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# COMPLEX BIOELECTROGRAPHIC APPROACH TO STUDY OF ALTERED STATES OF CONSCIOUSNESS

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Using complementary potentialities of modern computerised technologies - digital electroencephalography, registration of concentration-kinetic potential of acupoints and evoked energy-emission activity - bioelectrographic correlates of the Altered state of consciousness after systematic mental training have been studied. It was demonstrated statistically reliable correlations between different bioelectrographic parameters and their correspondence to the profile of mood states. For the first time the phenomenon of phase activation of energy-emission processes during mental activity in the Altered state of consciousness has been discovered. The obtained data have been analysed according to the specificity of the neurophysiological and mental mechanisms of altered states of consciousness.

## INTRODUCTION.

The main objective of this research carried out within the international project "Mental Training for Sport and Life", was to study the bioelectrographic correlates and the psycho-physiological mechanisms of an altered state of consciousness (ASC) during a systematic mental training. It is agreed nowadays, that many of the mental training modalities widely used in healing and creative work are based on the heteroinduction or self-induction of ASC [Unestahl and Bundzen, 1996, Tiller, 1997, Gerber, 2000]. This relates particularly to the Swedish mental training program gaining popularity today [Unestahl, 1997]. The study of the brain mechanisms of ASC and the development of new practical techniques for this purpose seems to be a very important task. It may be solved by using complex Bioelectrography approach which is based both on different brain mapping methods (EEG, PAT-scan, etc.) and techniques which measure the distribution of bioelectrography parameters throughout the body (acupoint measurements and Gas Discharge Visualisation (GDV) Technique). Taking into consideration the long periods of preparation and training required for every participant on the one hand, and the individual character of a particular person's reaction on the other hand, we are not expecting a high level of statistical repeatability of the quantitative data but are rather looking for the common trends in bioelectrography patterns and activity. These trends are best revealed using computer processing and modelling.

## MATERIALS AND METHODS

**Mental training, modelling and control of ASC.** The experiments were performed in Sweden and Russia from 1996 to 1999 using authentic versions of the Swedish mental training program. The participants of the study consisted of 61 healthy volunteers ranging in age from 17 to 23. The control group included 56 subjects not engaged in mental training. The ASC self-induction training technique (independently on the language version of the mental training audio-program) took approximately 7±2 weeks. The time required and the depth of the altered state was related to the degree of hypnotizability. Hypnotizability was measured using the Stanford scale. According to the Swedish experts, healthy people engaged in mental training for at least 2 years are capable of acquiring ASC rapidly and maintain the state for extended periods of time.

Audio-programs from the Swedish mental training program, including the stages of body relaxation, mental relaxation-1 and mental relaxation-2, were used for this study. The sessions were carried out three times a week for seven weeks. The basic audio-program "Mental relaxation –2" included a series of the following fragments: body relaxation - 4'30"; attaining ASC (ASC-1), - 4'; mental activity

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while in ASC (ASC-2) - 4'50", leaving ASC or mental relaxation -1'30". All exercises were backed by musical pieces from "AVSLAPPINGSMUSIK" by L-E. Unestahl.

During a given session the subjects practiced active mental imagination following the audio-program contents. The specific goal of the mental imagery was to merge with nature and to absorb solar energy. The participants in the control group were listening to the stereo-recording of the ocean waves sound for 14'50".

**Psychological evaluation.** To monitor the psychological state of the participants and the process of obtaining ASC, self-reports of the patients, linguistic test [Spivak, 1986] and "Profile of Mood States" (POMS) diagnostic test [McNair 1992] were used. Russian adapted and verified version of POMS, developed by P. Bundzen was applied for Russian participants. The parameter, characterizing relative psycho-energetic readiness (hereinafter PEPR) was determined by a formula:

$$PEPR = \frac{V}{\frac{\sum\left(A_n + D + A + F + C\right)}{5}},$$

where: A – Aggression, $A_n$ – Anxiety, C – confusion, D – Depression, F – Fatigue, V – Vigor – standard scales of POMS.

**Computerised electroencephalography.** Spectral analysis of electroencephalograms (EEG), analysis of the spectral coefficients of local activation and fractality analysis of EEG spectra were used for 29 participants. Recording of EEG was carried out using 16 cup electrodes, connected with loop electrodes and settled strictly according to the 10/20 system. Each patient was reclining in a comfortable chair with the eyes closed. Visual control was carried out on a video monitor to remove artefacts before processing the EEG fragments. 12-channel digital EEG recordings with 256/sec digitalisation were used. EEG measurements were taken both during heteroinduction and selfinduction of ASC.

During the first stage of processing, Brain Electrical Activity Mapping (BEAM) was carried out using the following EEG characteristics: $F_3$, $F_4$, $F_7$, $F_8$, $F_3$, $C_3$, $C_4$, $C_Z$, $T_3$, $T_4$, $T_5$, $T_6$, $P_3$, $P_4$, $P_Z$, $O_1$, $O_2$.

For the spectral analysis at least 15 non-artefact, two-second EEG recordings were selected. The standard frequency bands of EEG analysis - delta, theta, alpha, beta-1 and beta-2 – were used. After Furies-processing, based on two-second recordings, matrixes of the averaged power according to the EEG frequency components for each band zone were built. The matrixes were built for each patient according to the following patterns: background, body relaxation, mental relaxation (ASC-1), mental activity (ASC-2) and post-action. Both individual data and average data of the experimental (15 patients) and control (14 patients) groups were analysed.

Statistic analysis was carried out on matrixes of the averaged power according to the EEG frequency components. The following parameters were analysed:

1. changes in the average power of the EEG spectrum components during the mental state transformations.
2. changes in the absolute value of the spectral coefficients of local activation during the mental state transformations. Coefficients of spectral activation were calculated according to the method proposed in [Pavlova and Romanenko 1988]. Patterns of cortical activation were determined which reflect the distribution and relationships between local activation coefficients in the analysed brain regions [Bundzen et al, 1996].
3. fluctuations and fractality attractors in the EEG power spectrum as a punctuation of the mental state: passive state (D-mode) and ASC (A-mode) [Yoshida, 1991].

