

On the Reliability of Spectral Evidences of Electronic Copying Phenomenon Used to Produce Homeopathic-Like Preparations in Complementary Medicine

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Abstract

So-called electronic copying is used in complementary medicine to produce preparations similar to homeopathic treatments. The physical basis of electronic copying is of scientific interest. Previously, significant spectral distinctions between electronic copies and hidden controls were found in near-infrared absorption [Korenbaum *et al.* (2013)] spectra. Concerns appeared regarding the reliability of the obtained evidence since most wavelengths coincide with the regions of transmission coefficient minima in water. Signals at those levels in photodetectors are comparable to background noise. To increase signal to noise ratio, a study involving water-based electronic copies with radically thinner samples was undertaken. The absorption spectra of electronic copies of five parent substances were evaluated using IR-Fourier spectrometry (IRAffinity-1, Shimadzu) between 4000 – 400 cm⁻¹. In absorption spectra of the electronic copies of three of five were found to host bands showing statistically significant differences in relation to the control spectrum. Most wavelengths were found outside the minima (noise-like) transmission

coefficient area of water substrate, implying reliability in the spectral evidences of an electronic copying phenomenon. The wavelengths were characterized at energies of 0.37–0.45 eV, close to the modeled prediction of the oscillatory energies in coherent domains of water molecules; 0.54 eV [Del Giudice *et al.* (2015)]. The spectral proximity indicates the possibility of using this model as a hypothetical physical basis for electronic copying phenomenon.

Introduction

Electronic copies of bio-active materials or so named “nosodes” are produced by the “imprinting” of a parent substance onto water. This process occurs via electronic copying mechanisms that have received a certain acceptance in some fields of complementary medicine including modern homeopathy, Voll & Schimmel electro-puncture diagnostics, and applied kinesiology. A few firms, Meripharm GmbH DE, Metabolics UK, have produce broad sets of diagnostic “nosodes” as of the time of writing.

The problem of the physical basis of electronic copying in preparing homeopathic-like substances was formulated by T. Chernysheva, who began using applied kinesiology in her medical practice in 1994. One of the explanations was of a “water memory” effect [Korenbaum *et al.* (2003), Thomas Y (2007)]. That hypothesis is studied herein with a rigorous and academic structure.

Several types of devices for electronic copying are available now. The first to be made available was the “radionic” magneto-geometric copying apparatus, invented by M. Rae [Towsey and Hasan (1995)]. Simulator (Metabolics Ltd, UK) is a version of M. Rae’s apparatus, which is widely used in applied kinesiology. The apparatus contains two copper tubes, the right of which (M) is used for the parent substance copied, whereas the left one (C) is used for the prepared electronic copy (EC). Other electronic copying techniques were invented additionally (for example, [Thomas *et al.* (2000), Montagnier *et al.* 2009]).

The physical basis of the electronic copying phenomenon is unclear but there are a few suppositions connecting interaction from the human experimenter with external electromagnetic fields [Korenbaum *et al.* (2003)]. There are few rigorous, well documented, empirical observations of the supposition on the similarity of the biomedical action of electronic copies of parent bio-active substances as compared to the behavior of the parent substances or conventional (dilution/shaking) homeopathic preparations.

Consequently, it is clear that only an empirical approach is pertinent for an objective study of such a complex and unusual effect. Owing to the vagueness surrounding the physical basis of the electronic copying mechanism, the electronic copying instrument should be treated as a “black box” that changes the physical properties of water preparations.

One approach is to study the objective physical changes produced by the “black box” by observing absorption spectra of water-based copies [Klein *et al.* (2016)]. However, this procedure must be strictly double-blind in order to avoid possible human bias [Jonas *et al.* (2006), Shang *et al.* (2005)].

Background

To implement a spectral approach, an experimental procedure was developed [Korenbaum *et al.* (2006), Korenbaum *et al.* (2013)] illustrated in *Figure 1*. Only the electronic copying step (*Step 1*) of the procedure is not blind and therefore influenced by the human experimenter. All other steps are double-blind (*Steps 2 and 3*) or strictly predetermined (*Steps 4 and 5*). Thus the impact of the human experimenter is minimized.

In accordance with the described procedure, the authors studied near-infrared absorption spectra of electronic copies of seven homeopathic preparations [Korenbaum *et al.* (2013)]. Three independent experiments with the same parent substances were carried out. In the first and second experiments the carrier was a sterile saline solution (NaCl 0.9 wt%) while in the third experiment the carrier was sterile medical-grade distilled water. Both solutions were contained in 5-ml factory-sealed ampoules. Electronic copies of parent substances were made with the Simulator (Metabolics Ltd, UK). 19 electronic copies of each parent substance were produced and compared against 3 x 19 ampoules of a hidden control in each experiment.

