Health Implications of Long-term Exposure to Electrosmog

Karl Hecht

Effects of Wireless Communication Technologies

A Brochure Series of the
Competence Initiative for the Protection of
Humanity, the Environment and Democracy e.V.

Brochure 6

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Title Image
Radar victims and widows of deceased radar victims demonstrate for their rights and against the violation of their human dignity in a state of law [Hecht Archives]

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Foreword and interim evaluation of the editors

As the sixth brochure in our brochure series *Effects of Wireless Communication Technologies*, we present the brochure by Karl Hecht on the *Health Implications of Long-term Exposure to Electrosmog*. The author documents and confirms the serious consequences of observed tendencies to consciously ignore and deny existing health implications. All six brochures of this series supplement each other, exposing a sick government system called health and environmental protection, which exploits the present and future of public health for its own irresponsible political agenda.

The Brochure Series
Effects of Wireless Communication Technologies

In the brochure series *Effects of Wireless Communication Technologies*,[1] the Competence Initiative for the Protection of Humanity, the Environment and Democracy e.V., a coalition of independent scientists, physicians, and lawyers, documents currently available scientific findings of international research that have not been considered by the German Telecommunication Research Programme (DMF). Using *Bees, Birds and Mankind* as an example, Brochure 1 shows the degree of interference and destruction the growing exposure levels of artificial electromagnetic fields cause in the naturally occurring biophysical organization of all life. By documenting the biological effects and effect mechanisms shared by humans and animals, this brochure calls for a holistic understanding of our natural surroundings and life itself, which seems to be completely beyond the creators of the German telecommunications policy. Brochure 2 exposes how *Gefährdung und Schädigung von Kindern [Our Children's Health Is at Risk]*, citing the many areas of international research that describe the special vulnerability of children. Brochure 3—*How Susceptible Are Genes to Mobile Phone Radiation*—and Brochure 5—*Radiation Protection in Conflict with Science*—show how broad-based the evidence of genotoxic effects of cell phone radiation is today and all that has been done to destroy this inconvenient evidence. In Brochure 4 *Warum Grenzwerte schädigen, nicht schützen* [*Why Exposure Limits Are Harmful, Not Safe*], a team of scientists details how anachronistic and scientifically tenuous the basis is on which the government justifies its extremely high exposure limits.

Long-term effects of electrosmog and strategies on how to dispose of them

Since numerous studies on the effects of microwaves show evidence of chronic diseases[2] and we know that mitochondrial damage is passed down through mothers over generations,[3] this requires risk research to change its thinking and consider longer periods. In the case of many other toxic agents, this is common practice today. The telecommunications policy of the German government, however, has so far made its business easy by mostly shutting out the time factor. The exposure limits do not consider them. To date, government and industry have almost exclusively funded short-term studies, which rather suppress the issue of long-term effects instead of helping to clarify it.[4] Furthermore, this brochure describes how inconvenient findings are dealt with—even if the government itself had commissioned the research contract, as was the case for the findings presented here.

The review findings by Hecht—which disappeared into the government archives as soon as they had been submitted and which we are now making available to the public in this brochure in its most comprehensive form to date—are based on the assessment of 878 Russian studies between 1960 and 1997. To pretend as if there were no connection between microwave technologies from the past and those from today is like burying one's head in the sand. This tactic is well illustrated by the current politics regarding radar victims and the increasing group of persons with electromagnetic hypersensitivity. In his final appeal on "Health—A Basic Human Right," Hecht reminds those in political power on the wording of their official oath, which binds them to dedicate their efforts to the well-being of the people and the constitution of the democratic state of law. He could also have reminded them that restricting scientific truth was part of the totalitarian atrocities having occurred in two German dictatorships not that long ago. In the policy areas of technology, economy, and health, a financially healthy industry has succeeded in gaining government support for securing a future of distorting the truth in supposedly democratic times. We can only hope that ordinary citizens will wake up and realize the extent of the deception of the current telecommunications policy and how this deception was produced by industry and government lobbyists.

The German Telecommunications Research Programme (DMF)—Its weaknesses and implications

German governments, which have received many billion dollars from the cell phone industry over the years, have

a hard time accepting all of the scientific truth, supporting independent research, and at the same time, adequately protecting the public.

The German Telecommunications Research Programme perfectly illustrates these three shortcomings. Funded in equal parts by the government and the industry, it was apparently meant to ensure the rampant expansion of wireless communication technologies for as long as possible. This is also reflected in its personnel choices because the majority of bioscience projects were awarded to a scientist who is well known for his particularly close ties to the industry as well as for his notorious claims of safety. Regarding the quality of EMF research projects, it now could be confirmed that the contributions to the DMF Programme by the latter scientist are a mixture of poor scientific work and manipulations, which also seem to explain his claims of safety and endorsement of the official exposure limits.[5] Regarding the structure of EMF research projects, it is obvious that such central questions as to specific effects on children, long-term effects, but also health effects in animals and plants have been entirely excluded from the DMF Programme. Considering that government, industry, and their common supporters have been using this DMF Programme to keep repeating their claims of safety—from our perspective—this approach amounts to aiding and abetting a crime of negligent assault and homicide in view of all the Programme's weaknesses.

"Institutional corruption" instead of precaution

The way the government accommodates the cell phone industry does not stop with the DMF Programme. For example, public information campaigns are mostly left to the Information Centre for Mobile Communications (IZMF), which provides a platform for the highly successful advertising campaign "Mobile Communications and Health" by the lobby group of cell phone providers that downplays any risks. The scientist, however, who had made himself the most reliable pillar of this industry program, is not only identical with the above-mentioned members of the DMF; apparently, his reliability in promoting industry and government interests qualified him in the eyes of the German government for leading positions in the German radiation protection agency—now in his third term of office.

With this kind of composition of the health and environmental protection agencies, the results of the German information policy are also accordingly. Physicians and parents are told that there is no reason to deny young children the use of cell phones. Schools are told that cell phones and Wi-Fi should be used as educational tools. Leading news agencies, which seem to have handed over their investigative abilities at the door of the cell phone industry, lend a hand to a smear campaign that is designed to make genotoxic effects of cell phone radiation appear to be a phantom.[6] The judiciary is provided with anachronistic exposure limits, which basically allow the industry to do anything and spare those in political power to be liable for anything, thereby passing any risks on to those affected. Lately the DMF Programme is also used to convince churches that the steeples of their houses of worship can serve as antenna sites, which are safe and at the same time profitable.[7] Furthermore, when physicians or environmental organizations such as the BUND (the German branch of the Friends of the Earth) refer to the risks children are exposed to, which have been verified, they are called out by the top radiation official himself.[8]

However, who of those in power will actually bear the responsibility for this social policy when children who are made addicted to their wireless devices will grow into a generation of adults with many disabilities, who then will become a great burden to our national economy? A well-known report of the European Environment Agency about the precautionary principle concludes, based on numerous case histories, that the economic burden of precautions not taken are “horrendous” and the avoidable risks to human life are “immeasurable.”[9] At this point, it also becomes clear that, in most cases, neither politicians nor industry or their common supporters are held accountable and that the total damage is always borne by the public. Is this the reason why those in power of all the various groups have such an easy time ignoring the lessons of history?

The German conditions described above are the result of a considerable number of lobbyists who have penetrated and infiltrated health and environmental protection agencies in key areas. We do not hesitate calling this a form of "institutional corruption" as did Franz Adlkofer and a symposium held at the Center for Ethics of Harvard Law School in Cambridge (U.S.).[10] In this form of corruption, money ranks above health, whereby the government’s own interests provide this ranking of things a legal basis that is difficult to cut through. Anybody who has grown up with biblical images might sometimes wonder if the euros of today are no better than the silver shillings of ancient times. The German telecommunications policy demonstrates that in this field trial, which involves 80 million people in Germany, the right to legal protection has been betrayed for the sake of commercial interests.

Prof. Dr. phil. K. Richter, Prof. Dr. med. K. Hecht,
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The endnotes of the foreword can be found on page 55.
The summary of this documentation can be found on page 53 f.

1. Introduction

As a physician, if I wish to try a new therapeutic agent or a new diagnostic device on my patients, I have to meet strict legal requirements for compliance. Studies must be carried out in a certain sequence, following specified standards. This is the right thing to do and reasonable. We would have no reason for complaint if manufacturers and distributors of technical devices, which may be damaging to human health and the environment, would have to meet the same standards for the protection of the same—which is not happening at this time.

Over the last century, a rapid technical development has occurred that—as is usually asserted—serves human well-being and provides jobs. The downsides of these successes and advancements, however, are kept silent; for an increasing number of people, the new technical achievements have become a burden. Let us recall a few facts.

On a daily basis, harmful chemical and physical agents affect humans and the environment: chemicals as environmental pollutants [Servan-Schreiber 2008]; radionuclides (e.g. from nuclear power plants); noise [Maschke et al. 2003]; ionizing and nonionizing radiation [Becker 1994]. Furthermore, such disasters as Chernobyl and Fukushima can occur at another place at any time.

New diseases are emerging. The incidence of known disease keeps increasing, sometimes dramatically so: electromagnetic hypersensitivity, multiple chemical sensitivity, noise sensitivity, tinnitus and auditory processing disorders, depression, sleeplessness, helplessness syndrome with serious consequences of distress, and many others.

Yet business and industry mostly ignore any possible connections between these harmful factors and these newly emerging diseases. Even lawmakers, who often are advised by lobbies from both sectors, ignore and downplay the risks that have already been known for quite some time. In addition, even in the event of a scandal being actually exposed, there will almost always follow a message that says that all is well and safe soon thereafter. This is what happened in 2011, for example, when uncontrolled feed with dioxin-containing fats had been given to animals whose meat and eggs were then contaminated with dioxin—a toxin whose effect is thousand times worse than potassium cyanide [Klinisches Wörterbuch Pschyrembel 2007].

The dealing with the risks of nonthermal nonionizing radiation emitted by modern wireless communication technologies is also rather unclear. The fact that humans cannot hear, see, smell, taste, or perceive this type of radiation at all promotes confusion. Therefore, adverse health effects, especially those on the functions of the central nervous system, are ignored and downplayed; repeated claims of safety replace implementing long overdue preventive measures. Since only the thermal effects of electromagnetic fields can be detected with human senses, a dogma widely held by "experts" for the past 50 years claims that only these thermal effects exist or at least are the only ones that can do harm. The truth is that harmful nonthermal effects caused by radio waves in humans have been known since the 1980s: sleep disorders, neurasthenia (also brain fatigue), headaches, and others [Schliephake 1932].

Forty years ago, physicians and scientists pressured the U.S. government to issue a report on the effects of electromagnetic fields [Brodeur 1977]. In December 1971, this report was released under the title *Program for Control of Electromagnetic Pollution of the Environment.* The report was written by experts appointed by the U.S. Office of Telecommunications Policy (OTP) in 1968. This expert report revealed the extent of an environmental risk associated with the increasing use of microwaves in technical communication technologies and in the industry that has hardly been known before. A few quotes from the report will speak for themselves:

The electromagnetic radiation emanating from radar, television, communications systems, microwave ovens, industrial heat-treatment systems, medical diathermy units, and many other sources permeate the modern

environment, both civilian and military. [...] This type of man-made radiation exposure has no counterpart in man's evolutionary background; it was relatively negligible prior to World War II.

After the description of the increasing number of radiation sources since 1940, the beginning of World War II for the United States, the report already expressly warned of health threats:

> *Power levels in and around American cities, airports, military installations and tracking centers, ships and pleasure craft, industry and homes may already be biologically significant. [...] Unless adequate monitoring and control based on a fundamental understanding of biological effects are instituted in the near future, in the decades ahead, man may enter an era of energy pollution of the environment comparable to the chemical pollution of today. [...] The consequences of undervaluing or misjudging the biological effects of long-term, low-level exposure could become a critical problem for the public health, especially if genetic effects are involved.* [Based on quotes in Brodeur 1977, p.14]

The implementation of this government report seems to have failed due to opposition by the business and military sectors [Brodeur 1977]. The current generation of EMF researchers usually does not even know about this report. The further development of EMF research in the United States has been determined by those scientists who supposedly could not find any harmful effects of electromagnetic fields. Like in Germany, these U.S. scientists also tend to ignore and deny non-thermal effects [Becker 1994].

The question—as to whether the research approach and fundamental theorems on which the safety claims of nonionizing radiation are based are still valid and up to date—however, has become ever more important. A position paper by the VDE (German Association for Electrical, Electronic & Information Technologies) from March 2002 takes the easy way out when it acknowledges "the safety of any physical and chemical exposure cannot be proven," but at the same time believes to be released from the responsibility of proving that EMF exposure is compatible with human health [2002]. This also raises the question whether the reasoning of safety as well as the call for "proof" of the opposite side is not based too heavily on a physical way of thinking that contradicts the current state of knowledge in life sciences and cannot ensure the protection of life. It is rather as Szent-Gyorgyi put it so perceptively already back in 1960: that even though biologists depend on the judgment of physicists in many things, they must be very cautious when it is said that something or other would be unlikely. [Szent-Gyorgyi 1960].

The review of the Russian research reports and papers on the long-term effects of electromagnetic fields summarized here had been commissioned by the German Federal Agency of Telecommunications (today the Federal Network Agency). The review results prove that radiation is a cause of multimorbid clinical findings and nonspecific regulatory disorders. That these findings were not welcome by commercial interests is probably responsible for the fact that the 120-page research report immediately disappeared into the archives of the selfsame agency that had commissioned the report in the first place. Likewise, the federal minister of environment was not interested anymore either.

Both of these reactions, we find, are not compatible with public health. Anybody who finds the strength to accept the necessary responsibility will also have to be willing to depart from the dogma that says that harmful biological effects are only possible through thermal interactions. This would be a breakthrough for a research approach that is becoming more aware of the autonomy of life and the modern life sciences.

2. Common research misconceptions about the effects of electromagnetic fields

2.1 Physical methods cannot describe life processes in humans and animals

Regarding the research about the effects of radio-frequency radiation on the human body, the above-quoted VDE position paper [2002] unintentionally confirms what Immanuel Kant and, more recently, Niels Bohr, Werner Heisenberg, Friedrich Cramer, and many others have been saying all along: physical methods are not suitable for the study and description of life processes.

Kant's philosophy of experience had distinguished between ordering principles of "aggregation" and "organization": between natural objects, *the sum of nonliving objects*, and others that are *organized life*. According to this, the logic of the "exact" natural sciences could not be biology, which is equivalent to organization. In the consciousness of modern sciences, the former Director of the Max Planck Institute of Experimental Medicine Friedrich Cramer [2001] also stands up for a clear distinction:

Today we have reached the point at which we must study life in its entirety if we wish to have an accurate picture of our world. We cannot do so yet with the current methods. The responsibility for life itself and the suffering of patients prohibit adopting the scheme of causality from physics, the present leading science. Life sciences can never be particular. They are always holistic. It is possible then that the so-called exact sciences will ridicule them and not take them seriously. We will have to bear this burden because we deal with living things for which we have responsibility.

2.2 Short-term studies cannot provide evidence of adverse health effects

A second aspect, which researchers of the telecommunications sector tend to neglect, is the duration of the radiation exposure. Everybody knows that exposure to the sun's rays for short periods is good. However, when we stay in the sun for too long, painful sunburn will appear. Thus the exposure duration is an important factor for health effects of all sources of radiation.

In Western Europe, the exposure duration of electromagnetic fields has been given rather little attention so far. As a result, mostly short-term studies and no real long-term studies have been carried out. One might almost get the impression that this would be done on purpose to make it easier for those who prefer announcing claims of safety.

As an example for this observable trend, I would like to quote the environmental report no. 162 on *Non-ionizing Radiation: High-frequency Radiation and Health* by the Swiss Agency for the Environment, Forests and Landscape (BUWAL) [2003], which I subjected to a critical analysis. The BUWAL report is written in German and has a summary in French, Italian, and English. This report is based on 206 scientific publications. Only seven of those references are from Eastern European countries, especially regarding the effects of high frequency microwaves on the central nervous system, including sleep functions. The report provides many tables with overviews of scientific studies. In the summary, it says that the selection of the scientific studies had been checked for its completeness. However, I cannot even remotely confirm the completeness of the relevant scientific literature listed.

Many studies from the English scientific literature are missing. Studies from the Russian scientific literature are omitted entirely (see among others [Hecht and Balzer 1997]).

Table 1: Overview of the exposure duration of high frequency microwaves based on 129 scientific papers or studies cited in the BUWAL report

	Up to 1 h	**Up to 3 days**	**Up to 30 days**	**More than 30 days**
Hormone system	3	5	3	4
Immune system	3	5	3	4
EEG (awake)	15	4	1	0
Stimulus perception, stimulus processing	10	6	3	1
Cardiovascular system	3	2	0	3
General well-being	9	2	2	6
Headaches	7	1	0	4
Sleep	7	4	2	3
In vivo exposed blood cells	-	-	-	4
Total	57 = 44 %	29 = 22,5 %	14 = 11 %	29 = 22,5 %

Data summary in the table shows:

1. In 66,5 % of the studies, the maximum exposure duration was three days. It is not surprising then that, at best, biological, but no harmful effects could be detected. Some scientists were at least honest enough to admit that their findings cannot say anything about long-term effects [Preece 2002; Krause et al. 2002; Freude et al. 2000].

2. As health symptoms, the BUWAL report lists headaches, sleep disorders, general well-being, EEG changes, information processing, and effects on the cardiovascular, hormone, and immune system, which, according to the authors, cannot be explained with thermal effects of electromagnetic fields. However, the authors did not consider nonthermal effects that can trigger such health symptoms!

In the tables of the BUWAL report, the time factor of the exposure is also not considered. The duration of an effect is divided into the following categories:

I = Immediately Up to 1 h
S = Short term Up to 3 days
M = Medium term 3 to 30 days
L = Long term Up to > 1 month (without limits)

From the tables of the BUWAL report, I compiled Table 1 below, showing the exposure duration of the high frequency microwave radiation of the 129 scientific papers and studies that form the basis of the reported findings for the different functional systems or states of well-being. In 44% of the cases, immediate effects were studied; in 22.5% of the cases, short-term effects and, in 11% of the cases, medium-term effects. Only 22.5% of the studies on radio-frequency radiation looked at exposure durations greater than one month.

Table 2: Examples of findings of electromagnetic field effects from cell phones on the information processing of the central nervous system in humans

Authors	Topic	Findings	Conclusions	Subjects
Alan Preece 2000	EMF effects on cognitive functions in humans EMF: 0.8 m + 50 Hz • Not pulsed 915 MHz • Pulsed 217 MHz	Improves: memory, reaction time, reaction pattern, vigilance	• Temperature increase in the brain • Formation of heat shock proteins • Influence of synaptic processes • Long-term effects cannot be derived	16
Christina Krause et al. 2002	EMF effects on the performance of oscillatory brain activity 0.25 W	During memory exercises, changes in the 6-8 Hz and 8-10 Hz EEG band, shorter response times during reaction and attention tests as well as mental math	• RF electromagnetic fields increase processing speed in CNS (central nervous system) and cognitive processes • Long-term effects cannot be derived	120
Gabriele Freude et al. 2000	Influence of electromagnetic fields from cell phones on slow brain potentials (SP) 2.8 W; 9.6 W	Slow brain potentials (SP) change in amplitude during visual tasks of secondary responses and tasks for the designation of an expectation threshold	• There are interactions between EMF and CNS structures • Statements regarding long-term effects cannot be derived based on these findings	28

Tabelle 3: Examples of findings of EMF short-term effects on EEG (Western Europe)

Authors	Subjects	EMF-Type	EMF strength	Exposure duration	Findings
Hietanen et al. 1997	19	GSM 900 217 Hz	-	20 min	No effect
Spittler et al. 1997	25 + 27	GSM 900 217 Hz	8 W 40 V	10 min	No effect
Röschke und Mann 1997	34	GSM 900 217 Hz	8 W 40 V	10 min	No effect
Reiser 1995	36	150 MHz 10 Hz	400 pt	15 min	Increase in alpha waves
Klitzing 1995	17	150 MHz 217 Hz	1 µW/cm²	15 min	No effect
Krafzcyk 1998	16	GSM 1800 218 Hz	1 W	20 min	No effect
Krafzcyk 1998	15	GSM 900 217 Hz	2 W	20 min	No effect
Krafzcyk 1998	8	GSM	25/8 W	20 min	No effect

We already have enough tables of this kind with exposure durations no longer than a few minutes up to an hour. That it is not possible to trigger even biological reactions with such short exposure durations does not surprise because the adaptation capacity of a healthy human brain is sufficient to deal with short-term exposures. This is different for ill people or those who have been sensitized by daily, long-term exposures to electrosmog.

3. Results of a Russian scientific literature review on the long-term exposure effects of radio-frequency and microwave radiation in humans between 1960 and 1996

In 1996/1997, Hecht and Balzer [1997] from the I.S.F Institut für Stressforschung GmbH, 10115 Berlin, conducted a review of the Russian scientific literature between 1960 and 1997, which had been commissioned by the Federal Agency of Telecommunications (later the regulatory agency, today the Federal Network Agency) with the contract number 4231/630402 from 14/11/1996. Topic: *Biologische Wirkungen elektromagnetischer Felder im Frequenzbereich 0 bis 3 GHz auf den Menschen [Biological Effects of Electromagnetic Fields in the Frequency Range of 0 to 3 GHz in Humans].* Out of more than 1500 scientific publications, we included 878 in our review report of approximately 120 pages. In particular, the findings of long-term effects in humans during occupational EMF exposure over several years were considered.

After submission, this review report immediately disappeared into the archives of the regulatory agency. Furthermore, this review report was not forwarded to the federal minister of the environment or made public, as had been indicated before. It rather suffered the same fate as the above-mentioned report of the U.S. government from 1971. Only through our own publication efforts have these findings been made known; in the future, they will also be available in Spanish and Italian. Fortunately, there had been no clause included in our government contract that would prohibit any such publication on our own.

In 1999, when we presented parts of our literature review at the 10th International Congress of Stress in Monetreux (Switzerland), which was partly dedicated to biomagnetism, we caused quite a shock wave among the scientists from the United States, as they were quick to admit. Why?

First: The exposure limits in Russia and in other former Eastern bloc countries are lower by three orders of magnitude compared to the United States and other European countries.

Second: When these lower exposure levels were met and initially healthy subjects were exposed, pathological findings were only detected after three to five years of exposure or even after longer exposure durations. The scientists from the United States confirmed that the term of a research project would last at the most two years, usually shorter. Naturally, adverse effects could not be shown in research projects of this kind. Sometimes even positive effects were found. Soon we will see why.

Third: The U.S. scientists did not know anything about the preventive studies of the then USSR, which had been carried out within the framework of the occupational health and industrial hygiene management.

In the next chapter, I will present the findings of our review of the Russian scientific literature between 1960 and 1996 as a summary before I will share more detailed findings in the following chapters.

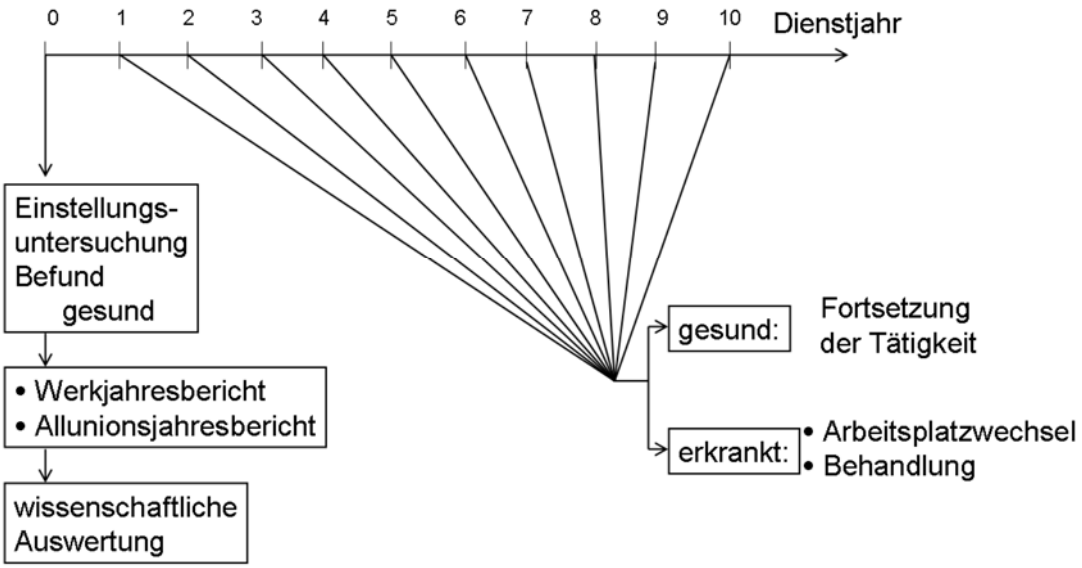
3.1 Study Conditions

In the former USSR, all employees working in an environment where they were exposed to radio-frequency electromagnetic fields had to have at least one health check per year by an occupational health care professional and industrial hygienist [see Gordon 1966]. Among others, this applies to employees of

- All electric utilities
- Electric substations
- Electric industry
- Radio stations
- Radar stations
- Electronics industry
- Electrical engineering
- Airport staff

Applicants for work in these sectors had to be certified "healthy" at their pre-employment medical examination. Otherwise, they could not be hired. This type of medical examination had to be repeated at least once a year as a preventive health check. “Healthy” meant this person could stay “employed” under these working conditions; “ill” meant this person could “not anymore be employed” under these working conditions. The latter classification also meant that such a person would receive therapy and be transferred to a workplace away from the exposure area of nonionizing radiation. Those who were discharged due to illness also had to receive medical treatment. The medical team that carried out the legally required medical examinations had an occupational health care unit or an occupational health clinic on site of the relevant plants. The medical professionals, however, were not employees of the plant, but the government health care system and thus independent of the company.

