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## Neurotropic and biophysics effects of mental practices. Focus on Kyokushin karate kata

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**Abstract. Background.** In Eastern martial arts, non-contact mental influence on a partner is described, often associated with the concept of energy-informational exchange. The Kyokushin karate kata (KKK) practice is particularly noteworthy in this context. The purpose was to explore the neurophysiological and biophysical mechanisms underlying the effect of KKK on brain activity of the sender and the physiological state of the receiver in both animal models (rat's hippocampal slice) and non-biological systems (distilled water). **Materials and methods.** Three experiments were conducted: 1) electroencephalography (EEG), heart rate variability (HRV), and electro-photonic imaging/gas discharge visualization (EPI/GDV) were recorded in KKK master and Reiki practitioner; 2) synaptic efficacy in rat's hippocampal slice was measured during remote mental interventions; 3) light activity of distilled water, induced by gas discharge, was analyzed after exposure to KKK and canonical Christian prayer. Data analysis included EEG and EPI signal processing, entropy calculations, correlation, canonical, multiple regression and discriminant analysis. **Results.** KKK practice, but not Reiki significantly increased EEG delta, alpha and theta spectral power density (SPD), to the greatest extent in temporal and parietal loci, while decreased beta SPD to the greatest extent in frontal, prefrontal and central loci, reduced both spectral and EPI entropy, and enhanced EPI energy characteristics. Remote KKK influence induced a notable increase in rat's hippocampal synaptic efficacy ( $+7.5 \pm 5.1\%$ ) while Reiki was ineffective ( $-0.5 \pm 4.8\%$ ) (mean  $\pm$  SD). Strong canonical correlations were identified between sender's parameters during sessions and changes in rat's hippocampal synaptic efficacy as the receiver:  $R = 0.936; 0.931; 0.913$ , and  $0.959$  with EEG SPD, EEG entropy, EPI entropy and EEG & EPI in total, respectively. Both KKK and Christian prayer increased the light activity of distilled water, but only in cases where they increased SPD of delta rhythm while decreased EEG entropy and energy of the third virtual chakra. **Conclusions.** Findings support the proposed hypothesis of a dual-biophotonic (energy-mediated) and negentropic (information-mediated) mechanism underlying KKK effects, observable through objective neurophysiological and biophysical parameters. Compared to other mental practices, KKK demonstrated more pronounced (Reiki) or equal (prayer) systemic influence.

**Keywords:** mental practices; Kyokushin karate kata; Reiki; prayer; EEG; EPI/GDV; entropy; energy-informational interaction; rat's hippocampal slice; synaptic efficacy; water light activity; neurophysiology

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## Introduction

In Japanese martial arts history, there were records that some martial artists could throw opponents without touching. This is known as the Tohate technique (literally, hit from a distance), and is considered to be the ultimate form of martial arts [1, 2]. However, this has been a secret technique for centuries and no curriculum to master this technique was taught. Only in the 90s at least three Japanese Ki masters (Kozo Nishino, Hiroyuki Aoki and Kojo Tsuboi) are reported to be able to perform the Tohate technique [3, 4]. It is interesting to note that two of them (Nishino and Tsuboi) had practiced aikido; Aoki was an expert in karate [2].

A Japanese word Ki (equivalent to Qi or Chi in Chinese; “vitality” or “life-energy” when Western people talk about Ki in terms of the healing arts) is the fundamental concept in both Eastern medicine and martial arts. In the view of martial artists, Ki is a source of spiritual strength for winning. Therefore, the Tohate is claimed to be an applied skill of Ki [1, 2, 5]. The already mentioned master Nishino developed the Nishino breathing method (NBM) and called him the Taiki-practice. It is a method of enhancing the level of a students’ Ki through Ki-communication between an instructor and a student. When master Nishino emits his Ki in the Taiki-practice, many of his students respond to it with various body movements (they jump, step back, run or roll on the floor) [6–9].

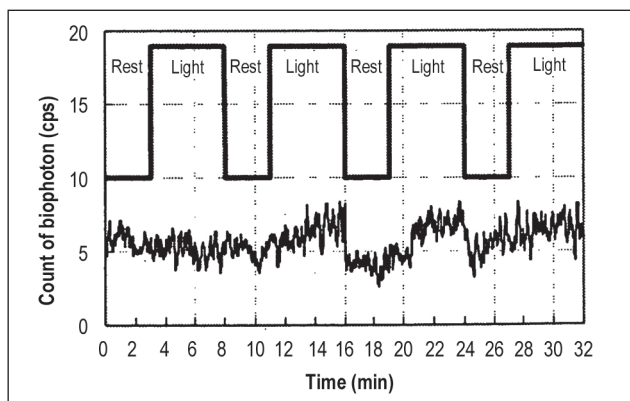
From the collaboration with master Nishino, Ohnishi S.T. & Ohnishi T. showed that Ki is not a paranormal or parapsychological phenomenon, but a natural phenomenon. Using established biochemical and cellular models, authors demonstrated that Ki inhibited cultured cancer cell division [10], it protected isolated rat liver mitochondria from oxidative injury [11], and it may have a beneficial effect on osteoporosis [12]. Therefore, authors proposed that the healing effects of Ki may be related to an energy aspect E and an information aspect (or an entropy aspect) S of Ki [13, 14].

Japanese brain physiologists recorded changes in the body of two subjects. The receiver was a 64-year-old man, a founder of one martial arts association and a veteran for 40 years. The sender was a 58-year-old man, his pupil and a head instructor. Subjects were isolated in two rooms, one as sender and the other as receiver. The receiver’s room was an electromagnetic shield room. The experimenters were in a third room which was partitioned from the sender’s room by curtains. At a time set randomly within 80 seconds (1 trial), one practitioner (sender) emitted Qi. The other one (receiver) made a sign with a switch when he sensed the Qi. The receiver’s EEGs were analyzed in each 5.12 seconds of 4 periods; those were, before sending Qi, during sending, after sending and before sensing Qi was being received. The following data were recorded: the receiver’s ECGs, respiratory patterns and EEGs, as well as the sender’s and the receiver’s switch signals. For the receiver photoplethysmogram and skin conductance were also recorded. The following results were obtained and published in four papers. At the time of actually receiving Qi (during sending), alpha waves were synchronized with the occipital ones in this phase more than those while the receiver sensed Qi was being received [15–17]. In another paper, changes of the mean amplitudes

of alpha and theta wave of the receiver during a period of 10 seconds around the sending time were analyzed at an interval of 1 second. Compared with values of the resting state, statistically significant decreases of theta activity were found in C4 and T6 areas, while statistically significant increases of the alpha wave were found in Fp1, Fp2 and T5 areas. However, when compared to values during the period of non-sending, statistically significant changes of alpha wave were found in T5, T6, O1 and O2 areas [18]. The receiver’s ECG R-R intervals were measured also. Heart beat fluctuations were analyzed before and after the sending and receiving times. In trials within a 5-second time difference between the sending and receiving times, coefficients of variation of R-R intervals (as HRV-marker of vagal tone, let’s add from ourselves) between a 15-second period before and a 15-second period after the sending and receiving times each showed statistical significance [19]. Fluctuation of the receiver’s skin conductance during sending was found to be smaller than before and after. Skin conductance peaked at 3.5 s after receiving and then reduced gradually. The receiver’s skin conductance showed an anomalous change at sending time. Observed electrodermal activity (EDA) values were nearly equal to the expected curve before sending, but not equal after it. The specific EDA response by remote action was considered as a non-sweating response because the response appears immediately after sending and its amplitude was smaller [20].

But the real breakthrough in this area of research was the detection of biophoton emission. Surprisingly, this breakthrough was not made by the researchers cited above, but by their neighbors from Inaba’s laboratory. However, this situation seems quite natural, because over a period of the previous three decades this laboratory had pursued the research and development of highly sensitive technology for detecting, analyzing, and processing extremely weak optical signals such as those not detectable by the human eye, especially the type known as biophoton emission [21]. Usa M. & Inaba H. [22, 23] performed the measurement of biophoton emission from the finger of Chinese Qigong male practitioner during his training. Moreover, simultaneous detection of biophoton emission intensity from both the practitioner and another Japanese male subject showed a very interesting correlation during Qigong therapy. Their EEG were monitored for the same period. Unfortunately, both publications are unavailable to us. Then the measurement of biophoton emission from acupuncture points distributed on the hand and finger was carried out and intensity was compared with that of non-acupuncture points [24, 25]. The former intensity was found in general to be higher than the latter. Around the forearms and hands, the emission intensity of biophotons had a tendency to decrease gradually from the Shang-yang point to Ho-ku and then Chu-chih points, and their intensities differed between right and left hands. Also, author found that the insertion of a needle and laser beam needle into the acupuncture point induced intensity enhancement of biophoton emissions from other acupuncture points. Again, we are forced to quote from Inaba H. [21].

It is obvious that under the influence of these studies, Nakamura H. et al. [26] measured biophotons emitted from the human hand and temperatures of the hand surface by



**Figure 1. Biophoton change of the middle finger (running average of 10 seconds) (subject C) [27]**

thermograph, in order to clarify the correlation of Qigong, biophotons, and a skin surface temperature. Subjects were three healthy men and one woman from 20 to 50 years old. The biophoton emission was measured from the fingertip of qigong master with the cooled photo multiplier tube (PMT) measuring device. Typically, the middle finger of the right hand was used. In the measurements, two trial patterns of qigong were used; “A” trial in which Qi emission and relaxation periods were interleaved every 1 minute for 5 times (10 minutes the whole trial) and “B” trial in which Qi emission was performed for 4 to 6 minutes continuously. The subject’s mental image at the time of Qi emission was an image of light emission from the hand. Measurements of biophotons emitted from the hand during Qigong and relaxation, and the infrared radiation skin surface temperature show, that although the photon intensity usually increases when temperature raises under normal conditions, with the certain subjects, the increase of biophoton intensity and decrease of the skin surface temperature was observed during Qigong. A correlation seems to exist of the biophoton intensity increase during Qigong and the skin surface temperature drop. The trend obtained this time was observed for only one subject (50 years old male), but in a few trials. Authors concluded that in order to confirm it universally, the measurements of many Qigong masters are required.

In their next study [27], beginners in Qigong (two males) and untrained people (four males and four females) performed the same experiment. Subject B who was a beginner (15-year-old male, Qigong training for only two months) had an obvious increase in his skin surface temperature of the middle finger during Qigong compared with temperature at rest. Subject C (20-year-old female) who was untrained showed her middle finger radiated more biophotons when doing a light imagery task. Opposite the case of subject A, subject B’s skin surface temperature of middle finger increased remarkably during Qigong compared to rest. There was a maximum difference of 3.3 °C for subject B. The data of subject C was smoothed for 10 points. As shown in Fig. 1, from the second trial, the biophoton count showed an increasing trend during a light imagery task. The average of biophotons (cpm) during rest and light imagery is  $304 \pm 18$  and  $344 \pm 18$  ( $p = 0.09$ ). Compared with subject A ( $346 \pm 12$

and  $382 \pm 7$ ;  $p = 0.003$ ) who showed 1 % or less statistical significance by a one-sided t-test, subject C had a P value of 10 %. However, it could be observed that the biophoton count showed a larger increasing trend during light imagery than at rest.

Chen W. et al. [27] concluded that because the skin temperature is controlled by the autonomic nerves, the results suggest that not only a skilled Qigong master but also more people can influence their physiological functions just as the autonomic nerves do when they are making Qigong conscious concentration. On the other hand, although the detailed mechanism of the origin of biophotons is not cleared, it is considered to be concerned with radical oxygen. The results of subject C suggest that even untrained persons can influence biophotons in relation to physiological metabolic behavior when they are doing a light imagery task. And the results are also considered to be connected with explaining the origin of biophotons. Various physiological data such as blood flow and EEG are necessary to study physiological changes during Qigong and light imagery tasks. Although the change for a finger can be measured easily, the measured data of other regions are also necessary.

Since origin the martial arts were not simply combat techniques, but acquired a high artistic sensitivity and spirituality. The masters trained themselves to enhance Ki through meditation and breathing. Orthodox Zen-Buddhist practitioners, aiming to prove the most original true-self, discover and uncover the inner energy or light on the way towards their goal. This form of energy is interpreted by Zen-Buddhism practitioners as “the radiance of our fundamental nature, the light of wisdom, or the light of eternal life”. Perception of the inner light can be comprehended as resonance. Uncovering the inner energy optimizes physiological and mental health. In the meditation experiment, a significant correlation was observed between perception of the inner light and EEG alpha blockage [28]. However, the latter statement is debatable. In a comparative study, Kawano K. et al. [17] found the following. During deep Zen meditation, alpha frequency became slower and sometimes theta waves could also be observed. However, some changes in thought or in imagination made the frequency fast. During Qigong, by using Qi images the frequency often became fast. In experiment with two meditators (healthy adult male and female), the alpha amplitude tended to become larger for both subjects, when their transcendental meditation became deeper. Male’s alpha amplitude showed small fluctuation, and was not decreased much even while listening to the meditation tape which he declared he did not like so much. Female’s alpha amplitude tended to become larger in the course of meditation and became slightly smaller when she said various images came out with the tape. Male’s alpha peak frequency was a little slow even in the resting condition and became much slower during meditation. The deeper female’s meditation went, the slower the frequency became, but it became faster again when some images came out. Although the changes of the alpha amplitude and frequency were different in each method, a common characteristic of EEGs during meditation was appearance of the alpha waves on the frontal area. The alpha waves which were usually large

on the occipital area, spread toward the central and frontal areas during meditation. The ratio of the effective alpha amplitude of the frontal to occipital area (Fp2/O2) sometimes became larger than 1 for Zen priests and experienced Qigong masters.

