

Dr. Robert O. Becker Book Excerpts:

Cross Currents – The Perils of Electropollution – The Promise of Electromedicine by Robert O. Becker M.D. – page 72.

In 1975, Professor Richard Blakemore, also of Woods Hole Marine Biological Laboratory, became intrigued by the strange behavior of some bacteria he was studying. Blakemore noticed that the bacteria always clustered at the north side of their culture dish. Even if he turned the dish so that they were at the south end and left it overnight, the next morning the bacteria were back at the north side. While such "magnetotrophic" bacteria had been described before, no one had ever done what Blakemore did next: he looked at them under the electron microscope. What he found was astonishing. Each bacterium contained a chain of tiny magnets! The magnets were actually crystals of the naturally magnetic mineral magnetite, the original lodestone of preliterate peoples. Somehow, the bacteria absorbed the soluble components from the water and put them together in their bodies as the insoluble crystalline chain.

Later studies showed that this arrangement was of value to these bacteria, which lived in the mud on the bottom of shallow bays and marshes. If they were moved by the tide or by storm waves, their magnetic chains were large enough (in comparison to their body size) to physically turn their bodies so that they pointed down at an angle corresponding to the direction of magnetic north. All the bacteria had to do was swim in that direction, and sooner or later they would be back in the mud. This was an interesting mechanism, but it did not contain any sophisticated information transfer. The bacteria did not "know" that north was the way to swim; they just did so. However, these observations opened up a much more interesting series of investigations.

The Body Electric by Robert O. Becker, M.D., and Gary Selden - (pages 276-278)

Subliminal Stress

After Howard Friedman, Charlie Bachman, and I had found evidence that "abnormal natural" fields from solar magnetic storms were effecting the human mind as reflected in psychiatric hospital admissions, we decided the time had come for direct experiments with people. We exposed volunteers to magnetic fields placed so the lines of force passed through the brain from ear to ear, cutting across the brainstem-frontal current. The fields were 5 to 11 gauss, not much compared with the 3,000 gauss needed to put a salamander to sleep, but ten to twenty times earth's background and well above the level of most magnetic storms. We measured their influence on a standard test of reaction time - having subjects press a button as fast as possible in response to a red light. Steady fields produced no effect, but when we modulated the field with a slow pulse of a cycle every 5 seconds (one of the delta wave frequencies we'd observed in salamander brains during a change from one level of consciousness to another), people's reactions slowed down. We found no changes in the EEG or the front-to-back voltage from fields up to 100 gauss, but these indicators reflect major alterations in awareness, so we didn't expect them to shift.

We were excited, eagerly planning experiments that would tell us more, when we came upon a frightening Russian report. Yuri Kholodov had administered steady magnetic fields of 100 and 200 gauss to rabbits and found areas of cell death in their brains during autopsy. Although his fields were ten times as strong as ours, we stopped all human experiments immediately.

Friedman decided to duplicate Kholodov's experiment with a more detailed analysis of the brain tissue. He made the slides and sent them to an expert on rabbit brain diseases, but coded them so no one knew which were which until later.

The report showed that all the animals had been infected with a brain parasite that was peculiar to rabbits and common throughout the world. However, in half the animals the protozoa had been

under control by the immune system, whereas the other half they'd routed the defenders and destroyed parts of their brain. The expert suggested that we must have done something to undermine resistance of the rabbits in the experimental group. The code confirmed that most of the brain damage had occurred in animals subjected to the magnetic fields. Later, Friedman did biochemical tests on another series of rabbits and found that the fields were causing a generalized stress reactions marked by large amounts of cortisone in the bloodstream. This is the response called forth by a prolonged stress, like a disease, that isn't an immediate threat to life, as opposed to the fight-or-flight response generated by adrenaline.