Spectral measurements were made by means of a Varian Cary 5000i (Agilent Technologies, USA) double-beam analytical spectrophotometer in the wavelengths of 3000 nm – 600 nm with intervals of 0.5 nm. Statistically significant distinctions

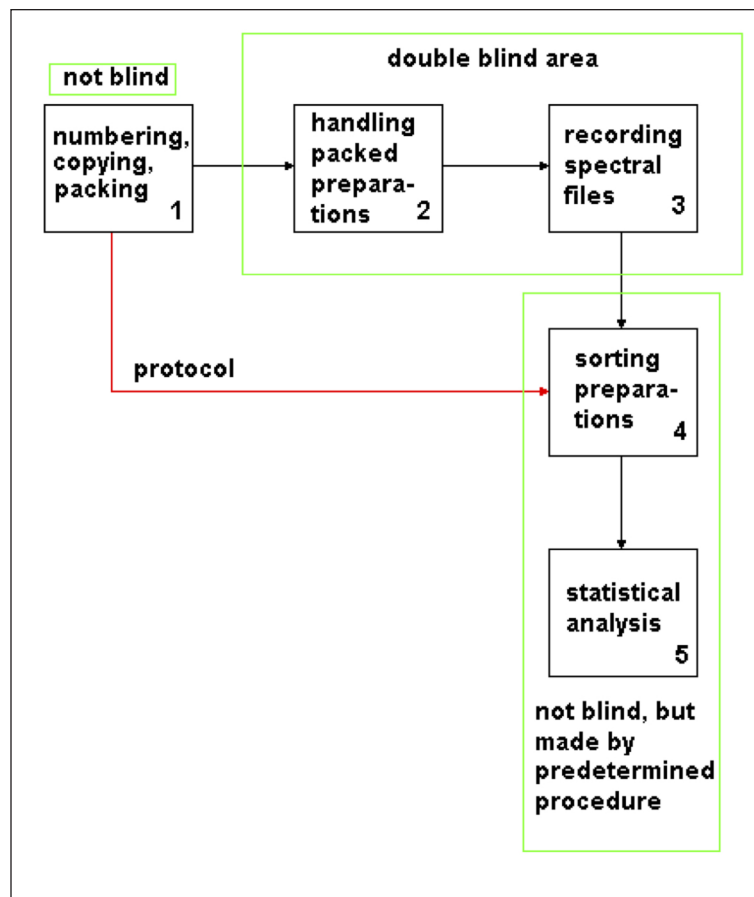


Figure 1: Flow-chart of the procedure of experimental study and analysis of spectra.

(Mann-Whitney non-parametric U-test) between electronic copies and the control were found at a number of wavelengths between 3000 nm and 1400 nm (3332 and 7141cm⁻¹) in all three experiments. The observations were treated as spectral evidence of the response of water to electronic copying, at least in part.

Advanced analysis of the experimental results led to concerns on the reliability of obtained spectral evidence, since most of the wavelengths revealed coincide with the regions of where the transmission coefficients of water are at a minimum. At such minima, the output of the photodetectors are comparable to background noise.

The procedure and results seem to be reliable because, in accordance with the signal processing theory, we applied coherent accumulation of signals among 19 samples

which resulted in 4.4 (√19) times amplification above background noise level. On the other hand, experts in spectral measurements will ask why one should put themselves in obviously unfavorable conditions using very weak signals not reliable in principle.

As maximal absorption of water is caused by thick water layer of samples (10 mm in previous experiments) it was attempted to apply cuvettes with a thinner water layer of 2 mm in the same double-beam spectrophotometer. However, there were still portions of the wavelength that fell in the area of the spectra with low signal output (<https://archives.waterconf.org/2016-speakers/>).

Apparently, a more radical decrease in the thickness of the layer of water samples would be required in order to study the absorption spectra. The current study seeks to perform that analysis.

Methods

To decrease a thickness of water layer samples further, an IR-Fourier spectrometer IRAffinity-1 (Shimadzu) was used. Samples with 0.025 mm water layer were analyzed. Analysis was applied in $4000 - 400 \text{ cm}^{-1}$ ($3000 - 25000 \text{ nm}$) band, with a resolution 4 cm^{-1} , and a number of scans equal to 30. The transmission coefficients passing through the samples (T%) were calculated. Samples were analyzed in random order and in the double-blind manner (*Figure 1*).