Faber P.L. et al. [29] studied EEG of experienced Qigong meditators who regularly perform the exercises “Thinking of Nothing” and “Qigong” during their meditations. In the EEG alpha-2 frequency, 125 voxels differed significantly; all were more active during “Qigong” than “Thinking of Nothing”, forming a single cluster in parietal Brodmann areas 5, 7, 31, and 40, all in the right hemisphere. In the EEG beta-1 frequency, 37 voxels differed significantly; all were more active during “Thinking of Nothing” than “Qigong”, forming a single cluster in prefrontal Brodmann areas 6, 8, and 9, all in the left hemisphere. Compared to combined initial-final notask resting, “Qigong” showed activation in posterior areas whereas “Thinking of Nothing” showed activation in anterior areas. Authors concluded that the stronger activity of posterior (right) parietal areas during “Qigong” and anterior (left) prefrontal areas during “Thinking of Nothing” may reflect a predominance of self-reference, attention and input-centered processing in the “Qigong” meditation, and of control-centered processing in the “Thinking of Nothing” meditation.

It is known that kata is a sequence of blocks, kicks, and punches from one or more positions, involving forward, backward, and sideways movement. The number of movements and their sequence are very specific. The balance between offensive and defensive techniques, the positions used, and the direction and flow of movements give each kata its distinctive character. A higher level of training can be achieved through dedication, concentration, and practice, when the kata becomes so ingrained in the subconscious that conscious attention is not required. This is what Zen masters call *mushin*, or “mindless”. Conscious, rational thought practice is not used at all — what has already been memorized becomes spontaneous. Kyokushin karate has developed a specialized system of kata — a formalized sequence of movements that are combined according to the principles of fighting an imaginary opponent or group of opponents. It is the quintessence of the technique of a particular martial arts style and a powerful means of mobilizing the athlete’s physical, functional and psycho-emotional reserves, which is achieved through the following indicators: passive and active meditation; formation of rational, perfect and variable technique, consolidation of clear motor reflexes; active dynamic psychotraining; accumulation, control, stimulation and direction of bioenergy at one’s own will to activate physiological and energy processes, implementation of the necessary dynamic structures at the level of the individual’s maximum capabilities. Sanchin means “three battles” or “three conflicts”. It is the main kata in certain styles of Okinawan karate, such as Goju Ryu and Uechi Ryu, and is probably one of the oldest kata. Some legends attribute the creation of Sanchin to Bodhidharma at the beginning of the sixth century. Sanchin kata aims to develop three elements simultaneously: body, mind, and technique; internal organs, circulation, and nervous system; and three

Ki located in: the crown of the head (I try), the diaphragm (hara) and the lower abdomen (tan den). Sanchin kata is an isometric type, where each movement is performed in a state of full tension, accompanied by powerful, deep breathing (Ibuki), starting from the lower abdomen (tan den). The practice of Sanchin leads not only to strengthening the body, but also to the development of internal energy (Ki) and coordination of mind and body [30, 31]. So, Kyokushin karate kata (KKK) is related to the practices described. Kyokushin karate master Babelyuk generate kata by imagining golden light in combination with voluntary prolongation of inhalation and exhalation.

**Aim of the study.** The primary aim of this study was to elucidate the potential neurophysiological and biophysical mechanisms underlying the effects of performing KKK on the brain activity of both the performer (sender) and the recipient(s). Specifically, we sought to determine whether the structured execution of KKK, characterized by deep intentional focus and controlled breathing, elicits measurable changes in electroencephalographic (EEG) rhythms, heart rate variability (HRV), and electro-photonic imaging (EPI) parameters, and whether these changes correlate with physiological responses in biological (rat hippocampal slices) and physical (water) recipient systems. The study also aimed to compare these effects with those induced by Reiki practice and canonical prayer, thereby assessing the specificity and magnitude of KKK as a psycho-energetic intervention.

## Materials and methods

**Participants.** The first experiment was carried out with the participation of the first author (50-year-old, right-handed, Kyokushin karate master, black belt, IV dan, who is also a psychotherapist, PhD degree, and hypnotist) and 50-year-old female Svitlana Holubinka (right-handed, level II Reiki practitioner, and professional psychologist). It is nice to note that the first author is “dual” colleague of Ohnishi S.T. & Ohnishi T. who also embody a unique combination of a MD (PhD degree in biophysics) and a master of martial arts (a black belt in Aikido).

**Procedure/test protocol/skill test trial/measure/instruments.** In the morning in basal conditions at first was registered (by Dubkova G.I., PhD degree) the Kirlianogram by the method of gas discharge visualization/electrophotonic imaging (GDV/EPI) by the device of GDV chamber.

Method of EPI, essence of which consists in registration of photo-electronic emission of skin of all ten fingers, induced by high-frequency electromagnetic impulses, measures the distribution of electron densities in human systems and organs. These electron densities are the main basis of physiological energy, so there is reason to say that the GDV method allows us to measure the body’s potential energy reserve as well as to estimate integrated psycho-somatic state of organism. The first base parameter of GDV is area of electrophotonic image (EPI) in right, frontal and left projections registered both with and without polyethylene filter. The second base parameter is a coefficient of shape (ratio of square of length of external contour of EPI toward his area), which characterizes the measure of serration/fractality of external contour. The third base parameter of EPI is entropy. It is

considered that EPI, taken off without filter, characterizes the functional changes of organism, and with a filter characterizes organic changes. At the same time, the EPI method is a bridge between the logical science of the West and the intuitive science of the East. Author put forward the concept that each chakra is associated with apart of the finger. This approach is embodied in the GDV chakras program, which allows us to quantify the state of virtual chakras [32–34].

Then after 5 minutes was recorded (by Korolyshyn T.A., VMD) an electrocardiogram in II lead for 7 minutes in the sitting position to assess the parameters of heart rate variability (HRV) (software and hardware complex CardioLab + HRV produced by KhAI-Medica, Kharkiv, Ukraine). For further analyses the following HRV parameters were selected. Temporal parameters (time domain methods): HR, the mode (Mo), the standard deviation of all NN intervals (SDNN), the square root of the mean of the sum of the squares of differences between adjacent NN intervals (RMSSD), the percent of interval differences of successive NN intervals greater than 50 msec (pNN50); triangular index (TNN). Spectral parameters (frequency domain methods): absolute (msec<sup>2</sup>) and relative (%) spectral power density (SPD) bands of HRV: high-frequency (HF, range 0.4 ÷ 0.15 Hz), low-frequency (LF, range 0.15 ÷ 0.04 Hz), very low-frequency (VLF, range 0.04 ÷ 0.015 Hz), and ultralow-frequency (ULF, range 0.015 ÷ 0.003 Hz). Calculated classical indexes: LF/HF; (VLF + LF)/HF; LFnu = 100 % · LF/(LF + HF) [35–37].

Simultaneously was recorded by hardware-software complex NeuroCom Standard (KhAI-Medica) EEG monopolar in 16 loci (Fp1, Fp2, F3, F4, F7, F8, C3, C4, T3, T4, P3, P4, T5, T6, O1, O2) by 10–20 international system, with the reference electrodes A and Ref on the earlobes, four times two minutes after the eyes had been closed, obtaining four 25-s epochs. Among the options considered the average EEG amplitude (µV), average frequency (Hz), frequency deviation (Hz), index (%), coefficient of asymmetry (%) and absolute (µV<sup>2</sup>/Hz) and relative (%) SPD of basic rhythms: β (35 ÷ 13 Hz), α (13 ÷ 8 Hz), θ (8 ÷ 4 Hz) and δ (4 ÷ 0.5 Hz) in all loci, according to the instructions of the device.

We calculated also for HRV and each locus of EEG the entropy (h) of normalized SPD using Popovych's [38–40] equations based on classic Shannon's CE [41] equation:

$$h_{EEG} = -[SPD\alpha \cdot \log_2 SPD\alpha + SPD\beta \cdot \log_2 SPD\beta + SPD\theta \cdot \log_2 SPD\theta + SPD\delta \cdot \log_2 SPD\delta] / \log_2 4;$$

$$h_{HRV} = -[SPDHF \cdot \log_2 SPDHF + SPDLF \cdot \log_2 SPDLF + SPDVLF \cdot \log_2 SPDVLF + SPDULF \cdot \log_2 SPDULF] / \log_2 4.$$

After recording the baseline HRV and EEG, immediately began to re-register HRV within 11 minutes and simultaneously recorded EEG obtaining seven 25-s epochs. During re-registration of HRV & EEG Kyokushin karate master and Reiki practitioner carried out self-sessions of kata and Reiki, respectively. After that, the Kirlianogram was re-recorded.

In the second experiment at first evaluated (by Romanov A., PhD degree) the synaptic efficacy in rat's hippocampal slice by method extracellular recording techniques [42]. Experiment was performed in accordance with the guidelines set by the Animal Care Committee of Bogomolets

Institute of Physiology. The Wistar male rat (postnatal day 20–21) was deeply anesthetized using sevoflurane and decapitated. Brain slice was prepared using a WPI SYS-NVSL (World Precision Instruments Inc.). Slice was produced and maintained in continuously carboxygenated (95% O<sub>2</sub> – 5% CO<sub>2</sub>) artificial cerebrospinal fluid composed of NaCl 125 mM, KCl 3.5 mM, CaCl<sub>2</sub> 2 mM, MgCl<sub>2</sub> 6H<sub>2</sub>O 1.3 mM, NaH<sub>2</sub>PO<sub>4</sub> 1.25 mM, NaHCO<sub>3</sub> 24 mM, glucose 11 mM, pH 7.35.

In this first was recorded during 11 minutes basal level, then within the same period carried out manipulation by Reiki practitioner, and after she, has influence Kyokushin karate master; registration continued for another 11 minutes after the session. The distance between sender's and the tray with the rat hippocampus slice was about 2 meters. Data were collected and analyzed using pCLAMP 9.0 (Axon Instruments). Origin 7.5 (Microcal Software, Northampton, MA) and Mini Analysis (version 6.0.3; Synaptosoft, Decatur, GA) software.

The third experiment was conducted with the participation of the first author and our guest friend, the Greek Catholic priest Father Volodymyr (44 years old, right-handed), to compare the effect of the KKK and the canonical Christian prayer for the consecration of water on the light activity of pharmacy distilled water (in glass vials). Both participants performed four sessions in turn. The Kirlianogram and EEG were recorded before and after each session.

The light activity was recorded by Dobrovolskyi Y.G., a specialist in physical optics (DSc degree), by the discharge-optical device designed and patented by him [43]. Author moistened a pellet of factory activated carbon with treated water, placed it in a device and exposed it to three 7–10-second discharges (25 kV) from at an interval of 40 seconds, recording the brightness value (Cd/m<sup>2</sup>). Distilled water from another ampoule of the same package served as a control. The KKK and prayer effects was evaluated by the ratio of the light activity of treated and ordinary distilled water [44, 45].

*Data collection and analysis/statistical analysis.* Statistical analysis was conducted using Microsoft Excel 2016, Statistica 6.4 (StatSoft Inc., Tulsa, OK, USA), and Claude AI 3.5 Sonnet (Anthropic, USA).

## Results

If the synaptic efficacy in the rat's hippocampus during sessions expressed in percents of baselines, we get the following authentic patterns (Fig. 2, top). It has been documented that during an 11-minute KKK session, hippocampal synaptic efficacy increased significantly and even continued to increase for the next 11 minutes despite the session being terminated. In contrast, the Reiki session, contrary to reasonable expectations, was ineffective (Table 1). Looking ahead, we note that in another experiment, the results of which will be published in a future article, the Reiki session affected a number of EEG parameters in humans to approximately the same extent as the KKK session.

Preliminary analysis of EEGs parameters of both sender's showed that the average values of seven consecutive epochs also oscillated. Therefore, in order to compare the oscillations of the participants' EEGs (as sender's) and the

**Table 1. Changes in synaptic efficacy in the rat's hippocampus slice during and after KKK and during Reiki sessions (authentic data from Romanov A.)**

State and session	N total	Change, %	SD	SE	Change, Z	SE	Min	Median	Max
During Reiki	32	-0.5	4.8	0.85	-0.10	0.17	90.2	100.0	108.8
During kata	32	+7.5	5.1	0.90	+1.58	0.19	97.2	106.5	118.6
After kata	32	+7.2	4.3	0.76	+1.78	0.19	99.2	107.9	117.4

rat's hippocampal synaptic efficacy (HSE) (as receiver), the continuous HSE patterns were fragmented by calculating the average values for the time intervals corresponding to the intervals between the seven EEGs recordings during the self-sessions (Fig. 2, middle).

This approach, despite certain limitations due to asynchronous registrations of two processes, allows us to analyze correlations between the patterns of EEGs parameters of sender's and rat's HSE. More on that later, but now we will clarify the differences between the EEG parameters of both sender's as a possible reason for their different effects on rat's HSE.

Reference values of EEG parameters were taken from the database of Truskavets Scientific School of Balneology (n = 112). It was found (Fig. 3) that during KKK session SPD of delta rhythm in T3 and T4 loci increased drastically. In P3, P4, O1 and T5 loci less pronounced increase of SPD of delta rhythm was combined with increase of SPD of alpha rhythm. In contrast, during Reiki session levels of these parameters practically did not differ from reference ones. However, after calculating Z-scores [ $Z = (V/R - 1)/Cv$ ], including for HSE, it was found (Fig. 4) that the most pronounced effects of KKK on EEG were still an increase in the SPD of delta rhythm in both temporal, parietal and occipital loci, as well as in the Fp1 locus. In addition, there was an effect of KKK on theta rhythm in T4 locus, which was not noticeable in the scale of absolute values of SPD of delta and alpha rhythms.

The entropy of SPD of EEG also did not differ significantly from the reference one during Reiki session, while during kata session it was significantly smaller (Fig. 5, 6). At the same time, the most noticeable deviations again occurred in T3, T4 and Fp1 loci, the second positions were occupied by central loci, displacing parietal ones, and deviations in occipital loci were insignificant. Special attention deserves the entropy of HRV bands, which after KKK was moderately but significantly reduced, while after Reiki session it was increased to the same extent, mainly due to unidirectional deviations of the relative SPD of HF band ( $Z \pm 2.78 \cdot SE$ ):  $-0.51 \pm 0.33$  and  $1.29 \pm 0.14$ , respectively. This was accompanied by opposite deviations in the HRV-marker of sympathetic tone:  $0.73 \pm 0.07$  and  $-1.02 \pm 0.26$ , respectively. We have previously demonstrated close relationships between HRV and EEG variables [46].

