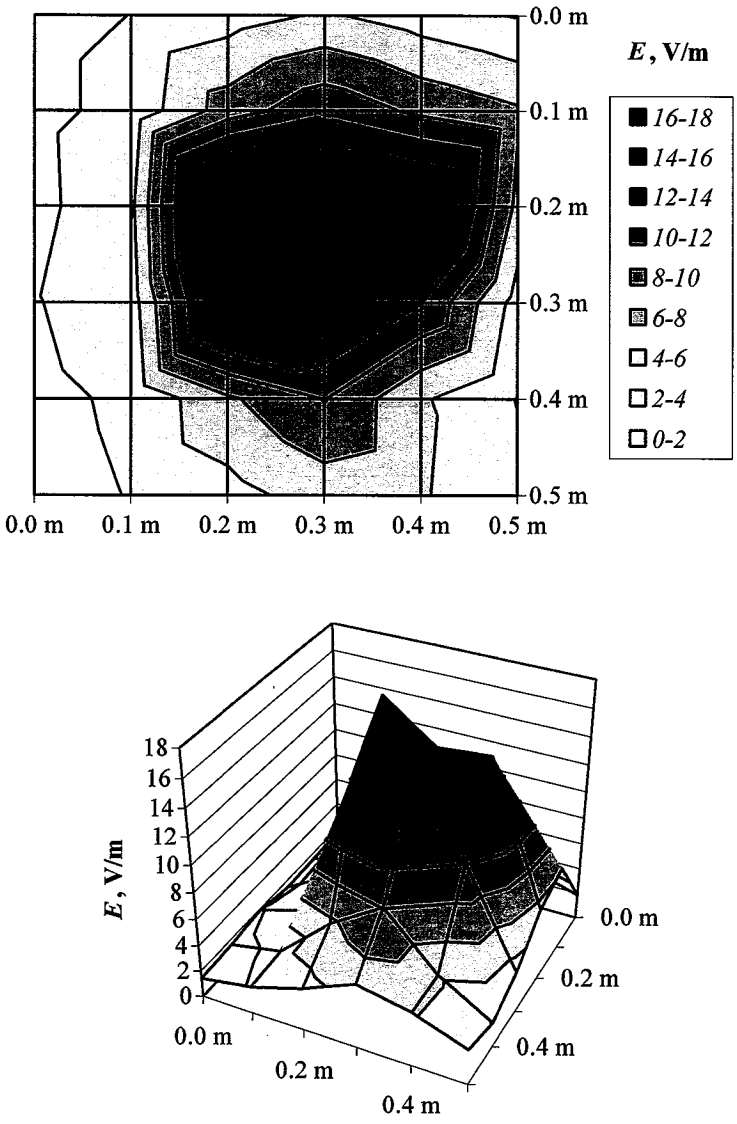

Figure 2: RF EMF levels distribution (E-field) at 1714 MHz

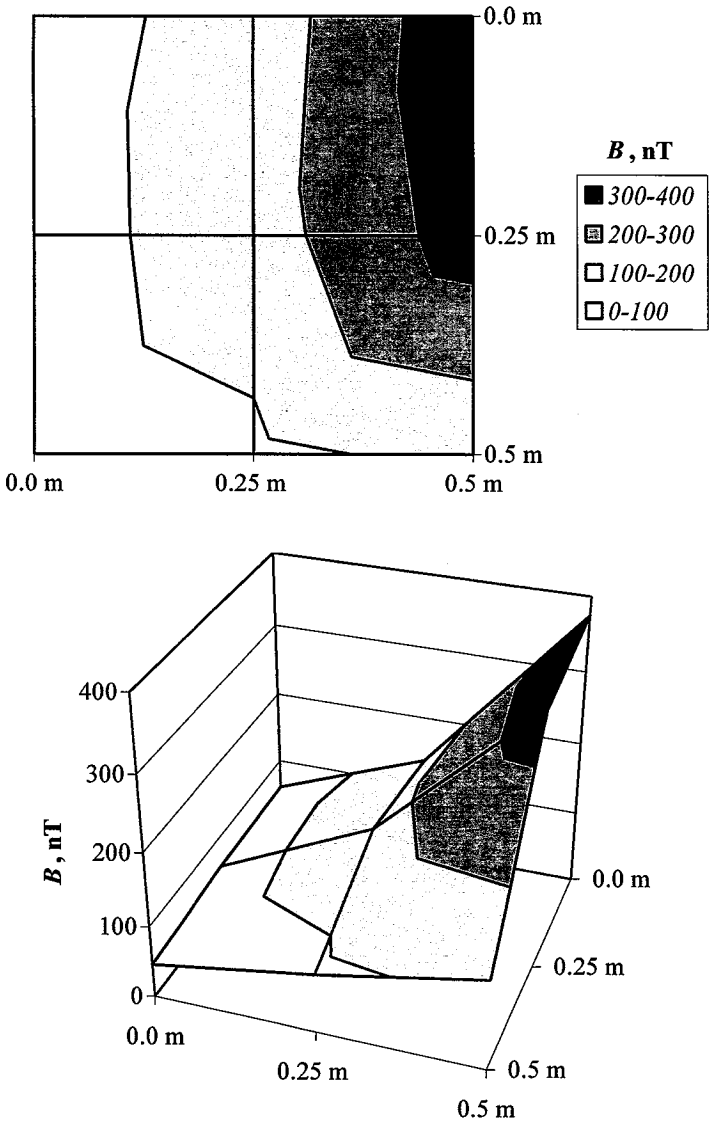

Figure 3: EMF (50 Hz) levels distribution (B-field)