Measurements were made with an assembled cuvette having windows of calcium fluoride (CaF_2), separated by a lead gasket with a thickness of 0.025 mm, into the internal cavity in which the test solution was placed. Before each measurement, the window and the gasket were washed with medical grade distilled water and dried with filter paper.

The absorption spectra of electronic copies of 5 bio-active substances were studied:

- 1) hydroplasma (hypl) – a preparation for tissue repair (VITAEST, Kazakhstan);
- 2) lidocaine (lyd) – standard pharmacological drug;
- 3) alloplant (all) – drug stimulator of vasculogenesis (Russian Center for Eye and Plastic Surgery, Bashkortostan, RF);
- 4) Epstein-Barr virus (veb) – a homeopathic preparation (Meripharm GmbH DE);
- 5) chorionic gonadotropin (hgch) – standard pharmacological drug.

A total of 15 samples of electronic copies of each listed substance were prepared. In order to compare spectra. An additional 15 samples of hidden control (blank water carrier) were prepared as well. All samples were sealed 5-ml ampoules with medical grade distilled water (nine boxes of ten ampoules), taken from the same factory lot. The vials were mixed, randomly numbered from 1 to 90, and remixed thoroughly.

The preparation of electronic copies was carried out with the Simulator (Metabolics Ltd, UK) by operators V.G. and R.G., who did not participate in further spectral analysis and processing. The copying procedure was made according to the apparatus's manual. An initial operation of "deleting previous information" was carried out. For this purpose, 5 ampoules were sequentially placed into the container "C", whereas the container "M" was left empty. The operator activated the apparatus. No other manipulations were performed with the hidden control ampoules. When preparing the electronic copy, the vial with the parent (copied) bio-active substance was inserted into the apparatus container "M", and the prepared samples (ampoules) were sequentially placed into container "C". The operator activated the device and produced an electronic copy. The preparation of samples of each copy was carried out sequentially in groups of five ampoules with an exposure time of one minute. According to the copying results, a protocol was drawn up for the number of ampoules to be tested. The absorption spectra of preparations under study were determined within 15 days after completion of the electronic copying procedure. Every ampoule was opened only immediately before measurement, and the contents were injected with a disposable syringe into the assembled cuvette. The value of each ampoule was not revealed until the completion of the spectral analysis and recording its results in text files (*Figure 1, Step 3*). After completing, and recording, of the spectral analysis the spectral readings of individual samples (electronic copies and hidden control) were sorted by substances according to the numbering protocol which was revealed at Step 4 (*Figure 1, Step 4*).

During statistical processing (*Figure 1, Step 5*) each spectral reading of 1609 cm^{-1} of every electronic copy spectra, is represented by an ensemble of 15 samples, was compared with the same spectral reading represented by the ensemble of 15 samples