To create a complete picture, Fig. 7 also shows the area of the EPI, which was found to be enlarged in the frontal projection after kata session, but reduced in both lateral projections, again against the background of the absence of significant deviations in the size of the areas from the reference

ones after Reiki session. Given the drastic deviations of the SPD of the delta rhythm, against the background of which the deviations of other EEG and EPI parameters become unclear, they are replaced by the total SPD values.

It is extremely important that after KKK session a significant decrease in the entropy of the electro-photonic image (EPI/GDI) was also detected, maximally expressed in the right projection, while after Reiki session its level did not differ significantly from the reference one (Fig. 7). Interestingly, the entropy levels of EEG and EPI are closely correlated despite being calculated by different methods (Fig. 8, Table 4).

The overall impression is that the KKK-induced increase in rat's HSE is realized by changes in sender's EEG, HRV and EPI parameters. Correlation analysis was used to confirm this impression.

Screening of correlations of rat's HSE with sender's SPD (Fig. 9) revealed maximum coefficients for total SPD in T4 and P4 loci, and significant coefficients in 14 loci out of 16. The maximum coefficient for SPD of delta rhythm was recorded in T4 loci, and significant coefficients in 13 loci. The maximum coefficient for SPD of alpha rhythm was recorded in T5 loci, and significant coefficients only in 5 loci. SPD of theta rhythm, in contrast to the previous two, along with positive associations with HSE in 6 loci, with a maximum in T4 locus, showed a significant negative association in C4 locus.

According to the results of multiple correlation analysis with stepwise elimination until the maximum value of adjusted R2 is achieved, only 9 parameters of delta and alpha rhythms remained in the regression model, which, taken together, determine HSE by 87.6 % (Table 2, Fig. 10).

SPD of beta rhythm, unlike the previous ones, in 11 loci correlated negatively with HSE, however, in T4 locus a significant positive correlation was recorded (Fig. 11). However, a significant negative correlation was found with SPD entropy in 14 loci, except for borderline levels in both occipital loci, with a maximum in the P3 locus. However, the most closely related to HSE was the entropy of SPD of HRV bands. After its inclusion in the regression model, the degree of determination of HSE reached 93.2 % (Table 3, Fig. 12).

Now let's analyze the relationships between the EEG parameters selected at the previous stage, on the one hand, and electrophotonic imaging — on the other hand (Table 4).

Area of EPI in frontal projection was found to be most strongly related to SPD total in T4 locus and entropy of SPD in T4 locus, while entropy of EPI in Right projection (f) was found to be most strongly related to entropy of SPD in T3 locus and SPD total in O1 locus. The canonical correlation between biophysical and informational EPI parameters,

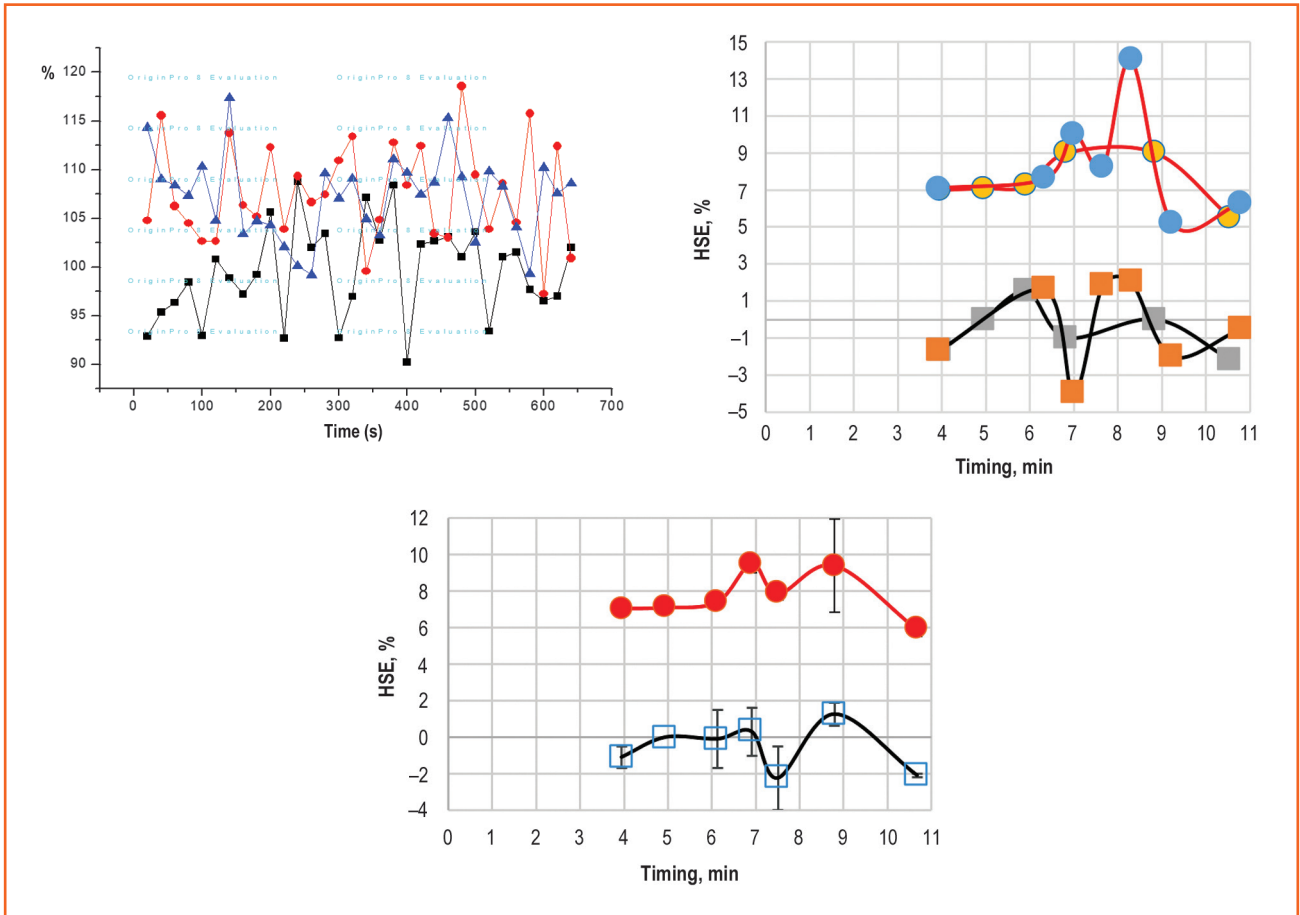


Figure 2. Authentic (top) and formatted for EEG registration (middle) patterns of synaptic efficacy (% of baseline and changes, respectively) in the rat's hippocampus slice during (circles) and after (triangles) KKK and during Reiki (squares) sessions as well as simulation from two experiments (bottom)

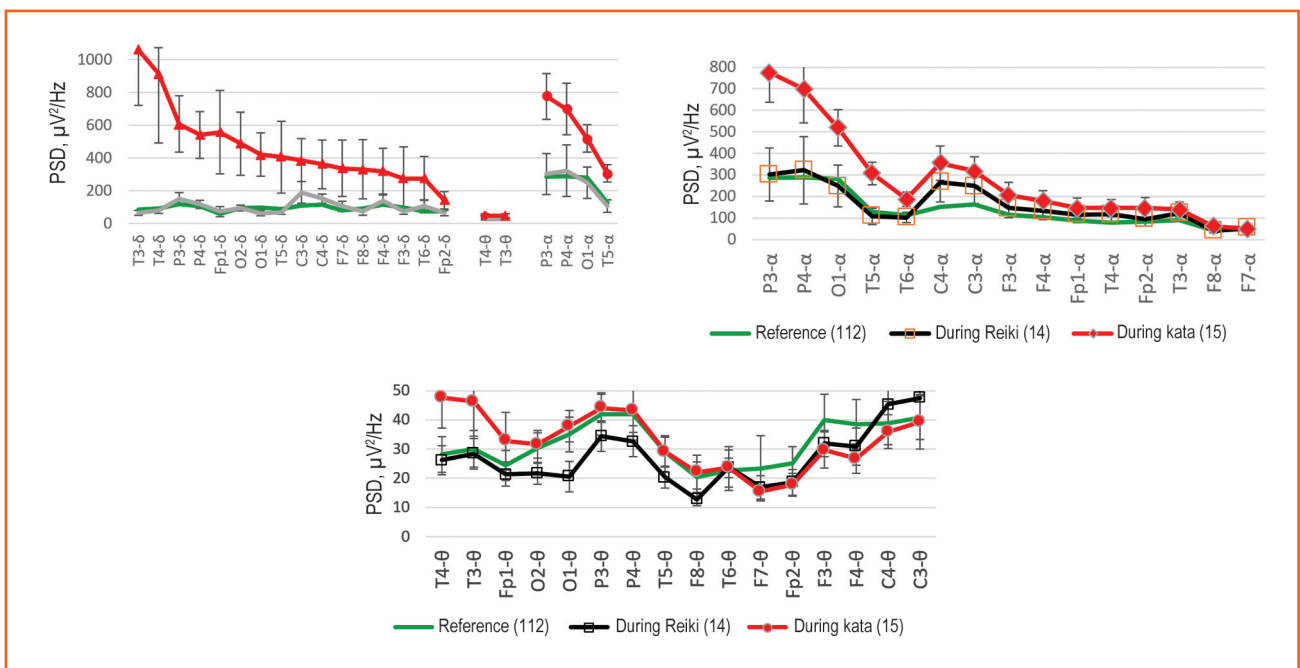


Figure 3. Average (mean  $\pm 2.05 \cdot SE$ ) values of spectral power density of delta, theta and alpha rhythms during kata (n = 15) and Reiki (n = 14) session as well as their reference levels (n = 112)

on the one hand, and biophysical and informational EEG parameters, on the other hand, turned out to be very strong (Table 5, Fig. 13).

Fig. 15 shows relation between sets from the position of the Western paradigm, according to which the causal factor is the electrical activity of the brain, which by sympathetic cholinergic nerves regulates the electrical conductivity of the acupuncture points of the fingertips [47, 48], which is reflected in the area and entropy of EPI [31, 34].

Instead, from the position of the Eastern paradigm, the primary one is the vital energy qi/ki/prana, which by chakras and acupuncture meridians (newly-discovered Bonghan's circulatory system) regulates the activity of the brain as well as other organs [5, 13, 49–56].

This position is confirmed by the multiple correlation result, according to which sender's entropy of EPI affects the electrical activity of both their own brain and the rat's brain slice, determining its HSE by 83.4 % (Table 6, Fig. 14).

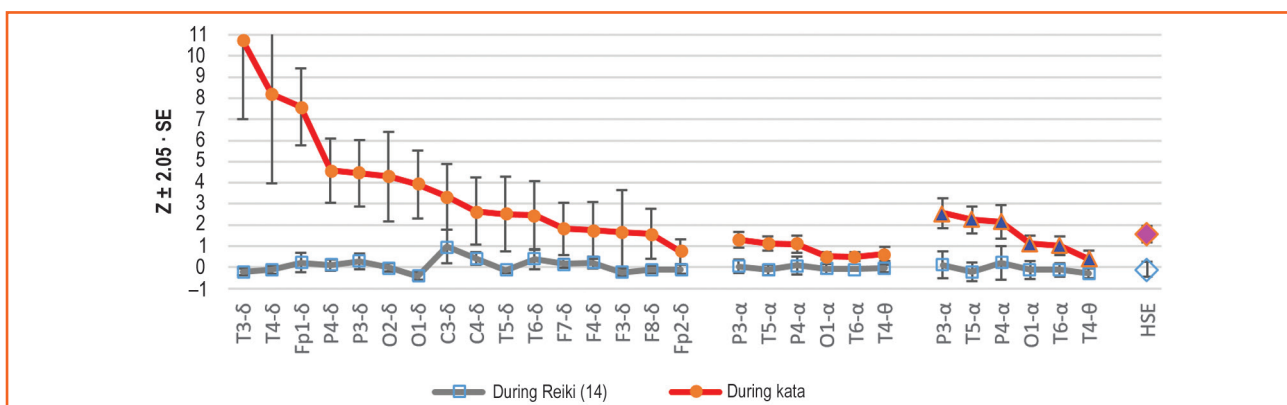


Figure 4. Average (mean  $\pm$  2.05 · SE) Z-scores of SPD of delta, alpha and theta rhythms (circles) during kata and Reiki session as well as Z-scores of SP (triangles) and rat's hippocampal synaptic efficacy (HSE)

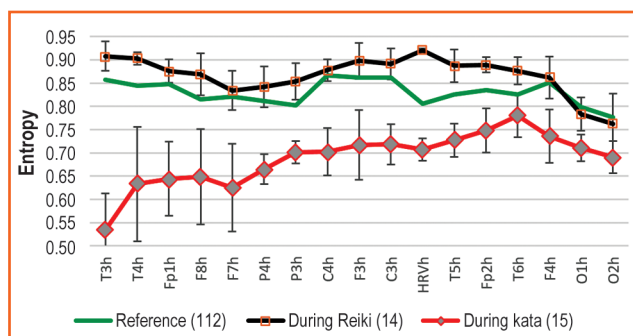


Figure 5. Average (mean  $\pm$  2.05 · SE) levels of entropy of SPD of EEG & HRV during kata and Reiki sessions as well as their reference levels

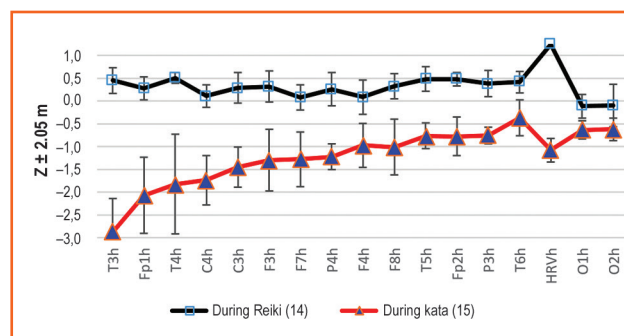


Figure 6. Average (mean  $\pm$  2.05 · SE) Z-scores of entropy of SPD of EEG & HRV during kata and Reiki sessions

