

Robert O. Becker

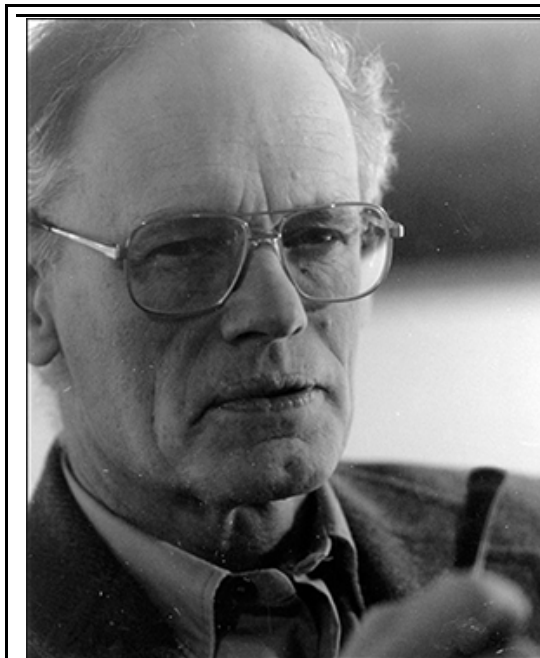
We posted this article repeatedly on Wikipedia, but each time it was taken down by trolls ignorant of Dr. Becker's work, biased against him, or both. The Wikipedia rules allow any 'editor' to object to an article, and ignorance of the subject is no bar. In contrast, knowledge of the subject is an absolute bar. The Wikipedia rules dealing with the problem are an infinite regress, and consequently we elected to post the article here rather than to continue our efforts to deal with Wikipedia, having decided that populism in publishing is a failure. Anyone interested in further details can find them on the Talk page for the abominable Wikipedia article that now exists at "Robert O. Becker."

Joel Ray and Andrew Marino May 23, 2018

Robert Otto Becker (May 31, 1923–May 14, 2008) was a U.S. orthopedic surgeon who is best known for his research in biocybernetics. He spent his entire career at the Veterans Administration Hospital, Syracuse, New York, where he served as chief of orthopedic surgery, chief of research, and head of a research laboratory devoted to studying the role of bioelectrical phenomena in growth and healing, tissue regeneration, and the health impact of artificial environmental electromagnetic energy.[1]

Formative Years

Robert Otto Becker was born in 1923 in River Edge, New Jersey, and raised in Valley Stream, New York, where his father Otto Julius Becker served as the pastor of St. Paul's Lutheran Church for forty years;[2] his mother was Elizabeth Blanck Becker. In 1941 he entered Gettysburg College in Pennsylvania, where he majored in biology and performed his first experiments on salamander regeneration.[3] He served in the army from 1942 to 1946; when he completed his bachelor's degree he entered medical school at New York University, and met and married Lillian Moller, a fellow student.[3] He obtained his medical degree in 1948, interned for a year, and for the next seven years studied pathology, surgery, and orthopedic surgery; for two of those years he was a medical officer in the army.[4] He chose to specialize in orthopedic surgery, and his training took place



Robert Becker, 1979

Born	31 May 1923 River Edge, New Jersey
Died	14 May 2008 Lowville, New York

mostly at the Veterans Administration hospital in Brooklyn.

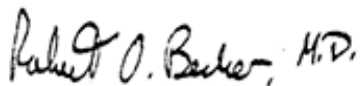
Professional Life

The Veterans Administration offered Becker the opportunity to do supported research as well as clinical medicine, and in 1956 he became the chief of orthopedics at the Veterans Administration hospital in Syracuse, NY. The job was generally regarded as unattractive for a physician, but he accepted it in exchange for the resources and freedom to do research.[1] He also became an adjunct professor at the State University of New York, on the same campus as the hospital.