**Quasi-DC potential (QDCP).** Digital registration of QDCP of the milli-Volt range was carried out using a two-channel microprocessor tester [Bundzen and Kozevnicov, patent №20113775, 1994]. Input resistance of the constant current amplifier was 100 Mom, the range of the registered potential ±100 mV. Quantisation of QDCP recordings took 3 seconds per recording channel. Disposable silver-chloride electrodes from "Medico Teknik" (Denmark) were used. Polarisation of the electrodes did not exceed 2,2 mV per hour. Bipolar leads were used: frontal leads on the right and left forehead sides and corresponding hand tenor. Information was decoded using either a digital display tester or an IBM computer.

**Functional state of meridianal acupoints (AP).** To study the functional state of AP of 12 acupuncture meridians, the computerised "Nakatany" system designed by Electron Medicine Systems (Saint Petersburg) and the "Zodiak" system [Zagrantcev et all., patent №2100960, 1998] were used. The following parameters were used for the analysis:
functional AP index:

$$B = n_{norm} / N$$

where N – number of AP measured; $n_{norm}$ – number of AP, characterised by the current parameters in terms of the physiological norm (80±10 mkA);
balance between the current parameters of AP of the left-side and right-side meridians:

$$B_{LR} = \frac{\sum X(i_R) - \sum X(i_L)}{\sum X(i_R) + \sum X(i_L)} \times 100\%$$

where $i_R$ and $i_L$ are currents, measured on the right and left side of the body, correspondingly;
balance between the AP current parameters, referring to the Ying and Yang meridians:

$$B_{YI} = \frac{\sum X(i_Y) - \sum X(i_I)}{\sum X(i_Y) + \sum X(i_I)} \times 100\%$$

where $i_Y$ and $i_I$ are currents, measured on the Yang and Yin acupoints, correspondingly.
Good value for both balance coefficients is 0% within +/- 5%.

**Energo-emission Intensity (Kirlian effect).** Integral intensity of glow of the energy-emission activity was measured using the "Sigma 10" device ("PEPKIN ELMER" company) and video-recordings of the digital parameters. The stimulation generator had the following parameters: single impulse duration – 10 mcs; repetition frequency – 100-1000 Hz; induction interval – 0,5 s; electrode voltage – 15 kV. System photosensitivity in 215-650 nm ranges was no less than 97mcA/lm.

**Evoked energy-emission activity (GDV technique).** "GDV Camera" instrument designed by the "Kirlionics Technologies International" allowed quantative estimation of the evoked energy-emission patterns (GDV-grams) with calculation of the following parameters:

- integral parameters – glow area, normalised glow area, number of fragments, spectral distribution, background level of noise;
- fractality parameters – form coefficient and fractality according to Mandelbrot;
- probability parameters – entropy, an autocorrelation function;

## EXPERIMENTAL RESULTS AND DISCUSSION

### INDIVIDUAL PSYCHO-EMOTIONAL STATUS CHANGES UNDER SYSTEMATIC MENTAL TRAINING INFLUENCE

Researches into psycho-emotional status (hereinafter PES) were conducted for all the participants three times during the mental training course: before the beginning of the program, after the basic course (three weeks), and upon the whole course completion (seven weeks).

Averaged data of POMS scales values diversity for the experimental group are represented on fig.1. According to the data provided, the mental training basic course, mainly, has an influence upon PES. The POMS profile is getting close to the well-known "ice-berg" model as the "Vigour" parameter is dominant and the PEPR parameter is ever changing ($p<0,001$) in statistically reliable manner. According to POMS modifications, we can conclude also that the mental training course results in individual statistically reliable stress-tolerance development. Moreover, not only stress-tolerance factors, but also psychosocial adaptation values are under positive change. For the control group it was found no significant changes in the POMS curve profile during the same period of seven weeks.

It is important to point out, that similar POMS factors variations are accompanied by reliable stress-hormone (cortisole, dehydroepiandrosteron) level modifications and immunity improvement [Bundzen et al,1998].

Testees' self-reports completely confirm the discovered POMS modifications by emphasising the development of such qualities as "Cheerfulness", "Alertness", and "Vigor". Stress-profile changes demonstrate statistically reliable increase of stress-tolerance (fig.2).

Basing upon data received and analysed, it is possible to sum up that the systematic mental training course has integrated psycho-dynamic effects, including testees' stress-tolerance increase, psychosocial adaptation rise, and strongly pronounced psycho-energetic effects.

## BRAIN BIOELECTRIC ACTIVITY

Statistic analysis of the averaged power values of the EEG spectral components demonstrated that experimental subjects in an ASC revealed the following statistically significant distinctive features absent at the control group:

1. in the process of mental relaxation while in the ASC (ASC-1) statistically reliable increases in theta and alpha activity in the following regions of the frontal cortex were registered: $F_3$, $F_4$, $C_3$, $C_4$, $T_6$, $O_1$ ($p < 0,05$);
2. during active imagination (ASC-2) the decrease in power of alpha-activity power in the retrocentral zones of the cortex was observed: $T_5$, $T_6$, $P_3$, $P_4$, $O_1$, $O_2$ ($p < 0,05$-$0,01$). Simultaneously beta-1 activity increases in the right-lobe zones $F_4$ and $F_8$ ($p < 0,05$). These changes lead to the levelling off of alpha-activity with a frontal-occipital trend. Besides, among the majority of the patients the given changes were followed with splitting the peak of the dominant alpha-rhythm frequency in $P_3$, $P_4$, $O_1$, $O_2$ into two peaks: low frequency (6,8±0,3 Hz) and high-frequency (11,0±0,4 Hz). The dominant frequencies occurred in the ratio 1,61±10%.

It is noteworthy, that during active imagination in ASC-2 the EEG power spectrum profile, both of the anticentral and retrocentral zones, statistically followed the function l/f. The attractor of the spectrum subdominant frequencies (delta, theta, alpha and beta-1) had a ratio of 1,61±10% (fig.3, Table 1). This ratio is well known in the literature as the "golden mean". It should be noted, that a similar structure of the EEG spectrum was discovered previously during modelling of positive mental states [Yoshida et al, 1991], and fractal l/f fluctuations in the EEG spectrum were considered as the reflection of a general biological integration and harmonisation mechanism of the functional cortex systems [Korotkov and Krizanovsky, 2000].