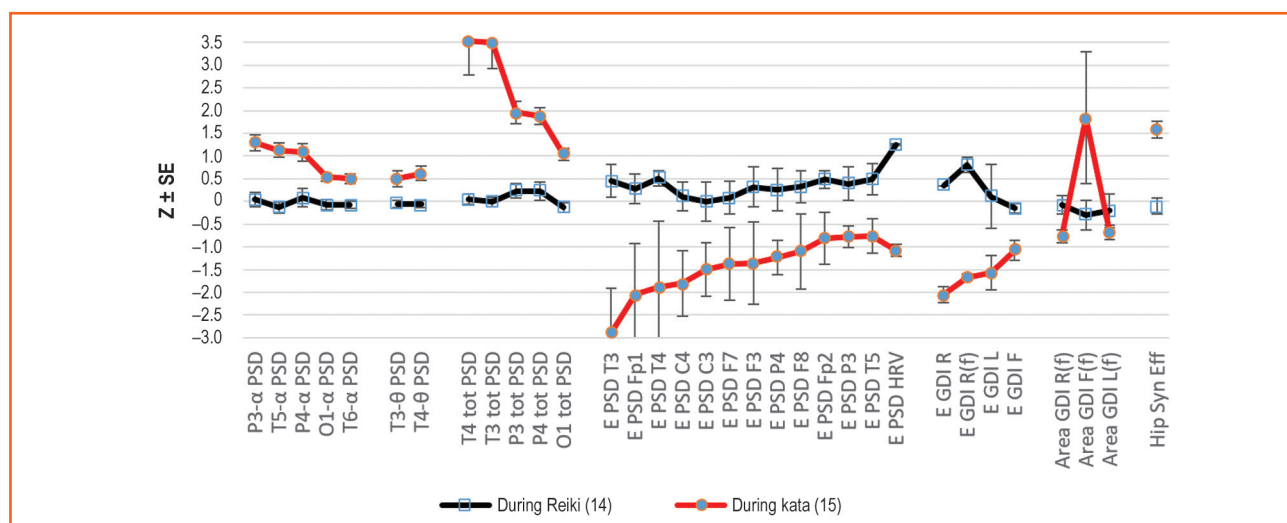
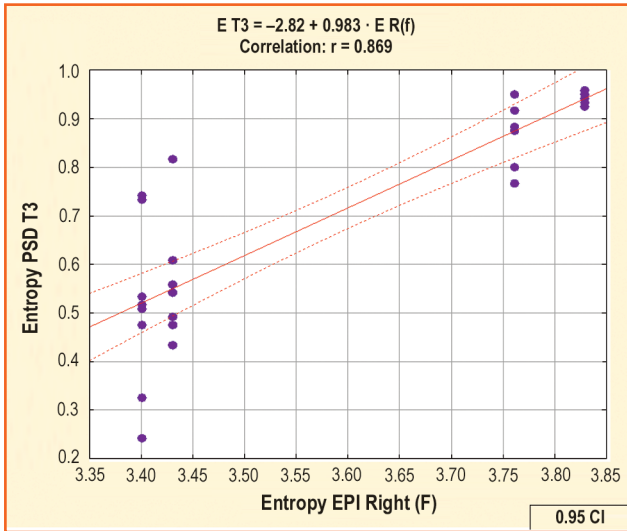
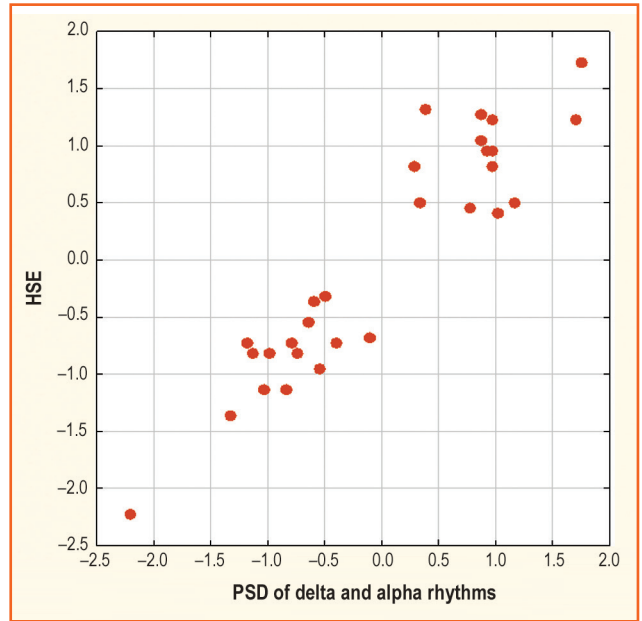


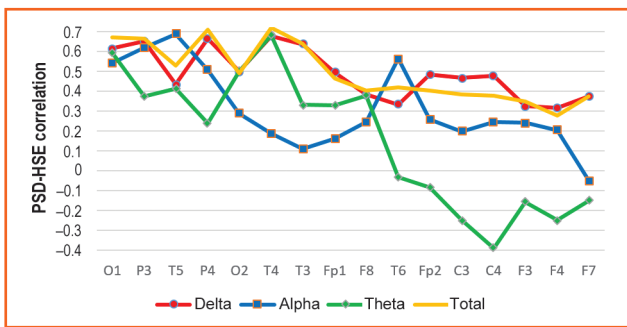
Figure 7. Patterns of EEG and EPI parameters of sender's and rat's hippocampal synaptic efficacy



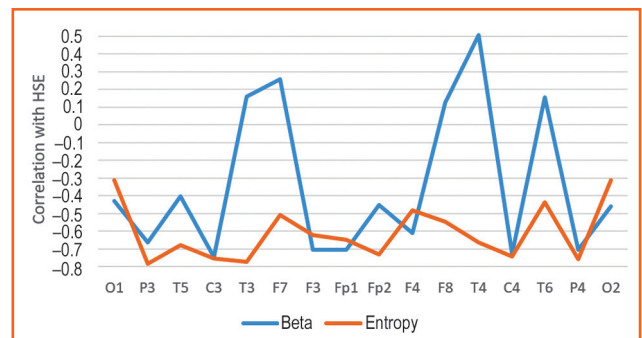
**Figure 8.** Scatterplot of correlation between entropy of EPI in right projection (X-line) and entropy of EEG in T3 locus (Y-line)



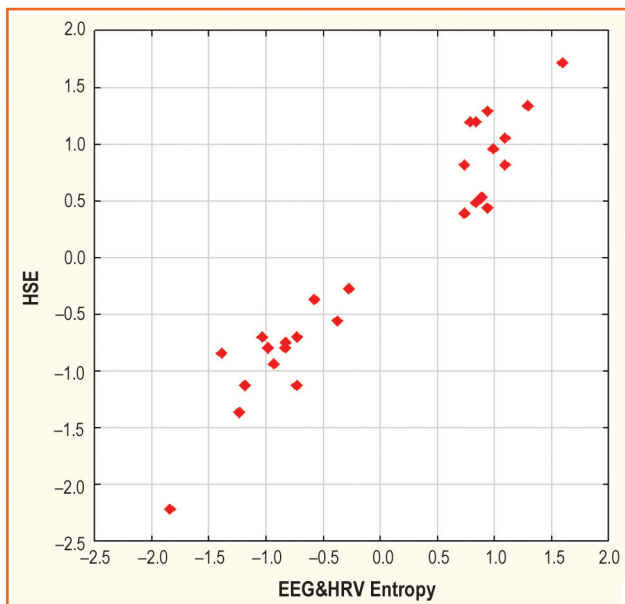
**Figure 10.** Scatterplot of canonical correlation between sender's SPD of delta and alpha rhythms and rat's hippocampal synaptic efficacy  
Notes:  $R = 0.936$ ;  $R^2 = 0.876$ ;  $\chi^2_{(9)} = 47$ ;  $p < 10^{-6}$ ;  $\Lambda_{prime} = 0.124$ .



**Figure 9.** Coefficients of correlation between sender's SPD of delta, alpha and theta rhythms as well as total SPD and rat's hippocampal synaptic efficacy (for  $n = 29$   $0.05|r| > 0.37$ ;  $0.01|r| > 0.48$ ;  $0.001|r| > 0.61$ )



**Figure 11.** Coefficients of correlation of sender's SPD of beta rhythm and SPD entropy with rat's hippocampal synaptic efficacy



**Figure 12.** Scatterplot of canonical correlation between sender's EEG & HRV entropy and rat's hippocampal synaptic efficacy  
Notes:  $R = 0.965$ ;  $R^2 = 0.932$ ;  $\chi^2_{(7)} = 63$ ;  $p < 10^{-6}$ ;  $\Lambda_{prime} = 0.068$ .

Thus, it seems that changes in rat's HSE are caused by sender's SPD and entropy of EEG as well as entropy of EPI, but not its Area. These factors, included in the regression model, determine rat's HSE by 92.0 % (Table 7, Fig. 15).

Thus, we have shown that the changes in biophysical and informational parameters induced by KKK, as a type of mental practice, both EEG/brain and EPI/skin are capable

of non-contact influence on the synaptic efficacy of rat's hippocampus.

Given that 4/5 of the brain mass is water, we assumed that kata session is capable of influencing the biophysical parameters of water, in particular its light activity (glow). As a control/comparative factor of influence on water in this experiment, a canonical Christian prayer for the consecration of water, pronounced by a Greek Catholic priest, was used.

**Table 2. Regression summary for HSE vs. EEG SPD**

N = 29		Beta	St. err. of beta	B	St. err. of B	t <sub>(19)</sub>	p-level
Variables, $\mu V^2/Hz$	r		Intercept	-5.92	1.37	-4.33	10 <sup>-3</sup>
P4- $\delta$ SPD	0.664	1.809	0.263	0.0291	0.0042	6.88	10 <sup>-5</sup>
T3- $\delta$ SPD	0.635	1.356	0.355	0.0093	0.0024	3.82	0.001
O1- $\delta$ SPD	0.614	1.208	0.322	0.0677	0.0180	3.75	0.001
T6- $\alpha$ SPD	0.562	1.013	0.312	0.0686	0.0212	3.24	0.004
O1- $\alpha$ SPD	0.540	-1.369	0.312	-0.0152	0.0035	-4.39	10 <sup>-3</sup>
P4- $\alpha$ SPD	0.506	1.006	0.216	0.0136	0.0029	4.66	10 <sup>-3</sup>
Fp1- $\delta$ SPD	0.494	-1.369	0.312	-0.0155	0.0035	-4.39	10 <sup>-3</sup>
Fp2- $\delta$ SPD	0.484	1.208	0.322	0.0677	0.0180	3.75	0.001
C4- $\delta$ SPD	0.476	-0.752	0.316	-0.0155	0.0065	-2.38	0.028

Notes:  $R = 0.936$ ;  $R^2 = 0.876$ ; adjusted  $R^2 = 0.817$ ;  $F_{(9,2)} = 14.9$ ;  $p < 10^{-6}$ ; SE of estimate: 2.0 %.

**Table 3. Regression summary for HSE vs. HRV & EEG entropy**

N = 29		Beta	St. err. of beta	B	St. err. of B	t <sub>(21)</sub>	p-level
Variables	r		Intercept	25.5	3.9	6.56	10 <sup>-5</sup>
Entropy SPD HRV	-0.890	-0.808	0.114	-33.75	4.765	-7.08	10 <sup>-6</sup>
Entropy SPD T3	-0.772	-0.313	0.134	-6.594	2.835	-2.33	0.030
Entropy SPD C3	-0.752	-0.582	0.156	-24.06	6.438	-3.74	0.001
Entropy SPD F7	-0.509	0.672	0.120	18.11	3.237	5.59	10 <sup>-4</sup>
Entropy SPD F4	-0.481	-0.222	0.102	-9.088	4.187	-2.17	0.042
Entropy SPD T6	-0.435	0.405	0.099	21.63	5.274	4.10	0.001
Entropy SPD O2	-0.311	0.174	0.085	8.182	3.989	2.05	0.053

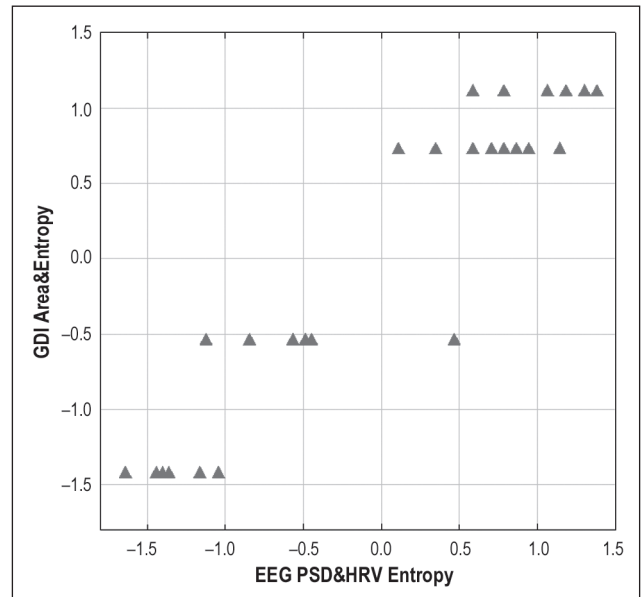
Notes:  $R = 0.965$ ;  $R^2 = 0.932$ ; adjusted  $R^2 = 0.909$ ;  $F_{(7,2)} = 41.2$ ;  $p < 10^{-6}$ ; SE of estimate: 1.4 %.