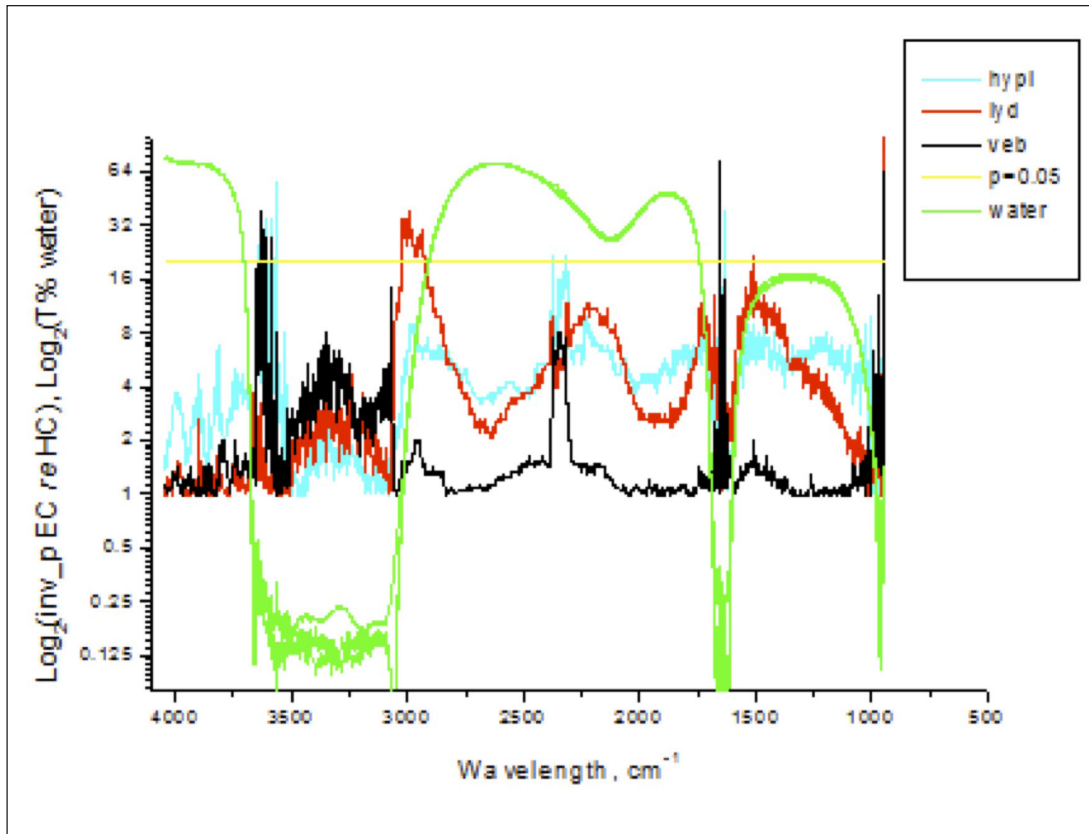


Figure 2: Spectra of studied substances: $\text{Log}_2(1/p)$ along ordinate for electronic copies (EC) “hypl”, “lyd”, “veb” in relation to the hidden control (HC) and statistical significance limit $p=0.05$; $\text{Log}_2(T\%)$ along ordinate for hidden control (water).

of hidden control, using the Mann-Whitney non-parametric U-test (Statistica, StatSoft Inc.). Any spectral reading (wavelength) with significant differences ($p < 0.05$) between an electronic copy and hidden control was registered.

To meet Bonferroni’s multiple comparison problem (comparison of 1609 pairs of spectral readings) a level of statistical significance should be $p_B = 0.05/1609 = 3.1 \cdot 10^{-5}$. Therefore, statistically significant differences in the spectra were accepted when the condition Eq. 1 was satisfied at some adjacent wavelengths.

$$p_{\text{cum}} = p_1 * p_2 * \dots * p_n < 3.1 \cdot 10^{-5} \quad (1)$$

Where p_{cum} – cumulative statistical significance, 1, 2, ..., n – numbers of adjacent wavelengths (cm^{-1}), for each the results showed statistically significant difference $p < 0.05$ in the spectral reading of the hidden control.

Results

Using Mann-Whitney non-parametric U-test, spectral regions were found for which adjacent wavelengths contained amplitudes of the spectral readings that were significantly ($p < 0.05$) higher than spectral readings of the hidden control (HC). This occurred in 3 electronic copies (EC) “hypl”, “lyd”, “veb” of the five studied.

The inverse statistical significance ($1/p$) spectra of the preparations (hypl, lyd, veb) are represented in Figure 2 along with the spectrum of transmission coefficients (T%) of three randomly taken samples of hidden control (water). The graph of the figure is on a logarithmic-logarithmic scale. The line of the statistical significance limit ($p = 0.05$) is visible in Figure 2 to define regions where the spectrum crosses the boundary into statistical significance.

In Figure 2 there are areas of statistically

significant differences lying above the statistical significance limit line at ($p < 0.05$). These regions are where the absorption spectra of electronic copies “hypl” and “veb” are at the short wavelength border of the intense water absorption band near 3600cm^{-1} (2760 nm). While for the electronic copy “lyd”, an extended section of statistical significance in the absorption spectrum, above the line of statistical significance limit ($p < 0.05$), is located at the long wavelength border of the band of intense water absorption. The extended section is at about 2970cm^{-1} (3360 nm).

