

# REFLEX report shows that mobile phone radiation damages living cells

*The REFLEX Project - December, 2004*

## Summary:

Twelve institutes in seven countries have found genotoxic effects and modified expressions on numerous genes and proteins after Radio frequency and extremely low frequency EMF exposure at low levels, below current international safety guidance, to living cells in-vitro. These results confirm the likelihood of long-term genetic damage in the blood and brains of users of mobile phones and other sources of electromagnetic fields. The idea behind the REFLEX study was to attempt replicate damage already reported to see if the effects were real and whether, or not, more money should be spent of research into the possible adverse health effects of EMF exposure. They concluded that in-vitro damage is real and that it is important to carry out much more research, especially monitoring the long-term health of people.

"Project Leader Franz Adlkofer advised against the use of a mobile phone when an alternative fixed-line phone was available and recommended using a headset whenever possible.

"He said: "We don't want to create a panic but it is good to take precautions"."

Page 21, Tuesday 21st December 2004 Issue,  
Daily Express

Ross Adey's FOREWORD to the report should be read - it contains much wisdom. It is reproduced in full below.

The REFLEX project (QLK4-CT-1999-01574 / REFLEX / Final Report) has made a substantial contribution to the database on biological effects of both ELF-EMF and RF-EMF on in vitro cellular systems. The study was designed to investigate whether or not EMF exposure below the energy density reflected by the present safety levels generates in vitro critical cellular events. Gene mutations, deregulated cell proliferation and suppressed or exaggerated programmed cell death (apoptosis) that are caused by or result in an altered gene and protein expression profile are such critical events, the convergence of which is required for the development of chronic diseases. Genotoxic effects and a modified expression of numerous genes and proteins after EMF exposure could be demonstrated with great certainty, while effects on cell proliferation, cell differentiation and apoptosis were much less conclusive. Since all these observations were made in in vitro studies, the results obtained neither preclude nor confirm a health risk due to EMF exposure, but they speak in favour of such a possibility. Because of their fundamental character the findings will be presented to WHO, IARC and ICNIRP. It will be up to these organisations to make use of them for risk evaluation, in combination with findings from animal and epidemiological studies.

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FOREWORD by Professor Ross Adey

Ross Adey, who made fundamental contributions to the emerging science of the biological effects of electromagnetic fields (EMF's), died in May 2004. In memory of his achievements as a scientist and in recognition of his support of the REFLEX work, the consortium decided that his message would be an inspiration to all those scientists who are willing to accept the challenges posed by EMF research, and in addition, make a fitting introduction to the final report.

The Future Of Fundamental Research In A Society Seeking Categorical Answers To Health Risks Of New Technologies

## The Challenge to Conventional Wisdom

The history of bioelectromagnetics epitomizes a range of problems that arise whenever a community of sciences is confronted with a frontier that delves deeply into the established orthodoxies of biology, the physical sciences and engineering. These conflicts have become even more sharply defined when emerging new knowledge in bioelectromagnetics research has challenged the conventional wisdom in each part of this trinity.

Thirty-five years ago, we, who first voiced our observations of physiological responses to a spectrum of environmental EMF's at levels below thresholds for significant tissue heating, were promptly challenged by acolytes of orthodoxies in the biological and physical sciences. At best, we were euphemistically described

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as "controversial", a designation that persists to this day. A Yale physicist recently added the charming term "crackpot" to describe a highly qualified biophysicist investigator.

What is the basis of this deep thorn of discontent? Historically, excitation in biological systems has been modelled and tested in terms of equilibrium thermodynamics. In this classic tradition, it was assumed that the potential effectiveness of an exciting agent could be assessed by its ability to transfer energy to the receptor in excess of its random thermal atomic and molecular collisions. Thus, the physical expression  $kT$ , the union of the Boltzmann constant and temperature, has been regarded as an expression of an immutable threshold below which an exciting agent would not be physiologically effective. In like fashion from the quantum realm of the physicist, photon energies of low-frequency magnetic fields, now known to act as effective physiological stimuli, would also fall below this thermal barrier.

Here is one example: The human auditory threshold involves a hair cell vibration of 10-11 meters, or about the diameter of a single hydrogen atom. But, by an as-yet-unknown mechanism, the ear suppresses the vastly larger noise of its thermal atomic and molecular collisions, functioning as an almost "perfect" amplifier close to 0°K.

Clearly, we face a profound paradox, with answers to be sought in cooperative states and nonequilibrium thermodynamics, as first suggested in a biological context almost 60 years ago by Herbert Frohlich.

The lesson is clear. The awesome complexity of biological organization demands our most careful consideration.

### **The Recent History of Technology Applications**

We also find the heat of controversy in the recent history of technological applications in western societies. At no point in the last 20 years has public school education ensured that a majority of citizens has even a basic understanding of sophisticated communication devices and systems, such as telephones, radio and television. Similarly, automotive engineering remains a sea of vast ignorance for most users. Nor is such knowledge considered appropriate or necessary.

In summary, we have become superstitious users of an ever-growing range of technologies, but we are now unable to escape the web that they have woven around us.