**Table 4. Correlation matrix for EEG and EPI parameters**

	T3 E	T4 E	T4-tot	T4- $\theta$	T4- $\delta$	C3 E	T5- $\alpha$	P3 E	P4 E	P4- $\delta$	P4-tot	O1-tot
AF(f)	-0.566	<b>-0.892</b>	<b>0.828</b>	0.692	0.838	-0.623	0.733	-0.542	-0.478	0.203	0.464	0.565
AF	-0.519	-0.893	0.809	0.626	0.839	-0.542	0.670	-0.492	-0.393	0.156	0.375	0.484
ER(f)	<b>0.869</b>	0.672	-0.684	-0.634	-0.631	0.819	-0.811	0.815	0.819	-0.727	-0.819	<b>-0.826</b>
ER	0.838	0.537	-0.559	-0.517	-0.505	0.747	-0.715	0.780	0.786	-0.776	-0.788	-0.771
EF	0.756	0.310	-0.374	-0.422	-0.292	0.689	-0.608	0.707	0.772	-0.786	-0.782	-0.729
EF(f)	0.779	0.508	-0.510	-0.415	-0.479	0.639	-0.621	0.717	0.683	-0.736	-0.679	-0.667
AR	0.631	0.327	-0.325	-0.215	-0.310	0.445	-0.419	0.570	0.518	-0.666	-0.512	-0.486
AR(f)	0.686	0.743	-0.678	-0.470	-0.699	0.559	-0.629	0.629	0.515	-0.494	-0.498	-0.551
AL	0.731	0.565	-0.539	-0.391	-0.533	0.574	-0.588	0.669	0.595	-0.653	-0.586	-0.594

**Table 5. Factor structure of EPI and EEG canonical roots**

Electrophotonic imaging set	R
Entropy EPI right (f)	-0.962
Entropy EPI right	-0.950
Area EPI frontal (f), pixels	0.467
Area EPI frontal, pixels	0.366
Electroencephalogram set	R
Entropy SPD P4	-0.881
Entropy SPD T3	-0.874
Entropy SPD C3	-0.846
P4 total SPD, $\mu V^2/Hz$	0.889
O1 total SPD, $\mu V^2/Hz$	0.866
T4 total SPD, $\mu V^2/Hz$	0.589
T4- $\delta$ SPD, $\mu V^2/Hz$	0.507

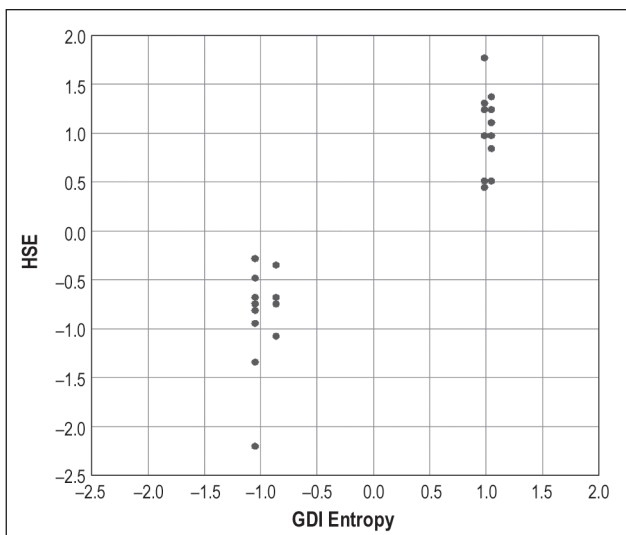


**Figure 13. Scatterplot of canonical correlation between sender's EEG and EPI parameters**  
 Notes:  $R = 0.948$ ;  $R^2 = 0.900$ ;  $\chi^2_{(28)} = 110$ ;  $p < 10^{-6}$ ;  $\Lambda_{prime} = 0.0066$ .

**Table 6. Regression summary for HSE vs. EPI entropy**

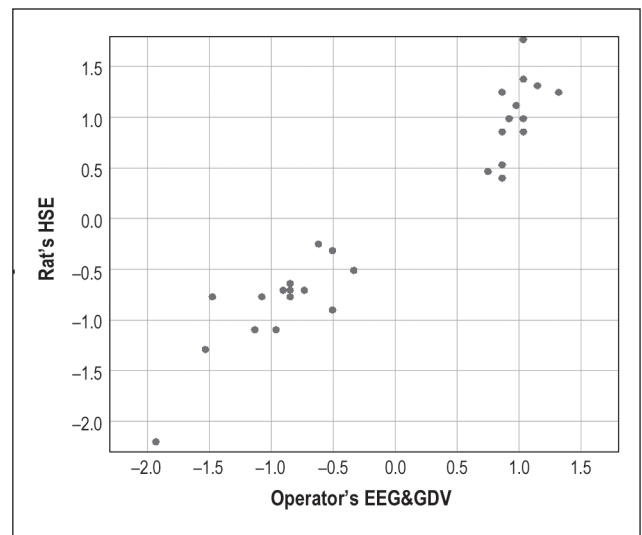
N = 29		Beta	St. err. of beta	B	St. err. of B	$t_{(25)}$	p-level
Variables	r		Intercept	83.3	8.2	6.56	$10^{-6}$
Entropy EPI right (f)	-0.904	-0.978	0.416	-23.33	9.925	-2.35	0.027
Entropy EPI right	-0.893	0.555	0.679	14.72	18.00	0.817	0.421
Entropy EPI frontal (f)	-0.863	-0.516	0.373	-13.77	9.963	-1.38	0.179

Notes:  $R = 0.913$ ;  $R^2 = 0.834$ ; adjusted  $R^2 = 0.814$ ;  $F_{(3,3)} = 41.8$ ;  $p < 10^{-6}$ ; SE of estimate: 2.0 %.



**Figure 14. Scatterplot of canonical correlation between sender's entropy of EPI (X-axis) and rat's hippocampal synaptic efficacy (Y-axis)**

Notes:  $R = 0.913$ ;  $R^2 = 0.834$ ;  $\chi^2_{(3)} = 46$ ;  $p < 10^{-6}$ ;  $\Lambda_{prime} = 0.166$ .



**Figure 15. Scatterplot of canonical correlation between sender's EEG and EPI variables (X-axis) and rat's hippocampal synaptic efficacy (Y-axis)**

Notes:  $R = 0.959$ ;  $R^2 = 0.920$ ;  $\chi^2_{(5)} = 62$ ;  $p < 10^{-6}$ ;  $\Lambda_{prime} = 0.080$ .

**Table 7. Regression summary for HSE vs. EEG and EPI variables**

N = 29		Beta	St. err. of beta	B	St. err. of B	t <sub>(23)</sub>	p-level
Variables	r		Intercept	74.5	11.8	6.29	10 <sup>-5</sup>
Entropy EPI right	-0.893	-0.674	0.143	-17.86	3.793	-4.71	10 <sup>-4</sup>
Entropy SPD T3	-0.772	-0.338	0.208	-7.118	4.378	-1.63	0.118
T4 total SPD, μV <sup>2</sup> /Hz	0.719	0.441	0.084	0.0029	0.0006	5.22	10 <sup>-4</sup>
P4 total SPD, μV <sup>2</sup> /Hz	0.703	0.491	0.207	0.0047	0.0020	2.38	0.026
O1 total SPD, μV <sup>2</sup> /Hz	0.668	-0.905	0.273	-0.0105	0.0032	-3.32	0.003

**Notes: R = 0.959; R<sup>2</sup> = 0.920; adjusted R<sup>2</sup> = 0.903; F<sub>(5,2)</sub> = 53; p < 10<sup>-6</sup>; SE of estimate: 1.45 %.**

Alternate sequential effects on ampoules with distilled water gave the following series of changes (%) of its light activity (glow). KKK: +92; -3; +50; +143; prayer: +224; -51; +4; +133.

However, the disappointment from the ambiguity of the data changed to heuristic delight after the analysis of the correlations between the changes in light activity of treated water and EPI parameters of both sender's after the sessions. It turned out that both the directionality and the expressiveness of the influence on the light activity of water of both mental practices are determined by the state of the third chakra of the sender's (Fig. 16). It is interesting also that Father Volodymyr was not at all surprised by the ineffectiveness of the second and third prayers, informing us that according to the canons, priests are allowed to consecrate water only once a day!

Considering that in the previous two experiment, the chakra 3 energy levels after kata were -0.36 and -0.39, while after Reiki -0.11 and 0.06, it is easy to calculate from the regression equation that the light activity of water could increase by 153 and 163 versus 74 and 20 %, respectively. On the other hand, the SPD levels of delta rhythm in Fp1 locus recorded after kata such as 388 and 751 μV<sup>2</sup>/Hz, while after Reiki 26 and 119 μV<sup>2</sup>/Hz, could increase the light activity of water by 108 and 138 versus 78 and 86 %, respectively, as follows from the following regression equation (Fig. 17).

Next, calculations based on the entropy SPD levels in Fp1 locus after kata (0.68 and 0.61) and after Reiki (0.89 and 0.861) give a possible increase in the light activity of water of 102 and 119 versus 51 and 58 %, respectively (Fig. 18).

The use of three presented regressive models makes it possible to estimate the increase in the light activity of water (M ± SD) under the influence of KKK by 131 ± 25 %, then the effect of Reiki would be 61 ± 24 % (t = 4.95; p < 0.01).

## Discussion

In this study, developing the preliminary communication [57], we have shown for the first time that Kyokushin karate master Babelyuk, while performing kata, is able to significantly influence the electrical activity of a rat hippocampal slice without contact with it, that is, to exert a remote neurotropic effect. This can be interpreted as modeling the Tohate phenomenon, since it is obvious that the motor response of the receiver is realized by his motor neurons. In contrast, the Reiki session under similar

conditions turned out to be ineffective. Hence the hypothesis arises that such a situation is due to significant differences between the electrical activity of the brain of both sender's during their sessions. Indeed, the screening revealed that the KKK session was accompanied by increased levels of SPD alpha, theta and, especially, delta rhythms, as well as total SPD while during the Reiki session such parameters practically did not differ from the reference ones.

The most congruent with the patterns of rat's HSE during two KKK and Reiki sessions were the patterns of total SPD in T4 loci (Fig. 19), which was confirmed by correlation analysis (Fig. 20). It should be noted that the coefficient of determination R<sup>2</sup> increases from 0.510 to 0.614 if SPD is converted to the natural logarithm.

It would seem that this fits perfectly with the original hypothesis of Hosseini E. [58] about the brain-to-brain communication in the following interpretation. The visual imagery activates neurons generating delta, alpha and theta rhythms; the electromagnetic field of neurons of the sender brain reaches the slice of the rat hippocampus, where it affects Cav1.2, Cav1.3 and KCa channels, which is manifested in the enhancement of synaptic efficacy [59-62]. It is obvious that the ineffectiveness of the Reiki session is due to the lack of activation of neurons of her brain.

However, the results of the calculations performed by the program Claude 3.7 Sonnet AI Anthropic showed that the brain's electric field at a distance of 10 cm, even enhanced by kata (alpha: 48.0; theta: 25.7; delta: 12.2 μV/cm vs. 37.6; 22.6; 10.5 μV/cm by Reiki) is too weak to be detected by another person (human detection threshold: 1 mV/cm). This obviously applies to a slice of the rat hippocampus placed at a distance of 2 m from sender's. It is interesting to note that the electrosensitive animals (sharks and rays), which can detect field as small as 5 nV/cm [63], would react to KKK and Reiki session in our virtual experiment even at a distance of 9.7 and 8.6 m, respectively (and when conducting the experiment in seawater, this distance would be much greater).

Despite the physical inability of activated neurons of the sender brain to influence rat's HSE with their electromagnetic field, such an influence takes place and is confirmed by the close canonical correlation between the patterns of electrical activity of sender and receiver neurons. Therefore, biophotons emitted by the brain should be considered as an active factor.

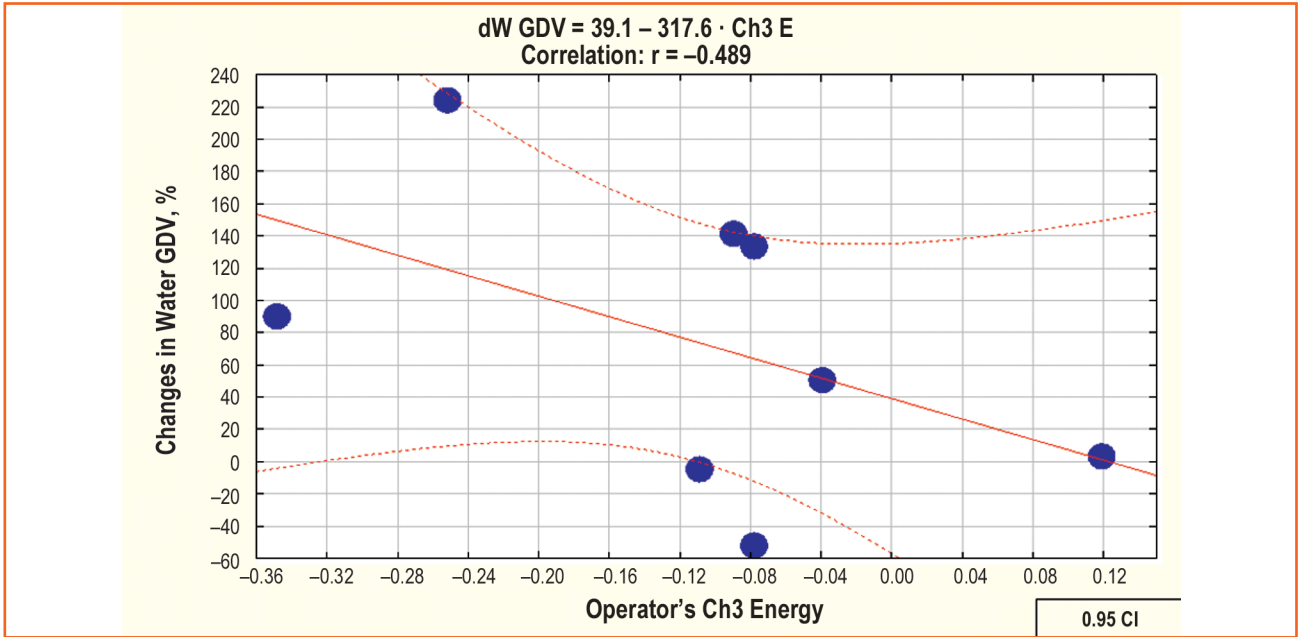


Figure 16. Scatterplot of correlation between karate master's and Greek-Catholic priest's third chakra energy after kata or prayer (X-line) and changes in the light activity of water they treated (Y-line)

