

The Energy Perspective in Neurophysics and Vedanta

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In order to understand conscious experience, appreciating the *energy perspective* is essential. All Life is embedded in a holarchically unified, matter-energy-information field. From Einstein's equation $E = MC^2$, it is reasonable to correlate the material, information and energy aspects of our experience. Matter-energy-information manifests at multiple levels of all natural phenomena including body, mind, self and consciousness.

In *Neuro-electrophysiology*, many mechanisms of energy transduction are established, for instance, the sensory perception, brainstem and cortical evoked potentials, brainstem reticular activating system, electroencephalography, magneto-encephalography, electromyography, nerve conduction studies, electro-retinography, electrococleography, electrocardiography, electro-dermal response, deep brain stimulation, transcranial magnetic stimulation, etc.

Sensory systems provide a continuous representation of the internal state of the body and the external world in a way that makes sense to the organism. Some of the neural mechanisms of signal-energy transduction are well described. Neural epithelial membrane is endowed with properties that transduce molecular energy into electromagnetic field potentials. Living organisms are full of such electromagnetic fields. Such energy transductions occur, both within as well as on the surface of an organism. Sensory energy-transductions include:

- i) *Photo-transduction* i.e., conversion of light energy, photons, into quanta of neural electromagnetic energy in retinal rods and cones using pigment molecules and the isomerization of vitamin A. This information is transmitted to the visual areas of the brain in terms of neuronal spike trains.
- ii) *Phono-transduction* i.e., conversion of auditory-accoustic energy, phonons, into quantal, electrococlear spike trains representing different auditory frequencies.
- iii) *Olfactory transduction* i.e. conversion of odorant, molecular energy into quantal, neural electromagnetic energy. Such energy transductions are crucial for prey-predator interactions, food-selection, reproductive activities including signals used for attracting mates, identifying them, copulating, blocking pregnancy, facilitating nipple attachment by infants, infant identification, social organization and mentation.
- iv) *Taste transduction* i.e., conversion of molecular energy in food, water and air into quantal, neural electromagnetic energy. Ionic stimuli (H^+ ions or protons in acids, and Na^+ sodium ions in salts) interact directly to ion channels to activate the taste cells in the tongue, palate, and other oral sites.
- v) *Mechano-transduction* i.e., conversion of vibrational energy into quantal, neural electromagnetic energy. Organisms are capable of detecting both remotely generated, mechanical perturbations in the environment like sounds and vibrations and also self-generated mechanical perturbations induced by movements of the body, limbs and vocal cords.

The personal *feeling* of conscious arousal-energy is a feeling of one's ability to act, to execute, to stop and withhold an action, a movement, speech, or cognition. Our feeling of arousal-energy can take three forms: i) personal energy-being, ii) collective energy-being, and iii) holistic energy-being.

The ascent of Kuṇḍalini Shakti or energy may represent biological evolution. The human mind evolves through four stages of development, growth and maturation, namely, i) collective unconscious, ii) individual unconscious, iii) individual conscious, and iv) collective conscious. These four stages of evolution are also reflected in the four stages of human sleep-wake cycle and the four states of human learning according to the conscious competence theory.