Robert O. Becker, M. D., Retired Prof. of Medicine at Upstate Medical Center, Syracuse , Director of Orthopedic Surgery at the Veterans Hospital, Syracuse, New York and author of *Cross Currents and The Body Electric*: "When you get into this business of the environmental effects of electromagnetic fields, I was involved in the early stages of questions of microwave radar safety surfaced. My approach was: OK, first of all we have to know if electromagnetic fields, the fields in the space around you emitted from any sort of radiating source of such energy - do they have any biological effects? And secondly, what was the natural electromagnetic field environment before Thomas Edison came along.

Now if you look at the question of: Are there biological effects, the engineers and the physicists say absolutely not. Their view in general of what living systems consist of is that the cells are little plastic bags filled with minestrone soup. And you can then with that sort of a concept calculate the field strength and the frequencies you would need to produce an effect on the minestrone soup. And this is exactly the concept that was employed after it became apparent that radar systems could heat up the human body. The physicists that were involved in answering the question: Are there effects? And at what level do they occur? And what would be a safe level? Basically, they followed a basic precept which was to consider a spherical cow, a circular oval object filled with conducting solution and composed of a skin that is transparent to the radio frequency waves that microwave generators produce. And on that basis, they asked: How much does it take to heat this up? Where does the cow's temperature start to rise?

And that number was calculated and confirmed in actual procedures in the lab using the spherical cow concept. They said, "OK, that's the number at which you are going to start heating people. Let's say that's not such a good idea and we'll set a level ten times lower as the safe levels."

That level was applied for several decades to everything that concerned electromagnetic pollution. Of course, this is not correct. Any biologist can tell you that the body is much more complicated than that and the work I had done up to that point had involved the body's actual use of electric currents generated in the body that regulated certain things like healing. Wound healing is associated with a rather specific electrical current and voltage. So, the premise that was applied by the physicists and the engineers was erroneous from the start.

That's number one. Number two, what would be the normal electromagnetic environment assuming that we're starting from scratch at Edison's time - and not Edison either because he went to DC current to light the light bulb. It was Nikolai Tesla who conceived of the system we presently use and who, incidentally, gets no credit for it: the 60 second electromagnetic field that is carried by power lines, the big lines that are strung across the country, and provides the current that comes into your home and appears in the wall socket and you use to run the coffee maker and the TV and all the rest of the things in the house. 60 cycles. That didn't even exist one hundred

years ago.

The only electromagnetic fields on the earth were those inherent in the basic magnetic field of the earth as it is influenced by the sun. And these were all at either a steady state magnetic field which is one that is non-varying. The earth's field is roughly 500 milligauss. The power, the magnetic field strength of the refrigerator magnet is higher than that.

The magnetic field strength inherent in the communication frequencies is far, far lower than that, but all of these are *oscillating*. They are frequency-dependent. The earth's field does not oscillate very much at all. It goes up and down to a slight extent depending on the time of the day and the situation on the sun.

SO, WE HAVE SURFACE LIFE THAT HAS BEEN USED TO EVOLVING AND GROWING IN A VERY SPECIFIC KIND OF FIELD THAT THE EARTH HAS EMANATED STEADILY AND THEN SUDDENLY SINCE EDISON, ABOUT ONE HUNDRED YEARS AGO, EVERYTHING CHANGED.

Everything markedly changed and if you graphed the curve of increasing incidence of use, it would go up in an exponential fashion. It has been a rise that doubles itself every couple of years.

AND BASED ON YOUR KNOWLEDGE IN THE WORK YOU HAVE DONE IN YOUR CAREER CONCERNING ELECTROMAGNETIC FIELDS AND BIOLOGY, WHAT IS YOUR OWN ASSESSMENT OF WHERE WE STAND TODAY IN 2000 IN RELATIONSHIP TO THE PROLIFERATION OF CELL PHONES AND THE MAST TOWERS THAT PUT OUT THE RADIO FREQUENCIES?

