

THE BASIS OF BIOELECTRICMAGNETISM

D. Lawrence Burk, Jr., M.D.

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The emergence of magnetic resonance imaging (MRI) in the 1980s as an important clinical tool has made the name "Tesla" a household word, since the size of the MRI scanners is measured in this unit of magnetic field strength. One Tesla is equal to 10,000 Gauss, so Nikola Tesla must have exhibited considerably more personal magnetism than Professor Gauss!

The resurgence of interest in this eccentric genius can be correlated with the recent rediscovery of the exciting field of electromedicine. At the turn of the century when Tesla was doing his pioneering work, there was also tremendous interest in the medical applications of electromagnetism. Unfortunately, due to the political and scientific climate of the time, Tesla died a misunderstood pauper and electromedicine was effectively suppressed by the medical establishment, along with other alternative practices such as homeopathy. Both Tesla and electromedicine were guilty of being ahead of their time, but it seems now, 90 years later, perhaps the world is ready for new ideas.

Born in Croatia, Tesla had a vision as a child that he would eventually harness the power of Niagara Falls. After he came to America as an electrical engineer, he went to work for Thomas Edison and then was hired by George Westinghouse, Edison's arch rival. The banking magnate, J. P. Morgan, pitted the two companies in a bitter competition to provide power for New York City from the hydroelectric resources of Niagara Falls. Edison believed the entire country could be lighted by direct current (DC), while Tesla invented alternating current (AC) as a more efficient means of transmitting power. Edison eventually had to admit bitter defeat, as Tesla succeeded in harnessing Niagara Falls just as he had envisioned.

Tesla obtained over 100 patents for electromagnetic devices, including the high-voltage Tesla coil. He moved on to pursue his dream of transmitting power around the world without wires. He planned to exploit the resonance frequency of the earth, which he calculated to be approximately 8 Hertz based upon certain parameters such as the thickness of the ionosphere and the velocity of light. But Marconi used the knowledge he obtained from Tesla to successfully produce the first radio-transmission across the Atlantic Ocean, and Tesla fell from favor with J. P. Morgan. His name faded into obscurity until the recent development of MRI.

The tremendous potential of electromedicine was also overlooked until the 1950s when Robert Becker, M.D., an orthopedic surgeon, developed an interest in the bioelectric basis of limb regeneration. His experiments on salamanders as he studied the current of injury following limb amputation, led to his discovery of the DC semiconductive analog system, an alternative pathway for transmission of electrical information along the nerves.

Becker hypothesized that the myelin sheath, which helps speed up the propagation of digital action potentials along the axons, also forms the basis of a second communication system that controls important, slower processes such as healing, growth and

development. Using this theory, he and others were able to produce evidence of regeneration in frogs and rats by implanting small batteries. As a spin-off of this research, he also discovered the basic principles of bioelectric bone healing which has developed into a major commercial industry in the field of orthopedic surgery. Advanced research is being pursued by members of the Bioelectric Repair and Growth Society (B.R.A.G.S.) into new areas such as wound, tendon and cartilage healing, as well as nerve and spinal cord regeneration.

Becker's studies led him into other more interesting areas including electroanesthesia, acupuncture, geomagnetic evolution and the health effects of electromagnetic radiation. Again using salamanders, he was able to show that changes in states of consciousness could be correlated with changes in measurable electrical potentials. Assuming the opposite also would be true, he proceeded to induce sleep by the application of electrical currents. These experiments have been duplicated in humans in the Soviet Union, where considerable research has been done in the field of electroanesthesia.

In the 1970s at the height of the resurgence of interest in China, Becker was asked by the federal government to investigate the electrophysiologic basis of acupuncture. He was the first to describe the marked reduction in skin resistance that occurs at the acupoints on the classical meridians. This characteristic electrical phenomenon is now exploited by modern commercial point finders, to confirm the locations on the body that have long been known to the practitioners of the ancient art of acupuncture.

At this point, Becker's interest in the electromagnetic basis of life led him to question the safety of our exposure to environmental radiation from power lines and radars. Picking up on Tesla's theories of earth resonance, he reasoned that due to our intimate relationship with the earth's magnetic field during millions of years of evolution, the frequencies near 8 Hertz must have considerable biological significance. Unfortunately, the military-industrial complex took a dim view of his actions in testifying about the potential hazards of extremely low frequency (ELF) radiation, and the grants he had been given to study acupuncture and other topics, vanished, leading to his premature retirement from academics.

Fortunately, the story does not end here, thanks to the determined efforts of many researchers in the International Society of Bioelectricity (ISB) and the Bioelectromagnetic Society (BEMS), who have pursued the basic science aspects of the interactions between electromagnetic fields and biological systems. It is now apparent these fields can have direct effects at the level of the cell membrane, and on calcium ion channels that regulate intracellular enzyme systems, through the postulated mechanisms of cyclotron resonance.

Carl Blackman, Ph.D., current president of BEMS and a biophysicist at the Environmental Protection Agency, has shown that not only are cells sensitive to specific ELF frequencies, but the effects are modulated by the strength of the local geomagnetic field which is in the range of 0.5 Gauss.

These windows of sensitivity maybe arranged in a fractal distribution as described in chaos theory, suggesting the cell membranes operate at a critical level of instability in which a transient phase shift can be induced by the appropriate electromagnetic field. Essentially, the growth of cells can be switched on and off, providing a possible mechanism for the promotion of cancer growth, suggested by epidemiological studies of leukernia in children and tumors in power line workers. Thus, the stimulation of cell

growth by electromagnetic fields can be seen as a double-edged sword with potential impact on theories of healing and malignancy.

Our relationship to the earth's electromagnetic properties may be even more intimate than Tesla first imagined. Magnetic sensing organs have been discovered in many organisms, and researchers have demonstrated the importance of the geomagnetic field in navigation by many forms of life from bacteria to birds. In humans, it appears that the pineal gland may provide an important link between electromagnetism and the brain. This master gland, which was once thought to be a vestigial organ with little function, controls the major biorhythms of the body and is exquisitely sensitive to light, as well as other forms of electromagnetic radiation.

There is increasing evidence that the resulting neuroendocrine effects may lead to alterations in reproductive functions, neurophysiology and behavior. There have been links to miscarriages in video display terminal operators and electric blanket users. A generalized stress response produced by exposure to electromagnetic fields may lead to alterations in immune functions. Depression has been found to be related to low light levels during the winter, and increased suicide rates have been correlated with living near power lines. Psychiatric disturbances increase when the geomagnetic field fluctuates due to sunspot activity and the lunar cycle.

Neuroscientist Michael Persinger from Laurentian University in Canada, believes the temporal lobes may also be involved in sensing these fluctuations in the earth's field, possibly resulting in microseizures in sensitive individuals. He has gone so far as to design a magnetic helmet that pulses the temporal lobes with earth resonance frequencies producing mystical experiences in student volunteers.

There are also many new mind machines from California, popularized by author Michael Hutchinson which produce meditative states through entrainment of brain waves, using light and sound at ELF frequencies. The fact the alpha frequency of the brain as determined by electroencephalograph is in the range of 8 to 10 Hertz, may not be a coincidence. Perhaps when yogis and adepts are modulating their brain wave frequencies during meditation, they really are achieving altered states of consciousness by tuning in to the earth. Perhaps, we should, too.

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