RESONANT INTERACTION OF THE PSYCHE, CIRCADIAN RHYTHMS AND EXTERNAL ELECTROMAGNETIC FIELDS

ABSTRACT

We consider the human body as an open self-regulating liquid system (LS) functioning in a gaseous environment (GE). This paper considers two systemic critical points. The first is birth (F): the start of a set of trajectories of unsynchronised circadian rhythms during the transition from the liquid intrauterine to the external gaseous environment; the appearance of gas-exchange metabolic function of the lungs; restructuring of the vascular, nervous, endocrine systems, activation of the hypothalamus. The second is biological mortality (M), which we consider as a zone of convergence and final degradation of all circadian rhythms and homeostatic mechanisms. "M" is an attractor of homeostasis of biological life forms. The graph shows a significant phase similarity in time and vector parameters "F", "M", "IPB" (integral population biorhythm) and Schumann resonance (SR). SR action is considered as an external regulatory influence on processes (F/M), the dynamics of which has no signs of interaction at short time intervals. Parametric resonance is considered as a universal communicator of external and internal interactions.

The bifurcation point for all circadian rhythms is cardiac arrest, following which brain activity is determined by the time interval of metabolically permissible activity. In the terminal phase (from cardiac arrest to isoelectric EEG), all the trajectories of LS regulation in the GE are focused in the attraction pool of the attractor (M). High brain activity and growing dynamic chaos in the terminal phase lead to the mobilisation of the entire range of compensatory brain information constructs aimed at restoring homeostasis (the uncontested goal of this phase). The final stage of brain activity in the final stage of the terminal phase, with the total exhaustion of regulatory resources, leads to the creation of an extract from the entire spectrum of homeostasis regulation algorithms, an integral information package of maximum density.

The dominant communicative and integrative role during the terminal phase is played by brain structures, the activity of which is manifested by an EEG gamma rhythm spectrum. We believe the gamma-rhythm burst in this phase is a sign of the activity of brain structures that include a network gateway for information conversion (consciousness).

KEYWORDS: Schumann resonance; circadian rhythm; parametric resonance; terminal phase; homeostasis attractor.

ABBREVIATIONS: LS – liquid system; GE – gas environment; F – fertility; M – mortality; IPB – integral population biorhythm; SR – Schumann resonances; GC, generator-converter; NCG, network conversion gateway; IIP, integrated information package.

INTRODUCTION.

We view the human body as an open self-regulating dynamic fluid system (LS) located in unstable equilibrium and functioning in a gaseous environment (GE). Transitions of such systems to other states (including critical ones) are possible with a weak external influence having a noise level. We have presented our views on the mechanisms of homeostatic stabilisation and regulation of LS in GE before (1 et al.).

The dynamics of the totality of regulatory circadian rhythms and homeostasis of human physiological processes (LS in GE) has critical points. This paper considers the dynamics of two such: initial and final.

1– Birth (F): In addition to those already working, a set of trajectories of unsynchronised circadian rhythms and mechanisms for ensuring homeostatic interaction with GE are launched. In the transition from the liquid intrauterine environment to the external gaseous environment, the functions of the vascular, nervous and endocrine systems radically change. What appears is a new physiological function of the pulmonary gas exchange metabolism. The hypothalamus, the circadian rhythm regulatory centre, which begans functioning in utero, is activated at birth, providing perinatal synchronisation of bioeffective rhythms and emergency correction of hormonal status (2,3,4,5,6), i.e., adaptive response to environmental change.

2 — We consider biological mortality (M) as the point of convergence and final degradation of the trajectories of all regulatory circadian rhythms and homeostatic adaptation mechanisms. In other words, we consider mortality as an attractor of homeostasis of biological life forms.

MATERIALS. DISCUSSION.

In the process of studying the dynamics of LS, we built a graph of hourly relationships of various phases LS and the external static electromagnetic field - SR.

GRAPH 1. Comparison of the daily schedules "F", "M" and "IPB" (average of F/M) with "SR" phase dynamics.