As far as I'm concerned, these factors DO have biological effects. I think that the overwhelming evidence indicates that happens. There is an effect even though physicists and engineers continue to say it's impossible. But the biologists know biology. The engineers know engineering and electromagnetics and the two were never able to see eye to eye on this subject.

I have no doubt in my mind that at the present time that the greatest polluting element in the earth's environment is the proliferation of electromagnetic fields. I consider that to be far greater on a global scale than warming...

GLOBAL WARMING....

yeah, and the increase in chemical elements in the environment. All of these things are reduced when compared to the proliferating affect of the electromagnetic fields. The only difference is that we don't know they are there.

YES, IT'S AN INVISIBLE POLLUTION.

Yes, it's invisible to us. We don't know that it's there. So, it has never been a particularly prominent question even among the environmental people. And part of the problem is that our total economy is based on unlimited use of electromagnetic energy.

WHAT IS YOUR GREATEST CONCERN ABOUT WHAT THE EFFECTS AND CONSEQUENCES OF THIS INVISIBLE MICROWAVE AND ELECTROMAGNETIC POLLUTION IS UPON US ALL?

There are basically two most important biological effects of electromagnetic effects on, or in, living systems are their effects on growth and development. There is potential for producing disturbances in growth processes in the body that can lead to the presence of malignancies. And in that regard, for a long time the National Institutes of Health had studiously insisted there was absolutely no evidence that there was ANY affect of such fields upon any cancer system in the human. I think this is absolute nonsense. And last year, the NIH - without any fanfare and rather quietly in the dark of the night - issued a little report that says there is a relationship between electromagnetic effects and childhood leukemia. Period. End of story, as though that was all. That's not true. Absolutely not true.

THAT THERE ARE MORE CONSEQUENCES?

Much more. And much more in the area of abnormal growth, the production of malignancies, the production of cancers. That's number one.

The second one is in the operation of the central nervous system, the brain. There are definitive effects of low strength oscillating electromagnetic fields on brain function. Now, we look around at the present time and I have lived through roughly half of this period of increasing use of electromagnetic energies. We're looking at an entirely different behavioral aspect of the population at the present time. We certainly have a far different social attitude at the present time among the majority of the population.

THAN A HUNDRED YEARS AGO WHEN THERE WAS NOT OSCILLATING FREQUENCIES?

Yeah.

AND WOULD YOU PUT AT THE TOP OF THAT LIST IRRATIONAL VIOLENCE AND ROAD RAGE?

Yeah, I would put it up there. I don't know if it's the first thing on the list. If you look at the proliferation of what is called Attention Deficit Disorder (ADD) - that wasn't

even here when I was young. That was not a diagnosis. It never existed.

SO ATTENTION DEFICIT DISORDER WHICH HAS BEEN A BIG DEAL IN SCHOOLS IN THE LAST HALF OF THIS CENTURY IS SOMETHING THAT IS RELATIVELY MODERN AND COULD BE ASSOCIATED WITH THIS PROLIFERATION OF OSCILLATING ELECTROMAGNETIC FIELDS?

I have no doubt of that. There are people who were interested in this. No one, though, has done the definitive study. This would involve the exposure of humans to fields which gets to be morally difficult. But we should know. These are very important questions. And the problem is that this is such an important aspect of our entire economic structure, and not to mention our military posture, you cannot get very much in the way of support from federal granting agencies to study this sort of thing.

SO SCIENTISTS AND RESEARCHERS ARE STYMIED IN THAT REGARD?

Yeah. There is no money.

AND IN ENGLAND AND IN AUSTRALIA WHERE THERE HAS BEEN SOME SUPPORT FOR THAT RESEARCH, THIS IS WHERE WE ARE GETTING THE LARGEST BREAKTHROUGHS IN TERMS OF DATA AND THIS WEEK THERE HAVE BEEN ANNOUNCEMENTS FROM ENGLAND, SPECIFICALLY FROM TAYSIDE UNIVERSITY IN SCOTLAND. THEY ARE RAISING A BIG RED FLAG ABOUT KEEPING CELL PHONES AWAY FROM CHILDREN. ARE YOU FAMILIAR WITH THIS WORK AND WHAT IS YOUR COMMENT?

