



The Body Electric: A Brief History of Healing and Regeneration with Electric and Magnetic Fields

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Electricity is basic to all life as we know it, and we continue to discover roles for electricity and magnetism in healing. The idea of using electric currents and magnets for healing has ancient roots; in China approximately 2000 years ago, “magnetic stones” were advocated to correct health imbalances,¹ and in Europe, Scribonius Largus, court physician to the Roman emperor Claudius, recorded in his *Compositiones Medicae* of 46 AD the use of torpedo fish for treatment of headaches and gout² and pain, by standing upon the fish at the seashore.³ In the 16th Century, the famous Swiss physician and alchemist, Paracelsus (1493-1543) declared that, “*The magnet is the king of all secrets*” and used it to treat a variety of conditions including headache and rheumatic problems.⁴

Into the 20th century, Burr and Northrup studied the role of bioelectric signals in embryonic development and regeneration,⁵ and in the 1940s, Marsh and Beams made the remarkable discovery that applying electric fields of different polarities to flatworms (planaria) could change the direction of regeneration.⁶ Significant steps forward were also made by Robert Becker, who mapped the bioelectric potentials associated with growth and repair processes and found that regeneration could be enhanced by applying electricity to wound sites at the wound when there was a negative potential outside the amputation

stub.⁷ Robert Becker popularized these and other advances in our understanding of the role of electric and magnetic fields in healing and regeneration in the 1985 publication in of *The Body Electric*.⁸ In the 1970s, it was found that electromagnetic fields (EMFs) could promote bone repair,⁹ and later, a seminal series or research by Colin McCaig showed that electric potentials naturally arising in wounds were critical for healing and regeneration,¹⁰ and a variety of therapeutic uses of EMFs have been developed, including bone and soft tissue repair.^{11, 12}

Today, Michael Levin and colleagues at Tufts University are continuing to forward the exploration of bioelectromagnetics and physiology by demonstrating that patterns in the electrical activity of biological cells act as key regulators of a variety of critical processes such as embryogenesis, regeneration, tumorigenesis and metastatic transformation, and that electrical patterning plays key roles in regenerative processes such as limb regeneration in salamanders, eye induction, craniofacial patterning and head-tail polarity in planaria.¹³ Levin has shown that patterns of bioelectric signaling constitute “... *an autonomous layer of control not reducible to a biochemical or genetic account of cell state.*”¹³ In a recent review dedicated to Robert Becker, Kelly McLaughlin and Michael Levin point towards the future, noting that, “*The ability of bioelectric signaling to direct cell behavior has been*



described in the literature for over a century, yet only recently are we gaining sufficient insight about mechanisms and global dynamics to enable biomedicine to unlock this valuable information.”¹⁴

This exciting chapter in today’s science is bringing new understanding of bioelectricity as a basic element of life. The modern biofield viewpoint that is emerging from this work — of an informational field-based view of life — has striking parallels in ancient viewpoints such as the Tibetan, Vedic and Jain medical traditions, where concepts of energy and information patterns are fundamental. For example, Jain teachings

processes in the body, have been suggested as non-invasive, low cost diagnostic and testing methods in agriculture, food chemistry and biomedicine.¹⁷ This ‘body of light’ has been shown to reflect a variety of different states of health and disease, and for example, Fritz-Albert Popp observed in 2009 that as living cells become more crowded in a cell culture dish, cancer cells exhibit increased biophoton emissions, while normal cells do not.¹⁸ A systematic review from John Ives and colleagues on the diagnostic use of biophotons concluded that the peer reviewed literature is “surprisingly large,” with the majority of studies of “good to high” quality.¹⁹ The authors recommended

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describe the interaction of the soul’s consciousness with the karmic field, producing emanations known as *adhyavasāya*, which interact with a subtle body called the *tejas sarir* (“fiery body”), which supports mental and physical health, and are described in a manner resembling modern descriptions of electromagnetic fields.¹⁵ Similarly, the Vedic concept of the energetic body known as *prāṇamayakosa*, and the Tibetan Buddhist description of a subtle body known as the “*vajra body*” (Sanskrit: *vajradeha*; Tibetan: *sku rdorje* or *rdo rje lus*) refers to a network of invisible energy channels that guide bodily functions.¹⁵

A fascinating aspect of bioelectromagnetics are biophoton emissions, which are the spectrum of light emitted naturally by all living things. Much weaker than the bioluminescence found in fireflies and many marine animals, biophoton emissions occur over a very broad range of frequencies, spanning the infrared, visible and ultraviolet ranges.^{16, 17} These “ultra-weak” biophoton emissions are too faint to see with the naked eye, even in complete darkness, but can be detected with modern equipment and have been increasingly studied in recent years.¹⁷