Figure 1: How the findings of the Russian scientists and physicians were obtained



Dienstjahr = Years of employment | Einstellungsuntersuchungbefund gesund = Preemployment medical examination result: healthy | Werkjahresbericht = Annual report of company | Allunionsjahresbericht = Annual report of union | wissenschaftliche Auswertung = Scientific evaluation | gesund: = Healthy: | Fortsetzung der Tätigkeit = Continued employment | erkrankt: = Ill: | Arbeitsplatzwechsel = Change of workplace | Behandlung = Treatment

This assessment model of occupational health, which, for example, has also been used in the Spandau Health Survey on noise effects [Maschke et al. 2003], in my opinion, is a perfect example of how to verify health hazards because it starts with a "healthy" baseline. Furthermore, it observes the development of a person’s health over a long period.

The assessment of the health status followed the WHO classification system. The diagnostics were based on the holistic principle with a focus on the central nervous system (CNS). Besides the classic medical, clinical, and paraclinical diagnostic methods, there were also especially those used that are able to diagnose neurophysiological, neurological, and psychosomatic disorders as well as depression.

At this point, we would like to mention that in the former Soviet Union (now CIS), functional disorders and long-term studies formed the basis of medical investigations. The neurophysiological holistic pathophysiology, inspired by the German pathophysiology of the 19th century, is considered one of the major medical disciplines.

It should also be mentioned here that the exposure limits in the former USSR (as well as in the CIS states today) are one to three magnitudes lower than in Western European countries and in the United States [see Hecht 2009]. Furthermore, for the setting of the exposure limits, the time of the exposure duration has also been taken into account. The long-term exposure duration is usually given in years of service (age of service) and with regard to the daily EMF exposure.

3.2 Selected findings from the relevant Russian scientific literature between 1960 and 1996

Clinical and occupational health care aspects of EMF (electromagnetic field) long-term effects

3.2.1 General information

Most of the studies are large-scale occupational investigations, similar to long-term field studies.

In the discussion below, about 60 studies (1960-1985) were considered. In 23 of those studies, the number of subjects studied is given. Total: 3549 patients, 477 healthy persons as controls. In the other studies, the subject numbers are uncertain. For example, there are statements like several thousand persons or patients.

The exposure factors included electromagnetic fields occurring in industrial settings such as radar stations and high-voltage transmission lines. A distinction was made between continuous and intermittent exposures, as well as occasional exposures only at certain periods (weeks/days).

The statements regarding long-term effects ranged from 200 hours up to 20 years. The majority of the studies looked at exposure durations of more than three years; the average was about nine years. The age of the patients ranged from 26 to 60 years.

The EMF exposure level was usually below the Russian exposure limits, but, in some cases, it was also five to ten times higher.

As described in the papers, the type of EMF as well as the exposure limits did not seem to play a dominant role for the causation of chronic health symptoms, but the exposure duration in years if the exposure occurs daily for several hours (2–8 hours). Short-term EMF exposures—up to 20 minutes daily—had no essential effects on living processes, even if repeated frequently.

Abbreviations used hereafter:

EF =	Electric field(s)
EMF =	Electromagnetic field(s)
GOST =	Government standards of the Soviet Union or Russia
HF =	High frequency
LF/ELF =	Low frequency / extremely low frequency
SHF =	Super high frequency
UHF =	Ultra high frequency
RF =	Radio-frequency

As a dominant symptom complex, the hypotensive-based neurovegetative-asthenic syndrome due to long-term EMF exposures is given [Drogitchina and Sadtschikova 1964, 1965, 1968; Lysina et al. 1982; Kapitanenko 1964; Besdolnaja 1987; Owsjannikov 1973; Bojzov and Osinzeva 1984; Osipow and Kaljada 1968; Nikolajewa 1982].

3.2.2 Important findings after long-term EMF and EF exposure (summary)

Objective findings

- Neurasthenia, neurotic symptoms
- EEG changes (breakdown of alpha rhythm into theta and occasional delta rhythm)
- Sleep disorders
- Deformation of the hierarchy of biological rhythm
- Disorders of the hypothalamic-pituitary-adrenal axis
- Arterial hypotension, more rarely arterial hypertension, bradycardia, or tachycardia
- Vagotonic shift in cardiovascular function
- Hyperactivity of thyroid
- Erectile dysfunction
- Digestive disorders
- Slowing down sensorimotor system
- Resting tremor of fingers
- Hair loss
- Tinnitus
- Increased susceptibility to infection

[Drogitchina et al. 1966; Drogitchina and Sadchikova 1968, 1965, 1964; Gordon 1966; Ginsburg and Sadchikova 1964; Kapitanenko 1964]

Subjective symptoms

- Fatigue, lack of energy
- Daytime tiredness
- Getting tired quickly under stress
- Impairment of physical and mental performance
- Reduced concentration and memory
- Lack of concentration
- Headaches
- Head dizziness
- Attacks of sweating
- Spontaneously occurring excitability due to hypotensive responses, especially under stress
- Cardiac pain, racing heart

[Rubzova 1983; Rakitin 1977; Drogitchina et al. 1966; Gordon 1966; Drogitchina and Sadchikova 1965, 1964; Piskunova and Abramowitsch-Poljakov 1961].

3.2.3 Findings after EMF exposure of more than five years

Not all listed symptoms occur in all patients at the same time. As an example, an investigation by Lysina and Rapoport [1968] is presented here:

SHF exposure > 5 years
85 patients (60 healthy subjects as controls)

Neurocirculatory dystonia:
20 subjects

Vagotonic vegetative dystonia:
14 subjects

Asthenic syndrome:
11 subjects

Bradycardia:
26 subjects

Tachycardia:
8 subjects

No findings:
6 subjects

In most of the other studies, the following dominant symptoms are given: neurocirculatory dystonia and vagotonic responses (arterial hypotension with bradycardia or also tachycardia) and a slowing down of the sensorimotor system, which can be permeated with periods of increased excitability as well as a decline in physical and mental processes.

3.2.4 Exposure duration important for effects to occur

Depending on their years of service, the subjects were divided into groups of 1–5, 5–9, and more than 10 years of working under conditions of SHF and HF exposure with a power density exposure level of 20-60 µW/m^2, an electric field component of 100 V/m, and a magnetic field component of 3 A/m.

The findings revealed that the initially healthy subjects with a service age of less than five years showed no or only slightly stimulating changes in the body. In the group of five to nine years of service, vegetative-circulatory dystonia was observed and, in the group of more than ten years of service, various disorders of the CNS and other organs [Tjashelova 1983]. Based on these findings, three different stages with regard to the exposure duration are distinguished:

Slight changes (1–5 years of exposure):
Activation of physiological responses during short-term exposure with medium exposure levels or during chronic exposure with low exposure levels.

Medium changes (5–10 years of exposure):
Early stage of pathological changes.

Serious changes (more than 10 years of exposure):
Classified as a disease [Tjashelova 1983].

A similar classification has also been used in other studies [Piskunova and Abramowitsch-Poljakov 1961; Drogitchina and Sadtschikova 1964; Shuk et al. 1967].

Stage 1 (3–5 years after working under SHF exposure conditions): a vegetative and asthenic (fatigue) syndrome were observed. This is characterized by the vagotonic symptoms of vegetative and cardiovascular responses; in addition, bradycardia, arrhythmia, arterial hypotension, responses of skin arteries to histamine.

Stage 2 (up to 10 years of continued work under these exposure conditions) is characterized by the asthenic-vegetative syndrome, often associated with angiodystonic and neurotic symptoms.

Stage 3 (more than 10 years): neurocirculatory dystonia and diencephalic syndrome (neurotic, depressive, psychosomatic complex of symptoms) were observed.

The studies also reveal that, during the first three years of exposure, subjects show either no symptoms or a sympathicotonic response in the sense of a eustress response. Therefore, the above-mentioned scientists from the United States had even found positive effects in studies of one to two years of exposure. From the third to the fifth year of exposure, changes in the vagotonic area occur.

Plechanov [1987] points out that the initial state of the biosystem also plays an important role with regard to the effects of EMF exposure: "When, as a result of endogenous or exogenous processes, the biosystem under investigation has reached a state of low resistance, in 10% to 15% of the changes in individual parameters, the normal regulation can become disrupted and additional exposures can lead to the development of pathological and even fatal outcomes." The state of health of a given individual and the duration of exposure are obviously crucial factors for the manifestation of bioactive or adverse health effects due to EMF exposure.

3.2.5 Overview of additional studies on EMF long-term effects and their effects on functional systems in humans

Type of EMF Author	Exposure duration	Number of subjects	Dominant symptoms	Prevalence Frequency
SHF Ginsburg und Sadtschikova 1964	> 3-5 years	100 (103 controls)	Neurasthenia, autonomic nervous system, cardiovascular system, vagotonia	After 5 years 33%
SHF Lysina und Rapoport 1968	> 5 years	85 (65 controls)	Neurasthenia, autonomic nervous system, sensory somatic disorders	After 10 years 91%
SHF + Noise 65-70 dB Plechanov 1987	> 5 years	110 Arbeiter unter Industriebedingungen	Neurasthenia, CNS and autonomic nervous system, concentration and memory loss, chronic headaches	After 5 years 50%
SHF Sadtschikova et al. 1964	> 4 years	1.000 (400 controls)	Neurasthenia, autonomic nervous system, depression, sleep disorders, resting tremor, tinnitus, hair loss	After 5 years 59 %
SHF 50 Hz Drogitschina 1960	> 5 years	260 Frauen	Neurasthenia, autonomic nervous system, especially cardiovascular system, sleep disorders, depressive states	After 5 years 66%
SHF Sadtschikova und Nikonova 1971	> 10 years	244	Neurasthenia, autonomic nervous system, sensorimotor disorders, sleep disorders, chronic fatigue	After 10 years 69%
RF industry Panov and Tjagin 1966	> 10 years	106	Disorders of the circadian rhythm, body temperature, and heart rate	After 10 years 85%
Microwaves Drogitchina and Sadchikova 1964	5-10 years	160	Neurasthenia, autonomic nervous system, cardiovascular disorders, hypotension, hypoglycemia	After 10 years 59%
Electric fields subway 50 Hz, 1000–10,000 A/m Rubzova 1983	> 5 years	104	Resting tremor of fingers	After 5 years, 54 of the workers (= 52%) had to receive neurological treatment

Overall, the numerous available studies undoubtedly prove two points:

1. Long-term exposure is a crucial factor for the manifestation of adverse health effects due to EMF.
2. In this context, the diminished resistance of the body is a very important aspect, has has been stated emphatically, for example, by Plechanov [1987].

4. Scientific discussion and implications

4.1 General classification of stages regarding the development of pathological processes after EMF exposure

Based on the findings and insights of the numerous scientific studies of the literature review by Hecht and Balzer [1997], a general classification of the stages regarding the development of pathological processes after EMF exposure can be proposed. The different stages of this effect correspond to the stages of stress according to Hans Selye [1953].

Three-stage development

I. Early stage (1 – 3 years)

For the first one to three years, a mostly sympathicotonia-driven initial stage has been demonstrated, which can consist of three substages that occur either individually or in sequence over a period of three to five years.

First early substage: Pronounced sympathicotonic (hypertensive) activation stage. This stage is comparable to the alarm stage of Selye's general adaptation syndrome and to the nonspecific activation according to Lindsley [1951; Lacey 1967; and others].

Second early substage: Performance-enhancing sympathicotonic reaction stage in the sense of a eustress response or an emotional activation [Lindsley 1951]. Following Selye [1953], it can be interpreted as the resistance stage.

Third early substage: Adaptive, compensatory stage with little sympathicotonic activity. Body functions are still within the range of homeostasis so that lab tests are normal even though latent symptoms, intermittently surfacing, may already manifest themselves. This stage still falls within the resistance stage according to Selye [1953].

II. Premorbid or early stage of chronic disease (3 – 5 years)

After three to five years of exposure, initially healthy subjects develop slightly visible and/or more severe pathological manifestations of a basic asthenic complex of symptoms with tendencies toward vagotonic responses, sleep disorders, and daytime tiredness.

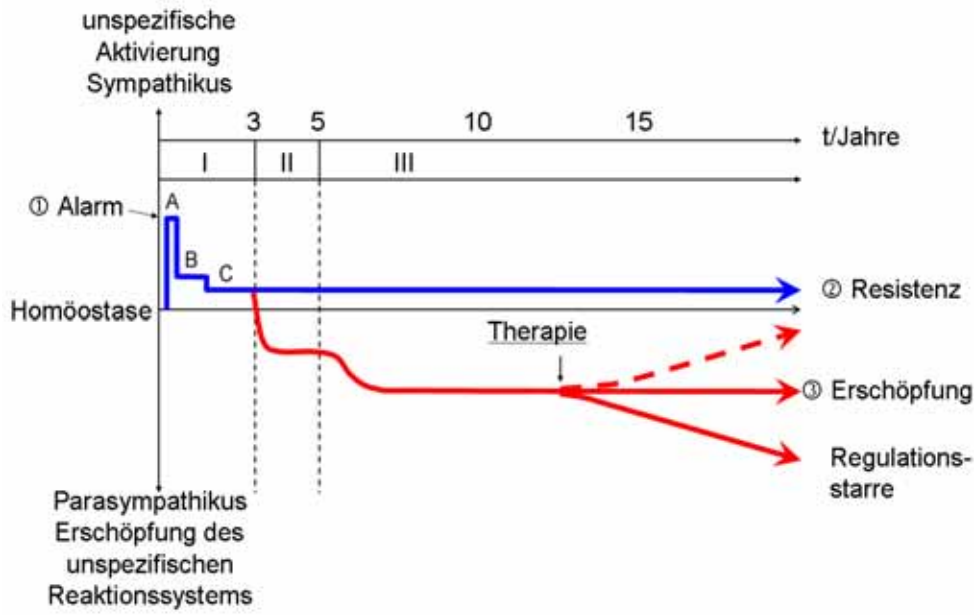
III. Fatigue syndrome (> 5 years)

For an exposure of more than five years, dominant symptoms include pronounced neurasthenic symptoms with increasingly pathological developments of the regulatory system, neurotic and neurasthenic symptoms, sleep disorders, daytime tiredness, and general fatigue.

Some authors suggest a fourth stage, that is, when a disease manifests itself after an exposure of more than ten years. The classic stages and their classification with reference to initially healthy subjects are shown in Figure 2.

It is also well known that not all humans respond to external stimuli in the same way (see [Virchow 1868]), which can also be clearly observed in association with EMF effects [Plechanov 1987]).

Psychophysiology, therefore, advocates an *individual-specific* response and, based on relevant studies, rejects a *stimulus-specific* response [Schandry 1998]. In Figure 3, this is taken into account. Based on the literature review by Hecht and Balzer, this particular graph shows examples of possible individual pathological responses to long-term EMF exposure. The initial health status of subjects "not anymore healthy" or "previously injured" [Plechanov 1987; Gordon 1966] are also considered.



unspezifische Aktivierung Sympathikus = Nonspecific activation of sympathetic nervous system

Parasympathikus = Parasympathetic nervous system

Erschöpfung des unspezifischen Reaktionssystems = Exhaustion of nonspecific regulatory system responses

Alarm = Alarm

Homöostase = Homeostasis

t/Jahre = Time/years

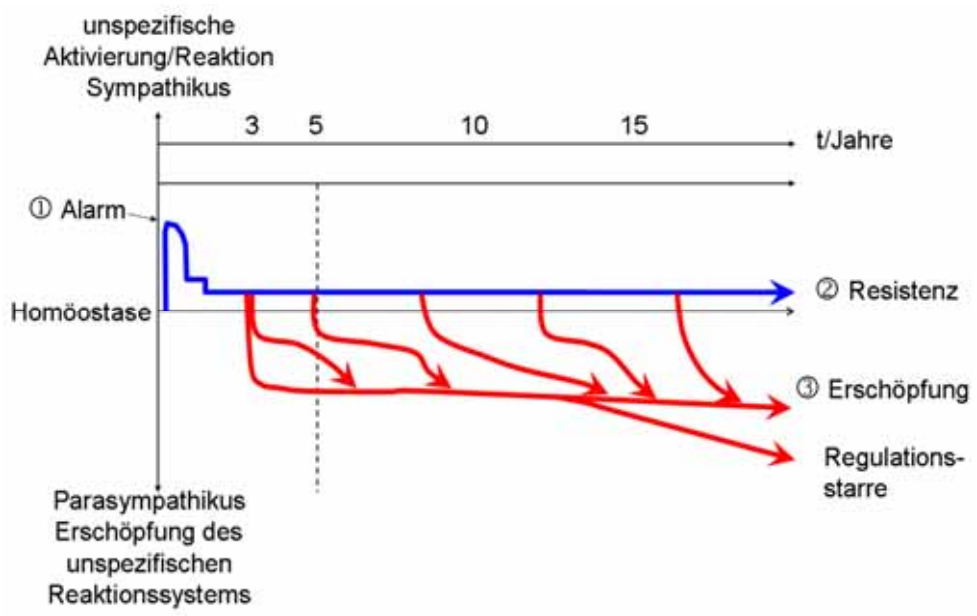
Therapie = Treatment

Resistenz = Resistance

Erschöpfung = Exhaustion

Regulationsstarre = Regulation rigidity

Figure 2: Developmental disease stages of healthy subjects after long-term EMF exposure in comparison to the stages (j, k and l) of the general adaptation syndrome according to Hans Selye [1953]
I = Activation stage
A = Activation (excitability); (corresponds to Selye ① alarm stage)
B = Positive stimulation, C = Adaptive state (corresponds to Selye ② resistance stage)
II = Latent, weak pathological development (corresponds still to Selye ② resistance stage) III = Serious pathological development (corresponds to Selye ③ exhaustion stage)
Graph based on the results of a literature review by Hecht and Balzer [1997]



unspezifische Aktivierung/ Reaktion Sympathikus = Nonspecific activation/ response of sympathetic nervous system

Parasympathikus = Parasympathetic nervous system

Erschöpfung des unspezifischen Reaktionssystems = Exhaustion of nonspecific regulatory system responses

Alarm = Alarm

Homöostase = Homeostasis

t/Jahre = Time/years

Therapie = Treatment

Resistenz = Resistance

Erschöpfung = Exhaustion

Regulationsstarre = Regulation rigidity

Figure 3: Possible individual pathological responses by subjects not anymore healthy or previously injured after EMF long-term exposure (not bound by the time stages shown for initially healthy subjects, who were not previously injured and are relatively resilient) in comparison to stages of the general adaptation syndrome (j, k and l) according to Hans Selye [1953]
Graph based on the results of a literature review by Hecht and Balzer [1997]

4.2 Prevalence of symptoms

The prevalence of pathological symptoms increases with the increasing duration of exposure (years of service). In initially healthy workers, first early symptoms may sometimes develop after three years of exposure—this, however, is quite rare. Symptoms can largely be verified after five years of exposure or years of service, for a daily exposure of at least two to eight hours and at least five times per week, whereby the exposure limits are sometimes met and sometimes exceeded. However, not all symptoms always occur in each person.

A severe manifestation and great prevalence of symptoms have been documented for more than ten years of service (exposure). At that time, chronic diseases start to manifest in many workers.

In various studies [Plechanov 1987; Garkavi et al. 1984; Kolodub 1984; Moros 1984; Plechanov 1984; Tjashelova 1983; Krylov et al. 1982; Kolodub et al. 1979; Rakitin 1977; Abramowitsch-Poljakow et al. 1974; Medwedev 1973; Lysina and Rapoport 1968; Sokolov and Tschulina 1968a and b; Schuh et al. 1987; Panov and Tjagin 1966; Plechanov and Wedjuschkina 1966; Drogichina and Sadtschikova 1962; Piskunowa and Abramowitsch-Poljakow 1961; Lejtes and Skurishina 1961; Drogichina 1960], therefore, different data are found for the prevalence of manifested symptoms, ranging from 20% to 25% up to 30% to 60%, and even up to 50% to 90% [see Virchow 1868].

For these different percentages, different factors are to be included in the assessment.

4.3 If detected early, effective therapy possible

In those cases where EMF symptoms could be detected early enough and the person could be transferred to another workplace without EMF exposure, symptoms would recede [Gordon 1966; Drogichina and Sadchikova 1968, 1965]. A medical case will illustrate this point [Drogichina and Sadchikova 1968].

Exposure duration	Exposure duration < 20 min daily, 5 times per week has no pathological implications In healthy persons, pathological symptoms only manifest themselves after ca. 3 years at the earliest With an increasing exposure duration, the EMF effect also increases due to accumulation [Gordon 1966; Presman 1970]
Age	Younger persons show a greater sensitivity to electromagnetic fields than adults
Individual health status Electromagnetic hypersensitivity	Decline in health status increasingly amplifies EMF effects Frequent, long-term, repeated exposure to EMF leads to accumulation [Gordon 1966; Presman 1970; Plechanov 1987]
Status of electrolyte/mineral household	Lack of minerals and pollution load increase EMF effects
Additional stress effects	E.g. noise, other types of radiation, conflict, stress, chemical pollutants increase EMF effects
Active substances and medications	Stimulating substances, e.g. caffeine, can increase EMF effect

Figure 4: Selected factors that can influence the development of an illness due to nonthermal/biological, nonionizing EMF

Case history:

Patient, 22 years old, male, showed the following pronounced symptoms after starting to work as an equipment technician with an EMF exposure in the 65 to 100 MHz range and up to eight hours a day five times a week:

- Fatigue
- Daytime tiredness
- Sleeplessness at night
- Severe decline in concentration during work, increasingly making mistakes
- Buzzing in the ears
- Loss of muscle strength
- Nervousness
- Hyperactivity of thyroid
- Deterioration of eyesight in the second half of the day
- Hair loss

After the transfer to a workplace without EMF exposure, however, the above-listed symptoms receded within three years—all of this was carried out under constant medical supervision.

Annual occupational health checks make it possible to implement appropriate preventive measures, to start relevant treatment early enough, and to provide a more suitable workplace.

4.4 Findings of Prof. Zinaida Gordon [1970, 1966]

In Western European countries and in the United States, especially the studies by the Russian researchers Zinaida Gordon [1970, 1966] and Alexander Presman [1970] became known, which were made available in English, but also the research by Malysev and Kolesnik [1968]. At the Moscow Institute of Industrial Hygiene and Occupational Health [Gordon 1966], for example, more than a 1000 persons were studied for more than 10 years in cooperation with several clinics since 1948. As is typical for the microwave syndrome, the following symptoms were described:

- Neurovegetative disorders
- Neurosis
- Depression
- Daytime tiredness
- Decrease in performance
- Sleeplessness
- Headaches
- Various cardiovascular regulatory changes
- Hyperactivity and inner restlessness

With an increasing exposure duration, the symptoms and sensitivity against microwave radiation increase (cumulative effects) according to Gordon [1966].

At the Moscow Institute of Industrial Hygiene and Occupational Health, interactive effects between EMF exposure and air temperature, air humidity, noise impact, light sensitivity, as well as lifestyle factors were also studied.