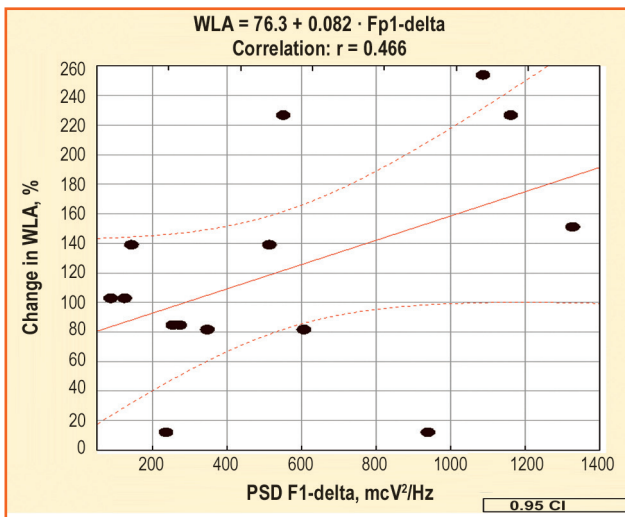


Figure 17. Scatterplot of correlation between karate master's and Greek-Catholic priest's SPD Fp1-delta after kata or prayer (X-line) and changes in the light activity of water they treated (Y-line)

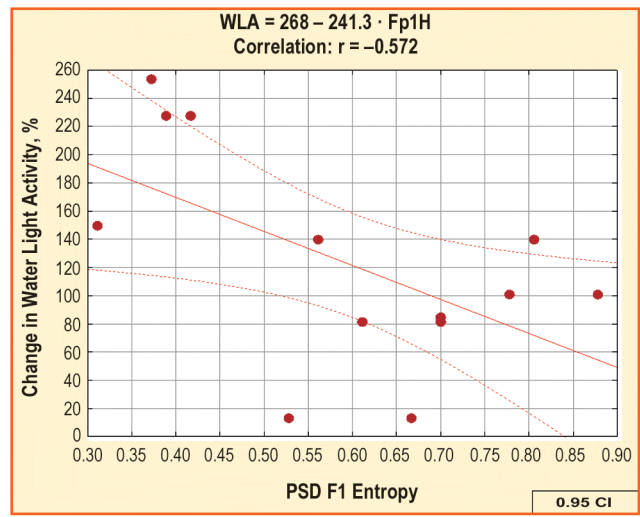


Figure 18. Scatterplot of correlation between karate master's and Greek-Catholic priest's SPD Fp1 entropy after kata or prayer (X-line) and changes in the light activity of water they treated (Y-line)

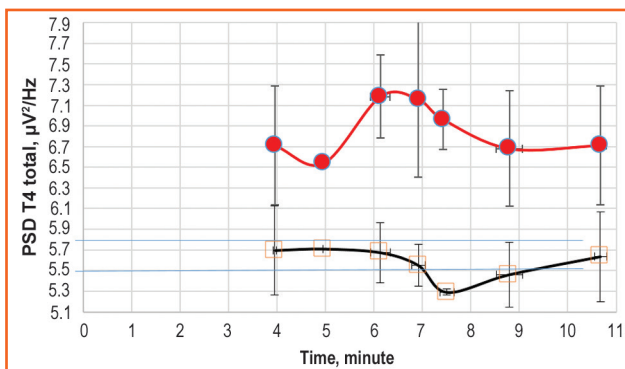


Figure 19. Patterns of InSPD T4 total ( $M \pm SE$ ;  $n = 2$ ) during KKK and Reiki sessions. The reference range ( $M \pm 2SE$ ;  $n = 112$ ) is outlined by horizontal lines

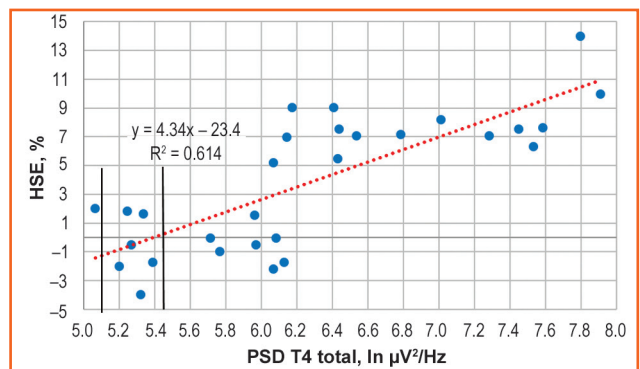


Figure 20. Scatterplot of correlation between sender's InSPD T4 total and rat's HSE during sessions

It should be recalled that the increase in biophoton emission from the skin surface of the hand during Qigong and light imagery tasks was discovered by Japanese researchers quite a long time ago (see Introduction), but its connection with the electrical activity of the brain was not clarified. In addition, we were unable to find their subsequent publications in this direction.

This is all the more surprising given that other Japanese researchers have successfully studied the emission of biophotons by the brain. Isojima Y. et al. [64], who for the first time detected ultraweak biochemiluminescence from rat hippocampal slice preparation at the order of 10–19 W/mm<sup>2</sup>, showed that depolarization induced by the high concentration of potassium caused an increase in the intensity of biochemiluminescence from the slice, and that suppression of neural activity by tetrodotoxin elicited a decrease of its luminescence. Kobayashi M. et al. [65, 66] found that baseline photon emissions from rat brains were between ~ 10–11 and 10–12 W/m<sup>2</sup>. The value decreased by about 60 % of baseline levels following a protracted period of hypoxia. During hyperoxia (100% O<sub>2</sub> inhalation) photon emission intensity was enhanced by 130 % relative to baseline particularly over the frontal regions. Theta wave power within slices of hippocampus was coupled to the intensity of the photon emissions ( $r = 0.641$ ).

Bókkon I. [67, 68] proposed a seminal redox molecular hypothesis about the natural biophysical substrate of visual perception and visual imagery. This hypothesis is based on the redox and bioluminescent processes of neuronal cells in retinotopically organized cytochrome oxidase-rich visual areas. This hypothesis is in line with the functional roles of reactive oxygen and nitrogen species in living cells that are not part of haphazard process, but rather a very strict mechanism used in signaling pathways. Author points out that there is a direct relationship between neuronal activity and the biophoton emission process in the brain. Electrical and biochemical processes in the brain represent sensory information from the external world. During encoding or retrieval of information, electrical signals of neurons can be converted into synchronized biophoton signals by bioluminescent radical and non-radical processes. Therefore, information in the brain appears not only as an electrical (chemical) signal but also as a regulated biophoton (weak optical) signal inside neurons. During visual perception, the topological distribution of photon stimuli on the retina is represented by electrical neuronal activity in retinotopically organized visual areas. These retinotopic electrical signals in visual neurons can be converted into synchronized biophoton signals by radical and non-radical processes in retinotopically organized mitochondrial-rich areas. As a result, regulated bioluminescent biophotons can create intrinsic pictures (depictive representation) in retinotopically organized cytochrome oxidase-rich visual areas during visual imagery and visual perception. The long-term visual memory is interpreted as epigenetic information regulated by free radicals and redox processes. This hypothesis does not claim to solve the secret of consciousness, but proposes that the evolution of higher levels of complexity made the intrinsic picture representation of the external visual world

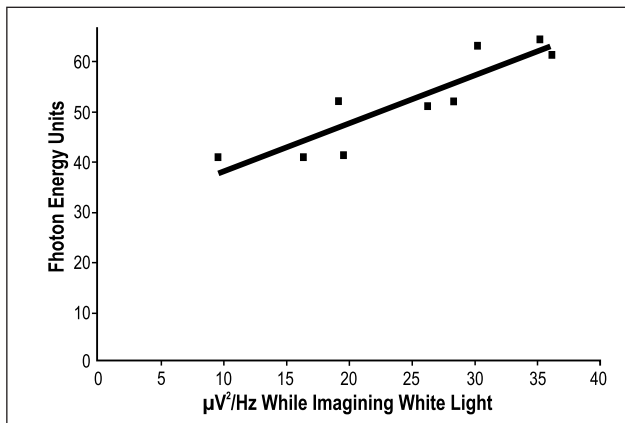
possible by regulated redox and bioluminescent reactions in the visual system during visual perception and visual imagery.

Rahnama M., Tuszyński J.A., Bókkon I. et al. [69] argued that, in addition to electrical and chemical signals propagating in the neurons of the brain, signal propagation takes place in the form of biophotons production. This statement is supported by recent experimental confirmation of photon guiding properties of a single neuron. The authors have investigated the interaction of mitochondrial biophotons with microtubules from a quantum mechanical point of view. Their theoretical analysis indicates that the interaction of biophotons and microtubules causes transitions/fluctuations of microtubules between coherent and incoherent states. The authors argued that the role of biophotons in the brain merits special attention.

To test Bókkon's hypothesis, four separate studies were conducted in the Persinger's laboratory.

The first experiment [70] with a psychic Sean Harribance demonstrated an increase of photon emission from his right hemisphere when he was "calling his angel" — engaged in the "interpretational state". Such visual imagery accompanied by activation of certain areas of the brain: increases of PSD in all lobes within the delta (1 to 4 Hz) and theta (4 to 8 Hz) range. The increases in power within the delta and theta band were most apparent over his right temporal lobe. The authors found a significant inverse correlation between the intensity of photon emission and intensity of the horizontal geomagnetic field (perpendicular to the temporal plane). Decreases over 10 to 15 s of 15 and 5 nT at 0.25 m and 1 m from the right side of his head were associated with the same magnitude of energy (10–11 J) that was associated with the net increase in photon emissions during that period. This energy, assuming each action potential is associated with  $1.9 \cdot 10^{-20}$  J, would be the equivalent of the activity of about 1 billion neurons (the human cerebral cortices contain in the order of 20 to 40 billion of neurons).

The second study [71] was conducted with the participation of 8 normal volunteers (ages 23 through 26; 4 men, 4 women). In the first experiment authors measured the photon emission from the right side of the head in the same plane as the temporo-parietal lobes. Instructions to think about white light (60 s) and project the light into the PMT along the right side of the head followed rest or "baseline" intervals (also 60 s, most of which involved either no recollection or thoughts about friends or studies) were given vocally from another room and repeated three times. The means for the PMT values for each of the 6 intervals (3 thinking about light, 3 not) were obtained for each subject. There was a statistically significant increase in ultraweak photon emission (UPE) while the subjects were thinking about white light compared to not thinking about light. This increase was noted for all 8 subjects. The net difference in energy emission between the two conditions ranged between 25 and 100 pW/m<sup>2</sup>. In general, from the time of the instruction to imagine white light to the first increases in photon emission above background fluctuations was about 4 s. During the 60 s intervals of imaging white light the durations of the elevations in UPE occurred in cycles of approximately 7–9 s peaks followed by 3–4 s troughs.



**Figure 21. Regression line and plot for the correlation between photon energy units (1 unit =  $5 \cdot 10^{-11}$  W/m<sup>2</sup>) measured by the PMT over the right hemispheres and EEG power (averaged  $\mu\text{V}^2/\text{Hz}$  for all bands) over the left prefrontal regions during intervals of “imagining white light”. These values were not correlated significantly during reference intervals (casual thinking) [71]**

This was not observed during the intervals of the reference condition. These fluctuations suggest that the averaged values for the UPE per 60 s interval may be underestimates of the peak output.

During the PMT measurements for the same instruction procedure in the second experiment (QEEG) was recorded 3 subjects. As can be seen in Fig. 21, the correlation between the average fluctuations in quantitative EEG power (sum of all bands) over the left prefrontal region for the intervals of “imaging light” and the fluctuations in UPE from the right hemisphere was 0.95 ( $p < 0.01$ ).

On the other hand, the energy for photon emissions was negatively correlated with the power within the beta band (13–20 Hz) over the right frontal ( $\rho$  and  $r = -0.65$ ,  $p < 0.05$ ) lobe with marginal effects over the right temporal lobe (T4,  $r = -0.40$ ,  $p < 0.10$ ). There was no significant correlation ( $r = 0.13$ ,  $p > 0.05$ ) between the energy of biophoton emission from the right hemisphere and the EEG power over the left prefrontal region during the intervals associated with not thinking about white light, i.e., thoughts about mundane events. At a distance of 0.15 m for this system, where 1 unit of increase is  $5 \cdot 10^{-11}$  W/m<sup>2</sup>, the increased photon emission while thinking of white light would be equivalent to between  $3$  and  $6 \cdot 10^{-12}$  J/s when the cross-sectional area of the cerebrum is accommodated. When divided by the essential quantum of  $2 \cdot 10^{-20}$  J/action potential [72] and assuming an average of  $\sim 20$  Hz per neuron, this would suggest that an additional  $10^7$  (on average) neurons within the cerebral cortices were activated during the imagining of light by the subjects. One argument that the photon emissions were functionally coupled to cognition was the strong correlation between the power spectra of the quantitative EEG during intervals when the light was being visualized and the absolute increase in UPE. The net change in EEG power associated with the range in photon density while imagining white light (vs. not imagining) was  $\sim 25 \mu\text{V}^2/\text{Hz}$ . When this value

is multiplied by the sum of 1 Hz increments within about 15 Hz (low beta band) the potential is 20  $\mu\text{V}$ . The net change in energy detected by the PMT during this activity was  $\sim 2 \cdot 10^{-9}$  W/m<sup>2</sup> or  $3 \cdot 10^{-10}$  J from the cerebrum at the measured distance. The quotient of energy to voltage would be  $\sim 10^{-5}$  A s or the equivalent of 1014 charges. With the summed movement of about  $10^6$  to  $10^7$  ions across a membrane [72] to produce an action potential, this would involve about  $10^7$  to  $10^8$  neurons. A particularly intriguing observation was the strong positive correlation between EEG power from the left prefrontal region and UPE from the right side of the head but negative correlation between frontal and temporal EEG power (within the beta range) over the right hemisphere and UPE. The left prefrontal positive correlation is consistent with the volitional and intentional nature of the task. However, this inverse relationship between cerebral fluctuation in electroencephalographic voltage and photon levels from the right hemisphere would be consistent with the principle of conservation of energy.