Evaluation of cumulative statistical significance in the frequency band using Eq. 1 revealed statistical significance in the spectra of the electronic copies. All three preparations (hypl, lyd, veb) displayed significance when compared to the hidden control by Bonferroni’s multiple comparison correction. The results obtained from these three preparations are presented in the Table 1. The direction of difference between amplitudes of spectral readings in electronic copies and in the hidden control is determined by the magnitude of the Z distribution. The Z distribution approximates the Mann-Whitney statistics (Statistica, StatSoft Inc.). It is seen in Table 1 that all differences between amplitudes of spectral readings in electronic copies and in hidden control have the same sign (+). The central wavelengths of spectral regions characterized by statistical significance, in addition to the scale of cm^{-1} , are also presented in the Table 1 in the scale of nm, according

to the ratio $\lambda \text{ (nm)} = 10^7/\lambda \text{ (cm}^{-1}\text{)}$. In accordance with the ratio $1 \text{ (eV)} = 8066 \text{ (cm}^{-1}\text{)} = 1240 \text{ (nm)}$, the wavelength of the spectrum describes the spectral energy. The energy levels determined for the central wavelengths of the spectral bands $E\lambda_{\text{centr}} \text{ (eV)}$ are calculated and also presented in the Table 1. There was insufficient statistical significance presented in the spectra of the other two electronic copies (all, hgch). As such, their relation to the control was not defined.

Discussion

A double-blind, randomized, experiment was completed in which infrared Fourier absorption spectra of 15 samples of electronic copies of five substances prepared in distilled water were compared with the same spectra of 15 samples of hidden control (blank distilled water) were defined for each spectral reading by means of the non-parametric Mann-Whitney U-test. The results were that absorption spectra areas (sets of adjacent spectral readings) were found, characterized by a statistically significant deviation from the hidden control spectra for electronic copies of three substances (Table 1). The statistical significance in the spectra, within the identified bands, was evaluated as sufficient by the Bonferroni’s multiple comparison correction (Eq. 1). The directions of the spectral differences were the same: the amplitudes of the spectral readings of electronic copies were higher than the amplitudes of the spectral readings of hidden control in all

Electronic copy	$\lambda_{\text{centr}} \text{ cm}^{-1}$	$\lambda_{\text{centr}} \text{ nm}$	p_{cum}	Direction of differences	$E\lambda_{\text{centr}} \text{ eV}$
hypl	3612.67	2768.03	1.29E-06*	+	0.45
lyd	2972.31	3364.39	2.05E-72*	+	0.37
veb	3628.10	2756.26	2.77E-05*	+	0.45

* indicates statistically significant values of p_{cum} , satisfying Eq. 1

Table 1: Spectral bands with significant differences of electronic copies preparations (hypl, lyd, veb) in relation to hidden control

identified spectral bands. Thus, the statistical significance of spectral differences between the electronic copies and corresponding hidden controls (found in more than half of studied substances) seems reliable.

The first question is whether the spectra distinctions might be connected to an apparatus error. All tested preparations (both electronic copies and hidden control) were measured in the same cuvette of the same IR-Fourier spectrometer, in a random order. Therefore, it seems reasonable to neglect possible bias in the results due to drift in the apparatus characteristics. At the same time, variations in the assembly (washing, drying) of the measurement setup, as well as in electronic copying procedure, could lead to random error. However, random error is taken into account by the Mann-Whitney test, used to establish the statistical significance of the differences in spectra with ensembles of preparations. Thus, identified distinctions in spectra of electronic copies and hidden control cannot be attributed to an apparatus bias or random error.

The next question is a problem of transmission coefficients $T\%$ comparison with background noise at the output of photodetectors of the spectrometer addressed above. Regions of statistically significant differences in the absorption spectra of electronic copies lie on the boundaries of the water absorption band, between 3600 and 3000 cm^{-1} (*Figure 1*). The spectral regions are characterized by the values of the transmission coefficient $T\%$ between 10% and 0.25% (i.e. not worse than -72 dB from the maximum of 100%). It is obviously not the part of the spectrum where the transmission coefficient $T\%$ is comparable to the IR-Fourier spectrometer IRAffinity-1 (Shimadzu) background noise, as the claimed dynamic range of the instrument is at least 80 dB. Whereas in previous works [Korenbaum *et al.* (2013)] $T\%$ was comparable with back-

ground noise making the signal/noise ratio too small, and spectral distinctions questionable. That is why the spectral measurement procedure was changed to use samples with a 0.025 mm water layer in the current study to enhance signal/noise ratio and improve reliability. Due to mentioned reasons, the metrological reliability of the spectral evidence of the electronic copying phenomena obtained in the current study may be considered reasonable.

Herein is proved only the existence of partial spectral differences between the electronic copies and the hidden control. There is insufficient evidence that electronic copies influence living beings in a fashion similar to copied bio-active substances. That topic is planned for future works and probably may be studied only with the use of living organisms.