Soon thereafter, Friedman measured cortisone levels in monkeys exposed to a 200-gauss magnetic fields for four hours a day. They showed the stress response for six days, but it then subsided, suggesting adaptation to the field. Such seeming tolerance of continued stress is illusory, however. In his pioneering lifework on stress, Dr. Hans Selye has clearly drawn the invariable pattern: Initially, the stress activates the hormonal and/or immune systems to a higher-than-normal level, enabling the animal to escape danger or combat disease. If the stress continues, hormone levels and immune activity gradually decline to normal. If you stop your experiment at this point, you're apparently justified in saying, "The animal has adapted; the stress is doing it no harm." Nevertheless, if the stressful condition persists, hormone and immune levels decline further, well below normal. In medical terms, stress decompensation has set in, and the animal is now more susceptible to other stressors, including malignant growth and infectious disease.

In the mid-1970's, two Russian groups found stress hormones released in rats exposed to microwaves, even if they were irradiated only briefly by minute amounts of energy. Other Eastern European work found the same reaction to 50-hertz electric fields. Several Russian and Polish groups have since established that after prolonged exposure the activation of the stress system changes to a depression of it in the familiar pattern, indicating exhaustion of the adrenal cortex. There has even been one report of hemorrhage and cell damage in the adrenal cortex from a month's exposure to a 50-hertz, 130-gauss magnetic field.

Soviet biophysicist N. A. Udintsev has systematically studied the effects of one ELF magnetic field (200 gauss at 50hz) on the endocrine system. In addition to the "slow" stress response we've been discussing, he found activation of the "fast" fight-or-flight hormones centering on adrenaline from the adrenal medulla. This response was triggered in rats by just *one day* in Udinstev's field, and hormone levels didn't return to normal for one or two weeks. Udinstev also documented an insulin insufficiency and rise in blood sugar from the same field.

One aspect of the syndrome was very puzzling. When undergoing these hormonal changes, an animal would normally be aware that its body was under attack, yet, as far as we could tell, the rabbits were not. They showed no outward signs of fear, agitation, or illness. Most humans certainly wouldn't be able to detect a 100-gauss magnetic field, at least not consciously. Only several years after Friedman's work did anyone find out how this was happening.

In 1976 a group under J. J. Noval at the Naval Aerospace Medical Research Laboratory at Pensacola, Florida, found the slow stress response in rats from very weak electric fields, as low as five thousandths of a volt per centimeter. They discovered that when such fields vibrated in the ELF range, they increased levels of the neurotransmitter acetylcholine in the brainstem, apparently in a way that activated a distress signal subliminally, without the animal's becoming aware of it. The scariest part was that the fields Noval used were well within the background levels of a typical office, with its overhead lighting, typewriters, computers, and other equipment. Workers in such an environment are exposed to electric fields between a hundredth and a tenth of a volt per centimeter and magnetic fields between a hundredth and a tenth of a gauss.

Cross Currents – The Perils of Electropollution – The Promise of Electromedicine by Dr. Robert O. Becker (pages 194-197) – I added the bold type...

In the early 1980's, the U.S. Air Force School of Aerospace Medicine funded a very large, very expensive study at the University of Washington, under the direction of Dr. Arthur W. Guy. In this study, rats were continuously exposed to high frequency microwaves of 2.45 gigahertz (with one gigahertz equaling one billion hertz) at approximately 0.5mW/cm², twenty times lower than the "safe" thermal level. The exposures lasted for as long as 25 months, and 155 different measures of health and behavior were collected.

This appeared to be a well-designed study that would finally answer the question of whether there were any potential hazards to human beings from chronic exposure to microwave radiation. According to Guy, "The results revealed few differences between the exposed and control rats, and those differences for the most part were either not statistically significant or came and went, suggesting that they may be due to chance."

However, one striking observation was noted: "Primary malignant tumors developed in eighteen of the exposed animals but in only 5 of the controls." Guy hastened to explain that the incidence of cancers even in the experimental group was actually *lower* than normally expected for the strain of rat used in the experiment. He suggested that no hasty conclusions should be drawn, and that a "consensus among most investigators that the only strong evidence for the hazards of microwaves is found at high levels of exposure" was still valid.

The project was widely reported in the press and discussed in scientific meetings, and it was the subject of a major article in the September 1986 issue of *Scientific American* (from which the quotes have been drawn). **A significant aspect of the experiment was not reported either in that article or in the popular press - but at the scientific meeting at which the results of the study were first reported, it was revealed that all of the animals used, both experimental and control were gnotobiotic (a term meaning germ and virus free).** This circumstance alone was responsible for a major part of the \$5 million cost of the project.