The third study [73] was conducted with the participation of 2 normal volunteers (non-meditators) and one meditator. It was shown that the real time absolute values of the correlations between photon emissions and electroencephalographic power were moderately strong and indicated that the fluctuations in amplitudes of photon emissions and the ratio of alpha/beta activity shared about 25 % of the variance. This association was found primarily between whole right hemispheric photon emission and the electroencephalographic power within a specific region of the brains: the right prefrontal-central areas. However, it is noteworthy that a decrease in photon emissions was also recorded, more pronounced in both non-meditators, and moreover, with the same magnitudes of the correlation coefficients, their signs were opposite. The results of the coupled, real-time measurements of the changes in the Earth’s magnetic field intensity at 25 cm from the right side of the meditator’s head and concurrent photon emission were similar to the measurements of Sean Harribance [70] while he focused upon the “inner light” during which time he reported information about others. The slope of the equation indicated that for every  $0.5 \cdot 10^{-11}$  W/m<sup>2</sup> increase in photon emissions from the subject’s right hemisphere there was 10 nT decrease in the intensity of the Earth’s magnetic field in the horizontal plane.

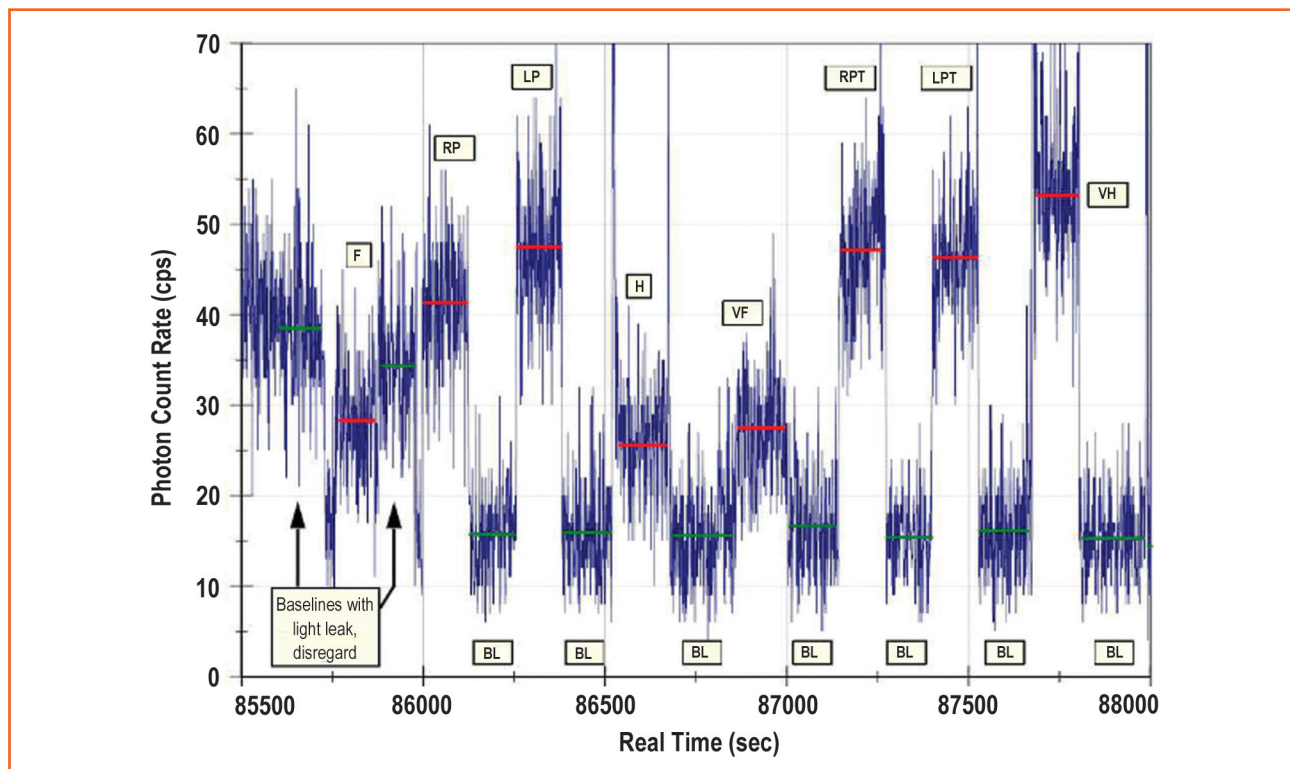
The subject of fourth experiment [74] was a 28-year-old female graduate student in psychology. She has been a meditation practitioner for approximately 5 years and a level II Reiki practitioner for two years. She was asked to think about sending light out from her consciousness into the sensor of the PMT for about 2 min which was followed by 2 min of relaxation. The procedure was repeated four times with a rest of about 5 minutes between the 2 min–2 min pairs in order to reset some of the equipment (from outside of the chamber). The numbers of photons were sampled 50 times per second (20 ms  $\Delta t$ ) while the EEG data from all sensors were sampled at 250 times per second. The geomagnetic field measures were sampled 3 times per second. The differences in collection times were limited by the software associated with the different equipment. Authors selected 2 min

sequences for measurement rather than 30 s, employed in previous studies, to ensure time for the cognitive processes to maximally affect the photon emissions. There was marked increase in power within the delta (1 to 4 Hz) band and the low beta to gamma band (13 to 35 Hz) associated with bilateral activation within the para-hippocampal gyri within both hemispheres during periods when light was imagined compared to the non-imagining intervals (rest periods). One way analysis of variance indicated there was significantly more power within this band during the imagining compared to the “non-imagining” periods. Only during the first 15 s of each of the 4 trials where white light was imagined was the photon emission significantly higher than the equivalent first 15 s of the resting trials. This is in excellent agreement with our data on changes in the light activity of water treated by sender’s [44]. The correlation ( $r$ ,  $\rho$ ) between the change (nT) for the horizontal component of the geomagnetic field and the numbers of photon counts for the 2 min intervals was strongly negative ( $-0.90$ ,  $-0.83$ , respectively). This effect was similar to what the authors have measured in two previous studies [70, 73]. The decrease in the change of the intensity in the geomagnetic field was clearly associated with an increased cerebral photon emission. The mean decrease in range during the intervals of imagining white light was about 7 nT [74].

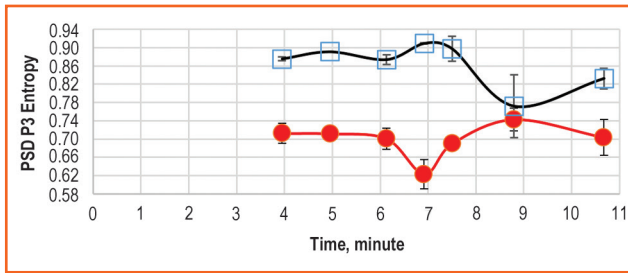
Rubik B. & Jabs H. [75] conducted a unique experiment involving a 54-year-old male. He is a highly experienced practitioner and teacher from the International Academy of Consciousness (IAC). The IAC develops and teaches techniques that help people achieve out-of-the-body states

to explore the multidimensionality of consciousness. One technique is the voluntary energetic longitudinal oscillation (VELO). To perform VELO, one continuously mobilizes an energetic pulse in complete, successive, longitudinal cycles up and down the whole body length, with the objective of producing a cohesive, stationary wave that encompasses the entire energetic body. Induction of the VELO may lead to the vibrational state, considered by the IAC one of the most fundamental resources of lucid psychic self-control. In this case study, the subject was first measured in his ordinary state of consciousness and then while performing VELO. Measurements were made for two minutes at each bodily region alternating with baseline measurements as previously described. The raw data from the PMT are shown in Fig. 22.

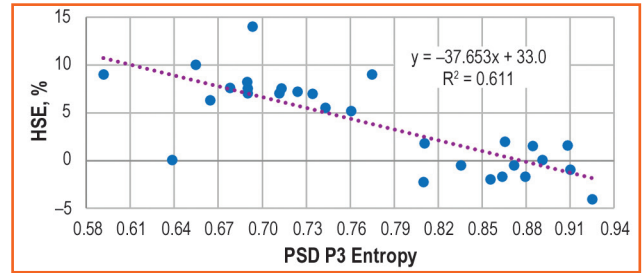
The facts presented give us strong grounds to assume that KKK and prayer was also accompanied by an increase in the emission of biophotons. Unfortunately, we cannot provide direct evidence. Alternative, but much cheaper methods of assessing biophoton emission are methods based on the Kirlian effect [76, 77]. The method of color coronal spectral analysis on a device with an electrode made of polyethylene terephthalate with applied electric voltage 15 kV, electric impulse duration 10  $\mu$ s, and electric current frequency 15 kHz detected the specific photon emission from part of the human thumb as a spectrum of various colors. It was established that photons corresponding to a red color emission of visible electromagnetic spectrum have energy at 1.82 eV. The orange color — 2.05, yellow — 2.14, blue-green (cyan) — 2.43, blue — 2.64, and violet — 3.03 eV. The reliable result measurement norm was at  $E \geq 2.53$  eV,



**Figure 22. Session with subject 5 showing biophoton emission (cps): BL – baseline; F – forehead; RP – right palm; LP – left palm; H – heart; VF – forehead during VELO; RPT – right palm transmitting energy during VELO; LPT – left palm transmitting energy during VELO; VH – heart during VELO [75]**



**Figure 23. Patterns of SPD P3 entropy ( $M \pm SE$ ;  $n = 2$ ) during KKK and Reiki sessions**



**Figure 24. Scatterplot of correlation between sender's SPD P3 entropy and rat's HSE during sessions**

while the spectral range of the emission was within 380–495 and 570–750 nm. The incidence of bioelectrical activity of the body reducing the intensity of gas discharge glow. Pathology in the organism and surrounding tissues also alter the bioelectric activity and the shape and color of gas discharge glow. If the value is over 2.54 eV this is an indicator of normal bioelectrical status. Some people with high energy status possess the values of photon emission over 2.90 eV. The high values of this parameter are possible with practicing yoga, sport etc. [78]. Authors found, first, higher than normal level of biophoton emission from the thumb of the Bulgarian healer Dimitar Risimanski (3.03 vs. 2.64 eV), and second, his ability to increase the patient's low biophoton emission from 1.94 to 3.00 eV. It is unfortunate that authors did not indicate whether the increased level of biophoton emission was permanent (which is unlikely given the data from Persinger's laboratory), and if it was increased before the healing session, then by what means?

So, at least in three laboratories, using at least two methods, it has been documented that mental exercises are accompanied by an increase in the emission of biophotons from the surface of at least the head and palms of even ordinary people, not to mention meditators, psychics, and healers. Four separate experiments of the Persinger's laboratory documented concomitant changes in EEG, naturally quantitatively related to the emission of biophotons.

Rastmanesh R. & Pitkänen M. [79], based on the studies we cited, wrote: hence one may argue that biophotons — or whatever is behind them — propagating along pathways parallel to axons analogous to wave guides could serve as carriers of neuronal and biological information. This would force the views about the role of nerve pulses to be challenged. Liu N., Wang Z., & Dai J. [80] generated three kinds of ultraweak lasers, called as simulated biophotons, with different spectra (red: 650 nm, green: 532 nm, and blue: 405 nm) and intensities to implement intracellular stimulation in a single nerve cell of the hippocampal areas in mouse brain slices combined with intracellular membrane potential recording and biophoton imaging techniques. The low, medium, and high levels of simulated biophotons radiated from the tip of the optic fiber within the micro-glass tube were evaluated with the ultraweak biophoton imaging system, and the relative gray values (RGVs) were approximately 900, 1800, and 3600, respectively, of which the high intensity was approximately 12 times the average intensity level of biophoton emissions in a mouse brain slice

induced by 50 mM glutamate [81, 82], since biophoton intensity can be considerably higher inside cells than outside [68]. Authors found that the simulated biophoton stimulation can lead to transsynaptic biophotonic activities and transmission in the ipsilateral and contralateral projection circuits in the hippocampus. The activity and transmission characteristics were related to the spectra and intensities of the simulated biophotons but not to the levels of membrane potentials before stimulation. These findings present specific characteristics of neural biophoton signal transmission, which may be involved in the mechanisms of processing, encoding, and storage of neural signals as well as explain our data [80].

However, judging by the correlation coefficients, the information factor, in particular the entropy of neurons that project to the C4, C3, P4, P3, and T3 loci as well as neurons of the autonomic nervous system, turned out to be an even more powerful factor of the sender's neurotropic effect than the biophysical (energetic) one. The degree of determination of HSE by entropy was 93.2 % (Table 4, Fig. 12).

The most congruent with the patterns of rat's HSE during two KKK and Reiki sessions were the patterns of SPD entropy in P3 loci (Fig. 23), which was confirmed by correlation analysis (Fig. 24).