Becker was interested in the medically significant problem of how the body regulated growth and healing such that the processes started and stopped as appropriate for the host, and produced exactly the kind of tissue needed. He was influenced by the cybernetic concepts of John von Neumann and W. Ross Ashby, the biological theories of Rene Dubos, the scientific philosophy of Peter Medawar, the observations of Harold Burr in experimental biology, and the theory of bioelectronic energy flow proposed by Albert Szent-Györgi; he adapted their work to his interest in how biological processes were controlled.[1] [3]

From the outset, Becker's research was novel and controversial. His biocybernetic approach to the study of growth-related phenomena differed from the orthodox approach based on biochemistry. In each area where he pursued biocybernetic models he encountered criticism from established researchers who favored models based on reductionism. His critics included W. Ross Adey in the area of public health,[5] Lionel Jaffe in limb regeneration,[6] C. Andrew Bassett in side-effects of electrical stimulation,[7] Philip Handler in interpretation of animal studies,[8] [9] Paul Weiss in the role of cellular dedifferentiation,[10] and Morris Shamos in the biophysics of bone.[11]

Becker's initial research studies were well received as evidenced by a series of fourteen papers in experimental biology published in prestigious journals during a four-year period in the early 1960s.[12] [13] [14] [15] [16] [17] [18] [19] [20] [21] [22] [23] [24] [25] In 1964 he won the William A. Middleton Award, given by US Veterans Affairs to the scientist who

Cause of death	Pneumonia
Spouse	Lillian Janet Moller Married 1946
Education	Gettysburg College New York University School of Medicine Bellevue Hospital (internship) Dartmouth Medical School (pathology) SUNY Downstate Medical Center (orthopedic residency)
Children	Michael, Lisa, Adam
Awards	Middleton Award (1964) Nicholas Andry Award (1979) Nominated for Nobel Prize for physiology or medicine (1978) [100]
Known for	Limb regeneration Cell dedifferentiation Biopotential measurements Electrical treatment of nonunions and osteomyelitis Hazards of artificial environmental electromagnetic energy Acupuncture
Scientific Career	
Fields	Biocybernetics Bioelectricity Biophysics Public health
Influenced By	Albert Szent-Györgyi Harold Burr Marcus Singer John von Neumann W. Ross Ashby Peter Medawar
Institutions	Veterans Administration Hospital Upstate Medical School LSU Medical School
Books	Mechanisms of Growth Control (1981) Electromagnetism and Life (1982) The Body Electric (1985) Cross Currents (1990)
	

produced the most outstanding research.[26] The same year he was appointed a Medical Investigator at the Veterans Administration, a distinction he held until 1976.



He believed that it was the duty of a taxpayer-funded researcher to speak directly to laypersons regarding his research results,[27] and he did so frequently throughout his twenty-year research career. Especially noteworthy were articles in *Saturday Review*, [28] *Hutchings Journal*, [29] *the Medical World News*, [30] and *Technology Review*, [31] his interview on the national television show “60 Minutes,” [32] his statements on public health made to the US House of Representatives, [33] [34] [35] and his testimony in hearings in New York concerning the health impacts of high-voltage powerlines. [36]

The cumulative effect of the novelty of his research and his practice of speaking publicly about its implications was the loss of his research funding from the National Institutes of Health and the Veterans Administration; according to an official at the Veterans Administration, Becker’s public activities brought unwanted controversy to the agency. [1] Following a public dispute with the president of the National Academy of Sciences regarding scientific bias in the evaluation of a

public health issue, [8] [9] Becker was forced to retire. [37]

Research

Wellspring Studies

In 1958 Becker started research on how growth and healing are controlled. While investigating a clinical problem of muscle weakness, [12] he measured slowly changing electrical signals on the skin of his patients, which he concluded were the sign of internal electric currents. This work led to studies on salamanders in which he found that they exhibited a pattern of measurable electrical signals on the skin that corresponded to the anatomic structure of the nervous system, suggesting to him that the signals originated in nerves. [13] Working with salamanders, which naturally regenerate missing limbs, and frogs, which do not, he found important differences between the two species in the duration and polarity of the electrical signals in animals that had undergone surgical amputations, suggesting that the internal flow of electrical energy played a major role in the healing process. [14] He found that the energy flow along peripheral nerves in salamanders could be altered by applying a magnetic field [15] and by sectioning the nerves, [20] suggesting that the flow consisted of the movement of electrons rather than ions.