1) - first mode of Schumann resonances – "SR" (7);
2) - daily fertility schedule – "F" (10);
3) - daily mortality schedule – "M" (8);
4) - daily schedule of the integral population biorhythm – "IPB".

We believe that the significant phase similarity of the graphical profiles of the main population indicators (F/M), which do not have obvious signs of direct dependence at short time intervals, is due to a common external regulatory mechanism (ERM). Of the known ERMs, this paper considers the Schumann resonances (SR). Graph 1 shows a comparison of the daily schedules "F", "M" and "IPB" (average of F/M) with "SR" phase dynamics. We consider the body's external electromagnetic influences and integral physiological processes as interrelated.

The calculated integral population biorhythm (IPB) schedule is derived from the start/finish processes regulating the homeostasis of LS in GE.

The main daily variations in the frequency of the first SR mode are: 7.42; 7.64; 7.8; 8.02 Hz with subsequent modal intervals of 6.5 Hz. As a reference, we have selected one of the real profiles of the daily SR. It is interesting that with the variability of the daily values of SR, the graphs have almost identical

profiles with insignificant deviations (7), which allows applying any of the SR profiles without making corrections.

On graph "M", we emphasise the presence of two peak values: 2-6 hours (47%) and 18-22 hours (29%) (8). Against the background of modern therapy (including intensive), the peak of night mortality shifts to 8 a.m., reaching 60% of the total number of deaths (9).

From the daily F charts (10), we give "home" as the most natural (physiological). We note a significant change in the profile and a shift in time for the delivery schedule using external influence methods.

The phase coincidence of the profiles of the SR, F, M, IPB charts in terms of time and vector parameters demonstrates the interaction of systems (direct or indirect). The graph also demonstrates the presence of an external regulatory influence on the integral daily circadian biological rhythm (IPB), i.e. the "natural movement of the population", which has peak maximum amplitude values in 4-6 hours and minimum in 12-14 hours.

Electromagnetic forms of energy have all the necessary qualities for the transmission of bioinformation and the performance of informational and regulatory functions: penetrating power, high speed, and the ability to influence remotely (11,12). Empirically, the parametric interaction of the body and geomagnetic disturbances is evidenced by a significant increase in myocardial infarctions (13%), strokes (7%) (14), as well as the correlation of CNS activity indicators with changes in solar and geomagnetic activity (13).

SR is a non-equilibrium thermodynamic system with frequency fluctuations, short stable states and bifurcation points. At the initial stages of biological evolution, SR was the only (known to us) constant electromagnetic field possible for parametric synchronisation. When a weak periodic signal is applied to a nonlinear system, a stochastic resonance occurs. Resonance between stochastic noise and a weak deterministic periodic signal leads to an increase in the output signal. We believe that SR, starting from the primary organised cell, as a stochastic noise, evolutionarily influenced the electroactivity of biological species.

The brain is a functional electromagnetic dipole in which all qualitative characteristics of cognitive processes (memory, consciousness, etc.) are considered as quantitative configurations of temporal patterns of electromagnetic quantities (15), i.e., as functional dipoles. We emphasise that dipole-dipole (inductive resonant) energy transfer has been studied in detail for energy exchange between chromophores (Förster resonance energy transfer).

Considering the brain as a "generator/converter" (16), we have defined the functions as properties of the brain (psyche) for the wakefulness phase. We see this phase as a dynamic process of ensuring the homeostatic equilibrium of the LS in GE. We define consciousness as a network gateway for two-way conversion (NCG) of information between the psyche and the external/internal environment. In the wakefulness state, the NCG converts updated homeostasis regulation algorithms into effector constructs. We believe that the NCG can have a dominant influence on the selection, separation and quantisation of information volumes during memorisation and subsequent retention in memory.

We consider sleep as a sensory deprivation of the psyche, a “turn-off” of receptor fields, an inversion of the NCG vector with the exclusion of the "external environment" (as the source/addressee of the information flow) and a significant increase in the excitability threshold. It is possible that inversion of the NCG vector in sleep most likely ensures its participation in "internal effects" during dreams, hallucinations and meditation (17,18,19). Indirect evidence of the NCG inversion activity are the near-death experiences remaining in the memory that have similar plots (30).