To produce gnotobiotic animals, the young must be delivered by cesarean section under the strictest possible sterile operating-room conditions (much more stringent than those in use in operating or delivery rooms for people). Following delivery, the animals must be raised and then housed in totally sterile environments for the entire duration of the experiment. This type of environment is akin to the decontamination rooms used to house the astronauts after they returned from the moon, or the "bubbles" within which children born without immune systems are housed.

The use of gnotobiotic animals seems to be not only totally unnecessary, but undesirable as well. **Neither we nor the laboratory rat normally live in a sterile world, devoid of bacteria or viruses.** On the contrary, we live surrounded by uncountable numbers of organisms. We generally do not get sick unless we are injured and bacteria enter the body through the wound, or unless our immunity is inadequate and we get a communicable disease or infection. An experiment on germ- and virus-free animals has no relevance to the real world.

The point becomes even more apparent when two established facts are considered. First, present evidence shows that at least 20% of human cancers are caused by viral infection, and the percentage is considerably higher in animals. Therefore, animals that are maintained in a germ- and virus-free state have an incidence of cancer that is much lower than expected. Second, it is well-established that exposure to any abnormal electromagnetic field produces a stress response. If the exposure is prolonged, the stress-response system becomes exhausted, and the competency of the immune system declines to below normal. In such a state, animals and humans are more susceptible to cancer and infectious diseases.

One can only conclude that the experiment at Washington was deliberately designed to sharply reduce the incidence of cancer and infectious diseases in the exposed animals. There can be no other reason for the requirement that the animals be gnotobiotic.

Therefore, if we knew the facts in advance, and we wanted to set up a "scientific" project to expose animals to microwaves for a long time but were required to get negative results, we would have only one choice - to use germ- and virus-free test animals. Being gnotobiotic, both the unexposed control animals and the exposed experimental animals would be protected against the usual dangers of infection and cancer. In Guy's study, the fact that the experimental animals had a lower-than-normal incidence of cancer was totally expected. What was unexpected and highly significant was that even with this protection, the cancer incidence in the animals exposed to microwaves was four times that in the control animals.

The well-designed experiment that should have "proved" that microwaves are safe fell into a trap, and the nature of the trap is revealed by the types of cancer that occurred in the experimental group. These were mainly limited to cancers of the pituitary, thyroid, and adrenal glands; these cancers were accompanied by a significant number of pheochromocytomas, which are benign tumors of the adrenal glands. There were no significant cancers of any of the usual tissues.

The experiment was designed to prevent the results of stress, but the planners forgot that it would *produce* stress. Because stress resistance is mediated chiefly through the three glands just mentioned, we must conclude that the microwave exposure produced an extremely high level of stress - so much so that the resultant prolonged hyperactivity of these glands led to their becoming cancerous. Considering the extreme stress experienced by the exposed animals, if the animals had been normal (rather than gnotobiotic) the entire experimental group would have died of infection or cancer before the close of the experiment.

Some of the 155 biochemical determinations done by Guy in the course of the experiment confirm this interpretation. Plasma cortisol is one of the chemical substances produced by the adrenal glands under conditions of stress, and it was one of the substances measured in the experiment. At the start, the plasma cortisol was equal in both the control and experimental groups; in the early months of microwave exposure, however, cortisol in the experimental group was elevated above that in the control group, indicating that the experimental animals were reacting to stress. By the latter phase of the experiment, the plasma cortisol of the exposed animals was depressed below that of the controls, indicating that the stress response systems of the experimental animals had become exhausted. This result is exactly as expected for a condition of chronic stress.

These data, which are buried in a multivolume official Air Force report of the project, were first published in the July-August 1984 issue of *Microwave News*. The experiment was planned cleverly, but not cleverly enough. It clearly indicated that chronic exposure to microwaves at levels 20 times below the established safe thermal level, produced profound stress and ultimately exhaustion of the stress-response system. Because the experiment involved gnotobiotic animals, this resulted only in an increase in cancers of the stress-response glands. Had the experiment been performed under real world conditions, the result would have been catastrophic for the exposed group of animals.