Furthermore, it was common practice to include large population groups that were not occupationally exposed to EMF as controls in these studies. Petrov [1970], who conducted his occupational health research in Leningrad (today St. Petersburg), also reported about the microwave syndrome due to weak electromagnetic field exposure. He found the following dominant symptoms in his study subjects:

- Tendency to neurosis
- Psycho-neurovegetative dystonia
- Headaches
- Sleep disorders
- Daytime tiredness
- Heart arrhythmias
- Changes in EEG activity
- Asthenia
- Cardiac pain

In her book on occupational health from 1966, Zinaida Gordon demanded that the safety guidelines must be strictly adhered to when dealing with radio-frequency electromagnetic fields. Already in November 1958, the Soviet minister of health issued legal safety guidelines for persons working near microwave generators.

4.5 EEG in cases of EMF long-term effects

In the following studies of various authors [Besdolnaja 1987; Baranski and Edelwejn 1972; Ginsburg and Stadchikova 1964; Ermakov 1969; Ermakov and Muraschvo 1970; Rubzova 1983; Stadchikova and Nikonova 1971; Wolfovskaja et al. 1961; Rubzova 1993; Ladchikova 1964], the EEG of patients with long-term

EMF exposure, who already had developed the vagotonic-neurovegetative-asthenic syndrome, was examined.

- **SHF (10 µV/cm^2) (more than 5 years)**
  37 males, 25–40 years old;
  2–8 years of SHF exposure

  EEG: changes, decrease in frequency: alpha and theta waves;
  In 50% of study subjects, asthenic neurovegetative disorders.

- **SHF (3.5–5 µW/cm^2) long-term exposure (more than 5 years)**
  Ca. 1000 persons;
  EEG: desynchronization, disintegration of alpha waves;
  In a portion of the study subjects, neurasthenic disorder, affecting the ascending reticular activating system (ARAS) in the sense of a weakening of the CNS (drowsiness, tiredness).

- **Radio waves (SHF, UHF, HF)**
  48 persons, long-term exposure (ca. 7 years);
  EEG: mesendiencephalic disorders in the sense of a neurovegetative asthenia, bilateral synchronous paroxysmal activity.

- **SHF, 7–14 years of exposure**
  Summary of results from 1978-1983;
  Effects of SHF above 100 µW/cm^2;
  EEG: changes in alpha rhythm, disintegration of alpha rhythm.

- **EEG studies, long-term effects**
  On average, 7 years of exposure to an electric ffield of 100-150 V/m to 600-2500 V/m;
  101 women: in ca. 50% of the study subjects, EEG changes in the sense of desynchronization: disintegration of alpha rhythm.

- **SHF: 80 workers under industrial conditions**
  In ca. 50% of study subjects, EEG changes with a tendency to theta delta wave activity (2.5 years of exposure);

  Increase in thyroid function, vagotonic response, neurovegetative-asthenic syndrome.

4.6 Hypotensive (vagotonic)-based neurovegetative-asthenic syndrome

Examples of occupational examinations, especially from long-term studies. Examinations were usually carried out annually.

- **SHF more than 1000 subjects**
  Asthenic effects in functions of central and autonomic nervous system with a tendency to neurotic depression and a vagotonic response of autonomic system, hypofunction of blood pressure, blood sugar, and others;
  Shift to vagotonic responses correlates with increasing exposure duration (> 4 years of exposure).

- **SHF women**
  50 Hz, 1000-10,000 A/m (> 4 years of exposure);
  High portion of subjects with resting tremor (increasing with increase in exposure duration), arterial hypotension and vegetative-cardiovascular dystonia.

- **SHF long-term effect (> 5 years of exposure)**
  A group of 244 subjects at the age of 26 to 44 years, who worked under SHF conditions for a longer period, was studied. The patients complained about, headaches, irritability, tearfulness, decline in memory and attention, cardiac symptoms, arm and leg symptoms, drowsiness at work, increased tiredness, decrease in well-being.
  In a number of patients, trophic disorders, hair loss, osteoporosis, and severely delayed healing of facial ulcers were observed.
  In men: decline in sexual potency.
  In women: menstrual cycle disorders.
  Evidence of asthenic-vegetative syndrome, tendency to hypotension, extrasystole, signs of vagotonia, tendency to capillary spasms, increase in reticulocytes to 1.8%, tendency to leukocytosis or unstable leukopenia.

- **SHF long-term effect**
  100 subjects, 103 controls;
  < 3 years of exposure, 37 subjects;
  3-5 years of exposure 28 subjects;
  > 5 years of exposure 35 subjects;
  Power density in the permissible range (33 subjects);
  Power density, which periodically is below the permissible range (67 persons); Independent of this dosage, the majority of those, who had been exposed to SHF for more than 3 years, developed with increasing exposure stages symptoms that are characterized by the hypotensive-vegetative-asthenic syndrome, e.g. bradycardia, arterial hypotension, fatigue, and others.
  In the first years of SHF exposure, no visible symptoms could be observed.

- **SHF long-term**
  14 men, 30–45 years of age, 30 controls;
  > 3 years of exposure;
  Neurovegetative-asthenic syndrome, vegetative dystonia with vagotonic component.

- **SHF exposure > 5 years**
  85 patients (60 controls)

Findings:	Subjects:
Neurocirculatory dystonia	20
Vegetative dystonia with vagotonic dominance	14
Asthenic-vegetative syndrome	11
Unstable pulse, bradycardia	26
Tachycardia	8
No findings	6

- **SHF exposure > 3 years + noise 65–75 dB with illumination of 50-100 Lux**
  110 workers under industrial exposure conditions;
  Early health symptoms showed after 3-5 years of exposure;
  Neurovegetative asthenia;
  Subjective: headaches, tachycardia, hair loss, lack of concentration, irritability, decreased memory.

[Garkawi et al. 1984; Drogitchina 1960; Drogitchina and Sadtschikova 1962, 1964; Shuk et al. 1967; Kolodub 1984; Kolodub et al. 1979; Panov and Tjagin 1966; Plechanov 1984, 1987; Plechanov and Wedjuschkina 1966; Sokolow and Tschulina 1968a and b; Abramowitsch-Poljakov et al. 1974; Tjashelova 1983; Medwedev 1973; Piskunova and Abramowitsch-Poljakov 1961; Rakitin 1977; Krylov et al. 1982; Moros 1984; Lejtes and Skurishina 1961; Lysina and Rapoport 1968]

4.7 Sensorimotor and motor function impairments

Selected studies of various authors [Wdowin and Osinzewa 1987; Koslowskij and Turowa 1987; Bojenko 1964; Bojenko and Budko 1964; Bojzow and Osinzewa 1984; Tichontschuk et al. 1987]

- **In relation to the number of exposure years, SHF leads to shortening of sensorimotor response times.**
  Slowing down of movement responses during differentiation tasks.

- **SHF long-term exposure with industrial frequency (subway)**
  Increase in excitability of movement;
  Shortening of response time.

- **14 workers with ELF long-term exposure (control group n = 13)**
  Coordination of motor functions and work speed were tested at the start and end of the shift.
  Start of shift ELF vs. controls = 53.7% increased;
  End of shift ELF vs. controls = 29.2 % increased.
  The error rate was the same in both groups.

- **Electric field (50 Hz, 1000-10,000 A/m) long-term exposure > 5 years**
  Resting tremor of fingers, increasing with increased years of exposure;
  54% of workers had to receive neurological treatment.

- **Hearing effects of pulsed EMF in SHF range**
  The development of subjective hearing perceptions as a nonspecific reaction of the body is the result of a transformation of electromagnetic energy into mechanical energy in the tissues of the head. There is no consensus yet.

- **Ringing ears (tinnitus) short-term effects at 200 -3000 MHz, power density 0.4 mW/cm2**
  It was observed that for each brain structure specific parameters of the EMF exposure, which are necessary to produce an effect, can be found. It was also demonstrated that, at exposure levels of 100 mW/cm2 at 380-500 MHz, subjects developed ringing in the ears, pulsing in the head, and aggressiveness toward the investigator.
  Special tests revealed that humans could hear different sounds at an EMF modulation: whistling, snapping, rattling, buzzing. These sounds disappeared when temple area was shielded. It was revealed that the frequency range of 200-3000 MHz and the power density of 0.4 mW/cm2 were effective in humans.
  In addition, it should be noted here: microwave hearing has also been described in the scientific EMF literature of the U.S. [see Brodeur 1977].

4.8 Cardiovascular system

Examples of EMF long-term exposure on the cardiovascular system in humans.

- **SHF long-term exposure and follow-up examination**
  160 workers and engineers, effect of industrial SHF;
  Nonspecific effect of SHF;
  Lasting changes of the circulatory system after 20 years of SHF exposure at work;
  Examinations 4–7 years after leaving this workplace revealed the following findings: increased blood lipid levels, myocardial ischemia, and arterial essential hypertension.
  Conclusion: in long-term exposure situations, SHF leads to a rapid development of cardiovascular diseases.
- **5–10 years of microwave exposure**
  Also leads to changes in hemodynamics of the brain circulatory system with a tendency of hypotension and restricted blood flow.
- **SHF causes the development and manifestation of a hypotensive-vegetative-vascular asthenia within 10 years of exposure**
  (73 men and 27 women at the age of 21–40)
  SHF > 5 years of exposure (exposure level: 5–10 times above exposure limit);
  72 workers (70% male, 30% female);
  69% hypotensive neurovegetative-cardiovascular asthenia.
- **SHF 1000-3000 hours of exposure**
  100 subjects
  4 subjects hypotension
  5 subjects hypertension
  7 subjects unstable pulse
  33 subjects bradycardia
- **SHF (10 µW/cm^2) 19 years of exposure, 4–7 years later follow-up examination**
  80 men (80 controls);
  Changes in cardiovascular function with a tendency to vagotonic response
  (arterial hypotension, bradycardia).

[Medwedev 1973, 1977; Sadtschikova et al. 1972; Wolynskij 1973, Drogitchina et al. 1966]

4.9 Biological rhythms and EMF long-term effects

Selected examples.

- **Circadian rhythm**
  Long-term exposure greater than 10 years with EMF in the radio-frequency range: changes in the circadian rhythm of the body temperature (81% of subjects) and changes in the circadian rhythm of the heart rate (88% of subjects). Vagotonic response increases with increasing age of service, which is possibly the cause for the disturbance of the circadian rhythm.
- **Circadian rhythm**
  The catecholamine release during long-term SHF exposure does not differ from people who live in situations without exposures.
- **Long-term SHF exposure**
  (> 3 years) leads to changes in seasonal rhythms of the digestive system.
- **Measurements of the constant electric field in humans**
  Revealed seasonal changes of the electric potential differences (EPD) between the neck and the distal ends of the extremities:
  fall-winter displacement to the range of positive values; spring-summer displacement to the range of negative values.

4.10 Animal experiments

In extensive experiments of different animal species, which will only be briefly mentioned here, similar effects were observed as in human studies [Hecht and Balzer 1997 review].

All applied EMFs and EFs, depending on a range of factors, e.g.:

- Exposure duration,
- Individual susceptibility,
- Type of EMF,
- Dosage and other factors,

Mainly caused a nonspecific response in the sense of Hans Selye [1953].

In animals, the biological effect of SHF can depend on the wavelength (at the same exposure level):

Millimeter waves cause weak biological effects. The strongest biological effects are caused by meter waves. Furthermore, the following temporal relationship between exposure duration and wavelength regarding the biological effects exists: to cause a biological effect, meter waves require a short exposure duration; in con trast, millimeter waves require a very long exposure duration.

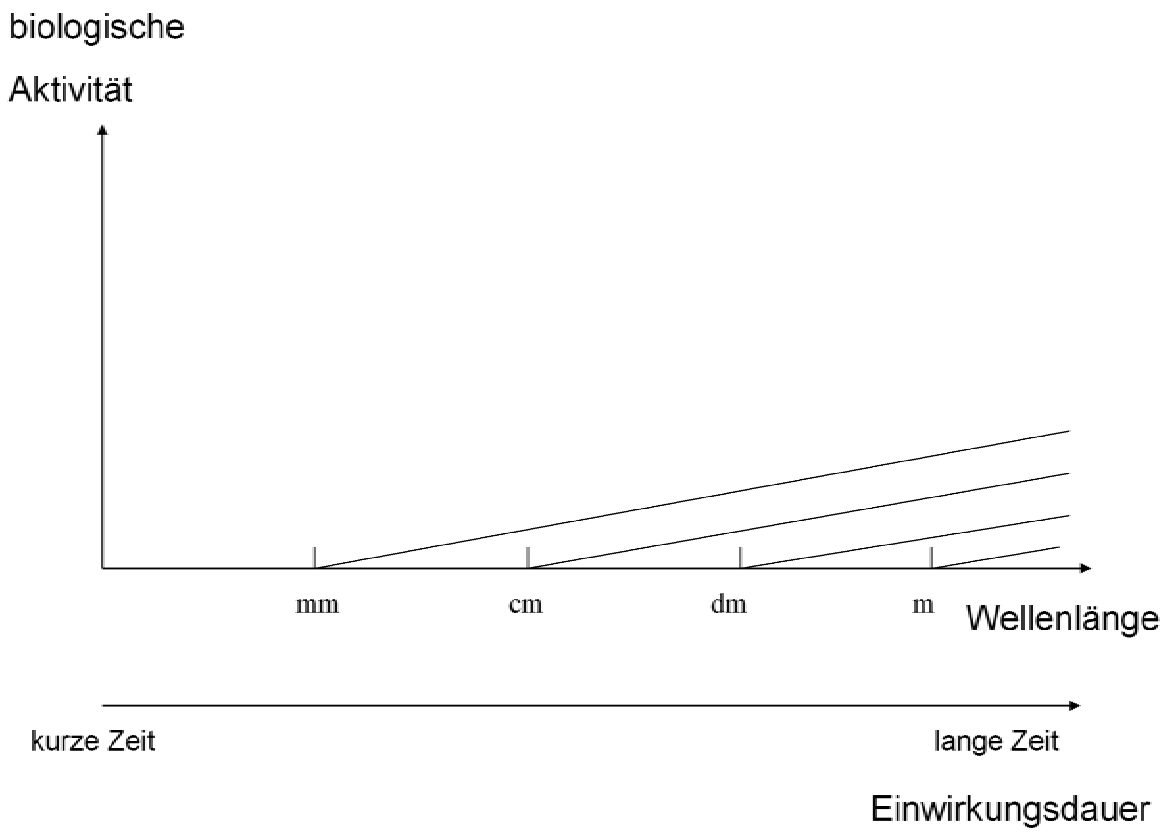


Figure 5: Relationship of wavelength, biological effect, and exposure duration in animals (simplified illustration)

Conclusion: EMF effects "require time" to cause verifiable adverse effects in humans. As we could show, it takes at least three to five years. In this context, I would like to point out that, in the Naila study, Eger et al. [2004] observed an increase in cancer incidence five years after the installation of the cell phone base stations.

4.11 Findings of long-term effects of noise

4.11.1 Noise and EMF exposures have similar long-term effects in humans

For decades, I have also studied noise research. Based on the available research results, I noted that the findings of long-term effects caused by EMF are in many respects similar to those caused by noise. For example, the long-term study by Christl Graff et al. [1968], which was also conducted under occupational health care conditions similar to the long-term studies on EMF in the former Soviet Union [Hecht and Balzer 1997], illustrates this point. Graff et al. [1968] studied male workers in a boilermaking facility (90-110 dB(A)) prior to their employment as well as after 6 and 13.5 years of employment. This group of boilermakers was compared to transport workers who had worked at noise levels of less than 60 dB(A) during the same period. The criteria were parameters of the cardiovascular system (blood pressure, ECG, and other functional diagnostic as well as biochemical parameters). In Table 4, the findings are presented.

Due to gathering a detailed family and personal history, persons with a disposition for hypertension could be excluded from the study. In addition, it should be noted that, in most cases, the noise level after work was lower because the workers lived in East Berlin and the outskirts of Berlin, where there was comparably little traffic noise (road, railroad, and air) in the 50s and 60s of the last century. In the Spandau Health Survey [Maschke et al. 2003], this method of monitoring long-term effects of noise could be successfully applied.

Prior to Graff et al. [1968], Andrjukin [1962] in the Soviet Union had already arrived at similar results. He studied male and female noise workers in 1932, who had been exposed to a noise level of 90 dB (frequency maximum 3000 Hz) for many years. The rate of essential hypertension was more than double in the noise workers compared to the control group, whose psycho-physiological exposure was similar but without excessive noise exposure. According to Andrujukin [1962], the number of illness cases increased proportional to the noise level and the exposure duration. It is highly recommended that EMF researchers also conduct this type of prospective studies.

We must assume that noise and EMF have similar stress effects from which functional psychosomatic (mental-physical) disorders develop. Psychosomatic disorders are more widespread today than commonly thought. Only in every fourth patient who sees a physician for pain can an organ-related diagnosis be made [Henningsen 1996]. For functional psychosomatic disorders (according to ICD 10F), it is believed to take seven to ten years before they develop into a verifiable organ-related diagnosis [von Uexküll 1990; Reimer et al. 1979]. In the United States, such patients (who go constantly doctor shopping) are classified with a cost factor of nine compared to the cost factor of average patients [Weiner 1988].

These results show that long-term studies are indispensable in obtaining evidence of adverse health effects of EMF and noise.

In the EMF exposure guidelines of the Soviet Union, the daily exposure duration had been considered; in Western Europe and the United States, this is not the case.

Table 4: Cardiovascular diseases in male workers of a boilermaking facility under noise conditions [Graff et al. 1968]

	Medical findings at point of hiring	**After 6 years of employment**	**After 13.5 years of employment**
Noise workers n=117	Healthy	31% ill	81% ill
Transport workers n=50	Healthy	6% ill	16% ill

As I could demonstrate, it is common practice in the scientific Russian literature to carry out long-term studies to obtain evidence of adverse health effects. In Western Europe and the United States, as described above, one makes mostly do with short-term studies with which only biological responses, but not adverse health effects can be detected. This means in plain language: based on a completely wrong research approach, misleading research results are produced that serve as the basis for "safety" guidelines, but they lack any scientific standards in the area of biology and medicine.

Furthermore, I could show that long-term noise exposure causes similar effects as long-term EMF exposure. Both belong to the group of stressors with nonspecific effects. In stress research, eustress and distress has been distinguished for 75 years, that is, health-promoting and performance-enhancing stress (eustress) and disease-causing distress. The latter type of stress can be verified only through long-term studies.

4.11.2 Studies on the interactions of EMF and noise effects are urgently needed

Our society does not only suffer from electromagnetic pollution, but also from permanent noise exposure from various sources (road traffic noise, air traffic noise, industrial noise, recreational noise, etc.) and from insidious pollution through chemical environmental factors in air, soil, water, and food. It is high time that the interactions between electrosmog, chemical pollutants, and noise and their effects on human health are not only studied, but that the results are also included in risk assessments. In my opinion, RF transmitting facilities should not be installed in areas with a high noise level. For some years, the light pollution of urban areas due to lighting has also been discussed as a health concern.

Studies about the interaction of two or more adverse human health factors, however, are doomed to fail by an anachronistic mindset in natural sciences that postulates monocausal effects. Unfortunately, this mindset is also binding for the courts. In this world out of touch with reality, it is assumed that a *single* environmental factor causes only a *single* disease. This kind of assumption cannot be applied to humans because, in the real world of our modern society, people are never exposed to only one single environmental factor at any given time. It is rather the rule that the interaction of different stressors with nonspecific effects cause interference throughout the entire body, resulting in multimorbidity (several diseases at the same time). The monocausal mindset is unable to convey any insight into the complexity of life processes in humans and the diversity of environmental factors they are exposed to. This is why this approach has been considered unscientific long ago.

5. Electromagnetic fields - Basis of life and source of interference

5.1 The arrogance of some EMF experts in their assessment of the Russian scientific literature

More often than not, when I lecture about the results of the long-term EMF effects documented in the Russian scientific literature, other experts—including high-ranking officials from the Ministry of Environment—argue, without providing any evidence, that these research results were not obtained by following Western standards of scientific research and, therefore, are not acceptable.

This type of arrogance and high-handedness, in my opinion, has nothing to do with science. Anybody could see for him- or herself that the presented research findings were obtained by applying relevant scientific methods of inquiry. Of course, not according to the Western standard of scientific research! However, does the Western model actually offer a convincing standard in this case? I myself have a number of objections in this regard, including the lack of accounting for the time factor, the impact on the psyche and the nervous system, chronobiological aspects, as well as the individuality of a given person.

The disparaging comments about the research findings of the Russian scientific literature, of course, are not new. As the following examples will illustrate, they have already been around in the United States for over 40 years [see Brodeur 1977]. Here are two examples:

1. In May 1968 at a US senate hearing on the evaluation of microwave radiation effects in humans, the following occurred: The only proponent of nonthermal biological effects of microwaves, who had been invited to this 5-day hearing and delivered a realistic evaluation of microwave effects in the human body, was Professor Dr. C. Süsskind [Prausnitz and Süsskind 1962, Süsskind 1959] from the University of Berkeley. He made reference to the findings of Soviet scientists and explained to the senate committee that U.S. scientists unfortunately hardly ever bothered to look for nonthermal microwave effects—though they should certainly know about their existence. To quote Süsskind, he pointed out reasonably: "We cannot very well dismiss a whole body of scientific literature just because it is Russian." He demanded that the Soviet experiments should be replicated to clarify whether the conclusions drawn by those scientists would be valid or not. Finally, he reminded his audience that the hazardous nature of ionizing radiation had become apparent only after years and decades of research. He then continued that it would not surprise him in the least "if nonionizing radiation were ultimately to prove a bigger and more vexing problem." He himself knew what he was talking about because he had conducted many animal experiments himself [Prausnitz and Süsskind 1962; Süsskind 1959; Brodeur 1977, p. 43].

2. EMF radiation experts including Dr. Allan Frey [1965, 1963a and b, 1962, 1961] were invited to join the Symposium on Biological Effects and Health Implications of Microwave Radiation at Richmond from 17 to 19 September 1969 [St. F. Cleary (ed.) Symposium Proceedings, U.S. Dept. of HEW 1970]. It is also referred to as the Richmond Symposium. All leading microwave radiation experts from the United States and some scientists from Poland and Czechoslovakia gathered at this symposium and discussed the findings of their research. Many of the attending independent scientists had already received background information on the scientific and health care policy decisions regarding the lower exposure limits of microwave radiation in the Soviet Union. They found their own research observations and findings confirmed, which suggested that many complaints and symptoms associated with microwave radiation exposure could not be traced back to thermal influences only.

Once again, a deep rift opened up between the representatives of the thermal-effects-only hypothesis and those who could not rule out nonthermal biological effects. The latter scientists applied for funding of relevant research projects, which, however, were declined. Conversely, those who promoted the thermal-effects-only hypothesis left themselves open to the accusation by the opposing side that they could not break with the old (= thermal) approach because their research was funded by the military and electrical industry. This rift

also shaped the discussion about the research findings of scientists from the Soviet Union.

The thermal-effects-only proponents flatly rejected these findings or doubted, for no objective reasons, the accuracy of the research methods used in the Soviet Union. The opposing side appealed to the participants of the symposium finally to recognize the colleagues from the Soviet Union as equal partners and scientists of integrity and to consider their findings in future research projects in the United States. The participants were even reminded of the fact that the low dosage recommendations for X-ray and ionizing radiation in the Soviet Union had previously been ridiculed in the United States, but later had to be recognized as being right.

At the Richmond Symposium, the participant from Czechoslovakia was Dr. Karel Marha et al. [1968/1971], the director of the RF radiation department at the Institute of Industrial Hygiene and Occupational Health in Prague. He reported that the exposure limit in Czechoslovakia was set at 0.01 mW/cm² for a daily 8-hour radiation exposure in pulse mode since the *cumulative effect* of high frequency microwaves must be regarded as proven. So far, this type of cumulative effect had only been acknowledged for X-ray and ionizing radiation. Karel Marha also emphasized that shift workers must only work part-time under exposure conditions of 0.01 mW/cm², that is, less than eight hours. As a rule, pregnant women were excluded from working at these types of workplaces [see Brodeur 1977]. The scientific findings and the objective arguments of the proponents of nonthermal effects of electromagnetic fields were so convincing that the large majority of the symposium participants decided to compile the above-mentioned US government report.

It is astonishing to see that the proponents of thermal effects of electromagnetic fields have learned nothing new over the past 40 years. The incorrect concept affects European and U.S. exposure limits, which cannot claim to provide protection. It affects research projects that only conduct short-term studies. It affects policies that claim safety where a warning should be in order. Furthermore, it also affects the administration of justice when incorrect judgments are passed—which the court is forced to do within its currently valid legal framework.

