Review Article

Homeodynamic Bio-Oscillations and the Conscious Self

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Abstract

The observable bio-phenomenal events are oscillatory. Bio-oscillations are ubiquitous in nature including many in human beings. Homeodynamic Bio-Oscillations (HBOs) are correlated with both biophysical and psychological processes. They can be mechanical, chemical, electrical, and magnetic. In fact, there is a certain specificity between the HBO energy patterns and the correlated human behavior experience. With the same understanding and the current scientific evidence, one can be aware of, not only one's objective behaviors, but also one's subjective feelings and experiences, both conscious and subconscious. Behaviors are highly dependent on the presence of appropriate HBOs in the living organisms and their surroundings. Our verbal and cognitive communications involve bio-frequencies and energies of 10 Hz to 20,000 Hz. Many large animals such as whales, elephants, rhinoceroses, giraffes, and alligators communicate by infrasonic signals (<20 Hz) at long distances up to several miles. Finally, it is proposed that our objective as well as subjective experiences of self and surroundings are highly correlated with the underlying complex and HBO energy and activity patterns. We are what we are now in existence. There is an intrinsic unity or wholeness in ourselves and the natural world that we are in. We are an integral part of existence. Nirvana, Samadhi, Turiya, and Transcendence are the actual states of self-actualization of this truth. The well-established human HBOs and the correlated behaviors – experiences are listed. The characteristic features of human consciousness, self, and Nirvana are listed.

Keywords: *Bio-oscillations, consciousness, homeodynamics, infrasound, Nirvana, Samadhi, self, transcendence, Turiya*

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Introduction

Homeodynamic Bio-Oscillations (HBOs) are universal. Homeodynamic (not homeostatic) means a bio-system change and then returns to a stable state recurrently. This is a fundamental feature of all bio-systems. HBOs are pervasive in all life-forms including us and our natural surroundings. Bio-Oscillation is the variation, typically in time, of some measured parameters as seen, for example, in a swinging pendulum. *Oscillatio* in Latin means swinging. Oscillations occur not only in the physical systems, but also in all biological systems.

The five essential factors involved in the bio-oscillatory homeodynamics are: (1) negative feedback, (2) positive feedback, (3) phase-time delay, (4) nonlinear dynamic autoregulation, and (5) random background fluctuations or noise.[1] A pair of coupled bio-oscillators, when out of phase, can create an elliptical phase-space-time field. Such an elliptical oscillatory field (BOF) is a common motif in biology. It is seen in embryos, developmental forms, organisms, swarms, flocks, schools of fish, and ecosystems. The natural reality manifests in many

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homeodynamic patterns including the elliptical galaxies and cosmos. One wonders whether the *Whole Cosmic Ellipse* is, in fact, a bistable homeodynamic oscillatory system of light and dark matter-energy with *Life-forms* in it!

The human HBO energy field is experienced by each of us individually. The conscious self can periodically experience it preconsciously, subconsciously, or unconsciously. The human sleep-wake cycle and many other physiological processes are constituted of HBO systems including the HBO activity and the circadian cycles. Most of the human behaviors and experiences are correlated with certain HBO activity. Many of these well-established correlations of human physiology are listed in Table 1. The seven 'A's of the aspects of human consciousness, the seven 'S's of human self, and the seven 'C's of Nirvana, Samadhi, Turiya, and transcendence are listed in Table 2.

Homeodynamic Bio-Oscillations and Behavior-Experience

Recently, Allison Hanson made a bold hypothetical proposal about the importance of *Spontaneous Electrical Low-Frequency Oscillations* (SELFOs).[2] These SELFOs, typically of 0.01–0.1 Hz, have been found throughout the living world including in Hydra, plants, fungi, protozoa, bacteria, and the human brain's default mode network (DMN), even during the resting mental state, the spontaneous thought, episodic memory, mind-wandering, and self-related processing. Similar cerebral cortical oscillations have been found in chimpanzees, macaques, sheep, baboons, pigs, dogs, cats, rabbits, guinea pigs, rats, hamsters, gerbils, mice, and bats. SELFOs are proposed as the fundamental feature of all living systems and they may serve as the *electrical organism organizer* during embryogenesis, development, growth, and regeneration.