Becker found a neural-related pattern of electrical signals on the surface of the human body, paralleling the link he had seen in salamanders, and he measured changes in the signals from subjects in certain reduced-attention states including sleep and anesthesia.[19] He also found that the signals varied with changes in consciousness induced by hypnosis.[16] He raised the possibility that the signals were directly related to the mechanism that controlled the various cognitive states.[25]

In a four-year study, using data on magnetic storms collected by government agencies, he found a correlation between admissions to psychiatric wards and changes in the earth's magnetic field, suggesting the possibility of the geomagnetic field's influence on human behavior.[21] [23] [38]

He took these collective results as evidence of the working of a biocybernetic control system, separate from the well-known nerve-impulse system, that regulated healing and growth processes and mediated the link between living systems and the environment.[24] [25]

Regeneration

Becker investigated the question of how fracture healing occurred in frogs by studying the morphological changes that occurred in cells at injury sites in relation to measured electrical changes.[39] [40] The results convinced him that, during healing, some cells in the vicinity of the injury became transformed into stem cells—a process known as dedifferentiation—as a consequence of electrical signals that originated in the nervous system. This controversial phenomenon became an important focus in Becker's pursuit of the larger question of regeneration in animals and in humans. In 1972 he electrically stimulated partial limb regeneration in a mammal, the rat,[41] [42] and discovered that salamanders could spontaneously regenerate heart muscle and recover function after the heart had been cut open.[43] His ideas and experimental approach were generally not pursued in other laboratories, where a more biochemically oriented approach was favored, although there were exceptions.[44]

In the late 1970s, newspaper and magazine articles raised public interest in Becker's approach to regeneration research.[45] [46] He received indications of support from the head of the Veterans Administration, a congressman, and two US senators.[47] But fierce opposition ultimately blocked funding of his regeneration program,[1] except for his proposal to hold an international conference on regeneration.[48]

Bone Bioelectricity

Becker believed that the currents flowing in the neural-based biocybernetic control system were electronic not ionic, and since the system involved instantaneous communications between distant points within the nervous system, he reasoned that the flow must occur by means of semiconduction. He confirmed that bone responded electrically to mechanical stress,[18] and hypothesized that regeneration of bone occurred as a result of internal electrical forces and electron currents, much as other healing and growth was controlled.[18] These ideas served as the rationale for detailed studies of how semiconduction, electromechanical forces, and bone growth were related, and as the basis for his proposed negative-feedback system for controlling bone growth.[49]

The existence of an electron conduction band was supported by studies using the techniques

of electron paramagnetic resonance [22] [50] and photoconductivity,[51] [52] which allowed demonstration of mobile electrons in bone; flame spectroscopy, which allowed detection of trace elements in bone that could account for the origin of the mobile charge carriers;[53] and dielectric dispersion, which allowed detection of the water molecules that could account for the ability of charge carriers to enter the conduction band.[54] Becker showed that electromechanical signals in bone originated as a result of the piezoelectric effect manifested by the collagen matrix of bone,[55] and that the signals were probably directly related to bone growth.[56]

An important implication of Becker's work on semiconduction is the suggestion that the origin of life might have been in a solid rather than in water.[57]

Clinical Research

In the early 1970s, influenced by McLean and Urist's admonition that "more reliance should be placed upon the primordial power of the human skeleton to regenerate injured and missing substance,"[58] Becker explored the clinical implications of the electrical control system with regard to stimulating regenerative healing in man.[59] He viewed the approach as a possible alternative to prosthetic implantation, which was then undergoing rapid expansion in use in orthopedic surgery. His approach to the use of electromagnetic energy for the promotion of healing differed markedly from that of other prominent orthopedists, who he felt were using levels of electrical energy in clinical treatment that had not been tested sufficiently in laboratory and animal studies and might be too high for purposes of safety and effectiveness.[60]

Using currents far smaller than those employed by other orthopedists who were using electrical methods,[61] he conducted laboratory experiments to evaluate both the mechanism of action and the effectiveness of the technique for particular applications, especially osteomyelitis.[62] [63] In subsequent clinical applications he developed the use of anti-infective silver electrodes to improve the healing process,[64] [65] [66] and described his clinical technique in a textbook.[67] He remained concerned that the potential side-effect of the clinical use of electromagnetic energy had not been studied sufficiently.[68]

Acupuncture

Becker hypothesized that the underlying scientific explanation for the ancient Chinese method of clinical treatment known as acupuncture involved the flow of information via electromagnetic energy along channels in the body that were invisible to Western imaging techniques yet were regarded in China as ontologically real. Following Richard Nixon's 1972 visit to China, limited research funding for acupuncture studies became available from the National Institutes of Health and Becker secured one of the grants. He focused his research on seeking evidence for the existence of the channels (meridians), the external locations on the skin where they could be accessed by clinicians (acupuncture points), and electrodermal activity occurring at the points. Between 1975 and 1979 he published experimental studies that provided evidence for each of these phenomena [69] [70] [71] [72] [73] [74] as well as review and methods papers.[75] [76] His research in these areas compared favorably with that of the other Western scientists who studied acupuncture.[77] [78]