5.2 Thermoregulation

To better understand thermal effects of electromagnetic fields, a few explanations follow below.

Based on his observations, Schliephake [1932] had already assumed that symptoms of the radio wave syndrome were not associated with thermal effects but could be associated especially with an impaired thermoregulation. To understand this, we need insight into the physiology of thermoregulation.

As described in the first chapters of most textbooks on human physiology, thermoregulation keeps the temperature of the human body at a relatively constant level whose standard usually is given with 37°C (98.6° F). This value, however, is dependent on both the individuality of a given person and the time of day. In the morning, the body temperature is lower and in the evening it is higher which is why, for over 100 years, the body temperature has been taken both in the morning and in the evening at all hospitals of the world. Thermoregulation starts with the stimulation of the thermoreceptors in the skin (e.g. Ruffini corpuscle and Krause end bulbs), which constantly send signals about any deviation of the body temperature along the nerve pathways of the autonomic nervous system to the hypothalamus. In cases of cold or heat perception, higher brain structures such as the limbic system or even the cortex will receive messages from the hypothalamus and gear into action.

These functions are not considered when setting the mysterious SAR value (specific absorption rate) or other exposure limits. The SAR value has nothing to do with life sciences.

For example, it has been known for a long time that the human body lowers its temperature through perspiration. Local heating of organs causes the blood pressure and blood flow to change. Consequently, the increased blood flow acts as a "radiator" and regulates the local temperature. Body parts (muscles), which are well supplied with blood, can tolerate the partial heating caused by EMF much better than the eyes and testicles, which are not well supplied with blood.

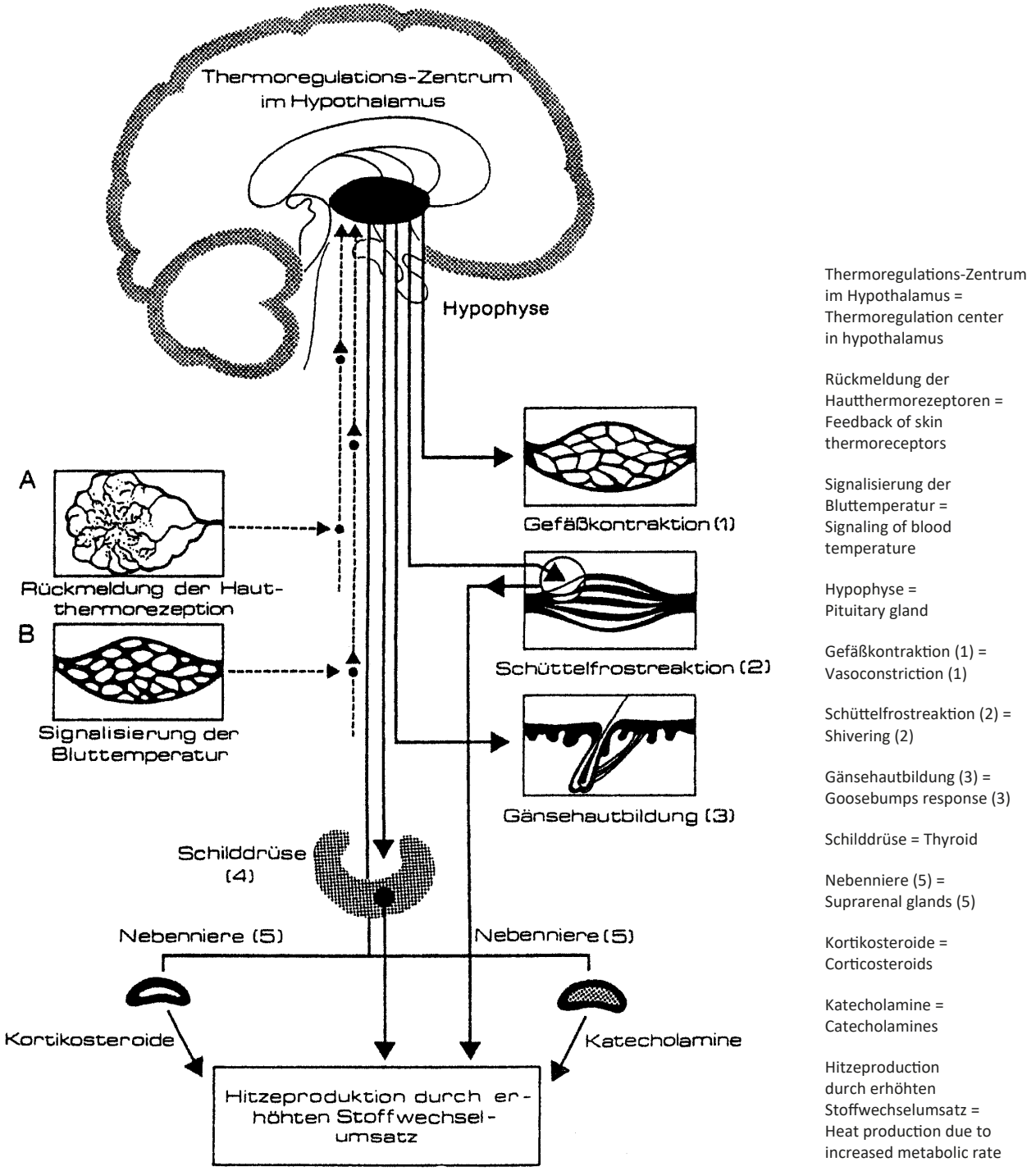


Figure 6: Functional adaptation capacity of the human body through thermoregulation during summer heat stress (ca. 35°C–40°C / ca. 95°F–104°F) [Köhnlechner 1981]

The hypothalamus contains the centers of the thermoregulation. They are connected to the pituitary gland via the releasing hormones. The pituitary gland releases its tropic hormones to the thyroid (4) and suprarenal glands to regulate the temperature. Information on the external heat level is provided by A: skin thermoreceptors, B: blood temperature perception organ. The mitigation of heat is controlled by three skin mechanisms: 1. vasoconstriction, 2. shivering, and 3. goosebumps response.

5.3 R. Wever's spectacular studies about the interactions of the human circadian rhythm and the 10 Hz frequency of the Earth's EMFs in the famous Andechs bunker near Munich

Wever [1968] asked himself whether—and possibly how—magnetic field factors of the environment can affect the endogenously regulated circadian rhythm of body functions. According to his way of thinking, the interactions could go like this.

- Under constant conditions, the period (and other parameters) can depend on the free-running oscillation of the prevailing conditions.
- Under the influence of periodically variable environmental factors can the oscillation—within a limited frequency range—be synchronized.

For Wever, it was necessary to clarify how physical agents such as EMF, which are not perceived consciously, can affect the circadian rhythm of body functions. According to Wever [1968], the electric and magnetic fields in our atmosphere, whereby the magnetic field of about 10 Hz [Schumann and König 1954] is of particular interest, are such physical agents because the latter field is characterized by a pronounced diurnal pattern and thus could possibly contribute to a synchronization of a 24-hour period.

Wever then ponders the following questions: "With the evidence of 10 Hz field effects on the human circadian rhythm, the question of possible effects of such fields in humans is then answered. For this question, the frequency of ca. 10 Hz is also of interest. The especially stable alpha wave component of the electroencephalogram has a frequency of 10 Hz [Berger 1929]; furthermore, the entire body surface of warm-blooded animals mechanically vibrates with a frequency of about 10 Hz [Rohracher 1949]. After the discovery of the 10 Hz atmospheric radiation (the Earth's surface also mechanically vibrates at a frequency of about 10 Hz [Rohracher 1949]), the question has been raised regarding an effect of the terrestrial vibration on humans through the vibration of a similar frequency in humans [König and Ankermüller 1960]. For answering this question, the measurement of the circadian period under constant conditions has proven to be a particularly sensitive test."

Initially, Wever carried out the following experiments. At the Andechs bunker facility of the Max Planck Institute of Behavioral Physiology, the following comparison experiment was carried out. The diurnal rhythm of activity/rest phases, body temperature, potassium and calcium excretion in urine, telling time, speed of doing mental math, and general well-being were monitored in a group of subjects who occupied rooms that were shielded against electromagnetic fields and another group whose rooms were not shielded. After one month into the study, the subjects in the shielded rooms showed a 25-hour to 26-hour rhythm as well as the desynchronization of the diurnal-rhythmic parameters. Deviations among the individual study subjects also showed considerable differences. Subjects who lived in rooms for one month, which were not electromagnetically shielded, maintained their 24-hour rhythm. When the subjects of the shielded group lived again under normal conditions, the 24-hour rhythm and all other synchronization processes reestablished themselves. The same occurred when Wever applied a pulsed 10 Hz magnetic field to the subjects in the shielded group.[1]

5.4 Earth's magnetic field controls circadian rhythm in humans

Under specific study conditions, Wever could prove that the naturally occurring electromagnetic fields have the same effect on the circadian rhythm of body functions as an artificially produced 10 Hz electric field. However, when these fields were missing, an endogenous desynchronization occurred. He summarized his findings as follows:

- *Both fields accelerate the slowed circadian rhythm. As is demonstrated by the large distribution of measured rhythms around the respective average value in individual experiments, this accelerating effect is the greater, the longer the period without a field is.*
- *Both fields prevent internal desynchronization, which has been observed only in the absence of both the natural and artificial fields.* [Wever 1968]

In this context, Wever emphasized "that the 10 Hz radiation is not the only component of natural fields that affects humans; however, there is strong evidence for 10 Hz being an essential component of these fields that at least has an effect on the circadian rhythm. Overall, the described experiments show, on one hand, that the circadian rhythm can also be influenced by nonper-

[1] The value 10 Hz is an average value. In general, the alpha waves of the EEG fluctuate between 7 Hz and 12 Hz. The so-called Schumann wave is given with 8.5 Hz. This is also an average value.

ceivable physical factors and, on the other hand, that factors of our natural environment, which have not been previously considered, may actually cause a measurable effect in humans." [Wever 1968]

Presman [1970] also reported about connections between the diurnal rhythm of various physiological functions and EMF in humans. The research of Wever [1968] and Presman [1970] has been continued by scientists of various countries (e.g. [Ludwig 2002, 1974; König 1974; de Large and Marr 1974; Persinger et al. 1974]).

Together these researchers have produced the evidence that low-level electromagnetic fields, which are not consciously perceived, can affect especially rhythmic processes either in a synchronizing or a desynchronizing manner. A desynchronization causes stress and triggers symptoms that are also known to occur in the microwave syndrome, but also in jet lag or shift work maladaptation [Moore-Ede 1993].

5.5 Interaction between brain function and weak electromagnetic fields

Adey and Bawin [1977] also demonstrated the interaction between brain function and weak electromagnetic fields. Likewise, Presman [1970] presented extensive findings regarding the effects of weak electromagnetic fields. Like Persinger et al. [1974] and Ludwig [2002], Presman also considered brain functions to be highly sensitive to weak natural and artificial electromagnetic fields, as Wever [1968] had observed with regard to rhythmic processes such as the circadian rhythm of body functions.

5.6 Earth's magnetic field also controls internal clock in humans

From the studies by Rütger Wever [1976, 1974a and c, 1971 a and b, 1970, 1969 a and b, 1968 a and b, 1967, 1966], Wever and Persinger [1974], Persinger et al. [1974], as well as Presman [1970, 1968], we can learn that, for the control of the "inner clock" (circadian rhythm) of humans, the ca. 10 Hz pulsation of the magnetic field or the atmosphere is indispensable. If the exposure to this field is missing, the system of the circadian rhythm becomes unstable and desynchronization occurs, as is also known to occur in the jet leg syndrome.

Here we can see connections to the findings of the Russian scientists, which they recognized in their long-term studies of the microwave syndrome (exposure limit </= 10 µW/cm²). Associated with the chronic symptoms of the microwave syndrome, they had always observed a decline in alpha rhythm (8–10 Hz) and frequently also the presence of delta waves in the awake EEG [Medwedew 1973; Sadchikova et al. 1972; Pawlowa and Drogitchina 1968; Presman 1968; Drogitchina 1960; and others].

The jet leg syndrome also seems to fit here. The symptoms, which had already been described by Schliephake, and the symptoms, which are commonly listed for the jet leg syndrome in chronobiological handbooks, are very similar (e.g. [Zulley and Knab 2000]). The same applies to the symptoms of the microwave syndrome as described by Russian scientists: [Abramowitsch-Poljakow et al. 1974; Baranski and Edelwejn 1972; Besdolnaja 1987; Drogitchina 1960; Grogitschina and Sadchikova 1968, 1965, 1964; Drogitchina et al. 1966; Garkawi et al. 1984; Ginsburg and Sadchikova 1964; Gordon 1970, 1966; Krylow et al. 1982; Lysina and Rapoport 1968; Lysina et al. 1982; Martynjuk and Bartynjuk 1993; Moros 1984; Osipow and Kaljada 1968; Panow and Tjagin 1966; Plechanov 1987, 1984; Rakitin 1977; Rubzova 1983; Sadchikova 1964; Sadchikova and Nikonova 1971; Sadchikova et al. 1972; Tjashelova 1983].

It must be assumed that the interference with the electrophysiological activity of the brain due to magnetic storms or radio wave-microwave EMFs also interferes with the biomagnetic regulation of the human body and, due to its dysregulation, also affects molecular and submolecular processes [see Warnke 1997; Halberg et al. 2000; Cornélissen et al. 2002; Cornélissen and Halberg 1994]. Depending in which state of regulatory function a given individual is, insufficiency will occur after a certain exposure time [Virchow

1868]. This insufficiency of the regulatory system will manifest itself in the form of the microwave syndrome or electromagnetic hypersensitivity.

5.7 Presman's information theory about the effects of low-level EMF magnetic energy

Presman [1970, 1968] assumed the following evolutionary basic conditions: The biomagnetic fields of a living organism are in constant communication with the environmental magnetic fields, especially the magnetosphere; and the respective central nervous system, no matter at which developmental stage the living organism is, plays the mediating role. This must also be considered in studies about artificial electromagnetic field exposures such as radio waves and microwaves: the functions of the central nervous system, which maintains the interactions between the autonomic, hormone, motor, and immune systems down to the cellular and molecular regulatory levels and controls regulatory functions, must primarily be tested with neurophysiological, neuropsychoimmunological, and neuropsychophysiological diagnostic methods.

5.8 Long-term exposure effects of weak magnetic fields are cumulative

Presman [1968] summarized his findings as follows: The studies on many groups of human subjects, who had been chronically exposed to a low field strength (<10 μW/cm²), showed—with considerable intersubject variability—changes in the brain's electrical processes similar to an inhibition of central nervous processes. In the case of long exposure durations (repeated exposure), cumulative effects were observed. Gordon [1966], Marha et al. [1968, 1971], Süsskind [1959], and Prausnitz and Süsskind [1962] also reported cumulative effects of nonionizing radiation.

In the animal experiments, awake EEGs also showed the presence of delta waves beside a decline in the alpha rhythm, which are symptoms commonly observed in sleep. The greatest sensitivity to EMF was found in the functions of the cortex and diencephalon. These are the processes that regulate the autonomic, hormone, and immune functions and also interfere with the functions of the hypothalamus-pituitary-adrenal stress axis.

5.9 Low-level microwave radiation greatly affects the human brain

These findings of Presman [1970], Persinger et al. [1974], Wever [1968a and b], and other scientists also explain the electrophysiological transient response of the brain, which has been described by Freude et al. [2000] and Krause et al. [2002] in study subjects during short-term cell phone radiation exposure. Both research groups reached the same conclusion, that is, short-term exposure to cell phone radiation can affect the information processing of the brain. Unfortunately, they do not make any reference to the essential findings of previous studies.

Presman [1970] recognized another important phenomenon in his studies, which would be so important to be also considered by current EMF research projects: his research team observed (in humans and animals) that the response to weak electromagnetic fields under in vivo conditions was much more sensitive than under in vitro conditions of isolated cells and organs or macromolecules in solutions. Thus, it was shown that a functioning body as a whole shows the highest level of sensitivity to weak electromagnetic fields. In this context, Presman [1970] also pointed out that EMF sensitivity is a sign of the specific nature of life in the sense that information processing in living organisms is tied to highly organized, complex living systems. At the same time, this also underlined the demand for research methods that adequately document the physiology of organized life processes in contrast to those methods of classical physics that do not do so.

5.10 Why smallest amounts of magnetic energy may cause major effects in the human body

The more than 35-year old research findings of Presman [1970, 1968], Wever [1968], Adey and Bawin [1977], Persinger et al. [1974] and others, which provide evidence for the great importance of electromagnetic fields in regard to the information processing of the central nervous system, continue to remain highly relevant. In the meantime, this early research has been confirmed and usefully supplemented by modern findings, among others by Ulrich Warnke [2004, 1997]. In one of his papers, Warnke [2004] explains very thoroughly why the smallest amount of electromagnetic

energy can trigger great effects in humans and thus confirms the understanding of Presman [1970] and many other Russian scientists (see [Hecht and Balzer 1997]). In another paper, Warnke [1997] presents new insights in the information processing of the central nervous system based on structures in the brain, which have been detected by electron microscopy and verified by intracellular electrophysiologic studies. He explains the new insights into the information processing of the brain as follows:

1. *Dendrites are not passive receptors, but active presynaptic information pathways due to their dendrodendritic synapses.*
2. *Previously, action potentials have been postulated for the transmission of information. Now it has become clear that information can also be transmitted without the presence of any action potential, but through very small potential fluctuations (< 1 mV).*
3. *Local circuits not only extend to millimeters or meters, as previously assumed, but they also extend to micrometers in a larger network. (So far, they have been found in the retina of the eyes and in the cortex of the cerebrum and cerebellum.) The small circuits of the microneurons work very fast and can be connected to form systems of highest complexity.*
4. *Microneurons do not use chemical transmitters, but gap junctions based on electronic coupling as is found in the impulse conduction of the heart. Apparently, a synchronization of nerve stimulation can be triggered this way, just like the burst trigger in the organs of electric fish.*
5. *We now know that, in classical synapses, the release of the transmitter substances is primarily not initiated by the electric field of the action potential, i.e. not by the depolarization of the membrane, but that the permeability of calcium across the presynaptic membrane is the trigger. The release of the transmitters is directly proportional to the calcium influx. Consequently, synapses respond effectively to small electric changes in the presynaptic membrane. The presynaptic permeability of calcium ions is a sigmoidal function of the membrane potential. Under suitable conditions, a Ca^{2+}-stimulated chain of membrane-related events can be initiated by only a few tenths of a millivolt [Kaczmarek 1976].*
6. *A transneuronal molecular transport has been observed in dendrites as well as in axons for glycoproteins and nucleosides.*

Overall, these findings tell us that the nervous system is more sensitive by one or two orders of magnitude than has previously been known. As to magnetic field effects, this means that already relatively small induction strengths can cause sufficiently large voltages that trigger microneurons with all its implications.

Conclusion: All of these new findings about the information processing of weak magnetic field signals and the nonspecific responses of the human body are extremely important for relevant research. They form the basis for classifying radio-frequency radiation of low and very low field strength as a stressor, which can act as eustressor during short exposure durations and distressor during long exposure durations. They show the different performance levels of our brain, but also make us understand the vulnerability of the same.

5.11 Humans are electromagnetic beings

As is generally known, humans are electrical beings. The electric currents of the brain (EEG), heart (ECG), muscles (EMG), and skin (EDA) can be measured and are a versatile tool for diagnostic tests and health checks. When the bioelectricity of a person is disturbed, illness will be present. Clinical death is defined as cessation of the electrical activity in the brain. Illness is always associated with a disturbance of the electrobiological activity in the human body.

5.11.1 Magnetic fields in the human body

Wherever electric force and information fields occur as a manifestation of an electrical being such as a human being, there will also be eigenfrequencies of magnetic fields. The flux density of magnetic fields that naturally occur in humans is given with 10-13 to 10-6 tesla [Weiss 1991].

The weakest magnetic fields in the human body are emitted by the eyes. As light strikes the eye, electric potentials of 0.1–30 Hz are activated.

As has been mentioned before, electric potentials of 0.1-30 Hz also occur in the EEG. The relevant magnetic fields of the brain are about 1 picotesla. Thus, they are 10 times higher than in the eyes.

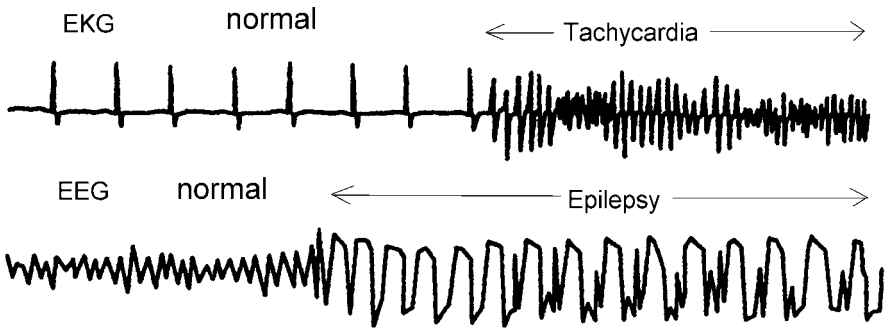


Figure 7: Tachycardia and epilepsy (modified according to Coveney and Highfield 1994]

optimale Elektrophysiologie = Optimal electrophysiology

Elektrophysiologie bei Dysmineralose = Electrophysiology in electrolyte disorders

Elektrophysiologie bei schwerer chronischer Erkrankung = Electrophysiology in severe chronic disease

erloschene Elektrophysiologie im Todesfall = Expired electrophysiology in the case of death

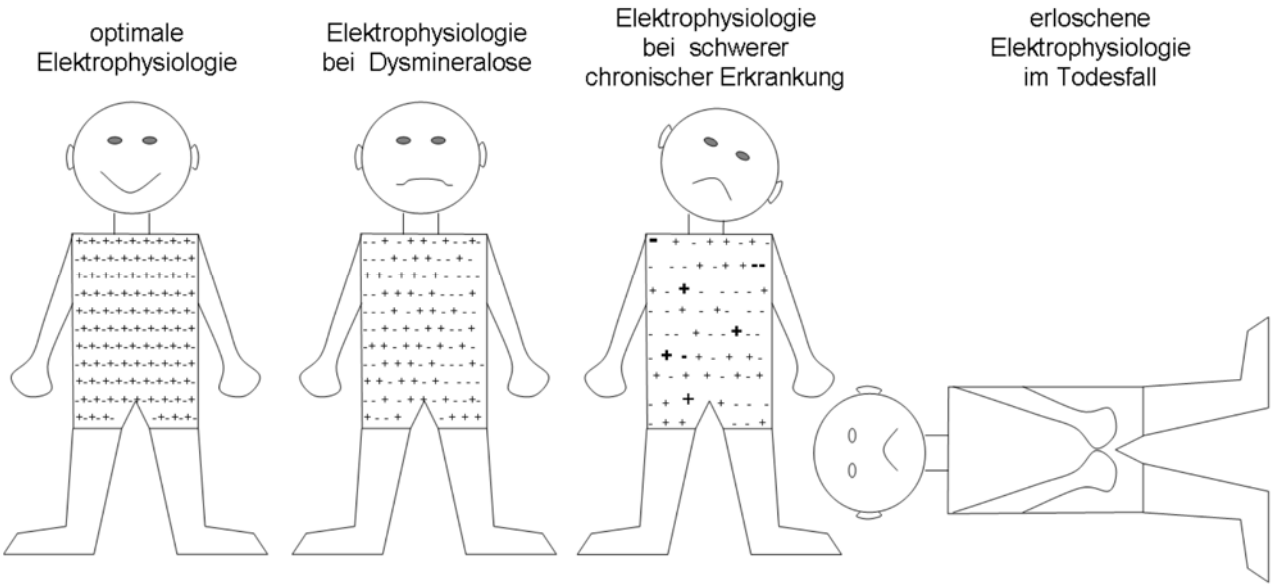


Figure 8: Humans—Electrical beings as an example of optimal electrolyte regulation and its impairments

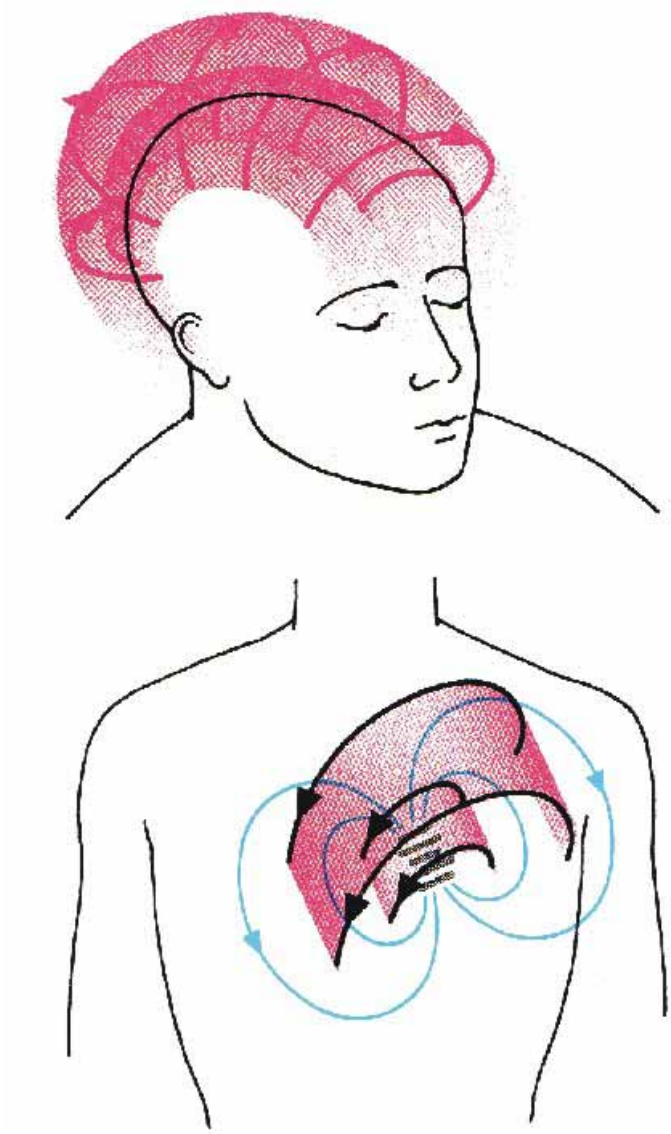


Figure 9: Models of magnetic fields of the brain (top) and heart (bottom) according to Weiss [1991]

The brain model corresponds to a random phase of the alpha rhythm (7-12 Hz).