Michael Levin has done considerable foundational research on the role of ions like Na, K, H, and Ca, in embryonic development, growth, and the nervous system functions.[3] The authors summarize their findings as "Ion channels play fundamental second-to-second roles in maintaining appropriate ion gradients and membrane potentials for all cells, enabling rapid signaling in excitable cells and standing patterns of voltage in nonexcitable tissues. Recent work has revealed that ion channels play critical roles in the development of excitable and nonexcitable cells and organs, neural degeneration, disease, and tissue remodeling/cellular regeneration."

The brain's resting state, DMN, is functional not only at the cerebral cortical level, but also at the brainstem level. Recent functional MRI analysis in 154 healthy participants revealed that the dopaminergic midbrain centers and the serotonergic dorsal raphe nucleus are functionally integrated with the cortical DMN, whereas the remaining serotonergic raphe nuclei and the noradrenergic locus coeruleus nucleus are functionally integrated with the executive-control network (ECN).[4]

There is a reciprocal relationship between the DMN and ECN networks. In general, the rest-activity states in all life-forms are oscillatory. The basic rest-activity cycle was described in human sleep-wake research.[5] There is an oscillatory complementarity between the circadian and the homeodynamic bio-processes.[6] The concept

Table 1: Human homeodynamic bio-oscillatory spectrum

Frequency	Behavior or Activity
0.01-0.1 Hz	Resting bio-oscillatory activity
	Brain's default mode network activity
0.2-0.3 Hz	Human average blink rate
1-4 Hz	EEG delta activity
4-8 Hz	EEG theta activity
9-11 Hz	EEG alpha activity
12-30 Hz	EEG beta activity
30-80 Hz	EEG gamma activity
20-20,000 Hz	Human auditory range
125-8000 Hz	Human conversational speech
400-700 nm	Wave lengths of visible light
3 Hz	Human eye movements
4-10 Hz	Visual saccade rate
0.05-0.25 Hz	Breath rate
1-2 Hz	Heart rate
5-6 min/mi	Fast walking
27.5 mi/h	Fastest running
10-12 s	100 m run
2.29 m/s	Fastest swimming
0.25 s	Visual reaction time
0.17 s	Auditory reaction time
0.15 s	Tactile reaction time
80-200 Hz	Fast EEG activity
200-600 Hz	Ultrafast EEG activity
2-15 Hz	Locus coeruleus, active wake state
0.5-2 Hz	Locus coeruleus, relaxed wake state
<0.5 Hz	Locus coeruleus, NREM sleep

EEG: Electroencephalography, NREM: Nonrapid eye movement

Table 2: Consciousness, self, and Nirvana

Consciousness (7 'A's)	Self (7 'S's)	Nirvana (7 'C's)
Arousal	Still	Calm
Awareness	Silent	Clear
Attention	Serene	Cheerful
Agency	Spontaneous	Content
Affect	Singular	Compassionate
Action	Symmetrical	Curious
Awakening	Synchronous	Creative

of homeodynamics was proposed and explained as follows. "Biological systems are homeodynamic because intracellular processes through their dynamic self-organization may exhibit not only monotonic states, but also a capacity for bistable switching threshold phenomena, waves, gradients, mutual entrainment, and periodic as well as chaotic behavior."[7] The *Two-Process Model* of circadian and homeodynamic processes, in sleep-wake states, is the currently accepted model. It also applies to many other human physiological processes.