The above-mentioned, as well as the fact that the EEG spectrum in ASC-2 was characterised by the polyharmony of frequency components, allowed the assumption of a possible increase in "harmonic resonance" in the process of activity in ASC [Oschman, 2000].

The second stage of the study of ASC neurodynamic correlates was the analysis of the dynamics of system-structural transformations of cortical activation, based on the application of a method, well-known in applied psychophysiology – calculation of the spectral activation coefficients (SAC – fig.4,).

The mapping of the dynamics of changes in cortical activation according to the SAC values testified to the statistically reliable transformation of both front–occipital and bilateral asymmetry of the brain in the process of ASC-2 (fig.4, fragment 3).

Stability of the given processes was determined, mainly, by the duration and systematic character of mental training and was not dependent on the hypnotizability of a patient. Thus, in the process of ASC, transformation of the brain's dominant system-structural organisation, characteristic of a regular state of consciousness (D-mode), transition into a state of "non-dominant activation" (A-mode), characterised by the symmetry of brain lobe activation, took place. With this, leaving ASC, the restoration of the dominant system-structural organisation was observed, although, maximum activation was shifted to the anticentral and central structures of the right lobe (fig.4 , fragment 4).

The analysis of quasi-DC potential (QDCP) during consciousness transformation in ASC-2 revealed the disappearance of bilateral asymmetry in the milli-Volt band. This allowed the assumption for the participation of a super-slow controlling system in the system-structural reorganisation processes of brain activity during transformation into ASC (fig.5). In the control group statistically reliable changes in the spatial organisation patterns of spectral activation coefficients (SAC) and QDCP were not observed. Among some of the patients, the decreases in SAC absolute values and levelling of QDCP bilateral asymmetry were observed within 7-10 minutes of listening to the ocean waves sound. However, the mentioned changes were statistically unreliable.

It is noteworthy, that the disappearance of asymmetry between the brain lobes was also observed in ASC induced by drugs, in particular, in the case of "dissociative states of consciousness" provoked by ketamine, or in hypnotic states [Cherednechenko, 1997, Koekina, 1997].

All the above mentioned and published data allowed the assertion that consciousness transformation into ASC was associated with a system reorganisation of brain activity. According to the data obtained, the change in the interaction of thalamus-cortical and limbic-reticular systems took place. This conclusion was supported by the results of study of the dynamics of amplitude-time dependences of middle-latent evoked responses under the influence of ketamine (phencyclidine) [Koekina, 1997], as well as by the calculations of doublet sources of slow waves in $C_Z$ and $F_Z$ areas generated in ASC. With this, the fact that the patients described their mental state in ASC-2 not only as the state of positive psycho-energy activation, but also as the state of "inner euphoria" allowed the assumption that an ASC activation of "self - rewarding" brain systems took place. The later is likely as phencyclidine brain receptors belong to the positive self-maintenance systems of the brain [Bundzen and Saad, 1984].

In general, the above-described data enabled the assertion that in ASC the measure of brain dissipative functions as an informational system changes considerably. In this case, the most favourable conditions for the reproduction of centrally determined reactions and memory activation can be formed [Terner and Poppel, 1995]. In addition, retardation of reflective processes results in vivid mental images in ASC.

At the same time, the discovery of EEG spectrum characteristics specific for ASC, in particular changes of EEG fractal components, allowed the supposition that the energy-informational interaction in these terms is not limited by the brain. Therefore, we can refer to energy-informational interrelations on the level of transpersonal, multilevel subconscious perception [Tiller, 1997, Oschman, 2000].

## AP FUNCTIONAL STATE

The results of statistical analysis demonstrated that the following changes in the AP functional state took place during mental training:

1. changes in the electroconductivity level of representative AP ($p<0,05$) and stabilisation of the average current value (85,2 ±11,3 mcA);
2. levelling of electroconductivity values in the symmetric right- and left-side AP after leaving ASC, revealed through changes in the $B_{LR}$ index: $B_{LR} < 1,4\%$;
3. the improved balance between AP electroconductivity levels of "Ying" and "Yang" meridian systems.

Thus, taking into account the relation of "Ying" and "Yang" meridian systems to ergo- and trophotropic subsystems of somatic-vegetative regulation, we can conclude that mental training leads to considerable changes in the homeostasis of the organism's energy.

To analyse the dynamical changes in the functional state of the AP during ASC-1 and ASC-2 the computerised "Zodiak" system was used [Zagrantcev et al, 1997]. It allowed for non-artifactual dynamic registration of the ш-potential using liquid electrodes and an extremely low intensity testing current ($10 \cdot 10^{-9}$ A).

The research carried out proved that during ASC-2, i.e. in the period of intense mental activity, the ш–potential grew to its maximum value. Simultaneously, the levelling of bilateral asymmetry occurred in the representative points of the symmetric meridian channels: (P) – tai-Juang, (C) - shang, (MC) – da-ling and (TR) – yang-chi.

It was revealed that the integrated mental training course resulted in highly reliable [$p<0.001$] bilateral balance indexes of all the main 12 paired meridians. Thus, discovered AP functional state modifications can be defined as personal bio-energetic homeostasis harmonisation under mental training influence.

In the literature, the transformation of bio-physical AP characteristics usually refers to changes in both their receptive properties and the human "energy field" as a whole [Syldona and Rein, 1999, Korotkov, 1999, Gerber, 2000]. Therefore, we were expecting to get valuable data from the study of the evoked energy-emission processes in ASC-1 and ASC-2.

## EVOKED ENERGY-EMISSION PROCESSES

The research revealed changes in the intensity of the energy-emission patterns in ASC. These changes were registered by applying various physical principals: photography, currents measurements with the "Digel" system" and pattern recognition with the computerised "GDV-Camera". The GDV patterns were found to be most informative. Parameters calculated in the GDV programs demonstrated precise follow-up of the person's state in different phases of mental training. Most important, statistically significant GDV spatial patterns were found specific to transformation into ASC.