We believe that it is the NCG inversion that is the mechanism for experiencing ecstatic, shamanic, some hallucinatory and other similar states.

Modern ideas about the activity of the brain (psyche) in sleep, in a state of information deprivation and inversion of the NCG vector, have been, with the exception of the ascertaining results of instrumental studies, mainly theoretical in nature and are not of interest to us. Objective methods have confirmed high brain activity (EEG rhythms, cerebral blood flow, etc.) during sleep.

Until the appearance of isoelectric EEG, continuous EEG recording in rats revealed a surge in synchronous gamma-rhythm oscillations following cardiac arrest. Gamma oscillations were global and highly coherent. A close phase relationship with theta and alpha waves was established. High-frequency neurophysiological activity in the near-death state exceeded the wakefulness state levels. Following cardiac arrest, direct and feedback connections of alpha, delta, theta, low/mid frequency gamma waves increased, with the level of directional cortical connections significantly exceeding the wakefulness state levels. In near-death states, the mammalian brain generates neural correlates of increased activity exceeding the cognitive information processing levels. (20).

Cross-frequency connection of gamma and theta rhythms determines long-range neural communication, perception, memory (21, 22, 23). These data demonstrate brain excitation following cardiac arrest with a high level of internal information processing in near-death states.

Of particular importance is the high-frequency activity of the gamma rhythm (human and animal) with frequencies of 30-200 (or more) Hz at an amplitude of 5-10 μV (24). The main role in the electrogenesis of the gamma rhythm with a frequency of 30-80 Hz is played by postsynaptic potentials, higher-frequency oscillations are the result of the total synchronised pulse activity of neurons. The amplitude and frequency depend on the type of cognitive task being performed (25). Gamma rhythm is an indicator of the transition from sensory information processing to information synthesis, with phase coupling of the gamma rhythm at frequencies of 46-90 Hz and the alpha rhythm at frequencies of 8-10 Hz (26). The most significant changes in cortical interactions are observed at gamma-rhythm frequencies, which play a connecting role between various EEG frequency components (25). A distributed gamma oscillator (dipole) system allows evaluating gamma activity in a certain time quantum as an indicator of total brain activity (24). Synchronisation of gamma dipoles in various brain regions is evidence of the action of a selectively distributed system of gamma oscillators facilitating communication (integration) between various neural networks during information processing (27). The phase relationship between theta and gamma activity of the cerebral cortex is an indicator of the integration of neurocognitive processes of consciousness and memory (28).

In a person (29), cardiac arrest is followed by a significant increase in the absolute power of the gamma rhythm in both narrow and wide ranges. Cessation of cerebral blood flow was followed by transfrequency modulation of alpha and theta rhythms from the gamma rhythm.

The appearance of gamma rhythm in humans and animals (including invertebrates) in response to sensory stimulation simultaneously in various brain structures (cortex, trunk, thalamus, hippocampus, cerebellum) is evidence to the participation of gamma rhythms in the basic processes of information processing by neural networks. Gamma oscillations are a sign of the functional activity of the brain, providing all types of sensory and cognitive activity of the brain [26].

In other words, cardiac arrest causes an integrated activation of neurophysiological responses that exceed wakefulness levels. At that, synchronisation and functional unification of spatially distant populations of neurons occurs at gamma rhythm frequencies. Brain structures, the activity of which is manifested by the entire spectrum of gamma rhythms, play the dominant communicative and integrative role. We consider the gamma-rhythm burst in the terminal phase as a sign of the activity of brain structures of the NCG with an inverted vector.

The classical theory of synchronisation operates with the so-called self-sustaining periodic oscillators. When exposed to an external periodic force of the appropriate amplitude and frequency, the autonomous oscillator is phase-synchronized with the external signal. In other words, the result of external influence will be phase and frequency, parametric synchronisation. For the occurrence of a parametric resonance having a threshold level, the oscillator must have its own (even insignificant) oscillations at close frequencies.