I'm only familiar with the press releases that came out. It's a very good idea. I certainly would not permit any child of mine under the age of sixteen to walk around with a cell phone in their pocket.

The funny thing is that 20 or 15 years ago, maybe even a decade ago, cell phones weren't around. Now, when you're using this, you put the telephone right up against your head. The antenna that is emitting the signal that is picked up by the cell phone towers and then sent to wherever you intend to go is irradiating the brain. There is no doubt about it. It does.

Can this be good? As far as I am concerned - No, it can't be good.
Could it possibly be neutral? In other words, have it and not get sick from it?
I'm going to negate that one, too. I say I don't believe that. I think that any time you have an extraneous energetic source of electromagnetic energy introduced into a body carries a potential for harm.

AND THAT'S BASED ON YOUR MEDICAL WORK?

Yes.

AND THEY ARE SAYING IN THIS NEW WORK THAT THEY HAVE DATA TO THEIR OWN SURPRISE THAT "ONE ODD FINDING CAME UP WHEN WE LOOKED AT MICROWAVE RADIATION IN NEMATODE WORMS THAT SHOWED ODD CHANGES TO THE PROTEIN STRUCTURES. AND THAT IT WAS A KIND OF HEAT SHOCK ON THE PROTEIN, SLIGHTLY COOKED." AND THAT CHILDREN ARE THE MOST SUSCEPTIBLE.

That's correct.

THEY ARE GROWING.

They are still forming structures in the brain. They are still forming synaptic connections throughout the whole brain. You introduce something that is going to change things there and you are running the risk of producing a permanent alteration in some aspect of cerebral functioning.

Now, I'm sorry, I know how important this is from an economic point of view. But I think it's a very bad thing to do. I think the cell phone proliferation has resulted in exposing more people to electromagnetic energy that's exceeded only to our exposure to the 60 cycle radiation coming from our power frequency, electric power grid. That exposes almost everybody in the world. It's either 50 cycle or 60 cycle and you can't go any place on the face of the earth and put up an antenna and find an electromagnetic environment NOT contaminated with one or another or many more of these frequencies.

AND IT'S NOT CLEAR WHAT THE CONSEQUENCES OF ALL THIS IS ON OUR EVOLUTIONARY PROCESSES?

Absolutely no.

AND THE INCREASING VIOLENCE AND RAGE AND IRRITABILITIES IN SO MANY LEVELS OF SOCIETY, ESPECIALLY IN THE INDUSTRIALIZED WORLD, COULD BE LINKED DIRECTLY TO THIS?

I don't know of any data that says that, but as far as I am concerned that would constitute a perfectly valid hypothesis.

AND IN YOUR WORK, DID YOU EVER WORK WITH MICROWAVE FREQUENCIES TO SEE WHAT THE IMPACT WOULD BE ON BIOLOGIES?

No, I did not. I stayed closer to the natural frequencies. I did a lot of work on 60 cycles. Back then, microwaves were theoretically considered capable of only heating

things.

I've lived through a fairly lengthy period of time in which science looking at this problem - both the biologists and physicists and engineers looking at it - have changed their mind and have grown closer together in regards to the potential for harm.

AGREEING THERE IS A POTENTIAL FOR HARM.

Yeah. I think at the present time that the majority of the physicists in the United States view with practically the same amount of alarm as you and I do. And at one time that was not true. So, there has been a learning curve in all this and we're still on that learning curve! Now, how do we learn more. It's rather simple. Make available more money and make it available to independent researchers who have no connections to any aspects of the economic end of the electromagnetic usage. This is very important.

The Electric Power Institute funded large studies and they found nothing!