Media reporters in general are no better informed. Lacking either responsibility or accountability, they have created feeding frenzies from the tiniest snippets of information gleaned from scientific meetings or from their own inaccurate interpretation of published research. In consequence, the public has turned with pleading voices to government legislatures and bureaucracies for guidance.

### **Public Concerns and the Evolving Pattern of Research Funding**

We face the problem brought on by the blind leading the blind. Because of public pressure for rapid answers to very complex biological and physical issues, short-term research programs have been funded to answer specific questions about certain health risks.

Participating scientists have all too often accepted unrealistic expectations that, in a matter of a few years, they will provide answers to pivotal questions in cell and molecular biology that can only be achieved slowly, painstakingly and collaboratively over a decade or more.

Using EMFs as tools, we have launched our ship on a vast, uncharted ocean, seeking a new understanding of the very essence of living matter in physical processes at the atomic level. This is an awesome and humbling prospect, surely not to be ignored or forgotten in the pragmatic philosophies of most risk research.

In many countries, and particularly in the USA, the effects of such harassing and troublesome tactics on independent, careful fundamental research have been near tragic. Beguiled by health hazard research as the only source of funding, accomplished basic scientists have diverted from a completely new frontier in physical regulation of biological mechanisms at the atomic level. Not only have governments permitted corporate interests in the communications industry to fund this research, they have even permitted them to determine the research questions to be addressed and to select the institutions performing the research.

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These policies overlook the immutable needs of the march of science. In their hasty rush to judgment, they have sought a scientific consensus where none can yet exist. Such a consensus will occur only after experimental convergence emerges from a spectrum of related but certainly not identical experiments.

### **Defining the Role of Epidemiology in Current Controversies**

Much in the fashion of ancient Romans, standing four-square and reading the auguries of future events by noting flight patterns of passing birds, the modern-day epidemiologist has become the high priest in the search for correlates of disease processes with a constellation of environmental observables. It is rare for them to be competent in delving into questions of causality, particularly where no exposure metric has been established for a suspected environmental factor. Nevertheless, in courts of law, in legislatures, and among a concerned public, epidemiological opinions have become a gold standard, typically outranking evidence based on a balanced and often cautionary review of current medical science.

We should remind ourselves that their professional tool is biostatistics - they build endless Byzantine edifices of levels of statistical risk, with little or no commitment to the underlying science or medicine. Their mutual discussions have produced the technique of meta-analysis, the pooling of statistical analyses from a series of epidemiological studies. The method ignores the nuances of both experimental design and epidemiological findings in the separate studies, and blinds us to options for further research based on the possible uniqueness of these separate observations.

It appears reasonable that there should be no more large epidemiological studies on human EMF exposures until essential exposure metrics are established, based on mechanisms of field interactions in tissues.

### **Repairing the Body Politic of Science: Some Personal Reflections**

The passage of time across the years has not diminished in any way the importance, even the urgency, that one feels towards the growing edifice of science. We must not fail to engender in younger minds a passionate curiosity and an imagination sufficient to kindle their commitment to all that is great and good in the scientific method.

As I reflect on major changes wrought in the U.S. national research scene over the past 40 years, I sense a deep and growing concern that research training and the culture of research accomplishment have stifled the burning thorn of personal discontent that should be the creative option of all young minds entering on a research career.

Graduate students are assigned a project that is typically a segment of their advisor's grand vista. They may not deviate to ask creative "what if?" questions. They emerge from the chrysalis of their training, bearing a parchment for the professional market place, affirming proficiency in certain techniques, but in no way proclaiming the arrival of that precious citadel of a creative mind.

Please allow me to conclude with an urgent proposal that comes from my own research experience. Formal instruction in physics, theoretical and applied, has become the weakest link for those entering on a career in medical research.

Bioelectromagnetics research has opened the door to a new understanding of the very essence of living matter in physical regulation at the atomic level, beyond the realm of chemical reactions in the exquisite fabric of biomolecules. Without versatility in biophysics that matches their typical knowledge in molecular biology and biochemistry, none of these students may cross this threshold to the cutting edge of in future medical research. Let us not see this opportunity lost prematurely through prostitution of mechanistic research in the market place of possible health risks.

Thank you for the great privilege of offering these personal reflections.

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### **From 7.12 Summary**

... the omnipresence of EMF's in infrastructures and consumer products have become a topic of public concern. This is due to the fear of people that based on the many conflicting research data a risk to their health cannot be excluded with some certainty. Therefore, the overall objective of REFLEX was to find out

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whether or not the fundamental biological processes at the cellular and molecular level support such an assumption. For this purpose, possible effects of EMFs on cellular events controlling key functions, including those involved in carcinogenesis and in the pathogenesis of neurodegenerative disorders, were studied through focussed research. Failure to observe the occurrence of such key critical events in living cells after EMF exposure would have suggested that further research efforts in this field could be suspended and financial resources be reallocated to the investigation of more important issues. But as clearly demonstrated, the results of the REFLEX project show the way into the opposite direction.  
(Comment: i.e. more funding for important research is urgently needed)

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