The model of the electric processes in the heart dipole are shown at the bottom: the generator produces electric (blue) and magnetic (red) fields.

It has been known for a long time that bioelectricity and bioelectromagnetic fields can be measured. It is, therefore, rather astonishing that this knowledge has so far not been sufficiently included in the assessment of possible adverse health effects by the proponents of the thermal effects hypothesis.

5.12 Oscillating life processes in communication with frequencies of the Earth's magnetic field

The naturally occurring Earth's magnetic field consists of the following pulsation (frequency) components:

First, the stationary field, which is subject to diurnal fluctuations and follows a circadian rhythm.

Second, the micropulsations, which are oscillations that are in the extremely low frequency range of 1–30 Hz and 8–12 Hz.

Third, visible light pulsations, which are in the terahertz range [Becker 1994].

The geomagnetic field and light are quasi-stationary, i.e. constantly present, and are subject to certain diurnal fluctuations. The micropulsations fall into the extremely low frequency range, that is, ca. 1–30 Hz. The most dominant signal of this pulsation falls between 7 and 12 Hz. This, of course, is the frequency range of the eigenfrequency of groups of cells, especially nerve cells. (The average frequency of the Schumann waves is reported with 7.8 Hz.)

Today it is assumed [among others, Becker 1994; Persinger et al. 1974; Presman 1970; Wever 1968] that the symbiosis between living organisms and naturally occurring fields of the magnetosphere of the Earth, which has developed over the course of evolution, can be disturbed by both magnetic storms from the sun and the many different types of radio-frequency radiation of technical origin [Halberg et al. 2000; Cornélissen et al. 2000; Cornélissen and Halberg 1994]. These disturbances can cause stress or desynchronization [Wever 1968] and lead to the development of the microwave syndrome whose symptoms are similar to the jet lag syndrome and shift work maladaptation syndrome [Moore-Ede 1993].

Figure 11 (page 39) serves as an explanation model. It shows examples of EMFs that humans are exposed to and affected by and that are the cause of the electromagnetic pollution of our planet, which had already been predicted in the U.S. government report from 1971.

Steuerung der funktionellen Zeitstruktur = Control of the functional time structure | Gehirn = Brain |
magnetisches System = magnetic system | Zirbeldrüse = Pituitary gland | Melatonin = Melatonin |

neuro-magnetische Aktivität = Neuromagnetic activity | epineurale elektrische Gleichströme = Epineural electric DC currents |
Steuerung des Aktivitätsniveaus = Control of activity level | neuro-elektrische Aktivität = Neuroelectric activity |

Wachstum = Growth | Heilung = Healing | biologische Rhythmen = Biological rhythms |
Motorik = Motor system | Sensorik = Sensory system | Hormonsystem = Hormone system |
Immunsystem = Immune system | Vegetativum = Autonomic nervous system |

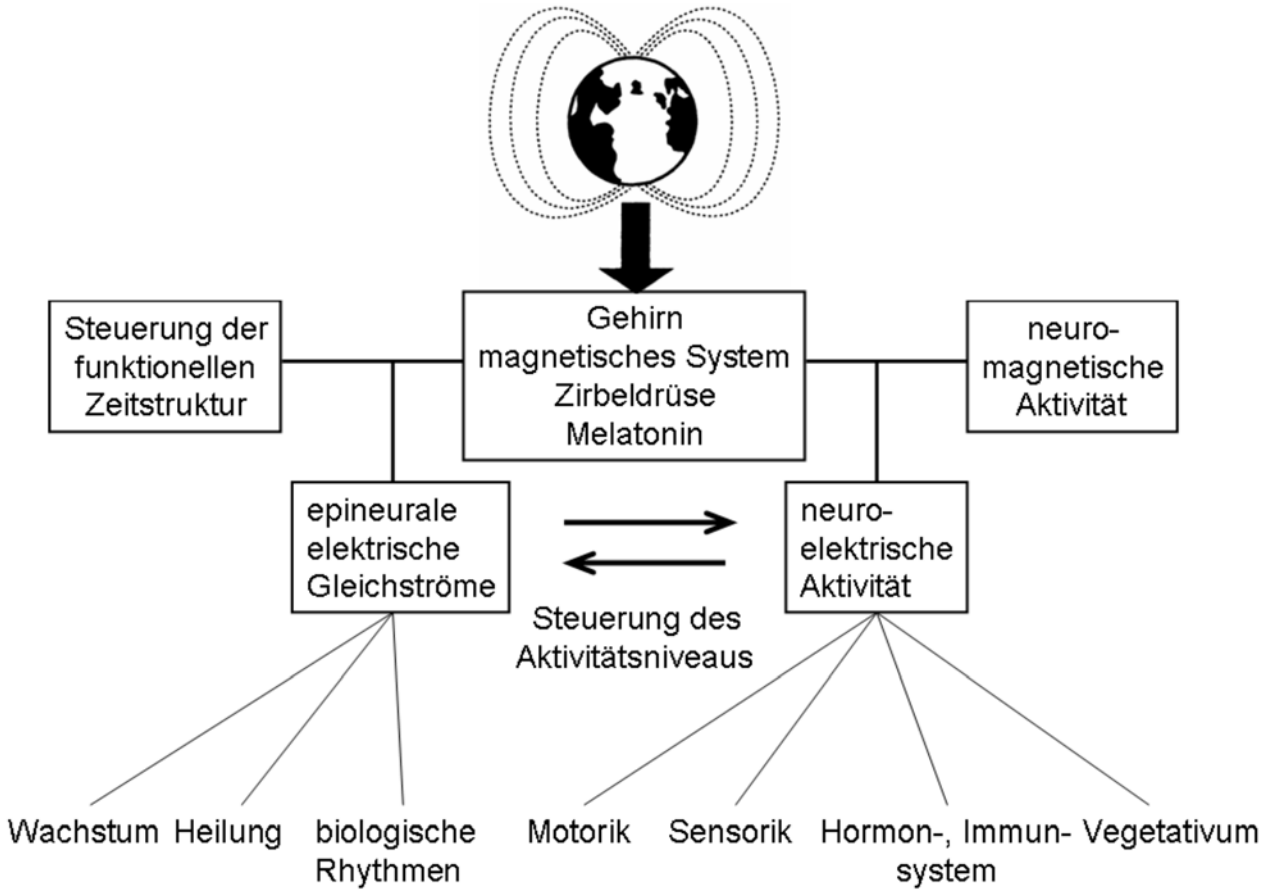


Figure 10: Interactions between the Earth's magnetic field and the functions of the nervous system and the epineural DC control system [Becker 1994; Marino 1988] (modified according to Becker 1994)

Warnke [2009] also considers the diverse interactions between geomagnetic fields and electromagnetic radiation as a cause for functional impairments and adverse effects in living organisms. He provides evidence that nitrosative and oxidative stress initiated under these conditions leads to regulatory disorders. With Warnke's experimentally validated model of 2009, the diverse responses of different people to electromagnetic field exposures can be explained, as has been discussed above.

However, it also raises additional questions: Why does one person become ill from exposure to electromagnetic radiation and why not the other? Furthermore, where does health end and illness begin? Such terms as adverse health effect, biological effect or biological response often become mixed up and are not always clearly distinguished from each other, which can also lead to confusion among experts. However, we must clearly distinguish between effects that are "biologically active" and those "harmful to health." Therefore, some brief definitions will follow.

Natürliches Magnetfeld der Erde = Natural Earth's magnetic field | Blitz = Lightning | Sichtbares Licht der Sonne = Visible light of the sun | einst = In the past | Tausend = Thousand | Million = Million | Milliarde = Billion | Schwingungen/Sekunde = Cycles/second

Evolutionäre Adaptation des Menschen an die natürlichen Frequenzen des natürlichen Magnetfelds der Erde und an die Sonnenenergie (nach [Becker 1994]) = Evolutionary adaptation of humans to the natural frequencies of the natural Earth's magnetic field and solar energy

Jetzt = Now | Elektrische Energie = Electrical energy | Militärische ELF/VHF-Frequenzen = Military ELF/VHF frequencies | Leitstrahlsender = Beacon | AM = AM | Kurzwelle = Shortwave | FM (UKW) = FM | TV = TV | Mikrowelle = Microwave | Natürliches Magnetfeld der Erde = Natural Earth's magnetic field | Sichtbares Licht der Sonne = Visible light of the sun

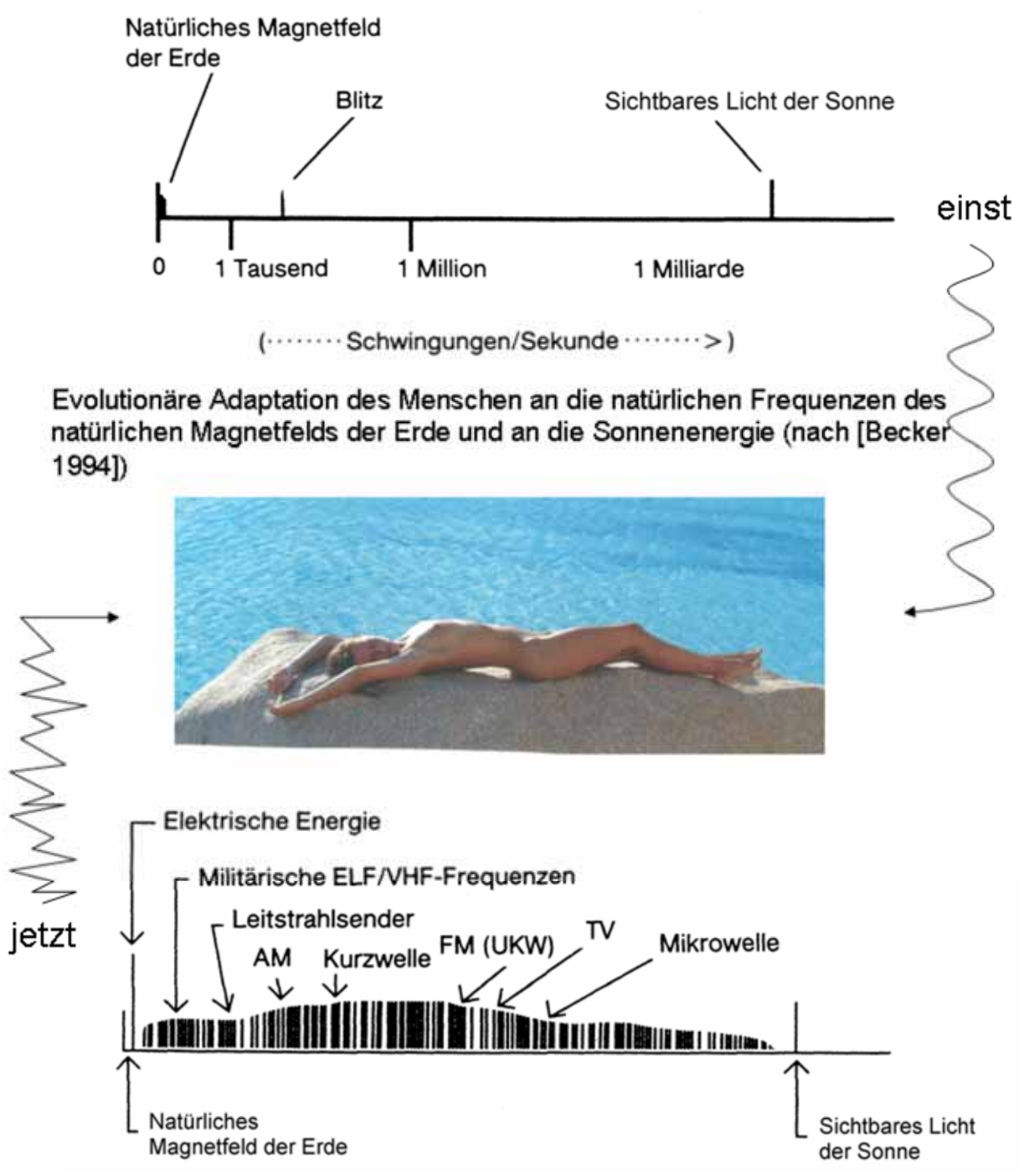


Figure 11: Simple comparison between a clean pre-electrosmog era (top) and our modern electromagnetic EMF and EF pollution (bottom) according to Becker [1994]. The EMF-EF effect is a silent stressor: at first, one feels well until after years of exposure, long-term effects will occur.

6. About the relationship of health and disease

6.1 Definition of terms: "biological effect" and "adverse health effect"

A bioactive or biological effect is usually a nonspecific response of the body to external stimuli of diverse origin (physical, chemical, social, bacterial, viral). In this context, we must distinguish

- whether this reaction is temporary and the homeostasis (normal state) will be reestablished through a reversible transient;
- whether the changed reaction will remain for some time (e.g. several days) after which everything will be "normalized" through a reversible transient;
- whether the reaction to the stimulus will remain for good, which is associated with symptoms as well as restrictions in performance and to the quality of life and not reversible anymore.

In the first case, a normal adaptive response in a given individual is observed. In the second case, a disturbance of the regulatory process occurs in which the external exposure is effective as a trigger, but the self-regulatory mechanism of the body can restore the normal state after some time. In the third case, the exposure is harmful to human health.

When something causes an adverse health effect, a permanent or temporarily irreversible change in the physio-psychosocial functioning of a given individual occurs. Harm can occur as a result of short-term or long-term exposure to a toxic agent, or also as a response to an intense, short-term exposure (e.g. shock) [Pischinger 1990; 1975; Weiner 1990; Perger 1988, 19981, 1979; Rimpler 1987; Trepel 1968; Schober 1953, 1951/52].

6.2 When does health end and when does illness begin?

Already in December 1868, Rudolf Virchow contemplated this question in his presentation “About the Current Status of Pathology" at the naturalist meeting in Innsbruck. Here he not only speaks as a pathological anatomist, as he is generally seen, but also as a pathophysiologist. On this issue, he states:

This known and amazing accommodation capacity of the body at the same time is a measure of where the border of illness lies. Illness begins in the moment in which the regulatory facility of the body is not sufficient to remove the disturbance. Not life under abnormal conditions, not the disturbance as such causes illness, but illness begins with the insufficiency of the regulatory system. When this system is not sufficient anymore to restore the natural state within a short time, then a person is ill. This is why, under the same conditions, one person can cope by means of a strong regulatory system, maybe experiencing only a few unpleasant situations, and another person will experience unease for a longer time, possibly taking hours or days until he has adapted to the new situation. A third person will become ill rather quickly and in a fourth person, it may take several days, maybe even weeks, until the illness eventually will break out.

These apparently large differences—which quite often have been used to show how unreliable it is to acknowledge known causes of disease as sufficient reasons—can all be explained when we contemplate the various energies of the regulatory facilities, when we consider each individual in his capacity as an individual because he is an individual who has special features, that is, special features of his body, his constitution that he does not share with his gender, nor with his entire race, nor with his entire people, not even with his entire family, but which are characteristic of him alone.

Consequently, there is no linear chain of response from pathogen to illness—as has been suggested by the bacteriologists Robert Koch (1843-1910) and Louis Pasteur

(1822-1895) and many other medical professionals and natural scientists to date — but numerous regulatory circuits whose functions become impaired and from which pathological processes develop.

At least two complex factors interact: the pathogenic agent (pathogen, stimulus) and the health status of the individual with its diverse environmental interactions. It must be assumed that each stimulus or agent initiates diverse psychophysiological regulatory responses. At the conference of the Academy of Military Medicine at St. Petersburg in 1885, the Nobel laureate Pavlov put it this way: "The remarkable stimuli, which make themselves known in the form of pathogenic causes are at the same time also the stimuli that prompt the protective mechanisms of the body to take up the fight with the relevant pathogenic agents."

Based on the above, the terms "resistance" and "resilience" emerged. *Resistance* is understood as the nonspecific protective mechanism of the body against infections, toxins, and other harmful substances. *Resilience* is the ability to muster physical and mental resistance, develop power and strength in the face of life crises, conflicts, high demands, poor living conditions (e.g. poverty), great misfortunes, separations, extreme exposures, and others, without suffering from longer-term impairments of health and personality structure [Seligman 1999; Flach 1997; Wright 1997].

Individuals who have good resistance and resilience are therefore more resilient against electromagnetic fields than those with a poor capacity for resistance and resilience. These facts should be considered in relevant studies. Since study subjects are often young and healthy males, it can be assumed that they enjoy great resistance and resilience and, as a result, no serious regulatory disorders due to exogenous influences, e.g. electromagnetic fields, will show. As was demonstrated above in the discussion about the Russian studies, pathological effects in study subjects are only to be expected after ten or more years of daily exposure. Consequently, short-term studies of healthy males are completely unsuitable to provide evidence of adverse effects.

6.3 Researchers must understand the interaction between sanogenesis and pathogenesis

Weiner [1990], Hecht and Baumann [1974], Pavlov [1885], and Virchow [1868] do not see the line between health and disease as an abrupt change, but rather as a flowing transition with many gray areas. Ibn Sina, who is known under the name Avicenna (980-1037), also saw it this way. He classified six stages between the states of health and disease.

At minimum, we can distinguish between a state of health, a premorbid stage, an early disease stage, and disease itself [Hecht and Baumann 1974]. Following the model of Avicenna and based on objective measurements of chronobiological regulatory diagnostics [review: Hecht 2001; Hecht et al. 2001], we classify six different stages [Hecht 2001; Anske 2003]: very healthy, healthy, still healthy (premorbid stage), not healthy anymore (early disease stage), ill, and very ill.

In the context of detecting adverse health effects early, the interactions between sanogenesis and pathogenesis, which are shown as a model in Figure 12, are especially important.

Sanogenesis is the entire process of optimal self-regulation within the body (sanos = health). The term sanogenesis has been coined by Pavlenko [1973] for the first time. Hecht and Baumann [1974] described sanogenesis as a complex self-regulatory process that stimulates functions of adaptation, protection, and self-healing. Sanogenesis must be seen as a holistic process in which primarily the nervous, hormone, immune, and metabolic systems, the regulation of the extracellular matrix, as well as the healing and growth systems are included in the self-regulatory process.

Primäre Prävention = Primary prevention | Sekundäre Prävention = Secondary prevention |

Pathogenese = Pathogenesis | Sanogenese = Sanogenesis |

Hyperreaktivität = Hyperresponsiveness | Hyporeaktivität = Hyporesponsiveness | irreversible = Irreversible | Krankheit = Disease | reversible = Reversible | Frühstadium der Krankheit = Early stage of disease | Vorfeld der Krankheit = Preliminary stage of disease | Gesundheit = Health | Leistungsbreite = Range of performance |

sehr krank = Very ill | krank = Ill | nicht mehr gesund = Not healthy anymore | noch gesund = Still healthy | gesund = Healthy

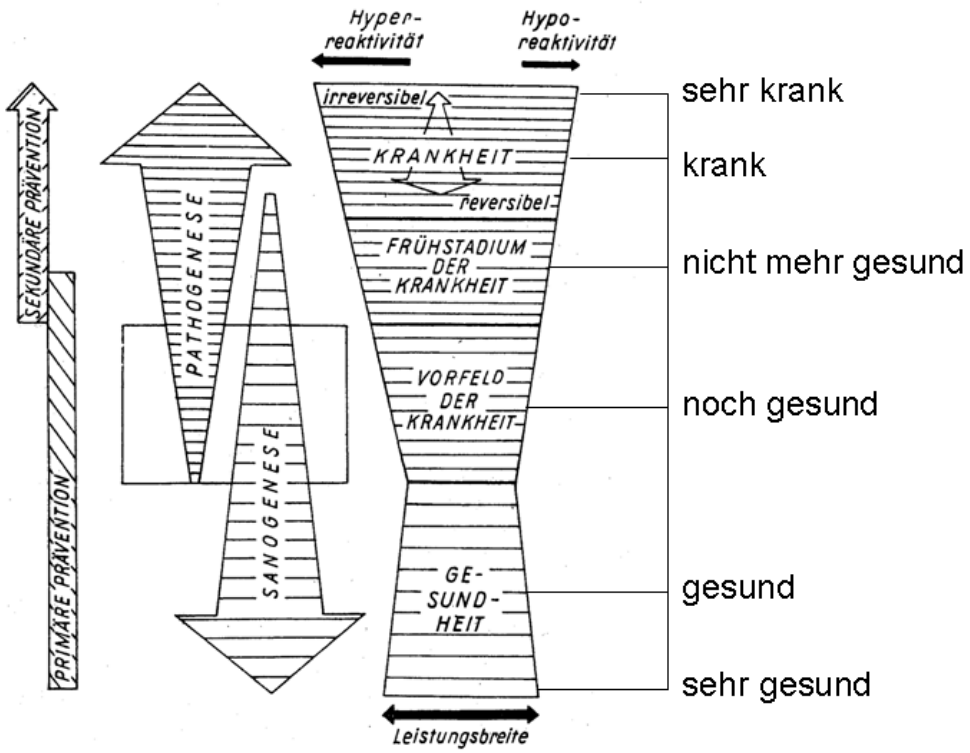


Figure 12: Model of the relationship between health and disease [according to Hecht 1984]

7. Ignorance and inhumanity in dealing with persons with electromagnetic hypersensitivity and disabilities

7.1 Electromagnetic hypersensitivity and microwave syndrome

Regarding health impairments due to EMF, experts distinguish between two but still related types of response:

1. Electromagnetic hypersensitivity,
2. Microwave syndrome.

Those belonging to the first group, who have been previously injured, for example, due to cumulative exposures, may show severe reactions after only a few exposures to EMFs. Those belonging to the second group develop microwave (radio wave) symptoms only after a latency period of several years, as has been discussed in detail above. Those belonging to the first group usually show symptoms of both reaction types: highly electrosensitive and microwave (radio wave) symptoms.

Over the past 15 years, more than a 1000 people with electromagnetic hypersensitivity and microwave illness sought my help as a physician; among them were many members of the armed forces of both German states, i.e. the Federal Armed Forces and the National People's Army of the former GDR, who had worked with radar. Physicians who know of the mentioned pathological manifestations made similar reports. However, the majority of physicians, courts, telecommunication service providers, health insurances, and other insurance companies usually do not listen to the concerns of electrosensitive persons. Frequently, they are ridiculed and, more often than not, they are shipped off to psychiatry. Below are two examples to illustrate this point.