BECAUSE THEY HAD A VESTED INTEREST IN NOT FINDING SOMETHING.

You can design a project to be negative if you like to from the very start.

IN THIS TIME WHEN SCIENTISTS THEMSELVES ARE EXPRESSING CONCERN ABOUT THE POLLUTION OF ELECTROMAGNETIC FREQUENCIES, ISN'T IT IRONIC THAT NOW IS THE TIME THAT THE VESTED POLITICAL AND ECONOMIC INTERESTS ARE EVERYWHERE WORKING TO MAKE THIS AN ELECTRONICALLY CONNECTED WORLD. IS THERE ANYWAY OF PERSUADING ANYONE THAT GOING THIS ROUTE COULD HAVE AN INCREASING PSYCHOLOGICAL AND OTHER NEGATIVE IMPACTS ON PEOPLE?

I don't believe there is ever going to be a real solid unimpeded study of these factors. I think we will continue to increase the exposure of the global population, that we will see as a result of this, increases in cancer. We already have. We're at the point now where every other person, one out of two, is very likely to in the course of their life time to develop a malignancy. It was too long ago that it was one out of three. And a little bit further back, it was one out of four.

NOW, IF WE'RE AT ONE OUT OF TWO, IT'S ALSO POSSIBLE THAT NO ONE COULD LIVE WITHOUT HAVING A MALIGNANCY.

That's right. We shouldn't have to have it. We should be able to prevent it. Who is looking at prevention?

And as far as the other aspect of it - growth control and central nervous system operations. Now, on that side of it, I will give you the prediction that you are going to

see more and more hyperactive attention deficit disorder, you're going to see more and more aberrant behavior in the mature population. Where does this end? Every time you start thinking that we're at the end of the line as far as the development of electromagnetic devices that radiate into the environment, then something new comes along. The cell phone is a very new item and it has become ubiquitous in our environment and in most industrialized nations.

In the Scandinavian countries, Sweden, Norway, Denmark, Finland - they have been looking very closely at the power frequency, electric power, 60 cycles. And to the best of my knowledge, they are the only countries that have set up standards for exposure to that and regulations as to what you can build and what you can put into the environment.

WHAT KIND OF RADIO FREQUENCIES ARE EMITTED FROM THE TYPICAL CELL PHONE?

The present generation of cell phones, some are operating at the megahertz range. Others are operating at the gigahertz range which is billions of cycles per second. So, the radiation is oscillating at the enormously rapid frequency. Even standard TV signals are megahertz signals. These are just an awful lot faster frequency. The fact of the matter is that the higher up in frequency you go, the more energy the radiation happens to have.

IN YOUR CAREER, YOU WERE ON THE TRACK OF BEING ABLE TO HEAL FRACTURES AND POSSIBLE SPINAL INJURIES AND WHAT IN THE WORLD WOULD BE MOTIVATING THE MINDS AT THE TIME TO STOP RESEARCH IN THAT DIRECTION?

At that point in time, it was primarily a military problem in the Dept. of Defense. We were shifting very rapidly from the standard warfare or WWII to the more high technology of the Vietnam war. This is where most of the technology that we see now in the military evolved was during Vietnam. The use of electromagnetic fields for communication and remote sensing and things of this nature were considered to be essential and here I was saying, 'Hey, it might not be such a great idea.'

WHAT DO YOU THINK IT WOULD TAKE TO HAVE THE POLITICAL AND MONEY POWERS CHANGE THEIR PRIORITIES?

(long laugh) I don't know. Maybe at the end of the line when the occurrence of malignancy is two in every person during their life time and we have rioting in the streets for no cause and obvious problems with the psychology of the human race - maybe some people will still be OK enough to say, 'Geez, we made a terrible mistake.' But I don't see anything happening between now and then. Or there may be a technology that becomes available that is capable of safely replacing the cell phones. I don't know. But the longer it goes, the more and more difficult it will be in affecting a

change in our economic structure."