As for the physical aspects of the results, it is not surprising that identified portions of the spectra, characterized by the most prominent variations in electronic copies and hidden controls, lie in the areas of maximal water absorption (*Figure 1*). In these regions intensive interaction between infrared radiation and the molecular structure of water take place. Thus if the electronic copying procedure results in any changes in the properties of the water preparations, one would expect these changes to be found in the spectral regions of high absorption.

In light of the last statement, note the energy values $E\lambda_{\text{centr}}$ for identified spectral bands (*Table 1*). These energies lie within limits of 0.37 – 0.45 eV. Interpreting this according to the quantum-electrodynamic hypothesis of Guiliano Preparata [Del Giudice *et al.* (2015)], liquid water consists of coherently oscillating molecules, which form coherent domains together within the associated electromagnetic fields. The domains are immersed in gas-like incoherent water (composed of randomly oscillating molecules). In the coherent domains, a common electron cloud oscillates between

the base level at 12.60 eV and the excited state at 12.06 eV. Thus $12.60 - 12.06 = 0.54$ eV is the energy value that can be radiated and/or absorbed under coherent oscillations water molecule domains.

This predicted energy value 0.54 eV is surprisingly close to the central wavelengths of absorption bands with statistically significant differences between electronic copies and hidden control observed in the experiment at 0.37–0.45 eV (*Table 1*). These spectral variations are unidirectional and indicate less absorption of infrared radiation in electronic copies. Consequently, most of the coherent water domains in the electronic copies can be regarded as having an excited state. By being in an excited state, that eliminates the absorption of additional energy radiated from the spectrometer during spectrum measurements. Contrasting, in the hidden control, an additional absorption of radiation in the spectrometer should be considered. Additional absorption may be attributed to the transition in portions of the coherent domains from the unexcited state into the excited one during measurement. Thus the excited state of most coherent domains of water as a result of the electronic copying procedure likely characterizes, in some way, the physical basis of the electronic copying phenomenon.

What physical impact can lead to the transition of a significant part of the coherent water domains into the excited state in the process of electronic copying? Strictly speaking, this question cannot be answered while remaining within the framework of the model of an electronic copying device as a “black box.”

It should be noted that the statistically significant differences between infrared absorption spectra in certain electronic copies and hidden controls cannot by themselves be considered exhaustive proof of the functionality of the electronic copying process. Instead they are merely a pilot result that inspires certain hopes for solving the prob-

lem of physical basis of the phenomenon.

Conclusions

1. In infrared absorption spectra of electronic copies of three preparations of distilled water (of the five studied) during a double-blind randomized study, the spectral bands were found to possess statistically significant variations in relation to the spectra of the hidden control via Mann-Whitney U-test with Bonferroni’s multiple comparison corrections.
2. Most of the wavelengths at which significant differences between the electronic copy spectra and hidden control are observed were found just outside the minimum (high-noise) transmission coefficient area of the water substrate. Thus was confirmed reliability of spectral evidence in the electronic copying phenomenon.
3. The wavelengths with statistically significant differences between electronic copy spectra and hidden control spectra, are characterized by energies of 0.37–0.45 eV, close to the model predictions [Del Giudice *et al.* (2015)] of oscillatory energies of coherent domains of water molecules 0.54 eV. The presence of this data indicates a possibility of using the model as a theoretical physical basis for the electronic copying phenomenon.

In the absorption spectra measurements, the study was supported by the Program of Basic Research of Russian Academy of Sciences (No. 0271-2019-0010).

Discussion with Reviewers

Reviewer 1:

The paper is an important step towards proving the reliability and understanding the mechanism of electronic copies. Adding to the notes in the reviewed paper, it is

worth suggesting to analyze the acquired spectral data using multivariate analysis in order to see the spectral pattern differences in different categories of samples looking for significance not only at single bands, but exploring relative transmittance at various bands presented as a spectral pattern.

The aim of the manuscript was only comparing electronic copies with hidden control preparations and, strictly speaking, a comparing electronic copies of various bio-active substances by spectral patterns is the topic for future study.

However we made preliminary comparison and it was confusing.

Using multivariate analysis (Kruskal-Wallis nonparametric ANOVA test) we found only unit spectral readings characterized by significant ($p < 0.05$) difference between all five electronic copies preparations. Unfortunately, these differences did not meet Bonferroni's multiple comparison rule. Thus in contrast with paired comparison of electronic copies and hidden control (Mann-Whitney nonparametric test) where the number of adjacent spectral readings having significant differences ($p < 0.05$) was found meeting Bonferroni's multiple comparison rule, there were no such adjacent spectral readings found by the multivariate analysis.