In order to understand the human brain, behavior, and experience, it is essential to study the evolutionary history of all life-forms and to appreciate how complex functional structures emerged from simpler bio-systems. An excellent review of such a phylogenetic perspective has been published.[8] The evolution of complex functional networks emerges from the basic life-forms such as sponges, fishes, reptiles, birds, marsupials, rodents, chimpanzees, and humans. The behavioral history extends from the brainstem tectal *approach* or *avoid* responses to the cerebral cortical *exploit* or *explore* behaviors. There may be a limit to the growth of the primate brain and its cognitive capacity. "It will be argued that at a brain size of about 3500 cm^3, corresponding to a brain volume two to three times that of modern man, the brain seems to reach its maximum processing capacity. The larger the brain grows beyond this critical size, the less efficient it will become, thus limiting any improvement in cognitive power."[9]

Continuous natural speech was studied with EEG and MEG in thirty volunteers.[10] Midbrain auditory frequency-following responses were observed at around 100–300 Hz. The auditory cortical responses were correlated with the 80–100 Hz envelopes of the midbrain carrier frequency at a latency of 40 ms.

The aerodynamics of normal phonation of vowels a, i, and u, and their performance before and after Bhramari Pranayama were studied in 26 female participants between the ages of 20–25 years.[11] The average fundamental speech frequency F^0 improved from 211.27 Hz to 217.32 Hz and the voice pitch improved from 223.01 Hz to 253.25 Hz after Bhramari Pranayama. Bhramari Pranayama is a well-established Yoga technique for interrupting the wandering mental activity and generating a relaxation response, mental poise, and calmness.

Infrasound is the sound of frequencies <20 Hz. It is an interesting phenomenon with a long complex history.[12] Many large animals communicate in the infrasound range including whales, elephants, hippopotamuses, rhinoceroses, giraffes, okapis, peacocks, and alligators. Human vocalists can produce notes of infrasound. In ideal conditions, humans can detect infrasound of 12 Hz. Such spontaneous continuous background sounds have been described as the sound of inner silence, Anāhata Nada, Sound of Avalokiteshvara and Brahma-Nada.[13]

Homeodynamic Bio-Oscillatory Conscious Self and Nirvana

The conscious self, Nirvana, Samadhi, Turiya, and Transcendence are hard to define. However, by meta-awareness, which is awareness of conscious contents, all of us have an intrinsic capacity to experience these states. Nirvana, Samadhi, Turiya, and Transcendence have been documented as true human states for millennia. In Table 2, I have listed some of the key features of these three terms as the seven 'A's of consciousness, the seven 'S's of self, and the seven 'C's of Nirvana.

The conscious self cannot be defined objectively because it is a personal subjectively felt experience. Each one of us knows what one is intrinsically, but it is an ineffable nonspecific experience. Many neuroscientists and philosophers have tried to objectify it, but finally it was described as the *hard problem of consciousness*. Many leading researchers have taken a variety of approaches to overcome this obstacle.

Our self-description has gone through many phrases and phases. Some of the famous phrases are: "I think therefore I am." (Descartes); "I feel therefore I am." (Panksepp); "I predict therefore I am." (Seth); "I am conscious therefore I am." (Marks), and "I am what I am *now*." (Deshmukh). I have a homeodynamic *feeling* of my own *existence*, therefore I am. This primal *feeling of self-existence* is fundamental to all living organisms. That is the basis of the survival instinct.

Jaak Panksepp made the statement, "I feel therefore I am," in 1998.[14] He also coined the term SELF, which stands for Simple Ego-type Life Form – "a coherent center of gravity for internal visceral-affective and external sensory-motor representations. The problem of the human "soul"– reflecting our ineffable feeling that each of us is unique "I"– has a tortuous history."[15] He suggested to make a differentiation between the primary process of *affective consciousness* and the secondary and tertiary process of *cognitive consciousness*.

David Marks proposed, "I am conscious, therefore, I am." He elaborated, "Organisms are adapted to each other and the environment because there is an inbuilt striving toward security, stability, and equilibrium. A General Theory of Behavior connects imagery, affect, and action with the central executive system

we call consciousness, a direct emergent property of cerebral activity. The General Theory is founded on the assumption that the primary motivation of all of consciousness and intentional behavior is psychological homeostasis. Psychological homeostasis is as important to the organization of mind and behavior as physiological homeostasis is to the organization of bodily systems… Consciousness is the "I am" control center for integration and regulation of (my) thoughts, (my) feelings, and (my) actions with (my) conscious mental imagery as foundation stones."[16]