Energy-emission processes rate, measured by "Digel" system, is ever increasing in 215-650nm range up to statistically reliable upper limits at 7$^{th}$ course week. (fig.6) Energy-emission intensity reinforcement corresponds to discussed above PEPR dynamics, defined by POMS parameters.

Data received upon seven weeks course completion were analyzed by correlative and factorial analyses (Table 2). It testifies that nearly all parameters correlating with psycho-energetic status (POMS – Vigour scale; AP current; ш-potential; GDV Energy-Emission), are in a statistically reliable interconnection and belong to the factor 1. Therefore, factor1 could be adopted as a psycho-energetic potential factor.

Factor 2 might be taken as psycho-energetic asymmetry parameter, thus factor 3 registers individual psychosomatic self-regulation peculiarities.

As a matter of fact, the maximum energy-emission changes were observed in ASC-2. They coincided in time with the levelling of bilateral functional asymmetry both at the brain level and at the AP level. During intense mental activity in ASC-2 (subject concentrating on mental images or ideomotor reproduction of psycho-motor attainment) these changes had the characteristic of a short-term phase activation in the energy-emission processes. Considering the functional loading specificity, e.g. concentration of attention, memory activation, or fanciful imagination, it is fair from our viewpoint to describe the given phenomenon in terms of **phase psycho-energy activation (PPEA)**. It is possible to single out the following functional features of PPEA:

1. PPEA was regularly revealed only among people who had completed all sessions of the mental training program for at least 7 weeks;
2. the specific trait of forming PPEA in ASC-2 was mental relaxation followed by active mental imagination;
3. most often (80% of cases) PPEA was registered selectively on the ring fingers in the zones corresponding to the neuro-endocrine regulation centres according to Mandel (1987) and Korotkov (1999);
4. PPEA was revealed as the two types of spatial patterns: either reinforcement of the energy-emission intensity within the specific topographic zones or in the form of separated fragments of concentrated emission (fig.7);
5. the necessary condition of PPEA generation were: first, the bilateral balance of quasi-DC potentials, which was described earlier as the differential diagnostic feature of forming ASC-2, and second, peak values of the energy-emission currents for a given subject (fig.8).
6. in the ASC-2 GDV patterns of different people lost their distinctive features characteristic for the particular person and transformed to very similar patterns with high fractality and "openness"; this fact corresponds to the data of Robert C. Beck (1986) who revealed for a big group of healers that they produced similar brain wave patterns when they were in their "altered state" and performing a healing.

Thus, in contrast to the changes of the AP functional state, PPEA had a phase character and is directly connected with mental activity in ASC-2. Taking into account the character of the altered energy-emission patterns we could assume that at the given conditions the physical nature of the registered glow also changed and the hypothesis of "quasi–coherence behaviour" [Korotkov, 1999, Oschman, 2000, Gerber, 2000] might be applied.

The fact that the PPEA was revealed in topographic zones corresponding to the centres of neuro-endocrine regulation gives an opportunity to study the hypothesis on the PPEA relation to the activation of energy-informational interchange in ASC-2 between the physical body and the "outer informational space" [Syldona and Rein, 1999, Gerber, 2000]. To a certain extent these conclusions are supported by the descriptions given by the participants, having feelings of an "extended mental space" and "flying", very similar to trance states.

The phenomenon of PPEA was statistically reliable and was measured by the authors in different experiments: in hypnotic states, for top athletes in the process of competition imagination, for actors during theatrical performance, and for healers in the healing mode. Sharp decreases in GDV-gram areas and increases in the number of fragments, i.e. increase in image fractality, were registered for a lot of professionals in Russia, Sweden, Finland and USA.

## S U M M A R Y

To summarize research results and progress, it is sound to infer that psycho-dynamic modifications under mental training influence are of complex energy-informative nature, whose interpretation might be of vital importance for the cognition of both mental training and "bio-energetic therapy" fundamentals of psychosomatic medicine.

Energy-emission phasing reinforcement effect by mental functioning in ASC, first discovered in the researches, requires further detailed study. Experimental data, however, confirms psycho-energetic self-regulation transitions in the state of consciousness transformation. It may be practically applied as a criterion of mental training, meditation and healing efficiency.

In general, the revealed correlates and phenomena lead to the conclusion that in ASC, providing mental relaxation occurs, a change in both psychosomatic and psycho-energetic autoregulation takes place. With this, special attention should be paid to the following revealed features:

1. harmonisation of the biopotential field of the brain appeared both in ASC-1 and ASC-2;
2. a psycho-energetic activation directly correlated with mental activity in ASC-2, revealed as a GDV phase intensification and, seemingly, caused by the change in the physical nature of the GDV evoked energy-emission processes.

A problem on the functional role of the discovered phenomena arises, in particular, the relationship between the processes of interaction of brain activity and the energy-informational space, i.e. the energy-information homeostasis of the biofield. No doubt this problem needs to be carefully studied further. However, from our viewpoint, the data obtained allows the claim that bioelectrographic correlates of the mechanisms of mental activity in altered states of consciousness do not refer just to the electrochemical level of the brain.

Coming to this conclusion, we would like to stress that at the turn of the XXI century, it becomes impossible to study psychophysiological mechanisms of consciousness and altered states of consciousness without considering psycho-energetic approaches. Our research required a great deal of complex bioelectrography technology, thus unifying analytical aspects of psycho-physiological and psychophysical methods of research.

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**LEGENDS**

Fig.1. Modifications of the Profile of Mood States and psycho-energetic readiness parameter (PER) under influence of the integrative mental training.
ANX – Anxiety, DEP – Depression, AGG – Aggression, VIG – Vigor, FAT – Fatigue, CON – Confusion

Fig.3. Averaged profiles of EEG spectrum for the rest state (eyes closed) 10 min before mental relaxation (dotted line) and ASC-Act (firm line).
Abscissa axis – frequency in Herz, ordinates axis – relative power of spectrum components. Number of participants N=11. Reliability of frequency difference: delta $p < 0.001$; theta $p < 0.001$; alpha $p < 0.05$; beta $p < 0.05$.
Smooth descending curve corresponds to 1/f dependence of the flicker noise. Arrows indicate projection of the spectrum peaks in ASC-Act to the function 1/f. Relation between function values in the points 1,2,3,4,5,and 6 supports idea of the polymodal harmonization of EEG spectrum in ASC.