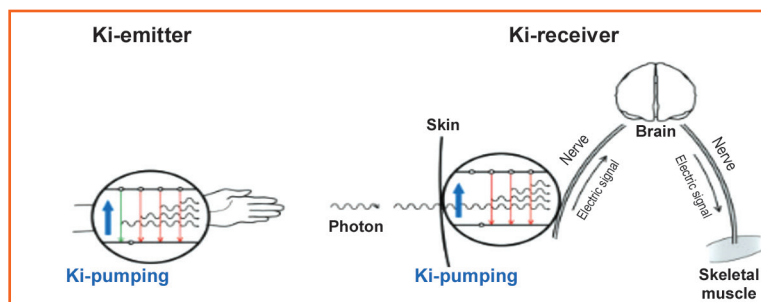
It is time to move to considering the original hypothesis of Ohnishi S.T. & Ohnishi T., announced in the introduction. There was reports that Qi-energy may have components represented by electrostatic energy, magnetic energy, low frequency sound energy and so on [83–86]. A Chinese Qigong research group found that Qi-energy has an infrared component [87]. This was confirmed by Japanese scientists [83]. Ohnishi S.T. et al. [10] also observed that Ki-energy seems to have a component of near infrared radiation because it was blocked by a black acrylic plate and aluminum foil. It was blocked by an optical filter in the visible range (400–760 nm) but not blocked by a filter in the near-infrared range (800–2700 nm) [10, 11]. For the outdoor reflection experiment, authors used a 3 mm thick acrylic mirror in which the light had to travel through an acrylic layer of 8.5 mm. Since the transmittance spectrum of a similar acrylic plate (9 mm thick) had a cut-off wavelength around 1600 nm, they concluded that the wavelength of Ki-energy should be shorter than 1600 nm. Combining with previous results [11, 13], the wavelength range would be between 800 and 1600 nm. Authors decided to further narrow down the Ki-wavelength. They used a linear variable interference filter

which can cover from 400 to 1100 nm and found that the Ki-energy had a peak around 1000 nm [2]. Since authors did not measure the wavelength between 1100 and 1600 nm, they concluded that there is still the possibility that another Ki-wavelength peak may exist, however, at this point, it is possible say that Ki-energy has, at least, one peak wavelength at around 1000 nm. We are delighted to note that this data has been confirmed in a high-tech study by Wang Z. et al. [88]. Combining the ultraweak biophoton imaging system with the biophoton spectral analysis device, authors found that glutamate-induced biophotonic activities and transmission in the brain, which has recently been demonstrated as a novel neural signal communication mechanism, present a special red ship from animals (in order of bullfrog, mouse, chicken, pig, and monkey) to humans, even up to a near-infrared wavelength (~ 865 nm) in the human brain, in comparison from 691 nm in bullfrog to 806 nm in monkey!

Another interesting result of Ohnishi S.T. & Ohnishi T. [2] experiment was that a Ki-beam seems to have a small divergence angle. It was rather surprising that the intensity of the Ki-beam did not decay too much at 100 m. Authors observed that the receiver's body moved both with and without the blindfold, indicating that the Taiki-reaction was caused by neither psychological nor hypnotic effects. All of their results suggest that Ki-energy has the following properties: 1) the Ki-beam is directional with a small divergence angle and can be aimed in a desired direction; 2) the beam can be reflected by a mirror; 3) Ki-energy may have a specific wavelength. All of these properties are characteristics of laser light. Thus, Ohnishi S.T. & Ohnishi T. [2] hypothesized that our bodies could emit laser light (Fig. 25).

The hypothesis is based on the fact that an essential secret in the practice of NBM is to keep the muscles of our bodies completely relaxed. If the emitter's hand is stiff, the Ki will not be released. Our skeletal muscle has a repeating striation of approximately 2500 nm, and the length of a thin filament (actin filament) is 1000 nm. If these repeating structures of skeletal muscle can cause a standing wave with a wavelength of 1000 nm, this can enhance the "laser" radiation. Therefore, skeletal muscle can serve as a "resonator of light".

Ohnishi S.T. & Ohnishi T. [13] note that in the Taiki-practice, the most interesting observation is that one can transfer information through Ki. An important concern in this five sense-independent communication is that the information is not a form of energy. It is a physical quantity called entropy as Shannon C.E. [41] described it. Energy and entropy are two different physical quantities. The relationship between information and negative entropy in living cells was first pointed out by Schrödinger E. [89], one of the key figures in the development of quantum physics. Of course, living beings require energy for their growth,



**Figure 25. Hypothetical diagram for Ki generation and Ki transmission [2].**

**Ki-emitter side.** The electron distribution of chromophores in the emitter's hand (or fingers) is in the state of 'population inversion' by the Ki-energy of the emitter (Ki-pumping as indicated by a blue arrow). This will trigger "stimulated emission" of photons in the near infrared region. **Ki-receiver side.** The electron distribution of chromophores in the Ki-receiver's skin is also in the state of "population inversion" by his/her own Ki-energy. Then, the incident photon would trigger the "stimulated emission", through which the incident light energy would be amplified by the same mechanism as in the Ki-emitter. When the energy becomes sufficiently high through the amplification process, this would excite the central nervous system to reach the brain. Subsequently, the brain would send out signals to skeletal muscle to respond to the signal [2]

activity and reproduction. However, without information, they do not know how to grow, how to act and how to reproduce.

Ohnishi S.T. & Ohnishi T. [13] cited the Shinagawa Y. [83] who discovered that a Qigong healer emitted information. His group found that the brain wave activity of a volunteer who sat down in front of a Qigong healer synchronized with that of the healer. He also observed that when the healer sent his Qi-energy, the subject lifted her hand. He was so surprised to see that information was dispatched by the healer, transmitted through the air and received by another individual. Actually, Shinagawa Y. had witnessed a Taiki-effect. Next authors cited the Machi Y. [84] who observed that infrared radiation (from 0.8 to 25 mm) was emitted from the hand of a Qigong healer, and that its amplitude was modulated with a low frequency of 1.2 Hz. He hypothesized that the information from the healer may be conveyed by the amplitude modulation of the infrared radiation. Ohnishi S.T. & Ohnishi T. [13] concluded that this is an interesting idea, however, if the information is carried by amplitude modulation of 1.2 Hz, then the time resolution of the information would be on the order of 1.2 s or longer. In the Nishino's Taiki-practice, his students respond to his instruction almost instantly. When Nishino sends signs to run or to stop, a student responds to it immediately, even though he/she was facing the opposite direction so that he/she could not see Nishino (observers can see both Nishino's gestures and student's responses). If it is not an amplitude modulation, then it may be either frequency modulation or digital modulation. Authors cited that many Chinese scientists regarded Qi as a real substance flowing in our body, which can be represented by mass (m). On the contrary, most Japanese scientists treated Ki as energy (E), except for Shinagawa Y. who considered it to be information. Ohnishi S.T. & Ohnishi T. [13] would like to propose that Qi or Ki has both physical quantities of energy (E) and entropy

(S) (according to Einstein A., both  $E$  and  $m$  are the same physical entity, because  $E = mc^2$ ).

Coincidentally or naturally, in our study the coefficient of determination of rat's HSE by sender's entropy (both EEG & HRV and EPI) even slightly exceeded that by SPD. That is, the influence of the information factor on rat's HSE is even stronger than the biophysical one. By the way, purely mathematically, the decrease in EEG entropy reflects the decrease in the percentage of SPD of beta rhythm. SPD of beta rhythm, in turn, positively correlates with the entropy of EPI R, R(f) and F(f) ( $R = 0.950$ ), but negatively with SPD of delta, alpha and theta rhythm in many loci ( $R = 0.995$ ). Thus, the decrease in EEG entropy is associated with an increase in the PSD of non-beta rhythms. Since it is difficult for us to understand how it is possible to enhance the influence of a factor on some physiological process by reducing the strength of this factor, we consider the operating factor not to be entropy, but Negentropy, which is consistent with Schrödinger's concept. The question of how information/negentropy can affect a living object in general and a neuron in particular goes far beyond the scope of this study. Let us limit ourselves to the assumption that the objects of information influence can be: water on both sides of the cell membrane of a neuron, ion channels, enzymes, nucleic acids, etc.

It is time to demonstrate the ability of our colleague Dimitar Risimanski to influence the biophysical state of water. Color Kirlian images of water droplets of different types of water are studied with method of color coronal spectral analysis [78]. The photographing of the coronal spectrum is one of the physical methods in which the image has a much better quality on photographic film, than the electric images filmed with digital methods and with Polaroid. The dielectric permittivity of water is high and this is important for its properties as a solvent. Coronal images of water droplets show that different water perceives differently the electric field. Authors compared the color coronal glow on photographic film of water drops from the control sample from deionized water and deionized water after the bioinfluence of Dimitar Risimanski. The photon emission of the drop from the control sample is 2.07 eV while from the treated sample is 2.71 eV. Thus, there is increasing photon emission after the influence of Risimanski with 0.64 eV. It is the proof for increasing electric permittivity as result of restructuring of water molecules after bioinfluence of Dimitar Risimanski. There are the following effects as results of restructuring of water molecules and reliable extremums in water spectrum — improvement of nervous conductivity, anti-inflammatory effect, inhabitation of development of tumor cells of molecular level. Experiments with the electric glow of water droplets prove the self-organization as a result of the polarization of water clusters with a tendency to store information in a living cell. Coronal glow is basically related to dielectric permittivity and respectively the polarization of the water clusters from an electric field. A parallel spectral analysis of water shows that the water with the more pronounced electrical images has more pronounced peaks in the spectrum.

But what exactly does the light activity of water reflect? The result, which is recalculated with the “differential non-equilibrium energy spectrum of water” (DNES) method,

show the increasing the values of the energy of hydrogen bonds after the bioinfluence of Risimanski [78].

Thus, there are good reasons to assume that KKK causes a significant increase in the electrical activity and negentropy of neurons in some structures of Babelyuk's brain, which is accompanied by an increase in the emission of biophotons by neurons and their negentropy. According to Persinger's laboratory, biophotons, penetrating through the bones and scalp, fall into distilled water placed in front of the operator. However, referring to the experiments of Rubik B. & Jabs H. [75], we consider the situation more realistic that brain biophotons are transferred through the meridians (Bonghan system) to the acupuncture points of the fingers [51] and from there through air and glass into the water located both in ampule and in tray with the rat hippocampus slice. Both Valeriy Babelyuk and Dimitar Risimanski as well as Father Volodymyr through different, but essentially related in visual imagery, mental practices are able to change light activity of water.

We recently showed that distilled water, treated by KKK, had a significant effect on the EEG of five receivers [78]. A paper on the effect of KKK on the EEG of other receivers is also in preparation for publication.

## Conclusions

During KKK sessions, EEG recordings revealed a marked enhancement in alpha and delta band power, with the most pronounced increases observed in the temporal (T3, T4), parietal (P3, P4), and occipital (O1, O2) regions as well as decrease in beta band power and spectral entropy. KKK induces a statistically significant increase in hippocampal synaptic efficacy in rat. Multiple EEG features predict hippocampal activity with high statistical precision. EEG spectral power density explain 88 % of the variance in hippocampal activity. Beta EEG activity negatively correlates with hippocampal efficacy, except in T4 region. There is a robust negative correlation between EEG and HRV entropy in the sender and the synaptic activity in the receiver (rat model). EEG and HRV entropy jointly explain over 93 % of the variance in hippocampal activity. Entropy reduction reflects systemic negentropic (ordering) influence of KKK practice. KKK functions as a multilevel psychophysiological modality with measurable systemic coherence.

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## Нейротропні та біофізичні ефекти ментальних практик. Зосередження на кіокушинкай карате ката

**Резюме. Актуальність.** У східних бойових мистецтвах описується безконтактний психічний вплив на партнера, який часто асоціюється з поняттям енергоінформаційного обміну. У цьому контексті особливо варто відзначити практику кіокушинкай карате ката (ККК). **Мета:** дослідити нейрофізіологічні та біофізичні механізми, що лежать в основі впливу ККК на активність мозку відправника та фізіологічний стан приймача, як на тваринній моделі (зріз гіпокампа щура), так і в небіологічній системі (дистильована вода). **Матеріали та методи.** Було проведено три експерименти: 1) електроенцефалографію (ЕЕГ), варіабельність серцевого ритму (ВРС) й електрофотонне зображення/газорозрядну візуалізацію (ЕФЗ/ГРВ) реєстрували в майстра ККК та практикуючого спеціаліста Рейкі; 2) синаптичну ефективність у зрізі гіпокампа щура вимірювали під час дистанційних психічних втручань; 3) світлову активність дистильованої води, індуковану газовим розрядом, аналізували після впливу ККК та канонічної християнської молитви при освяченні води. Аналіз даних включав обробку сигналів ЕЕГ, ВРС й ЕФЗ, розрахунки ентропії, кореляційний, канонічний, множинний регресійний та дискримінантний аналізи. **Результати.** Практика ККК, але не Рейкі значно збільшувала щільність спектральної потужності (ЩСП) дельта-, альфа- і тета-ритмів ЕЕГ, переважно в скроневих і тім'яних локусах, натомість знижувала ЩСП бета-ритму, найбільшою мірою у фронтальних, префронтальних і центральних локусах,

зменшувала як спектральну ентропію, так і ЕФЗ-ентропію і покращувала енергетичні характеристики ЕФЗ. Дистанційний вплив ККК викликав помітне зростання синаптичної ефективності гіпокампа щура ( $+7,5 \pm 5,1 \%$ ), тоді як Рейкі було неефективним ( $-0,5 \pm 4,8 \%$ ) (середнє  $\pm$  стандартне відхилення). Виявлено сильні канонічні кореляції між параметрами відправника під час сеансів та змінами синаптичної ефективності гіпокампа щура як приймача:  $R = 0,936; 0,931; 0,913$  та  $0,959$  із ЩСП ЕЕГ, ентропією ЕЕГ, ентропією ЕФЗ, ЕЕГ та ЕФЗ загалом відповідно. Як ККК, так і християнська молитва підвищували світлову активність дистильованої води, але лише у випадках, коли вони збільшували ЩСП дельта-ритму й знижували ентропію ЕЕГ і енергію третьої віртуальної чакри. **Висновки.** Результати підтверджують запропоновану гіпотезу про дуалістичний біофотонний (енергетично-опосередкований) та негентропійний (інформаційно-опосередкований) механізм, що лежить в основі нейротропних ефектів ККК, які можна спостерігати за об'єктивними нейрофізіологічними й біофізичними параметрами. Порівняно з іншими ментальними практиками ККК продемонстрували більш виражений, ніж Рейкі, або рівний з молитвою системний вплив.

**Ключові слова:** ментальні практики; кіокушинкай карате ката; Рейкі; молитва; ЕЕГ; ЕФЗ/ГРВ; ентропія; енергоінформаційна взаємодія; зріз гіпокампа щура; синаптична ефективність; світлова активність води; нейрофізіологія