

# **Sensitivity of chicken embryos to portable computer radiation (LCD \*) and protective effectiveness validation of a compensation magnetic oscillator \*\***

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## **Introduction**

There are a lot of scientific evidences that weak electromagnetic fields, similar to those irradiated by a variety of home appliances, affect biological systems, sometimes resulting in harmful effects for human health [1]. Physical origin of such effects remains unclear, though a new approach of the problem appeared recently [2]. Most hotly are debated adverse effects of mobile phones and computer monitors, because of necessarily short distance between users and these devices, duration of use, and multi-frequency electromagnetic spectrum of these devices. Experiments on adverse effects of cathode ray tube (CRT) computer monitors were previously published [3, 4, 5], however insufficiently concerning portable computers (LCD). In our laboratory a previous study indicated that electromagnetic fields (EMFs) radiated by desk computers were harmful for chicken embryos (5). This toxic effect was notably attenuated by means of a compensation magnetic oscillator designed to counteract EMF-induced deleterious effects (6). The present study was set up to test the sensitivity of chicken embryos to portable computer radiation, as well as to validate the protective effectiveness of the compensation magnetic oscillator.

## **Materials and methods**

The exposure set up comprised a portable computer (PowerBook 5300 ce, N° M2785, Macintosh, Apple Computer inc., Cupertino, California, USA) fixed on wooden platform. The latter was made of two plans at right angle in order to simulate the position of somebody using a computer (Figure 1). The keyboard of the portable computer was held horizontally 10 cm above the eggs placed on the horizontal plan and the screen was 30 cm away from the eggs disposed on the vertical plan (Figure 1). The magnitude of VLF and ELF fields was measured at different locations (A, B, C, D, E, F, G, H) of the egg platform (Figure 1, Table 1). Fertilized chicken eggs were purchased from Couvoir Cévennes Camargue (Lédenon, France). At receipt the eggs were candled for the detection of cracks and cracked eggs were discarded. Then the eggs were randomly distributed into three groups of 90 eggs each. They were incubated under  $38 \pm 1$  °C, 45-60 % humidity and permanent darkness during 21 days. The eggs from the three experimental groups were submitted to electromagnetic treatment as follows: the sham-exposed or control group was exposed to switched off computer; the exposed group was irradiated by switched on computer; the protected group was irradiated by switched on computer with the compensation magnetic oscillator installed. Irradiation was continuous during the incubation period (21 days). Embryonic mortality was evaluated at 2-day intervals from 3 to 13 days of incubation. From 13 to 21 days of incubation the eggs are so opaque that the embryos can hardly be mirrored through the shell. Therefore embryonic mortality between 13 and 21 days of incubation was evaluated by opening the eggs from which chicks did not hatch on day 21. Six independent experiments (control vs. assay groups) were performed (Table 2).

\*: Liquid Crystal display; \*\*: Tecno AO technology (International patent)

## Results

The results are summarized in Table 2. Averaged embryonic mortality rate was 16.55 %, 61.41 % and 31.35 % in the control, exposed and protected groups respectively. The mortality rate specifically induced by portable computer irradiation was 44.86 % and 14.80 % in the exposed and protected groups respectively. As featured in Figure 2, embryonic mortality was low and sparsely distributed in the control and protected groups; on the other hand, in the exposed group, it was high and mostly concentrated in the vicinity of the computer's keyboard, i.e. on the horizontal plan.

## Conclusion

Together, these findings suggest that radiation from portable computers (LCD) was toxic for chicken embryos, while this deleterious effect was substantially counteracted by the compensation magnetic oscillator. These data are consistent with previous obtained with desk computers which work CRT (5, 6)

## References

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