Fig.4. Averaged patterns of spectral coefficients of cortical activity for the studied psychic states: 1 – state of calm awakening (background); 2 – state of muscle relaxation; 3 – state of mental relaxation (ASC-Rx); 4 – state of active imagination (ASC-Act); 5 – state of calm awakening (10 min after submerging to ASC). Diameter of dots corresponds to the values of activation coefficients in EEG zones in accordance with 10/20 system. Number of participants N=11.

Fig.5. Time dependence of the averaged QDC potential for different states of consciousness.
1 – muscle relaxation; 2 – mental relaxation (ASC-Rx); 3 –active imagination (ASC-Act); 4 – after-state. R and L – right and left side measurements. Number of participants N=15.

Figure 7. Modification of the patterns of the GDV energy emission of left ring finger for four testees in conditions of mental work - active imagination in the process of transformation to ASC-Act.
A and B – patterns before and in the process of immersion to the ASC-Act, correspondingly.

Figure 8.Time dependence of the averaged QDC potential and current of the energy emission during immersion to ASC and active imagination in ASC-Act.
1 and 2 - QDC potential of the left and right sides of the body, correspondingly;
3 - GDV current; ---- time of the mental relaxation and imagination (8-16 min); images on top – examples of GDV patterns in different states.

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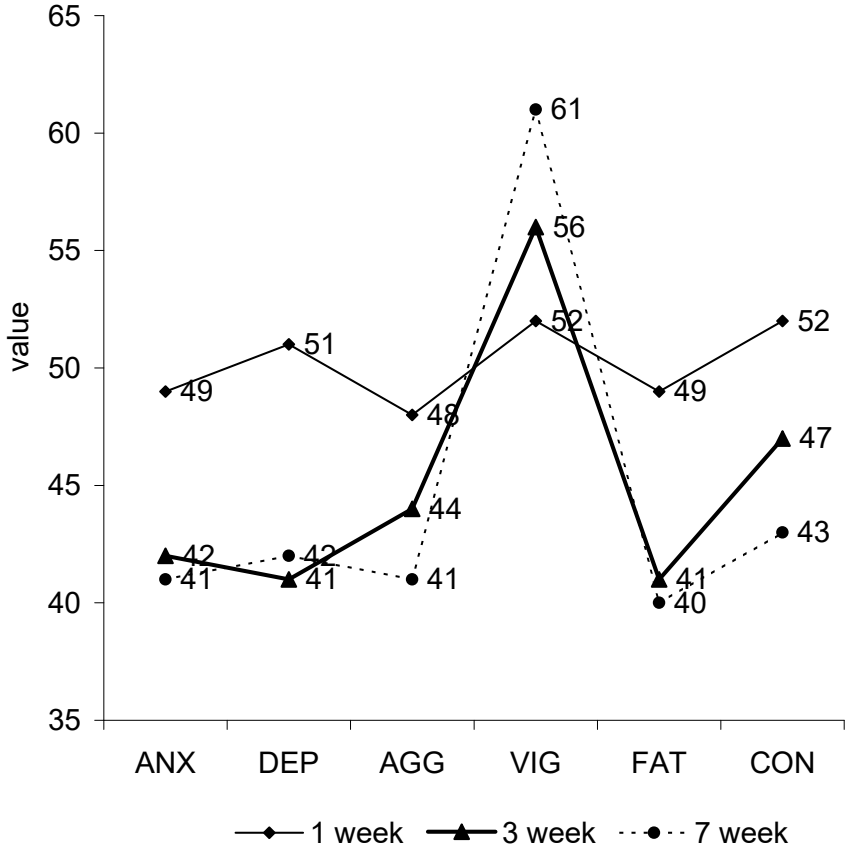
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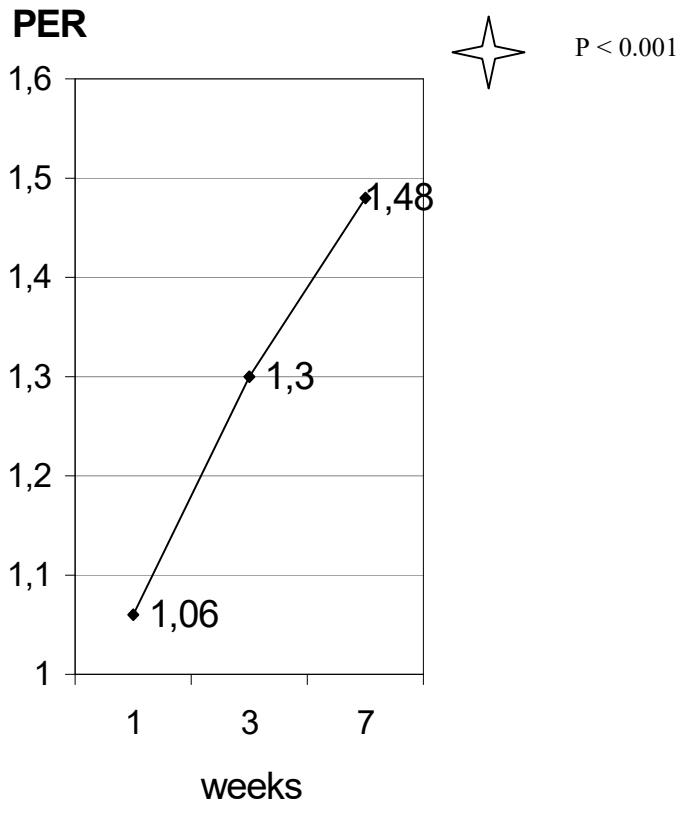
43