Anil Seth made the statement, "I predict therefore I am" in his lecture on "Neuroscience of Consciousness" to the Royal Institute.[17] I used the phrase, "I am what I am *now*" in one of my poems, titled, *Now and Beyond*.[18]

Feinberg and Mallatt proposed an interesting solution to the emergence of consciousness based on the evolution of complex systems. They stated, "we use some ideas of complex system theory to trace the emergent features of life and then of complex brains through three progressive stages or levels: Level 1 (life), Level 2 (nervous systems), and Level 3 (special neurobiological features), each representing increasing biological and neurobiological complexity and ultimately, leading to the emergence of phenomenal consciousness, all in physical systems."[19]

Mark Solms proposed a free energy principle model of consciousness. He summarized it as "the free energy principle to the hard problem of consciousness. After clarifying some philosophical issues concerning functionalism, it identifies the elemental form of consciousness as affect and locates its physiological mechanism in the upper brainstem. This mechanism is then formalized in terms of free energy minimization where decreases and increases in expected uncertainty are felt as pleasure and unpleasure, respectively. Emphasis is placed on the reasons why such existential imperatives feel like something to and for an organism."[20]

Since the publication of a book, *The Feeling of Life Itself* by Christof Koch, the words, *Sentience* and *Panpsychism,* have been more frequently used in the neuroscience and quantum physics literature.[21] Koch defined consciousness as (direct) *experience*. He further elaborated experience as structured; it is informative, integrated, and definite; it has a point of view, and it occurs in time. "Any one experience takes place at a particular moment, the present *now*…Panpsychism is unitary…Consciousness is an intrinsic, fundamental aspect of reality…It is the irreducible *Whole* that forms my conscious experience, not the underlying neurons."

In quantum physics, some bold ideas were proposed. For instance, the idea that the omnipresent background of the zero point field (ZPF) interacts with the HBOs of living organisms including us. "high level cognitive processes involving consciousness employ a universal mechanism by means of which they access and modulate an omnipresent background field that is identified with the ZPF specified by stochastic electrodynamics, a branch of physics that deals with the universal principles underlying quantum systems. In addition to its known physical properties and memory capacities, the ZPF is hypothesized to be an immanently sentient medium."[22]

Another article talked about *Cosmopsychism*.[23] The authors suggested a "ubiquitous field of consciousness (UFC)." Here is their quote: "In this article, we address these questions using a novel variant of *Cosmopsychism*, a holistic form of panpsychism relying on the central idea that the universe is imbued with a UFC. This field is understood as a foundational dual-aspect component of the cosmos, the extrinsic appearance of which is physical in nature and the intrinsic manifestation of which is phenomenological in nature."

The Global Neuronal Workspace (GNW) hypothesis was reviewed recently.[24] It was proposed that "in the conscious state, a non-linear network ignition associated with recurrent processing amplifies and sustains a neural representation, allowing the corresponding information to be globally accessed by local processors." The central core of GNW receives input from (a) the perceptual systems (present), (b) long-term memory (past), (c) evaluative systems (value), and (d) the attentional systems (focus). The central output is by (e) the motor systems (future).

The Sphere Model of Consciousness (SMC) was the latest addition to the many theories and models of human conscious self.[25] Here is their summary: "The SMC delineates a sphere-shaped matrix that aims to describe subjective experiences using geometric coordinates, in accordance with a neurophenomenological perspective. According to the SMC, an experience of overcoming the habitual self and the conditioning of memories could be placed at the center of the matrix, which can then be called the Place of Pre-Existence (PPE). The PPE is causally associated with self-determination. In this context, we suggest that silence could be considered an intentional inner environment enabling self-perception to focus on the "here and now," which in turn improves perception of one's own body in space."