Using paired comparison of electronic copies (Mann-Whitney nonparametric test) in ten compared pairs of electronic copies of bio-active substances we found statistically significant differences (meeting Bonferroni's multiple comparison rule) only in three pairs (veb : all, 3066 cm^{-1} ; hgch : lyd, 970 cm^{-1} ; hyp1 : all, 970 cm^{-1}). Furthermore only the first of pairs has wavelength close to found wavelengths for comparison of electronic copies with hidden control (Table 1 of manuscript).

Summarizing both results we suspect an

absence of significant differences in spectral patterns of electronic copies of, at least, studied bio-active substances. That is why the topic has to be studied additionally and cannot be included in the current manuscript.

I would suggest publishing this paper as it makes interesting points, but it should be revised adding additional calculations and comparison between experiments.

Reviewer 3

The paper discusses the phenomenon of electronic copying (in terminology of authors: homeopathic-like preparations) and investigates it by using the absorption spectroscopy. Sections "Introduction" and "Background" describe several state-of-the-art publications that consider this effect from different points of view (electromagnetic, operator effects, biomedical and methodological aspects). Sections "Methods" and "Results" overview the used devices, preparation of samples, handling procedures, and obtained results. Results are compared primarily from the statistical point of view by the Mann-Whitney U-test. Discussion overviews again these results and attempts to correlate them with other approaches and theories.

General impression of this paper is positive, it is written in a scientific manner with involving reasonable amount of technical details. Positive is the description of operators and their roles since this represents one of influencing factors. We would suggest to publish this work provided authors improve it by following comments and by reacting to questions (intended to improve the work).

Open Questions:

1. Authors state that "Due to a vagueness of a physical basis of the electronic copying, we should treat an electronic copying instrument as a "black box" that changes

the physical properties of studied water preparations” (later they say “field of permanent magnet set in copying device”).

We argue that the copying mechanism can influence the water samples by itself (e.g. EM or optical excitation dramatically modifies the ionic dynamics of fluids and is well measurable by impedance spectroscopy). Thus, the copying mechanism should be described if authors would like to go in open-science way, otherwise hiding details of treatment procedure would generate a wrong impression why authors prepared this paper.

Unfortunately the copying mechanism could not now be described evidentially in terms of official science. That is why we have to use the “black box” approach. Only this approach responds to high-level scientific standards for such study. While the reviewer is right that a statement “field of permanent magnet set in copying device” and the whole fragment describing hypothetical copying mechanism look superfluous in the strict scientific frame of the manuscript. These fragments were deleted from the revised version of manuscript.

2. To test the excitation produced by “black box” correctly, it needs to compare “substance-copied water” with “empty-copied-water” (e.g. water imprinted by “water”). Authors used control samples: “To compare spectra 15 samples of hidden control (blank water carrier) were prepared additionally...” “For this purpose by five ampoules were sequentially placed into the container “C,” whereas the container “M” was left empty. The operator pressed the appropriate button of the apparatus. No other manipulations were performed with the hidden control ampoules.” However, it seems that copied samples and control samples are treated differently (e.g. by avoiding the “copying procedure” for control samples). This would create some critical consideration about what authors try to analyze? For instance, a critical

reader would say that “As a result absorption spectra areas (sets of adjacent spectral readings) were found, characterized by significant differences from the hidden control spectra for the electronic copies of three substances” are produced by the treatment procedure...

Really, the answer for the last problem mentioned was found in our study: we proved that part of electronic copies preparations differs from hidden control preparation in absorption spectra! All preparations were treated first time for “erasing previous information” with empty container “M.” Electronic copies preparations were treated additionally by electronic copying procedure. Thus we compared “twice treated” electronic copies with “once treated” hidden control to find distinctions implied only by the electronic copying procedure from parent (copied) bio-active substances.

Copying water to water analysis seems to be another study, which was not aimed here!

3. Authors need to describe in more detail what is “blank distilled water” used for control samples. In “Methods” these samples are described as treated, but in “Discussion” as not treated.

The “blank distilled water” in our study is hidden control. This term is used in Discussion to designate in more clear sense for readers preparations of hidden control, not subjected to electronic copying procedure, and such way differing from electronic copies preparations, subjected to electronic copying procedure from parent (copied) bio-active substances.