FIG.2


PER
P < 0.001
1,6
1,5
1,4
1,3
1,2
1,1
1
1,48
1,3
1,06
1
3
7
weeks

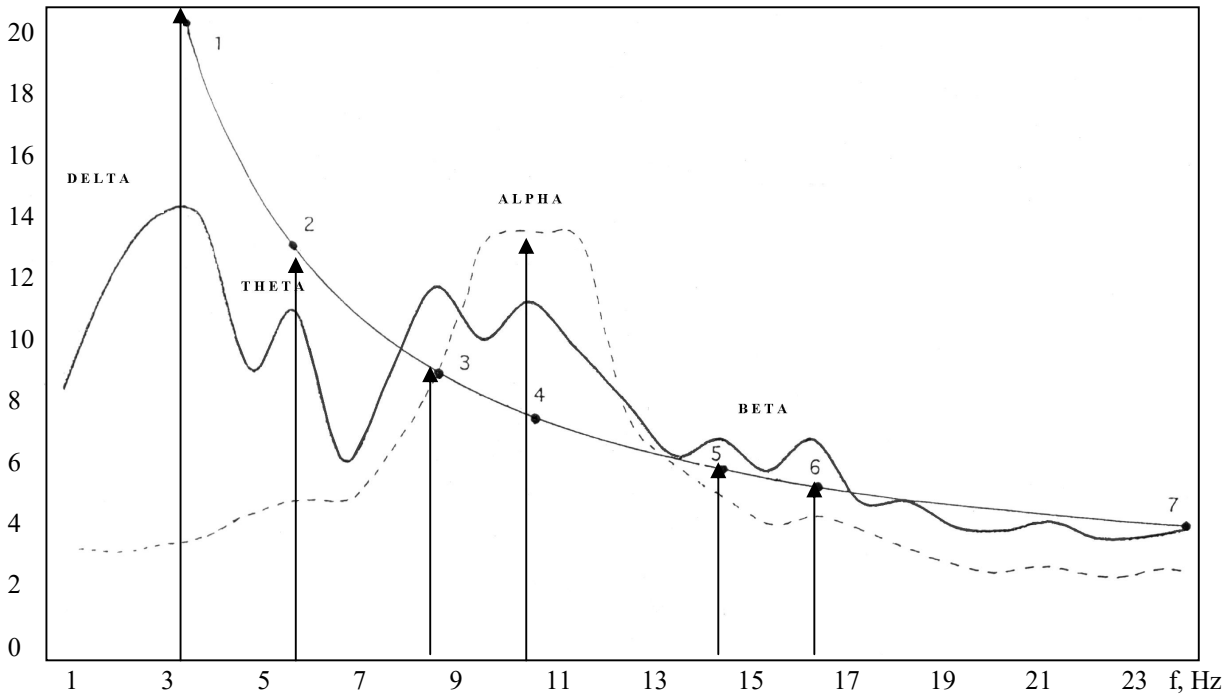

20
18
16
14
12
10
8
6
4
2
0
DELTA
THETA
ALPHA
BETA
1
2
3
4
5
6
7
1
3
5
7
9
11
13
15
17
19
21
23
f, Hz

Fig.3

Fig.4

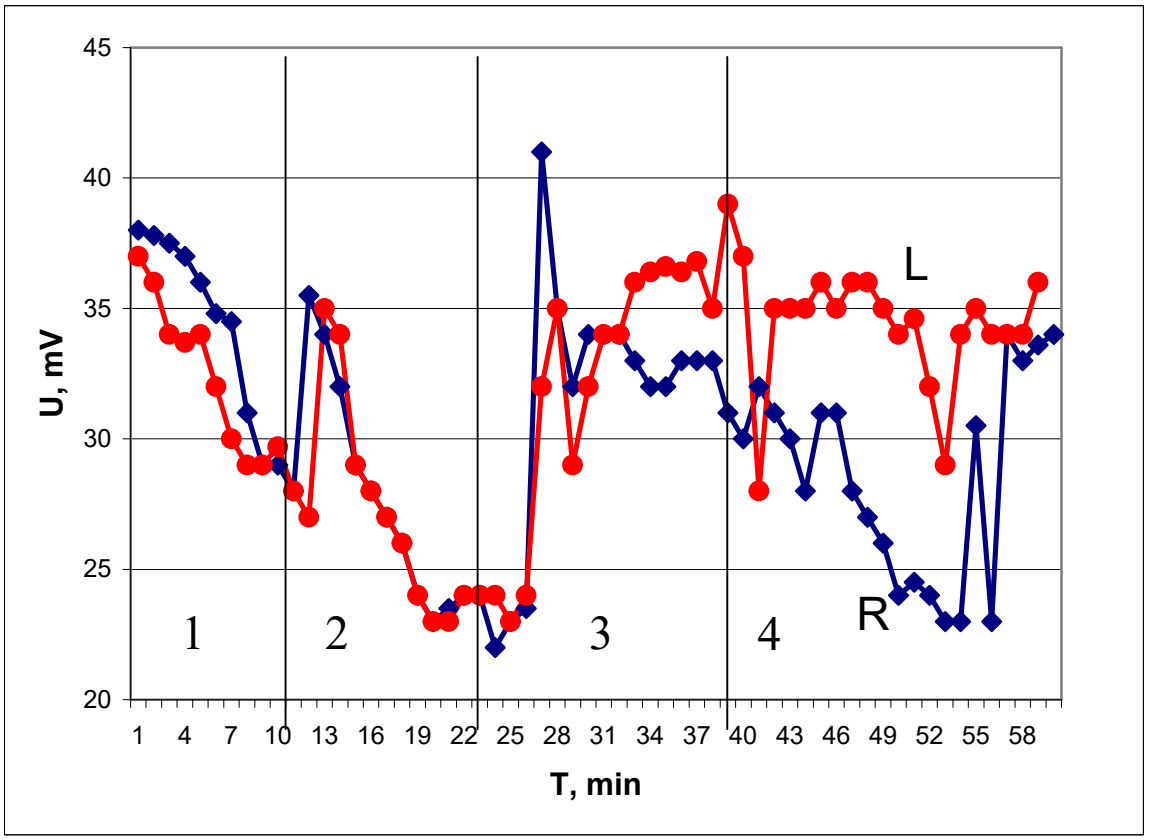

45
40
35
30
25
20
U, mV
1
2
3
4
L
R
1 4 7 10 13 16 19 22 25 28 31 34 37 40 43 46 49 52 55 58
T, min