7.2 The case of Mary M.

The EMF expert Robert O. Becker [Becker 1990, p. 250-251] from the United States provides the following typical case history of someone suffering from the hypersensitivity syndrome:

Mary M. (not her real name) had worked for an international company for many years as a computer supervisor. She enjoyed her work and had had no medical problems of note until she was asked to try out a different make of computer that the company was considering using. The machine seemed perfect—it was easy to use as well as fast and powerful, and she enjoyed working with it the first day. She went home that night with a minor headache, which subsided with an aspirin. Returning to work the next day, she used the new machine for less than an hour, and the headache returned. She took another aspirin and wondered whether she was "coming down with something." As she continued to work with the new computer, she became nauseated and dizzy, and the headache did not go away.

Mary then went to the dispensary, where she was told that she had a slight fever and was no doubt "coming down with the flu." She took two days off, and she felt fine when she returned to work. But within minutes of turning on the computer, she experienced the return of the nausea, dizziness, and headache. A short time later, she began to experience severe fatigue, an inability to concentrate, and difficulty with her vision. As she continued to work, the symptoms became worse, until finally she could not continue. She began to think that perhaps something was wrong with the machine, and she mentioned this to the dispensary staff before going home again. When she reached her home, she noted that her face and the exposed portions of her neck and chest were noticeably reddened. This time she took a full week of sick leave; on returning to work she went straight to the dispensary so that the doctor could see that she was quite well before she used the new machine. She was told that in her absence the manufacturer had checked her machine and found that it was operating normally and not producing a harmful field.

As she opened the door to her area, she felt as though she "had walked into a blast furnace." The whole room had been equipped with the machines, and her staff was busily working with them. She stayed for only a few minutes, during which time she became extremely ill and had to leave. This time the doctor asked if she were having any emotional or personal problems of any kind, and he suggested that if so, she see a professional about them. Mary refused to return to work, and she left for home.

She then noticed that her TV and stereo produced the same symptoms in her if she was within a few feet of them. Over the next few weeks, her condition gradually worsened, until even using the telephone made her ill. She also developed what appeared to her to be "allergies" to sunlight and to the smells of such things as laundry bleach and perfumes, all of which made her feel nauseous and dizzy. The skin rash reappeared, and Mary consulted a dermatologist, who told her that the electromagnetic radiation from the computer was the culprit and that he had seen similar cases. He recommended that she go away for a few weeks to some very rural area and see whether she recovered. His other patients had sometimes been able to return to work after such a respite from electromagnetic fields.

Mary took his advice, and she did get better. However, when she returned to the city, her symptoms returned. She never returned to her old job, and she now lives in a very rural area of a foreign country, where she is fine. One final note on this case is that the computers are no longer in use by the company, which refuses to discuss the situation.

This happened about 30 years ago.

7.3 The case of Vera F.

A typical case in my medical practice Vera F. (not her real name to protect her privacy) presented with the same symptoms as Mary M. as described above. She asked for my help and an expert opinion for court proceedings with which she fought for the recognition of her occupational disability (2009/2010).

The then 54-year-old patient described her current illness as follows:

I have worked—as a healthy person without any complaints—at the same company in L. for almost 24 years until February 2001. Only after moving to a new building, which was located right across several cell phone base stations (and the company had been newly equipped with DECT cordless phones), I developed symptoms (pain) after a few months. The pain grew worse and worse, and I felt as if someone would suck the energy right out of my body. Initially, this only happened in this particular environment; when I was in nature, I had strength and energy. I had no idea where my symptoms were coming from; my general practitioner did also not find any cause. I still enjoyed my work and the building was more beautiful and new; there was also no reason for mental stress.

She described her symptoms as follows:

A strong burning sensation in the head, neck and along the spine, on the chest, back, and severe pain in the left side of my teeth—though all teeth are okay, meanwhile a tingling sensation on the legs, severe headaches and concentration difficulties, and such symptoms as heart arrhythmia and lethargy. I feel as if I had lead in my bones. Sometimes I also have difficulties breathing and coughing spells. However, initially I had all these symptoms only in the vicinity of wireless transmitters or cordless phones.

Since she had read newspaper articles that described similar symptoms in persons with electrosensitivity, she saw various doctors who confirmed her electrosensitivity but otherwise could not help. Vera F. also came to see me to undergo a medical examination. I ran several tests with various diagnostic methods.

On the day of the first examination at my office on 2 July 2008, she reported tachycardia and heart arrhythmias (skipped heart beats). The latter were confirmed during blood pressure measurements.

She described burning pain, which occurred especially in her left side. At that time, the symptoms did not seem to be as bad as usual.[2] She continued reporting that she could not sleep well over the last days and that she felt very fatigued.

Additional functional impairments: sleep disorders, concentration impairments, difficulties finding words, simultaneously speaking very hastily, slight tremor of fingers. Impaired during ironing, vertigo, and a feeling of empty head.

During conversations, attack-like "heavy breathing." Rapid mental fatigue during conversations so that breaks had to be taken. During the interview, the patient reported to be depressive from time to time and to suffer from occasional tinnitus.

The assessment revealed pronounced muscle tension in the neck-shoulder region, which caused painful sensations during palpations, as well as blockage of the cervical spine, thoracic spine, and lumbar spine.

These symptoms fit known diseases such as neurasthenia, psychosomatic disorders, chronic fatigue syndrome, and fibromyalgia. Neurasthenia includes constant, painful complaints about increased fatigability or physical weakness and exhaustion, muscle weakness and tension. During additional tests with high EMF exposure, the symptoms became even more severe.

Before Vera F. came to see me, four experts had described the same symptoms and they did so independently of each other. Yet they did not make the connection with electromagnetic hypersensitivity or microwave illness; they also did not draw any conclusions regarding occupational disability. They even questioned that the occupational disability could have been caused by EMF exposure. Cumulative effects with repeated EMF exposures were completely unknown.

7.4 How physicians and judges contribute to the helplessness of those affected

Subsequently, I subjected her to special tests, e.g. measurements of outpatient bioelectric sleep tests, cardiovascular parameters and electrical skin activity, and under different types of EMF exposure. Even though I could attest to Vera F.'s severely restricted ability to work based on her test results, the court rejected my expert opinion because the tests did not meet standard procedures. As a result, the Social Court Stuttgart rejected Vera F.'s application for occupational disability. The court admitted the claim of the defendant's pension insurance.

The pension insurance sent me a paper by Dr. med. Wolfgang Hausotter, Medical Specialist of Neurology and Psychiatry, Social Medicine, Rehabilitation, Environmental Medicine, Special Pain Therapy from 87527 Sonthofen, with the title *Anmerkungen zur Begutachtung der ‚modernen' Leiden aus neurologisch- psychiatrischer Sicht [Comments on the Evaluation of 'Modern' Afflictions from a Neurological-psychiatric Perspective]*, Zeitschrift Arbeitsmedizin, Sozialmedizin, Umweltmedizin 41/5, 2006, p. 258-263. In this package, the

[2] She lived in a Berlin area where ambient EMF exposure levels were not elevated at that time.

insurance company also recommended that I read the enclosed paper on what a standard medical expert report should look like. Regarding "electrosensitivity," it stated:

Electrosensitivity

For many years, the impact of electromagnetic waves and fields on humans has been discussed under the catchphrase of "electrosmog," whereby, once again, a broad range of subjective symptoms is cited. Even though concerned citizen groups and self-appointed "experts," mostly naturopaths, have blamed high-voltage transmission lines, wireless antennas, and especially the cell phone base stations on the neighbor's roof and not so much the own cell phone, no validated evidence of an objectifiable risk could be provided to date. [Berg et al. 2003; Berz 2003]

This evaluation of a medical doctor, far removed from the known knowledge of the past 70 years, is a mockery to those suffering severely from microwave exposure and electrosensitivity, and it reveals an arrogant disregard for the validated evidence as described above. In this country, which is regarded as a "state of law," court decisions are based on those types of recommendations. Furthermore, the inhumane rejection of Vera F. before the Social Court Stuttgart is not an isolated case.

While Mary M., as described by Robert Becker, could still escape to a low-EMF environment 30 years ago, today this is not anymore an option for Vera F. due to the global electromagnetic pollution. She continues to suffer—as do many other people in our country in a similar situation.

7.5 Helplessness syndrome—The second toxic agent for persons with electromagnetic hypersensitivity

Patients as described by Dr. Becker and Dr. Rae, radar victims (whom we will come back to further below), and many other persons who severely suffer from EMF exposure are put in a state of helplessness as a result of inhumane treatment by medical health care professionals, courts, and insurance companies. Consequently, they have to deal with a second toxic agent, a second disease-promoting factor, which Martin E. P. Seligman had already pointed out 35 years ago [Seligman 1975; German translation 1992].

Helplessness refers to the state in which a person is unable to act deliberately, but is completely exposed and defenseless against a situation, which he or she cannot change and is beyond his or her control. In the long term, various symptoms develop including depression, psychosomatic disorders, distress, and eventually oncological disorders, and in extreme cases, even death.

From a psychoneuroimmunological perspective, Schubert and Schüssler [2003] are of the opinion that, for example, subjective feelings are conditioned by helplessness and hopelessness, which not only promote the formation of tumor cells and tumor progression, but may secondarily also initiate and promote tumor growth through the neuronal effects of transmitter substances peripherally released [Schmale and Iker 1966, 1971; Dantzer and Kelley 1989; Murr et al. 2000].

Halberstadt et al. [1984] as well as Bovi and Reinhard [1988] describe associations between helplessness, hopelessness, and depression. Schwarzer and Walschburger [1985] report relationships between helplessness, stress, and anxiety.

A person with electromagnetic hypersensitivity who suffers severely and is not heard is in the sense of Seligman's findings [1992] exposed to severe stress. Physicians or judges who do not acknowledge the suffering of persons with electromagnetic hypersensitivity commit an act of negligence and cause harm to the patient's health and life. They contribute to the formation of a vicious cycle for the electrosensitive patient who will be dragged even deeper into the abyss of disease: EMF effect → helplessness → EMF effect → helplessness and so on.

Helplessness, i.e. a lack of hope ever to be able to escape a situation one is defenselessly against and any associated despair, will lead to the formation of the "helplessness syndrome." Especially in psychoneuroendocrinology, this type of health implication has been described repeatedly: "helplessness hormones" are formed; the immune system is negatively affected in many ways [Schubert and Schüssler 2003, Birbaumer and Schmidt 1996; Dantzer and Kelley 1989; Murr et al. 2000; Schavit and Martin 1987]. In noise research, similar observations have been made.[3]

According to Seligman [1975] as well as Birbaumer and Schmidt [1996], the helplessness syndrome is one of the most powerful stressors (stimuli) of the functional axis: limbic-hypothalamic-pituitary-adrenal.

In seniors, who were characterized as helpless, psychosomatic disorders, memory and immune impairments have been observed that were caused by the "helplessness syndrome."

At the center of the helplessness hormones, there are endorphins, so-called opioid peptides that bind to opioid receptors, thereby initiating or accelerating the conditioning process [Ader and Cohen 1985]. Due to the excessive release of growth hormones, ACTH, beta endorphins, prolactin, coricosteroids, catecholamines, and enkephalin, these substances can have a negative impact on the immune system and even promote tumor formation [Shavit et al. 1985].

Birbaumer and Schmidt [1996] distinguish between opioid stress and nonopioid stress. The latter occurs during short-term stress exposure. The former is the result of permanent or long-term stress exposure. While nonopioid stress delays or prevents tumor and metastases formation in experiments, opioid stress accelerates these processes and inhibits the activity of natural killer cells (NK) and cytotoxic lymphocytes. Opiate compounds (exogenous and endogenous) seem to play a special role in conditioning processes, whereby the disease becomes even more established.

[3] This type of negative emotional reactions due to helplessness have also been observed in situations with noise exposure. These negative emotions surface especially when sleep at night is disturbed by noise and the affected persons are unable to do anything about it.

7.6 Treatment of persons with electromagnetic hypersensitivity — One exception and the rule

According to a report by Robert Becker [1994], health care professionals may also develop the electromagnetic hypersensitivity syndrome because of technical equipment in operating rooms. Dr. William Rae, a U.S. surgeon, had to make this experience for himself at the beginning of the 1980s. As a result, he quit his work as a surgeon and established a health clinic that does research on the electromagnetic hypersensitivity syndrome and treats those affected by it. His Environmental Health Center in Dallas, Texas, is considered the best-equipped health clinic of its kind in the United States. Patients are tested for their responses to various electromagnetic fields, without being aware of it. In some patients, it is possible to determine a permanent intolerance to certain frequencies, which can be quantified through objective measurements of autonomic nervous system activity levels. In this manner, Rae was able to prove that the electromagnetic hypersensitivity syndrome is a real clinical disorder.

However, this kind of treatment for persons affected by electromagnetic hypersensitivity is the rare exception, not the rule. Dr. Rae expressed his indignation about the fact that patients with the electromagnetic hypersensitivity syndrome usually are told by their health care provider that their symptoms are only imagined and that they should go and see a psychiatrist [Becker 1990, 1994].

An increasing number of affected persons can confirm that this is not any different in Germany—apart from the question as to which EMF exposure levels are common in German operating rooms and intensive care units. To disregard persons with the electromagnetic hypersensitivity syndrome as a group of imaginary and/or mentally ill persons is also rather the rule in Germany. Admitting such persons to psychiatric clinics is given preference over possible healing through the preservation of our natural living environment. With the support of willing scientific advisors, those in political power relieve their conscience with the dogma that electrosensitive persons do not exist. What is not said out loud, however, is that they should and must not exist because their recognition would interfere with commercial interests.

8. Long-term radiation effects at radar station workplaces of the German Federal Armed Forces and the former National People's Army of the GDR

What happened to the soldiers of radar stations of the German Federal Armed Forces and the National People's Army (NVA) of the GDR was and still is outrageous. I have access to quite a large number of files about both armies because numerous relatives of affected soldiers sought my help and asked for my expert opinion for court proceedings, which I delivered. Retrospectively, this radar exposure could be called a "long-term experiment on unaware subjects." Within the framework of this brochure, I would like to share only a brief report to make the public aware of what consequences such long-term effects of radar radiation have and to what degree the human dignity of those affected has been violated.

During the medical treatment of "radar victims," I was also in communication with the "Bund zur Unterstützung der Radargeschädigten der Bundeswehr Deutschland e.V." [Association for the Support of Radar Victims of the Federal Armed Forces Germany] as well as with the counterpart association of the National People's Army "RADAR-NVA."

To be clear, these soldiers (some of them highly qualified civilians) were exposed to three different types of radiation at radar stations:

- X-ray radiation
- Radio-frequency radiation (radar waves)
- Radium 226-based luminescent paint, which had to be repainted from time to time

The majority of these radar victims had been exposed to X-ray and/or radar radiation for different periods. As an example of overexposure to all three types of radiation, I would like to introduce T. M. (initials were changed):

ca. 2 years 1650 hours/year
ca. 3 years 420 hours/year
ca. 15 years 260 hours/year

The above data apply directly to the workplace of the radar equipment. Frequently, living rooms and bedrooms were located not far from the workplace.

As a reply to my questions, none of the radar victims could remember ever having the risks explained to them or having received health and safety instructions.

As can be read in the test report of the “Fernmeldetechnische Zentralamt Darmstadt" from August 1958 about the Konrad Kaufbeuren radar station, those working at radar equipment had been repeatedly overexposed to ionizing radiation. In the expert report of the physicist Dipl.-Phys. Günter Gold from the Institute of Radiation Therapy at the Charité Berlin, among other things, we can read the following about the handling of radium 226-based luminescent paints at this radar station: "The handling of radioactive luminescent paint at the Federal Armed Forces must be classified as contrary to regulations. It posed a serious hazard to the members of the armed forces and possibly also to the civilian population."

Regarding long-term radiation overexposure, the Federal Ministry of Defense asserted that the Konrad radar post was an exception. The information shared by radar victims during the interviews of their medical history conveys a similar picture of radar exposure at other radar posts of the two armies.

We will probably never know how many radar victims there are because some have already died before applying and others have been unable to file an application. According to the information available to me, there still seemed to be almost 1500 applications outstanding in 2010, waiting to have their disability recognized based on military service injuries. The number of those already deceased cannot be determined either. According to my knowledge, the majority of radar victims, at least until 2010, had the recognition of their disability declined, even with a documented diagnosis of skin cancer or other types of cancer. In most cases, the recognition was declined through court proceedings. After that, radar victims felt ridiculed, deceived, and helpless.

In their rejections, the courts usually made reference to the expert commission's report on the *Gefährdung durch Strahlung in früheren Radareinrichtungen der Bundeswehr und der NVA [Health Risks due to Radiation Exposure from Former Radar Facilities of the Federal Armed Forces and the National People's Army]* (Radar Commission), Berlin, 2 June 2003. From my perspective and according to the scientific evidence available to me, this radar report shows many gaps. The report does not provide a useful tool for a court decision, as is also indicated in the report itself. Some passages from the executive summary of the report support this:

Exposure to high-frequency radiation

With regard to the possibility to reach or exceed a performance flux density that is sufficient for inducing a cataract (clouding of the lens) in case of chronic exposure, a categorisation according to time of use, place of use and weapon system can be made.

Accordingly, times of use prior to or, respectively, after protection regulations came into force have to be differentiated. For the Federal Armed Forces, the first protection regulation came into force in 1958. The earliest regulation of the NVA known to the Commission dates from 1976.

The places of use can be subdivided into two categories: Categories where the risk of an overexposure can be classified as high and categories where it can be classified as low.

The first category comprises workplaces at a short distance of [continuous wave] radar or [powerful surveillance] radar and workplaces in closed rooms where the possibility of reflections of radiation at building structures cannot be excluded. This includes in particular repair halls. The second category includes places of use at radar units that were located at stationary places at a distance of radar transmitters with which critical performance flux densities can be excluded or exposure was only possible through surveillance radar elements with which duration of exposure remained low when reaching critical performance flux densities.

The insufficient basis for the evaluation of occupational health risks at radar units is described as follows:

To evaluate symptoms, the Federal Ministry of Defense put anonymized data at the Commission's disposal. These neither enabled an exact description of the frequency of the single diseases nor a statement on statistical accumulations of single diseases within the exposed group. The registration of the diseased is incomplete and the extent and age distribution of the population taken as a basis are not known.

The study "Investigations on the determination of the health risks of members of the Federal Armed Forces in the field of work of radar from 1956-1985" [study cost 1.4 million DM; author's note] ordered by the Federal Armed Forces, carried out as a mortality study, and presented in May 2003 is unsuitable for the evaluation of health risks of members of the Federal Armed Forces due to exposure to radar because of serious methodical deficiencies. Neither can it provide data on the frequency of diseases in the affected group.

The Commission therefore bases statements and recommendations on hazards to health exclusively on the state-of-the-art of scientific research documented in international specialist literature.

Instead of using the cases that were the subject of the legal disputes as a guide, the Commission retreated to general statements of the scientific literature. The Radar Commission came to the following recommendations:

The following three conditions for acknowledgement must be fulfilled:

1. *In principle, all malignant tumours—with the exception of chronic lymphogenous leukemia (CLL)—have to be considered qualifying diseases due to exposure to stray X-ray radiation, the cataracts due to exposure to HF radiation and/or ionising radiation. In case of incorporation of radium containing fluorescent paint primarily cancer of the bones (sarcoma of bones and surrounding connective tissue) has to be considered a specific qualifying disease.*
2. *Prerequisite are diagnoses confirmed by a physician with pathological-histological results.*
3. *The occurrence of a solid tumour must be at least 5 years after the beginning of radiation exposure, in case of leukemia and bone sarcoma at least 2 years must have passed between radiation exposure and their occurrence.*

In the report of the Radar Commission, there is another long list of symptoms that is not acknowledged. This list also includes those symptoms that I found in my review of the Russian scientific literature as well as those that were contraindicated for work at radar equipment in the NVA, as documented in a telefax from the Medical Services of the Ministry of National Defense to the military doctors of the NVA from 17 October 1980. Let me quote a few passages from this document:

Subject: Microwave outpatient unit

As part of the revolution in the military, microwave units for very diverse tasks have been equipped with increasingly more powerful microwave generators, and their number has been steadily increasing.

Fundamental difficulties in the assessment of microwave effects on the health status of radar personnel have to do with the complex exposure of several harmful factors such as noise, unfavorable composition of air, radioactive radiation, high temperatures, poor lighting conditions, social factors, and microwave radiation for which only approximate exposure level data are available.

For the deployment of radar personnel, the following contraindications according to Voigt should be considered: [...]

Degenerative changes of the cornea, changes of the retina, clouding of the lens, hypermetropia of higher grades, astigmatism, vegetative dystonia, organ-related and functional permanent damage to the brain, active tuberculosis, chronic rheumatism, constantly changing blood-forming system, frequent headaches, great tiredness, sleeplessness, lack of appetite, visual tiredness, clouding of the lens, disinclination to work, pressure pain in heart area, bradycardia, arrhythmia, lymphopenia, eosinophilia, monocytosis, unstable blood pressure, memory decline, tremors and impaired reflexes, hyperactivity of thyroid, erectile dysfunction.

This document was, in particular, the result of efforts made by Major Dr. med. C. Voigt from the military medical services. Voigt extensively studied the effect of radio-frequency radiation in humans and published scientific papers on this topic, one of which dealt with questions of the evaluation of relevant risks: *Problems with an expert opinion at the National People's Army based on a military service disability in a member of the radio personnel* [Zeitschrift für Militärmedizin, 1/1968, p. 17-18].

Unfortunately, this important work by Voigt has not been considered by the Radar Commission in which none of the scientists or physicians came from one of the new federal states of the former GDR. Radar victims and widows of deceased radar victims went several times to Berlin and demonstrated for their rights, for example, in front of the Reichstag building and Brandenburg Gate (see below), which I would like to document with the following images:

The chapter in this brochure only covers a small part of the issues this group of affected persons has to cope with. Since I feel obligated to those suffering and seeking help as radar victims, I intended to address their humiliating treatment in this brochure.[4]

At the same time, I intend to demonstrate clearly the implications of long-term effects of electrosmog and other sources of wireless radiation when I present the case of radar victims here. Since humans are unable to detect this type of radiation that can affect their health and the exposure limits do not provide protection, I would like to make every citizen of our country aware of this insidious and disease-causing danger.

[4] During the printing of the first edition of this brochure in 2012, we received news from the German state broadcaster ARD Capital Studio that the German government and parliament are planning to establish a foundation for radar victims. Even if the plan would actually be put into effect: The funds discussed to date, the reference to special cases of hardship, while maintaining a long and bureaucratic application procedure do not seem to be an adequate replacement for an appropriate legal compensation regulation.

Radar victims and widows of deceased radar victims demonstrate for their rights and against the violation of their human dignity in a state of law. [Hecht Archives]

9. An appeal to those in political power: Health — A basic human right

On 10 December 1948, the General Assembly of the United Nations issued the Universal Declaration of Human Rights. In Article 25 of this Human Rights Charta, the right of health is defined as a basic human right. It says in this Charta: "Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services." The regulations and policies regarding wireless telecommunication technologies in their current form are against this right to health, as has been revealed by the facts and shown in this brochure. They do so by maintaining exposure limits that represent a pseudoscientific anachronism compared to the evidence currently available in life sciences and thereby put the public at risk. And they do so, in particular, where they deprive persons with electromagnetic hypersensitivity and the microwave syndrome but also the groups of radar victims of the Federal Armed Forces and NVA of this right to health.

In my own name, but also in the name of all scientists and health care professionals who have joined forces in the Competence Initiative for the Protection of Humanity, the Environment and Democracy e.V., I hereby appeal to those in political power:

- Support independent research that protects public health and is not subject to commercial interests.
- Establish exposure limits that are scientifically up to date and politically responsible for a sustainable future.
- Promote a telecommunications policy that respects the human right to health.

With this appeal, we especially call on all members of the German parliament as well as the representatives of the German federal government, with Chancellor Dr. Angela Merkel and her ministers leading the way. Furthermore, we refer to the wording of the official oath that leading politicians must swear upon taking office: "I swear that I will dedicate my efforts to the well-being of the German people, promote their welfare, protect them from harm, uphold and defend the Basic Law and the laws of the Federation, perform my duties conscientiously, and do justice to all."