Using simplification as a phase of the structural analysis of brain activity, we consider the brain (psyche) to be an arsenal of spatially distributed oscillator-dipoles (ODs). That is, ODs are functional oscillators that have their own range of bioeffective frequencies. The frequency of oscillations is a carrier of information, and bodily oscillations can be transformed from one type to another (principle of the brain as a generator/converter - 16).

In other words, parametric resonance in the body is effective for different types of external and internal interactions, probably playing the role of a universal communicator. Circadian rhythms, which form homeostasis and all oscillatory processes of the body, have a frequency, amplitude (oscillatory) and temporal variation. It is these fluctuations in values ("circadian tremor") that allow the body system as a whole to be adjusted to changes in external rhythmic structures.

All circadian rhythms and homeostatic processes fall into the attractor pool (M) at the bifurcation point, which we believe is cardiac arrest. The attraction of the attractor pool is activated when the action of the heart, the most powerful electromagnetic generator (dipole) of the body that normally has a frequency of 60-80 Hz (gamma-rhythm frequency range), ceases.

From the moment of cardiac arrest throughout the terminal phase, the brain works under conditions of determinism by the time interval of metabolically permissible activity.

In other words, in the terminal period (from cardiac arrest to the isoelectric direct EEG), all regulation trajectories (LS in GE) are focused in the attractor attraction pool (M) with degradation of controllability and plasticity functions of the entire physiology spectrum. Simplification of the structure and regulatory continuum, in comparison with the previous dynamics of the body as a whole, forms a specific type of behaviour of the dynamic system on the border of regular development and deterministic chaos. Such systems produce information at small time intervals with increasing system chaoticity, with modulation of the chaotic signal from the informational signal one (32). The above-described trajectory of movement of a dynamic system (LS) with high brain activity and increasing dynamic chaos in the terminal phase most likely leads to the creation of information constructs in the brain containing an extract from the entire spectrum of homeostasis regulation algorithms. In the absence of positive feedback, cascade degradation of homeostasis regulation inevitably expands the spectrum and range of activation of systemic compensatory constructs of the brain up to the limit values. Aimed at maintaining homeostasis (the non-alternative goal of this phase), the activity of brain structures producing gamma rhythms modulates and integrates the rest of the brain structures in phase, amplitude, frequency (modulation with respect to delta, alpha, theta rhythms).

It is clear that after the total exhaustion of regulatory resources, the activity of structures of the brain as a whole that is aimed at restoring homeostasis ends with the creation of an extract from the "information matrix" (16): an integral information package (IIP) of vital information of maximum density (a quantum of unknown volume and content). It is possible to assume that, as a result of parametric resonance formed in the terminal phase by the dominant gamma rhythm, the IIP can be translated (analogous to the inductive-resonant energy transfer of interacting systems) into Schumann Resonator (SR modes above 3rd) with the potential for interaction (preservation/degradation). Understanding the limits of permissible analogies, assuming them as a reason and line of research, we

consider the transfer mechanism of IIP to SR conditionally possible, similar to Bluetooth algorithms.
We believe that the interaction of SR and brain activity through parametric resonance is evolutionarily determined for vertebrates (possibly for all forms of biological life) and independent of the initiation mechanism (hypercapnia, neural interactions, dissociative drugs, etc.)

CONCLUSIONS

The Schumann resonance exerts an external regulatory effect on the phase indicators of "birth" and "death", the dynamics of which show no signs of interaction at short time intervals. Parametric resonance in the body is effective in both external and internal interactions, functioning as a universal communicator.
The point of bifurcation and active attraction of the attractor pool (M) for the entire spectrum of circadian biorhythms is cardiac arrest. Brain activity in the terminal phase is determined by the time interval of metabolically permissible activity. The dominant communicative and integrative role during the terminal phase is played by brain structures, the activity of which is manifested by the spectrum of EEG gamma rhythms. High brain activity and increasing dynamic chaos in the terminal phase lead to the mobilisation of the entire range of compensatory information constructs aimed at restoring homeostasis.
The final stage of brain activity in the terminal phase ends with the creation of an extract from the entire spectrum of homeostasis regulation algorithms, forming an integral information package (quantum) of maximum density.

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