Fig.5

Fig.7

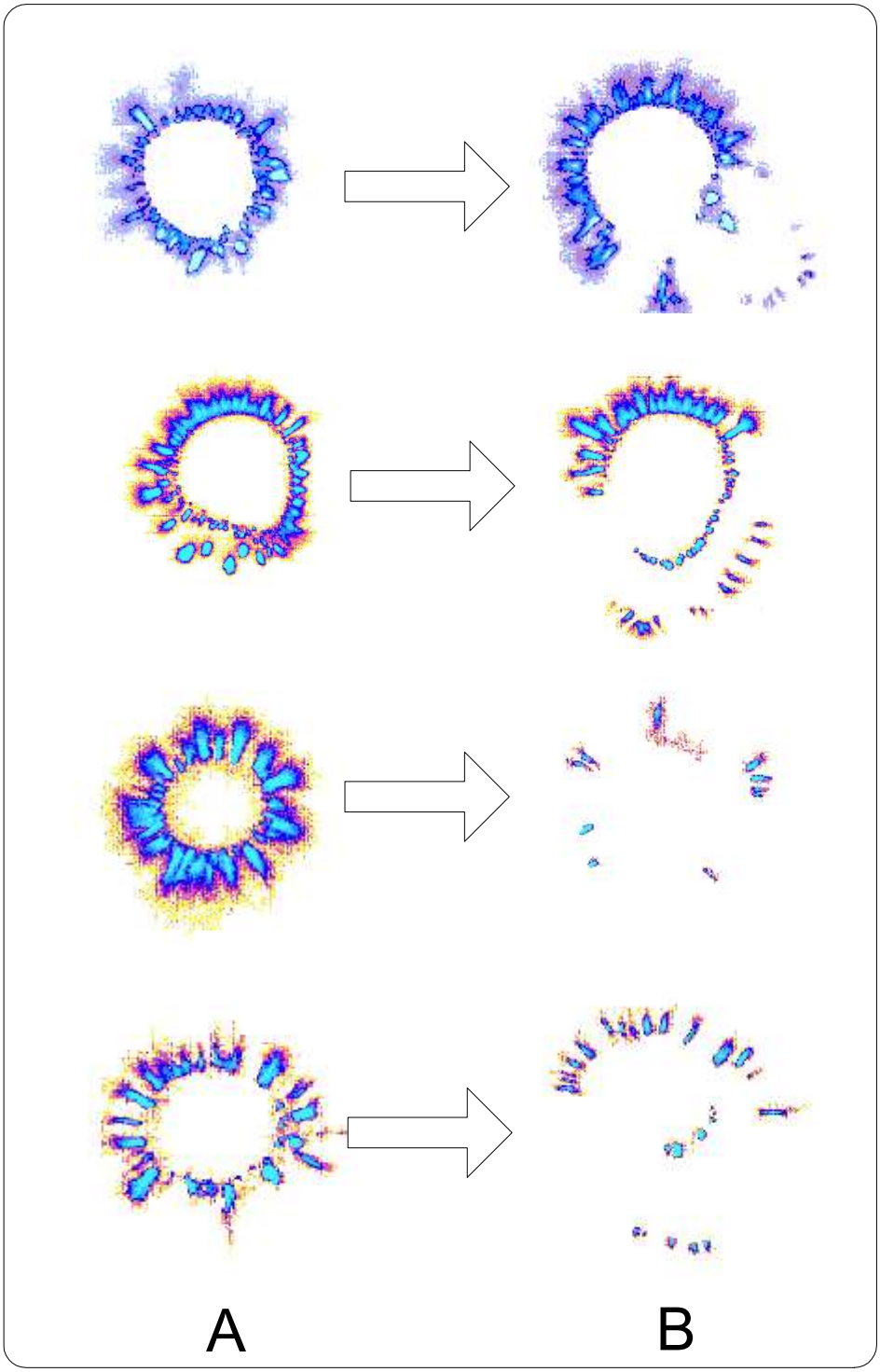



Fig.8

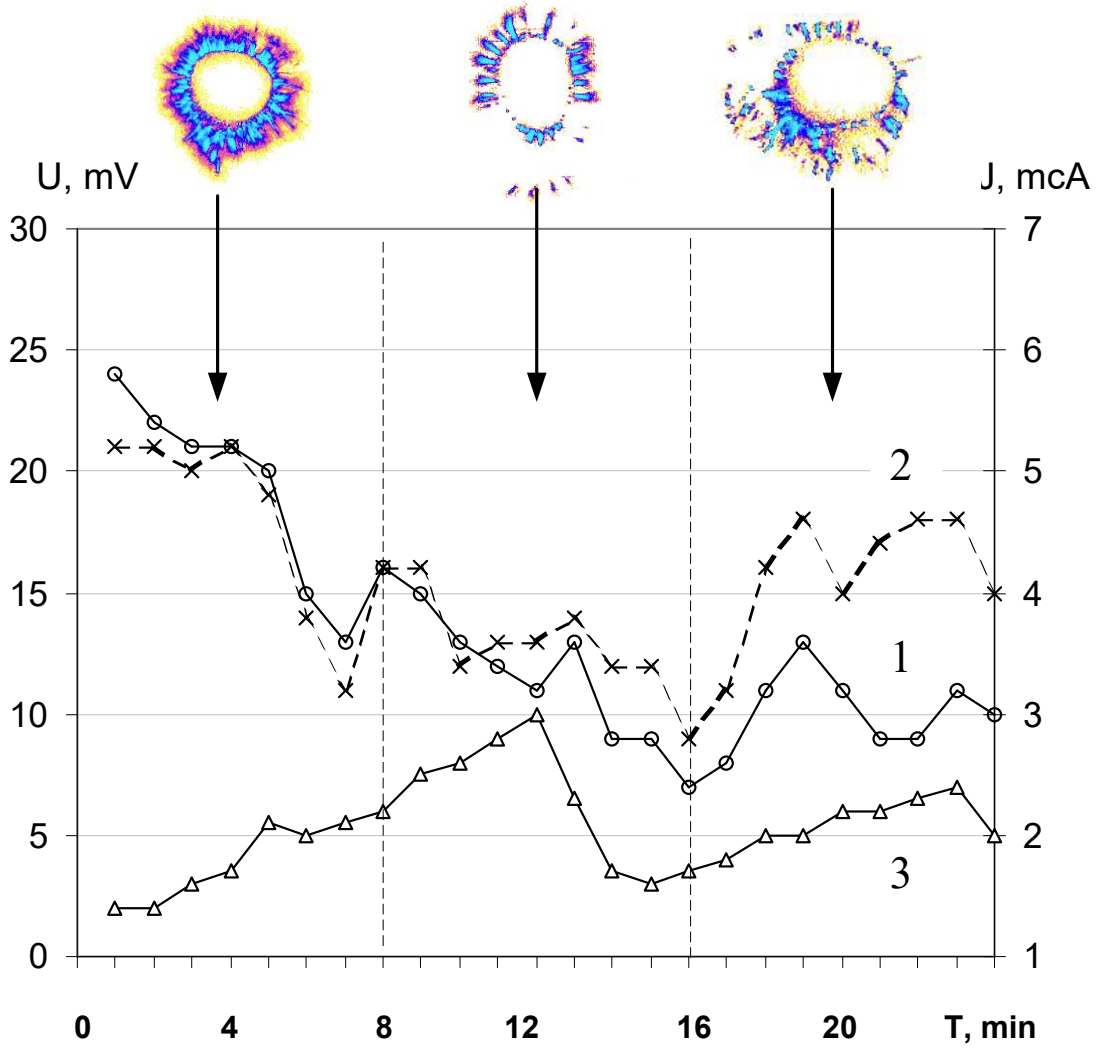

U, mV
J, mcA
30
25
20
15
10
5
0
7
6
5
4
3
2
1
2
1
3
0
4
8
12
16
20
T, min

**Table 1.** Deviation of averaged electroencephalogram profile ($O_1$ region) from $1/f$ dependence in the frequency range 1-25 Hz for the state of calm awakening and ASC-2

| | | Frequency Range, Hz | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Value $1/f$ | | 74.0 | 37.0 | 24.7 | 18.5 | 14.8 | 12.3 | 10.6 | 9.3 | 8.2 | 7.4 | 6.7 | 6.2 | 5.7 |
| РД | Value | 2.5 | 2.4 | 2.6 | 2.9 | 3.6 | 4.1 | 4.1 | 5.8 | 8.2 | 12.6 | 12.9 | 12.8 | 6.8 |
| | % | -97 | -94 | -90 | -84 | -75 | -67 | -61 | -37 | 0 | 70 | 92 | 107 | 19 |
| РА | Value | 7.8 | 11.3 | 13.4 | 13.4 | 8.3 | 10.2 | 5.3 | 8.0 | 11.0 | 9.3 | 10.5 | 8.9 | 7.2 |
| | % | -90 | -70 | -46 | -28 | -44 | -17 | -50 | -13 | 33 | 25 | 56 | 44 | 26 |
| | | Frequency Range, Hz | | | | | | | | | | | | |
| | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | |
| Value $1/f$ | | 5.3 | 4.9 | 4.6 | 4.4 | 4.1 | 3.9 | 3.7 | 3.5 | 3.4 | 3.2 | 3.1 | 3.0 | |
| РД | Value | 5.0 | 4.0 | 3.1 | 3.4 | 2.9 | 3.3 | 1.6 | 1.5 | 1.6 | 1.3 | 1.5 | 1.5 | |
| | % | -5 | -19 | -33 | -22 | -30 | -42 | -57 | -57 | -53 | -60 | -52 | -49 | |