4. Performed methodological procedure uses the well-known approach “is there any difference between treated and untreated samples.” Most of publications done in last ten years indicated that these differences exist but this fact does not prove that the treated samples are really “copied substances.” There are a large number of

factors that can create the difference between control and experimental samples. In fact, if operator takes a sample in the hand for a short time, the differences (created in thermal, electrostatic and mechanical ways and leading e.g. to a changed CO₂ content) are well measurable, authors even confirmed this: “Every ampoule was opened just before measurement, and the contents were injected with a disposable syringe into the assembled cuvette.” We would expect more “functional tests” for such a proof (at least a discussion towards this topic).

It is very important remark (“... are really ‘copied substances’...”)! Really, we only proved partial spectral differences involved by electronic copying. It is not evidence that electronic copies influence on living beings similarly to parent (copied) bio-active substances. The latter was not the objective of our study. The topic is planned for future works and probably may be finally studied only with using living organisms as tested objects. This statement is included in revised manuscript.

However it should be noted that “a large number of factors...” or random error is parried in our study by statistical averaging in the ensembles consisting of 15 samples (in combination with double-blind procedure of analysis). One side of this topic was discussed in the manuscript “At the same time, variations in the assembling (washing, drying) of the measuring setup can lead to random error. However, this kind of error is taken into account by the Mann-Whitney test, used to establish the statistical significance of the differences in spectra.” Now we added an analogous statement for random errors in electronic copying procedure to the revised manuscript.

5. “Most of the wavelengths at which significant differences between spectra of electronic copies and hidden control are observed were firstly found outside the minimum (noise-like) transmission coef-

ficient area of water substrate, thus confirming the reliability of spectral evidence of an electronic copying phenomenon.” We (and probably a reader as well) cannot follow why this confirms a reliability? If this point is expressed even as a title of the paper, authors should put more effort to describe it properly.

The statement cited by the reviewer “...” means that found spectral differences were found with high enough signal/noise ratio. Whereas in our previous works the signal/noise ratio was too small. Thus “advanced, analysis of the results of previous experiments led us to concerns on the reliability of obtained spectral evidence, since most of the wavelengths revealed coincide with the regions of minima of transmission coefficients of water (maxima of absorption), in which the signal levels at the output of photodetectors of the spectrophotometer are comparable to background noise” (see Background). That is why we had to change spectral measurement procedure using samples with 0.025 mm water layer in current study to enhance reliability of finding. This logical chain is enforced in revised manuscript.

6. In “Discussion:” “Thus, we are ‘bathing’ in external electromagnetic fields. By the way similar picture should be observed in radiofrequency part of electromagnetic fields. Indeed these external electromagnetic fields could agitate a significant part of the coherent domains of water in excited state. But how could it manifest in the difference between the electronic copy and the hidden control during producing with electronic copying device?”

“The latter may be discussed only hypothetically. Human body is a source of wide-band electromagnetic emanations associated with the vital activity of cells and organs. Moreover, this activity takes place against the aforementioned external electromagnetic fields, and with a field of permanent magnet set in copying device.

Then it may not be excluded that copied parent substance, interpreted as a kind of passive ‘resonator’ [Korenbaum et al. (2003)], might modify the field of electromagnetic emission of the operator’s organism or interaction between his field and external electromagnetic fields.”

This discussion is of interest but this is confusing by the used terminology. Why water is a “passive resonator” of EM fields? What is the “self-field of the parent substance?”

Yes, I agree. This fragment is quite fuzzy, and looks superfluous in the strict scientific frame of the manuscript. It is deleted from the revised version of manuscript.

7. In similar way, such notions as “the parent bio-active substance,” “electromagnetic field of human-operator,” or “vibrational energies of coherent domains” should be more precise defined (in more or less scientific way) or their usage should be avoided.

Yes, I agree. This fragment is quite fuzzy, and looks superfluous in the strict scientific frame of the manuscript. It was deleted from the revised version of manuscript.

Author’s Contributions

Vladimir Korenbaum: developing design of study involving spectral and statistical analysis, statistical analysis, physical interpretations, drafting manuscript.

Tatiana Chernysheva: formulating the research task, developing design of study involving studied preparations, editing manuscript.

Victoria Galay: electronic copying, editing manuscript.

Roman Galay: preparing samples, numbering protocol, editing manuscript.

Ustinov Alexander: design of IR spectral analysis.

Kostin Vladislav: spectral measurements.

Sergei Zakharkov: optimisation of IR spectral analysis, physical interpretations.

There are no conflicts of interest.

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