Ultra-weak biophoton emissions, most commonly produced during oxidative metabolic or stress

that randomized controlled clinical trials should be performed to determine if biophoton techniques could be used for non-invasively evaluating the specific inflammatory state of the individual and providing a general measure of overall health.¹⁹

A growing body of research suggests that ultra-weak biophoton emissions can also play roles in how cells and tissues in the body grow, repair and divide. The first report in 1923 of ultraviolet (UV) light emission during cell division was from Alexander Gurwitsch,²⁰ who subsequently found that UV light could stimulate cell division in onion roots, and posited the existence of “mitogenic rays” governing basic processes of growth and repair.²¹ The early observations of Gurwitsch were further developed in the 1980’s and 1990’s by Fritz-Albert Popp and L.V. Belousov, who elucidated many of the basic properties of ultra-weak biophoton emissions.^{21, 22} Since that time, biophotons have been reported to be involved in a variety of biological functions,²³ including secretion of regulatory neurotransmitters,²⁴ respiratory activity in white blood cells,²⁵ seed germination,²⁶ yeast growth,^{27, 28} algae growth²⁹ and interactions between fish eggs and embryos.³⁰

While it may not be surprising that biophoton emis-



sions reflect biochemical activity, there is increasing evidence that light itself plays a role in how the cells in our bodies communicate with one another.³¹ Two seminal studies from Gunther Albrecht-Buehler in the Proceedings of the National Academy of Sciences USA^{32, 33} reported long-range interactions between cells due to infrared light, concluding that “The results suggest that near-infrared light scattering by the cells mediate a long-range attraction between them, which does not require physical contact and enables them to detect each other’s presence.”³³

And a remarkable study by Daniel Fels in 2009 reported that cells can influence one another using non-molecular signals, most probably photons.³⁴ Fels looked at interactions between two groups of single-celled organisms (*paramecium caudatum*) chemically isolated from each other in clear containers. In a series of experiments, Fels reported that information regulating cell division and energy uptake passed through a quartz window between the cells but was blocked by one made of glass. Since quartz easily transmits UV light, whereas glass does not, Fels suggested that the long-range effect was mediated by photons in the UV range. Since 2009, Fels has continued with this research, in 2016 reporting interactions between two different species of microorganisms, *Paramecium caudatum*, and *Euglena viridis*.^{35, 36} Fels also conducted experiments in which the groups of microorganisms were shielded from each other against EMFs in the optical spectrum. He found that some effects were blocked by EMF shielding, suggesting that an electromagnetic interaction was involved.

These modern observations of ultra-weak biophoton emissions are reminiscent of ancient concepts where the gross physical body and mind are connected through a ‘body of light,’ an intermediate subtle body that is described in energetic terms.³⁷ For example, the Jain concept of the *kārman sarir*, describes a subtle body that surrounds the soul, interacting with consciousness emanating from the soul (Figure 1). Jain teachings describe the interaction of the soul’s consciousness with the karmic field, producing emanations termed *adhyavasāya*. *Adhyavasāya* are described as 2 types: psychical and physiological.

These *adhyavasāya* are thought to be energetic in nature and are described in a manner that bears strong resemblance to modern descriptions of electromagnetic fields.³⁷

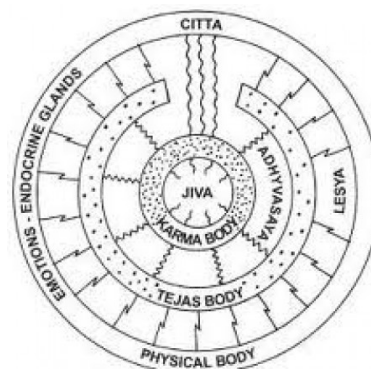


Figure 1. Simplistic description of Jain theories regarding the relationship between the embodied soul (*jiva*), consciousness (*citta*), and the interaction of consciousness with the subtle bodies (*karma body*, *tejas body*, *physical body*): Jains describe the rays of consciousness from the soul as interacting with the karma body to give rise to subtle vibrations (*adhyavasaya*) that influence the makeup and dynamics of the fiery (*tejas*) body and thus impact physical and emotional functioning. The interaction of *adhyavasaya* with the fiery body also gives rise to organized biofields of information that relay one’s psychospiritual state (*lesya*).

Ancient viewpoints such as these are reflected in an emerging biofield paradigm describing a complex dynamic informational field essential to all life.³⁸ This shift from a purely mechanical, chemistry-based viewpoint to an information-based view is reflected in advances in closely-related fields that once seemed disconnected: biophysics, biology, psychology and the developing fields of mind-body research such as psychoneuroimmunology and psychosocial genomics.³⁸ These results have helped substantially to form a foundation for an expanded integrative medical model and hold promise for a better understanding of health, healing and a better science of life.³⁸ €



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