Nirvana, Samadhi, Turiya, and Transcendence

The Encyclopedia of Eastern Philosophy and Religion defined Nirvana as "the state of liberation

or illumination, characterized by the merging of the individual, transitory "I" in *Brahman*. *Nirvana* frees one from (experience of) suffering, (fear of) death, and (hope of) rebirth, and all other worldly bonds. It is the highest, transcendent consciousness, referred to in *Bhagavad-Gita* as *Brahman-Nirvana*, in the Upanishads as *Turiya*, in Yoga as *Nirbija Samadhi*, and in Vedanta as *Nirvikalpa Samadhi*."[26]

Recently, I have reviewed *Vedic Psychology* and the *Neurophilosophy of Meditation*.[27,28] The body–mind complex model has been extended to the body–mind–self (*atman*) model for explaining the process of holistic wellbeing or *eudaimonia*.[29] The Yogic concept of *Prana* as the underlying energy was well reviewed by Nagendra in his recent editorial. Briefly, "*Prana*, therefore, is like the underlying electricity which lightens all the light with different shapes and colors."[30]

Travis proposed that consciousness is primary. He concluded his review article as: "consciousness as a field of pure consciousness exists entirely by itself and does not depend on anything else for its existence. This model is not just philosophy but includes a meditation technique, Transcendental Meditation, to directly experience pure consciousness. This field model of consciousness (1) provides an answer to the "hard problem" of how the brain produces consciousness, (2) delineates higher states of consciousness that substantially extend the end point of human development, and (3) gives a new basis for rehabilitation.[31] I would add that this *field of pure consciousness* is the *primordial feeling of self-existence* in all living beings, as *I am, I exist.* One cannot deny one's existence. One has to *exist*, even to deny it. Turiya, the fourth state of holistic consciousness, the state of nondual awareness, and the state consciousness without content, have been documented recently.[32-34]

The bridge between bio-oscillatory fields and Nirvana

The intuitive insight into the potential bridge between the BOFs and Nirvana is unpredictable, as it cannot be entirely voluntary or intentional. One has to prepare oneself for this radical change to happen through utter vigilance and self-discipline. Technically, it is a nonlinear, homeodynamic self-transformation. One has to undergo a nondual self-integration to actualize its truth, which is Nirvana.

All living beings including us process and manage both *conscious* and *subconscious* information from within oneself and from the surroundings. One becomes *conscious* of the processed information as a result of the subject–object interaction. Otherwise, the information remains *preconscious*, *subconscious,* or *unconscious*. In view of the *uncertainty principle,* the unknown is *infinite*. As conscious beings, we try to *sculp out* the *known* from the *Unknown*, both individually and collectively. Our collective knowledge and experience accumulate in the form of our *human culture* including all of our sciences and arts.

The management of information can be intentional, reactive, or spontaneous. All human activity or behavior is emotionally charged. The *intentional* management of information gives us a sense of being an agent, a manager, or an ego. The *reactive* management is usually in response to a sensory stimulus like a perceived object, a person, an image, or a word. The *spontaneous* information processing is subconscious, egoless, and instantaneous. There are many examples of a sudden insight into one's intrinsic nature. In the Zen literature, it has been described as *Satori* or *Kensho,* which means the sudden awakening, when there is no distinction between the *knower* and the *known* or the *observer* and the *observed*.

For Nirvana to happen, the conscious self has to be mentally *present,* still, silent, serene, spontaneous, calm, composed, content, and blissful. All of these exceptional personal qualities have to come together for such a unique insightful moment of absolute *self-integration*. When it does happen, it is Nirvana!

उपाधिविलयाद्विष्णौ निर्विशेषं विशेन्मुनिः।
जले जलं वियद्व्योम्नि तेजस्तेजसि वा यथा॥ ५३॥

On letting go of the limiting mental superimpositions (mental preoccupations, wanderings, and the egoistic self-perspective), the sage becomes one with *Vishnu*, the all-pervasive *One* without (second and without) any residue (*Vishnu*: the personified all-pervasive *Deity*, the self-organizing *Life* principle symbolizing the *Universal* energy), as water merges in *Water*, formed space in existential *Space*, and the individual light (of awareness) in the whole field of *Light*, (The *Cosmic Self-Sentient Energy-Matter*).[35]

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