Summary

Why claims of safety do not do justice to the currently available evidence

At the very latest since the findings of Dr. Erwin Schliephake in 1932, do we know that radio-frequency radiation of longer exposure duration can cause illness in humans, especially affecting the central nervous system and its control functions. And as early as 1971, observations of pathogenic effects of electromagnetic radiation have been included in the U.S. government report with the title *Program for Control of Electromagnetic Pollution of the Environment,* which urgently warns of the associated risks. The authors of the report are convinced that "in the decades ahead, man may enter an era of energy pollution of the environment comparable to the chemical pollution of today." They predict, "The consequences of undervaluing or misjudging the biological effects of *long-term* [author's emphasis], low-level exposure could become a critical problem for public health."

Even though research independent of industry has constantly produced new evidence that proves the above prediction right, the public is regularly told how safe wireless radiation is—and nowhere else have these messages become more frequent than in Germany over the last years. The authorities call on studies that investigate neither long-term EMF exposures nor biological effects of low-level exposure as has already been demanded by the authors of the above-discussed government report. The current exposure limits, which are supposed to protect the public, only consider possible thermal effects.

The information provided in this brochure makes clear that short-term studies cannot answer any questions regarding long-term health risks. The current exposure limits, which we mostly owe to the physicists' way of thinking, are a scientific anachronism. Furthermore, by using the concrete example of a research review, it has been shown how the authorities have ignored and continue to ignore that which is important for public health and a sustainable future, but would be contrary to economic interests.

What the findings of our long-term review tell us

In 1996, the author and his associate Balzer had been commissioned by the German Federal Agency of Telecommunications (today the Federal Network Agency) to carry out a review of the Russian scientific literature between 1960 and 1997 [Hecht, Balzer 1997]. Under the title *Biologische Wirkungen elektromagnetischer Felder im Frequenzbereich 0 bis 3 GHz auf den Menschen* [*Biological Effects of Electromagnetic Fields on Humans in the Frequency Range of 0 to 3 GHz]*, they submitted their review in 1997. Those who had commissioned the review, however, were eager to suppress the results of this 120-page research report.

The report revealed which central role the time factor plays for the biological effects of electromagnetic fields: In healthy persons, symptoms, especially those that affect the functions of the central nervous system (brain), will appear at the earliest after three to five years of EMF exposure (2–8 h/day). Only after five years of EMF exposure, and even more pronounced after ten years of EMF exposure, did the number and severity of the diseases increase.

Furthermore, these findings on long-term effects of electromagnetic fields have been obtained from a broad range of research. Out of more than 1500 Russian scientific papers, the authors selected 878 for the government-commissioned review. The selected papers were based on annual occupational health and industrial hygiene assessments legally required for those occupationally exposed to electromagnetic fields and most of these assessments had been carried out on thousands of workers over long periods. It was of particular interest to see that cases of illness clearly increased even though the Russian exposure limits of electromagnetic fields are three orders of magnitude lower than in Western Europe.

Beyond the great importance of exposure duration, it could be demonstrated that the effect of electromagnetic fields in humans is also dependent on other fac-

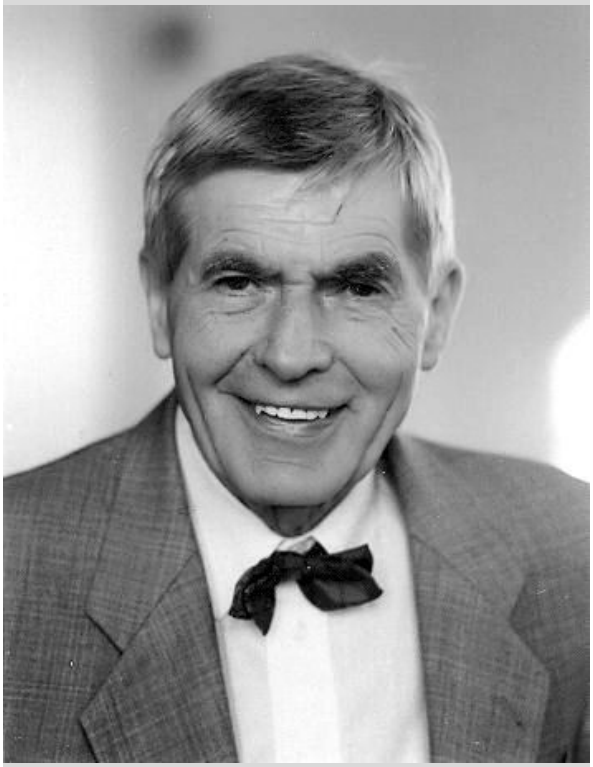
tors, especially the simultaneous exposure to other environmental factors as well as an individual's state of health and age.

How ignorance or denial of such findings impact those affected

As a scientist, physician, and expert witness, the author has been involved in numerous cases of persons with electromagnetic hypersensitivity as well as radar victims of the German Armed Forces and the National People's Army of the former GDR. He describes the helplessness official agencies and ignorant physicians cause in those affected by electromagnetic hypersensitivity, the microwave syndrome, and radar exposure. He shows how the continuous experience of helplessness turns into a great stressor itself that exacerbates the disease-causing long-term effects of electromagnetic field exposure.

He also criticizes the loss of democratic culture, which makes the implications of the telecommunications policy for the public even worse. The brochure concludes with an appeal that sees the human right to health violated on several levels. He calls on the government and the political parties of the Federal Republic of Germany to put suitable protective measures into place that protect our living environment from increasing levels of EMF and that guarantee the public's right to health.

About the author



Prof. Dr. med. habil. Karl Hecht, born in 1924, is a physician and retired Professor of Neuro-physiology of the Medical Faculty (Charité) at the Humboldt University in Berlin.

For the past 20 years, his major research areas have included: stress, sleep, chronomedicine, environmental medicine, space medicine, as well as health sciences and holistic naturopathy.

He is the author of 48 specialist and nonfiction books and has also published more than 800 scientific papers in national and international journals.

Endnotes and references

Endnotes of foreword of the editors

1) All brochures listed in this section are available both in print and online. For brochures, visit http://kompetenzinitiative.net/KIT/KIT/english-brochures/

2) For additional information, visit www.mobilfunkstudien.de , a website of the environmental and consumer protection organization Diagnose-Funk

3) U. Warnke: Bees, Birds and Mankind. Destroying Nature by "Electrosmog," 2009, p. 38-40.

4) See also p. 9 and 28 in this brochure.

5) See also the detailed statements of F. Adlkofer and K. Richter: Radiation Protection in Conflict with Science. A Documentation, 2011, especially Part II: Scientific Flaws in the German Telecommunication Research Programme.

6) Ibid. Part I: A Campaign to Destroy Scientific Findings.

7) In this sense, the Official Journal of the Diocese of Trier, Issue 155 (2011) No. 530, as well as supplementary written statements of the diocese, which are available to us.

8) Among others, see correspondence between Prof. A. Lerchl and Dr. med. J. Mutter (http://www.kompetenzinitiative.net/themen/ gesundheit/strahlenschutz-kommission/dr-mutter-antwort-auf-kritik-von-prof-lerchl.html); debate with the BUND, especially after its collaboration on the flyer *Mobilfunkstrahlung – ein besonderes Risiko für Kinder* (http://www.kompetenzinitiative.net/ publikationen/ pressemitteilungen/schutz-von-kindern-und-jugendlichen-vor-mf-risiken.html) in e-mails, which are available to us.

9) Late Lessons from Early Warnings: The Precautionary Principle 1896-2000; Translated by German Federal Environment Agency in 2004; Quote from the German Edition p. III.

10) Internet publication http://www.pandora - stiftung.eu/dokumentation/ein-ergebnis- institutioneller-korruption.html

Abramowitsch-Poljakow, D. K.; A. I. Kleiner; F. A. Kolodub; et al. (1974): [Clinical characteristics of effects of electromagnetic exposure during resistance welding.] Wratschabnoje delo 4, p. 106 (in Russian)

Ader, R.; N. Cohen (1985): CNS-immune system interactions. Conditioning phenomena. Behav. Brain. Sci. 8, p. 379-425

Adey, W. R.; S. M. Bawin (1977): Brain interactions with weak electric and magnetic fields. Neurosciences Res. Prog. Bull. 15/1, p. 1-129

Andrjukin, A. A. (1962): Über die Höhe des Blutdrucks und über das Vorkommen von Hypertonie bei Arbeitern in Lärmbetrieben. Gig. Trud. Prof. Zabol. 5, 21, ref. Zbl. Arbeitsmed. 12, p. 176

Anske, U. (2003): Chronopsychobiologische Pilotstudie zur objektiven Bestimmung funktioneller Gesundheitszustände. Dissertation, Med. Fak. Charité, Humboldt-Universität in Berlin

Baranski, S.; S. Edelwejn (1972): [The study of the effects of microwaves on the nervous system.] In: [Industrial Hygiene and Biological Effects of Electromagnetic Radiation.] Moscow. Gigiena truda i biologitscheskoe dejstwie elektromagnitnych woin radiotschastot, p. 31 (in Russian)

Becker, R. O. (1990): Cross currents. J. P. Tarcher Inc., New York. German Edition (1994): Heilkraft und Gefahren der Elektrizität. Scherz-Verlag, Bern, München, Wien

Berg, G.; J. Breckenkamp; M. Blettner (2003): Gesundheitliche Auswirkungen hochfrequenter Strahlenexposition. Dt. Ärztebl. 100, p. A2738-2740

Berger, H. (1929): Über das Elektroenzephalogramm des Menschen. Arch. Psychiatrie Nerv. 87, p. 527-570

Berz, R. (2003): Krank durch Mobilfunk? Hans Huber, Bern

Besdolnaja, I. S. (1987): [The biological effect and evaluation criteria of the functional state of the CNS of a person exposed to the electrical field at hygiene standard levels with a power frequency of 50 Hz.] Simposium Mechanismy biologitscheskogo dejstwija elektromagnitnych Istutschenij Tesisy dokladow, Puschtschino, p. 169 (in Russian)

Birbaumer, N.; R. R. Schmidt (1996): Biologische Psychologie. Springer Verlag, Berlin, Heidelberg

Bojenko, I. D. (1964): Physiologische Einwirkungseffekte von elektromagnetischen Schwingungen der Ton- und Radiofrequenzbereiche auf den Organismus. Veröffentlichungen der Woronesher Abteilung der Pawlow-UPG 7

Bojenko, I. D.; L. N. Budko (1964): Interrozeptive Reizung als Faktor, der das Verhältnis des Organismus zur Einwirkung der EMF-Energie (EMF - elektromagnetisches Feld) des Schall- und Radiofrequenzbereichs verändert. Einige Fragen von Physiologie und Biophysik. Veröffentlichungen der Woronesher Abteilung der Pawlow-WFO 78

Bojzow, W. W.; T. P. Osinzewa (1984): [Excitability index of the motion centers of persons with different occupational exposure durations.] In: [EMF exposure conditions of the electromagnetic field of industry frequency. Biological Mechanisms and Effect Phenomena of ELF and Static EMF on Living Systems.] TGU: Tomsk, p. 98 (in Russian)

Bovi, U.; H. G. Reinhard (1988): Erlernte Hilflosigkeit und Depression. Acta Paedopsychiatrica, 51, p. 90-97

Brodeur, P. (1977): The Zapping of America: Microwaves, Their Deadly Risk, and the Cover-Up. W. W. Norton & Co Inc.

BUWAL (2003): Nicht ionisierende Strahlung. Hochfrequente Strahlung und Gesundheit. Umweltmaterialien Nr. 162, Bundesamt für Umwelt, Wald und Landschaft (BUWAL), Bern

Chisambeew, Sch. R.; G. M. Kupzow (1982): Medizinische Untersuchung der psychischen Arbeitsfähigkeit eines Operators unter den Bedingungen der Einwirkung nieder-frequenter elektromagnetischer Felder. Kosmische Biologie und Weltraummedizin VII. Allunionskonferenz zur kosmischen Biologie und Weltraummedizin, Kaluga. Vol. 2, p. 24

Cornélissen, G.; F. Halberg (1994): Introduction to Chronobiology-Medtronic. Chronobiology Seminar #7, April, p. 52 ff (Library of Congress Catalog Card #94-060580, http:// revilla.mac.lie.uva.es/chrono).

Cornélissen, G.; F. Halberg ; L. Gheonjian; T. Paatashvili; P. Faraone; Y. Watanabe; K. Otsuka; R. B. Sothern; T. Breus; Baevsky; M. Engebretson; W. Schröder (2000): Schwabe's ca. 10.5- and Hale's ca. 21-year cycles in human pathology and physiology. In: W. Schröder (ed.): Long- and Short-Tern Variability in Sun's History and Global Change. Science Edition, Bremen, p. 79-88

Cornélissen, G.; F. Halberg; T. Breus; E. V. Syutkina; R. Baevski; A. Weydahl; Y. Watanabe; K. Otsuka; J. Siegelova; F. Fiber; E. E. Bakken (2002): Non-photic solar associations of heart rate variability and myocardial infarction. J. Atoms Solar-Terr. Phys. 64, p. 707-720

Coveney, P.; R. Highfield (1994): Anti-Chaos – Der Pfeil in der Zeit der Selbstorganisation des Lebens. Rowohlt, Reinbeck bei Hamburg

Cramer F. (2001): Interview: Wir haben in der Genforschung einen falschen Ansatz. Psychologie Heute 9/2000, p. 28-32

Dantzer, R.; K. W. Kelley (1989): Stress and immunity: an integrated view of relationships between the brain and the immune system. Life Sci. 44, p. 1995-2008

Drogitchina, E. A. (1960): [The clinical course of the chronic effect of SHF on humans.] Trudy Instituta gigieny truda i profsabolewanij AMN SSR, p. 23 (Reports of the Institute of Industrial Hygiene and Occupational Health of the Academy of Medical Sciences of the Soviet Union, Moscow) (in Russian)

Drogitchina, E. A.; M. N. Sadchikova (1962): [Some clinical manifestations of long-term effects of cm waves.] Gigiena truda i professionalaye sabolewanija 1, p. 28 (in Russian)

Drogitchina, E. A.; M. N. Sadchikova (1964): [Clinical symptoms due to the effect of different radio-frequency ranges.] O biologitscheskom wosdejstwii bio-logitscheskich polej radiotschastot 2, p. 105 (in Russian)

Drogitchina, E. A.; M. N. Sadchikova (1965): [Clinical symptoms due to the effect of different radiowave ranges.] Gigiena truda i professionalaye sabolewanija 1, p. 17 (in Russian)

Drogitchina, E. A.,N. M. Kontschalowskaja; K. W. Glotowa et al. (1966): [About vegetative and cardiovascular symptoms due to long-term effects of electromagnetic fields of super high frequency.] Gigiena truda i professionalaye sabolewanija 7, p. 13 (in Russian)

Drogitchina, E. A.; M. N. Sadchikova (1968): [Classification of clinical symptoms due to the chronic exposure to radio-frequency electromagnetic fields.] Gigiena truda i biologitscheskoe dejstwie elektromagnitnych woin radiotschastot 2, p. 42 (in Russian)

Eger, H.; K. U. Hagen; B. Lucas; P. Vogel; H. Voit (2004a): Einfluss der räumlichen Nähe von Mobilfunksendeanlagen auf die Krebsinzidenz. Umwelt-Medizin-Gesellschaft 17/4, 326-332 Naila study, www.naila.de

Ermakow, E. W. (1969): [Mechanism of the development of asthenic-vegetative disorders due to chronic exposure to an SHF field.] Wojenno-medizinskij shurnal. 3, p. 42 (in Russian)

Ermakow, E. W.; B. F. Muraschwo (1970): [Pathogenesis of neuroendocrine disorders due to long-term exposure of electromagnetic fields in the SHF range.] Sowetskaja medizina 9, p. 136 (in Russian)

Flach, J. (1997): Resilience. Hather Leight Press, New York

Freude, G.; P. Ullperger; S. Eggert; I. Ruppe (2000): Microwaves emitted by cellular telephones affect human slow brain potentials. Eur. J. App. Physiol. 81, p. 18-27

Frey, A. H. (1961): Auditory systems response to radio frequency energy. Aerospace Medicine, Vol. 32, No. 12, p. 1140-42

Frey, A. H. (1962): Human auditory system response to modulated electromagnetic energy. Journal of Applied Physiology. Vol. 17, No. 4, p. 689-92

Frey, A. H. (1963a): Some effects on human subjects of ultra high frequency radiation. Am. J. Med. Electronics 2, p. 28

Frey, A. H. (1963b): Human response to very low frequency electromagnetic energy. Naval. Res. Rev. 16, p. 1

Frey, A. H. (1965): Behavioural biophysics. Psychol. Bull. 63, p. 322

Garkawi, L. Ch.; E. B. Kwakina; E. P. Korobejnikow et al. (1984): [Changes in the adaptation response of the organism and its resilience under the influence of electromagnetic fields.] Elektromagnitnye polja w biosfere T2, Biologitscheskoe dejstwie elektromagnitnych polej, p. 46 (in Russian)

Ginsburg, D. A.; M. N. Sadchikova (1964): [Changes of the electroencephalogram under long-term exposure to radio waves. About the influence of electromagnetic radiation.] Moscow 1972 O biologitscheskom dejst- wii elektromagnitnych polej radiotschasiot, p. 126 (in Russian)

Gordon, Z. V. (1966): [Problems of industrial hygiene and biological effects of super high frequency electromagnetic fields.] Medizina, Moscow (in Russian)

Gordon, Z. V. (1970): Occupational health aspects of radio-frequency radiation. Proc. ILO-ENPI International Symp. on Ergonomics and Physical Environmental Factors. Rome, 1968, International Labor Office, Geneva

Graff, Ch.; F. Bockmühl; V. Tietze (1968): Lärmbelastung und arterielle (essentielle) Hypertoniekrankheit beim Menschen. In: S. Nitschkoff; G. Kriwizkaja: Lärmbelastung, akustischer Reiz und neurovegetative Störungen. Georg-Thieme Verlag, p. 112-126

Halberg, F.; G. Cornélissen; K. Otsuka; Y. Watanabe; G. S. Katinas; N. Burjoka; A. Delyukov; Y. Gorgo; Z. Zhao; A. Weydahl; R. B. Sothern; J. Siegelova; B. Fiser; J. Dusck; E. V. Syutkina; F. Perfetto; R. Tarquini; R. B. Singh; B. Rhees; D. Lofstrom; P. Lofstrom; P. W. C. Johnson; O. Schwartzkopff; International BIOCOS Study Group (2000b): Cross-spectrally coherent ca. 10.5- and 21-year biological and physical cycles, magnetic storms and myocardial infarctions.

Halberstadt, L. J.; D. Andrews; G. I. Metalsky; L. Y. Abramson (1984): Helplessness, hopelessness and depression: A review of progress and future directions. In: N. S. Endler; J. M. Hunt (eds.): Personality and the behavioral disorders. Vol. 1, Wiley, New York, 2nd edition

Hecht, K.; R. Baumann (1974): Stresssensibilität und Adaptation. Belr. Ges. Inn. Med. 8, p. 673

Hecht, K. (1984): Dynamik der Wechselbeziehungen zwischen Gesundheit und Krankheit. In: M. M. Chananaschwili; K. Hecht: Neurosen. Akademie Verlag Berlin, p. 93-99

Hecht, K.; H.-U. Balzer (1997): Biologische Wirkungen elektromagnetischer Felder im Frequenzbereich 0 bis 3 GHz auf den Menschen. Commissioned by Bundesinstitut für Telekommunikation. Contract No. 4231/630402. Summary of review of the Russian scientific literature between 1960 and 1996

Hecht, K. (2001a): Auswirkungen von elektromagnetischen Feldern. Umwelt-Medizin-Gesellschaft 24/3, p. 222- 231

Hecht, K. (2001b): Ein stiller Stressor: Die elektromagnetischen Felder? In: K. Hecht, H. P. Scherf, O. König (eds.): Emotioneller Stress durch Überforderung und Unterforderung. Schibri Verlag, Berlin, Milow, p. 79-100

Hecht, K. (2009): Zur Geschichte der Grenzwerte für nichtionisierende Strahlung. In: K. Hecht; M. Klein; K. Richter; H. Ch. Scheiner (eds.): Warum Grenzwerte schädigen, nicht schützen, aber aufrechterhalten werden. Beweise eines wissenschaftlichen und politischen Skandals. Brochure 4 of the brochure series of the Competence Initiative for the Protection of Humanity, the Environment and Democracy, p. 14-23

Henningsen, P. (1996): Psychische Störungen bei Patienten im Allgemeinkrankenhaus. Deutsches Ärzteblatt 95/7, p. C-286

Hietanen, M. et al. 1997: EEG activity of the human brain during exposure to cellular phones. 2nd World Congress for Electricity and Magnetism in Biology and Medicine, Bologna

Kaczmarek, L. K. (1976): Frequency sensitive biochemical reaction. Biophys. Chem. 4, p. 249-252

Kaljada, T. W. (1987): [The characteristics of functional changes of some systems in humans at the exposure to electromagnetic radiation in the radio-frequency range.] Simposium Mechanismy biologitscheskogo dejstwija elektromagnitnych islut- schenij Tesisy dokladow, Puschtschino, p. 139 (in Russian)

Kapitanenko, A. M. (1964): [Clinical manifestations of illness and therapeutic measure in cases of chronic exposures to an SHF field.] Wojenno-medizinskij Shurnal 10, p. 19 (in Russian)

King, M. G.; A. J. Husband (1996): Konditionierung immunologischer Funktionen. In: M. Schedlowski; U. Tews (eds.): Psychoimmunologie. Spektrum Akademischer Verlag, Heidelberg, Berlin, Oxford, p. 537-560

Klitzing von, L. (1995): Low-frequency pulsed electromagnetic fields influence EEG of man. Physica Medica 11(2), p. 7-80

Klosterhalfen, W.; S. Klosterhalfen (1990): Psychoimmunologie. In: Uexküll: Psychosomatische Medizin. Urban und Schwarzenberg, München, Wien, Baltimore, p. 195- 211

Köhnlechner, M. (1981): Wetterbeschwerden. W. Heyne Verlag, München, p. 19

Köhnlechner, M.; W. M. Malyschew; B. F. Muraschow (1967): [Disorders of the endocrine system in the case of a chronic effect from an SHF field.] Wojenno-medizinskij Shurnal 7, p. 39 (in Russian)

Kolesnik, F. A. (1968): [The functional state of the stomach and intestines in persons working under conditions of SHF exposure.] Gigienda truda i biologitscheskoe dejstwie elektromagnitnych polej, p. 75 (in Russian)

Kolodub, F. A.; I. N. Siniza; O. N. Tschernyschewa (1979): [The role of the thyroid in the mechanism of the separation effect of electromagnetic fields on the processes of oxidation phosphorylation in the brain and liver of rats.] 4-J Wsesojusnyl biochimit- schesklj sjesd 2, p. 101 (in Russian)

Kolodub, W. A. (1984): [The effect of electromagnetic fields of different frequency ranges on the metabolism and the ferment system of the organism.] Elektromagnitnye polja w blosfere T2, Biologit- scheskoe dejstwie elektromagnitnych polej, p. 115 (in Russian)

König, H.; F. Ankermüller (1960): Über den Einfluss besonders niederfrequenter elektrischer Vorgänge in der Atmosphäre auf den Menschen. Die Naturwissenschaften 21, p. 486-490

König, H. L. (1974a): ELF and VLF signal properties: Physical characteristics. In: M. A. Persinger (ed.): ELF and VLF Electromagnetic Field Effects. Plenum Press, New York, London, p. 9-34

König, H. L. (1974b): Behavioural changes in human subjects associated with ELF electric fields. In: M. A. Persinger (ed.): ELF and VLF Electromagnetic Field Effects. Plenum Press, New York, London, p. 81-100

Koslowskij, W. A.; T. F. Turowa (1987): [Criteria of coordinometry in workers who have contact with alternating electromagnetic fields with industry frequency.] Simposium Mechanismy biologitscheskogo dejstwija elektromagnitnych islutschenij Teslsy dokledow, Puschtschino, p. 148 (in Russian)

Krafzcyk, L. E. (1998): Keine Änderung der elektrischen Hirnaktivität durch Handy-Strahlung. EEG-Messung des Einflusses von Mobiltelefonen. Bulletin des schweizerischen Elektrotechnishcen Vereins 19, p. 11-16

Krause, Ch, M.; M. Koivislo; L. Sillanmaki; A. Häggavist; C. Saarela; Ch. Haarale; A. Revonsuo; M. Laine; Hämäiainen (2002): Effect of mobile phones on human performance and EEG oscillatory activity. Conference Proceedings 122, Schriftenreihe der Bundesanstalt für Arbeitsschutz und Arbeitsmedizin - Arbeitsmedizin, p. 119-127