IV.2. Embryonic mortality

The distribution and kinetics of embryonic mortality for the three experimental groups tested are featured in the diagrams of Figure 4 for sham-exposures, Figure 5 for the cell phone group and Figure 6 for the cell + Tecno AO group. The results of mortality and hatching rate are summarized in Table 1. In the sham-exposed group, embryonic mortality was low and sparsely distributed, contrasting with the cell phone group where the death rate increased progressively during the irradiation session. Total death rate 5-fold higher in the cell phone than in the sham-exposed group (75 % vs. 16 %). On the other hand, in the cell phone + Tecno AO group, the mortality distribution and kinetics were half-way between what

observed in the sham-exposed and cell phone groups, and total death rate was half of that recorded in the cell phone group (34 % vs. 75 %).

V. Conclusion

The results of the present study confirm data previously reported from the study performed at the University of Montpellier (France), indicating that:

1. NIR given off by GSM cell phone was harmfull for chicken embryos;

2. the compensataion technology Teno AO effectively reduced NIR-induced lethal effect.

Figure 4:
Sham-exposed group

Date of hatching : 18/02/2001

Strain : Brown Loman

■ Non-fertilized eggs

□ Current mortality

■ Previous mortality

D3 : 22/02/2001								
1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63

D5 : 24/02/2001								
1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63

D7 : 26/02/2001								
1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45

46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63

D9 : 28/02/2001								
1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63

D11 : 02/03/2001								
1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63

D13 : 04/03/2001								
1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63

D21 : 12/03/2001								
1	2	3	4	5	6	7	8	9
10	11	12	13	14	15		17	18
19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45

46	■	48	49	50	51	52	53	54
55	56	57	58	59	■	61	62	63

Figure 5:
Cell phone group

Date of hatching : 18/02/2001

Strain : Brown Loman

■ Non-fertilized eggs

□ Current mortality

■ Previous mortality

D3 : 22/02/2001								
1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63

D5 : 24/02/2001								
1	2	3	4	5	6	7	8	9
10	11	12	13	■	15	16	17	18
19	20	21	22	■	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63

D7 : 26/02/2001								
1	2	3		5	6	7	8	9
10	11	12	13		15	16	17	
19	20	21	22		24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63

D9 : 28/02/2001								
1	2	3		5	6	7	8	9
10	11	12	13		15	16	17	
19	20	21	22		24	25	26	27
28	29	30		32	33	34	35	
37	38	39	40		42	43	44	45
46		48	49	50	51	52	53	54
55	56		58	59	60	61	62	63

D11 : 02/03/2001								
1	2	3		5	6	7	8	9
10	11	12	13		15	16	17	
19	20	21	22		24	25	26	27
	29	30		32	33	34	35	
37	38	39			42	43	44	45
		48	49	50	51	52	53	54
55	56		58	59	60	61	62	63

D13 : 04/03/2001								
1	2	3		5	6	7	8	9
10	11	12	13		15	16	17	
19	20	21	22		24	25	26	27
	29			32	33	34	35	
37	38	39			42	43	44	45
		48	49	50	51	52	53	54
55	56		58	59	60	61	62	63

D21 : 12/03/2001								
1	2			5	6	7	8	9
10	11	12			15	16	17	
19		21			24	25	26	27
	29			32	33	34	35	
37	38	39			42	43	44	45
		48	49	50			53	54
55	56		58	59	60	61	62	63

Figure 6:
Cell phone +TAO group

Date of hatching : 18/02/2001

Strain : Brown Loman

■ Non-fertilized eggs

□ Current mortality

■ Previous mortality

D3 : 22/02/2001								
1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63

D5 : 24/02/2001								
1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18

19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63

D7 : 26/02/2001								
1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29		31	32	33	34	35	36
	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63

D9 : 28/02/2001								
1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29		31	32	33	34	35	36
	38	39	40	41		43	44	45
46	47	48	49		51	52	53	54
55	56	57	58	59	60	61	62	63

D11 : 02/03/2001								
1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29		31	32	33	34	35	36
	38	39	40	41		43	44	45
46	47	48	49		51	52	53	54
55	56	57	58	59	60	61	62	63

D13 : 04/03/2001								
1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18

19	20	21	22	23	24	25	26	27
28	29		31	32	33	34	35	36
	38	39	40	41		43	44	45
46	47	48	49		51	52	53	54
55	56	57	58	59	60	61	62	63

D21 : 12/03/2001								
	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29		31	32	33	34	35	36
	38	39	40	41			44	45
46	47	48	49		51	52	53	54
55	56	57	58	59	60	61	62	63

Table 1: Summary of the results

Groups	Incubated	Non-fertilized	Fertilized	Embryonic mortality									Hatched	
	D1	D3		D3	D5	D7	D9	D11	D13	D21	Total	Rate	Total	Rate
Sham	63	2	61	0	0	0	0	0	2	8	10	**16%**	51	84%
Telephone	63	0	63	2	2	5	3	1	6	28	47	**75%**	16	25%
Telephone + TAO	63	4	59	0	2	2	0	0	2	14	20	**34%**	39	66%