Public Health

Becker reasoned that the physiological control system he had described [1] [17] [19] [79] would be influenced by external electromagnetic energy because the system was electrical in nature. He presented supporting experimental evidence in November 1961 at a Massachusetts Institute of Technology symposium on magnetic fields, where he described correlations between changes in the geomagnetic field and admissions to psychiatric hospitals (subsequently described more fully [21] [38]). In a literature review he concluded that the geomagnetic field could regulate living organisms, even though the underlying mechanisms were poorly understood.[24]

Following a laboratory study in which he found that artificially modulated magnetic fields altered human reaction times,[80] Becker agreed to a congressional request to testify in favor of a pending bill that would create pre-market safety regulations regarding permissible levels of electromagnetic energy emitted by commercial devices. He urged a cautionary approach,[33] and presented a supporting analysis in a report for the Joint Technical Advisory Committee of the IEEE.[81]

In 1972 he delivered a paper at an annual convention of the IEEE in which, based on considerations regarding the body's cybernetic control system, he warned against "the continuous exposure of the entire North American population to an electromagnetic environment in which is present the possibility of inducing currents or voltages comparable with those now known to exist in biological control systems." [31] Subsequently he reported experimental studies in which animals were exposed for relatively long times to artificial electromagnetic energy. Employing energy levels comparable to those in the general environment, he found that continuous exposure to the energy for periods of weeks or months caused altered growth rates in mice,[82] [83] deficient bone healing in rats,[84] [85] stress-related changes in the neuroendocrine system in rats,[86] and chromosome changes in tumor cells.[87] He published explanations of his work and that of others who found similar results, and in several publications discussed the implications of the animal studies with regard to human health risks.[88] [89] [90]

In a New York hearing on the safety of high-voltage powerlines, he testified in favor of independent research regarding the health risks of artificial environmental electromagnetic energy, and was cross-examined for four days.[36] He gave similar testimony before a congressional committee.[34] Becker was the first to use the term "electromagnetic pollution." [89]

Forced Retirement

During Becker's public involvement in the four-year powerline hearings, his grant renewal requests were denied, sometimes without explanation; a main NIH grant that had funded positions in his lab for over a decade was terminated, as was his grant to study acupuncture. [1] Soon after he lost the grants, during an interview on "60 Minutes" in February 1977 regarding the Navy's proposed Sanguine antenna, Becker suggested that the National Academy of Sciences committee then evaluating the safety of the antenna was biased against finding biological effects.[32] The Academy president Philip Handler, who had selected the committee, called for Becker's firing; Becker continued to function as a staff

physician but lost his appointment as Medical Investigator, which had the effect of reducing his staff by half.[1] In early 1979 the Veterans Administration closed his laboratory; with no capacity to continue his research, he retired. He was 56. In his preface to a 1985 book about the New York hearings and aftermath, he wrote that the book revealed not only the health hazard, but also “the hazards...of raising the issue.”[91]

Later Life

In the following years, Becker wrote extensively about his research in articles,[92] [93] [94] books,[3] [37] [48] [95] and public testimony,[34] [35] recounting its history, explaining its meaning, and providing what he viewed as a coherent basis for examining medical issues in general and the specific issue of electromagnetic health risks. He cofounded the Journal of Bioelectricity (subsequently Electromagnetic Medicine and Biology), gave the 1983 President’s Guest Address before the American Academy of Orthopedic Surgeons,[96] and testified again in congressional hearings on health risks from electromagnetic technologies. [35]

Becker articulated his views in four books. In *Electromagnetism and Life*, published in 1982, he argued that exposure to artificial environmental electromagnetic energy was a general biologic stressor and can produce functional changes in biological systems.[95] *Mechanisms of Growth Control*, published in 1981,[48] was the proceedings of an international conference on regeneration that he organized. Writing for a general audience in *The Body Electric* in 1985 [3] and *Cross Currents* [37] in 1990, Becker summarized his research and his views on science and medicine in historical perspective.

He patented a cell-modification process in which cells were dedifferentiated by ions from electrically positive silver electrodes; the modified cells were said to be capable of regenerating organs and tissues.[97] [98] An FDA-approved clinical study of his method was sponsored by the Sybron Corporation at the LSU Medical School in Shreveport to study the safety and efficacy of the method for treating osteomyelitis, but the Sybron product was not brought to market.[99]

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