| РА | Value | 5.4 | 5.9 | 4.9 | 5.9 | 3.8 | 3.9 | 2.9 | 2.8 | 3.1 | 2.6 | 2.6 | 2.8 | |
| | % | 2 | 20 | 5 | 36 | -7 | -1 | -20 | -20 | -7 | -20 | -16 | -4 | |

Table. 1. Factorial analyses of data received upon seven weeks course of mental training completion

| Items | Factors | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| POMS-ANXIETY | -0.53 | - | +0.59 |
| POMS- DEPRESSION | -0.69 | - | +0.53 |
| POMS-AGGRESSION | -0.58 | - | +0.61 |
| POMS-VIGOR | ***+0.80*** | -0.55 | - |
| POMS-FATIGUE | -0.61 | - | - |
| POMS-CONFUSION | - | -0.57 | - |
| KSI-POTENTIAL | ***+0.67*** | -0.53 | - |
| QDC POTENTIAL LEVEL | +0.63 | - | - |
| QDC POTENTIAL ASYMMETRY | -0.66 | +0.57 | - |
| GDV IMAGE AREA L 1 | - | +0.61 | - |
| GDV IMAGE AREA L 2 | - | - | - |
| GDV IMAGE AREA L 3 | - | +0.55 | - |
| GDV IMAGE AREA L 4 | ***+0.68*** | - | - |
| GDV IMAGE AREA L 5 | ***+0.54*** | - | - |
| GDV IMAGE AREA R 1 | - | +0.59 | - |
| GDV IMAGE AREA R 2 | - | - | - |
| GDV IMAGE AREA R3 | - | +0.67 | - |
| GDV IMAGE AREA R 4 | ***+0.77*** | - | - |
| GDV IMAGE AREA R 5 | - | +0.53 | - |
| GDV IMAGE AREA R 4 in ASC-Act | - | - | - |
| GDV IMAGE AREA L 4 in ASC-Act | ***+0.84*** | - | - |
| Percentage of variance | 0.41 | 0.14 | 0.10 |

L1…L5 and R1…R5 – left and right fingers, numbered from the thumb.