Krylow, O. A.; M. S. Golinskaja; S. M. Subkowa et al. (1982): [Characteristics of somatic and vegetative responses of the organism to the effect of decimeter waves.] Biologitscheskoe dejstwie elektromagnitnych polej Wsesojusnyj simposium Tesisy dokladow, Puschtschino, p. 38 (in Russian)

de Large, J.; H. H. Marr (1974): Operant methods assessing the effects of ELF electromagnetic fields. In: M. A. Persinger (ed.): ELF and VLF Electromagnetic Field Effects. Plenum Press, New York, London, p. 145-176

Lacey, J. I. (1967): Somatic response patterning and stress: Some revisions of activation theory. In: M. H. Appley, R. Trumbull (ed.): Psychological Stress: Issues in Research. Appleton-Century-Crafts, New York

Lejtes, F. I.; L. A. Skurischina (1961): [The effect of microwaves on the hormone activity of the adrenal cortex.] Bjulieten eksperimentalnoj biologii i mediziny 52/12, p. 47 (in Russian)

Lindsley, D. B. (1951): Emotion. In: S. S. Stevens (ed.): Handbook of Experimental Psychology. Wiley, New York

Ludwig, H. W. (1974): Electric and magnet field strength in the open and in shielded rooms in the ULF to LF zone. In: M. A. Persinger (ed.): ELF and VLF Electromagnetic Field Effects. Plenum Press, New York, London, p. 35-80

Ludwig, H. W. (2002): Körper, Seele, Geist im Lichte der modernen Naturwissenschaften. Interview zu den biophysikalischen Grundlagen eines neuen Medizinverständnisses. Publication to Commemorate the 75th Birthday of Dr. rer. nat. W. Ludwig Bioinfomative Medizin. Ein Lesebuch aus der Praxis für die Praxis. AMB GmbH, D-97941 Tauberbischofsheim

Lysina, G. G.; M. B. Rapoport (1968): [Regulation of hemodynamics in the case of exposure to electromagnetic radio waves in the SHF range (clinical experimental study).] Gigiena truda i biologitscheskoe dejsiwie elektromagnitnych woin radiotschastot Sb materialwo 3-go. Wsesojusnogo simposiuma, p. 108 (in Russian)

Lysina, G. G.; E. P. Krasnjuk; A. O. Nawakatikjan et al. (1982): [About preclinical manifestations of a combined exposure to SHF electromagnetic field and lead under manufacturing conditions.] Wsesojusnyj symposium Biologitscheskoje dejstwie elektromagnitnych polej Teslsy doktadow, Puschtschino, p. 134 (in Russian)

Malysew, V. W.; F. A. Kolesnik (1968): [Radio-frequency electromagnetic waves and their effect on humans.] Leningrad (in Russian)

Marha, K.; J. Musil; H. Tuha (1968/1971): Electromagnetic Fields and the Life Environment. San Francisco Press, San Francisco, 1968 Prague (in Czech), 1971 San Francisco (in English)

Marino, A. A. (1988): Modern Bioelectricity. Marcel Dekker, New York

Martynjuk, W. S.; S. B. Bartynjuk (1993): [The influence of weak ELF electromagnetic fields on the ultradian rhythm of physiological processes.] Proceedings of International Symposium about Chemical and Physical Environmental Factors, p. 115 (in Russian)

Maschke, C.; U. Wolf; Th. Leitmann (2003): Epidemiologische Untersuchungen zum Einfluss von Lärmstress auf das Immunsystem und die Entstehung von Arteriosklerose. (Spandauer Gesundheits-Survey) Umweltforschungsplan des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit. Aktionsprogramm „Umwelt und Gesundheit", (UFOPLAN) Forschungsbericht 29862515, UBA- FB000387, Umweltbundesamt WaBoLu-Hefte 1/03

McQueen, G.; J. Marshall; M. Perdue; S. Shepard; J. Bienenstock (1989): [Pavlovian conditioning of rat mucosal mast cells to secrete rat mast cell proteases II.] Science 242, p. 83-85 (in Russian)

Medwedew, W. P. (1973): [Cardiovascular disease in persons exposed to SHF electromagnetic fields in the past.] Gigiena truda i professionalaye sabolewanija 3, p. 6 (in Russian)

Medwedew, W. P. (1977): [The human cardiovascular system in the case of exposure to SHF electromagnetic fields.] Gigiena truda i profsabolewanija 1, p. 18 (in Russian)

Moore-Ede, M. (1993): Die Nonstopgesellschaft. Risikofaktoren und Grenzen menschlicher Leistungsfähigkeit in der 24-Stunden-Welt. W. Heyne, München

Moros, W. W. (1984): Funktioneller Zustand des hypophysären Nebennierensystems bei Einwirkung von variablem magnetischen Niederfrequenzfeld. Biologische Mechanismen und Einwirkungsphänomene von Niederfrequenz- und statischem EMF auf die lebenden Systeme. Tomsk TGU, p. 34

Murr, C.; Widner; B. Sperner-Unterweger; M. Ledochowski; C. Schubert; D. Fuchs (2000): Immune reaction links disease progression in cancer patients with depression. Med. Hypothese 55, p. 138-140

Nikolajewa, L. A. (1982): [Changes in the spectrum of blood hormones under the influence of microwaves in the centimeter range.] Biologitscheskoe dejstwie elektromagnitnych polej Wsesojusnyj simposium Tesisy dokladow, Puschtschino, p. 23 (in Russian)

Osipow, J. A.; T. W. Kaljada (1968): [UHF EMF exposure of nonthermal intensity on the functional state of the body in workers. Issues of Industrial Hygiene and EMF Effects on the Human Body.] Collection of Publications L., p. 56 (in Russian)

Owsjannikow, W. A. (1973): [Some hygiene questions regarding the effects of electromagnetic fields on the human body.] Wlijanie elektromagnit- nych polej na biologitscheskie objekty 53, p. 63 (in Russian)

Panow, A. G.; N. W. Tjagin (1966): [Symptomatology. Classification and expertise regarding the implications of SHF field exposure on the human body. Wojenno-medizinskij Shurnal 9, p. 13 (in Russian)

Pavlenko, S. M. (1973): Discussion Contribution in: [Emotional stress and arterial hypertension.] Materials of the 1st Meeting of the Scientific Council of the 1st Medical Institute of Moscow, Moscow (in Russian)

Pavlov, I. P. (1885): In: Zukowveresnikow, I. M. (1952): Zurn vyss. nerv. dejatl. 2/1, p. 10-19

Pavlov, I. P. (1927): Conditioned Reflexes: Investigations of the Physiological Activity of the Cerebral Cortex (Anrep GV, transl-ed). London, oxford University Press; German Edition: I. P. Pawlow: Sämtliche Werke Bd. IV (1953), Akademie Verlag, Berlin

Pawlowa, I. W.; E. A. Drogitchina et al. (1968): [Biochemical changes in long-term effects of SHF-EMF.] Gigiena truda i biologitscheskoe dejstwie elektromagnitnych woin radiotschastot, p. 124 (in Russian)

Perger, F. (1979): Das Grundsystem nach Pischinger. Phys. Med. u. Reh. 20, p. 275-287

Perger, F. (1981): Regulationsstörungen im Vorfeld der Malignomentwicklung. Wien. med. Wschr. 131, p. 189-196

Perger, F. (1988): Fragen der Herderkrankung. Deutscher Zahnärztekalender, Carl Hanser Verlag, München, Wien, p. 23-38

Persinger, M. A.; G. F. Lafrenière; K. P. Ossenkopf (1974): Behavioural physiological and histological chances in rats exposed during various developmental stages to ELF magnetic fields. In: M. A. Persinger (ed.): ELF and VLF Electromagnetic Field Effects. Plenum Press, New York, London, p. 177-226

Petrov, I. R. (ed) (1970): Influence of microwave radiation in the organism of man and animals. NASA TT-F-708, Feb. 1972. National Technical Information Service, Springfield VA

Pischinger, A. (1990): Das System der Grundregulation. 1st edition (1975) and 8th edition (1990), Haug Verlag, Heidelberg

Piskunowa, W. G.; D. K. Abramowitsch-Poljakow (1961): [About a peculiar disturbance of the nervous-endocrine system when exposed to currents of high frequency.] Wratschebnoje delo 3, p. 121 (in Russian)

Plechanov, G. F.; W. W. Wedjuschkina (1966): [The formation of a conditional vascular reflex in humans when the field strength of an electromagnetic field of high frequency changes.] Shurnal wysschej nerwnoj dejatelnosti im IP Pawlowa 16/1, p. 34 (in Russian)

Plechanov, G. F. (1984): [Three levels of mechanisms of biological effects of ELF electromagnetic fields.] Biologi- tscheskie mechanismy i fenomeny dejslwija niskotschastotnych i statitscheskich elektromagnitnych polej na shiwya sistemy (Materialy wsesojusnogo simposiuma Tomsk, 14-16 sent 1982); p. 3 (in Russian)

Plechanov, G. F. (1987): [The most important laws of the biological effect of ELF electric fields on the biocenosis of objects.] Simposium Mechanismy biologitscheskogo dejstwija elektromagnitnych islutschenij Teslsy doktadow, p. 103 (in Russian)

Prausnitz, S.; C. Süsskind (1962): Effects of chronic micro- wave irradiation on mice. IRE Transactions on Bio-Medical Electronics, Vol. BME-9, No. 2, April

Preece, A. W. (2002): EMF effects on cognitive function in humans. Conference Proceedings Tb 122, Schriftenreihe der Bundesanstalt für Arbeitsschutz und Arbeitsmedizin.

Presman, A. S. (1968): [Electromagnetic Fields and Life.] Nauka, Moscow (in Russian)

Presman, A. S. (1970): Electromagnetic Fields and Life. Plenum Press, New York, p. 141-55

Pschyrembel, Klinisches Wörterbuch. 261. Edition, Walter de Gruyter, Berlin, New York

Rakitin, I. A. (1977): [Clinical observation of health status of women working under radio wave exposure.] Trudy Leningradskogo sanitarno- gigienitscheskogo medizinskogo instituta Faktory wne- schnej sredy i tschelowek 116, p. 31 (in Russian)

Reimer, C.; L. Hempfing; B. Dahme (1979): Iatrogne Chronifizierung in der Vorbehandlung psychogener Erkrankun- gen. Praxis Psychother. Psychosom. 24, p. 123-133

Reiser, H. P. (1995): The influence of electromagnetic fields on human brain activity. Journal of Medical Research 1, p. 27-32

Rimpler, M. (1987): Der Extrazellulärraum – eine unterschätzte Größe. Ein neuer Ansatz der Zellpathologie. Therapie Woche 37, p. 37-40

Rohracher, H. (1949): Mechanische Mikroschwingungen des menschlichen Körpers. Wien

Romanov, Ju. A.; S. A. Tschepurnow, Klewesai; et al. (1980): [The biological rhythms and solar activity. Problems of cosmic biology.] Vol. 41/8, Moscow, Nauka, p. 289 (in Russian)

Röschke, J.; K. Mann (1997): No short-term effects of digital mobile radio telephone on the awake human electroencephalogram. Bioelectromagnetics 18(2), p. 172-176

Rubzova, N. B. (1983a): [Current data on the effects of microwaves on the functional state of the nervous system. Hygiene Exposure Limits and Biological Effects of Microwave Radiation.] Moscow Gigienitscheskaja ozenka i biologitscheskoe dejstwie prerywistych mikrowolnowych oblutschenij. p. 56 (in Russian)

Rubzova, N. B. (1983b): [The state of electrical activity of the human brain under localized exposure to the heel of the hand.] Simposium Mechanismy biologitscheskogo dejstwija elektromagnitnych islut- schenij Tesisy dokladow, Puschtschino, p. 144 (in Russian)

Russel, M.; K. A. Dark; R. W. Cummins; G. Ellmann; E. Callaway; H. V. S. Peek (1984): Learned histamine release. Science 17, p. 733-734

Sadchikova, M. N. (1964): [The clinical picture of changes in the nervous system, which are caused by the effect of radio waves of different frequency ranges.] O biologitscheskom dejstwlii elektro- magnitnych polej rakiotschastol, p. 110 (in Russian)

Sadchikova, M. N. (1971): [Comparison evaluation of health status of persons working under microwave exposure of different intensities.] Gigiena truda i profsabolewanika 9, p. 10 (in Russian)

Sadchikova, M. N.; W. G. Oslpowa; S. N. Durnewa (1972): [Brain and peripheral blood circulation in microwave illness during geographical investigations.] Gigiena truda i profsabolewanija 9, p. 12 (in Russian)

Sazepina, G. N.; A. O. Lasarew; S. W. Tulskij (1980): [The difference of electrical potentials between human skin parts as a characteristic of the physiological state of the body.] Biofisika 25(2), p. 330 (in Russian)

Schandry, R. (1998): Lehrbuch Psychophysiologie. Beltz, Psychologie Verlags Union, Weinheim

Schavit, Y.; F. G. Martin (1987): Opiates, stress and immunity: animal studies. Ann. Beh. Med. 9, p. 11-15

Schliephake, E. (1932): Arbeitsgebiete auf dem Kurzwellengebiet. Deutsche Medizinische Wochenschrift 32, p. 1235-1240

Schmale, A. H.; H. Iker (1966): The effect of hopelessness and the development of cancer. Psychosomat. Med. 28, p. 714-721

Schmale, A. H.; H. Iker (1971): Hopelessness as a predicator of cervical cancer. Soc. Sci. Med. 5, p. 95-100

Schmalhausen, I. I. (1964): The regulation of morphogenesis in individual development. Nanka,

Schober, R. (1951/52): Die Beteiligung des Mesenchyms bei der experimentellen Erzeugung von Hautkarzinomen der Maus durch Benzpyren. Z. Krebsforsch. 58, p. 36-55

Schober, R. (1951/52): Die Beteiligung des Mesenchyms bei der experimentellen Erzeugung von Hautkarzinomen der Maus durch Benzpyren. Z. Krebsforsch. 58, p. 36-55

Schober, R. (1953): Beziehungen der Nebennierenrindenhormone zum experimentellen Geschwulstwachstum. 2. Krebsforschung 59, p. 28.43

Schubert C.; G. Schüssler (2003): Psychoimmunologie – empirische Befunde. In Uexküll: Psychosomatische Medizin, 6th edition. Urban Fischer, München, Jena, p. 145-160

Schuh, J.; R. Gattermann; J. A. Romanow (ed.) (1987): Chronobiologie – Chronomedizin. Martin-Luther-Universität Halle/Wittenberg, Wiss. Beiträge 36

Schumann, W. O.; H. König (1954): Naturwissenschaften 41, p. 183

Schwarzer, R.; P. Walschburger (1985): Stress, Angst und Hilflosigkeit. In: R. Schwarzer (ed.): Stress and social support. Berlin: Research Report, 4. Department of Psychology

Seligman, M. E. P. (1975): Helplessness. On Depression, Development and Death. San Francisco, N. H. Freeman and Company. ISBN 9780-7167-0751-9

Seligman, M. E. P. (1992): Erlernte Hilflosigkeit. Belz Taschenbuch 16, Belzverlag, Weinheim, Basel

Seligman, M. E. P. (1999): Kinder brauchen Optimismus. Rowohlt-Verlag. Vers. 1994: The Optimistic Child Harper Perennial. A. Division of Harper Collins Publisher

Selye, H. (1953): Einführung in die Lehre vom Adaptationssyndrom. Thieme, Stuttgart

Servan-Schreiber, D. (2008): Anticancer. Chapter 9: The anticancer mind, Chapter 10: Defusing fear Pinguin Group, New York

Shavit, Y; G. W. Terman; P. C. Martin; J. W. Lewis; J. C. Liebeskind; R. P. Gale (1985): Stress, opioid peptides, the immune system and cancer. J. Immunol 135, p. 834-837

Shuk, R. D.; A. Ja. Chrupina; T. Ja. Kaznelson (1967): Sostojanie krowotworenija u boinych ot wosdejstwija SWTSCH. [The state of blood formation in patients due to the exposure to SHF fields.] Woprosy gematologli i Immunopa- tologii, p. 164 (in Russian)

Sokolow, W. W.; N. A. Tschulina (1968a): [The proliferation and chromosome impairment of bone marrow cells in persons having worked under SHF-EMF exposures for a long time.] Gigiena truda i biologitscheskoe dejstwie elektromagnitnych woin radiotschastot, p. 147 (in Russian)

Sokolow, W. W.; N. A. Tschulina (1968a): [Changes of the hematopoiesis under SHF-EMF exposure.] Trudy laboratorii elektromagnitnych polej radiotschastot Instituta gigleny truda i proffeionalnych sabolewanij AMN SR 3, p. 41 (in Russian)

Spitter, J. F.; P. Calabrese et al. (1997): Cerebro-biological effects in low-frequency pulsed RF-fields. 2nd World Congress for Electricity and Magnetism in Biology and Medicine, Bologna

Süsskind, C. (ed) (1959): Proceedings of the Third Annual Tri-Service Conference on Biological Effects of Microwave Radiating Equipment. August 25-27, University of California

Szent-Gyorgyi, A. (1960): Introduction to a Submolecular Biology. Academic Press, New York

Tichontschuk, W. S.; I. B. Uschakow; W. P. Fedorow (1987): [The structural-metabolic analysis of the nervous system response to the combined exposure of microwaves and ionizing radiation.] Radiobiologija 27(3), p. 361 (in Russian)

Tjashelova, W. G. (1983): [Criteria for damage due to chronic EMF exposure.] Kriteril porashenija pri chronitscheskom wosdejstwii elektromagnitnogo islutschenija. Collection of Scientific Papers of the Academy of Medical Sciences of the USSR, Puschtschino, p. 132 (in Russian)

Trepel, F. (1968): Tumorproliferation. Theorie und Ergebnisse. Med. Klin. 63, p. 656

von Uexküll, Th. (1990): Psychosomatische Medizin. Urban und Schwarzberg, 4th edition

VDE (2002): Position Paper "Mobilfunk und Gesundheit" of VDE (Verband der Elektrotechnik, Elektronik, Informationstechnik) March 2002, Frankfurt/Main, p. 1-19

Virchow. R. (1868): Rede auf der Naturforscherversammlung 1869 in Innsbruck. In: K. Sudhoff (ed.): Rudolf Virchow und die deutschen Naturforscherversammlungen. (1922) Akademische Verlagsgesellschaft, Leipzig, p. 93

Warnke, U. (1997): Der Mensch und die 3. Kraft. Elektromagnetische Wechselwirkungen zwischen Stress und Therapie. Popular Academic Verlagsgesellschaft, Saarbrücken, p. 170-227

Warnke, U. (2004): Warum können kleinste Leistungsflussdichten elektromagnetischer Energie große Effekte am Menschen auslösen? www.hese-project.de

Warnke, U. (2009): Ein initialer Mechanismus zu Schädigungseffekten durch Magnetfelder bei gleichzeitig ein- wirkender Hochfrequenz des Mobil- und Kommunikationsfunks. Umwelt-Medizin-Gesellschaft 22/3, p. 219-238

Wdowin, G. K.; T. P. Osinzewa (1987): Die sensomotorischen Reaktionen bei Arbeitern, die einem EMF mit Industriefrequenz ausgesetzt sind. Simposium Mechanismy biologitscheskogo dejstwija elektromagnitnych eslutschenij Tesisy dokladow, Puschtschino, S. 148 (russisch)

Weiner, H. (1988): The functional bowel disorders. In: H. Weiner; A. Baum (ed.): Perspectives in Behavioral Medicine: Eating Regulation and Discontrol. Erdbaum, Hillsdale

Weiner, H. (1990): Anwendung psychosomatischer Konzepte in der Psychiatrie. In: Th. von Uexküll: Psychosomatische Medizin. Urban Schwarzberg, München, Wien, Baltimore, S. 920

Weiss, H. (1991): Umwelt und Magnetismus. Deutscher Verlag der Wissenschaften, Berlin

Wever, R. (1966): Das Schwingungsgesetz der biologischen Tagesperiodik. Umschau H. 14, S. 462-469

Wever, R. (1967): Über die Beeinflussung der zirkadianen Periodik des Menschen durch schwache elektromagnetische Felder. Z. vergl. Physiol. 56, S. 111-128

Wever, R. (1968a): Einfluss schwacher elektromagnetischer Felder auf die circadiane Periodik des Menschen. Naturwissenschaften 55, S. 29-32

Wever, R. (1968b): Gesetzmäßigkeiten der circadianen Periodik des Menschen, geprüft an der Wirkung eines schwachen elektrischen Wechselfeldes. Pfluegers Arch. 302, S. 97-112

Wever, R. (1969a): Autonome circadiane Periodik des Menschen unter dem Einfluss verschiedener Beleuchtungs-Bedingungen. Pfluegers Arch. 306, S. 71-91

Wever, R. (1969b): Untersuchungen zur circadianen Periodik des Menschen mit besonderer Berücksichtigung des Einflusses schwacher elektrischer Wechselfelder. Bundesminist. Wiss. Forsch., Forschungsber. W 69-31

Wever, R. (1970): The effects of electric fields on circadian rhythms in men. Life Sce. Space Res. 8, S. 171-187

Wever, R. (1971a): Die circadiane Periodik des Menschen als Indikator für die biologische Wirkung elektromagnetischer Felder. Z. Physik. Med. 2, S. 439-471

Wever, R. (1971b): Influence of electric fields on some parameters of circadian rhythms in man. In: M. Menaker (ed): Biochronometry. Washington D.C. Nat. Acad. Scienc., S. 117-132

Wever, R. (1974a): Different aspects of the studies of human circadian rhythms under the influence of weak elektric fields. In: L. E. Scheving; F. Halberg; J. E. Pauly (eds): Chronobiology. Igaku Shoin Ltd., Tokyo, S. 694-699

Wever, R. (1974b): Der Einfluss des Lichts auf die circadiane Periodik des Menschen. II. Zeitgeber-Einfluss. Z. Physik. Med. 3, S. 137-150

Wever, R. (1974c): ELF-effects on human circadian rhythms. In: M. A. Persinger (ed): ELF and VLF Electromagnetic Field Effects. Plenum Press, New York, London, S. 101-144

Wever, R. (1974d): Influence of light on human circadian rhythms. Nordic Council Arct. Med. Res. Rep. 10, S. 33-47

Wever, R.; M. A. Persinger (1974): ELF and VLF Electromagnetic Field Effects. Plenum-Press, New York

Wever, R. (1976): Effects of weak 10 Hz fields on separated vegetative rhythms involved in the human circadian multi-oscillator system. Arch. Met. Geoph. Biokl. Ser.B 24, S. 123-124

Wolfowskaja, R. N.; A. Ju. Osipow; T. W. Koljada; u. a. (1961): K woprosu o kombinirowannom wosdejstwii polja wysoloj tschastoty i rentgenowskogo Isiutschenijew proiswodstwennych uslowijach. Zu Fragen des kombinierten Einflusses von HF-Feldern und Röntgenstrahlung unter Produktionsbedingungen. Hygiene und Gesundheit 5, S. 8 Gigiena I sanitanja 5, S. 8 (russisch)

Wolynskij, A. M. (1973): Die Veränderung von Herz- und Nerventätigkeit bei Tieren verschiedenen Alters unter den Einwirkung des elektromagnetischen Niederfrequenzfeldes geringer Stärke. EMF-Einwirkung auf die biologischen Objekte. Veröffentlichungen der Krimer medizinischen Hochschule, Charkow 53, S. 7 (russisch)

Wright, N. H. (1997): Resilience. Servant Publications, Then Arbor Michigan

Zulley, J.; B. Knab (2000): Unsere innere Uhr. Herder, Freiburg

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About this brochure

“The information provided in this brochure makes clear that short-term studies cannot answer any questions regarding long-term risks. The current exposure limits, which we mostly owe to the physics way of thinking, are a scientific anachronism. Furthermore, by using the concrete example of a research review, it is shown how the authorities have ignored and continue to ignore that which is important for public health and a sustainable future, but would be contrary to economic interests." (from the Summary)

"It is astonishing to see that the proponents of thermal effects of electromagnetic fields have learned nothing new over the last 40 years. The incorrect concept affects European and US exposure limits, which cannot claim to provide protection. It affects research projects that only conduct short-term studies. It affects policies that claim safety where a warning would be in order. And it also affects the administration of justice when incorrect judgments are passed—which the court is forced to do within the currently valid legal framework." (from Chapter 5)

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